Mazda MX-5 Training Manual

FOREWORD

This manual contains the changes and/or additions relating to each component or system operation and function for the Mazda MX-5.

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

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

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

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.

CONTENTS

There are explanations given only for the sections marked with shadow (■).

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3322-10-98A

VEHICLE IDENTIFICATION NUMBERS (VIN)

JMZ NB18P20# 100001 —
JMZ NB18620# 100001 —
JM0 NB30P100 100001 —

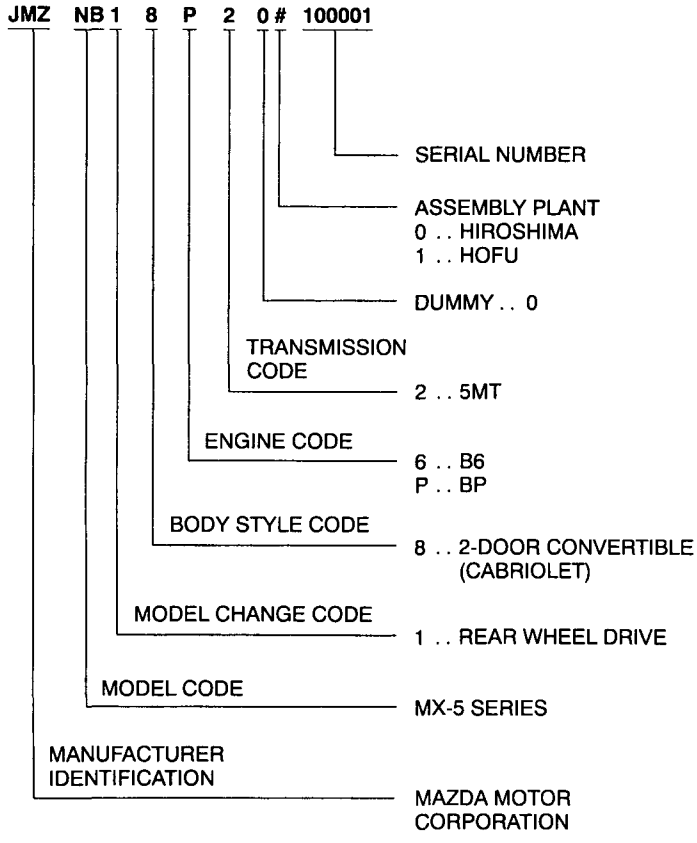
RELATED MATERIALS

MX-5 Training Manual (Australia, Europe) 3165-10-89I
MX-5 Workshop Manual Supplement (Europe) 1246-10-90G
MX-5 Workshop Manual Supplement (Europe) 1372-10-93I
MX-5 Workshop Manual Supplement (Europe) 1451-10-94L
MX-5 Workshop Manual Supplement (Europe) 1509-10-95I
MX-5 Workshop Manual Supplement (Australia) ... 1236-10-90C
MX-5 Workshop Manual Supplement (Australia) ... 1373-10-93I
MX-5 Workshop Manual Supplement (Australia) ... 1452-10-94L
MX-5 Workshop Manual Supplement (Australia) ... 1510-10-95I

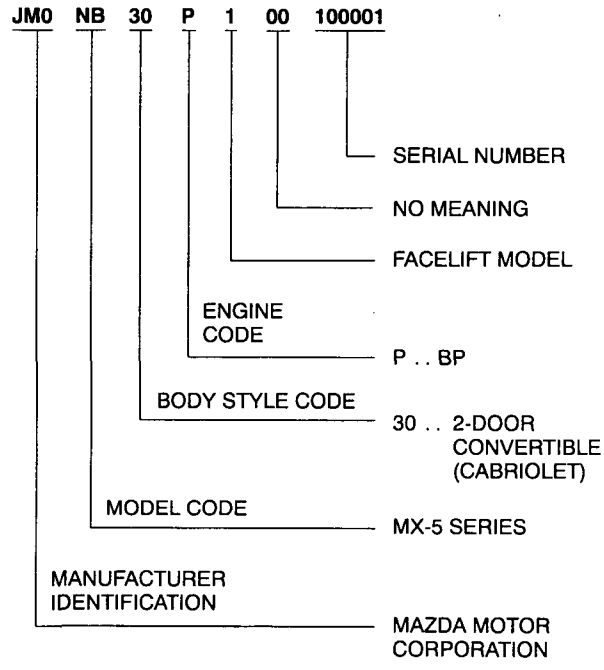
GENERAL INFORMATION

VIN CODE

EUROPE, GENERAL (L.H.D.)



AUSTRALIA, GENERAL (R.H.D.)



UNITS

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

Conversion to SI Units (Système International d'Unités)

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

Rounding off

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

Upper and lower limits

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

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

- The actual converted values for 2.7 kgf/cm^2 are 264 kPa and 38.4 psi. In the top specification, 2.7 is used as an upper limit, so its converted values are rounded down to 260 and 38. In the bottom specification, 2.7 is used as a lower limit, so its converted values are rounded up to 270 and 39.

NEW STANDARDS

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

Previous Standard		New Standard		
Abbreviation	Name	Abbreviation	Name	Remark
—	Accelerator Pedal	AP	Accelerator Pedal	
—	Air Cleaner	ACL	Air Cleaner	
—	Air Conditioning	A/C	Air Conditioning	
—	Airflow Meter	VAF	Volume Air Flow Sensor	
—	Airflow Sensor	MAF	Mass Air Flow Sensor	
—	Alternator	GEN	Generator	
—	ATF Thermosensor	—	Transmission (Transaxle) Fluid Temperature Sensor	
—	Atmospheric Pressure	BARO	Barometric Pressure	
V_B	Battery Voltage	B+	Battery Positive Voltage	
—	Catalytic Converter	OC	Oxidation Catalytic Converter	
		TWC	Three Way Catalytic Converter	
		WU-TWC	Warm Up Three Way Catalytic Converter	#1
—	Circuit Opening Relay	FPR	Fuel Pump Relay	#2
—	Clutch Position	CPP	Clutch Pedal Position	
—	Crank Angle Sensor	CMP	Camshaft Position Sensor	
—	Crank Angle Sensor 2	CKP	Crankshaft Position Sensor	
—	Diagnosis Connector	DLC	Data Link Connector	
—	Diagnosis/Self-Diagnosis	OBD	On-Board Diagnostic	
—	Direct Ignition	DLI	Distributorless Ignition	
—	EC-AT Control Unit	TCM	Transmission (Transaxle) Control Module	
EGI	Electronic Gasoline Injection System	CIS	Continuous Fuel Injection System	
—	Electronic Spark Ignition	EI	Electronic Ignition	#3
ECU	Engine Control Unit	PCM	Powertrain Control Module	#4
—	Engine Modification	EM	Engine Modification	
—	Engine RPM Signal	—	Engine Speed Input Signal	
—	Evaporative Emission	EVAP	Evaporative Emission	
—	Exhaust Gas Recirculation	EGR	Exhaust Gas Recirculation	
—	Fan Control	FC	Fan Control	
—	Feedback System	CLS	Closed Loop System	
—	Flexible Fuel	FF	Flexible Fuel	
—	Fuel Pump	FP	Fuel Pump	
—	Fully Closed	CTP	Closed Throttle Position	
—	Fully Open	WOT	Wide Open Throttle	
—	Ground/Earth	GND	Ground	

#1: Directly connected to exhaust manifold
#2: In some models, there is a fuel pump relay that controls pump speed. That relay is now called the fuel pump relay (speed).
#3: Controlled by the PCM
#4: Device that controls engine and powertrain

Previous Standard		New Standard		
Abbreviation	Name	Abbreviation	Name	Remark
—	IC Regulator	VR	Voltage Regulator	
—	Idle Speed Control	IAC	Idle Air control	
—	Idle Switch	—	Closed Throttle Position Switch	
—	Inhibitor Position	TR	Transmission (Transaxle) Range	
—	Intake Air Pressure	MAP	Manifold Absolute Pressure	
—	Intake Air Thermo	IAT	Intake Air Temperature	
—	Intercooler	CAC	Charge Air Cooler	
—	Knock Sensor	KS	Knock Sensor	
—	Line Pressure Solenoid Valve	—	Pressure Control Solenoid	
—	Lock-up Position	TCC	Torque Converter Clutch	
—	Malfunction Indicator Light	MIL	Malfunction Indicator Lamp	
—	Multiport Fuel Injection	MFL	Multiport Fuel Injection	
—	Open Loop	OL	Open Loop	
—	Overdrive	4GR	Fourth Gear	
—	Oxygen Sensor	HO2S	Heated Oxygen Sensor	With heater
		O2S	Oxygen Sensor	
—	Park/Neutral Range	PNP	Park/Neutral Position	
—	Power Steering Pressure	PSP	Power Steering Pressure	
—	Pulse Generator	—	Input/Turbine Speed Sensor	
—	Reed Valve	SAPV	Secondary Air Pulse Valve	
—	Secondary Air Injection System	PAIR	Pulsed Secondary Air Injection	Pulsed injection
		AIR	Secondary Air Injection	Inject with compressor
—	Sequential Fuel Injection	SFI	Sequential Multipoint Fuel Injection	
—	Service Code(s)	DTC	Diagnostic Trouble Code (s)	
—	Spark Ignition	DI	Distributor Ignition	
—	Stoplight Switch	—	Brake Switch	
—	Test Mode	DTM	Diagnostic Test Mode	#5
—	Throttle Body	TB	Throttle Body	
—	Throttle Sensor	TP	Throttle Position Sensor	
—	Turbocharger	TC	Turbocharger	
—	Vehicle Speed Sensor	VSS	Vehicle Speed Sensor	
—	Vehicle Speed Sensor 1	—	Output Speed Sensor	
—	Water Thermo	ECT	Engine Coolant Temperature	
—	1-2 Shift Solenoid Valve	—	Shift Solenoid A	
	Shift A Solenoid Valve			
—	2-3 Shift Solenoid Valve	—	Shift Solenoid B	
	Shift B Solenoid Valve			
—	3-4 Shift Solenoid Valve	—	Shift Solenoid C	
—	3rd Gear	3GR	Third Gear	
—	—	—	Incorrect Gear Ratio	

#5: Diagnostic trouble codes depend on the diagnostic test mode

ENGINE

ABBREVIATIONS

ABDC	After bottom dead center	EX	Exhaust
ATDC	After top dead center	HLA	Hydraulic lash adjuster
BBDC	Before bottom dead center	IN	Intake
BTDC	Before top dead center	MLA	Mechanical lash adjuster
DOHC	Double over head camshaft	-	-

OUTLINE

OUTLINE OF CONSTRUCTION

- The construction and operation of the B6 and BP engine system are basically the same as those of previous Mazda MX-5 models. Following are the major differences between previous and new MX-5. (Refer to Mazda MX-5 Workshop Manual Supplement 1451-10-94L (Europe) or 1373-10-93I (Australia).)

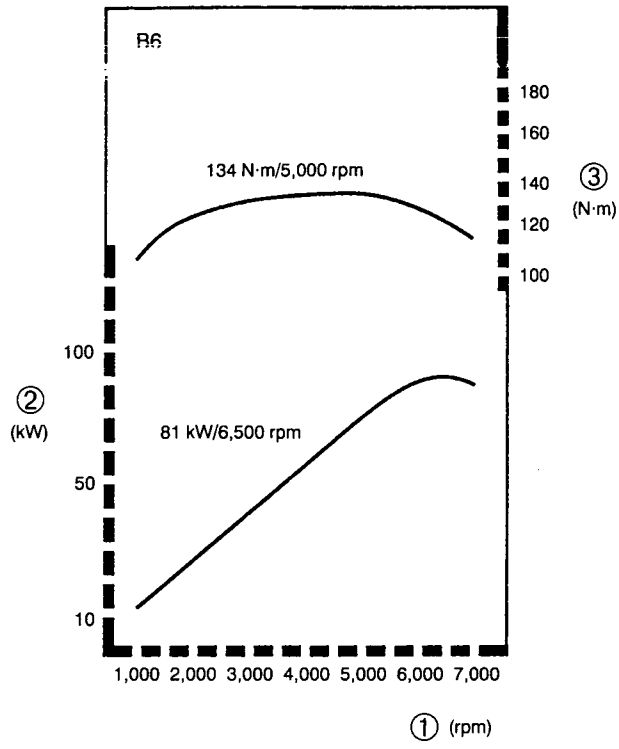
(1) The configuration of the piston has been modified. (BP engine model.)
(2) The intake port shape has been modified.
(3) The valve timing has been changed.
(4) The MLA has been adopted instead of HLA. According to this change, valve clearance inspection/adjustment has been added.
(5) Configuration of the right side engine mount bracket has been modified.

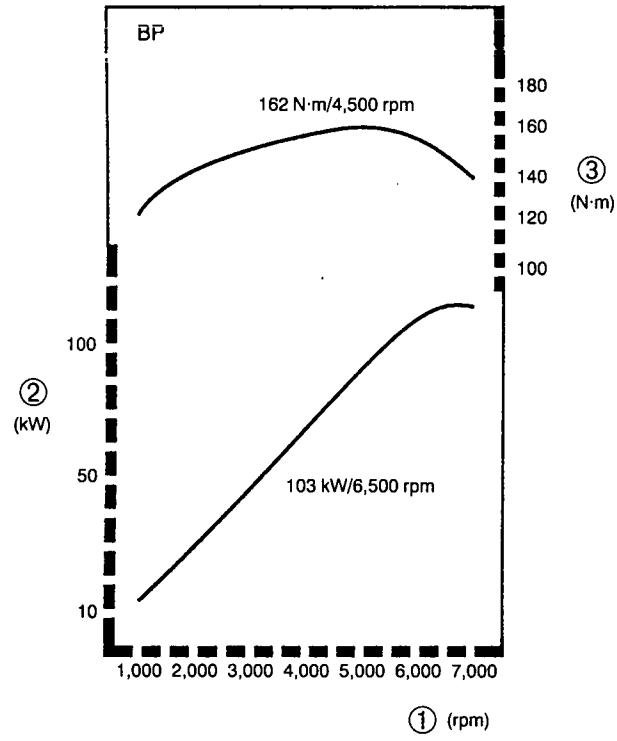
SPECIFICATIONS

Item				Engine	
				B6	BP
Type				Gasoline, 4 cycle	
Cylinder arrangement and number				In-line, 4 cylinders	
Combustion chamber				Pentroof	
Valve system				DOHC, timing belt-driven, 16 valves	
Displacement (ml {cc, cu in})				1,597 {1,597, 97.42}	1,840 {1,840, 112}
Bore × stroke (mm {in})				78.0 × 83.6 {3.07 × 3.29}	83.0 × 85.0 {3.27 × 3.35}
Compression ratio				9.4	9.5
Compression pressure (kpa {kgf/cm^2, psi} [rpm])				1,461 {14.9, 212} [300]	1,442 {14.7, 209} [300]
Valve timing	IN	Open	BTDC	-1°	8°
		Close	ABDC	53°	53°
	EX	Open	BBDC	51°	53°
		Close	ATDC	6°	9°
Valve clearance [Engine cold]		IN	(mm {in})	0.17—0.23 {0.0070—0.0091} (0.20 ± 0.03 {0.0079 ± 0.0012})	0.18—0.24 {0.0071—0.0094} (0.21 ± 0.03 {0.0083 ± 0.0012})
		EX	(mm {in})	0.27—0.33 {0.0106—0.0129} (0.30 ± 0.03 {0.0118 ± 0.0012})	0.28—0.34 {0.0110—0.0133} (0.31 ± 0.03 {0.0122 ± 0.0012})

▭ Indicates new specifications

ENGINE PERFORMANCE CURVE (ONLY FOR EUROPE)



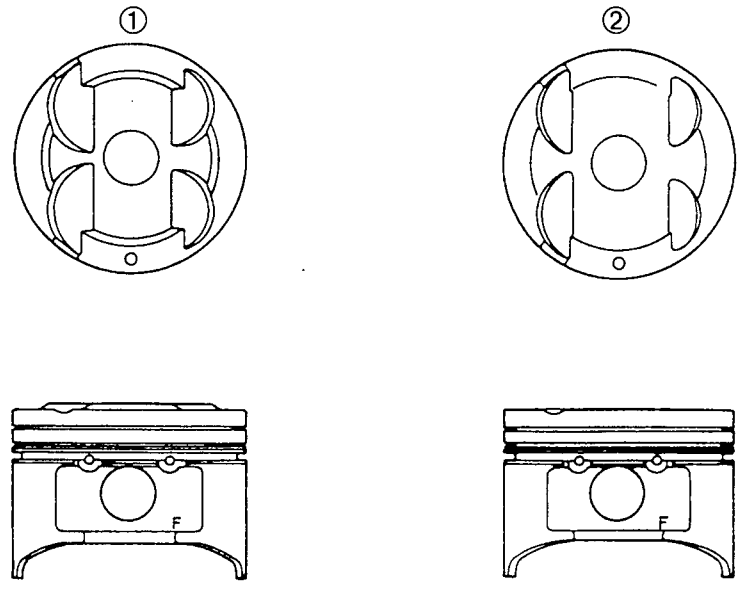


1	Engine speed
2	Output

3	Torque

ENGINE MECHANISM

PISTON [BP]

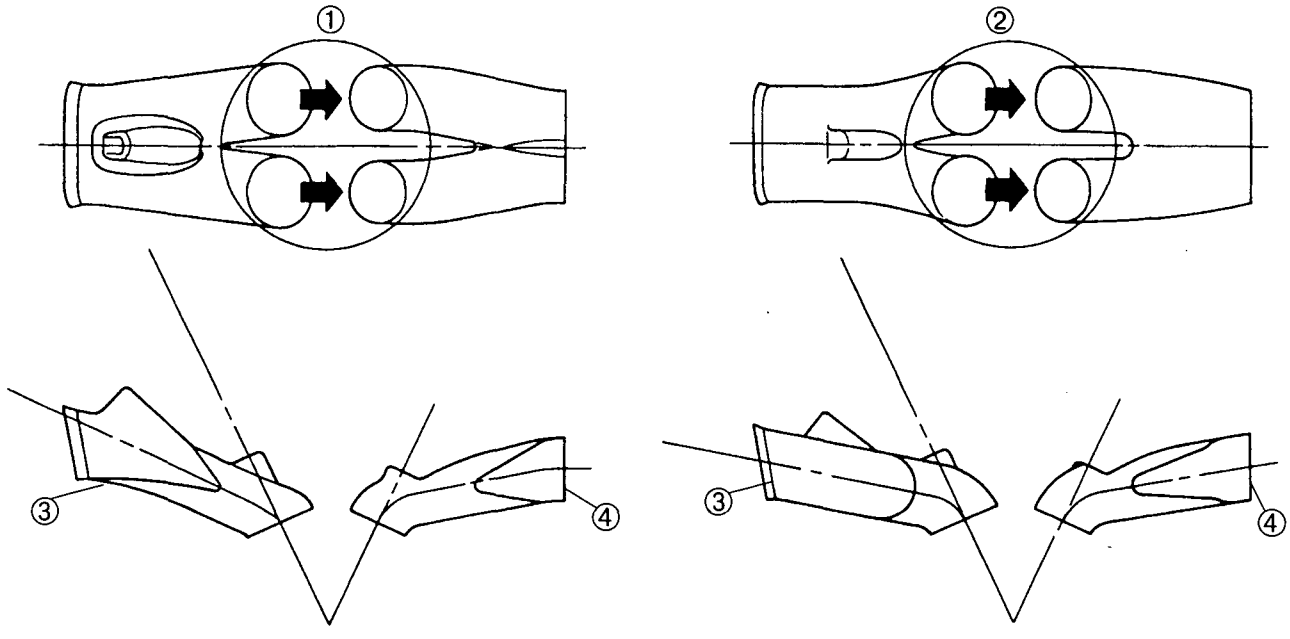


1	New model

2	Previous model

- The shape of piston has been modified to improve combustion efficiency.

CYLINDER HEAD



1	New model
2	Previous model

3	Intake port
4	Exhaust port

- The shape of the intake ports have been modified to improve intake air efficiency.

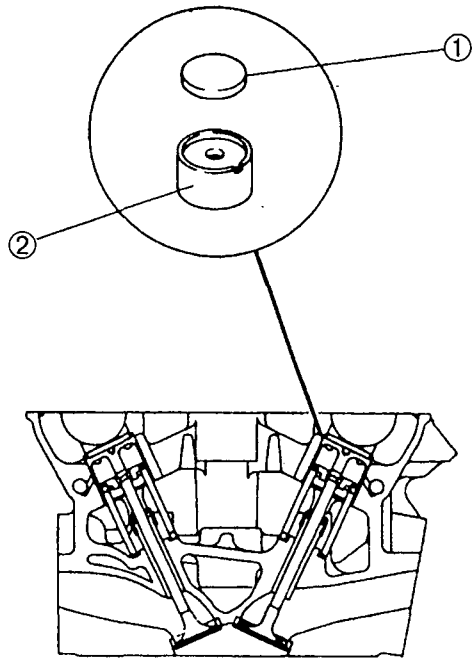
CAMSHAFT

Item				Engine			
				B6		BP	
				New model	Previous model	New model	Previous model
Valve timing	IN	Open	BTDC	-1°	5°	9°	5°
		Close	ABDC	53°	40°	53°	48°
	EX	Open	BBDC	51°	55°	53°	56°
		Close	ATDC	6°	5°	9°	14°

- The valve timing has been modified to improve engine performance.

VALVE MECHANISM

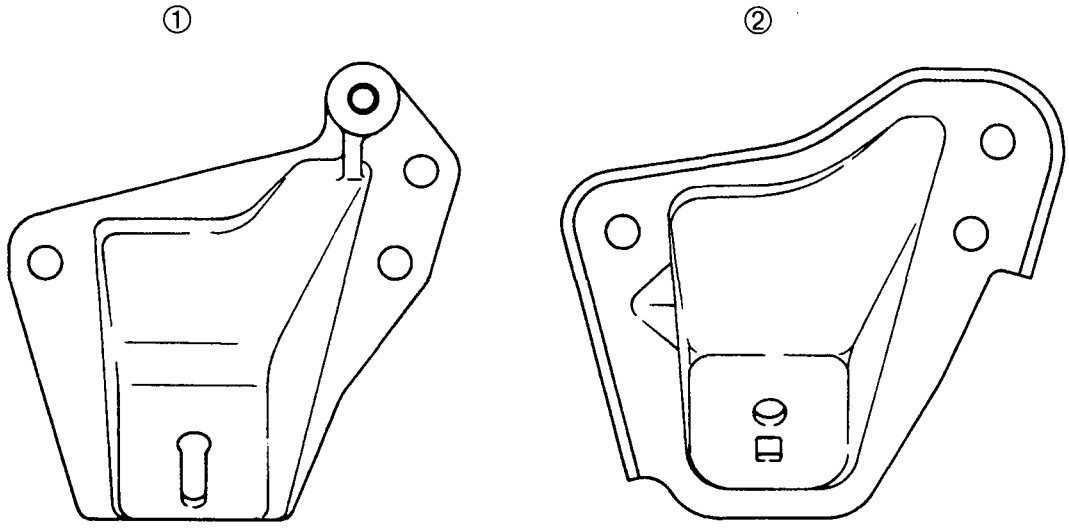
TAPPET AND ADJUSTMENT SHIM



1	Adjustment shim	2	Tappet

- Valve clearance is adjusted by changing the adjustment shim thickness.
- A tappet and an adjustment shim are fitted between the camshaft and the valve.

ENGINE MOUNT



1	New model

2	Previous model

- The engine mount layout is basically the same as that of previous models.
- The shape of right side engine mount bracket has been modified to reduce noise and vibration.

LUBRICATION SYSTEM

OUTLINE

OUTLINE OF CONSTRUCTION

The construction and operation of the B6 and BP engine lubrication system are basically the same as those of previous Mazda MX-5 models except the following point. (Refer to Mazda MX-5 Workshop Manual Supplement 1372-10-93I (Europe) or 1373-10-93I (Australia).)

- The grade of engine oil has been added.

SPECIFICATIONS

Item		Engine	
		B6	BP
Lubrication system		Force-fed type	
Oil pump	Type	Trochoid gear	
	Relief pressure (kPa {kgf/cm^2, psi})	344-441 {3.5-4.5, 50-63}	
Oil filter	Type	full-flow, paper element	
	Bypass pressure (kPa {kgf/cm^2, psi})	79-117 {0.8-1.2, 12-17}	
Oil capacity	Total (dry engine) (L {US qt, Imp qt})	3.6 {3.8, 3.2}	4.0 {4.2, 3.5}
	Oil replacement (L {US qt, Imp qt})	3.2 {3.4, 2.8}	3.6 {3.8, 3.2}
	Oil and oil filter replacement (L {US qt, Imp qt})	3.4 {3.6, 3.0}	3.8 {4.0, 3.3}
Engine oil		API Service SG, SH or SJ (Europe) API service SD, SE, SF or SG (Australia)	
Viscosity	Above 30°C {86°F}	SAE 40	
	0°C—40°C {32°F—104°F}	SAE 30	
	-10°C—20°C {14°F—68°F}	SAE 20W-20	
	-25°C—30°C {-13°F—86°F}	SAE 10W-30 (SD, SE and SF)	
	Above -25°C {-13°F}	SAE 10W-40, 10W-50, 10W-30 (SG)	
	Above -10°C {14°F}	SAE 20W-40, 20W-50	
	Below -20°C {-4°F}	SAE 5W-20	
	Below 0°C {32°F}	SAE 5W-30	

▭ Indicates new specification

COOLING SYSTEM

ABBREVIATIONS

EC-AT	Electronically controled automatic transmission	MT	Manual transmission

OUTLINE

OUTLINE OF CONSTRUCTION

- The construction and operation of the B6 and BP engine cooling system are similar to those of previous Mazda MX-5 models but not the same. Following is the major difference between previous and new MX-5. (Refer to Mazda MX-5 Workshop Manual Supplement 1451-10-94L (Europe) or 1373-10-93I (Australia).)
- The specification of radiator, which carries out unity of the MT models and EC-AT models, has been adopted.

SPECIFICATIONS

Item			Engine	
			B6	BP
Cooling system			Water-cooled, forced circulation	
Coolant capacity		(L {US qt, Imp qt})	6.0 {6.3, 5.3}	
Water pump	Type		centrifugal, V-ribbed belt driven	
Thermostat	Type		Wax, bottom-bypass	
	Initial-opening temperature	(°C {°F })	83.5—88.0 {183—190}	
	Full-open temperature	(°C {°F })	100 {212}	
	Full-open lift	(mm {in})	8.5 {0.33} min.	
Radiator	Type		Corrugated fin	
	Cap valve opening pressure	(kPa {kgf/cm^2, psi})	94—122 {0.95—1.25, 13.5—17.7}	
Cooling fan	Type		Electrical	
	Blade	Outer diameter (mm {in})	320 {12.6}	
		Number	5	

▭ Indicates new specification

RADIATOR

- The radiator mounting method has been changed to reduce noise and vibration.

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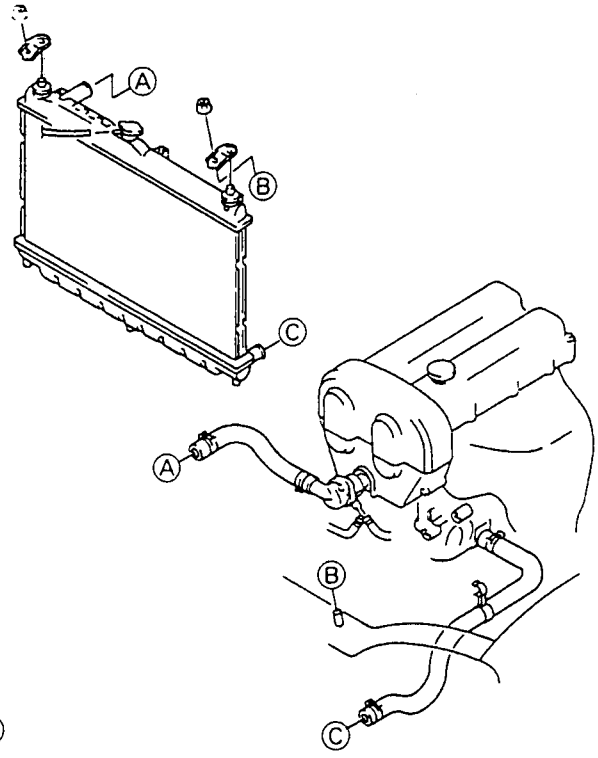

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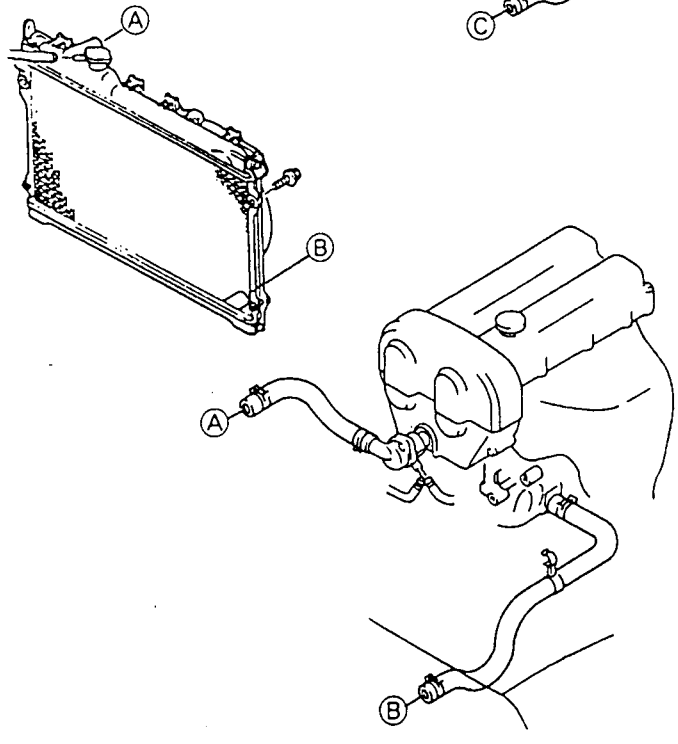


1	New model

2	Previous model

FUEL AND EMISSION CONTROL SYSTEMS

F

ABBREVIATIONS

A/C	Air conditioner	PCM	Powertrain control module
AT	Automatic transmission	PCV	Positive crankcase ventilation
DTC	Diagnostic trouble code	PID	Parameter identification
EGR	Exhaust gas recirculation	PRC	Pressure regulator control
IAC	Idle air control	R.H.D.	Right hand drive
L.H.D.	Left hand drive	TCM	Transmission control module
MT	Manual transmission	VICS	Variable inertia charging system

OUTLINE

OUTLINE OF CONSTRUCTION

- The following points have been changed compared with previous models.

Intake-air system

- The air valve has been eliminated to simplify the system.
- The dashpot has been eliminated to simplify the system.
- The variable inertia charging system (VICS) has been adopted to improve engine performance. (BP)

Fuel system

- The PRC solenoid valve has been adopted to improve startability. (B6)
- The quick release connectors and plastic fuel hoses have been adopted to improve serviceability.

Emission system

- The EGR valve has been changed from a duty type to a stepping motor type to obtain low level emission. (BP)
- The EGR system has been adopted to obtain low level emission. (B6)

Control system

- The mass air flow sensor has been changed from a hot wire type to a heat resistor type.
- The camshaft position sensor has been changed to improve system reliability.
- The crankshaft position sensor has been changed to improve system reliability.
- The knock sensor has been adopted to improve engine performance.
- The idle switch has been eliminated to simplify the system.

PRC

- The PRC has been adopted because of PRC solenoid valve adoption. (B6)

Heated oxygen sensor heater control

- The control of the heated oxygen sensor has been adopted to obtain low level emission.

EGR

- The control of the EGR has been adopted because of EGR vavle adoption. (B6)
- The control of the EGR has been changed because of EGR valve modification. (BP)

VICS

- The control of the VICS has been adopted to improve engine performance. (BP)

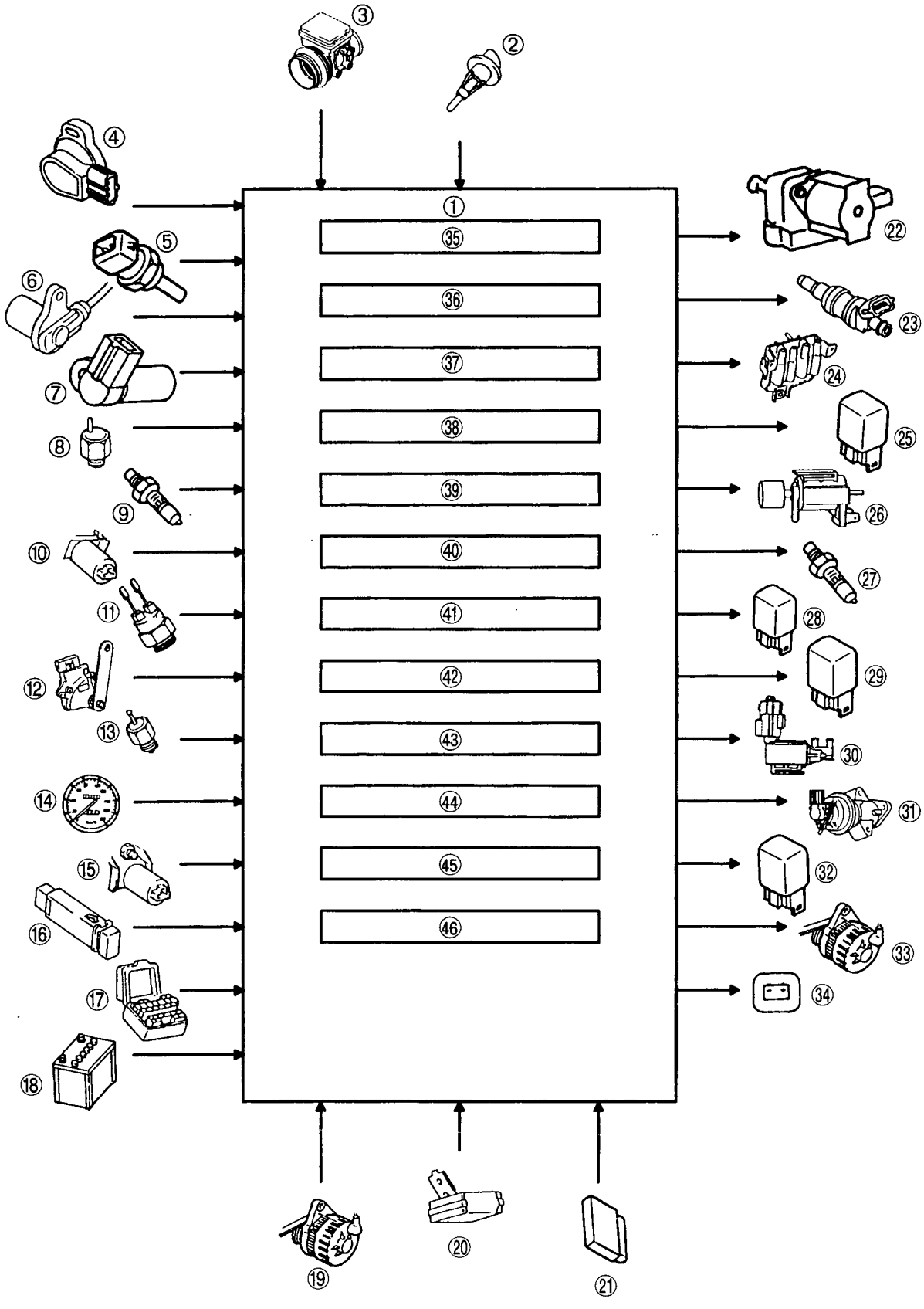
Generator control

- The generator control has been adopted to improve idle stability.

SPECIFICATION

Item			Engine	
			B6	BP
Air cleaner element		Type	Paper element (wet type)	
Idle air control		Type	Duty control	
Supercharger		Type	-	
Injector		Type	Hi-ohmic	
		Type of fuel deliverly	Top-feed	
		Type of drive	Voltage	
Pressure regulator	Regulating pressure (kPa {kgf/cm^2, psi})		210—250 {2.1—2.6, 30—36}	
Fuel pump	Type		Impeller (in-tank)	
Fuel tank	Capacity (L {US qt, Imp qt})		Europe, General (L.H.D.): 50 {53, 44} Australia, General (R.H.D.): 48 {51, 42}	
Fuel	Specification		Europe, General (L.H.D.): Unleaded (RON 95 or higher) Australia, General (R.H.D.): Unleaded (RON 90 or higher)	
EGR control	Type		Stepping motor type	
Catalyst	Type		Three way catalytic converter (monolithic)	
Evaporative emission control system	Type		Canister type	
Positive crankcase ventilation system	Type		Closed type	

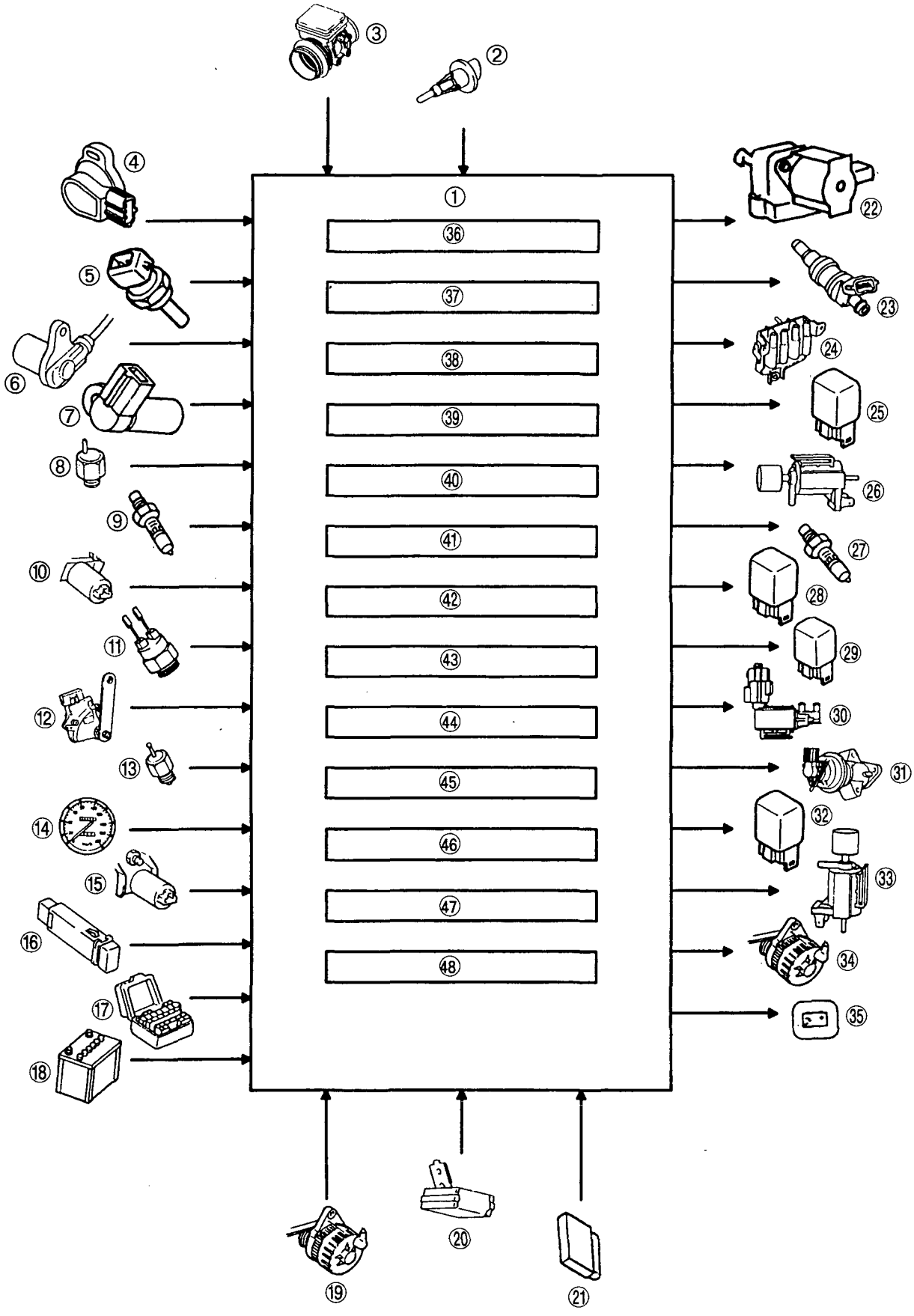
BLOCK DIAGRAM
B6



F

1	PCM
2	Intake air temperature sensor
3	Mass air flow sensor
4	Throttle position sensor
5	Engine coolant temperature sensor
6	Crankshaft position sensor
7	Camshaft position sensor
8	Knock sensor
9	Heated oxygen sensor
10	Clutch switch (MT)
11	Neutral switch (MT)
12	Transmission range switch (AT)
13	Power steering pressure switch
14	Vehicle speed sensor
15	Brake switch
16	Refrigerant pressure switch (A/C equipped model)
17	Data link connector
18	Battery
19	Generator (terminal P; output voltage)
20	Immobilizer unit (with immobilizer system)
21	TCM (AT)
22	IAC valve
23	Fuel injectors

24	Ignition coil
25	Fuel pump relay
26	PRC solenoid valve
27	Heated oxygen sensor heater
28	Cooling fan relay
29	Condenser fan relay
30	Purge solenoid valve
31	EGR valve
32	A/C relay
33	Generator (terminal D: field coil)
34	Generator warning light
35	IAC
36	Fuel injection control
37	Electrical spark control
38	Fuel pump control
39	Pressure regulator control
40	Heated oxygen sensor heater control
41	Electrical fan control
42	Purge control
43	EGR
44	A/C cut-off control
45	Generator control
46	Immobilizer system (if equipped)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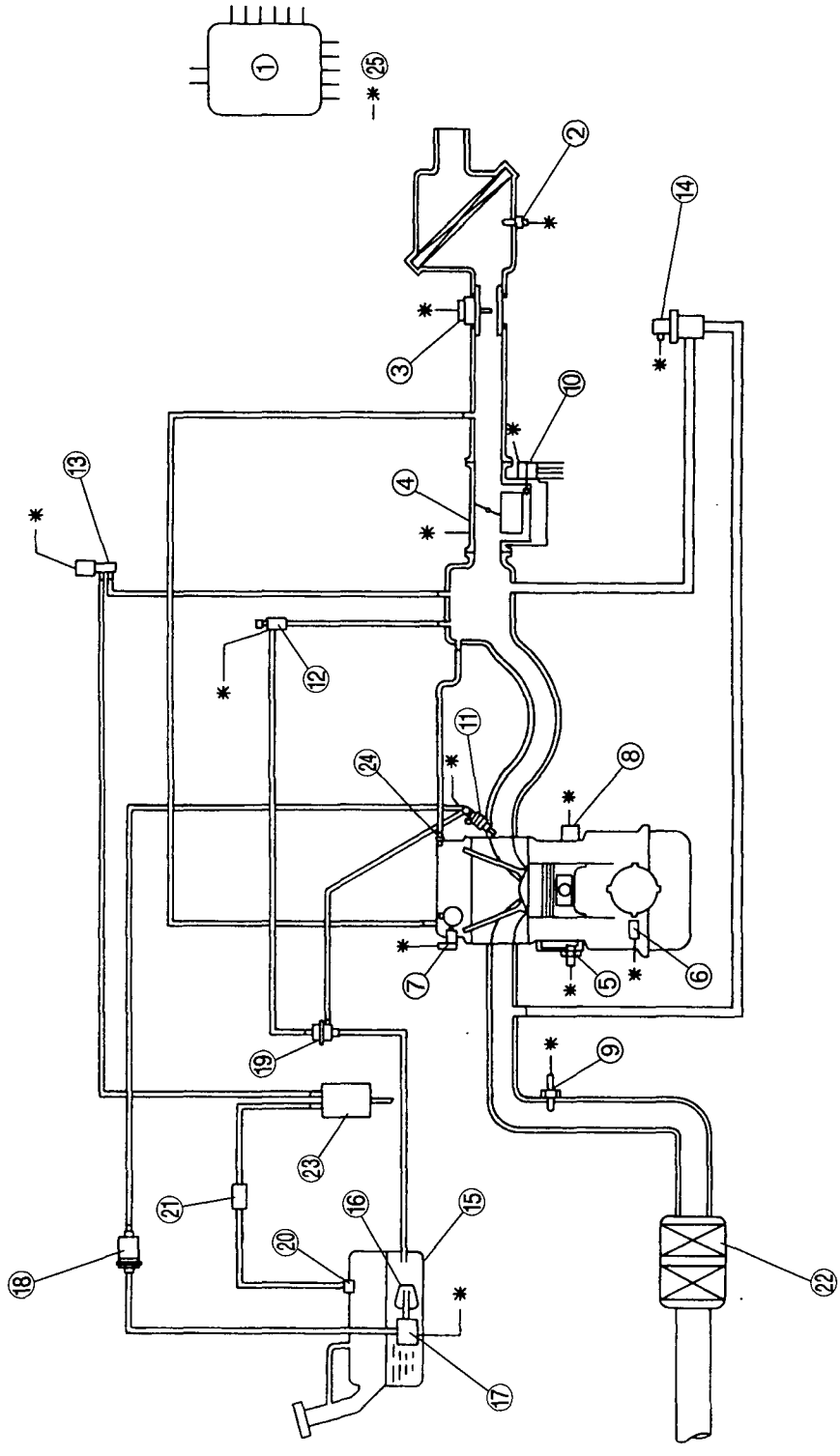
1	PCM
2	Intake air temperature sensor
3	Mass air flow sensor
4	Throttle position sensor
5	Engine coolant temperature sensor
6	Crankshaft position sensor
7	Camshaft position sensor
8	Knock sensor
9	Heated oxygen sensor
10	Clutch switch (MT vehicle)
11	Neutral switch (MT vehicle)
12	Transmission range switch (AT vehicle)
13	Power steering pressure switch
14	Vehicle speed sensor
15	Brake switch
16	Refrigerant pressure switch (A/C equipped model)
17	Data link connector
18	Battery
19	Generator (terminal P; output voltage)
20	Immobilizer unit (with immobilizer system)
21	TCM (AT vehicle)
22	IAC valve
23	Fuel injectors
24	Ignition coil

25	Fuel pump relay
26	PRC solenoid valve
27	Heated oxygen sensor heater
28	Cooling fan relay
29	Condenser fan relay
30	Purge solenoid valve
31	EGR valve
32	A/C relay
33	VICS solenoid valve
34	Generator (terminal D: field coil)
35	Generator warning light
36	IAC
37	Fuel injection control
38	Electrical spark control
39	Fuel pump control
40	Pressure regulator control
41	Heated oxygen sensor heater control
42	Electrical fan control
43	Purge control
44	EGR
45	A/C cut-off control
46	VICS
47	Generator control
48	Immobilizer system (if equipped)

CONTROL SYSTEM DIAGRAM
B6

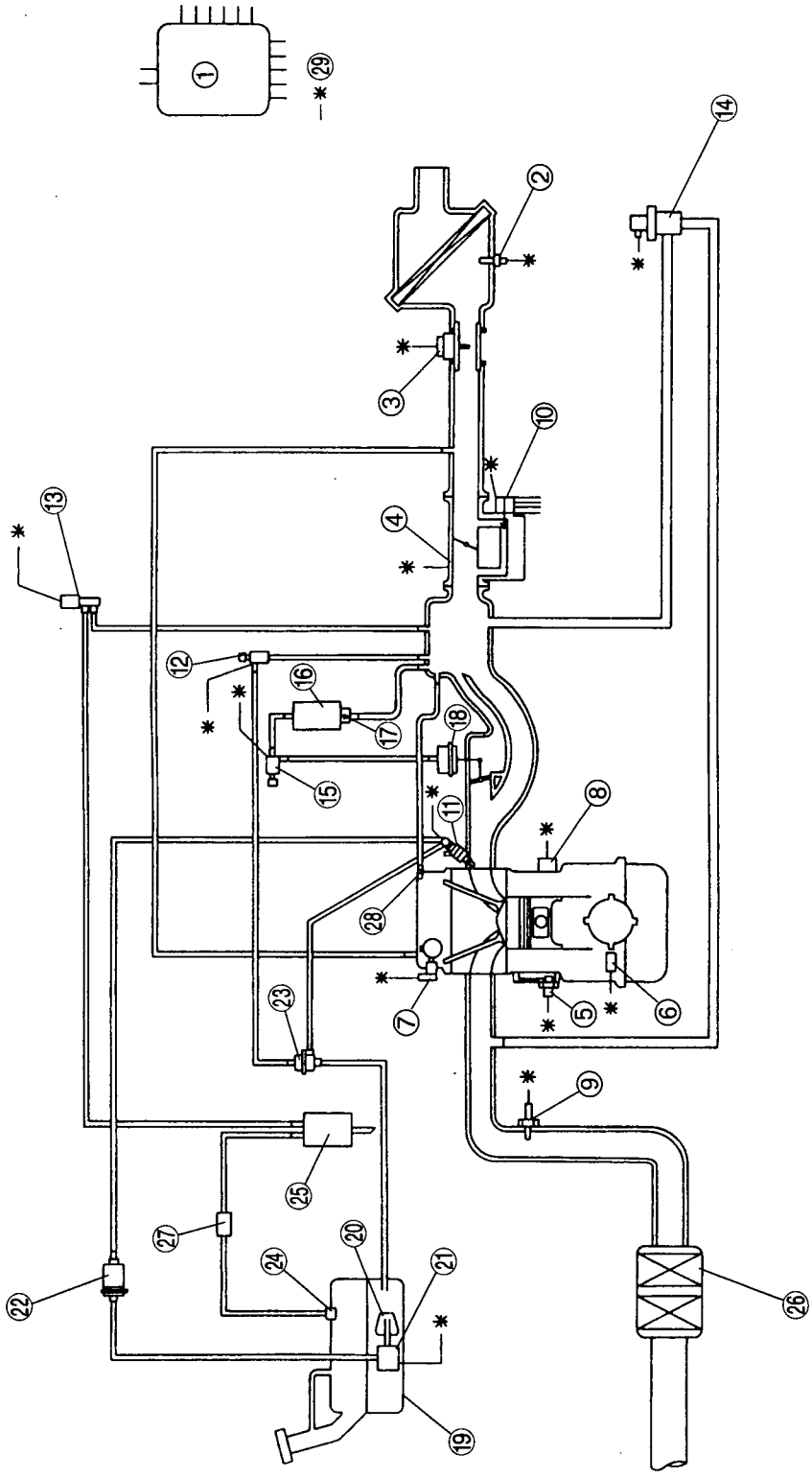


1	PCM
2	Intake air temperature sensor
3	Mass air flow sensor
4	Throttle position sensor
5	Engine coolant temperature sensor
6	Crankshaft position sensor
7	Camshaft position sensor
8	Knock sensor
9	Heated oxygen sensor (integrated with heated oxygen sensor heater)
10	IAC valve
11	Fuel injectors
12	PRC solenoid valve

13	Purge solenoid valve
14	EGR valve
15	Fuel tank
16	Fuel filter (low-pressure)
17	Fuel pump
18	Fuel filter (high-pressure)
19	Pressure regulator
20	Rollover valve
21	Evaporative gas check valve (two-way)
22	Three way catalytic converter
23	Charcoal canister
24	PCV valve
25	To PCM

BP

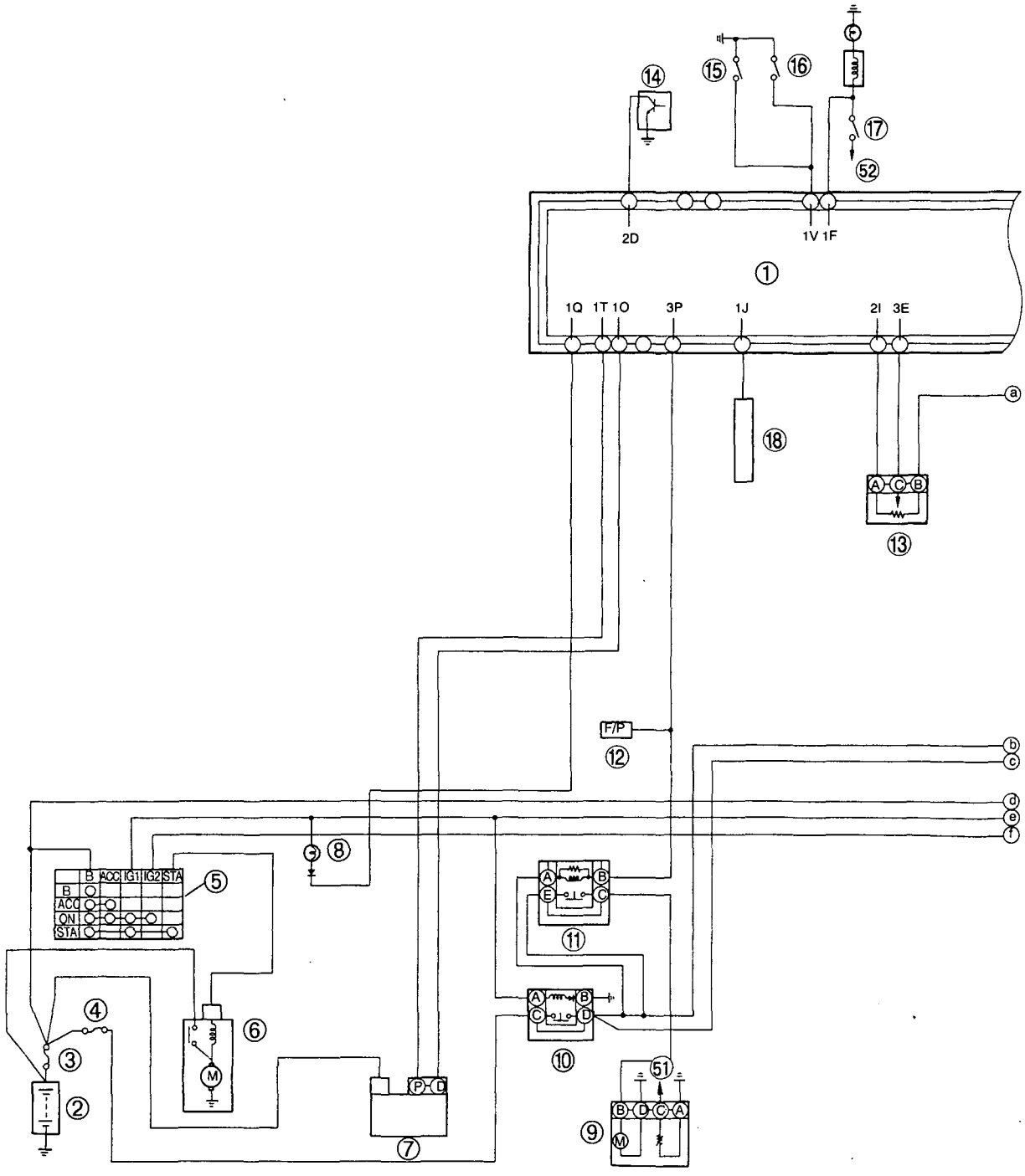
F

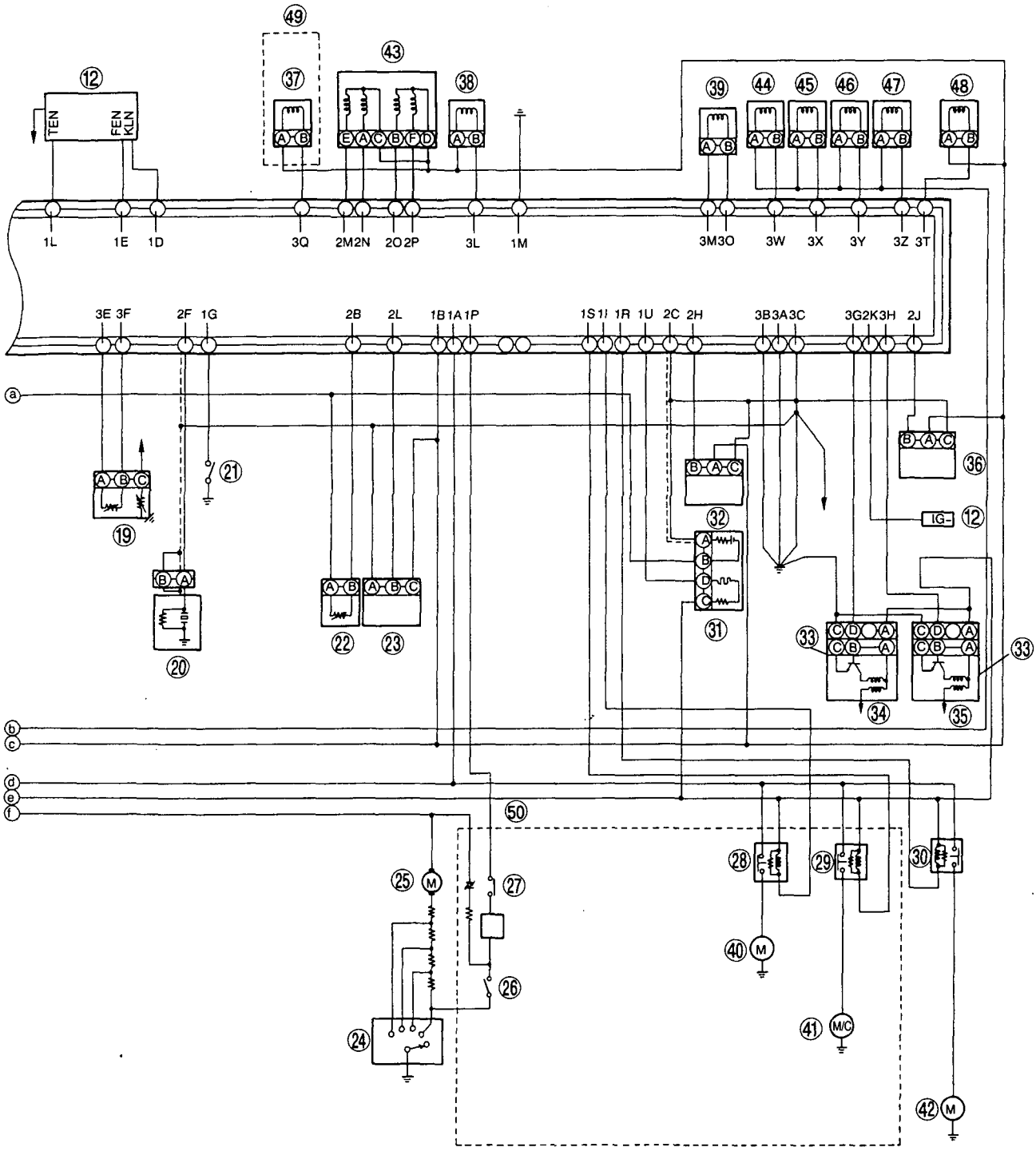


1	PCM
2	Intake air temperature sensor
3	Mass air flow sensor
4	Throttle position sensor
5	Engine coolant temperature sensor
6	Crankshaft position sensor
7	Camshaft position sensor
8	Knock sensor
9	Heated oxygen sensor (integrated with heated oxygen sensor heater)
10	IAC valve
11	Fuel injectors
12	PRC solenoid valve
13	Purge solenoid valve
14	EGR valve

15	VICS solenoid valve
16	VICS vacuum chamber
17	VICS check valve (one-way)
18	VICS actuator
19	Fuel tank
20	Fuel filter (low-pressure side)
21	Fuel pump
22	Fuel filter (high-pressure side)
23	Pressure regulator
24	Rollover valve
25	Charcoal canister
26	Three way catalytic converter
27	Evaporative gas check valve (two-way)
28	PCV valve
29	To PCM

CONTROL SYSTEM WIRING DIAGRAM
Europe, General (L.H.D.)
B6, BP
With immobilizer system

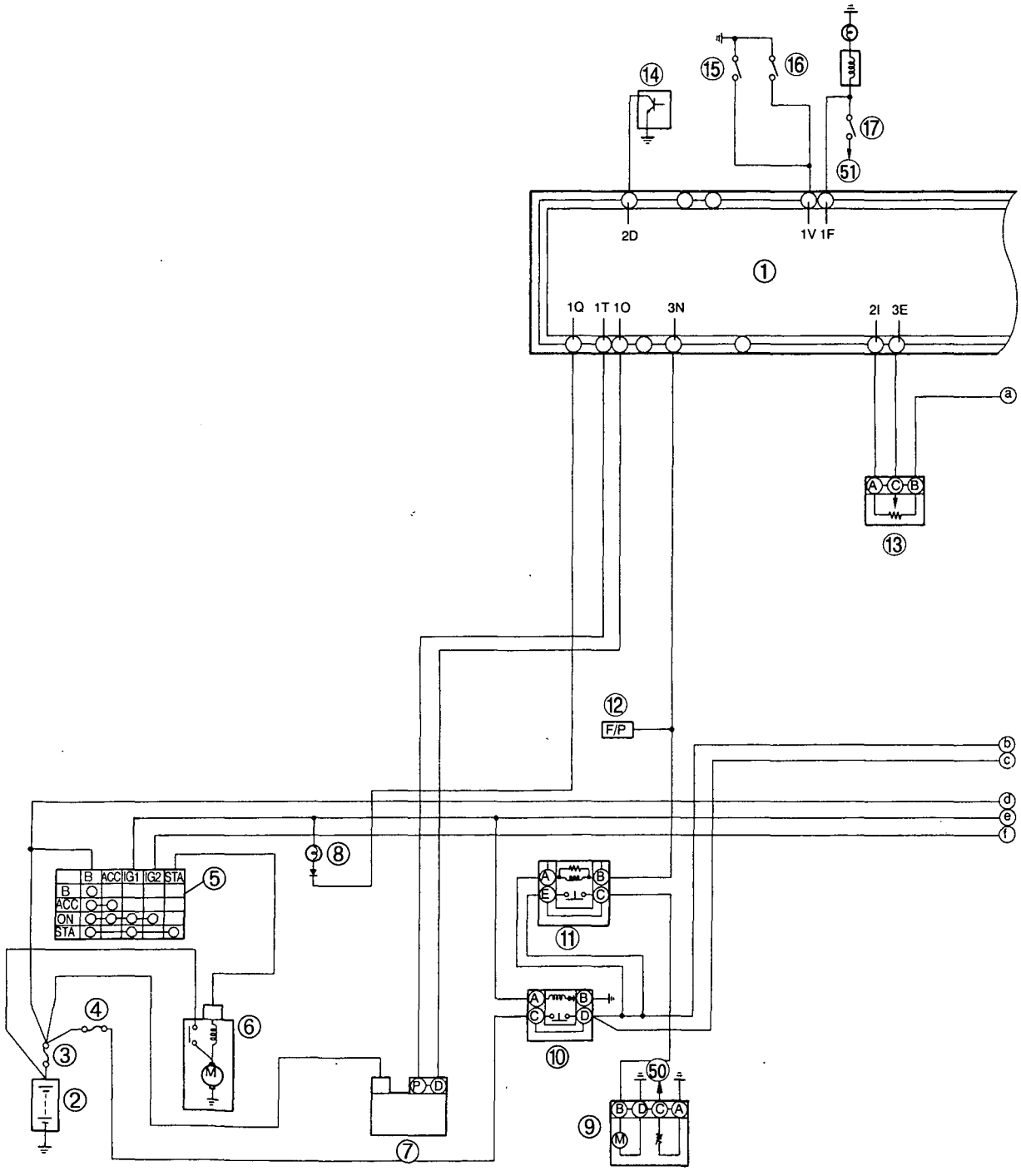


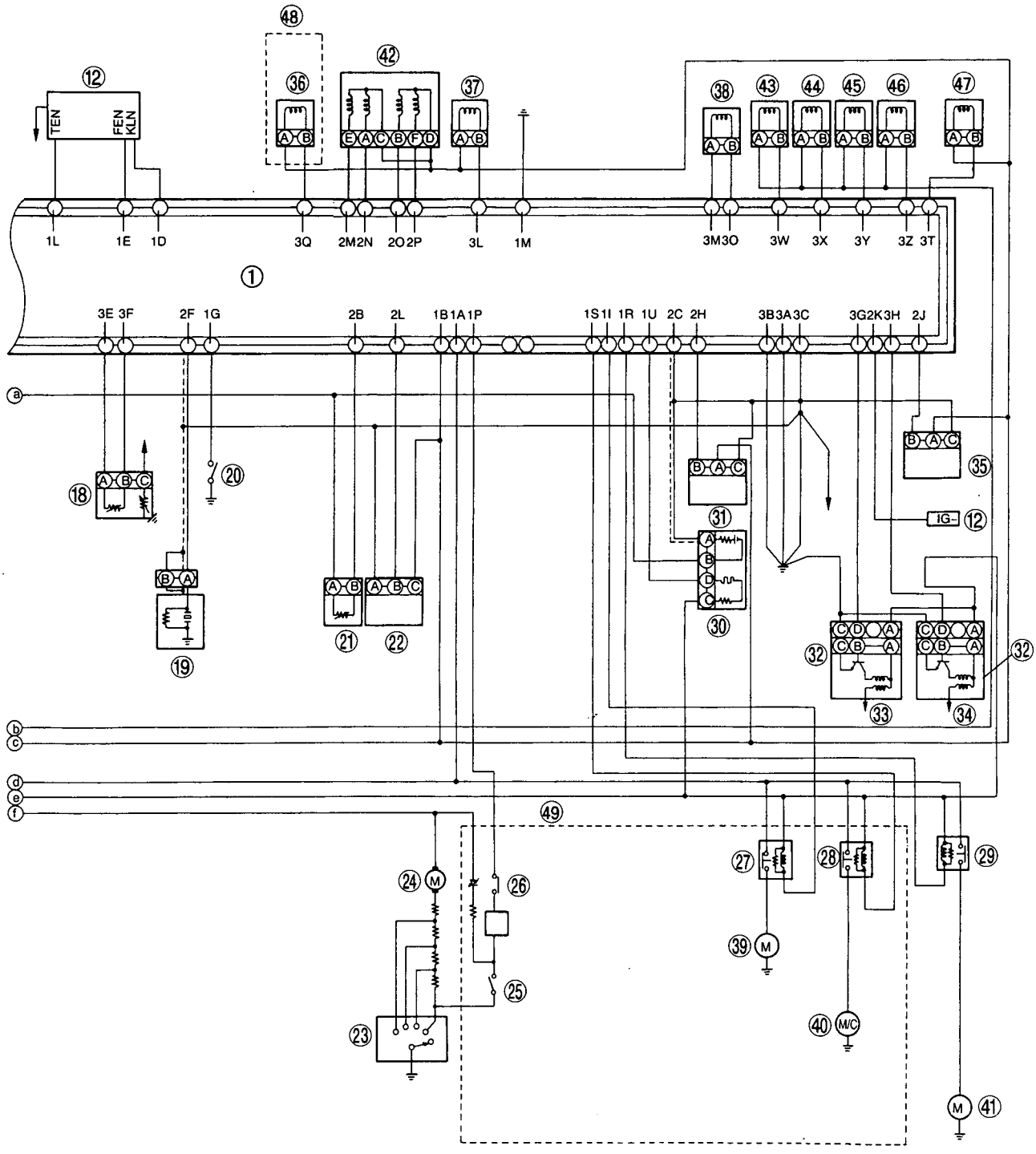

TEN
FEN
KLN
1L 1E 1D 3Q 2M 2N 2O 2P 3L 1M 3M 3O 3W 3X 3Y 3Z 3T
3E 3F 2F 1G 2B 2L 1B 1A 1P 1S 1J 1R 1U 2C 2H 3B 3A 3C 3G 2K 3H 2J
IG-

1	PCM
2	Battery
3	MAIN fuse
4	EGI fuse
5	Ignition switch
6	Starter
7	Generator
8	Generator warning light
9	Fuel pump
10	Main relay
11	Fuel pump relay
12	Data link connector
13	Throttle position sensor
14	Vehicle speed sensor
15	Clutch switch
16	Neutral switch
17	Brake switch
18	Immobilizer unit
19	Engine coolant temperature sensor
20	Knock sensor
21	Power steering pressure switch
22	Intake air temperature sensor
23	Mass air flow sensor
24	Fan switch
25	Blower motor
26	Refrigerant pressure switch

27	A/C pressure switch
28	Condenser fan relay
29	A/C relay
30	Cooling fan relay
31	Heated oxygen sensor
32	Camshaft position sensor
33	Ignition coil
34	Spark plugs No.1, No.4
35	Spark plugs No.2, No.3
36	Crankshaft position sensor
37	VICS solenoid valve
38	Purge solenoid valve
39	IAC valve
40	Condenser fan
41	A/C compressor
42	Cooling fan
43	EGR vavle
44	Fuel injector No.1
45	Fuel injector No.2
46	Fuel injector No.3
47	Fuel injector No.4
48	PRC solenoid valve
49	BP
50	A/C equipped model only
51	To instrument cluster
52	To battery

Without immobilizer system




⑫
TEN
FEN
KLN
⑱
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㉑
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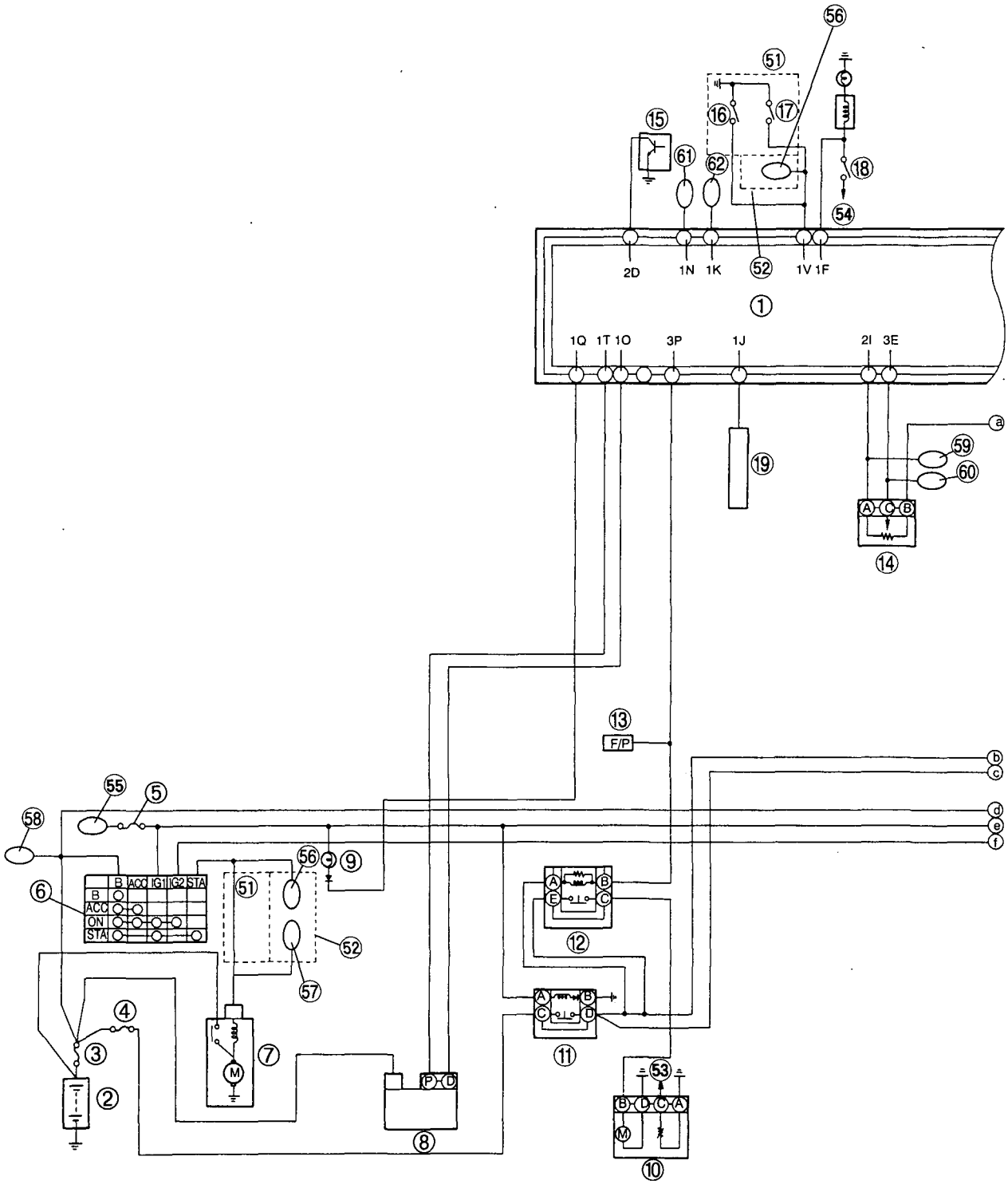
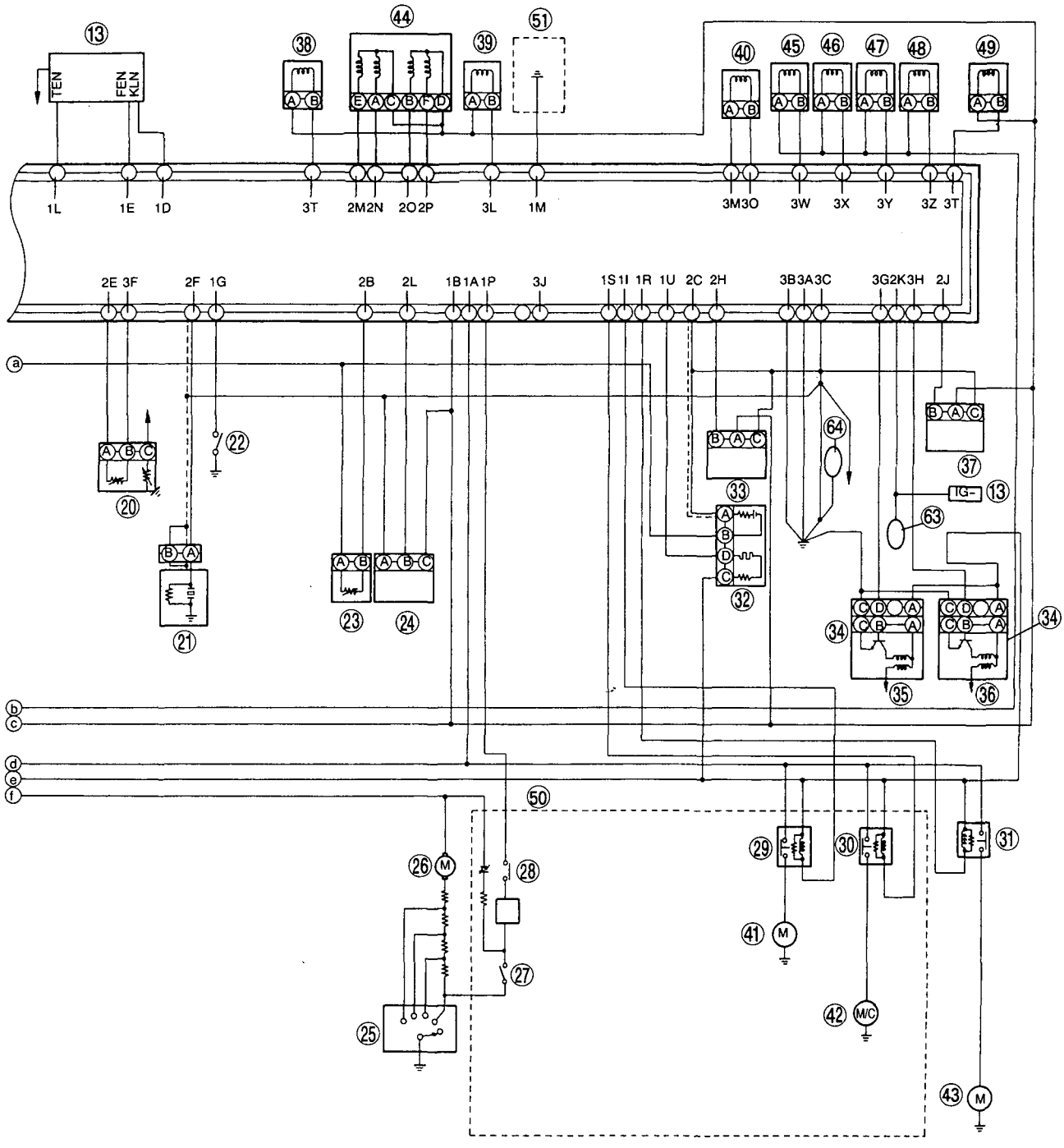
㉞
㉟
IG-
⑫
㉙
㉗
㉘
㉙
㊴
㊵
M/C
㊶
㉔
㉖
㉕
㉓
㊾
1L 1E 1D 3Q 2M 2N 2O 2P 3L 1M 3M 3O 3W 3X 3Y 3Z 3T
3E 3F 2F 1G 2B 2L 1B 1A 1P 1S 1I 1R 1U 2C 2H 3B 3A 3C 3G 2K 3H 2J

1	PCM
2	Battery
3	MAIN fuse
4	EGI fuse
5	Ignition switch
6	Starter
7	Generator
8	Generator warning light
9	Fuel pump
10	Main relay
11	Fuel pump relay
12	Data link connector
13	Throttle position sensor
14	Vehicle speed sensor
15	Clutch switch
16	Neutral switch
17	Brake switch
18	Engine coolant temperature sensor
19	Knock sensor
20	Power steering pressure switch
21	Intake air temperature sensor
22	Mass air flow sensor
23	Fan switch
24	Blower motor
25	Refrigerant pressure switch
26	A/C pressure switch

27	Condenser fan relay
28	A/C relay
29	Cooling fan relay
30	Heated oxygen sensor
31	Camshaft position sensor
32	Ignition coil
33	Spark plugs No.1, No.4
34	Spark plugs No.2, No.3
35	Crankshaft position sensor
36	VICS solenoid valve
37	Purge solenoid valve
38	IAC valve
39	Condenser fan
40	A/C compressor
41	Cooling fan
42	EGR vavle
43	Fuel injector No.1
44	Fuel injector No.2
45	Fuel injector No.3
46	Fuel injector No.4
47	PRC solenoid valve
48	BP
49	A/C equipped model only
50	To instrument cluster
51	To battery

Australia, General (R.H.D.)
BP




TEN
FEN
KLN
1L 1E 1D 3T 2M 2N 2O 2P 3L 1M 3M 3O 3W 3X 3Y 3Z 3T
2E 3F 2F 1G 2B 2L 1B 1A 1P 3J 1S 1I 1R 1U 2C 2H 3B 3A 3C 3G 2K 3H 2J
IG-
M
M/C

1	PCM
2	Battery
3	MAIN fuse
4	EGI fuse
5	METER fuse
6	Ignition switch
7	Starter
8	Generator
9	Generator warning light
10	Fuel pump
11	Main relay
12	Fuel pump relay
13	Data link connector
14	Throttle position sensor
15	Vehicle speed sensor
16	Clutch switch
17	Neutral switch
18	Brake switch
19	Immobilizer unit
20	Engine coolant temperature sensor
21	Knock sensor
22	Power steering pressure switch
23	Intake air temperature sensor
24	Mass air flow sensor
25	Fan switch
26	Blower motor
27	Refrigerant pressure switch
28	A/C pressure switch
29	Condenser fan relay
30	A/C relay
31	Cooling fan relay
32	Heated oxygen sensor

33	Camshaft position sensor
34	Ignition coil
35	Spark plugs No.1, No.4
36	Spark plugs No.2, No.3
37	Crankshaft position sensor
38	VICS solenoid valve
39	Purge solenoid valve
40	IAC valve
41	Condenser fan
42	A/C compressor
43	Cooling fan
44	EGR valve
45	Fuel injector No.1
46	Fuel injector No.2
47	Fuel injector No.3
48	Fuel injector No.4
49	PRC solenoid valve
50	A/C equipped model only
51	MT vehicle
52	AT vehicle
53	To instrument cluster
54	To battery
55	To transmission range switch terminal I
56	To transmission range switch terminal D
57	To transmission range switch terminal C
58	To TCM terminal AR
59	To TCM terminal R
60	To TCM terminal U
61	To TCM terminal O
62	To TCM terminal AL
63	To TCM terminal AG
64	To TCM terminal AP

CONTROL SYSTEM DEVICE AND CONTROL RELATIONSHIP CHART

○: Applied

	Component	Idle air control (IAC) system	Fuel injection control	Electrical spark control	Fuel pump control	Pressure regulator control	Heated oxygen sensor heater control	Electrical fan control	Purge control	Exhaust gas recirculation (EGR)	A/C cut-off control	Variable inertia charging system (VICS)	Generator control	Immobilizer system
Input	Intake air temperature sensor	○	○	○		○			○				○	
	Mass air flow sensor	○	○	○			○		○	○				
	Throttle position sensor	○	○	○		○		○	○	○	○			
	Engine coolant temperature sensor	○	○	○		○		○	○	○	○			
	Crankshaft position sensor (NE signal)	○	○	○	○	○	○	○	○	○	○	○	○	
	Camshaft position sensor (SGC signal)		○	○										
	Knock sensor			○										
	Heated oxygen sensor		○						○					
	Clutch switch (MT vehicle)	○	○	○		○								
	Neutral switch (MT vehicle)	○	○	○		○								
	Transmission range switch (AT vehicle)	○	○	○		○								
	Power steering pressure switch	○	○	○										
	Vehicle speed sensor	○								○				
	Brake switch		○											
	Refrigerant pressure switch (A/C equipped)	○	○	○				○			○			
	Data link connector (TEN terminal)	○		○		○		○						
	Battery		○						○				○	
	Generator (terminal P: output voltage)	○											○	
	Immobilizer unit (Immobilizer equipped)		○	○										○
	TCM (Reduce torque signal) (AT)	○	○	○										
Output	IAC valve	○												
	Fuel injectors		○											○
	Ignition coil			○										○
	Fuel pump relay				○									
	PRC solenoid valve					○								
	Heated oxygen sensor heater						○							
	Cooling fan relay							○						
	Condenser fan relay (A/C equipped)							○						
	Purge solenoid valve								○					
	EGR valve									○				
	A/C relay (A/C equipped)							○			○			
	VICS solenoid valve (BP)											○		
	Generator (terminal D: field coil)												○	
	Generator warning light												○	
	TCM (Torque reduce signal) (AT)		○	○										

INTAKE-AIR SYSTEM

OUTLINE

The intake-air system of the new MX-5 is basically the same as that of previous model.
A comparison of major parts for the new MX-5 and previous model is as follows:

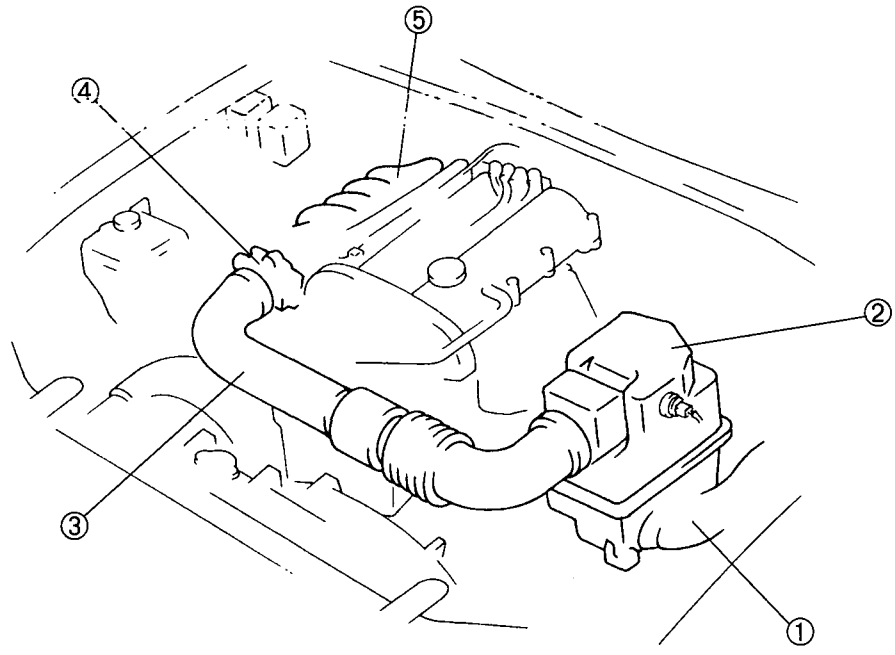
○: Applied
×: Not applied

Item	B6		BP			
	New model	Previous model	New model		Previous model	
	Europe, General (L.H.D.)		Europe, General (L.H.D.)	Australia, General (R.H.D.)	Europe, General (L.H.D.)	Australia, General (R.H.D.)
Air cleaner capacity (cc)	6000	3900	6000		4600	
VICS	×		○		×	
Resonance chamber	○		○	×	○	
Dashpot	×	○	×			
Air valve	×	○	×			
IAC valve	○*1		○*2			
BAC valve	×		×		○	

*1 Because of the elimination of the dashpot and air valve, the performance of the IAC valve has been improved to cover their functions. The maximum airflow rate of the IAC valve is twice as much as the previous MX-5.
*2 Because of the elimination of the air valve, which had been integrated into the BAC valve with the IAC valve, the IAC valve has been improved in performance to cover its function. The maximum airflow rate of the IAC valve is twice as much as the previous MX-5.

INTAKE-AIR SYSTEM STRUCTURAL VIEW

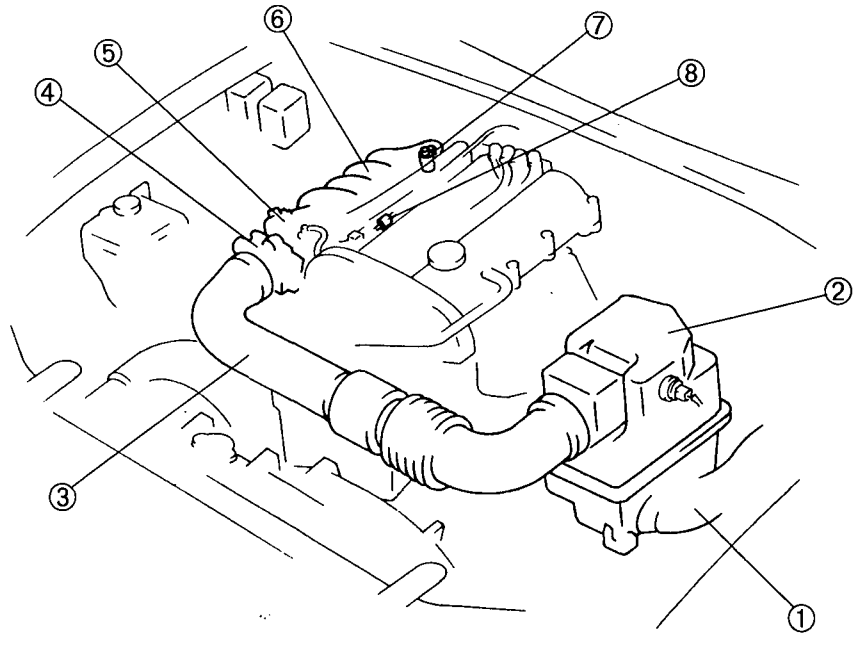
B6



1	Fresh-air duct
2	Air cleaner
3	Air hose

4	Throttle body
5	Intake manifold (integrated with dynamic chamber)

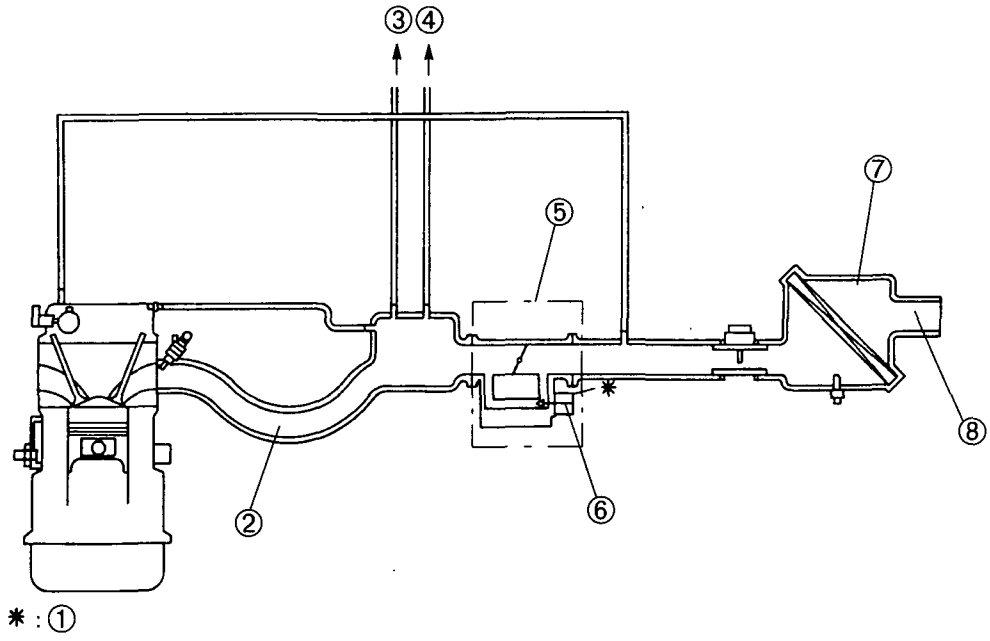
BP



1	Fresh-air duct
2	Air cleaner
3	Air hose
4	Throttle body
5	VICS shutter valve actuator

6	Intake manifold (separated from dynamic chamber)
7	VICS solenoid valve
8	VICS check valve (one-way)

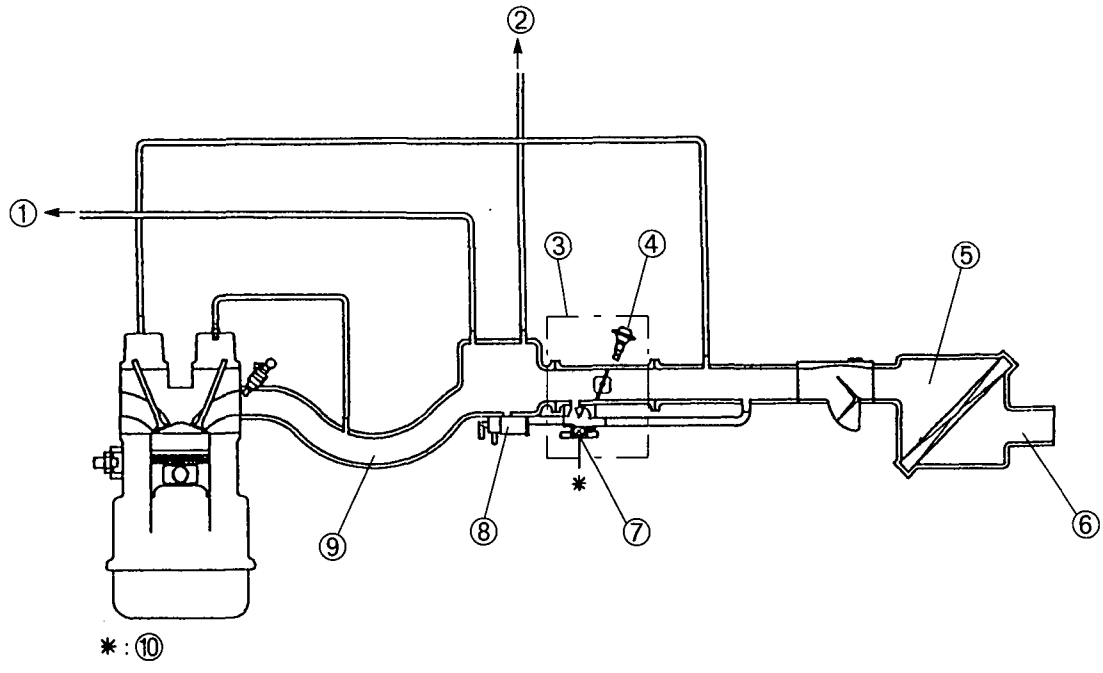
SYSTEM DIAGRAM
B6
NEW MODEL



1	To PCM
2	Intake manifold
3	To PRC solenoid valve
4	To purge solenoid valve

5	Throttle body
6	IAC valve
7	Air cleaner
8	Fresh-air duct

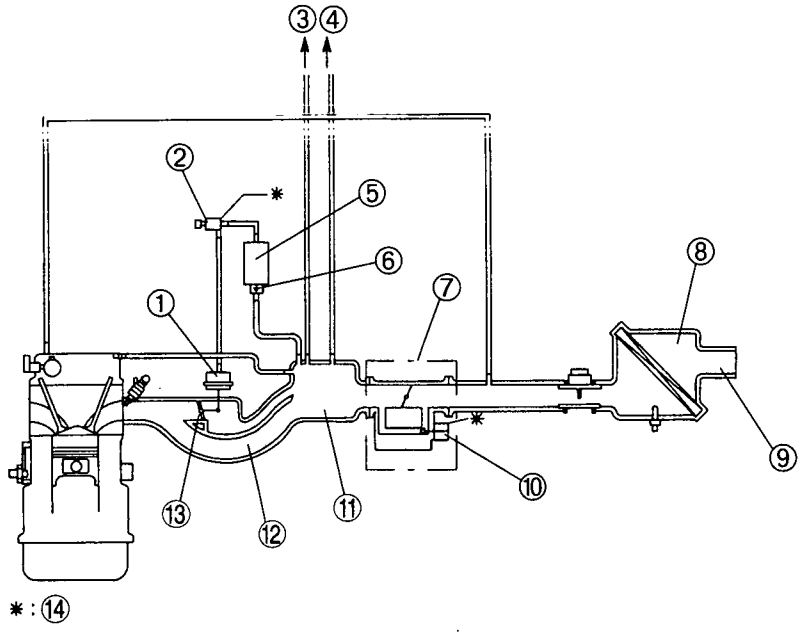
PREVIOUS MODEL



1	To pressure regulator
2	To purge solenoid valve
3	Throttle body
4	Dashpot
5	Air cleaner

6	Fresh-air duct
7	IAC valve
8	Air valve
9	Intake manifold
10	To PCM

BP
NEW MODEL

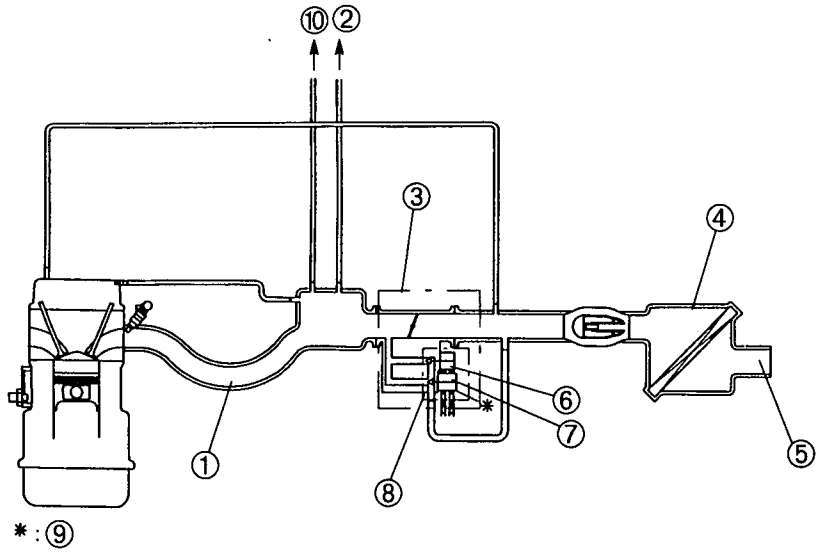


✱ : ⑭

1	VICS shutter valve actuator
2	VICS solenoid valve
3	To PRC solenoid valve
4	To purge solenoid valve
5	VICS vacuum chamber (built in intake manifold)
6	VICS check valve (one-way)
7	Throttle body

8	Air cleaner
9	Fresh-air duct
10	IAC valve
11	Dynamic chamber
12	Intake manifold
13	VICS shutter valve
14	To PCM

PREVIOUS MODEL



✱ : ⑨

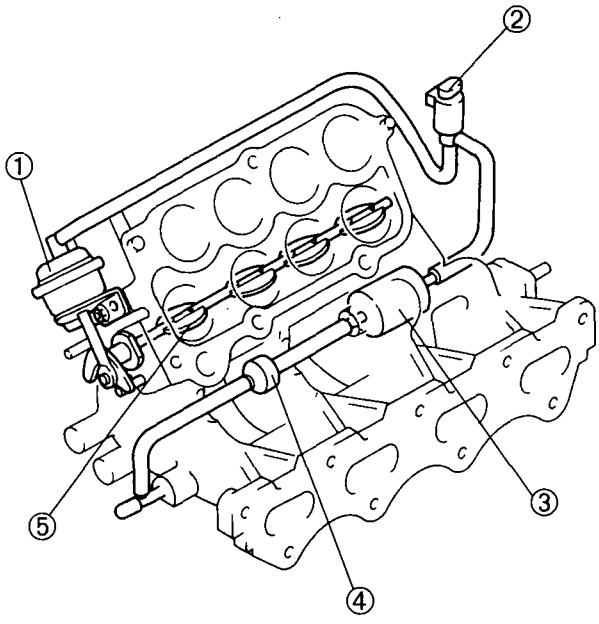
1	Intake manifold
2	To purge solenoid valve
3	Throttle body
4	Air cleaner
5	Fresh-air duct
6	(Air valve)
7	(IAC valve)

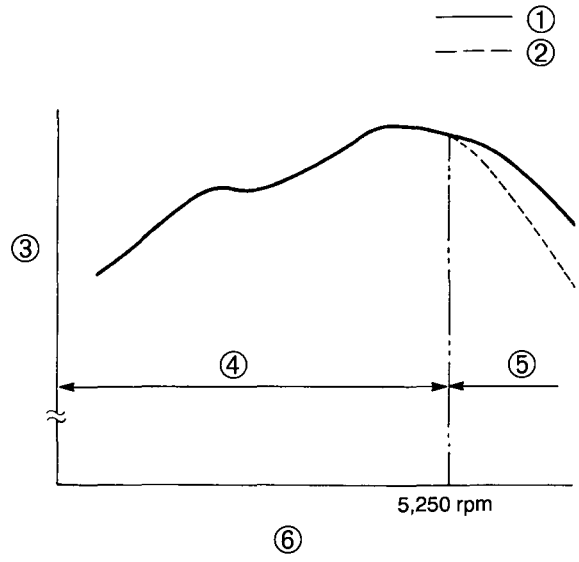
8	BAC valve
9	To PCM
10	• To pressure regulator (MT vehicle for Australia, General (R.H.D.)) • To PRC solenoid valve (Except MT vehicle for Australia, General (R.H.D.))

VARIABLE INERTIA CHARGING SYSTEM (VICS) [BP]

Outline

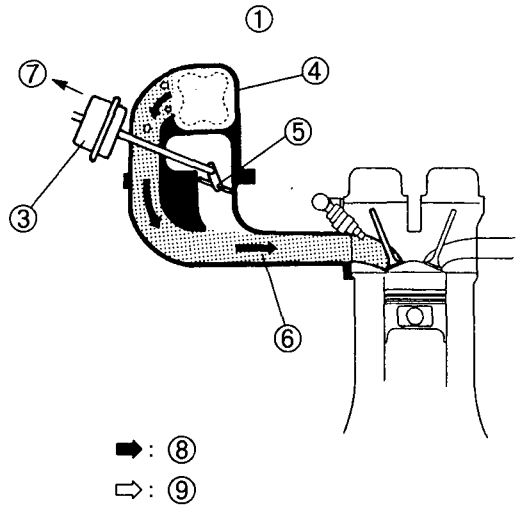
- The VICS has been adopted to improve the engine torque at high engine speed.

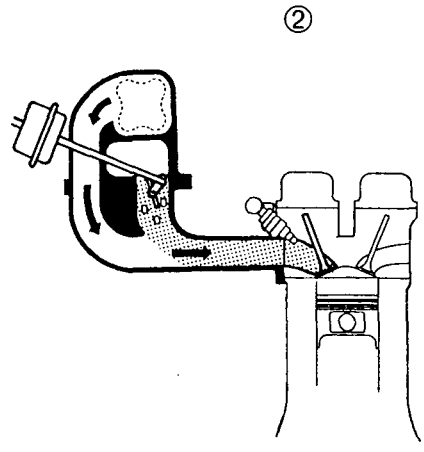




1	VICS shutter valve actuator
2	VICS solenoid valve
3	VICS vacuum chamber
4	VICS check valve (one-way)
5	VICS shutter valve

1	With the VICS
2	Without the VICS
3	Engine torque
4	VICS shutter valve closed
5	VICS shutter valve open
6	Engine speed





1	**VICS shutter valve closed Below 5,250 rpm**
2	**VICS shutter valve open Above 5,250 rpm**
3	VICS shutter valve actuator
4	Dynamic chamber

5	VICS shutter valve
6	Intake manifold
7	Intake manifold negative pressure
8	Airflow
9	Reflection of pressure waves

FUEL SYSTEM

OUTLINE

- The fuel system of the new MX-5 is basically the same as that of previous model. A comparison of major parts for the new MX-5 and previous model is as follows:

○ : Applied
× : Not applied

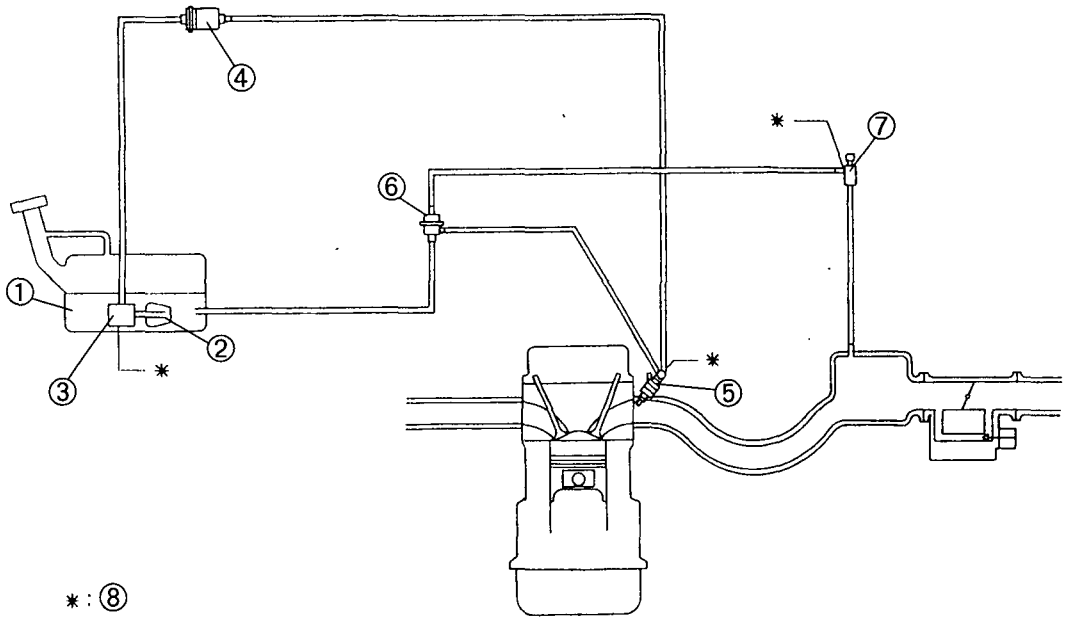
Item	B6		BP		
	New model	Previous model	New model	Previous model	
	Europe, General (L.H.D.)		Europe, General (L.H.D.), Australia, General (R.H.D.)	Europe, General (L.H.D.)	Australia, General (R.H.D.)
Fuel tank	○		○		
Fuel pump	○		○		
Fuel filter (high-pressure)	○		○		
Fuel injector	○		○		
Pressure regulator	○		○		
PRC solenoid valve	○	×	○	○	○ (AT)
Quick release connector and plastic fuel hose *1	○	×	○	×	

*1: The quick release connectors and plastic fuel hoses have been adopted around the fuel tank, fuel pump, and fuel filter (high-pressure).

SYSTEM DIAGRAM

B6

NEW MODEL

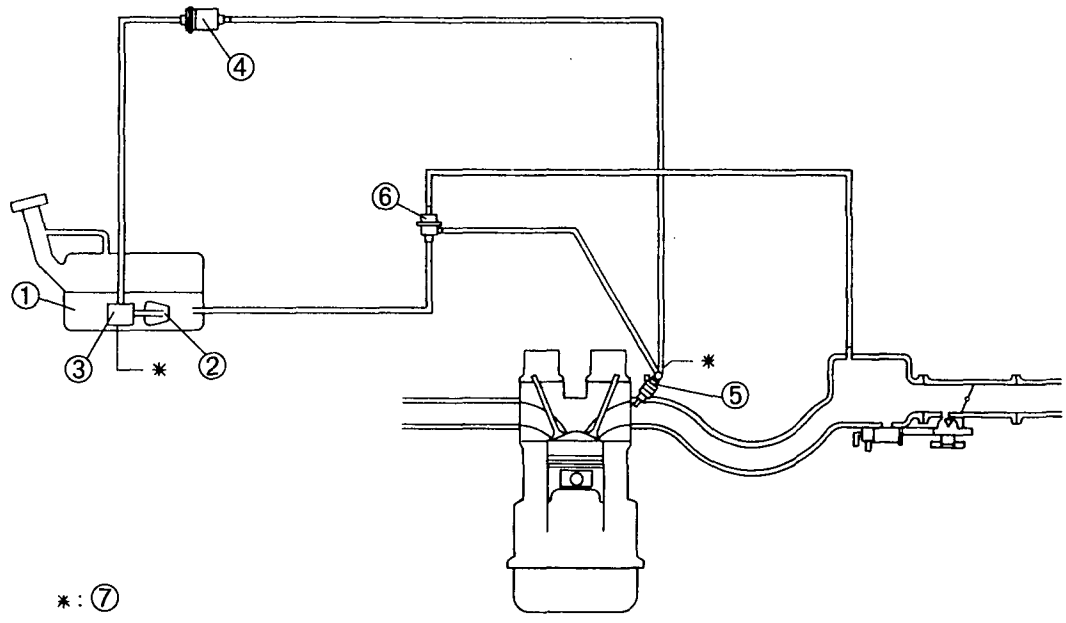


✱ : ⑧

1	Fuel tank
2	Fuel filter (low-pressure)
3	Fuel pump
4	Fuel filter (high-pressure)

5	Fuel injector
6	Pressure regulator
7	PRC solenoid valve
8	To PCM

PREVIOUS MODEL

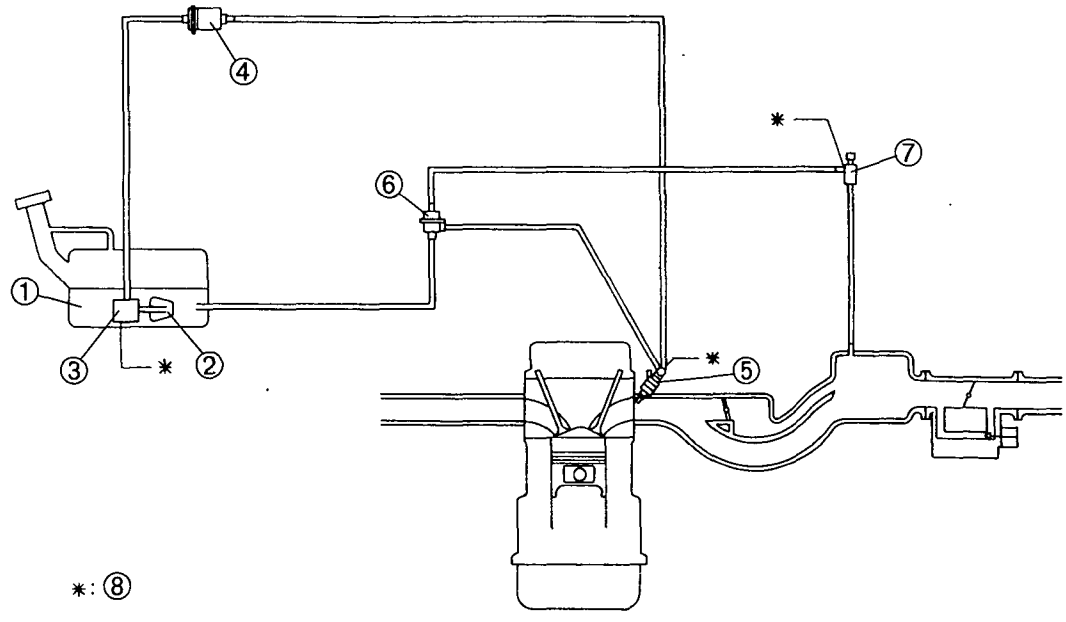


✱: ⑦

1	Fuel tank
2	Fuel filter (low-pressure)
3	Fuel pump
4	Fuel filter (high-pressure)

5	Fuel injector
6	Pressure regulator
7	To PCM

BP
NEW MODEL

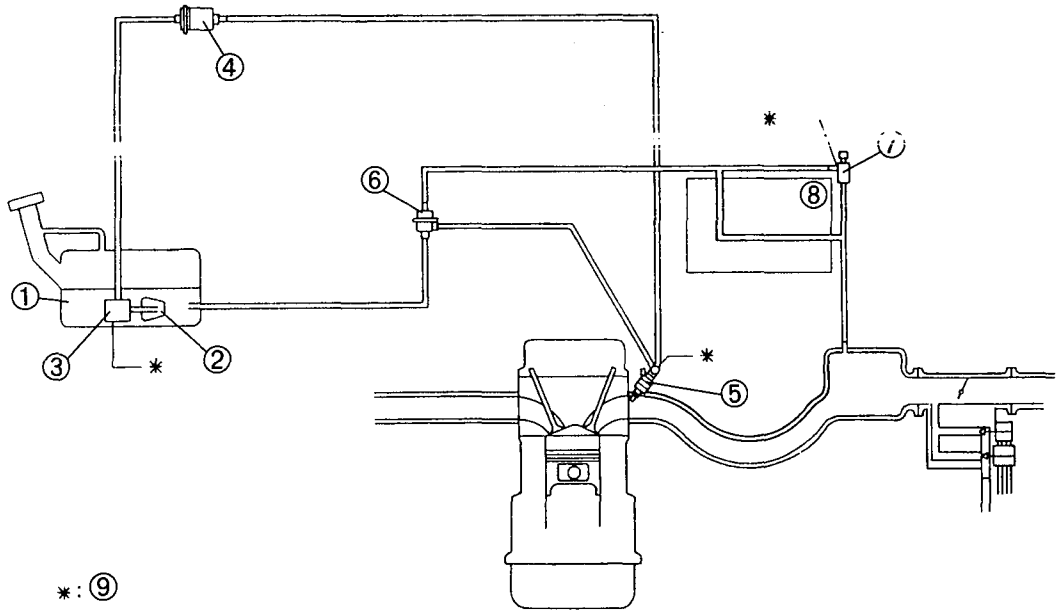


✱: ⑧

1	Fuel tank
2	Fuel filter (low-pressure)
3	Fuel pump
4	Fuel filter (high-pressure)

5	Fuel injector
6	Pressure regulator
7	PRC solenoid valve
8	To PCM

PREVIOUS MODEL



1	Fuel tank
2	Fuel filter (low-pressure)
3	Fuel pump
4	Fuel filter (high-pressure)
5	Fuel injector

6	Pressure regulator
7	PRC solenoid valve Except MT vehicle for Australia, General (R.H.D.)
8	Applied to MT vehicle for Australia, General (R.H.D.)
9	To PCM

QUICK RELEASE CONNECTOR

Outline

- Serviceability and durability have improved at the fuel line of the fuel tank and fuel filter (high-pressure), due to the adoption of the quick release connector and plastic fuel hose.

Function

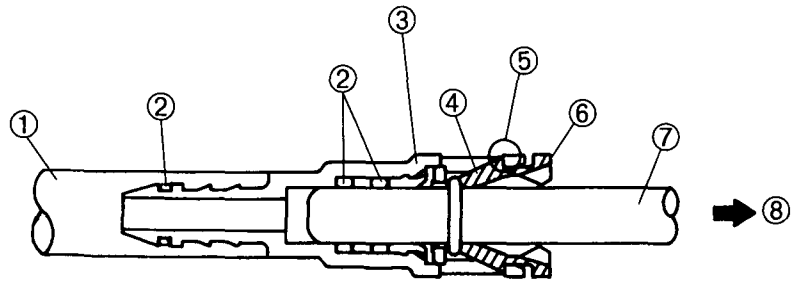
- *The quick release connector enables easy connection and disconnection of the plastic fuel hose and fuel pipe.*

Structure

- The quick release connector is made up of the retainer, O-ring, etc.
- The quick release connector and plastic fuel hose are integrated and cannot be disconnected.
- *The retainer remains on the fuel pipe when the quick release connector is disconnected from the fuel pipe.* Do not reuse the retainer if removed from the fuel pipe.

Operation

- Squeeze the tabs of the retainer to unlock and disconnect the quick release connector from the fuel pipe.
- A click sound can be heard when the tabs of the retainer are pushed correctly into the lock of the quick release connector.



1	Plastic fuel hose
2	O-ring
3	Quick release connector
4	Retainer

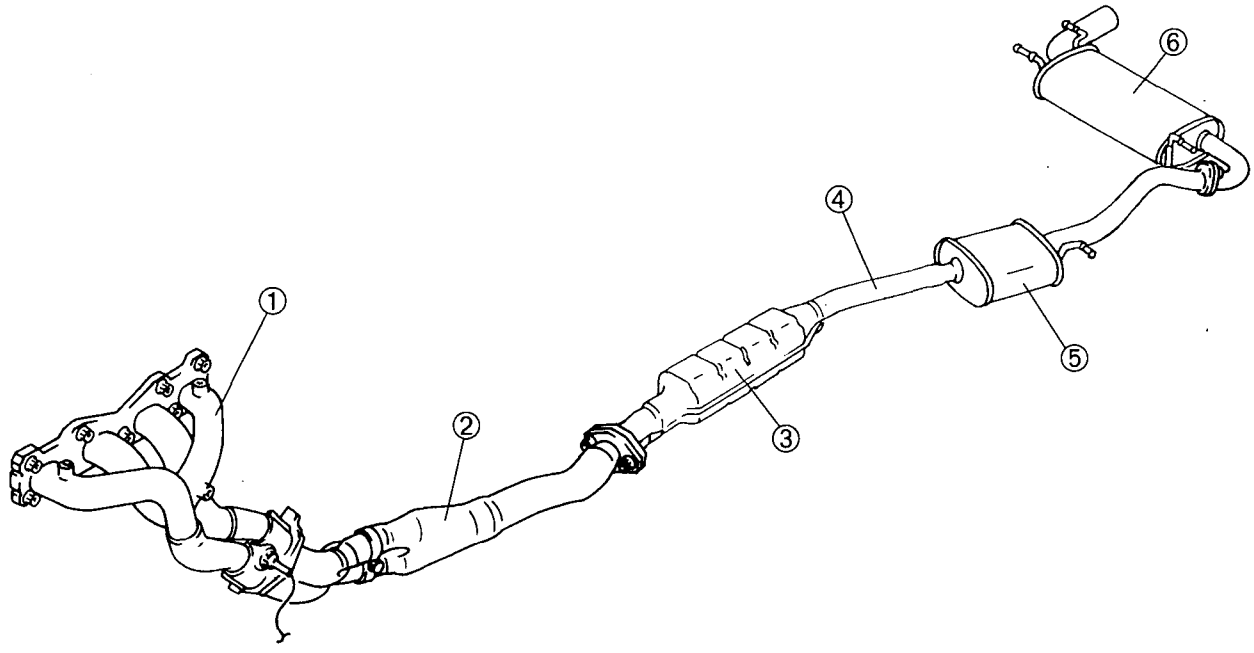
5	Lock
6	Tab
7	Fuel pipe
8	Disconnect

EXHAUST SYSTEM

OUTLINE

- The four exhaust pipes are gathered into two pipes at the exhaust manifold, then unified at the front pipe. Because of this, exhaust resistance is reduced, improving exhaust efficiency.
- According to the increase in engine output, the capacities of the main silencer and the presilencer have been increased as shown below to conform with External Noise of Motor Vehicles regulations (96/20/EC, ADR 28/01).
  - Main silencer capacity increase: approx. 20 %
  - Presilencer capacity increase: approx. 60 %

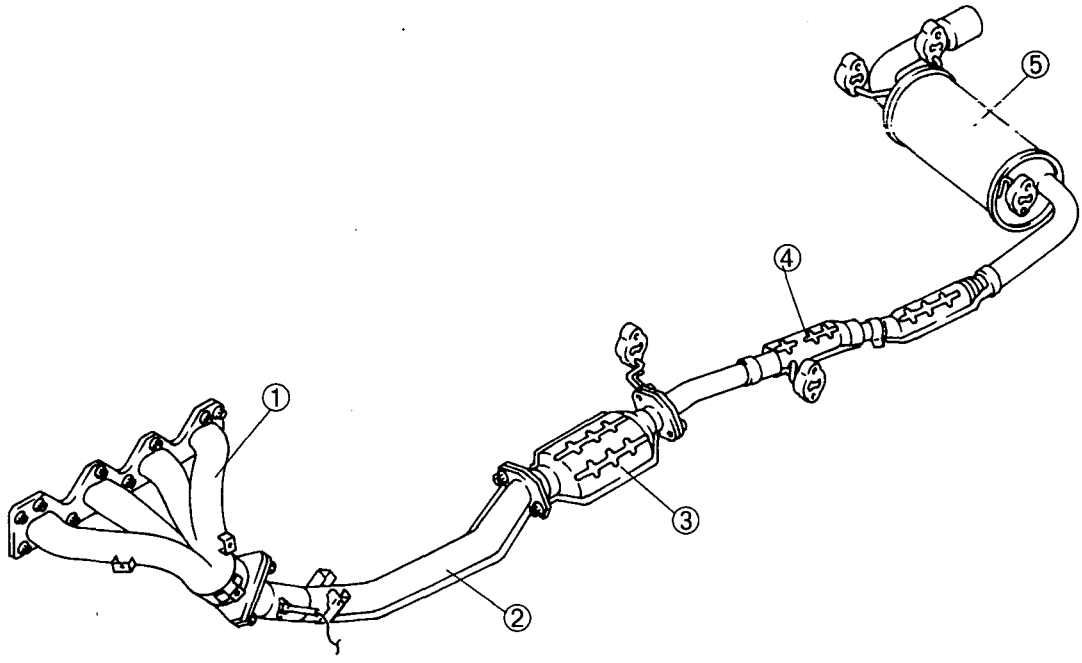
NEW MODEL



1	Exhaust manifold
2	Front pipe
3	(Catalytic converter)

4	Middle pipe
5	(Presilencer)
6	Main silencer

PREVIOUS MODEL



1	Exhaust manifold
2	Front pipe
3	Catalytic converter

4	(Presilencer)
5	Main silencer

EMISSION SYSTEM

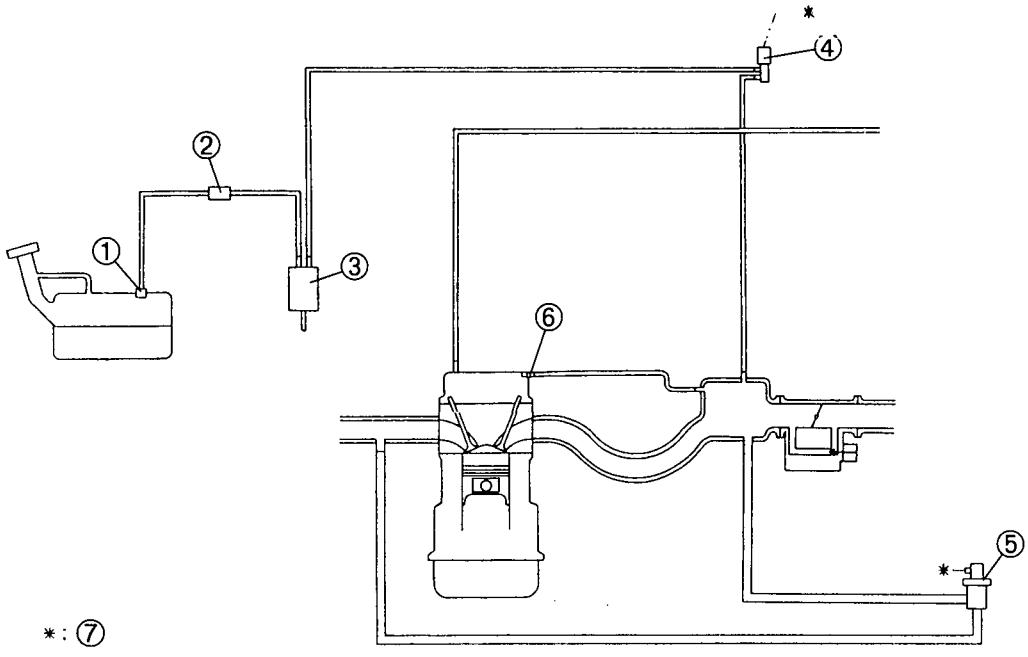
OUTLINE

- The emission system of the new MX-5 is basically the same as that of previous model. A comparison of major parts for the new MX-5 and previous model is as follows:

○ : Applied
× : Not applied

Item	B6		BP		
	New model	Previous model	New model	Previous model	
	Europe, General (L.H.D.)		Europe, General (L.H.D.), Australia, General (R.H.D.)	Europe, General (L.H.D.)	Australia, General (R.H.D.)
Rollover valve	○		○		
Evaporative gas check valve (two-way)	○		○		
Evaporative gas check valve (three-way)	×		×	○	
Charcoal canister	○		○		
Purge solenoid valve	○		○		
EGR valve	○ (Stepping motor type)	×	○ (Stepping motor type)	○ (Duty type)	
EGR solenoid valve (vacuum, vent)	×		×	○	
PCV valve	○ (Straight type)		○ (L type)	○ (Straight type)	

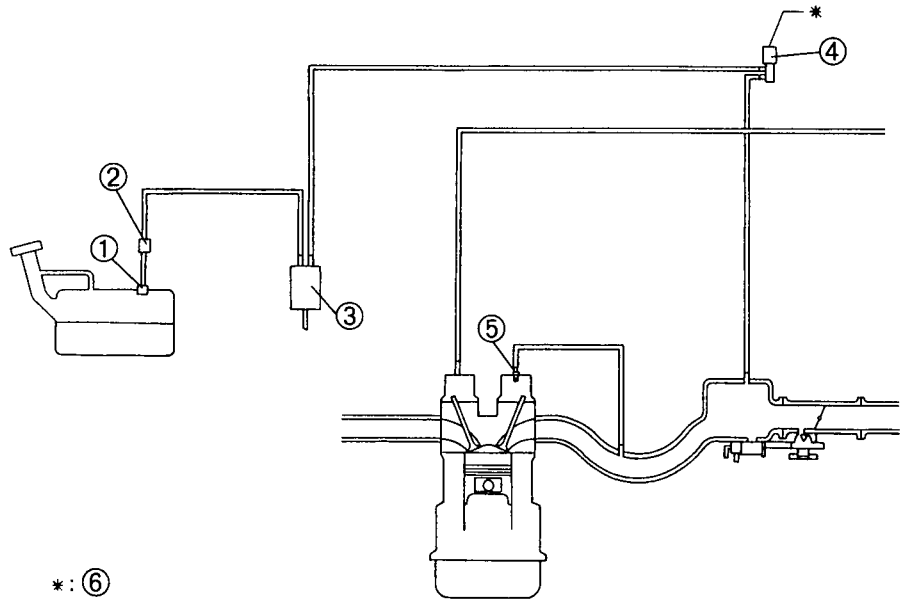
SYSTEM DIAGRAM
B6
NEW MODEL



1	Rollover valve
2	Evaporative gas check valve (two-way)
3	Charcoal canister
4	Purge solenoid valve

5	EGR valve
6	PCV valve
7	To PCM

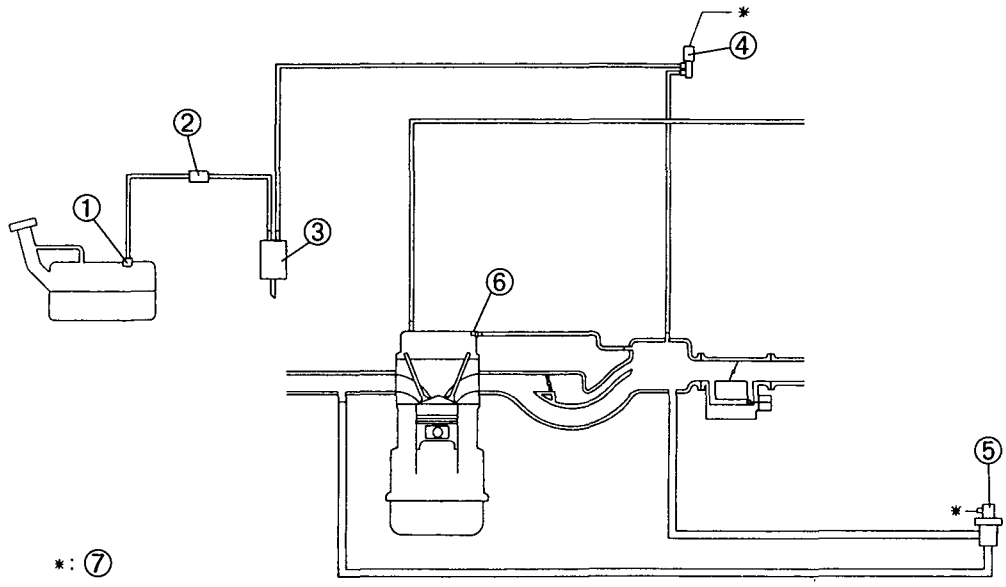
PREVIOUS MODEL



1	Rollover valve
2	Evaporative gas check valve (two-way)
3	Charcoal canister

4	Purge solenoid valve
5	PCV valve
6	To PCM

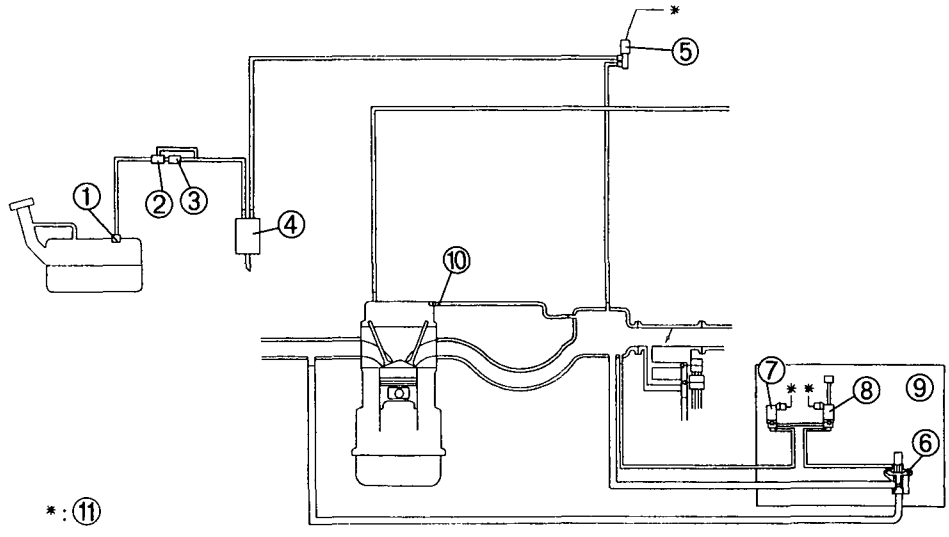
BP
NEW MODEL



1	Rollover valve
2	Evaporative gas check valve (two-way)
3	Charcoal canister
4	Purge solenoid valve

5	EGR valve
6	PCV valve
7	To PCM

PREVIOUS MODEL



1	Rollover valve
2	Evaporative gas check valve (three-way)
3	Evaporative gas check valve (two-way)
4	Charcoal canister
5	Purge solenoid valve
6	EGR valve

7	EGR solenoid valve (vacuum)
8	EGR solenoid valve (vent)
9	Except MT vehicle for Australia, General (R.H.D.)
10	PCV valve
11	To PCM

EGR VALVE
Outline

- A stepping motor type EGR valve has been newly adopted to B6 engine models, and modified from a duty type for BP engine models.

Function

- The stepping motor type EGR valve is basically the same as that of "323 (BA)" Z5, BP engine models and "626 (GF)".

CONTROL SYSTEM

CONTROL SYSTEM OUTLINE

- The control system of the new MX-5 is basically the same as that of previous model. A comparison of major parts for the new MX-5 and previous model is as follows:

Input

○ : Applied
× : Not applied

Item	B6		BP	
	New model	**Previous model**	**New model**	**Previous model**
Intake air temperature sensor	○		○	
Air flow sensor	Heat resistor type mass air flow sensor	Volume air flow sensor	Heat resistor type mass air flow sensor	Hot wire type mass air flow sensor
Throttle position sensor	○		○	
Idle switch	×	○	×	○
Engine coolant temperature sensor	○ (Integrated with water temperature sender unit)	○	○ (Integrated with water temperature sender unit)	○
Crankshaft position sensor	○*	×	○*	×
Camshaft position sensor	○*	○	○*	○
Knock sensor	○	×	○	×
Oxygen sensor	○ (Integrated with heated oxygen sensor heater)		○ (Integrated with heated oxygen sensor heater)	
Neutral switch (MT vehicle)	○		○	
Clutch switch (MT vehicle)	○		○	
Power steering pressure switch	○		○	

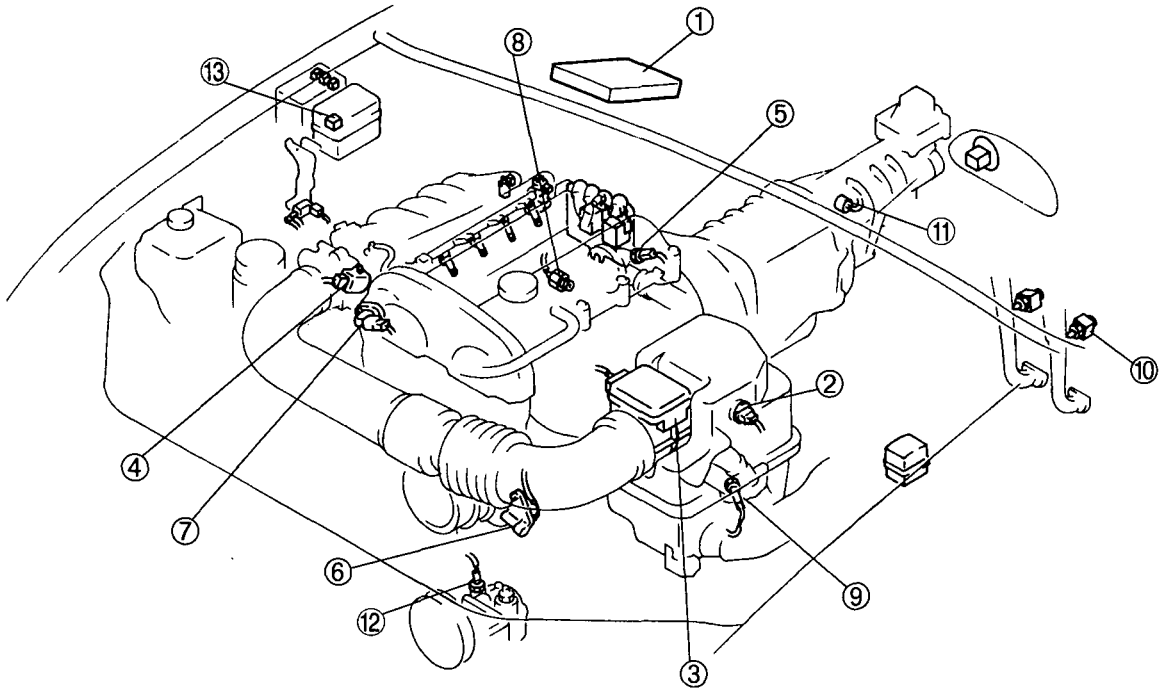
*: The sensor has an IC and transistor built-in to change alternating current wave into a square wave and input it to the PCM.

Output

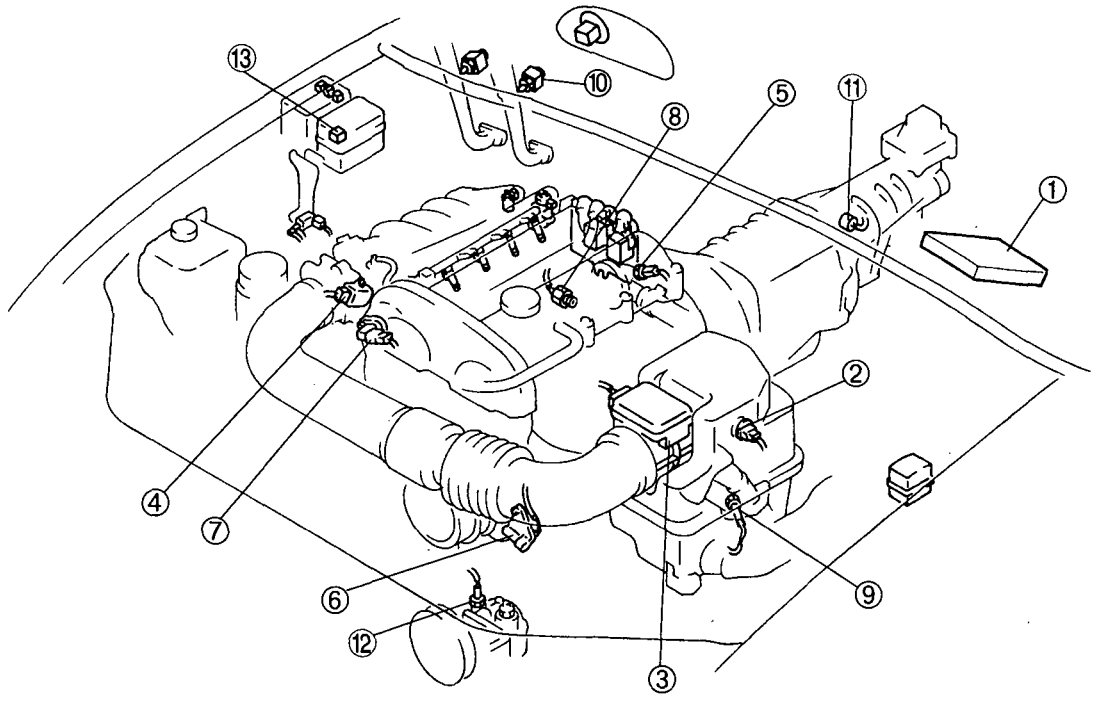
- The VICS solenoid valve has been added to improve the engine performance. (BP)
- The EGR valve has been changed from a duty type to a stepping motor type. (Refer to EMISSION SYSTEM, EGR VALVE DESCRIPTION.)
- The PRC solenoid valve has been added to improve the startability.

COMPONENT LOCATION

L.H.D.



R.H.D.

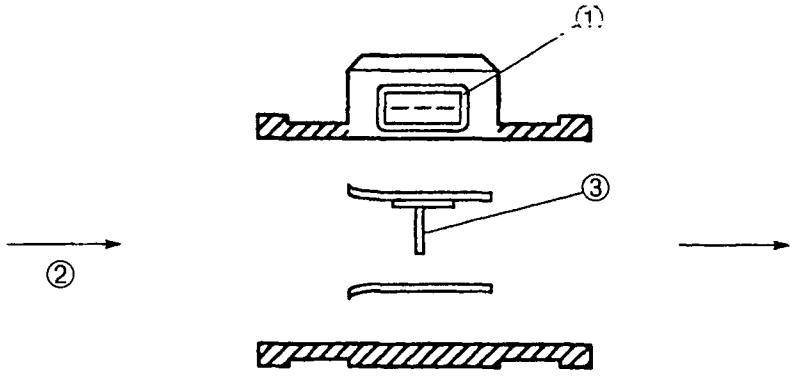


1	Powertrain control module (PCM)
2	Intake air temperature sensor
3	Mass air flow sensor
4	Throttle position sensor
5	Engine coolant temperature sensor
6	Crankshaft position sensor
7	Camshaft position sensor

8	Knock sensor
9	Heated oxygen sensor (integrated with heated oxygen sensor heater)
10	Clutch switch (MT vehicle)
11	Neutral switch (MT vehicle)
12	Power steering pressure switch
13	Main relay

MASS AIR FLOW SENSOR DESCRIPTION

- A heat resistor type mass air flow sensor is used.

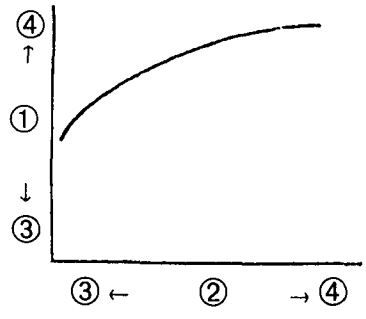


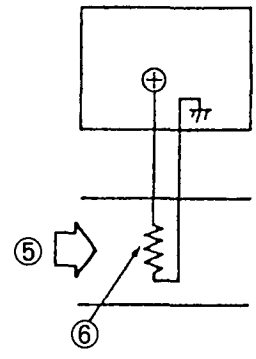
1	Connector
2	Airflow

3	Heat resistor

Structure and Operation

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



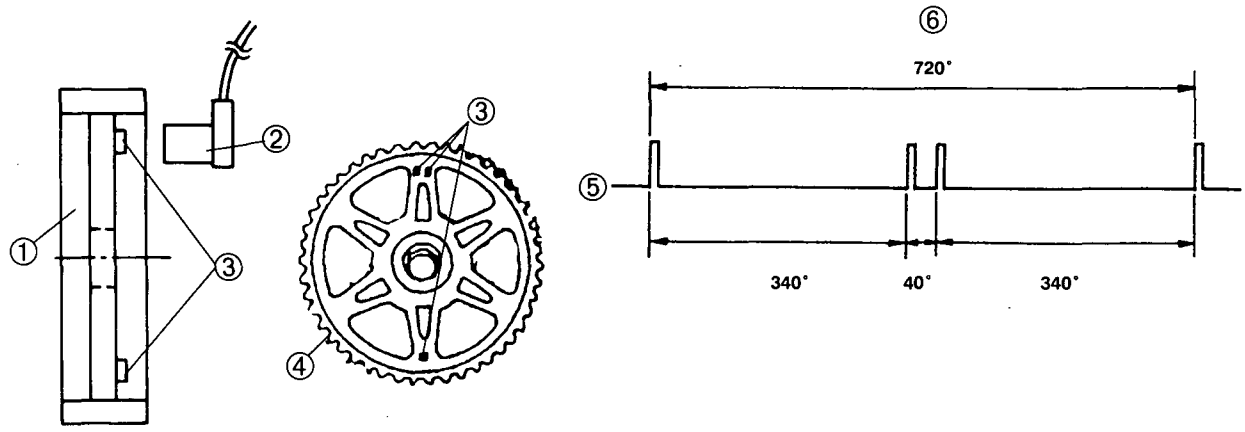


1	Output current
2	Mass intake airflow
3	Low

4	High
5	Intake airflow
6	Heat resistor

CAMSHAFT POSITION SENSOR DESCRIPTION

- The camshaft position sensor is located on the cylinder head. It creates 3 pulses per camshaft rotation (two turns of the crankshaft). The camshaft position sensor signal detects compression No.1 cylinder's top dead center (SGC signal), and is used for synchronizing the firing of sequential fuel injectors.
- The IC and the transistor in the cawshaft position sensor changes the alternating current wave detected in the magnetic pickup coil in the camshaft position sensor into a square wave, and sends it to the PCM.

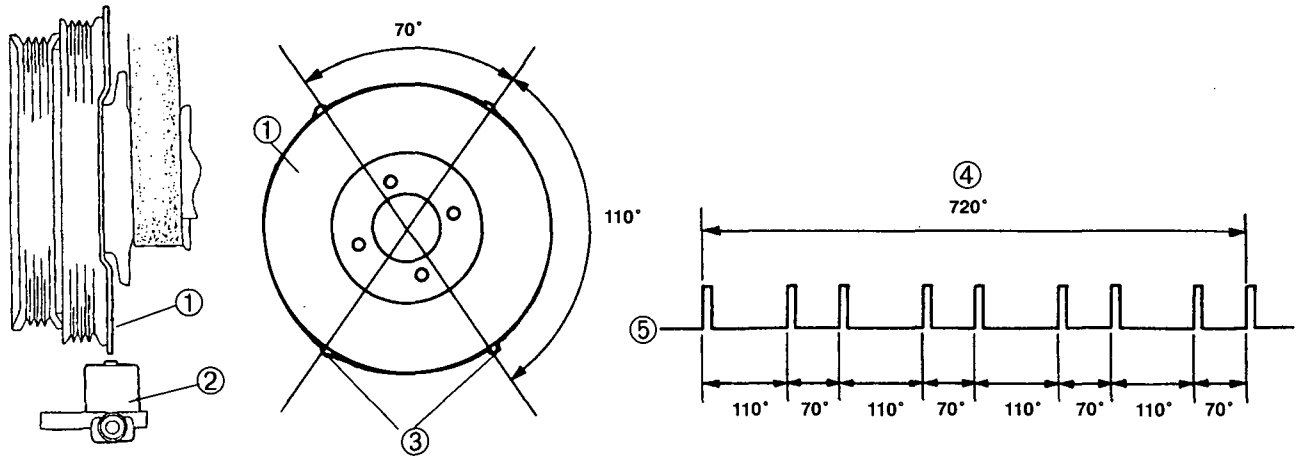


1	Intake camshaft pulley (side view)
2	Camshaft position sensor
3	Projections

4	Intake camshaft pulley
5	SGC signal
6	Crank angle (Two turns of crankshaft)

CRANKSHAFT POSITION SENSOR DESCRIPTION

- The crankshaft position sensor is located near the crankshaft pulley. It detects the pulley rotation signal (NE signal), and outputs it to the PCM. Since the NE signal is detected directly by the crankshaft rotation (signal rotor), accuracy is high and is not influenced by timing belt looseness or camshaft pulley misalignment.
- There are four projections spaced 110° and 70° apart on the signal rotor. The crankshaft position sensor detects eight pulses every two rotations of the crankshaft (1 cycle).
- The IC and the transistor in the crankshaft position sensor changes the alternating current wave detected in the magnetic pickup coil in the crankshaft position sensor into a square wave, and sends in to the PCM.

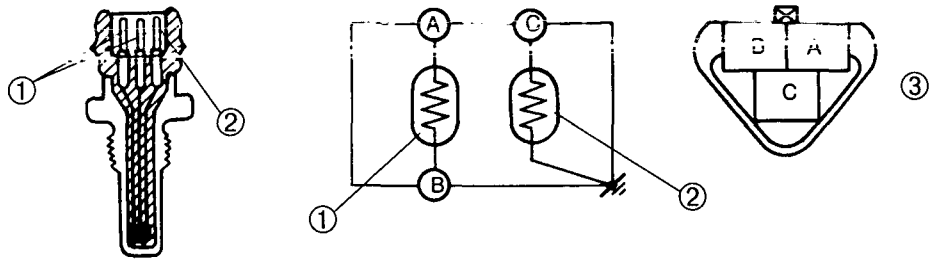


1	Signal rotor
2	Crankshaft position sensor
3	Projections

4	Crank angle (Two turns of crankshaft)
5	NE signal

ENGINE COOLANT TEMPERATURE SENSOR DESCRIPTION

- Engine coolant temperature sensor integrated with water temperature sender unit has been adopted.

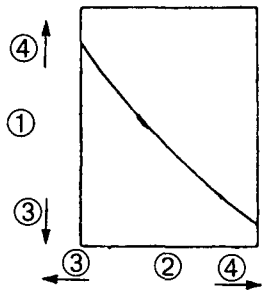


1	Engine coolant temperature sensor
2	Engine coolant temperature sender unit

3	Engine coolant temperature sensor connector

Characteristic

- The resistance characteristic of the engine coolant temperature sensor is as shown.



1	Resistance
2	Engine coolant temperature

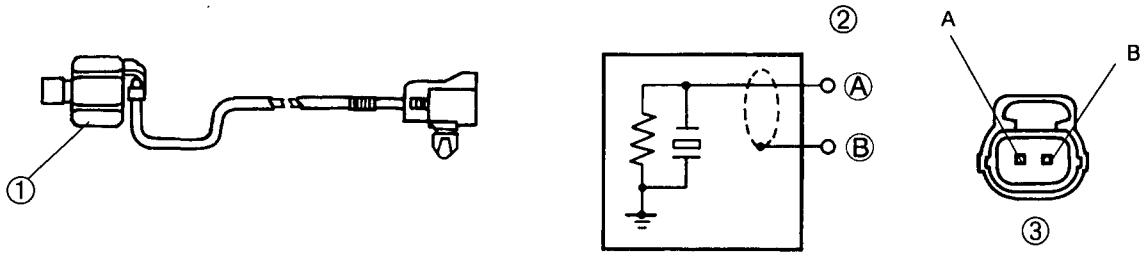
3	Low
4	High

KNOCK SENSOR DESCRIPTION

- A piezo-effect type knock sensor is used. It is a non-resonant type and has the feature of carrying out flat detection in relation to frequency.

Piezo-electric Effect

- In the piezo-electric effect, electric potential difference occurs at the end surfaces of a particular direction.



1	Knock sensor
2	Terminal

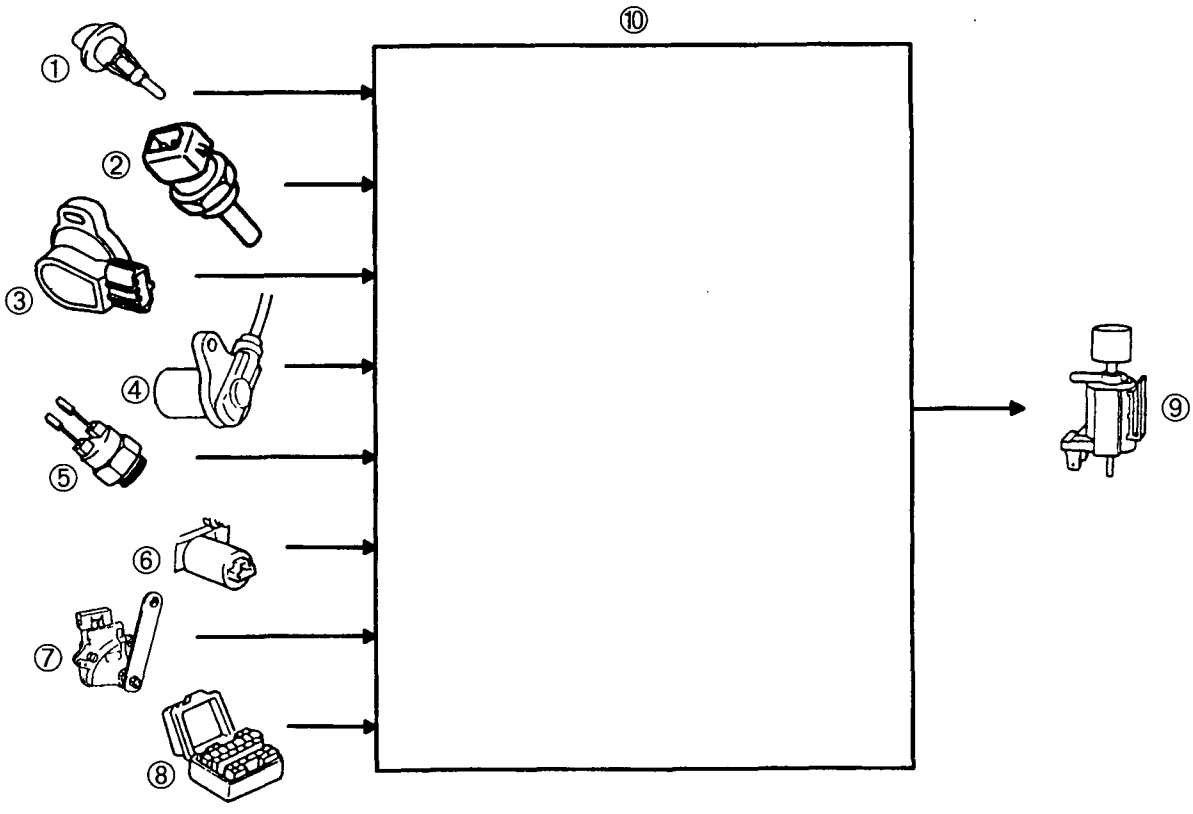
3	Knock sensor connector

PRESSURE REGULATOR CONTROL

OUTLINE

- The pressure regulator control cuts the vacuum applied to the pressure regulator when the engine is hot and for a specified period of time after the engine started for improved startability and idle stability after the engine is started.
- The pressure regulator control is basically the same as that of previous BP engine models.

Block Diagram



1	Intake air temperature sensor
2	Engine coolant temperature sensor
3	Throttle position sensor
4	Crankshaft position sensor (NE signal)
5	Neutral switch (MT vehicle)

6	Clutch switch (MT vehicle)
7	Transmission range switch (AT vehicle)
8	Data link connector (TEN terminal)
9	PRC solenoid valve
10	PCM

OPERATION

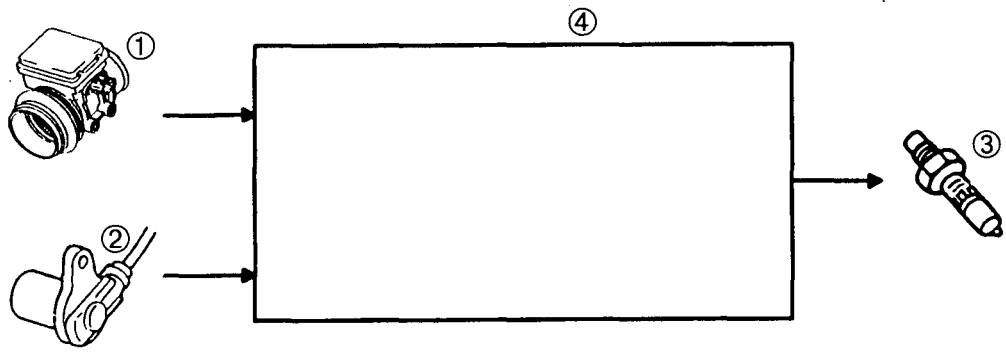
- When all seven of the conditions below are satisfied, the PCM actuates the PRC solenoid valve to cut the vacuum applied to the pressure regulator, so that fuel pressure is increased by the difference between atmospheric pressure and intake air vacuum.
  (1) At start and for 149 seconds after start.
  (2) Intake air temperature is above 65 °C {149 °F}.
  (3) Engine coolant temperature is above 90 °C {194 °F}.
  (4) Engine speed is below 1,500 rpm.
  (5) Throttle valve is fully closed.
  (6) Data link connector terminal TEN does not short to ground (control is stopped during test mode).
  (7) No load (transmission is in neutral position or clutch switch is depressed).

HEATED OXYGEN SENSOR HEATER CONTROL

OUTLINE

- In the heated oxygen sensor heater control, the PCM controls the heated oxygen sensor heater to obtain stable heated oxygen sensor signal detection when the exhaust gas temperature is low for improved emission performance.

Block Diagram



1	Mass air flow sensor
2	Crankshaft position sensor (NE signal)

3	Heated oxygen sensor heater
4	PCM

OPERATION

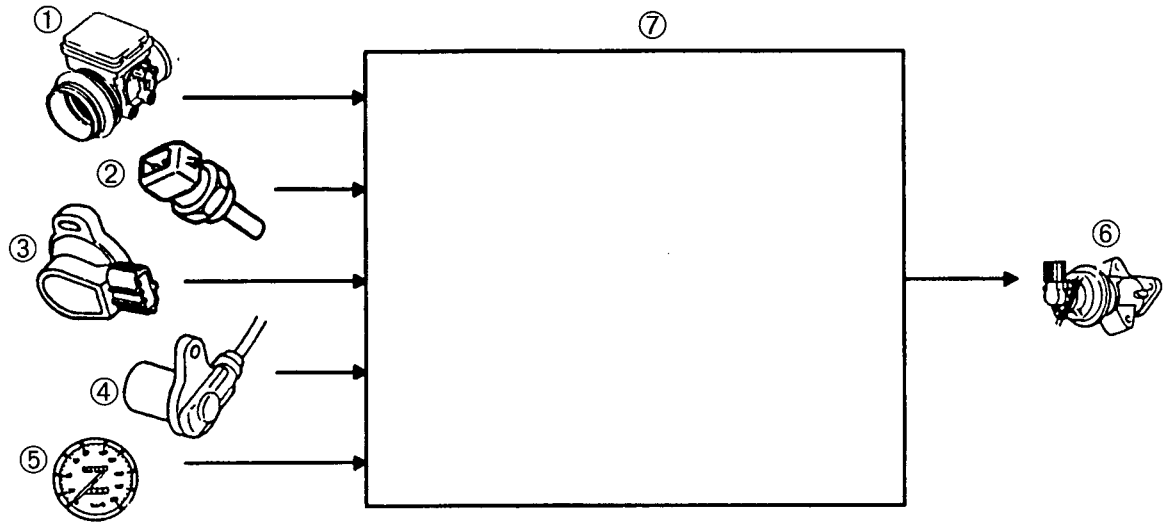
- The PCM actuates the heated oxygen sensor heater when the engine speed is low and intake air charging efficiency is low.

EXHAUST GAS RECIRCULATION (EGR)

OUTLINE

- EGR system has been adopted to obtain low level emission. (B6)
- EGR system has been changed from a duty type to a stepping motor type. The PCM adjusts the EGR amount by controlling the stepping motor coils in the EGR valve. (BP)

Block Diagram



1	Mass air flow sensor
2	Engine coolant temperature sensor
3	Throttle position sensor
4	Crankshaft position sensor (NE signal)

5	Vehicle speed sensor
6	EGR valve
7	PCM

CONTROL

Outline of Control

- 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 by using the following formula:

Target EGR valve position value =

Basic EGR valve position value × **Engine coolant temperature correction**

× **Acceleration/deceleration correction**

- The basic EGR valve position value is determined by the charging amount and the engine speed.
- The corrections at the EGR valve control are shown in the following table.

Correction

Item	Purpose	Conditions	Action
Engine coolant temperature correction	To improve drivability	According to engine coolant temperature when engine coolant temperatrue is above 55 °C {131 °F}	Higher engine coolant temperature → Larger correction
Acceleration/deceleration correction		According to throttle position sensor voltage charging amount	During acceleration → Correction to constant value During deceleration → No correction

OPERATION

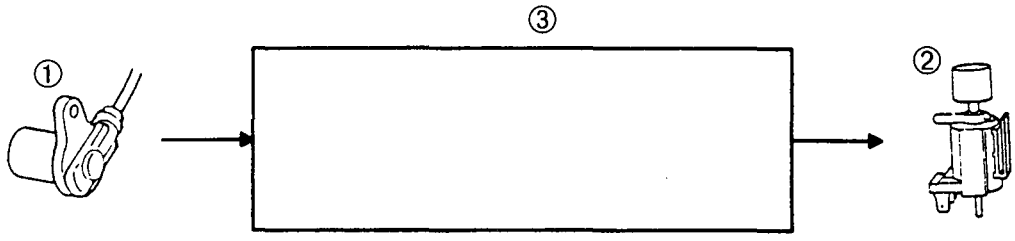
- The EGR operation is carried out when the vehicle is running after warm up and the engine speed is over 1,100 rpm.
- To maintain drivability, the EGR operation is canceled when any of the following conditions has been met.
  (1) Engine is idling. (Throttle valve is at the closed throttle position.)
  (2) Engine coolant temperature is below 55 °C {131 °F}.
  (3) Vehicle speed is below 11 km/h {2.48 mph}.
  (4) Engine speed is below 1,100 rpm.

VARIABLE INERTIA CHARGING SYSTEM (VICS)

OUTLINE

- The variable inertia charging system actuates the VICS solenoid valve to opens/closes the shutter valve in the dynamic chamber to change the intake air pipe length, thus enhances the inertia charging effect.

Block Diagram



1	Crankshaft position sensor (NE signal)
2	VICS solenoid valve

3	PCM

OPERATION

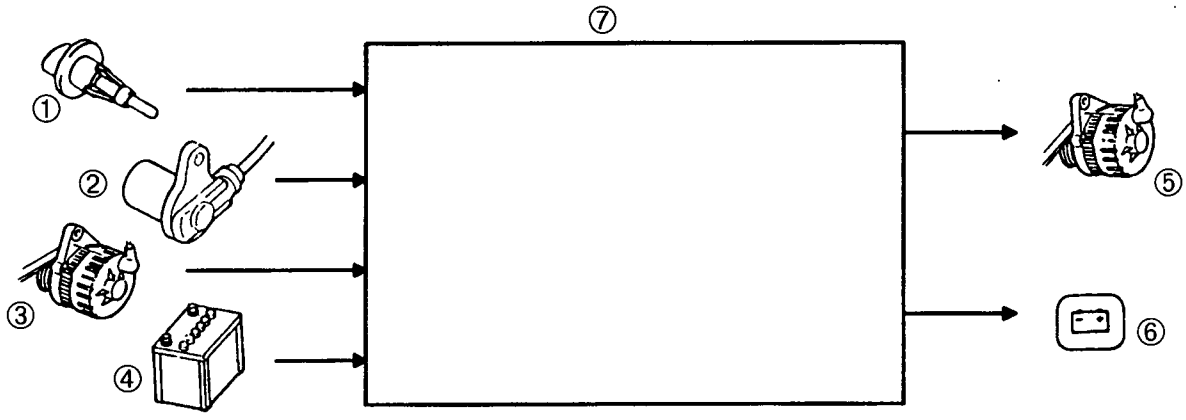
- The PCM energizes the VICS solenoid valve when the engine speed is 5,250 rpm. As a result, the shutter valve in the dynamic chamber is opened.

GENERATOR CONTROL

OUTLINE

- The PCM adjusts the field coil excitation current by duty control to obtain the optimum generator voltage according to the driving conditions for improved idle stability.

Block Diagram



1	Intake air temperature sensor
2	Crankshaft position sensor (NE signal)
3	Generator (Output voltage)
4	Battery (Battery positive voltage)

5	Generator (Field coil)
6	Generator warning light
7	PCM

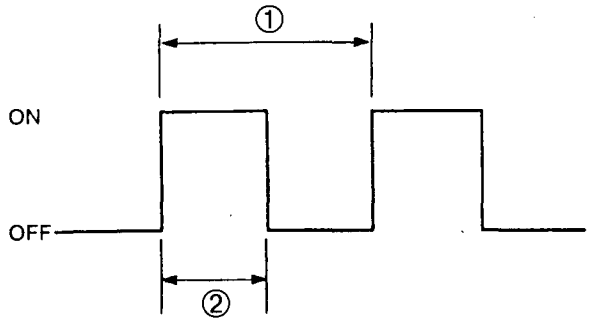
OPERATION

Outline of Control

- The PCM actuates the field coil (in the generator) excitation current by duty control according to the electrical load conditions.
- The duty control is carried out when the generator rotation speed is over 860 rpm.
- To generate more current, the field coil excitation duration is increased for generator current flow to the field coil. Increased current flow to the field coil creates more magnetic force resulting in more generated current.
- To decrease the generated current, the field coil excitation duration is decreased.
- When electrical loads is operated, the increased voltage is consumed and the battery positive voltage is reduced accordingly. This increases the target generated current, and excitation current flows to the field coil is increased so that the required generated current is maintained.
- The PCM illuminates the generator warning light when a problem is detected in any of the following conditions when the generator rotation speed is over 860 rpm.
  (1) Generator generated voltage is too low.
  (2) Generator terminal B is open.
  (3) Battery is overcharged.
  (4) Intake air temperature circuit malfunction

Duty Control
Outline of control

- To obtain the optimum generator control, 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.



$$③ = \frac{②}{①} \times 100\%$$

1	Actuation cycle
2	Actuation duration

3	Duty value

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 by using the following formula:

Target generated current =

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

× **Coefficients**

- The regulated voltage is determined by the battery fluid temperature. The battery fluid temperature is determined by the intake air temperature and the engine coolant temperature.

ON-BOARD DIAGNOSTIC SYSTEM

OUTLINE

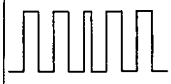
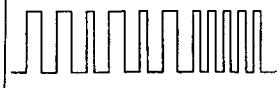
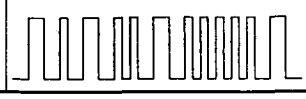
- The on-board diagnostic system is basically the same as previous models.

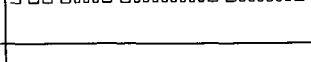
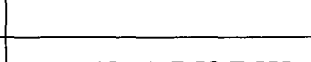
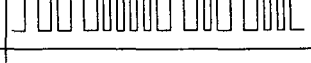
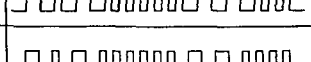
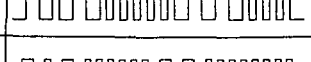
DIAGNOSTIC TROUBLE CODE

- The diagnostic trouble codes (DTCs) are shown in the following table.

Diagnostic Trouble Code Table

○ : Applied
× : Not applied

DTC No.	Output pattern	Diagnosed circuit	Detection condition	Fail-safe	Memory function
0100		Mass air flow signal circuit	Input voltage from mass air flow sensor is below 0.7 V or above 4.9 V when ignition switch is turned on.	Intake air amount is fixed value according to throttle valve opening angle.	○
0110		Intake air temperature signal circuit	Input voltage from intake air temperature sensor is below 0.15 V or above 4.8 V when ignition switch is turned on.	Intake air temperature is fixed at preset value.	○
0115		Engine coolant temperature signal circuit	Input voltage from engine coolant temperature sensor is below 0.1 V or above 4.9 V when ignition switch is turned on.	Engine coolant temperature is fixed at preset value.	○
0120		Throttle position signal circuit	Input voltage from throttle position sensor is below 0.1 V or above 4.9 V when ignition switch is turned on.	Throttle valve opening angle is fixed at preset value.	○
0134		Heated oxygen sensor signal circuit (No activity)	When heated oxygen sensor signal does not exceed 0.45 V after engine is started, or stays below 0.45 V for 98 seconds after engine has reached normal operating temperature, input voltage from throttle position sensor is above 0.62 V and running at 1,500 rpm or over.	Feedback correction for fuel injection is canceled.	○
0325		Knock sensor signal circuit	Input voltage from knock sensor is below 1.25 V or above 3.75 V when ignition switch is turned on.	Ignition retard of knocking is canceled.	○
0443		Purge solenoid valve control signal circuit	Open or short circuit is observed in purge solenoid valve system when ignition switch is turned on.	—	×
0505		Idle air control valve control circuit	Open or short circuit is observed in idle air control system.	Cut off power supply of idle air control valve.	○
1170		Heated oxygen sensor signal circuit (Stuck)	When heated oxygen sensor signal stays above 0.45 V for 42 seconds after engine has reached normal operating temperature and running at 1,500 rpm or over.	Feedback correction for fuel injection is canceled.	○
1250		PRC solenoid valve control signal circuit	Open or short circuit is observed in PRC solenoid valve when ignition switch is turned on.	—	×

DTC No.	Output pattern	Diagnosed circuit	Detection condition	Fail-safe	Memory function
1345		Camshaft position signal circuit	No SGC signal input from camshaft position sensor while engine rotates.	Ignition and fuel injection are canceled.	○
1496		EGR valve motor coil 1 control signal circuit	Open or short circuit in EGR valve (stepping motor 1 coil) system when ignition switch is turned on.	—	×
1497		EGR valve motor coil 2 control signal circuit	Open or short circuit in EGR valve (stepping motor 2 coil) system when ignition switch is turned on.	—	×
1498		EGR valve motor coil 3 control signal circuit	Open or short circuit in EGR valve (stepping motor 3 coil) system when ignition switch is turned on.	—	×
1499		EGR valve motor coil 4 control signal circuit	Open or short circuit in EGR valve (stepping motor 4 coil) system when ignition switch is turned on.	—	×
1523*1		VICS solenoid valve control circuit	Open or short circuit is observed in VICS solenoid valve system when ignition switch is turned on.	—	×
1601*3		PCM—TCM communication line	No PCM—TCM communication when ignition switch is turned on.		○
1602*2		Immobilizer unit—PCM communication line	Command transmission from PCM to immobilizer unit exceed limit No response from immobilizer unit.	—	×
1603*2		ID number unregistered (Immobilizer)	Code word is not registered in PCM.	—	×
1604*2		Code word unregistered (Immobilizer)	Key ID numbers are not registered in PCM.	—	×
1608		PCM internal circuit	PCM does not read DTC from output devices.	—	×
1621*2		Code words do not match (Immobilizer)	Code word stored in PCM and immobilizer unit do not match.	—	○
1622*2		ID numbers do not match (Immobilizer)	ID numbers stored in immobilizer unit and PCM do not match. (This DTC is indicated only after immobilizer unit is replaced and reprogramming system.)	—	○
1623*2		Code word/ID number writing and reading error (Immobilizer)	PCM internal EEPROM malfunction.	—	○

DTC No.	Output pattern	Diagnosed circuit	Detection condition	Fail-safe	Memory function
1624*2		PCM does not receive unlock signal from immobilizer unit (PCM is okay)	PCM detects immobilizer system malfunction more than three times.	—	×
1631		Generator generating voltage monitoring circuit	When PCM demands generated current above 20 A to generator, PCM judges generator output voltage below 8.5 V.	—	○
1633		Battery voltage monitoring signal circuit	When PCM judges generator output voltage above 18.5 V or battery positive voltage above 16 V.	Cut off field coil excitation current	○
1634		Generator terminal B related circuit	When PCM judges generator output voltage above 16 V and battery positive voltage below 11 V.	—	○

*1: BP
*2: With immobilizer system only
*3: AT vehicle

PID/DATA MONITOR AND RECORD

- The PID monitoring items are in the following table.

PID/DATA MONITOR Table

Monitor item (Display on NGS tester)	Monitoring item	Condition/unit		PCM terminal
A/C RLY	A/C relay	ON/OFF		1S
A/C SW	Refrigerant pressure switch	ON/OFF		1P
ALTF	Generator field coil control duty value	%		1O
ALTT V	Generator output voltage	V		1T
B+	Battery positive voltage	V		1B
BRK SW	Brake switch	ON/OFF		1F
CHRGLMP	Generator warning light	ON/OFF		1Q
ECT	Engine coolant temperature	°C	°F	2E
ECT V	Engine coolant temperature signal voltage	V		2E
FAN3	Cooling fan control	ON/OFF		1R
FAN2	Condenser fan control	ON/OFF		1I
FHO2S	Heated oxygen sensor	V		2C
FHO2SH	Heated oxygen sensor heater	ON/OFF		1U
FP RLY	Fuel pump relay	ON/OFF		3N*5, 3P*6
IACV	Idle air control valve	ms		3M, 3O
IAT	Intake air temperature	°C	°F	2B
IAT V	Intake air temperature signal voltage	V		2B
IGT	Ignition timing	BTC		3G, 3H
INJ	Fuel injection duration	ms		3W, 3X, 3Y, 3Z
KR	Knocking retard	DEG		2F
MAF V	Mass air flow signal voltage	V		2L
MT/AT*1	Transmission distinction	ON/OFF		1M
NL SW*2	Load / no load condition signal	ON/OFF		1V
PRCV	Pressure regulator control	ON/OFF		3T
PRGV	Purge solenoid valve duty value	%		3L
PSP SW	Power steering pressure switch	ON/OFF		1G
RPM	Engine speed	rpm		2J
SEGRP	EGR valve stepping motor position	step		2M, 2N, 2O, 2P
TEN	TEN terminal condition (in data link connector)	ON/OFF		1L
TP V	Throttle position sensor signal voltage	V		3E
TR SW*3	Transmission range switch	ON/OFF		1V
VICSV*4	VICS solenoid valve	ON/OFF		3Q
VS	Vehicle speed	KMH	MPH	2D

*1: Australia, General (R.H.D.)
*2: MT vehicle
*3: AT vehicle
*4: BP
*5: Without immobilizer system
*6: With immobilizer system

SIMULATION TEST

- The simulation items are in the following table.

Simulation Test Table

○: Applied ×: Not applied

Simulation item (Display on NGS tester)	Full name	Operation	Test condition		PCM terminal
			IG ON	IDLE	
A/C RLY	A/C relay	ON or OFF	○	○	1S
ALTF	Generator field coil	OFF	×	○	1O
CHRGLMP	Generator warning light	ON or OFF	○	○	1Q
FAN3	Cooling fan relay	ON or OFF	○	○	1R
FAN2	Condenser fan relay	ON or OFF	○	○	1I
FP RLY	Fuel pump relay	ON or OFF	○	○	3N*2, 3P*3
IACV	Idle air control valve	Actuate by any duty value (0—100%)	○	○	3M, 3O
INJ	Fuel injection duration	Actuate by any duty value (-50—+50%)	×	○	3W, 3X, 3Y, 3Z
INJ#1	Fuel injector No.1	OFF	×	○	3W
INJ#2	Fuel injector No.2	OFF	×	○	3X
INJ#3	Fuel injector No.3	OFF	×	○	3Y
INJ#4	Fuel injector No.4	OFF	×	○	3Z
PRCV	PRC solenoid valve	ON or OFF	○	○	3T
PRGV	Purge solenoid valve	Actuate by any duty value (0—100%)	○	○	3L
SEGRP	EGR valve position (number of EGR valve stepping motor step)	Actuate by any duty steps (0—60 steps)	○	○	2M, 2N, 2O, 2P
VICSV*1	VICS solenoid valve	ON or OFF	○	○	3Q

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

ENGINE ELECTRICAL SYSTEM

ABBREVIATIONS

AT	Automatic transmission

OUTLINE

OUTLINE OF CONSTRUCTION

- The generator has been changed.
- The ignition coil has been changed. (B6 engine)
- The resistance of high-tension lead has been changed. (B6 engine)
- The spark plug has been added.
- The starter has been changed.

SPECIFICATIONS

Item			Engine type	
			B6	BP
Battery	Voltage (V)		12	
	Type and capacity (5-hour rate) (A·h)		S46A24L(S) (32)	
Generator	Output (V-A)		12—70	
	Regulated voltage (V)		Integrated in PCM	
	Self-diagnosis function			
Ignition system	Type		Full transistor (distributorless)	
	Spark advance		Electronic	
	Firing order		1—3—4—2	
Spark plug	Type	NGK	BKR5E-11*1, BKR6E-11	
		DENSO	K16PR-U11*1, K20PR-U11	
		CHAMPION	RC10YC4*1, RC8YC4	
Starter	Type		Coaxial reduction	
	Output (kW)		1.0	

*1: Standard plug

Indicates new specification

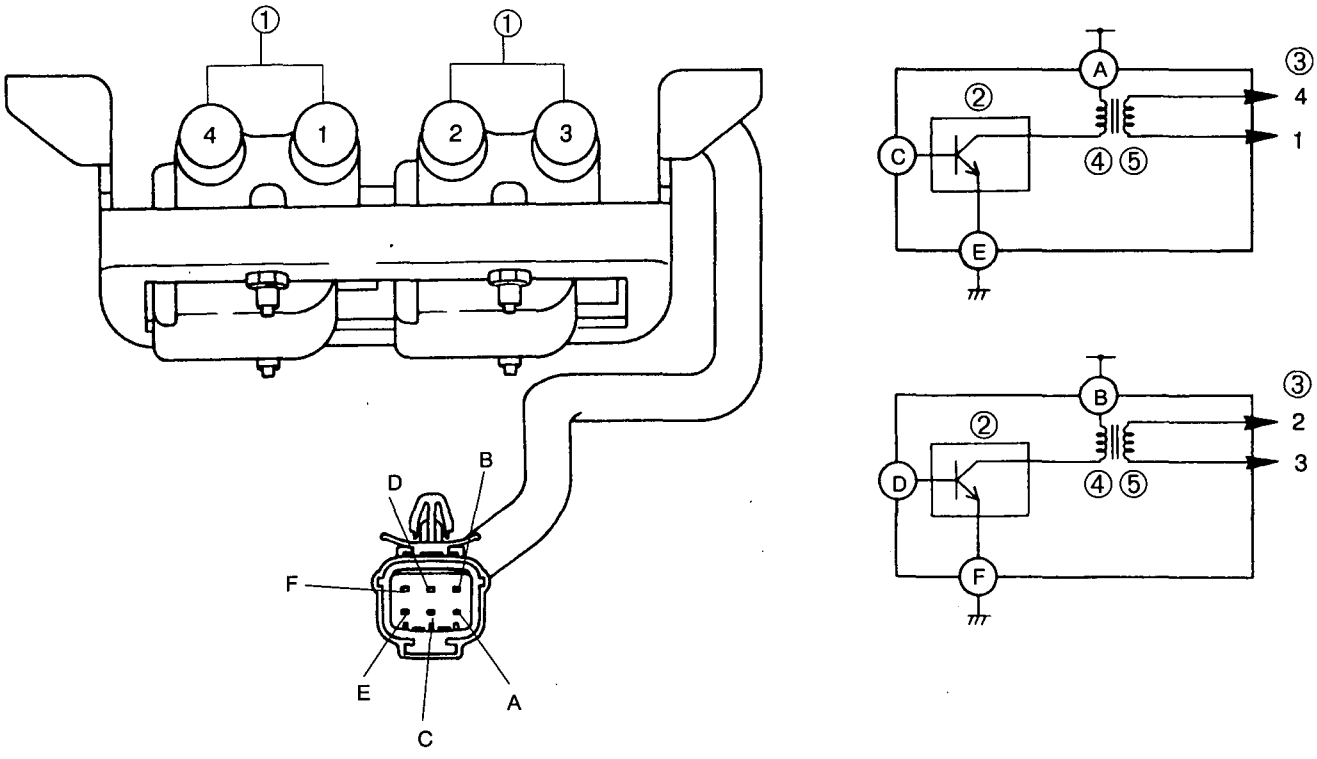
CHARGING SYSTEM

GENERATOR

- The voltage regulator has been eliminated, and generator control is carried out by the PCM. (Refer to section F, GENERATOR CONTROL.)

IGNITION SYSTEM

IGNITION COIL (B6)



1	Secondary terminal
2	Igniter
3	Cylinder number

4	Primary coil
5	Secondary coil

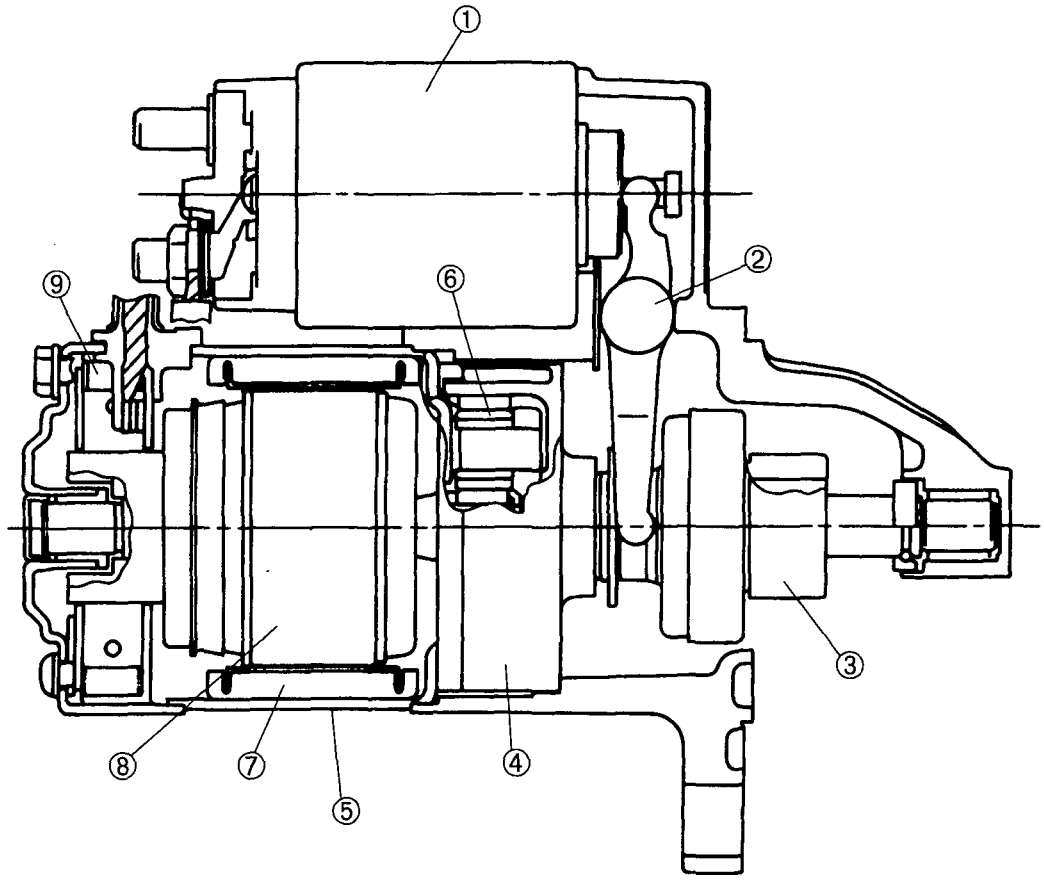
Terminal layout

Terminal		Signal
6-pin	A	Battery positive voltage (for ignition coil)
	B	Battery positive voltage (for ignition coil)
	C	Igniter drive signal
	D	Igniter drive signal
	E	Ground (for igniter)
	F	Ground (for igniter)

- The ignition coil includes an igniter.
- The construction and operation of the ignition coil for the B6 engine are basically the same as those of the ignition coil for the BP engine.

STARTING SYSTEM

STARTER



1	Magnetic switch
2	Lever
3	Drive pinion
4	Internal gear
5	Yoke

6	Planetary gear
7	Field coil
8	Armature
9	Brush holder

- The starter is a coaxial reduction type.
- The construction and operation of the starter for B6 and BP engines are basically the same as those of the starter for BP engine (AT).

CLUTCH

OUTLINE

OUTLINE OF CONSTRUCTION

- The construction and operation of the clutch are basically the same as those of previous MX-5 models, however, the clutch cover and the clutch disc for B6 engine models are different.

SPECIFICATIONS

Item				Engine	
				B6	BP
Transmission type				M15M-D	
Clutch control				Hydraulic	
Clutch cover	Type			Diaphragm spring	
	Set load		(N {kgf, lbf})	4,310 {440, 968}	4,609 {470, 1034}
Clutch disc	Outer diameter		(mm {in})	200 {7.87}	215 {8.46}
	Inner diameter		(mm {in})	130 {5.12}	150 {5.91}
	Thickness	Plessure plate side	(mm {in})	3.8 {0.15}	
		Flywheel side	(mm {in})	3.5 {0.14}	
Clutch pedal	Type			Suspended	
	Pedal ratio			6.13	
	Pedal travel		(mm {in})	120 {4.72}	
Clutch master cylinder	Type			Conventional	
	Inner diameter		(mm {in})	15.87 {0.625}	
Clutch release cylinder	Type			Adjustment	
	Inner diameter		(mm {in})	19.05 {0.750}	
Clutch fluid	Europe, UK			SAE J1703 or FMVSS 116 DOT-3 or DOT-4	
	Australia			SAE J1703 or FMVSS 116 DOT-3	

▭ Indicates new specifications

MANUAL TRANSMISSION (M15M-D)

ABBREVIATIONS

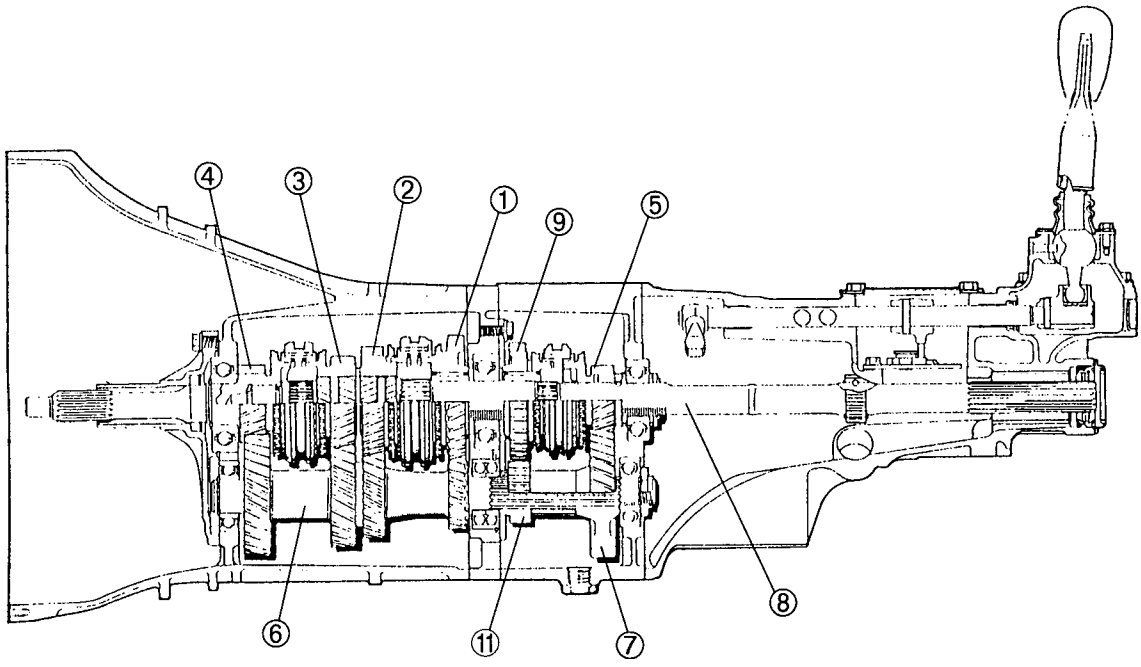
Rev	Reverse	3rd	Third
1st	First	4th	Fouth
2nd	Second	5th	Fifth

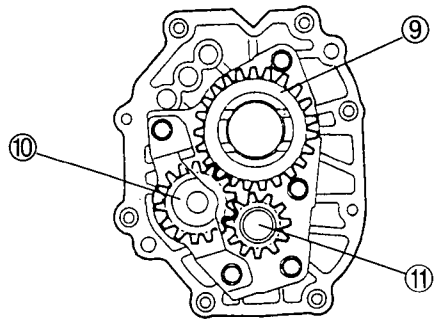
OUTLINE

OUTLINE OF CONSTRUCTION

- The construction and operation of the manual transmission are basically the same as those of the previous MX-5 models, however, the following points are different:
  (1) The shift pattern has been changed.
  (2) The reverse lockout mechanism has been changed.
  (3) The 2nd gear and the 3rd gear have been reconfigured to improve synchronization.
  (4) A double cone synchronizer mechanism is used for the 2nd gear.

MANUAL TRANSMISSION CROSS-SECTIONAL VIEW





1	1st gear
2	2nd gear
3	3rd gear
4	4th gear
5	5th gear
6	Countershaft

7	Counter 5th gear
8	Mainshaft
9	Reverse gear
10	Reverse idler gear
11	Counter reverse gear

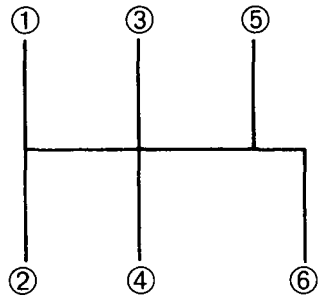
SPECIFICATIONS

Item			Engine	
			B6	BP
Transmission type			M15M-D	
Transmission control			Floor-shift	
Shift assist			Synchromesh	
Gear ratio	1st		3.136	
	2nd		1.888	
	3rd		1.330	
	4th		1.000	
	5th		0.814	
	Reverse		3.758	
Oil	Grade		API Service GL-4 or GL-5	
	Viscosity	All season	SAE 75W-90	
		Above 10°C {50°F }	SAE 80W-90	
	Capacity	(L {US qt, Imp qt})	2.0 {2.1, 1.8}	

J

MANUAL TRANSMISSION

SHIFT PATTERN



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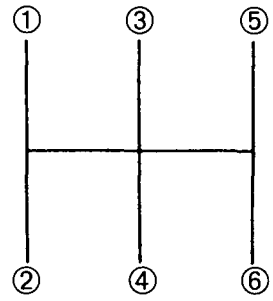


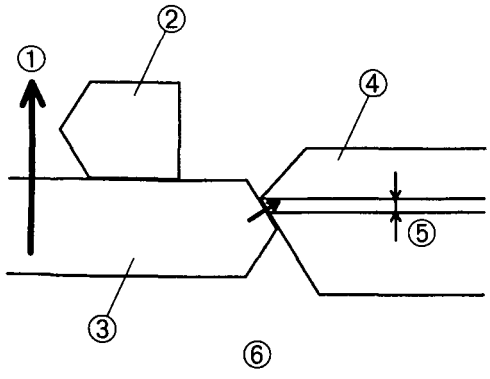
⑧

1	1st
2	2nd
3	3rd
4	4th

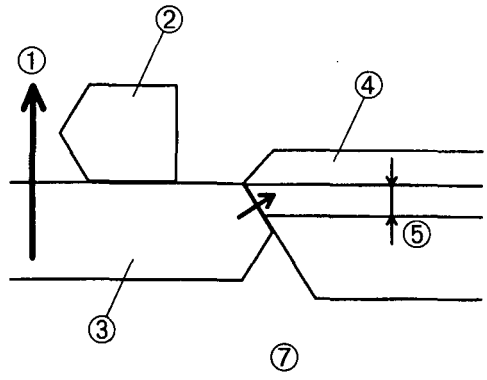
5	5th
6	Rev
7	Previous
8	New

- The reverse gear position has been changed to shorten the select stroke.

2ND GEAR AND 3RD GEAR



⑥



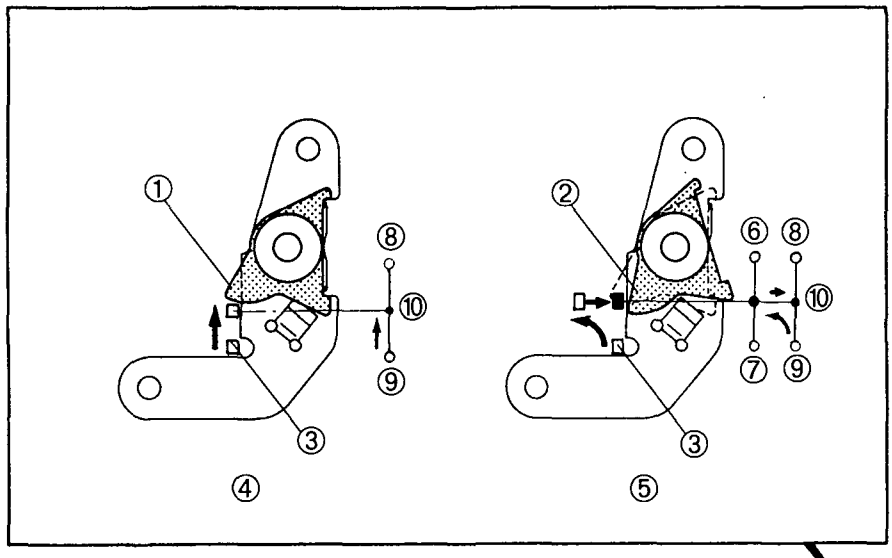
⑦

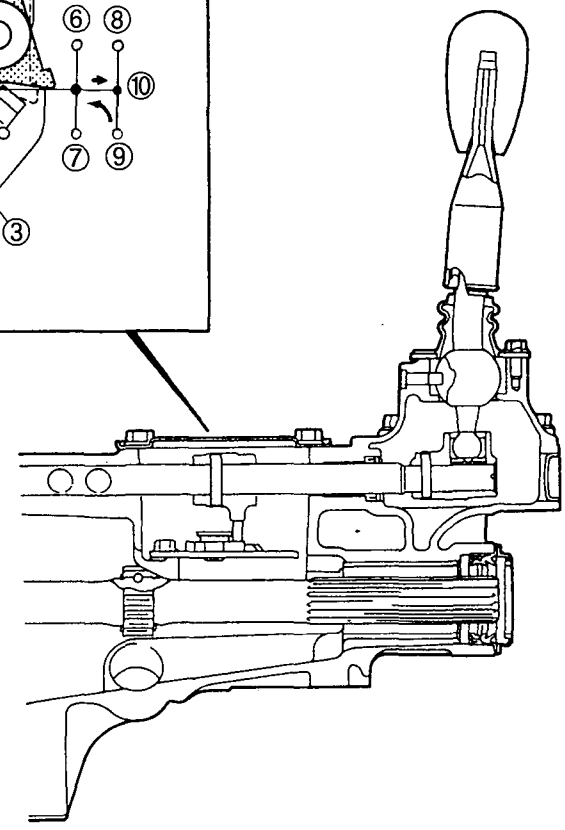
1	Rotating direction
2	Synchronizer ring
3	Hub sleeve
4	2nd/3rd gear

5	Chamfer offset
6	Previous
7	New

- Increased chamfer surface area contact, due to an increase in chamfer offset of the 2nd/3rd gear, is designed to improve synchronism.

REVERSE LOCKOUT MECHANISM



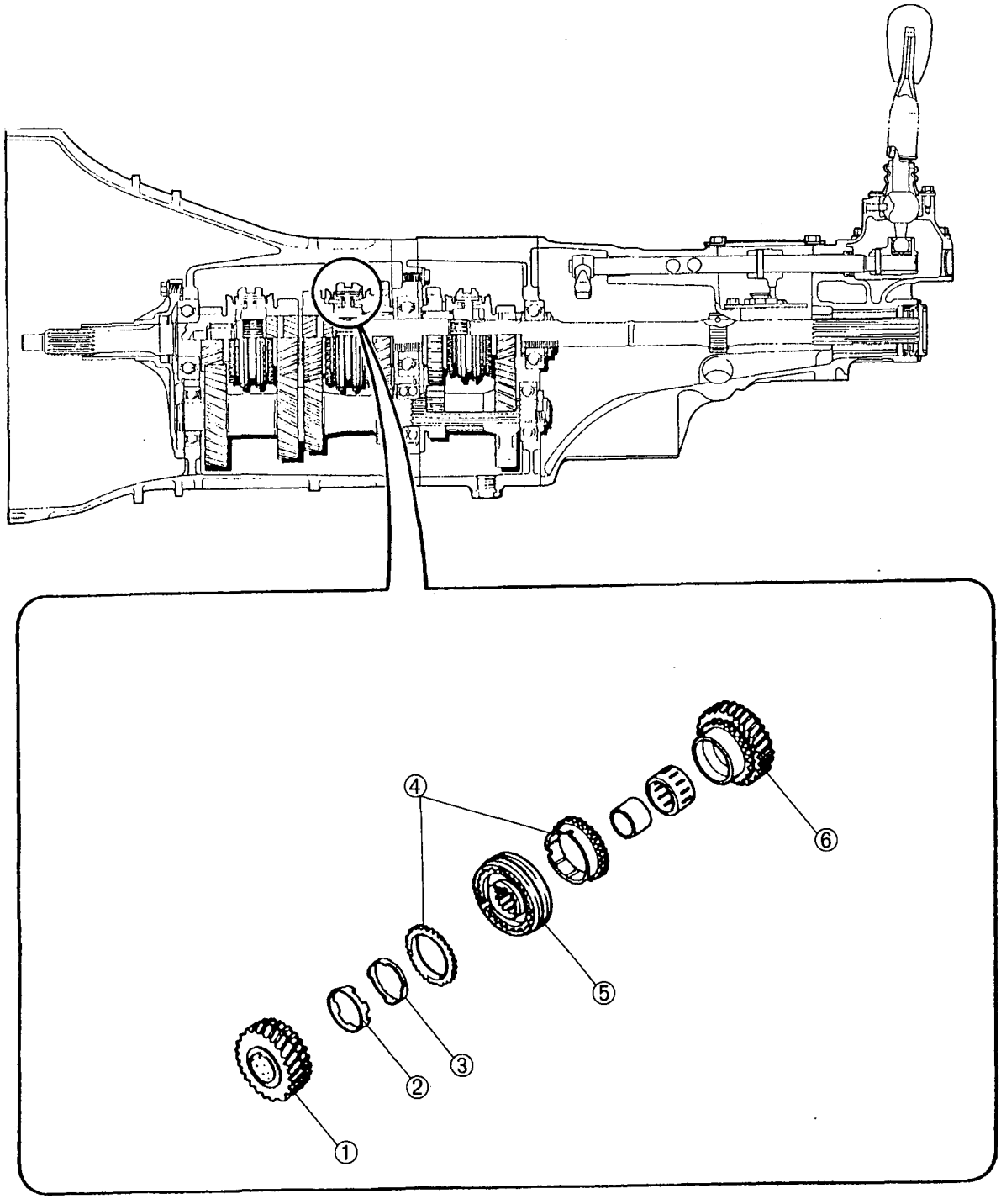


1	Prevents shifting
2	Cancels lockout
3	Selector
4	Gear shifting from 5th to reverse directly
5	Gear shifting from 5th to reverse via neutral position

6	4th
7	3rd
8	Rev
9	5th
10	Neutral

- A cam-type reverse lockout mechanism is adapted to secure reliability.
- The reverse lockout mechanism prevents the driver from accidentally shifting into reverse gear when down shifting from 5th gear to 4th gear.

DOUBLE CONE SYNCHRONIZER MECHANISM



1	2nd gear
2	Inner cone
3	Double cone

4	Synchronizer cone
5	Clutch hub component
6	1st gear

- The double cone synchronizer mechanism ensures compactness and heavy duty meshing.
- The double cone synchronizer mechanism is designed to ease operation and reduce meshing time.

AUTOMATIC TRANSMISSION (SB4A-EL)

K

ABBREVIATIONS

ATF	Automatic transmission fluid	R	Reverse
D	Drive	S	Slope
EC-AT	Electronically controlled automatic transmission	SST	Special service tool
L	Low	TCC	Torque converter clutch
N	Neutral	1GR	First gear
P	Park	2GR	Second gear

AUTOMATIC TRANSMISSION

AUTOMATIC TRANSMISSION OUTLINE

- To improve driveability, an AISIN AW-made automatic transmission is used.
- To improve serviceability, a serial communication control has been added.
- To improve driveability, a torque reduction control has been added.
- To improve serviceability, a transmission-engine total control has been added.
- The SB4A-EL is equipped with 10 types of friction elements: 4GR clutch, forward clutch, direct clutch, 4GR brake, second coast brake, second brake, 1st and reverse brake, one-way clutch No.0, No.1, No.2.
- Multi-plate type brake is used in SB4A-EL type automatic transmission instead of band type.
- Serial communication is used for mutual communication between PCM and TCM.

Outline of Construction

- The EC-AT can be divided into two parts: hydraulic pressure control, and electronic control which controls the hydraulic pressure.

<table>
<tr><th></th><th>System</th><th>Previous model (NC4A-EL)</th><th colspan="2">New model (SB4A-EL)</th></tr>
<tr><td rowspan="3">Transmission</td><td>Torque converter system</td><td>• Torque converter</td><td colspan="2">• Torque converter</td></tr>
<tr><td>Powertrain system</td><td>• Direct clutch
• Front clutch
• Rear clutch
• Low and reverse brake
• 2GR brake band
• 4GR brake band
• One-way clutch
• 4GR one-way clutch
• 4GR planetary gear unit
• Front planetary gear unit
• Rear planetary gear unit
• Input shaft
• Intermediate shaft
• Output shaft</td><td colspan="2">• 4GR clutch
• Forward clutch
• Direct clutch
• 4GR brake
• Second coast brake
• Second brake
• 1st and reverse brake
• One-way clutch No.0
• One-way clutch No.1
• One-way clutch No.2
• 4GR planetary gear unit
• Front planetary gear unit
• Rear planetary gear unit
• Input shaft
• Output shaft</td></tr>
<tr><td>Hydraulic control system</td><td>• Control valve
• Oil pump</td><td colspan="2">• Control valve
• Oil pump</td></tr>
<tr><td rowspan="4">Electronic control (Electronic system)</td><td rowspan="2">Input system</td><td rowspan="2">• HOLD switch
• Transmission range switch
• Throttle position sensor
• Closed throttle position switch
• Input/turbine speed sensor
• Transmission fluid temperature sensor
• Vehicle speed sensor
• Engine coolant temperature signal
• TAT terminal (Data link connector)</td><td colspan="2">• HOLD switch
• Transmission range switch
• Throttle position sensor
• Input/turbine speed sensor
• Output speed sensor
• Engine speed signal</td></tr>
<tr><td>Serial communication</td><td>• Engine coolant temperature signal
• Torque reduced signal
• Brake signal</td></tr>
<tr><td rowspan="2">Output system</td><td rowspan="2">• Shift solenoid A, B, C
• 3—2 control solenoid valve
• TCC control solenoid valve
• Inhibitor signal
• HOLD indicator light
• FAT terminal (Data link connector)</td><td colspan="2">• Shift solenoid A, B
• TCC solenoid valve
• HOLD indicator light
• Vehicle speed signal</td></tr>
<tr><td>Serial communication</td><td>• Reduce torque signal
• Inhibitor signal</td></tr>
<tr><td>Control system</td><td>• Transmission control module</td><td colspan="2">• Transmission control module</td></tr>
</table>

Outline of Operation

Ranges and modes

Range/ Position	Gear	Gear ratio	Non-HOLD mode			HOLD mode		
			Shift	TCC operation	Engine braking	Shift	TCC operation	Engine braking
P	—	—		—			—	
R	Reverse	2.222	—	—	○	—	—	○
N	—	—		—			—	
D	1GR	2.450	↕	—	—	↕	—	—
	2GR	1.450	↕	—	—	↕	—	—
	3GR	1.000	↕	○	○	↕	○	○
	4GR	0.730	↕	○	○	↑*	○	○
S	1GR	2.450	↕	—	—	—	—	—
	2GR	1.450	↕	—	○	↑	—	○
	3GR*	1.000	↕	○	○		○	○
L	1GR	2.450	↕	—	○	↑	—	○
	2GR*	1.450	↕	—	○		—	○

○ : Torque converter clutch or engine braking is available.
⬇⬆ : Cannot be selected unless the selector push button is pressed.
⇩⇧ : Can be selected without pressing the selector push button.
↕ : Gear can be shifted in the direction of the arrow.
* : Engine over speed protection.

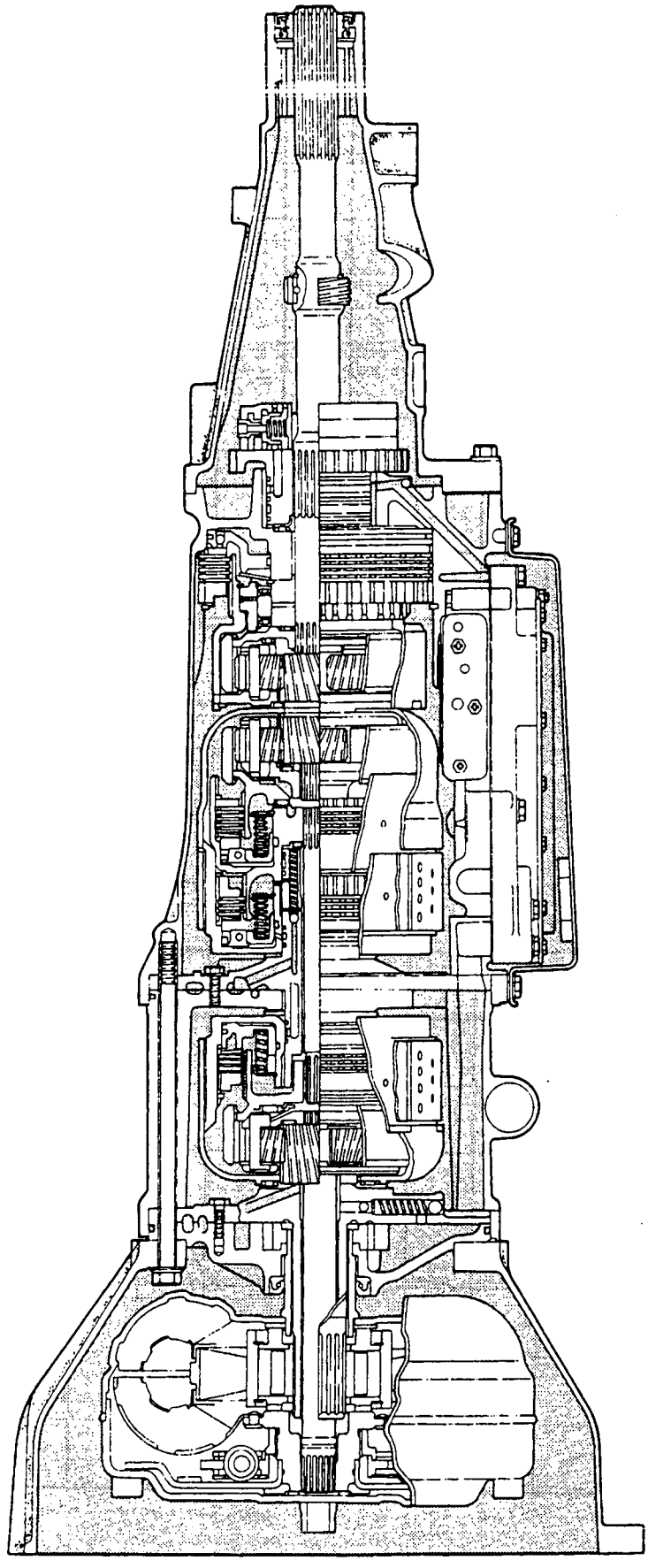
Gear position and operation of featured parts

Range/ Position	Gear position	Clutch				Brake					One-way clutch			Solenoid valve	
		C0	C1	C2		B0	B1	B2	B3		F0	F1	F2	S1	S2
				I.P.	O.P.				I.P.	O.P.					
P	—	○												○	
R	Reverse	○		○	○				○	○	○			○	
N	—	○												○	
D	1GR	○	○								○		○	○	
	2GR	○	○					○			○	○		○	○
	3GR	○	○	○				○			○				○
	4GR		○	○		○		○							
S	1GR	○	○								○		○	○	
	2GR	○	○				○	○			○	○		○	○
	3GR*	○	○	○				○			○				○
L	1GR	○	○						○	○	○		○	○	
	2GR*	○	○				○	○			○	○		○	○

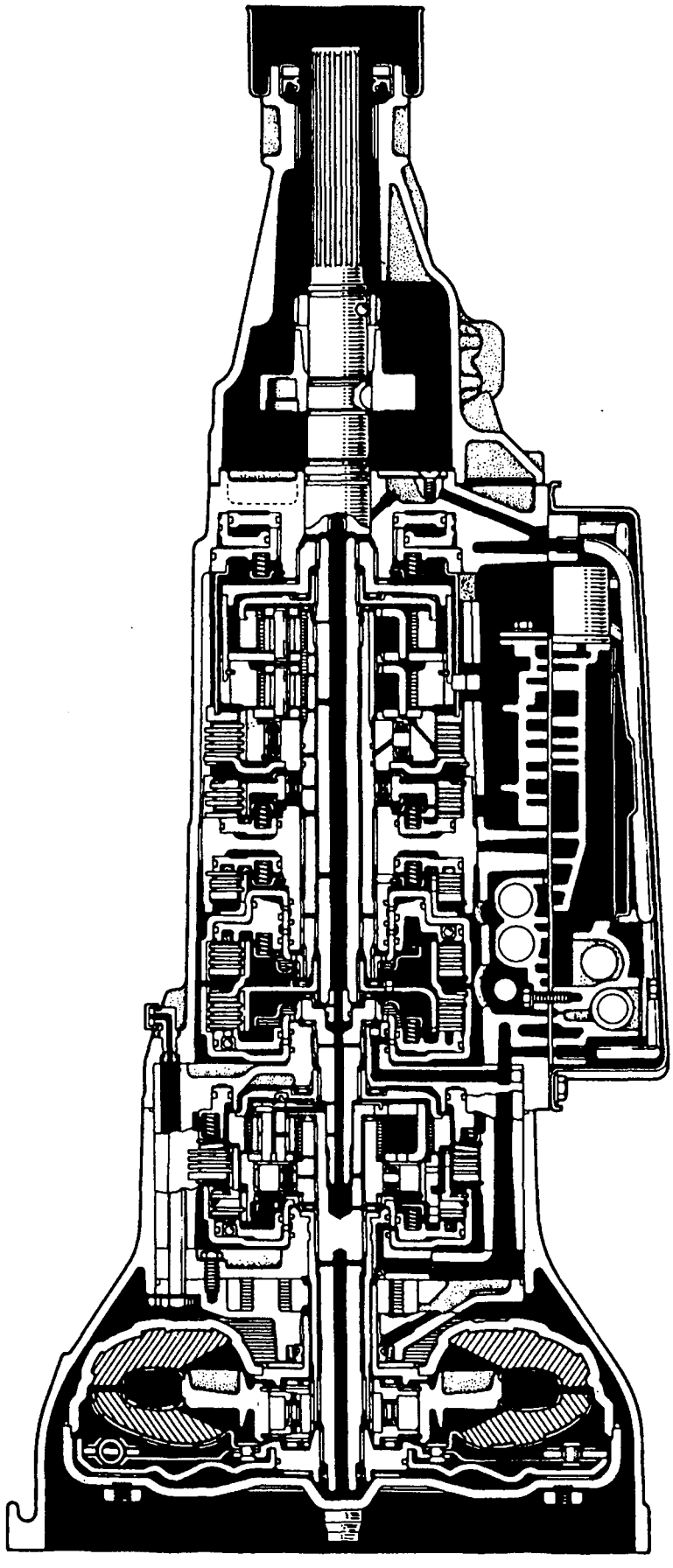
C0 : 4GR clutch
C1 : Forward clutch
C2 : Direct clutch
B0 : 4GR brake
B1 : Second coast brake
B2 : Second brake
B3 : 1st and reverse brake
F0 : One-way clutch No.0
F1 : One-way clutch No.1
F2 : One-way clutch No.2
S1 : Shift solenoid A
S2 : Shift solenoid B
○ : Operating
* : Engine over speed protection
I.P. : Inner piston
O.P. : Outer piston

K

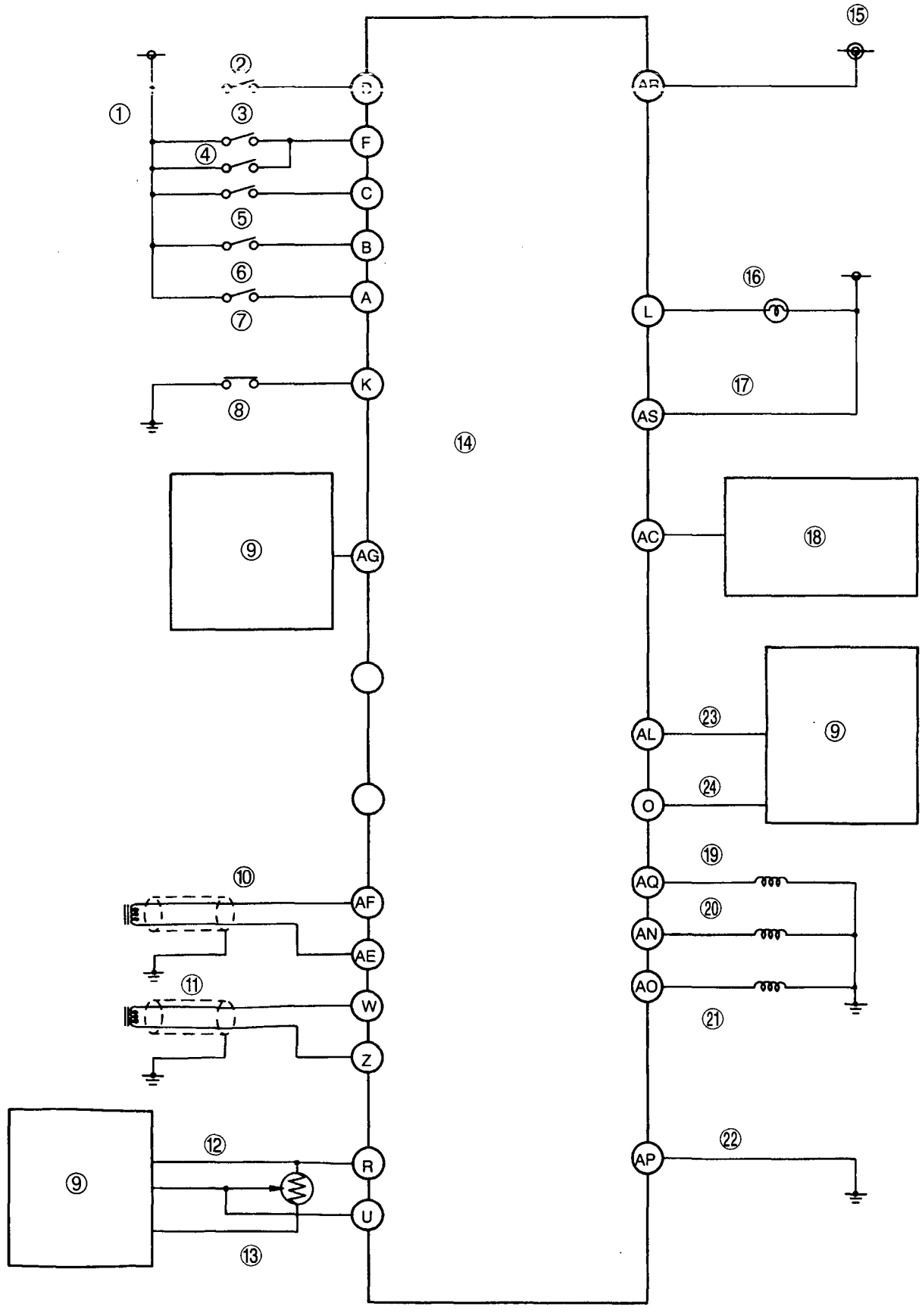
AUTOMATIC TRANSMISSION CROSS-SECTIONAL VIEW
Previous Model (NC4A-EL)



New Model (SB4A-EL)



AUTOMATIC TRANSMISSION SYSTEM WIRING DIAGRAM



1	Transmission range switch
2	R position
3	N position
4	P position
5	D range
6	S range
7	L range
8	HOLD switch
9	Powertrain control module (engine speed signal)
10	Output speed sensor
11	Input/turbine speed sensor
12	V_{REF}

13	Throttle position sensor
14	Transmission control module
15	Battery
16	HOLD indicator light
17	Ignition key
18	Vehicle speed sensor
19	Shift solenoid A
20	Shift solenoid B
21	Torque converter clutch solenoid valve
22	Ground
23	Serial communication (output line)
24	Serial communication (input line)

DEVICE AND CONTROL RELATIONSHIP CHART

Item		Shift control	TCC control	Engine-transmission total control		Fail-safe function	On-board diagnosis system
				N—D select output control	Torque reduction control		
Input							
HOLD switch		○	○				
Transmission range switch		○	○	○		○	○
Throttle position sensor		○	○		○	○	○
Input/turbine speed sensor		□		○	○	○	○
Output speed sensor		○	○	○	○	○	○
Engine speed signal						○	○
PCM–TCM Serial communication line	Engine coolant temperature signal		○				○
	Torque reduced signal				○		○
	Brake signal		○				○
Output							
Shift solenoid A		○				○	○
Shift solenoid B		○				○	○
TCC solenoid valve			○			○	○
Vehicle speed signal							
TCM–PCM Serial communication line	Reduce torque signal				○		○
	Inhibitor signal			○			○

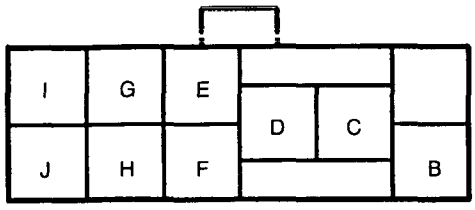
○ : Available
□ : Back up

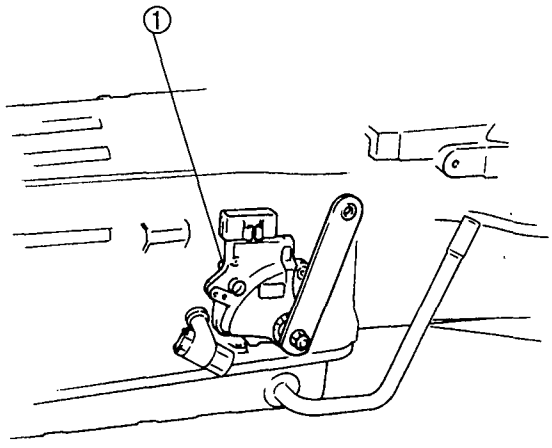
HOLD SWITCH DESCRIPTION

- A momentary type HOLD switch is attached to the selector lever knob.
- As a safeguard, the HOLD mode is canceled when the ignition switch is turned off. The HOLD switch internal circuit turns the HOLD switch on and off.

TRANSMISSION RANGE SWITCH DESCRIPTION

- The transmission range switch is installed in the side part of the transmission and detects the selector lever position in P/N, R position, D, S, and L ranges.
- When the selector lever is in P, R, or N position, or in D, S, or L range, each respective range/position switch is turned on.





②	③		④						
	D	C	I	B	F	J	H	E	G
P	○	○	○	○					
R			○		○				
N	○	○	○			○			
D			○				○		
S			○					○	
L			○						○

1	Transmission range switch
2	Range/position

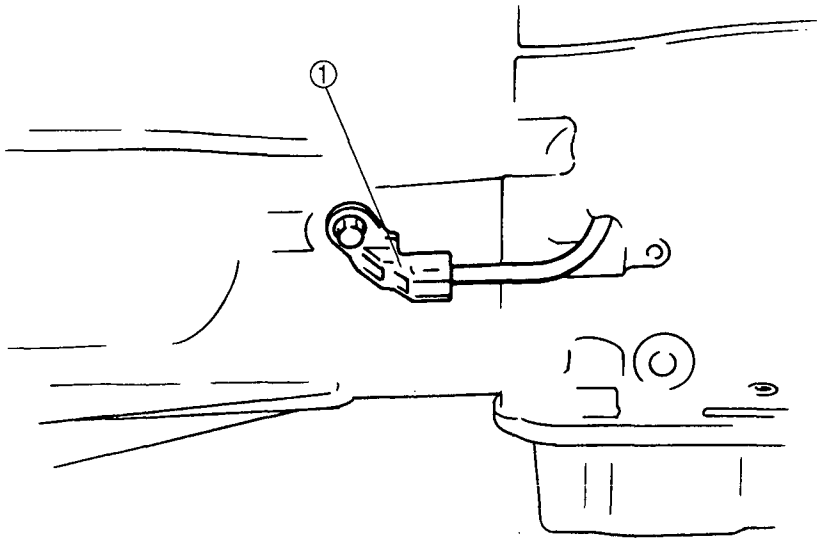
3	Starter
4	Position

THROTTLE POSITION SENSOR DESCRIPTION

(Refer to Section F, THROTTLE POSITION SENSOR DESCRIPTION)

INPUT/TURBINE SPEED SENSOR DESCRIPTION

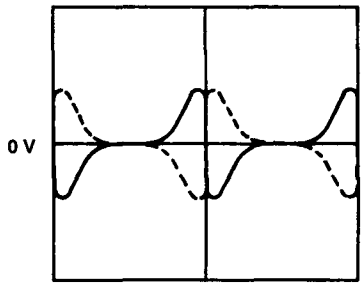
- A magnetic-pickup generator located in the converter housing detects the 4GR clutch drum speed (torque converter output speed).
- The input/turbine speed sensor is installed on the converter housing with clearance from the 4GR clutch drum.
- The 4GR clutch drum has a total of 8 projections at intervals of 45°, and generates alternating waveforms during rotation.
- When the 4GR clutch drum rotates, an induced electromotive force is generated in the input/turbine speed sensor, and alternating waveforms are created. These waveforms are input into the transmission control module for waveform rectifying and decoding of the number of pulses.
- The 4GR clutch drum generates 8 pulse signals per 4GR clutch drum rotation.
- If output speed sensor fails, input/turbine speed sensor acts as a substitute.

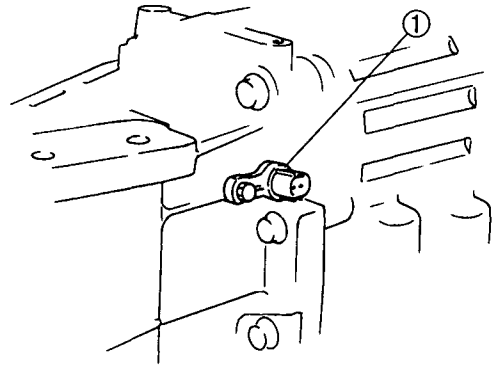


1	Input/turbine speed sensor

OUTPUT SPEED SENSOR DESCRIPTION

- A magnetic pickup generator located in the extension housing detects the sensor rotor.
- The output speed sensor is installed on the extension housing with clearance from the sensor rotor.
- The sensor rotor has a total of 4 projections at intervals of 90°, and generates alternating wave forms during rotation.
- When the sensor rotor rotates, an induced electromotive force is generated in the output speed sensor, and alternating wave forms are created. These wave forms are input into the transmission control module for wave form rectifying and decoding of the number of pulses.
- The sensor rotor generates 4 pulse signals per sensor rotor rotation.





1	Output speed sensor

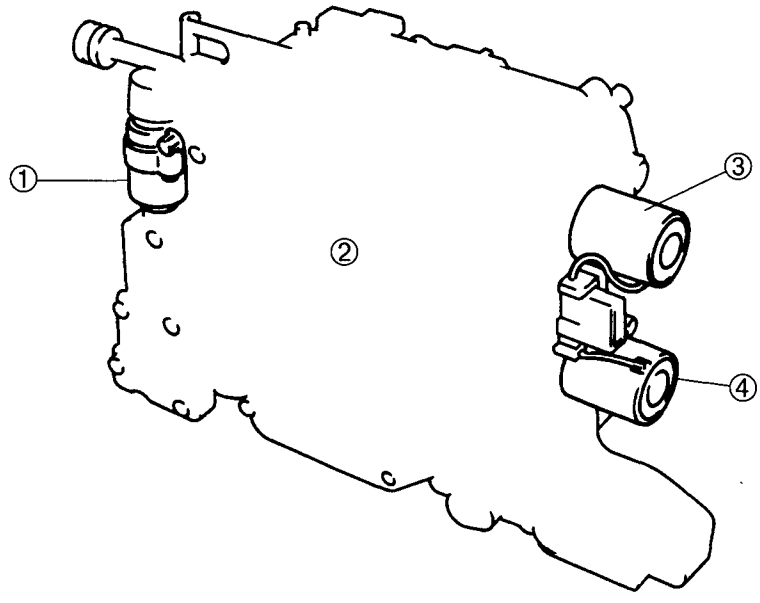
ENGINE SPEED SIGNAL DESCRIPTION

- The engine speed signal is sent from the crankshaft position sensor to the powertrain control module, and from there to the transmission control module.

SOLENOID VALVE DESCRIPTION

- The solenoid valves are installed on the transmission control valve body.

Solenoid valve name	Function	Type of solenoid
Shift solenoid A, B	Shifting	ON/OFF
Torque converter clutch solenoid valve	Torque converter clutch	ON/OFF



1	Torque converter clutch solenoid valve
2	Control valve body

3	Shift solenoid A
4	Shift solenoid B

Solenoid Valve (ON/OFF)

- The solenoid valve switches hydraulic pressure line within the control valve body.
- The solenoid valve is switched on and off by electric signals from the transmission control module.

Operation

ON: As the solenoid valve is energized by the transmission control module, the coil is magnetized. The magnetized coil moves the plunger to the right side, and the drain port is opened to drain pressure.
OFF: As the solenoid valve is not energized by the transmission control module, the plunger moves to the left side by spring force, and the drain port is closed to retain the pressure.

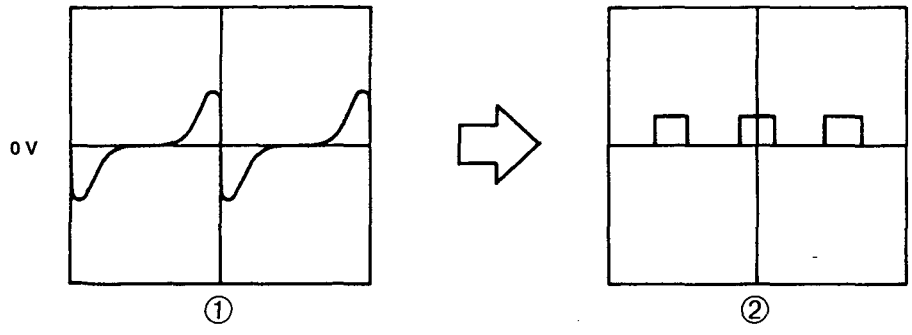
ATF flow	Solenoid valve (ON/OFF)
Retain	OFF
Drain	ON

Solenoid pattern

Solenoid	Gear position			
	1GR	2GR	3GR	4GR
Shift solenoid A	ON	ON	OFF	OFF
Shift solenoid B	OFF	ON	ON	OFF

VEHICLE SPEED SIGNAL DESCRIPTION

- The transmission control module outputs the vehicle speed signal to the vehicle speed sensor.
- The signal input from the output speed sensor to the transmission control module is changed to a vehicle speed signal within the transmission control module and output to the vehicle speed sensor within the combination meter.



1	Output speed sensor

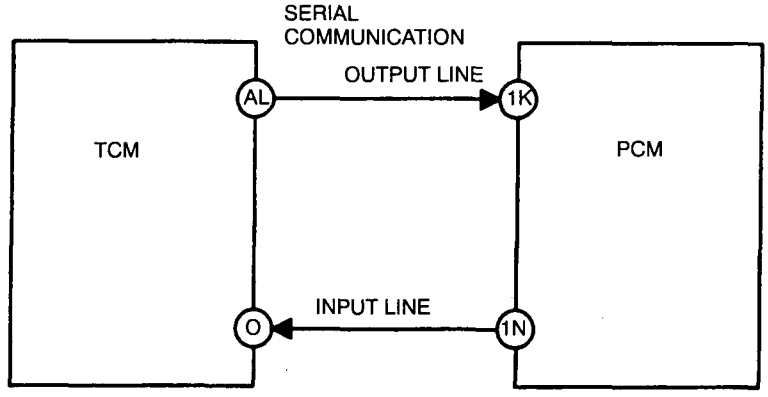
2	Vehicle speed signal

HOLD INDICATOR LIGHT DESCRIPTION

- The HOLD indicator light is included in the combination meter, and illuminates when the HOLD mode is selected.
- If a malfunction is detected by on-board diagnosis of the transmission control module, the HOLD indicator light flashes to warn the driver of the malfunction.

TCM-PCM SERIAL COMMUNICATION LINE DESCRIPTION

- The PCM and TCM mutually communicate with various information by using the serial communication line. There are two serial communication lines between TCM and PCM. One line transmits output signals from TCM to PCM, the other receives input signals from PCM to TCM. PCM and TCM constantly communicate the following information related to engine-transmission total control and failure diagnosis.
  - Output line (TCM to PCM)
    - Reduce torque signal
    - Inhibitor signal
    - FAIL signal
  - Input line (PCM to TCM)
    - Engine coolant temperature signal
    - Torque reduced signal
    - Brake signal
    - TEST signal



Reduce Torque Signal Description

- During shifting, the transmission control module sends the reduce torque signal to the powertrain control module.
- The powertrain control module judges whether torque reduction is possible or not based on the reduce torque signal and according to load condition. When torque reduction is determined to be possible, the powertrain control module sends a signal to the transmission control module and torque is reduced.

Inhibitor Signal Description

- The inhibitor signal detects the engine unloaded condition and outputs to the transmission control module.
- The P and N range switches primarily detect the engine unloaded condition, and based on the input shaft rotation speed, the inhibitor signal outputs from the powertrain control module in the optimum timing.

FAIL Signal Description

- If diagnostic trouble code is recorded in TCM, HOLD indicator light will blink and failure signal will be output to ECM.

Engine Coolant Temperature Signal Description

- The engine coolant temperature signal is sent by the powertrain control module. It detects coolant temperature.

Torque Reduced Signal Description

- The torque reduced signal is sent by the powertrain control module. It detects engine load conditions and available torque reduction control.

Brake Signal Description

- The brake signal is sent by powertrain control module. It detects brake pedal application.

TEST Signal Description

- The TEST signal detects the diagnostic test mode output from the powertrain control module to the transmission control module.
- If a malfunction is recorded, connect the NGS tester to data link connector 2. With the ignition switch at on position, the malfunction diagnostic trouble code will be output from the powertrain control module.

TRANSMISSION CONTROL MODULE DESCRIPTION

- The transmission control module makes judgments based on electrical signals from various sensors and sends electrical signals to the solenoid valves to perform the control described in the table below.
- The transmission control module constantly performs (ignition switch is on) on-board diagnosis on various sensors, and fail-safe mode is activated if a problem is detected.

Control item	Contents
Shift control	Detects engine load condition and vehicle speed. Shifts to the best gear position according to the programmed automatic shift diagram.
Torque converter clutch control	Controls torque converter clutch according to the programmed torque converter clutch operation points.
Engine transmission-total control	Temporarily lowers engine torque during shifting to improve shift feel.
On-board diagnostic system	Control module has an on-board diagnostic system for the parts essential for control of the EC-AT.
Fail-safe function	Maintains minimum driveability when a malfunction is detected by the on-board diagnostic system.

Shift Control

- The transmission control module selects the shift pattern based on the current mode and range. The transmission control module then reads the sensor rotor speed (vehicle speed) and throttle valve opening angle, and sends a signal to the solenoid valve, which sets the gear position.

Range determination

- When the selector lever is moved, the transmission range switches turn on and off, producing signals. The range is detected based on these signals.

Range determination conditions

- Range is determined when the following conditions are met:
  (1) D range
    - The D range switch is on (when shifted to D range).
  (2) S range
    - The S range switch is on (when shifted to S range).
  (3) L range
    - The L range switch is on (when shifted to L range).
  (4) P or N position
    - The P/N position switch is on (when shifted to P/N position).
  (5) R position
    - The R position switch is on (when shifted to R position).

Drive Pattern Selection Control

Mode determination

- Two types of modes, NORMAL mode or HOLD mode, can be selected by switching the HOLD switch.

Normal mode

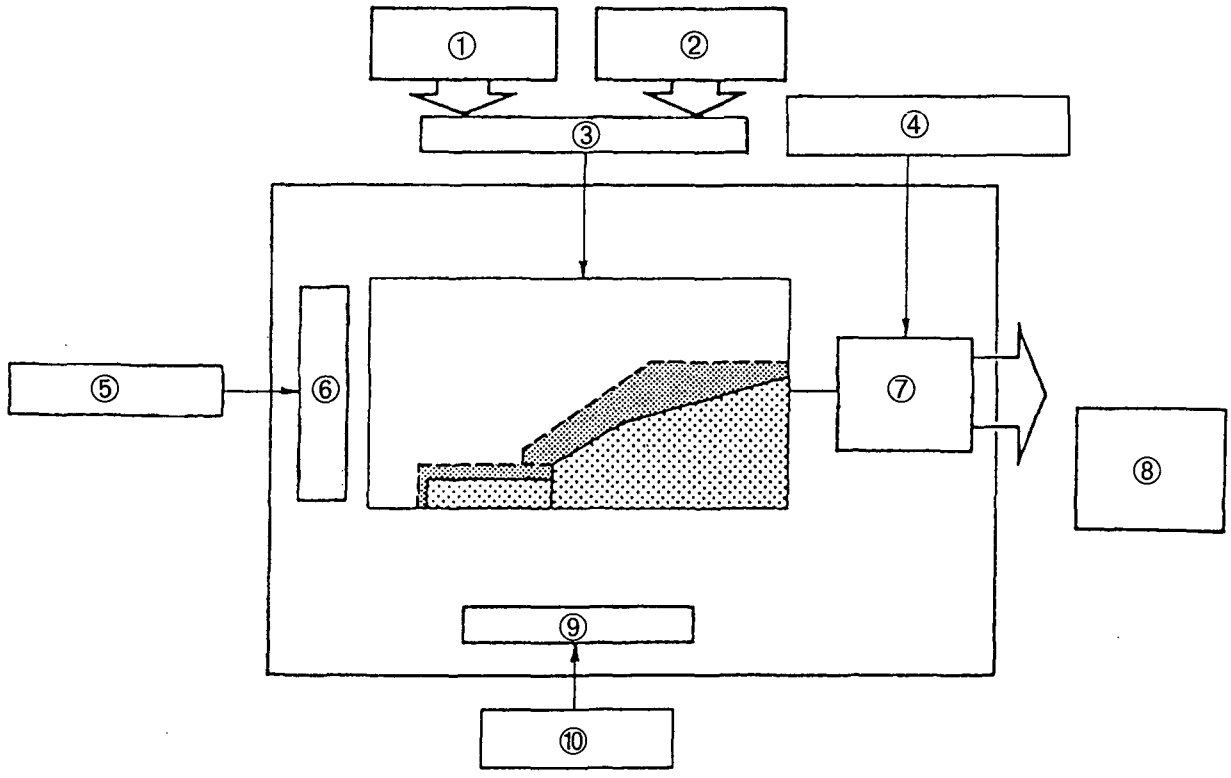
- Normal mode is the normal running mode when hold mode isn't selected.
  Torque converter clutch operates when in D range 4GR and 3GR and S range 3GR.

HOLD mode

- HOLD mode is activated when the HOLD switch is turned on. When in D range, acceleration is in 2GR and 3GR is held. 2GR is held in S range and 1GR is held in L range.

Torque Converter Clutch Control

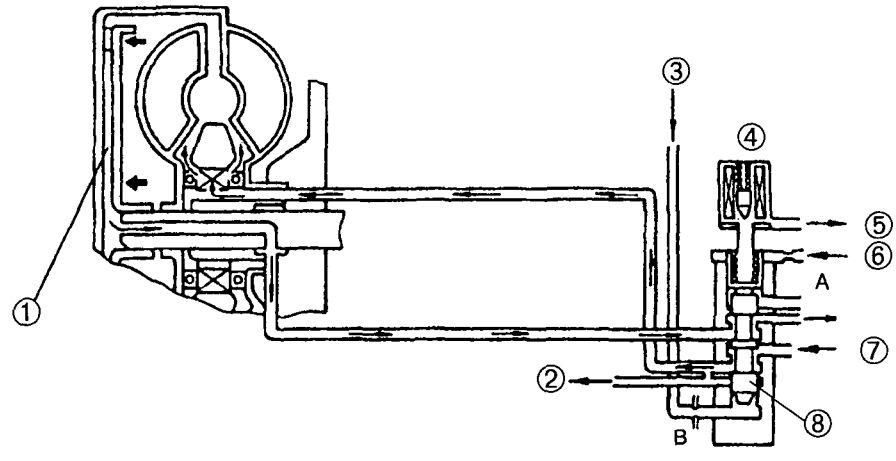
- Based on input signals from the output speed sensor, throttle position sensor, engine coolant temperature signal and range determination results, the transmission control module determines and selects torque converter clutch engagement, and sends signals to the torque converter clutch control solenoid valve for torque converter clutch operation.



1	Mode judgment
2	Range judgment
3	Torque converter clutch diagram selection
4	Engine coolant temperature signal
5	Throttle position sensor

6	Throttle opening angle
7	Torque converter clutch judgment
8	Torque converter clutch solenoid valve
9	Vehicle speed
10	Output speed sensor

Torque converter clutch operation

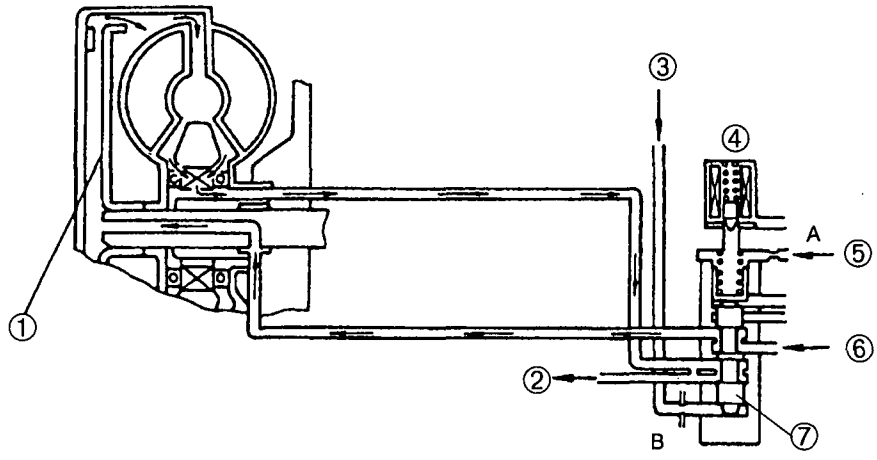


1	Torque converter clutch
2	To oil cooler
3	Line pressure
4	Torque converter clutch solenoid valve

5	Drain
6	Line pressure
7	Secondary pressure
8	Torque converter clutch control valve

- When the transmission control module detects complete torque converter clutch engagement, it sends an ON signal to the torque converter clutch solenoid valve. Consequently, no line pressure (A) is applied to the torque converter clutch control valve, allowing line pressure (B) to push them to the upper side.
- As a result, the torque converter clutch control valve drains the torque converter clutch pressure that works on the torque converter front chamber. The torque converter clutch is pressed tightly to the converter cover, thus engaging complete torque converter clutch.

Torque converter clutch non operation



1	Torque converter clutch
2	To oil cooler
3	Line pressure
4	Torque converter clutch solenoid valve

5	Line pressure
6	Secondary pressure
7	Torque converter clutch control valve

- When the transmission control module detects torque converter clutch release, it sends an OFF signal to the torque converter clutch solenoid valve. Consequently, line pressure (A) is applied to the down side.
- As a result, line pressure flows through the torque converter clutch apply chamber into the release chamber, releasing the torque converter clutch from the converter cover. Then torque converter clutch is released.

Conditions determining torque converter clutch inhibition

The torque converter clutch operation is inhibited in the following conditions:
- Engine coolant temperature is below 45 °C {113 °F}.
- Brake switch is on.
- Throttle valve closed throttle position.

Transmission-Engine Total Control System

Torque reduction control
- The transmission control module temporarily lowers engine torque to improve shift feeling. It does this by turning off fuel injection and retarding ignition timing during shifting. If the powertrain control module judges that torque reduction is impossible, the transmission control module raises shift timing.

N—D/R select output control
- When the selector lever is switched from the P/N position to the driving ranges, or vice versa, the powertrain control module reduces engine speed fluctuations by regulating fuel injection amount to improve select feel. Inhibitor signal is output to the powertrain control module in the following conditions:
  - When the selector lever is moved from the P/N position to the driving ranges and the 4GR clutch drum speed is less than specified.
  - When the selector lever is moved from the driving ranges to the P/N position and the 4GR clutch drum speed is more than specified.
- The powertrain control module regulates fuel injection amount based on the inhibitor signals to prevent engine speed fluctuations.

On-Board Diagnostic System
- The transmission control module has a built-in on-board diagnosis system for the main input sensors and all of the output solenoid valves. If a malfunction occurrs in the following systems, the on-board diagnostic system warns the driver by flashing the HOLD indicator light and records it in the transmission control module systems:

Diagnostic trouble code parts
Input/turbine speed sensor
Output speed sensor
Shift solenoid A
Shift solenoid B
Torque converter clutch solenoid valve
Throttle position sensor

- When a malfunction has been recorded, diagnostic trouble code can be verified by connecting the **SST** (NGS, disk monitor) or circuit tester to the data link connector.
- The display method is as follows: diagnostic trouble codes are displaying one time each in order starting with the smallest of the diagnostic trouble codes programmed at present.
  When the diagnostic trouble code than should be displayed next doesn't exist, the first diagnostic trouble code will be displayed again. (Refer to section F)
- After repairing malfunction, be sure to erase programmed diagnostic trouble code. However, because the transmission control module (TCM) stores diagnostic trouble codes even without battery power supply, the previous method of simply depressing the brake pedal for more than 20 seconds after disconnecting the battery cable, regardless of whether the ignition is on or off, will not erase diagnostic trouble codes. Refer to the following information when erasing diagnostic trouble codes.
  (1) When using the NGS tester, select "CLEAR" and diagnostic trouble code can be erased.
  (2) When the NGS tester is not used, diagnostic trouble codes can be erased by waiting for more than 5 seconds after turning the ignition off and then disconnecting the battery cable for more than 7 seconds.

Diagnostic trouble code chart

DTC No.		Indicator pattern	Diagnosed circuit	Self-diagnosis
Previous models	New models			
—	0705		Transmission range switch (short)	Short circuit
—	0706		Transmission range switch (open)	Open circuit
55	0715		Input/turbin speed sensor	Open or short circuit
—	0720		Output speed sensor	Open or short circuit
—	0725		Engine speed input signal	No input signal
60	—	—	Shift solenoid A	Open or short circuit
61	—	—	Shift solenoid B	Open or short circuit
62	—	—	Shift solenoid C	Open or short circuit
06	—	—	Vehicle speedometer sensor	Open or short circuit
—	1740		Torque converter clutch solenoid valve (open)	Open circuit
—	1742		Torque converter clutch solenoid valve (short)	Short circuit
63	—	—	Torque converter clutch control solenoid valve	Open or short circuit
—	1751		Shift solenoid A (open)	Open circuit
—	1752		Shift solenoid A (short)	Short circuit
—	1756		Shift solenoid B (open)	Open circuit

DTC No.		Indicator pattern	Diagnosed circuit	Self-diagnosis
Previous models	New models			
. .	1757		Shift solenoid B (short)	Short circuit
64	—	—	3—2 timing solenoid valve	Open or short circuit
—	1771		Throttle position sensor (open)	Open circuit
—	1772		Throttle position sensor (short)	Short circuit
12	—	—	Throttle position sensor	Open or short circuit

Fail-safe mode operation
When the on-board diagnostic system detects a malfunction, the transmission control module will maintain the minimum driveability. This is called the fail-safe function.

Transmission range switch
- If more than one range switch on signal is input, the priority order for range position is D→N→R→S→L.
- When transmission range switch circuit is open, the transmission control module will control driveability in D range.

Throttle position sensor
- The throttle valve opening angle is constantly assumed to be 0/8 (closed throttle position) in order to determine shift.

Output speed sensor
- Input/turbine speed sensor signals are used for shift control.
- The 4GR will be inhibited.

Shift solenoid A, Shift solenoid B
- If either shift solenoid A or shift solenoid B fails, the TCC solenoid valve will turn off.
- When a malfunction occurs in shift solenoid A and/or shift solenoid B the transmission control module will control the shifting as follows.

Range		D range				S range			L range	
Normal condition		1GR	2GR	3GR	4GR	1GR	2GR	3GR	1GR	2GR
Fail-safe mode	Shift solenoid A	3GR	3GR	3GR	4GR	3GR	3GR	3GR	2GR	2GR
	Shift solenoid B	1GR	4GR	4GR	4GR	1GR	3GR	3GR	1GR	1GR
	Shift solenoid A, B	4GR	4GR	4GR	4GR	3GR	3GR	3GR	1GR	1GR
	Input/turbine speed sensor and output speed sensor	1GR	1GR	1GR	1GR	1GR	1GR	1GR	1GR	1GR

Torque converter clutch solenoid valve
- Torque converter clutch solenoid valve will be OFF.

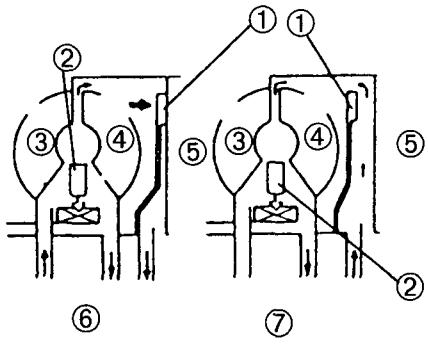
TORQUE CONVERTER DESCRIPTION

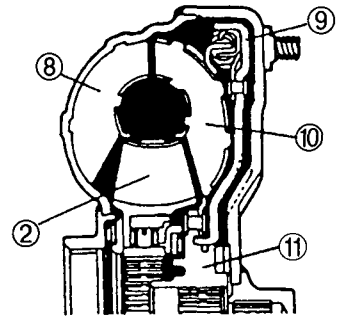
Outline

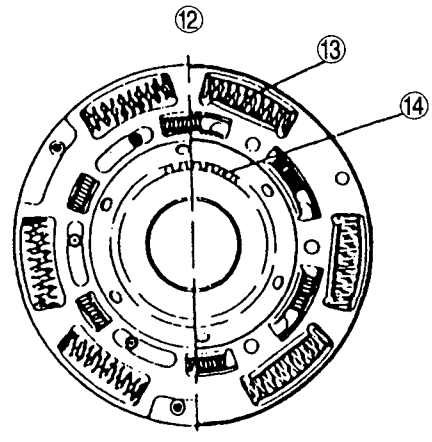
- The torque converter improves driveability by transmitting the drive force through the use of fluid. However, in certain ranges, a difference in rotation between the pump and the turbine caused by slipping of the fluid, decreases the transmission efficiency of the drive force as well as fuel efficiency.
- The torque converter clutch 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 in the manner mentioned above.

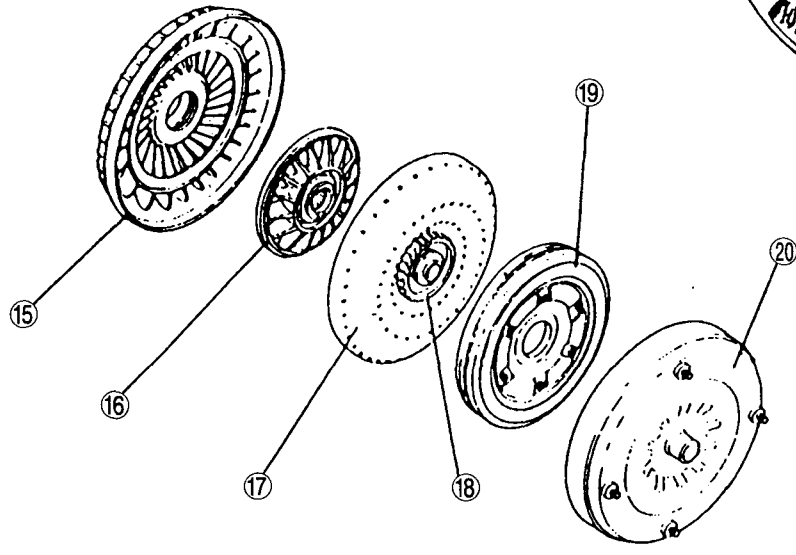
Construction

- The torque converter, which includes a torque converter clutch mechanism, houses the turbine runner, the pump impeller, the stator, and the torque converter clutch. The torque converter clutch is spline-fitted to the turbine hub. During torque converter clutch engagement, it slides over the turbine hub and is pressed tightly together with the converter cover. A torsion spring is installed in the torque converter clutch to absorb engine torque friction when the torque converter clutch is pressed onto the torque converter.









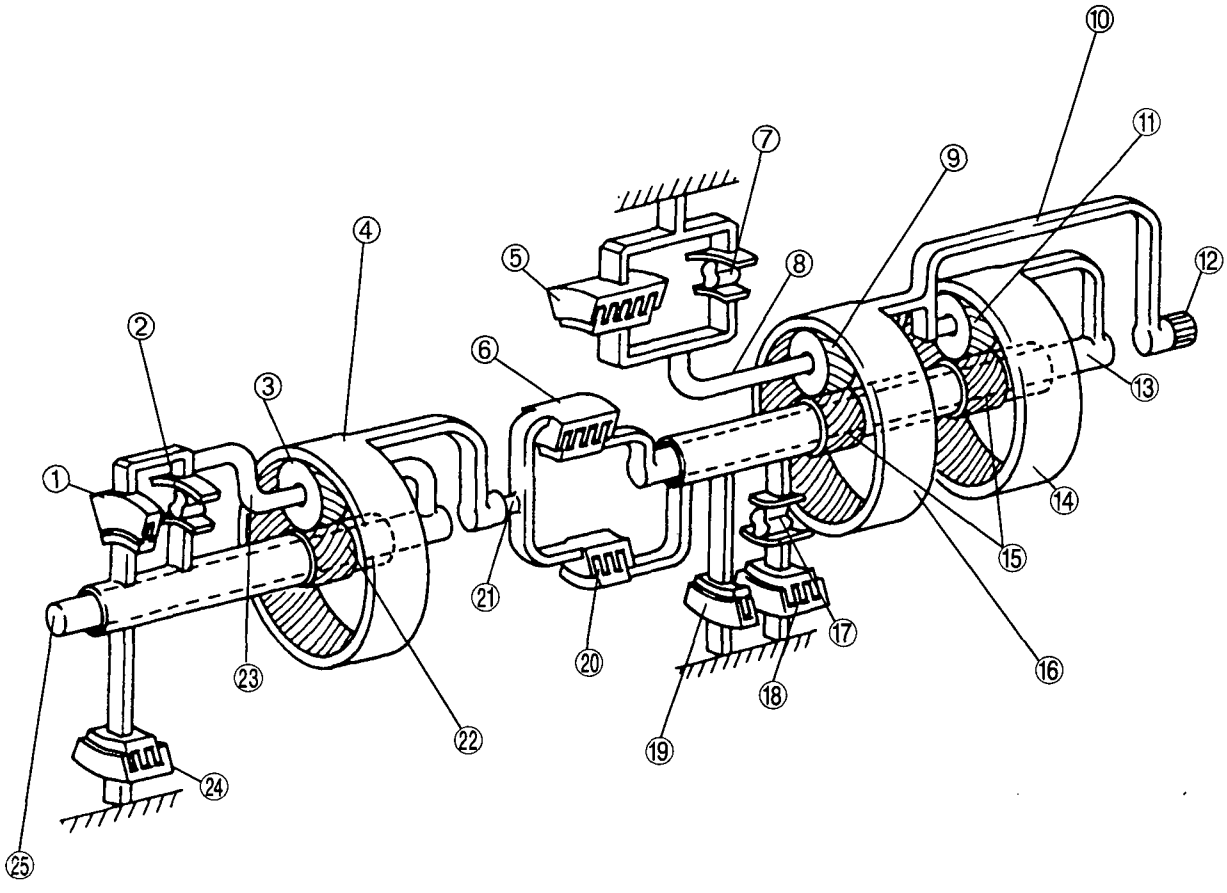
1	Torque converter clutch
2	Stator
3	Pump
4	Turbine
5	Converter cover
6	Torque converter clutch operation
7	Torque converter clutch non operation
8	Pump impeller
9	Torque converter clutch piston
10	Turbine runner

11	Turbine hub
12	Torque converter clutch piston (turbine runner side)
13	Torsion damper
14	Spline
15	Pump impeller
16	Stator
17	Turbine runner
18	Turbine hub
19	Torque converter clutch piston
20	Converter cover

POWERTRAIN DESCRIPTION

Component Descriptions

Component	Function
4GR clutch	Connects 4GR planetary pinion carrier and 4GR sun gear
Forward clutch	Connects input shaft and intermediate shaft
Direct clutch	Connects input shaft and sun gear
4GR brake	Locks 4GR sun gear
Second coast brake	Locks sun gear
Second brake	Locks counterclockwise rotation of sun gear
1st and reverse brake	Locks front planetary pinion carrier
One-way clutch No.0	Connects 4GR planetary pinion carrier and 4GR sun gear
One-way clutch No.1	Locks counterclockwise rotation of 4GR sun gear when second brake is on operation
One-way clutch No.2	Locks counterclockwise rotation of front planetary pinion carrier



1	4GR clutch
2	One-way clutch No.0
3	4GR pinion gear
4	4GR internal gear
5	1st and reverse brake
6	Forward clutch
7	One-way clutch No.2
8	Front planetary pinion carrier
9	Front pinion gear
10	Rear planetary pinion carrier
11	Rear pinion gear
12	Output shaft
13	Intermediate shaft

14	Rear internal gear
15	Sun gear
16	Front internal gear
17	One-way clutch No.1
18	Second brake
19	Second coast brake
20	Direct clutch
21	Input shaft
22	4GR sun gear
23	4GR planetary pinion carrier
24	4GR brake
25	4GR input shaft

OIL PUMP DESCRIPTION

Outline

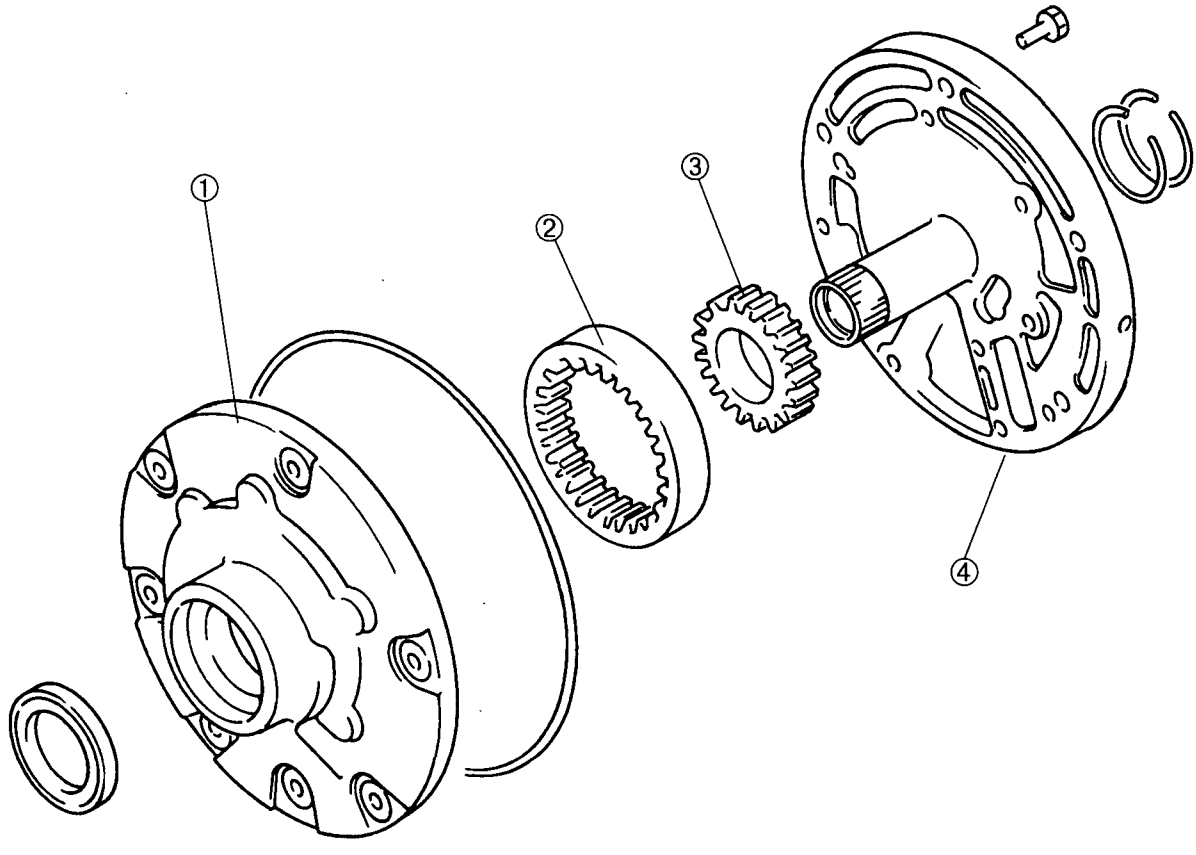
- The oil pump feeds oil to the torque converter, lubricates the powertrain, and maintains operating pressure for the hydraulic control system.

Construction

- The outer gear and inner gear are integrated in the oil pump housing, and they are offset with one part of the gear engaged.
- The inner gear is engaged on the end of the torque converter.
- Due to this, when the crankshaft rotates, the drive plate, torque converter, inner gear, and outer gear all rotate together as a single unit.

Operation

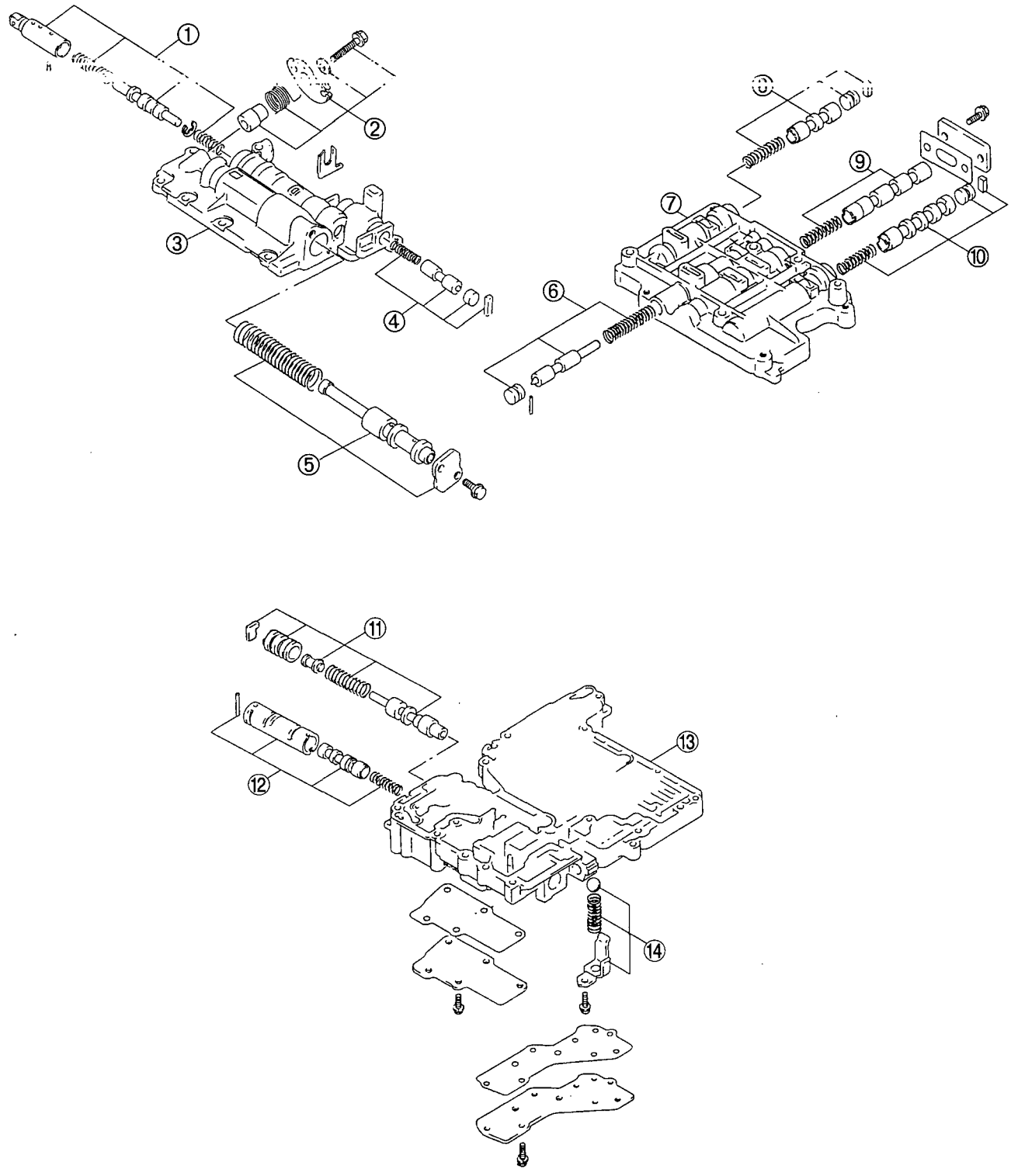
- When the inner gear and outer gear rotate, the fluid drawn up through the oil strainer is sent by the inner gear and outer gear to the control valve.



1	Oil pump body
2	Outer gear

3	Inner gear
4	Oil pump cover

CONTROL VALVE DESCRIPTION
Control Valve Component Location

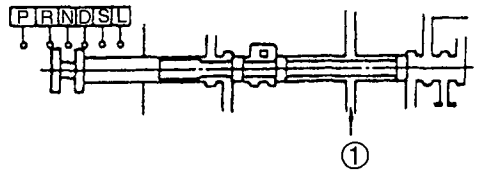


1	Throttle valve
2	Throttle valve cam
3	Front upper valve body
4	Cutback valve
5	Secondary regulator valve
6	Reverse brake sequence valve
7	Rear upper valve body

8	3—4 shift valve
9	1—2 shift valve
10	2—3 shift valve
11	Primary regulator valve
12	Torque converter clutch control valve
13	Lower valve body
14	Pressure relief valve

Manual Valve

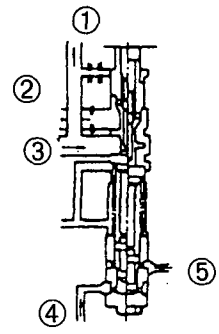
- The manual valve switches the hydraulic passages for the line pressure. It is linked to the selector lever beside the driver's seat and it switches the ranges P, R, N, D, S, and L according to the lever positions.



1	Line pressure

Primary Regulator Valve

- The primary regulator valve automatically adjusts the hydraulic pressure to each element to the most suitable level according to the vehicle speed and engine load (throttle valve opening). Consequently, it prevents the oil pump from losing power unnecessarily.

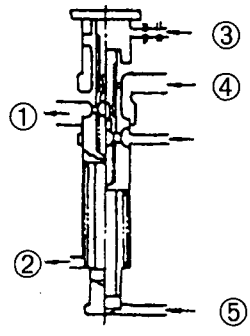


1	Line pressure
2	Secondary regulator valve
3	Oil pump

4	Throttle pressure
5	Line pressure

Secondary Regulator Valve

- The secondary regulator valve adjusts suitable converter pressure, lubrication hydraulic pressure, and cooler pressure according to the vehicle speed and the engine load (throttle valve opening).

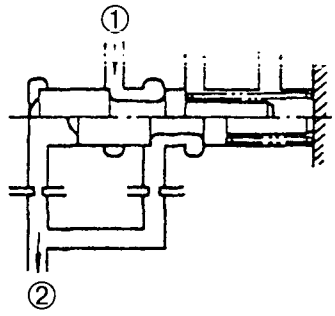


1	Lubrication
2	Drain
3	Primary regulator valve

4	Primary regulator valve
5	Throttle pressure

Intermediate Coast Modulator Valve

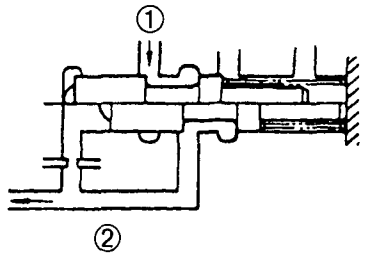
- The intermediate coast modulator valve adjusts the line pressure of the second coast brake piston to reduce the engine brake shock when the selector lever is in second gear, at S range.



1	Manual valve	2	Second brake

Low Coast Modulator Valve

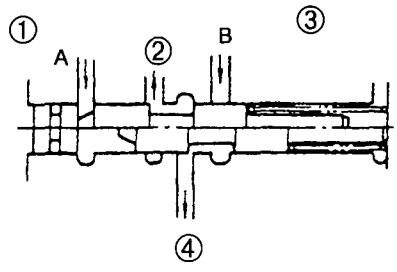
- The low coast modulator valve adjusts the line pressure which acts on this valve to the low hydraulic pressure (low modulator pressure) when the valve is at L range. The pressure goes through the low coast shift valve and operates on the 1st and reverse brake to reduce the brake shock.



1	Manual valve	2	1st and reverse brake

Reverse Brake Sequence Valve

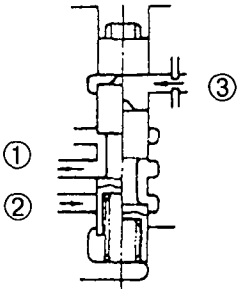
- The reverse brake sequence valve reduces the shock when the selector lever is shifted to R position, and it is controlled by the line pressure which acts on the direct clutch outer piston. The line pressure acts on both circuits A and B at the same time when the selector lever is at R position. The outer piston operates after the inner piston, since circuit B will not open until hydraulic pressure A on this valve or the line pressure on the inner piston overcomes the valve spring tension.
- When the selector lever is in third gear at D range, only the outer piston can operate since circuit B is closed by the manual valve.



1	Line pressure	3	Manual valve
2	2—3 shift valve	4	Direct clutch inner piston

Cutback Valve

- The cutback valve adjusts the cutback pressure which acts on the throttle valve. The cutback valve operates with the line pressure from the 1—2 shift valve and the throttle pressure. The cutback pressure's effect on the throttle valve reduces the throttle pressure and prevents the oil pump from losing power unnecessarily.

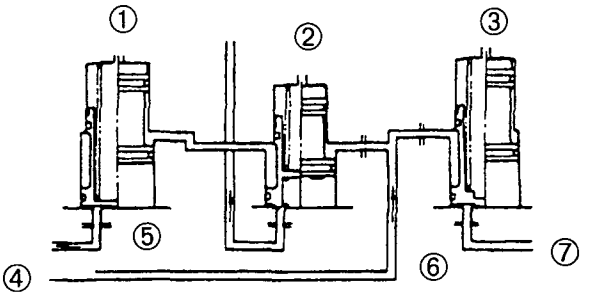


1	Throttle valve
2	Throttle pressure

3	1—2 shift valve

Accumulator

- Accumulators are set at each location to reduce shift shock generated when the forward clutch, the direct clutch, or second brake is in operation. There is an area difference between the working side and the back pressure side of the accumulator piston; the working side area is larger than the back pressure side. The line pressure acts on the back pressure side at all times to push down the piston. When the passage to the working side opens and the line pressure is in operation, the piston is gradually pushed up and reduces shift shock.

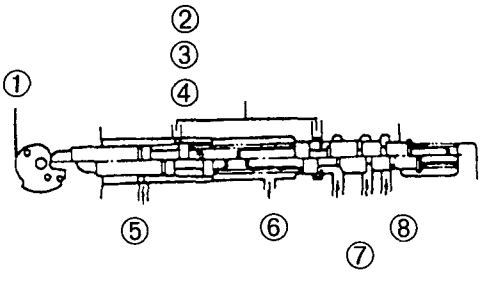


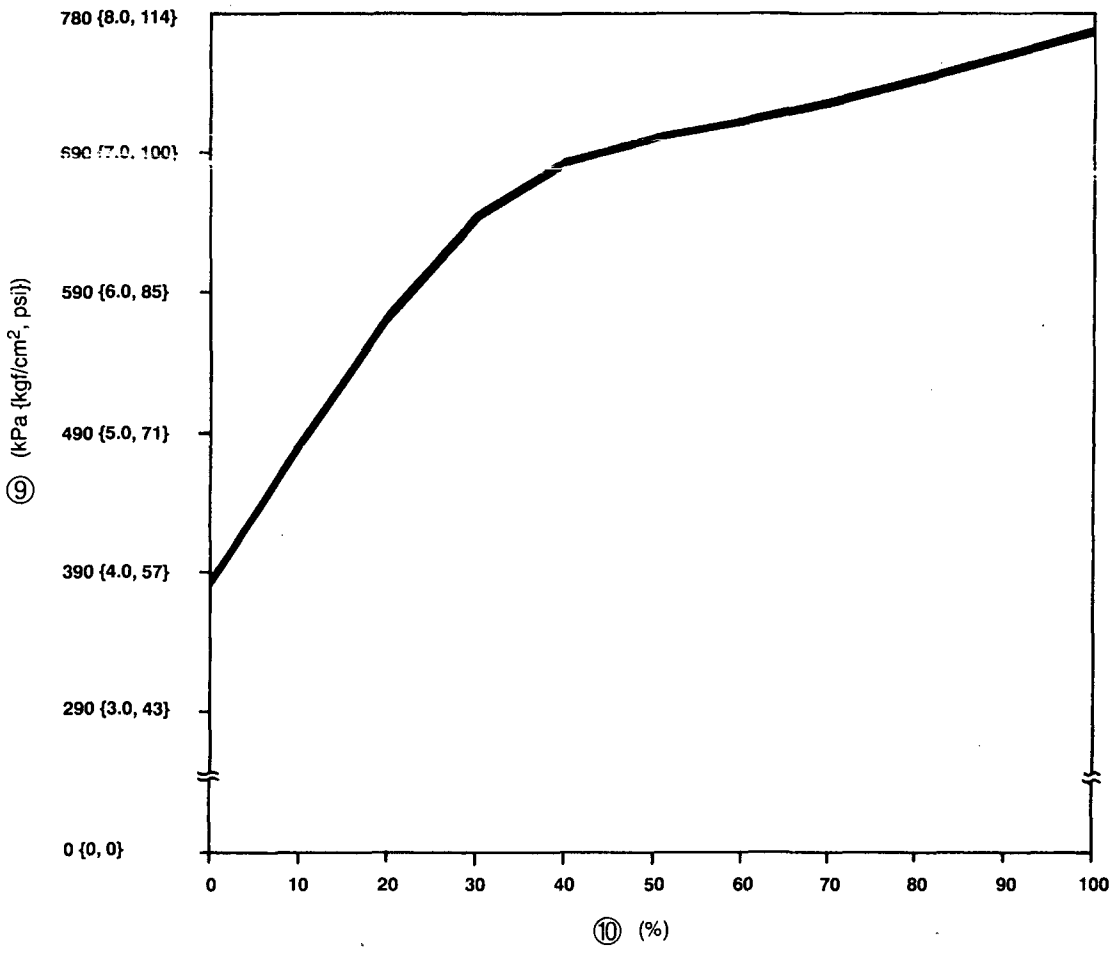
1	Second brake accumulator
2	Direct clutch accumulator
3	Forward clutch accumulator
4	Second brake

5	Direct clutch inner piston
6	Line pressure
7	Forward clutch

Throttle Valve

- The throttle valve gets the throttle pressure to correspond to acceleration or the engine load. The throttle cable interlocked with the accelerator pedal transmits the pressure to the throttle valve cam, and the throttle valve cam pushes the downshift plug to shift the throttle valve by compressing the two springs in front and behind. Then the line pressure passage opens and throttle pressure is generated. However, the throttle pressure also operates behind the valve, and the throttle valve is pushed back because of the hydraulic pressure. The throttle valve closes the line pressure passage, with the tension of the two springs in the downshift plug position balanced.
- Consequently, the throttle pressure is regulated by the throttle valve opening angles. The hydraulic pressure adjusts the primary regulator valve and the secondary regulator valve to relieve the line pressure.



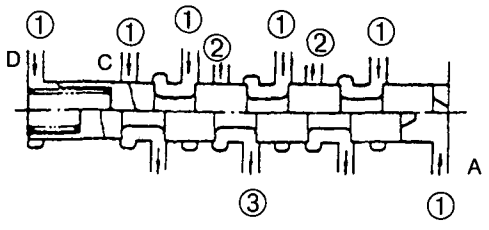


1	Throttle valve cam
2	Primary regulator valve
3	Secondary regulator valve
4	Cutback valve
5	Cutback valve

6	Drain
7	Cutback valve
8	Line pressure
9	Line pressure
10	Throttle opening angle

1—2 Shift Valve

- 1—2 shift valve automatically controls shifts between first and second gear by on/off signals from TCM via shift solenoid B.
- In first gear position, with shift solenoid B off, line pressure from passage A acts on the valve to shift, and the passage to second brake is closed. With shift solenoid B on, passage A line pressure is drained, the valve shifts with the spring tension, the passage to second brake is opened, and the position turns to second gear.
- In S or L range, passage B line pressure acts on second coast brake through the intermediate modulator valve, only when the valve is in second position. This enables the engine brake to operate in second gear. In L range, passage C pressure acts on reverse brake only when the valve is in first position. This enables the engine brake to operate in first gear.

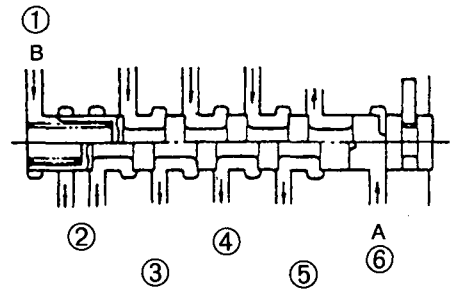


1	Line pressure
2	Drain

3	Intermediate coast modulator valve

2—3 Shift Valve

- The 2—3 shift valve automatically controls shifts between second and third gear by on/off signal from TCM via shift solenoid A.
- In second gear position, with shift solenoid A on, passage A line pressure is drained and the passage to the direct clutch is closed. The passage A line pressure causes the valve to shift by switching shift solenoid A off, and the passage to the direct clutch is opened, engaging third gear.

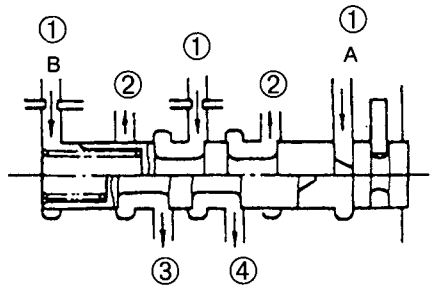


1	Line pressure
2	Low coast modulator valve
3	Direct clutch

4	3—4 shift valve
5	1—2 shift valve
6	Line pressure

3—4 Shift Valve

- The 3—4 shift valve automatically controls shifts between third gear and 4GR gear by on/off signal from TCM via shift solenoid B.
- In third gear position, with shift solenoid B on, passage A line pressure is drained. This allows the 4GR clutch passage to be opened and the 4GR brake passage to be closed. With shift solenoid B off, the passage A line pressure causes the valve to shift. This allows 4GR clutch passage to be closed and the 4GR brake passage to be opened, engaging 4GR gear.
- Also in first gear position, shift solenoid B is off and the passage A line pressure is on. However, the passages to the 4GR clutch and to the 4GR brake are not shifted, because passage B line pressure does not allow the valve to shift.



1	Line pressure
2	Drain

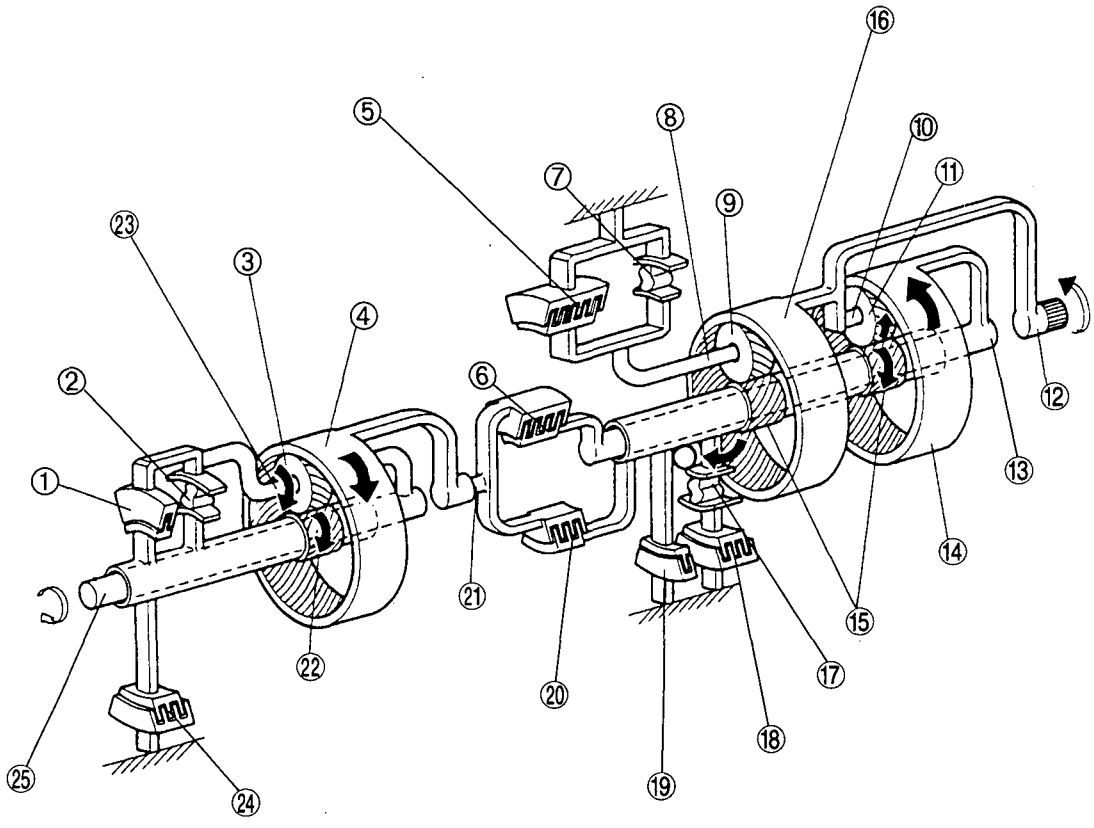
3	4GR clutch
4	4GR brake

POWER TRANSMISSION/HYDRAULIC MECHANISM DESCRIPTION

R Position

Power transmission

- The driving force of the 4GR input shaft is transmitted to the input shaft because 4GR clutch and one-way clutch No.0 are engaged, and 4GR planetary gear unit rotates as a unit.
- The driving force of the input shaft is transmitted to the sun gear through the direct clutch, causing the sun gear to rotate clockwise. The front pinion gear, however, does not revolve because the front planetary pinion carrier is locked by the reverse brake. This causes the sun gear to rotate the front planetary pinion gear counterclockwise.
- As a result, the output shaft also rotates counterclockwise, and the driving force is transmitted to the driving wheels.

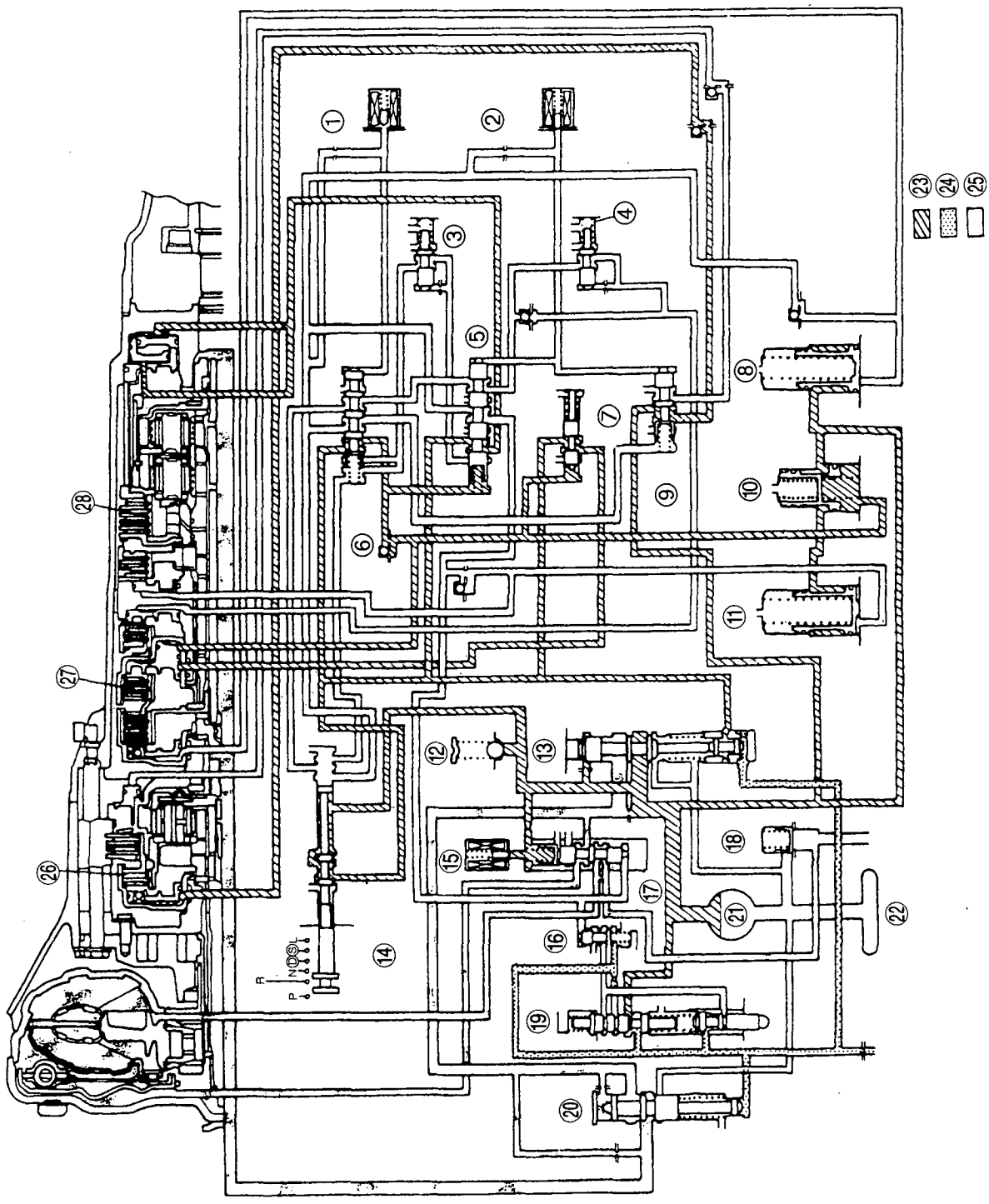


1	4GR clutch
2	One-way clutch No.0
3	4GR pinion gear
4	4GR internal gear
5	1st and reverse brake
6	Forward clutch
7	One-way clutch No.2
8	Front planetary pinion carrier
9	Front pinion gear
10	Rear planetary pinion carrier
11	Rear pinion gear
12	Output shaft
13	Intermediate shaft

14	Rear internal gear
15	Sun gear
16	Front internal gear
17	One-way clutch No.1
18	Second brake
19	Second coast brake
20	Direct clutch
21	Input shaft
22	4GR sun gear
23	4GR planetary pinion carrier
24	4GR brake
25	4GR input shaft

Hydraulic pressure operation

- The line pressure flows in the manual valve and operates the 4GR clutch, direct clutch, and 1st and reverse brake.



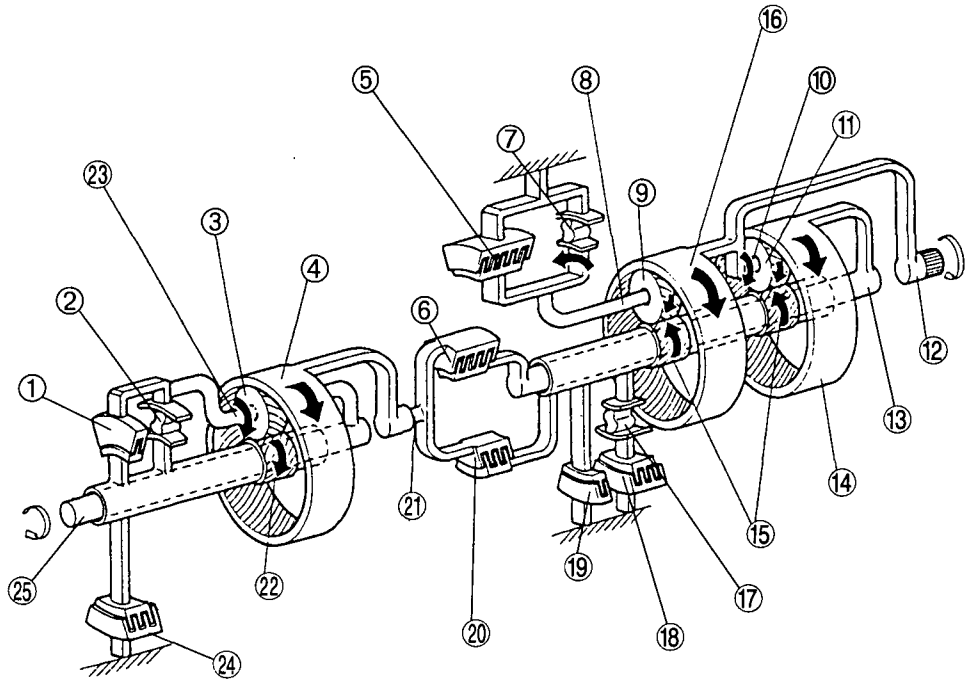
1	Shift solenoid A
2	Shift solenoid B
3	Low coast modulator valve
4	Intermediate coast modulator valve
5	1—2 shift valve
6	2—3 shift valve
7	Reverse brake sequence valve
8	Forward clutch accumulator
9	3—4 shift valve
10	Direct clutch accumulator
11	Second brake accumulator
12	Pressure relief valve
13	Primary regulator valve
14	Manual valve

15	Torque converter clutch solenoid valve
16	Cutback valve
17	Torque converter clutch control valve
18	Oil cooler bypass valve
19	Throttle valve
20	Secondary regulator valve
21	Oil pump
22	Strainer
23	Line pressure
24	Throttle pressure
25	Converter pressure
26	4GR clutch
27	Direct clutch
28	1st and reverse brake

First Gear

Power transmission

- The driving force of the 4GR input shaft is transmitted to the input shaft because 4GR clutch and one-way clutch No.0 are engaged, and 4GR planetary gear unit rotates as a unit. The forward clutch transmits this driving force to the rear internal gear to rotate. However, the rear planetary pinion carrier, which is set together with the output shaft or the driving wheels, does not revolve because it is locked by the load when the vehicle is at a standstill. This causes the rear pinion gear to rotate clockwise.
- This rotation is transmitted to the sun gear, causing the gear to rotate counterclockwise. However, the front internal gear, which is also set together with the output shaft, does not revolve when the vehicle is at a standstill. The front pinion gear cannot revolve counterclockwise due to one-way clutch No.2 set operation, though it is going to revolve around the sun gear while it is rotating clockwise.
- As a result, the front pinion gear rotates clockwise, overcoming the load of the stopped vehicle, and rotates the front internal gear clockwise. This also causes the output shaft to rotate clockwise, and this driving force is transmitted to the driving wheels through the propeller shaft.
- During deceleration, the front pinion gear rotates at higher speed than the sun gear, causing one-way clutch No.2 to freewheel and the front planetary pinion carrier to rotate clockwise. As a result, reverse torque from the driving wheels is not transmitted to the engine, so the engine brake does not operate.

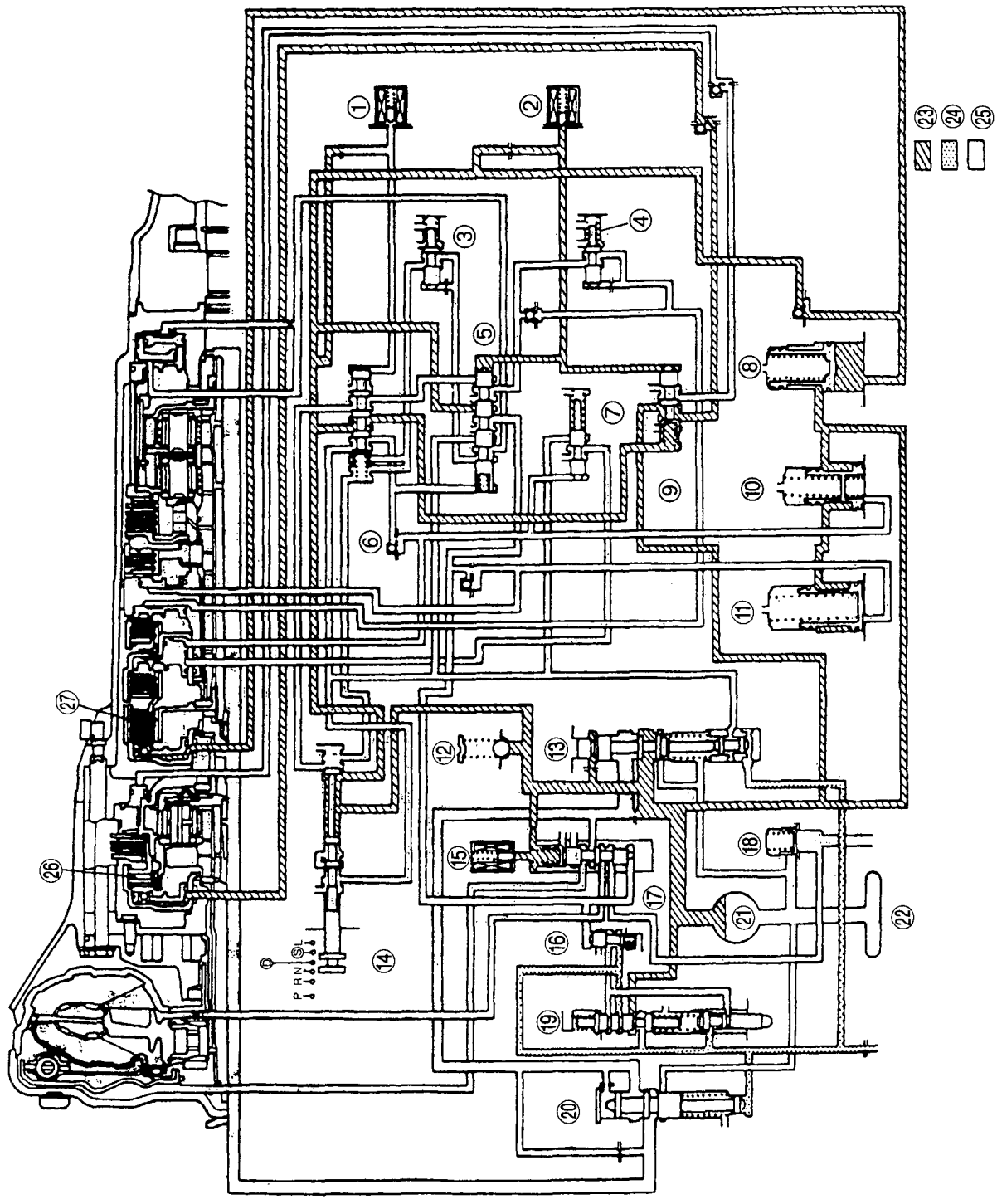


1	4GR clutch
2	One-way clutch No.0
3	4GR pinion gear
4	4GR internal gear
5	1st and reverse brake
6	Forward clutch
7	One-way clutch No.2
8	Front planetary pinion carrier
9	Front pinion gear
10	Rear planetary pinion carrier
11	Rear pinion gear
12	Output shaft
13	Intermediate shaft

14	Rear internal gear
15	Sun gear
16	Front internal gear
17	One-way clutch No.1
18	Second brake
19	Second coast brake
20	Direct clutch
21	Input shaft
22	4GR sun gear
23	4GR planetary pinion carrier
24	4GR brake
25	4GR input shaft

Hydraulic pressure operation

- The line pressure driven to the manual valve works on the forward clutch and 4GR clutch, engaging each clutch to be in first gear position. With the shift solenoid B off, the 1—2 shift valve is pushed to the left side, so the line pressure from the manual valve does not flow beyond the 1—2 shift valve.



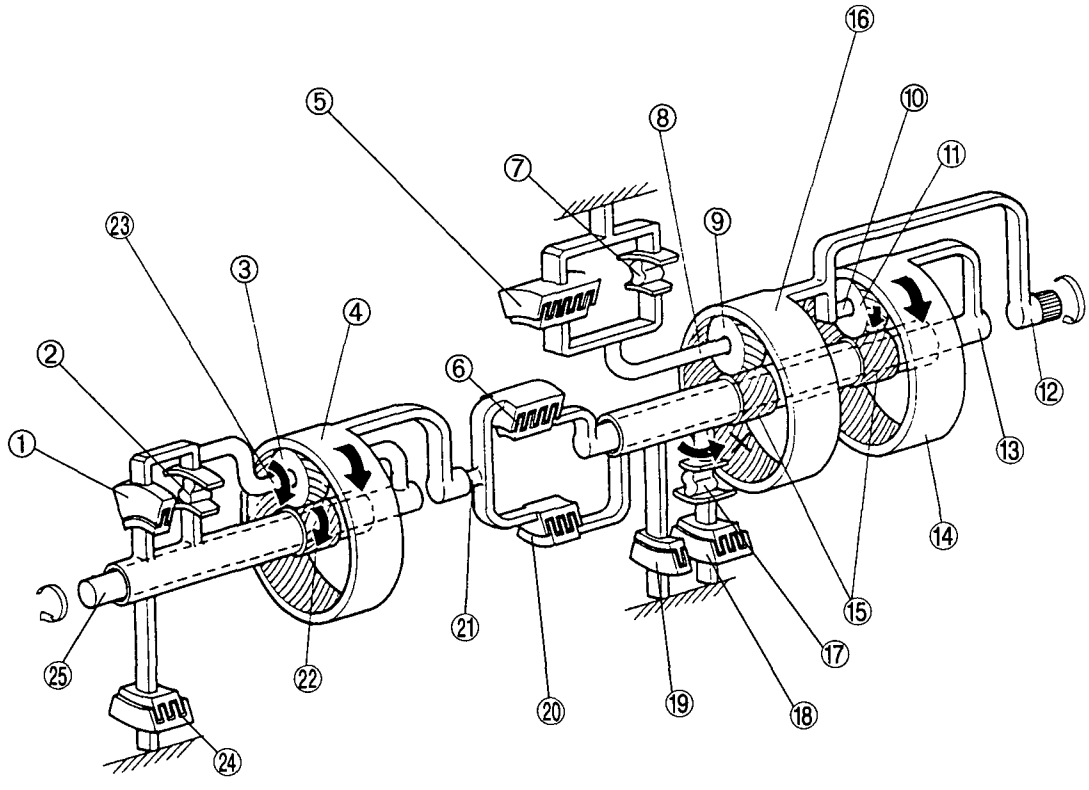
1	Shift solenoid A
2	Shift solenoid B
3	Low coast modulator valve
4	Intermediate coast modulator valve
5	1—2 shift valve
6	2—3 shift valve
7	Reverse brake sequence valve
8	Forward clutch accumulator
9	3—4 shift valve
10	Direct clutch accumulator
11	Second brake accumulator
12	Pressure relief valve
13	Primary regulator valve
14	Manual valve

15	Torque converter clutch solenoid valve
16	Cutback valve
17	Torque converter clutch control valve
18	Oil cooler bypass valve
19	Throttle valve
20	Secondary regulator valve
21	Oil pump
22	Strainer
23	Line pressure
24	Throttle pressure
25	Converter pressure
26	4GR clutch
27	Forward clutch

Second Gear

Power transmission

- The driving force of the 4GR input shaft is transmitted to the input shaft because 4GR clutch and one-way clutch No.0 are engaged, and 4GR planetary gear unit rotates as a unit. The driving force of the input shaft is transmitted to the rear internal gear through the forward clutch, causing the rear internal gear to rotate.
- This rotation is transmitted to the sun gear through the pinion gear. Though the sun gear normallg rotates counterclockwise, it cannot due to second brake set operation.
- As a result, the rear pinion gear rotates clockwise, and it rotates the rear planetary pinion carrier clockwise. The output shaft also rotates clockwise, and the driving force is transmitted to the driving wheels through the propeller shaft.
- During deceleration, the driving force is transmitted from the driving wheels, as opposed to the operation in driving. This causes the one-way clutch No.2 to freewheel. Thus the reverse torque from the driving wheels is not transmitted to the engine, and the engine brake does not operate.

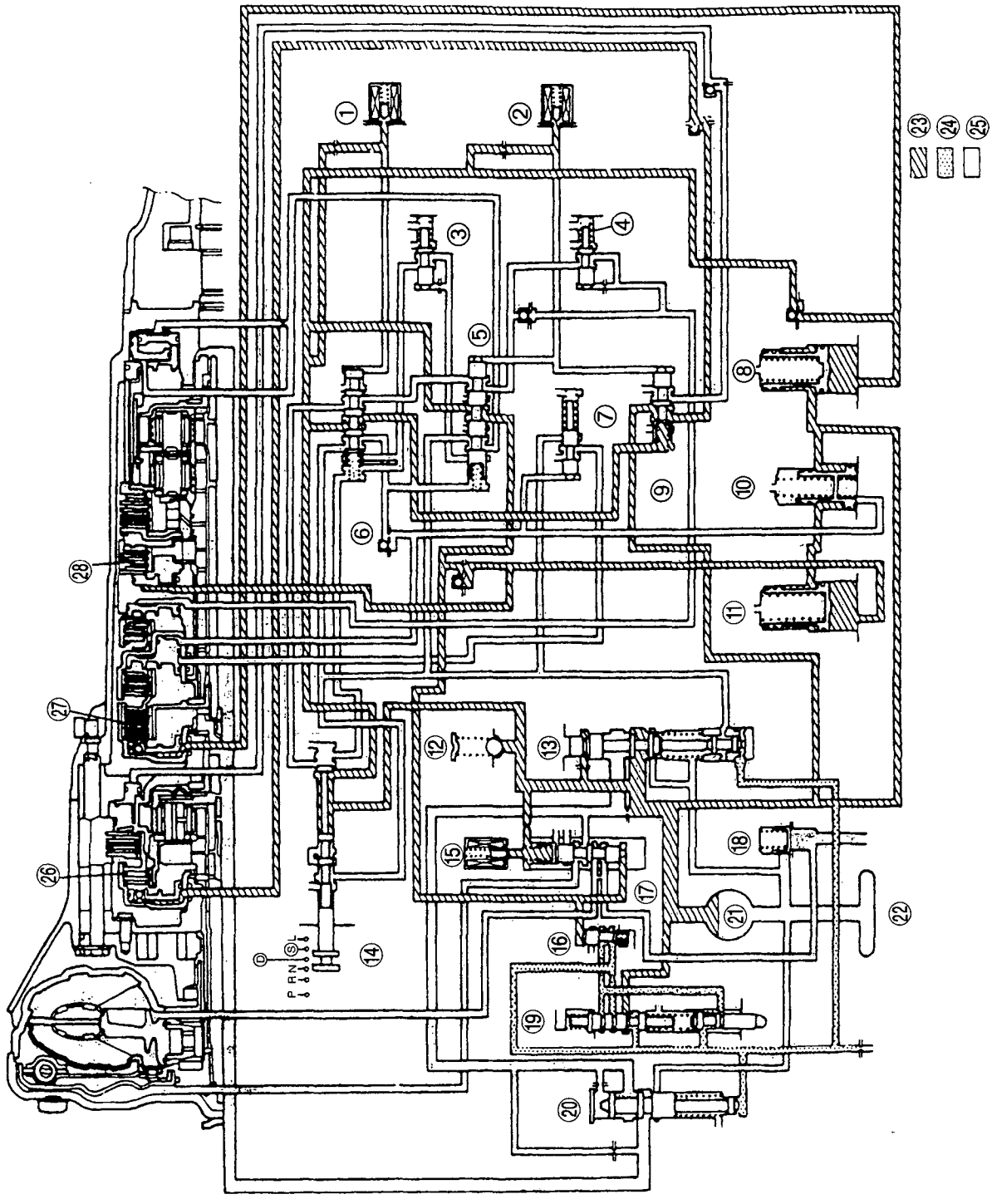


1	4GR clutch
2	One-way clutch No.0
3	4GR pinion gear
4	4GR internal gear
5	1st and reverse brake
6	Forward clutch
7	One-way clutch No.2
8	Front planetary pinion carrier
9	Front pinion gear
10	Rear planetary pinion carrier
11	Rear pinion gear
12	Output shaft
13	Intermediate shaft

14	Rear internal gear
15	Sun gear
16	Front internal gear
17	One-way clutch No.1
18	Second brake
19	Second coast brake
20	Direct clutch
21	Input shaft
22	4GR sun gear
23	4GR planetary pinion carrier
24	4GR brake
25	4GR input shaft

Hydraulic pressure operation

- When the position is switched to second gear after accelerating in first gear, shift solenoid B turns on and line pressure works on the 1—2 shift valve. The hydraulic pressure which works on the 1—2 shift valve flows to the accumulator and to second brake, causing second brake to operate. The accumulator reduces shift shock generated when second brake is operated.



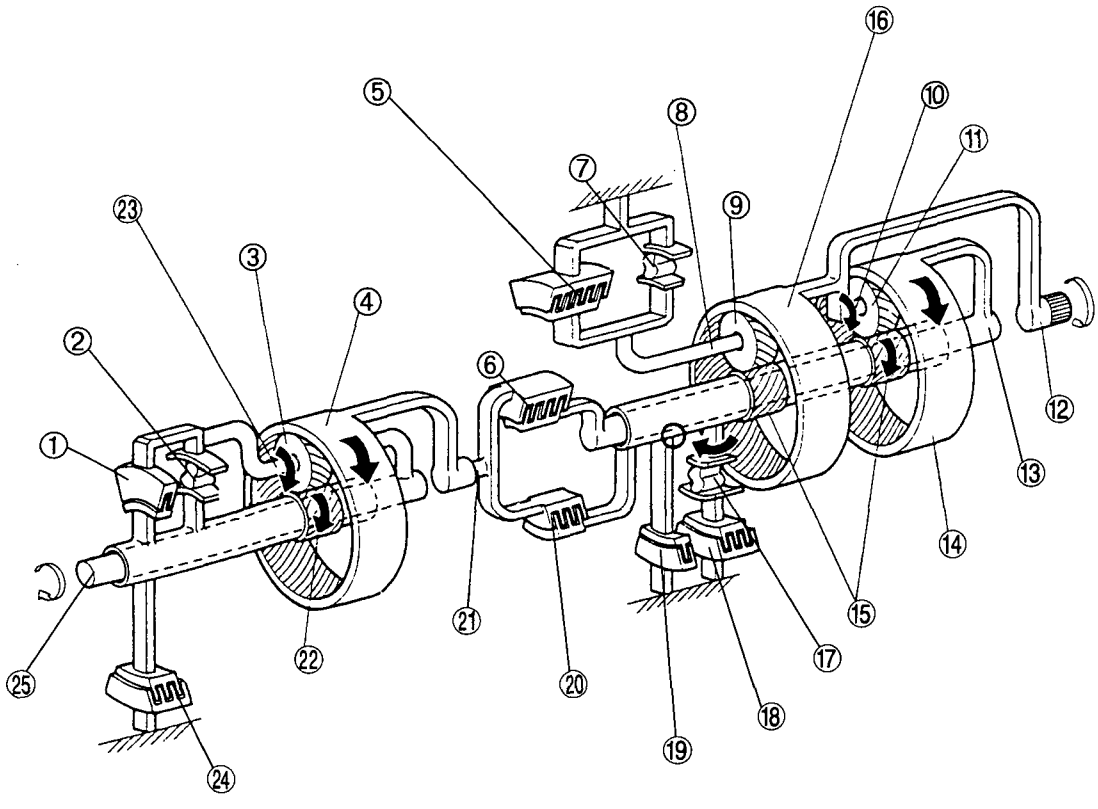
1	Shift solenoid A
2	Shift solenoid B
3	Low coast modulator valve
4	Intermediate coast modulator valve
5	1—2 shift valve
6	2—3 shift valve
7	Reverse brake sequence valve
8	Forward clutch accumulator
9	3—4 shift valve
10	Direct clutch accumulator
11	Second brake accumulator
12	Pressure relief valve
13	Primary regulator valve
14	Manual valve

15	Torque converter clutch solenoid valve
16	Cutback valve
17	Torque converter clutch control valve
18	Oil cooler bypass valve
19	Throttle valve
20	Secondary regulator valve
21	Oil pump
22	Strainer
23	Line pressure
24	Throttle pressre
25	Converter pressure
26	4GR clutch
27	Forward clutch
28	Second brake

Third Gear

Power transmission

- The driving force of the 4GR input shaft is transmitted to the input shaft because 4GR clutch and one-way clutch No.0 are engaged, and 4GR planetary gear unit rotates as a unit. The driving force of the input shaft is transmitted to the rear internal gear through the forward clutch, causing the rear internal gear to rotate clockwise. The force is also transmitted to the sun gear through the direct clutch, and it rotates the sun gear clockwise.
- Because the rear internal gear and the sun gear rotate in the same direction at the same time, the rear pinion gear does not rotate, causing the rear planetary pinion carrier to rotate together with the rear internal gear and the sun gear. This torque is transmitted to the driving wheels through the propeller shaft.
- During deceleration, the driving force is transmitted from the driving wheels as opposed to the operation in driving, causing the engine brake to operate.

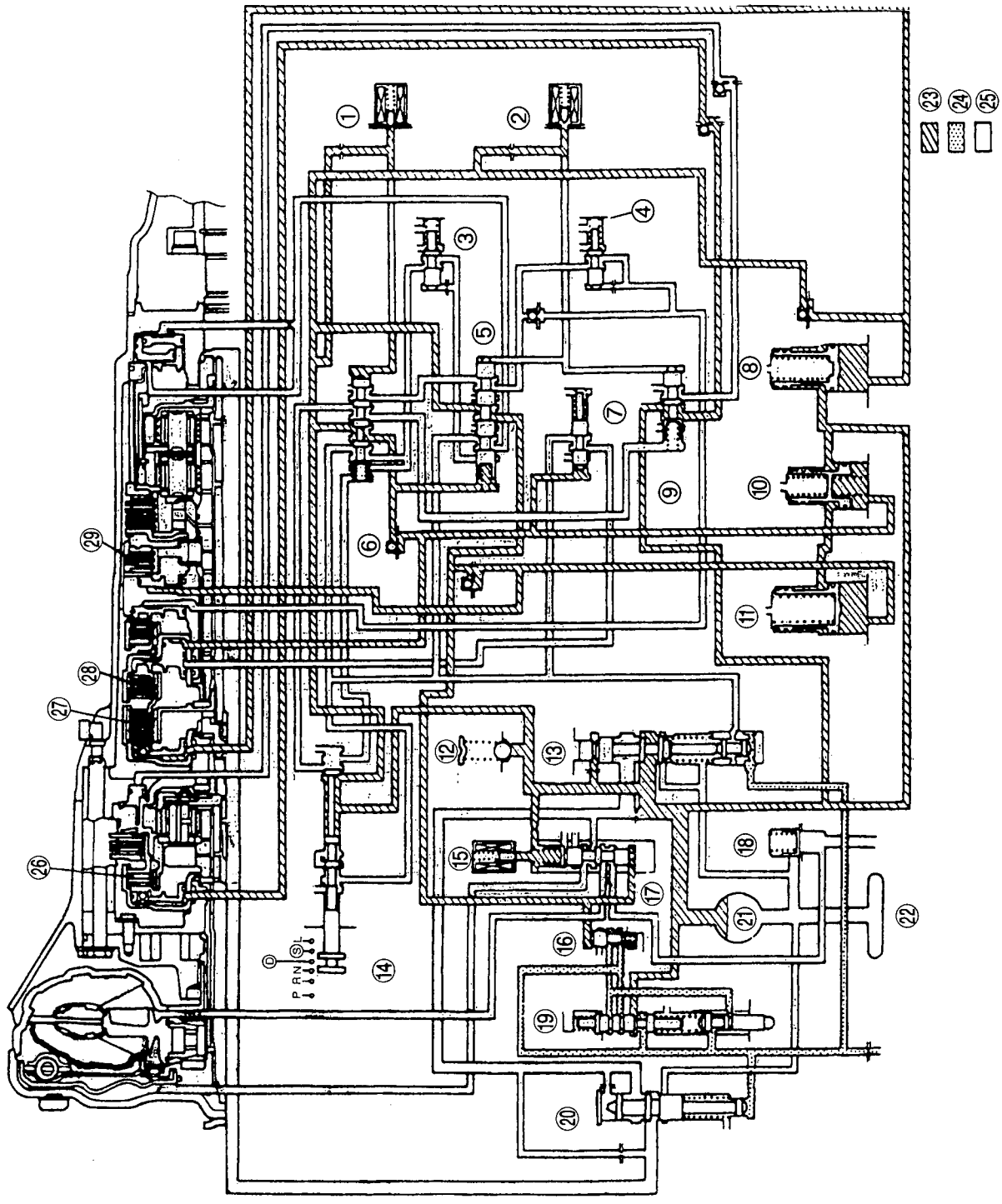


1	4GR clutch
2	One-way clutch No.0
3	4GR pinion gear
4	4GR internal gear
5	1st and reverse brake
6	Forward clutch
7	One-way clutch No.2
8	Front planetary pinion carrier
9	Front pinion gear
10	Rear planetary pinion carrier
11	Rear pinion gear
12	Output shaft
13	Intermediate shaft

14	Rear internal gear
15	Sun gear
16	Front internal gear
17	One-way clutch No.1
18	Second brake
19	Second coast brake
20	Direct clutch
21	Input shaft
22	4GR sun gear
23	4GR planetary pinion carrier
24	4GR brake
25	4GR input shaft

Hydraulic pressure operation

- When the position is switched to third gear after accelerating in second gear, shift solenoid A turns off. Thus the hydraulic pressure works on the 2—3 shift valve and operates the direct clutch.



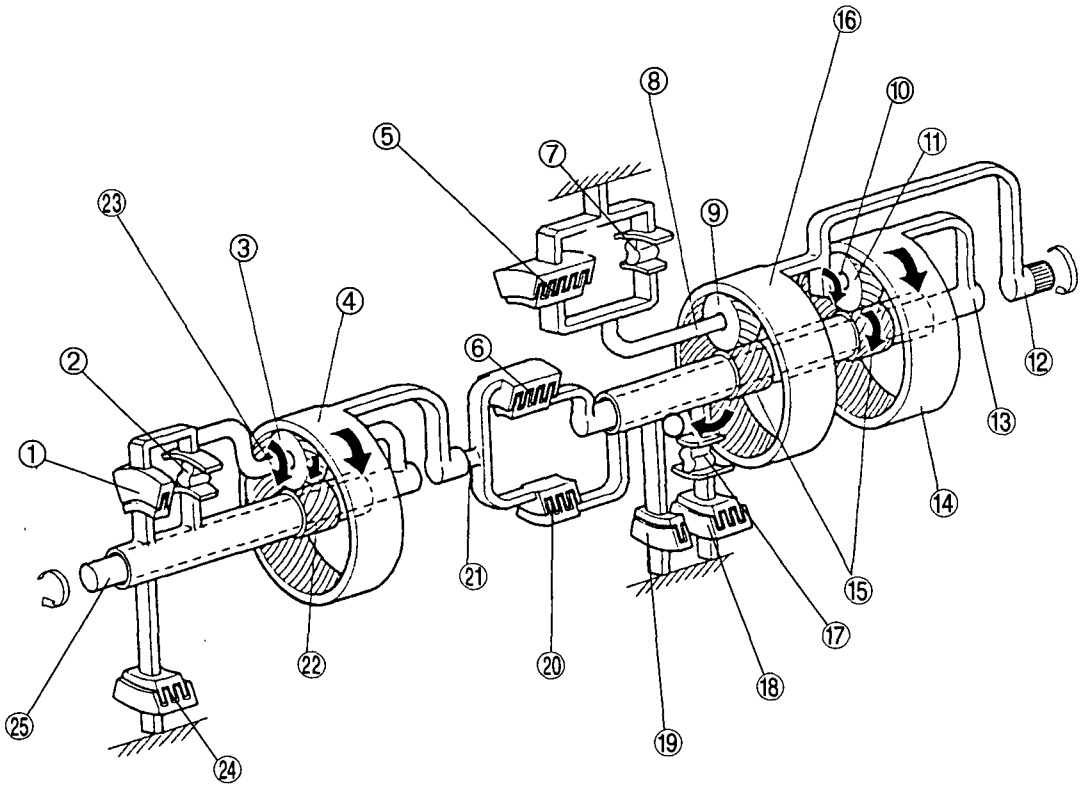
1	Shift solenoid A
2	Shift solenoid B
3	Low coast modulator valve
4	Intermediate coast modulator valve
5	1—2 shift valve
6	2—3 shift valve
7	Reverse brake sequence valve
8	Forward clutch accumulator
9	3—4 shift valve
10	Direct clutch accumulator
11	Second brake accumulator
12	Pressure relief valve
13	Primary regulator valve
14	Manual valve
15	Torque converter clutch solenoid valve

16	Cutback valve
17	Torque converter clutch control valve
18	Oil cooler bypass valve
19	Throttle valve
20	Secondary regulator valve
21	Oil pump
22	Strainer
23	Line pressure
24	Throttle pressure
25	Converter pressure
26	4GR clutch
27	Forward clutch
28	Direct clutch
29	Second brake

Fourth Gear

Power transmission

- The driving force of the 4GR input shaft is transmitted to the 4GR planetary pinion carrier, causing the 4GR planetary pinion carrier to rotate clockwise. The 4GR sun gear does not rotate, locked by the 4GR brake. This causes the 4GR pinion gear to revolve and rotate clockwise, the 4GR internal gear to rotate clockwise, and the force is transmitted to the input shaft. The driving force of the input shaft is transmitted to the rear internal gear through the forward clutch, causing the rear internal gear to rotate clockwise. Also the force is transmitted to the sun gear through the direct clutch, causing the sun gear to rotate clockwise.
- Because the rear internal gear and the sun gear rotate in the same direction at the same time, the rear pinion gear does not rotate, causing the planetary pinion carrier to rotate together with the rear internal gear and the sun gear. This torque is transmitted to the driving wheels through the propeller shaft.
- During deceleration, the driving force is transmitted from the driving wheels as opposed to the operation in driving, causing the engine brake to operate.

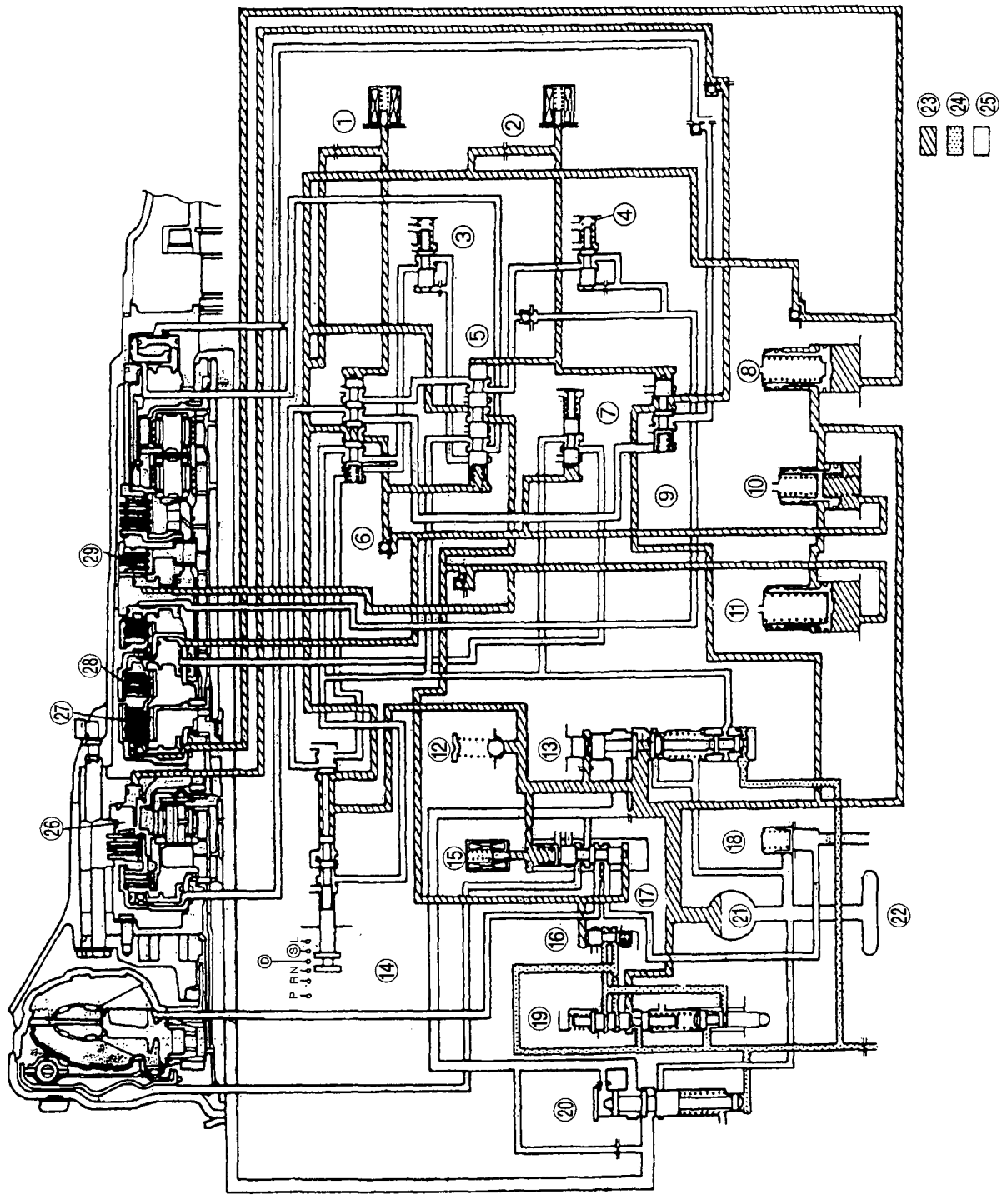


1	4GR clutch
2	One-way clutch No.0
3	4GR pinion gear
4	4GR internal gear
5	1st and reverse brake
6	Forward clutch
7	One-way clutch No.2
8	Front planetary pinion carrier
9	Front pinion gear
10	Rear planetary pinion carrier
11	Rear pinion gear
12	Output shaft
13	Intermediate shaft

14	Rear internal gear
15	Sun gear
16	Front internal gear
17	One-way clutch No.1
18	Second brake
19	Second coast brake
20	Direct clutch
21	Input shaft
22	4GR sun gear
23	4GR planetary pinion carrier
24	4GR brake
25	4GR input shaft

Hydraulic pressure operation

- When the position is switched to fourth gear after accelerating in third gear, shift solenoid B is switched off and the line pressure works on the 3—4 shift valve. The hydraulic pressure which works on the 3—4 shift valve flows to the 4GR brake, causing the brake to operate.



1	Shift solenoid A
2	Shift solenoid B
3	Low coast modulator valve
4	Intermediate coast modulator valve
5	1—2 shift valve
6	2—3 shift valve
7	Reverse brake sequence valve
8	Forward clutch accumulator
9	3—4 shift valve
10	Direct clutch accumulator
11	Second brake accumulator
12	Pressure relief valve
13	Primary regulator valve
14	Manual valve
15	Torque converter clutch solenoid valve

16	Cutback valve
17	Torque converter clutch control valve
18	Oil cooler bypass valve
19	Throttle valve
20	Secondary regulator valve
21	Oil pump
22	Strainer
23	Line pressure
24	Throttle pressure
25	Converter pressure
26	4GR clutch
27	Forward clutch
28	Direct clutch
29	Second brake

AUTOMATIC TRANSMISSION SHIFT MECHANISM

AUTOMATIC TRANSMISSION SHIFT MECHANISM OUTLINE

1. The selector lever cannot be moved from P position unless the brake pedal is depressed and the ignition switch is on.
2. The locked selector lever can be released by operation of the emergency override button if necessary (i.e., battery voltage is low).
3. The ignition key cannot be turned to LOCK position with the selector lever in ranges other than P position.

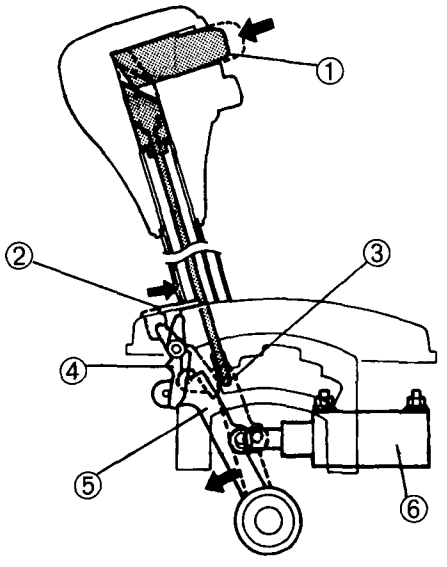
SELECTOR LEVER DESCRIPTION

Construction

- The shift-lock system consists of the shift-lock actuator, the P position switch and the lock lever, and the emergency override button. If an attempt is made to shift the selector lever from P position without setting the ignition switch on or depressing the brake pedal, the selector lever button cannot be depressed because movement of the guide pin is restricted by the lock lever. In this case no shift can be made.

Emergency Override Button

- The lock lever can be manually operated to release the guide pin by firmly sliding the emergency override button (located on shift console) rearward. The selector lever may then be moved from P position. This override button is available in the event when the system does not operate correctly due to a failure in the shift-lock system or loss of battery voltage.



1	Selector lever button
2	Emergency override button
3	Guide pin

4	Emergency override lever
5	Lock lever
6	Shift lock actuator

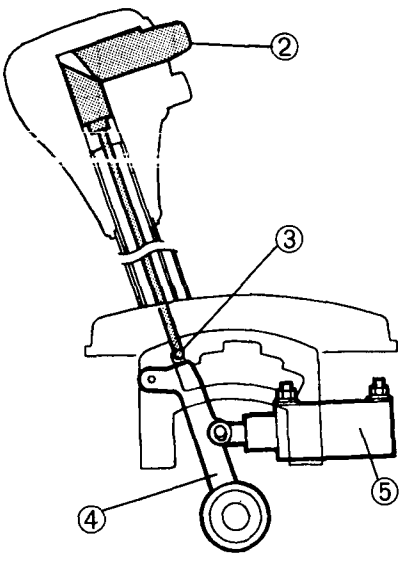
Operation

Shift-lock locked → unlocked

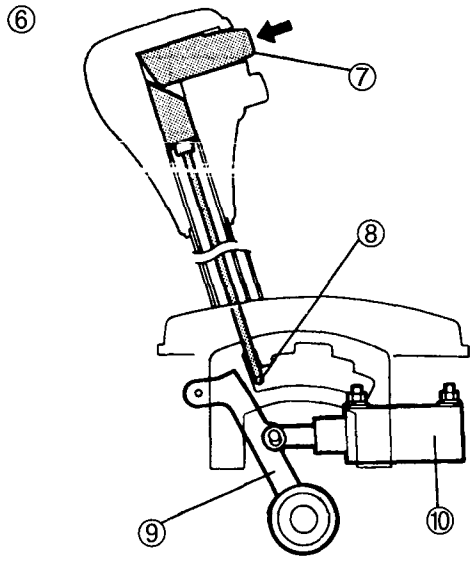
The selector lever can be shifted from P position only when the following conditions are satisfied:

- The ignition switch is on.
- The brake switch is on (brake pedal is depressed).
- The P position switch is on (selector lever is at P position and selector lever button is released.)

The shift-lock actuator is in the locked condition when the ignition switch is off and the P position switch is on. There is no current flow in the coil of the relays within the shift-lock actuator until the brake pedal is depressed (even if the ignition switch is on) because the ground circuit is not completed. The lock lever prevents movement of the guide pin, and there can be no shift from P position.
When the brake pedal is depressed, current flows to ground energizing the relays.



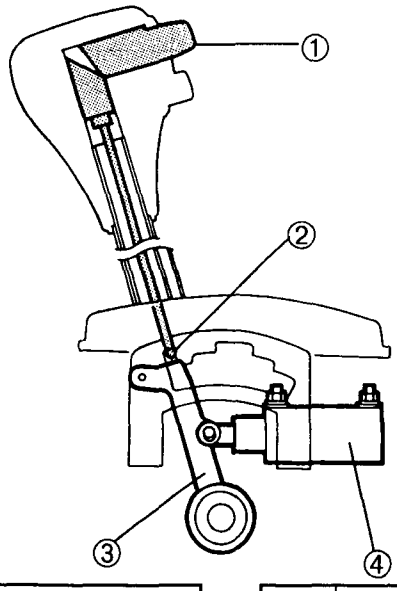
1	Brake pedal not depressed
2	Selector lever button
3	Guide pin
4	Lock lever
5	Shift lock actuator



6	Brake pedal depressed
7	Selector lever button
8	Guide pin
9	Lock lever
10	Shift lock actuator

Shift-lock unlocked → locked

When the selector lever is shifted out of P position, the P position switch turns off, and no current flows within the shift-lock actuator. Consequently, the shift-lock actuator is held in the unlocked position.
When the selector lever is moved back to P position, the P position switch turns on. Current flows within the shift-lock actuator, and the shift-lock actuator moves the lock lever to the locked position.



1	Selector lever button
2	Guide pin

3	Lock lever
4	Shift lock actuator

KEY INTERLOCK SYSTEM DESCRIPTION

Construction

The key interlock system consists of the key interlock solenoid, key interlock unit, P position switch, slider, cam, and return spring (built into the key cylinder).
This system controls the movement of the key cylinder by moving the slider through the key interlock solenoid installed on the key cylinder.

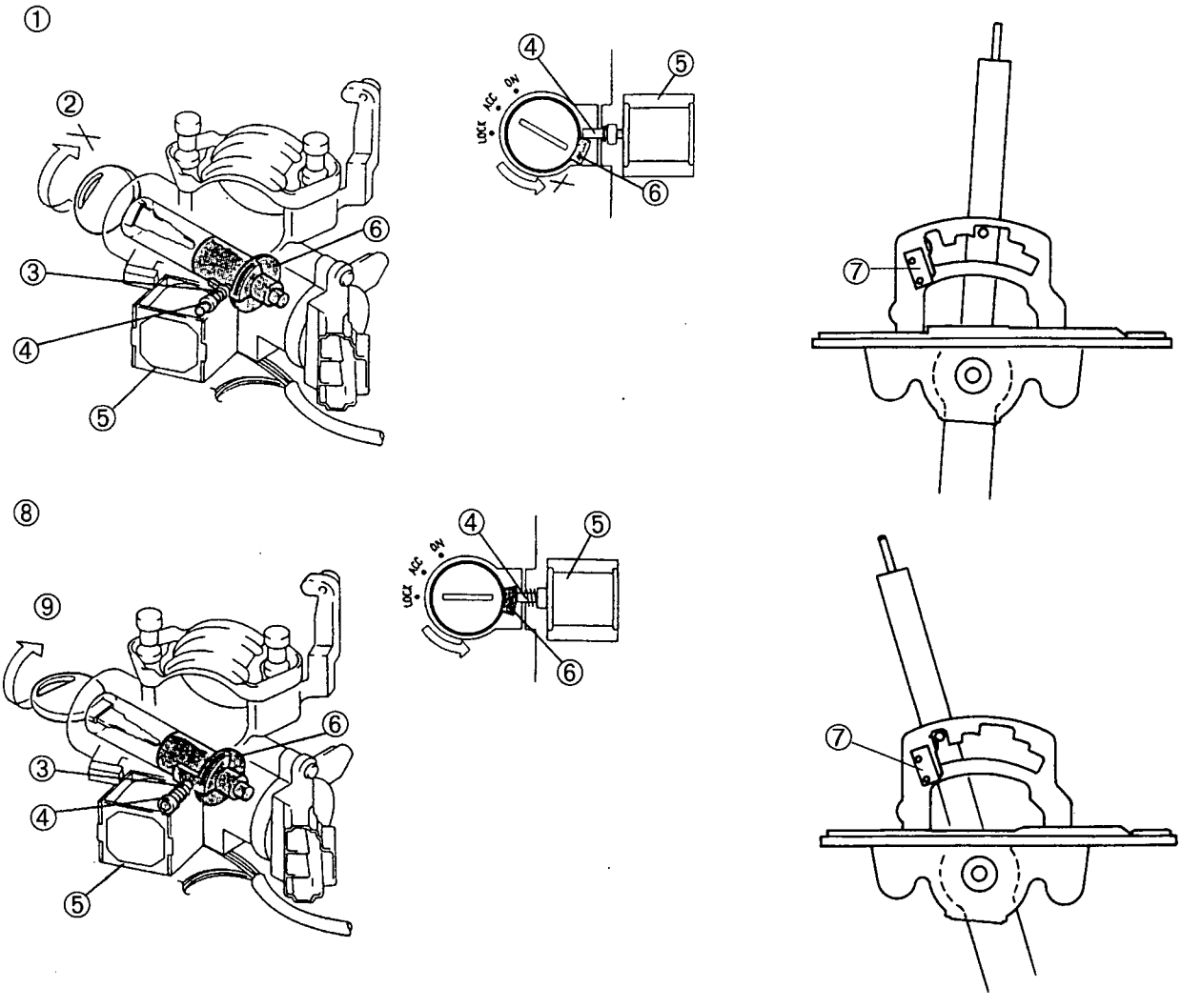
Operation

P position (no current flows to key interlock solenoid)

When the selector lever is at P position, the P position switch will be on and no current will flow to the key interlock solenoid. Because the slider will be pulled back by the return spring (when no current is applied to the key interlock solenoid), the cylinder can be turned to the LOCK position.

Ranges other than P position (current flows to key interlock solenoid)

When the selector lever is in ranges other than P position, the P position switch will be off and current will flow to the key interlock solenoid. Because the slider will move toward the cylinder (when current flows to the key interlock solenoid), the cam will hit against the slider, then the cylinder cannot be turned to the LOCK position.



1	Selector lever is in ranges other than P position
2	Impossible turn key to lock position
3	Return spring
4	Slider
5	Key interlock solenoid

6	Cam
7	P position switch
8	Selector lever is at P position
9	Possible to turn key to lock position

PROPELLER SHAFT

OUTLINE

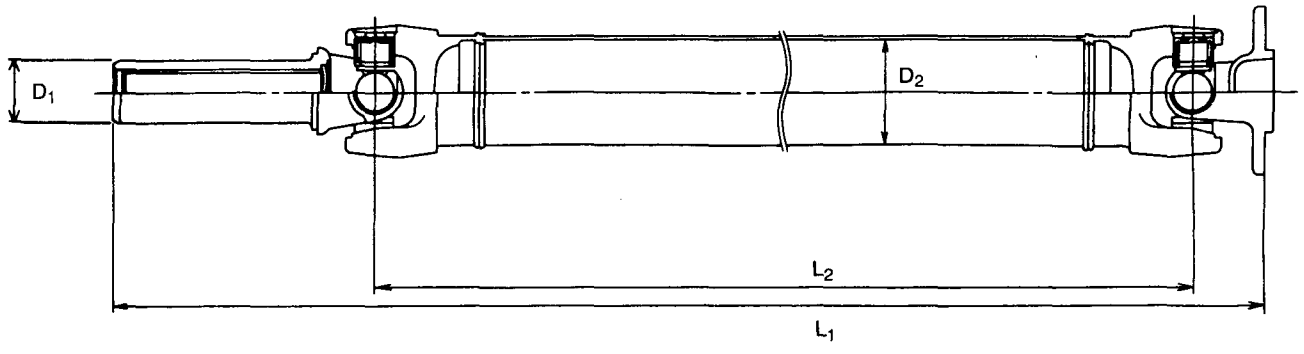
OUTLINE OF CONSTRUCTION

- The construction is basically the same as that of previous MX-5 models; however, the propeller shaft sliding yoke for automatic transmission models is different.

SPECIFICATIONS

Item			Transmission type	
			MT	AT
Length	mm {in}	L_1	1001 {39.41}	
		L_2	816 {32.13}	
Outer diameter	mm {in}	D_1	34.909—34.934 {1.3744—1.3753}	37.909—37.934 {1.4925—1.4934}
		D_2	60.3—60.7 {2.375—2.389}	

▭ Indicates new specification



FRONT AND REAR AXLES

ABBREVIATIONS

L.H.D.	Left hand drive	LSD	Limited slip differential

OUTLINE

OUTLINE OF CONSTRUCTION

- The construction and operation of the front and rear axles are basically the same as those of the previous models. (Refer to MAZDA MX-5 Workshop Manual Supplement 1509-10-95I and 1510-10-95I.)

M

Improved Driveability

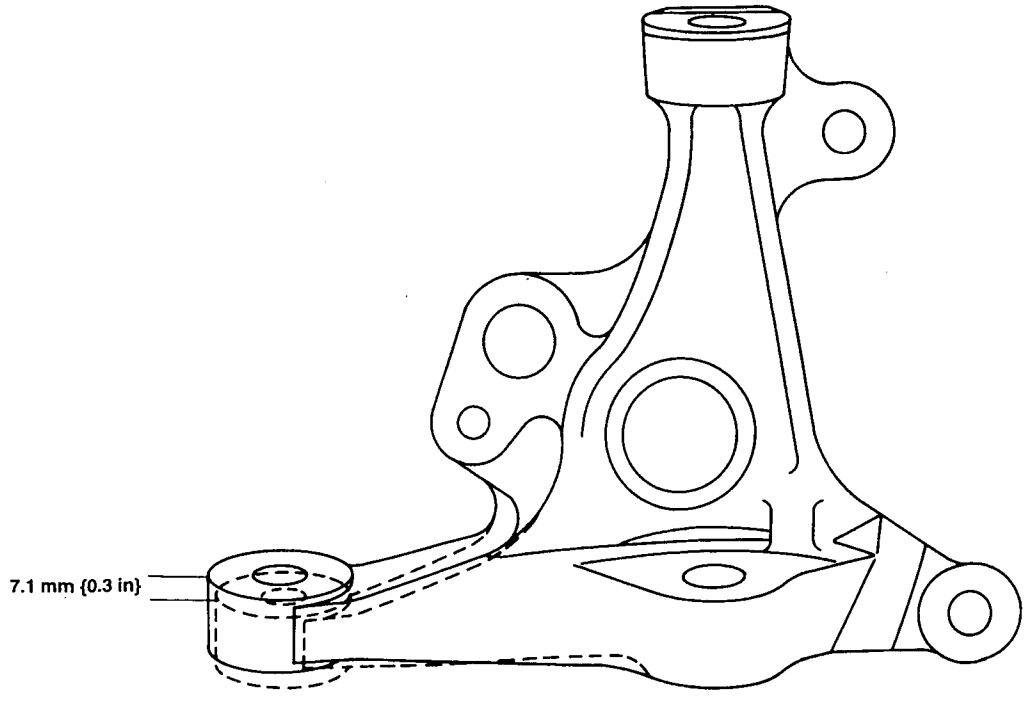
- Modified front knuckle shape to restrain the toe variation.
- Modified rear knuckle shape to widen the tread.
- Modified drive shaft length from **767.3—777.3 mm {30.21—30.60 in}** to **772.6—782.6 mm {30.42—30.81 in}**.
- Revised torque sensing LSD.

SPECIFICATIONS

Item			Specification
Front axle	Wheel bearing type		Angular ball bearing
Rear axle	Wheel bearing type		Angular ball bearing
Drive shaft	Joint type	Wheel side	Bell joint
		Differential side	Double offset joint
	Shaft diameter (mm {in})		22.0 {0.87}
Differential	Reduction gear		Hypoid gear
	Differential gear		Straight bevel gear [Standard], Helical gear [LSD]
	Differential ring gear size (mm {in})		181.6 {7.15}
	Reduction ratio		4.100
	Oil	Grade	API service GL-4, GL-5
		Viscosity	Above -18 °C {0 °F}: SAE 90 Below -18 °C {0 °F}: SAE 80
		Capacity (L {US qt, Imp qt})	1.00 {1.06, 0.88}

FRONT AXLE

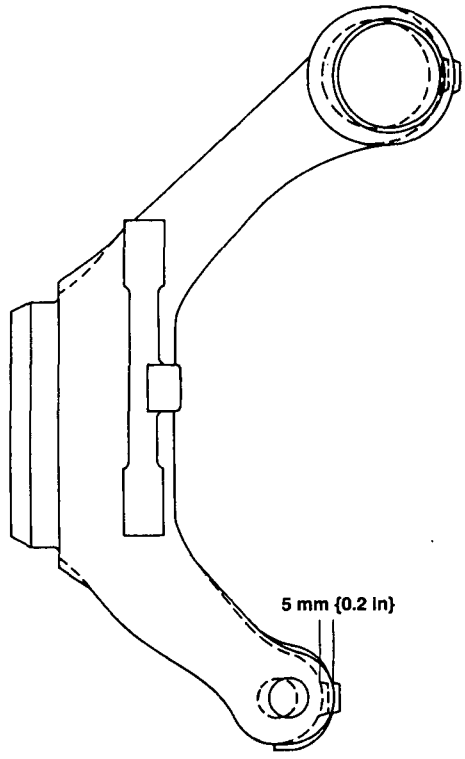
FRONT KNUCKLE



- In addition to a modified suspension, the tie-rod end installation point has been raised **7.1 mm {0.3 in}** to restrain the toe variation.

REAR AXLE

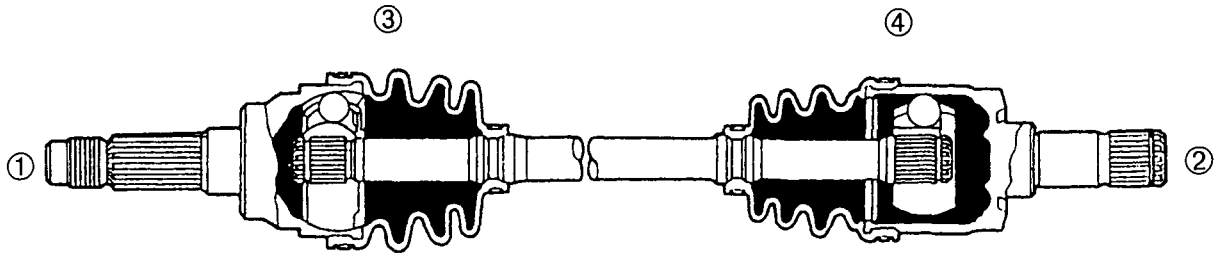
REAR KNUCKLE



- The rear knuckle shape has been modified to widen the tread.

DRIVE SHAFT

CROSS-SECTIONAL VIEW



1	Wheel side
2	Differential side

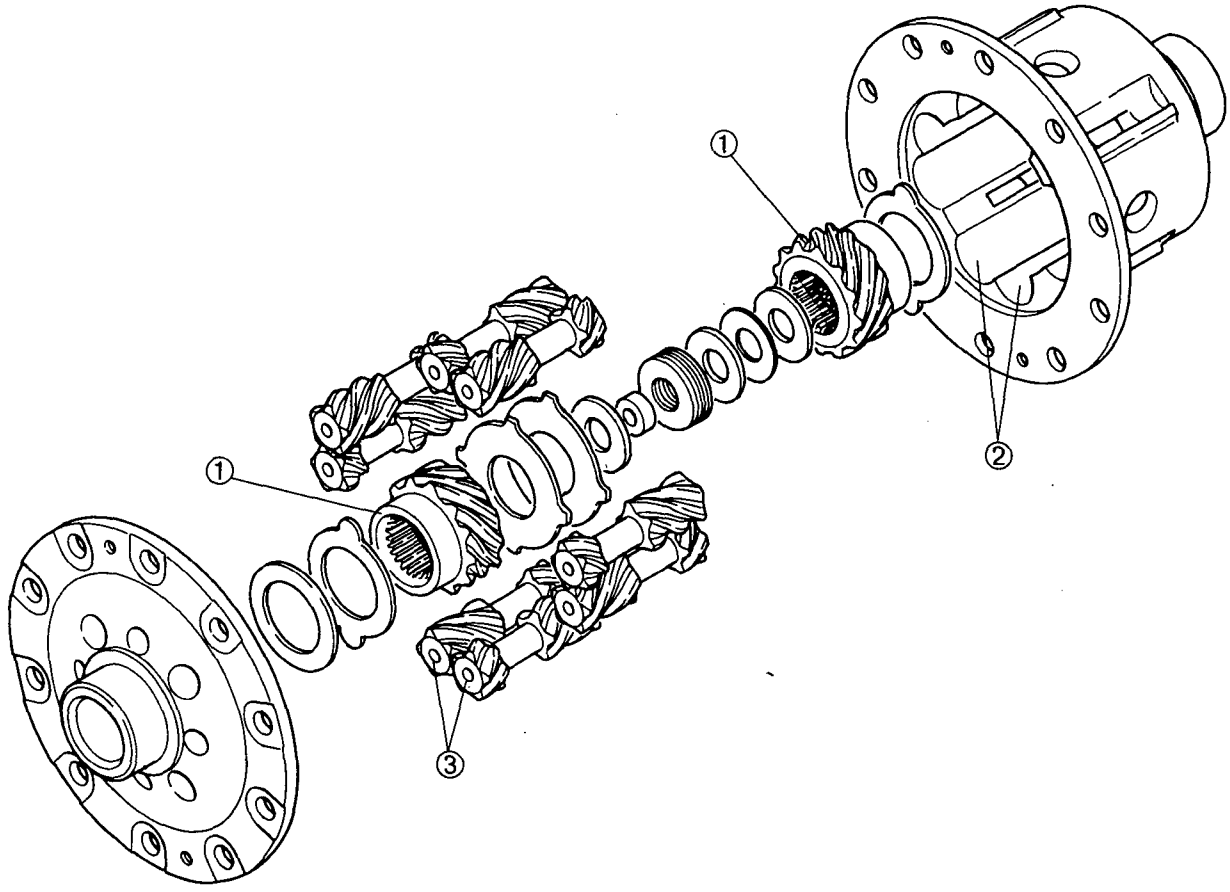
3	Bell joint
4	Double offset joint

DIFFERENTIAL

OUTLINE

- The torque sensing LSD has been optionally equipped for L.H.D. and UK to improve driveability and stability.
- The operation and function of the revised torque sensing LSD is basically the same as that of the previous torque sensing LSD.

TORQUE SENSING LSD



1	Side gear
2	Pocket

3	Planet gear

- Six thrust washers have been added to increase the bias ratio in the coast direction.
- The torque sensing LSD component consists of two side gears, eight planet gears, and eleven thrust washers. The side gears are located on both ends of the drive shaft. Four planet gears are engaged with each side gear in parallel direction. These planet gears engage with each other by the helical gear at both ends as shown. The planet gears are supported by the gear pockets in the gear case.
- The torque sensing LSD component cannot be disassembled.

STEERING SYSTEM

ABBREVIATIONS

AT	Automatic transmission	MT	Manual transmission
L.H.D.	Left hand drive	R.H.D.	Right hand drive

OUTLINE

OUTLINE OF CONSTRUCTION

- The construction and operation of the steering system are basically the same as those of the previous models. (Refer to MAZDA MX-5 Workshop Manual Supplement 1509-10-95I and 1510-10-95I.)

Improved Driveability

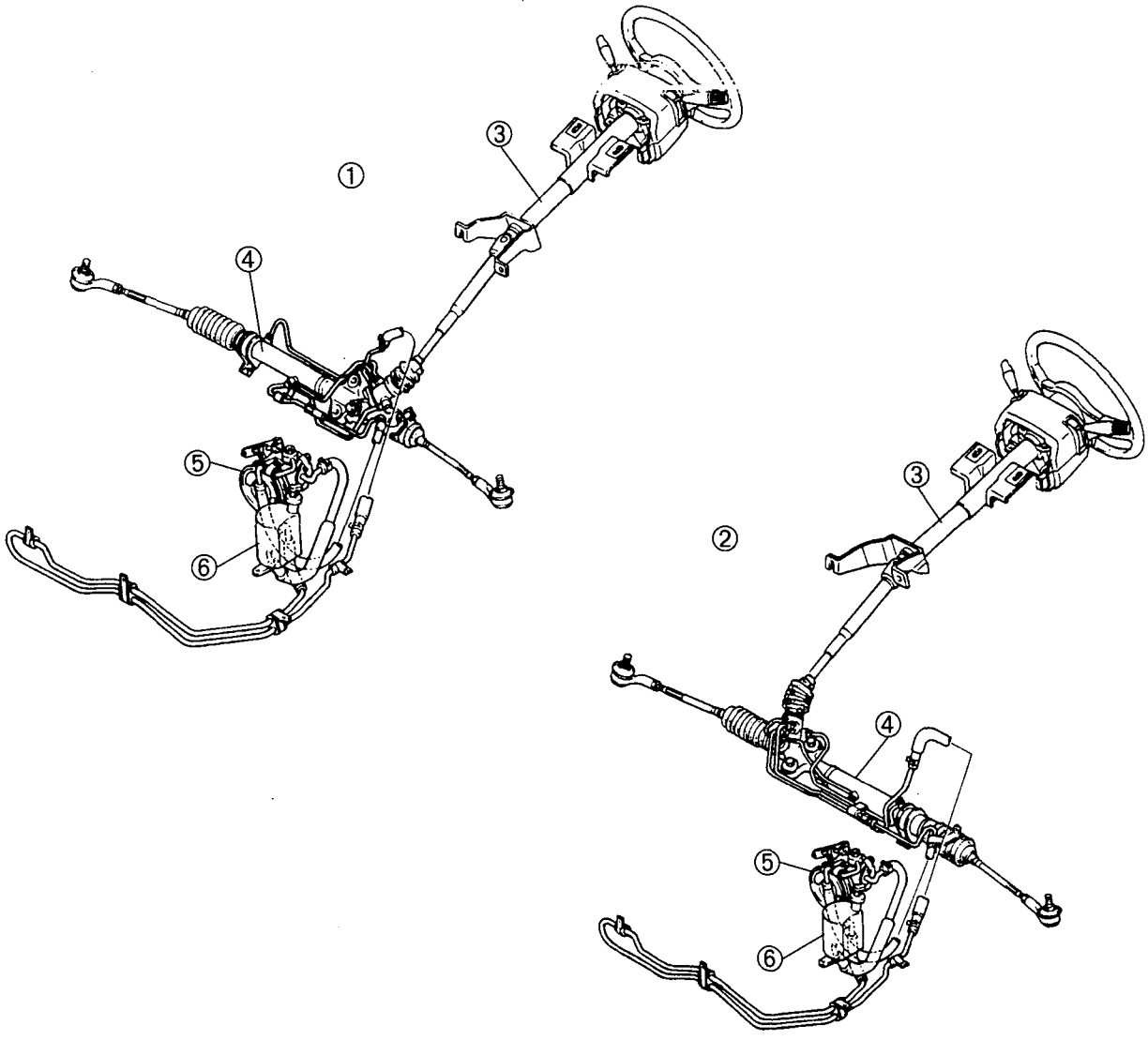
- Modified steering gear mounting type for gear housing side.

Improved Safety

- Modified steering shaft length from **584.8 mm{23.02 in}** to **594.8 mm{23.42 in}**.

N

STRUCTURAL VIEW



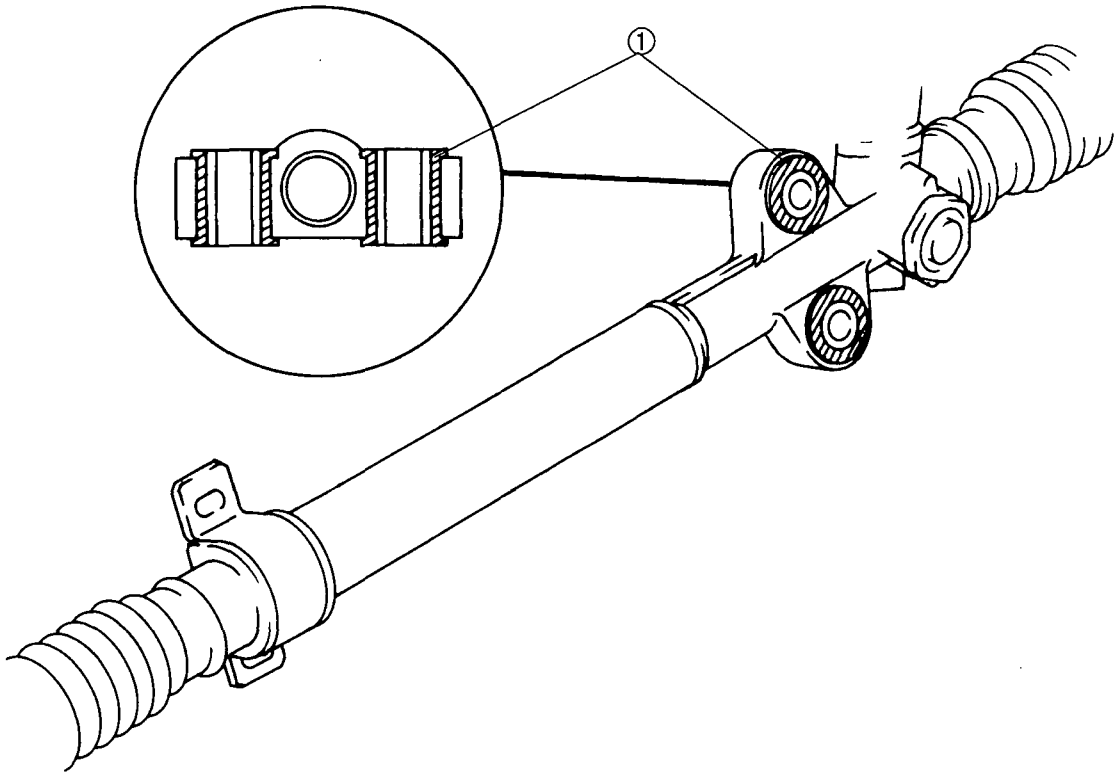
1	L.H.D.
2	R.H.D.
3	Steering shaft

4	Steering gear
5	Power steering oil pump
6	Reserver tank

SPECIFICATIONS

Item				Specification
Steering wheel	Outer diameter		(mm{in})	370 {14.6}[3-spoke], 380 {15.0}[4-spoke]
	Lock-to-lock		(turns)	2.65
Steering gear	Type			Rack-and-pinion
	Rack stroke		(mm{in})	121.0{4.76}
Steering column and shaft	Shaft type			Collapsible, non-tilt
	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{US qt,Imp qt})	0.81{0.86, 0.71} [R.H.D. MT], 0.71{0.75, 0.62} [R.H.D. AT], 0.79{0.84, 0.70} [L.H.D.]

STEERING GEAR



1	Mounting rubber

- Clamping plate and rubber have been abolished for gear housing side.
- A steering gear mounting part has been attached to the gear to increase the mounting rigidity and improve the wheel response to the operation of the steering wheel.

BRAKING SYSTEM

OUTLINE

ABBREVIATIONS

DTC	Diagnostic trouble code

OUTLINE OF CONSTRUCTION

- The construction and operation of the braking system are basically the same as those of the previous models. However, the brake size for B6 engine models has been changed to the same as that of BP engine models.
- Diagnostic trouble codes for antilock brake system have been added to improve serviceability. (Europe)

SPECIFICATIONS

Item		Specification
CONVENTIONAL BRAKE SYSTEM		
Brake pedal	Type	Suspended
	Pedal lever ratio	4.1:1
	Maximum stroke (mm {in})	127 {5.00}
Master cylinder	Type	Tandem (with level sensor)
	Bore (mm {in})	22.22 {0.875}
Front disc brake	Type	Disc (ventilated)
	Cylinder bore (mm {in})	51.1 {2.01}
	Pad dimensions (area × thickness) (mm^2 × mm {in^2 × in})	4,300 × 8.0 {6.66 × 0.31}
	Disc plate dimension (effective diameter × thickness) (mm {in})	255 × 20 {10.04 × 0.79}
Rear disc brake	Type	Disc (solid)
	Cylinder bore (mm {in})	31.75 {1.25]
	Pad dimensions (area × thickness) (mm^2 × mm {in^2 × in})	2,600 × 8.0 {4.01 × 0.31}
	Disc plate dimension (effective diameter × thickness) (mm {in})	251 × 9 {9.88 × 0.35}
Power brake unit	Type	Vacuum multiplier
	Size (mm {in})	214 {8}
Braking force control device	Type	Proportioning bypass valve
Brake fluid type		SAE J1703 or FMVSS 116: DOT-3 or DOT-4
PARKING BRAKE SYSTEM		
Type		Mechanical, two rear brakes
Operation system		Hand lever

ON-BOARD DIAGNOSTIC FUNCTION

ANTILOCK BRAKE SYSTEM

- To improve serviceability, diagnostic trouble code (DTC) 63 has been added, and the detection condition for DTC 11—15 are divided into DTC 11—15 and 41—44.

DTC	Display on the NGS	Diagnosis system component	Detection condition	Fail-safe	Memorized
11	WSS, SR (RF) — OPEN OR SHORT	Right front ABS wheel-speed sensor	Open circuit or circuit shorted to power supply is detected.	System down	○
12	WSS, SR (LF) — OPEN OR SHORT	Left front ABS wheel-speed sensor			
13	WSS, SR (RR) — OPEN OR SHORT	Right rear ABS wheel-speed sensor			
14	WSS, SR (LR) — OPEN OR SHORT	Left rear ABS wheel-speed sensor			
15	WSS, SR — OPEN OR SHORT	wheel-speed sensor/ sensor rotor	Disagreement of wheel speed and vehicle speed is detected.		
41	WSS, SR (RF) — OPEN OR SHORT	Right front ABS wheel-speed sensor/rotor	• Wheel speed changes to 0 km/h {0 mph} instantaneously while vehicle speed is 40 km/h {25 mph} or more. • Disagreement with other sensors is detected. • Circuit shorted to ground is detected.		
42	WSS, SR (LF) — OPEN OR SHORT	Left front ABS wheel-speed sensor/rotor			
43	WSS, SR (RR) — OPEN OR SHORT	Right rear ABS wheel-speed sensor/rotor			
44	WSS, SR (LR) — OPEN OR SHORT	Left rear ABS wheel-speed sensor/rotor			
63	POWER SUPPLY — MALFUNCTION	Power supply Ground	Power supply voltage is out of specification.	Temporal interruption until voltage becomes normal	○*

* :Memorized when vehicle speed is 6 km/h {3.7 mph} or more.

SUSPENSION

OUTLINE

OUTLINE OF CONSTRUCTION

- The construction and operation of the suspension system are basically the same as those of the previous system. However, the following points have been improved.

Reduced Vibration

- Stiffened front and rear cross bar

Improved Cornering Performance

- Urethane bound stopper
- Lengthened rear suspension stroke
- Separate input type shock absorber mount

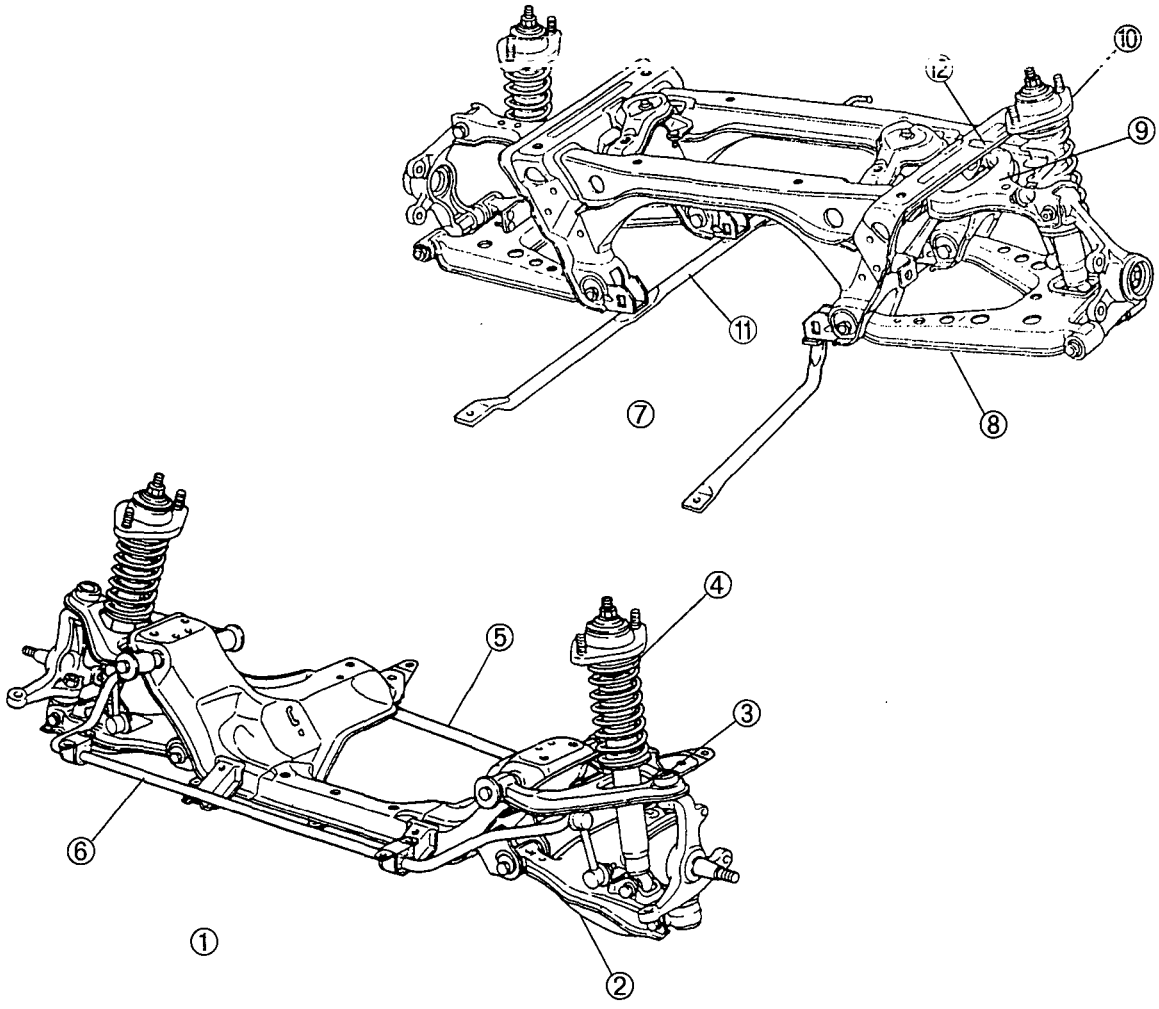
Improved Straight-ahead Driving Stability

- Enlarged caster trail

Improved Roll Control

- Lowered roll center height

STRUCTURAL VIEW



1	FRONT SUSPENSION
2	FRONT LOWER ARM
3	FRONT UPPER ARM
4	FRONT SHOCK ABSORBER AND COIL SPRING
5	FRONT CROSSBAR
6	FRONT STABILIZER

7	REAR SUSPENSION
8	REAR LOWER ARM
9	REAR UPPER ARM
10	REAR SHOCK ABSORBER AND COIL SPRING
11	REAR CROSSBAR
12	REAR STABILIZER

SPECIFICATIONS

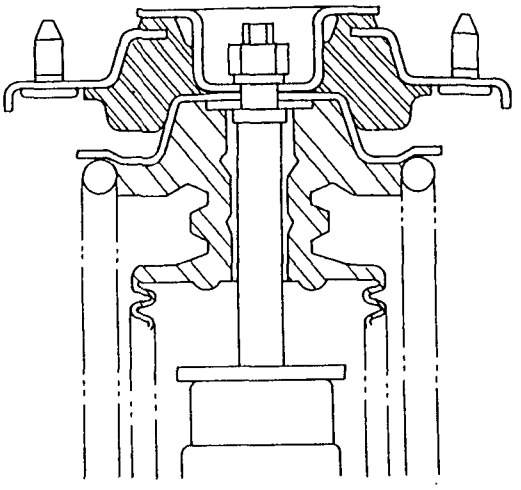
Item				Specification
Front suspension	Suspension type			Double-wishbone
	Shock absorber type			Cylindrical, double-acting (low-pressure gas charged)
	Spring type			Coil spring
	Stabilizer	Type		Torsion bar
		Diameter	(mm {in})	22 {0.87}
	Wheel alignment (*Unloaded)	Maximum steering angle	Inner	38° ±3°
			Outer	33° ±3°
		Total toe-in	(mm {in})	Tire: 3±4 {0.12±0.15}, Rim inner: 2±3 {0.08±0.12}
			(degree)	0° 17′ ±24′
		Camber angle		0° 06′ ±1°
		Caster angle		5° 48′ ±1°
		Steering axis inclination		11° 38′
Rear suspension	Suspension type			Double-wishbone
	Shock absorber type			Cylindrical, double-acting (low-pressure gas charged)
	Spring type			Coil spring
	Stabilizer	Type		Torsion bar
		Diameter	(mm {in})	11 {0.43}
	Wheel alignment (*Unloaded)	Total toe-in	(mm {in})	Tire: 3±4 {0.12±0.15}, Rim inner: 2±3 {0.08±0.12}
			(degree)	0° 19′ ±24′
		Camber angle		-0° 47′ ±1°

*: Fuel tank full; engine coolant and engine oil at specified level, and spare tire, jack and tools in designated positions.

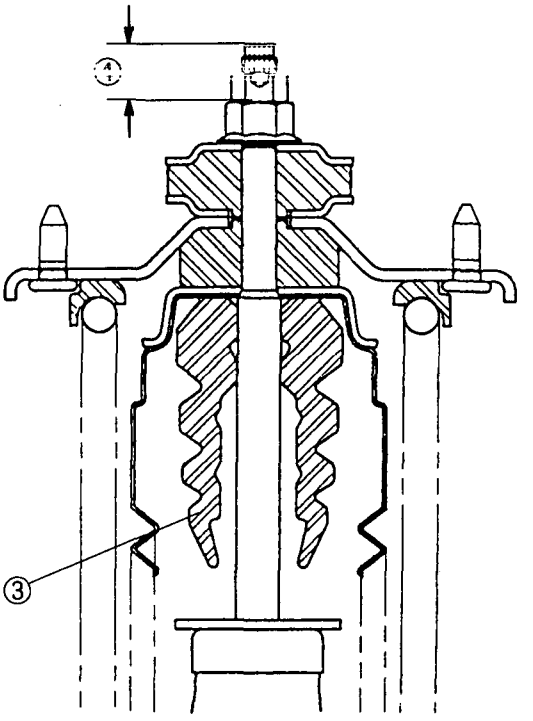
R

FRONT SUSPENSION

FRONT SHOCK ABSORBER AND COIL SPRING



①



②

1	PREVIOUS
2	NEW

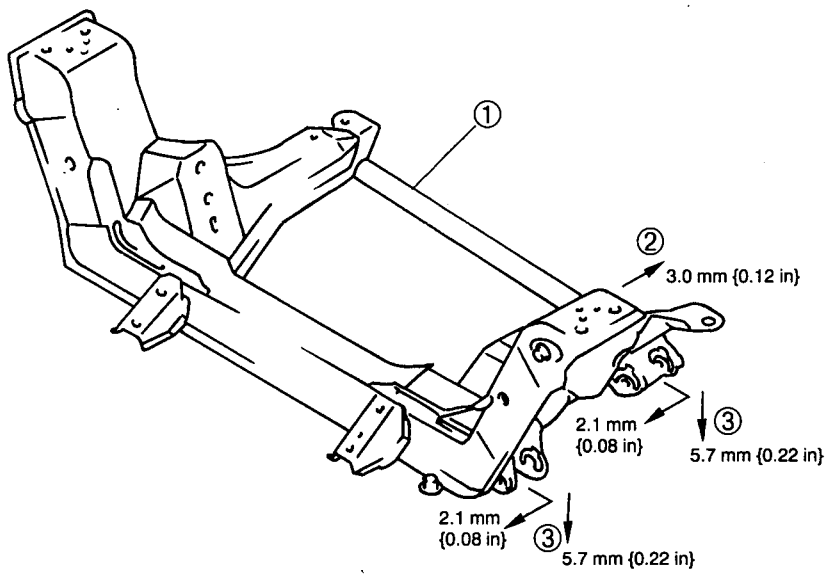
3	URETHANE BOUND STOPPER
4	15.7—17.7 mm {0.62—0.69 in}

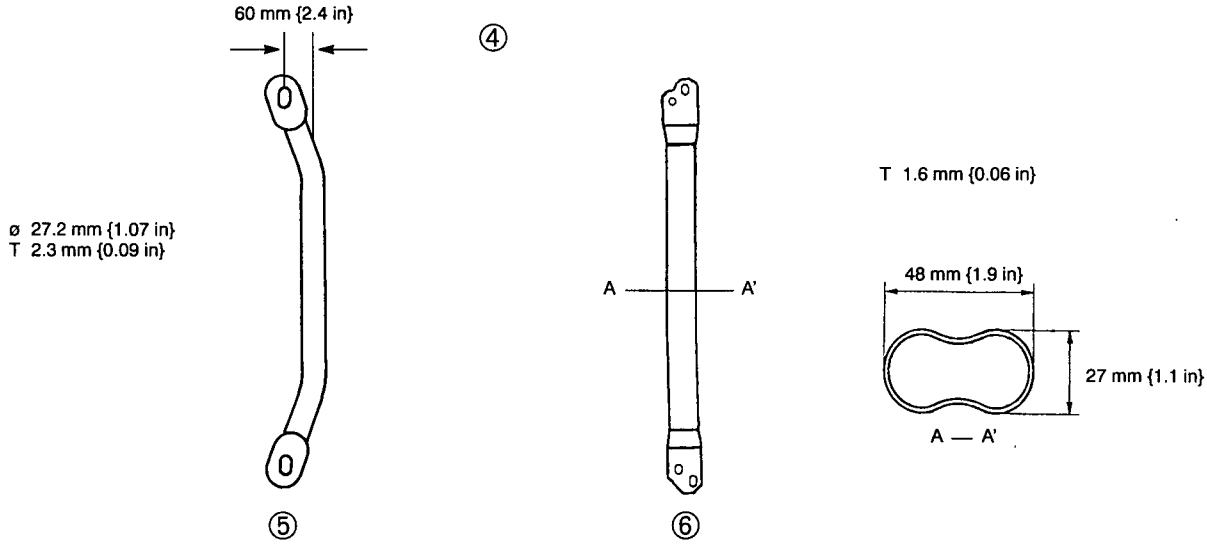
- An input split type mount, with a separated plate that receives the reaction force of the coil spring and the piston rod, has been adopted. This construction enhances the damping force and improves cornering when changing lanes and at the same time by reducing the damping force of the piston rod's slow speed range, riding comfort is improved.
- Reducing roll speed by improving damping force and setting suspension geometry appropriately by changing the tie rod end ball joint installation position of the front knuckle (refer to section M, FRONT AXLE, FRONT KNUCKLE) eliminate sudden over steering when approaching the cornering limit. In addition, stable cornering performance is obtained from low to high gravitational force range.
- When disassembling/assembling the front shock absorber and the coil spring, apply an antirust penetrating oil lubricant to the piston rod thread when loosening/tightening the lower piston rod nuts. Using hand tools, tighten the nuts so that the exposed thread as shown in the diagram is between **15.7—17.7 mm {0.62—0.69 in}**.

Caution
- **Using an air tool will damage the piston rod thread. Do not use air tool.**

- The bound stopper now uses urethane, which improves foaming. Because urethane has damping force, the bound stopper reduces the skipping sensation experienced during strong lateral gravitational force on rough road surfaces and improves cornering.

FRONT CROSSMEMBER





1	FRONT CROSSBAR
2	UPPER ARM INSTALLATION POSITION
3	LOWER ARM INSTALLATION POSITION

4	FRONT CROSSBAR
5	PREVIOUS
6	NEW

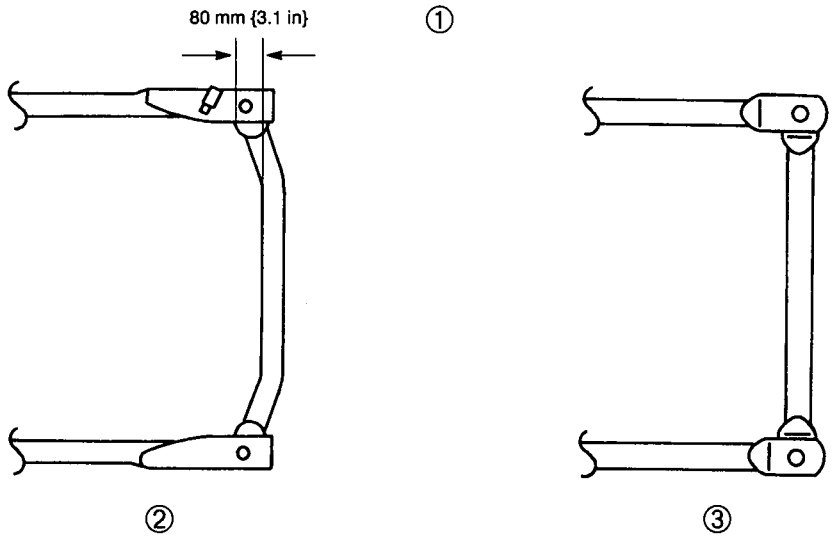
- The front crossbar has been modified, improving strength without increasing weight. Accordingly, shaking caused by radial force variation of tires during high speeds and trembling sensation caused by the road surface has been greatly reduced.
- In order to improve straight ahead stability by increasing the caster trail, the lower arm installation position has been moved forward **2.1 mm {0.08 in}** and the upper arm installation has been moved backward **3.0 mm {0.12 in}**.
- In order to reduce the floating roll of the inner wheel by lowering the roll center height, the front lower arm installation position has been lowered **5.7 mm {0.22 in}**.
- When only the caster trail is enlarged to improve straight ahead steering stability, it is possible that steering response during turning may worsen. However, the steering gear mount of the new MX-5 has been changed (refer to section N, STEERING GEAR), eliminating poor steering response.

REAR SUSPENSION

REAR SHOCK ABSORBER AND COIL SPRING

- The rear shock absorber and coil spring have the same construction as the front shock absorber and coil spring. In addition, the stroke of the rear shock absorber has been increased **11 mm {0.43 in}**.

REAR CROSSBAR



1	REAR CROSSBAR
2	PREVIOUS

3	NEW

- The rear crossbar has been modified in the same way as the front crossbar improving strength and substantially reducing shaking and trembling sensation.

BODY

ABBREVIATIONS

IG	Ignition	M	Motor
L.H.D.	Left hand drive	R.H.D.	Right hand drive

OUTLINE

Improved safety
- Rear defroster power-cut switch has been adopted.
- Pretensioner seat belt has been adopted. (Europe, UK)
- Load limiter retractor has been adopted. (Australia, R.H.D., L.H.D.)
- Seat belt warning has been adopted.

Improved convenience
- Power door lock system has been adopted.
- Open and holding force of trunk lid has been increased.
- Rear window defroster has been adopted.

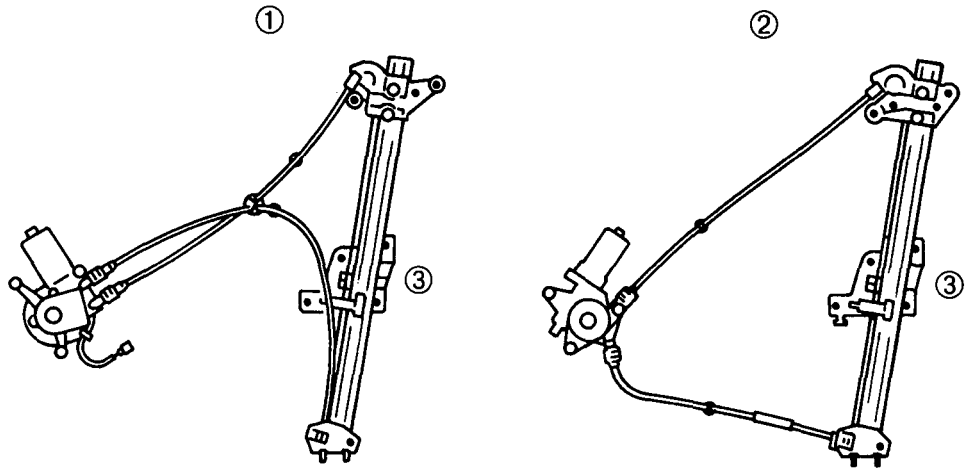
Improved visibility
- Material of the rear window has been changed.

Improved reliability
- Power window regulator has been changed.

POWER WINDOW SYSTEM

OUTLINE

- The construction and operation of the power window system for the new MX-5 are the same as those of the previous MX-5, however, the shape of the power window regulator is different.



1	Previous
2	New

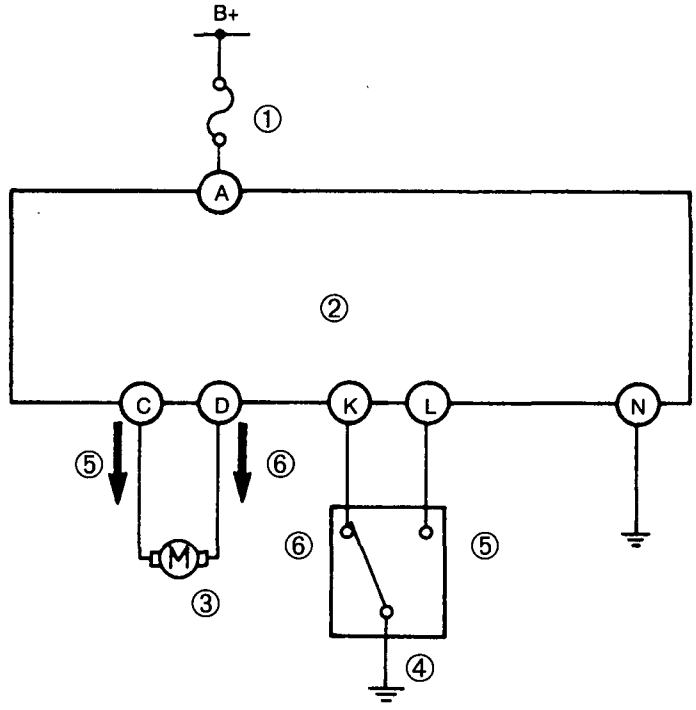
3	Power window regulator

POWER DOOR LOCK SYSTEM

OUTLINE

- Power door lock system includes door key interlock function and door lock knob interlock function.

SYSTEM DIAGRAM



1	D. LOCK 10 A fuse
2	Door lock timer unit
3	Door lock actuator (passenger's side)

4	Door lock-link switch (driver's side)
5	Unlock
6	Lock

DOOR KEY INTERLOCK FUNCTION

- When the driver's side door key cylinder is locked/unlocked, the passenger's side door is also locked/unlocked.

DOOR LOCK KNOB INTERLOCK FUNCTION

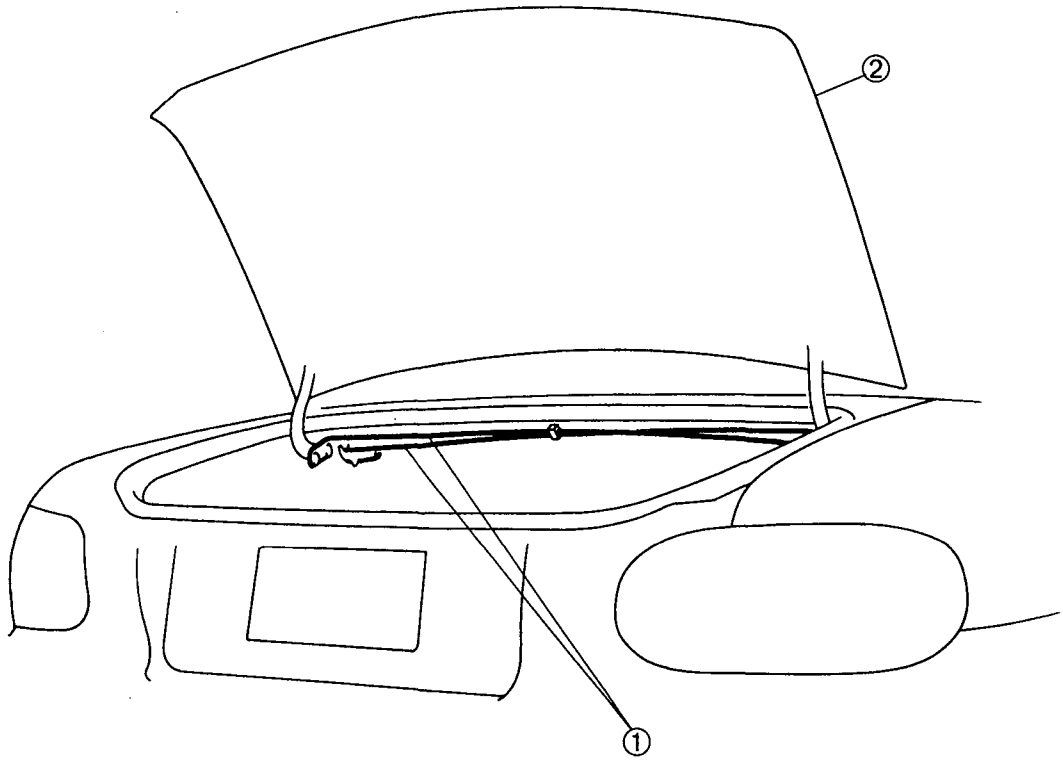
- When the driver's side door lock knob is locked/unlocked, the passenger's side door is also locked/unlocked.

TRUNK LID

OUTLINE

- By changing the balance spring, the trunk lid of the new MX-5 opens and is held open with more force.

STRUCTURAL VIEW



1	Balance spring

2	Trunk lid

BALANCE SPRING

Structure

- The angle between the free condition and the set up condition of the balance spring is the twist angle.
- The twist angle has increased from 87° to 105°. Accordingly, the twist moment has increased.

EXTERIOR ATTACHMENT

CONVERTIBLE TOP

Outline

- To improve visibility, the material of the rear window has changed and a rear window defroster has been adopted in accordance.
- The convertible top has been designed to be able to be opened easily by simply releasing the top lock. As a result, the method of exchanging the rear window has changed.

Material

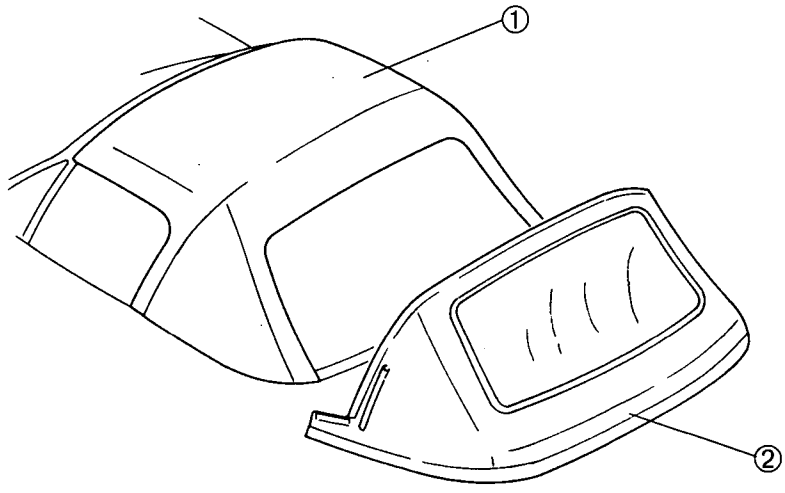
- The material of the rear window has changed as follows.

Rear window	Previous	New
Material	Vinyl chloride	Tempered glass

Exchanging Method

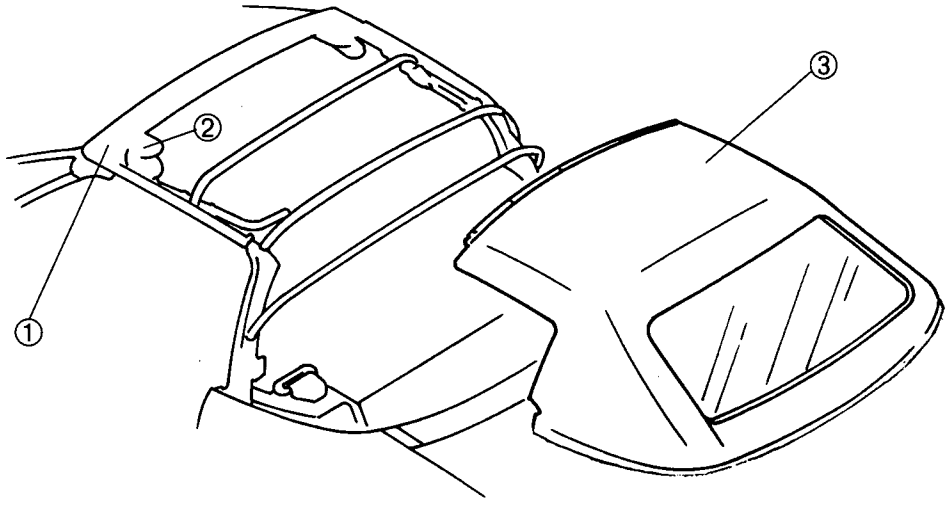
- The method of exchanging the rear window has changed as follows.

Previous...Remove the rear window assembly from the top fabric.



1	Top fabric	2	Rear window assembly

New...Remove the top cloth assembly from the link.



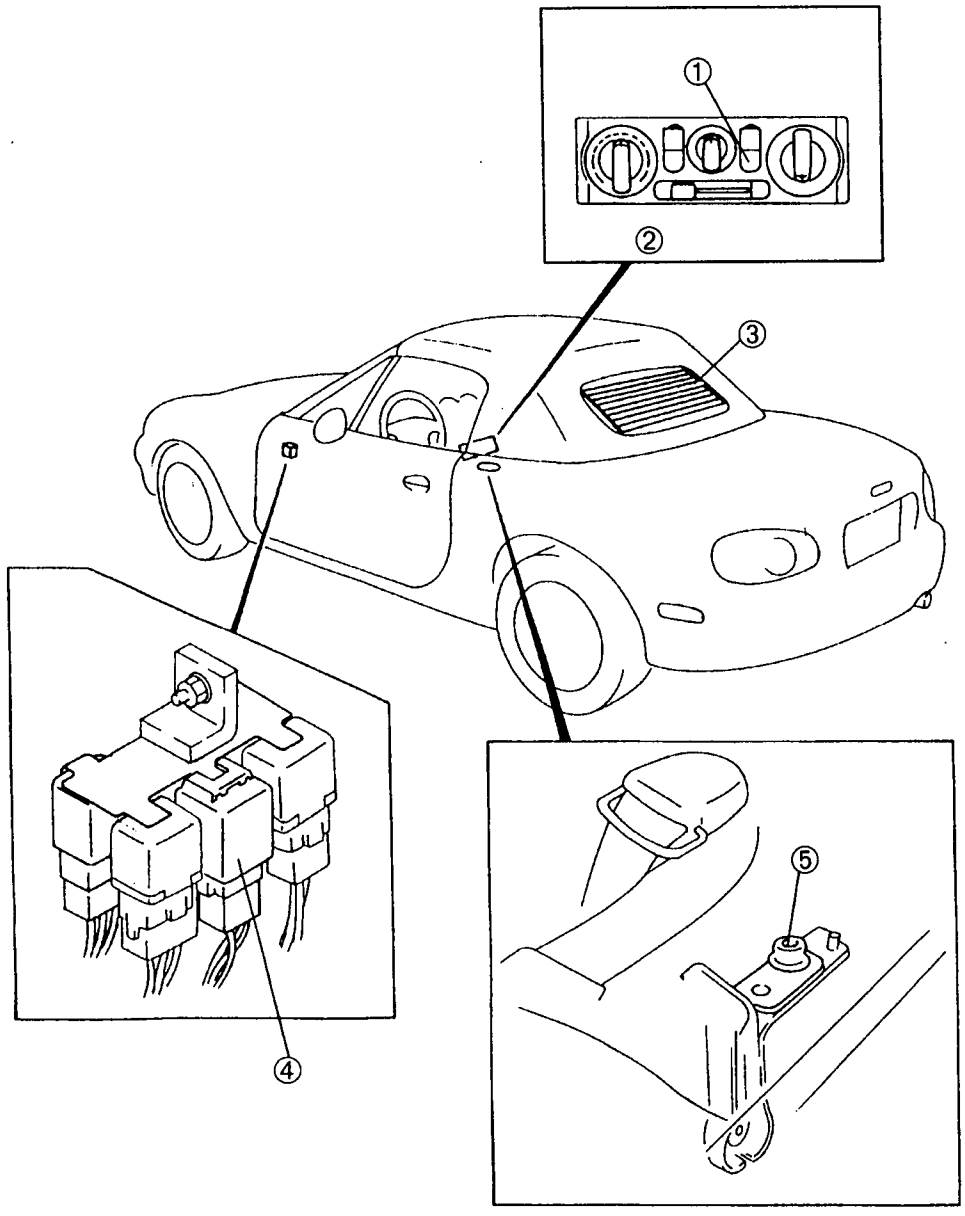
1	Link	3	Top cloth assembly
2	Top lock		

REAR WINDOW DEFROSTER

OUTLINE

- Filament has been adopted to the rear window glass of both of the convertible top and the detachable hardtop.
- The rear window defroster power cut switch is installed to the link bracket of the convertible top. It regulates the operation of the rear window defroster.

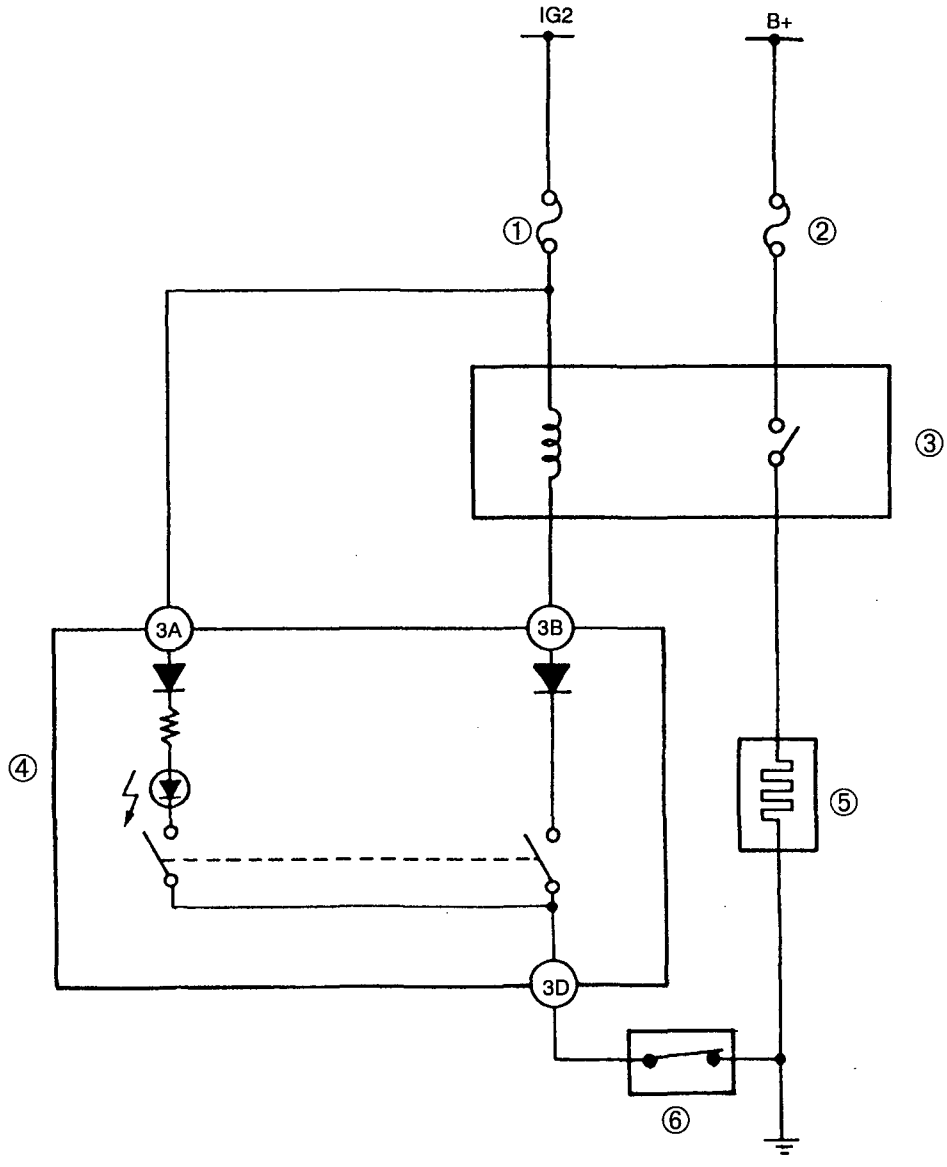
STRUCTURAL VIEW



1	Rear window defroster switch
2	Heater control unit
3	Filament

4	Rear window defroster relay
5	Rear window defroster power-cut switch

SYSTEM DIAGRAM

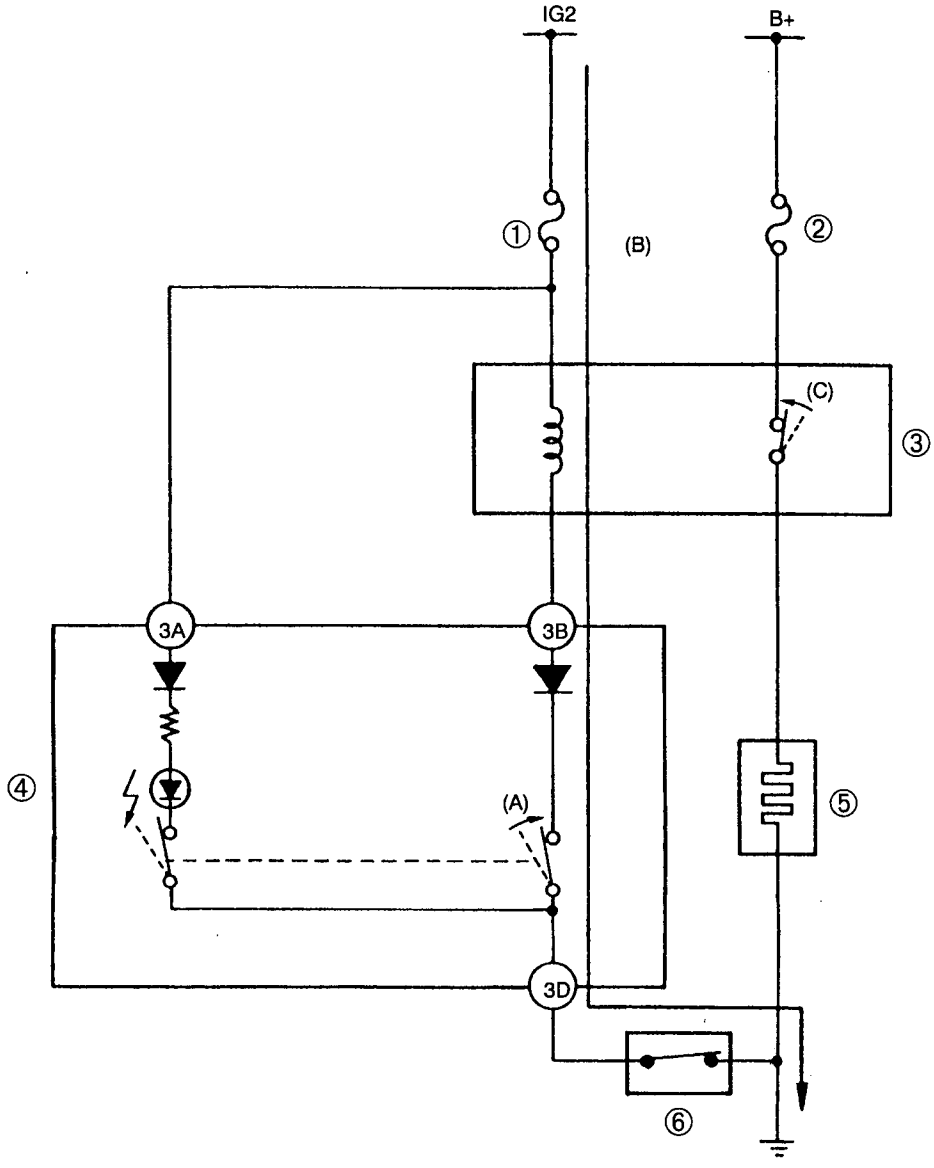


1	A/C 10 A fuse
2	DEFOG 15 A fuse
3	Rear window defroster relay

4	Rear window defroster switch
5	Filament
6	Rear window defroster power-cut switch

OPERATION

- When the rear window defroster switch turns on (A), the current flows through the coil of the rear window defroster relay (B) and turns on the relay (C). This causes the rear window defroster to operate.
- When the rear window defroster power-cut switch is off, the current (B) does not flow. Therefore, the rear window defroster does not operate even if the rear window defroster switch is on.



1	A/C 10 A fuse
2	DEFOG 15A fuse
3	Rear window defroster relay

4	Rear window defroster switch
5	Filament
6	Rear window defroster power-cut switch

REAR WINDOW DEFROSTER POWER-CUT SWITCH

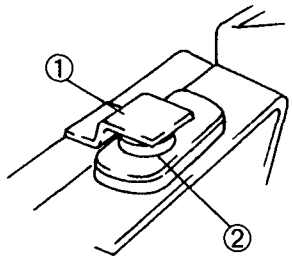
Outline

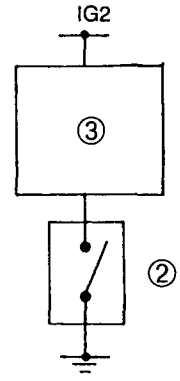
- A rear window defroster power-cut switch prevents the rear window defroster from operating when the convertible top is open. If the rear window defroster operates when the convertible top is open, the rear window glass heats excessively and causes breakage.

Operation

Rear window defroster power-cut switch off

- When the convertible top is open, the rear window defroster power-cut switch is pushed by link, and turns off. The rear window defroster does not operate even if the rear window defroster switch is on.





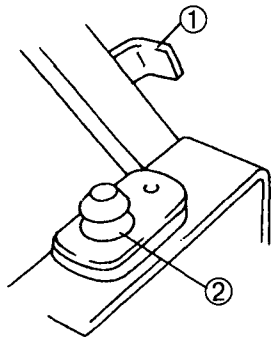
1	Link
2	Rear window defroster power-cut switch

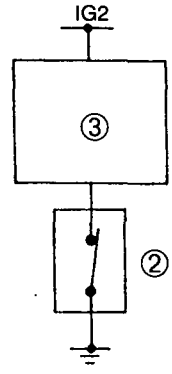
3	Rear window defroster switch

S

Rear window defroster power-cut switch on

- When the convertible top is closed, the rear window defroster power-cut switch is released, and turns on. The rear window defroster operates when the rear window defroster switch is on.





1	Link
2	Rear window defroster power-cut switch

3	Rear window defroster switch

SEAT BELT

OUTLINE

- A load limiter mechanism with a direct clamp has been adopted.
- The seat belt now uses a seat belt switch instead of a buckle switch. (Australia, R.H.D., L.H.D.)
- The seat belt warning light and the seat belt warning buzzer is now controlled by microcomputer within instrument cluster.

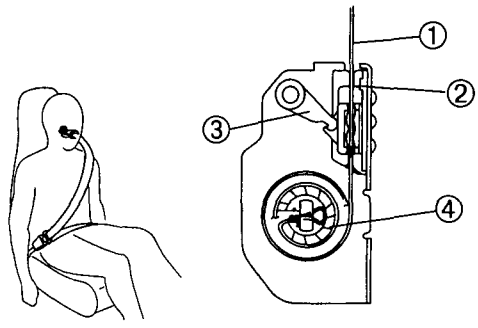
LOAD LIMITER RETRACTOR

Outline

- A load limiter mechanism, which operates when a load beyond a certain amount is applied against the seat belt, is built-in together with a direct clamp mechanism, which can quickly restrain the passenger when the vehicle brakes suddenly or is involved in a collision.
- The load limiter mechanism reduces the force of restriction against the passenger when the belt locks.

Operation

1. Initial state

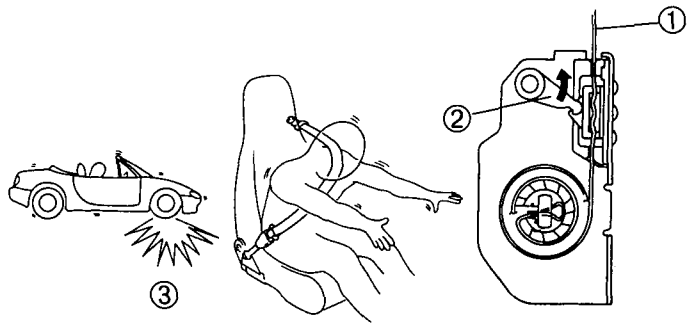


1	Seat belt
2	Stopper

3	Direct clamp
4	Collapsible component

2. Direct clamp lock state

The direct clamp improves initial passenger restraint by locking the seat belt when the vehicle reaches **0.45 G** during deceleration.

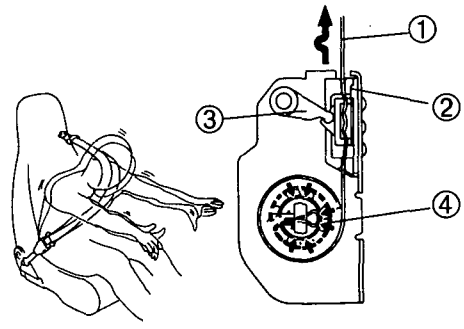


1	Seat belt
2	Direct clamp

3	The vehicle is involved in an impact

3. Load limiter operating state

When a load large enough to cause an injury to the chest is applied against the seat belt after the load limiter locks, the collapsible component within the retractor is crushed and the seat belt is extracted only an amount required to adsorb the load against the chest. This restrains the forse of restriction against the passenger.



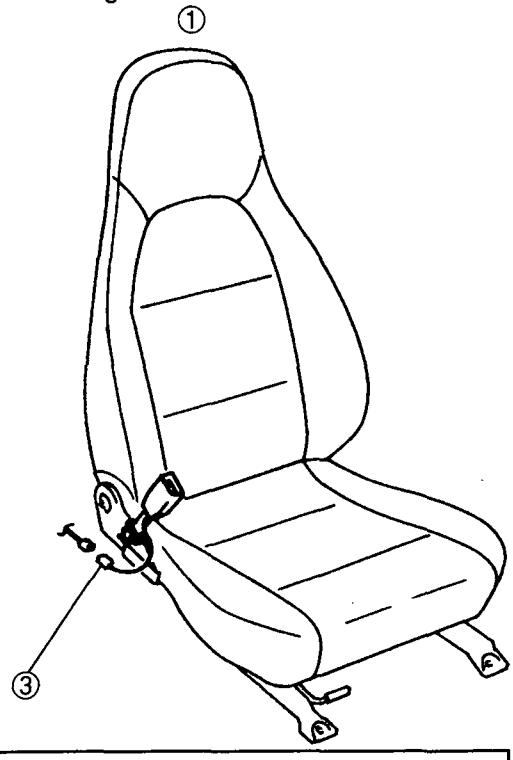
1	Seat belt
2	Stopper

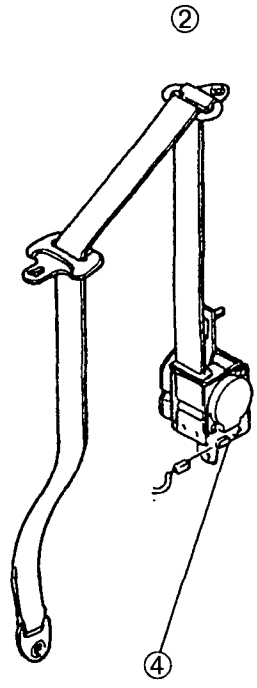
3	Direct clamp
4	Collapsible component

SEAT BELT WARNING SWITCH

Outline

- Seat belt warning switch is turned on or off according to the amount of the seat belt that is pulled out.

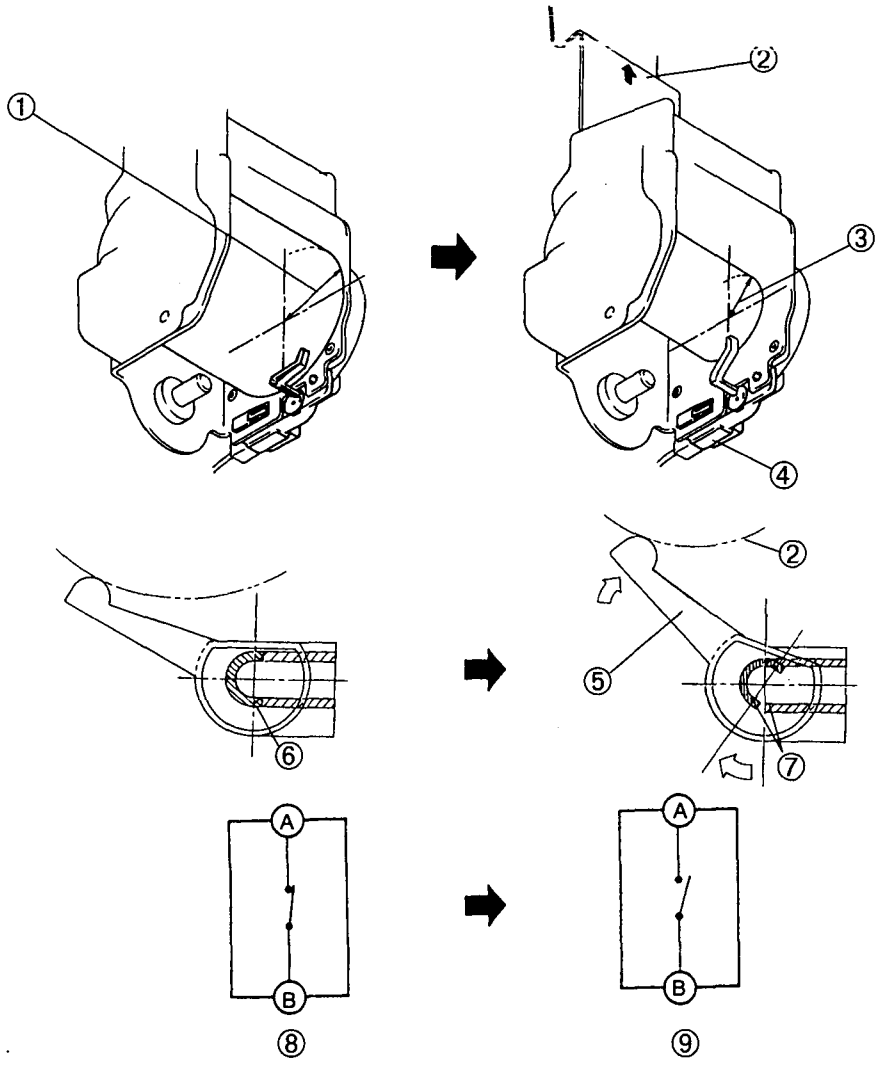




1	Previous
2	New

3	Buckle switch
4	Seat belt warning switch

Operation
When the seat belt is pulled out, the diameter of the spool decreases. The lever moves according to the change in the size of the spool. As the lever moves, the contact point of the switch disengages and the seat belt warning switch turns off.



1	Spool diameter (When seat belt is not pulled out)
2	Seat belt
3	Spool diameter (When seat belt is pulled out)
4	Seat belt warning switch
5	Lever

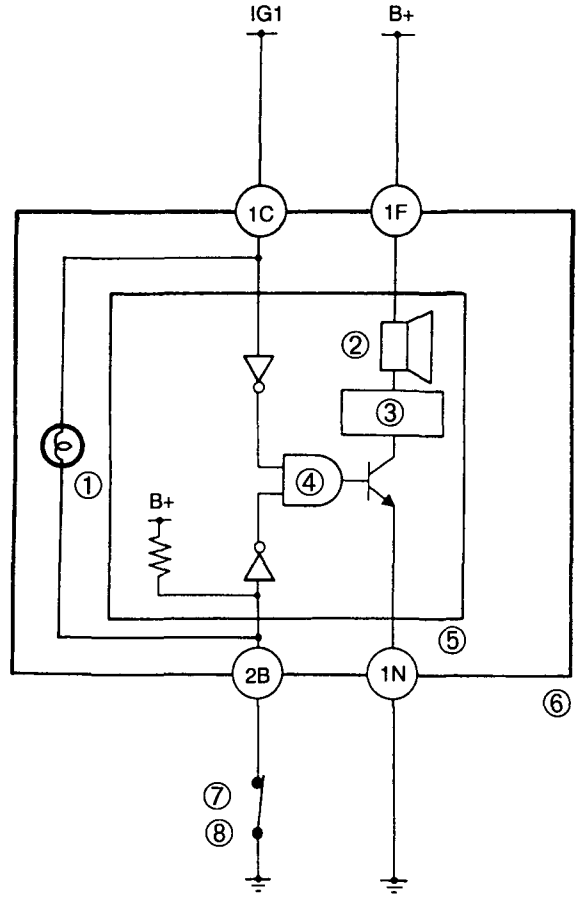
6	Contact point (on)
7	No contact (off)
8	Seat belt warning switch is on
9	Seat belt warning switch is off

SEAT BELT WARNING

Outline

- A system, which illuminates the seat belt warning light and sounds the seat belt warning buzzer within the instrument cluster when the seat belt is not worn, is used.

System Diagram



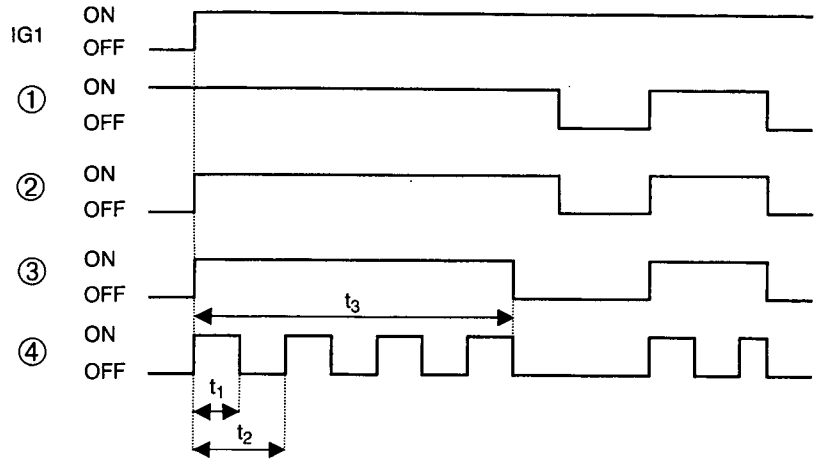
1	Seat belt warning light
2	Seat belt warning buzzer
3	Timer
4	AND circuit

5	Microcomputer
6	Instrument cluster
7	Buckle switch (Europe, UK)
8	Seat belt warning switch (Australia, R.H.D., L.H.D.)

Operation

- Seat belt warning light illuminates and seat belt warning buzzer sounds intermittently when all conditions are satisfied.
  (1) Ignition switch is turned on.
  (2) Seat belt warning swithch is turned on.

Timing chart



t_1: 0.35—0.65 s
t_2: 0.7—1.3 s
t_3: 4—8 s

1	Seat belt warning switch
2	Seat belt warning light

3	Timer
4	Seat belt warning buzzer

BODY SHELL

OUTLINE

- The body shell has been designed to increase vehicle structural rigidity and reduce shock to the body, thus improving safety.
- By using lightweight materials to reinforce the body, an increase in vehicle weight has been kept to a minimum.
- By increasing trunk room space, every day usability of the trunk room has been improved.

FEATURES

Improved Driving Control

By adding or changing the following parts, torsional strength of the body has been improved.

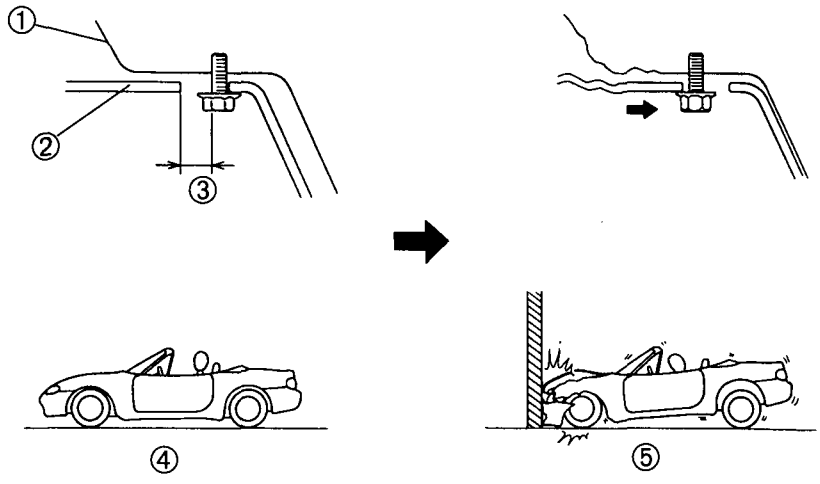
- The tunnel side junction has been enlarged and its panels have been made thicker. (Thickness=1.2 mm {0.05 in} →2.3 mm {0.10 in})
- The tunnel gusset has been enlarged and its panels have been made thicker. (Thickness=1.2 mm {0.05 in} →2.3 mm {0.10 in})
- Front pillar reinforcement has been enlarged and its panels have been made thicker. (Thickness=1.0 mm {0.04 in} →1.8 mm {0.07 in})
- The cross section of the side sill reinforcement has been changed.
- The side sill reinforcement has been lengthened.
- The panels of the hinge gusset have been made thicker. (Thickness=1.0 mm {0.04 in} →2.0 mm {0.08 in})
- A side sill gusset has been added. (Thickness=2.3 mm {0.10 in})

Improved Safety

1. By adding or changing the following parts, body strength in a collision has been improved.
   (1) head-on collision
   - Reinforcement has been added to the front side frame.
   - The bumper bracket has been lengthened 20 mm {0.8 in}.

   (2) Side collision
   - The impact bar has been lengthened.
   - An additional impact bar has been added.
   - Crash pads have been added to the doors and the door trims.

2. By changing the following parts, shock (G) to the body in a collision has been reduced.
   - By making a slide hole in the installation section of the front crossmember, the front crossmember can now slide and absorb shock (G) in a collision.



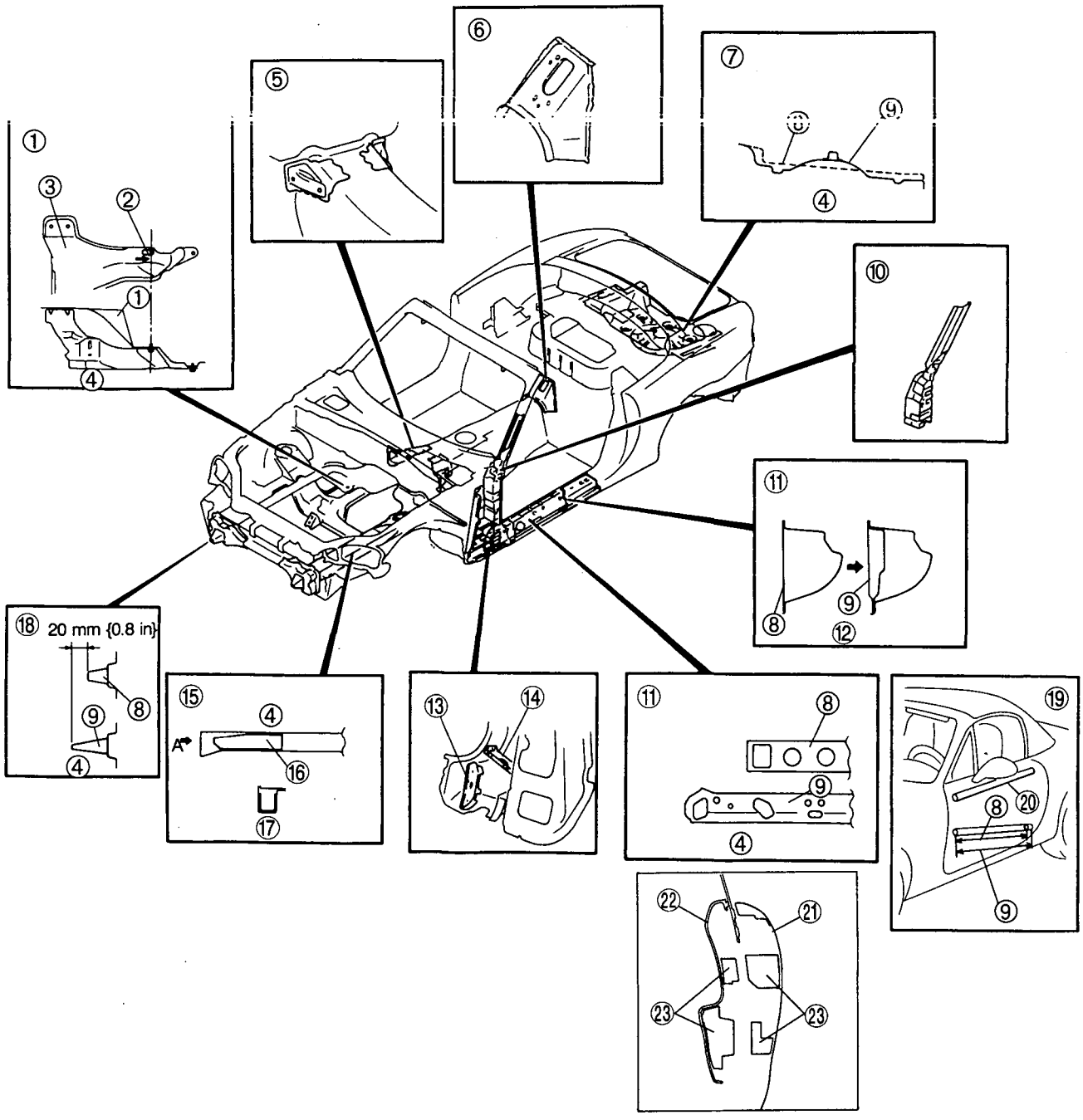
1	Front frame rear
2	Front crossmember
3	Part of slide

4	Ordinary
5	Collision

Improved Practicality

- By reconfiguring the rear floor pan, trunk room space has been increased.

STRUCTURAL VIEW



1	Front frame rear
2	Part of slide
3	Front crossmember
4	Side view
5	Tunnel side junction
6	Tunnel gusset
7	Rear floor pan
8	Previous
9	New
10	Front pillar reinforcement
11	Side sill reinforcement
12	Cross section

13	Side sill gusset
14	Hinge gusset
15	Front side frame
16	Reinforcement
17	View A
18	Bumper bracket
19	Impact bar
20	Impact bar (newly added)
21	Door
22	Door trim
23	Crash pad

BODY ELECTRICAL SYSTEM

ABBREVIATIONS

ABS	Antilock brake system	M	Motor
ACC	Accessories	MT	Manual transmission
AT	Automatic transmission	PCM	Powertrain control module
DTC	Diagnostic trouble code	RH	Right hand
IG	Ignition	R.H.D.	Right hand drive
LCD	Liquid crystal display	SAS	Sophisticated air bag sensor
LH	Left hand	TNS	Tail number side lights
L.H.D.	Left hand drive		

OUTLINE

Improved safety
- Air bag system
- Seat belt warning buzzer (R.H.D. except UK)

Improved security
- Lights-on reminder warning buzzer
- Key reminder warning buzzer (R.H.D. except UK)
- Immobilizer system
- Anti-theft system

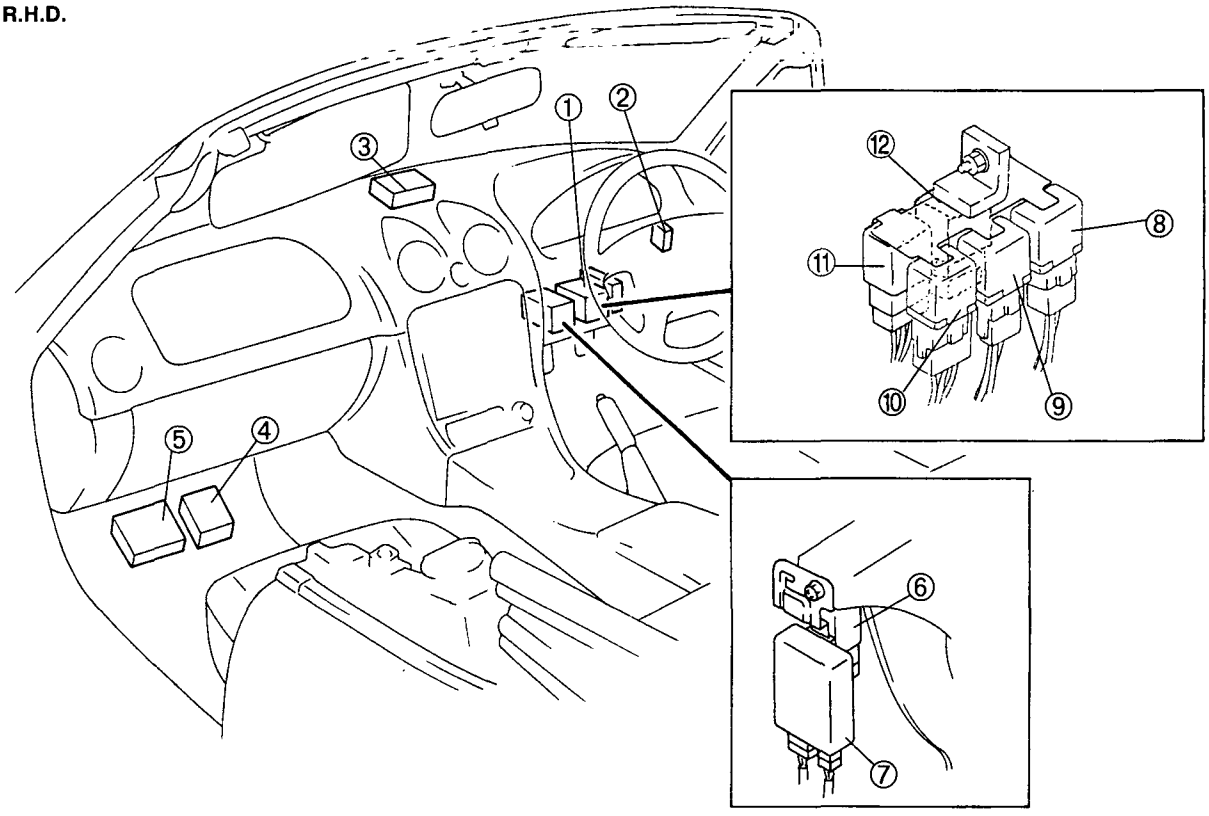
Improved serviceability
- Input/output check mode

Improved marketability
- Tweeter speaker

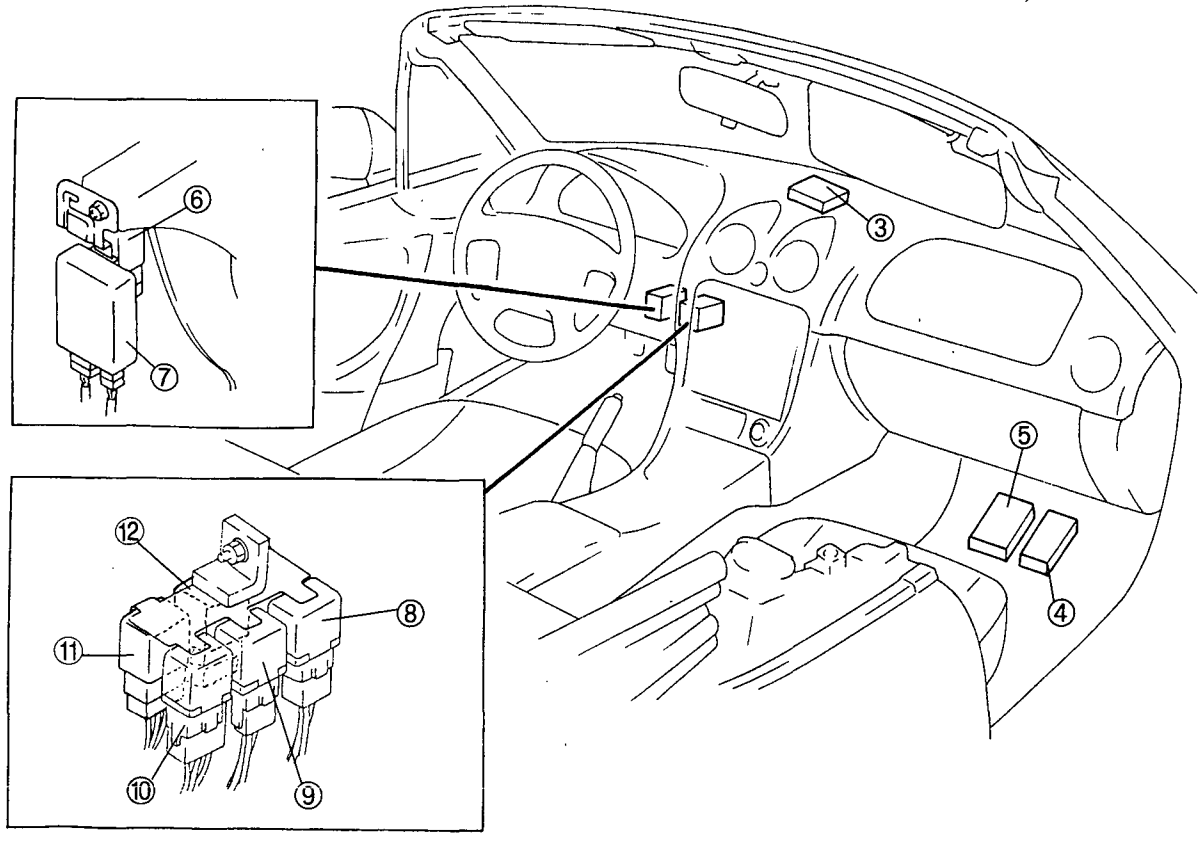
RELAY AND UNIT

RELAY AND UNIT LOCATION

R.H.D.

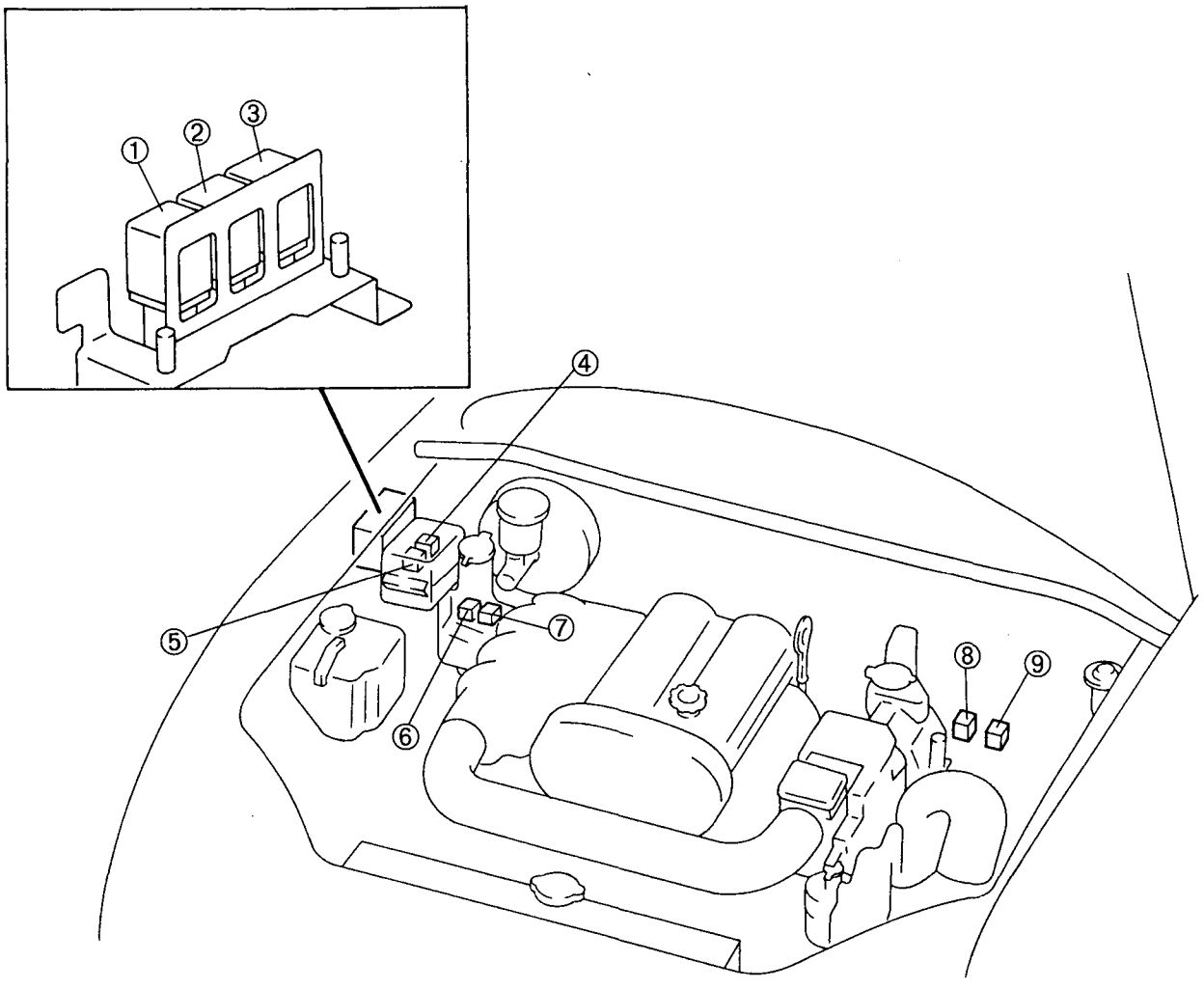


L.H.D.



1	Transmission control module (Australia)
2	Key interlock unit (Australia)
3	SAS unit
4	ABS control module
5	PCM
6	Door lock timer unit

7	Immobilizer unit
8	Flasher unit
9	Rear window defroster relay
10	Blower relay
11	Rear fog light relay
12	Circuit opening relay



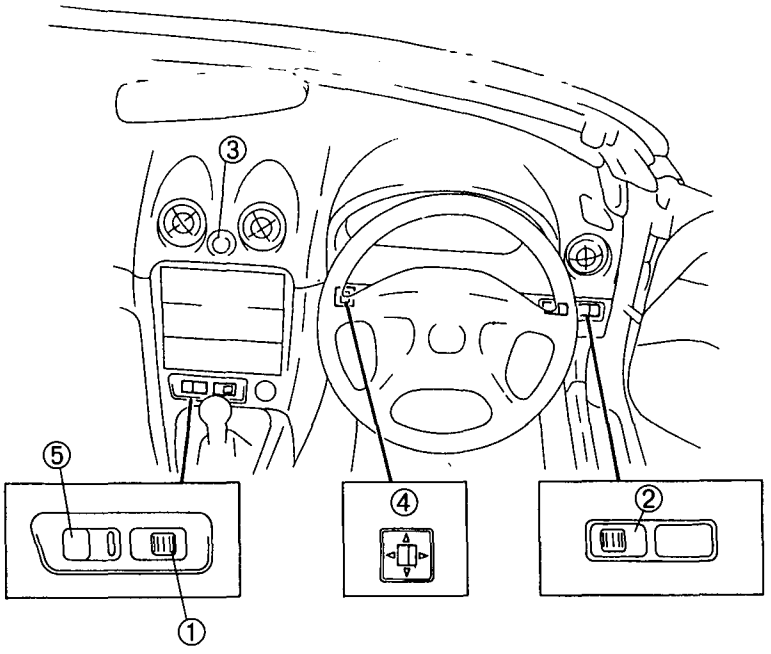
1	Headlight relay
2	TNS relay
3	Cooling fan relay
4	Horn relay
5	Main relay

6	ABS (motor) relay (L.H.D.)
7	ABS (valve) relay (L.H.D.)
8	ABS (motor) relay (R.H.D.)
9	ABS (valve) relay (R.H.D.)

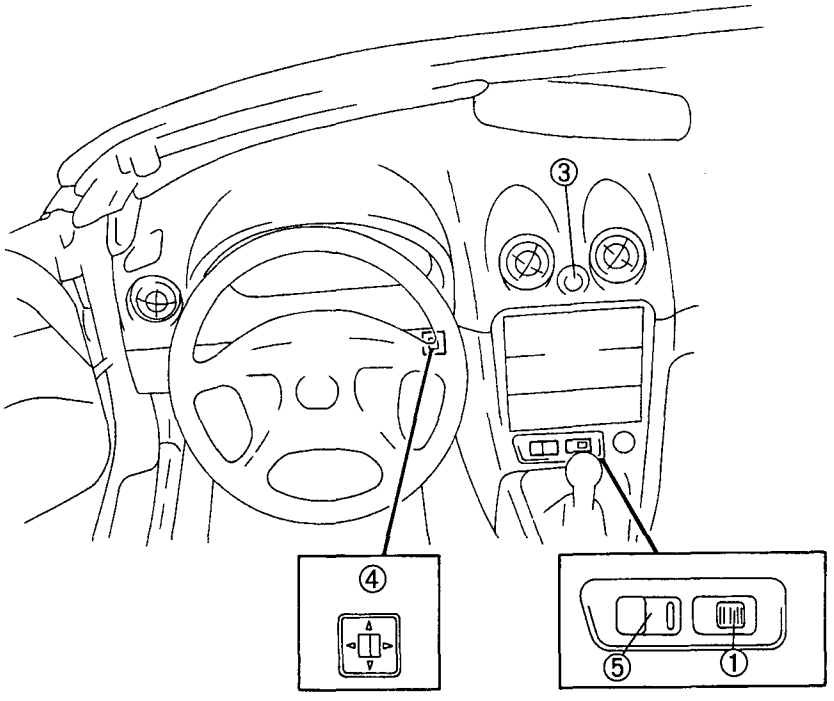
T

SWITCH LOCATION

R.H.D.



L.H.D.



1	Headlight leveling switch
2	Panel light control switch
3	Hazard warning switch

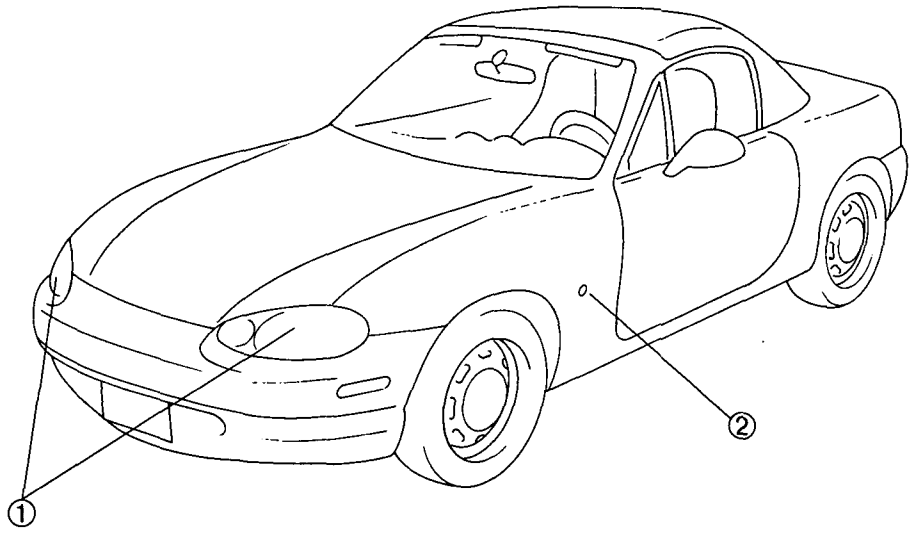
4	Power outside mirror switch
5	Rear fog light switch

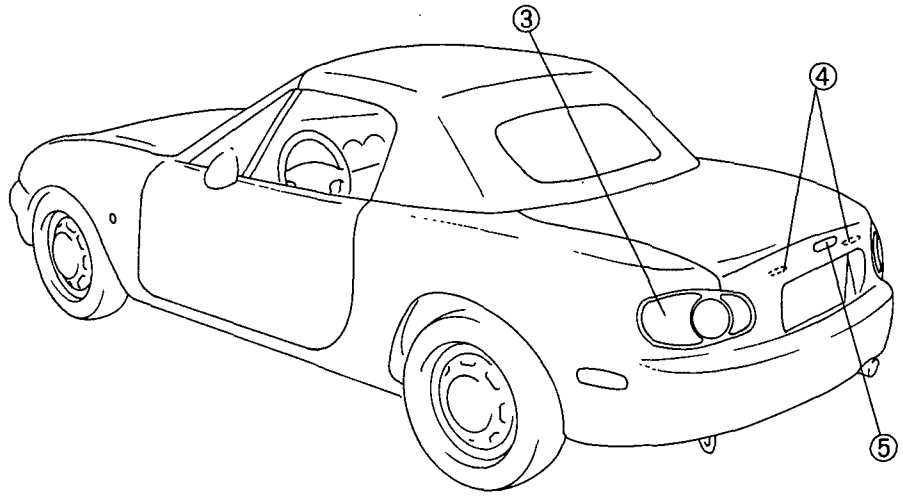
EXTERIOR LIGHTING SYSTEM

OUTLINE

- The headlight has been changed from a retractable type to a fixed type.
- The headlight leveling system has been changed from a type that moves the whole headlight to one that moves only the reflector.
- The license plate light is a trunk lid loading type downward illuminating light, and also acts as a trunk compartment light.
- A lights-on reminder warning buzzer system has been added to the new MX-5.

STRUCTURAL VIEW





1	Front combination light
2	Front side turn light
3	Rear combination light

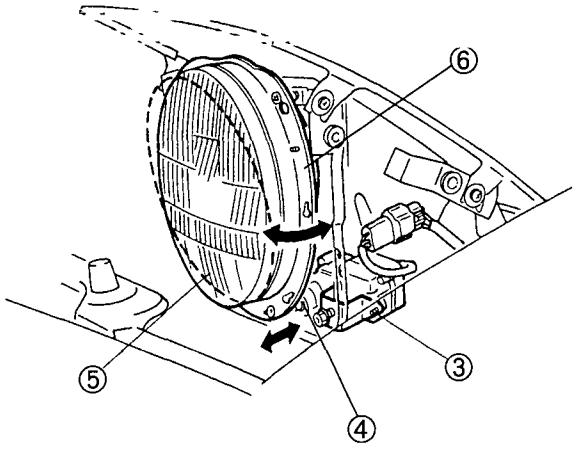
4	License plate light
5	High-mount brake light

T

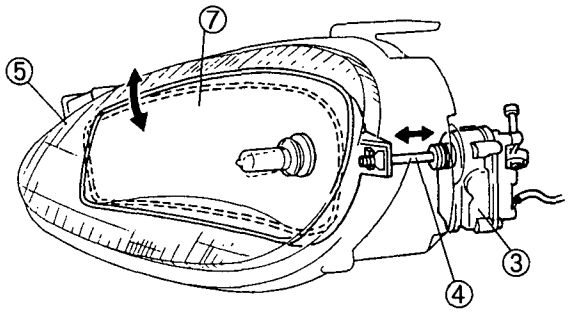
HEADLIGHT LEVELING SYSTEM

- The headlight leveling actuator is connected to the reflector and makes only the reflector move.

①



②



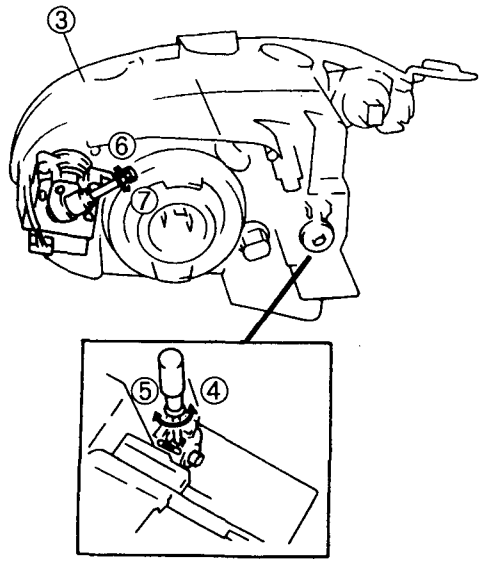
1	Previous MX-5
2	New MX-5
3	Headlight leveling actuator
4	Shaft

5	Lens
6	Bracket
7	Reflector

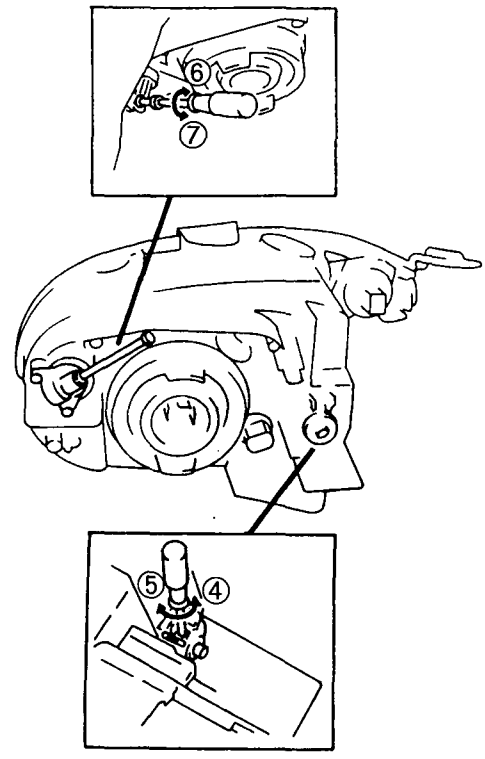
HEADLIGHT AIMING

- The headlight adjustment can be adjusted by the adjusting screw.The adjusting screw position has been changed to the back face of the front combination light.

①



②

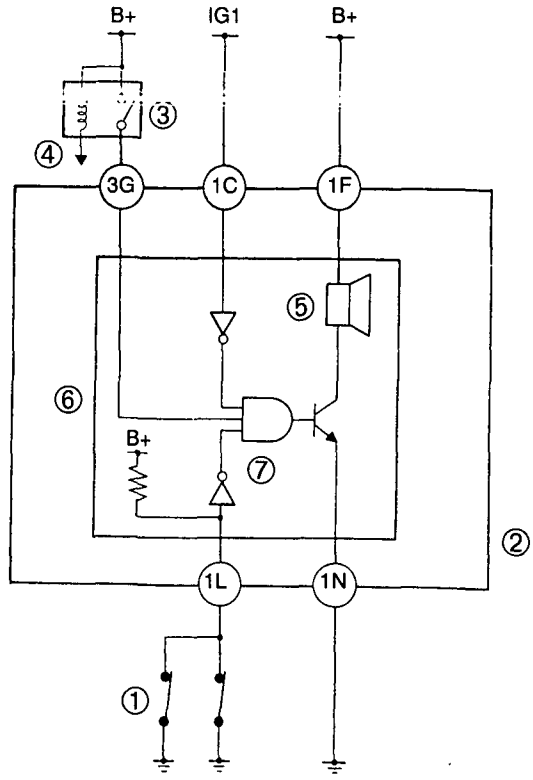


1	With headlight leveling system
2	Without headlight leveling system
3	Front combination light
4	Inward

5	Outward
6	Up
7	Down

T

LIGHTS-ON REMINDER WARNING BUZZER SYSTEM
System Diagram



1	Door switch
2	Instrument cluster
3	TNS relay
4	To headlight switch

5	Buzzer
6	Microcomputer
7	AND circuit

Specifications

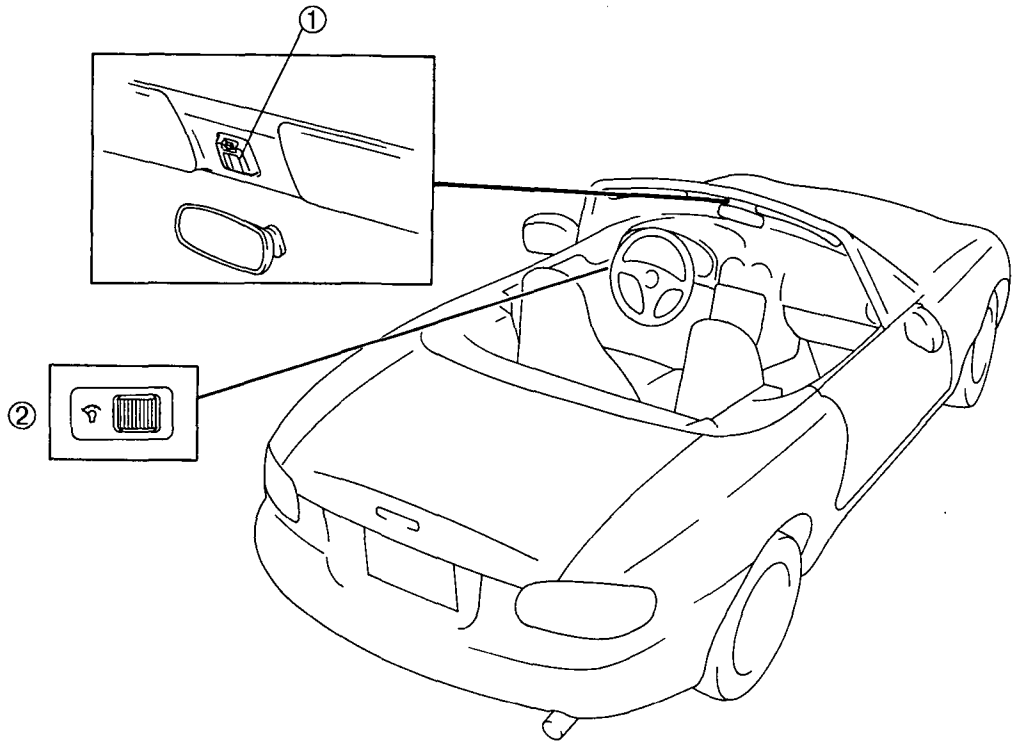
Operating condition (When all conditions are satisfied)	Sounding cycle
• Ignition switch is at LOCK or ACC position. • Headlight switch is at TNS or ON position. • Any door switch is on.	Continuous ON OFF

INTERIOR LIGHTING SYSTEM

OUTLINE

- The panel light control system is the same as the previous MX-5.

STRUCTURAL VIEW



1	Interior light
2	Panel light control switch

T

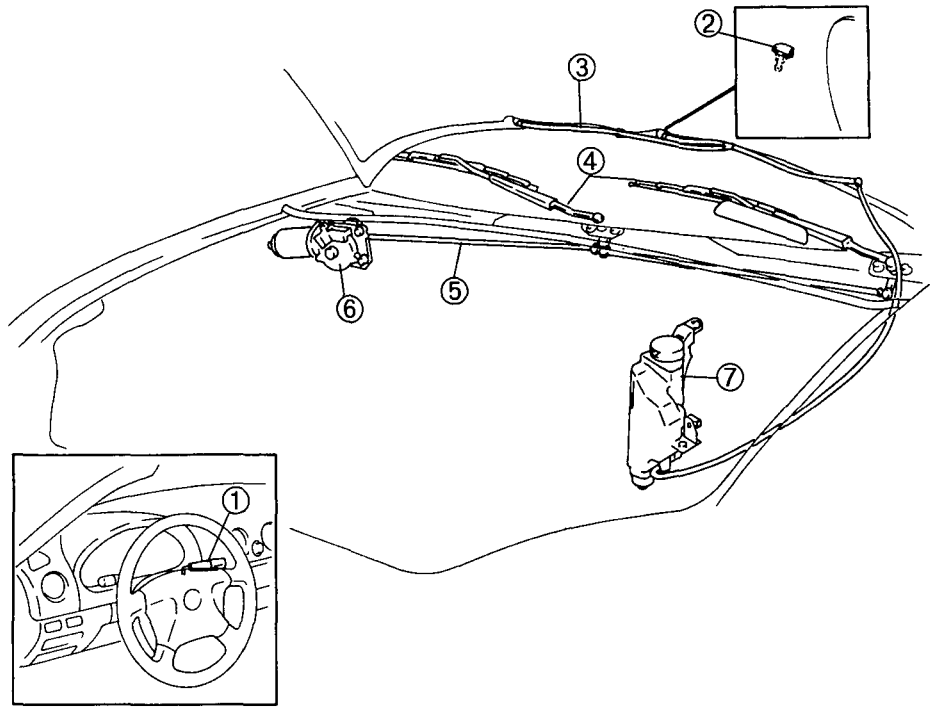
WIPER AND WASHER

OUTLINE

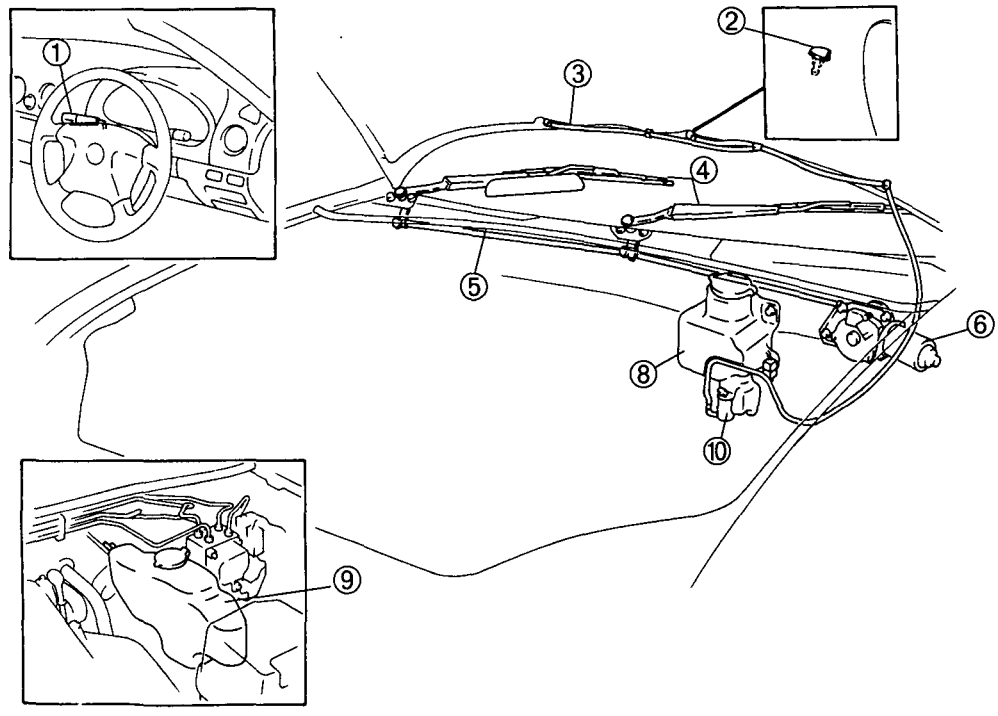
- The wiper and washer system is the same as the previous MX-5.

STRUCTURAL VIEW

L.H.D.



R.H.D.



1	Windshield wiper and washer switch
2	Windshield washer nozzle
3	Windshield washer pipe
4	Windshield wiper arm and blade
5	Windshield wiper link

6	Windshield wiper motor
7	Windshield washer tank
8	Windshield washer tank (Without ABS)
9	Windshield washer tank (With ABS)
10	Windshield washer motor

WARNING AND INDICATOR SYSTEM

OUTLINE

- A new instrument cluster has been adopted which has a built-in microcomputer.
- The built-in microcomputer controls the input/output check mode for improved serviceability.
- The built-in microcomputer controls each warning buzzer which used to be performed by the warning unit.
- The speedometer type is changed from the eddy current type meter to the cross coil type meter.
- Because the speedometer type has been changed, the speedometer operation signal is sent from the signal source.
  (MT: vehicle speedometer sensor, AT: transmission control module)
- The water temperature sender unit has been integrated with the engine coolant temperature sensor.

MICROCOMPUTER

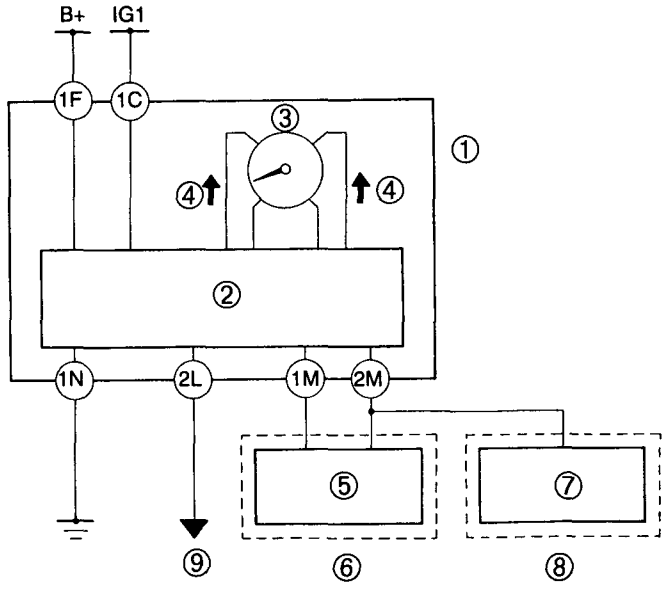
- A microcomputer is used by the instrument cluster for each of the electric component functions.

Functions	R.H.D. except UK	L.H.D.	UK	Reference
Speedometer control	△	△	△	T-11
Tachometer control	△	△	△	T-12
Fuel-level warning light control	×	○*1	×	T-12
Input/output check mode	○	○	○	T-13
Lights-on reminder warning buzzer	○	○	○	T- 8
Key reminder warning buzzer	○	×	×	T-16
Seat belt warning buzzer	△	×	×	Section S

○ : Added
△ : Changed
× : Not equipped
*1 : Only Czech Republic and Slovak Republic

SPEEDOMETER CONTROL

- The microcomputer receives vehicle speed as an 8-pulse signal from the vehicle speedometer sensor (AT: transmission control module). When the microcomputer receives 8202 pulses/hour from the vehicle speedometer sensor (AT: transmission control module), the microcomputer sends electric current to the coil in the speedometer to make the speedometer indicate 1 mile/h (When the microcomputer receives 5096 pulses/hour, the speedometer indicates 1 km/h).
- The microcomputer sends vehicle speed as a 4-pulse signal to other units.

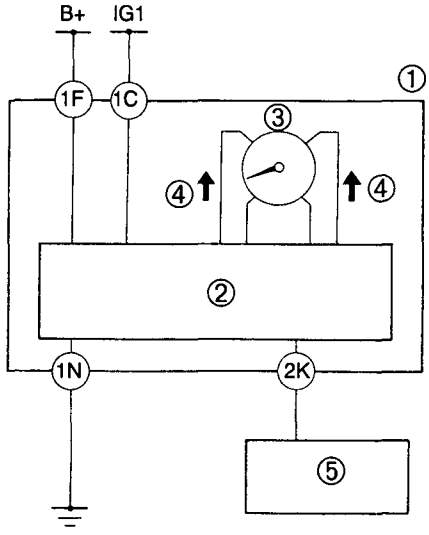


1	Instrument cluster
2	Microcomputer
3	Speedometer
4	Electric current
5	Vehicle speed sensor

6	MT
7	Transmission control module
8	AT
9	4-pulse to other units

TACHOMETER CONTROL

- The microcomputer receives engine revolution as a 4-pulse signal from the PCM. When the microcomputer receives 4 pulses/minute from the PCM, the microcomputer sends electric current to the coil in the tachometer to make the tachometer indicate 2 revolutions/minute.

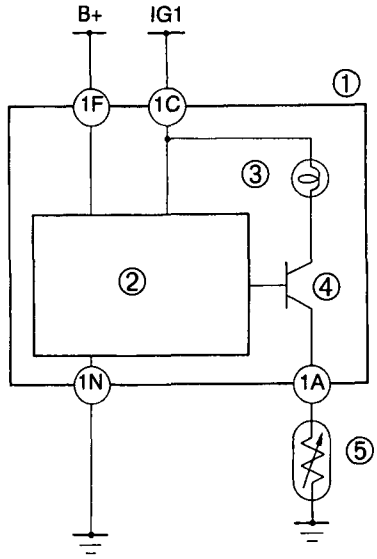


1	Instrument cluster
2	Microcomputer
3	Tachometer

4	Electric current
5	PCM

FUEL-LEVEL WARNING LIGHT CONTROL

- The microcomputer measures the resistance value of the fuel gauge sender unit. If the fuel gauge sender unit's resistance value exceeds 75.5—87.5 ohms for 21—31 seconds, the microcomputer illuminates the fuel-level warning light. When the fuel-level warning light is illuminated and the fuel gauge sender unit's resistance value remains below 58—68 ohms for 3 seconds, the microcomputer turns off the fuel-level warning light.



1	Instrument cluster
2	Microcomputer
3	Fuel-level warning light

4	Transistor
5	Fuel gauge sender unit

INPUT/OUTPUT CHECK MODE

- The built-in microcomputer judges the quality of the input signal or the individual part.
- Input/output check mode has both an input circuit check and an individual part check function.

Input Circuit Check

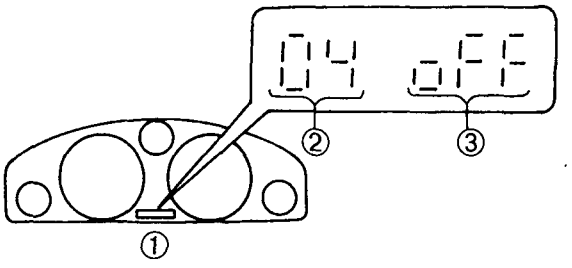
- The built-in microcomputer judges the quality of the input circuit based on the signal to the instrument cluster when the part of the input circuit check is operated.

Individual Part Check

- The built-in microcomputer forcibly operates the part of the individual part check and judges the quality of the individual part.

Diagnostic Trouble Code Indication

- Diagnostic trouble codes for both the input circuit check and the individual part check are displayed on the odometer/tripmeter.



1	Instrument cluster
2	Diagnostic trouble code

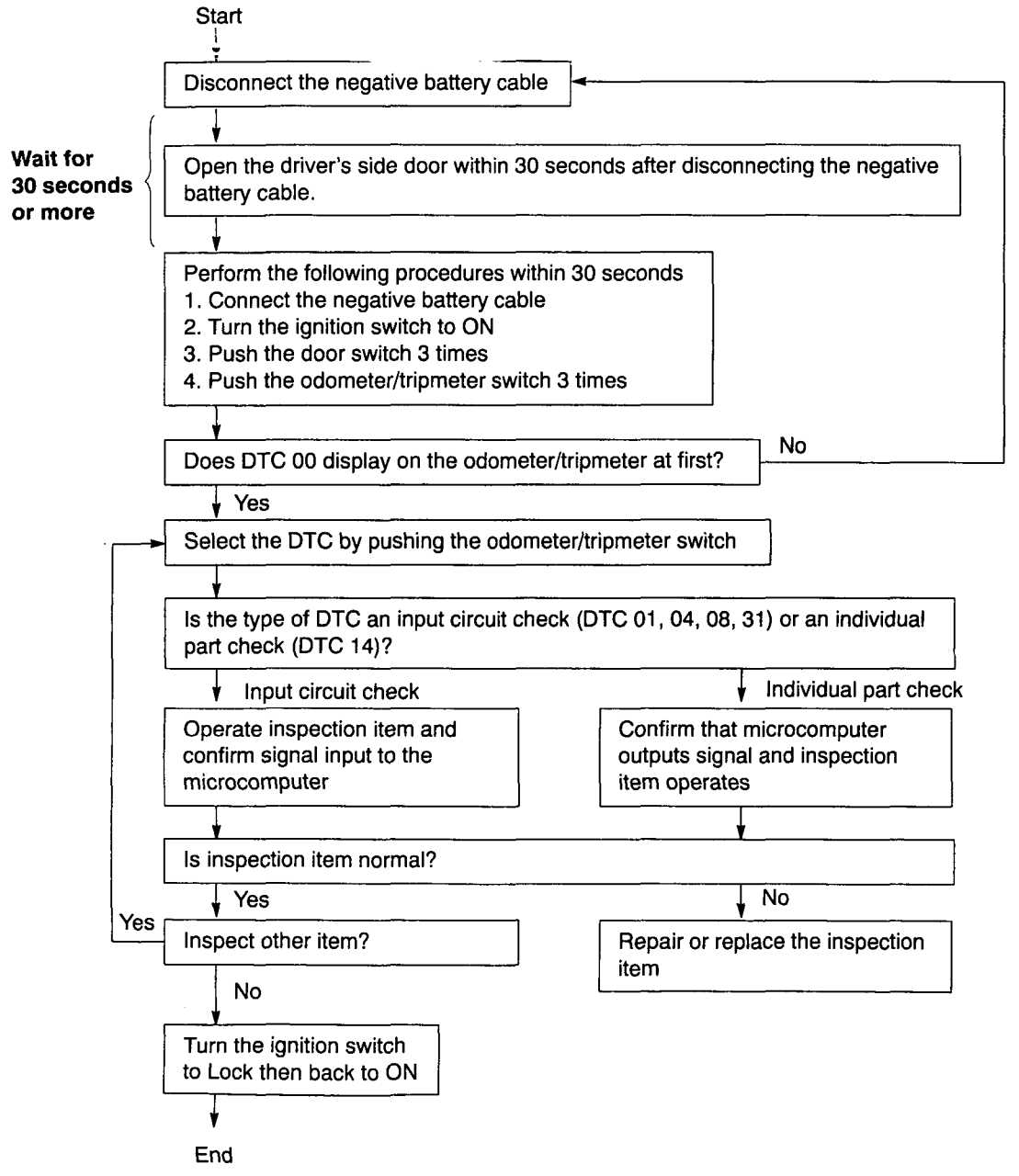
3	Result

Diagnostic Trouble Code Chart

Diagnostic trouble code	Inspection part	Type of DTC
00	—	—
01	Seat belt switch*1	Input circuit check
04	Door switch	Input circuit check
05	—	—
08	TNS relay	Input circuit check
14	Buzzer	Individual part check
31	Key reminder switch	Input circuit check

*1 : Only Australia

Inspection Procedure



Diagnostic Trouble Codes

DTC 01	Seat belt switch
LCD indication	**Situation**
	Pull the seat belt. (Seat belt switch is on.)
	Release the seat belt. (Seat belt switch is off.)

DTC 04	Door switch
LCD indication	**Situation**
	Open any door. (Door switch is on.)
	Close all doors. (Door switch is off.)

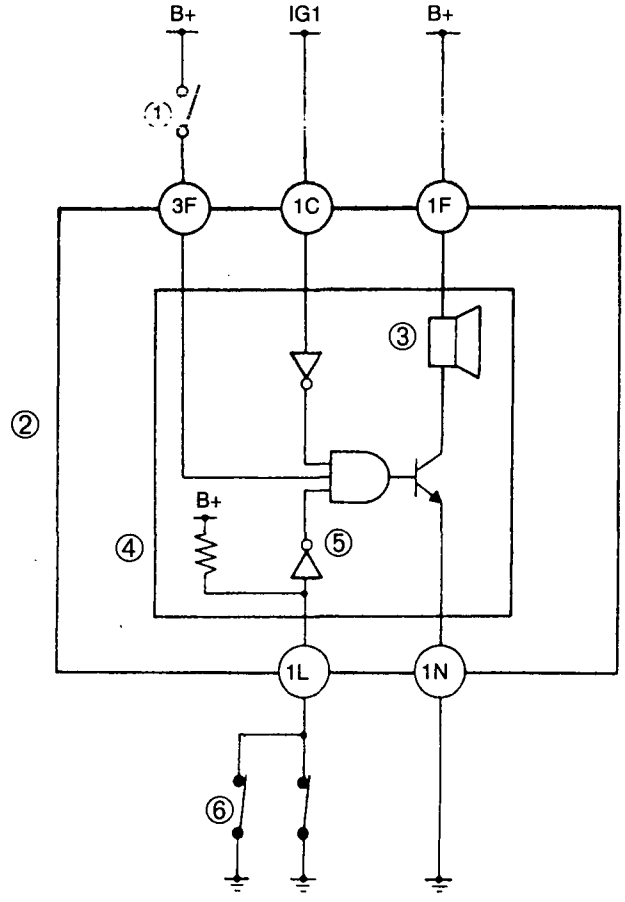
DTC 08	TNS relay
LCD indication	**Situation**
	Turn the headlight switch to TNS position. (TNS relay is on.)
	Turn the headlight switch to OFF position. (TNS relay is off.)

DTC 14	Buzzer
LCD indication	**Situation**
	Wait for 2 seconds. (Buzzer sounds continuously.)

DTC 31	Key reminder switch
LCD indication	**Situation**
	Insert the key into the steering lock. (Key reminder switch is on.)
	Remove the key from the steering lock. (Key reminder switch is off.)

KEY REMINDER WARNING BUZZER SYSTEM

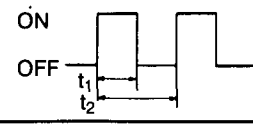
System Diagram



1	Key reminder switch
2	Instrument cluster
3	Buzzer

4	Microcomputer
5	AND circuit
6	Door switch

Specifications

Operating condition (When all conditions are satisfied)	Sounding cycle
• Ignition switch is at LOCK or ACC position. • Key reminder switch is on. • Any door switch is on.	 t_1 : 0.18—0.32 seconds t_2 : 0.35—0.65 seconds

IMMOBILIZER SYSTEM

OUTLINE

- When a key with an unregistered ID number is inserted into steering lock, the engine does not start.
- The system is same as 626 (GF) model.

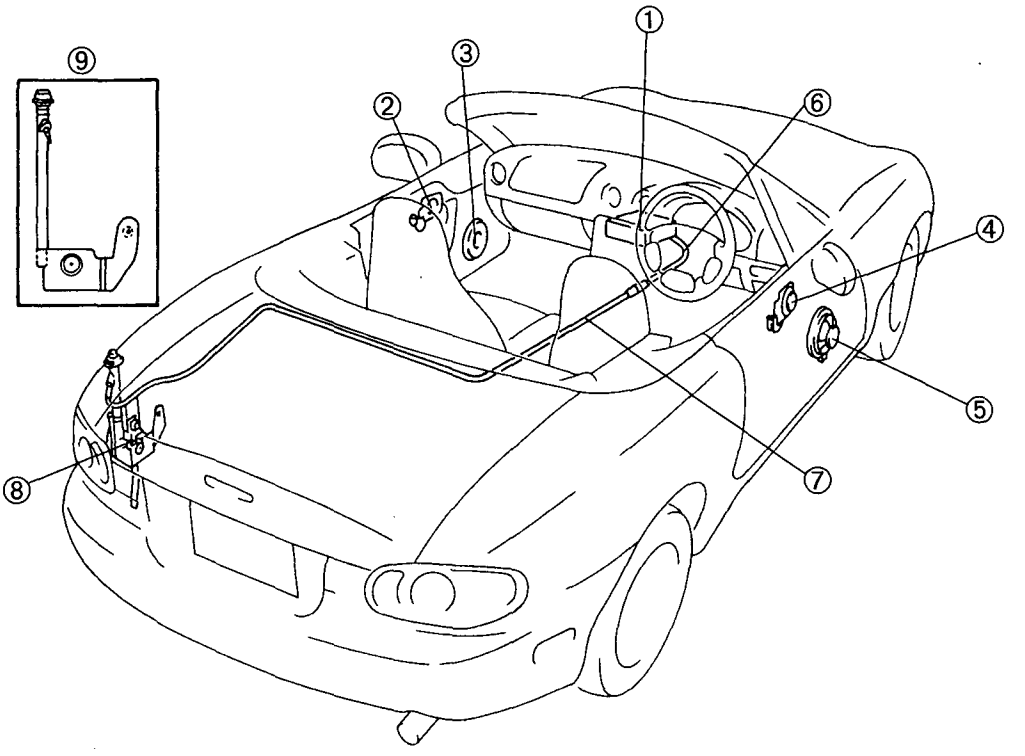
AUDIO

OUTLINE

- A new audio unit, which has an anti-theft system, has been adopted for R.H.D. except UK.
- A tweeter speaker has been adopted for improved marketability.
- The antenna installation position is changed from the right side to the left side of the trunk room.

STRUCTURAL VIEW

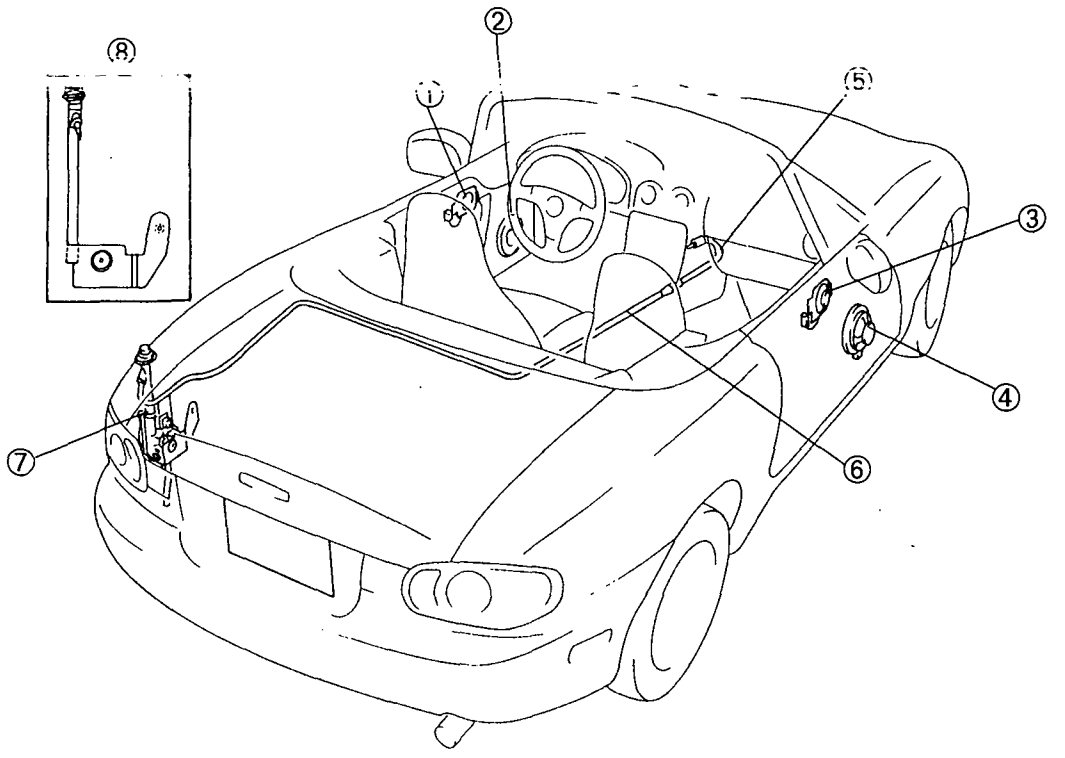
R.H.D. Except UK



1	Audio unit
2	Tweeter speaker LH
3	Door speaker LH
4	Tweeter speaker RH
5	Door speaker RH

6	Front antenna feeder
7	Rear antenna feeder
8	Power antenna
9	Manual antenna

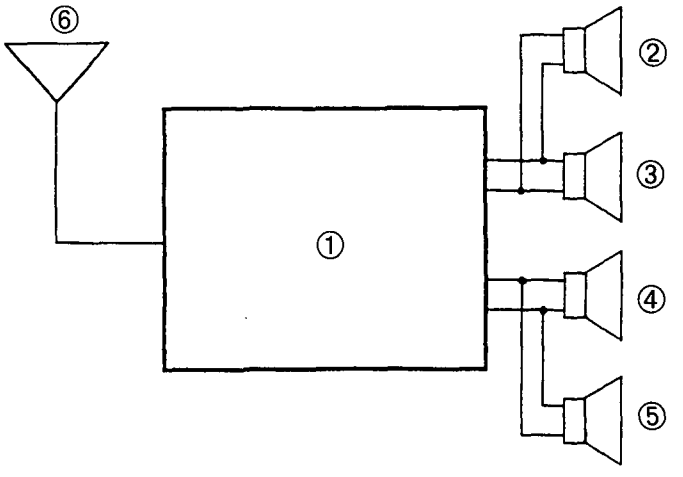
L.H.D. and UK



1	Tweeter speaker LH
2	Door speaker LH
3	Tweeter speaker RH
4	Door speaker RH

5	Front antenna feeder
6	Rear antenna feeder
7	Power antenna
8	Manual antenna

WIRING DIAGRAM



1	Audio unit (R.H.D. except UK)
2	Tweeter speaker LH
3	Door speaker LH

4	Door speaker RH
5	Tweeter speaker RH
6	Power antenna (manual antenna)

SPECIFICATIONS

Audio Unit (R.H.D. Except UK)

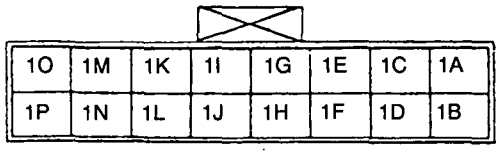
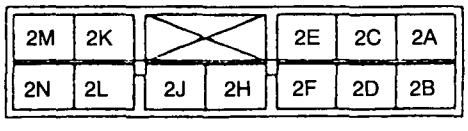
Item		Specification
Rated voltage	(V)	12
Frequency band	(KHz) (MHz)	AM: 522—1629 FM: 87.5—108
Amplifier maximum output power	(W)	25 × 4
Output impedance	(Ω)	4

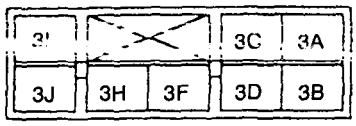
Speaker

Item		Specification	
		Door speaker	Tweeter speaker
Maximum input	(W)	25	
Impedance	(Ω)	4	
Size	(mm {in})	140 × 191 {5.5 × 7.5}	30 × 30 {1.2 × 1.2}

TERMINAL LAYOUT AND SIGNAL

Audio Unit

Terminal		Signal
	1A	Input RH (+)
	1B	Signal ground
	1C	Input LH (+)
	1D	Combination control
	1E	Auxiliary control
	1F	Auxiliary control
	1G	Bus (–)
	1H	Bus (–)
	1I	ACC
	1J	Power ground
	1K	B+
	1L	System mute
	1M	TNS (+)
	1N	Illumination (–)
	1O	—
	1P	—
	2A	ACC
	2B	Telephone mute
	2C	B+
	2D	Antenna switch
	2E	TNS (+)
	2F	Illumination (–)
	2H	Steering switch
	2J	Amplifier control
	2K	Front speaker LH (+)
	2L	Front speaker LH (–)
	2M	Front speaker RH (+)
	2N	Front speaker RH (–)

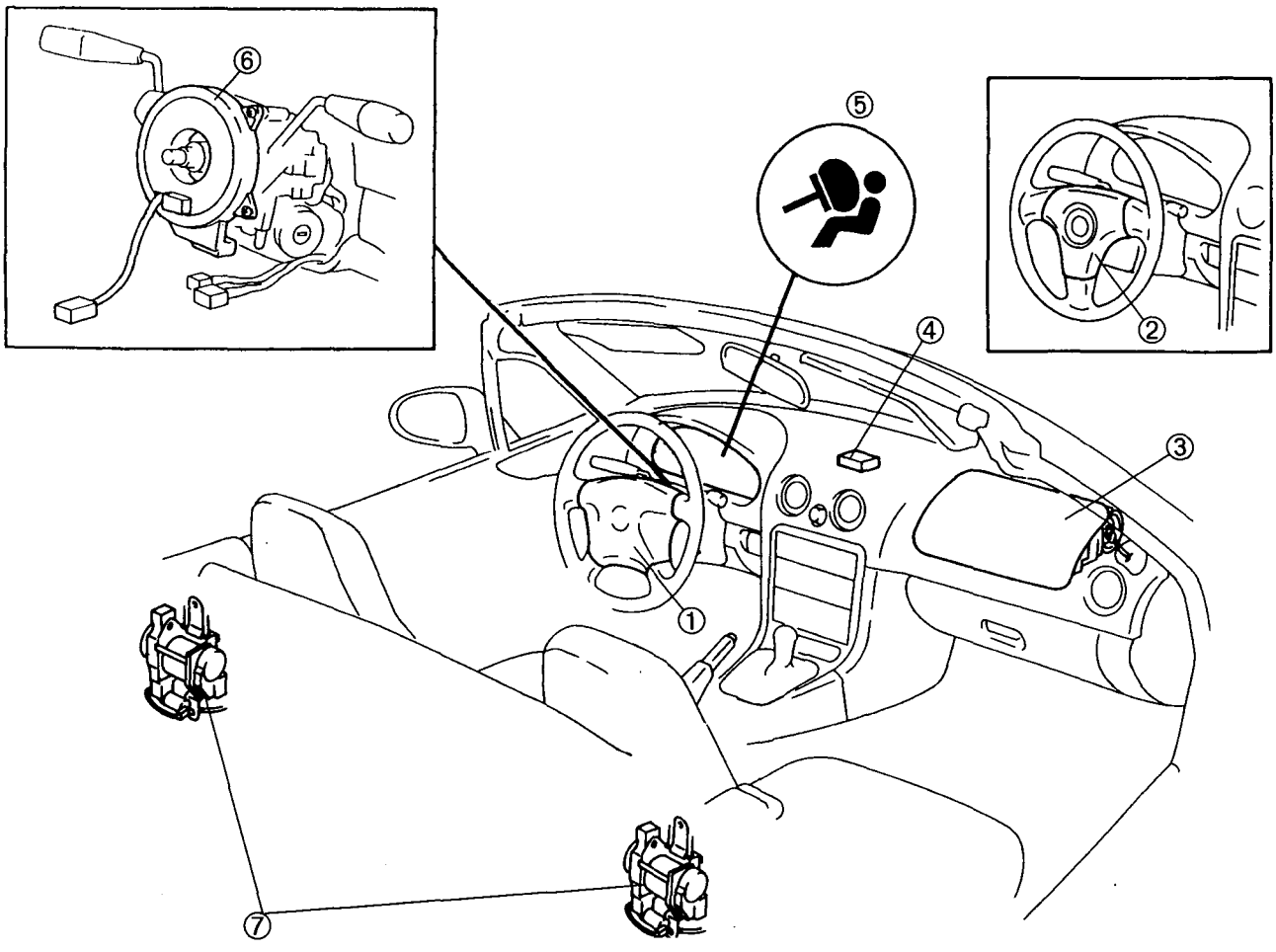
Terminal		Signal
	3A	Rear speaker LH (+)
	3B	Rear speaker LH (–)
	3C	—
	3D	—
	3F	Rear speaker RH (+)
	3H	Rear speaker RH (–)
	3I	—
	3J	—
	4A	Ground

AIR BAG SYSTEM

OUTLINE

- An air bag system has been adopted for improved safety in Australian models.
- Air bag modules have been installed on the driver-side and the passenger-side of all vehicles.
- The design of the driver-side and passenger-side air bag modules have changed for improved marketability.
- There are two types of driver-side air bag modules: standard and sports.
- Pre-tensioner seat belts have been adopted in L.H.D. and UK.
- The diagnostic trouble codes detected by the on-board diagnostic function of the SAS unit have been subdivided. Therefore service codes 01 and 02 have been added. Service codes 11 and 12 have been added when equipped with the pre-tensioner seat belts.

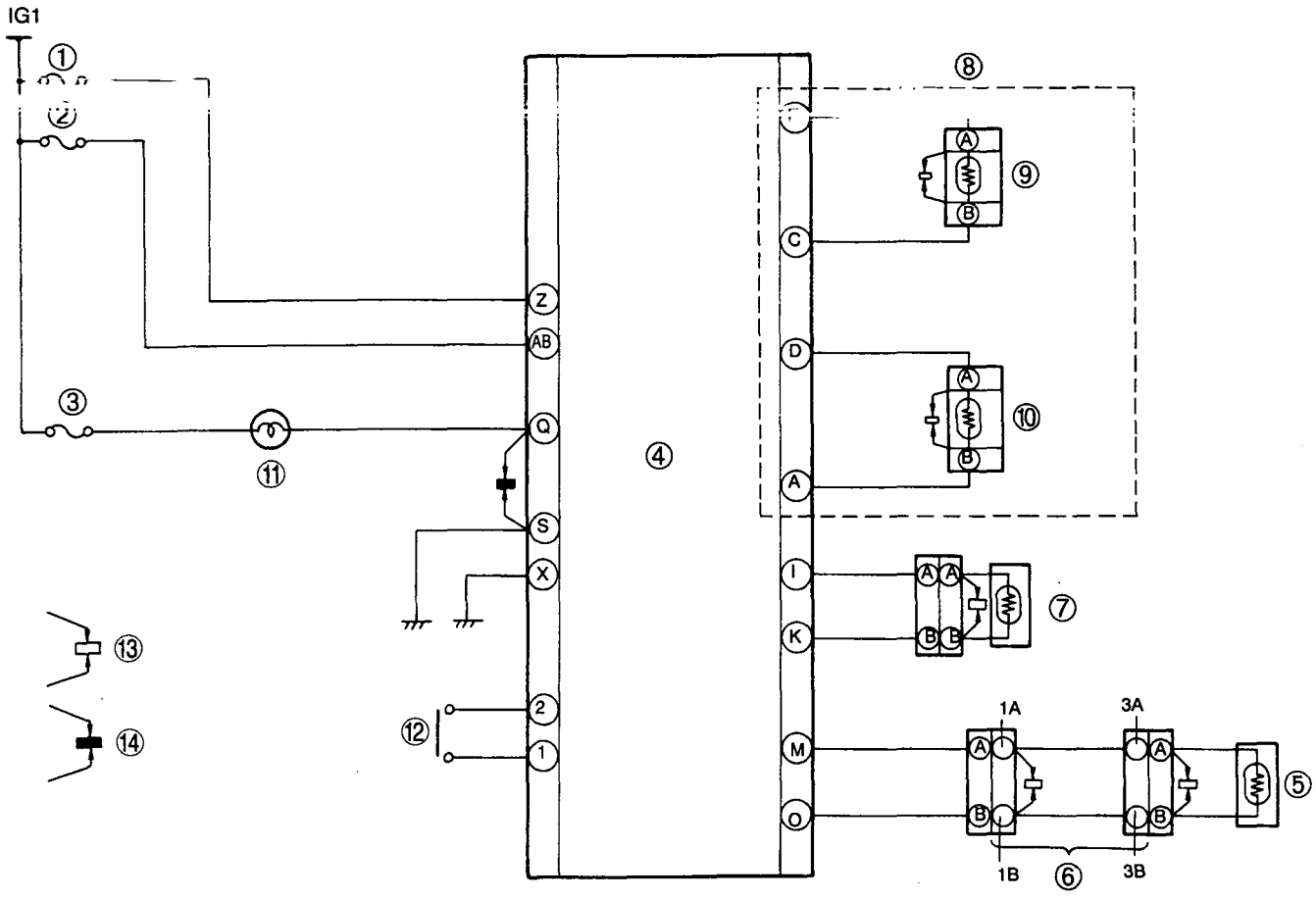
STRUCTURAL VIEW



1	Driver-side air bag module (Standard type)
2	Driver-side air bag module (Sports type)
3	Passenger-side air bag module
4	SAS unit

5	Air bag system warning light
6	Clock spring
7	Pre-tensioner seat belt

WIRING DIAGRAM



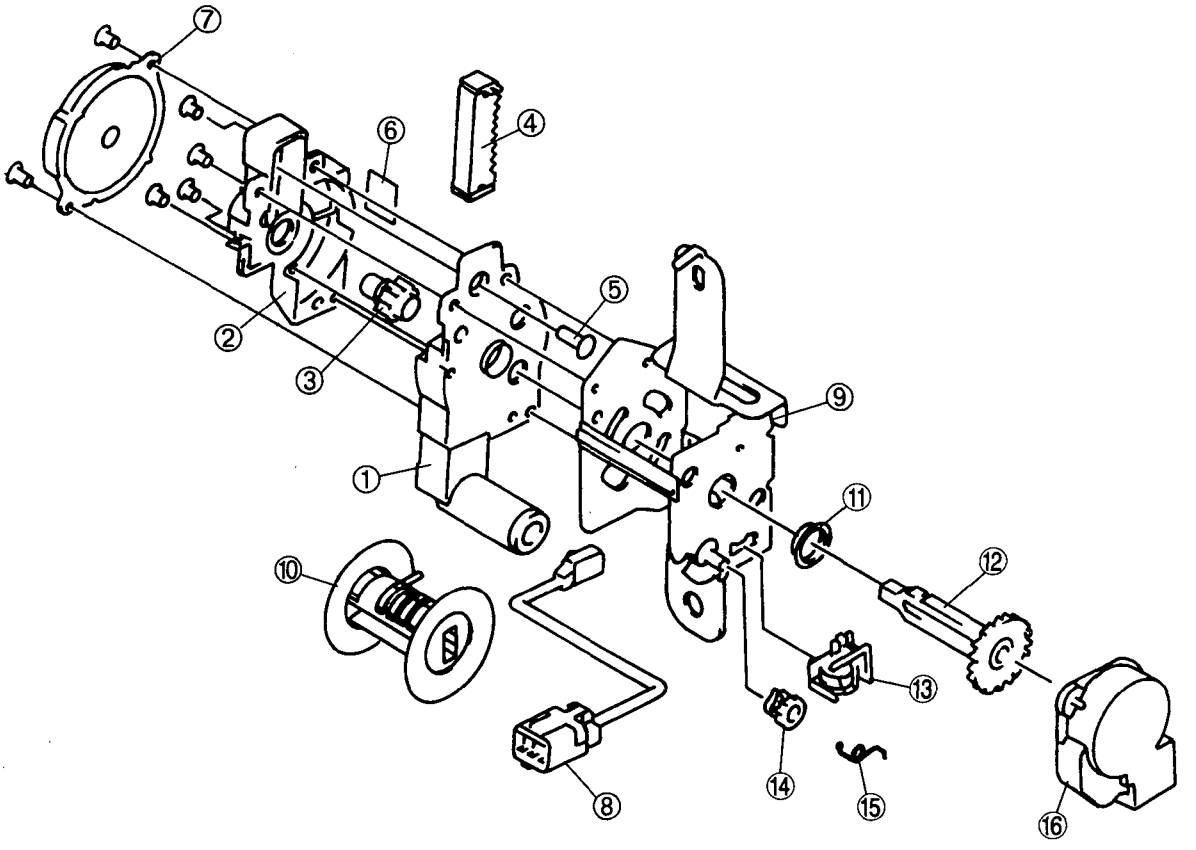
1	ENGINE 15 A fuse
2	A/B 10 A fuse
3	METER 15 A fuse
4	SAS unit
5	Driver-side air bag module
6	Clock spring
7	Passenger-side air bag module

8	With pre-tensioner seat belt
9	Driver-side pre-tensioner seat belt
10	Passenger-side pre-tensioner seat belt
11	Air bag system warning light
12	Poor connection detector bar
13	Short bar inside of part-side connector
14	Short bar inside of vehicle-side connector

PRE-TENSIONER SEAT BELT

- The front seat belts have a pre-tensioner function.
- If the vehicle suffers a frontal crash, the SAS unit sends an electrical signal to the pre-tensioner seat belts. The pre-tensioner seat belts instantly wind up the slack of the webbing to protect the driver and the passenger.

Structural View

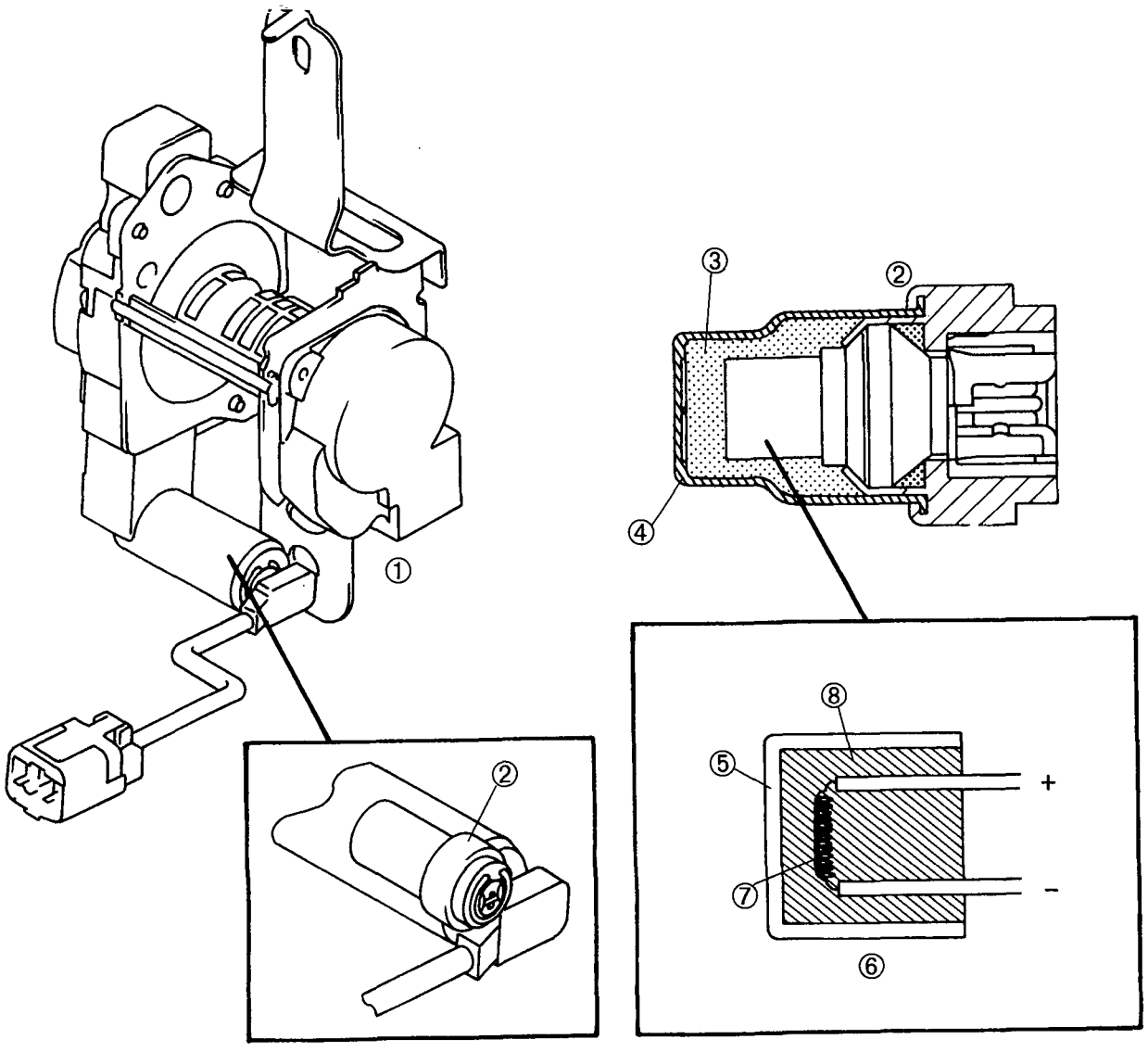


1	Case
2	Cover
3	Gear
4	Piston
5	Stop shaft
6	Seal
7	Spring case
8	Connector

9	Housing
10	Guide drum
11	Bearing
12	Spindle
13	G sensor
14	Pawl
15	Return spring
16	Mechanism case

Ignition Mechanism

- The internal nichrome wire is energized and heated by a signal from the SAS unit. When the temperature of the nichrome wire rises above the firing temperature, the nichrome wire fires and ignites the ignition intensifier.
- Burning of the ignition intensifier breaks the igniter cover and ignites the gas generator. The case then breaks due to gas pressure and generates the gas.



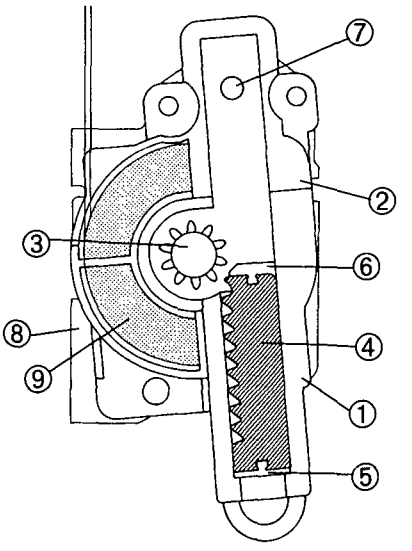
1	Pre-tensioner seat belt
2	Holder
3	Gas generator
4	Case

5	Igniter cover
6	Igniter
7	Nichrome wire
8	Ignition intensifier

Operation

Before activation (Normal condition)

- The piston and the rubber plate are held to the case by the piston stopper.
- The piston and the gear are completely disconnected.
- The gear is connected to the guide drum and the spindle, and they rotate together as a single unit.

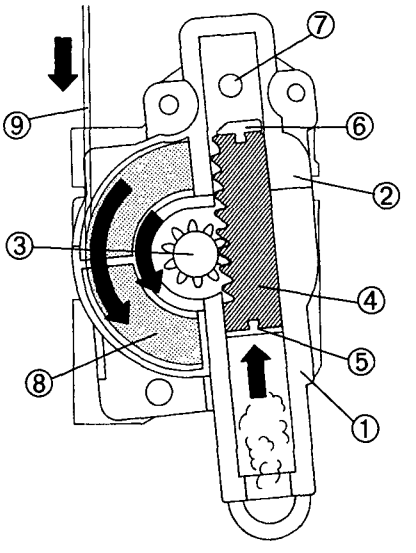


1	Case
2	Cover
3	Gear
4	Piston
5	Rubber plate

6	Piston stopper
7	Stop shaft
8	Housing
9	Guide drum

During activation

1. The generating gas gets into the case, and its pressure forces the piston upward.
2. The piston engages with the gear.
3. The gear converts the straight motion of the piston to a revolving motion.
4. The gear, connected to the guide drum and the spindle, pulls the webbing downward by this revolving motion to retract the seat belt.



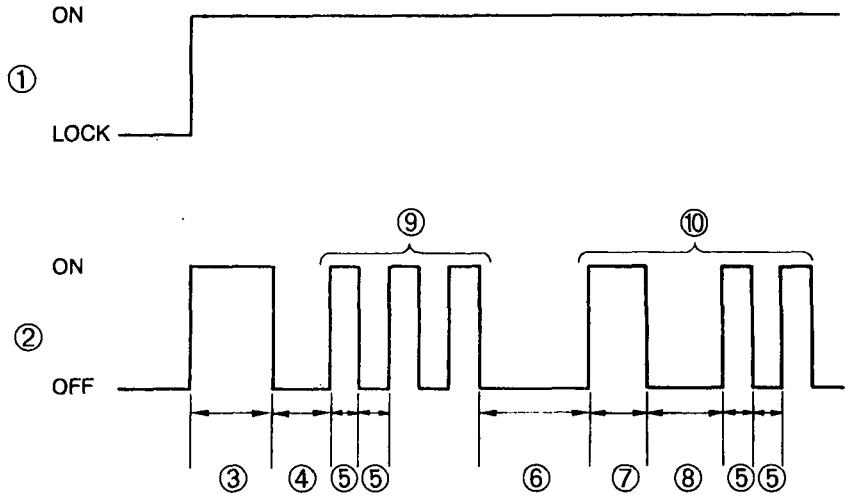
1	Case
2	Cover
3	Gear
4	Piston
5	Rubber plate

6	Piston stopper
7	Stop shaft
8	Guide drum
9	Webbing

SAS UNIT

On-board Diagnostic Function

- The on-board diagnostic function indicates an air bag system malfunction by flashing or illuminating the air bag system warning light.
- Normally, when the ignition switch is turned to ON position, the air bag system warning light illuminates for 4—8 seconds then goes off.
- After the ignition switch is turned to ON position, the air bag system warning light illuminates for 4—8 seconds, goes out for 1.4—2.6 seconds, then illuminates again or flashes a pattern, indicating a diagnostic trouble code.
- When there are multiple malfunctions, the diagnostic trouble code are displayed in numerical order.



1	Ignition switch
2	Air bag system warning light
3	4—8 seconds
4	1.4—2.6 seconds
5	0.28—0.52 seconds

6	2.8—5.2 seconds
7	0.84—1.56 seconds
8	1.12—2.08 seconds
9	Diagnostic trouble code "3"
10	Diagnostic trouble code "12"

Diagnostic trouble code

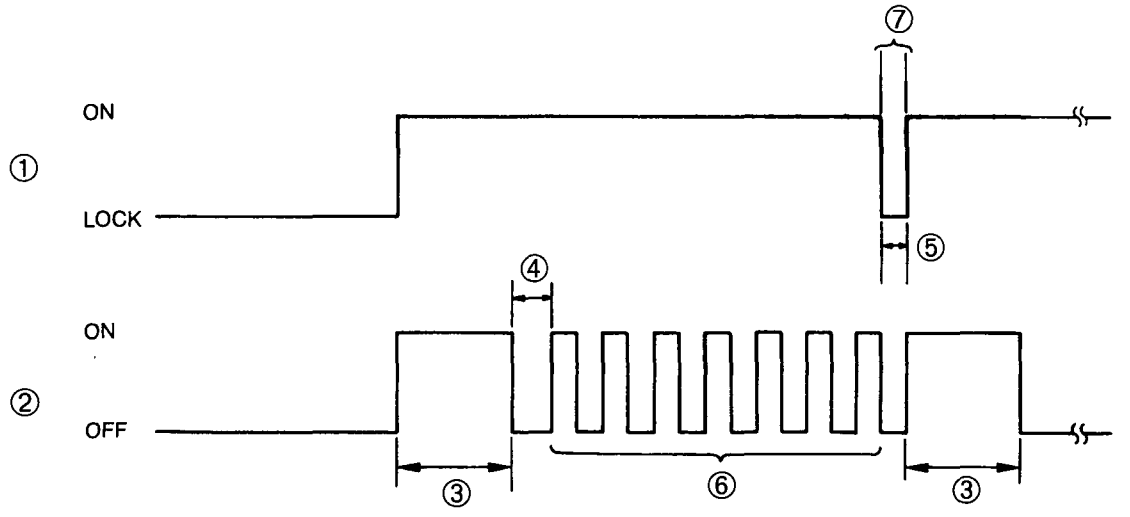
DTC	Output signal	Malfunction location
1		SAS unit connector poor connection
2		SAS unit
3		Battery
6		Driver-side air bag module
7		Passenger-side air bag module
11		Driver-side pre-tensioner seat belt
12		Passenger-side pre-tensioner seat belt
-	Continuously flashes	Deployment authorization standby code

Note

- If the air bag system warning light does not illuminate when the ignition switch is turned to ON position, inspect and repair the air bag system warning light lighting circuit system and then reconfirm the operating state of the air bag system warning.
- When installing a new SAS unit, if the air bag system warning light continuously flashes, perform the deployment authorization.

Deployment Authorization

- In order to make air bag modules and pre-tensioner seat belts operational, the deployment signal must be input to the SAS unit. Although this signal is normally input during assembly at the factory, when the SAS unit is replaced with a new unit, the signal must be input again. Input the signal according to the procedure below.
- With a new SAS unit installed, the air bag system warning light illuminates for 4—8 seconds and goes out for 1.4—2.6 seconds, then flashes the standby code continuously after the ignition switch is turned to ON position. However, if there is a malfunction in the air bag system, the diagnostic trouble code is indicated. The standby code is indicated by continuous flashing after the malfunction area is corrected.
- While the air bag system warning light outputs the standby code(flashes continuously), turn the ignition switch to LOCK position (for 1 second or more) then back to ON position to input the authorization signal. If the signal has been input correctly, the air bag system warning light stays on for 4—8 seconds then goes off. If it does not go off, perform the deployment authorization procedure again.



1	Ignition switch
2	Air bag system warning light
3	4—8 seconds
4	1.4—2.6 seconds

5	1 second or more
6	Standby code (flashes continuously)
7	Authorization signal

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