WARNING

Servicing a vehicle can be dangerous. If you have not received service-related training, the risks of injury and property damage increase. The recommended servicing procedures for the vehicle in this workshop manual were developed with Mazda-trained technicians in mind. This manual may be useful to non-Mazda trained technicians, but a technician with our service-related training and experience will be at less risk when performing servicing operations. However, all users of this manual are expected to know general safety procedures.

This manual contains "Warnings" and "Cautions" applicable to risks not normally encountered in a general technician's experience. They should be followed to reduce the risk of injury and the risk that improper service or repair may damage the vehicle or render it unsafe. It is also important to understand that the "Warnings" and "Cautions" are not exhaustive. It is impossible to warn of all the hazardous consequences that might result from failure to follow the procedures.

The procedures recommended and described in this manual are effective methods of performing service and repair. Some require tools specifically designed for a specific purpose. Nonrecommended procedures and tools should include consideration for safety of the technician and continued safe operation of the vehicle.

Parts should be replaced with genuine Mazda replacement parts, not parts of lesser quality. Use of a nonrecommended replacement part should include consideration for safety of the technician and continued safe operation of the vehicle.

Mazda MX-5 Workshop Manual Supplement

FOREWORD

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.

WARRANTY

The manufacturer's warranty on Mazda vehicles and engines can be voided if improper service or repairs are performed by persons other than those at an Authorized Mazda Dealer.

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

Title		Section
General Information		GI
Pre-Delivery Inspection and Scheduled Maintenance		A
Engine	B6	B1
Cooling System		E
Fuel and Emission Control Systems	B6	F1
	BP	F2
Engine Electrical System		G
Propeller Shaft		L
Front and Rear Axles		M
Braking System		P
Body Electrical System		T
Technical Data		TD
Special Tools		ST

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

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VEHICLE IDENTIFICATION NUMBERS (VIN)

JMZ NA18P20# 200001 —
JMZ NA18C20# 200001 —

RELATED MATERIALS

MX–5 Training Manual	3165–10–89I
MX–5 Workshop Manual	1221–10–89I
MX–5 Workshop Manual Supplement	1246–10–90G
MX–5 Workshop Manual Supplement	1372–10–93I
MX–5 Wiring Diagram (Europe)	5333–10–94L
MX–5 Wiring Diagram (UK)	5334–10–94L

GENERAL INFORMATION

SAFETY INFORMATION ..... **GI– 2**
DYNAMOMETER ..... **GI– 2**
ABBREVIATIONS ..... **GI– 2**
NEW STANDARDS ..... **GI– 3**

SAFETY INFORMATION

DYNAMOMETER

When test-running a vehicle on a dynamometer

- Place a fan, preferably a vehicle-speed proportional type, in front of the vehicle.
- Connect an exhaust gas ventilation unit.
- Cool the exhaust pipes with a fan.
- Keep the area around the vehicle uncluttered.
- Watch the water temperature gauge.

Note

- If the tires are rotated by using a chassis roller with the ignition switch at ON, the ABS control module may memorize the action as a malfunction and the ABS warning light may illuminate. (Refer to the Troubleshooting Notes for the antilock brake system, section P.) If the ignition switch is turned to LOCK and then to ON again, the ABS warning light will not illuminate, because the action will be considered a past malfunction.

ABBREVIATIONS

ABDC	After bottom dead center
ABS	Antilock brake system
ACC	Accessory
ATDC	After top dead center
BAC	Bypass air control
BBDC	Before bottom dead center
BDC	Bottom dead center
BTDC	Before top dead center
CID	Cylinder identification display
CM	Control module
DOHC	Double overhead camshaft
ECM	Engine control module
ELR	Emergency locking retractor
EPC	Electronic pressure control
ESPS	Engine speed sensing power steering
EX	Exhaust
FMEM	Failure mode effects management
HFC	High fan control
HLA	Hydraulic lash adjuster
HU	ABS Hydraulic unit
IC	Integrated circuit
IG	Ignition
IN	Intake
INT	Intermittent
LFC	Low fan control
LH	Left hand
LSD	Limited slip differential
...	Motor
F RTN	Mass airflow return
S	Manual Steering
...	Manual transmission
V	Positive crankcase ventilation
P	Profile ignition pickup
C	Pressure regulator control
...	Power steering
R GND	Power ground
...	Right hand
M	Revolutions per minute
S	Sophisticated air bag sensor
G RTN	Signal return
OUT	Spark output
T	Special service tool
...	Start
...	Switch
C	Top dead center
S	Tail number side lights
WR	Vehicle power

NEW STANDARDS

In accordance with new regulations, SAE (Society of Automotive Engineers) standard names and abbreviations are now used in this manual. The table below lists the names and abbreviations that have been used in Mazda manuals up to now and their SAE equivalents.

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
		ECM	Engine Control Module	
—	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 ECM (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	
—	Igniter	ICM	Ignition Control Module	
—	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	
—	2–3 shift Solenoid Valve	—	Shift Solenoid B	
—	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

PRE-DELIVERY INSPECTION AND SCHEDULED MAINTENANCE

PRE-DELIVERY INSPECTION ..... **A– 2**
PRE-DELIVERY INSPECTION TABLE ..... **A– 2**
SCHEDULED MAINTENANCE ..... **A– 3**
SCHEDULED MAINTENANCE TABLE ..... **A– 3**

PRE-DELIVERY INSPECTION

PRE-DELIVERY INSPECTION TABLE

EXTERIOR

INSPECT and **ADJUST**, if necessary, the following items to specification:
- ☐ Glass, exterior bright metal, and paint for damage
- ☐ Convertible top and detachable hardtop (if equipped) for damage
- ☐ Wheel lug nuts
  89–117 N·m {9—12 kgf·m, 66—86 ft·lbf }
- ☐ Tire pressure
- ☐ All tires for damage and abnormal wear
- ☐ Operation of bonnet release and lock
- ☐ Operation of fuel and trunk lids
- ☐ Door operation and alignment
- ☐ Headlight aiming

INSTALL the following parts:
- ☐ Wheel caps
- ☐ Mast antenna (if equipped)

UNDER BONNET-ENGINE OFF

INSPECT and **ADJUST**, if necessary, the following items to specification:
- ☐ Fuel, coolant and hydraulic lines, fittings, connections, and components for leaks
- ☐ Engine oil level
- ☐ Power steering fluid level (if equipped)
- ☐ Brake fluid level
- ☐ Clutch fluid level
- ☐ Windshield washer reservoir fluid level
- ☐ Radiator coolant level and specific gravity

Protection °C {°F}	Specific gravity at 20°C {68°F}
–16 {3}	1.054
–26 {–15}	1.066
–40 {–40}	1.078

- ☐ Tightness of water hose clamps (including heater hoses)
- ☐ Tightness of battery terminals
- ☐ Drive belt tensions
- ☐ Accelerator cable and linkage for free movement

CLEAN spark plugs

INTERIOR

INSTALL the following parts:
- ☐ Fuse for accessories

CHECK operation of the following items:
- ☐ Seat controls (sliding and reclining)
- ☐ Door locks
- ☐ Seat belts and warning system
- ☐ Air bag system using warning light (if equipped)
- ☐ Ignition switch and steering lock
- ☐ Starter interlock switch (clutch pedal)
- ☐ All lights, including warning and indicator lights
- ☐ Audible warning system
- ☐ Horn, wipers, and washers
- ☐ Cigarette lighter
- ☐ Power outside mirrors (if equipped)
- ☐ Power windows (if equipped)
- ☐ Heater and defroster at all mode selections

CHECK the following items:
- ☐ Presence of spare fuses
- ☐ Upholstery and interior finish

CHECK and **ADJUST**, if necessary, the following items:
- ☐ Operation and fit of windows
- ☐ Pedal height and free play of brake and clutch pedals

	Pedal height mm {in}	Pedal free play mm {in}
Clutch pedal	175—188 {6.89—7.28} (with carpet)	0.6—3.1 {0.02—0.12}
Brake pedal	171—181 {6.73—7.13} (with carpet)	4.0—8.4 {0.16—0.33}

- ☐ Parking brake
  7–9 notches/196 N {20 kgf, 44 lbf }

UNDER BONNET-ENGINE RUNNING AT OPERATING TEMPERATURE

CHECK the following items:
- ☐ Initial ignition timing
  10° ± 1° BTDC*
- ☐ Idle speed
  850 ± 50 rpm*

  *...with data link connector TEN and GND terminals connected

ON HOIST

CHECK the following items:
- ☐ Underside fuel, coolant and hydraulic lines, fittings, connections, and components for leaks
- ☐ Tires for cuts or bruises
- ☐ Steering linkage, suspension, exhaust system, and all underside hardware for looseness or damage
- ☐ Manual transmission oil level
- ☐ Rear axle oil level

ROAD TEST

CHECK the following items:
- ☐ Brake operation
- ☐ Clutch operation
- ☐ Steering control
- ☐ Operation of meters and gauges
- ☐ Squeaks, rattles or unusual noises
- ☐ Overall engine performance
- ☐ Seat belt emergency locking retractors

AFTER ROAD TEST

REMOVE seat and floor mat protective covers

CHECK for necessary owner information materials, tools and spare tire in vehicle

SCHEDULED MAINTENANCE

SCHEDULED MAINTENANCE TABLE

Chart symbols:

I : Inspect and clean, repair, or replace as necessary
A: Adjust
R: Replace
T : Tighten

Remarks:

- To ensure efficient operation of the engine and all systems related to emission control, the ignition and fuel systems must be serviced regularly. It is strongly recommended that all servicing related to these systems be done by an authorized Mazda Dealer.
- After 90,000 km {54,000 miles} or 72 months, continue to follow the described maintenance at the recommended intervals.
- Refer below for a description of items marked* in the maintenance chart.
  - *1 : Also adjust and inspect the power steering and air conditioner drive belts, if equipped.
  - *2 : Replacement of the timing belt is required at every 90,000 km {54,000 miles}. Failure to replace the timing belt may result in damage to the engine.
  - *3 : If the vehicle is operated under any of the following conditions, change the engine oil and oil filter every 10,000 km {6,000 miles} or shorter.
    a) Driving in dusty conditions
    b) Extended periods of idling or low speed operation
    c) Driving for long periods in cold temperatures or driving regularly at short distances (less than 8 km {5 miles}) only
  - *4 : If the vehicle is operated in very dusty or sandy areas, inspect and replace necessary the air cleaner element more often than the recommended intervals.
  - *5 : This is a full function check of electrical system such as lights, wiper and washer systems (including wiper blades), and power windows, sunroof, horn etc.
  - *6 : If the brakes are used extensively (for example, continuous hard driving or mountain driving) or if the vehicle is operated in extremely humid climates, change the brake fluid annually.

SCHEDULED MAINTENANCE

Maintenance interval / Maintenance item	Number of months or kilometers {miles}, whichever comes first						
Months	—	12	24	36	48	60	72
Kilometers	1,000	15,000	30,000	45,000	60,000	75,000	90,000
Miles	600	9,000	18,000	27,000	36,000	45,000	54,000
Drive belts	A						
Engine timing belt*2	Replace every 90,000 km {54,000 miles}						
Engine oil*3		R	R	R	R	R	R
Oil filter*3		R	R	R	R	R	R
Cooling system (including coolant level adjustment)			I		I		I
Engine coolant	Replace every 2 years						
Idle speed			A		A		A
Air cleaner element*4		I	I	R	I	I	R
Fuel filter					R		
Fuel lines and hoses			I		I		I
Initial ignition timing			I		I		I
Spark plugs			A		A		A
Spark plugs (only for sweden)	Adjust every 50,000 km {30,000 miles}						
EGR system			I		I		I
EGR system (only for sweden)	Inspect every 80,000 km {48,000 miles}						
Evaporative system			I		I		I
Evaporative system (only for sweden)	Inspect every 80,000 km {48,000 miles}						
Dash pot			A		A		A
Dash pot (only for sweden)	Adjust every 80,000 km {48,000 miles}						
Battery condition		I	I	I	I	I	I
All electrical system*5			I				
Headlight alignment				A		A	
Brake and clutch pedal			I		I	I	I
Clutch fluid					I	I	I
Brake lines, hoses and connections			I	I	I	I	I
Brake fluid*6			I	R	I	R	I
Parking brake			A	A	A	A	A
Power brake unit and hoses			I	I	I	I	I
Disc brakes			I	I	I	I	I
Power steering fluid			I	I	I	I	I
Power steering system and hoses			I	I	I	I	I
Steering and front suspension			I	I	I	I	I
Manual transmission oil				A		A	R
Rear axle oil				A		A	R
Drive shaft dust boots				I		I	I
Rear suspension ball joints				I		I	I
Bolts and nuts on chassis and body	T	T	T	T	T	T	T
Body condition (for rust, corrosion and perforation)	Inspect annually						
Exhaust system and heat shields	I		I		I		I
Tires (including spare tire) with inflation pressure adjustment		I	I	I	I	I	I
Hinges and catches		A	A	A	A	A	A
Underside of vehicle		I	I	I	I	I	I
Seat belts			I		I		I
Road test		I	I	I	I	I	I

Before beginning any service procedure, refer to section T of this manual for air bag system service warnings.

ENGINE (B6 DOHC)

FEATURES

OUTLINE **B1–2**
OUTLINE OF CONSTRUCTION **B1–2**
SPECIFICATIONS **B1–2**
ENGINE
CAMSHAFT **B1–3**
PISTON **B1–3**

SERVICE

SUPPLEMENTAL SERVICE INFORMATION ... **B1–4**
INSPECTION / REPAIR **B1–4**
CAMSHAFT **B1–4**
PISTON, PISTON RING, AND PISTON PIN **B1–6**

OUTLINE

OUTLINE OF CONSTRUCTION

The following parts have been modified.
The purpose of the modification is to increase the low speed torque by changing the valve timing and compression ratio.

- Camshaft
- Piston
- Piston pin
- Piston ring (oil ring)

The following table shows the modified specifications.

SPECIFICATIONS

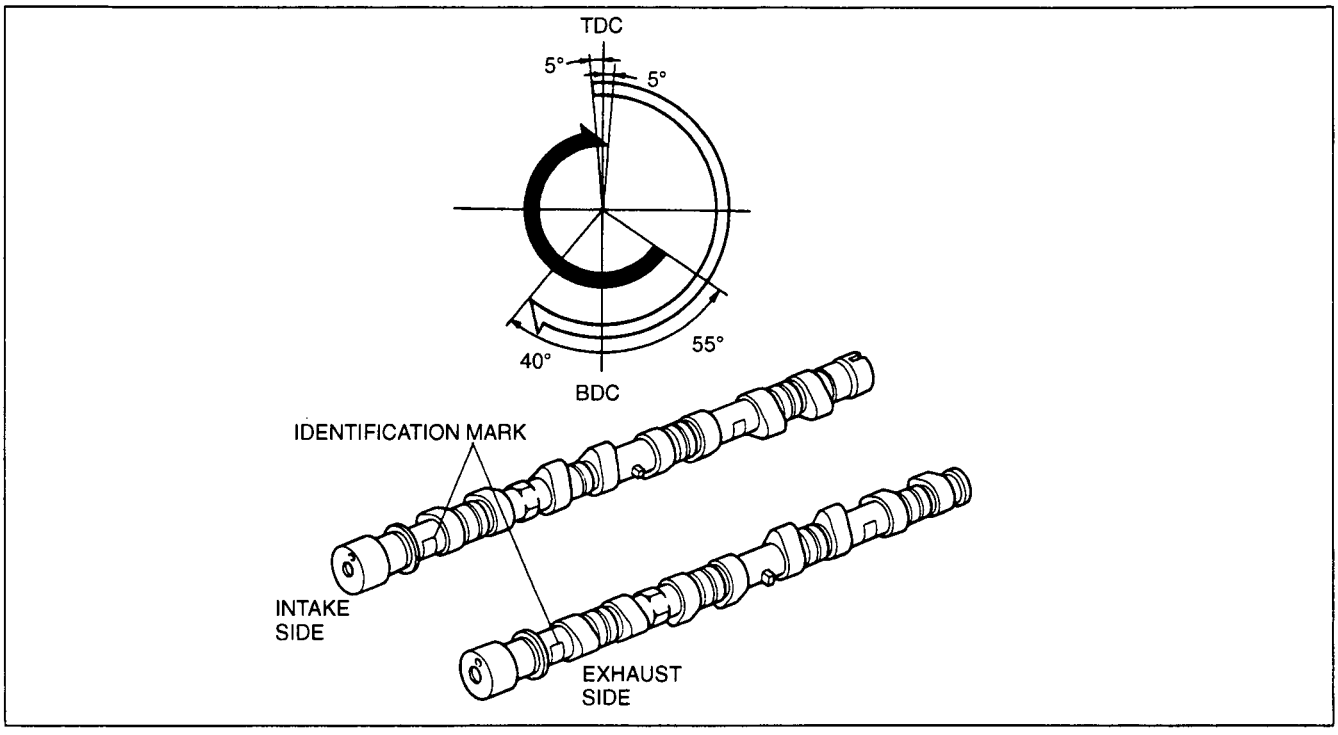
Item \ Engine				B6 DOHC
Type				Gasoline, 4-cycle
Cylinder arrangement and number				In-line, 4-cylinders
Combustion chamber				Pentroof
Valve system				DOHC, belt-driven
Displacement			ml { cc , cu in }	1,597 {1,597, 97.42}
Bore × stroke			mm { in }	78.0 × 83.6 {3.07 × 3.29}
Compression ratio				9.0
Compression pressure			kPa { kgf/cm^2 , psi }-rpm	1,324 {13.5, 192} – 300
Valve timing	IN	Open	(BTDC°)	5
		Close	(ABDC°)	40
	EX	Open	(BBDC°)	55
		Close	(ATDC°)	5
Valve clearance		IN	mm { in }	0 {0} : Maintenance-free
		EX	mm { in }	0 {0} : Maintenance-free

- ▨ Indicates new specifications

ENGINE

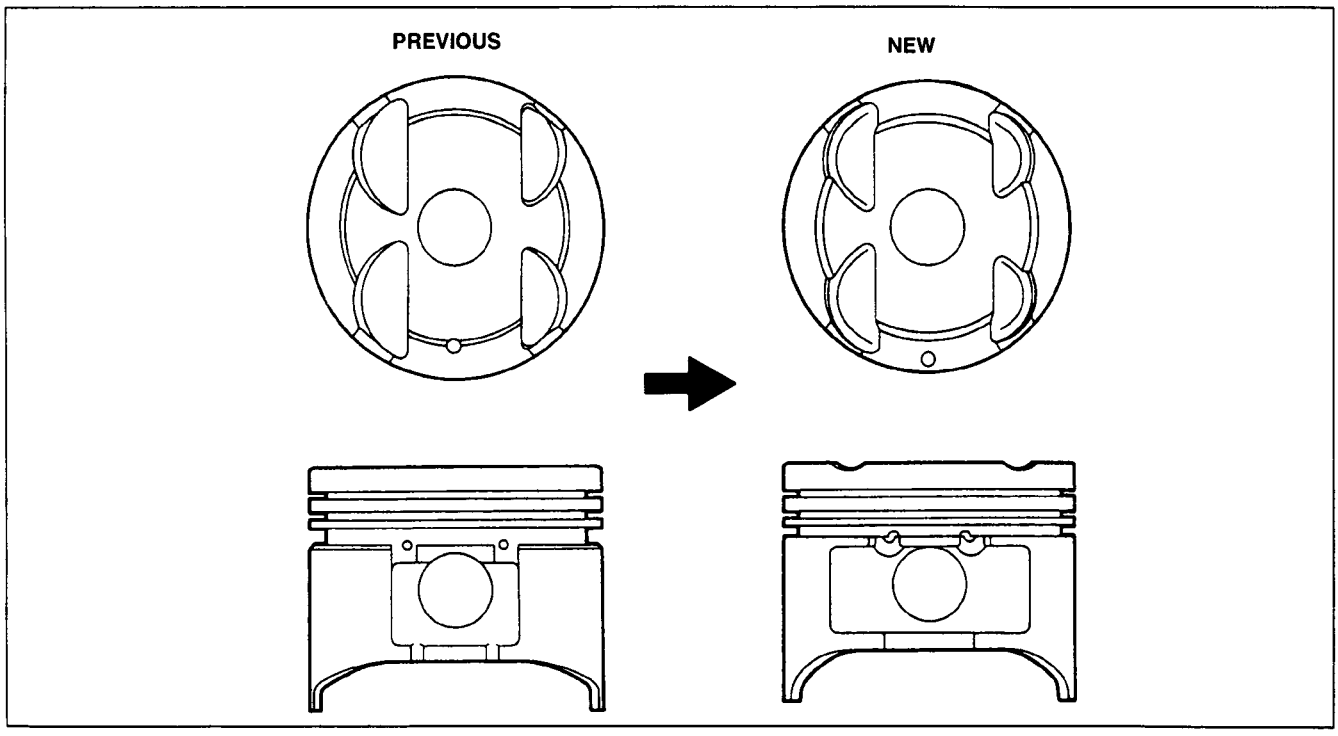
CAMSHAFT

- The configuration of the camshafts have been modified.



PISTON

- The configuration of the pistons have been modified for the new piston ring application.
- The configuration of the piston pins have been modified.

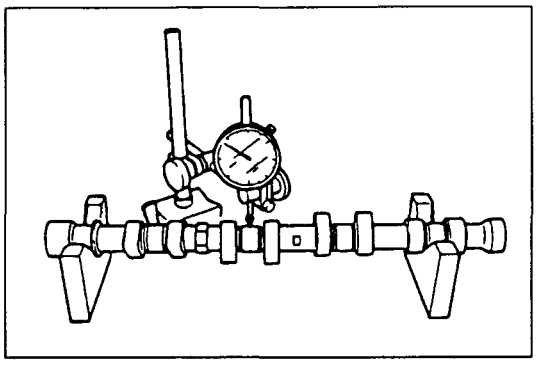


SUPPLEMENTAL SERVICE INFORMATION

The following changes and/or additions have been made since publication of the Mazda MX–5 Workshop Manual (1221–10–89I).

Camshaft
- Inspection / Repair procedure modified

Piston, Piston ring, and Piston pin
- Inspection / Repair procedure modified

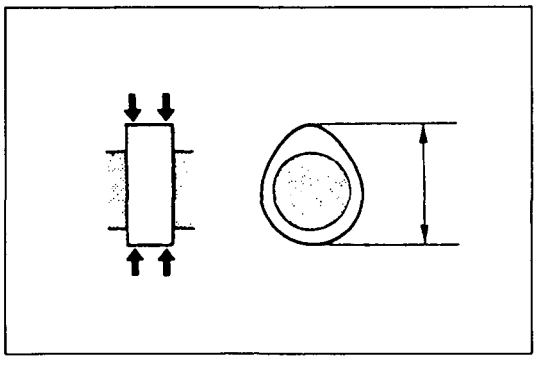


INSPECTION / REPAIR

CAMSHAFT

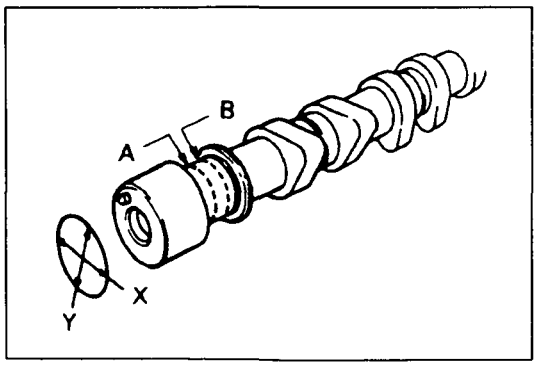
1. Set the No.1 and No.5 journals on V-blocks.
2. Measure the camshaft runout. Replace the camshaft if necessary.

Runout: 0.03 mm {0.0012 in } max.



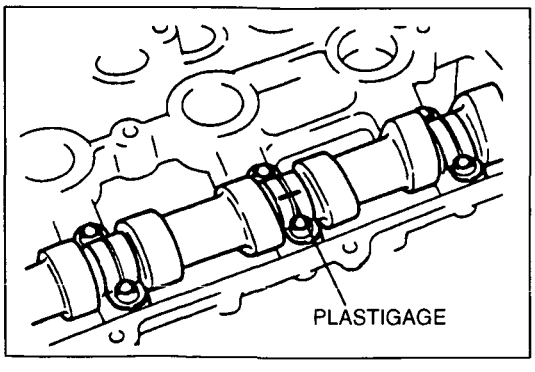
3. Inspect the camshaft for wear or damage. Replace the camshaft if necessary.
4. Measure the cam lobe heights at the two points as shown.

Height
Standard
IN : 39.984 mm {1.5742 in }
EX: 40.888 mm {1.6098 in }
Minimum
IN : 39.784 mm {1.5663 in }
EX: 40.688 mm {1.6019 in }

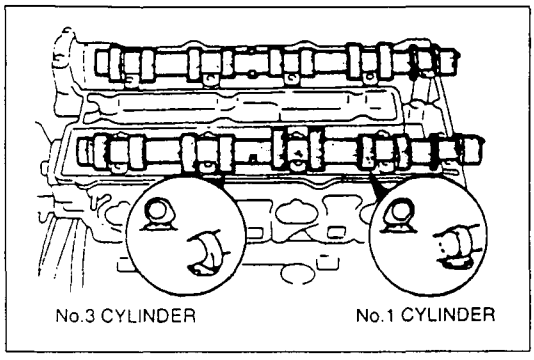


5. Measure the journal diameters in X and Y directions at the two points (A and B) shown. Replace the camshaft if necessary.

Diameter
Standard:
25.940—25.965 mm {1.0213—1.0222 in }
Minimum: 25.910 mm {1.0201 in }



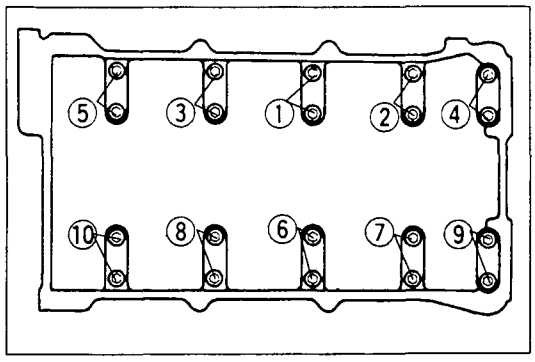
6. With the HLA removed, measure the camshaft journal oil clearances as follows.
   (1) Position Plastigage atop the journals in the axial direction.
   (2) Do not rotate the camshaft when measuring the oil clearances.



(3) Install the camshaft caps according to the cap number and arrow mark.

Caution

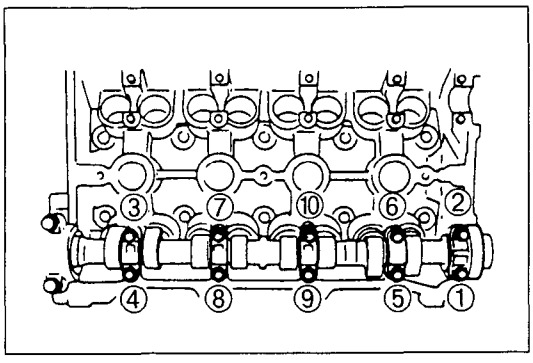
- **Because there is little camshaft thrust clearance, the camshaft must be held horizontally while it is installed. Otherwise, excessive force will be applied to the thrust area, causing burr on the thrust receiving area of the cylinder head journal. To avoid this, the following procedure must be observed.**



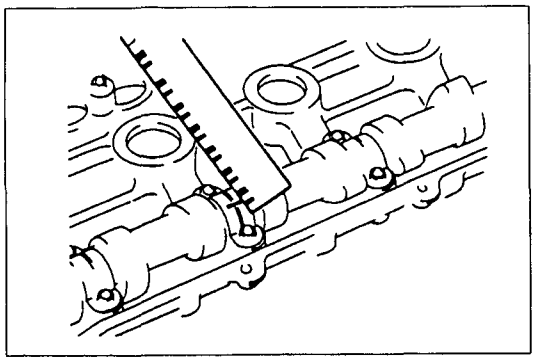
(4) Assemble the camshaft onto the cylinder head, facing the cam noses at No.1 and No.3 cylinders as shown.
(5) Tighten the camshaft cap bolts in two or three steps in the order shown.

Tightening torque:
11.3—14.2 N·m
{115—145 kgf·cm , 100—125 in·lbf }

(6) Verify that the camshaft settles horizontally when two bearing cap bolts at No.3 journal are tightened.



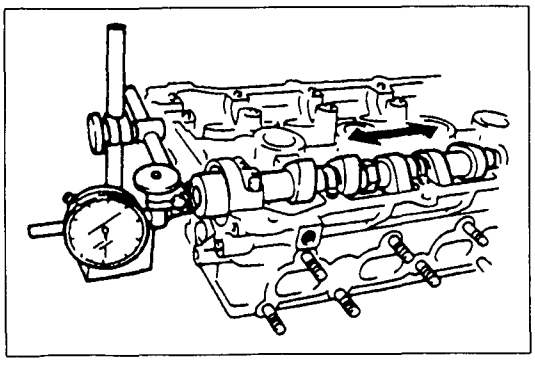
(7) Loosen the camshaft cap bolts in two or three steps in the order shown.
(8) Remove the camshaft caps.



(9) Measure the oil clearance.

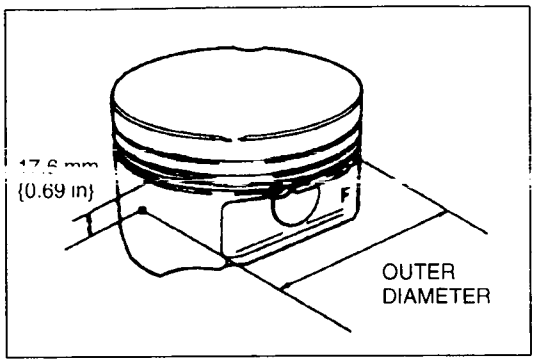
Oil clearance
Standard:
0.035—0.081 mm {0.0014—0.0031 in }
Maximum: 0.15 mm {0.0059 in }

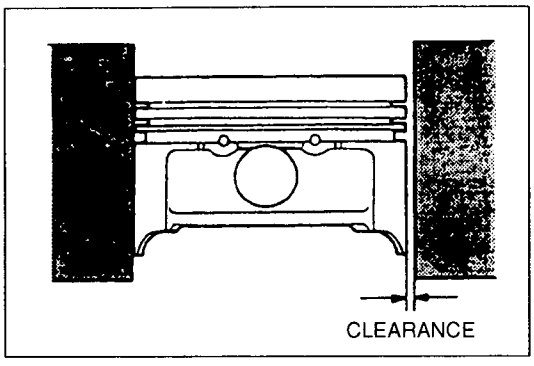
(10) If the oil clearance exceeds the maximum, replace the camshaft or the cylinder head.



7. Install the front camshaft cap.
8. Measure the camshaft end play. If it exceeds the maximum, replace the cylinder head or camshaft.

End play
Standard:
0.057—0.127 mm {0.0023—0.0049 in }
Maximum: 0.20 mm {0.0079 in }





PISTON, PISTON RING, AND PISTON PIN

Piston

1. Inspect the outer circumferences of all pistons for seizure or scoring. Replace the piston if necessary.
2. Measure the outer diameter of each piston at a right angle (90°) to the piston pin **17.6 mm {0.69 in}** below the oil ring land lower edge.

Piston diameter

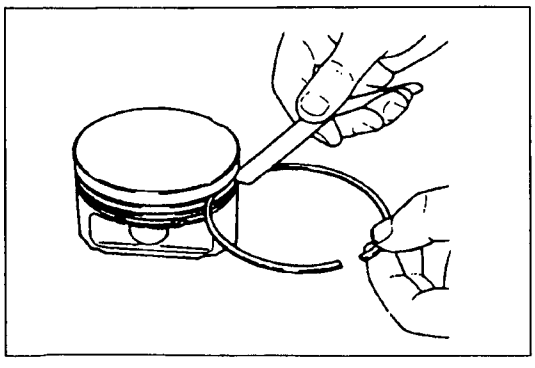
mm { in }

Piston size	Diameter
Standard	77.954—77.974 {3.0691—3.0698}
0.25 {0.01} oversize	78.204—78.224 {3.0789—3.0796}
0.50 {0.02} oversize	78.454—78.474 {3.0888—3.0895}

3. Calculate the piston-to-cylinder clearance. Subtract the piston diameter from the cylinder bore of the corresponding cylinder.

   Clearance: 0.024—0.037 mm {0.0010—0.0014 in }
   Maximum: 0.15 mm {0.006 in }

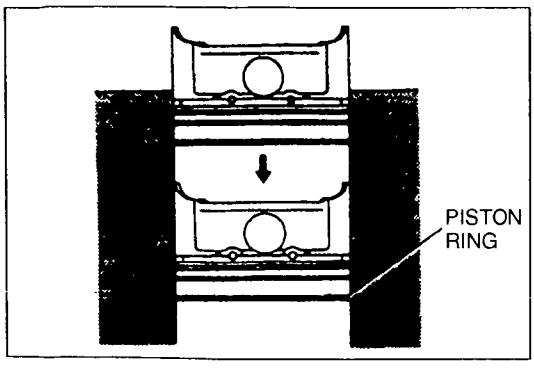
4. If the clearance exceeds the maximum, replace the piston or rebore the cylinders to fit oversize pistons.
5. If the piston is replaced, the piston rings must also be replaced.



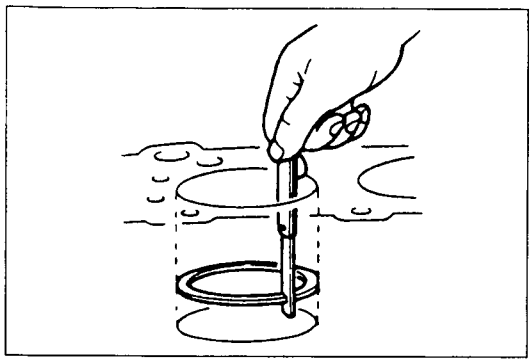
Piston and Piston Rings

1. Measure the piston ring-to-ring land clearance around the entire circumference using a new piston ring.

   Clearance
   Top: 0.030—0.065 mm {0.0012—0.0026 in }
   Second: 0.030—0.070 mm {0.0012—0.0027 in }
   Oil: 0.06—0.15 mm {0.003—0.005 in }
   Maximum: 0.15 mm {0.006 in }

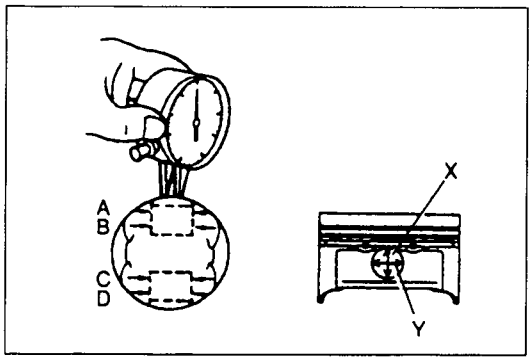


2. If the clearance exceeds the maximum, replace the piston and piston ring.
3. Inspect the piston rings for damage, abnormal wear, or breakage. Replace the piston rings if necessary.
4. Insert the piston ring into the cylinder by hand and use the piston to push it to the bottom of the ring travel.



5. Measure each piston ring end gap with a feeler gauge. Replace the piston ring if necessary.

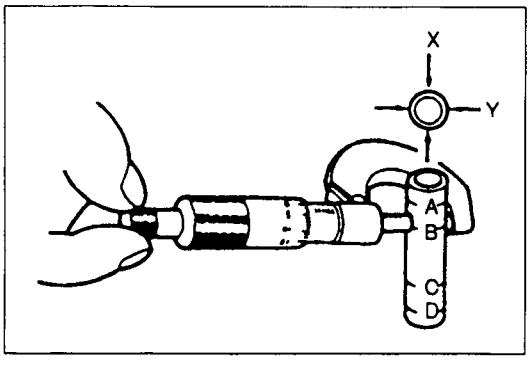
End gap
Top: 0.15—0.30 mm {0.006—0.011 in }
Second: 0.30—0.45 mm {0.012—0.017 in }
Oil rail: 0.20—0.70 mm {0.008—0.027 in }
Maximum: 1.0 mm {0.039 in }



Piston and Piston Pin

1. Measure each piston pin hole diameter in X and Y direction at the four points (A, B, C, and D) as shown.

Diameter: 19.988—20.000 mm {0.7870—0.7874 in }



2. Measure each piston pin diameter in X and Y directions at the four points (A, B, C, and D) as shown.

Diameter: 19.987—19.993 mm {0.7869—0.7871 in }

3. Calculate the piston pin-to-piston pin bore clearance.

Clearance: –0.005—0.013 mm {–0.0001—0.0005 in }

4. If the clearace exceeds the specification, replace the piston and/or piston pin.

Before beginning any service procedure, refer to section T of this manual for air bag system service warnings.

COOLING SYSTEM

FEATURES

OUTLINE ..... **E– 2**
OUTLINE OF CONSTRUCTION ..... **E– 2**
SPECIFICATIONS ..... **E– 2**

SERVICE

SUPPLEMENTAL SERVICE INFORMATION . **E– 3**
THERMOSTAT ..... **E– 3**
INSPECTION ..... **E– 3**

OUTLINE

OUTLINE OF CONSTRUCTION

- The thermostat specifications for the B6 DOHC engine has been changed.

SPECIFICATIONS

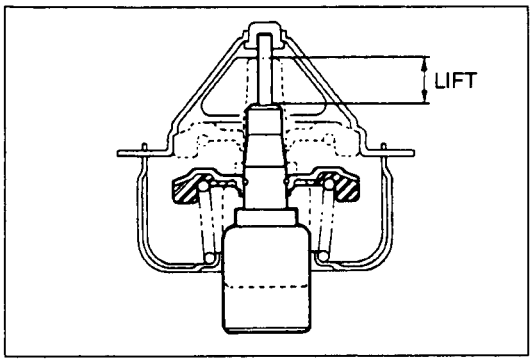
Item \ Engine			B6 DOHC
Cooling system			Water-Cooled, forced circulation
Coolant capacity		L { US qt , Imp qt }	6.0 {6.3, 5.3}
Water pump	Type		Centrifugal, V belt-driven
	Water seal		Unified mechanical seal
Thermostat	Type		Wax
	Opening temperature	°C { °F }	86.5–89.5 {188–193}
	Full-open temperature	°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 }	73.6–102 {0.75–1.05, 10.7–14.9}
Cooling fan	Type		Electric
	Blade	Outer diameter mm { in }	320 {12.6}
		Number	5
	Motor	Capacity W-V	70–12
		Current A	5.9 + 10% max.

- ▒ Indicates new specifications

SUPPLEMENTAL SERVICE INFORMATION

The following changes and/or additions have been made since publication of the Mazda MX-5 Workshop Manual (1221–10–89I).

Thermostat
- Inspection procedure modified



THERMOSTAT

INSPECTION

1. Visually check that the thermostat valve is airtight.
2. Place the thermostat and a thermometer in water.
3. Heat the water and check the following:

Initial-opening temperature:
86.5—89.5 °C {188—193 °F }
Full-open temperature: 100 °C {212 °F }
Full-open lift: 8.5 mm {0.33 in } min.

Before beginning any service procedure, refer to section T of this manual for air bag system service warnings.

FUEL AND EMISSION CONTROL SYSTEMS (B6)

FEATURES

OUTLINE F1– 2
OUTLINE OF CONSTRUCTION F1– 2
FEATURES F1– 2
SYSTEM WIRING DIAGRAM F1– 3
SPECIFICATIONS F1– 4
RELATIONSHIP CHART F1– 5
FUEL INJECTION CONTROL SYSTEM F1– 6
OUTLINE F1– 6
FUEL INJECTION TIMING F1– 6
ON–BOARD DIAGNOSTIC SYSTEM F1– 7
DIAGNOSTIC TROUBLE CODE F1– 7

SERVICE

SUPPLEMENTAL SERVICE INFORMATION F1– 8
ON–BOARD DIAGNOSTIC SYSTEM F1– 9
PREPARATION F1– 9
DIAGNOSTIC TROUBLE CODE F1– 9
FUEL SYSTEM F1–12
FUEL PUMP F1–12
EXHAUST SYSTEM F1–14
COMPONENTS F1–14
EVAPORATIVE EMISSION CONTROL SYSTEM F1–15
CHECK VALVE F1–15
CONTROL SYSTEM F1–16
PREPARATION F1–16
ENGINE CONTROL MODULE (ECM) F1–17
HEATED OXYGEN SENSOR F1–24

OUTLINE

OUTLINE OF CONSTRUCTION

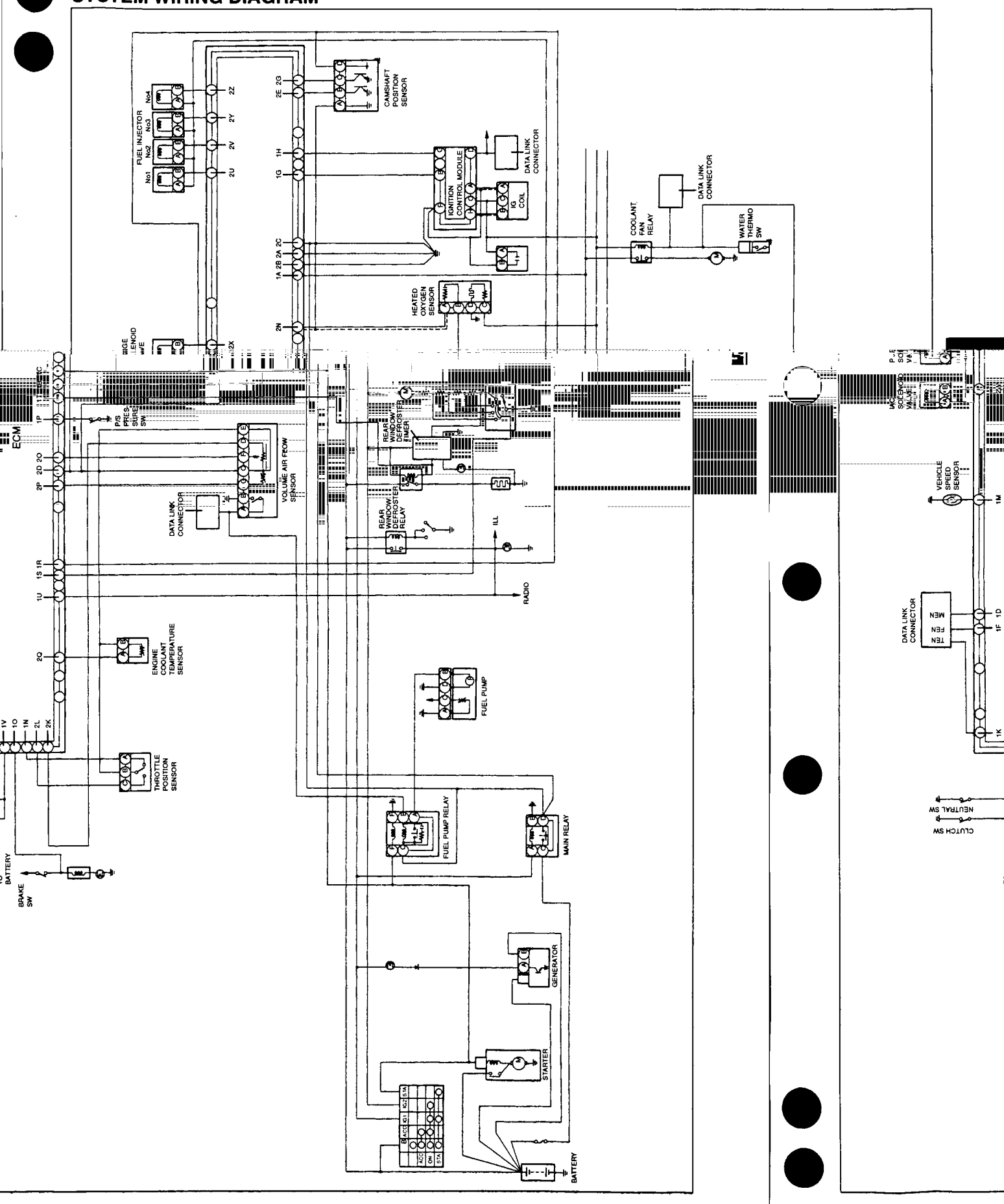
According to the readoption of the B6 engine model, the following changes have been made.

- Injection method has been changed from the two–group injection to the sequential injection.
- IAC load correction has been added according to the addition of the rear window defroster signal input to the ECM.
- IGF signal input to the ECM has been discontinued.
- Signal names have been changed as follows.
  Ne→SGT G→SGC
- Diagnostic trouble codes No. 01 have been discontinued.
- Vehicle speed sensor input have been added.
- In the exhaust system, the front pipe and the parts after it are the same as that of the BP engine model.
- The heated oxygen sensor has been adopted and its installation position has been changed.
- The fuel tank capacity has been enlarged and the cruising range has been increased accordingly.
- The check valve have been changed.

FEATURES

Excellent drivability and improved engine performance ——— Sequential multiport fuel injection

SYSTEM WIRING DIAGRAM



SPECIFICATIONS

Item		Specification
Idle speed	rpm	800—900 (850 ± 50)*
Ignition timing	BTDC	9°—11° (10 ± 1°)*
Throttle body		
Type		Horizontal draft
Throat diameter	mm { in }	55 {2.2}
Fuel pump		
Type		Impeller (in-tank)
Output pressure	kPa { kgf/cm², psi }	441—589 {4.5—6.0, 64—85}
Fuel filter		
Type	Low-pressure side	Nylon element
	High-pressure side	Paper element
Pressure regulator		
Type	kPa { kgf/cm², psi }	Diaphragm
Regulating pressure		265—314 {2.7—3.2, 38—
Fuel injector		
Type		High-ohmic
Type of drive		Voltage
Resistance	Ω	12—16 [at 20°C {68°F}
IAC valve (solenoid valve [Idle air control])		
Solenoid resistance	Ω	11—13 [at 20°C {68°F}
Purge solenoid valve		
Solenoid resistance	Ω	23—27 [at 20°C {68°F}
Camshaft position sensor		
Type		Photo diode
Volume air flow sensor		
Resistance Ω	E_2 ↔ Vs	Fully closed: 200 — 600
		Fully open: 20 — 1,200
	E_2 ↔ Vc	200 — 400
	E_2↔THAA (Intake air temperature sensor)	–20°C {–4°F}: 13,600 — 18,400
		20°C {68°F}: 2,210 — 2,690
		60°C {140°F}: 493 — 667
	E_1 ↔ Fc	Fully closed: ∞
		Fully open: 0
Engine coolant temperature sensor		
Resistance kΩ		–20°C {–4°F}: 14.6—17.8
		20°C {68°F}: 2.2—2.7
		80°C {176°F}: 0.29—0.35
Fuel pump relay		
Resistance Ω		STA—E_1: 21—43
		B—Fc: 109—226
		B—Fp: ∞
Fuel tank		
Capacity	L { US gal, Imp gal }	48 {12.6, 10.6}
Air cleaner		
Element type		Oil permeated
Accelerator cable		
Free play	mm { in }	1—3 {0.039—0.118}

Indicates new specification

*...TEN terminal grounded

RELATIONSHIP CHART

INPUT DEVICES \ OUTPUT DEVICES		FUEL INJECTOR	IAC VALVE	PURGE SOLENOID VALVE	IGNITION CONTROL MODULE
TEST TERMINAL			○		○
IGNITION SWITCH (START POSITION)		○	○	○	○
P/S PRESSURE SWITCH			○		
WATER THERMOSWITCH (FOR FAN CONTROL)			○		
FAN SWITCH			○		
REAR WINDOW DEFROSTER SWITCH			○		
HEADLIGHT SWITCH			○		
BRAKE SWITCH		○			
NEUTRAL AND CLUTCH SWITCHES		○	○	○	○
THROTTLE POSITION SENSOR	CLOSED THROTTLE POSITION TERMINAL	○	○	○	○
	POWER TERMINAL	○			
VEHICLE SPEED SENSOR		○			
HEATED OXYGEN SENSOR		○		○	
ENGINE COOLANT TEMPERATURE SENSOR		○	○	○	○
VOLUME AIR FLOW SENSOR	POTENTIOMETER	○	○	○	○
	INTAKE AIR TEMPERATURE SENSOR	○	○	○	○
CAMSHAFT POSITION SENSOR	SGT SIGNAL	○	○	○	○
	SGC SIGNAL	○			○

FUEL INJECTION CONTROL SYSTEM

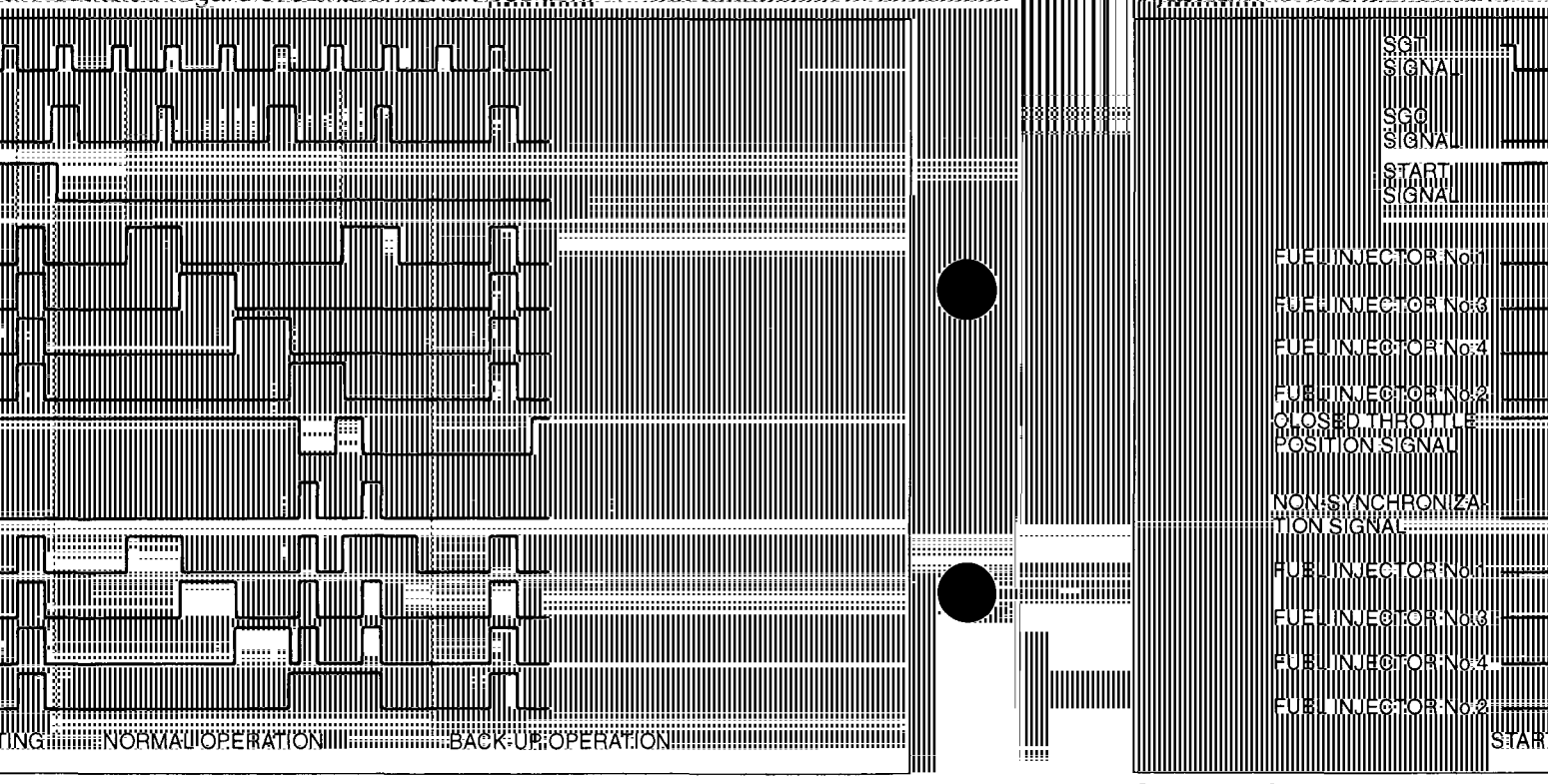
OUTLINE

According to the readoption of the B6 engine model, the injection method has been changed from the two-group injection to the sequential injection for improved engine performance.

FUEL INJECTION TIMING

Outline of control

There are two types of fuel injection timing, "synchronized timing" and "non-synchronized timing". In the synchronized timing, fuel is injected at the preset crankshaft position. In the non-synchronized timing, fuel is injected when certain conditions are satisfied regardless of crankshaft position.



onized control:

s cannot be identified until SGC signals are received, and because intake simultaneously injected to all cylinders in synchronization with the SGT

s independently injected to each cylinder at the optimum timing for each

nchronized injection control;

tion

n switch is turned to OFF, fuel is injected to all cylinders simultaneously for ne engine coolant temperature.

synchronized injection

all cylinders is carried out for a certain period according to the volume air d the engine coolant temperature.

ed injection and non-synchronized injection when both synchronized and required at the same time, injection time will be addition of these two val-

Synchronized injection

- There are two types of synchr

1. Simultaneous injection

During start, because cylinders air amount is unstable, fuel is signal build-up.

2. Sequential injection

During normal operation, fuel i cylinder.

Non-synchronized injection

- There are two types of non-sy

1. Idle non-synchronized injec

When the closed throttle positic a certain period according to t

2. Volume air flow sensor non-

Simultaneous fuel injection to flow sensor output voltage and

Relationship between synchroniz non-synchronized injections are ues.

ON–BOARD DIAGNOSTIC SYSTEM

DIAGNOSTIC TROUBLE CODE

- The diagnostic trouble codes have been changed / discontinued as follows.

Signal name changed

1. Code No. 02 NE signal → Code No. 02 SGT signal
2. Code No. 03 G signal → Code No. 03 SGC signal

Eliminated

3. Code No. 01 IGF signal

SUPPLEMENTAL SERVICE INFORMATION

The following changes and / or additions have been made since publication of the Mazda MX–5 Workshop Manual (1221–10–89I).

On-board diagnostic system
- Inspection procedure modified

Fuel pump
- Replacement procedure modified

Exhaust system
- Removal / Installation procedure modified

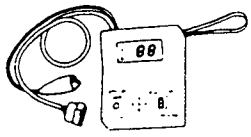
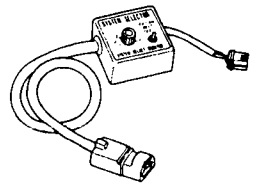
Check valve
- Inspection procedure modified

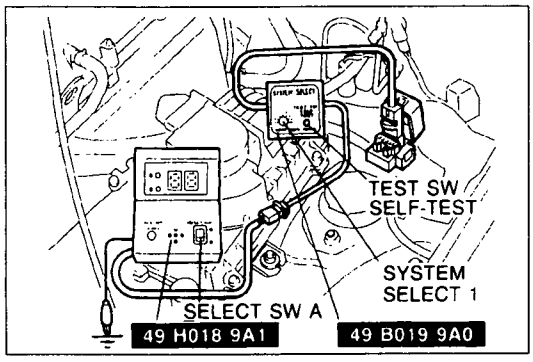
Engine control module
- Inspection procedure modified

Heated oxygen sensor
- Inspection procedure modified
- Replacement procedure modified

ON–BOARD DIAGNOSTIC SYSTEM

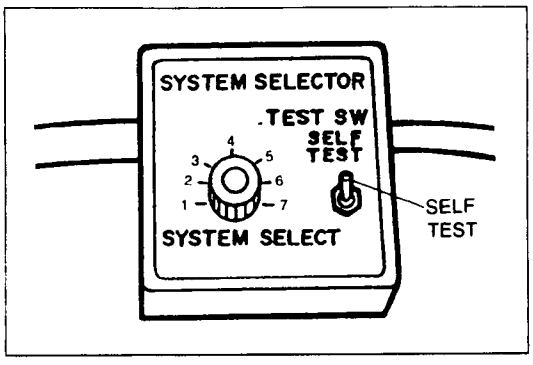
PREPARATION
SST

49 H018 9A1 Self-diagnosis checker		For diagnosis	49 B019 9A0 System selector		For diagnosis

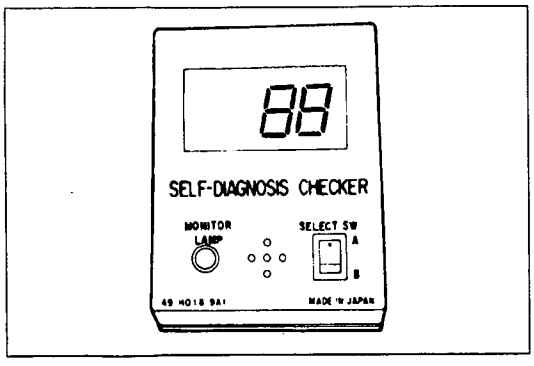


DIAGNOSTIC TROUBLE CODE
Inspection

1. Connect the **SSTs** to the data link connector and a ground.
2. Set the select switch to position A.



3. Set the **SST** (System selector) to position 1 and SELF TEST as shown.



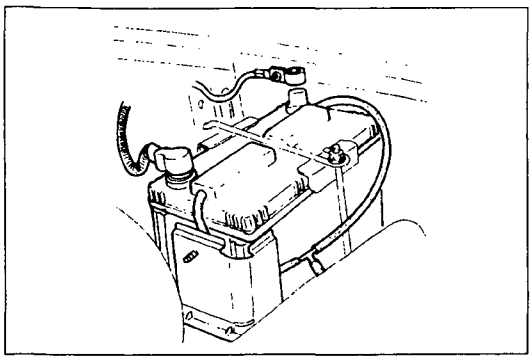
4. Turn the ignition switch ON.
5. Verify that **88** flashes on the digital display and that the buzzer sounds for **3 sec.** after turning the ignition switch ON.
6. If **88** does not flash, check the main relay, power supply circuit, and connector wiring.
7. If **88** flashes and the buzzer sounds continuously for more than **20 sec.**, check for a short circuit between the engine control module terminal 1F and the data link connector. Replace the engine control module if necessary and perform steps 3 and 4 again.
8. Note any code numbers and check for the causes by referring to the check sequences.
9. After repairs, cancel the code numbers by performing the "After-repair Procedures". (Refer to page F1–11)

Service Code Number

Code No.	Pattern of output signal	Sensor or sub system	Self-diagnosis	Fail-safe
02		SGT signal	No SGT signal	Cancels fuel injection and ignition
03		SGC signal	No SGC signal	Cancels fuel injection
08		Volume air flow sensor	Open or short circuit	Basic fuel injection amount fixed as for two driving modes (1) Idle switch: ON (2) Idle switch: OFF
09		Engine coolant temperature sensor	Open or short circuit	Maintains constant 40°C (104°F) command for CIS 80°C (176°F) command for IAC
10		Intake air temperature sensor (Volume air flow sensor)	Open or short circuit	Maintains constant 20°C (68°F) command
14		Barometric pressure sensor (Engine control module)	Open or short circuit	Maintains constant command of sea level pressure
15		Heated oxygen sensor	Sensor output continues less than 0.55V for 120 sec. after engine speed exceeds 1,500 rpm	Cancels engine closed loop operation
17		Closed loop system	Sensor output remains unchanged for max 80 sec. after engine speed exceeds 1,500 rpm	Cancels engine closed loop operation
26		Purge solenoid valve	Open or short circuit	–
34		IAC valve	Open or short circuit	–

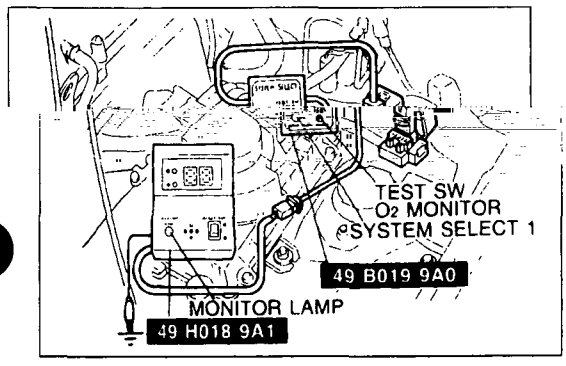
Note

- If more than one failure is present, the code number will be indicated in numerical order. After repairs, cancel the code numbers by performing the "After-repair Procedures". (Refer to page F1–11)



After-repair Procedure

1. Cancel the memory of malfunctions by disconnecting the negative battery cable and depressing the brake pedal for **at least 5 sec.** Reconnect the negative battery cable.



2. Connect the **SSTs** to the data link connector as shown.
3. Turn the ignition switch ON, but do not start the engine for **6 sec.**
4. Start and warm up the engine, then run it at 2,000 rpm for **180 sec.**
5. Verify that no service code numbers are displayed.

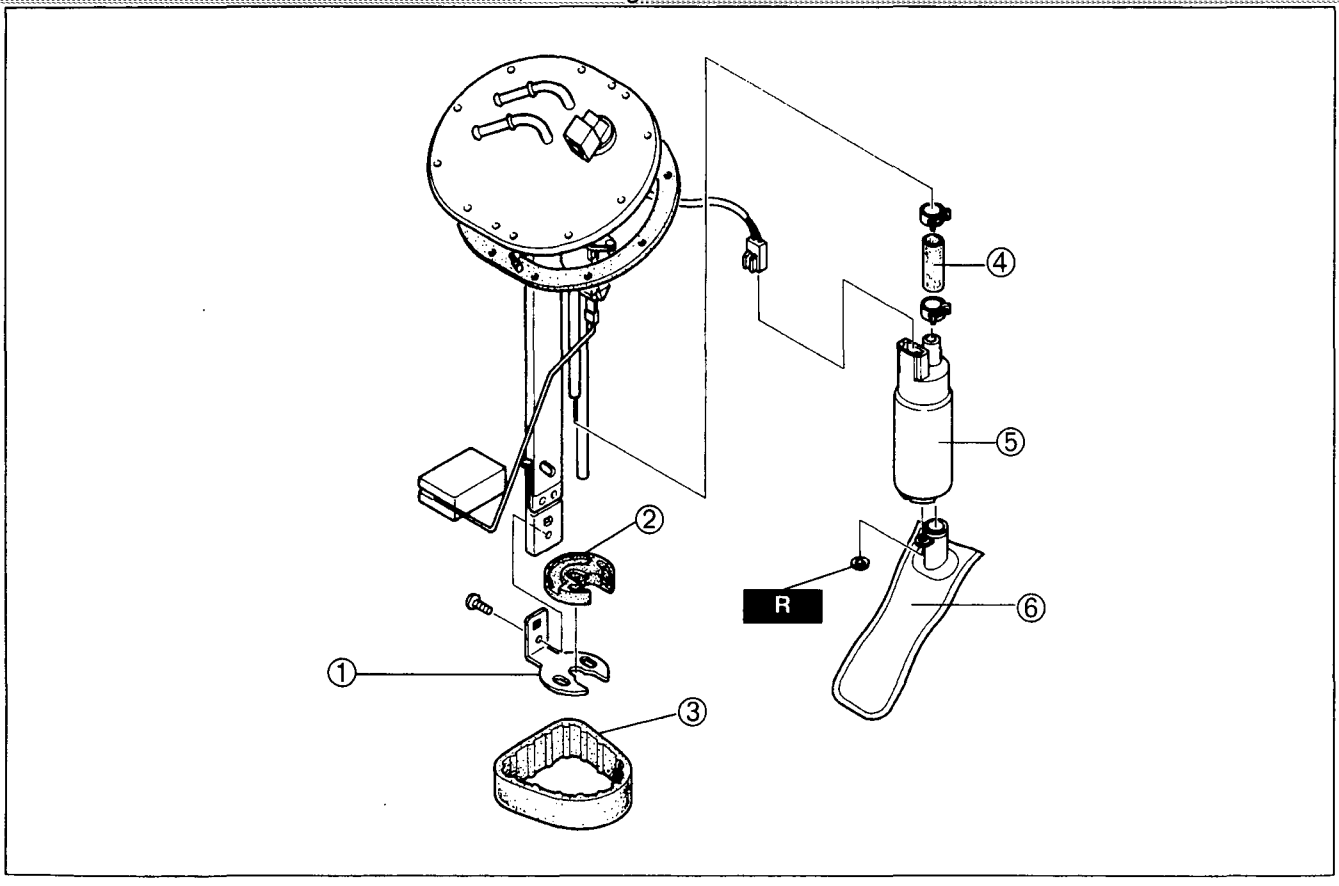
FUEL SYSTEM

FUEL PUMP
Replacement

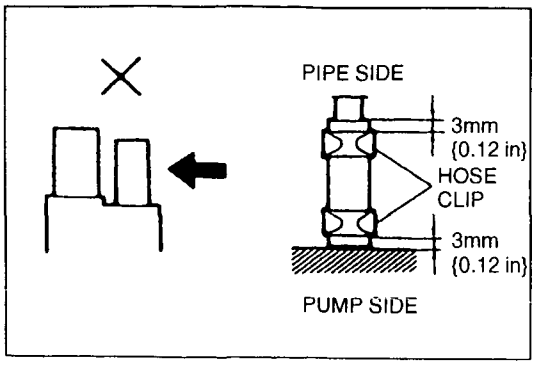
Warning

- **Fuel vapor is hazardous. It can very easily ignite, causing serious injury and damage. Always keep sparks and flames away from fuel.**

1. Disconnect the negative battery cable.
2. Remove in the order shown in the figure.
3. Install in the reverse order of removal referring to **Installation note**.

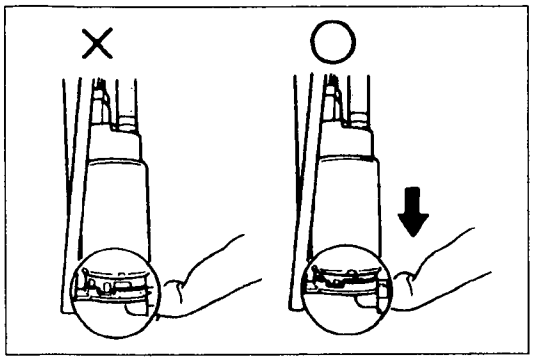


1. Bracket
2. Rubber mount
3. Band
4. Fuel hose
   Installation note ..... bellow
5. Fuel pump
   Installation note ..... page F1–13
6. Fuel filter (low pressure side)



Installation note
Fuel hose

1. Do not apply excessive side force when pushing the fuel hose onto the fuel pump nipple.
2. Install the clamps as shown.

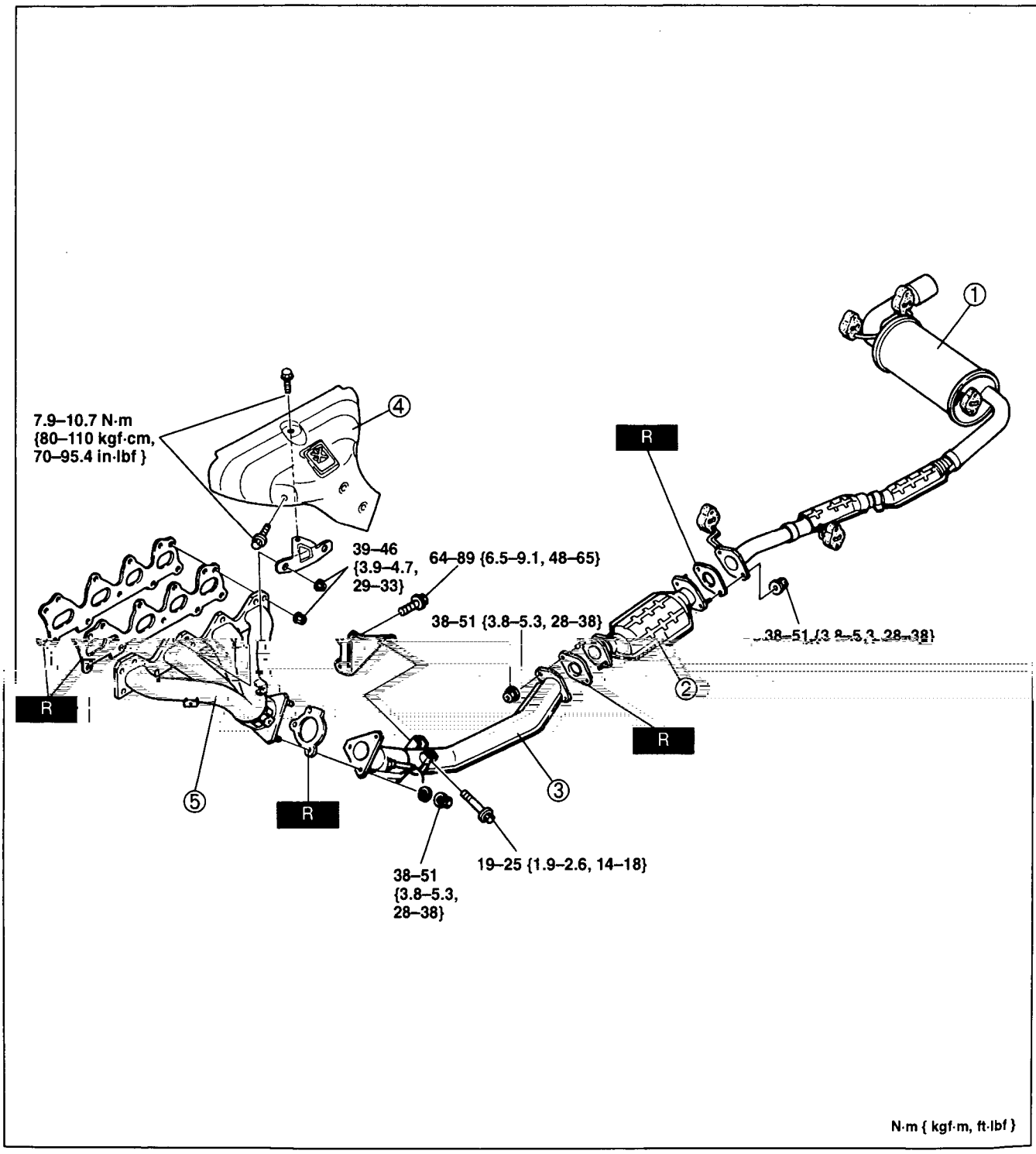


Fuel pump
After installing the fuel pump to the bracket, pull the pump down so that it is tight against the bracket.

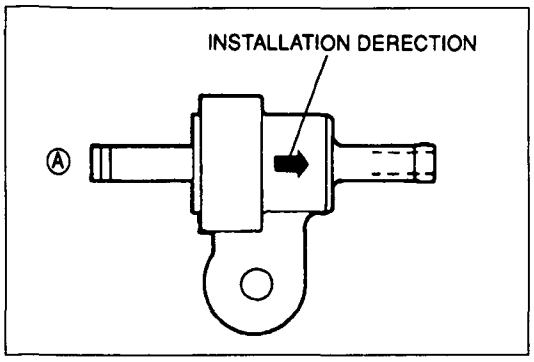
EXHAUST SYSTEM

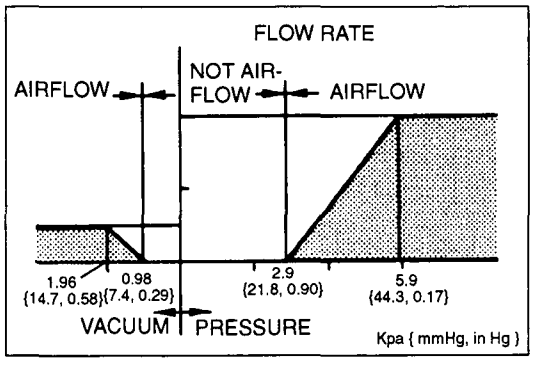
COMPONENTS
Removal / Installation

1. Disconnect the negative battery cable
2. Remove in the order shown in the figure.
3. Install in the reverse order of removal.



1. Main silencer
2. Three way catalytic converter
3. Front pipe
4. Exhaust manifold insulator
5. Exhaust manifold





EVAPORATIVE EMISSION CONTROL SYSTEM

CHECK VALVE

Inspection

1. Remove the check valve (two-way).
2. Apply pressure or vacuum to port A of the valve by using a vacuum pump, and check for the airflow.

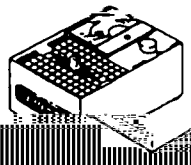
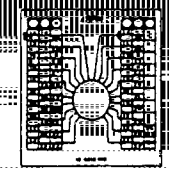
Specification

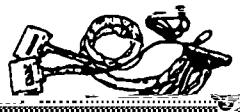
Condition	kPa { mmHg, inHg }	Airflow
Pressure	Below 2.9 {22, 0.90}	No
	Above 5.9 {44, 0.17}	Yes
Vacuum	Below 0.98 {7.4, 0.29}	Yes

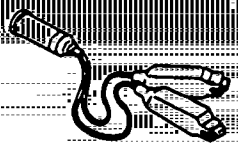
3. If not as specified, replace the check valve.

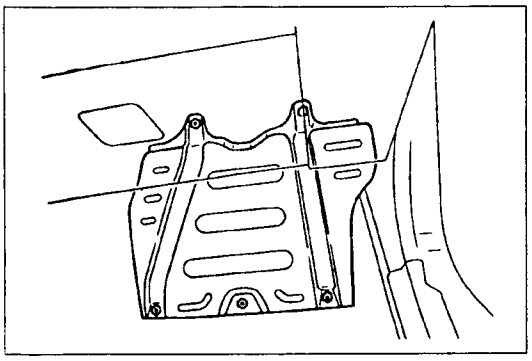
CONTROL SYSTEM

PREPARATION
SST

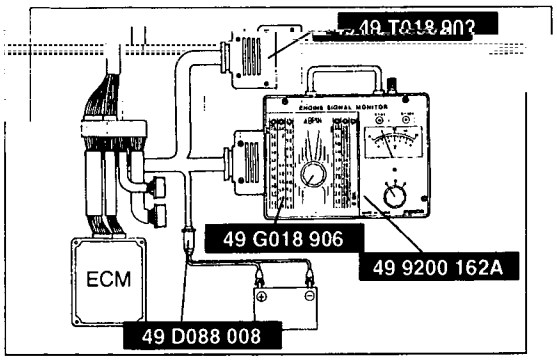
49 9200 162A Engine signal monitor		For inspection of engine control module (ECM)	49 1018 902 Harness adaptor
49 G018 906 Sheet		For inspection of engine control module (ECM)	49 D088 008 Harness adaptor (power



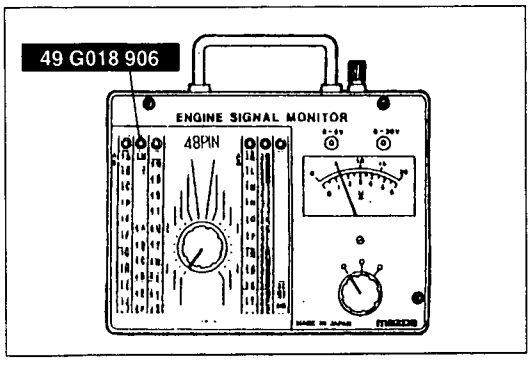




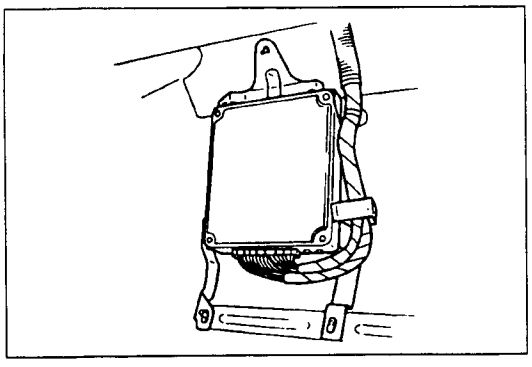
ENGINE CONTROL MODULE (ECM)
Inspection
1.Lift up the floormat in front of the passenger's seat.
2. Remove the protector cover.



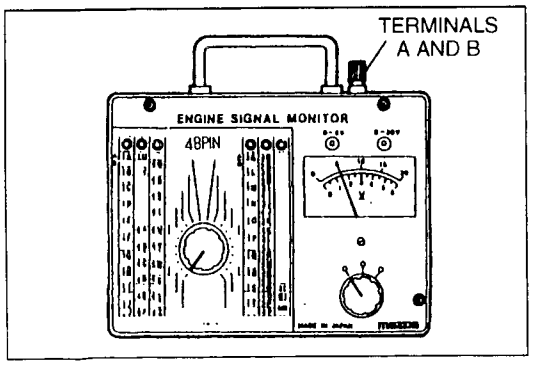
3. Connect the **SST** (Engine signal monitor) between the engine control module and the wiring harness using the **SSTs** (Harness adaptor, Harness adaptor power) as shown.



4. Place the **SST** (Sheet) on the **SST** (Engine signal monitor).
5. Measure the voltage at each terminal.



6. If any engine control module terminal voltage is incorrect, check the input / output devices and related wiring harnesses.
If they are normal, replace the engine control module.



Caution
- **Never apply voltage to SST terminals A and B because it will damage the SST.**

Terminal voltage (Reference)

B+: Battery positive voltage

Terminal	Input	Output	Connection to	Test condition	Voltage	Remark
1A	—	—	Battery	Constant	B+	For backup
1B	○		Main relay	Ignition switch OFF	Approx. 0V	
				Ignition switch ON	B+	
1C	○		Ignition switch (START position)	While cranking	Approx. 10V	
				Ignition switch ON	Approx. 0V	
1D		○	Self-diagnosis checker (Monitor lamp)	Test switch at "SELF-TEST" Lamp illuminated for 3 sec. after ignition switch OFF → ON	Approx. 5V	With Self-diagnosis checker and System selector
				Lamp not illuminated after 3 sec.	B+	
				Test switch at "O_2 MONITOR" at idle Monitor lamp illuminated	Approx. 5V	
				Test switch at "O_2 MONITOR " at idle Monitor lamp not illuminated	B+	
1E	—	—	—	—	—	—
1F		○	Self-diagnosis checker (Code number)	Buzzer sound for 3 sec. after ignition switch OFF → ON	Below 2.5V	• With Self-diagnosis checker and System selector • With System selector test switch at "SELF-TEST"
				Buzzer not sounded for after 3 sec.	B+	
				Buzzer sounded	Below 2.5V	
				Buzzer not sounded	B+	
1G		○	Ignition control module	Ignition switch ON	Approx. 0V	
				Idle	Approx. 0.2V	
1H		○	Ignition control module	Ignition switch ON	Approx. 0V	
				Idle	Approx. 0.2V	
1I	—	—	—	—	—	—
1J	—	—	—	—	—	—
1K	○		Data link connector	System selector test switch at "O_2 MONITOR"	B+	
				System selector test switch at "SELF-TEST"	Approx. 0V	
1L	—	—	—	—	—	—
1M	○		Vehicle speed sensor	While driving	2–5V	
				Vehicle stopped	1 or 7V	
1N	○		Throttle position sensor (Closed throttle position switch)	Accelerator pedal released	Approx. 0V	Ignition switch ON
				Accelerator pedal depressed	B+	
1O	○		Brake switch	Brake pedal released	0V	
				Brake pedal depressed	B+	
1P	○		P/S pressure switch	Ignition switch ON	B+	
				P/S ON (at idle)	0V	
				P/S OFF (at idle)	B+	
1Q	—	—	—	—	—	—
1R	○		Water thermo-switch (For fan control)	Fan operating (Engine coolant temperature over 91°C {196°F} or data link connector terminal TFA grounded)	Approx. 0V	
				Fan not operating (Idle)	B+	

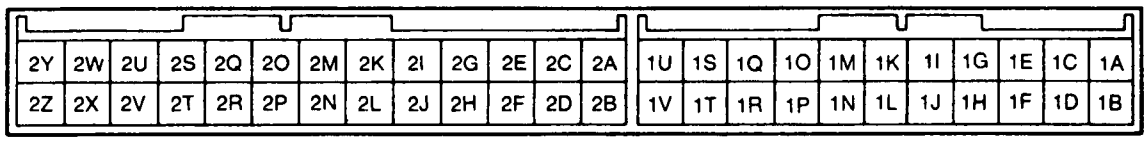
B+: Battery positive voltage

Terminal	Input	Output	Connection to	Test condition	Voltage	Remark
1S	○		Fan switch	Fan switch at mid, high or super high position	Approx. 0V	Ignition switch ON
				Fan switch OFF or low	B+	
1T	○	—	Rear window defroster switch	Rear window defroster switch OFF	Below1.0V	Ignition switch ON
				Rear window defroster switch ON	B+	
1U	○		Headlight switch	Headlights ON (Tail, parking, low beam/ high beam)	B+	
				Headlights OFF	0V	
1V	○		Neutral or clutch switch	Neutral position or clutch pedal depressed	Approx. 0V	
				Other conditions	B+	
2A	—	—	Ground (Injector)	Constant	0V	
2B	—	—	Ground (Output)	Constant	0V	
2C	—	—	Ground	Constant	0V	
2D	—	—	Ground (Input)	Constant	0V	
2E	○		Camshaft posiit-on sensor (SGT signal)	Ignition switch ON	Approx. 0V or 5V	
				Idle	Approx. 2V	
2F	—	—	—	—	—	—
2G	○		Camshaft posi-tion sensor (SGC signal)	Ignition switch ON	Approx. 0V or 5V	
				Idle	Approx. 1.5V	
2H	—	—	—	—	—	—
2I	—	—	—	—	—	—
2J	—	—	—	—	—	—
2K		○	Volume air flow sensor, Throttle position sensor	Constant	4.5—5.5V	
2L	○		Throttle position sensor (Power terminal)	Accelerator pedal released	Approx. 5V	
				Accelerator pedal fully depressed	Approx. 0V	
2M	—	—	—	—	—	—
2N	○		Heated oxygen sensor	Ignition switch ON	0V	
				Idle (Cold engine)	0V	
				Idle (After warm up)	0—1V	
				Increase engine speed (After warm up)	0.5—1V	
				Deceleration	0—0.4V	
2O	○		Volume air flow sensor	Ignition switch ON	Approx. 3.8V	
				Idle	Approx. 3.3V	
2P	○		Volume air flow sensor (Intake air temperature sensor)	Intake air temperature at 20°C {68°F}	Approx. 2.5V	
2Q	○		Engine coolant temperature sensor	Engine coolant temperature 20°C {68°F}	Approx. 2.5V	
				After warm up	Approx. 0.4V	
2R	—	—	—	—	—	—
2S	—	—	—	—	—	—
2T	—	—	—	—	—	—
2U		○	Fuel injector No.1	Idle	B+*	*Engine signal monitor: Green and red lights flash
2V		○	Fuel injector No.2			

B+: Battery positive voltage

Terminal	Input	Output	Connection to	Test condition	Voltage	Remark
2W		○	IAC valve	Ignition switch ON	Approx. 7V	
				Idle	Approx. 9V	
2X		○	Purge solenoid valve	Ignition switch ON	B+	
				Idle	B+	
2Y		○	Fuel injector No.3	Idle	B+*	*Engine signal monitor: Green and red lights flash
2Z		○	Fuel injector No.4			

Terminal location



Check Point for Each Terminal

B+: Battery positive voltage

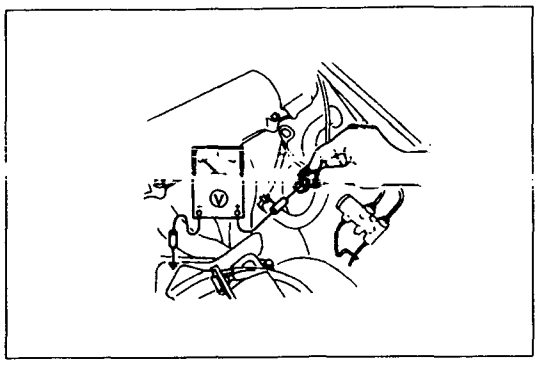
Terminal	Connection to	Abnormal voltage	Possible cause
1A	Battery	Always approx. 0V (Battery OK)	• ROOM 10A fuse burned • Open circuit in wiring from ROOM 10A fuse to ECM terminal 1A
1B	Main relay	Always approx. 0V	• Main relay malfunction • Open circuit in wiring from main relay to ECM terminal 1B
1C	Ignition switch (START position)	Always approx. 0V (Starter turns)	• Open circuit in wiring from starter to ECM terminal 1C
1D	Self-Diagnosis Checker (Monitor lamp)	Always approx. 0V	• Main relay malfunction • Open circuit in wiring from main relay to data link connector terminal +B • Open or short circuit in wiring from data link connector terminal MEN to ECM terminal 1D
		Always B+	• Poor connection at ECM connector • ECM malfunction
		Always approx. 5V	• ECM malfunction
1F	Self-Diagnosis Checker (Code No.)	Always below 2.5V (No display on Self-Diagnosis Checker)	• Main relay malfunction • Open circuit in wiring from main relay to data link connector terminal +B
		Always below 2.5V ("88" is displayed and buzzer sounds continuously)	• Open or short circuit in wiring from data link connector terminal FEN to ECM terminal 1F
		Always B+	• Poor connection at ECM connector • ECM malfunction
1G 1H	Ignition control module	Always approx. 0V	• Open or short circuit in wiring from Ignition control module ECM terminal 1G and 1H
1K	Data link connector (Terminal TEN)	Always approx. 0V	• Short circuit in wiring from ECM terminal 1K to data link connector terminal TEN
		Always B+	• Open circuit in wiring from ECM terminal 1K to data link connector terminal TEN • Open circuit in wiring from data link connector terminal GND to ground
1M	Vehicle speed sensor	Always approx. 1V	• Vehicle speed sensor malfunction • Short circuit in wiring from vehicle speed sensor to ECM terminal 1M
		Always approx. 7V	• Vehicle speed sensor malfunction • Open circuit in wiring from vehicle speed sensor to ECM terminal 1M
1N	Throttle position sensor (Closed throttle position switch)	Always approx. 0V	• Throttle position sensor misadjustment • Short circuit in wiring from ECM terminal 1N to throttle position sensor • ECM malfunction
		Always B+	• Throttle position sensor misadjustment • Open circuit in wiring from ECM terminal 1N to throttle position sensor • Open circuit in wiring from throttle position sensor to ground
1O	Brake switch	Always approx. 0V	• Open circuit in wiring from brake switch to ECM terminal 1O

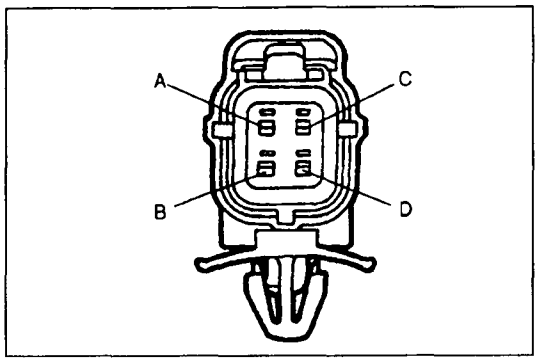
B+: Battery positive voltage

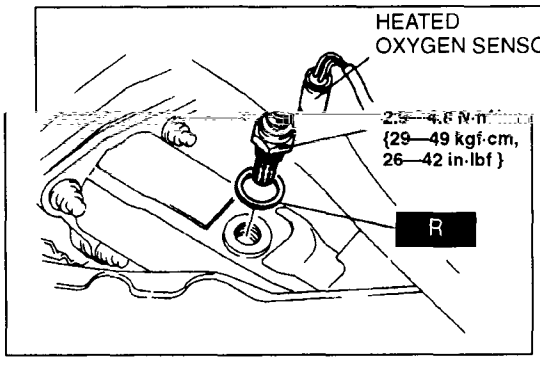
Terminal	Connection to	Abnormal voltage	Possible cause
1P	P/S pressure switch	Always approx. 0V	• P/S pressure switch malfunction • Short circuit in wiring from ECM terminal 1P to P/S pressure switch • ECM malfunction
		Always B+	• P/S pressure switch malfunction • Open circuit in wiring from ECM terminal 1P to P/S pressure switch • Open circuit in wiring from P/S pressure switch to ground
1R	Water thermoswitch (For fan control)	Always approx 0V (Cooling fan OK)	• Open or short circuit in wiring from electric cooling fan relay to ECM terminal 1R • ECM malfunction
1S	Fan switch	Always approx. 0V (Blower fan OK)	• Short circuit in wiring from fan switch to ECM terminal 1S • Poor connection at ECM connector • ECM malfunction
		Always B+ (Blower fan OK)	• Open circuit in wiring from fan switch to ECM terminal 1S
1T	Rear window defroster switch	Illumination light ON when rear window defroster switch ON	• Open or short circuit in wiring from rear window defroster switch to ECM terminal 1T
		Illumination light never ON	• Open or short circuit in wiring from ignition switch to rear window defroster switch • Rear window defroster switch malfunction
1U	Headlight switch	Always approx. 0V (Headlights OK)	• Open or short circuit in wiring from headlight relay to ECM terminal 1U
1V	Neutral switch Clutch switch	Always approx. 0V	• Neutral switch malfunction • Clutch switch malfunction • Short circuit in wiring from ECM terminal 1V to neutral or clutch switch • Poor connection at ECM connector • ECM malfunction • Open circuit in wiring from ECM terminal 1V to neutral and clutch switches
2A 2B 2C 2D	Ground	More than 0V	• Poor contact at ground terminal • Open circuit in wiring from ECM to ground
2E	Camshaft position sensor (SGT signal)	Always approx. 0V or apperox. 5V	• Refer to Code No.02 troubleshooting
2G	Camshaft position sensor (SGC signal)	Always approx. 0V or apperox. 5V	• Refer to Code No.03 troubleshooting
2K	Volume air flow sensor	Always approx. 0V	• Short circuit in wiring from ECM terminal 2K to volume air flow sensor • Poor connection at ECM connector • ECM malfunction
		Below 4.5V or above 5.5V	• ECM malfunction

B+: Battery positive voltage

Terminal	Connection to	Abnormal voltage	Possible cause
2L	Throttle position sensor (Power terminal)	Always approx. 0V	• Throttle position sensor misadjustment • Short circuit in wiring from ECM terminal 2L to throttle position sensor • Poor connection at ECM connector • ECM malfunction
		Always approx. 5V	• Throttle position sensor malfunction • Open circuit in wiring from ECM terminal 2L to throttle position sensor • Open circuit in wiring from throttle position sensor to ground
2N	Heated oxygen sensor	0V after warm-up	• Refer to Code No.15 troubleshooting
		Always approx. 1V after warm-up	• Refer to Code No.17 troubleshooting
2O	Volume air flow sensor	Always approx. 0V or apperox. 5V	• Refer to Code No.08 troubleshooting
2P	Volume air flow sensor (Intake air temperature sensor)	Always approx. 0V or apperox. 5V	• Refer to Code No.10 troubleshooting
2Q	Engine coolant temperature sensor	Always approx. 0V or apperox. 5V	• Refer to Code No.09 troubleshooting
2U 2V	Fuel injector	Always approx. 0V	• Main relay malfunction • Open or short circuit in wiring from fuel injector to ECM 2U or 2V
		Always B+	• ECM malfunction
2W	IAC valve	Always approx. 0V or B+	• Refer to Code No.34 troubleshooting
2X	Purge solenoid valve	Always approx. 0V or B+	• Refer to Code No.26 troubleshooting
2Y 2Z	Fuel injector	Always approx. 0V	• Main relay malfunction • Open or short circuit in wiring from fuel injector to ECM 2Y or 2Z
		Always B+	• ECM malfunction







HEATED OXYGEN SENSOR

Inspection

On-vehicle

1. Warm-up the engine to normal operating temperature and run it at idle.
2. Disconnect the heated oxygen sensor connector.
3. Measure the voltage at terminal A.

Specification

Engine condition	Idle(V)	Increasing engine speed(V)	Decreasing engine speed (V)
Terminal A	Below 1.0	0.5—1.0	0—0.4

4. If not as specified, check the intake air system, the fuel system and run the on-board diagnosis test.
5. If these systems are OK, replace the heated oxygen sensor.

Heater

1. Disconnect the heated oxygen sensor connector.
2. Measure resistance between terminals C and D.

Resistance: Approx. 13 Ω [20°C {68°F}]

3. Replace the heated oxygen sensor if not as specified.

Replacement

1. Disconnect the heated oxygen sensor connector.
2. Remove the heated oxygen sensor.
3. Install in the reverse order of removal.

Tightening torque:
2.9—4.8 N·m {29—49 kgf·cm, 26—42 in·lbf }

Before beginning any service procedure, refer to section T of this manual for air bag system service warnings.

FUEL AND EMISSION CONTROL SYSTEMS (BP)

FEATURES

OUTLINE **F2– 2**
OUTLINE OF CONSTRUCTION **F2– 2**
SYSTEM WIRING DIAGRAM **F2– 3**
SPECIFICATIONS **F2– 4**

SERVICE

SUPPLEMENTAL SERVICE INFORMATION **F2– 5**
CONTROL SYSTEM **F2– 6**
PREPARATION **F2– 6**
ENGINE CONTROL MODULE (ECM) **F2– 6**

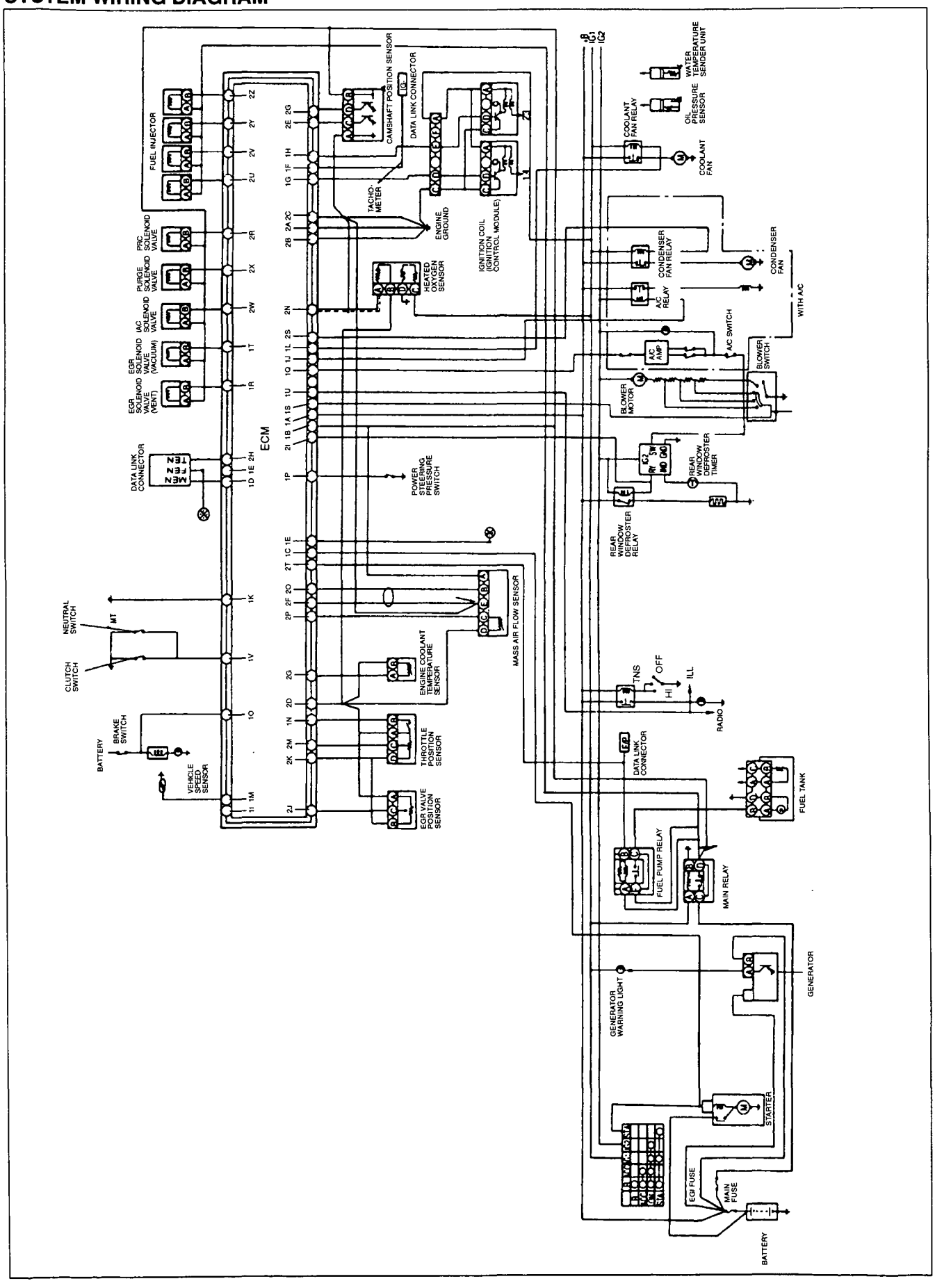
OUTLINE

OUTLINE OF CONSTRUCTION

The following points have been changed compared with the previous model.

- The IGF signal input has been discontinued.
- According to the discontinuation of the IGF signal input, diagnostic trouble code No. 01 has been eliminated.
- The tachometer signal output has been added.

SYSTEM WIRING DIAGRAM



SPECIFICATIONS

Item			Specification
Idle speed		rpm	800—900 (850 ± 50)*
Ignition timing		BTDC	9°—11° (10° ± 1°)*
Throttle body			
Type			Horizontal draft
Throat diameter		mm { in }	55 {2.2}
Fuel pump			
Type			Impeller (in-tank)
Output pressure		kPa { kgf/cm^2, psi }	480—657 {4.9—6.7, 69—95}
Fuel filter			
Type	Low-pressure side		Nylon element
	High-pressure side		Paper element
Pressure regulator			
Type			Diaphragm
Regulating pressure		kPa { kgf/cm^2, psi }	265—314 {2.7—3.2, 38.4—45.5}
Fuel injector			
Type			High-ohmic
Type of drive			Voltage
Resistance		Ω	12—16 [at 20°C {68°F}]
Bypass air control valve	**IAC solenoid valve**		
	Solenoid resistance	Ω	10.7—12.3 [at 20°C {68°F}]
	Air valve		
	Opening temperature		Below 40°C {104°F}
Purge solenoid valve			
Solenoid resistance		Ω	23—27 [at 20°C {68°F}]
Camshaft position sensor			
Type			Hall element
Engine coolant temperature sensor			
Resistance		kΩ	20°C {68°F} 2.3—2.6
			80°C {179°F} 0.3—0.4
Fuel tank			
Capacity		L { US gal, Imp gal }	48 {12.7, 10.5}
Air cleaner			
Element type			Oil permeated
Accelerator cable			
Free play		mm { in }	1—3 {0.039—0.118}

*...TEN terminal grounded.

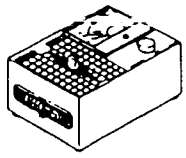
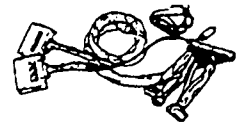
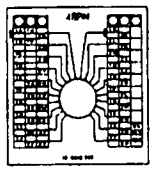
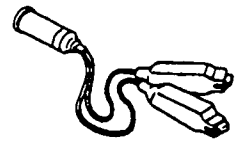
SUPPLEMENTAL SERVICE INFORMATION

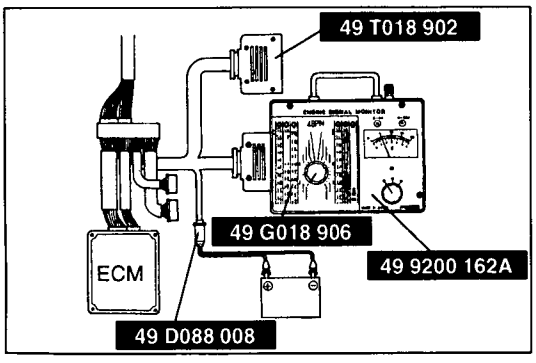
The following changes and / or additions have been made since publication of the Mazda MX–5 Workshop Manual (1221–10 89I) and Mazda MX–5 Workshop Manual Supplement (1372–10–93I).

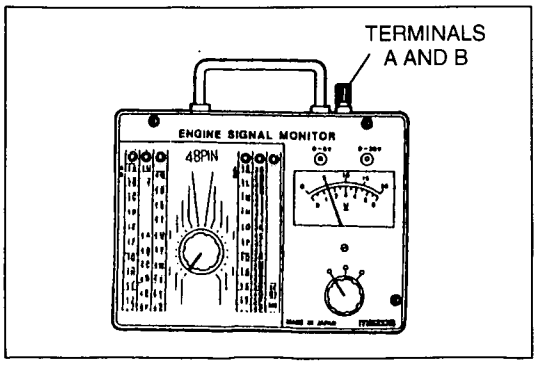
Engine control module (ECM)
- Inspection procedure modified

CONTROL SYSTEM

PREPARATION
SST

49 9200 162A Engine Signal Monitor		For inspection of engine control module (ECM)	49 T018 902 Adapter harness		For inspection of engine control module (ECM)
49 G018 906 Sheet		For inspection of engine control module (ECM)	49 D088 008 Harness adaptor power		For inspection of engine control module (ECM)





ENGINE CONTROL MODULE (ECM)
Inspection

1. Lift up the floormat in front of the passenger's seat.
2. Connect the **SST** (Engine Signal Monitor) between the engine control module (ECM) and the wiring harness by using the **SSTs** (Adapter harness, Harness adaptor power) as shown.
3. Place the **SST** (Sheet) on the **SST** (Engine Signal Monitor).
4. Measure the voltage at each terminal.
5. If any engine control module (ECM) terminal voltage is incorrect, check the input or output device and related wiring.
6. If they are normal, replace the engine control module (ECM).

Caution
- **Never apply voltage to SST terminals A and B because it will damage the SST.**

Terminal voltage
- The following terminal voltages have been changed from that of the previous model.

Terminal	Input	Output	Connection to	Test condition	Voltage	Remark
1F	—	○	Tachometer	Ignition switch ON	0 or Approx.11	★Engine signal Monitor : Green and red lights flash
				Idle	Approx.6★	
2I	—	—	—	—	—	—

Before beginning any service procedure, refer to section T of this manual for air bag system service warnings.

ENGINE ELECTRICAL SYSTEM

FEATURES

OUTLINE **G–2**
OUTLINE OF CONSTRUCTION **G–2**
SPECIFICATIONS **G–2**
IGNITION SYSTEM **G–3**
IGNITION CONTROL MODULE **G–3**

OUTLINE

OUTLINE OF CONSTRUCTION

This section explains the engine electrical system of the new MX–5. A comparison of major parts for the new MX–5 and the previous model is as follows.

- The circuit of ignition fail signal from the ignition control module (B6) or the ignition coil (BP) to the engine control module has been eliminated.
- The BKR7E–11 type and K22PR–U11 type spark plugs for the B6 engine model have been eliminated.

SPECIFICATIONS

Item \ Engine/Transmission				B6	BP
				MT	
Battery	Voltage		V	12	
	Type and capacity (5-hour rate)		A·h	S46A24L (S) (32)	
	Electrolyte gravity			1.27–1.29 [20°C {68°F }]	
	Dark current *1		mA	Max. 20	
Generator	Output		V–A	12–60	12–65
	Regulated voltage		V	14.1–14.7	14.3–14.9
	Self-diagnosis function			Equipped	
	Rotor resistance (Between slip rings)		Ω	3.9–4.5	3.5–4.1
	Brush length	Standard	mm { in }	21.5 {0.85}	18.5 {0.73}
		Minimum	mm { in }	8.0 {0.32}	11.5 {0.46}
	Brush spring force	Standard	N { kgf , lbf }	3.7 {0.38, 0.84}	5.2 {0.53, 1.17}
		Minimum	N { kgf , lbf }	1.8 {0.18, 0.40}	2.7 {0.27, 0.60}
Ignition control module	Type			Transistor	Transistor (Integrated in ignition coil)
Ignition coil	Type			Molded	
	Resistance	Primary coil	Ω	0.70–0.86 [20°C {68°F }]	—
		Secondary coil	kΩ	11.2–15.2 [20°C {68°F }]	8.7–12.9 [20°C {68°F }]
High-tension lead	Resistance		kΩ/m	16 [20°C {68°F }]	
Spark advance				Electronic	
Spark plug	Type	NGK		BKR5E–11 *2 BKR6E–11	
		NIPPONDENSO		K16PR–U11 *2 K20PR–U11	
	Plug gap		mm { in }	1.0–1.1 {0.040–0.043}	
	Resistance		kΩ	3.0–7.5 [20°C {68°F }]	
	Tightening torque		N·m { kgf·m , ft·lbf }	15–22 {1.5–2.3,11–16}	
Starter	Type			Direct	
	Output		kW	0.95	
	Commutator diameter	Standard	mm { in }	32.0 {1.26}	
		Minimum	mm { in }	31.4 {1.24}	
	Brush length	Standard	mm { in }	17.0 {0.67}	
		Minimum	mm { in }	11.5 {0.46}	
	Brush spring force	Standard	N { kgf , lbf }	19.2 {1.95, 4.29}	
		Minimum	N { kgf , lbf }	8.83 {0.90, 1.98}	
	Pinion gap		mm { in }	0.5–2.0 {0.020–0.078}	

*1 Dark current is the constant flow of current present while the ignition switch is OFF (i.e., audio unit, clock, etc.).
*2 Standard plug

IGNITION SYSTEM

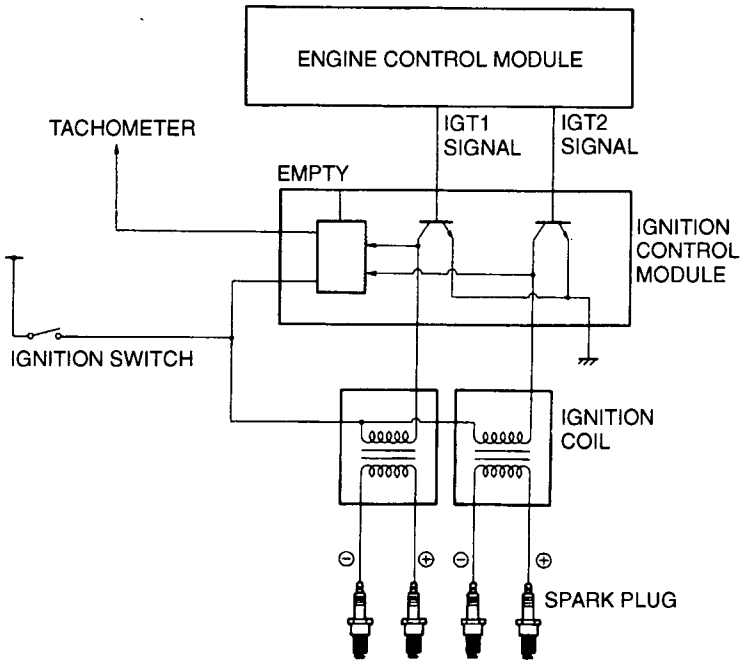
IGNITION CONTROL MODULE

Outline

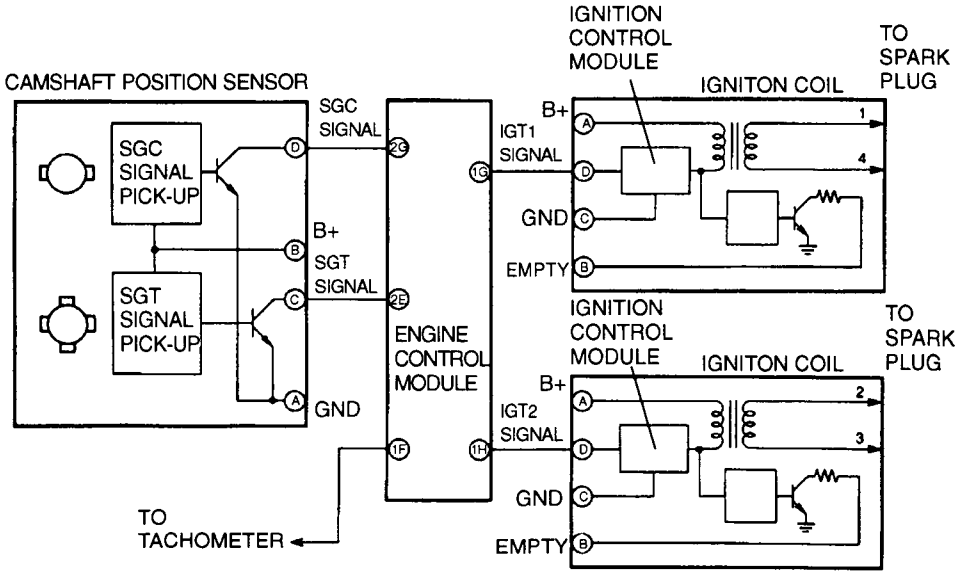
- The circuit of ignition fail signal from the ignition control module (B6) / ignition coil (BP) to the engine control module have been eliminated and the ignition control module (B6) / ignition coil (BP) has an empty terminal instead.

System Diagram

B6



BP



B+: BATTERY POSITIVE VOLTAGE

Before beginning any service procedure, refer to section T of this manual for air bag system service warnings.

PROPELLER SHAFT

FEATURES

OUTLINE **L–2**
OUTLINE OF CONSTRUCTION **L–2**
SPECIFICATIONS **L–2**

OUTLINE

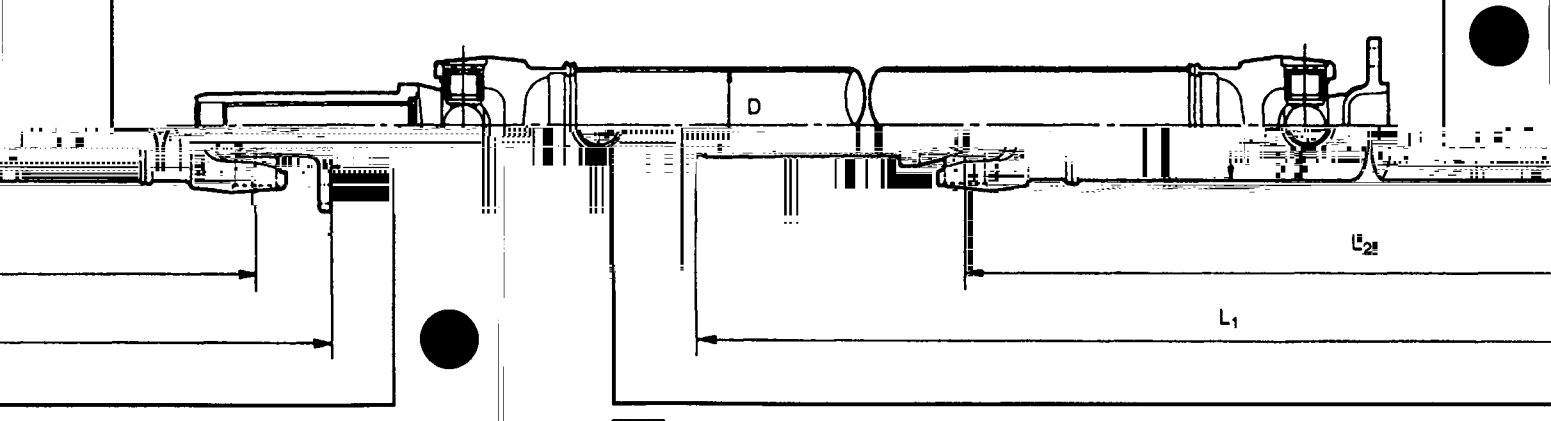
OUTLINE OF CONSTRUCTION

- The specifications and tightening torque of the propeller shaft of the re-introduced B6 engine are the same as those for the BP engine.

- Refer to section L of the 1993 MX–5 Workshop Manual (1221-10-89I) for service of the propeller shaft.

SPECIFICATIONS

Item \ Engine		B6 DOHC
Length mm { in }	L_1	1,001 {39.41}
	L_2	816 {32.1}
Outer diameter mm { in }	D	60.5 {2.38}
Runout mm { in }		0.4 {0.016}
Tightening torque (Differential — Propeller shaft) N·m { kgf·m, ft·lbf }		50—58 {5.0—6.0, 37—43}



Indicates new specifications

Before beginning any service procedure, refer to section T of this manual for air bag system service warnings.

FRONT AND REAR AXLES

OUTLINE ..... **M– 2**
OUTLINE OF CONSTRUCTION ..... **M– 2**
SPECIFICATIONS ..... **M– 2**

OUTLINE

OUTLINE OF CONSTRUCTION

- The differential and drive shaft which were introduced in Workshop Manual Supplement (1372-10-93I) for the BP engine are the same type that are used for the re-introduced B6 engine.
- Refer to Section M of Workshop Manual Supplement (1372-10-93I) for service of the standard differential.

SPECIFICATIONS

Item \ Engine		B6	BP	
Front axle				
Type		Double-wishbone		
Bearing		Angular ball bearing		
Wheel bearing play mm { in }	Maximum	0.05 {0.002}		
Rear axle				
Type		Double-wishbone		
Bearing		Angular ball bearing		
Wheel bearing play mm { in }	Maximum	0.05 {0.002}		
Drive shaft				
Joint type	Wheel side	Bell joint		
	Differential side	Double-off set joint		
Length mm { in } (between centers of joints)	Left side	470.3 {18.52}	470.3 {18.52}	
	Right side	470.3 {18.52}	470.3 {18.52}	
Shaft diameter mm { in }		22.5 {0.89}	22.5 {0.89}	
Differential				
Differential type		Standard		TORSEN® LSD
Ring gear size mm { in }		182.88 {7.20}	182.88 {7.20}	
Final gear ratio		4.100	4.100	
Reduction gear		Hypoid gear		
Differential gear		Straight-bevel gear		Worm gear
Ring gear teeth		41	41	
Drive pinion gear teeth		10	10	
Oil	Grade	API Service GL-5		
	Viscosity	Above −18 °C {0 °F }: SAE90 Below −18 °C {0 °F }: SAE80		
	Capacity L { US qt , Imp qt }	1.00 {1.06, 0.88}	1.00 {1.06, 0.88}	

▒ Indicates new specifications

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Before beginning any service procedure, refer to section T of this manual for air bag system service warnings.

BRAKING SYSTEM

INDEX ..... P– 2

FEATURES

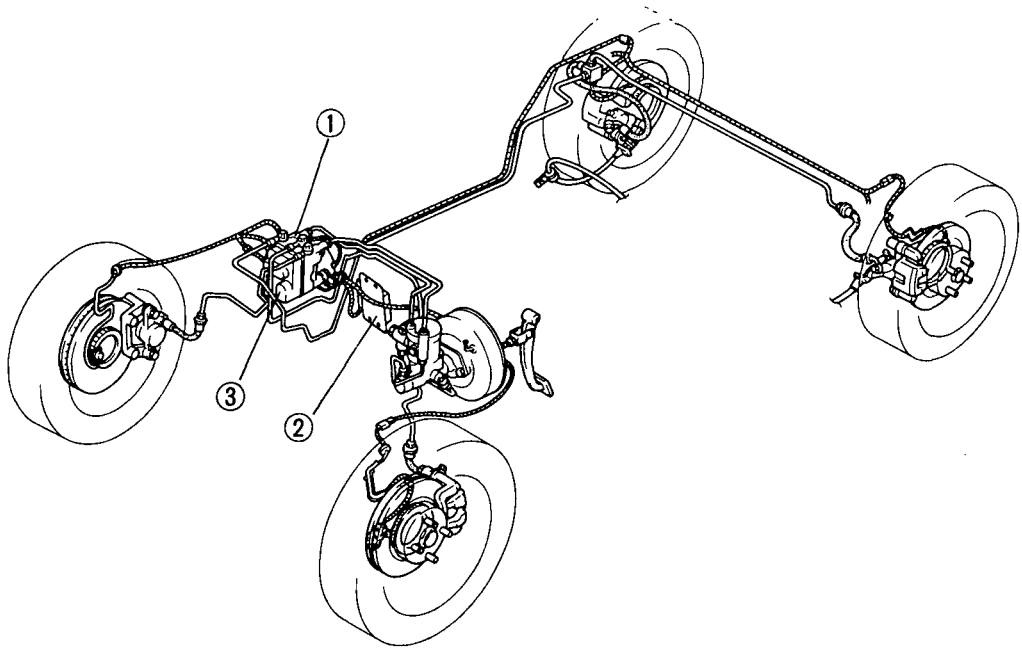
OUTLINE ..... P– 3
OUTLINE OF CONSTRUCTION ..... P– 3
SPECIFICATIONS ..... P– 3
ANTILOCK BRAKE SYSTEM (ABS) ..... P– 4
STRUCTURAL VIEW ..... P– 4
OUTLINE ..... P– 4
SYSTEM DIAGRAM ..... P– 5
ABS HYDRAULIC UNIT ..... P– 6
SOLENOID VALVES ..... P– 8
OPERATION ..... P– 9
VALVE RELAY AND MOTOR RELAY P–16
OPERATION OF ABS P–17
ABS CONTROL MODULE P–22
MEMORY FUNCTION AND ON-BOARD DIAGNOSIS P–25

SERVICE

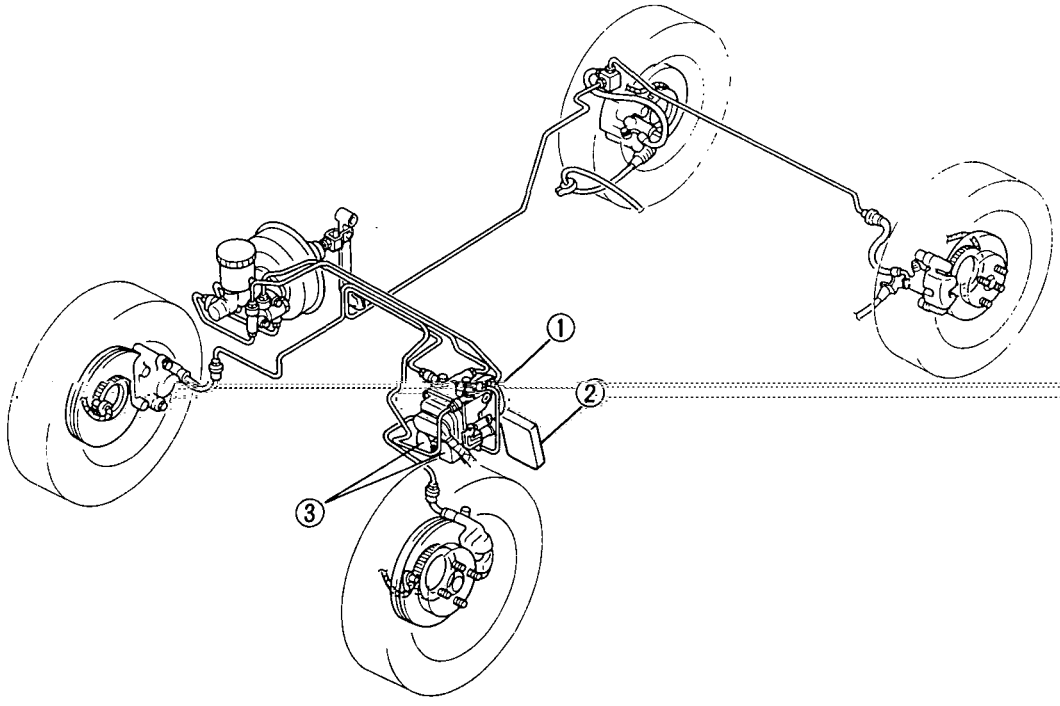
SUPPLEMENTAL SERVICE INFORMATION ... P–27
ANTILOCK BRAKE SYSTEM (ABS) P–28
PREPARATION P–28
TROUBLESHOOTING P–28
ON-BOARD DIAGNOSTIC FUNCTION P–37
ABS HYDRAULIC UNIT P–44
ABS CONTROL MODULE P–49
ABS RELAY P–53

INDEX

LHD



RHD



1. ABS hydraulic unit
Inspection (on-vehicle) ..... page P–44
Removal / Installation .....page P–47
2. ABS control module
Removal / Installation .....page P–49
3. ABS relay
Removal / Inspection / Installation ..... page P–53

OUTLINE

OUTLINE OF CONSTRUCTION

- The antilock brake system has been changed to improve reliability and to reduce weight and size.

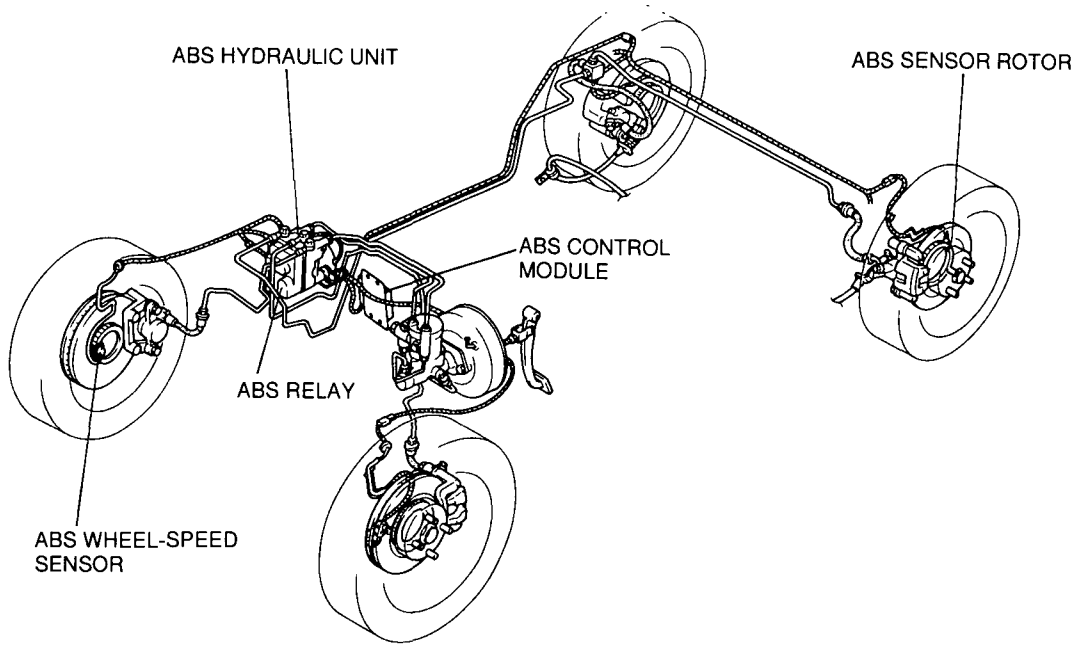
SPECIFICATIONS

Item			Specifications	
			B6 (Non ABS)	BP, B6 (ABS)
Brake pedal	Type		Suspended	
	Pedal lever ratio		4.1 : 1	
	Maximum stoke	mm {in}	127.8 {5.031}	
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}	3700 × 9.5 {5.73 × 0.37}	4300 × 8 {6.66 × 0.31}
	Disc plate dimensions (effective diameter × thickness)	mm {in}	235 × 18 {9.25 × 0.71}	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}	2600 × 8.0 {4.03 × 0.31}	
	Disc plate dimensions (effective diameter × thickness)	mm {in}	231 × 9 {9.09 × 0.35}	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 (PBV)	
Brake fluid			SAE J1703 or FMVSS 116, DOT-3	
Parking brake	Type		Mechanical, two rear brakes	
	Operation system		Hand lever	

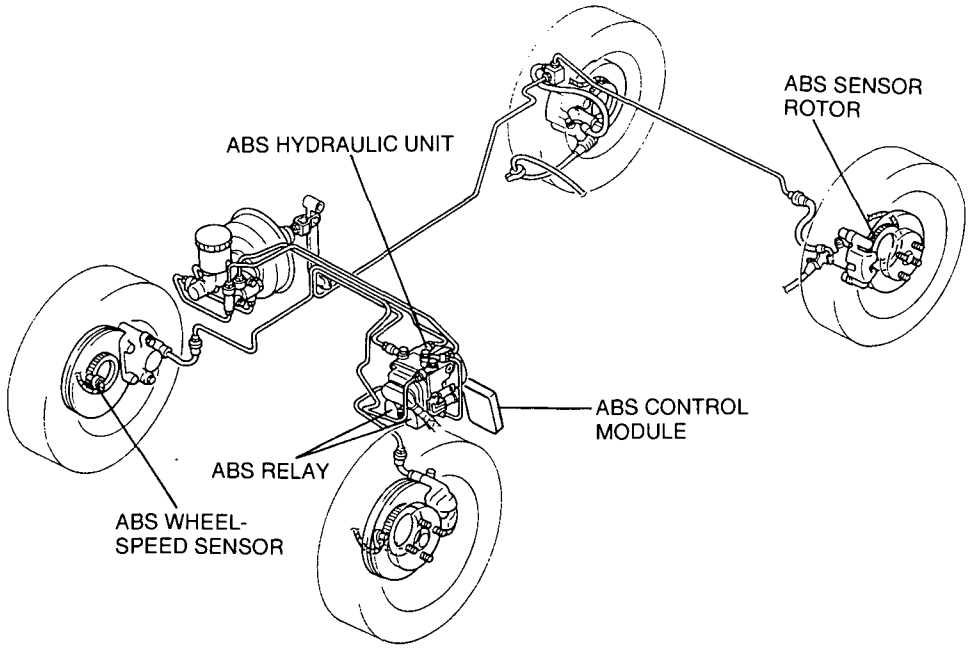
ANTILOCK BRAKE SYSTEM (ABS)

STRUCTURAL VIEW

LHD



RHD



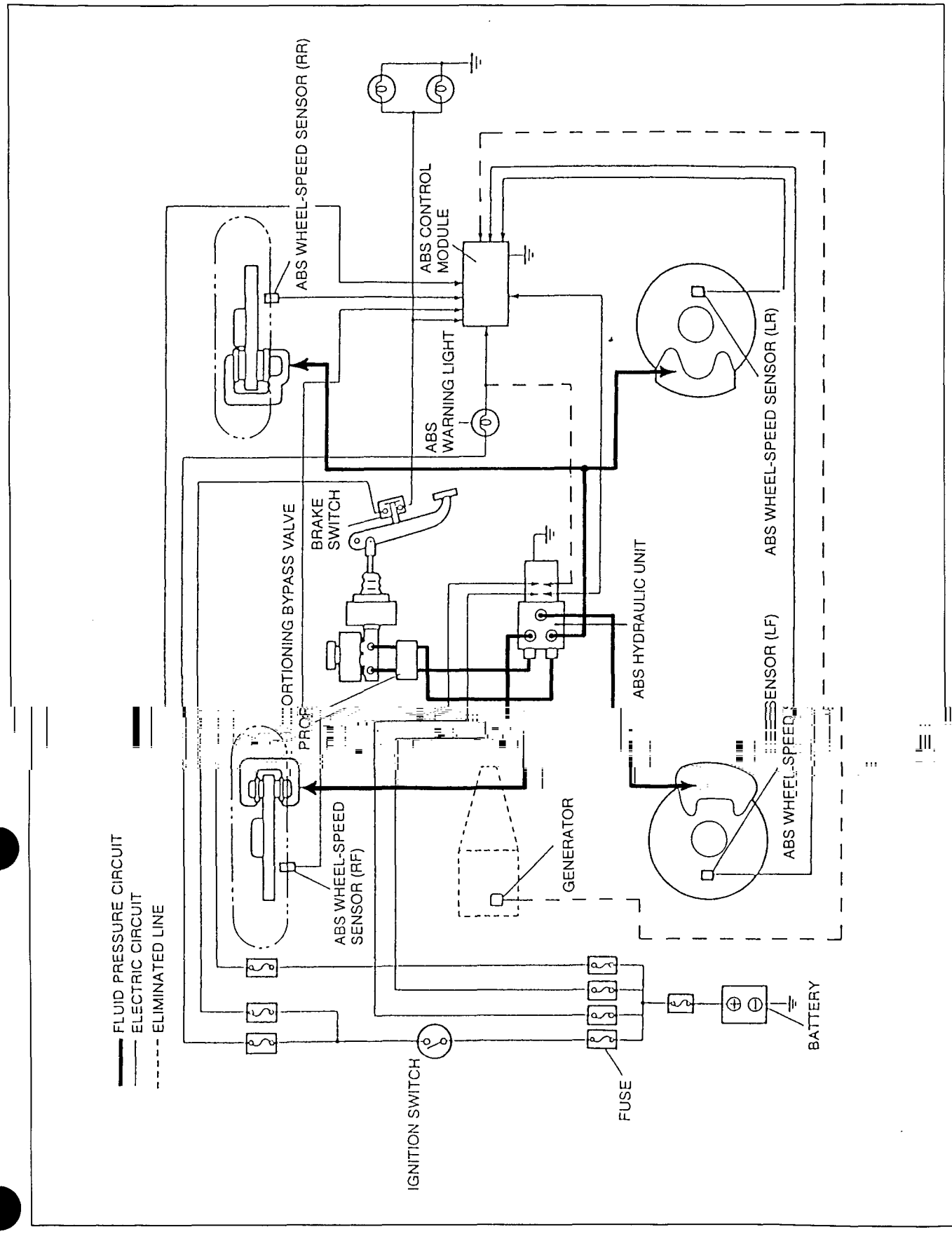
OUTLINE

The new Antilock Brake System (ABS) features a modified ABS hydraulic unit ("HU") and a modified ABS control module ("CM"). The modifications to the HU make the damping unit unnecessary, and it has been eliminated.

The structure and operation of all components apart from the ABS HU and ABS CM are the same as previous one.

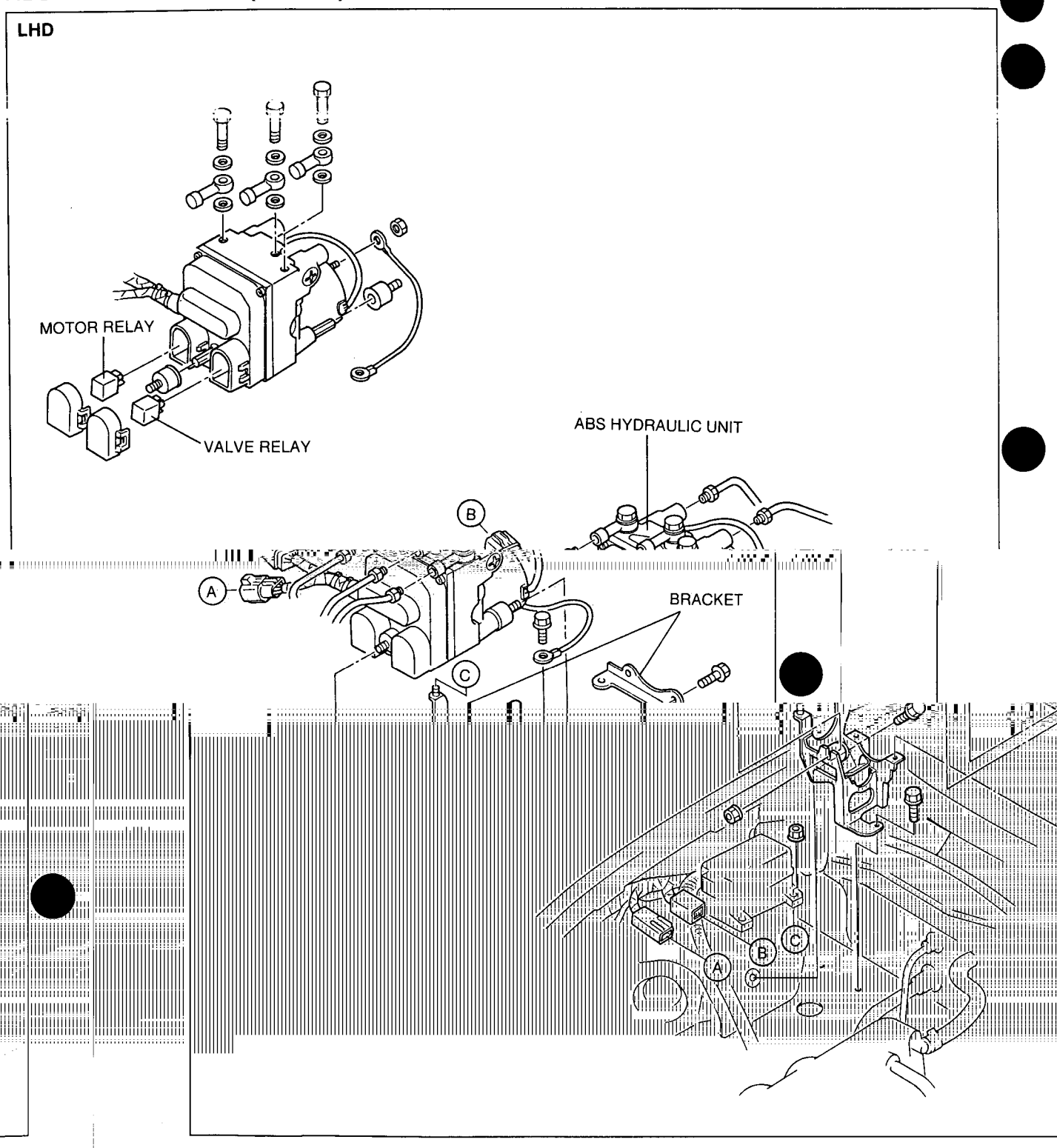
The functions, theory and operation of the ABS remain the same as previous one.

SYSTEM DIAGRAM



Input from generator terminal L to the ABS control module has been eliminated following the introduction of a time-based method of checking the ABS warning light bulb.

ABS HYDRAULIC UNIT (ABS HU)



ne wheels.

mper.

ing pressure
left and right
aneously.

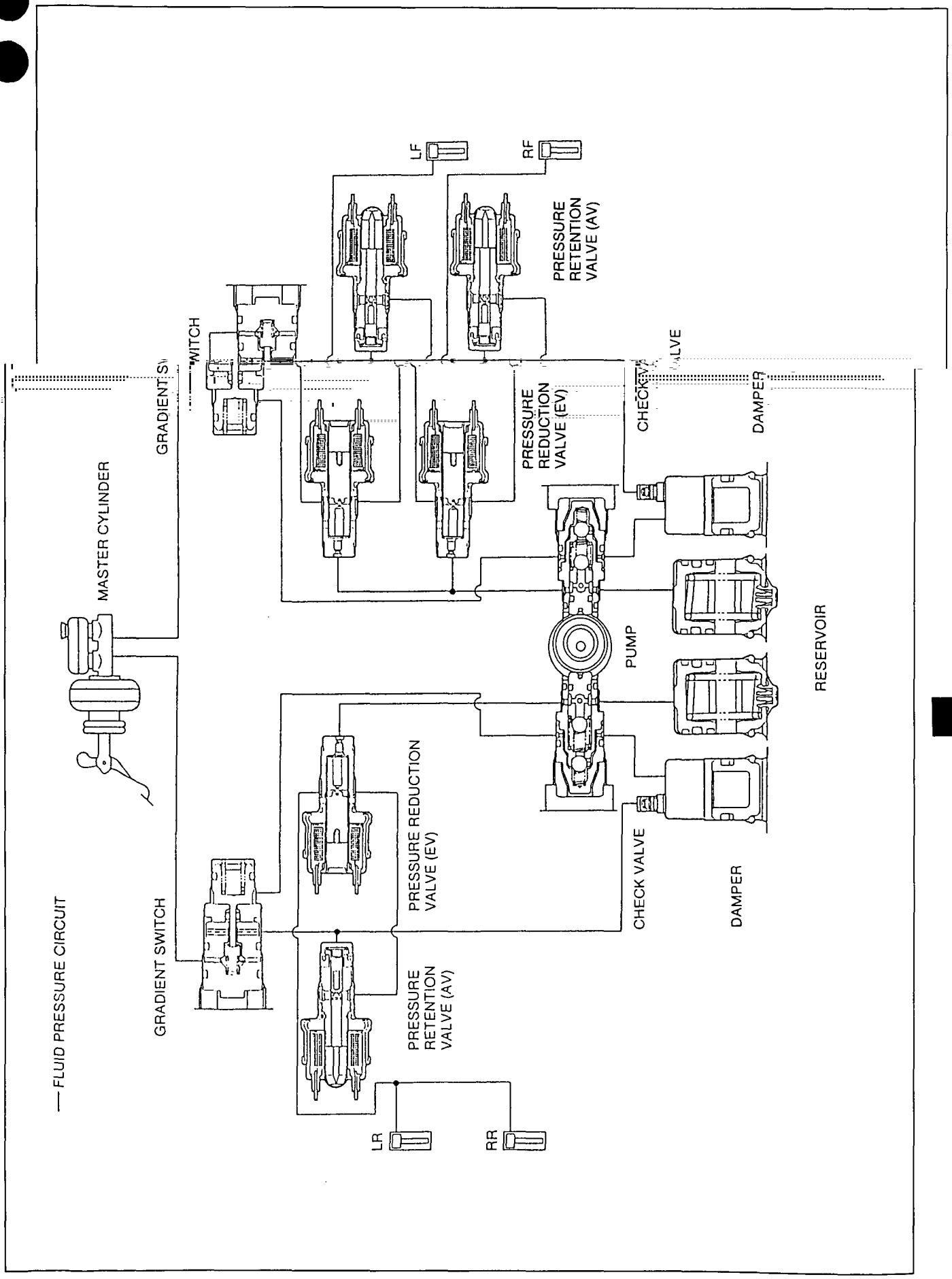
The ABS HU uses signals from the CM to control the pressure of the brake fluid acting on th

The main components of the HU are solenoid valves, reservoir, pump, pump motor, and dar

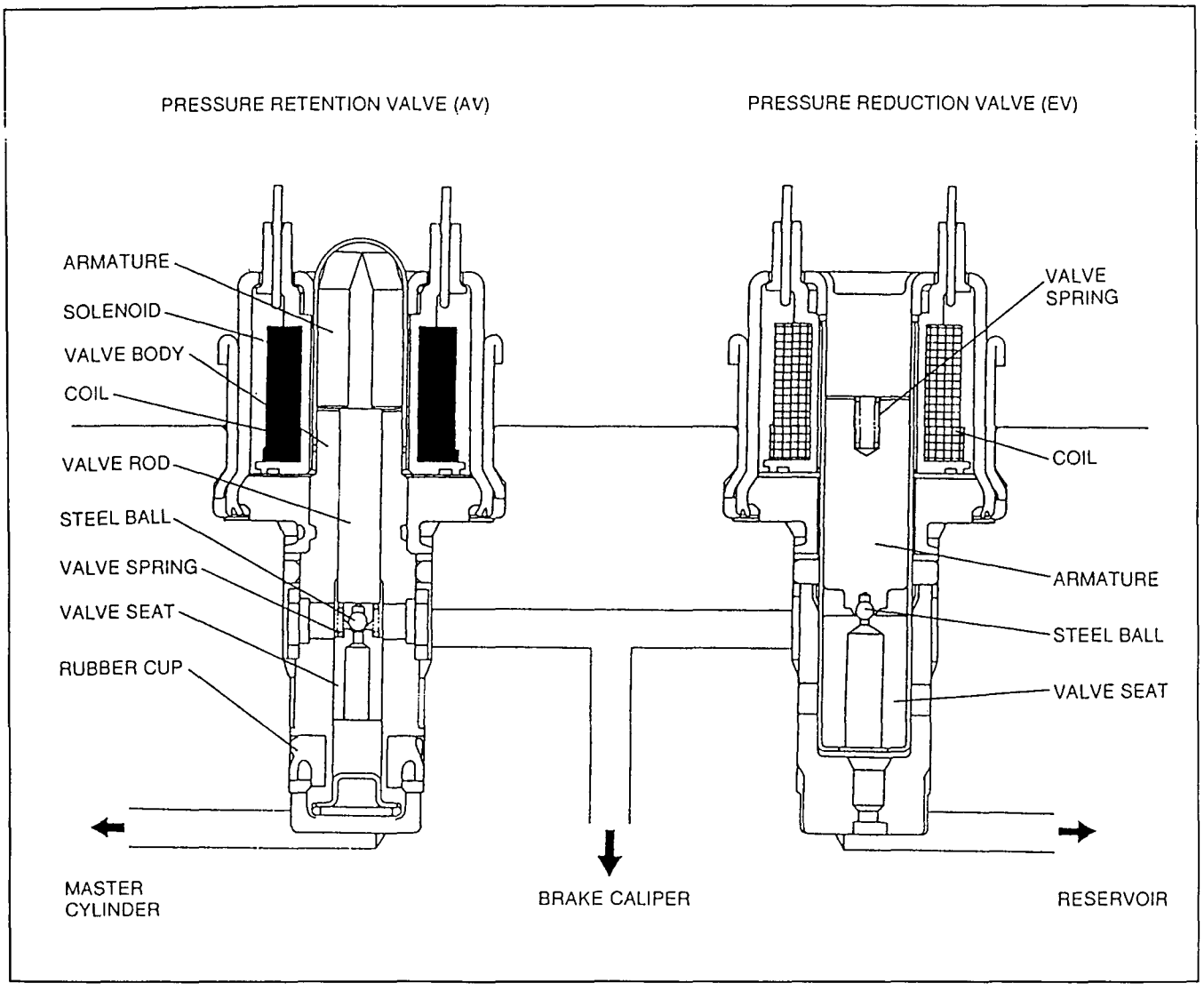
There are six solenoid valves in total and in each channel two solenoid valves (one for hold and one for reducing pressure) are used. There are four valves for front wheels and, the l wheels are controlled separately. The two valves are used to control the rear wheels simulta

The HU is installed in the engine compartment.

Function Diagram



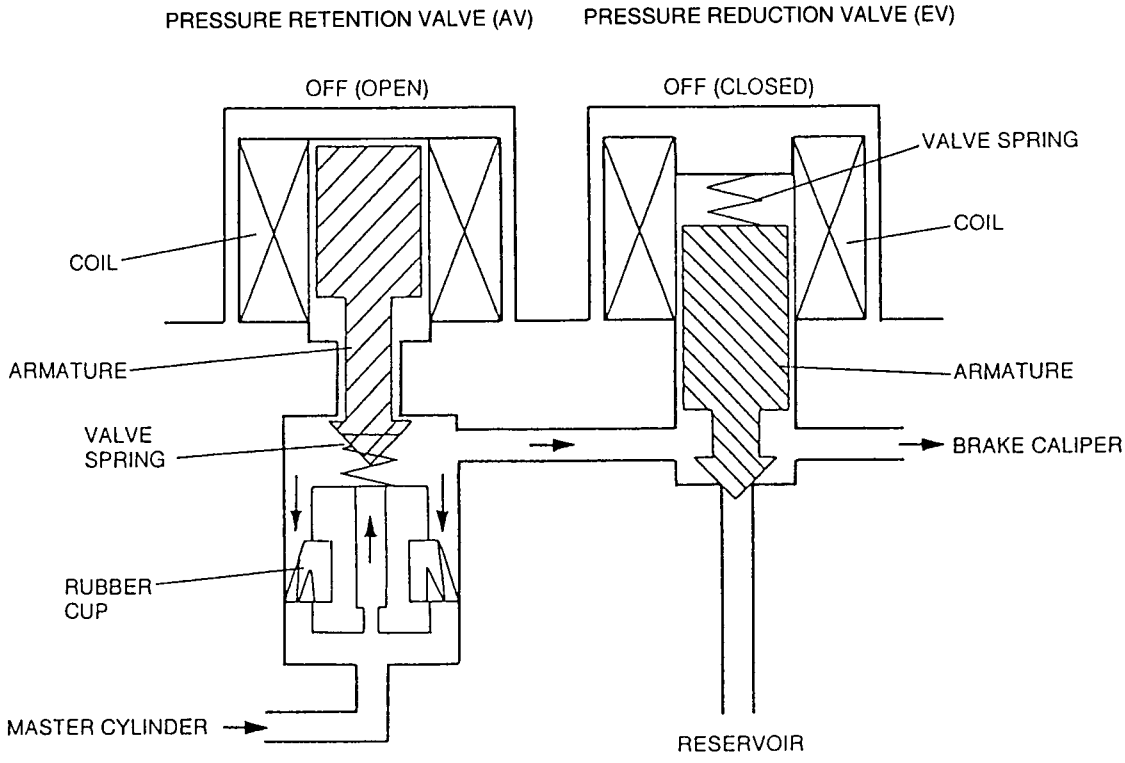
SOLENOID VALVES



Structure

Two types of solenoid valve are used: the pressure retention type and the pressure reduction type. The main components are: armature, coil, valve body, valve seat, steel ball, and valve spring.

OPERATION
Normal Braking and Pressure Increase

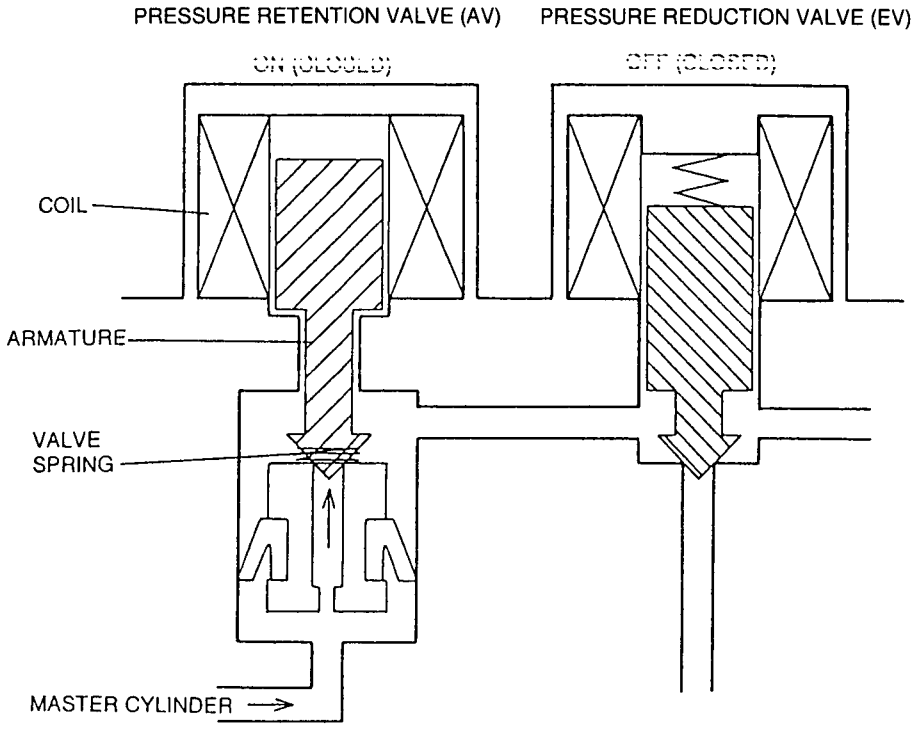


During normal braking and increase in pressure, current does not flow to the coils. The valve spring presses on the armature, causing the pressure retention valve to open and the pressure reduction valve to close.

The passage to the reservoir is blocked because the pressure reduction valve is closed. As a result, the brake fluid passes through the pressure retention valve and acts on the calipers.

A rubber cup is fitted to the pressure retention valve. The function of this cup is to make the brake fluid return smoothly from the calipers to the master cylinder side when the brake is released.

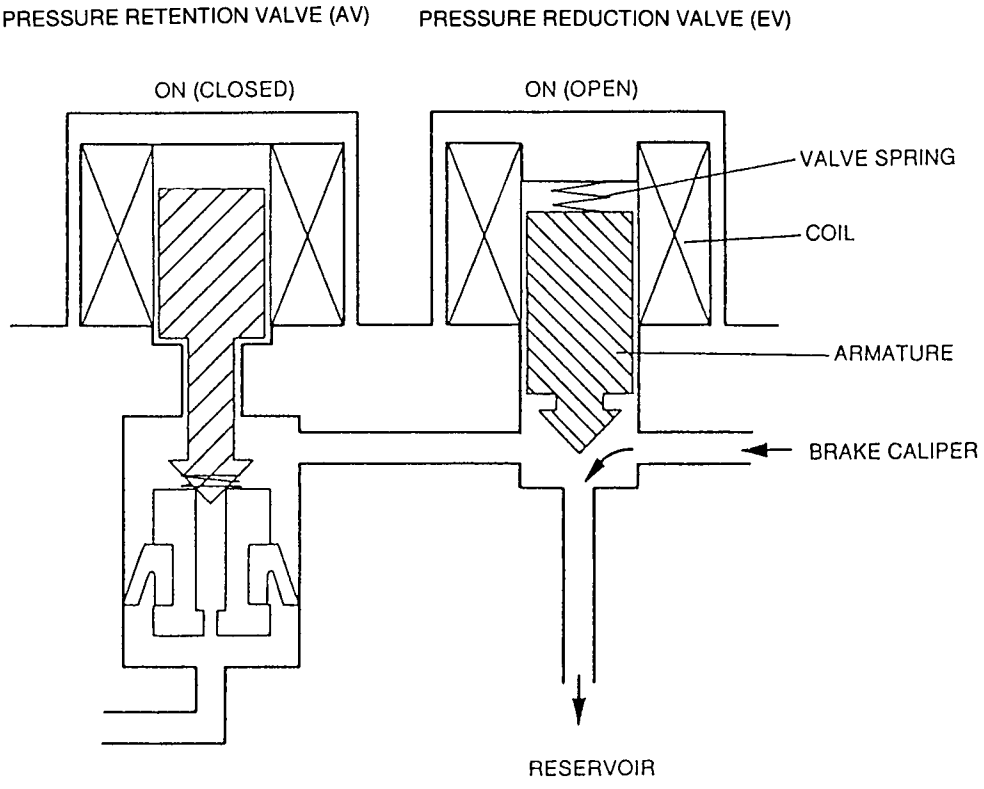
Pressure Retention



When pressure is being retained, current flows to the pressure retention valve coil. The magnetic force generated in the coil by the current enables the armature to overcome the force of the valve spring. As a result, the armature moves and closes the pressure retention valve.

When the pressure retention valve closes, the passage between the master cylinder and the brake calipers is blocked. This maintains the pressure of the brake fluid acting on the brake calipers.

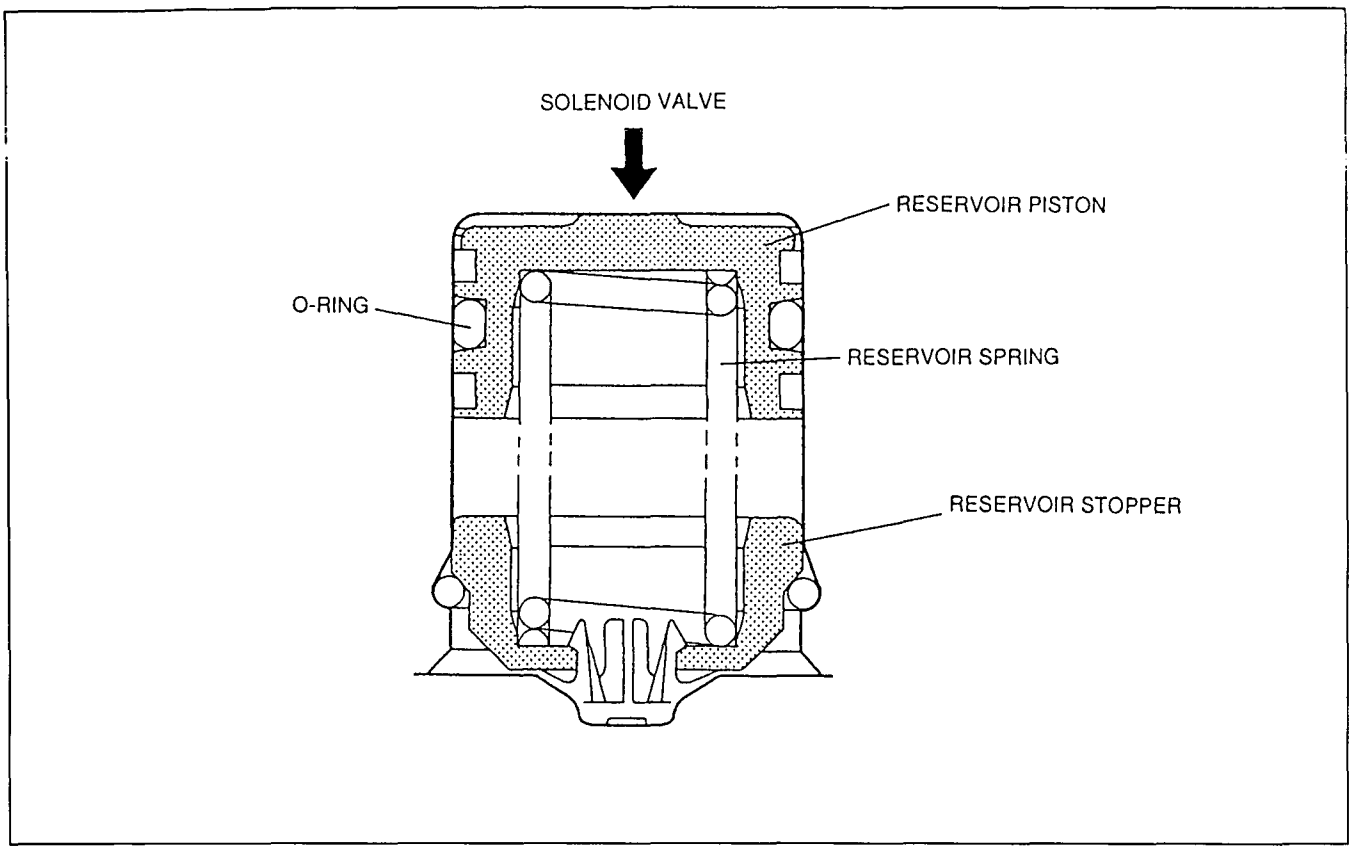
Pressure Reduction



When pressure is being reduced, current flows to the pressure retention valve and the pressure reduction valve. The magnetic force generated in the coil by the current enables the armature to overcome the force of the valve spring. As a result, the armature moves, closing the pressure retention valve and opening the pressure reduction valve.

When the pressure reduction valve opens, the passage between the reservoir and the brake calipers opens. This makes the pressure of the brake fluid on the calipers pass to the reservoir. As a result, pressure is reduced.

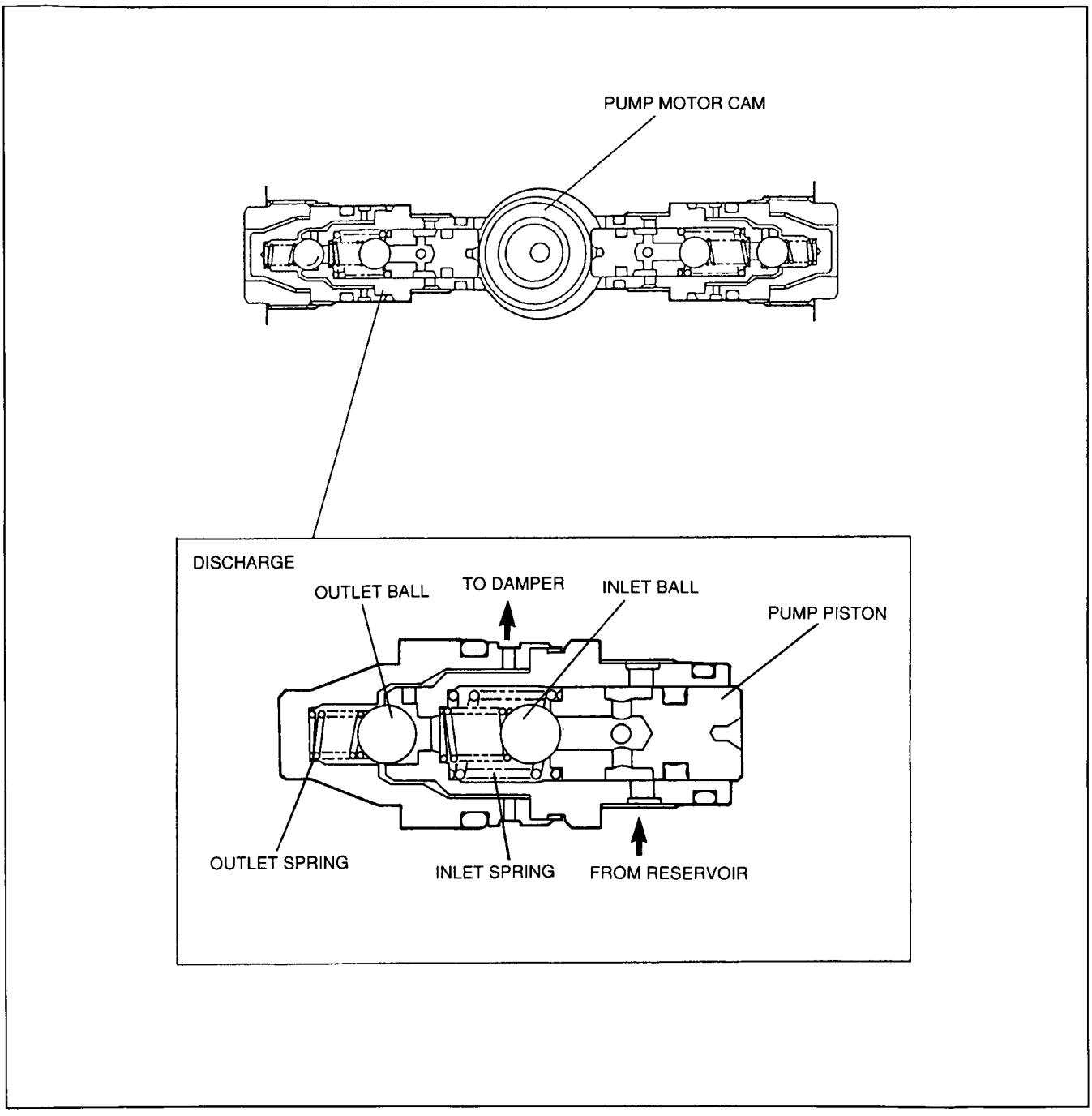
Reservoir



Structure
The two main components of the reservoir are the piston and the spring.
There are two reservoirs within the hydraulic unit.

Function
The reservoirs temporarily store the hydraulic pressure which flows from the brake caliper through the solenoid valve during pressure reduction.

Pump

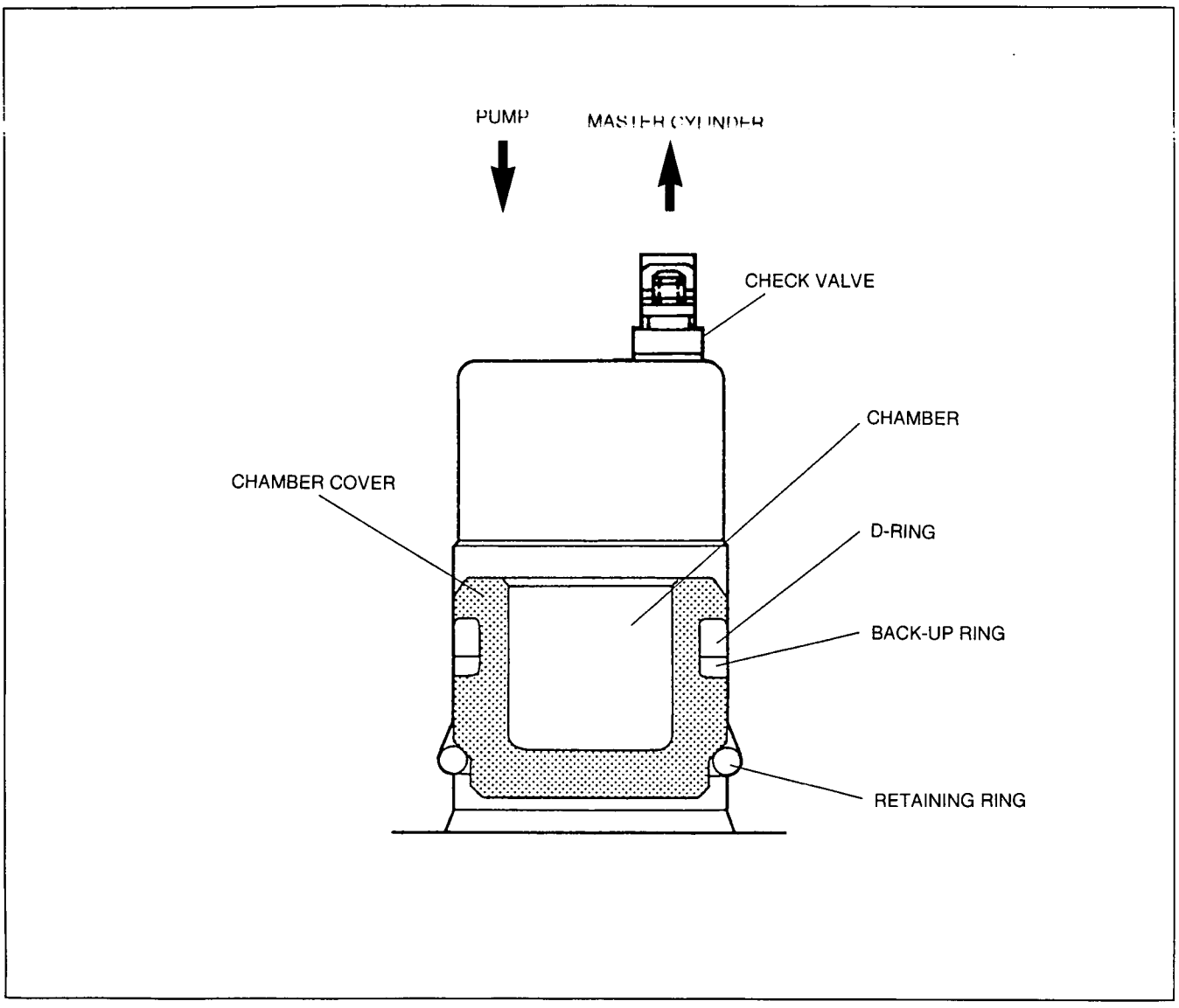


Structure
The main components of the pump are the cam, pump piston, inlet and outlet balls, and springs. The pump piston is driven by the pump motor cam.

Function
Suction
As the pump motor rotates the cam, it releases the pressure against the pump piston and the spring moves the piston toward the right.
As this happens, the volume of the inlet chamber increases and hydraulic pressure flows in from the reservoir, opening the inlet chamber.

Discharge
As the cam presses the pump piston toward the left, the volume of the inlet chamber decreases and the hydraulic pressure in the inlet chamber pushes open the outlet ball and flows to the damper.

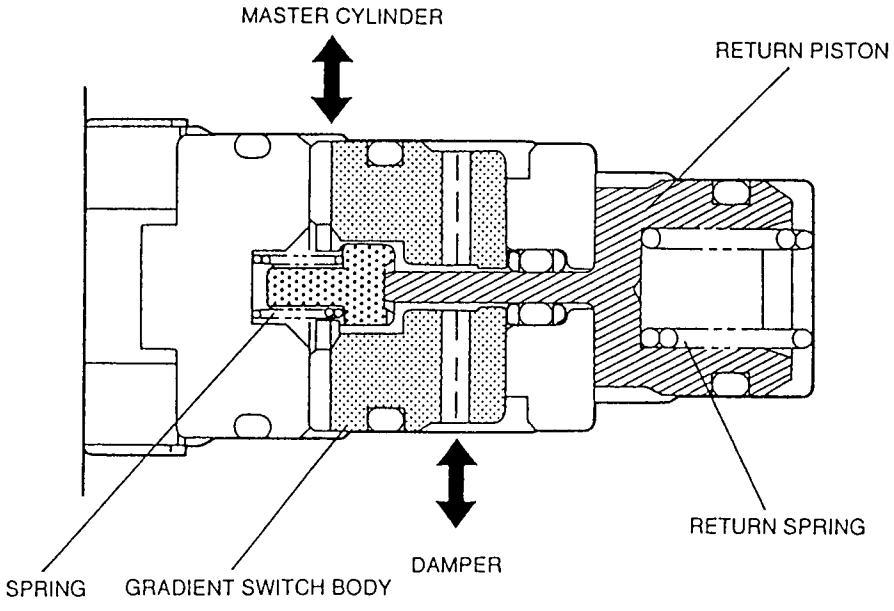
Damper



ber is located between the pump and the master cylinder. The chamber and the check valve ructuation in the brake fluid pressure generated by the pump. This reduces brake pedal kick-

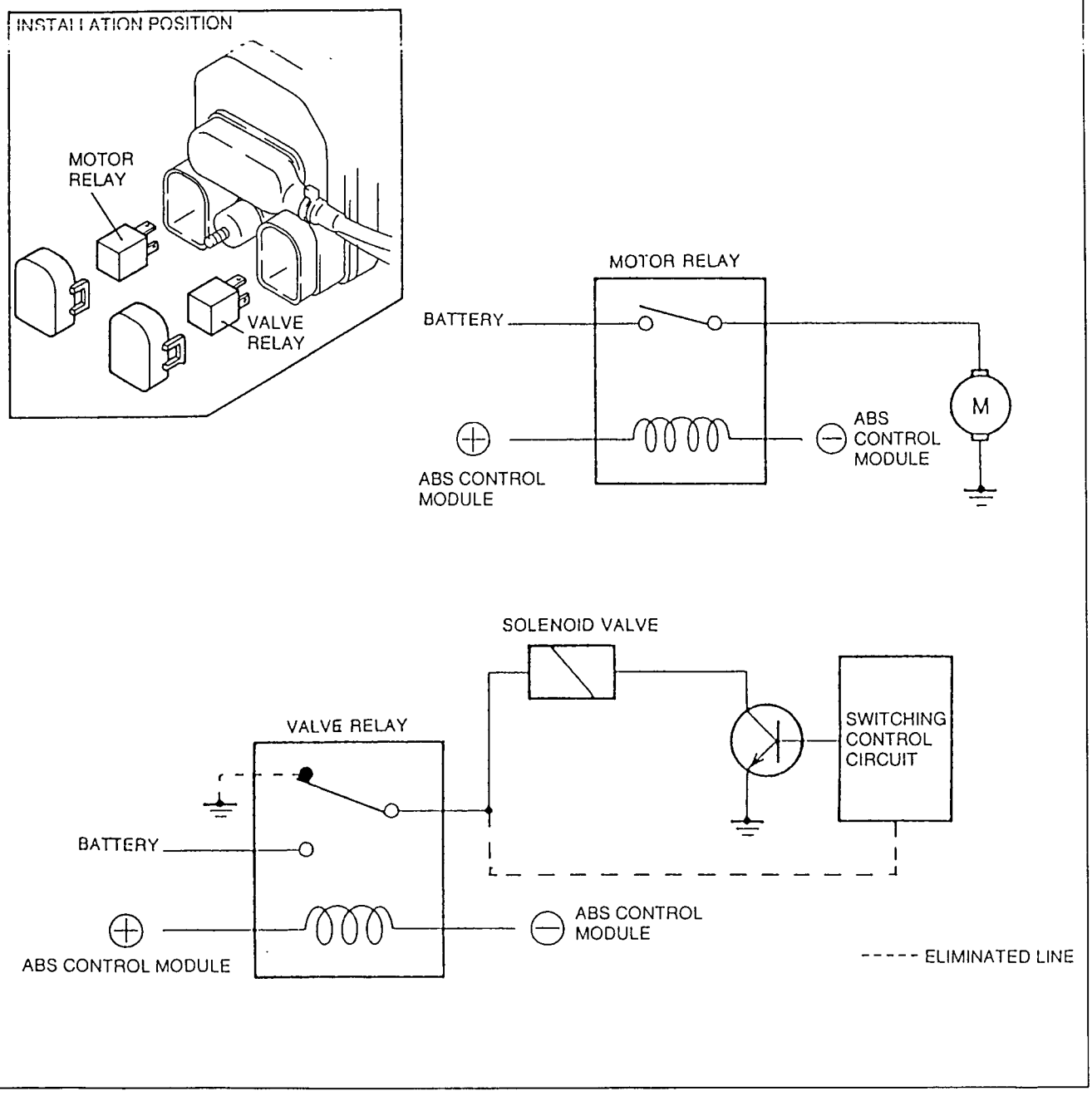
The damp reduce flu back.

Gradient Switch



The gradient switch is located between the damper and the master cylinder. It is actuated by pump discharge pressure during ABS control. When actuated, it reduces the area of the passage between the damper and the master cylinder. This reduces ABS operation noise.

VALVE RELAY AND MOTOR RELAY



Valve Relay

The valve relay is turned ON by drive signals from the ABS control module. When turned ON, it supplies current to the solenoid valves. If a system malfunction is detected, the valve relay is turned OFF. This shuts off the ABS current and returns the system to the normal braking condition.

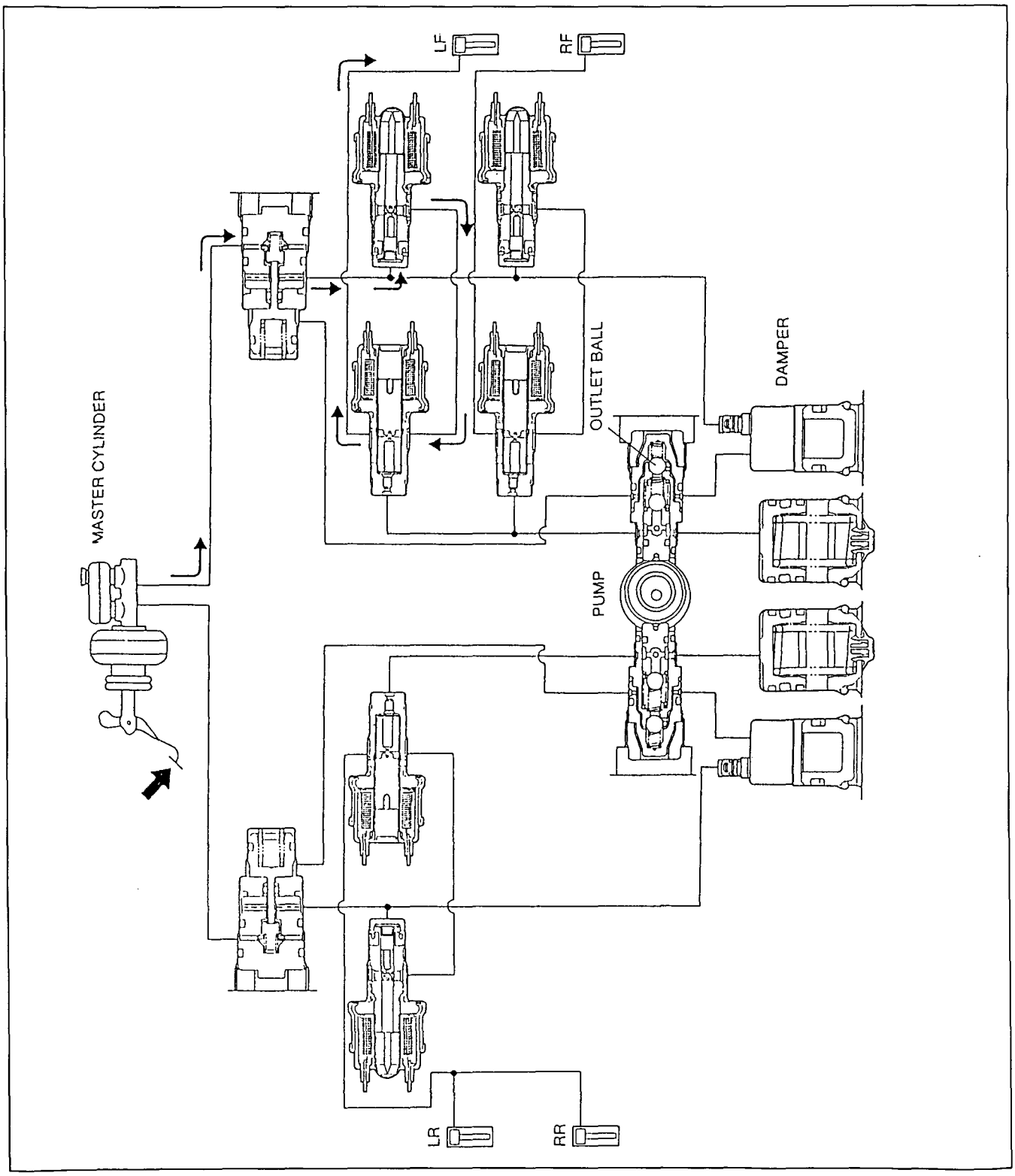
The valve relay is OFF only during self-testing (with the ignition turned ON) and when a system malfunction is detected (with the ignition turned OFF). At all other times, the valve relay is ON.

Motor Relay

The motor relay is turned ON by drive signals from the ABS control module during ABS control. When turned ON, it supplies current to the pump motor.
The motor relay is also turned ON for a short time after the vehicle moves off (at about 6 km/h {3.7 mph}). This is for self-testing.

OPERATION OF ABS

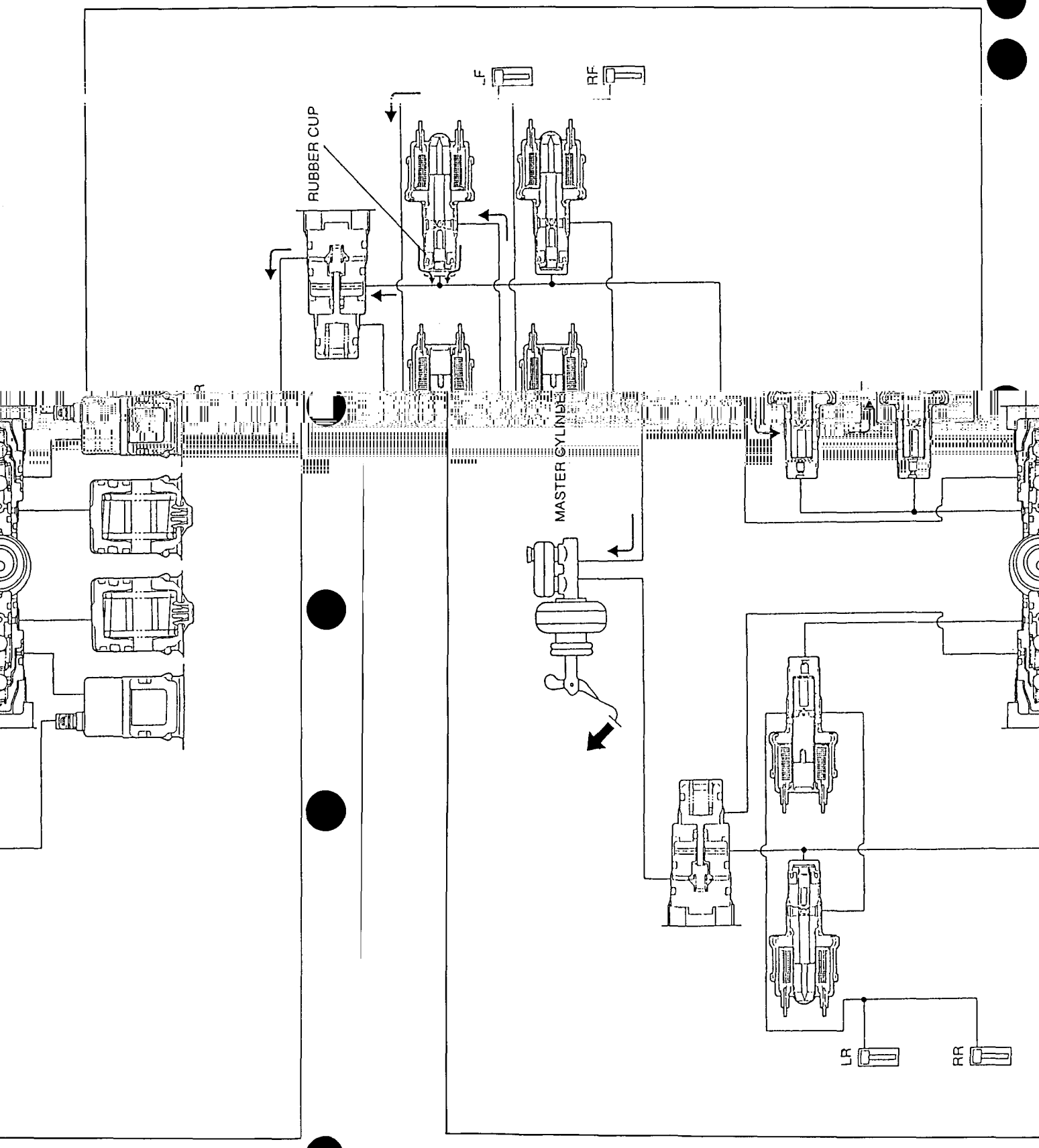
Normal Braking



When the brake pedal is depressed, the hydraulic pressure from the master cylinder flows to the solenoid valve. As there is no current flow to the solenoid valve, during normal braking, the passage from the master cylinder to the brake caliper is open (the same condition as pressure increase), and the brakes are activated.

The hydraulic pressure which has passed through the damper also reaches the pump but is prevented from flowing through it by the outlet ball.

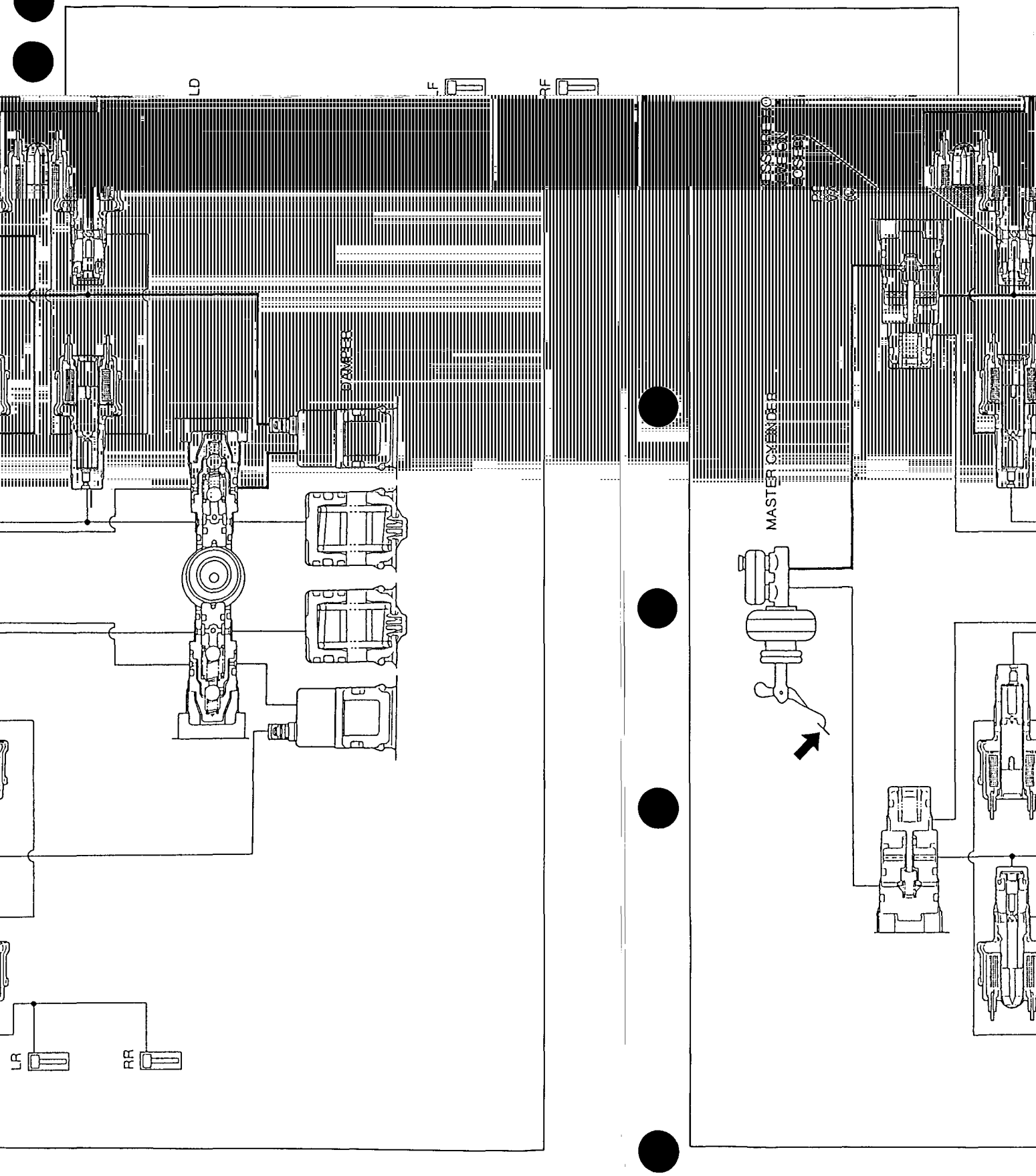
Brakes Released



ulic pressure decreases, and the
ler.
uid presses on this cup, and as a
the master cylinder side.

When the brake pedal is released, the master cylinder's hydrau
hydraulic pressure from the brake caliper returns to the master cylinc
A rubber cup is fitted to the pressure retention valve. The brake fl
result returns smoothly to the master cylinder side.

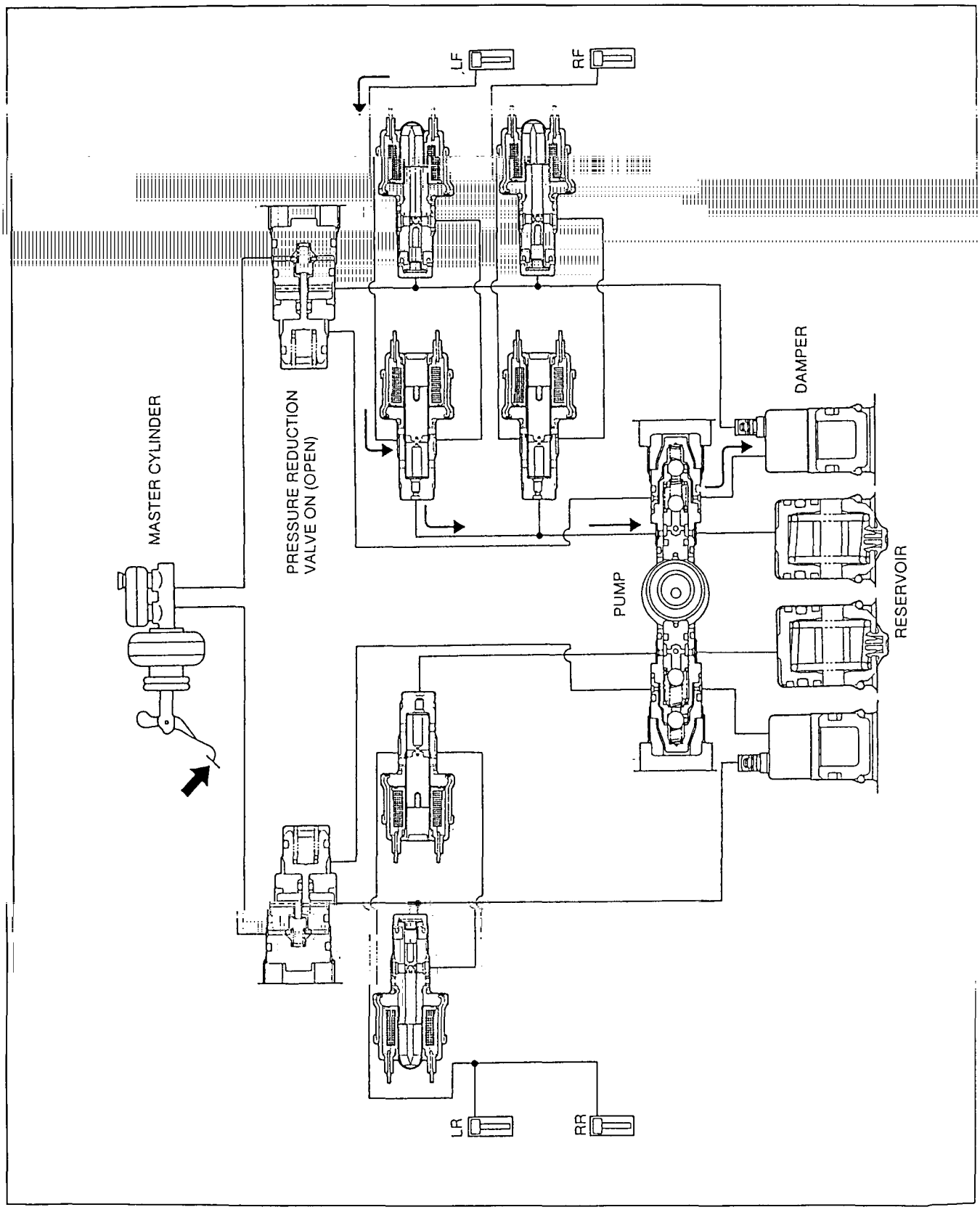
Pressure Retention



ayed from the ABS control module to the solenoid valve, the
e master cylinder reservoir, thereby retaining hydraulic pressure

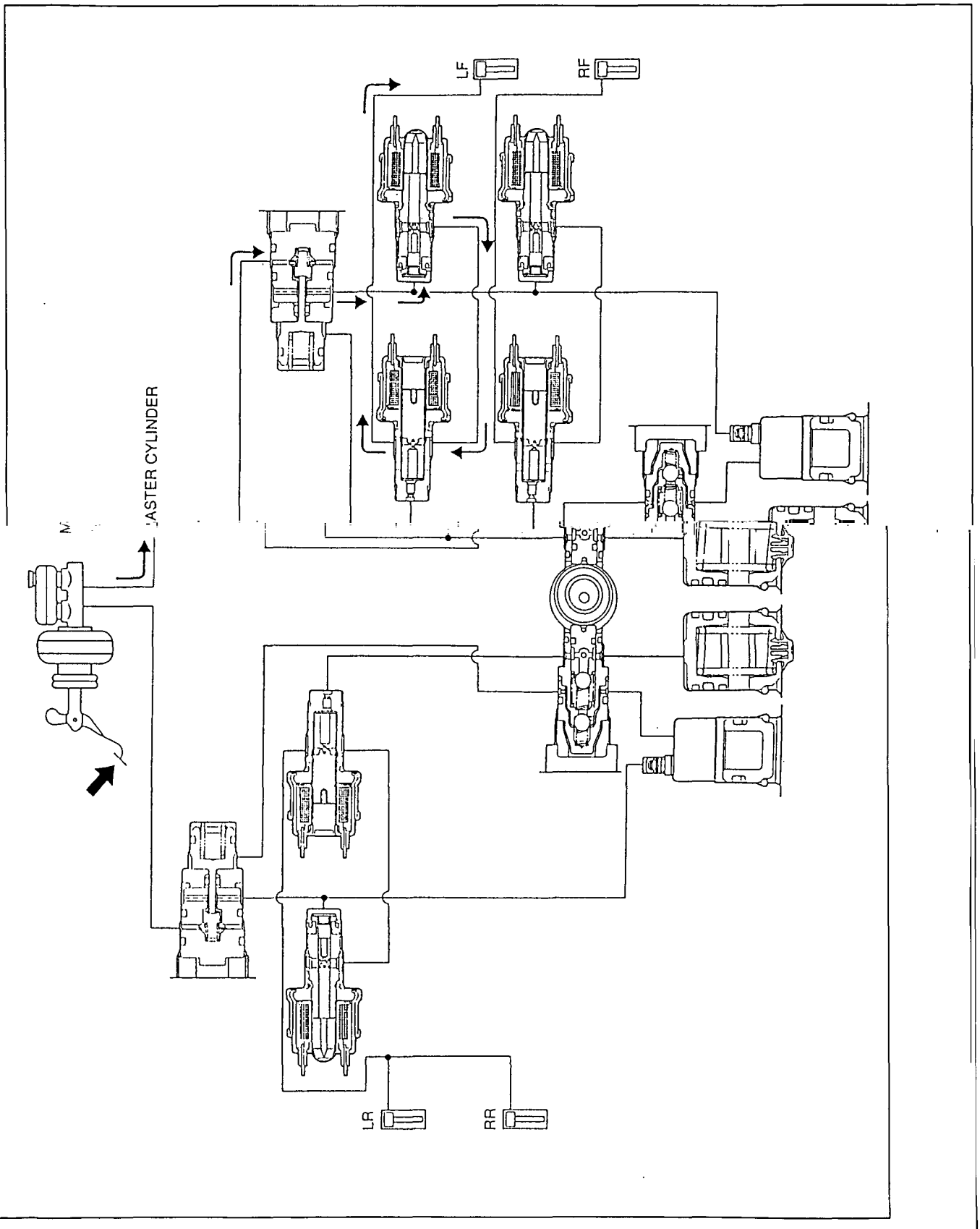
When a pressure retention signal is rel
solenoid valve closes the passage to the
within the brake caliper.

Pressure Reduction



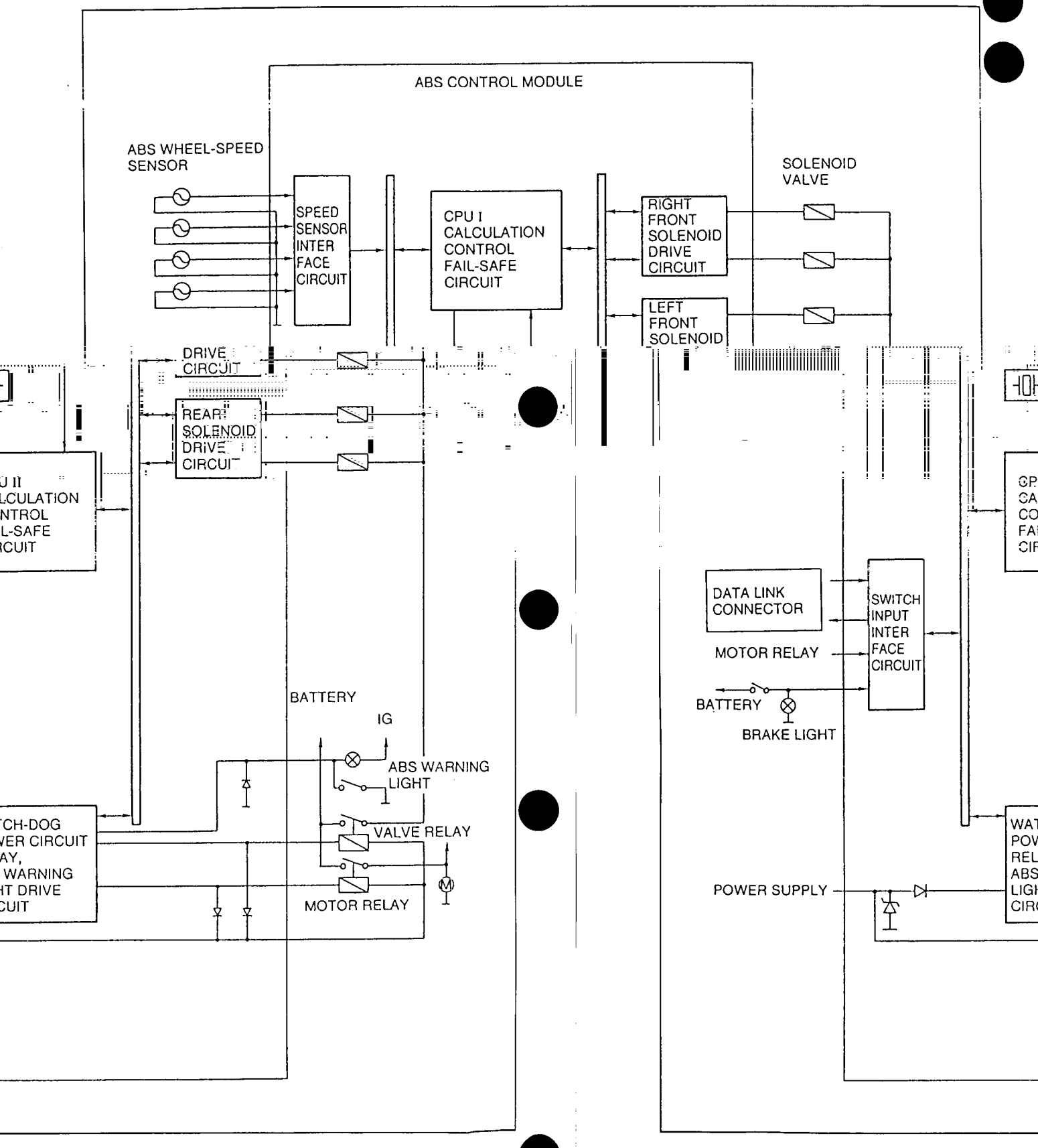
When a pressure reduction signal is relayed from the ABS control module to the solenoid valve, the solenoid valve stops the hydraulic pressure from the master cylinder, and hydraulic pressure is allowed to flow from the brake caliper to the reservoir.
The pressure reduction signal also causes the pump to operate, transferring the hydraulic fluid within the reservoir to the damper.

Pressure Increase



When a pressure increase signal is relayed from the ABS control module, cutting current to the solenoid valve, the solenoid valve opens the passage from the master cylinder to the brake caliper. When this happens, pressurized hydraulic fluid is sent to the brake caliper, thus again raising the hydraulic pressure in the brake caliper.

ABS CONTROL MODULE

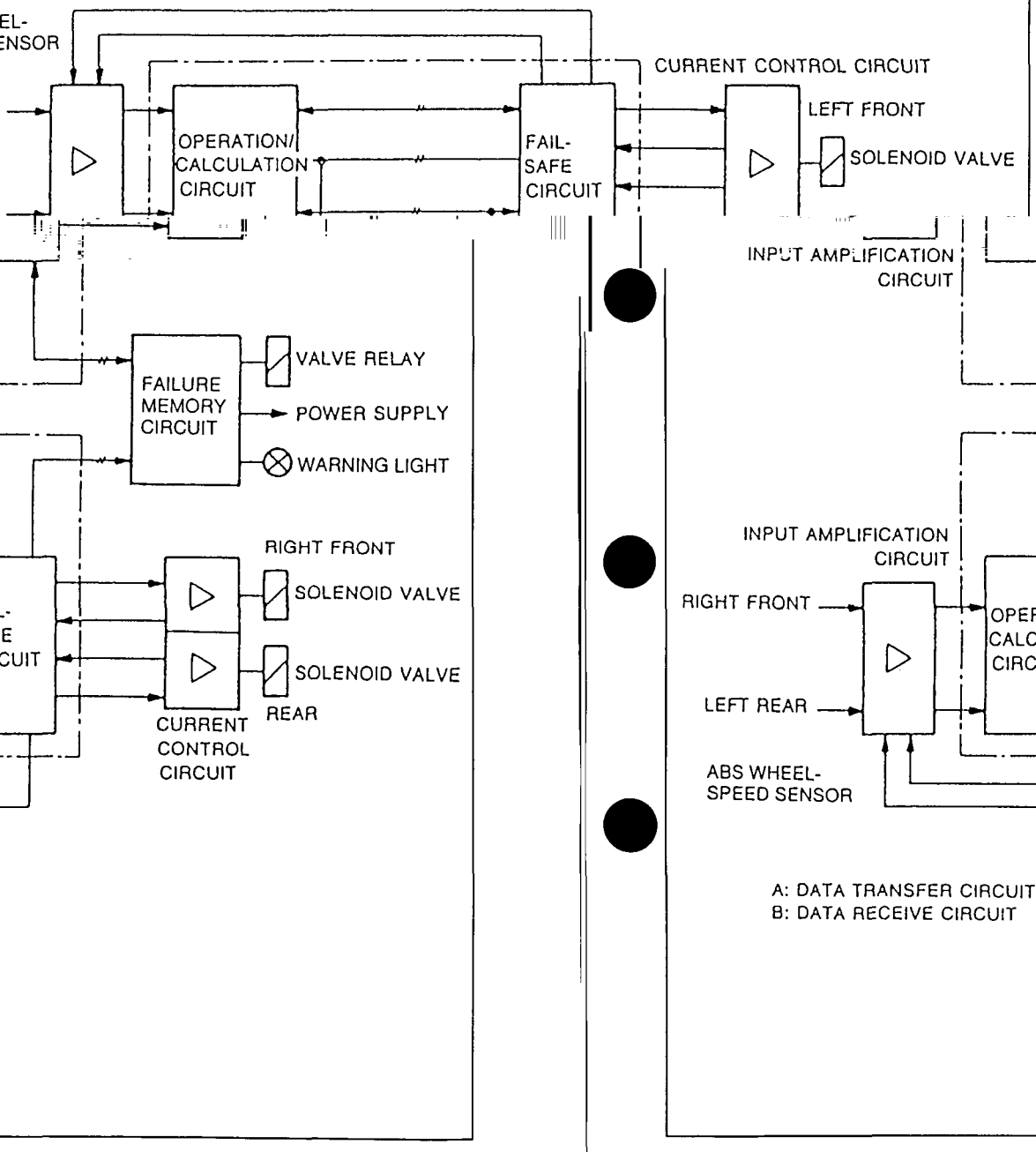


eds and evaluates the situation of the wheels based on the

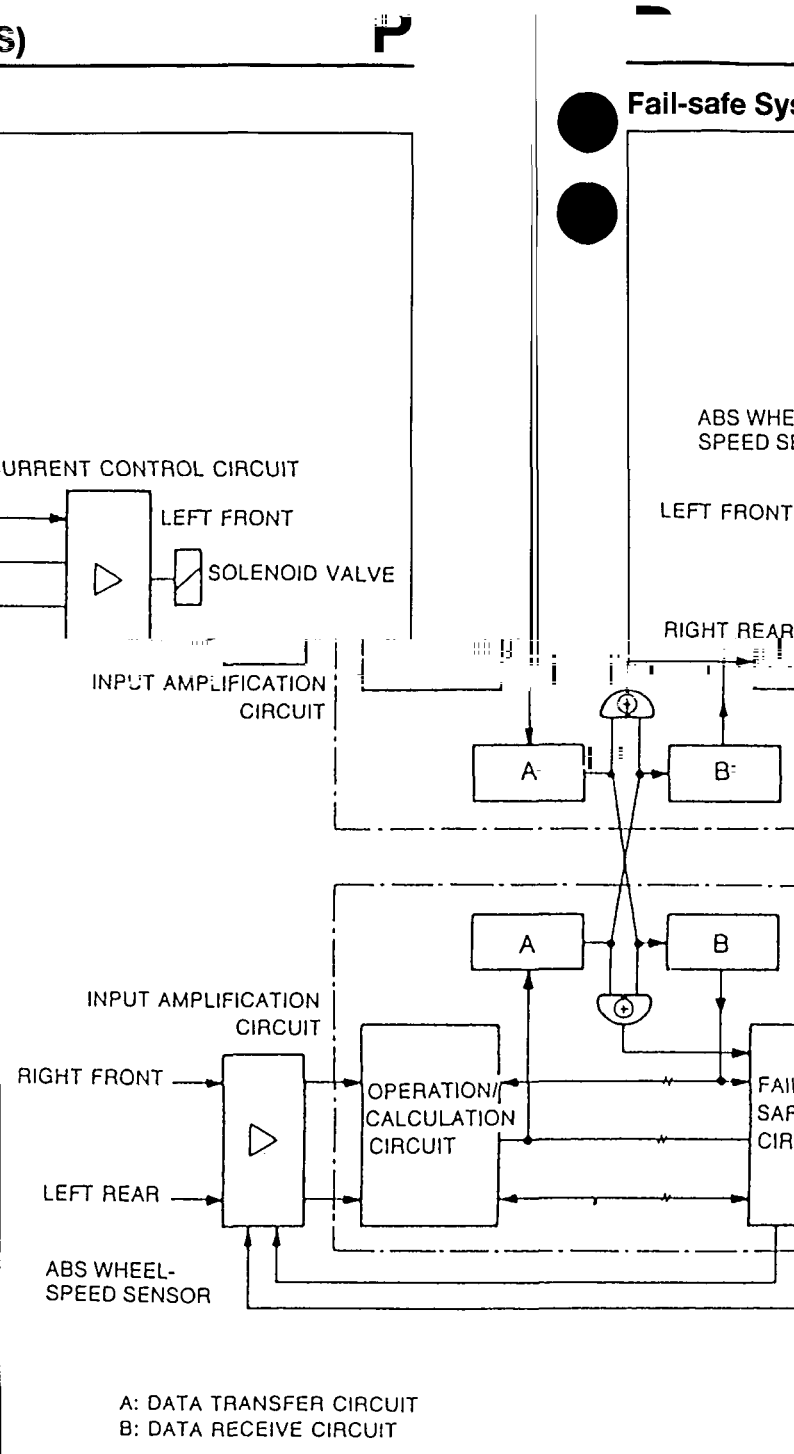
odule, the control module then relays signals to the solenoid
ulic unit to control wheel lock-up.

The ABS control module detects wheel spe
signals from the speed sensors.
Based on the program within the control mo
valves and the pump motor within the hydra

stem



Fail-safe Sys



rform the same function so that they can
e system.
waves and the wheel-speeds are calculat-

cuit is, then pass through the data transfer
afe circuits. The data from each are then
n, signals are input to the failure memory
tem.

The ABS control module incorporates two circuits which per
check each other and check for any abnormal conditions in the
After the voltage from the speed sensors is converted to sine
ed, control signals are output.
These control signals are input to their respective fail-safe circ
and the data receive circuits, and are input to the other fail-s
compared. If this comparison indicates an abnormal conditio
circuit from the fail-safe circuit, thus activating the fail-safe sys

On-board diagnosis

The ABS control module includes an on-board diagnosis function which checks for normal operation of the ABS.

Main self-diagnosis	Diagnosis period			Reaction to malfunction	Result
	A	B	C		
ABS control module	○		○	System shut-down Warning light illuminated	Normal braking
Solenoid valves	○	○	○	System shut-down Warning light illuminated	Normal braking
Pump motor	○	○	○	System shut-down Warning light illuminated	Normal braking
Valve relay	○		○	System shut-down Warning light illuminated	Normal braking
Wheel-speed sensors	○	○	○	System shut-down if failure occurs during normal (no ABS operation) driving. Warning light illuminated	Normal braking
Battery (Power supply)	○		○	System shut-down Warning light illuminated	Normal braking
Brake switch	○		○	Warning light illuminated	Normal control

Remarks

A ..... When ignition is turned ON
B ..... When vehicle moves off after ignition is turned ON
C ..... Driving

***Partial control:**

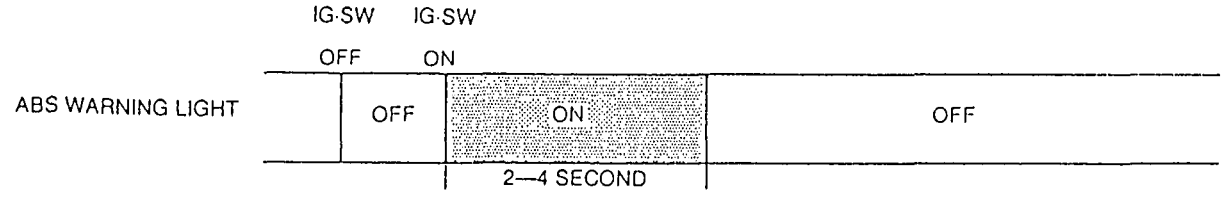
If failure of a sensor occurs during ABS operation, the system is controlled by the remaining sensors until the ABS cycle is completed, then the system is shut-down.

Note

- The pump motor operates briefly after the vehicle speed reaches approx. 6 km/h {3.7 mph} for on-board diagnosis of the pump motor. The operating sound is heard only momentarily.

ABS WARNING LIGHT

ILLUMINATION CYCLE WHEN ABS IS NORMAL

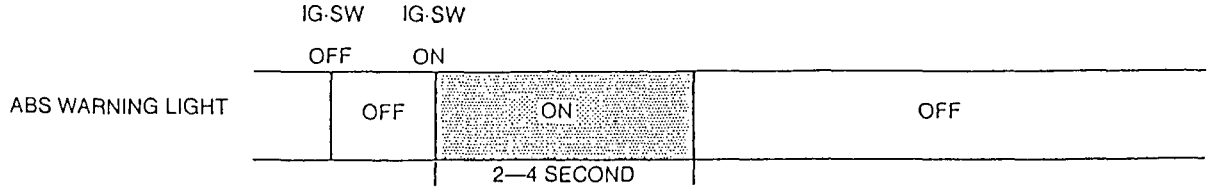


The ABS warning light is located within the instrument cluster.
If the warning light illuminates during driving, it indicates a malfunction in the ABS.

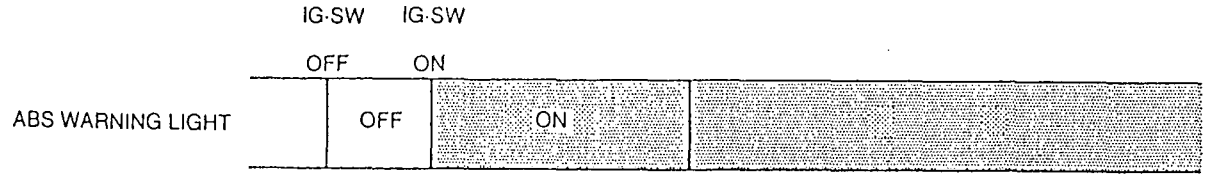
MEMORY FUNCTION AND ON-BOARD DIAGNOSIS

ABS Warning light indication pattern

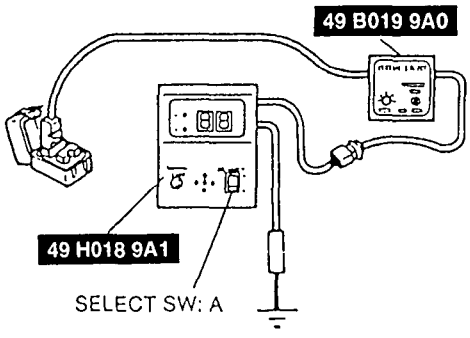
- Normal condition and in case of past failure



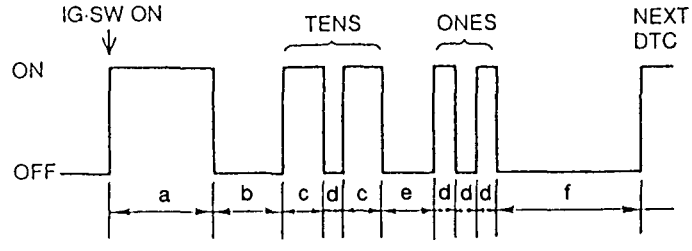
- In case of present failure
  (not excludes failures that only reappear during operation, such as in the ABS sensor rotor)



Diagnostic Test Mode (DTM)



LIGHT OPERATION (DIAGNOSTIC TROUBLE CODE "DTC")
(DTC 22)



a: 2.4 sec. b: 2 sec. c: 1.2 sec.
d: 0.4 sec. e: 1.6 sec. f: 4 sec.

- The ABS CM has a memory function and a mode for indicating the result of on-board diagnosis.
- The DTM is activated by connecting the GND and TBS terminals of the data link connector (DLC).
- The ABS CM has a nonvolatile memory. Diagnostic trouble codes are not erased if the battery is disconnected. The memory should be cleared when servicing is finished.

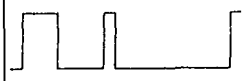
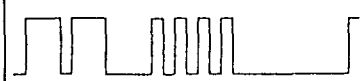
DTM

The **SST** (Self-Diagnosis Checker [49 H018 9A1] with System Selector [49 B019 9A0]) indicate malfunctions by way of DTC numbers and buzzer operation when connected to the DLC.

Note

- After turning the ignition switch ON, the warning light illuminates for about three seconds, goes OFF for about two seconds, and then flashes if there is a malfunction.
- The ABS warning light flashes when the SST outputs the DTC(s).

Diagnostic Trouble Code (DTC)

No*1	ABS Warning light indication pattern*2	Diagnosis system component		Condition	Memory
05		Brake switch		When open circuit detected in brake switch	○
11		FR	ABS wheel-speed sensor ABS sensor rotor	When open circuit or short detected Wheel speed signal is out of specification	○
12		FL			
13		RR			
14		RL			
15		One of the four wheel-speed sensors		When open circuit or short detected Wheel speed signal is out of specification	○
22		FR (AV)	Solenoid valve	Solenoid monitor signal does not track in response to solenoid ON/OFF command	○
23		FR (EV)			
24		FL (AV)			
25		FL (EV)			
26		R (AV)			
27		R (EV)			
51		Valve relay		Four or more valve systems are detected to be faulty among six systems	○
53		Motor, motor relay		Motor monitor signal does not track in response to motor relay ON/OFF command	○
61		ABS control module		The on-board diagnostic program detects a malfunction	○

No*1	ABS Warning light indication pattern*2	Diagnosis system component	Condition	Memory
—*3	—	ABS control module	The on-board diagnostic program or monitor circuits detect microcomputer malfunction	—
		Battery source voltage	Detects low voltage by IG monitor	—

*1 DTC
*2 ABS warning light displays the DTC when past or present failure exists.
*3 Possible failure when the warning light illuminates, but the DTC is not displayed

SUPPLEMENTAL SERVICE INFORMATION

The following changes and/or additions have made since publication of the Mazda MX-5 ABS Workshop Manual Supplement (1246-10-90G).

Antilock brake system (ABS)
- Troubleshooting procedure modified

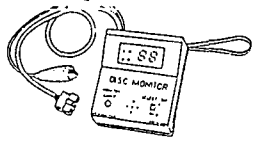
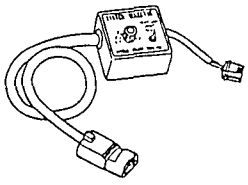
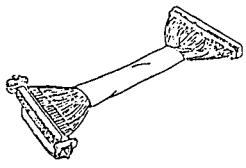
ABS hydraulic unit
- Inspection (on-vehicle) procedure modified
- Removal / Installation procedure modified

ABS control module
- Removal / Installation procedure modified

ABS relay
- Removal / Inspection / Installation procedure modified

ANTILOCK BRAKE SYSTEM (ABS)

PREPARATION
SST

49 0259 770B Wrench, flare nut 	For removal and installation of brake pipe	49 H018 9A1 Self-Diagnosis Checker 	For diagnosis of ABS
49 B019 9A0 System Selector 	For diagnosis of ABS	49 F066 002 Harness adapter 	For Inspection of wiring harness

TROUBLESHOOTING
Troubleshooting Notes

The ABS is composed of electrical components, mechanical components (ABS hydraulic unit), and the components of the standard system.

Fundamentally, malfunction of the ABS electrical or mechanical components is ju
board diagnostic function within the ABS control module. Malfunctions are indicate
light in the instrument panel. The technicians can locate a malfunction by switching t
diagnostic test mode.

The on-board diagnostic system must be used when diagnosis of the ABS.

Precaution

Conditions that are not malfunctions

1. Vibrations can sometimes be felt in the steering wheel, body, and/or brake panel v
   functioning; such vibrations are simply an indication that the ABS is functioning.
2. When (while the vehicle is jacked up, stuck on a chassis roller) the rear whe
   20 seconds or more, the ABS warning light may illuminate. In this condition,
   not illuminate a second time when ignition switch is turned OFF then back ON.
   trouble code 12 (front left wheel-speed sensor) may be memorized as a past f
   do the following procedures.

   (1) Activate the on-board diagnostic system and check for diagnostic trouble c
   P–36.)
   (2) If code 12 only is memorized, erase it. (Refer to P–38.)
   If code 12 and other codes are memorized, check for the causes by refer
   diagnostic chart for the other codes. (Refer to page P–37.)

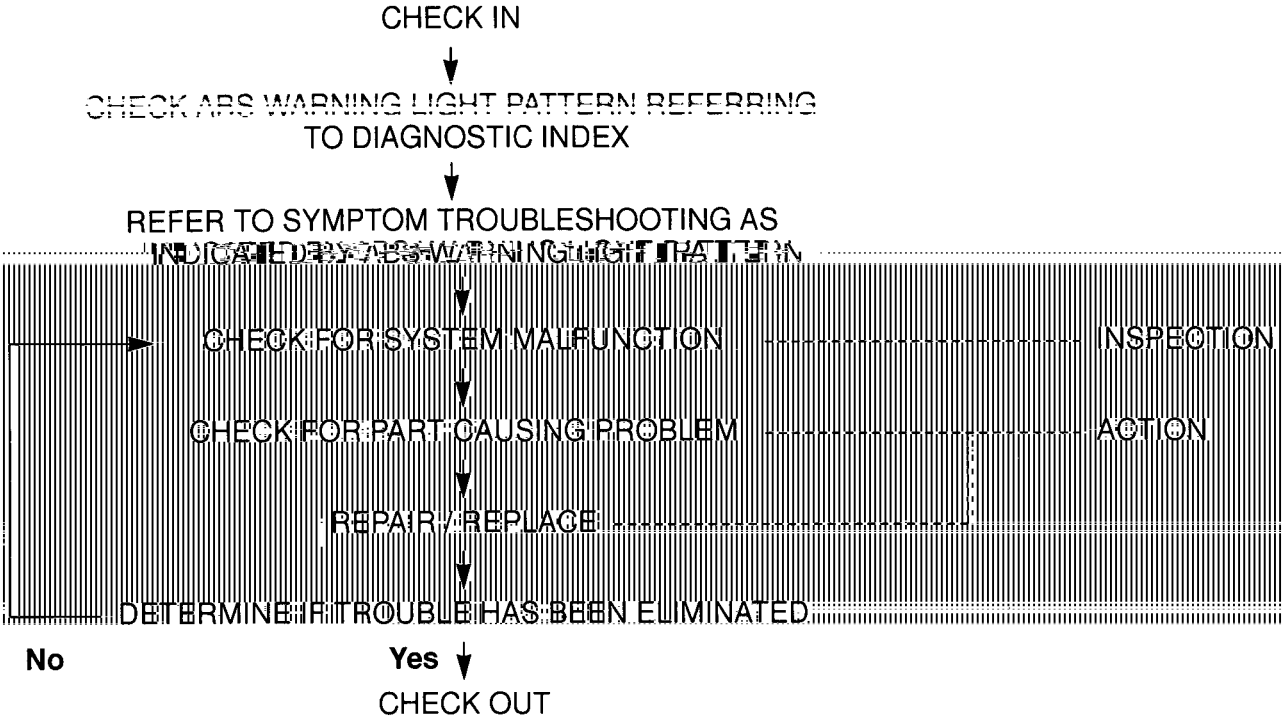
3. When battery voltage is insufficient, the warning light will illuminate and the ABS
   condition, at the moment battery voltage increases to the specified level, the wa
   and the system will return to normal control. There will also be no diagnostic
   made to the control module memory.

Diagnostic Chart

	Symptom \ Cause	ABS wheel-speed sensor	Brake switch harness	ABS hydraulic unit: Valve relay	ABS hydraulic unit: Motor relay	ABS hydraulic unit: Solenoid valve	ABS hydraulic unit: ABS motor	ABS warning light	Data link connector	ABS control module	Mechanical system	Power supply
1	ABS warning light not illuminated when ignition switch turned ON							○				
2	ABS warning light remains ON	○	○	○	○	○	○	○		○		○
3	ABS warning light flashes with vehicle stopped								○			○
4	ABS warning light illuminates during driving till IG SW turned OFF	○	○	○	○	○	○			○		
5	ABS warning light illuminates/goes off with vehicle stopped and during driving							○				○
6	ABS warning light indicates normal, however, ABS does not operate correctly										○	

Using This Section

Work flow



Diagnostic index

TROUBLESHOOTING ITEMS		DESCRIPTION	PAGE
No.	TROUBLE		
1	ABS warning light not illuminated when IG SW turned ON	—	below
2	ABS warning light remains ON	—	P–34
3	[illegible] stopped	ABS warning light goes off when vehicle started	P–35
		If IG SW turned ON again, ABS warning light goes off after a few seconds illumination	P–35
		—	

No.:
Each troubleshooting item is assigned a number.

TROUBLESHOOTING ITEM:
There are 6 troubleshooting items. Choose the item indicated by the ABS warning light.

DESCRIPTION:
Describes details of the symptom.

PAGE:
Shows the reference page.

Symptom troubleshooting

1	ABS WARNING LIGHT NOT ILLUMINATED WHEN IGNITION SWITCH TURNED ON		
DESCRIPTION		—	
[TROUBLESHOOTING HINTS] • If other warning indicators do not illuminate, METER 15A fuse may be burnt. • Failed warning light or open in related wiring harness.			
STEP	INSPECTION		ACTION
1	Is METER 15 A fuse OK?	Yes	Go to next step
		No	Replace METER 15 A fuse
2	Is harness of ABS warning light normal?	Yes	Inspect ABS warning light bulb and repair or replace if necessary
		No	• Inspect harness between ABS CM and ABS relay • Inspect harness between instrument panel and ABS CM • Inspect harness between instrument panel and ABS rel • Inspect ABS warning light bulb rect as necessary

DESCRIPTION:
Further describes the system. Confirm that the chart addresses the actual symptom before beginning troubleshooting.

TROUBLESHOOTING HINTS:
This describes the possible point of malfunction.

STEP:
This shows the order of troubleshooting. Proceed with troubleshooting as indicated.

INSPECTION:
This describes an inspection procedure to quickly determine where the faulty parts are. If a detailed procedure is necessary to perform the INSPECTION, refer to the page specified by the "☞" mark.

ACTION:
As a result of the "Yes/No" answers given under INSPECTION, this section recommends the appropriate action to take. The "☞" mark indicates the relevant reference page.

Diagnosis Index

TROUBLESHOOTING ITEMS		DESCRIPTION	PAGE
No.	TROUBLE		
1	ABS warning light not illuminated when IG SW turned ON	—	below
2	ABS warning light remains ON	—	P–34
3	ABS warning light flashes with vehicle stopped	ABS warning light goes off when vehicle started	P–35
4	ABS warning light illuminates during driving till IG SW turned OFF	If IG SW turned ON again, ABS warning light goes off after a few seconds illumination	P–35
5	ABS warning light illuminates/goes off with vehicle stopped and during driving	—	P–36
6	ABS warning light indicates normal, however ABS does not operates correctly	—	P–36

Symptom Troubleshooting

1	ABS WARNING LIGHT NOT ILLUMINATED WHEN IGNITION SWITCH TURNED ON		
DESCRIPTION	—		
[TROUBLESHOOTING HINTS] • Malfunction of meter • Failed warning light or open in related wiring harness			
STEP	INSPECTION		ACTION
1	With IG ON, do other indicators illuminate?	Yes	Check if failure(s) is memorized Note and check it later if necessary Go to next step
		No	Inspect meter
2	Disconnect ABS CM connector. Turn IG SW ON. Does ABS warning light illuminate?	Yes	Go to next step
		No	Go to step 6

Caution

- **Disconnecting and connecting the ABS CM connector must be done with the ignition switch OFF.**

STEP	INSPECTION		ACTION
3	Connect ABS CM connector. Turn IG SW ON. Does ABS warning light illuminate?	Yes	There was a temporarily poor contact in wiring harness or connector
		No	Go to next step
4	Is terminal AD of harness connector deformed?	Yes	Replace harness connector
		No	Replace ABS CM ☞ page P–49
5	With ABS CM connector disconnected, ground terminal AD of harness connector. Does ABS warning light illuminate?	Yes	Go to next step
		No	Go to step 7
6	With ABS CM connector disconnected, is there continuity between following terminals?: AB-body GND, AC-body GND, AM-body GND	Yes	Replace harness connector
		No	Repair harness
7	Is ABS warning light bulb burnt?	Yes	Replace bulb
		No	Go to next step
8	Is there continuity between AD of harness connector and 1K (C-01 connector) of meter?	Yes	Inspect meter
		No	Repair harness

Caution

- **Disconnecting and connecting the ABS CM connector must be done with the ignition switch OFF.**
- **When attaching the tester lead to the terminal of the harness connector, the SST must be used. (Refer to page P–50.)**
- **After above procedures have been completed, recheck for DTC and repair if necessary.**

Note

- If the above symptom has appeared in the past and it is normal at present, the possible cause is a temporarily poor contact in the wiring harness or connector. The ABS CM is normal.

2	ABS WARNING LIGHT REMAINS ON
DESCRIPTION	—

[TROUBLESHOOTING HINTS]
- Low battery voltage at ABS CM
- Malfunction of ABS warning light harness (short to ground)
- Malfunction of meter
- ABS CM detects a failure

STEP	INSPECTION		ACTION
1	Is battery positive voltage as specified?	Yes	Check if failure(s) is memorized and note it if necessary Go to next step
		No	Charge or replace if necessary
2	Verify that ABS CM connector is correctly connected. Turn IG SW ON. Does ABS warning light go off?	Yes	There was a temporarily poor contact in wiring harness or connector
		No	Go to next step
3	Disconnect ABS CM connector. Is voltage between following terminals of harness connector at B+?: A (voltage supply)–AM (GND), A–AB (GND), A–AC (GND)	Yes	Go to next step
		No	Repair voltage supply harness
4	Are there any codes in step 1?	Yes	Follow diagnostic chart ☞ **page P–40**
		No	Go to next step
5	Disconnect ABS CM connector. Connect the **SST** (49 F066 022) and turn IG SW ON. Does ABS warning light go off?	Yes	Replace ABS CM ☞ **page P–49**
		No	Repair shirt of ABS warning light drive harness or meter

Caution
- **Disconnecting and connecting the ABS CM connector must be done with the ignition switch OFF.**
- **When attaching the tester lead to the terminal of the harness connector, the SST must be used. (Refer to page P–50.)**

Note
- If voltage between terminal A (voltage supply) and GND at ABS CM is below approx. 10 V, the ABS warning light will illuminate.

3	ABS WARNING LIGHT FLASHES WITH VEHICLE STOPPED		
DESCRIPTION	**ABS warning light goes off when vehicle started**		
[TROUBLESHOOTING HINTS] • Terminal TBS at data link connector grounded • Low battery voltage at ABS CM			
STEP	**INSPECTION**		**ACTION**
1	Is battery positive voltage as specified?	Yes	Go to next step
		No	Charge or replace if necessary
2	Is there jumper wire between TBS and GND at data link connector?	Yes	Remove jumper wire
		No	Go to next step
3	Disconnect ABS CM connector. Is there continuity between terminal P of harness connector and GND?	Yes	Repair TBS harness
		No	Replace ABS CM ☞ page P–49

Caution
- **Disconnecting and connecting the ABS CM connector must be done with the ignition switch OFF.**
- **When attaching the tester lead to the terminal of the harness connector, the SST must be used. (Refer to page P–50.)**

4	ABS WARNING LIGHT ILLUMINATES DURING DRIVING TILL IG SW TURNED OFF		
DESCRIPTION	**If IG SW is turned ON again, ABS warning light goes off after a few seconds illumination**		
[TROUBLESHOOTING HINTS]			
STEP	**INSPECTION**		**ACTION**
1	Activate OBD system and check for DTC. Are there any?	Yes	Read DTC and follow diagnostic chart ☞page P–10
		No	Go to next step
2	Verify that ABS CM connector is correctly connected. Drive vehicle and recheck for symptom. Does it remain?	Yes	Replace ABS CM ☞
		No	There was a temporarily poor contact in wiring harness or connector

5	ABS WARNING LIGHT ILLUMINATES/GOES OFF WITH VEHICLE STOPPED AND DURING DRIVING

—

G HINTS]
e voltage at ABS CM
nd harness
warning light harness (short to ground)
er

INSPECTION		ACTION
ure(s) is memorized. eck it later if necessary. ABS CM connector. Turn IG varning light illuminate?	Yes	Go to next step
	No	Repair ABS warning light harness or meter
ABS CM connector. Is volt- n following terminals of har- ctor at B+?: upply)–AM (GND),)), A–AC (GND)	Yes	Go to next step
	No	Repair voltage supply or ground harness
S CM connector. e and recheck for symptom. ain?	Yes	Replace ABS CM ☞ page P–49
	No	There was a temporarily poor contact in wiring harness or connector

g and connecting the ABS CM connector must be done with the ignition switch

ing the tester lead to the terminal of the harness connector, the SST must be to page P–50.)

ween terminal A (voltage supply) and GND at ABS CM is below approx. 10 V, the ight will illuminate.

G LIGHT INDICATES NORMAL, HOWEVER, ABS DOES NOT OPERATE CORRECTLY

—

NG HINTS]
chanical system

INSPECTION		ACTION
BD system and check for ny?	Yes	Read DTC and follow diagnostic chart ☞ page P–40
	No	Inspect mechanical system

DESCRIPTION

[TROUBLESHOOTIN
- Low battery positiv
- Malfunction of grou
- Malfunction of ABS
- Malfunction of met

STEP	
1	Check if fail Note and ch Disconnect SW ON. Does ABS w
2	Disconnect age betwee ness conne A (voltage s A–AB (GND
3	Connect AB Drive vehicl Does it rem

Caution
- **Disconnectin OFF.**
- **When attach used. (Refer**

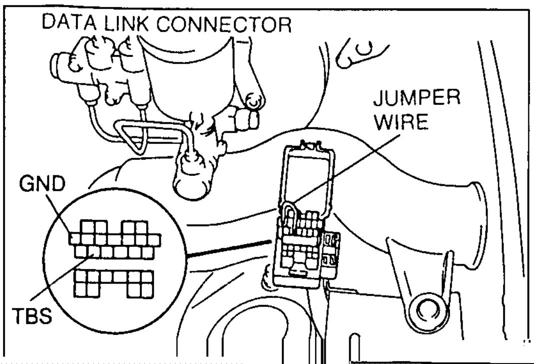
Note
- If voltage bet ABS warning l

6	ABS WARNIN

DESCRIPTION

[TROUBLESHOOTIN
- Malfunction of me

STEP	
1	Activate OB DTC. Are there a

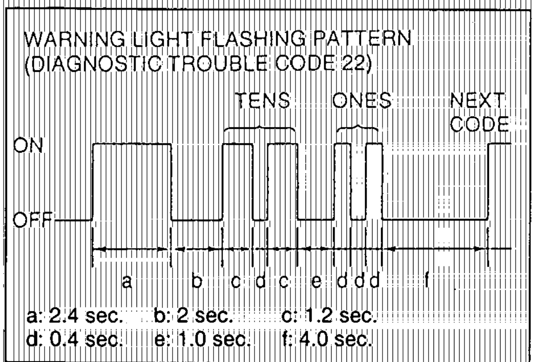


ON-BOARD DIAGNOSTIC FUNCTION
Diagnostic Trouble Code
Inspection using ABS warning light

1. Connect the TBS terminal to GND at the data link connector by using a jumper wire.
2. Turn the ignition switch ON.

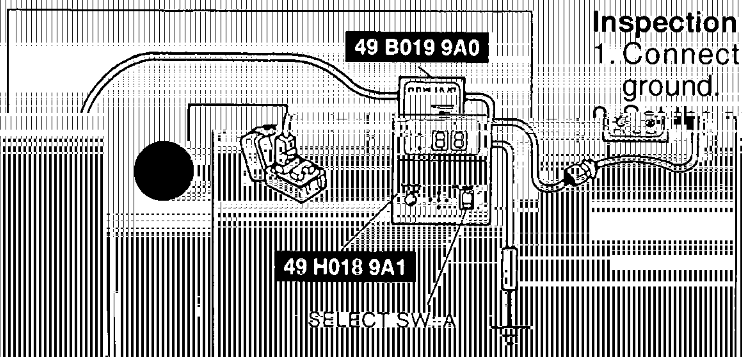
Note
- If the ignition switch is turned ON before connecting the terminals the diagnostic test mode will not start.

three seconds, it
s).
and check for the
stic chart (page
ode(s).



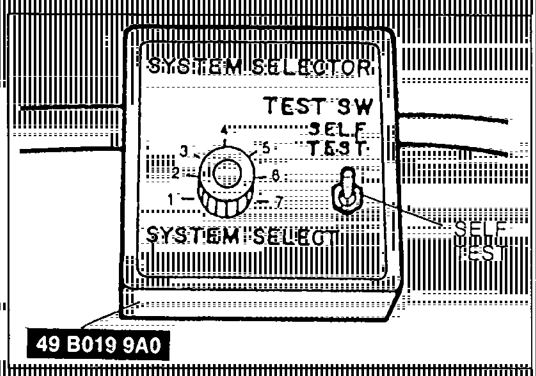
3. After the warning light illuminates for ... will indicate a diagnostic trouble code(
4. Read and note the code number(s) ... causes by referring to the Diagno... P–40).
5. After servicing is finished, erase the co... (Refer to page P–38.)

connector and a
position A.



Inspection using SST
1. Connect the **SSTs** to the data link ... ground.
2. Set the ... select switch t...

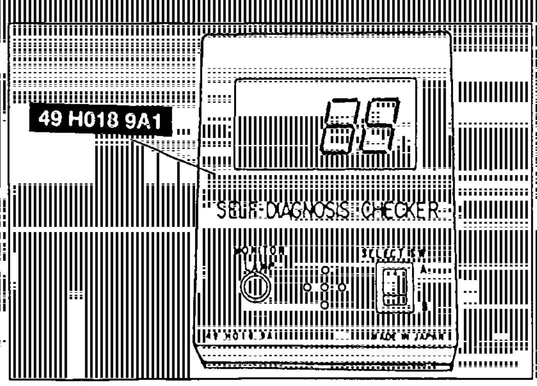
tor to position 6 and SELF TEST
ion ON.
n is turned ON before connecting
ostic test mode will not start.
es on the digital display and the
prox. **3 sec.** after turning the igni-
, check the power supply circuit
e buzzer continues for more than
hort circuit between terminal TBS
the ABS control module if neces-
s 3 and 4 again.
ers and check for the causes by
ostic Chart (page P–40).
hed, erase the code(s).

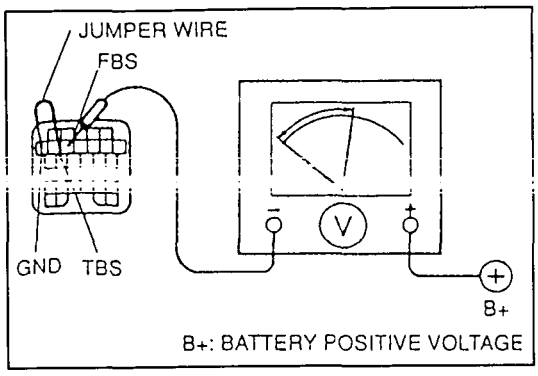


3. Set the System Selec... as shown.
4. Turn the ignition switc...

Note
- If the ignition switc... the **SSTs** the diagno...

5. Verify that "88" flash... buzzer sounds for app... tion switch ON.
6. If "88" does not flash... and the ground wiring...
7. If "88" flashes and th... **20 sec.**, check for a s... and ground. Replace... sary and perform step...
8. Note any code numb... referring to the Diagno...
9. After servicing is finish... (Refer to page P–38.)



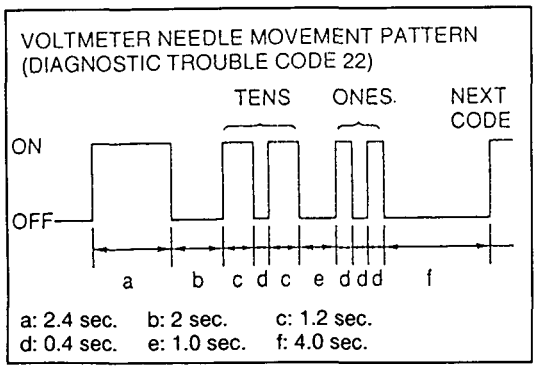


Inspection using voltmeter

1. Connect the TBS terminal to GND at the data link connector by using a jumper wire.
2. Connect an analog voltmeter as shown.
3. Turn the ignition switch ON.

Note

- If the ignition switch is turned ON before connecting the terminals, the diagnostic test mode will not start.



4. Read and note the code number(s) and check for the causes by referring to the Diagnostic chart (page P–40).
5. After servicing is finished, erase the code(s). (Refer to below.)

Memory cancel

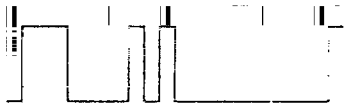
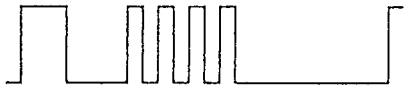
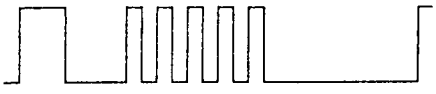
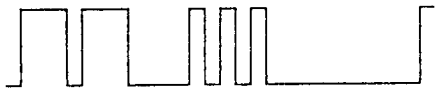
The ABS control module has a nonvolatile memory. Diagnostic trouble codes are not erased if the battery is disconnected. The memory should be cleared when servicing is finished.
Diagnostic trouble codes memorized in the ABS control module are canceled by performing the following steps.

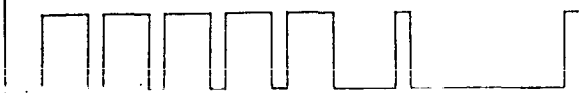
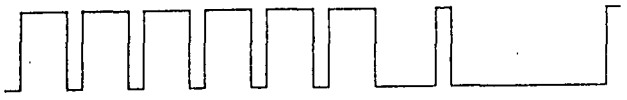
1. Connect the TBS terminal to GND at the data link connector.
2. Turn the ignition switch ON.
3. Output all memorized codes.
4. After verifying that the first code is repeated, depress the brake pedal 10 times at intervals of less than one second (**1 sec.**)
   Diagnostic trouble codes cannot be canceled if the following occur:
   - If intervals of depressing the brake pedal exceed one second (**1 sec.**)
   - The brake switch has failed.

Note

- When the memory cancel operation is finished, the ABS warning light comes on for 3 seconds, then goes off.
- After the memory is canceled, the ABS returns to normal control.

Diagnostic Trouble Code Table

Code No. (SST)	ABS warning light flashing pattern Voltmeter indicating pattern	Possible cause	Page
05		Harness between brake light to ABS CM	P–40
11		Right front wheel-speed sensor/ sensor rotor	P–41
12		Left front wheel-speed sensor/ sensor rotor	P–41
13		Right rear wheel-speed sensor/ sensor rotor	P–41
14		Left rear wheel-speed sensor/ sensor rotor	P–41
15		Wheel-speed sensor/sensor rotor	P–41
22		Right front solenoid valve (AV)	P–42
23		Right front solenoid valve (EV)	P–42
24		Left front solenoid valve (AV)	P–42
25		Left front solenoid valve (EV)	P–42
26		Rear solenoid valve (AV)	P–42
27		Rear solenoid valve (EV)	P–42

Code No. (SST)	ABS warning light flashing pattern Voltmeter indicating pattern	Possible cause	Page
51		Valve relay	P–42
53		Motor relay ABS motor	P–43
61		ABS control module	P–43

Diagnostic chart

Diagnostic trouble code No.05	Harness between brake light and ABS CM		
Possible cause	• Malfunction of related wiring harness		
STEP	**INSPECTION**		**ACTION**
1	Inspect harness between brake light and ABS CM. • Open circuit Is harness normal?	Yes	Go to next step
		No	Repair harness
2	Erase diagnostic trouble code, and recheck for diagnostic trouble codes. Is diagnostic trouble code 05 obtained?	Yes	Replace ABS CM ☞ page P–49
		No	There was a temporarily poor contact in wiring harness or connector

Caution

- **When attaching the tester lead to the terminal of the ABS CM harness connector, the SST must be used. (Refer to page P–50.)**

Diagnostic trouble codes No.11—14	ABS wheel-speed sensor (11: Right front 12: Left front 13: Right rear 14: Left rear)
Possible cause	• Malfunction of ABS wheel-speed sensor, sensor rotor, or ABS hydraulic unit • Malfunction of related wiring harness

STEP	INSPECTION	ACTION

Diagnostic trouble codes No.22, 23, 24, 25, 26, 27	Solenoid valve (22:Right front AV 23: Right front EV 24: Left front AV 25: Left front EV 26: Rear AV 27: Rear EV)
Possible cause	• Malfunction of solenoid valve • Malfunction of related wiring harness

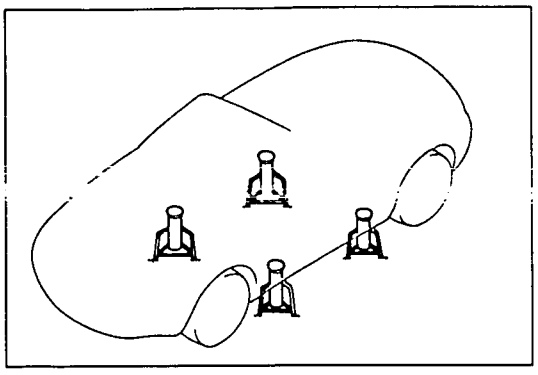
STEP	INSPECTION		ACTION
1	Is ABS CM connector connected properly?	Yes	Go to next step
		No	Correct as necessary
2	Inspect solenoid valve including valve relay. Is it OK? ☞ page P–45	Yes	Go to step 5
		No	Go to next step
3	Is solenoid valve OK? ☞ page P–45	Yes	Go to next step
		No	Replace ABS hydraulic unit ☞ page P–47
4	Is harness between solenoid valve and ABS CM OK?	Yes	Go to next step
		No	Repair harness
5	Erase diagnostic trouble code, and recheck for diagnostic trouble codes. Are diagnostic trouble codes 22—27 obtained?	Yes	Replace ABS CM ☞ page P–49
		No	There was a temporarily poor contact in wiring harness or connector

Diagnostic trouble code No.51	Valve relay
Possible cause	• Malfunction of valve relay • Malfunction of related wiring harness

STEP	INSPECTION		ACTION
1	Is BTN fuse (LHD: 30 A, RHD: 40 A) OK?	Yes	Go to next step
		No	Replace fuse
2	Inspect valve relay including harness. Is it OK? ☞ page P–54	Yes	Go to step 4
		No	Go to next step
3	Is valve relay OK? ☞ page P–54	Yes	Go to next step
		No	Replace valve relay ☞ page P–53
4	Erase diagnostic trouble code, and recheck for diagnostic trouble codes. Is diagnostic trouble code 51 obtained?	Yes	Replace ABS CM ☞ page P–49
		No	There was a temporarily poor contact in wiring harness or connector

Diagnostic trouble code No.53	ABS motor, motor relay		
Possible cause	• Malfunction of ABS motor or motor relay • Malfunction of related wiring harness		
STEP	INSPECTION		ACTION
1	With IG SW OFF, is motor operating?	Yes	Replace motor relay ☞ page P–53
		No	Go to next step
2	Is ABS fuse (30 A) OK?	Yes	Go to next step
		No	Replace fuse
3	Inspect motor relay including harness. Is it OK? ☞ page P–53	Yes	Go to step 7
		No	Go to next step
4	Is motor relay OK? ☞ page P–54	Yes	Go to next step
		No	Replace motor relay ☞ page P–53
5	Inspect ABS motor, including harness. Is it OK? ☞ page P–45	Yes	Go to step 7
		No	Go to next step
6	Is ABS motor OK? ☞ page P–45	Yes	Correct harness as necessary
		No	Replace ABS hydraulic unit ☞ page P–47
7	Erase diagnostic trouble code, and recheck for diagnostic trouble codes. Is diagnostic trouble code 53 obtained?	Yes	Replace ABS CM ☞ page P–49
		No	There was a temporarily poor contact in wiring harness or connector

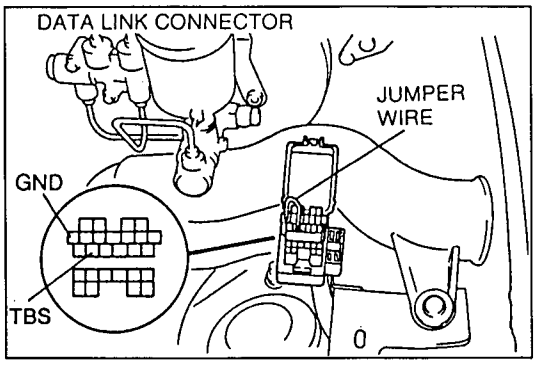
Diagnostic trouble code No.61	ABS control module		
Possible cause	• Malfunction of ABS control module		
STEP	INSPECTION		ACTION
1	Erase diagnostic trouble code, and recheck for diagnostic trouble codes. Is diagnostic trouble code 61 obtained?	Yes	Replace ABS CM ☞ page P–49
		No	There was a temporarily poor contact in wiring harness or connector



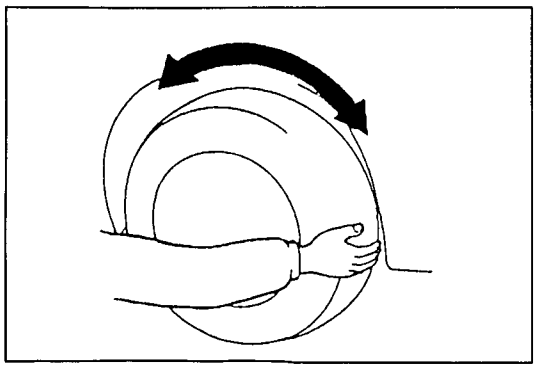
ABS HYDRAULIC UNIT
Inspection (on-vehicle)
System inspection

Note
- If a past diagnostic trouble code(s) is memorized, the system inspection mode will not work. Make sure that there is no code(s) in the ABS memory before doing this inspection.

1. Verify that the battery is fully charged.
   With the ignition switch ON, verify that the ABS warning light goes out after **2—4 seconds**.
2. If the light stays ON after **2—4 seconds** the ABS control module detects a failure and will not activate the ABS hydraulic unit. Follow the troubleshooting procedures.
3. Turn the ignition switch OFF.

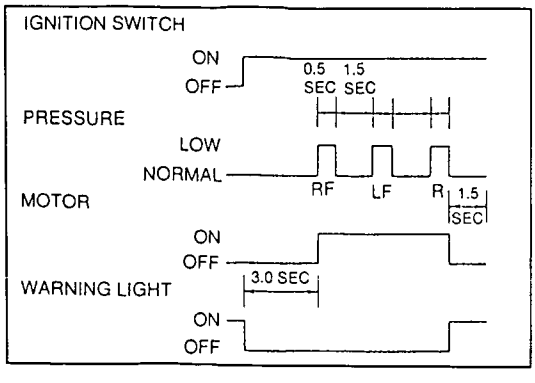


4. On level ground, jack up the vehicle and support it evenly on safety stands. Shift the transmission to neutral.
5. Release the parking brake.
6. Rotate the wheels by hand, and inspect for brake drag.
7. Using a jumper wire, connect the TBS and GND terminals of the data link connector.
8. Depress the brake pedal, and have an assistant verify that the right front wheel will not turn.

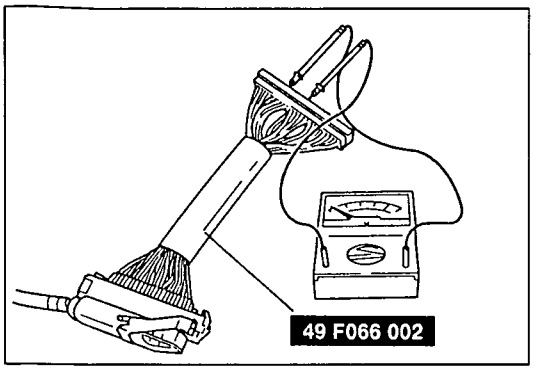


9. With the brake pedal still depressed, turn the ignition switch ON and verify that the brake is released momentarily (approx. **0.5 sec.**) and that the wheel turns when pressure-reduction operates.
10. Check operation of the remaining wheels in order: left front, right rear, left rear.
11. If Steps 9 and 10 show correct operation, the following systems are OK:
    - Brake piping to ABS hydraulic unit
    - Braking system, including ABS hydraulic unit
    - Electrical system in ABS hydraulic unit (solenoid, ABS motor, etc.)
    - ABS control module, its output system (solenoid, relay, etc.) and harness

    The following are not checked with the above steps:
    - Input system and harness of ABS control module
    - Intermittent failure
    - Fluid leakage



12. Replace the ABS hydraulic unit if necessary.

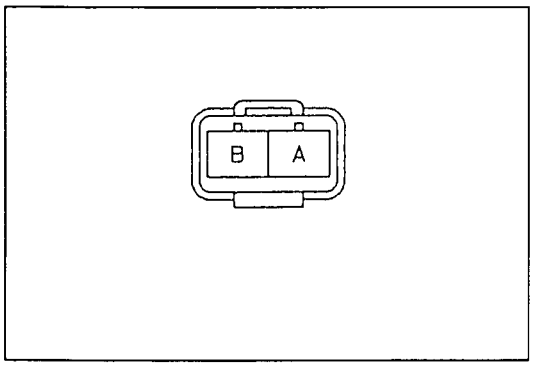


ABS motor (including harness to ABS control module)

1. Turn the ignition switch OFF, and disconnect the ABS control module connector.
2. Connect the **SST** to the ABS control module connector.
3. Measure the resistance between X terminal of the control module connector and a ground.

   Resistance: 1 Ω max.

4. If not as specified, check the wiring harness between the ABS motor and the control module and check the ABS motor. (Refer to below.)

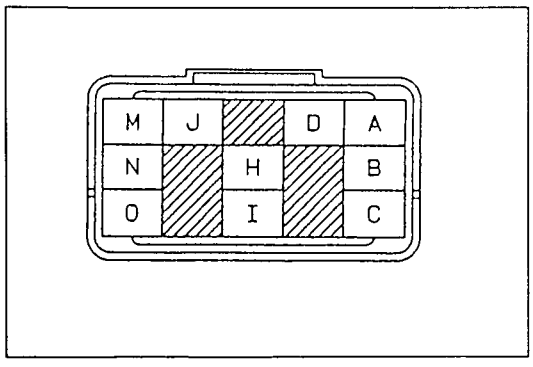


ABS motor

1. Turn the ignition switch OFF.
2. Disconnect the ABS hydraulic unit connector (2 pin).
3. Measure the resistance between terminal B of the ABS hydraulic unit connector and ground.

   Resistance: 1 Ω max.

4. Verify that the motor operates when applying B+ to the connector (2 pin).
5. If not as specified, repair harness of replace the ABS hydraulic unit if necessary.

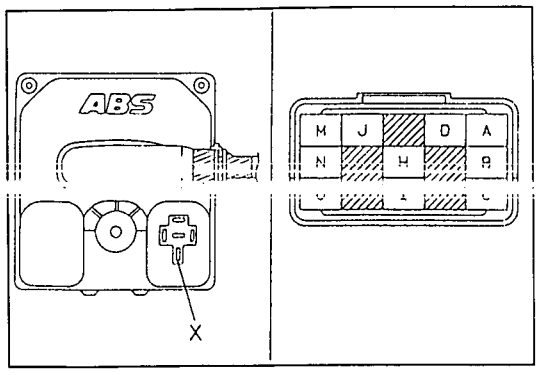


Solenoid valve (including valve relay)

1. Turn the ignition switch OFF.
2. Disconnect the ABS hydraulic unit connector (12 pin).
3. Apply 12 V between terminal A and D. Measure the resistance between terminal B and the following terminals at the ABS hydraulic unit connector (12 pin).

Terminal	H	I	J	M	N	O
Resistance (Ω)	4.7	4.7	4.7	9	9	9

4. If not as specified, check the valve relay and solenoid valves.



Solenoid valve

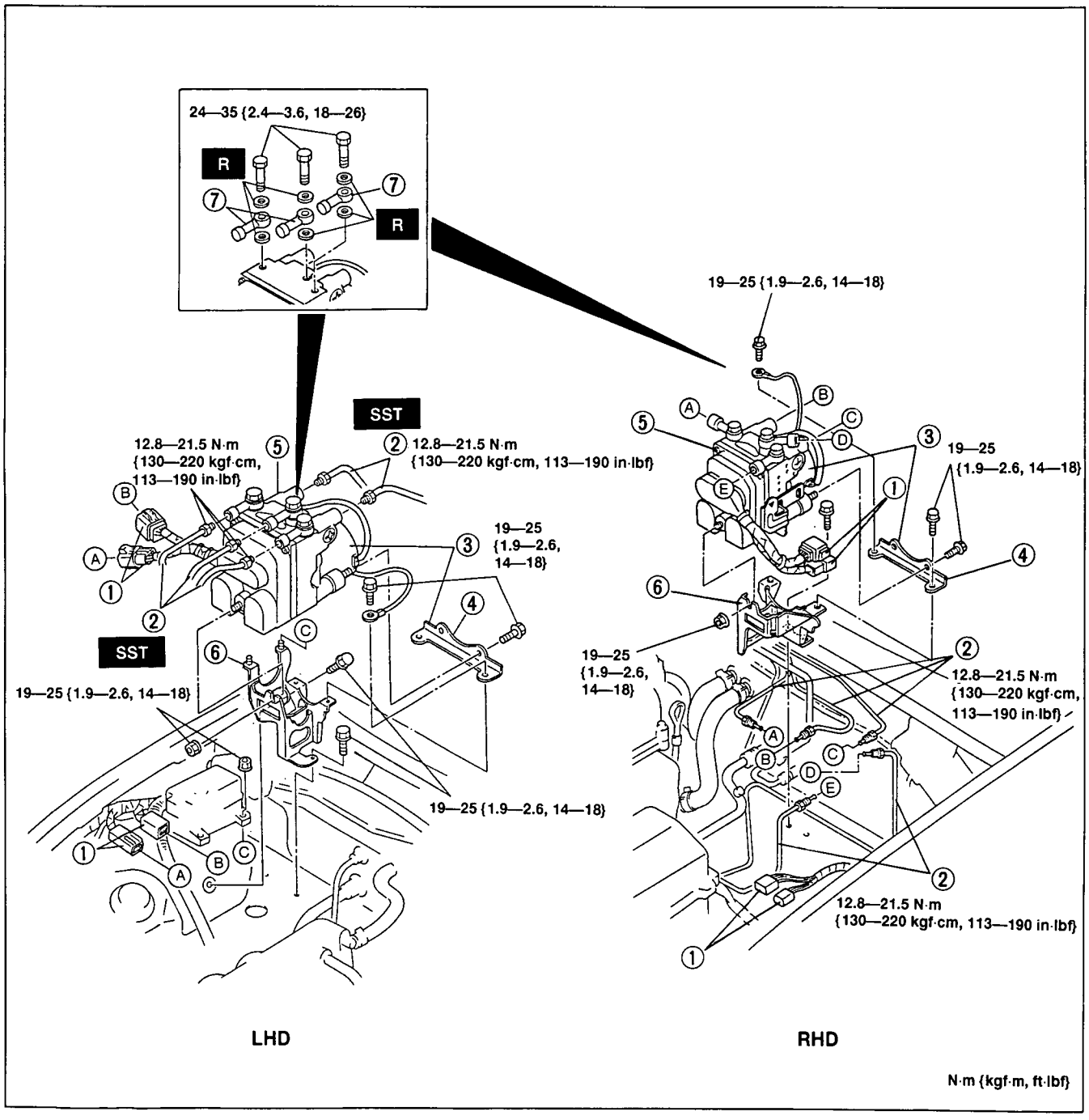
1. Remove the ABS hydraulic unit. (Refer to page P–47.)
2. Remove the valve relay. Measure the resistance between terminal X at the ABS hydraulic unit valve relay terminal and the following terminals at the ABS hydraulic unit connector.

Terminal	H	I	J	M	N	O
Resistance (Ω)	4.7	4.7	4.7	9	9	9

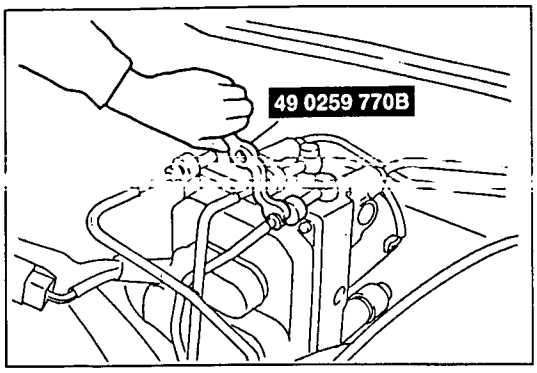
3. If not as specified, repair the harness or replace the ABS hydraulic unit if necessary.

Removal / Installation

1. Disconnect the negative battery cable.
2. Remove the No.1 resonance chamber. (RHD)
3. Remove in the order shown in the figure, referring to **Removal Note**.
4. The only serviceable parts of the hydraulic unit are the valve relay and the motor relay. If there is a failure of any other part, replace the hydraulic unit assembly.
5. Install in the reverse order of removal, referring to **Installation Note**.
6. After installation, perform the following.
   (1) Add fluid and bleed the air.
   (2) Check for fluid leakage.



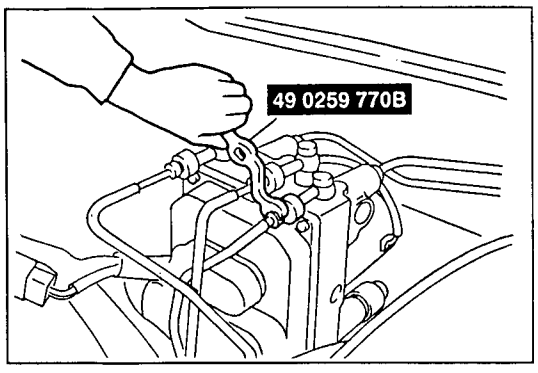
1. Connectors
2. Brake pipes
   Removal Note ..... page P–48
   Installation Note ..... page P–48
3. ABS hydraulic unit and bracket assembly
4. Bracket
5. ABS hydraulic unit
6. Bracket
7. Brake pipe connectors



Removal Note
Brake pipes

Caution
- **Brake fluid will damage painted surfaces. If brake fluid does get on a painted surface, wipe it off immediately.**

Loosen the brake pipes by using the **SST.**



Installation Note
Brake pipes

Caution
- **Brake fluid will damage painted surfaces. If brake fluid does get on a painted surface, wipe it off immediately.**

Tighten the brake pipes by using the **SST.**

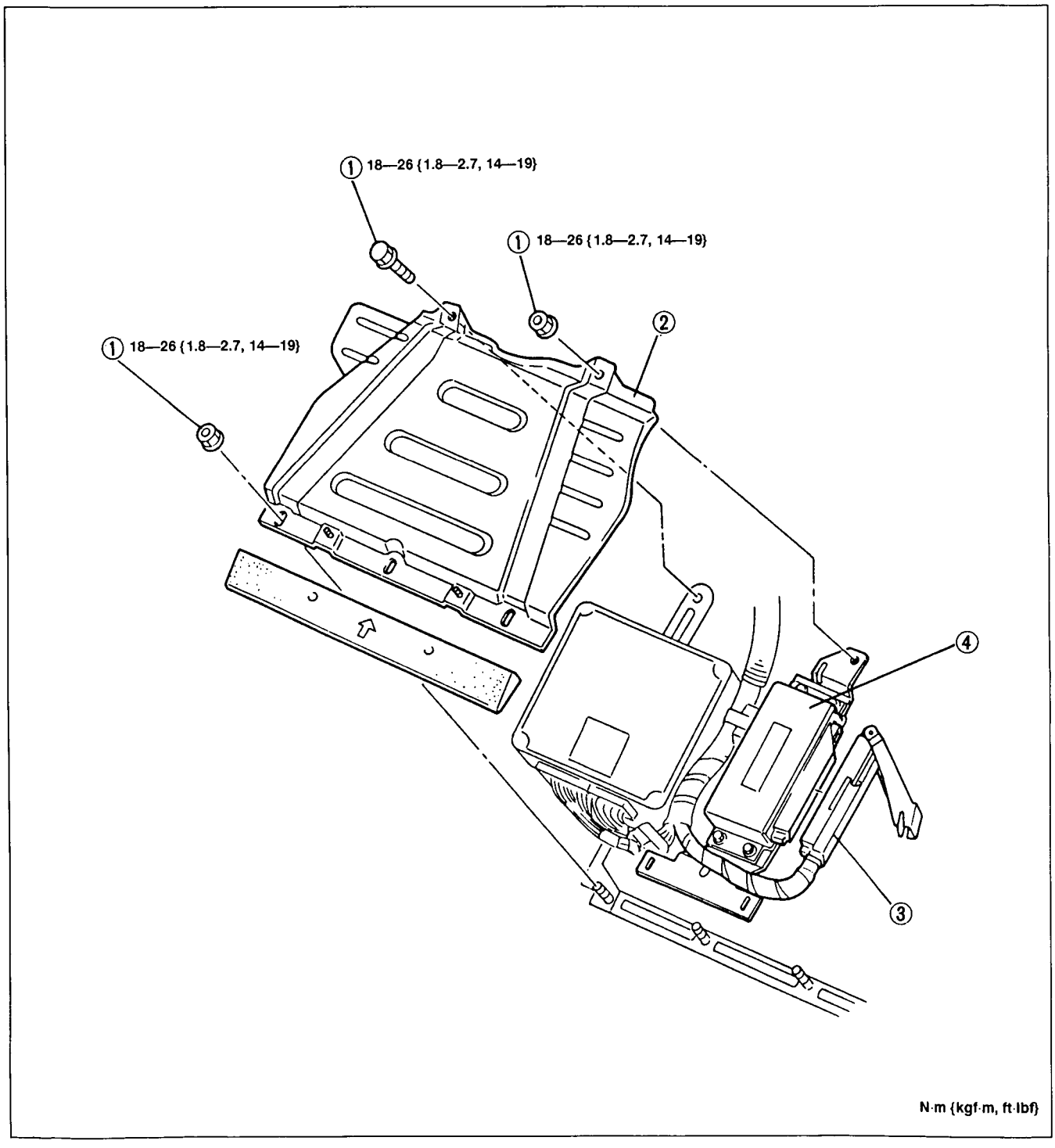
ABS CONTROL MODULE

Removal / Installation

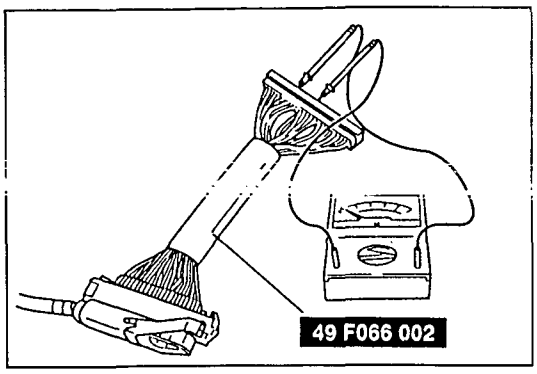
1. Disconnect the negative battery cable.
2. Lift up the passenger side carpet.
3. Remove in the order shown in the figure.
4. Install in the reverse order of removal.

Caution

- **Connect the connector securely. If a poor contact occurs, the ABS system may malfunction.**



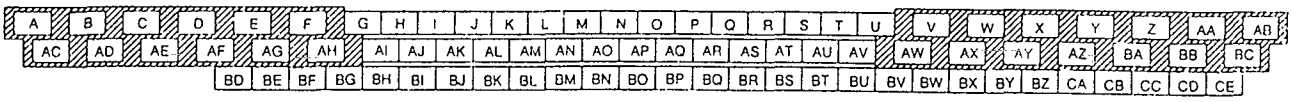
1. Bolt and nuts
2. Control module panel
3. Connector
4. ABS control module



Inspection at ABS Control Module Harness Connector

Caution
- **Disconnecting and connecting the ABS CM connector must be done with the ignition switch OFF.**
- **When checking the harness connector, the SST must be used.**

1. Disconnect the ABS CM connector and connect the **SST** to the harness connector with the ignition switch OFF.
2. Attach the tester leads to the **SST** to check voltage, continuity or resistance, referring to the table below.



Terminal	Signal name	Connected to	Item	Condition	Specification	Possible cause
A	Voltage supply (System)	IG SW	Voltage	IG SW ON	B+	Harness (IG SW-ABS CM connector)
				IG SW OFF	0 V	
B	Voltage supply (Relay drive)	HU (motor relay, valve relay coil)	Continuity	B – GND B – A (IG SW ON)	No No	Harness (B-motor relay-valve relay, G-motor relay, B-valve relay) Motor relay Valve relay
			Resistance	B – G B – AK	72—88 Ω 93—113 Ω	
G	Motor relay drive	HU (motor relay coil)	Continuity	G – GND G – A (IG SW ON)	No No	Harness (B-motor relay-valve relay, G-motor relay, B-valve relay) Motor relay Valve relay
			Resistance	B – G	72—88 Ω	
AK	Valve relay drive	HU (valve relay coil)	Continuity	AK – GND AK – A (IG SW ON)	No No	Harness (B-motor relay-valve relay, G-motor relay, B-valve relay) Motor relay Valve relay
			Resistance	B – AK	93—113 Ω	
P	On-board diagnosis TBS	Data link connector TBS	Continuity	P – GND P – A (IG SW ON) P – TBS at DLC	No No Yes	Harness (P-TBS at DLC)
AT	On-board diagnosis FBS	Data link connector FBS	Continuity	AT – GND AT – A (IG SW ON) AT – FBS at DLC	No No Yes	Harness (AT-FBS at DLC)

Note
- Voltage is measured between applicable terminal and GND terminal of ABS CM harness connector.

Terminal	Signal name	Connected to	Item	Condition	Specification	Possible cause
X	Motor monitor	HU (ABS motor)	Voltage	When B+ applied between B and G	B+	Harness (B-motor relay-G, motor relay-battery, X-motor relay-motor, motor-motor GND) Motor Motor relay
				When open between B and G	0V	
			Continuity	X-GND	Yes	
AB AC AM	System GND (power) System GND (power) System GND (signal)	Ground point	Continuity	AB-ground point AC-ground point AM-ground point	Yes Yes Yes	Harness (Each terminal-ground point)
				AB-AD AC-AD AM-AD	Yes Yes Yes	Short plate of harness connector
AD	Warning light	ABS warning light	Continuity	AD-GND (IG OFF) AD-A (IG OFF)	Yes Yes	Harness (AD-meter, meter-IG SW) Meter
			Voltage	When IG SW ON	B+	
AV	Brake switch	Brake switch	Voltage	When brake pedal depressed	B+	Harness (AV-brake SW) (When brake light normal)
				When brake pedal released	0V	
AJ J	LF wheel-speed	LF wheel-speed sensor	Voltage	Vehicle stopped	0V (AC)	Harness (sensor-ABS CM harness connector) Sensor, Installation condition
				When turned 1 revolution per second	0.25—1.2 V (AC)	
			Resistance	AJ-J	0.8—1.2 kΩ	
O N	RF wheel-speed	RF wheel-speed sensor	Voltage	Vehicle stopped	0V (AC)	Harness (sensor-ABS CM harness connector) Sensor, Installation condition
				When turned 1 revolution per second	0.25—1.2 V (AC)	
			Resistance	O-N	0.8—1.2 kΩ	
K AL	RR wheel-speed	RR wheel-speed sensor	Voltage	Vehicle stopped	0V (AC)	Harness (sensor-ABS CM harness connector) Sensor, Installation condition
				When turned 1 revolution per second	0.25—1.2 V (AC)	
			Resistance	K-AL	0.8—1.2 kΩ	
AN L	LR wheel-speed	LR wheel-speed sensor	Voltage	Vehicle stopped	0V (AC)	Harness (sensor-ABS CM harness connector) Sensor, Installation condition
				When turned 1 revolution per second	0.25—1.2 V (AC)	
			Resistance	AN-L	0.8—1.2 kΩ	

Note

- Voltage is measured between applicable terminal and GND terminal of ABS CM harness connector.

Terminal	Signal name	Connected to	Item	Condition	Specification	Possible cause
E	Left front solenoid valve (EV) drive	HU (LF solenoid valve)	Voltage	When B+ applied between B and AK	B+	Harness (B-motor relay-AK, valve relay-battery, valve relay-solenoid, Each terminal-solenoid valve) Valve relay Solenoid valve
			Continuity	E – GND E – A	No No	
AG	Left front solenoid valve (AV) drive	HU (LF solenoid valve)	Voltage	When B+ applied between B and AK	B+	
			Continuity	AG – GND AG – A	No No	
BB	Right front solenoid valve (EV) drive	HU (RF solenoid valve)	Voltage	When B+ applied between B and AK	B+	
			Continuity	BB – GND BB – A	No No	
Z	Right front solenoid valve (AV) drive	HU (RF solenoid valve)	Voltage	When B+ applied between B and AK	B+	
			Continuity	Z – GND Z – A	No No	
BA	Rear solenoid valve (EV) drive	HU (Rear solenoid valve)	Voltage	When B+ applied between B and AK	B+	
			Continuity	BA – GND BA – A	No No	
Y	Rear solenoid valve (AV) drive	HU (Rear solenoid valve)	Voltage	When B+ applied between B and AK	B+	
			Continuity	Y – GND Y – A	No No	

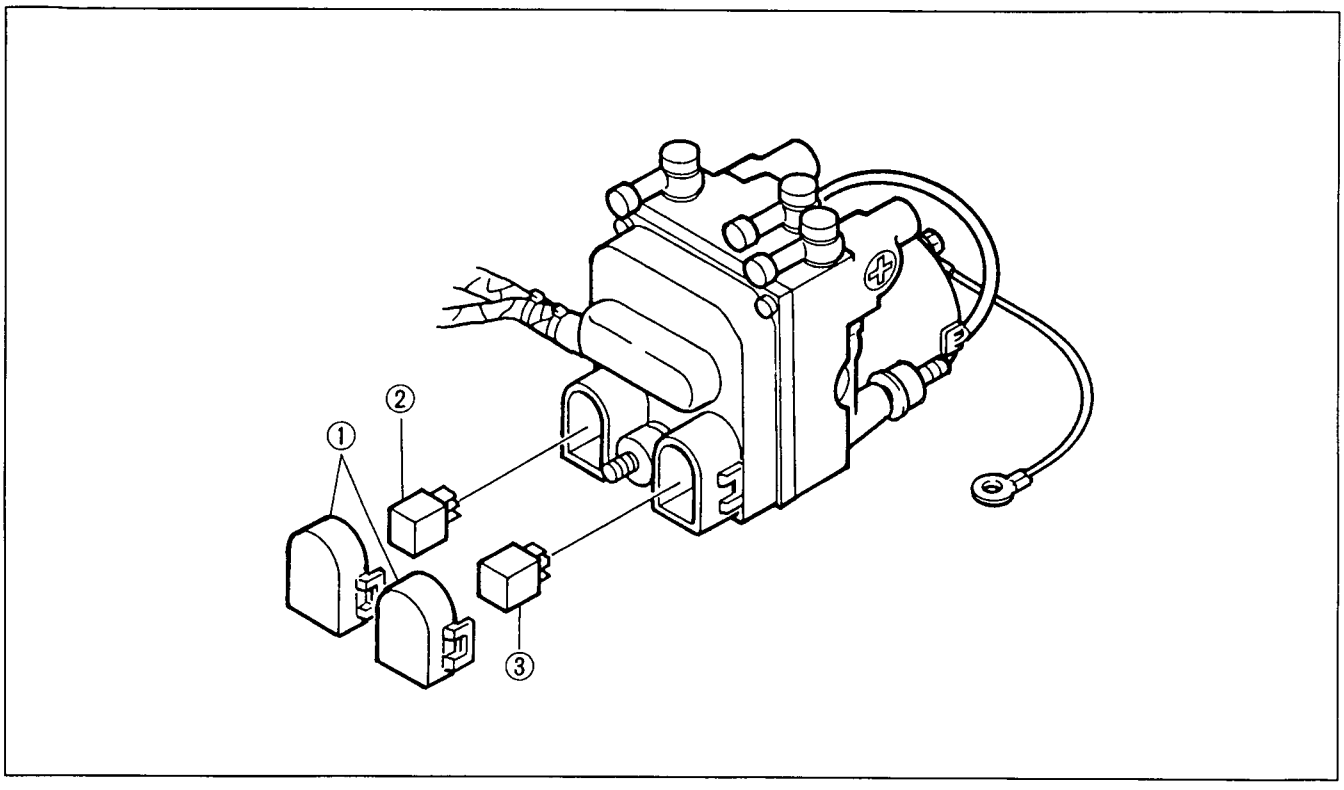
Note

- Voltage is measured between applicable terminal and GND terminal of ABS CM harness connector.

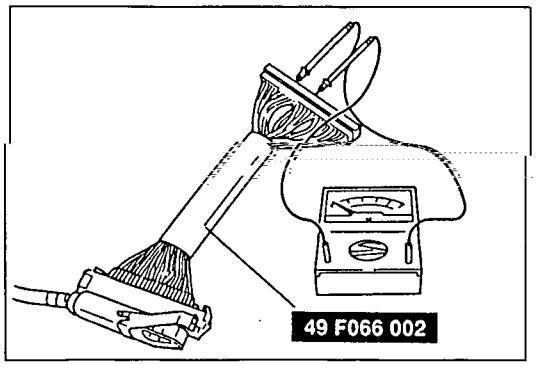
ABS RELAY

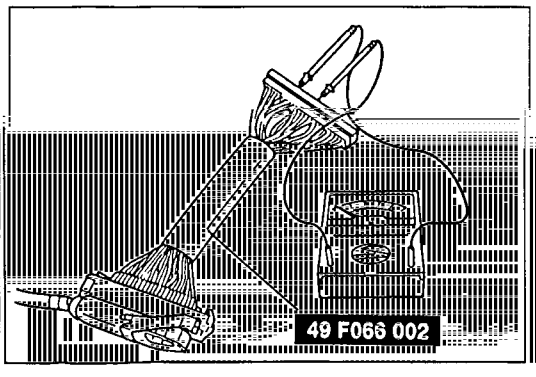
Removal / Inspection / Installation

1. Disconnect the negative battery cable.
2. Remove the ABS hydraulic unit. (Refer to page P–47.)
3. Remove in the order shown in the figure.
4. Install in the reverse order of removal.



1. Cover
2. Motor relay
   Inspection ..... below
3. Valve relay
   Inspection ..... page P–54





Inspection

Motor relay (including harness to ABS CM)

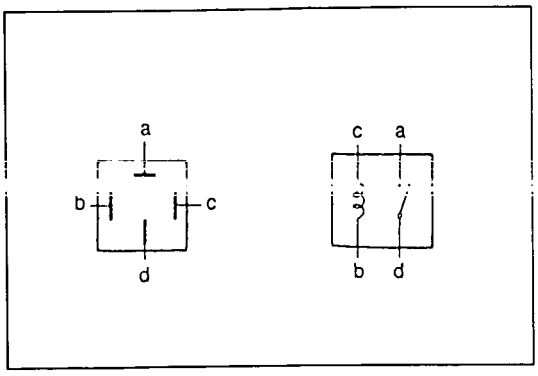
1. Turn the ignition switch OFF and disconnect the ABS control module connector.
2. Connect the SST to the ABS control module connector.
3. Turn the ignition switch ON.
4. Measure the voltage between terminal X and AB of the ABS control module connector.

   Voltage: 0 V

5. Apply Battery voltage to terminals B and G. Measure the voltage between terminal X and AB of the ABS control module connector.

   Voltage: B+

6. If not as specified, inspect the wiring harness and the motor relay.



Motor relay

1. Using an ohmmeter, check continuity of the relay terminals.

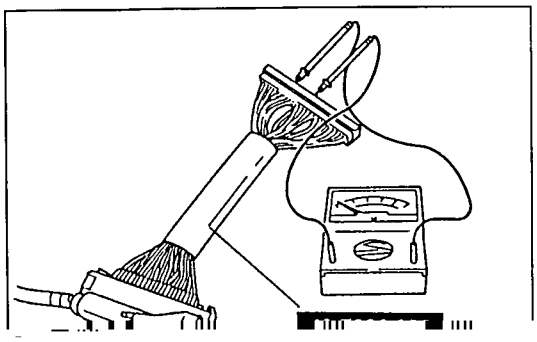
Connect to		a	b	c	d
12 V	Ground				
—	—		○—○		
c	b	○—			—○

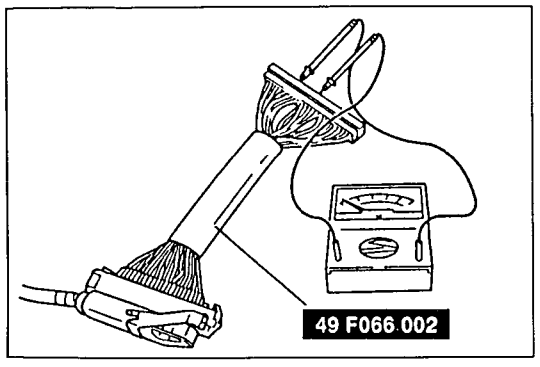
○—○ : Indicates continuity

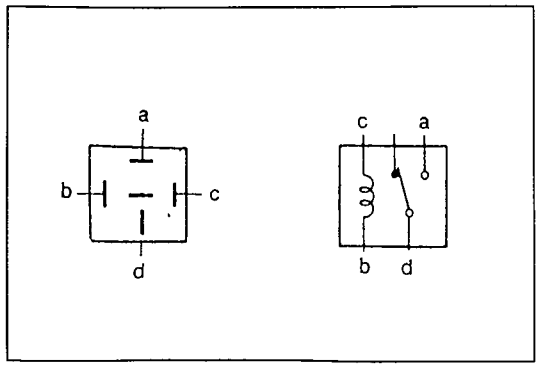
2. If not as specified, replace the motor relay.

Valve relay (including harness to ABS CM)

1. Turn the ignition switch OFF and disconnect the ABS control module connector.
2. Connect the **SST** to the ABS control module connector.
3. Turn the ignition switch ON.
4. Measure the voltage between the ground terminal AB and the following terminals at the ABS control module connector.
   Terminal: E, Z, Y, AG, BA, BB







ge: 0 V

Battery voltage to terminals B and AK. Measure oltage between the ground terminal AB and the following terminals at the ABS control module connector.
nal: E, Z, Y, AG, BA, BB

ge: B+

as specified, inspect the wiring harness and the relay.

lay

an ohmmeter, check continuity of the relay termi-

Connect to		a	b	c	d
V	Ground				
	—		○—○		
	c	○—			—○

dicates continuity

as specified, replace the valve relay.

Volta

5. Apply the vo lowing Termi

Volta

6. If not valve

Valve re

1. Using nals.

12	
—	
b	

○—○ : Ind

2. If not

BODY ELECTRICAL SYSTEM

INDEX ..... T- 2
INSTRUMENT CLUSTER,
AIR BAG SYSTEM ..... T- 2

FEATURES

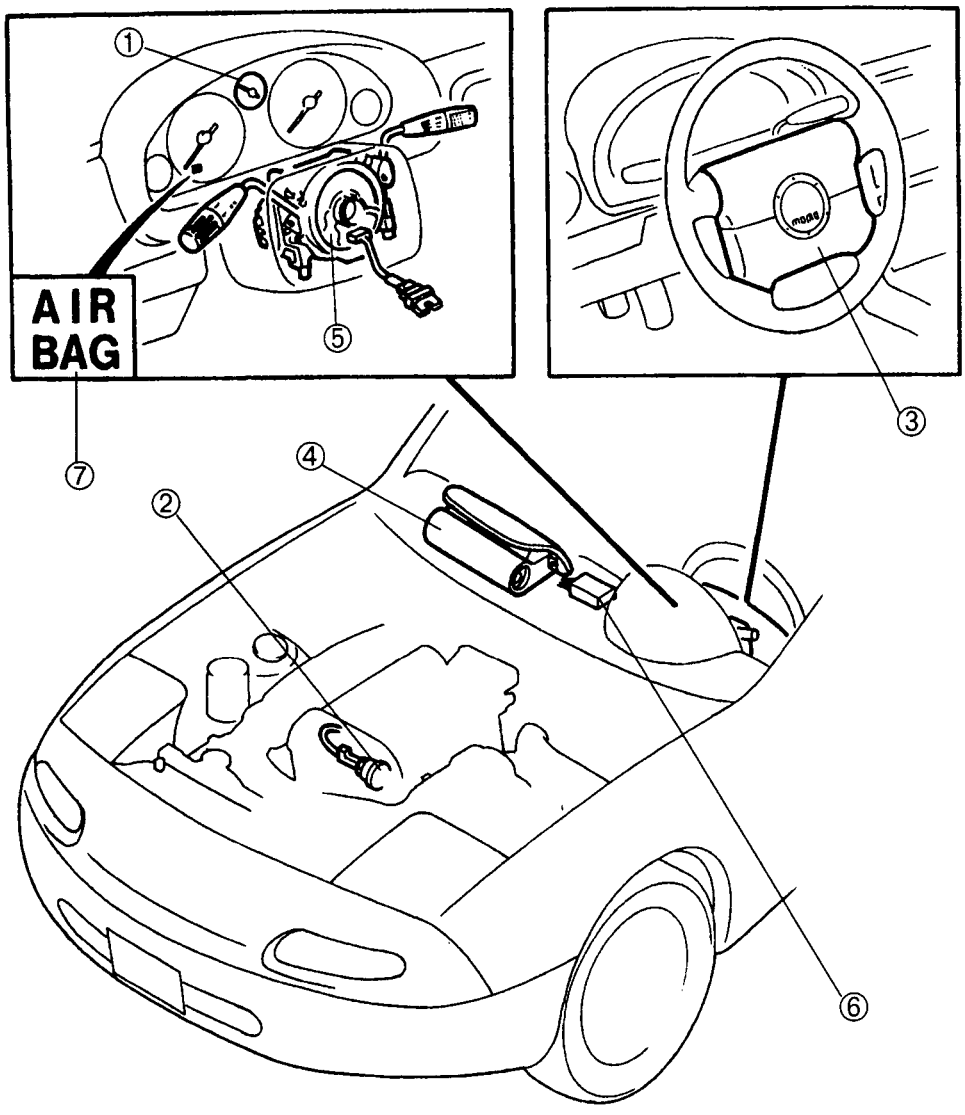
OUTLINE ..... T- 3
OUTLINE OF CONSTRUCTION ..... T- 3
FUSE ..... T- 3
SPECIFICATIONS ..... T- 3
AIR BAG SYSTEM ..... T- 4
STRUCTURAL VIEW ..... T- 4
SYSTEM DIAGRAM ..... T- 5
COMPONENT DESCRIPTION ..... T- 6
OPERATION ..... T- 6
SAS-UNIT ..... T- 7

SERVICE

SUPPLEMENTAL SERVICE INFORMATION . T- 8
INSTRUMENT CLUSTER ..... T- 9
TROUBLESHOOTING ..... T- 9
OIL PRESSURE GAUGE T-12
OIL PRESSURE SWITCH T-12
AIR BAG SYSTEM T-13
PREPARATION T-13
STRUCTURAL VIEW T-13
SERVICE WARNINGS T-14
GENERAL PROCEDURES T-15
TROUBLSHOOTING T-16
PASSENGER-SIDE AIR BAG MODULE T-25
SAS UNIT T-26
AIR BAG MODULE DISPOSAL
PROCEDURE T-28
INSPECTION OF SST
(DEPLOYMENT TOOL) T-30

INDEX

INSTRUMENT CLUSTER, AIR BAG SYSTEM



1. Oil pressure gauge
   Inspection ..... page T–12
2. Oil pressure switch
   Inspection ..... page T–12
3. Driver-side air bag module
4. Passenger-side air bag module (LHD only)
   Removal / Installation ..... page T–25
   Disposal procedure ..... page T–28
5. Clock spring
6. SAS-unit
   Removal / Installation ..... page T–26
7. Air bag system warning light

OUTLINE

OUTLINE OF CONSTRUCTION

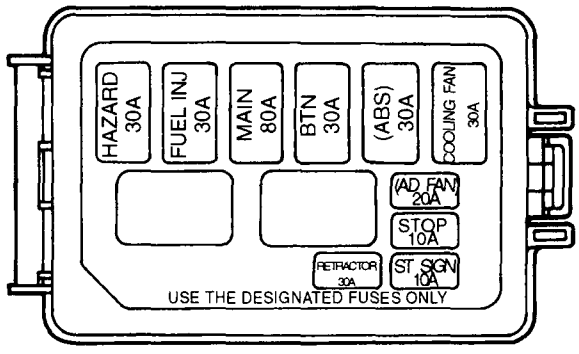
- Specifications for the main fuse block are changed.
- The panel light control switch is discontinued. (B6 DOHC only)
- The oil pressure gauge is changed.
- The oil pressure switch is changed.
- From the diagnostic module to SAS-unit is changed.

FUSE

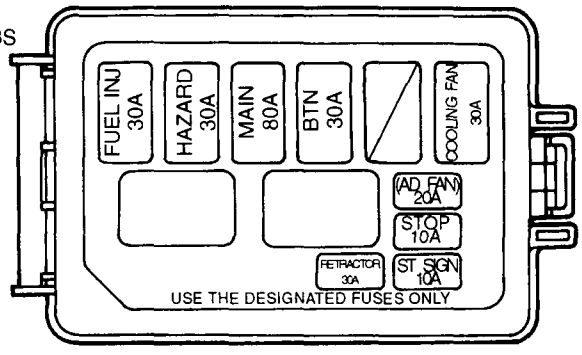
SPECIFICATIONS

EXCEPT UK

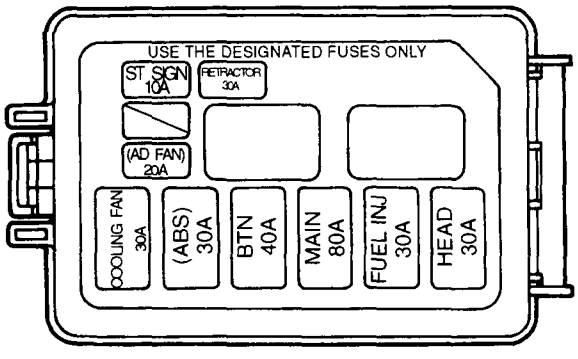
- BP DOHC
- B6 DOHC WITH ABS



- B6 DOHC WITHOUT ABS



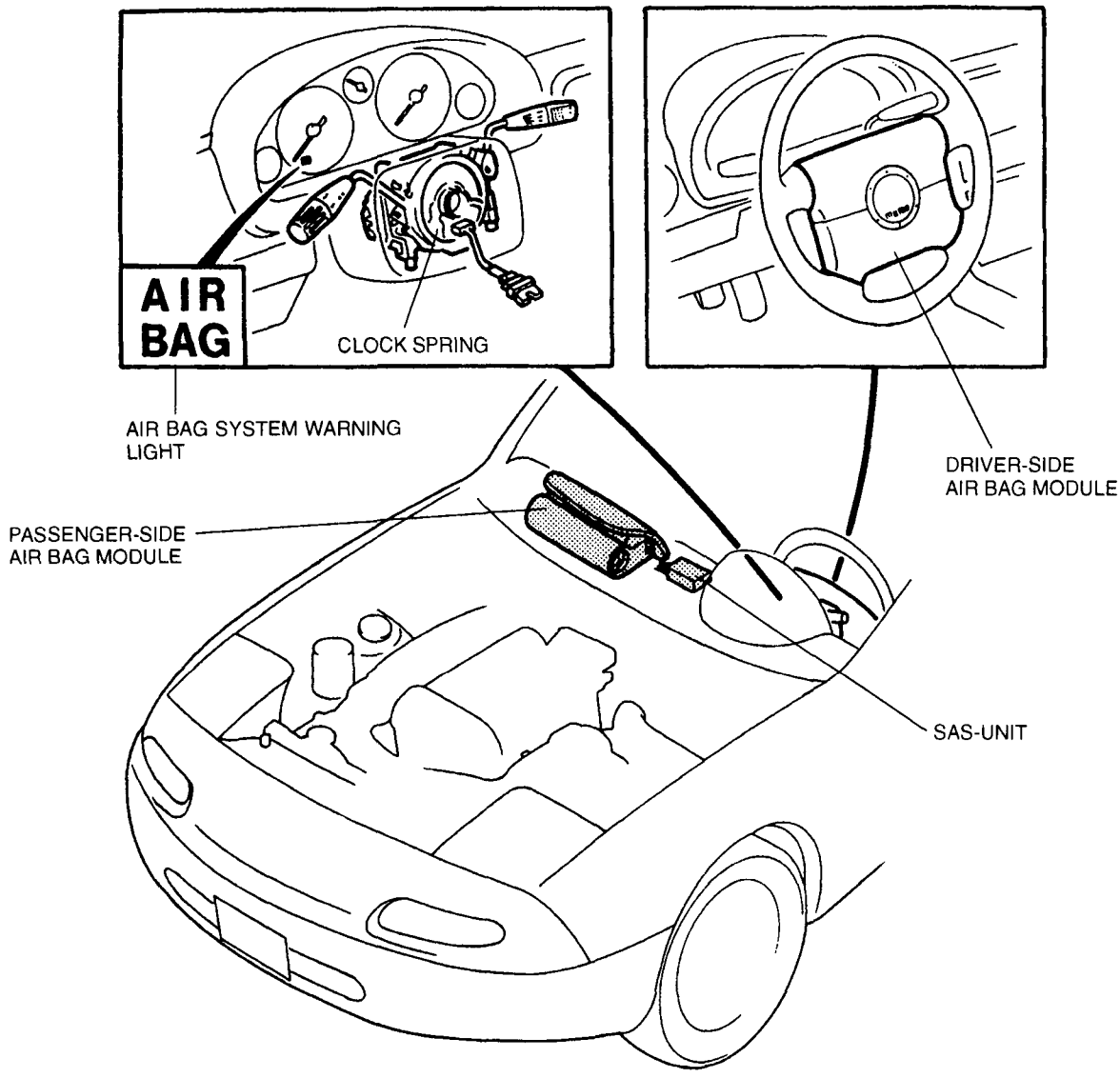
UK



- Specifications for the main fuse block are changed.

AIR BAG SYSTEM

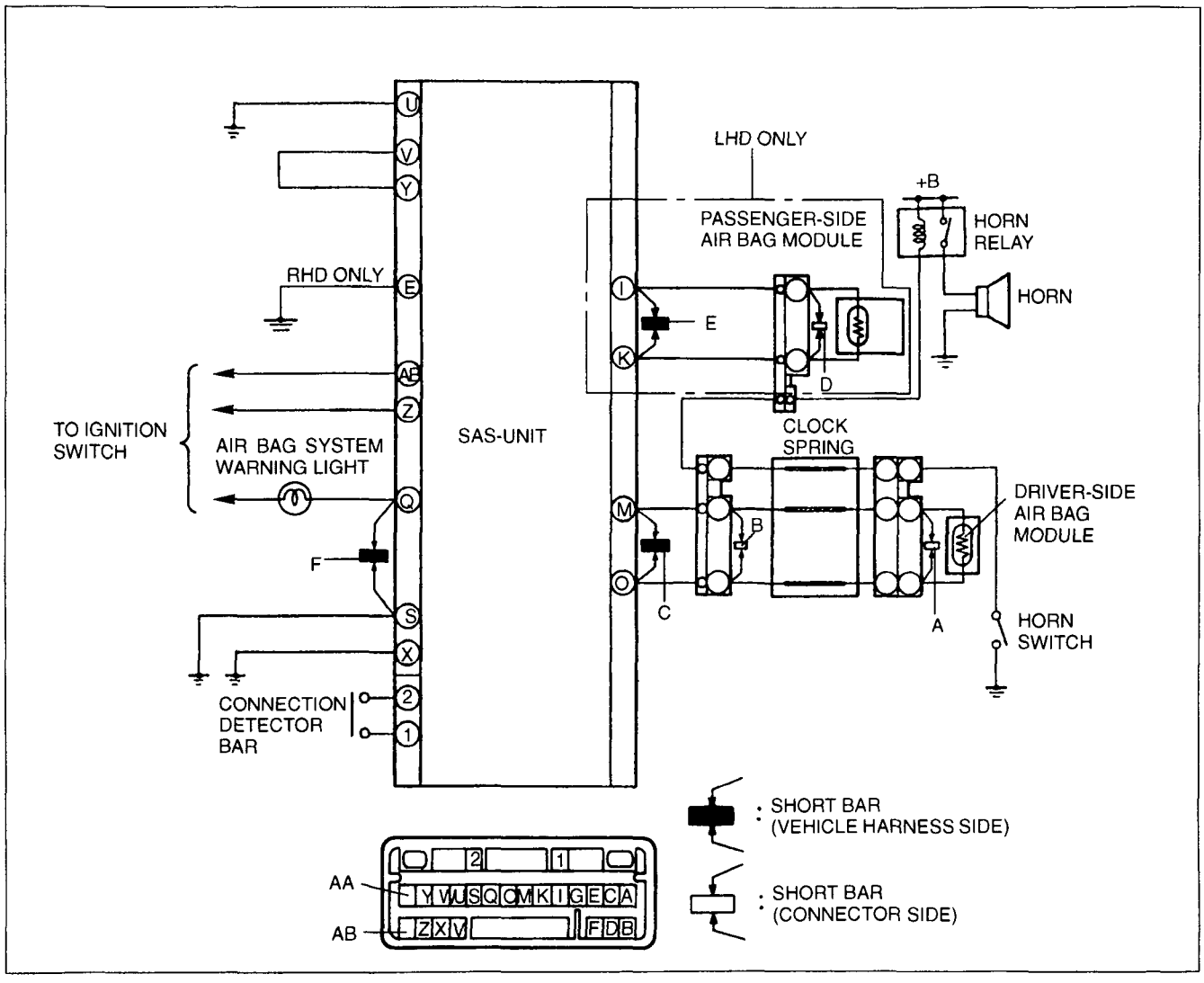
STRUCTURAL VIEW

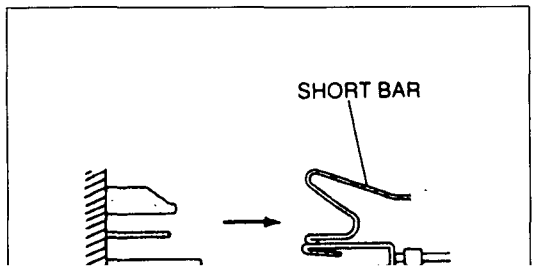


- The air bag system consists of :
  Driver-side air bag module
  Passenger-side air bag module (LHD only) *1
  SAS-unit (Sophisticated Air bag Sensor-unit) *2
  Clock spring
  Air bag system warning light

*1: Added
*2: Changed

SYSTEM DIAGRAM





Short Bar

- A short bar is used to short between two terminals when a connector is disconnected.
- Short bars A–C (RHD), A–E(LHD) prevent the air bag module from activating when the connector is disconnected.
- Short bar F keeps the air bag system warning light illuminated when the ignition switch is at ON and the SAS-unit

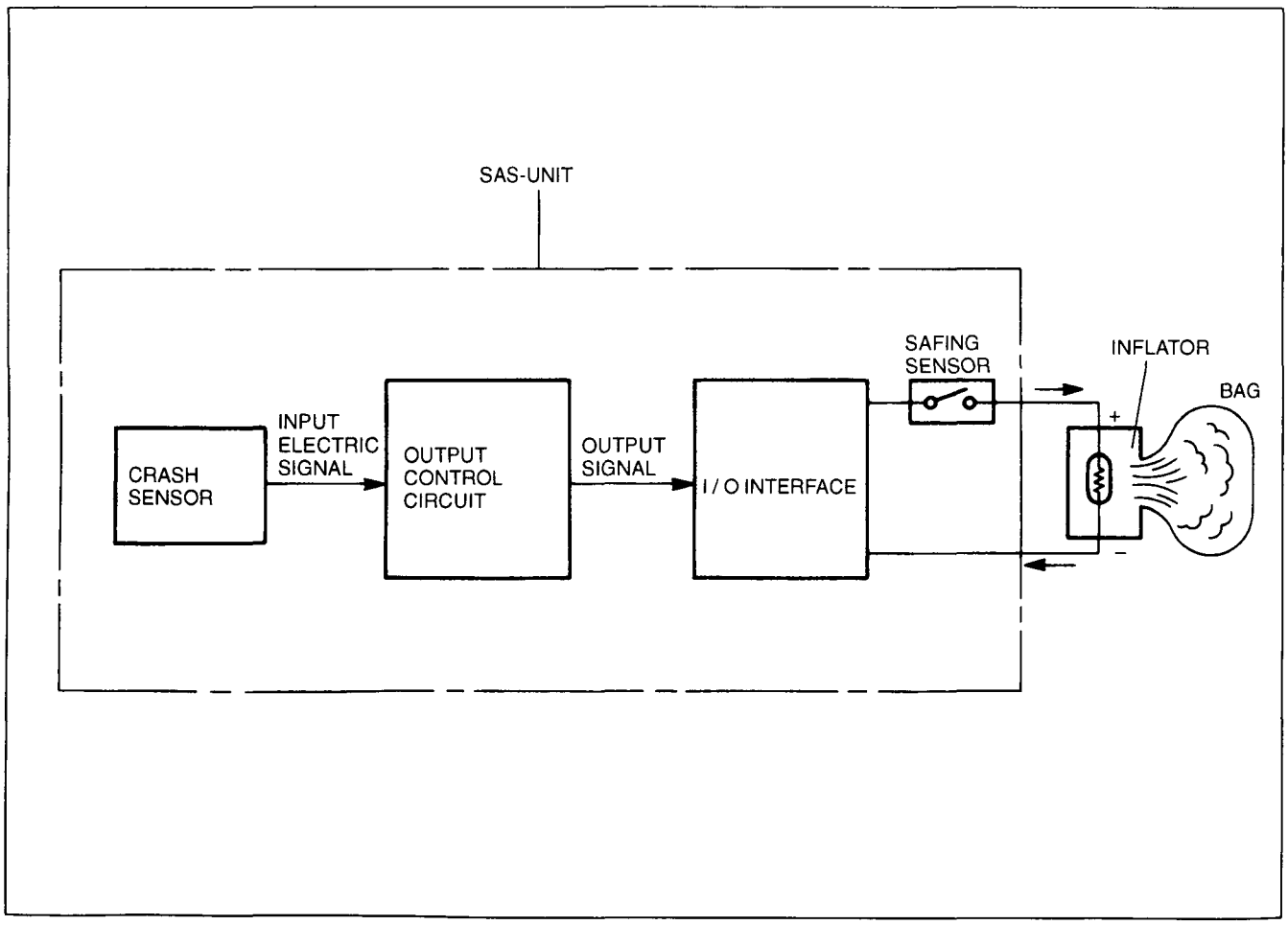
T

COMPONENT DESCRIPTION

Component	Function	Remarks
Air bag system warning light	Illuminates or flashes if malfunction occurs in air bag system.	Located in instrument cluster
Air bag module	Deploys air bag when current flows to integrated igniter.	Location: Driver-side . . . . . in steering wheel hub Passenger-side . . . above glove compartment *1
Clock spring	Ensures uninterrupted electrical connection to air bag module while allowing steering wheel to turn.	Part of combination switch
SAS-unit *2	Controls air bag system via built-in control module. Detects vehicle deceleration during collision via built-in crash sensor. . .	—

*1: Added
*2: Changed

OPERATION



- When the crash sensor in the SAS-unit detects vehicle deceleration, it outputs an electric signal.
- The output control circuit calculates the input electric signal and determines whether or not to send the signal to the I/O (input/output) interface.
- If the calculated value is more than the set value, the output control circuit sends an output signal to the I/O interface to activate the air bag modules.
- When the I/O interface receives the signal from the output control circuit, the I/O interface sends an output signal to the inflator via the safing sensor. (The sefing sensor is on with vehicle deceleration.)
- When the inflator receives the signal from the I/O interface, the ignition intensifier ignites, and nitrogen gas is generated.
- The air bag modules deploy the air bags because of the nitrogen gas.

SAS-UNIT

The SAS (Sophisticated Air bag Sensor) -unit contains the following functions and circuits.

Self-diagnostic Function

- The SAS-unit has a microcomputer that monitors the air bag system components, detects open or short circuits in the air bag system, and senses if the SAS-unit connector is disconnected.
- If a malfunction is detected in the system, the SAS-unit flashes or illuminates the air bag system warning light.
- System faults can be determined by the coded warning light display.
- If a malfunction occurs in the system and the warning light is burnt, an audible alarm in the SAS-unit will sound.

Backup Power Supply

The backup battery powers the air bag system and deploys the air bags in case the vehicle's battery becomes disconnected in a collision.

Booster Circuit (DC Converter)

If the battery positive voltage drops, the booster circuit will boost the voltage to deploy the air bags.

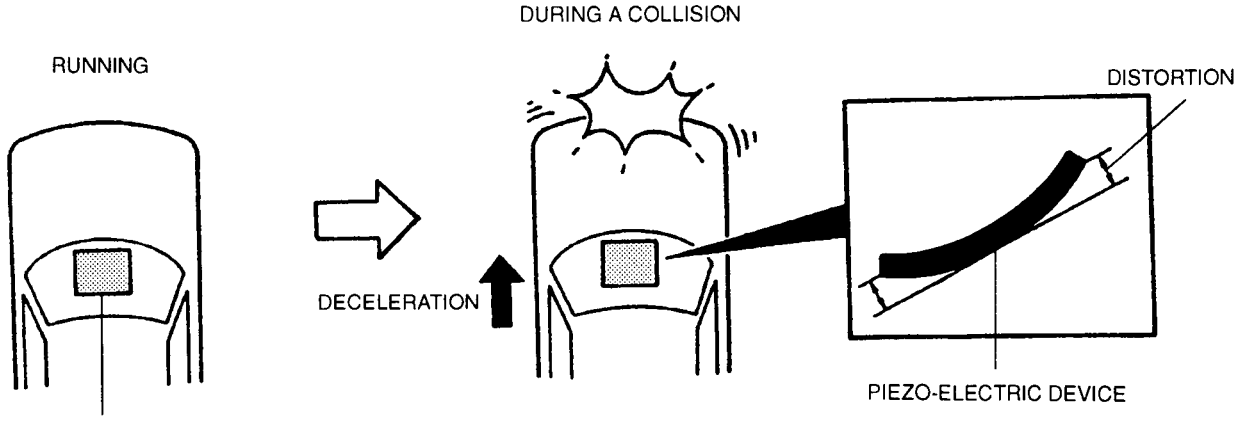
Fail-safe Function

If the air bag system cannot be properly maintained, the fail-safe function stops system control.

Crash Sensor

The crash sensor use a piezo-electric device to convert distortion (pressure displacement) to an electric signal.

Operation



During a collision, the piezo-electric device detects distortion (pressure displacement) and converts it to an electric signal. The electric signal is then output to the output control circuit.

SUPPLEMENTAL SERVICE INFORMATION

The following changes and /or additions have been made since publication of the Mazda MX–5 Workshop Manual (1221–10–89I), Mazda MX–5 Workshop Manual Supplement (1246–10–90G), Mazda MX–5 Workshop Manual Supplement (1372–10–93I).

Oil pressure gauge
- Troubleshooting procedure modified
- Inspection procedure modified

Oil pressure switch
- Troubleshooting procedure modified
- Inspection procedure modified

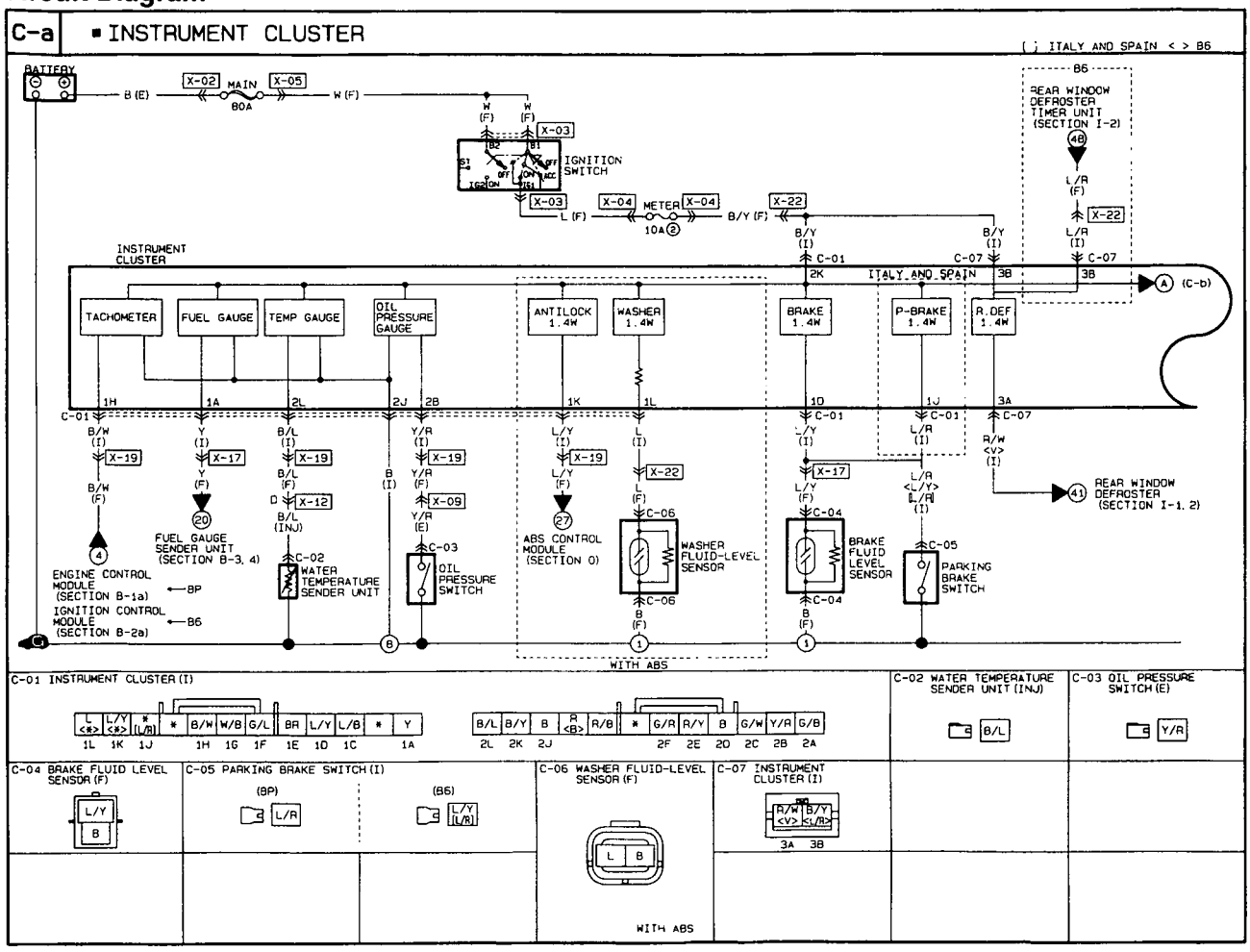
Passenger-side air bag module (LHD only)
- Removal / Installation procedure modified

SAS-unit
- Removal /Installation procedure modified

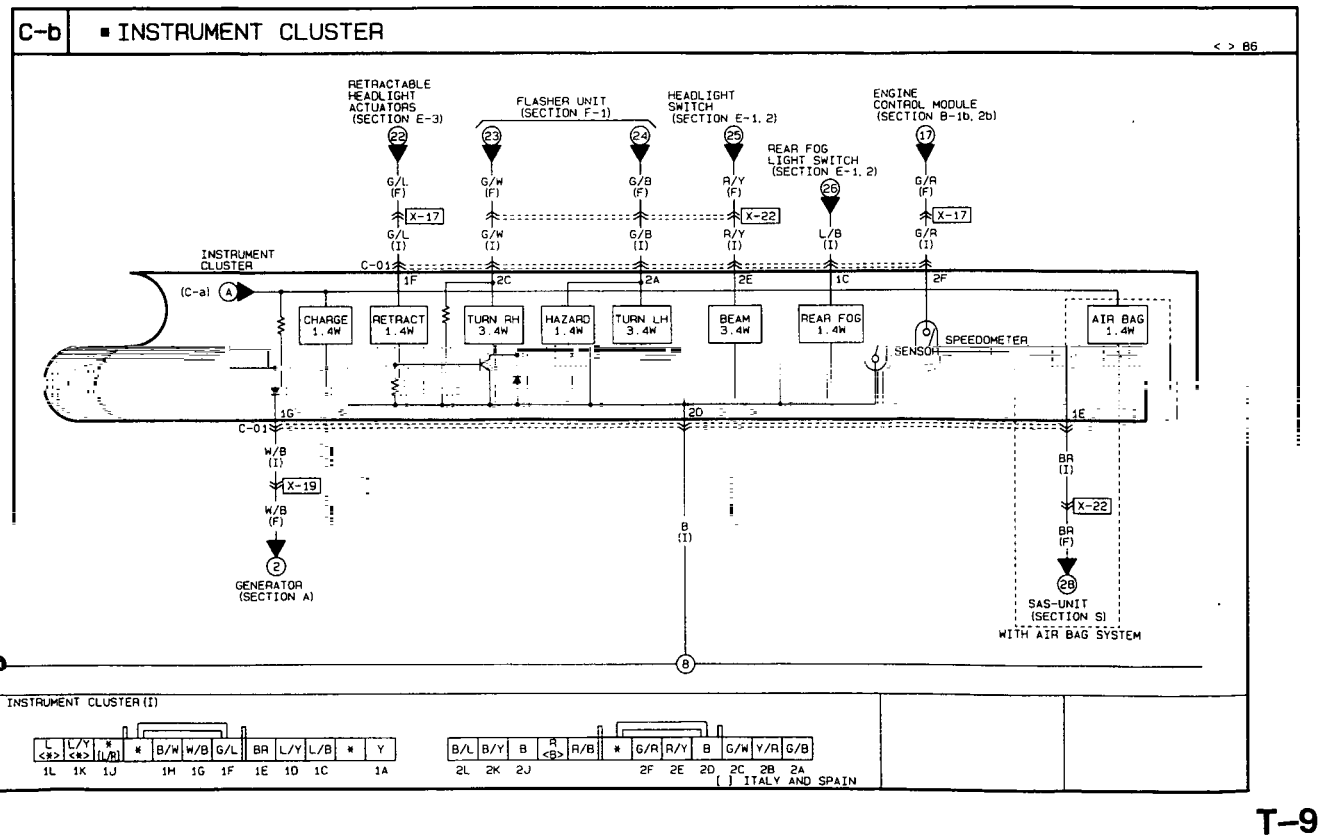
INSTRUMENT CLUSTER

TROUBLESHOOTING
Circuit Diagram

C-a ■ INSTRUMENT CLUSTER

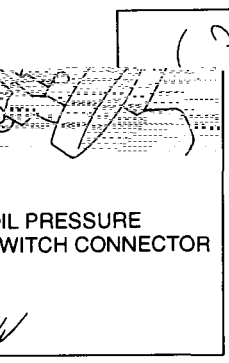


C-b ■ INSTRUMENT CLUSTER

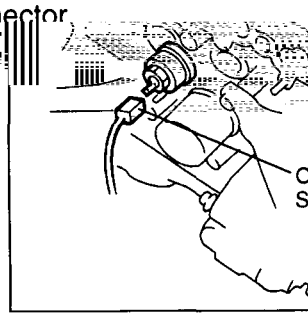


Symptom	Oil pressure gauge does not operate or is incorrect

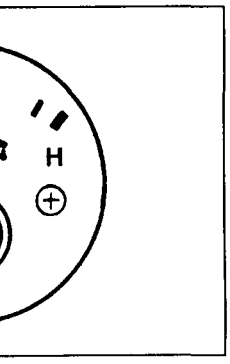
Possible cause
- Damaged oil pressure switch
- Damaged oil pressure gauge
- Open or short circuit in wiring harness
- Poor connection of connector



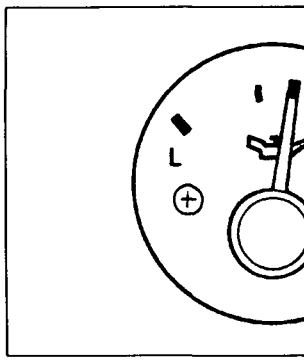
Step 1
1. Disconnect the oil pressure switch connector.
2. Turn the ignition switch to ON.



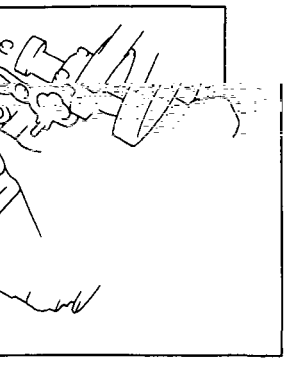
3. Verify that the oil pressure gauge indicates normal oil pressure as shown in the figure.

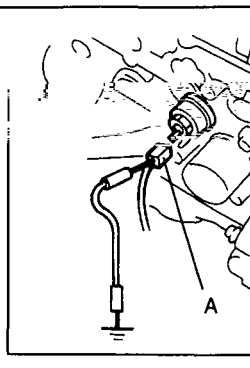


Gauge display	Action
Correct	Inspect oil pressure switch (Refer to page T–12)
Incorrect	Turn the ignition switch to LOCK and go to Step 2

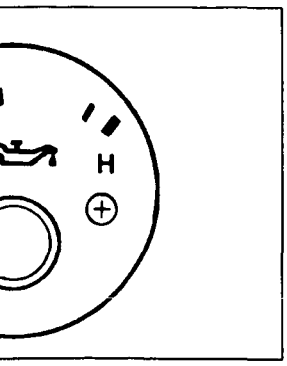


Step 2
1. Ground terminal A (Y/R) of the oil pressure switch connector.
2. Turn the ignition switch to ON.

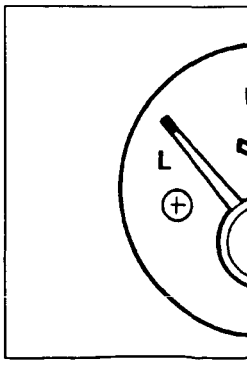


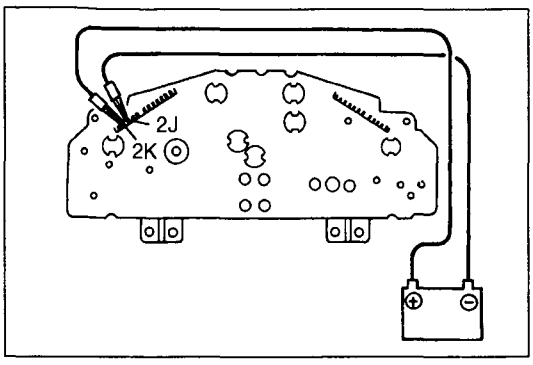


3. Verify that the oil pressure gauge indicates low oil pressure as shown in the figure.



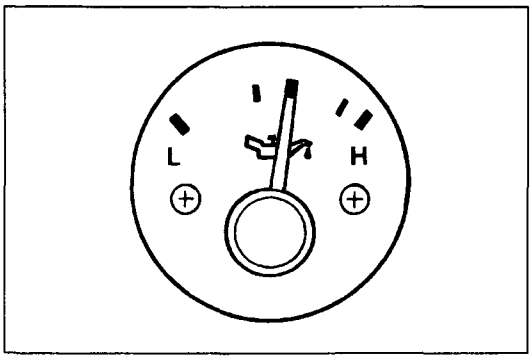
Gauge display	Action
Correct	Inspect oil pressure switch (Refer to page T–12)
Incorrect	Turn the ignition switch to LOCK and go to Step 3





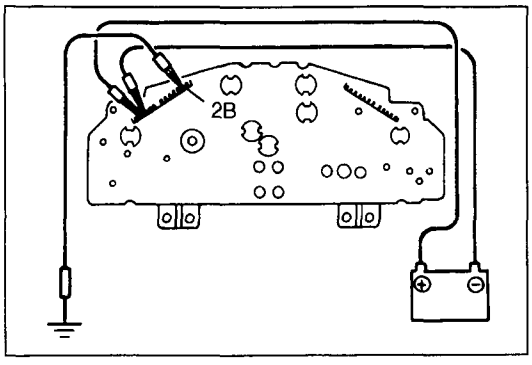
Step 3

1. Remove the instrument cluster.
   (Refer to Mazda MX–5 Workshop Manual (1221–10–89I), section T.)
2. Connect battery positive voltage to terminal 2K and ground to terminal 2J.



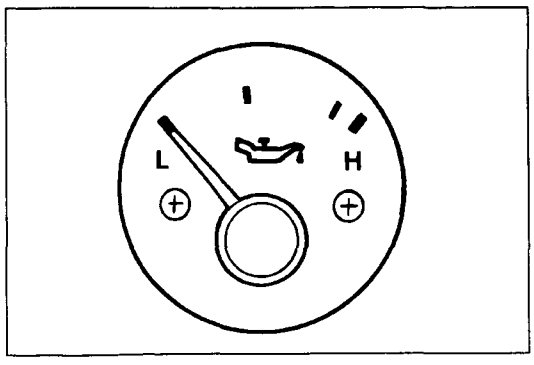
3. Verify that the oil pressure gauge indicates normal oil pressure as shown in the figure.

Gauge display	Action
Correct	Repair wiring harness (Instrument cluster — Oil pressure switch)
Incorrect	Go to Step 4



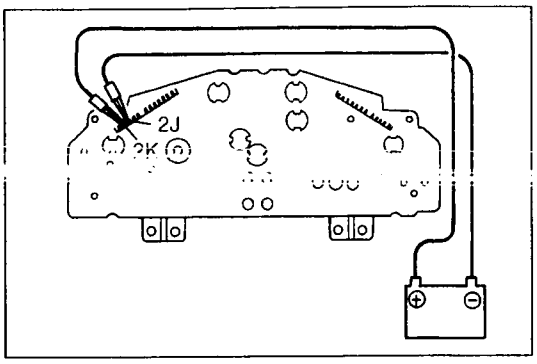
Step 4

1. Ground terminal 2B of the instrument cluster.



2. Verify that the oil pressure gauge indicates low oil pressure as shown in the figure.

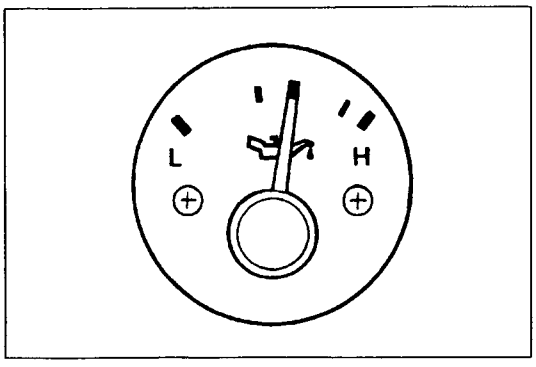
Gauge display	Action
Correct	Repair wiring harness (Instrument cluster — Oil pressure switch)
Incorrect	Replace oil pressure gauge (Refer to Mazda MX–5 Workshop Manual (1221–10–89I), section T.)



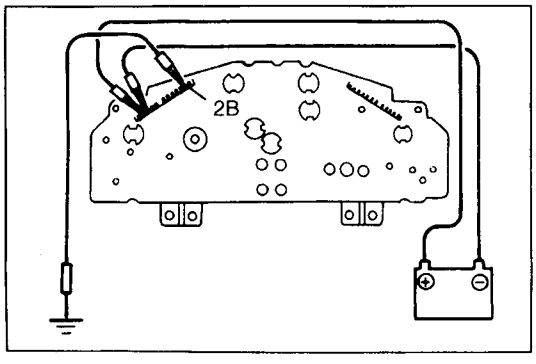
OIL PRESSURE GAUGE

Inspection

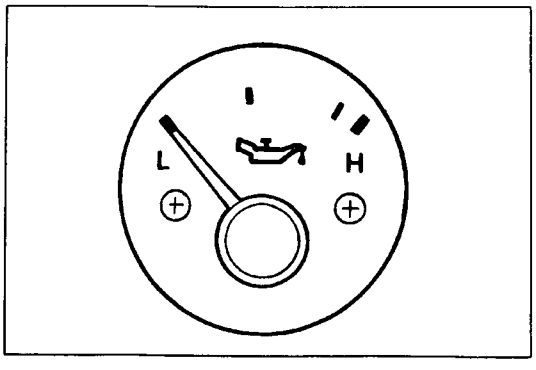
1. Remove the instrument cluster. (Refer to Mazda MX-5 Workshop Manual (1221-10-89I), section T.)
2. Connect battery positive voltage to terminal 2K and ground to terminal 2J of the instrument cluster.



3. Verify that the oil pressure gauge indicates normal oil pressure as shown in the figure.



4. Ground terminal 2B of the instrument cluster.



5. Verify that the oil pressure gauge indicates low oil pressure as shown in the figure.
6. If not as specified, replace the oil pressure gauge. (Refer to Mazda MX-5 Workshop Manual (1221-10-89I), section T.)

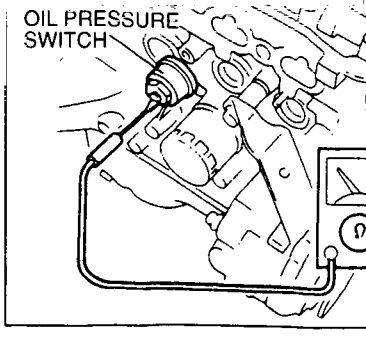
OIL PRESSURE SWITCH

Inspection

1. Disconnect the oil pressure switch connector.
2. Check for continuity between terminal of the oil pressure switch and ground.

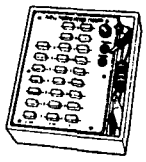
Engine condition	Continuity
Stopped	Yes
Running	No

3. If not as specified, replace the oil pressure switch.

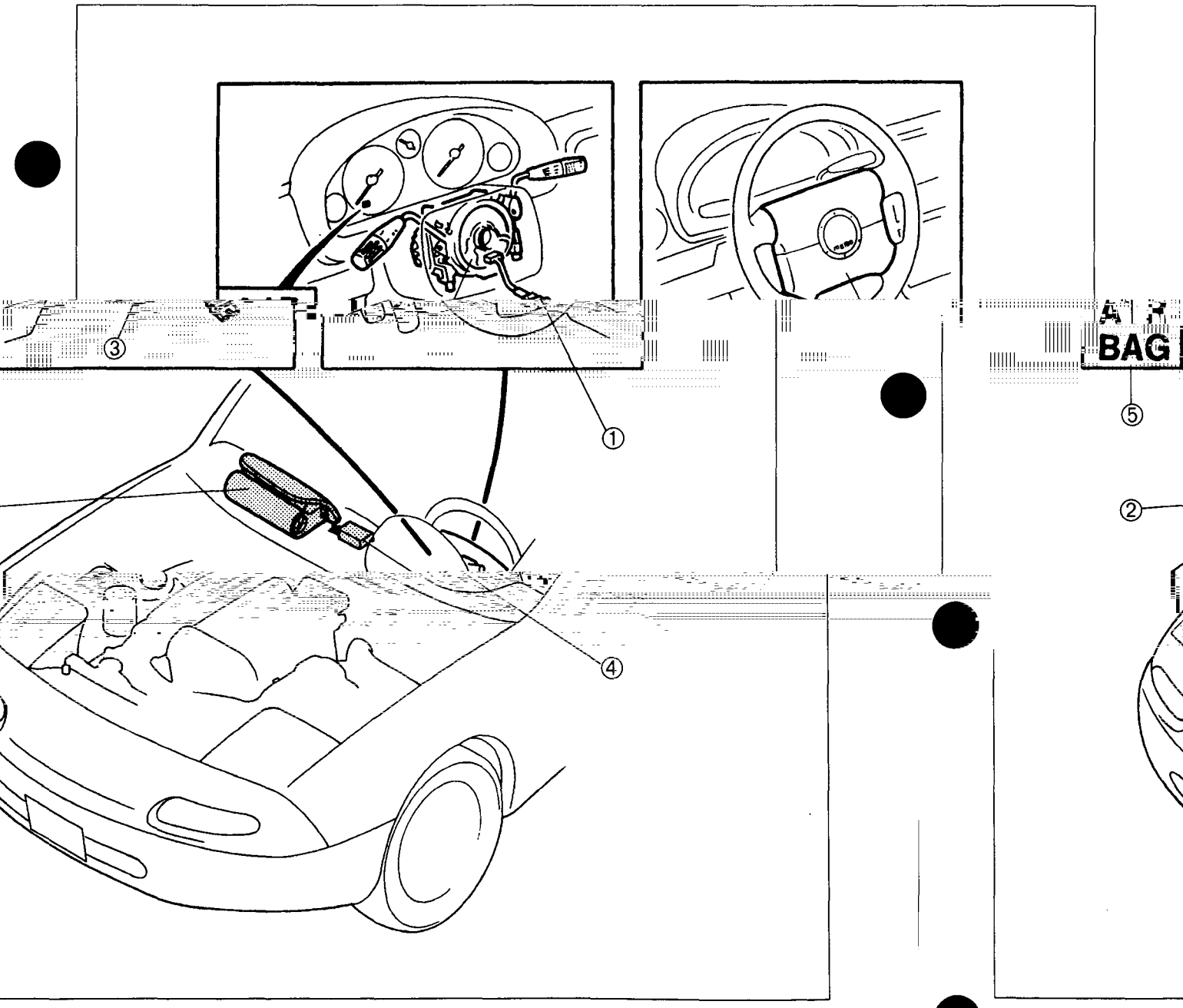


AIR BAG SYSTEM

PREPARATION
SST

49 0839 285 Checker, fuel thermometer		For inspection of air bag system	For diployment of air bag module
49 H066 002 Deployment tool			

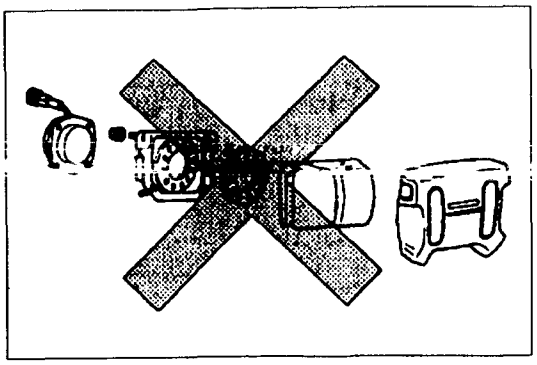
STRUCTURAL VIEW



bag module
e air bag module (LHD only)
tallation ..... page T–25
cedure ..... page T–28

3. Clock spring
4. SAS-unit
   Removal / Installation ..... page T–26
5. Air bag system warning light

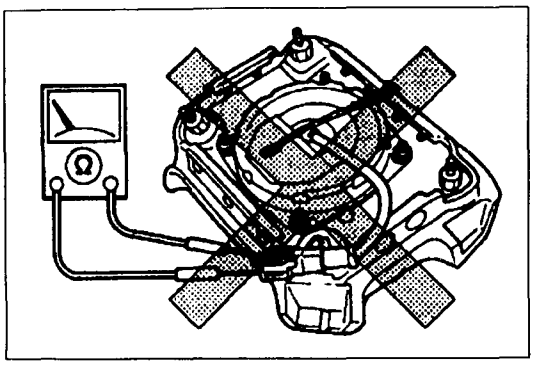
1. Driver-side air
2. Passenger-side
   Removal / Ins
   Disposal proc



SERVICE WARNINGS

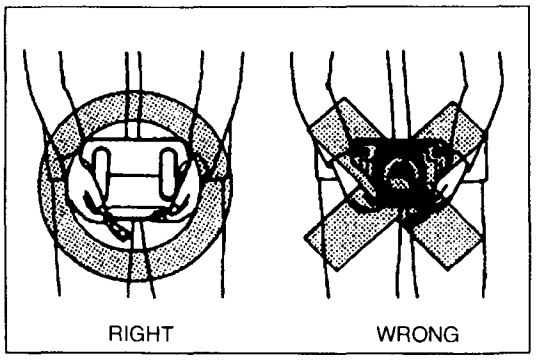
Component Disassembly

- Disassembling and reassembling the components of the air bag system can render the system inoperative, which may result in serious injury or death in the event of an accident. Do not disassemble any air bag system components.



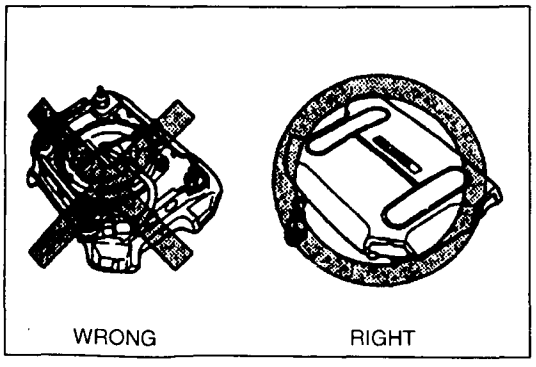
Air Bag Module Inspection

- Inspecting the air bag module with an ohmmeter can deploy the air bag, which can cause serious injury. Do not use an ohmmeter to inspect the air bag module.

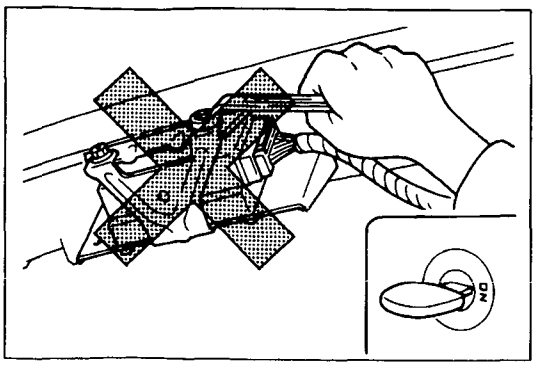


Air Bag Module Handling

- A live (undeployed) air bag may accidently deploy when it is handled and cause serious injury. When carrying a live air bag module, point the trim cover away from your body to lessen the chance of injury in case it deploys.

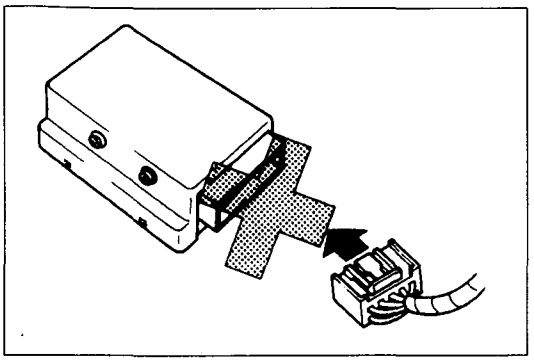


- A live air bag placed face down on a surface is dangerous. If the air bag deploys, the motion of the module can cause serious injury. Always face the trim cover up to reduce the motion of the module in case it accidently deploys.

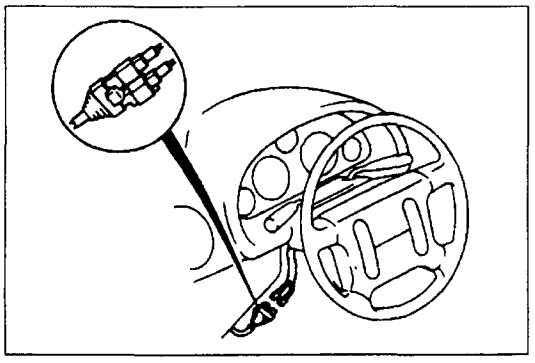


SAS-unit Handling

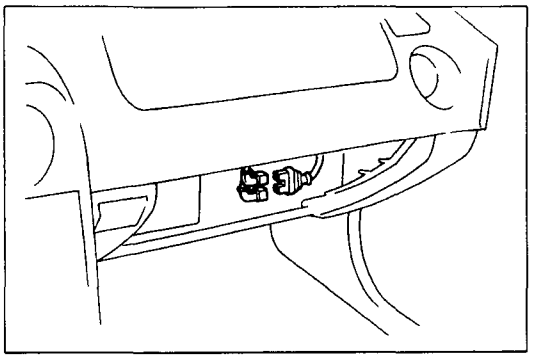
- Disconnecting the SAS-unit connector or removing the SAS-unit with the ignition switch at ON can cause the air bag to deploy, which may seriously injure you. Before disconnecting the SAS–unit connector or removing the SAS-unit, turn the ignition switch to LOCK.



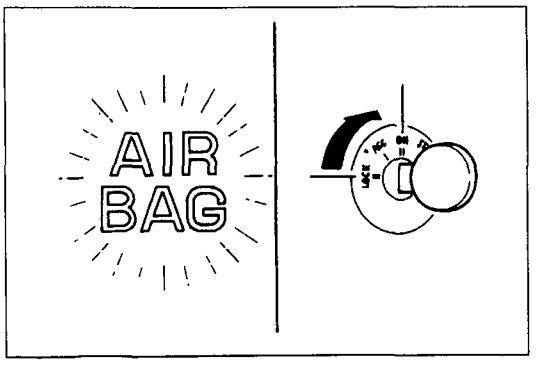
- **Connecting the SAS-unit connector before installing the SAS-unit is dangerous. The shock of installation can cause the air bag to deploy, which may seriously injure you. Before connecting the SAS-unit connector, firmly mount the SAS-unit to the vehicle.**



GENERAL PROCEDURES
Before Servicing
1. Disconnect the negative battery cable.
2. Remove the lower panel.
   (Refer to the Mazda MX–5 Workshop Manual Supplement (1372–10–93I), section S.)
3. Disconnect the orange and blue clock spring connectors.

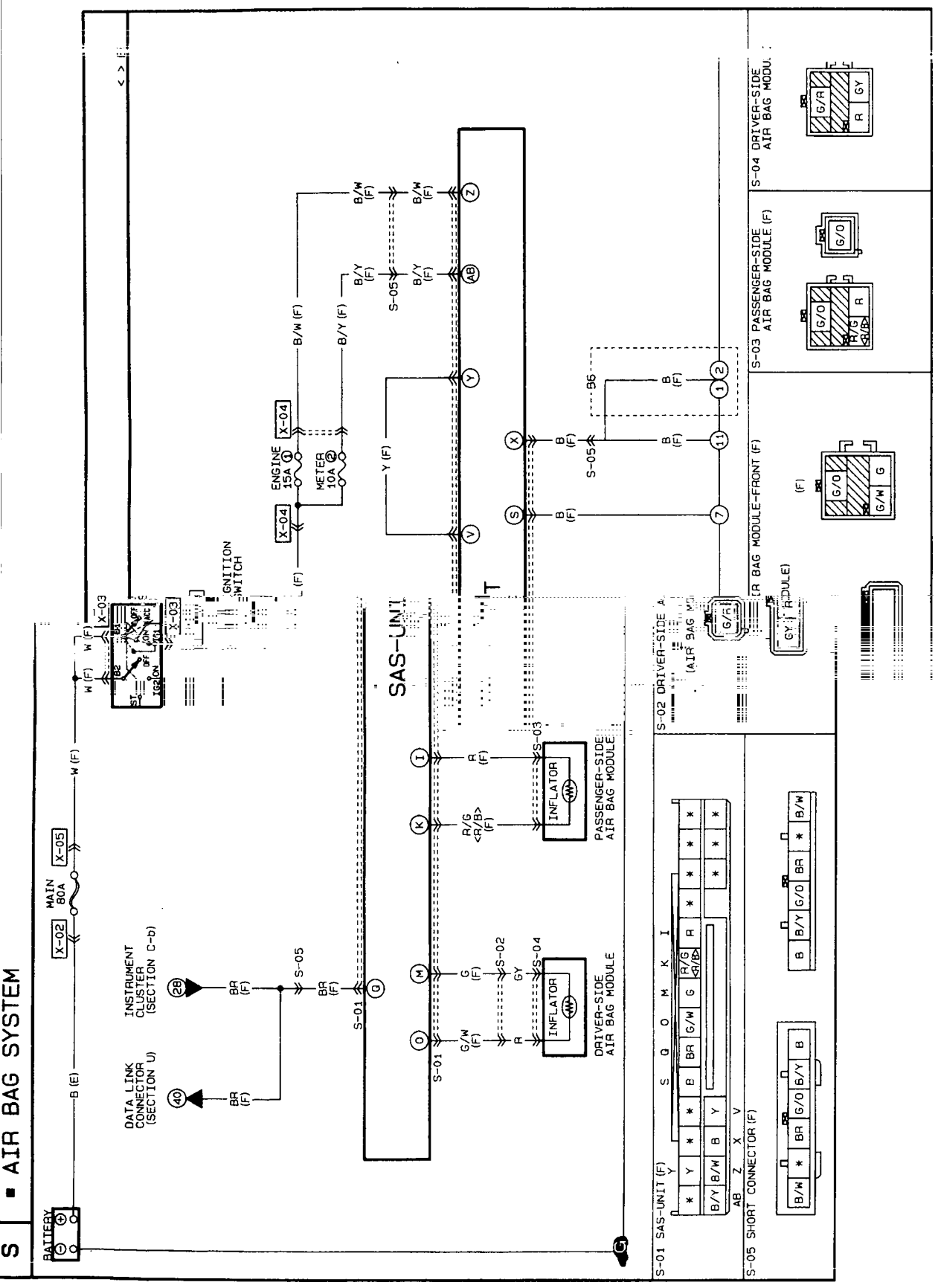


(LHD only)
4. Remove the glove compartment and undercover.
   (Refer to the Mazda MX–5 Workshop Manual Supplement (1372–10–93I), section S.)
5. Disconnect the orange and blue passenger-side air bag module connectors.

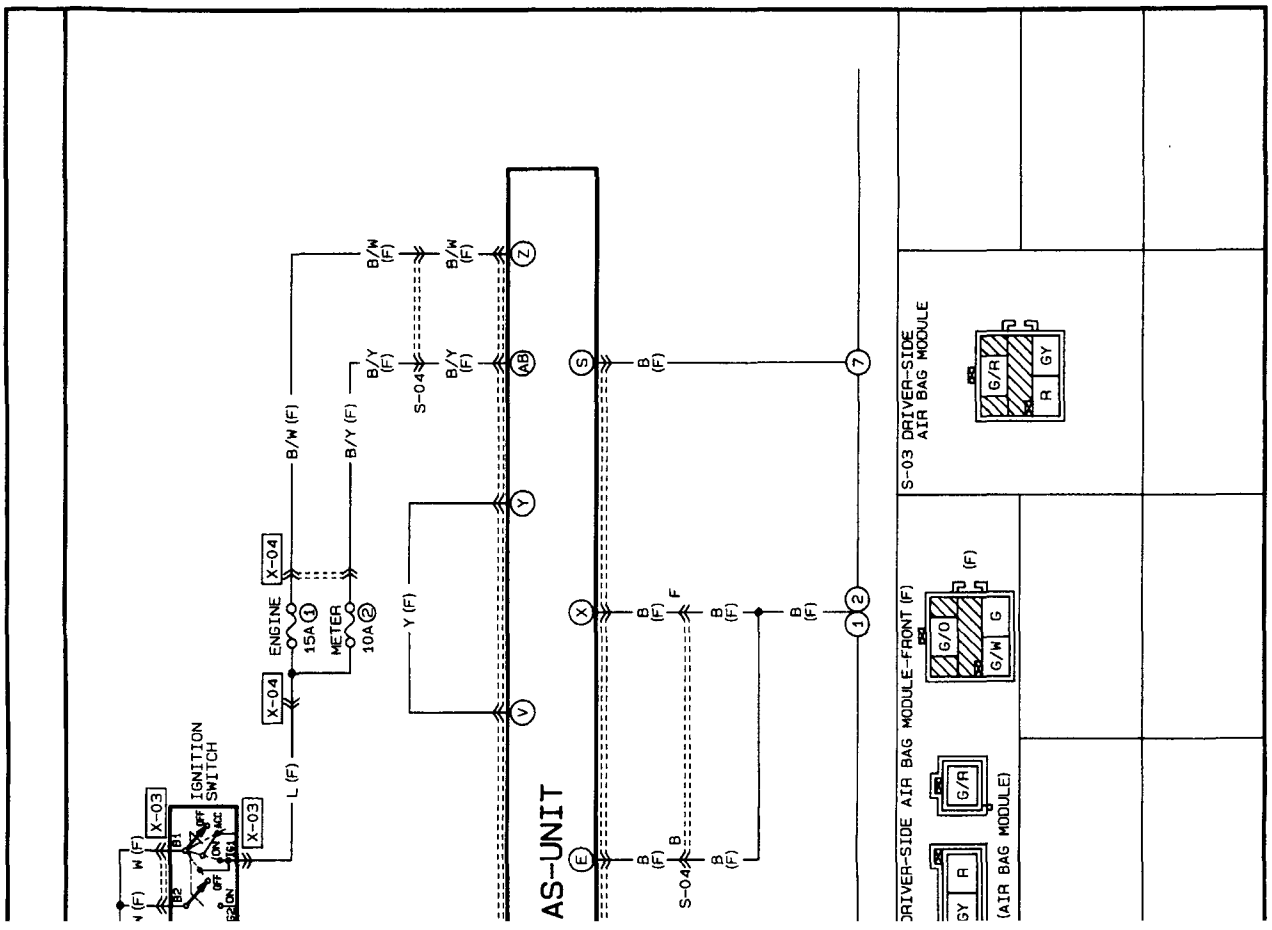


After Servicing
1. Connect the negative battery cable.
2. Turn the ignition switch to ON.
3. Verify that the air bag system warning light illuminates for 4—8 seconds and then goes off.

TROUBLESHOOTING
Circuit Diagram
LHD



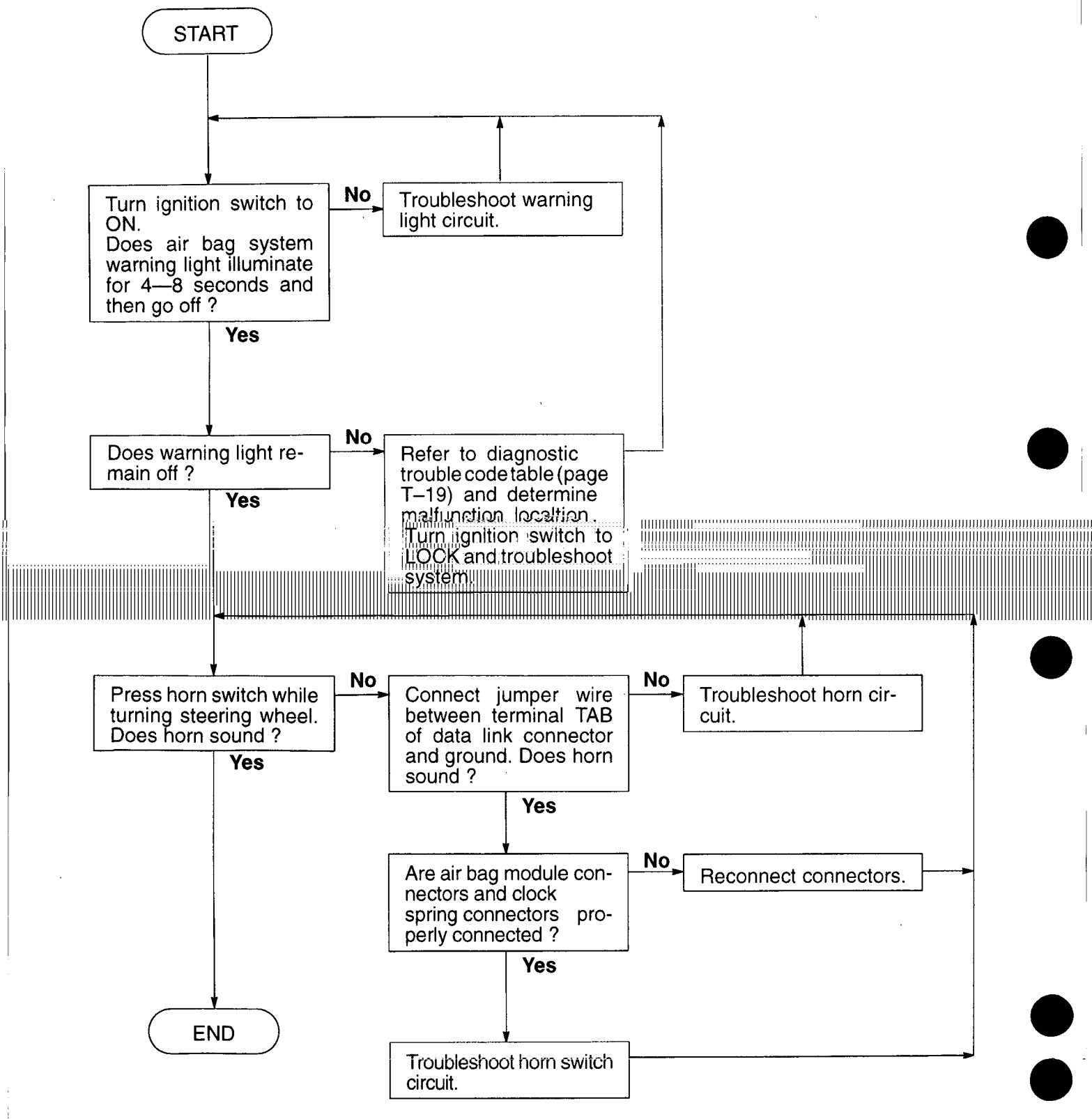
RHD


IGNITION SWITCH
X-03
X-04
ENGINE
15A
METER
10A
B/W (F)
B/Y (F)
L (F)
Y (F)
S-04
AS-UNIT
S-03 DRIVER-SIDE AIR BAG MODULE
DRIVER-SIDE AIR BAG MODULE-FRONT (F)
(AIR BAG MODULE)
G/R
G/O
G/W
G
R
GY

Troubleshooting Procedure

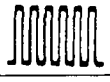
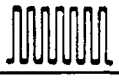
The SAS-unit has an on-board diagnostic function that flashes or illuminates the air bag system warning light to indicate trouble in the air bag system. The trouble can be determined by the warning light illumination or flashing pattern. If the light does not illuminate but the ststem still has trouble, a warning buzzer will sound 5 cycles of 5 times each.

Flowchart



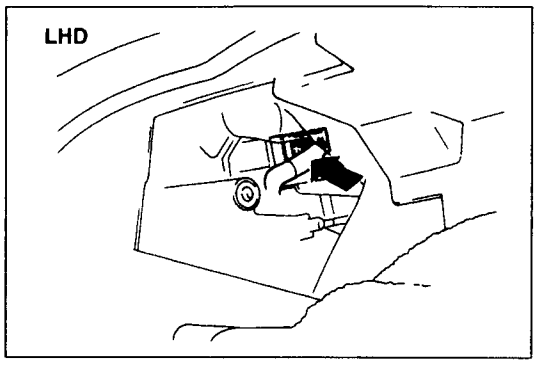
Diagnostic Trouble Code Table

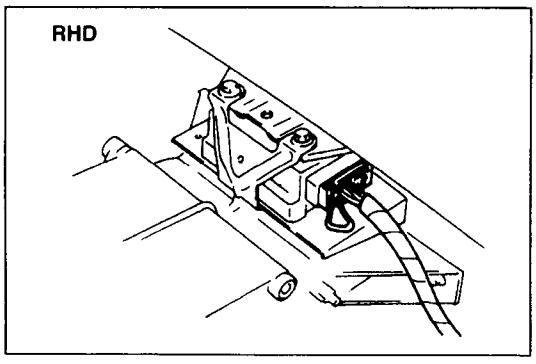
If there are two or more problems in the air bag system, the warning light indicates the problem with the highest priority.

Priority	Code No.	Warning light indication	Possible cause	Inspection area	Refer to page
1	0	Remains on	SAS-unit	SAS-unit connector	T-20
2	3		Weak battery	• Battery • Wiring harness (Battery—ENGINE 15A fuse—SAS unit, Battery—TURN 15A fuse—SAS unit, Battery—METER 15A fuse—SAS unit)	T-21
3	6		*Driver-side air bag module*	• Clock spring • Wiring harness (Clock spring—SAS-unit)	T-22
4 (LHD only)	7		Passenger-side air bag module	• Wiring harness (Passenger-side air bag module—SAS-unit)	T-24

Flowchart No.1	Symptom	Air bag system warning light renains on

Possible cause
- Damaged SAS unit
- Open or short circuit in wiring harness
- Poor connection of connector





Remedy

Warning
- **Handling the SAS-unit improperly can accidently deploy the air bags, which may seriously injure you. Read SERVICE WARNINGS, page T–14, before handling the SAS-unit.**

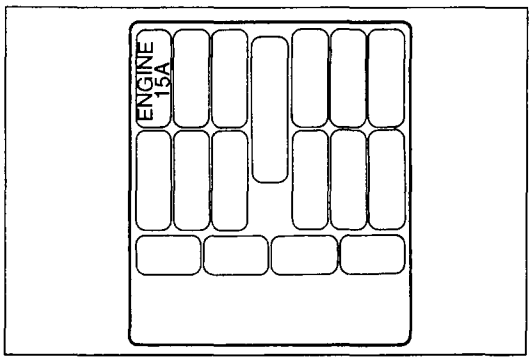
1. Verify that the ignition switch is at LOCK.
2. (LHD)
   Remove the passenger-side air bag module.
   (Refer to page T–25.)
   (RHD)
   Remove the dashboard.
   (Refer to the Mazda MX–5 Workshop Manual Supplement (1372–10–93I), section S.)
3. Check the SAS-unit connection.

Connection	Action
OK	Replace SAS-unit (Refer to page T–26)
Poor	Reconnect connector

Note
- Retry on-board diagnostic after replacing the SAS-unit. If the air bag system warning light remains on, there may be a short circuit in the wiring harness between the instrument cluster and the SAS-unit.

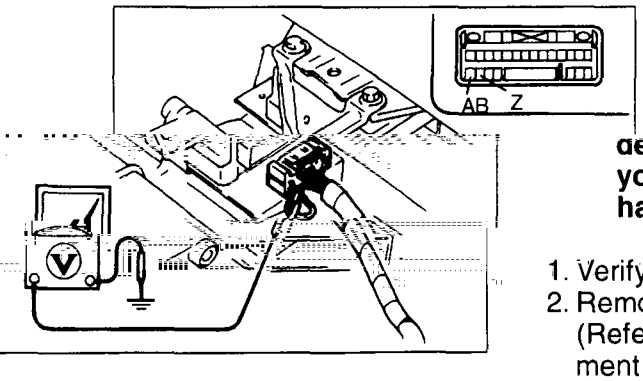
Flowchart No.2	Symptom	Diagnostic trouble code 3

Possible cause
- Burnt ENGINE 15 A fuse
- Damaged SAS-unit
- Open or short circuit in wiring harness
- Poor connection of connector



Step 1
Check the ENGINE 15 A fuse in the fuse block No.1.

Fuse	Action
OK	Go to Step 2
Burnt	Replace fuse after checking and repairing wiring harness



Step 2

Warning
- **Handling the SAS-unit improperly can accidently deploy the air bags, which may seriously injure you. Read SERVICE WARNINGS, page T–14, before handling the SAS-unit.**

1. Verify that the ignition switch is at LOCK.
2. Remove the dashboard.
   (Refer to the Mazda MX–5 Workshop Manual Supplement (1372–10–93I), section S.)
3. Disconnect the SAS-unit connector.
4. Turn the ignition switch to ON.
5. Measure the voltage at the terminals of the SAS-unit connector.

B+: Battery positive voltage

Terminal	Voltage	Action
AB (B/Y)	B+	Measure voltage at terminal Z
	Other	Repair wiring harness (METER 10 A fuse — SAS-unit)
Z (B/W)	B+	Replace SAS-unit (Refer to page T–26)
	Other	Repair wiring harness (ENGINE 15 A fuse — SAS-unit)

Flowchart No.3	Symptom	Diagnostic trouble code 6

Possible cause
- Damaged driver side air bag module
- Damaged clock spring
- Damaged SAS-unit
- Open or short circuit in wiring harness
- Poor connection of connector

Warning

air bag, which
ing the air bag

- **Handling the air bag module and SAS-unit improperly can accidently deploy the may seriously injure you. Read SERVICE WARNINGS, page T–14, before handli module and SAS-unit.**

re under GEN-

connector pin is

switch

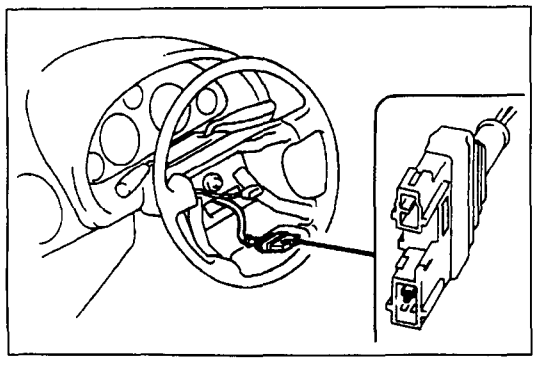
is not broken.

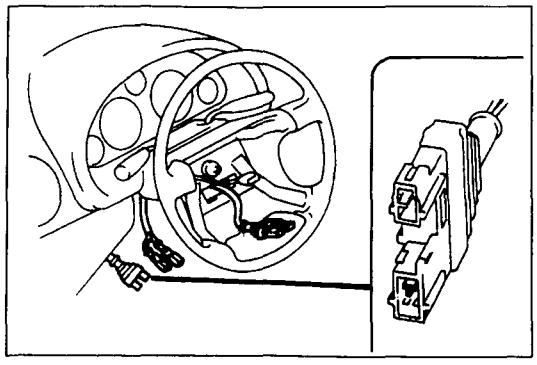
unit)

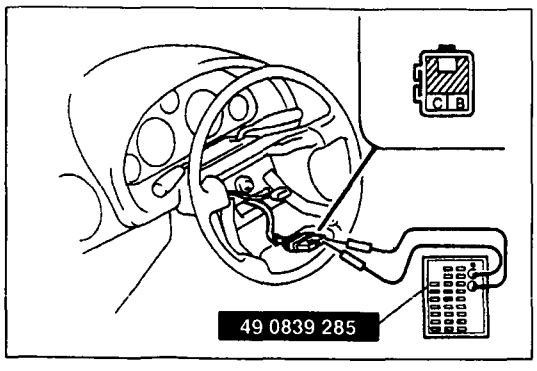
rminals B and C
or.

g connectors.
the diagnostic

bag module







Step 1
1. Carry out the "Before Servicing" procedu ERAL PROCEDURES, page T–15.
2. Remove the driver-side air bag module.
3. Verify that the driver-side air bag module not broken.

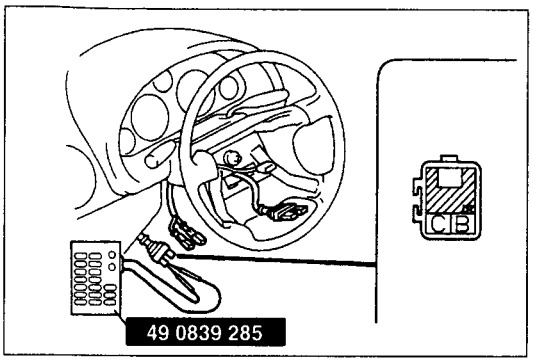
Pin	Actio
OK	Go to Step 2
Broken	Replace combination s

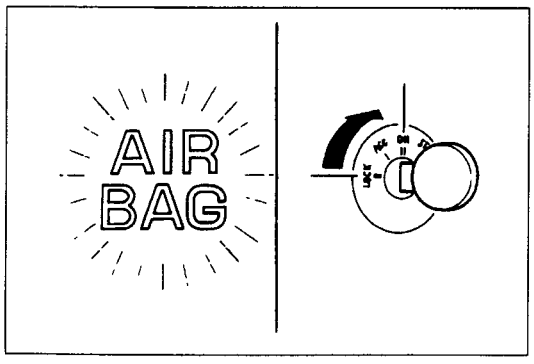
Step 2
Verify that the clock spring connector pin

Pin	Actio
OK	Go to Step 3
Broken	Repair wiring harness (Clock spring — SAS-u

Step 3
1. Connect the lead of the **SST** to between te of the driver-side air bag module connect
2. Set the resistance of the **SST** to 2 ohms.
3. Connect the orange and blue clock sprin
4. Turn the ignition switch to ON and check trouble code.

Diagnostic trouble code	Actio
6	Go to Step 4
Other	Replace driver-side air





Step 4
1. Turn the ignition switch to LOCK.
2. Disconnect the orange and blue clock spring connectors.
3. Connect the lead of the **SST** to between terminals B and C of the clock spring connector.
4. Set the resistance of the **SST** to 2 ohms.
5. Turn the ignition switch to ON and check the diagnostic trouble code.

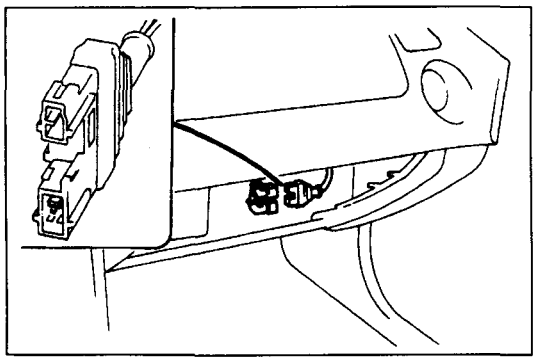
Diagnostic trouble code	Action
6	Go to Step 5
Other	Replace combination switch

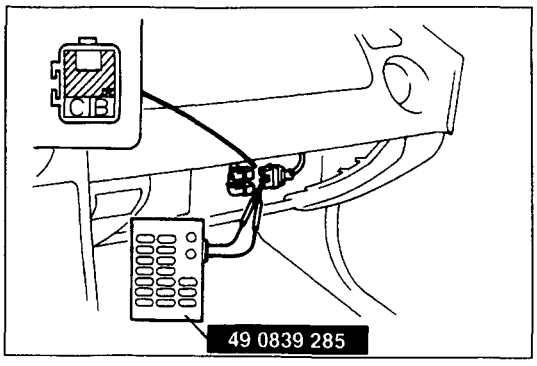
Step 5
1. Turn the ignition switch to LOCK.
2. Replace the SAS-unit. (Refer to page T–26.)
3. Turn the ignition switch to ON and check the diagnostic trouble code.
4. If diagnostic trouble code 6 is still set, repair the wiring harness (clock spring — SAS-unit).

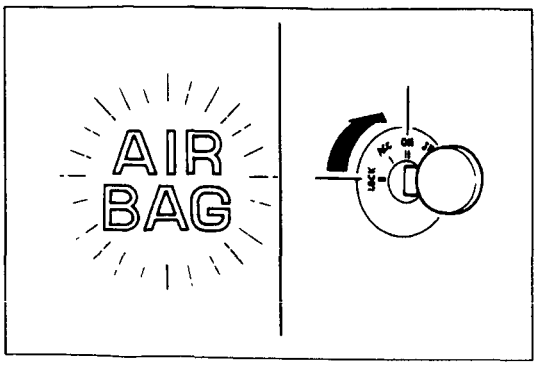
Flowchart No.4	Symptom	Diagnostic trouble code 7

Possible cause
- Damaged passenger-side air bag module
- Damaged SAS-unit
- Open or short circuit in wiring harness
- Poor connection of connector

Warning
- **Handling the air bag module and SAS-unit improperly can accidently deploy the air bag, which may seriously injure you. Read SERVICE WARNINGS, page T–14, before handling the air bag module and SAS-unit.**







Step 1
1. Carry out the "Before Servicing" procedure under GENERAL PROCEDURES, page T–15.
2. Verify that the passenger-side air bag module connector pin is not broken.

Pin	Action
OK	Go to Step 2
Broken	Repair wiring harness (Passenger-side air bag module — SAS-unit)

Step 2
1. Connect the lead of the **SST** to between terminals B and C of the passenger-side air bag module connector.
2. Set the resistance of the **SST** to 2 ohms.
3. Turn the ignition switch to ON and check the diagnostic trouble code.

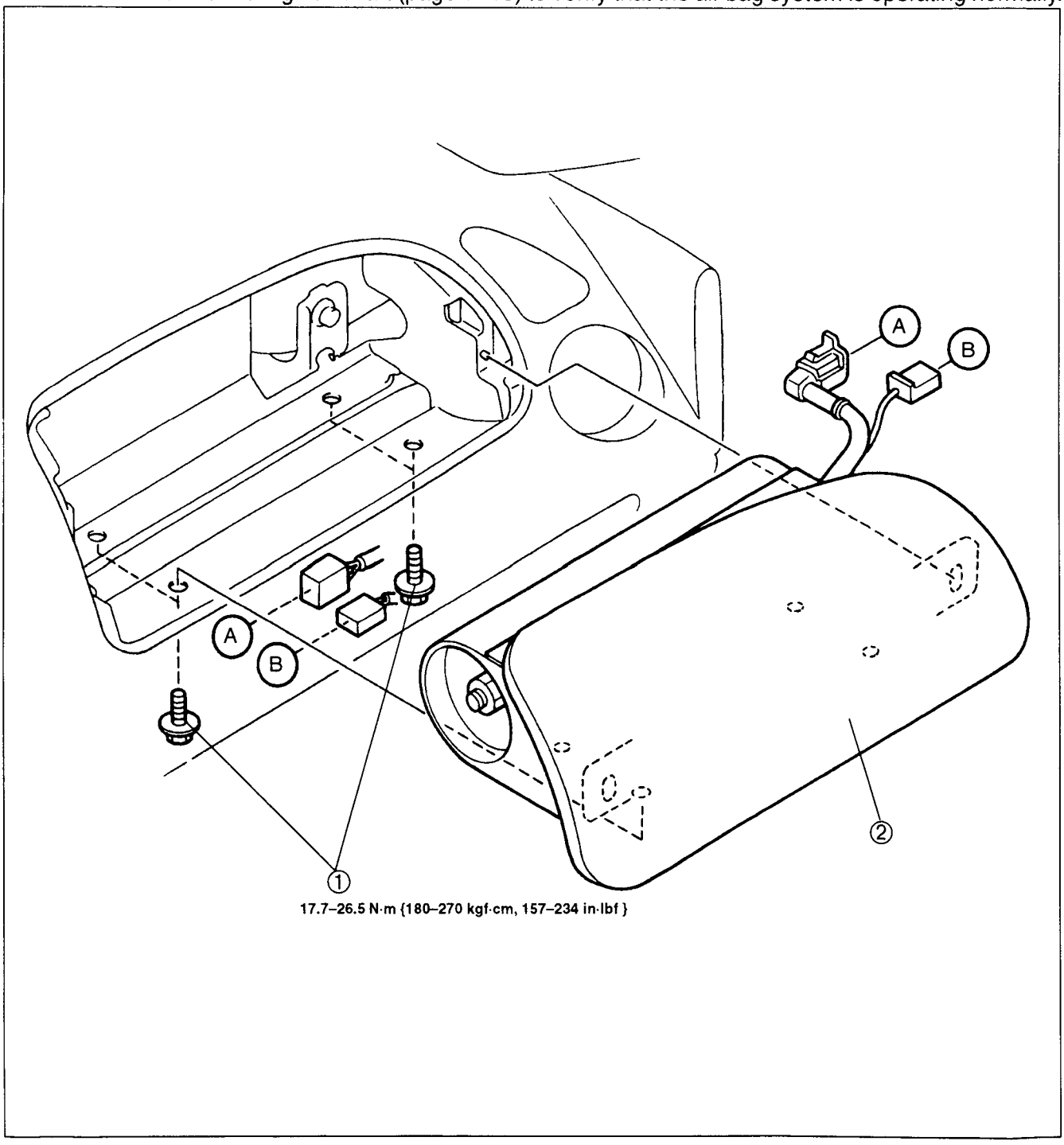
Diagnostic trouble code	Action
7	Go to Step 3
Other	Replace passenger-side air bag module (Refer to page T–25)

Step 3
1. Turn the ignition switch to LOCK.
2. Replace the SAS-unit. (Refer to page T–26.)
3. Turn the ignition switch to ON and check the diagnostic trouble code.
4. If diagnostic trouble code 7 is still set, repair the wiring harness (passenger-side air bag module — SAS-unit).

PASSENGER-SIDE AIR BAG MODULE
Removal / Installation

Warning
- **Handling the air bag module improperly can accidently deploy the air bag, which may seriously injure you. Read SERVICE WARNINGS, page T–14, before handling the air bag module.**

1. Carry out the "Before Servicing" procedure under GENERAL PROCEDURES, page T–15.
2. Remove the glove compartment and undercover.
3. Remove in the order shown in the figure.
4. Install in the reverse order of removal.
5. Follow the troubleshooting flowchart (page T–18) to verify that the air bag system is operating normally.

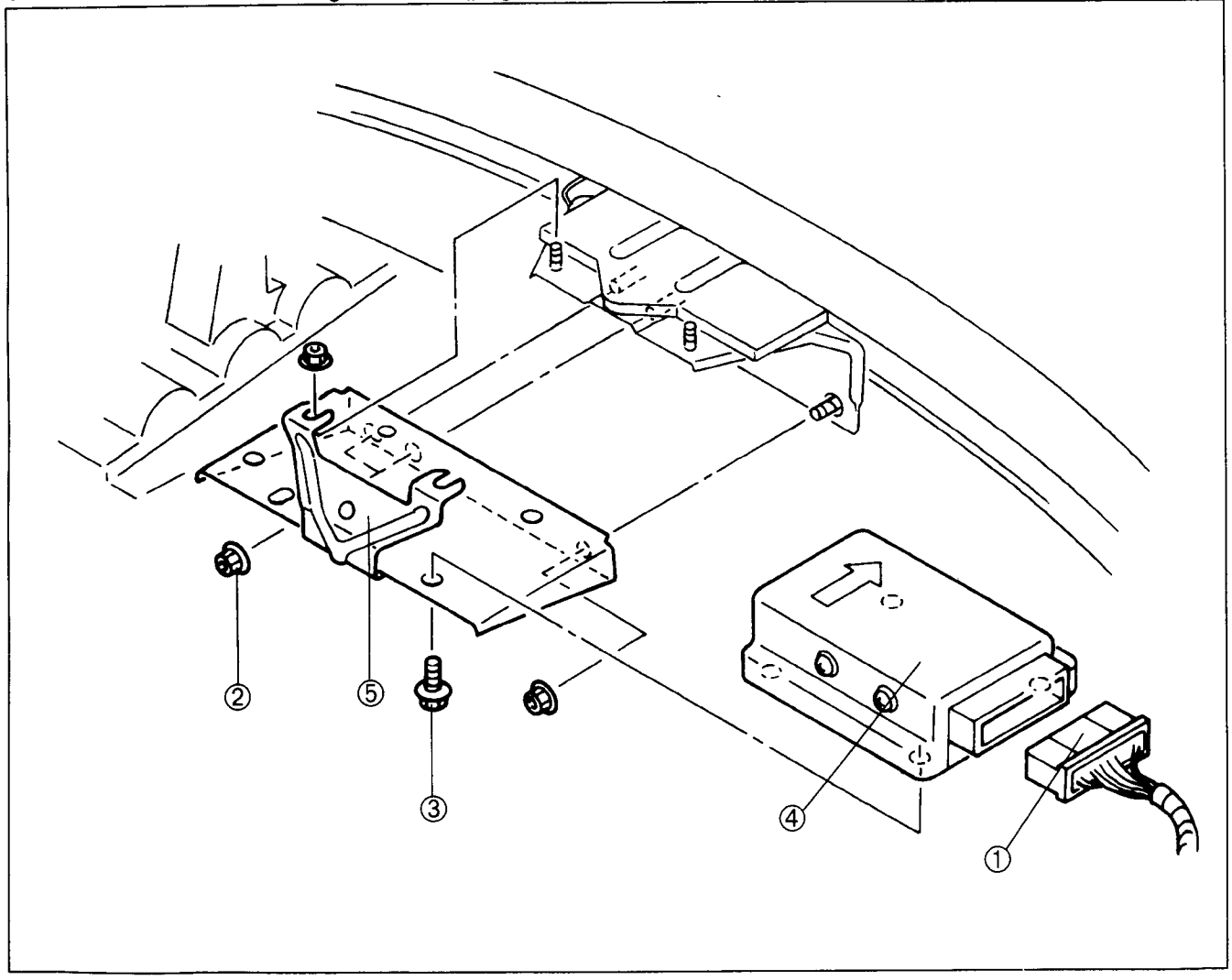


1. Bolts
2. Passenger-side air bag module

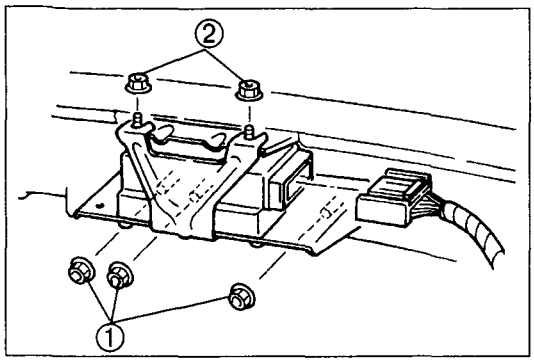
SAS-UNIT
Removal / Installation

Warning
- **Handling the SAS-unit improperly can accidently deploy the air bag, which may seriously injure you. Read SERVICE WARNINGS, page T-14, before handling the SAS-unit.**

1. Carry out the "Before Servicing" procedure under GENERAL PROCEDURES, page T-15.
2. Remove the dashboard. (Refer to the Mazda MX-5 Workshop Manual Supplement (1372-10-93I), section S.)
3. Remove the heater unit. (Refer to the Mazda MX-5 Workshop Manual (1221-10-89I), section S.)
4. Remove in the order shown in the figure.
5. Install in the reverse order of removal, referring to **Installation note**.
6. Follow the troubleshooting flowchart (page T-18) to verify that the air bag system is operating normally.

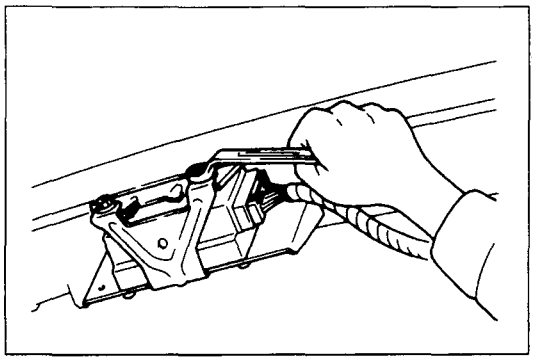


1. Connector
2. Nuts
   Installation note ..... page T-27
3. Bolts
4. SAS-unit
   Installation note ..... page T-27
5. Bracket
   Installation note ..... page T-27



Installation note
Nuts
Tighten the nuts in the order shown in the figure.

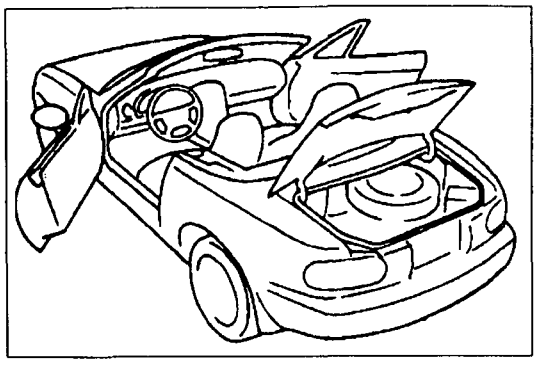
Tightening torque: 6.87—9.80 N·m {70—100 kgf·cm , 60.8—86.7 in·lbf}



SAS-unit and bracket
1. If the bracket mounting area is damaged, repair the area to its original shape.
2. Position the SAS-unit and bracket with the arrow on the SAS-unit facing toward the front of vehicle. Install them and tighten the bolts and nuts to the specified torque.

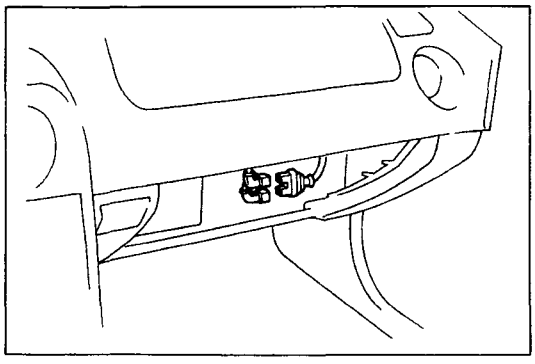
AIR BAG MODULE DISPOSAL PROCEDURE

Before scrapping a vehicle with an undeployed air bag module, deploy the air bag. Never dispose of a live air bag module. If the deployment tool **SST** is not available, consult the nearest Mazda representative for assistance.

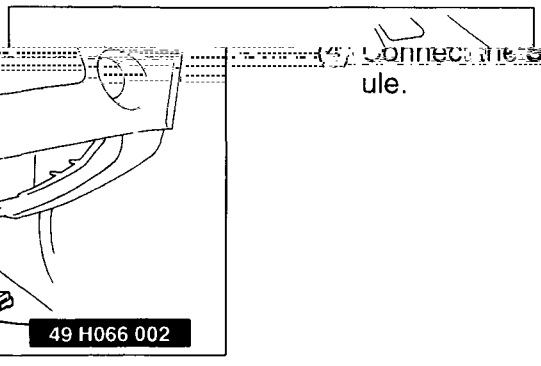


Air Bag Deployment

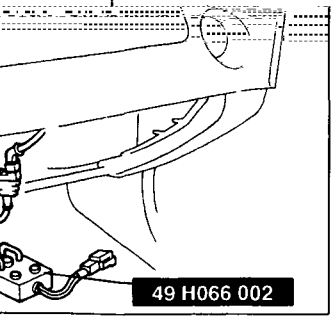
1. Move the vehicle to an open space, away from strong winds, and open all of the vehicle's doors.
2. Disconnect the negative battery cable.
3. Follow the appropriate procedure for the driver-side or passenger-side air bag module.

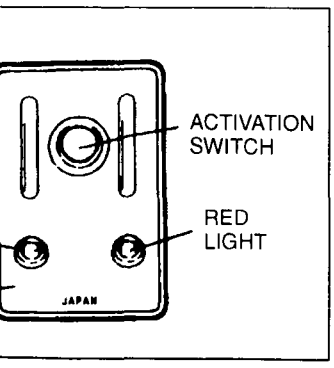


(1) Remove the glove compartment and undercover. (Refer to the Mazda MX-5 Workshop Manual Supplement (1372-10-93I), section S.)
(2) Disconnect the orange and blue passenger-side air bag module connector.

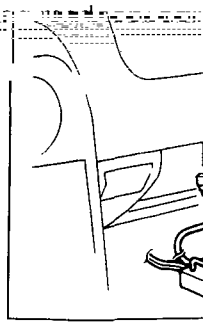


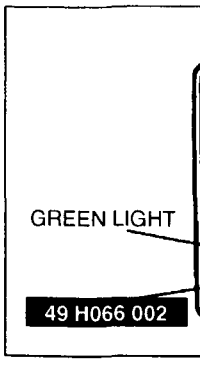
(3) Inspect the **SST** (Refer to page T-30.)
(4) Connect the **SST** to the passenger-side air bag module.

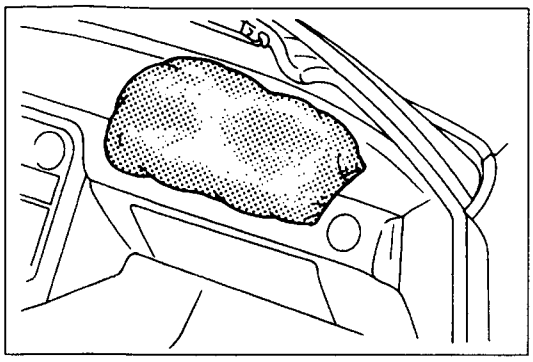




4. Connect the red clip of the **SST** to the positive battery terminal and the black clip to the negative terminal.
5. Verify that the red light on the **SST** is illuminated.
6. Make sure all persons are standing at least **6 m { 20 ft }** from the vehicle.
7. Press the activation switch on the **SST** to deploy the air bag.





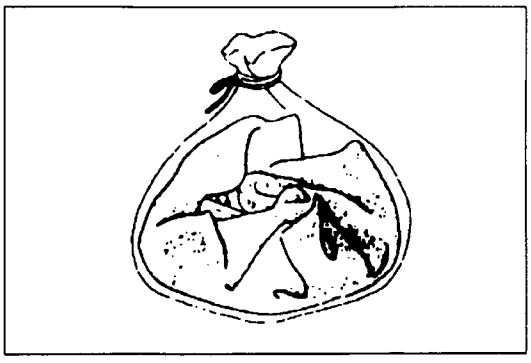


Air Bag Disposal

Warning
- **The air bag is very hot immediately after it deploys. You can be burned. Do not touch the air bag module for at least 15 minutes after deployment.**

Warning
- **Pouring water on a deployed air bag is dangerous. The water will mix with the residual gases to form a gas that can make breathing difficult if inhaled. Do not pour water on the deployed air bag module.**

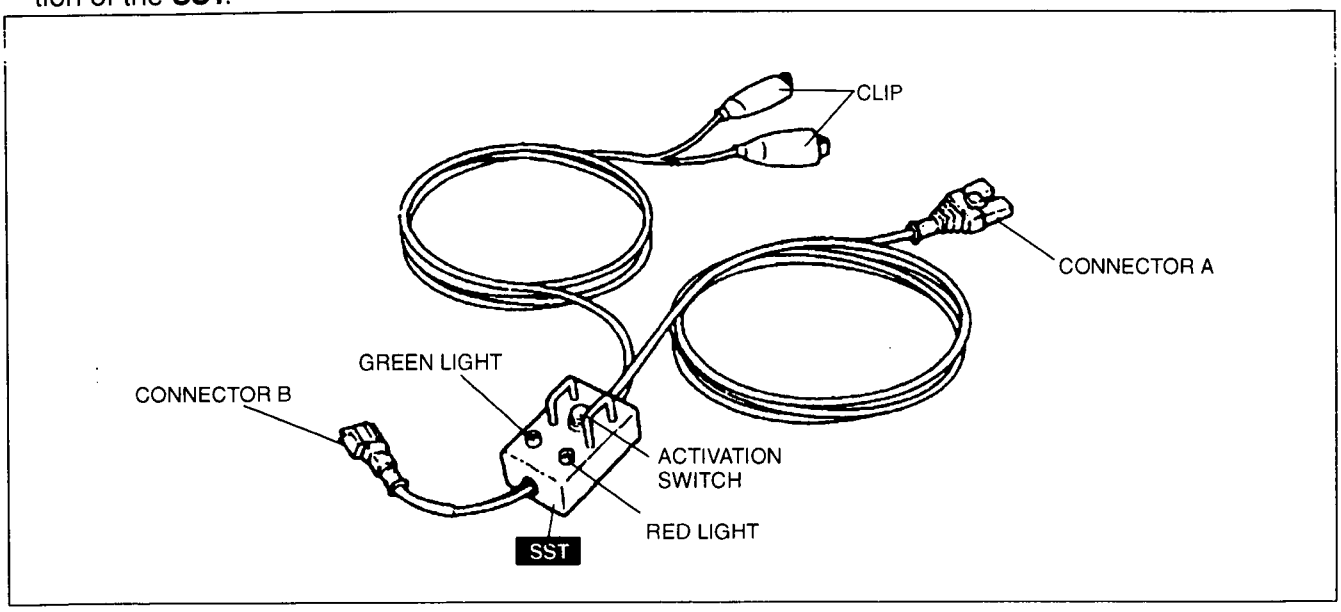
Warning
- **A deployed air bag module may contain deposits of sodium hydroxide, a caustic by-product of the gas -generated combustion. If this substance gets in your eyes or on your hands, it can cause irritation and itching. When handling a deployed air bag module, wear gloves and safety glasses.**

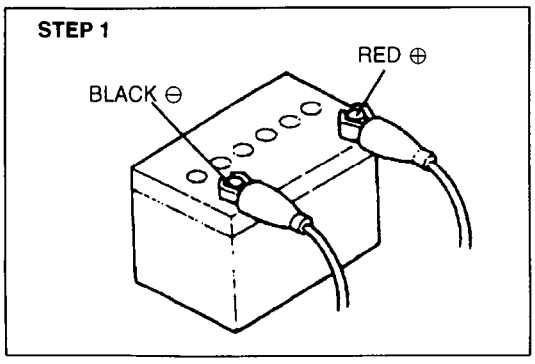


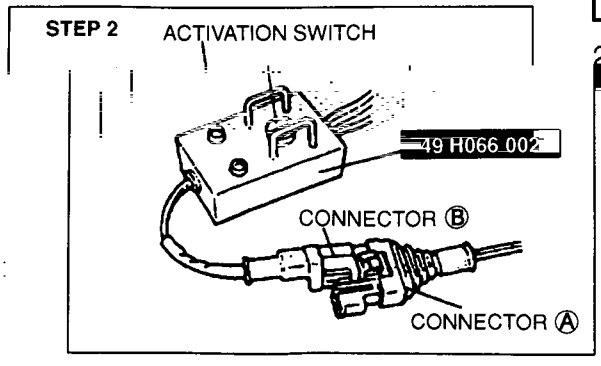
1. Put on gloves and safety glasses.
2. Place the deployed air bag module in a plastic bag, seal it, and then dispose of it.
3. Wash your hands after removing your gloves.

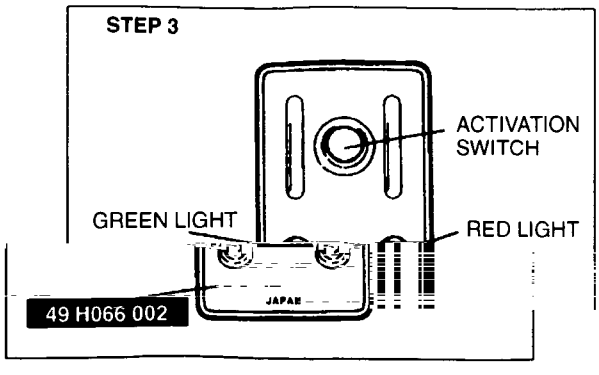
INSPECTION OF SST (DEPLOYMENT TOOL)

- Use the **SST** to deploy a live air bag module before disposing of it.
- Before connecting the **SST** to the clock spring connector or air bag module connector, inspect the operation of the **SST**.









Inspection Procedure

1. Follow the steps below to inspect the operation of the **SST**.

Step	Inspection procedure	Light condition	
		Green	Red
1	Connect red clip to positive battery terminal and black clip to negative battery terminal.	ON	OFF
2	Connect connectors A and B of **SST**.	OFF	ON
3	Press activation switch.	ON	OFF

2. If not as specified, do not use the **SST** because it may cause the air bag to unexpectedly deploy upon connection to the harnesses.

TECHNICAL DATA

ENGINE (B6 DOHC) ..... TD– 2
ENGINE (BP DOHC) ..... TD– 5
LUBRICATION SYSTEM ..... TD– 7
COOLING SYSTEM ..... TD– 8
FUEL AND EMISSION CONTROL SYSTEMS (B6 DOHC) ..... TD– 9
FUEL AND EMISSION CONTROL SYSTEMS (BP DOHC) TD–10
AXLES AND DIFFERENTIAL TD–12
M TD–12
ES TD–12
..... TD–13
L SYSTEM TD–14
FRONT AND REAR
BRAKING SYSTEM
WHEELS AND TIR
SUSPENSION ....
BODY ELECTRICA

B1. ENGINE (B6 DOHC)

Item \ Engine			B6 DOHC
Type			Gasoline, 4-cycle
Cylinder arrangement and number			In-line, 4-cylinders
Combustion chamber			Pentroof
Valve system			DOHC, belt-driven 16 valves
Bore × stroke mm { in }			78.0 × 83.6 {3.07 × 3.29}
Total piston displacement ml { cc, cu in }			1,597 {1,597, 97.42}
Compression ratio			9.0
Compression pressure kPa { kgf/cm², psi }-rpm	Standard		1,324 {13.5,192}-300
	Minimum		932 {9.5,135}-300
	Maximum difference between each cylinder		196 {2.0, 28}
Valve timing	IN	Open BTDC	5°
		Close ABDC	40°
	EX	Open BBDC	55°
		Close ATDC	5°
Valve clearance mm { in }		IN	0 {0}: Maintenance-free
		EX	0 {0}: Maintenance-free
Cylinder head			
Height mm { in }			133.8—134.0 {5.268—5.275}
Distortion mm { in }			0.15 {0.006} max.
Grinding mm { in }			0.20 {0.008} max.
Cylinder head-to-HLA clearance mm { in }		Standard	0.025—0.066 {0.0010—0.0025}
		Maximum	0.18 {0.0071}
Valve and valve guide			
Valve head diameter mm { in }		IN	30.85—31.15 {1.215—1.226}
		EX	26.05—26.35 {1.026—1.037}
Valve head margin thickness mm { in }		IN	1.0 {0.039}
		EX	1.0 {0.039}
Valve face angle		IN	45°
		EX	45°
Valve length mm { in }	IN	Standard	104.89—105.69 {4.1296—4.1610}
		Minimum	104.79 {4.1256}
	EX	Standard	104.99—105.79 {4.1335—4.1649}
		Minimum	104.89 {4.1295}
Valve stem diameter mm { in }		IN	5.970—5.985 {0.2351—0.2356}
		EX	5.965—5.980 {0.2349—0.2354}
Guide inner diameter mm { in }			6.01—6.03 {0.2367—0.2374}
Valve stem-to-guide clearance mm { in }		IN	0.025—0.060 {0.0010—0.0023}
		EX	0.030—0.065 {0.0012—0.0025}
		Maximum	0.20 {0.008}
Guide projection mm { in }		IN	16.8—17.4 {0.662—0.685}
		EX	16.8—17.4 {0.662—0.685}
Valve seat			
Seat angle		IN	45°
		EX	45°
Seat contact width mm { in }			0.8—1.4 {0.032—0.055}
Seat sinking mm { in }		Standard	43.5 {1.713}
		Maximum	45.0 {1.772}

Item			Engine: B6 DOHC
Valve spring			
Free length mm { in }	IN	Standard	48.32 {1.902}
		Minimum	47.32 {1.863}
	EX	Standard	48.34 {1.903}
		Minimum	47.34 {1.864}
Out-of-square mm { in }		IN	1.69 {0.0665} max.
		EX	1.69 {0.0665} max.
Setting load/height N { kgf, lbf }/ mm { in }		IN	217—246 {22.13—25.05, 48.6—55.2}/40.0 {1.575}
		EX	174—196 {17.67—20.0, 38.9—44.0}/40.0 {1.575}
Camshaft			
Cam height mm { in }	IN	Standard	39.984 {1.5742}
		Minimum	39.784 {1.5663}
	EX	Standard	40.888 {1.6098}
		Minimum	40.688 {1.6019}
Journal diameter mm { in }		Standard (No.1—No.5)	25.940—25.965 {1.0213—1.0222}
		Out-of-round	0.05 {0.002} max.
Camshaft bearing oil clearance mm { in }		Standard (No.1—No.5)	0.035—0.080 {0.0014—0.0031}
		Maximum	0.15 {0.006}
Camshaft runout mm{ in }			0.03 {0.0012} max.
Camshaft end play mm { in }		Standard	0.057—0.127 {0.0023—0.0049}
		Maximum	0.20 {0.0079}
Cylinder block			
Height mm { in }			221.5 {8.720}
Distortion mm { in }			0.15 {0.006} max.
Grinding mm { in }			0.20 {0.008} max.
Cylinder bore diameter mm{ in }	Standard size		78.000—78.019 {3.0709—3.0716}
	0.25 {0.01} oversize		78.250—78.269 {3.0808—3.0814}
	0.50 {0.02} oversize		78.500—78.519 {3.0906—3.0912}
Cylinder bore taper and out-of-round mm { in }			0.019 {0.0007} max.
Piston			
Piston diameter Measured at 90° to pin bore axis and 17.6mm {0.693 in} below oil ring groove mm { in }	Standard size		77.954—77.974 {3.0691—3.0698}
	0.25 {0.01} oversize		78.204—78.224 {3.0789—3.0796}
	0.50 {0.02} oversize		78.454—78.474 {3.0888—3.0895}
Piston-to-cylinder clearance mm { in }		Standard	0.024—0.037 {0.0010—0.0014}
		Maximum	0.15 {0.006}
Piston ring			
Thickness mm { in }		Top	1.497—1.499 {0.0590—0.0590}
		Second	1.497—1.499 {0.0590—0.0590}
End gap (Measured in cylinder) mm { in }		Top	0.15—0.30 {0.006—0.011}
		Second	0.30—0.45 {0.012—0.017}
		Oil (rail)	0.20—0.70 {0.008—0.027}
		Maximum	1.0 {0.039}
Ring groove width in piston mm {in }		Top	1.520—1.535 {0.0599—0.0604}
		Second	1.520—1.540 {0.0598—0.0606}
		Oil	3.010—3.030 {0.1186—0.1192}
Piston ring-to-ring groove clearance mm{ in }		Top	0.030—0.065 {0.0012—0.0026}
		Second	0.03—0.07 {0.0012—0.0027}
		Maximum	0.15 {0.006}

Item \ Engine			B6 DOHC
Piston pin			
Diameter		mm { in }	19.987—19.993 {0.7869—0.7871}
Piston to pin clearance		mm { in }	−0.005—0.013 {−0.0002—0.0005}
Connecting rod bush-to-piston pin clearance		mm { in }	0.010—0.027 {0.0004—0.0010}
Connecting rod and connecting rod bearing			
Length (Center to center)		mm { in }	132.85—132.95 {5.231—5.234}
Bending		mm { in }	0.075 {0.0030} max./50 {1.97}
Small end bore (Bush inner diameter)		mm { in }	20.003—20.014 {0.7876—0.7879}
Big end bore		mm { in }	48.000—48.016 {1.8898—1.8903}
Big end width		mm { in }	21.838—21.890 {0.8598—0.8618}
Connecting rod side clearance		mm { in }	Standard: 0.110—0.262 {0.0044—0.0103}; Maximum: 0.30 {0.012}
Crankshaft			
Crankshaft runout		mm { in }	0.04 {0.0016} max.
Main journal diameter	Standard size	mm { in }	Standard: 49.938—49.956 {1.9661—1.9667}; Minimum: 49.904 {1.9647}
	0.25 {0.01} undersize	mm { in }	Standard: 49.688—49.706 {1.9563—1.9569}; Minimum: 49.652 {1.9548}
	0.50 {0.02} undersize	mm { in }	Standard: 49.438—49.456 {1.9464—1.9470}; Minimum: 49.402 {1.9450}
	0.75 {0.03} undersize	mm { in }	Standard: 49.188—49.206 {1.9366—1.9372}; Minimum: 49.152 {1.9351}
Main journal taper and out-of round		mm {in}	0.05 {0.0020} max.
Crankpin diameter	Standard size	mm { in }	Standard: 44.940—44.956 {1.7693—1.7699}; Minimum: 44.908 {1.7680}
	0.25 {0.01} undersize	mm { in }	Standard: 44.690—44.706 {1.7595—1.7600}; Minimum: 44.658 {1.7582}
	0.50 {0.02} undersize	mm { in }	Standard: 44.440—44.456 {1.7497—1.7502}; Minimum: 44.408 {1.7483}
	0.75 {0.03} undersize	mm { in }	Standard: 44.190—44.206 {1.7398—1.7403}; Minimum: 44.158 {1.7385}
Crankpin taper and out-of-round		mm { in }	0.05 {0.0020} max.
Main bearing			
Main journal bearing oil clearance		mm{ in }	Standard: 0.018—0.036 {0.0008—0.0014}; Maximum: 0.10 {0.004}
Available undersize bearing		mm { in }	0.25 {0.01}, 0.50 {0.02}, 0.75 {0.03}
Crankpin bearing			
Crankpin bearing oil clearance		mm { in }	Standard: 0.028—0.068 {0.0012—0.0026}; Maximum: 0.10 {0.004}
Available undersize bearing		mm { in }	0.25 {0.01}, 0.50 {0.02}, 0.75 {0.03}
Thrust bearing			
Crankshaft end play		mm { in }	Standard: 0.080—0.282 {0.0032—0.0111}; Maximum: 0.30 {0.012}
Bearing width	Standard size	mm { in }	2.500—2.550 {0.0985—0.1003}
	0.25 {0.01} oversize	mm { in }	2.625—2.675 {0.1034—0.1053}
	0.50 {0.02} oversize	mm { in }	2.750—2.800 {0.1083—0.1102}
	0.75 {0.03} oversize	mm { in }	2.875—2.925 {0.1132—0.1151}
Timing belt			
Belt deflection		mm { in }/98 N {10 kgf, 22 lbf }	9.0—11.5 {0.36—0.45}

B2. ENGINE (BP DOHC)

Item \ Engine			BP DOHC
Type			Gasoline, 4-cycle
Cylinder arrangement and number			In-line, 4-cylinders
Combustion chamber			Pentroof
Valve system			DOHC, belt-driven 16 valves
Bore × stroke mm { in }			83.0 × 85.0 {3.27 × 3.35}
Total piston displacement ml { cc, cu in }			1,840 {1,840, 112}
Compression ratio			9.0
Compression pressure kPa { kgf/cm², psi }-rpm	Standard		1,255 {12.8, 182}-300
	Minimum		883 {9.0, 128}-300
	Maximum difference between each cylinder		196 {2.0, 28}
Valve timing	IN	Open (BTDC°)	5
		Close (ABDC°)	48
	EX	Open (BBDC°)	56
		Close (ATDC°)	14
Valve clearance mm { in }		IN	0 {0} : Maintenance-free
		EX	0 {0} : Maintenance-free
Cylinder head			
Height mm { in }			133.8—134.0 {5.268—5.275}
Distortion mm { in }			0.10 {0.004} max.
Grinding mm { in }			0.10 {0.004} max.
Cylinder head-to-HLA clearance mm { in }		Standard	0.025—0.066 {0.0010—0.0025}
		Maximum	0.18 {0.0071}
Valve and valve guide			
Valve head diameter mm { in }		IN	32.9—33.1 {1.296—1.303}
		EX	27.85—28.15 {1.097—1.108}
Valve head margin thickness mm { in }		IN	0.9 {0.035}
		EX	1.0 {0.039}
Valve face angle		IN	45°
		EX	45°
Valve length mm { in }	IN	Standard	101.89 {4.0114}
		Minimum	100.39 {3.9524}
	EX	Standard	101.99 {4.0153}
		Minimum	100.49 {3.9563}
Valve stem diameter mm { in }		IN	5.970—5.985 {0.2351—0.2356}
		EX	5.965—5.980 {0.2349—0.2354}
Guide inner diameter mm { in }			6.01—6.03 {0.2367—0.2374}
Valve stem-to-guide clearance mm { in }		IN	0.025—0.060 {0.0010—0.0023}
		EX	0.030—0.065 {0.0012—0.0025}
		Maximum	0.20 {0.008}
Guide projection mm { in }		IN	18.3—18.9 {0.721—0.744}
		EX	18.3—18.9 {0.721—0.744}
Valve seat			
Seat angle		IN	45°
		EX	45°
Seat contact width mm { in }			0.8—1.4 {0.032—0.055}
Seat sinking mm { in }		Standard	45.0 {1.772}
		Maximum	46.5 {1.831}

Item \ Engine			BP DOHC
Valve spring			
Free length mm { in }		IN	46.26 {1.821}
		EX	46.26 {1.821}
Minimum length mm { in }		IN	39.5 {1.56} with a set load of 224—253 N {22.8—25.8 kgf, 50.2—56.7 lbf}
		EX	39.5 {1.56} with a set load of 224—253 N {22.8—25.8 kgf, 50.2—56.7 lbf}
Out-of-square mm { in }		IN	1.62 {0.0638} max.
		EX	1.62 {0.0638} max.
Camshaft			
Cam height mm { in }	IN	Standard	44.094 {1.7360}
		Maximum	43.894 {1.7281}
	EX	Standard	44.600 {1.7559}
		Maximum	44.400 {1.7480}
Journal diameter mm { in }		Standard (No.1—No.5)	25.940—25.965 {1.0213—1.0222}
Camshaft bearing oil clearance mm { in }		Standard (No.1—No.5)	0.035—0.081 {0.0014—0.0031}
		Maximum	0.15 {0.006}
Camshaft runout mm { in }			0.03 {0.0012} max.
Camshaft end play mm { in }		Standard	0.057—0.127 {0.0023—0.0049}
		Maximum	0.20 {0.008}
Cylinder block			
Height mm { in }			221.5 {8.720}
Distortion mm { in }			0.15 {0.006} max.
Grinding mm { in }			0.20 {0.008} max.
Cylinder bore diamete mm { in }	Standard size		83.000—83.019 {3.2678—3.2684}
	0.25 {0.01} oversize		83.256—83.263 {3.2778—3.2780}
	0.50 {0.02} oversize		83.506—83.513 {3.2877—3.2879}
Cylinder bore taper and out-of-round mm { in }			0.019 {0.0007} max.
Piston			
Piston diameter Measured at 90° to pin bore axis and 16.5mm {0.65 in} below oil ring groove mm { in }	Standard size		82.954—82.974 {3.2660—3.2666}
	0.25 {0.01} oversize		83.211—83.217 {3.2761—3.2762}
	0.50 {0.02} oversize		83.461—83.467 {3.2859—3.2861}
Piston to cylinder clearance mm { in }		Standard	0.032—0.059 {0.0013—0.0023}
		Maximum	0.15 {0.006}
Piston ring			
Thickness mm { in }		Top	1.47—1.49 {0.0579—0.0586}
		Second	1.47—1.49 {0.0579—0.0586}
End gap (Measured in cylinder) mm { in }		Top	0.15—0.30 {0.006—0.011}
		Second	0.15—0.30 {0.006—0.011}
		Oil (rail)	0.20—0.70 {0.008—0.027}
		Maximum	1.0 {0.039}
Ring groove width in piston mm { in }		Top	1.52—1.535 {0.0599—0.0604}
		Second	1.52—1.54 {0.0599—0.0606}
		Oil	3.02—3.04 {0.1189—0.1196}
Piston ring-to-ring groove clearance mm { in }		Top	0.03—0.065 {0.0012—0.0025}
		Second	0.03—0.07 {0.0012—0.0027}
		Maximum	0.15 {0.006}
Piston pin			
Diameter mm { in }			19.987—19.993 {0.7869—0.7871}
Piston-to-piston pin clearance mm { in }			−0.005—0.013 {−0.0002—0.0005}
Connecting rod bush-to-piston pin clearance mm { in }			0.010—0.027 {0.0004—0.0010}

Item. \ Engine			BP DOHC
Connecting rod and connecting rod bearing			
Length (Center to center) mm { in }			132.85—132.95 {5.231—5.234}
Bending mm { in }			0.030 {0.0012} max. /100 {3.94}
Small end bore (Bush inner diameter) mm { in }			20.003—20.014 {0.7876—0.7879}
Big end bore mm { in }			48.000—48.016 {1.8898—1.8903}
Big end width mm { in }			21.838—21.890 {0.8598—0.8618}
Connecting rod side clearance mm { in }		Standard	0.110—0.262 {0.0044—0.0103}
		Maximum	0.30 {0.012}
Crankshaft			
Crankshaft runout mm { in }			0.04 {0.0016} max.
Main journal diameter mm { in }	Standard size	Standard	49.938—49.956 {1.9661—1.9667}
		Minimum	49.904 {1.9647}
	0.25 {0.01} undersize	Standard	49.688—49.706 {1.9563—1.9569}
		Minimum	49.652 {1.9548}
	0.50 {0.02} undersize	Standard	49.438—49.456 {1.9464—1.9470}
		Minimum	49.402 {1.9450}
	0.75 {0.03} undersize	Standard	49.188—49.206 {1.9366—1.9372}
		Minimum	49.152 {1.9351}
Main journal out-of-round mm { in }			0.05 {0.0020} max.
Crankpin diameter mm { in }	Standard size	Standard	44.940—44.956 {1.7693—1.7699}
		Minimum	44.908 {1.7680}
	0.25 {0.01} undersize	Standard	44.690—44.706 {1.7595—1.7600}
		Minimum	44.658 {1.7582}
	0.50 {0.02} undersize	Standard	44.440—44.456 {1.7497—1.7502}
		Minimum	44.408 {1.7483}
	0.75 {0.03} undersize	Standard	44.190—44.206 {1.7398—1.7403}
		Minimum	44.158 {1.7385}
Crankpin out-of-round mm { in }			0.05 {0.0020} max.
Main bearing			
Main journal bearing oil clearance mm { in }		Standard	0.018—0.036 {0.0008—0.0014}
		Maximum	0.10 {0.004}
Available undersized bearing mm { in }			0.25 {0.01}, 0.50 {0.02}, 0.75 {0.03}
Crankpin bearing			
Crankpin bearing oil clearance mm { in }		Standard	0.020—0.044 {0.0008—0.0017}
		Maximum	0.10 {0.004}
Available undersize bearing mm { in }			0.25 {0.01}, 0.50 {0.02}, 0.75 {0.03}
Thrust bearing			
Crankshaft end play mm { in }		Standard	0.080—0.282 {0.0032—0.0111}
		Maximum	0.30 {0.012}
Bearing width mm { in }	Standard size		2.500—2.550 {0.0985—0.1003}
	0.25 {0.01} oversize		2.625—2.675 {0.1034—0.1053}
	0.50 {0.02} oversize		2.750—2.800 {0.1083—0.1102}
	0.75 {0.03} oversize		2.875—2.925 {0.1132—0.1151}
Timing belt			
Belt deflection mm { in }/98 N {10 kgf, 22 lbf }			9.0—11.5 {0.36—0.45}

TD

D. LUBRICATION SYSTEM

Item \ Engine	B6 DOHC	BP DOHC
Lubricating method	Force-fed	
Oil pump		
Type	Trochoid gear	

Item \ Engine		B6 DOHC	BP DOHC
Relief pressure	kPa { kgf/cm², psi }	344—441 {3.5–4.5, 50—63}	
Oil pressure kPa { kgf/cm², psi }	1,000 rpm	98—196 {1.0—2.0, 15—28}	
	3,000 rpm	295—392 {3.0—4.0, 43—56}	
Inner rotor tooth tip to outer rotor clearance mm { in }	Standard	0.02—0.18 {0.0008—0.0070}	
	Maximum	0.20 {0.0079}	
Outer rotor to body clearance mm { in }	Standard	0.09—0.18 {0.0036—0.0070}	
	Maximum	0.22 {0.0087}	0.20 {0.0079}
Side clearance mm { in }	Standard	0.03—0.11 {0.0012—0.0043}	0.03—0.12 {0.0012—0.0047}
	Maximum	0.14 {0.0055}	
Oil filter			
Type		Full-flow, paper element	
Relief pressure differential	kPa { kgf/cm², psi }	78—118 {0.8—1.2,11—17}	
Engine oil			
Capacity L { US qt, Imp qt }	Total (dry engine)	3.6 {3.8, 3.2}	4.0 {4.2, 3.5}
	Oil replacement	3.2 {3.4, 2.8}	3.6 {3.8, 3.2}
	Oil and oil filter replacement	3.5 {3.7, 3.1}	3.8 {4.0, 3.3}
Grade		API service SD, SE, SF	
Viscosity number	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	
	Above –10 °C {14 °F }	SAE 20W-40 or 20W-50	
	–25 °C—30 °C {–13 °F —86 °F }	SAE 10W-30	
	Above –25 °C {–13 °F }	SAE 10W-40 or 10W-50	
	Below 0 °C {32 °F }	SAE 5W-30	
	Below –20 °C {–4 °F }	SAE 5W-20	

E. COOLING SYSTEM

Item \ Engine	B6 DOHC	BP DOHC
Cooling method	Water cooled, forced circulation	

Centrifugal, V-belt driven	
75 {2.95}	
6	
Unified mechanical seal	
	Wax, two-stage
—193}	Main: 86.5—89.5 {188—193}, Sub: 83.5—86.5 {183—187}
100 {212}	
in.	Main: 8.0 {0.31} min., Sub: 1.5 {0.06} min.
Corrugated fin	
—103 {0.75—1.05, 10.7—14.9}	
103 {1.05, 14.9}	
Electric	
5	
320 {12.6}	
97 {207}	
70-12	

Water pump		
Type		
Impeller diameter	mm { in }	
Number of impeller blades		
Water seal type		
Thermostat		
Type		Wax
Opening temperature	°C { °F }	86.5—89.5 {188
Full-open temperature	°C { °F }	
Full-open lift	mm { in }	8.5 {0.33} m
Radiator		
Type		
Cap valve opening pressure	kPa { kgf/cm², psi }	73.6
Cooling circuit checking pressure	kPa { kgf/cm², psi }	
Cooling fan		
Type		
Number of blades		
Outer diameter	mm { in }	
Switching temperature OFF → ON	°C { °F }	
Capacity	W-V	

Item \ Engine		B6 DOHC	BP DOHC
Current	A	5.9 + 10% max.	
Coolant			
Capacity	L { US qt, Imp qt }	6.0 {6.3, 5.3}	

	Coolant protection	Volume percentage %		Specific gravity at 20 °C {68 °F}
		Water	Coolant	
Antifreeze solution	Above –16 °C {3 °F}	65	35	1.054
	Above –26 °C {–15 °F}	55	45	1.066
	Above –40 °C {–40 °F}	45	55	1.078

F1. FUEL AND EMISSION CONTROL SYSTEMS (B6 DOHC)

Item				Specification
Idle speed			rpm	800—900 (850 ± 50)*
Ignition timing			BTDC	9° —11° (10° ± 1°)*
Throttle body				
Type				Horizontal draft
Throat diameter			mm{ in }	55 {2.2}
Dashpot				
Adjustment speed			rpm	25,00 ± 150
Volume airflow sensor				
Resistance	Ω	E_2↔V_S	Fully closed	200—600
			Fully open	20—1,200
		E_2↔V_C		200—400
		E_2↔THA_A (Intake air temperature sensor)	–20 °C {–4 °F}	13,600—18,400
			20 °C {68 °F}	2,210—2,690
			60 °C {140 °F}	493—667
		E_1↔F_C	Fully closed	∞
			Fully open	0
Fuel pump				
Type				Impeller (in-tank)
Output pressure			kPa { kgf/cm², psi }	441—589 {4.5—6.0, 64—85}
Fuel filter				
Type		Low-pressure side		Nylon element
		High-pressure side		Paper element
Pressure regulator				
Type				Diaphragm
Regulating pressure			kPa { kgf/cm², psi }	265—314 {2.7—3.2, 38—46}
Fuel injector				
Type				High-ohmic
Type of drive				Voltage
Resistance			Ω	12—16 [at 20 °C {68 °F}]
IAC valve (Solenoid valve [Idle air control])				
Solenoid resistance			Ω	11—13 [at 20 °C {68 °F}]
Fuel pump relay				
Resistance	Ω	STA — E_1		21—43
		B — F_C		109—226
		B — F_P		∞
Purge solenoid valve				
Solenoid resistance			Ω	23—27 [at 20 °C {68 °F}]
Camshaft position sensor				
Type				Photo diode

*...TEN terminal in data link connector grounded.

Item			Specification
Engine coolant temperature sensor			
Resistance	kΩ	–20 °C {–4 °F}	14.6—17.8
		20 °C {68 °F}	2.2—2.7
		80 °C {176 °F}	0.29—0.35
Air valve			
Opening temperature	°C {°F}		Below 40 {104}
Fuel Tank			
Capacity	L {US gal, Imp gal}		48 {12.6, 10.6}
Air cleaner			
Element type			Oil permeated
Accelerator cable			
Free play	mm {in}		1—3 {0.039—0.118}

F2. FUEL AND EMISSION CONTROL SYSTEMS (BP DOHC)

Item			Specification
Idle speed	rpm		800—900 (850 ± 50)*
Ignition timing	BTDC		9° —11° (10° ± 1°)*
Throttle body			
Type			Horizontal draft
Throat diameter	mm {in}		55 {2.2}
Fuel pump			
Type			Impeller (in-tank)
Output pressure	kPa {kgf/cm², psi}		480—657 {4.9—6.7, 69—95}
Fuel filter			
Type		Low-pressure side	Nylon element
		High-pressure side	Paper element
Pressure regulator			
Type			Diaphragm
Regulating pressure	kPa {kgf/cm², psi}		265—314 {2.7—3.2, 38—46}
Fuel injector			
Type			High-ohmic
Type of drive			Voltage
Resistance	Ω		12—16 [at 20 °C {68 °F}]
IAC solenoid valve			
Solenoid resistance	Ω		10.7—12.3 [at 20 °C {68 °F}]
Air valve			
Opening temperature	°C {°F}		Below 40 {104}
Purge solenoid valve			
Solenoid resistance	Ω		23—27 [at 20 °C {68 °F}]
Camshaft position sensor			
Type			Hall element
Engine coolant temperature sensor			
Resistance	kΩ	20 °C {68 °F}	2.3—2.6
		80 °C {176 °F}	0.3—0.4
Fuel tank			
Capacity	L {US gal, Imp gal}		48 {12.7,10.5}
Air cleaner			
Element type			Oil permeated
Accelerator cable			
Free play	mm {in}		1—3 {0.039—0.118}

*...TEN terminal in data link connector grounded.

M. FRONT AND REAR AXLES

Item \ Engine		B6	BP	
Front axle				
Type		Double-wishbone		
Bearing		Angular ball bearing		
Wheel bearing play mm { in }	Maximum	0.05 {0.002}		
Rear axle				
Type		Double-wishbone		
Bearing		Angular ball bearing		
Wheel bearing play mm { in }	Maximum	0.05 {0.002}		
Drive shaft				
Joint type	Wheel side	Bell joint		
	Differential side	Double-off set joint		
Length mm { in } (between centers of joints)	Left side	470.3 {18.52}		
	Right side	470.3 {18.52}		
Shaft diameter mm { in }		22.5 {0.89}		
Differential				
Differential type		Standard	TORSEN® LSD	
Ring gear size mm { in }		182.88 {7.20}		
Final gear ratio		4.100		
Reduction gear		Hypoid gear		
Differential gear		Straight-bevel gear	Worm gear	
Ring gear teeth		41		
Drive pinion gear teeth		10		
Oil	Grade	API Service GL-5		
	Viscosity	Above–18 °C {0 °F }: SAE90 Below–18 °C {0 °F }: SAE80		
	Capacity L { US qt , Imp qt }	1.00 {1.06, 0.88}		

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P. BRAKING SYSTEM

Item	Specifications	
	B6 (Non ABS)	BP. B6 (ABS)

R. SUSPENSION

Item			Specification
Front suspension			
Type			Double-wishbone
Stabilizer	Type		Torsion bar
	Diameter mm { in }		20.0 {0.79}
Shock absorber			Cylindrical double-acting, low-pressure gas charged
Rear suspension			
Type			Double-wishbone
Stabilizer	Type		Torsion bar
	Diameter mm { in }		11.0 {0.43}
Shock absorber			Cylindrical double-acting, low-pressure gas charged
Wheel alignment			
Front wheel alignment (Unladen*1)	Total toe-in	mm { in }	3 ± 4 {0.12 ± 0.15}
		degree	0° 18' ± 24' *2
	Maximum steering angle	Inner	37° 23' ± 2°
		Outer	32° 32' ± 2°
	Camber angle *3		0° 24' ± 1°
	Caster angle *3		4° 26' ± 1°
	SAI *4		11°20'
Rear wheel alignment (Unladen*1)	Total toe-in	mm { in }	3 ± 4 {0.12 ± 0.15}
		degree	0° 18' ± 24' *2
	Camber angle *3		–0° 43 ± 1°

*1 • Fuel tank full; radiator coolant and engine oil at specified levels; and spare tire, jack, and tools in designated positions
• Adjust to the median when carrying out wheel alignment

*2 Indicates measurements made by using the 4–wheel alignment tester

*3 Difference between left and right must not exceed 1.5°

*4 SAI: Steering Axis Inclination

T. BODY ELECTRICAL SYSTEM

Item	Wattage
Warning and indicator lights	
High beam indicator light	3.4
Turn indicator light	3.4
Instrument cluster illumination	3.4
Brake system warning light	1.4
Generator warning light	1.4
Hazard warning light	1.4
Rear fog indicator light	1.4
Retractor indicator light	1.4
ABS warning light	1.4
Washer fluid-level warning light	1.4
Air bag system warning	1.4
Rear window defroster indicator light	1.4
Brake fluid level warning light	1.4
Parking brake indicator light	1.4
Exterior lights	
Headlights	60/55
Front turn signal lights	21
Side turn signal lights	5
Licence plate lights	5
Rear turn signal lights	21
Brake/taillights	21/5
Back-up lights	21
High-mount brake light	18.4
Interior light	
Interior light	5
Illumination lights	
Ashtray illumination	3.4
Hazard warning switch illumination	1.4

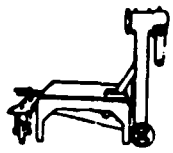
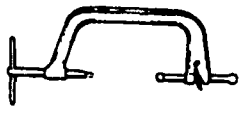
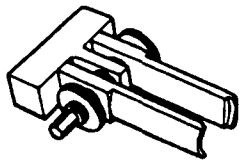
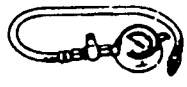
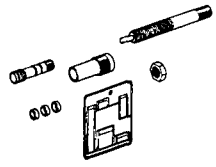
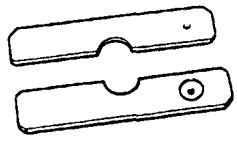
SPECIAL TOOLS

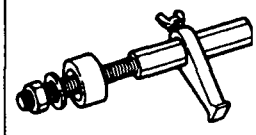
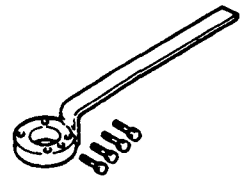
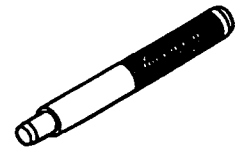
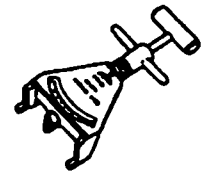
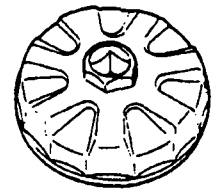
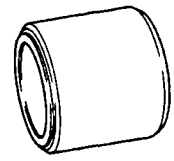
GENERAL INFORMATION ..... ST- 2
ENGINE ..... ST- 3
CLUTCH AND MANUAL TRANSMISSION . ST- 4
DIFFERENTIAL ..... ST- 5
FRONT AND REAR AXLES ..... ST- 6
STEERING SYSTEM ..... ST- 7
BRAKING SYSTEM ..... ST- 9
FRONT AND REAR SUSPENSIONS ST-10
CHECKERS AND OTHER EQUIPMENT ... ST-11

GENERAL INFORMATION

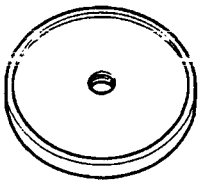
The letters A and B in the priority column indicate the degree of importance of each tool.
A . . . . . Indispensable
The tools ranked A in this list are indispensable for performing operations satisfactorily, easily, safely, and efficiently. It is, therefore, advisable that all service shops have these tools.
B . . . . . Selective
The tools ranked B are not as necessary as tools ranked A, but all service shops should have them to perform repairs more easily and efficiently.

ENGINE

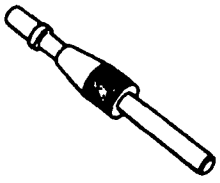
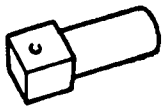
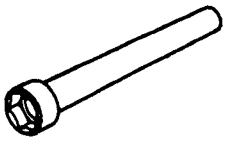
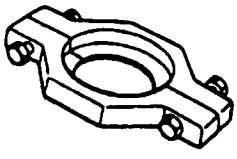
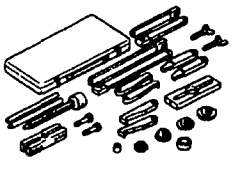
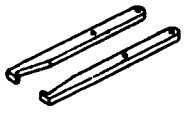
TOOL NUMBER & DESCRIPTION	PRIORITY	ILLUSTRATION
49 0107 680A Engine stand	A	
49 L010 1A0 Hanger set, engine stand	A	
49 0636 100B Arm, valve spring lifter	A	
49 B012 0A2 Pivot	A	
49 9200 145 Adapter set, radiator cap tester	A	
49 0187 280 Oil pressure gauge	A	
49 L012 0A0 Installer set, valve seal & valve guide	A	
49 E301 144 Removing plate	A	

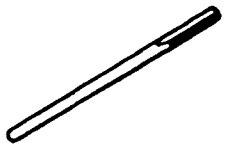
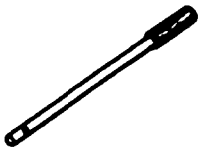
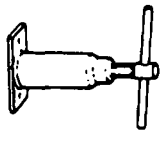
TOOL NUMBER & DESCRIPTION	PRIORITY	ILLUSTRATION
49 E011 1A0 Brake set, ring gear	A	
49 D011 102 Lock tool, crankshaft	A	
49 B012 005 Remover & installer, valve guide	A	
49 0221 061A Remover & installer, piston pin	B	
49 S120 170 Remover, valve seal	A	
49 9200 020A V-ribbed belt tension gauge	A	
49 G014 001 Wrench, oil filter	A	
49 B014 001 Installer, oil seal	A	

ENGINE (CONT'D)

TOOL NUMBER & DESCRIPTION	PRIORITY	ILLUSTRATION
49 W033 105 Installer, oil seal	A	

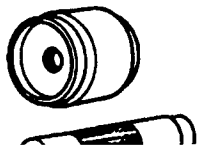
CLUTCH AND MANUAL TRANSMISSION

TOOL NUMBER & DESCRIPTION	PRIORITY	ILLUSTRATION
49 SE01 310A Centering tool, clutch disc	A	
49 0259 440 Holder, mainshaft	A	
49 1243 465A Wrench, mainshaft lock nut	A	
49 0636 145 Puller, fan pulley boss	A	
49 0839 425C Puller set, bearing	A	
49 H017 101 Hook	A	

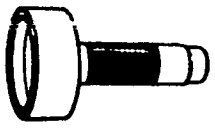
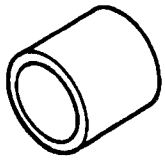
TOOL NUMBER & DESCRIPTION	PRIORITY	ILLUSTRATION
49 0259 770B Wrench, flare nut	A	
49 0187 451A Guide, interlock pin assembly	B	
49 0862 350 Guide, shift fork assembly	B	
49 0500 330 Installer, bearing	A	
49 0305 430 Pusher, main drive shaft	A	
49 0710 520 Puller, bearing	A	

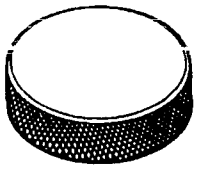
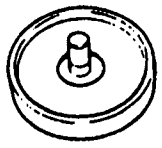
CLUTCH AND MANUAL TRANSMISSION (CONT'D)

TOOL NUMBER & DESCRIPTION	PRIORITY	ILLUSTRATION
49 0180 321A Installer, main drive gear	A	

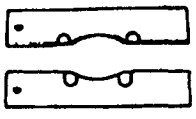
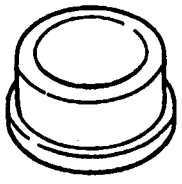
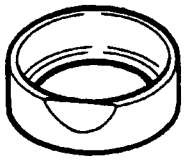
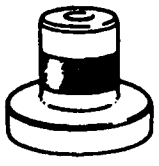
TOOL NUMBER & DESCRIPTION	PRIORITY	ILLUSTRATION
49 B025 0A0 Installer, dust seal	A	

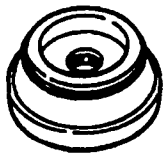
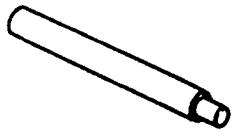
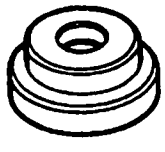
DIFFERENTIAL (CONT'D)

TOOL NUMBER & DESCRIPTION	PRIORITY	ILLUSTRATION
[illegible] Installer, oil seal	A	
49 U027 003 Installer, oil seal	A	
49 S120 710 Holder, coupling flange	A	

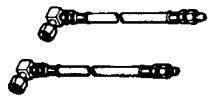
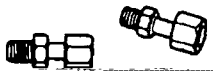
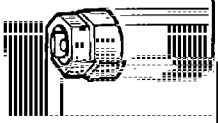
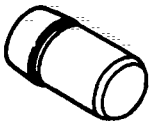
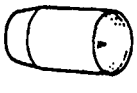
TOOL NUMBER & DESCRIPTION	PRIORITY	ILLUSTRATION
49 0305 555 Gauge block	A	
49 N034 213 Installer, rubber bushing	A	
49 F401 337A Attachment C	A	

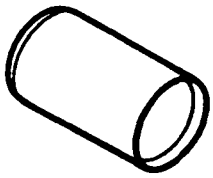
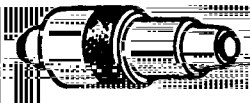
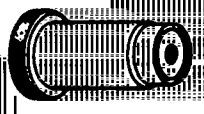
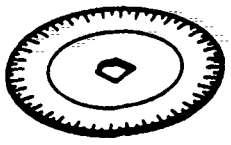
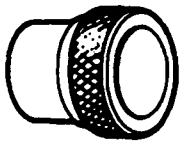
FRONT AND REAR AXLES

TOOL NUMBER & DESCRIPTION	PRIORITY	ILLUSTRATION
49 F026 103 Puller, wheel hub	A	
49 F027 009 Attachment Ø68 & Ø77	A	
49 G033 107A Installer, dust cover	A	
49 V001 795 Installer, oil seal	A	

TOOL NUMBER & DESCRIPTION	PRIORITY	ILLUSTRATION
49 F027 007 Attachment Ø72	A	
49 G033 102 Handle	A	
49 G030 727 Attachment A	A	

STEERING SYSTEM

TOOL NUMBER & DESCRIPTION	PRIORITY	ILLUSTRATION
49 1243 785 Installer, dust boot	A	
49 D032 310 Protector, pinion shaft (P/S)	A	
49 B032 305 Holder, power steering pump (P/S)	A	
49 D032 304 Installer, oil seal & bearing (P/S)	A	
49 D032 301 Installer, body oil seal & bearing (P/S)	A	
49 D032 306 Remover, oil seal & bearing (P/S)	A	
49 D032 316 Protractor	A	
49 D032 315 Seal ring former & guide (P/S)	A	

TOOL NUMBER & DESCRIPTION	PRIORITY	ILLUSTRATION
49 1232 670A Gauge set, power steering (P/S)	A	
49 H002 671 Adapter (P/S)	A	
49 B032 302A Adapter (P/S)	A	
49 H032 321A Hexagon wrench (M/S)	A	
49 N032 303 Remover, body back-up ring & oil seal (P/S)	A	
49 D032 302 Attachment (P/S)	A	
49 N032 302 Guide, oil seal (P/S)	A	
49 N032 304 Protecter, oil seal (P/S)	A	

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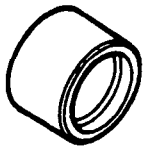
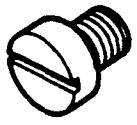
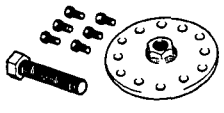
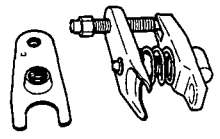
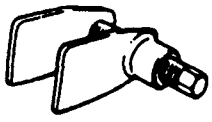
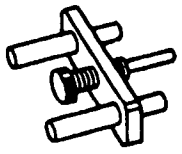
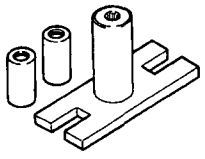
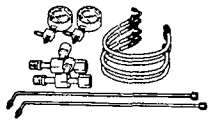
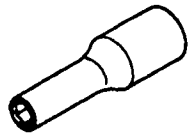
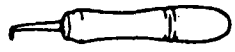
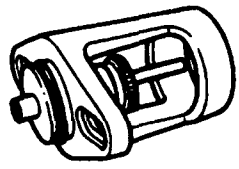
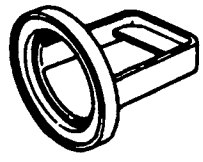
STEERING SYSTEM (CONT'D)

TOOL NUMBER & DESCRIPTION	PRIORITY	ILLUSTRATION
[illegible] Protector, back-up ring & oil seal (P/S)	A	
49 G032 317 Hose (P/S)	A	
49 D032 306 Support block (P/S)	A	
49 F032 303 Handle (P/S)	A	
49 D032 303 Attachment (P/S)	A	
49 0180 510B Attachment, preload measuring	B	
49 P032 001 Steering remover	A	

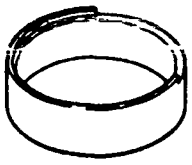
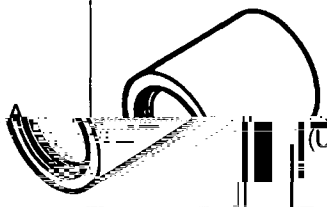
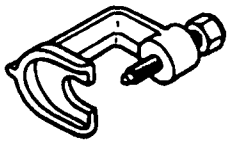
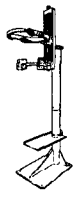
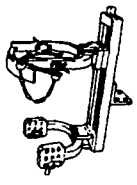
TOOL NUMBER & DESCRIPTION	PRIORITY	ILLUSTRATION
[illegible] Adapter (P/S)	A	
49 D032 313 Seal ring former (P/S)	A	
49 N032 301 Protector body, oil seal (P/S)	A	
49 D032 307 Remover, oil seal & bearing (P/S)	A	
49 T028 3A0 Puller set, ball joint	A	
49 H032 301 Wrench	A	

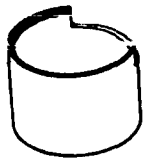
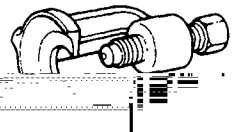
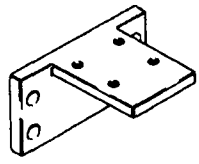
BRAKING SYSTEM

TOOL NUMBER & DESCRIPTION	PRIORITY	ILLUSTRATION
49 0221 600C Expand tool, disc brake	A	
49 F043 001 Adjust gauge	A	
49 E043 003A Lock tool, turning	A	
49 U043 0A0 Gauge set, oil pressure	A	

TOOL NUMBER & DESCRIPTION	PRIORITY	ILLUSTRATION
49 B043 004 Wrench, socket	A	
49 0208 701A Air out tool, boot	A	
49 B043 001 Adjust gauge	A	
49 H026 101A Installer, sensor rotor	A	

FRONT AND REAR SUSPENSIONS

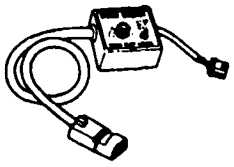
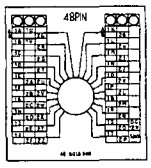
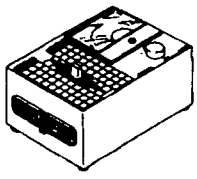
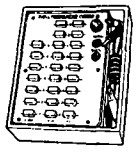
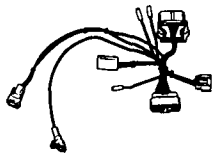
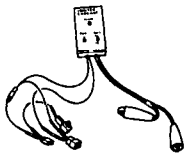
TOOL NUMBER & DESCRIPTION	PRIORITY	ILLUSTRATION
49 N028 201 Support block	A	
49 H028 301 Installer, dust boot	A	
49 0727 575 Puller, ball joint	B	
49 T034 1A0 Compressor set, coil spring Ⓐ	A	
49 T034 101 Compressor, coil spring Ⓒ	A	

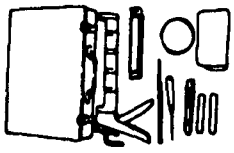
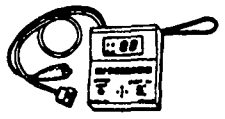
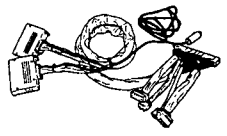
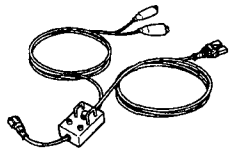
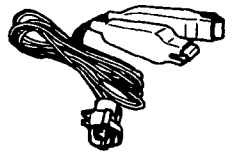
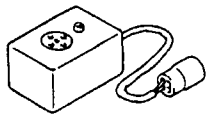
TOOL NUMBER & DESCRIPTION	PRIORITY	ILLUSTRATION
49 B034 201 Support block	A	
49 0118 850C Puller, ball joint (Upper arm)	A	
49 T034 105 Attachment Ⓑ	B	

Note

- **SST** Ⓐ, Ⓑ and Ⓒ are used in the following combinations.
  - Use Ⓐ only.
  - Use Ⓑ + Ⓒ + 49 0107 680A Engine stand.
    Either combination can be used.

CHECKERS AND OTHER EQUIPMENT

TOOL NUMBER & DESCRIPTION	PRIORITY	ILLUSTRATION
49 B019 9A0 System selector	A	
49 G050 1A0 Remover, sealant	A	
49 G018 906 Sheet (48 pin) (ECM)	A	
49 9200 162A Engine signal monitor (ECM)	A	
49 0839 285 Checker, fuel and thermometer	A	
49 F066 002 Harness adapter (ABS)	A	
49 N018 001 Adapter harness	A	
49 F018 002 Igniter checker	A	

TOOL NUMBER & DESCRIPTION	PRIORITY	ILLUSTRATION
49 0305 870A Tool set, window	A	
49 H018 9A1 Self-diagnosis checker	A	
49 T018 902 Harness adapter (ECM)	A	
49 H066 002 Tool, deployment	A	
49 L018 901 Injector, checker	A	
49 9200 165 Throttle sensor checker	A	
49 D088 008 Harness adapter, power	A