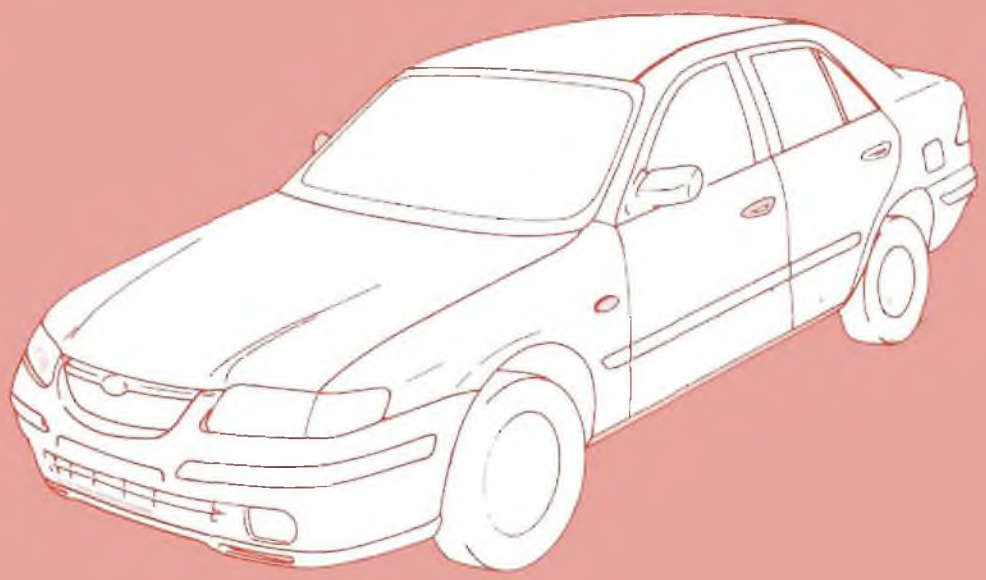
Mazda 626

626 Station Wagon

RF Turbo

Workshop Manual Supplement



JMZ GF12R2
JMZ GF12T2
JMZ GF14R2
JMZ GF14T2
JMZ GW19R2
JMZ GW19T2
JMZ GW69R2
JMZ GW69T2

4/98 1614-10-98D

mazda

Europe

Mazda 626 626 Station Wagon Workshop Manual Supplement

FOREWORD

This manual contains the changes and/or additions relating to on-vehicle service and diagnosis procedures for the Mazda 626 and 626 Station Wagon.

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

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

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

Mazda Motor Corporation
HIROSHIMA, JAPAN

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

CONTENTS

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

PRINTED IN THE NETHERLANDS, APR.1998 Ⓑ
1614-10-98D

VEHICLE IDENTIFICATION NUMBERS (VIN)

JMZ GF12R20# 100001 —
JMZ GF12R2W# 100001 —
JMZ GF12T20# 100001 —
JMZ GF12T2W# 100001 —
JMZ GF14R20# 100001 —
JMZ GF14R2W# 100001 —
JMZ GF14T20# 100001 —
JMZ GF14T2W# 100001 —
JMZ GW19R20# 100001 —
JMZ GW19R2W# 100001 —
JMZ GW19T20# 100001 —
JMZ GW19T2W# 100001 —
JMZ GW69R20# 100001 —
JMZ GW69R2W# 100001 —
JMZ GW69T20# 100001 —
JMZ GW69T2W# 100001 —

RELATED MATERIALS

GENERAL INFORMATION

HOW TO USE THIS MANUAL

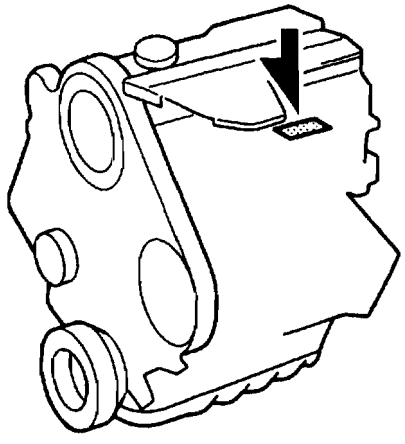
RANGE OF TOPICS

- This manual indicates only changes/additions, as it is the supplemental for the related materials. Therefore it may not contain the necessary referential service procedures to operate the services indicated in this manual. Only the referential section, e.g. (Refer to section B), is indicated, so refer to the appropriate section of the related materials for details.

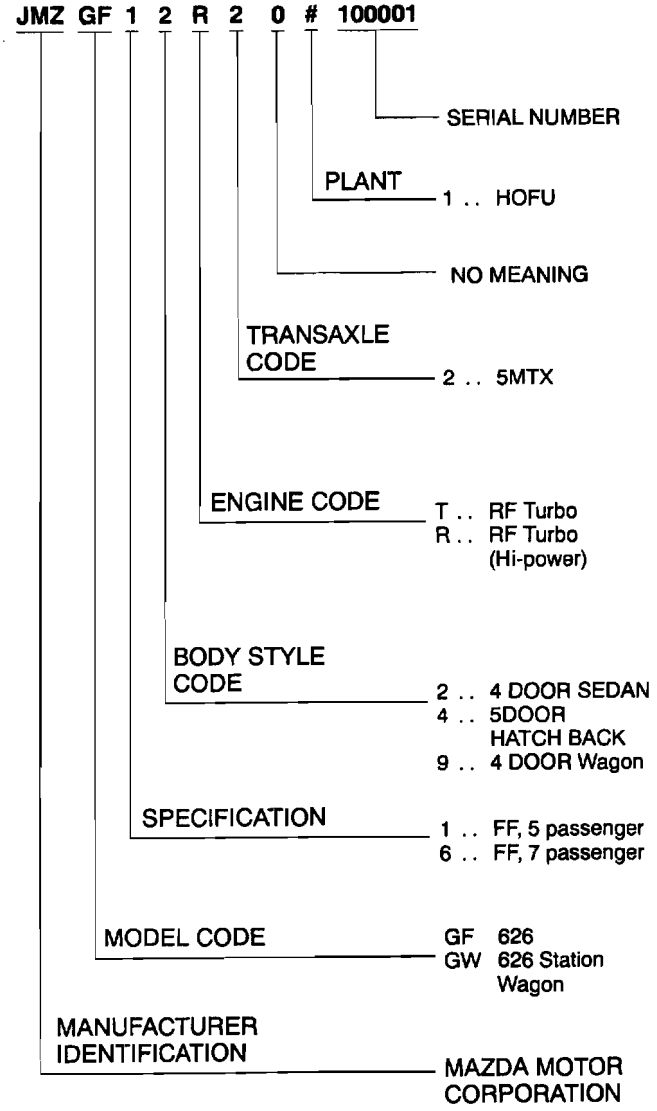
IDENTIFICATION NUMBER LOCATIONS

ENGINE IDENTIFICATION NUMBER

RF Turbo



VIN CODE


JMZ GF 1 2 R 2 0 # 100001
SERIAL NUMBER
PLANT
1 .. HOFU
NO MEANING
TRANSAXLE CODE
2 .. 5MTX
ENGINE CODE
T .. RF Turbo
R .. RF Turbo (Hi-power)
BODY STYLE CODE
2 .. 4 DOOR SEDAN
4 .. 5DOOR HATCH BACK
9 .. 4 DOOR Wagon
SPECIFICATION
1 .. FF, 5 passenger
6 .. FF, 7 passenger
MODEL CODE
GF 626
GW 626 Station Wagon
MANUFACTURER IDENTIFICATION
MAZDA MOTOR CORPORATION

NEW STANDARD

- The following is a comparison of the previous standard and new standard for the parts names of the diesel engine vehicle.

New Standard	Previous Standard
Calibration Resistor	Connected Resistance
Control Sleeve Sensor	Control Sleeve Position Sensor
Fuel shut Off Solenoid	Fuel Cut Valve
Injection Pump	Fuel Injection Pump
PCM Control Relay	Main Relay
Pump Speed Sensor	NE Sensor
Timer Control Valve	Timing Control Valve

ABBREVIATIONS

ABS	Antilock brake system
ATF	Automatic transaxle fluid
FSO	Fuel shut off
L.H.D.	Left hand drive
R.H.D.	Right hand drive
SAS	Sophisticated air bag sensor
SST	Special service tool
TCV	Timer control valve
TNS	Tail number side lights

SCHEDULED MAINTENANCE

SCHEDULED MAINTENANCE TABLE

Chart symbols:

I : Inspect
Inspect and clean, repair, or replace if necessary. (As for the air cleaner element wet type, inspect, and if necessary replace.)

R : Replace

T : Tighten

L : Lubricate

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 160,000 km (96,000 miles) or 96 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 100,000 km (60,000 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 more often than recommended intervals.
a) Driving in dusty conditions.
b) Extended periods of idling or low speed operation.
c) Driving for long period in cold temperatures or driving regularly at short distance(less than 8 km/5 miles) only.

*4 If the vehicle is operated in very dusty or sandy areas, inspect and replace, if necessary, the air cleaner element more often than the recommended intervals.

*5 This is a full function check of electrical systems such as lights, wiper and washer systems (including wiper blades), and power windows.

*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.

Maintenance Item	Maintenance Interval (Number of months or km (miles), whichever comes first)																Specific work required
	Months		12		24		36		48		60		72		84		96	
	×1000 Km	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150	160	
	(×1000 Miles)	(6)	(12)	(18)	(24)	(30)	(36)	(42)	(48)	(54)	(60)	(66)	(72)	(78)	(84)	(90)	(96)	
ENGINE																		
Engine valve clearance		Inspect every 30,000 km (18,000 miles) or 2 years																Measure clearance
Drive belts	*1	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	Inspect for wear, cracks and fraying, and check the tension. Replace drive belt as necessary.
Engine timing belt	*2	Replace every 100,000 km (60,000 miles)																Replace engine timing belt.
Engine oil	*3	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	Replace engine oil and inspect for leakage.
Oil filter	*3	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	Replace oil filter and inspect for leakage.
COOLING SYSTEM																		
Cooling system (Including coolant level adjustment)			I		I		I		I		I		I		I		I	Check coolant level and quality, and inspect for leakage.
Engine coolant		Replace at first 4 years or 100,000 km (60,000 miles); after that, every 2 years																Replace coolant.
FUEL SYSTEM																		
Air cleaner element	*4		I		R		I		R		I		R		I		R	Inspect for dirt, oil and damage. Replace air cleaner element.
Fuel filter					R				R				R				R	Replace fuel filter.
Fuel lines & hoses			I		I		I		I		I		I		I		I	Inspect for cracks, leakage and loose connection.
ELECTRICAL SYSTEM																		
Battery electrolyte level & specific gravity			I		I		I		I		I		I		I		I	Check level and specific gravity.
All electrical system	*5	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	Check function of lighting system, windshield wiper (including wiper blade condition) & washer and power windows.
Head light alignment				I			I			I			I			I		Check headlight alignment.
CHASSIS & BODY																		
Brake & clutch pedals		I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	Check pedal height and free play.
Brake lines, hoses & connections			I		I		I		I		I		I		I		I	Inspect for cracks, damage, chafing, corrosion, scars, swelling and fluid leakage.
Brake fluid	*6		I		R		I		R		I		R		I		R	Check fluid level and inspect for leakage. Replace brake fluid.
Clutch fluid			I		I		I		I		I		I		I		I	Check fluid level and inspect for leakage.
Parking brake			I		I		I		I		I		I		I		I	Check lever stroke.

Maintenance Item	Maintenance Interval (Number of months or km (miles), whichever comes first)																Specific work required
	Months		12		24		36		48		60		72		84		96	
	×1000 Km	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150	160	
	(×1000 Miles)	(6)	(12)	(18)	(24)	(30)	(36)	(42)	(48)	(54)	(60)	(66)	(72)	(78)	(84)	(90)	(96)	
Power brake unit & hoses			I		I		I		I		I		I		I		I	Check vacuum lines, connections and check valve for improper attachment, air tightness, cracks, chafing and deterioration.
Disc brakes			I		I		I		I		I		I		I		I	Test for judder and noise. Inspect caliper for correct operation and fluid leakage; brake pads for wear, and check disc plate condition and thickness.
Drum brakes			I		I		I		I		I		I		I		I	Test for judder and noise. inspect brake drum for were, scratches; brake lining for wear, peeling and cracks; wheel cylinder for fluid leakage.
Power steering fluid		I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	Check fluid level.
Power steering system & hoses			I		I		I		I		I		I		I		I	Check lines for improper attachment, leakage, cracks, damage, loose connections, chafing and deterioration.
Manual transaxle oil					I				R				I				R	Check oil level and inspect for leakage. Replace manual transaxle oil.
Steering & front suspension			I		I		I		I		I		I		I		I	Check free play of steering system, inspect shock absorbers for correct damping force, oil leakage, damage and looseness, and inspect coil springs, arms, links and stabilizer for damage and looseness.
Front suspension ball joints					I				I				I				I	Inspect for grease leakage, cracks, damage and looseness.
Driveshaft dust boots					I				I				I				I	Inspect for grease leakage, cracks, damage and looseness.
Bolts & nuts on chassis & body			T		T		T		T		T		T		T		T	Tighten bolts and nuts fastening suspension components, members and seat frames.
Body condition (for rust, corrosion & perforation)	Inspect annually																	Inspect body surface for paint damage, rust, corrosion and perforation.
Tyres (Including spare tyre) (with inflation pressure adjustment)			I		I		I		I		I		I		I		I	Check air pressure and inspect tyres for tread wear, damage and cracks; wheels for damage and corrosion.
Hinges & catches			L		L		L		L		L		L		L		L	Lubricate hinges and catches of doors, trunk lid and hood.
Seat belts				I			I			I			I			I		Inspect seat belt webbing for scratches, tears and wear, and check anchor bolt tightness.

Maintenance Item	Maintenance Interval (Number of months or km (miles), whichever comes first)																Specific work required
	Months		12		24		36		48		60		72		84		96	
	×1000 Km	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150	160	
	(×1000 Miles)	(6)	(12)	(18)	(24)	(30)	(36)	(42)	(48)	(54)	(60)	(66)	(72)	(78)	(84)	(90)	(96)	
Road test			I		I		I		I		I		I		I		I	Check brake operation/clutch operation/steering control/operation of meters and gauges/squeaks, rattles or unusual noises/engine general performance/emergency locking retractors .

AIR CONDITIONER SYSTEM (IF EQUIPPED)

Refrigerant amount		I				I				I				I			Check refrigerant amount.
Compressor operation		I				I				I				I			Check compressor operation, and inspect for noise, oil leakage, cracks and refrigerant leakage.

ENGINE
(RF Turbo, RF Turbo (Hi-power))

FEATURES

SERVICE

ABBREVIATIONS

ABDC	After bottom dead center
A/C	Air conditioner
ATDC	After top dead center
BBDC	Before bottom dead center

BTDC	Before top dead center
EX	Exhaust
IN	Intake
P/S	Power steering

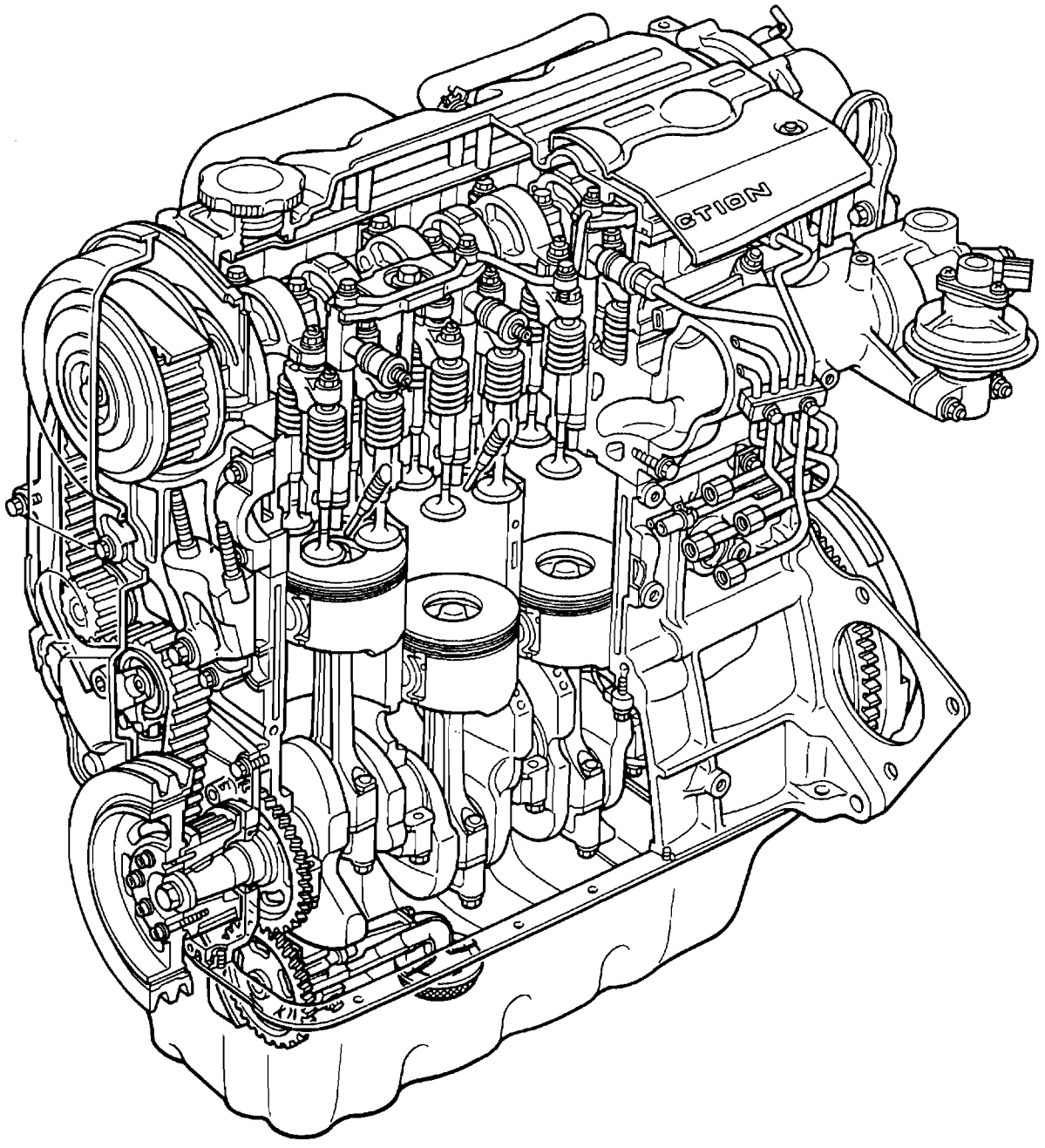
OUTLINE

OUTLINE OF CONSTRUCTION

The following are the major differences between the previous 323 (BA) model and the RF Turbo engine.

- The following have been adopted to improve fuel economy, increase output, and reduce emissions:
  - A system in which fuel is injected directly to the center of each cylinder.
  - A double-vortex combustion chamber.
  - A double tangential port (intake port).
- The following have been adapted to reduce weight and size:
  - Suspending the oil pump.
  - SOHC four valves per cylinder and rocker arm design.
- A drive system powered by the rear gear of the camshaft is used in the P/S pump, and a drive system powered directly by the rear gear of the camshaft is used in the vacuum pump to eliminate the drive belt, reducing the friction loss and improving reliability.
- To reduce vibration created by the rotation of the flywheel during idling, crankshaft support has been made more rigid by adopting a bearing beam in the No.4 and No.5 main bearing cap sections.
- The durability of the timing belt is improved by adopting:
  - A timing belt auto tensioner to maintain the tension of the timing belt.
  - A dynamic damper in the camshaft pulley to reduce the change in angular velocity and suppress excessive tension of the timing belt.

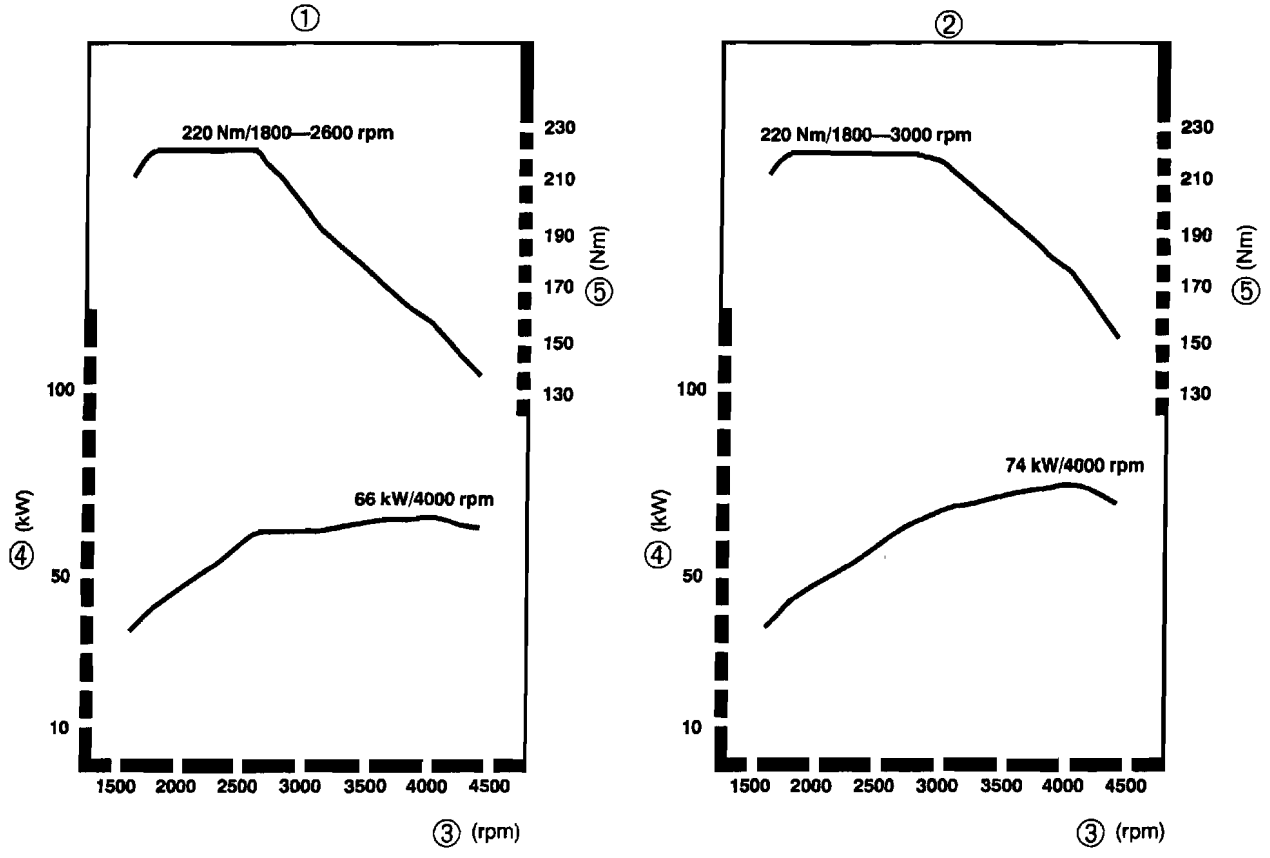
STRUCTURAL VIEW



SPECIFICATIONS

Item				Engine	
				RF Turbo	RF Turbo (Hi-power)
Type				Diesel, 4-cycle	
Cylinder arrangement and number				Inline, 4 cylinders	
Combustion chamber				Direct injection	
Valve system				OHC, belt-driven, 16 valves	
Displacement			(ml {cc, cu in})	1998 {1998, 122}	
Bore × stroke			(mm {in})	86.0 × 86.0 {3.39 × 3.39}	
Compression ratio				18.8	
Compression pressure			(kPa {kgf/cm^2, psi} [rpm])	2893 {29.5, 419} [260]	
Valve timing	IN	Open	BTDC	6°	
		Close	ABDC	30°	
	EX	Open	BBDC	41°	
		Close	ATDC	8°	
Valve clearance [Engine cold]		IN	(mm {in})	0.12—0.18 {0.005—0.007} (0.15 ± 0.03 {0.006 ± 0.001})	
		EX	(mm {in})	0.32—0.38 {0.013—0.014} (0.35 ± 0.03 {0.014 ± 0.001})	

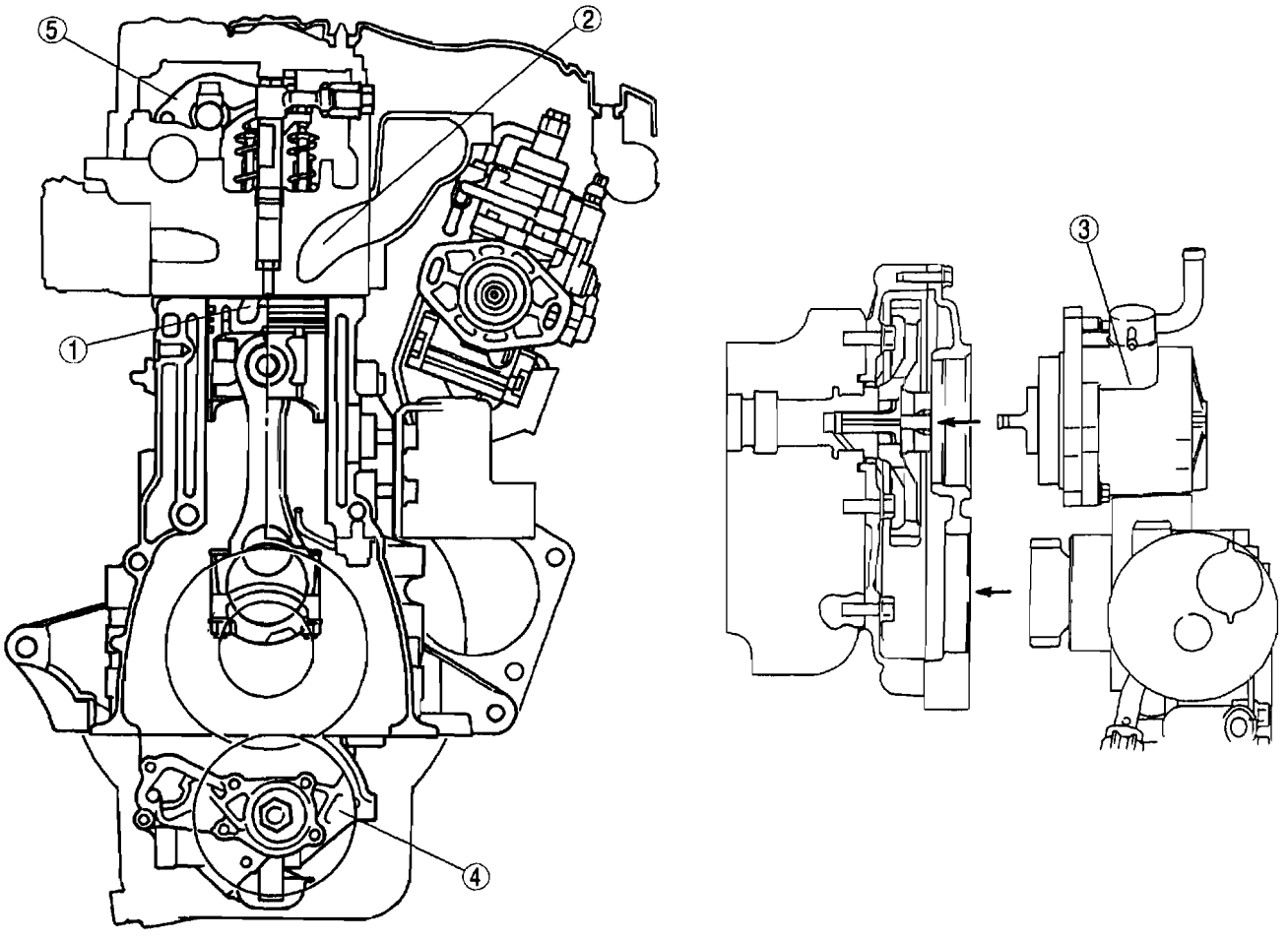
ENGINE PERFORMANCE CURVE



1	RF Turbo
2	RF Turbo (Hi-power)
3	Engine speed

4	Output
5	Torque

COMPARISON BETWEEN RF Turbo AND CONVENTIONAL RF

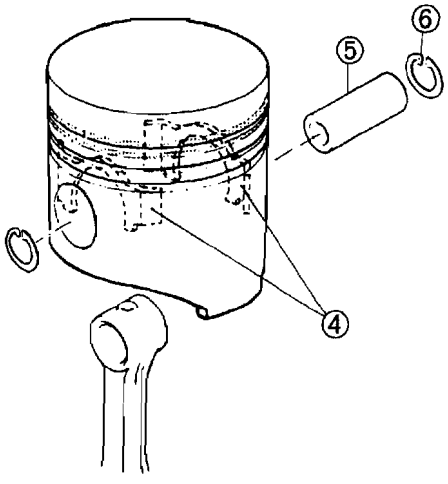


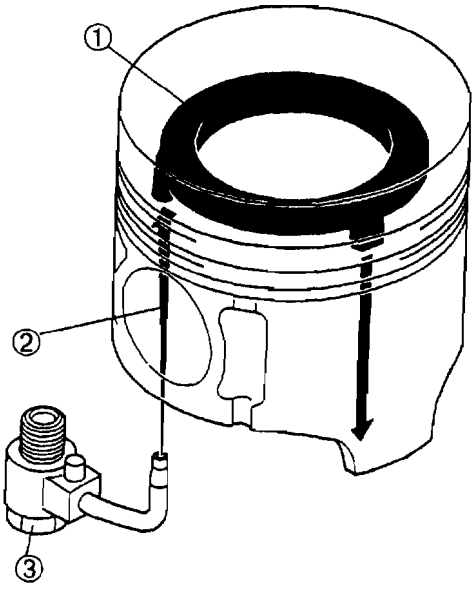
Improvement	No.	Item	RF Turbo	Conventional RF
Improved combustion and fuel economy	1	Combustion chamber	Mazda's original "double-vortex chamber" establish a balance between swirl and squish while it also generates a powerful flow of air throughout the entire combustion chamber to promote diffusion and atomization of injected fuel.	Swirl combustion chamber (Pre-chamber type)
	2	Port layout	The direct injection of fuel into the center of the cylinder combined with the powerful swirl and high volumetric efficiency of a "double tangential port" ensures a controlled, symmetrical flow of air-fuel mixture in the cylinder, while at the same time reducing intake resistance.	Straight port
Reduction of friction loss, reduced weight and compact size	3	Vacuum pump	Direct-drive was adapted for auxiliary system, such as the vacuum pump and power steering pump, reducing mechanical resistance to a lower level than attainable in engines with belt drive system.	Belt drive system powered by rear end pulley of camshaft
	4	Oil pump	Overall engine length was reduced by suspending the oil pump inside the oil pan.	Crankshaft direct drive system
	5	Valve mechanism	Use of an SOHC 4 valves and rocker arm design made it possible to lower the cylinder head and the overall height of the engine.	SOHC 2 valves and camshaft direct drive system

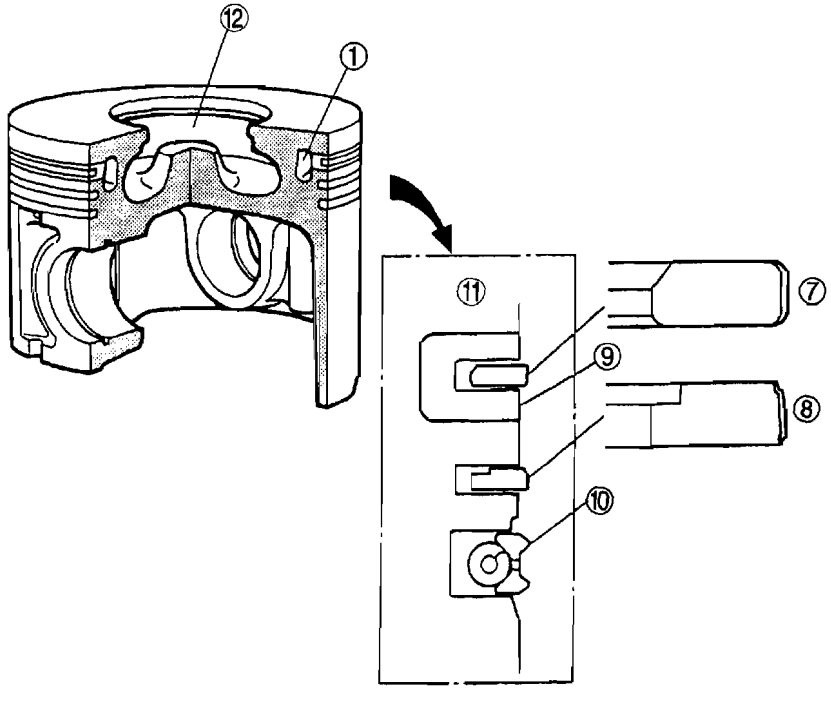
DIRECT INJECTION ENGINE MECHANISM

PISTON, PISTON RING, PISTON PIN

- The pistons are made of aluminum alloy and the double-vortex combustion chamber is adopted.
- The piston body has a cooling channel. Oil jets squirt oil into this cooling channel. The oil absorbs heat from around the rings and reduces piston ring and cylinder wall wear.
- Steel struts are cast into the boss to curb thermal expansion, thus minimizing the change in piston clearance by temperature and optimizing offset volume.
- The fitting of the piston, connecting rod, and piston pin is a full-floating type.





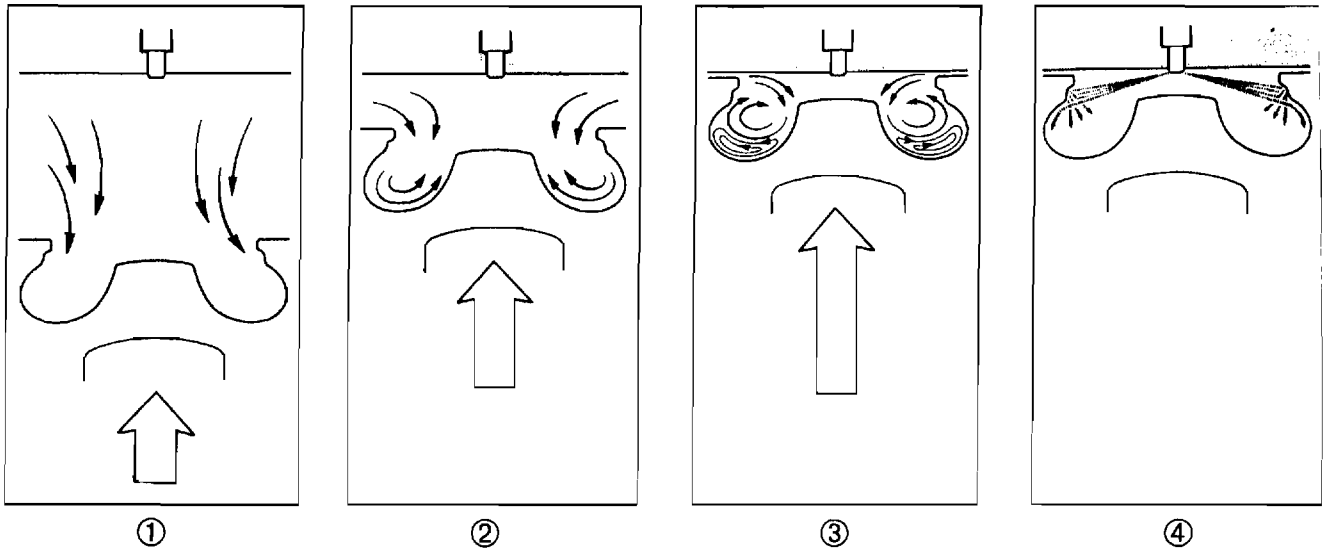


1	Cooling channel
2	Engine oil
3	Oil jet
4	Steel strut
5	Piston pin
6	Snap ring

7	Top ring
8	Second ring
9	Ring carrier
10	Oil ring
11	Section piston and piston ring
12	Double-vortex combustion chamber

Double-Vortex Combustion Chamber

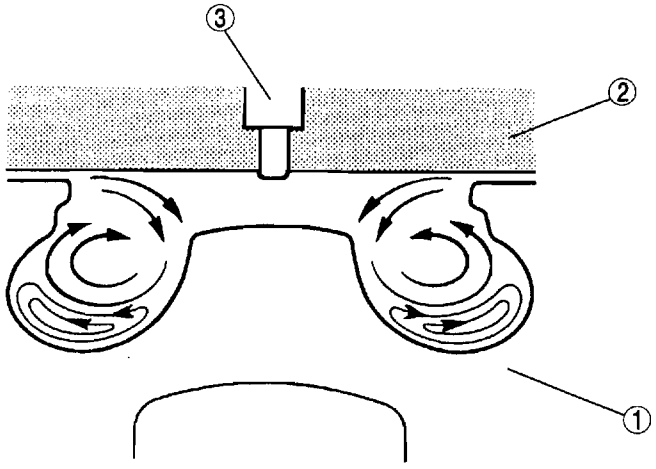
- The double-vortex combustion chamber establishes a balance between swirl and squish while it also generates a powerful flow of air throughout the entire combustion chamber to promote atomization of the injected fuel.



1	Compression starts
2	Air is compressed

3	Powerful flow before fuel injection
4	Fuel is injected

- As the piston rises, powerful airflow is created in the combustion chamber. This airflow hastens atomization and diffusion of the injected fuel, lowering emissions.

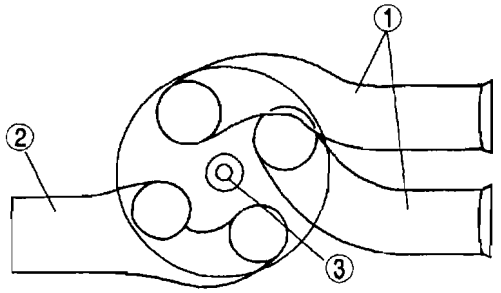
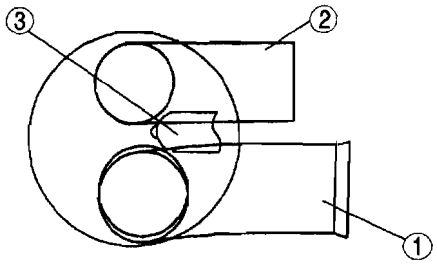
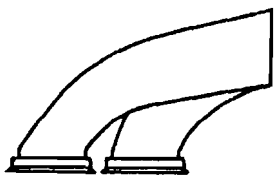
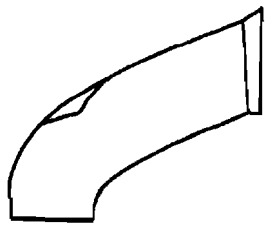


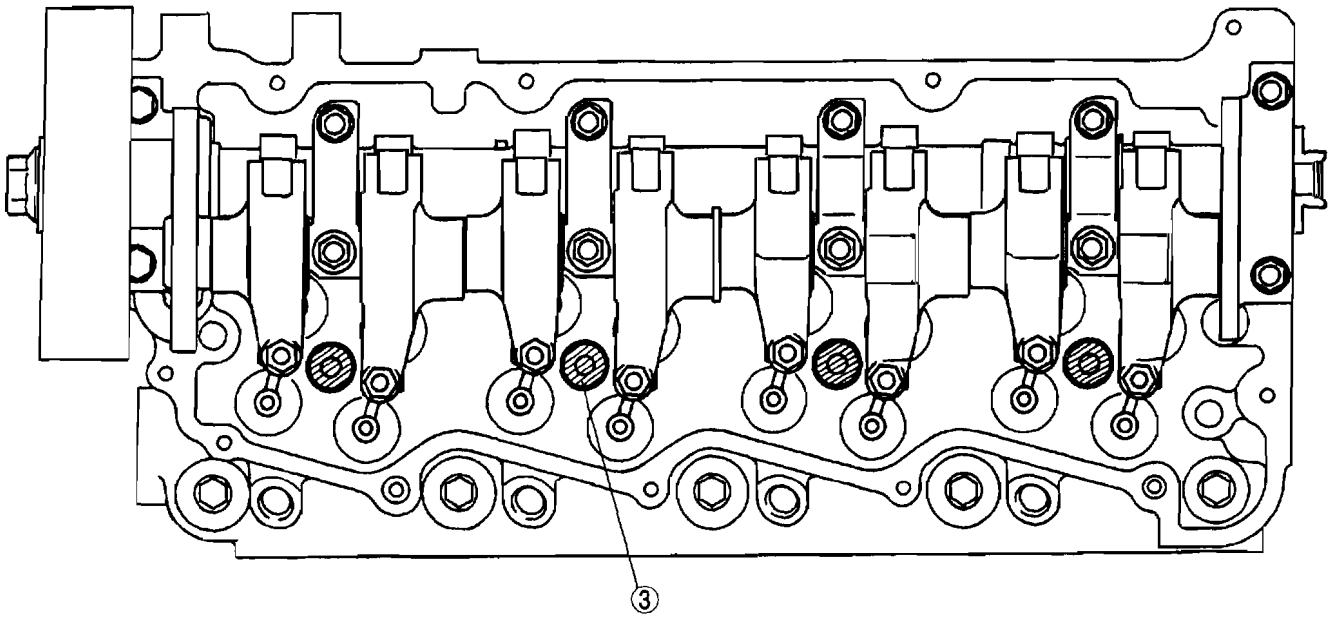
1	Piston
2	Cylinder head

3	Injection nozzle

CYLINDER HEAD
Double Tangential Port

- The entire port has been configured with bends to create sufficient swirl even during low engine speeds.
- Adopting four valves increases the valve opening area, improving charging efficiency.
- Straightening the intake port reduces intake resistance.
- Direct injection of fuel in the centre of the cylinder ensures uniform injection of fuel throughout the entire combustion chamber, and mixing fuel with the swirl produced in the double tangential port ensures a symmetrical flow of the air-fuel mixture in the cylinder.

Item	RF Turbo	Conventional RF
PORT LAYOUT		
INTAKE PORT CROSS SECTION		



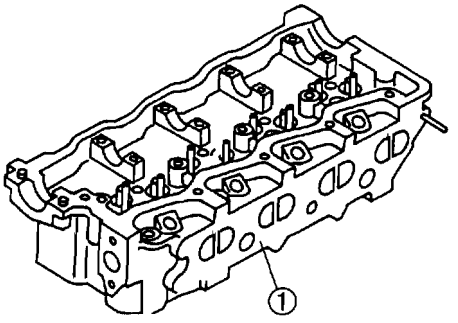
1	Intake port
2	Exhaust port

3	Injection nozzle installation part

ENGINE MECHANISM

CYLINDER HEAD, CYLINDER HEAD GASKET

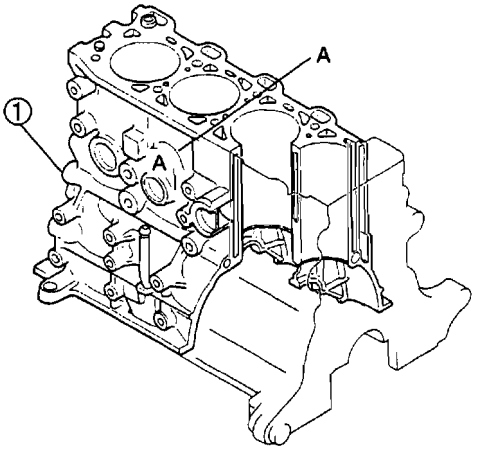
- The cylinder head is made of aluminum alloy.
- The cylinder head gasket is made of four laminated layers of stainless steel.

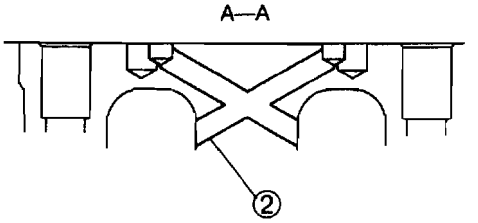


1	Cylinder head

CYLINDER BLOCK

- The cast iron alloy cylinder block is linerless, and has a deep skirt design for higher rigidity.
- The cross-drilled, coolant passages are provided between the cylinder bores.



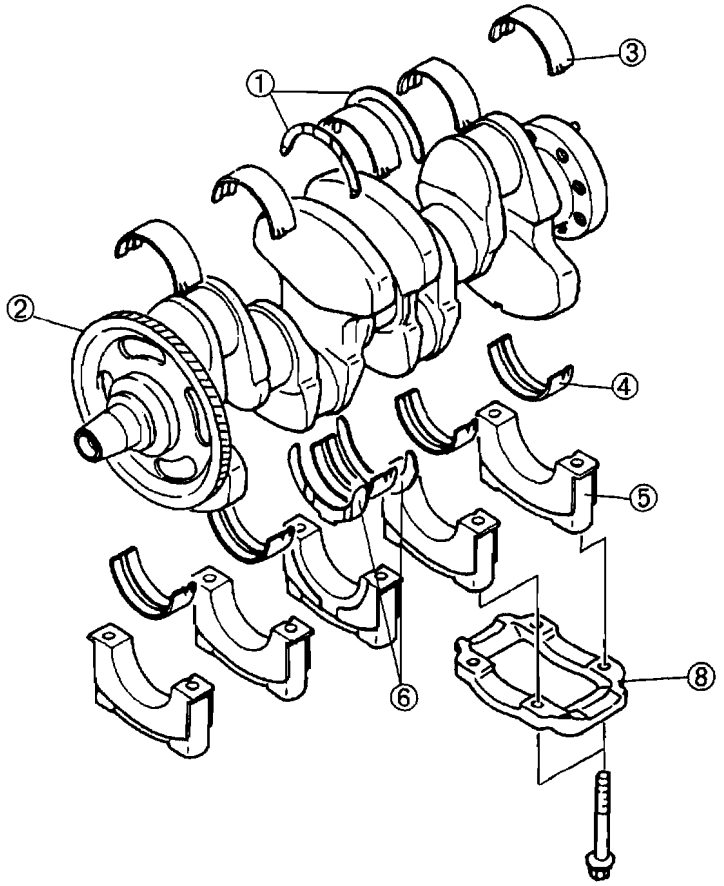


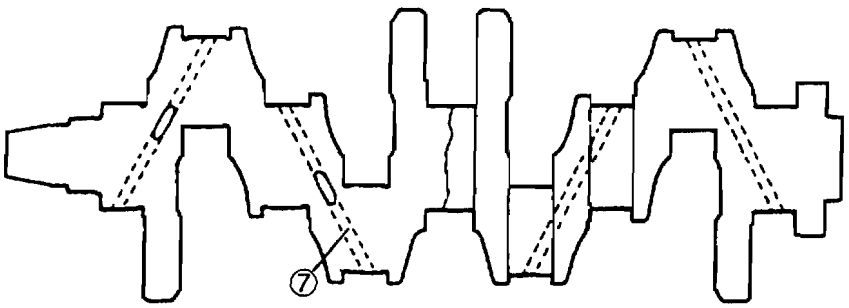
1	Cylinder block

2	Cross drill hole

CRANKSHAFT, MAIN BEARING

- The steel crankshaft has five journals and four balance weights.
- The main bearings are made of aluminum alloy. The main bearings are grooved to provide extra oil.
- The upper and lower halves of the main bearings are identical. However, the upper and lower halves of the third bearing are wider than the rest.
- Thrust bearings are fitted fore and aft of the No.3 journal bearings.
- To reduce vibration created by the rotation of the flywheel during idling, flywheel support has been made more rigid by adopting a bearing beam in the No.4 and No.5 main bearing cap sections.



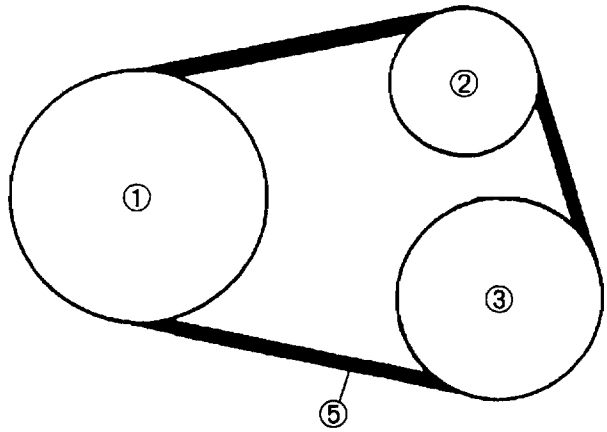


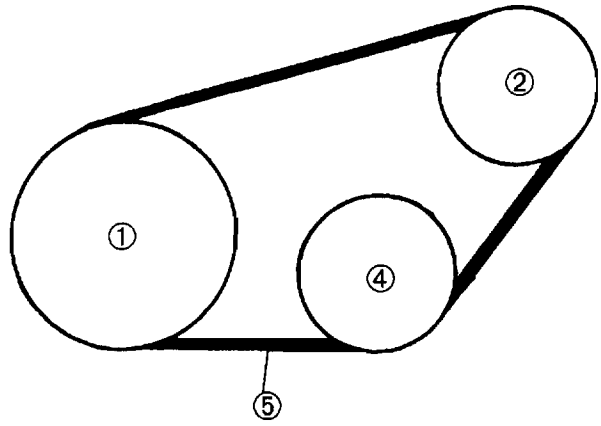
1	Upper thrust bearing
2	Oil pump drive gear
3	Upper main bearing
4	Lower main bearing

5	Main bearing cap
6	Lower thrust bearing
7	Oil passage
8	Bearing beam

DRIVE BELT

- The drive belts are V-belts.



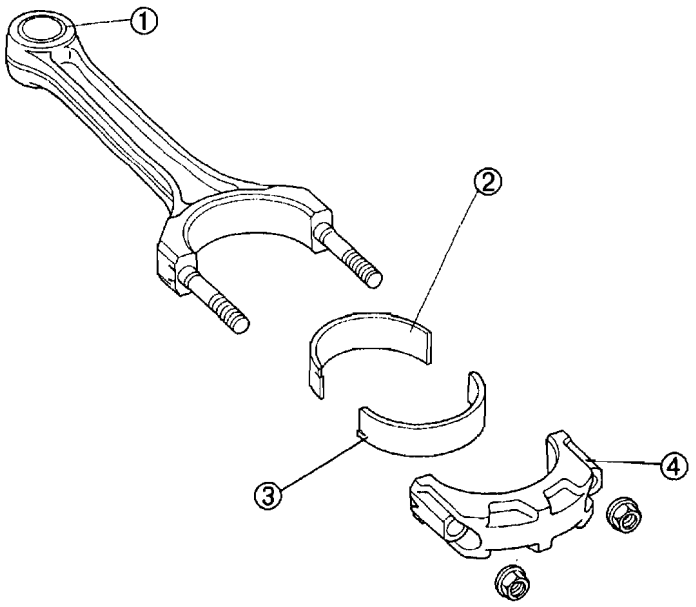


1	Crankshaft pulley
2	Generator
3	A/C compressor

4	Idler (without A/C compressor)
5	V-belts (two belts-driven)

CONNECTING ROD, CONNECTING ROD BEARING

- The connecting rods are made of carbon steel.
- The upper and lower connecting rod bearings are made of aluminum alloy.



1	Bush
2	Upper connecting rod bearing

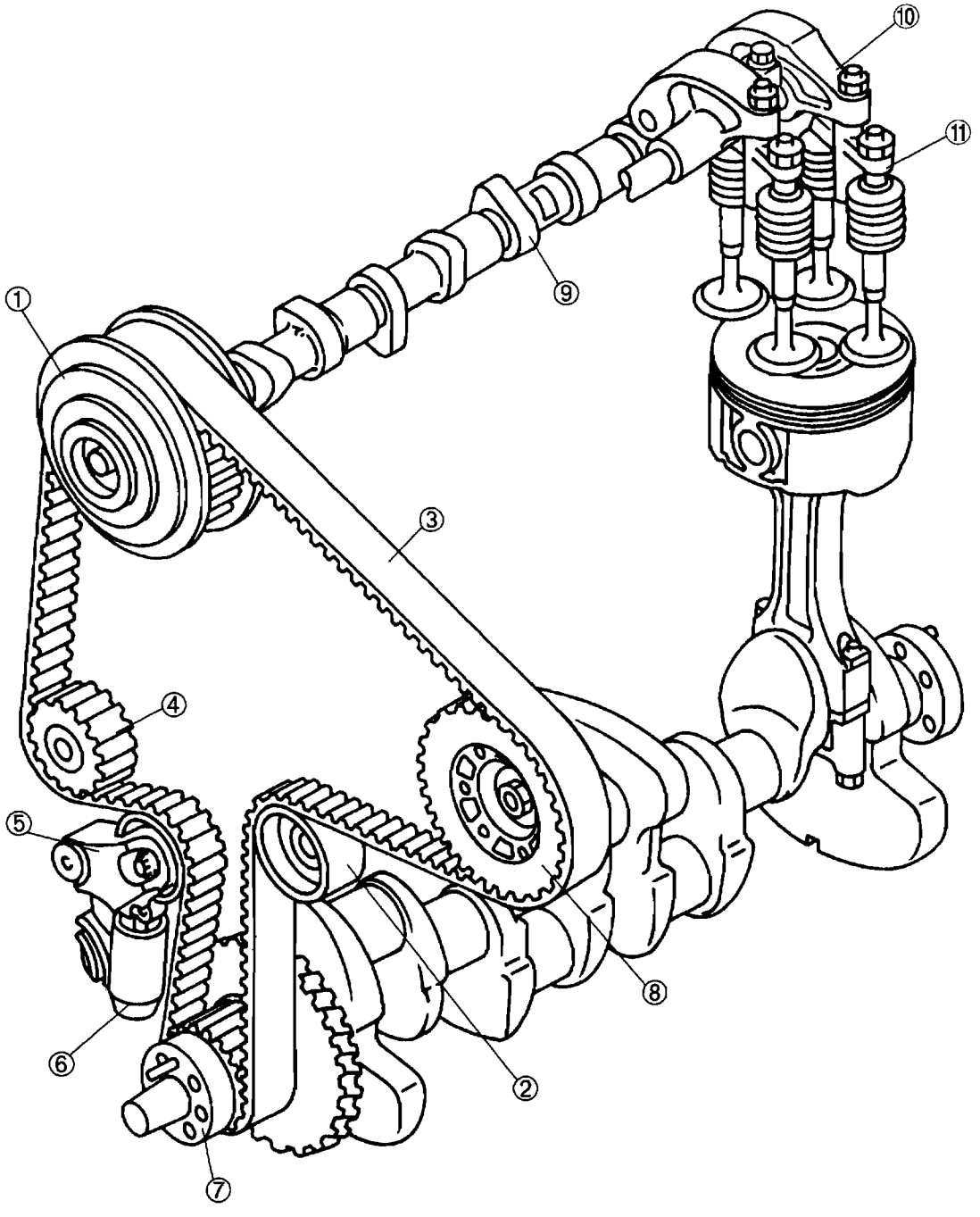
3	Lower connecting rod bearing
4	Connecting rod cap

VALVE MECHANISM

OUTLINE

- An SOHC system driving 16 valves-two intake and two exhaust valves per cylinder with a single camshaft through the rocker arm is used.

STRUCTURAL VIEW

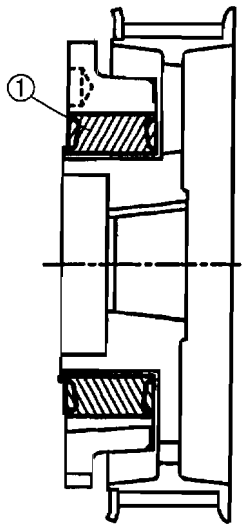


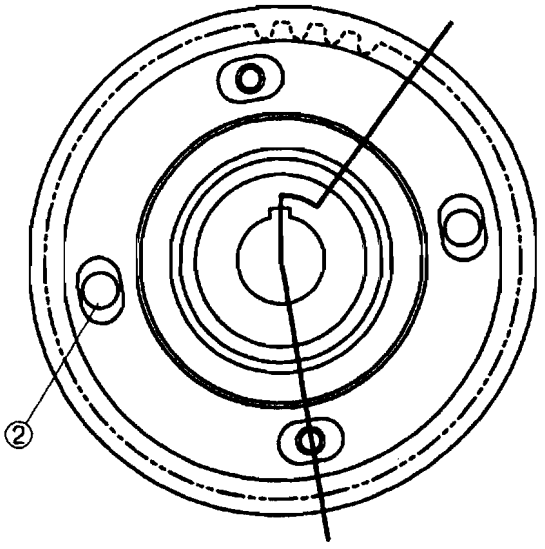
1	Camshaft pulley
2	Idler
3	Timing belt
4	Water pump pulley
5	Tensioner
6	Timing belt auto tensioner

7	Timing belt pulley
8	Injection pump pulley
9	Camshaft
10	Rocker arm
11	Rocker bridge

CAMSHAFT PULLEY

- To improve the durability of the timing belt, a dynamic damper in the camshaft pulley to reduce the change in angular velocity and excessive tension of the timing belt.
- A service hole is designed in the camshaft pulley. It is used to stop the camshaft pulley from turning during install of the timing belt.

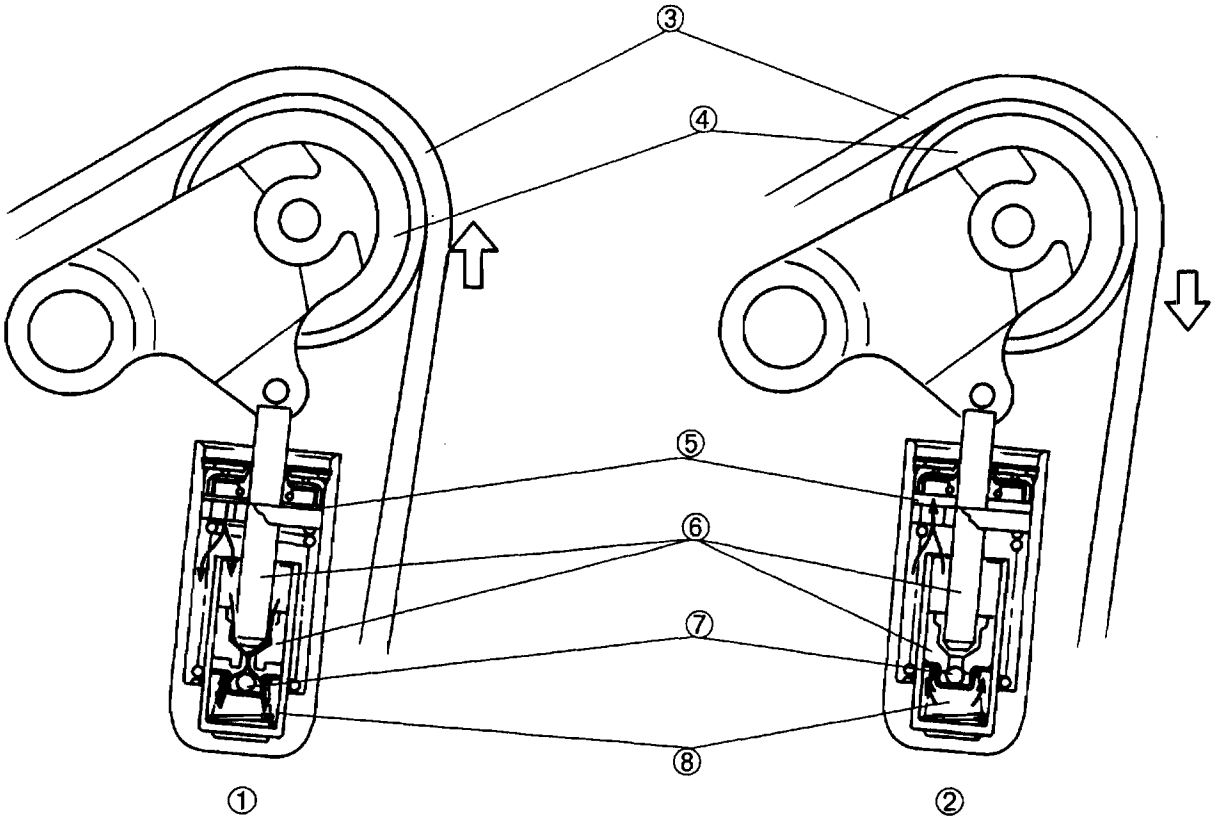




1	Rubber

2	Detent bolt service hole

TIMING BELT AUTO TENSIONER



1	When cold
2	When hot
3	Timing belt
4	Tensioner pulley

5	Chamber B
6	Rod and plunger
7	Ball
8	Chamber A

- By adopting a hydraulic auto tensioner for the timing belt train, the timing belt tension is always automatically maintained at the optimum level and is therefore maintenance-free.

When cold

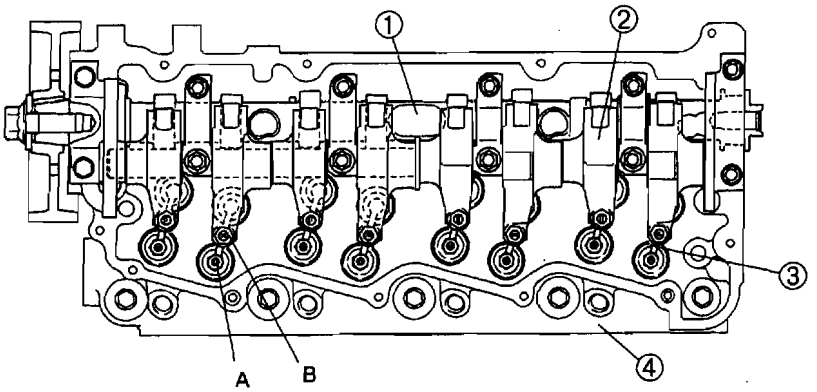
1. Belt tension is low.
2. The tensioner moves upward.
3. The auto tensioner rod and plunger are extended.
4. The rod moves upward by the spring force and the ball falls downward simultaneously so as to open the passage in the rod and plunger. The oil flows into chamber A.

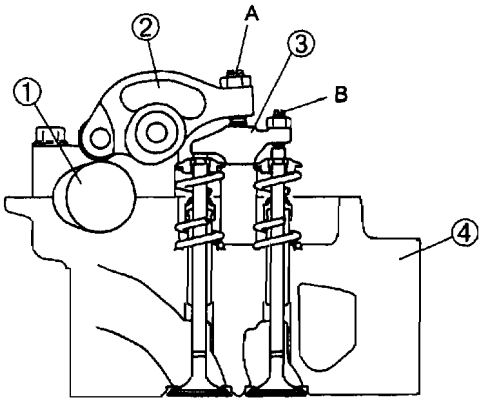
When hot

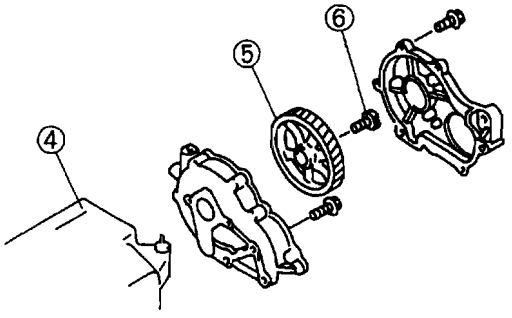
1. Belt tension is high.
2. The tensioner moves downward.
3. The auto tensioner rod and plunger are depressed.
4. The increased pressure in chamber A pushes the ball upward to block the passage. Oil passes by the wall and flows upward.

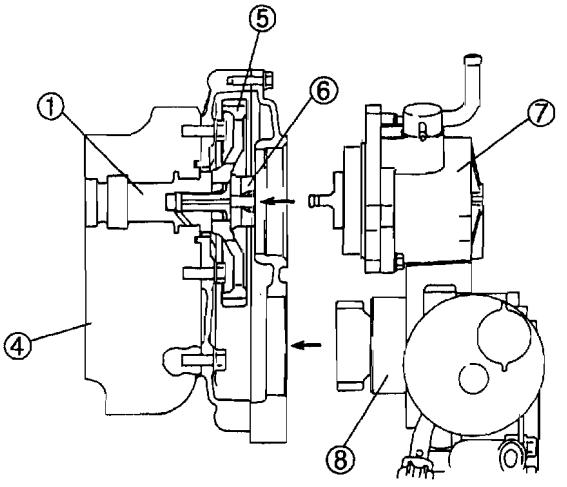
CAMSHAFT, ROCKER ARM, ROCKER BRIDGE

- Six journals support the cast iron camshaft. The flange on the No.6 journal controls end play.
- The intake and exhaust rocker bridges are the same.
- The rocker bridge transmits the movement of the rocker arm simultaneously to two valves.
- Because the distance from the rocker shaft to the valve differs on the intake side and the exhaust side, the rocker arm is configured independently on the intake side/exhaust side.
- A drive belt is no longer used due to the adoption of a vacuum pump and P/S pump in the drive system powered by the rear gear of the camshaft, thereby making the engine smaller and improving reliability.
- Due to the change from a valve mechanism to a rocker arm type, the valve clearance is now adjusted with a screw. (Refer to page B2-18)
- Valve clearance is adjusted at sections A and B.







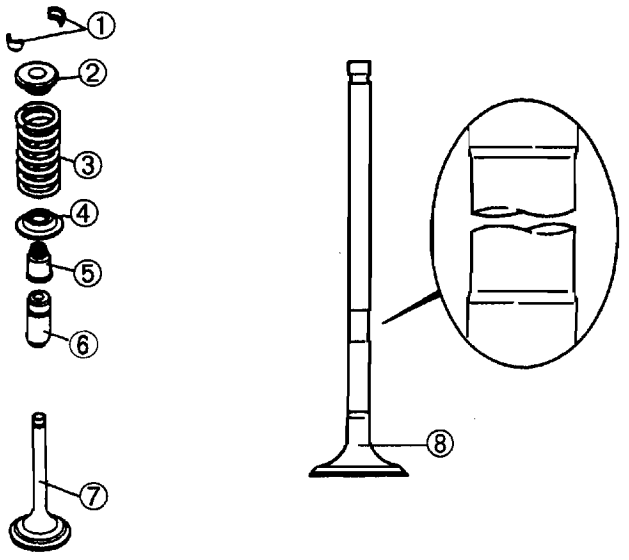


1	Camshaft
2	Rocker arm
3	Rocker bridge
4	Cylinder head

5	Drive gear
6	Lock bolt with groove for driving vacuum pump
7	Vacuum pump
8	P/S oil pump

VALVE

- The valves are made of heat-resistant steel.
- An equal pitch spring is used for the valve spring.
- The valve guides are made of sintered metal.
- Part of the exhaust valve stem is narrow and it is used as a carbon cutter. As a result, the valve guide does not have a carbon cutter and IN and EX use the same valve guide.



1	Valve keepers
2	Upper valve spring seat
3	Valve spring
4	Lower valve spring seat

5	Valve seal
6	Valve guide
7	Valve
8	Exhaust valve

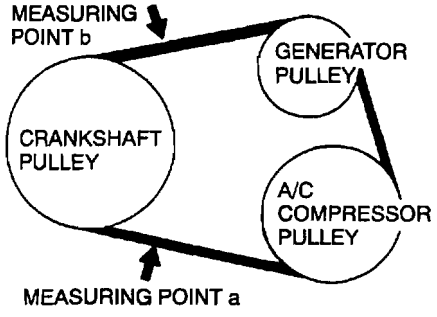
DRIVE BELT

DRIVE BELT INSPECTION

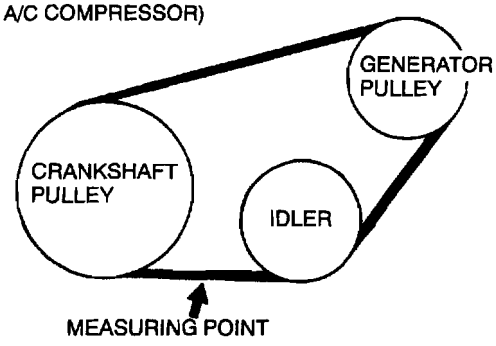
Drive Belt Deflection Inspection

1. Inspect the drive belt deflection when the engine is cold, or at least 30 minutes after the engine has been stopped. Apply moderate pressure **98 N {10 kgf, 22 lbf}** midway between the specified pulleys.

GENERATOR (WITH A/C COMPRESSOR)



(WITHOUT A/C COMPRESSOR)



Deflection

mm {in}

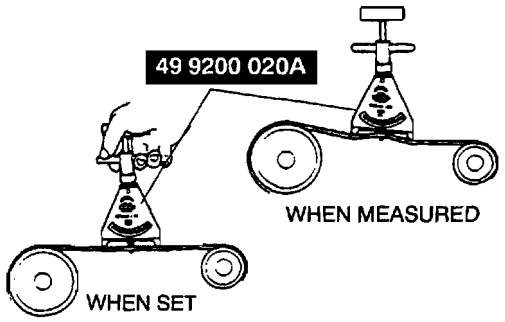
Drive belt		*New	Used	Limit
Generator with A/C	a	8.0—9.5 {0.32—0.37}	14—15 {0.56—0.59}	16 {0.63}
	b	8.5—10.0 {0.34—0.39}	13—14 {0.52—0.55}	15 {0.59}
Generator without A/C		8.0—9.5 {0.32—0.37}	13—14 {0.52—0.55}	15 {0.59}

* A belt that has been on a running engine for less than five minutes.

2. If the deflection is not within the specification, adjust it. (Refer to DRIVE BELT, DRIVE BELT ADJUSTMENT.)

Drive Belt Tension Inspection

1. Belt tension can be checked in place of belt deflection. Inspect the drive belt tension when the engine is cold, or at least 30 minutes after the engine has been stopped. Using the **SST**, inspect the belt tension between any two pulleys.



Tension

N {kgf, lbf}

Drive belt	*New	Used	Limit
Generator with A/C	393—490 {40—50, 88—110}	260—294 {26.5—30.0, 59—66}	226 {23, 51}
Generator without A/C	442—539 {45—55, 99—121}	260—294 {26.5—30.0, 59—66}	225 {23, 50}

* A belt that has been on a running engine for less than five minutes.

2. If the tension is not within the specification, adjust it. (Refer to DRIVE BELT, DRIVE BELT ADJUSTMENT.)

DRIVE BELT ADJUSTMENT

Generator Drive Belt

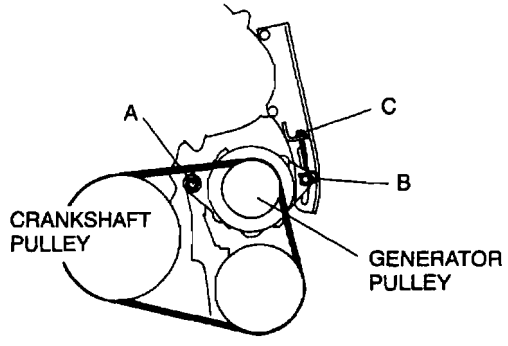
Caution

- **The two belts that drive the generator and A/C compressor must always be changed together. Changing only one belt will cause belt slippage.**

1. Loosen mounting nuts A and B.
2. Adjust the belt tension by adjusting bolt C. (Refer to DRIVE BELT, DRIVE BELT INSPECTION.)
3. Tighten bolts A and B.

Tightening torque

A: 19—25 N·m {1.9—2.6 kgf·m, 14—18 ft·lbf}
B: 38—51 N·m {3.8—5.3 kgf·m, 28—38 ft·lbf}



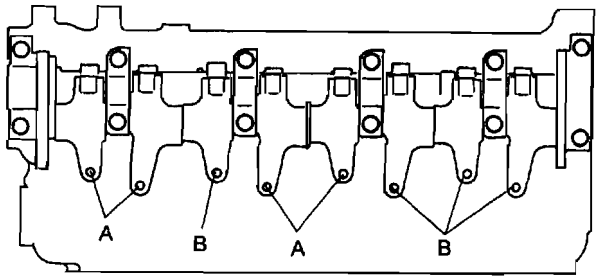
4. Inspect the belt deflection. (Refer to DRIVE BELT, DRIVE BELT INSPECTION.)

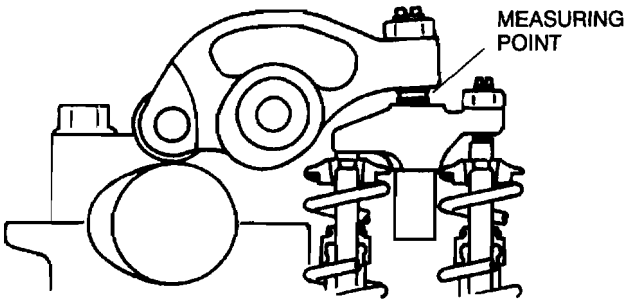
VALVE CLEARANCE

VALVE CLEARANCE INSPECTION

1. Remove the cylinder head cover.
2. Turn the crankshaft and align the timing mark so that the piston of the No.1 or No.4 cylinder is at TDC of compression.
3. Measure the valve clearances A with the No.1 cylinder at TDC of compression, and those of B with the No.4 cylinder at TDC of compression.

Valve clearance [Engine cold]
IN: 0.12—0.18 mm {0.005—0.007 in}
(0.15 ± 0.03 mm {0.006 ± 0.001 in})
EX:0.32—0.38 mm {0.013—0.014 in}
(0.35 ± 0.03 mm {0.014 ± 0.001 in})





4. If the valve clearance is not within the specification, adjust the valve clearance. (Refer to VALVE CLEARANCE, VALVE CLEARANCE ADJUSTMENT.)
5. Turn the crankshaft one full turn and measure the remaining valve clearances. Adjust if necessary.
6. Install the cylinder head cover. (Refer to CYLINDER HEAD GASKET, CYLINDER HEAD GASKET REPLACEMENT, Cylinder Head Cover Installation Note.)

VALVE CLEARANCE ADJUSTMENT

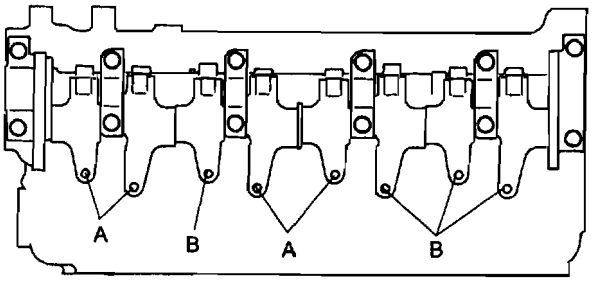
1. Remove the cylinder head cover.
2. Turn the crankshaft clockwise and set the No.1 cylinder to compression TDC.

Caution
- **If the crankshaft is turned without removing the glow plug, compression pressure acts on the injection nozzle and causes the injection nozzle to move. When the injection nozzle is moved, carbon stuck to the nozzle washer installation surface of the cylinder head may affect the seal. To avoid this, remove the glow plug to release the compression pressure. If the injection nozzle is moved, remove the carbon with a clean cloth and replace the washer.**

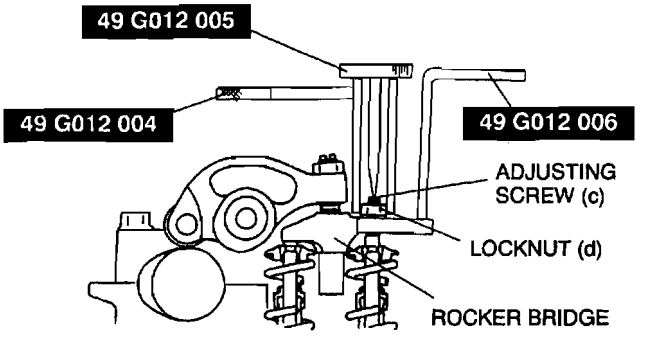
3. Remove the glow plugs. (Refer to section F2, INTAKE-AIR SYSTEM, GLOW PLUG REMOVAL/INSTALLATION)

Caution
- **When the injection nozzle is moved, carbon stuck to the nozzle washer installation surface of the cylinder head may affect the seal. After removing the injection nozzle bracket, do not move the injection nozzle. If the injection nozzle is moved, remove the carbon with a clean cloth and replace the washer.**

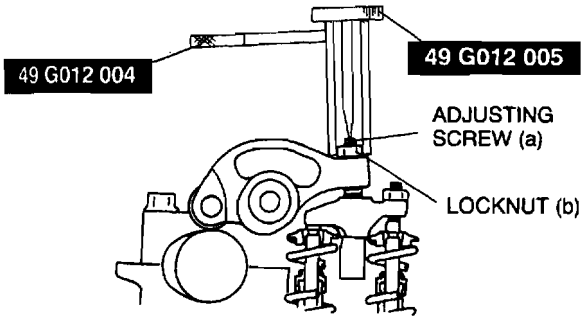
4. Remove the injection nozzle bracket. (Refer to CYLINDER HEAD GASKET, CYLINDER HEAD GASKET REMOVAL/INSTALLATION.)
5. Adjust the valve clearance A with the No.1 cylinder at TDC of compression, and those of B with the No.4 cylinder at TDC of compression.



(1) Hold the rocker bridge using the **SST** (49 G012 006).
(2) Loosen the locknut (d) using the **SST** (49 G012 004), and then turn the adjusting screw (c) using the **SST** (49 G012 005) until it is separated from the valve stem completely.

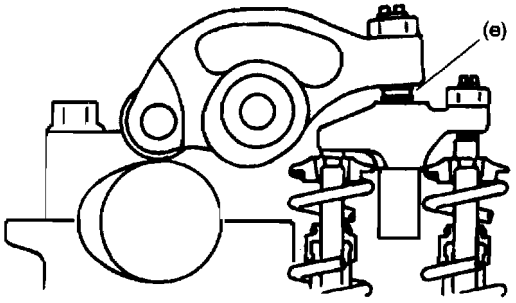


(3) Loosen the rocker arm locknut (b) using the **SST** (49 G012 004), and then turn the adjusting screw (a) using the **SST** (49 G012 005) until it is separated from the rocker bridge completely.



(4) Insert a feeler gauge between the rocker arm and rocker bridge (e).

Valve clearance [Engine cold]
IN: 0.12—0.18 mm {0.005—0.007 in}
(0.15 ± 0.03 mm {0.006 ± 0.001 in})
EX:0.32—0.38 mm {0.013—0.014 in}
(0.35 ± 0.03 mm {0.014 ± 0.001 in})



(5) Adjust the valve clearance by turning the adjuster (a) using the **SST** (49 G012 005). Then temporarily tighten locknut (b) using the **SST** (49 G012 004).
(6) With the feeler gauge inserted between the rocker arm and rocker bridge, verify that the feeler gauge remains firmly in place even when the adjusting screw (c) is loosened. If the feeler gauge does not remain firmly in place, repeat procedures from Step 1.
(7) Turn the adjusting screw (c) using the **SST** (49 G012 005) until it reaches the valve stem and the feeler gauge fits more firmly. Then tighten the locknut (d) using the **SST** (49 G012 004) to specified torque.

Tightening torque
16—20 N·m {1.6—2.1 kgf·m, 12—15 ft·lbf}

(8) Loosen the locknut (b) using the **SST** (49 G012 004) and readjust the valve clearance (e).

Valve clearance [Engine cold]
IN: 0.12—0.18 mm {0.005—0.007 in}
(0.15 ± 0.03 mm {0.006 ± 0.001 in})
EX:0.32—0.38 mm {0.013—0.014 in}
(0.35 ± 0.03 mm {0.014 ± 0.001 in})

(9) Tighten the locknut (b) using the **SST** (49 G012 004) to specified torque.

Tightening torque
16—20 N·m {1.6—2.1 kgf·m, 12—15 ft·lbf}

(10) Verify the valve clearance at (e).

Valve clearance [Engine cold]
IN: 0.12—0.18 mm {0.005—0.007 in}
(0.15 ± 0.03 mm {0.006 ± 0.001 in})
EX:0.32—0.38 mm {0.013—0.014 in}
(0.35 ± 0.03 mm {0.014 ± 0.001 in})

6. Turn the crankshaft one full turn and adjust the remaining valve clearances.
7. Install the injection nozzle bracket. (Refer to CYLINDER HEAD GASKET, CYLINDER HEAD GASKET REMOVAL/INSTALLATION.)
8. Install the fuel leak pipe. (Refer to CYLINDER HEAD GASKET, CYLINDER HEAD GASKET REMOVAL/INSTALLATION.)
9. Install the glow plug. (Refer to section F2, INTAKE-AIR SYSTEM, GLOW PLUG REMOVAL/INSTALLATION.)
10. Install the cylinder head cover. (Refer to CYLINDER HEAD GASKET, CYLINDER HEAD GASKET REPLACEMENT, Cylinder Head Cover Installation Note.)

COMPRESSION INSPECTION

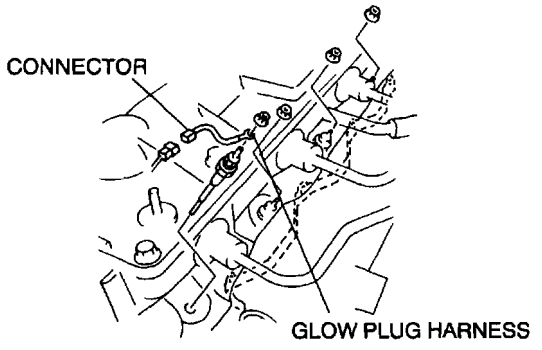
Warning
- **When the engine and the oil are hot, they can badly burn. Turn off the engine and wait until they are cool.**

1. Verify that the battery is fully charged. Recharge it if necessary. (Refer to section G, CHARGING SYSTEM, BATTERY INSPECTION, Battery.)
2. Warm up the engine to the normal operating temperature.
3. Stop the engine and allow it to cool off for about 10 minutes.

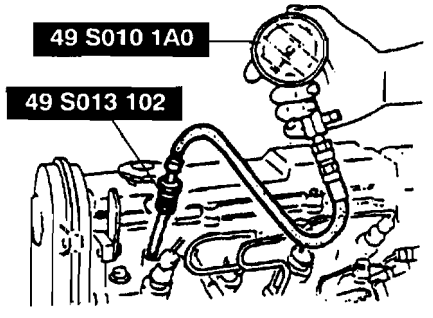
Warning
- **Fuel line spills and leakage are dangerous. Fuel can ignite and cause serious injuries or death and damage. Fuel can also irritate skin and eyes. To prevent fuel from spurting out of the glow plug hole, do not ground the fuel shut off (FSO) solenoid terminal.**

4. Disconnect the FSO solenoid connector.

Warning
- **If the glow plug harness connector is connected, the glow plug harness and engine component can come into contact and cause a short when the ignition is on. Disconnect the glow plug harness connector before turning the ignition on ignition.**



5. Remove the all glow plugs. (Refer to section F2, INTAKE-AIR SYSTEM, GLOW PLUG REMOVAL/ INSTALLATION.)
6. Install the **SSTs** into the glow plug hole.



7. Crank the engine and note the maximum gauge reading.
8. Inspect each cylinder as above.

Compression

kPa {kgf/cm^2, psi} [rpm]

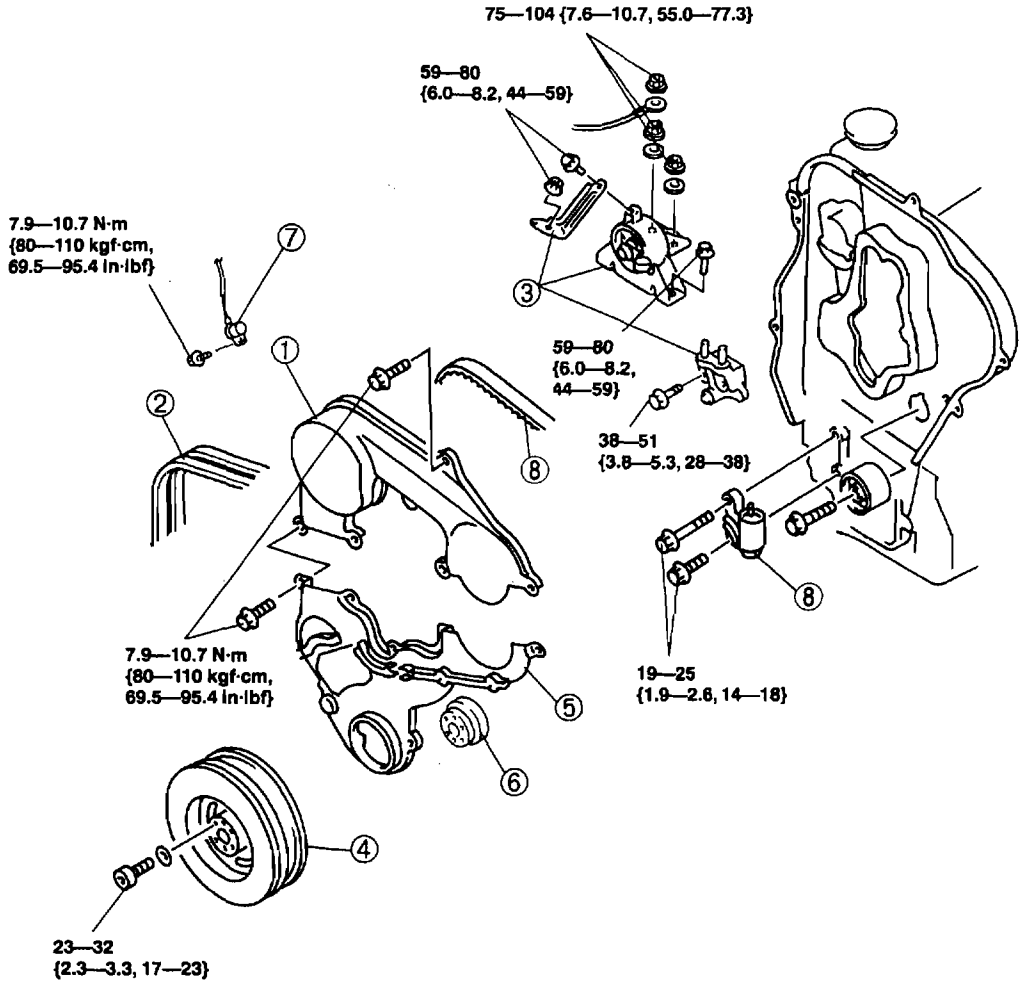
Item	Engine
	RF Turbo, RF Turbo (HI-power)
Standard	2,893 {29.5, 419} [260]
Minimum	2,599 {26.5, 377} [260]

9. If the compression in one or more cylinders is low, pour a small amount of clean engine oil into the cylinder and reinspect the compression.
   (1) If the compression increases, the piston, the piston rings, or cylinder wall may be worn and overhaul is required.
   (2) If the compression stays low, a valve may be stuck or improperly seated and overhaul is required.
   (3) If the compression in adjacent cylinders stays low, the cylinder head gasket may be damaged or the cylinder head maybe distorted and overhaul is required.
10. Remove the **SSTs**.
11. Install the glow plug. (Refer to section F2, INTAKE AIR SYSTEM, GLOW PLUG REMOVAL/INSTALLATION.)
12. Reconnect the FSO solenoid connector.

TIMING BELT

TIMING BELT REMOVAL/INSTALLATION

1. Disconnect the negative battery cable.
2. Drain the engine coolant. (Refer to section E.)
3. Remove the cylinder head cover insulator.
4. Remove in the order shown in the figure.
5. Install in the reverse order of removal.
6. Adjust the drive belt deflection/tension. (Refer to DRIVE BELT, DRIVE BELT ADJUSTMENT.)
7. Fill the radiator with the specified amount and type of engine coolant. (Refer to section E.)
8. Inspect the pulleys and the drive belt for runout and contact.

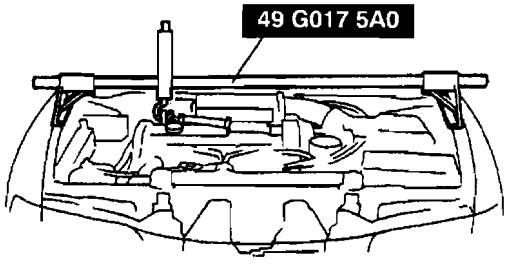


N·m {kgf·m, ft·lbf}

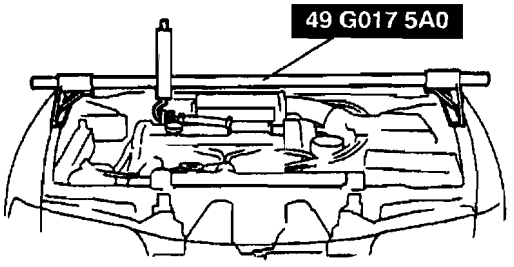
1	Upper timing belt cover
2	Drive belt
3	No.3 engine mount ☞ Removal Note ☞ Installation Note
4	Crankshaft pulley ☞ Removal Note ☞ Installation Note

5	Lower timing belt cover ☞ Removal Note
6	Guide plate
7	Crankshaft position sensor
8	Timing belt, Timing belt auto tensioner ☞ Removal Note ☞ Installation Note

No.3 Engine Mount Removal Note
- Suspend the engine using the **SST**.

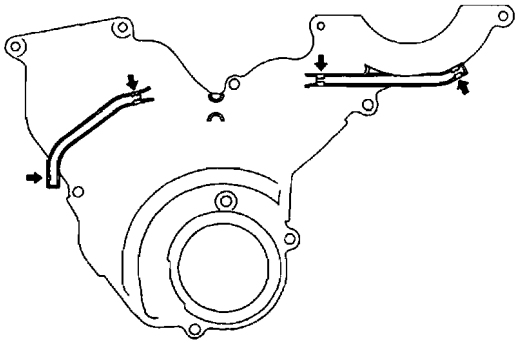


Crankshaft Pulley Removal Note
- Turn the **SST** adjusting bolt and lower the engine to remove the crankshaft pulley.

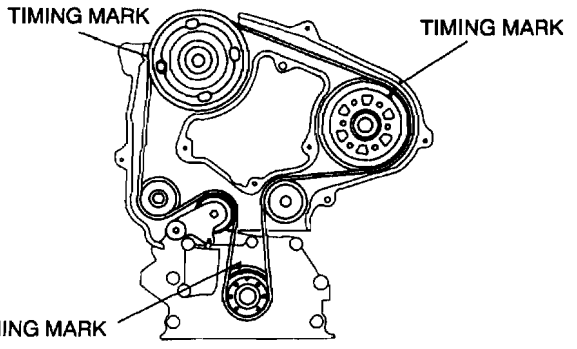


Lower Timing Belt Cover Removal Note

Caution
- **The timing belt cover could be damaged easily. Hold the timing belt cover at the locations indicated in the figure and remove the crankshaft position sensor harness slowly.**

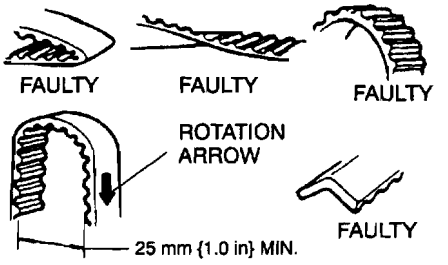


Timing Belt, Timing Belt Auto Tensioner Removal Note
1. Turn the crankshaft clockwise and align the timing marks as shown.



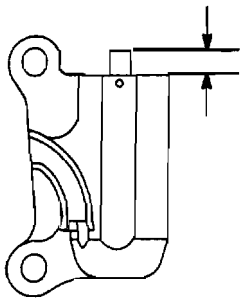
Caution
- **The following will damage the belt and shorten its life: forcefully twisting it, turning it inside out, or allowing oil or grease on it.**
- **After removing the timing belt, do not move the crankshaft and/or camshaft pulley from this position because it can cause the valve and piston to contact.**

2. Remove the timing belt auto tensioner.
3. Mark the timing belt rotation on the belt for proper reinstallation.



Timing Belt, Timing Belt Auto Tensioner Installation Note
1. Measure the tensioner rod projection length. Replace the auto tensioner if necessary.
2. Inspect the auto tensioner for oil leakage. Replace the auto tensioner if necessary.

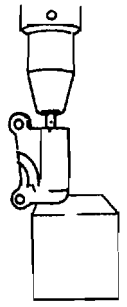
Projection (Free length)
12.9—14.6 mm {0.508—0.574 in}

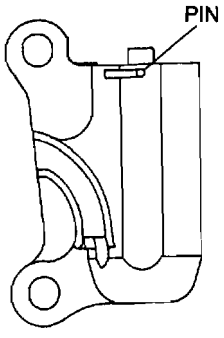


Caution
- **Placing the auto tensioner horizontally can cause oil leakage and damage the auto tensioner. Place the auto tensioner vertically when using a vise.**

3. Verify the thrust of the auto tensioner rod in the following order:
   (1) If the tensioner rod is rigid when it is pushed with a load of approximately 235 N {24 kgf, 53 lbf}, push it down slowly and fix the pin in the hole.
   (2) If the tensioner rod is not resistant and moves slightly when it is pushed with a load of approximately 235 N {24 kgf, 53 lbf};
      ① push it down slowly two or three times to the bottom end of the rod.
      ② when the rod protrudes approximately 8.1 mm {0.32 in}, verify that the rod is resistant

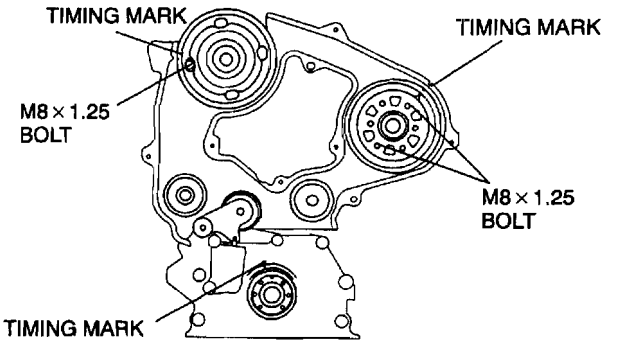
   When the rod is resistant, push it down slowly and fix the pin in the hole. If the rod does not become resistant, replace the auto tentioner.





Caution
- **To prevent the bolts (M8 × 1.25) from damaging the fuel injection pump and pulley, do not fully tighten the detent bolt. If it contacts the pulley surface, it will damage the pulley.**

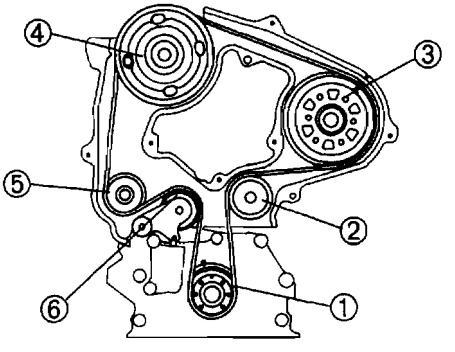
4. Verify that all timing marks are correctly aligned.
5. Fix the camshaft pulley to the cylinder head using bolt **M8 × 1.25**.
6. Fix the injection pump pulley to the bracket using two bolts **M8 × 1.25**.



7. If not, align all timing marks according to the procedure below.

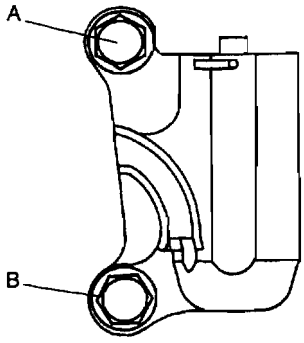
Caution
- **Turn the crankshaft in the direction which will prevent the TDC and BDC from being passed. Otherwise it can cause the valve and piston to contact.**

   (1) Turn the crankshaft and set it an angle of 45° or more away from the TDC and BDC.
   (2) Align the timing marks of the camshaft pulley.
   (3) Align the timing marks of the injection pump pulley.
   (4) Turn the crankshaft and align the timing marks of the timing belt pulley.
8. Install the timing belt on the pulleys in the order described below.
   (1) Timing belt pulley
   (2) Idler
   (3) Injection pump pulley
   (4) Camshaft pulley
   (5) Water pump pulley
   (6) Tensioner



9. Remove the injection pump pulley fixed bolts and camshaft pulley fixed bolt **M8 × 1.25**.
10. Hand tighten the auto tensioner bolts in the order A to B.

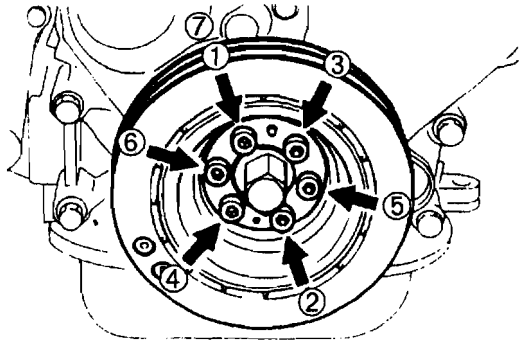
11. Tighten the auto tensioner bolts in the order A to B.



12. Remove the pin from the auto tensioner to apply tension to the belt.
13. Turn the crankshaft clockwise twice, and align the timing marks.
14. Verify that all timing marks are correctly aligned. If not, repeat from **Timing Belt, Timing Belt Auto Tensioner Removal Note**. (Refer to TIMING BELT, TIMING BELT REMOVAL/INSTALLATION, Timing Belt, Timing Belt Auto Tensioner Removal Note.)

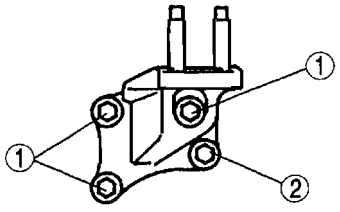
Crankshaft Pulley Installation Note

- Tighten the bolts in the order shown.



No.3 Engine Mount Installation Note

- Tighten the bolts in the order shown.



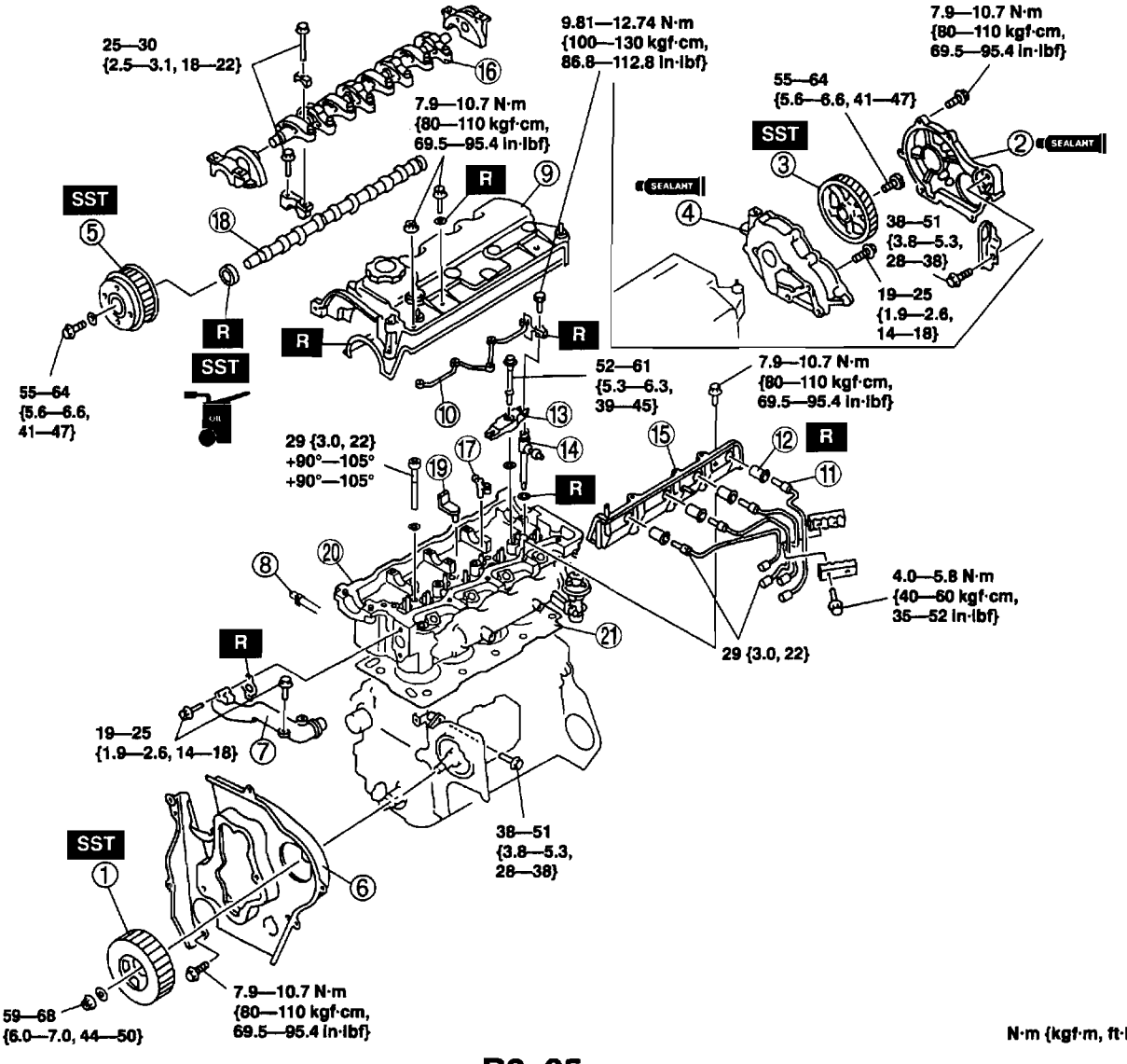
CYLINDER HEAD GASKET

CYLINDER HEAD GASKET REPLACEMENT

Warning

- **Fuel vapor is hazardous. It can very easily ignite, causing serious injury and damage. Always keep sparks and flames away from fuel.**
- **Fuel line spills and leakage are dangerous. Fuel can ignite and cause serious injuries or death and damage. Fuel can also irritate skin and eyes. To prevent this, always complete the "Fuel Line Safety Procedures" in section F2. (Refer to section F2, FUEL SYSTEM, BEFORE REPAIR PROCEDURE.)**

1. Remove the timing belt. (Refer to TIMING BELT, TIMING BELT REMOVAL/INSTALLATION.)
2. Remove the vacuum pump. (Refer to section P, CONVENTIONAL BRAKE SYSTEM, VACUUM PUMP REMOVAL/INSTALLATION.)
3. Remove the P/S oil pump with the oil hose still connected. Position the P/S oil pump so that it is out of the way.
4. Remove the turbocharger. (Refer to section F2, EXHAUST SYSTEM, EXHAUST SYSTEM REMOVAL/INSTALLATION.)
5. Remove all the glow plugs. (Refer to section F2, INTAKE-AIR SYSTEM, GLOW PLUG REMOVAL/INSTALLATION.)
6. Remove in the order shown in the figure.
7. Install in the reverse order of removal.
8. Inspect valve clearance. (Refer to VALVE CLEARANCE, VALVE CLEARANCE INSPECTION.)
9. Inspect the engine oil level. (Refer to section D, ENGINE OIL, ENGINE OIL INSPECTION.)
10. Inspect the compression. (Refer to COMPRESSION, COMPRESSION INSPECTION.)
11. Start the engine and
    (1) Inspect the engine oil, engine coolant, and fuel leakage.
    (2) Inspect the idle speed. (Refer to F2, ENGINE TUNE-UP, IDLE SPEED ADJUSTMENT.)



N·m {kgf·m, ft·lbf}

1	Injection pump pulley ☞ Removal Note ☞ Installation Note
2	Gear cover ☞ Installation Note
3	Drive gear ☞ Removal Note ☞ Installation Note
4	Gear case ☞ Installation Note
5	Camshaft pulley ☞ Removal Note ☞ Installation Note
6	Seal plate ☞ Removal Note ☞ Installation Note
7	Water outlet ☞ Installation Note
8	Oil cooler hose
9	Cylinder head cover ☞ Installation Note
10	Fuel leak pipe ☞ Installation Note
11	Injection pipe ☞ Installation Note
12	Nozzle seal
13	Injection nozzle bracket
14	Injection nozzle
15	Side wall ☞ Installation Note
16	Rocker arm and rocker arm shaft ☞ Removal Note ☞ Installation Note
17	Rocker bridge
18	Camshaft
19	Breather pipe
20	Cylinder head ☞ Removal Note ☞ Installation Note
21	Cylinder head gasket

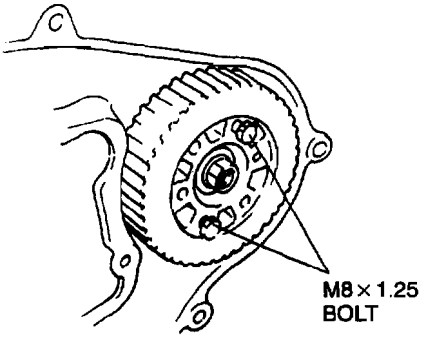
Injection Pump pulley Removal Note

1. Verify that timing marks are correctly aligned.

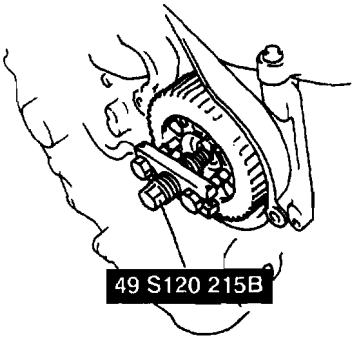
Caution

- **To prevent the bolts (M8 × 1.25) from damaging the injection pump and pulley, do not fully tighten the detent bolt. If it contacts the pulley surface, it will damage the pulley.**

2. Fix the injection pump pulley to the bracket using two bolts **M8 × 1.25**.



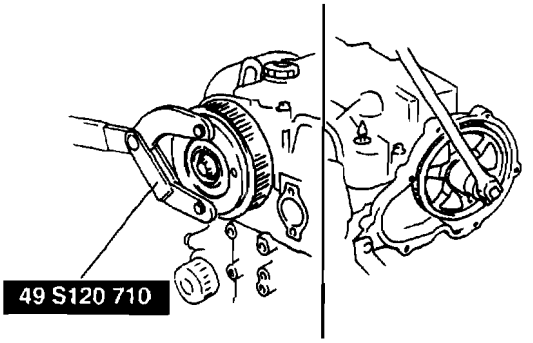
3. Loosen the injection pump pulley lock nut.
4. Separate the injection pump pulley from the injection pump shaft using the **SST**.



5. Remove the injection pump pulley fixed bolts **M8 × 1.25**.

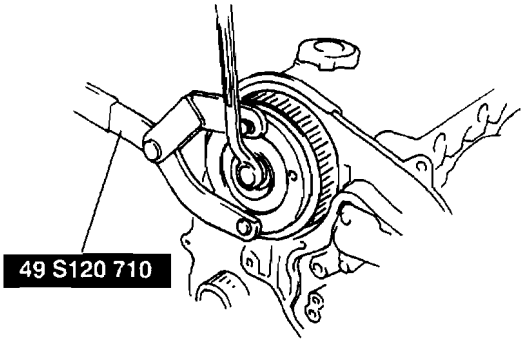
Drive Gear Removal Note

1. Hold the camshaft using the **SST**.
2. Remove the drive gear lock bolt.

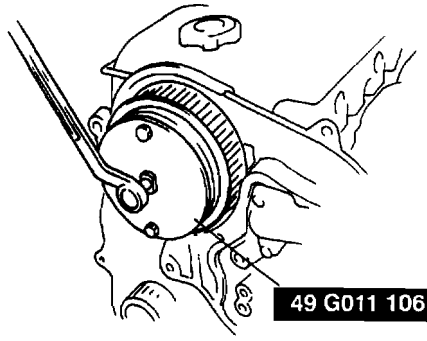


Camshaft Pulley Removal Note

1. Hold the camshaft using the **SST**.
2. Remove the camshaft pulley lock bolt.

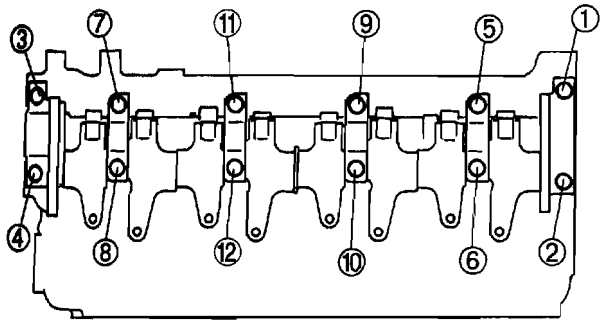


3. Remove the camshaft pulley using the **SST**.

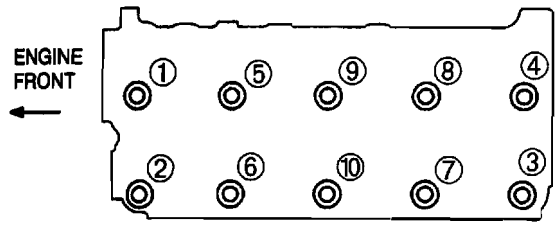


Seal Plate Removal Note
- Remove the seal plate from the engine component. However, the seal plate cannot be removed completely. Separate the seal plate from the engine component by removing the fitting bolts so that the cylinder head can be removed.

Rocker Arm And Rocker Arm Shaft Removal Note
- Loosen the bolts in two or three steps in the order shown.

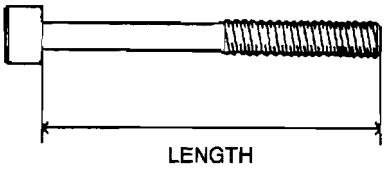


Cylinder Head Removal Note
- Loosen the cylinder head bolts in two or three steps in the order shown.



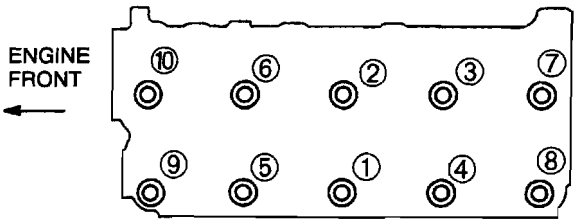
Cylinder Head Installation Note
1. Before installation, measure the length of each bolt. Replace any that exceed the maximum length.

Maximum length
116.8 mm {4.598 in}

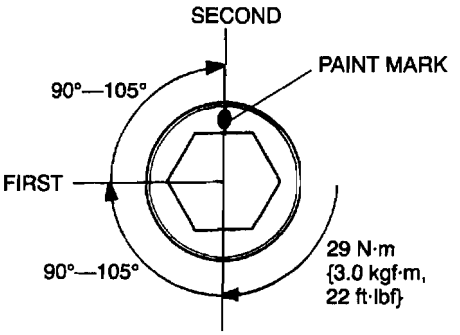


2. Tighten the bolts in two or three steps in the orde shown.

Tightening torque
29 N·m {3.0 kgf·m, 22 ft·lbf}

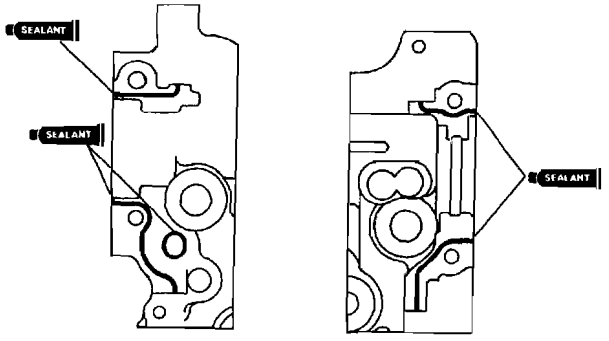


3. Put a paint mark on each bolt head.
4. Using the marks as a reference, tighten the bolts by turning each 90°—105° in the sequence shown.
5. Further tighten each bolt by turning another 90°—105°.



Rocker Arm And Rocker Arm Shaft Installation Note
1. Apply sealant as shown in the figure.

Thickness
ø2 mm {0.079 in} min.

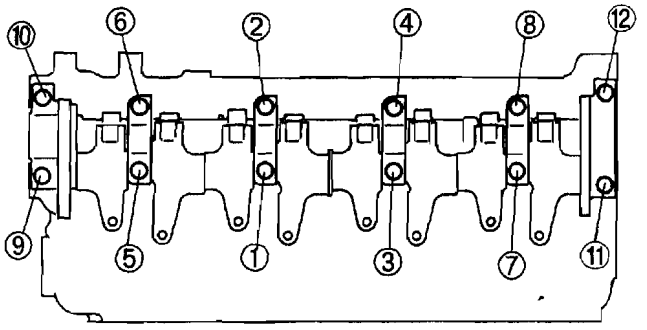


2. Install the camshaft caps according to the cap number.
3. Install the rocker arm shaft plane side upward.

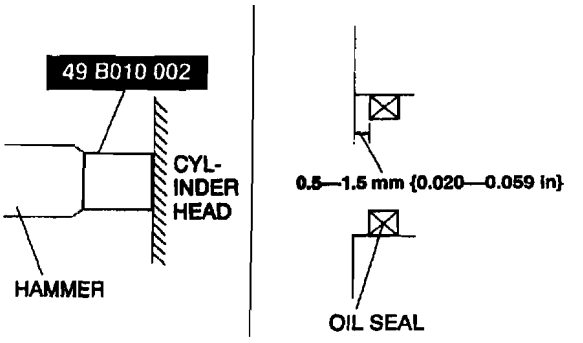
Caution

- **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. Tighten the bolts in two or three steps in the order shown.



5. Apply clean engine oil to the new oil seal.
6. Push the oil seal slighty in by hand.
7. Tap the oil seal into the cylinder head using the **SST** and a hammer.



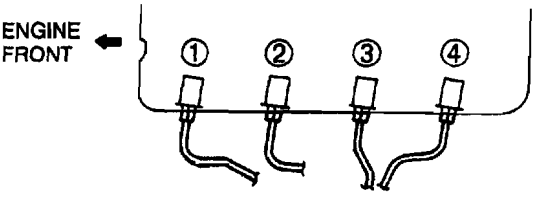
Side Wall Installation Note

- Apply silicone sealant as shown in the figure.

Thickness
ø2 mm {0.079 in} min.

Injection Pipe Installation Note

- Install the injection pipe in the order shown.

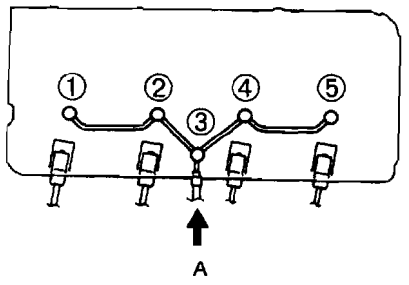


Fuel Leak Pipe Installation Note

Caution

- **If the gasket is reused, fuel can leak in the cylinder head, contaminating the oil and causing conditions such as abnormal wear to the friction parts. When a gasket is removed, be sure to install a new gasket.**

1. Tighten the fuel leak pipe in the order shown.
2. Apply soapy water to each installation part of the fuel leak pipe.
3. After installing the fuel leak pipe, apply air pressure of 98 kPa {1.0 kgf/cm^2, 14 psi} from the location marked A, and verify that there is no air leakage from each installation part.

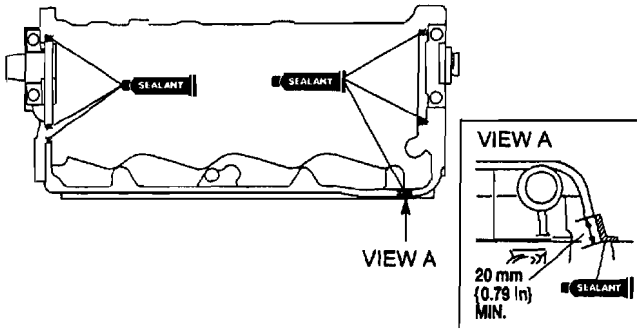


4. Inspect the fuel leak pipe for air leakage.

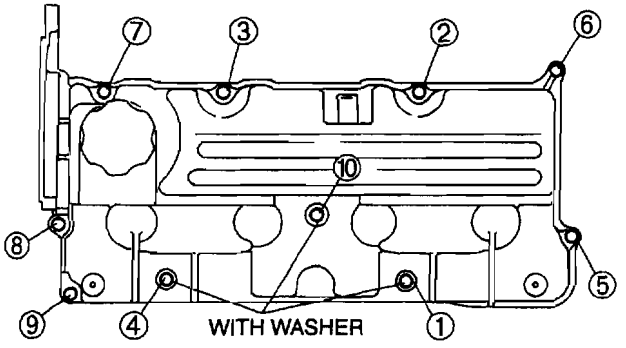
Cylinder Head Cover Installation Note

1. Apply silicone sealant to the shaded areas.

Thickness
ø2 mm {0.079 in} min.

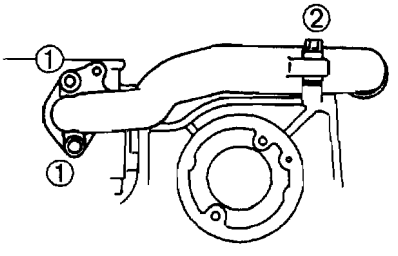


2. Tighten the bolts in the order shown.



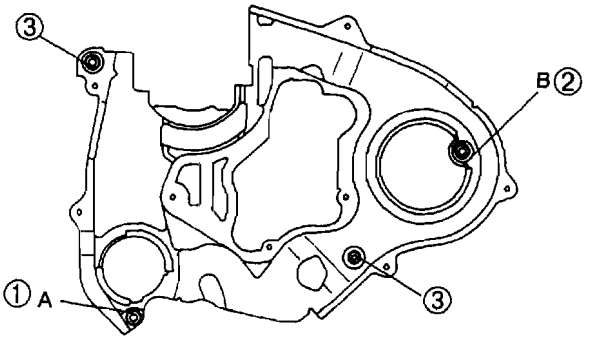
Water Outlet Installation Note

- Tighten the bolts in the order shown.



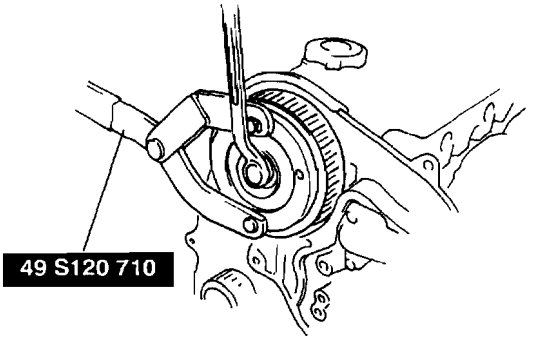
Seal Plate Installation Note

1. Install the seal plate and hand tighten the bolt ir the order A to B.
2. Tighten the bolts in the order shown.



Camshaft Pulley Installation Note

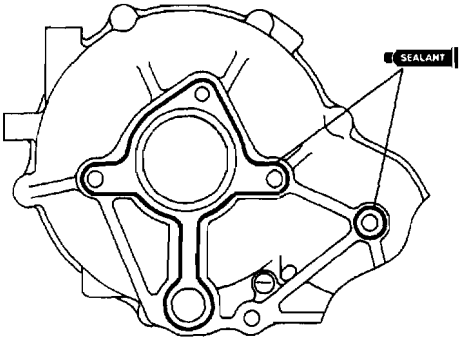
1. Hold the camshaft using the **SST**.



Gear Case Installation Note

1. Apply silicone sealant as shown in the figure.

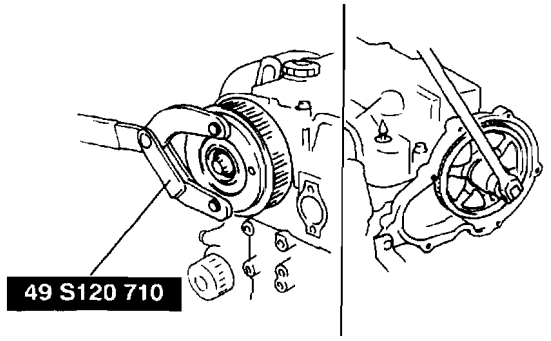
Thickness
ø1.5—2.5 mm {0.059—0.098 in}



2. Tighten the bolts in clockwise order.

Drive Gear Installation Note

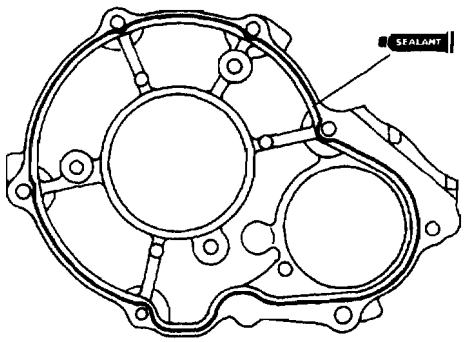
1. Hold the camshaft using the **SST**.
2. Tighten the drive gear lock bolt.



Gear Cover Installation Note

1. Apply silicone sealant to the shaded areas shown in the figure.

Thickness
ø1.5—2.5 mm {0.059—0.098 in}



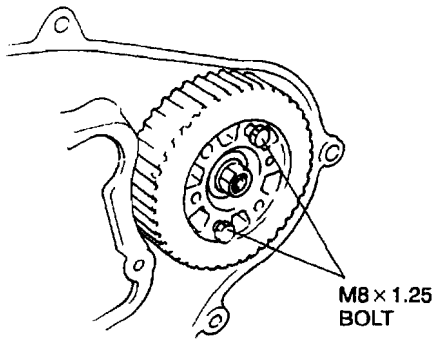
2. Tighten the bolts in clockwise order.

Injection Pump Pulley Installation Note

Caution

- **To prevent the bolts (M8 × 1.25) from damaging the injection pump and pulley, do not fully tighten the detent bolt. If it contacts the pulley surface, it will damage the pulley.**

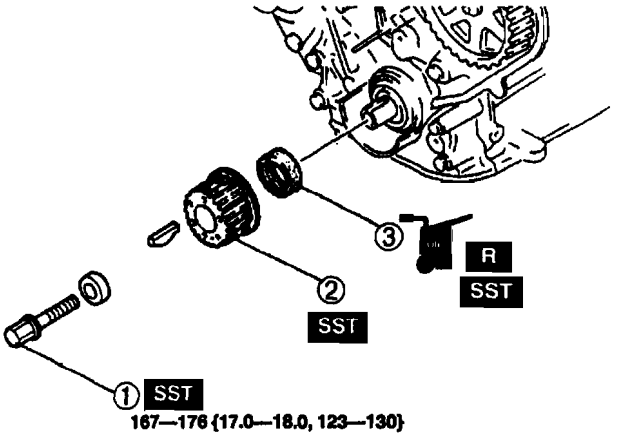
- Fix the injection pump pulley to the bracket using two bolts **M8 × 1.25**.



FRONT OIL SEAL

FRONT OIL SEAL REPLACEMENT

1. Remove the timing belt. (Refer to TIMING BELT, TIMING BELT REMOVAL/INSTALLATION.)
2. Remove in the order shown in the figure.
3. Install in the reverse order of removal.

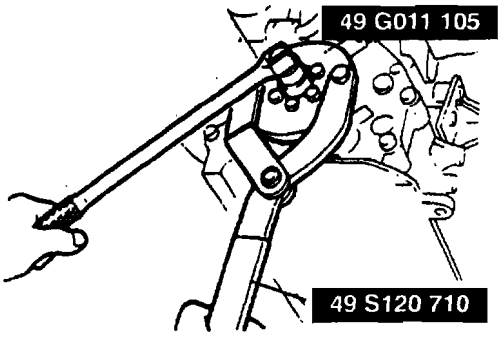


N·m {kgf·m, ft·lbf}

1	Timing belt pulley lock bolt ☞ Removal/Installation Note
2	Timing belt pulley ☞ Removal Note
3	Front oil seal ☞ Removal Note ☞ Installation Note

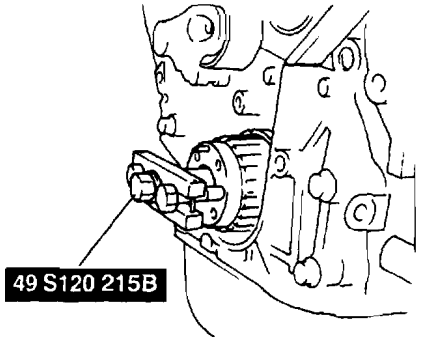
Timing Belt Pulley Lock Bolt Removal/Installation Note

- Hold the timing belt pulley using the **SST**.



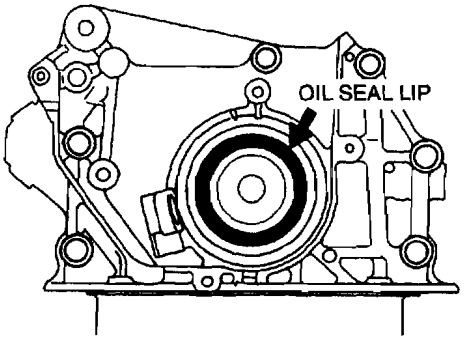
Timing Belt Pulley Removal Note

- Remove the timing belt pulley using the **SST**.

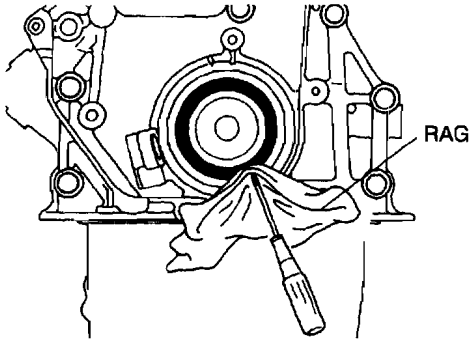


Front Oil Seal Removal Note

1. Cut the oil seal lip using a razor knife.

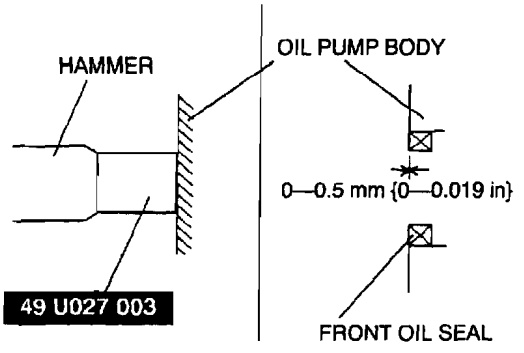


2. Remove the oil seal using a screwdriver protected with a rag.



Front Oil Seal Installation Note

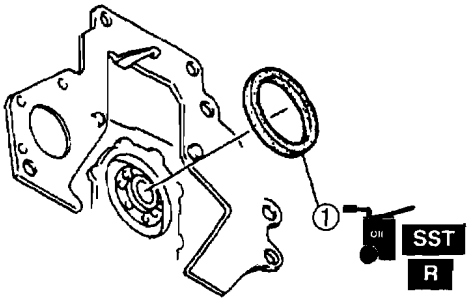
1. Apply clean engine oil to the oil seal lip.
2. Push the oil seal slightly in by hand.
3. Tap the oil seal in evenly using the **SST** and a hammer. The oil seal must be tapped in until it is flush with the edge of the oil pump body.



REAR OIL SEAL

REAR OIL SEAL REPLACEMENT

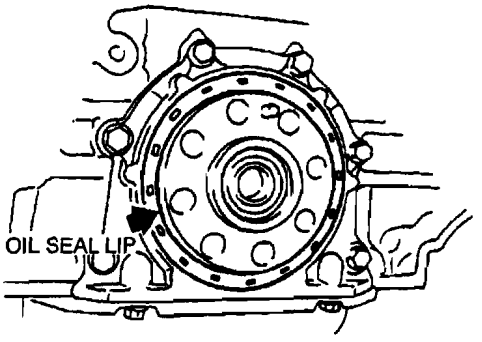
1. Remove the flywheel. (Refer to section H.)
2. Remove in the order shown in the figure.
3. Install in the reverse order of removal.



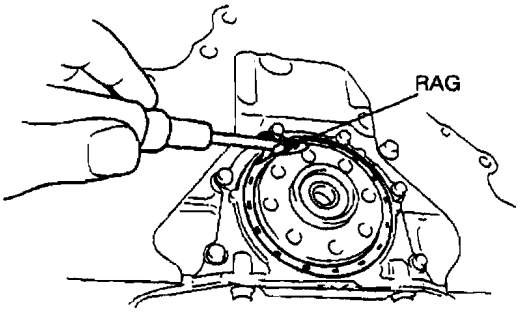
1	Rear oil seal ☞ Removal Note ☞ Installation Note

Rear Oil Seal Removal Note

1. Cut the oil seal lip using a razor knife.

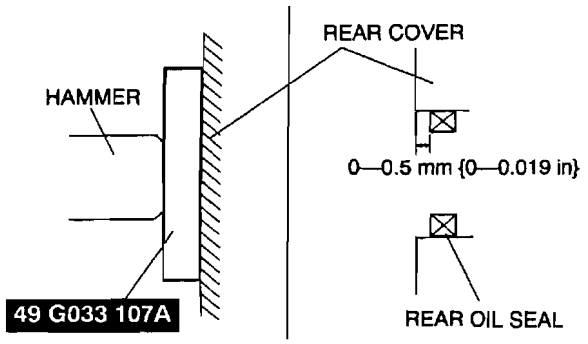


2. Remove the oil seal using a screwdriver protected with a rag.



Rear Oil Seal Installation Note

1. Apply clean engine oil to the oil seal lip.
2. Push the oil seal slightly in by hand.
3. Tap the oil seal in evenly using the **SST** and a hammer.



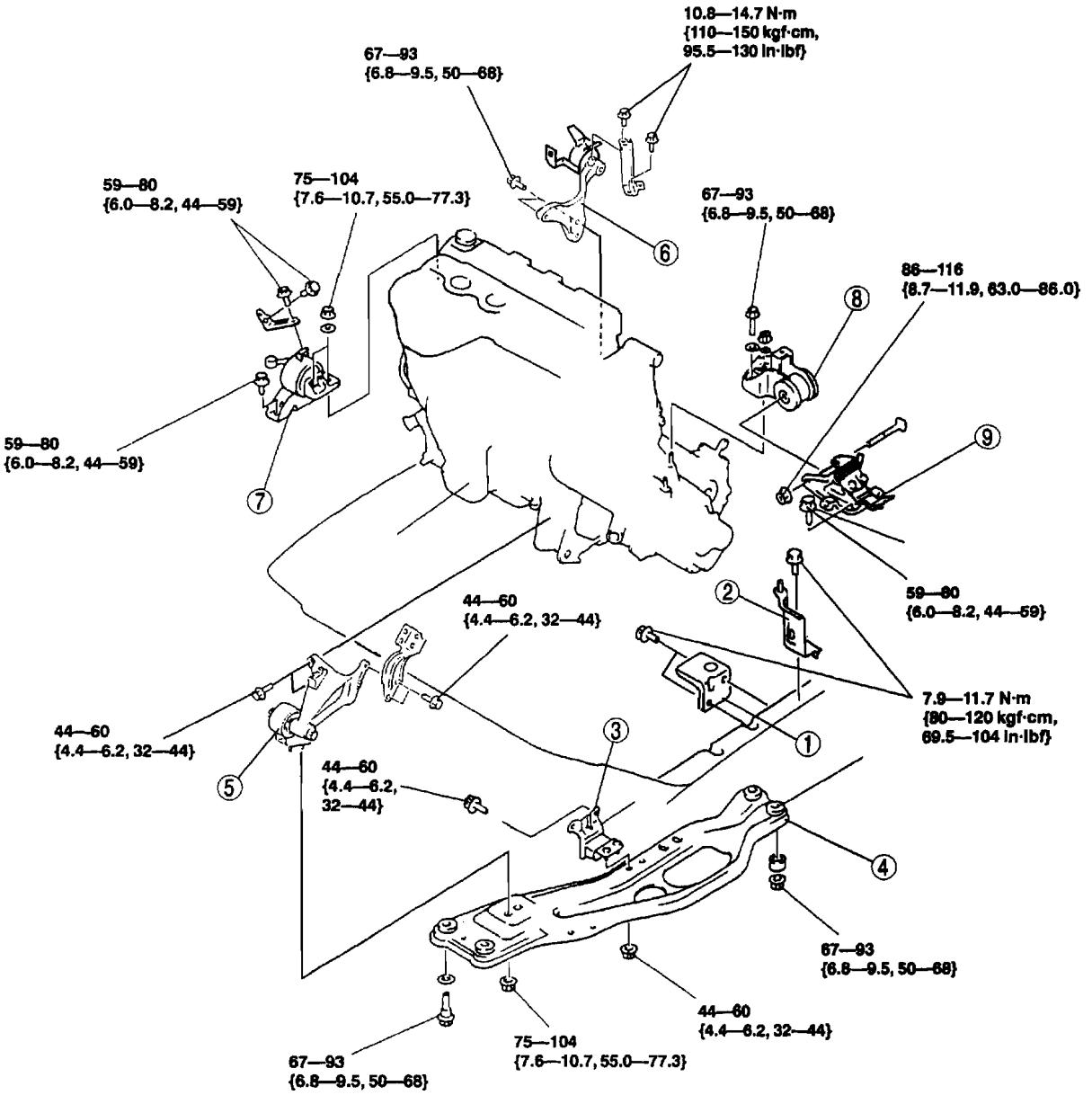
ENGINE

ENGINE REMOVAL/INSTALLATION

Warning

- **Fuel vapor is hazardous. It can very easily ignite, causing serious injury and damage. Always keep sparks and flames away from fuel.**
- **Fuel line spills and leakage are dangerous. Fuel can ignite and cause serious injuries or death and damage. Fuel can also irritate skin and eyes. To prevent this, always complete the "Fuel Line Safety Procedures" in section F2. (Refer to section F2, FUEL SYSTEM, BEFORE REPAIR PROCEDURE.)**

1. Disconnect the negative battery cable.
2. Remove the radiator. (Refer to section E.)
3. Remove the cylinder head cover insulator.
4. Remove the air cleaner and air hose. (Refer to section F2, INTAKE-AIR SYSTEM, INTAKE-AIR SYSTEM REMOVAL/INSTALLATION.)
5. Disconnect the fuel hose. (Refer to section F2, FUEL SYSTEM, BEFORE REPAIR PROCEDURE.) (Refer to section F2, FUEL SYSTEM, AFTER REPAIR PROCEDURE.)
6. Remove the transverse member. (Refer to section R.)
7. Remove the front pipe. (Refer to section F2, EXHAUST SYSTEM, EXHAUST SYSTEM REMOVAL/INSTALLATION.)
8. Remove the battery and carrier.
9. Remove the vacuum hose and the heater hose.
10. Remove the P/S oil pump with the oil hose still connected. Position the P/S oil pump so that it is out of the way.
11. Remove the A/C compressor with the pipe still connected. Position the A/C compressor so that it is out of the way.
12. Remove the drive shaft. (Refer to section M, DRIVE SHAFT, DRIVE SHAFT REMOVAL/INSTALLATION.)
13. Remove in the order indicated in the table.
14. Install in the reverse order of removal.
15. Fill the radiator with the specified amount and type of engine coolant. (Refer to section E.)
16. Adjust the drive belt deflection/tension. (Refer to DRIVE BELT, DRIVE BELT ADJUSTMENT.)
17. Bleed the air from the fuel line. (Refer to section F2, FUEL SYSTEM, FUEL FILTER AIR BLEEDING.)
18. Start the engine and
    (1) inspect the pulleys and the drive belt for runout and contact.
    (2) inspect the engine oil, engine coolant transaxle oil, P/S fluid, and fuel for leakage.
    (3) inspect the idle speed and idle mixture. (Refer to section F2, ENGINE TUNE-UP.)
19. Perform a road test.
20. Reinspect the engine oil, engine coolant, transaxle oil, and P/S fluid levels.



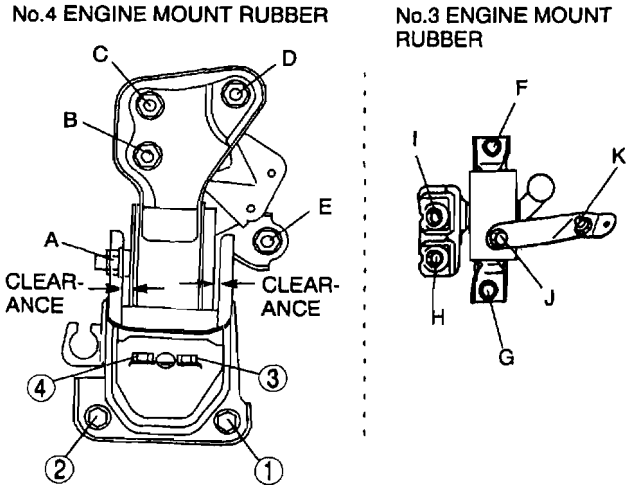
N·m {kgf·m, ft·lbf}

1	Battery bracket
2	Air cleaner stay
3	No.5 Engine mount rubber
4	Engine mount member
5	No.2 engine mount
6	No.1 Engine mount bolt

7	No.3 Engine mount rubber ☞ Installation Note
8	No.4 Engine mount rubber ☞ Installation Note
9	No.4 Engine mount bracket ☞ Installation Note

No.4 Engine Mount Bracket, No.3, No.4 Engine Mount Rubber Installation Note

1. Tighten the bolt in the order shown.
2. Hand tighten the No.3 and No.4 engine mount rubber bolts and nuts (A-K).

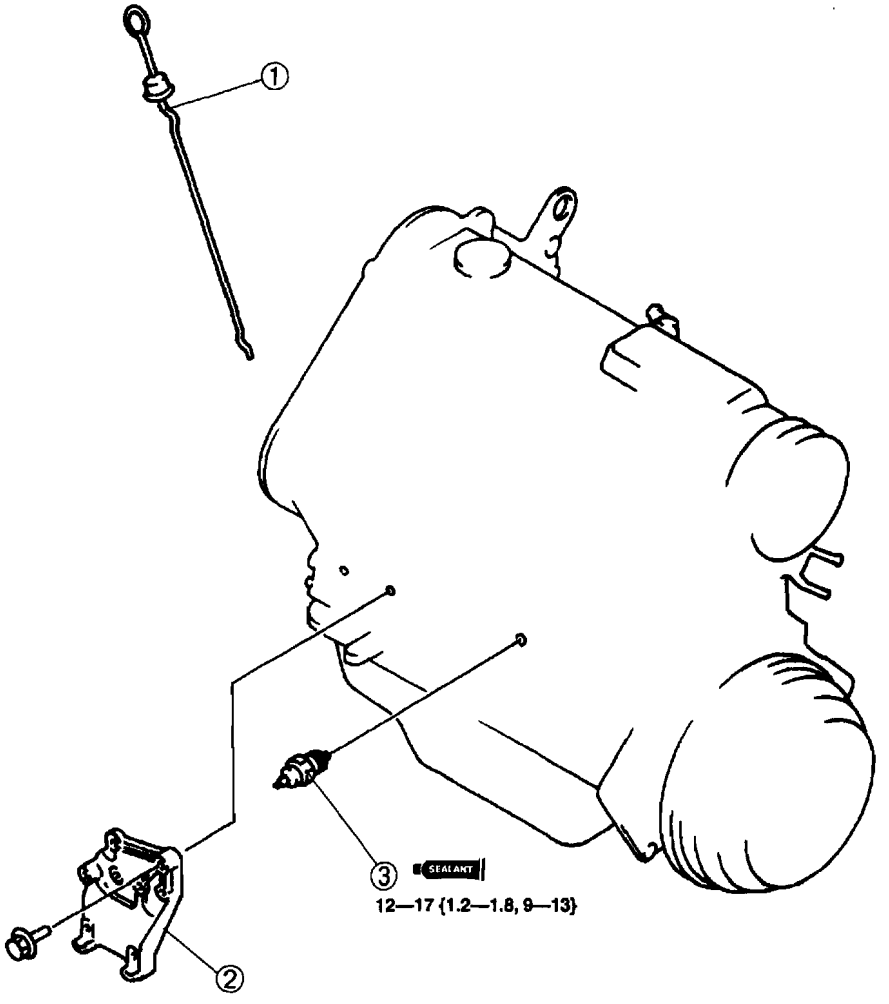


3. Tighten the No.4 engine mount rubber bolts and nuts (A-E).
4. Tighten the No.3 engine mount rubber bolts and nuts (F-K).
5. Measure the No.4 engine mount rubber clearance. If not within the specification, repeat from Step 1.

Standard clearance
4.0—6.0 mm {0.16—0.23 in}

ENGINE DISASSEMBLY/ASSEMBLY

1. Disconnect the engine and transaxle. (Refer to section J, MANUAL TRANSAXLE, TRANSAXLE REMOVAL/INSTALLATION)
2. Remove the exhaust system. (Refer to section F2, EXHAUST SYSTEM, EXHAUST SYSTEM REMOVAL/INSTALLATION.)
3. Remove the generator.
4. Remove the clutch. (Refer to section H.)
5. Remove the vacuum pump. (Refer to section P, CONVENTIONAL BRAKE SYSTEM, VACUUM PUMP REMOVAL/INSTALLATION.)
6. Remove the oil cooler. (Refer to section D, OIL COOLER, OIL COOLER REMOVAL/INSTALLATION.)
7. Disassemble in the order shown in the figure.
8. Assemble in the reverse order of disassembly.



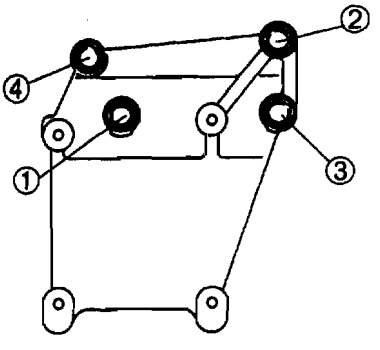
N·m { kgf·m , ft·lbf }

1	Dipstick
2	A/C compressor bracket, Idler ☞ Installation Note

3	Oil pressure switch ☞ section D

A/C Compressor Bracket, Idler Installation Note

- Tighten the A/C compressor bracket bolts in the order shown.



LUBRICATION

FEATURES

SERVICE

D

OUTLINE

OUTLINE OF CONSTRUCTION

The construction and operation of the RF engine lubrication system are basically the same as those of the previous Mazda 323 (BA) models. (Refer to Mazda 323 RF Workshop Manual Supplement 1588-10-97C.) However, the following changes have been made:

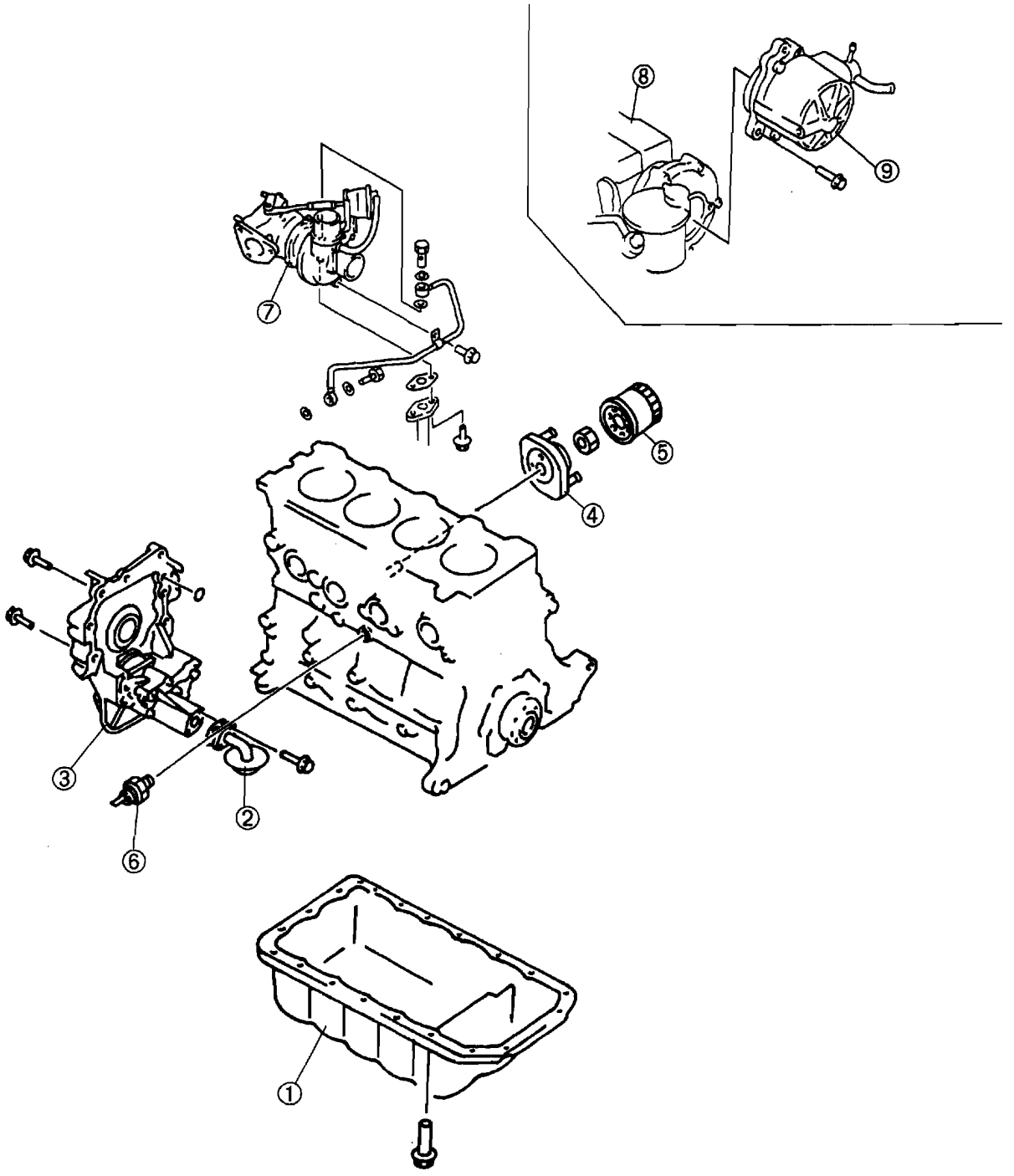
- As the overall length of the engine has been made shorter, a suspended type of oil pump has been adopted.
- The bypass filter has been eliminated in the RF Turbo engine due to low carbon output compared with the previous RF engine.
- Oil is supplied to the vacuum pump from the rear of the camshaft because the vacuum pump has been changed to a drive system powered by the rear end of the camshaft.

SPECIFICATIONS

Item		Engine	
		RF Turbo	RF Turbo (Hi-power)
Lubrication system		Force-Fed type	
Oil pump	Type	Trochoid gear	
	Relief pressure (kPa {kgf/cm^2, psi})	510-608 {5.2-6.2, 74-88}	
Oil filter	Type	Full-flow	
	Bypass pressure (kPa {kgf/cm^2, psi})	79—117 {0.8—1.2, 12—17}	
Oil capacity	Total (dry engine) (L {US qt, Imp qt})	5.4 {5.7, 4.8}	
	Oil replacement (L {US qt, Imp qt})	4.5 {4.8, 4.0}	
	Oil and oil filter replacement (L {US qt, Imp qt})	4.7 {5.0, 4.1}	
Engine oil		API service CD	
Viscosity	Below 10 °C {50 °F}	SAE 5W-30	
	-15 °C —40 °C {5 °F —104 °F }	SAE 10W-30	

LUBRICATION SYSTEM

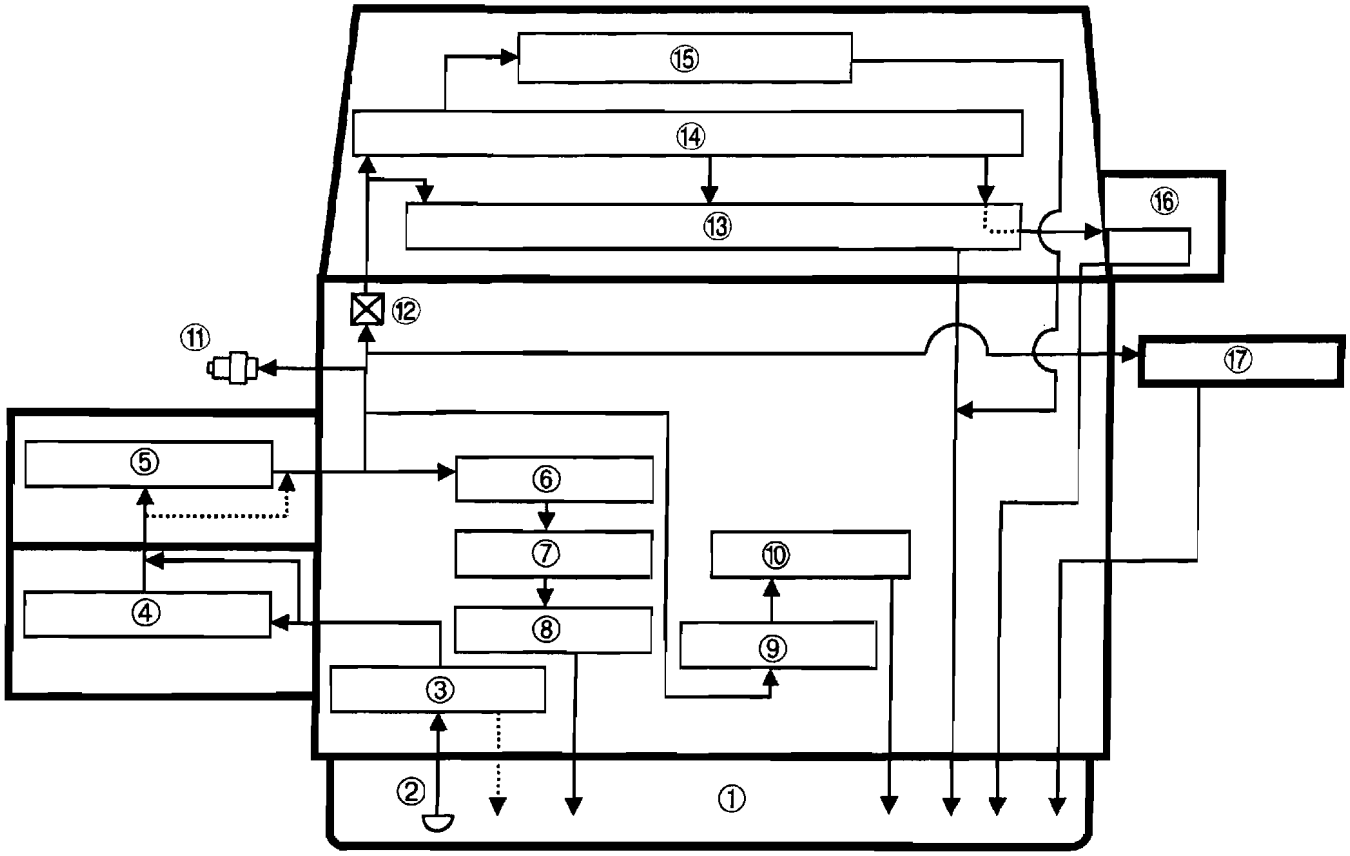
LUBRICATION SYSTEM STRUCTURAL VIEW



1	Oil pan
2	Oil strainer
3	Oil pump
4	Oil cooler
5	Oil filter

6	Oil pressure switch
7	Turbocharger
8	Cylinder head
9	Vacuum pump

LUBRICATION FLOW CHART



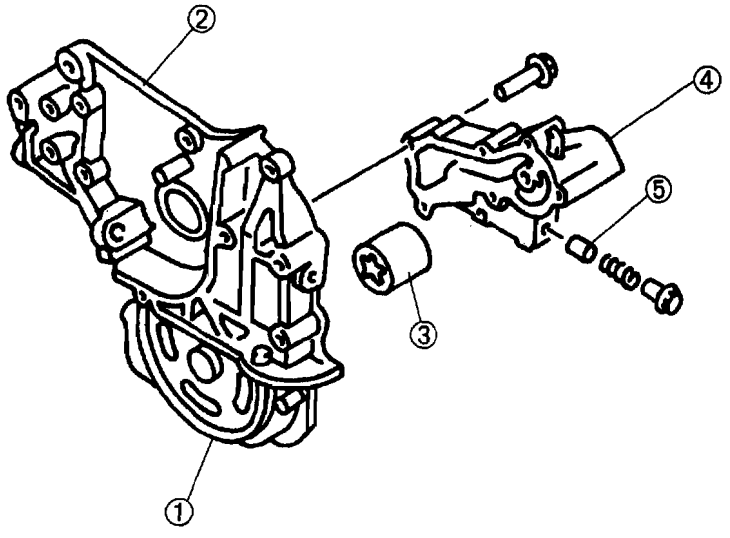
1	Oil pan
2	Oil strainer
3	Oil pump
4	Oil cooler
5	Oil filter
6	Main bearing
7	Crankshaft
8	Connecting rod bearing
9	Oil jet

10	Piston
11	Oil pressure switch
12	Orifice
13	Camshaft
14	Rocker arm shaft
15	Rocker arm, rocker bridge
16	Vacuum pump
17	Turbocharger

LUBRICATION MECHANISM

OIL PUMP

- The oil pump is trochoid type.
- Crankshaft rotation is transmitted to the oil pump driven gear through the oil pump drive gear installed to the crankshaft.
- The oil pressure relief valve is mounted in the oil pump cover.

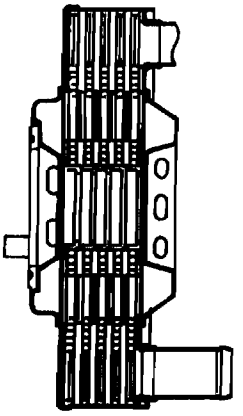


1	Oil pump driven gear
2	Oil pump body
3	Outer rotor

4	Oil pump cover
5	Oil pressure relief valve

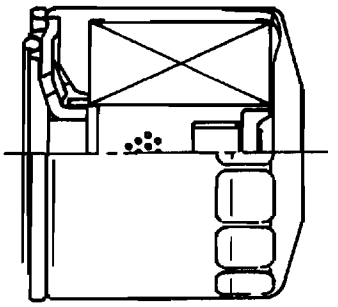
OIL COOLER

- The oil cooler is a water cooled, 5 layer type.
- The oil cooler lowers the engine oil temperature to prevent engine oil premature deterioration.



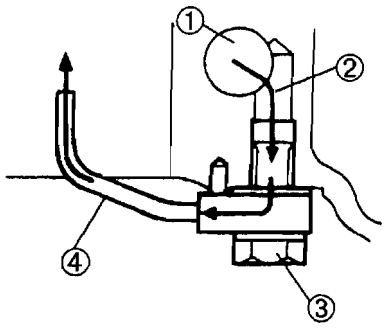
OIL FILTER

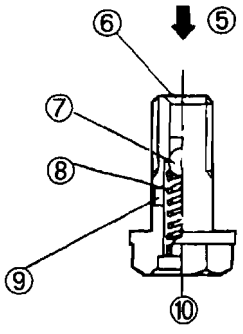
- The oil filter is small-sized full flow type with a paper element.



OIL JET

- The oil jets are employed.
- The oil jets continuously spray oil to cool the pistons when the oil pressure is 138—196 kPa {1.4—2.0 kgf/cm^2, 20—28 psi} or more. When the oil pressure is below the specified pressure, the oil jets stop spraying oil to avoid the oil pressure drop.





1	Cylinder block main gallery
2	Engine oil
3	Check valve
4	Nozzle
5	Oil pressure

6	Oil hole
7	Check ball
8	Check ball spring
9	Oil hole (to nozzle)
10	Check valve

SUPPLEMENTAL SERVICE INFORMATION

- The following additions have been made since publication of the Mazda 626 Workshop Manual (1577-10-97D).

Engine oil
- Engine oil capacity specification has been added. (Refer to section TD.)

Oil pressure
- Oil pressure specification has been added. (Refer to section TD.)

Oil filter
- Replacement procedure has been added.

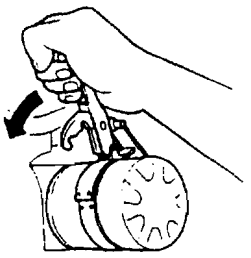
Oil cooler
- Removal / Installation procedure have been added.

Oil pan
- Removal / Installation procedure have been added.

OIL FILTER

OIL FILTER REPLACEMENT

1. Remove the oil filter using the filter wrench.

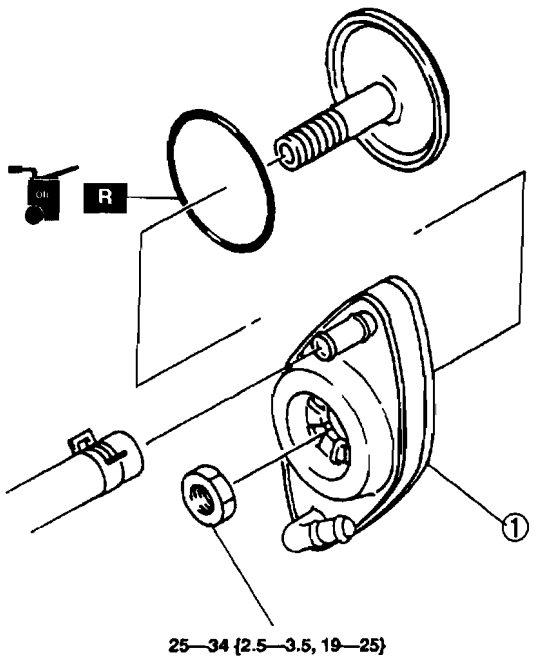


2. Tighten the filter according to the installation direction on the side of it or packing box using the filter wrench.
3. Start the engine and inspect for oil leakage.
4. Inspect the oil level and add oil if necessary. (Refer to section D.)

OIL COOLER

OIL COOLER REMOVAL/INSTALLATION

1. Disconnect the negative battery cable.
2. Drain the engine coolant. (Refer to section E.)
3. Remove the oil filter. (Refer to OIL FILTER, OIL FILTER REPLACEMENT.)
4. Remove in the order shown in the figure.
5. Install in the reverse order of removal.
6. Fill the radiator with the specified amount and type of engine coolant. (Refer to section E.)
7. Inspect the engine oil level. (Refer to section D.)
8. Start the engine and inspect for the engine coolant leakage.

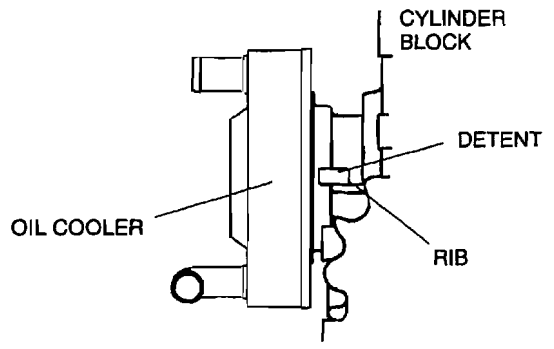


N·m { kgf·m , ft·lbf }

1	Oil cooler ☞ Installation Note

Oil Cooler Installation Note

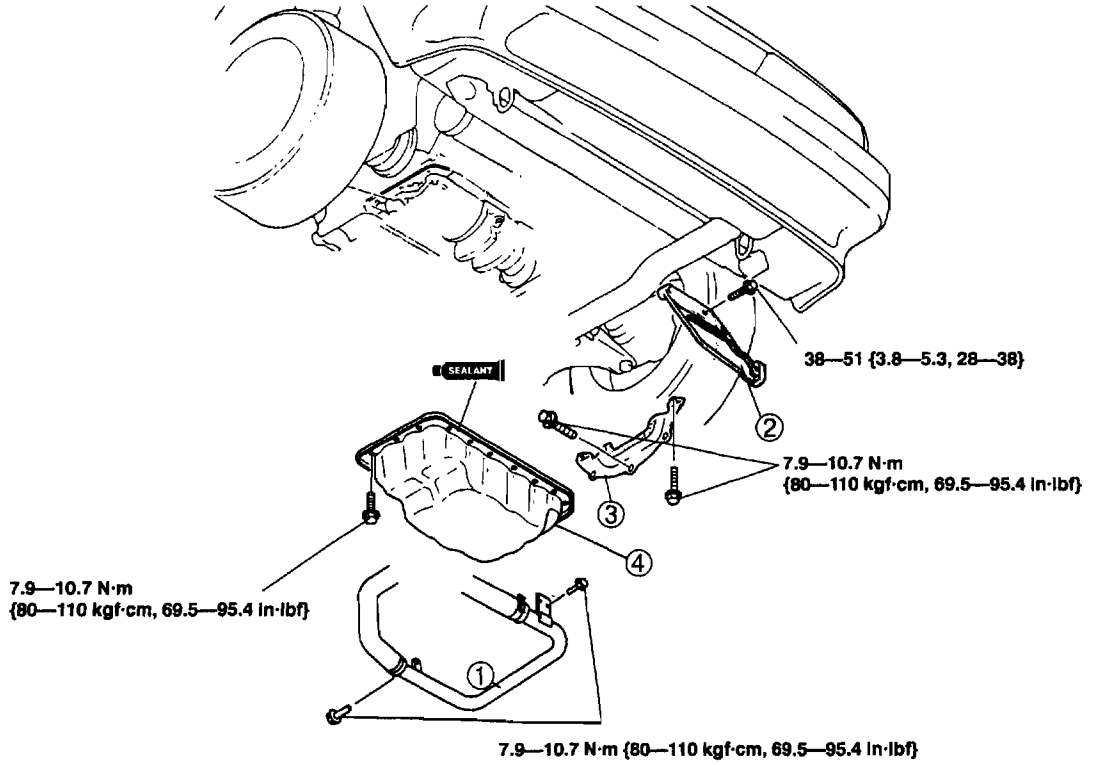
- Install the oil cooler with the detent against the rib of the cylinder block.



OIL PAN

OIL PAN REMOVAL / INSTALLATION

1. Disconnect the negative battery cable.
2. Drain the engine oil. (Refer to section D.)
3. Remove in the order shown in the figure.
4. Install in the reverse order of removal.
5. Fill with the specified amount and type of engine oil. (Refer to section D.)
6. Start the engine and inspect for the engine oil leakage.



N·m {kgf·m, ft·lbf}

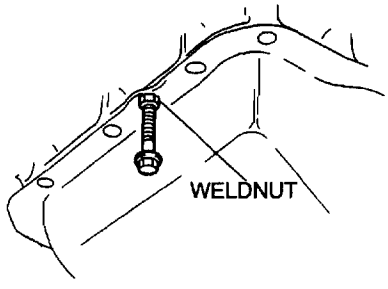
1	Water pipe ☞ Removal Note
2	Gusset plate
3	Clutch under cover
4	Oil pan ☞ Removal Note ☞ Installation Note

Water Pipe Removal Note

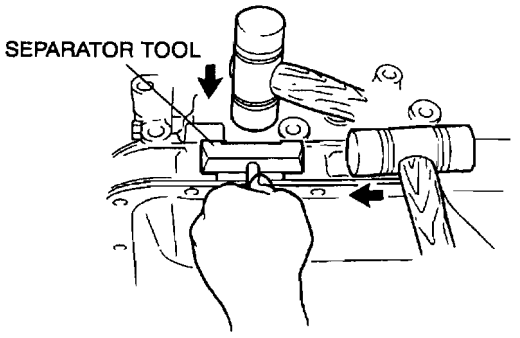
- Remove the water pipe with the water hoses still connected.

Oil Pan Removal Note

1. Remove the oil pan mounting bolts.
2. Remove the sealant from the bolt threads.
3. Screw an oil pan bolt into the weldnut to make a small gap between the cylinder block and the oil pan.



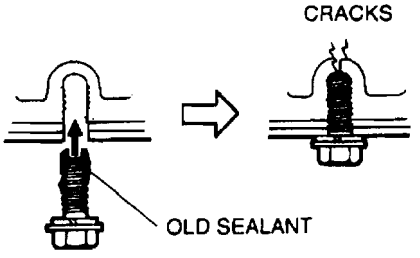
4. Using a separator tool, separate the oil pan.



Oil Pan Installation Note

Caution

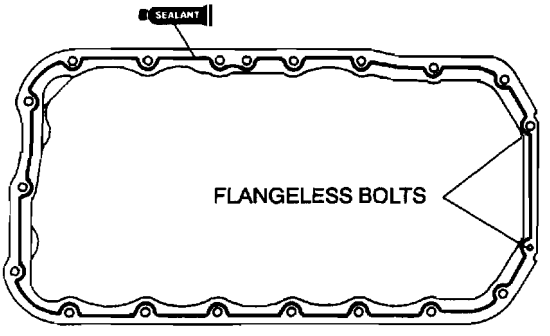
- **If the bolts are reused, remove the old sealant from the bolt threads. Tightening a bolt that has old sealant on can cause bolt hole damage.**



1. Apply silicone sealant to the oil pan along the inside of the bolt holes and overlap the ends.

   Thickness
   ø2.5—3.5 mm {0.099—0.137 in }

2. Hand tighten the flangeless bolts, and tighten the flanged bolts.



COOLING SYSTEM

FEATURES

SERVICE

E

OUTLINE

OUTLINE OF CONSTRUCTION

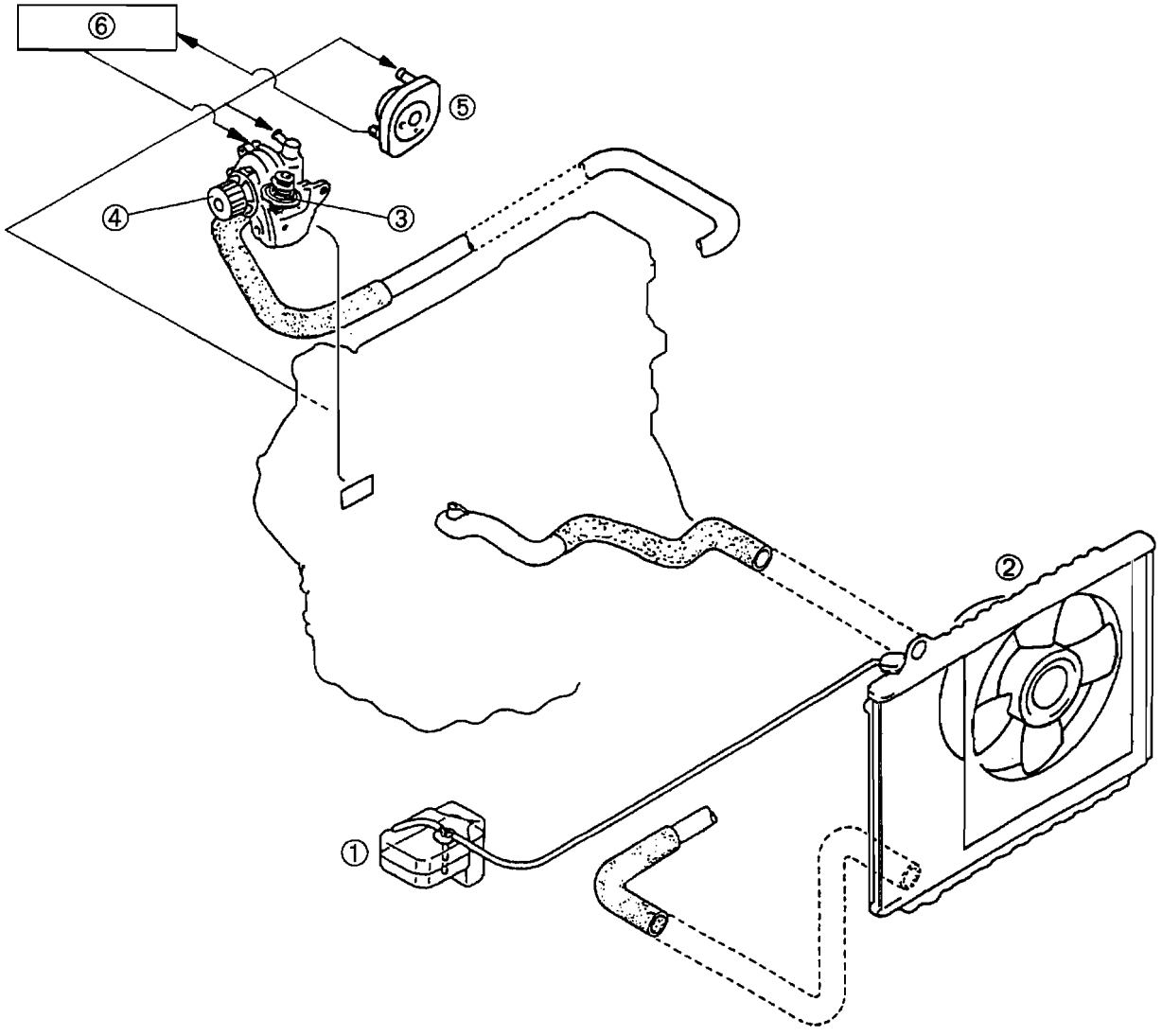
- The construction and operation of the RF engine cooling system are basically the same as those of the previous Mazda 323 (BA) models. (Refer to Mazda 323 RF Workshop Manual Supplement 1588-10-97C). However, the coolant flow is different as the cylinder head has been modified.

SPECIFICATIONS

Item			Engine	
			RF Turbo	RF Turbo (Hi-power)
Cooling system			Water-cooled, force circulation	
Coolant capacity		L {US qt, Imp qt}	9.0 {9.5, 7.9}	
Water pump	Type		Centrifugal, timing belt-driven	
Thermostat	Type		Wax, bottom bypass	
	Initial-opening temperature	(°C {°F })	80—84 {176—183}	
	Full-open temperature	(°C {°F })	95 {203}	
	Full-open lift	(mm {in})	8.5 {0.33} min.	
Radiator	Type		Corrugated fin	
	Cap valve opening pressure	(kPa {kgf/cm^2, psi})	94—122 {0.95—1.25, 13.5—17.7}	
Cooling fan	Type		Electric	
	Blade	Outer diameter (mm {in})	300 {11.8}	
		Number	5	

COOLING SYSTEM

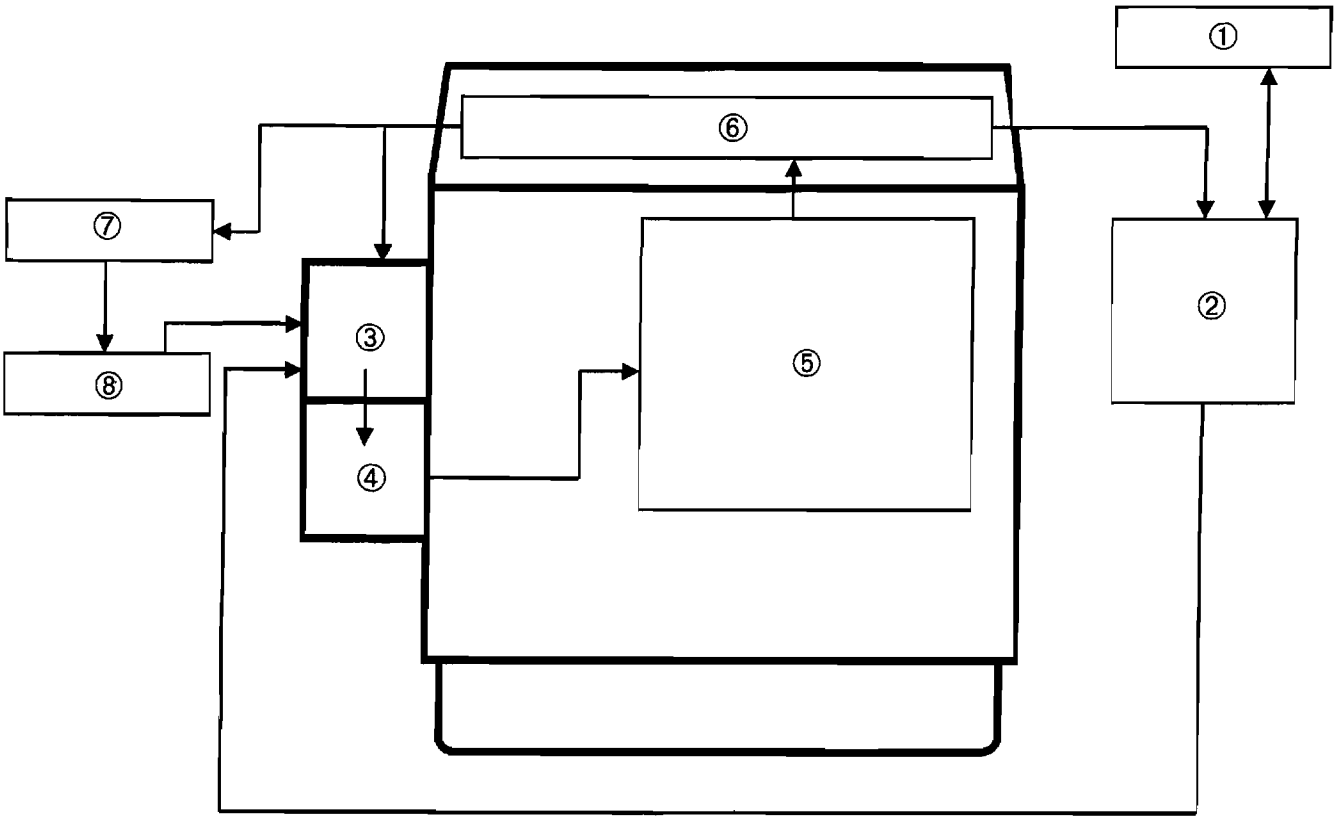
COOLING SYSTEM STRUCTURAL VIEW



1	Radiator reservoir
2	Radiator
3	Thermostat

4	Water pump
5	Oil cooler
6	Heater unit

COOLANT FLOW CHART



1	Radiator reservoir
2	Radiator
3	Thermostat
4	Water pump

5	Cylinder block
6	Cylinder head
7	Oil cooler
8	Heater unit

SUPPLEMENTAL SERVICE INFORMATION

- The following additions have been made since publication of the Mazda 626 Workshop Manual (1577-10-97D).

Thermostat
- Removal/Installation procedure have been added.
- Inspection procedure has been added.

Water pump
- Removal/Installation procedure have been added.

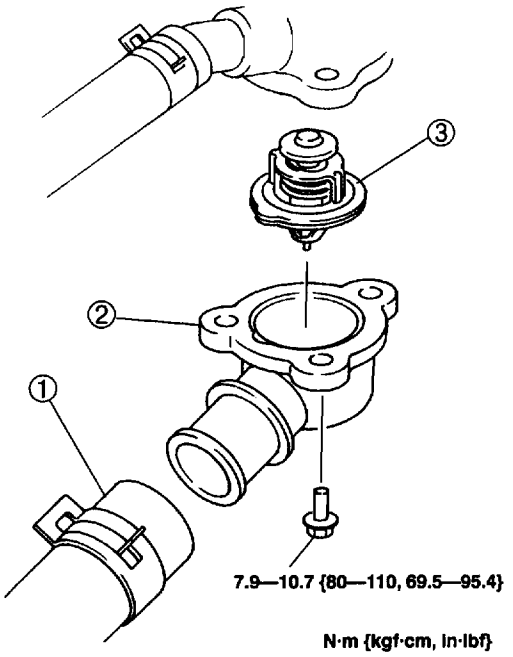
Cooling fan motor
- Cooling fan motor specification has been added. (Refer to section TD.)
- Removal/Installation procedure have been added.

Cooling fan relay
- Inspection has been added.

THERMOSTAT

THERMOSTAT REMOVAL/INSTALLATION

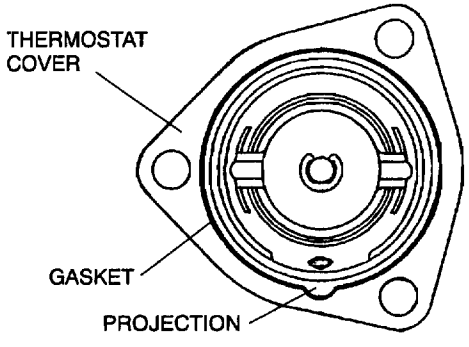
1. Disconnect the negative battery cable.
2. Drain the engine coolant. (Refer to section E.)
3. Remove the transverse member. (Refer to section R.)
4. Remove in the order shown in the figure.
5. Install in the reverse order of removal.
6. Fill the radiator with the specified amount and type of engine coolant. (Refer to section E.)



1	Radiator hose
2	Thermostat cover
3	Thermostat ☞ Installation Note

Thermostat Installation Note

- Install the thermostat into the thermostat cover, aligning the projection on the gasket to the thermostat cover as shown.



THERMOSTAT INSPECTION

Inspect the thermostat for the following and replace if necessary.

- Closed valve in room temperature
- Opening temperature and lift of the valve

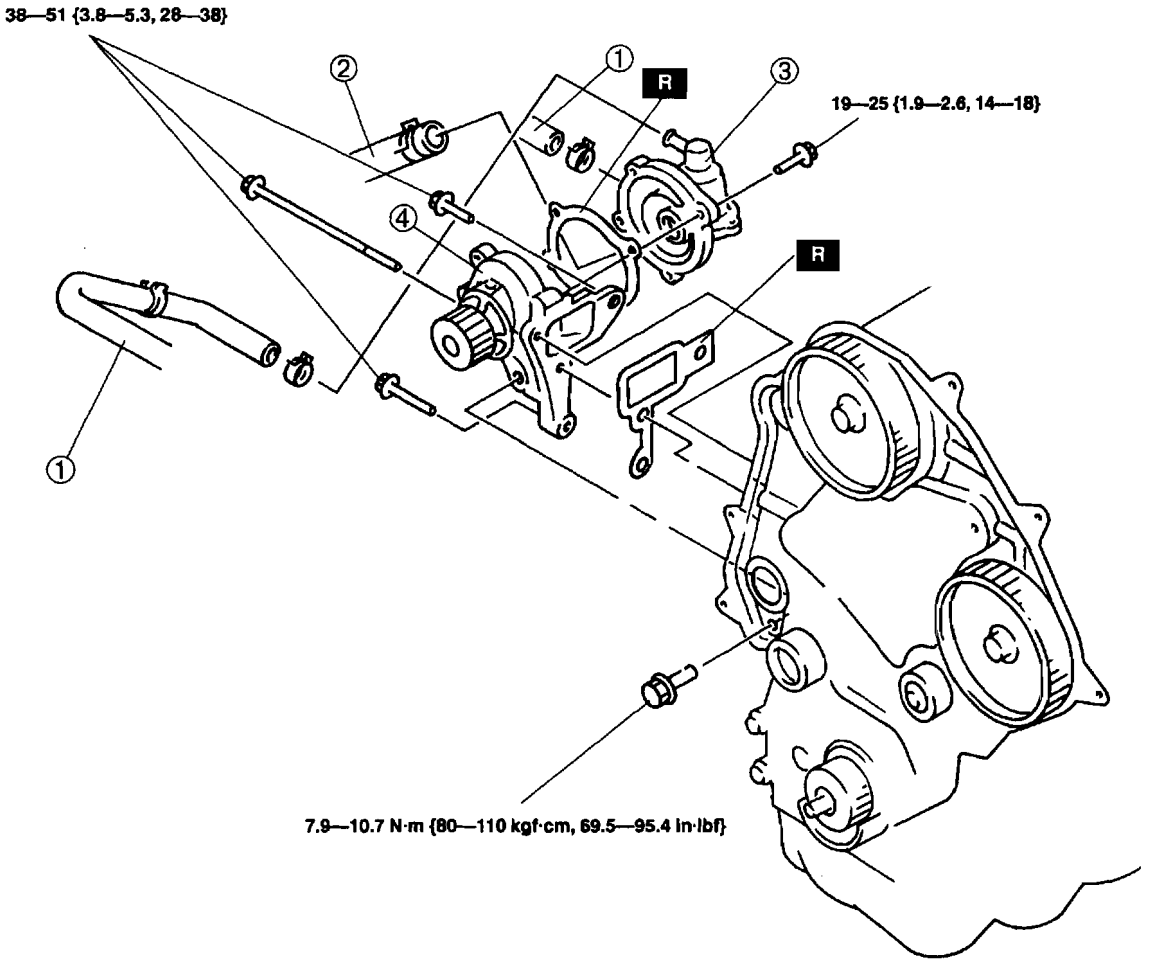
Initial-opening temperature °C {°F}	80—84 {176—183}
Full-open temperature °C {°F}	95 {203}
Full-open lift mm {in}	8.5 {0.33} min.

E

WATER PUMP

WATER PUMP REMOVAL/INSTALLATION

1. Disconnect the negative battery cable.
2. Drain the engine coolant. (Refer to section E.)
3. Remove the timing belt. (Refer to section B2, TIMING BELT, TIMING BELT REMOVAL/INSTALLATION.)
4. Remove in the order shown in the figure.
5. Install in the reverse order of removal.
6. Fill the radiator with the specified amount and type of engine coolant. (Refer to section E.)



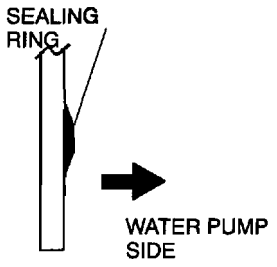
N·m {kgf·m, ft·lbf}

1	Hose
2	Lower radiator hose

3	Thermostat case ☞ Installation Note
4	Water pump ☞ Installation Note

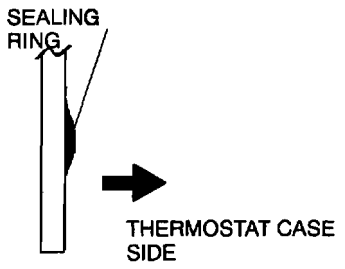
Water Pump Installation Note

- Install a new gasket with the sealing ring facing the water pump.



Thermostat Case Installation Note

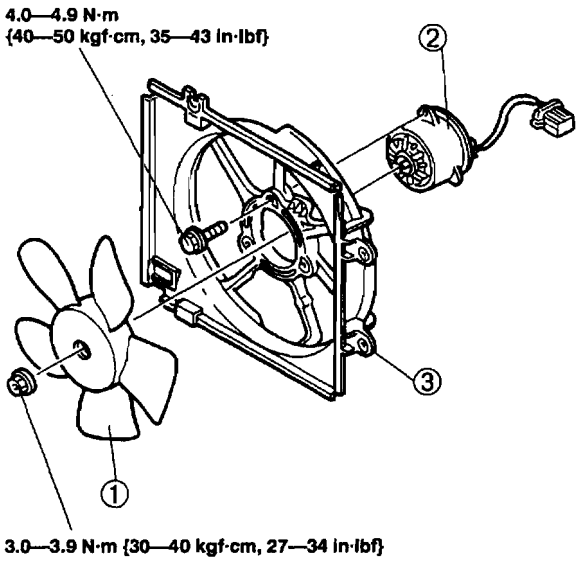
- Install a new gasket with the sealing ring facing the thermostat case.



COOLING FAN MOTOR

COOLING FAN MOTOR REMOVAL/ INSTALLATION

1. Remove the cooling fan component. (Refer to section E.)
2. Remove in the order indicated in the table.
3. Install in the reverse order of removal.



1	Cooling fan blade
2	Cooling fan motor
3	Radiator cowling

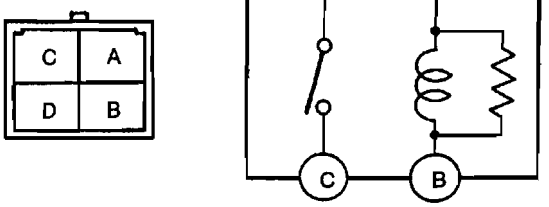
COOLING FAN RELAY

COOLING FAN RELAY INSPECTION

1. Apply battery positive voltage and inspect for continuity between terminals of the cooling fan relay by using an ohmmeter.

○—○ : Continuity

Step	Terminal			
	A	B	C	D
1	○	○		
2	B+	GND	○	○



2. If not as specified, replace the cooling fan relay.

FUEL AND EMISSION CONTROL SYSTEMS (RF TURBO)

FEATURES

SERVICE

F2

OUTLINE

- The fuel and emission control system has the following features compared to Mazda 323 (BA) RF engine model.

FEATURES

Improved power and drivability

- Due to the adoption of an electronic control type injection pump corresponding to the increased fuel injection pressure, a direct injection system can be adopted.
- A turbocharger with a charge air cooler is adopted to realize high output and torque.
- The "double tangential port" has been adopted as the intake port of the cylinder head to improve intake efficiency and realize an ideal combustion state.

Improved exhaust gas purification performance

- A direct injection system is adopted to increase fuel injection pressure and realize clean exhaust.
- Due to the increase in fuel injection pressure, a two-stages type injection nozzle is adopted.
- The air charging pressure of the turbocharger is increased to reduce black smoke gas under heavy load or when accelerating.

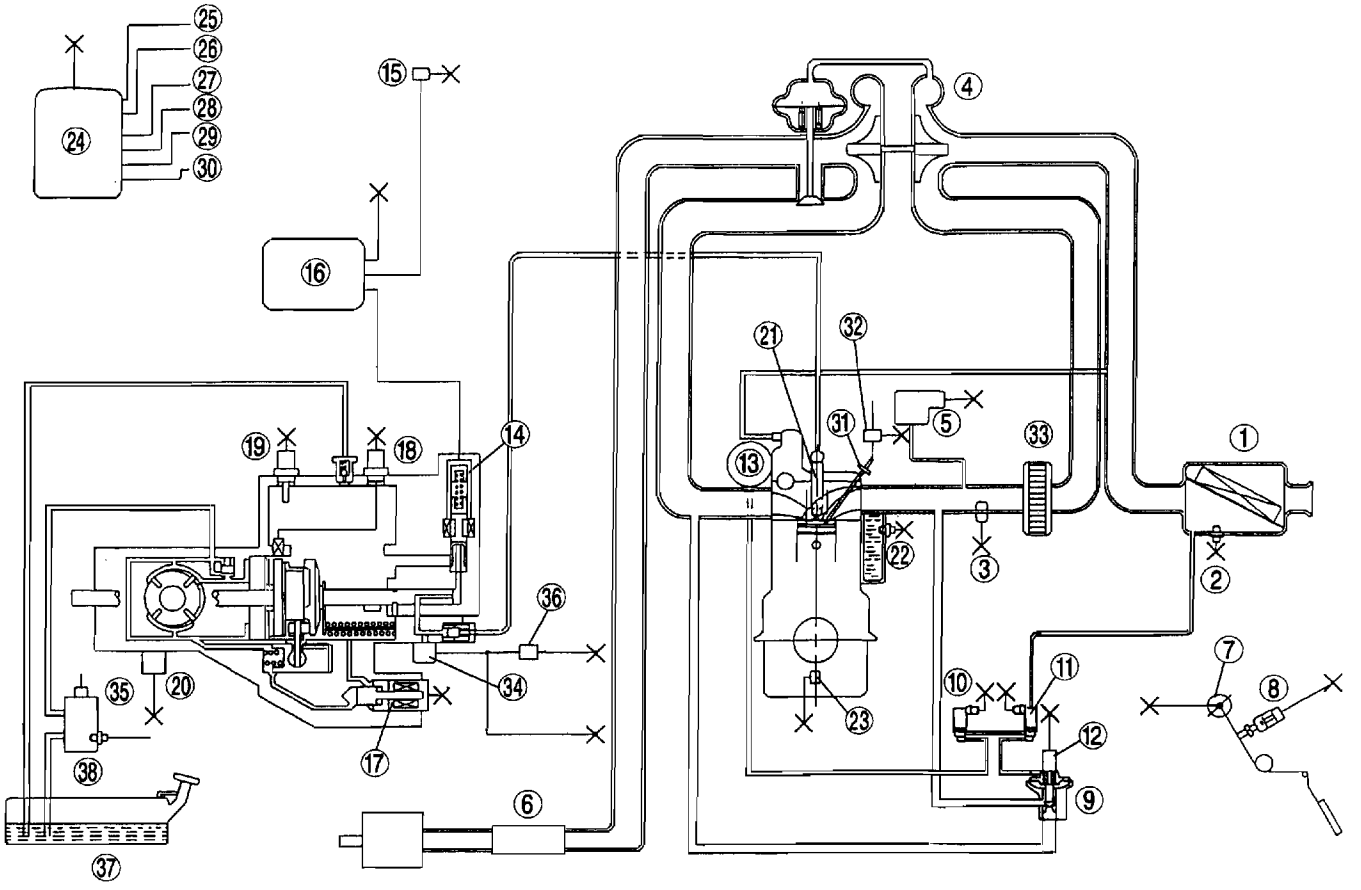
Improved serviceability

- The on-board diagnostic system equivalent to the CIS vehicles is adopted to improve serviceability.
- The PCM has been modified to simplify the procedures of "ENGINE TUNE-UP" and "INJECTION TIMING ADJUSTMENT".
- For cold areas, the fuel warmer is adopted to prevent the light oil component from hardening to block the fuel filter when the outside air temperature is low.

SPECIFICATIONS

Item	RF-Turbo
Air cleaner element type	Wet type
Supercharger type	Turbocharger
Injection pump type	Electric distribution
Fuel tank capacity (L {US qt, Imp qt})	64 {67.6, 56.3}
Glow plug type	Metal
EGR type	Duty control
Catalyst type	Oxidation catalyst
Evaporative emission control system	-
Positive crankcase ventilation (PCV) system	Closed

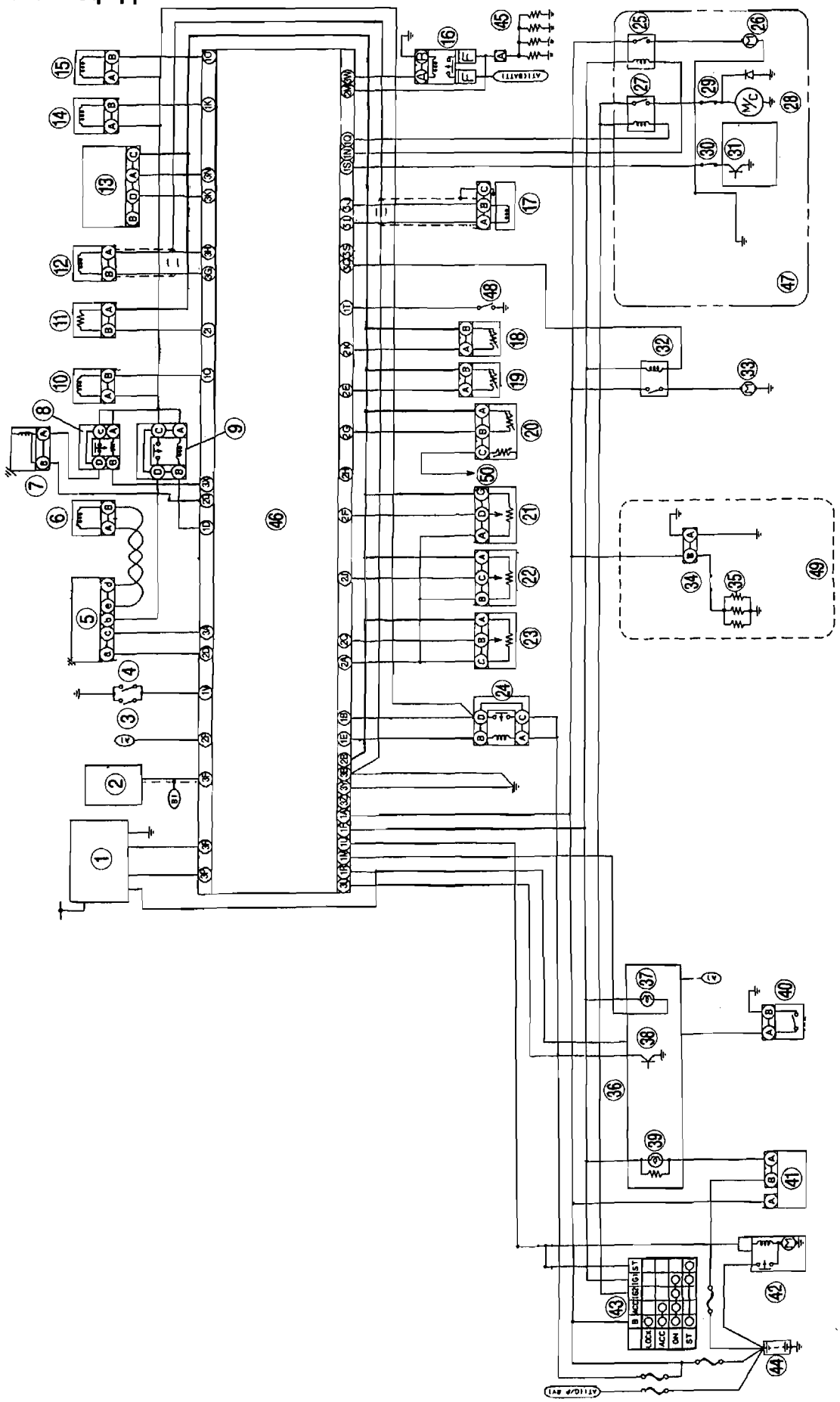
SYSTEM DIAGRAM



1	Air cleaner
2	IAT sensor No.1
3	IAT sensor No.2
4	Turbocharger
5	Boost sensor
6	Oxidation catalytic converter
7	Accelerator position sensor
8	Idle switch
9	EGR valve
10	EGR solenoid valve (vacuum)
11	EGR solenoid vavle (vent)
12	EGR valve position sensor
13	Vacuum pump
14	Spill valve
15	Spill valve relay
16	Injector driver module (IDM)
17	Timer control valve (TCV)
18	Pump speed sensor
19	Fuel temperature sensor

20	Injection pump EPROM
21	Injection nozzle
22	Engine coolant temperature sensor
23	TDC sensor
24	PCM
25	PCM control relay
26	Engine switch
27	Neutral/clutch switch
28	A/C switch
29	DLC
30	Vehicle speed sensor
31	Glow plug
32	Glow plug relay
33	Charge air cooler
34	Fuel shut off (FSO) solenoid
35	Fuel warmer
36	Fuel shut off (FSO) solenoid relay
37	Fuel tank
38	Fuel filter

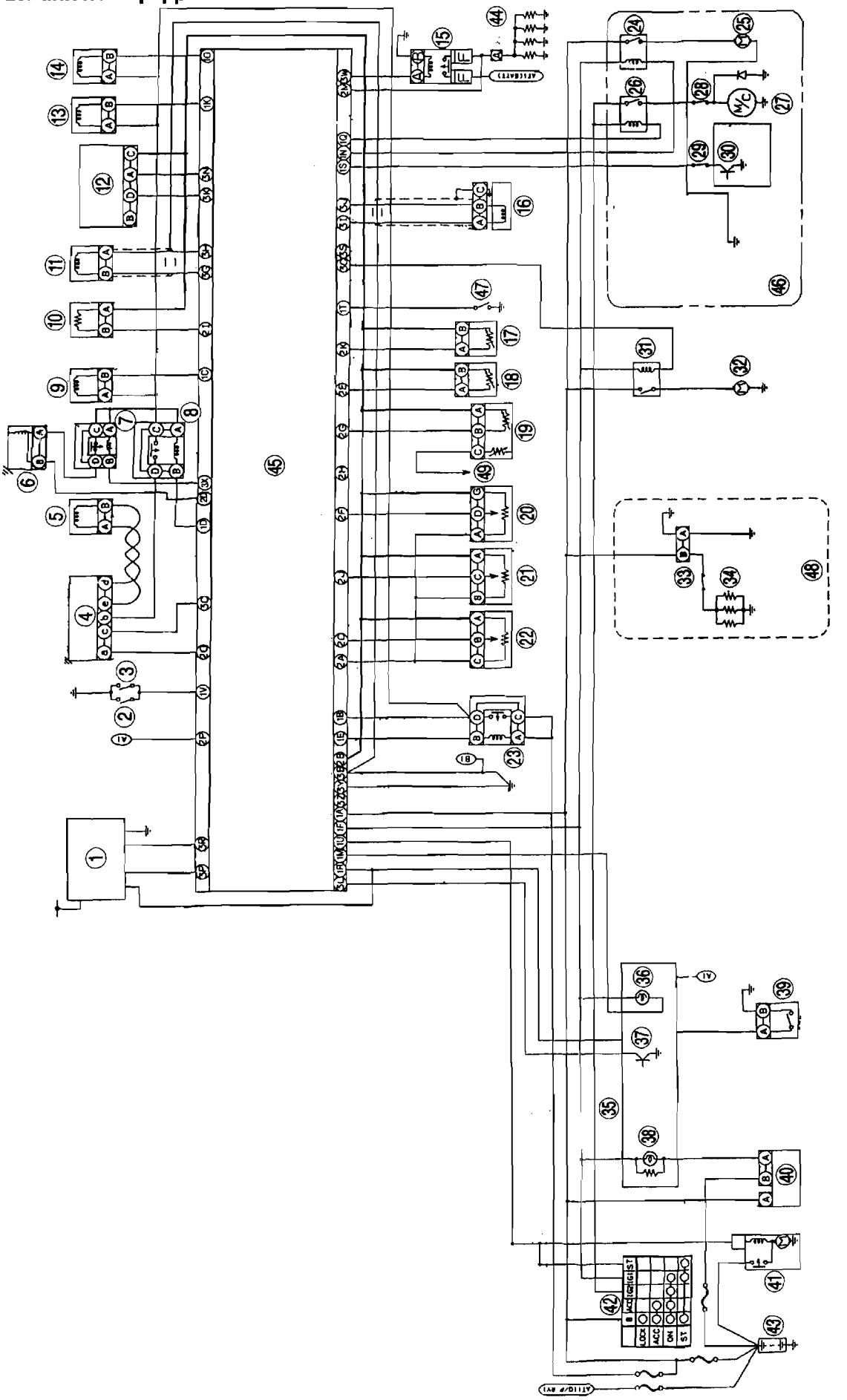
SYSTEM WIRING DIAGRAM
Immobilizer unit equipped



1	DLC
2	Immobilizer unit
3	Neutral switch
4	Clutch switch
5	Injector driver module (IDM)
6	Spill valve
7	Fuel shut off (FSO) solenoid
8	Fuel shut off (FSO) solenoid relay
9	Spill valve relay
10	Timer control valve (TCV)
11	Fuel temperature sensor
12	Pump speed sensor
13	Injection pump EPROM
14	EGR solenoid valve (vacuum)
15	EGR solenoid valve (vent)
16	Glow plug relay
17	TDC sensor
18	Intake air temperature (IAT) sensor No.2
19	Intake air temperature (IAT) sensor No.1
20	Engine coolant temperature (ECT) sensor
21	Accelerator position sensor
22	EGR position sensor
23	Boost sensor
24	PCM control relay
25	Condenser fan relay

26	Condenser fan
27	A/C relay
28	Magnetic clutch
29	Refrigerant pressure switch
30	A/C pressure switch
31	A/C amplifier
32	Cooling fan relay
33	Cooling fan
34	Vacuum switch
35	Fuel warmer
36	Instrument cluster
37	Grow indicator light
38	Vehicle speed sensor
39	Generator warning light
40	Sedimmentor switch
41	Generator
42	Starter
43	Engine switch
44	Battery
45	Glow plug
46	PCM
47	With A/C
48	Idle switch
49	With fuel warmer
50	to instrument cluster

Immobilizer unit not equipped



1	DLC
2	Neutral switch
3	Clutch switch
4	Injector driver module (IDM)
5	Spill valve
6	Fuel shut off (FSO) solenoid
7	Fuel shut off (FSO) solenoid relay
8	Spill valve relay
9	Timer control valve (TCV)
10	Fuel temperature sensor
11	Pump speed sensor
12	Injection pump EPROM
13	EGR solenoid valve (vacuum)
14	EGR solenoid valve (vent)
15	Glow plug relay
16	TDC sensor
17	Intake air temperature (IAT) sensor No.2
18	Intake air temperature (IAT) sensor No.1
19	Engine coolant temperature (ECT) sensor
20	Accelerator position sensor
21	EGR position sensor
22	Boost sensor
23	PCM control relay
24	Condenser fan relay
25	Condenser fan

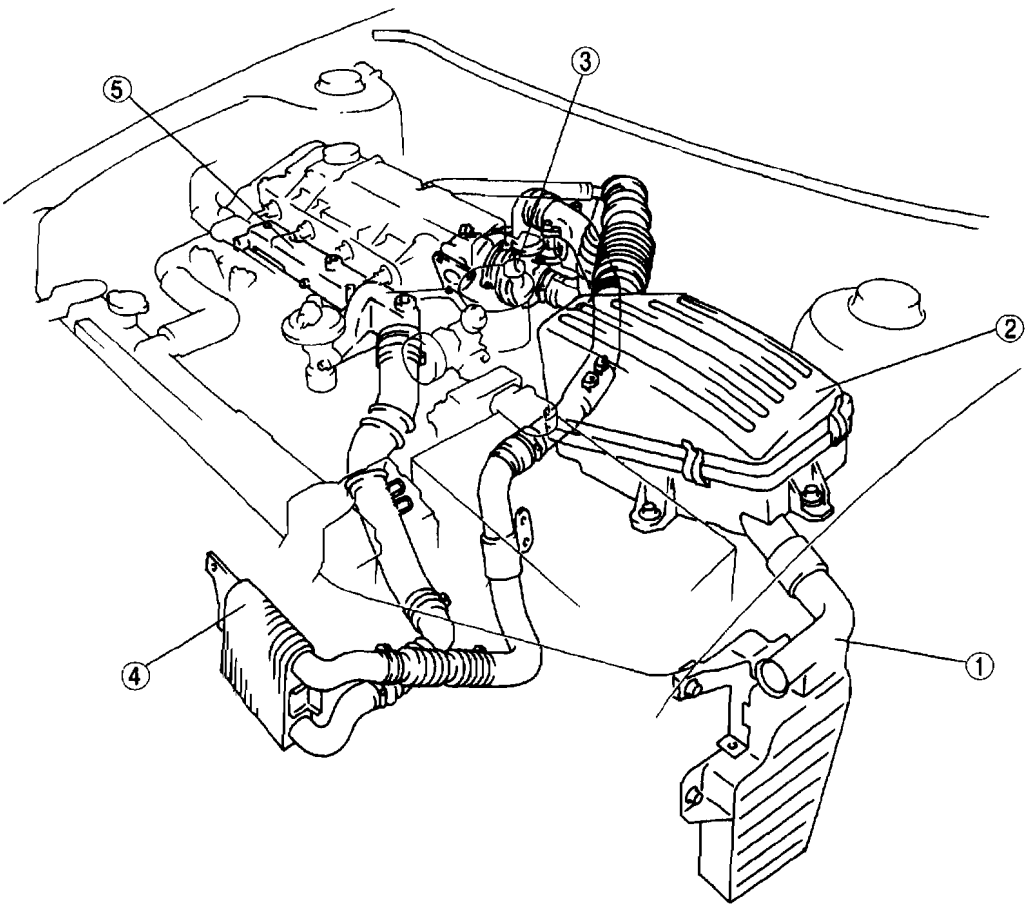
26	A/C relay
27	Magnetic clutch
28	Refrigerant pressure switch
29	A/C pressure switch
30	A/C amplifier
31	Cooling fan relay
32	Cooling fan
33	Vacuum switch
34	Fuel warmer
35	Instrument cluster
36	Grow indicator light
37	Vehicle speed sensor
38	Generator warning light
39	Sedimmentor switch
40	Generator
41	Starter
42	Engine switch
43	Battery
44	Glow plug
45	PCM
46	With A/C
47	Idle switch
48	With fuel warmer
49	To instrument cluster

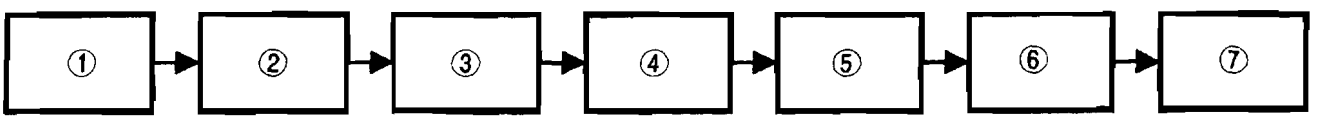
INTAKE-AIR SYSTEM

OUTLINE

- The intake-air system consists of the parts shown in the figure below.
- A mixed flow turbocharger with charge air cooler is adopted to realize high output and torque in low and middle speed renge.
- The valve opening pressure of the wastegate valve of the turbocharger is set higher than that of the Mazda MPV WL Turbo engine model to reduce the emission of black smoke when load is heavy and/or accelerating.
- Due to the adoption of the "double tangential port", the powerful swirl is generated, reducing intake resistance and improving fuel economy.

Structural View



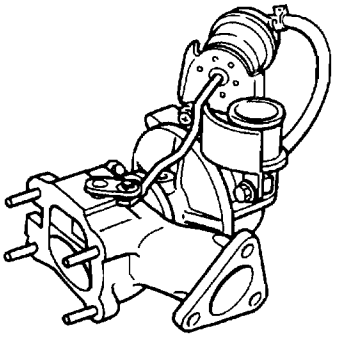


1	Fresh-air duct (integrated with resonance chamber)
2	Air cleaner
3	Turbocharger
4	Charge air cooler

5	Intake manifold
6	Double tangential port
7	Combustion chambers

AIR CHARGING SYSTEM

- A mixed flow turbocharger with charge air cooler is adopted as in the Mazda MPV WL Turbo engine model. (Refer to Mazda MPV Training Manual 3294-10-96C.)
- By increasing the force of the diaphragm spring in the wastegate actuator, the wastegate valve opening pressure of the turbocharger has been increased approximately 15% compared to the Mazda MPV WL Turbo engine model. As a result, air charging pressure has been increased and intake air charging efficiency has been improved.
  In addition:
  - High output and torque has been realized.
  - Emission of black smoke, caused by incomplete combustion due to the increase in fuel injection amount under heavy load or when accelerating, has been greatly reduced.

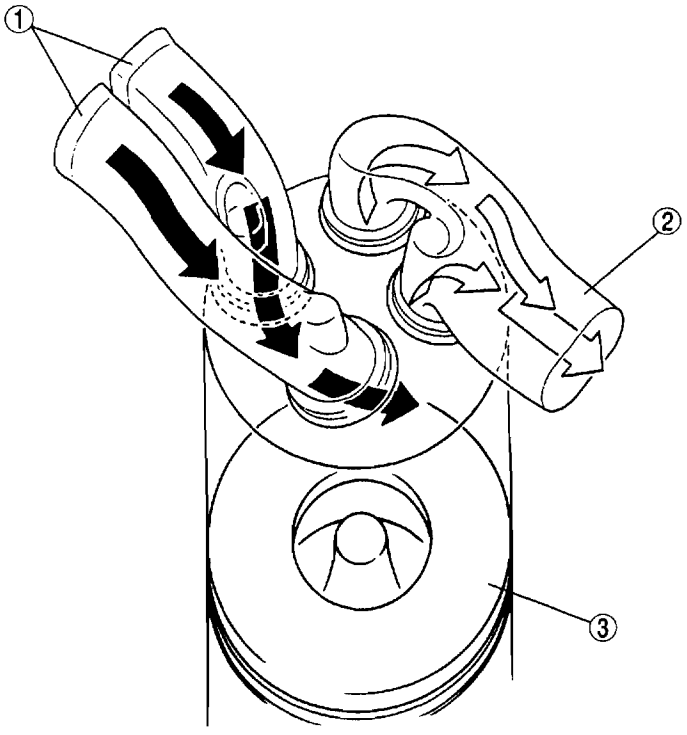


	Mazda 626 RF-Turbo	Mazda MPV WL Turbo
Wastegate valve opening pressure kPa {kgf/cm^2, psi}	245.6—257.5 {2.505—2.625, 35.63—37.32}	213.4—222.6 {2.176—2.269, 30.95—32.26}

F2

DOUBLE TANGENTIAL PORT

- The direct injection of fuel into the center of the cylinder combined with the powerful swirl and high volumetric efficiency of the double tangential port ensures a controlled, syjmmetrical flow of the air-fuel mixture in the cylinder, while at the same time reducing intake resistance. The advantage of this system is high charging efficiency of air and fuel, and the realization of an ideal combustion state.

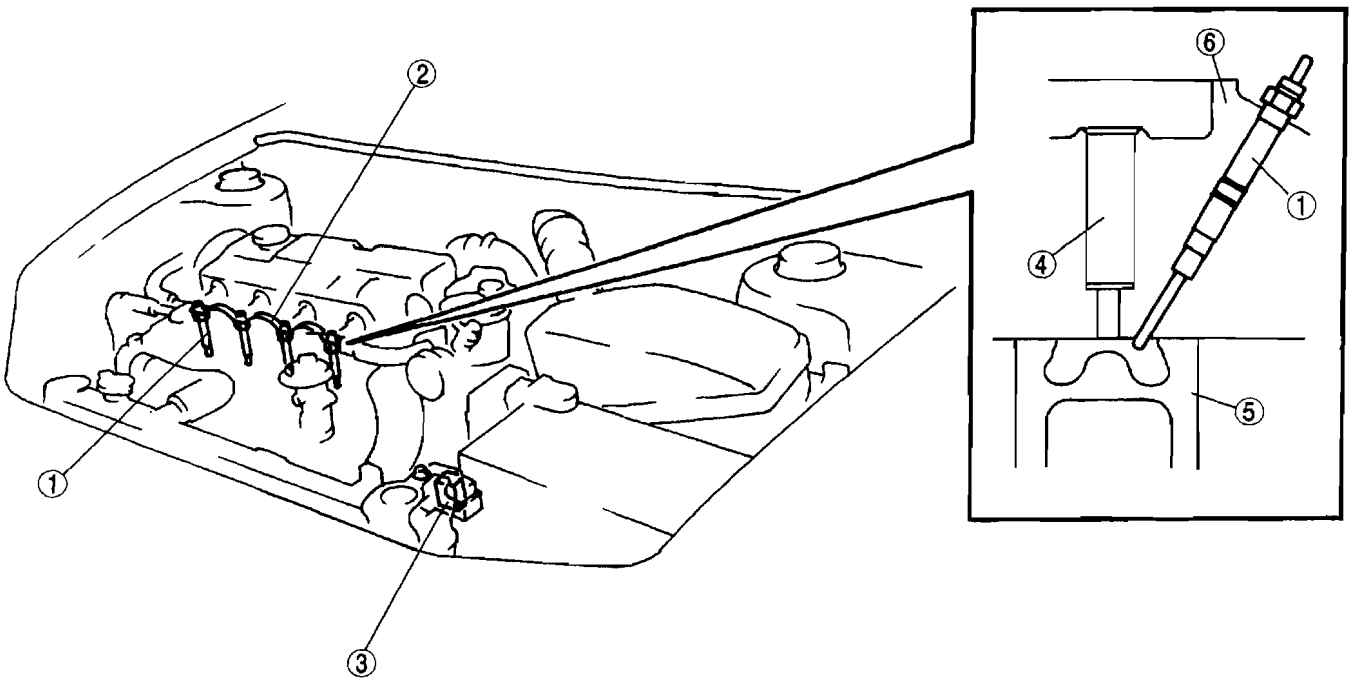


1	Intake port (Double tangential port)
2	Exhaust port

3	Piston

GLOW SYSTEM

- The glow system consists of the parts shown in the figure below.
- Due to the adoption of the direct injection system, the glow plug is installed shown in the figure below.

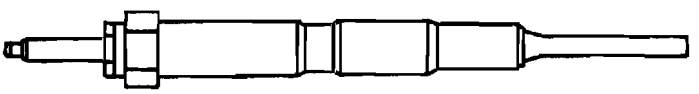


1	Glow plug
2	Glow plug lead
3	Glow plug relay

4	Injection nozzle
5	Piston
6	Cylinder head

Glow Plug

- A self-temperature control type has been adopted as in the Mazda 323 (BA) RF engine model.



FUEL SYSTEM

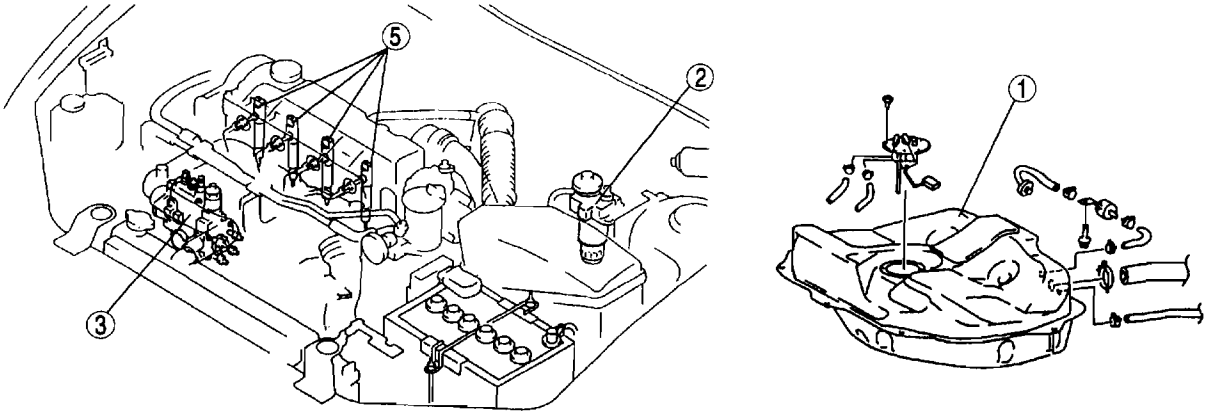
OUTLINE

- Due to the adoption of an electronic control type injection pump, the PCM adjusts to the optimal fuel injection amount and time according to the engine driving condition.
- An electronic control type injection pump, which controls the fuel injection amount directly with the spill valve, is adopted.
- The fuel injection timing is controlled by the timer control valve(TCV), as well as Mazda 323 (BA) RF engine model.
- Due to the adoption of the direct injection system, a small, two-stages type nozzle, which suits the high-pressure injection*1 of injection nozzle intake port pressure, is adopted for the injection nozzle.
- For cold district, the fuel warmer is adopted.

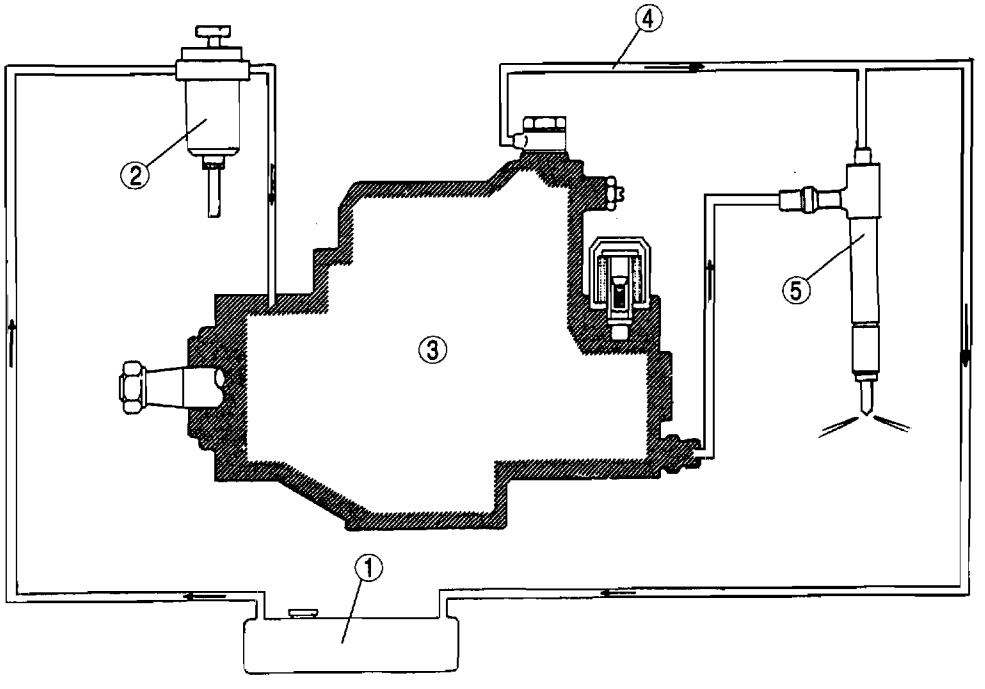
*1: Comparison

Item	New Mazda 626 RF Turbo engine model	Mazda 323 RF engine model
Injection nozzle intake port pressure	Approx. 100 MPa {1019 kgf/cm^2, 14490 psi}	Approx. 30 MPa {305 kgf/cm^2, 4337 psi}

Structural View



Flow Diagram



1	Fuel tank
2	Fuel filter
3	Injection pump

4	Overflow pipe
5	Injection nozzle

INJECTION PUMP

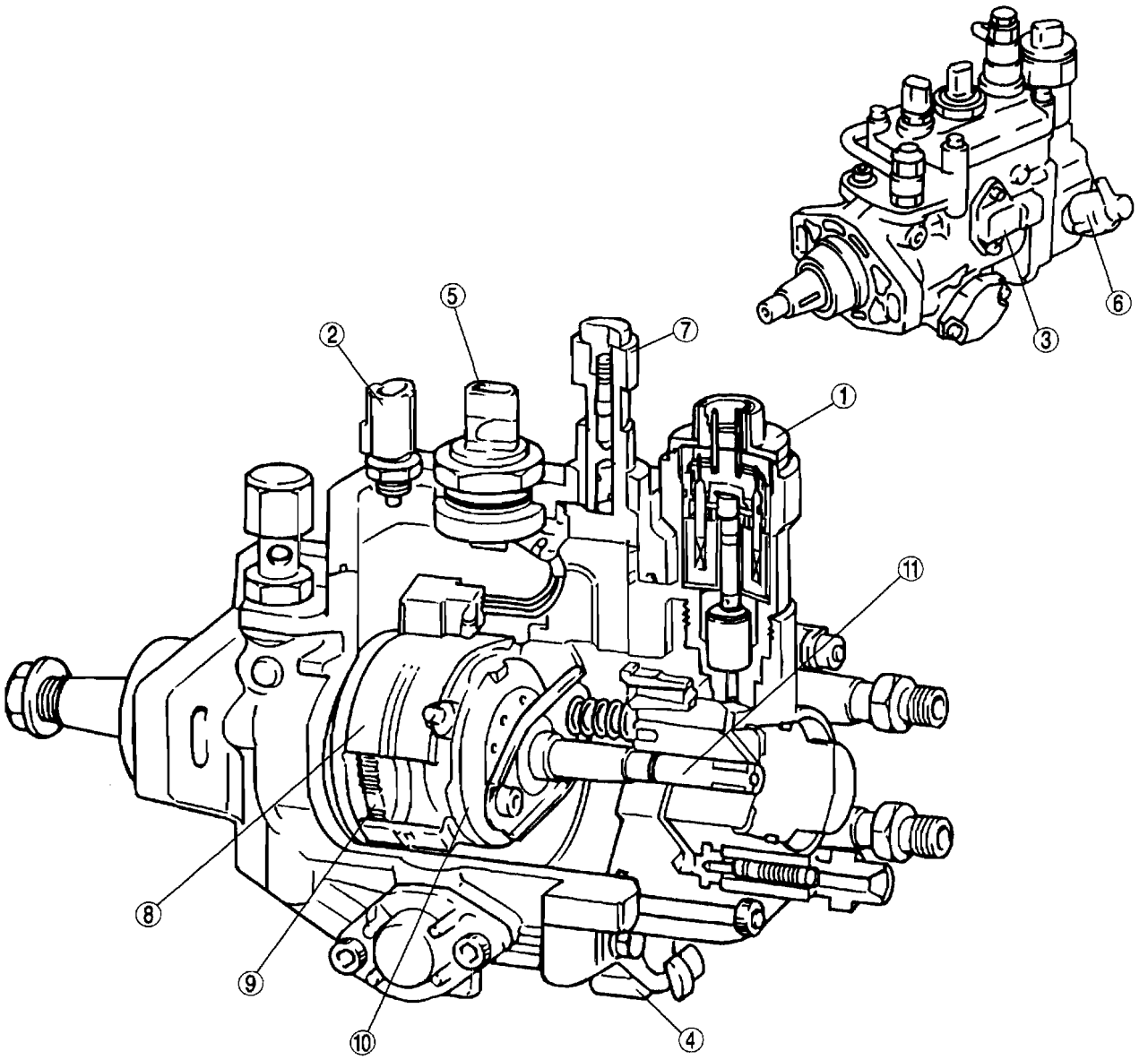
Outline

- The injection pump is equipped with a spill valve that directly controls the fuel injection amount.
- The spill valve is installed in the passage connecting the pressure chamber and the pump chamber. When the PCM cuts off the electrical current in the spill valve, the passage between the pressure chamber and the pump chamber opens to reduce the fuel pressure, and the fuel injection is finished.
- The function and operation of the TCV are the same as those of the 323 (BA) RF engine model.

Caution

- **The injection pump cannot be disassembled, as well as Mazda 323 (BA) RF model. Disassembling the injection pump can damage its function. Do not disassemble the injection pump.**

Structure



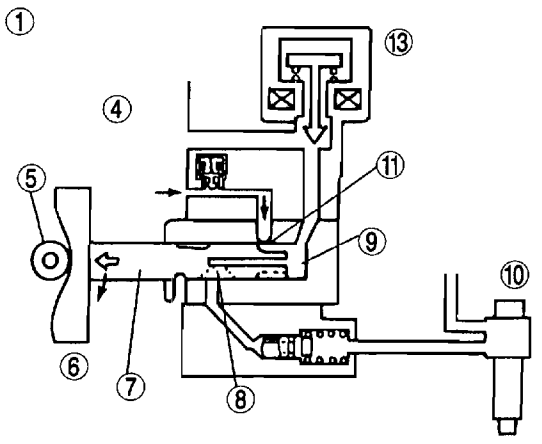
1	Spill valve
2	Fuel temperature sensor
3	Injection pump EPROM
4	Timer control valve (TCV)
5	Pump speed sensor
6	Fuel shut off (FSO) solenoid

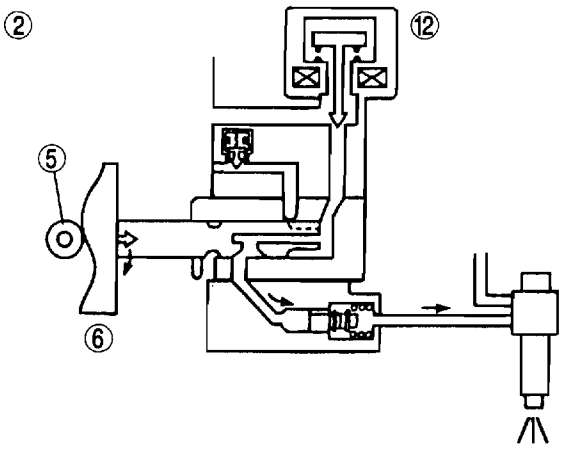
7	Overflow valve
8	Roller ring
9	Pulser
10	Cam plate
11	Plunger

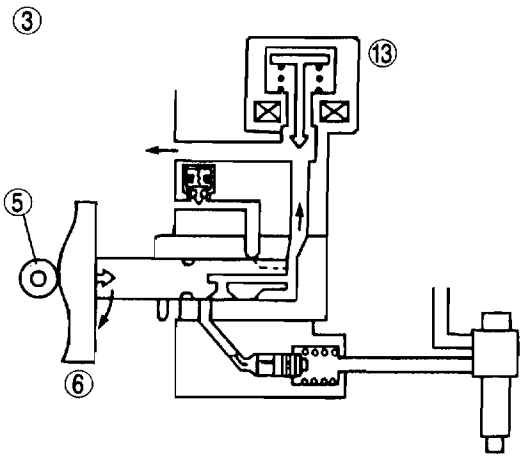
High Pressurization and Distribution of Fuel

- The plunger increases the fuel pressure and distributes it by repeating the following stages.

1. Intake
   As the plunger lowers, the fuel flows into the pressure chamber.
   - Intake port ..... Open
   - Distribution slot ..... Closed
   - Spill valve ..... Open (Deenergized)
2. Injection
   The plunger rotates while it rises, and compresses and feeds the fuel.
   - Intake port ..... Closed
   - Distribution slot ..... Open
   - Spill valve ..... Closed (Energized)
3. Injection end
   Power supply to the spill valve is stopped, and the valve opens.
   Pressurized fuel in the plunger is forced back into the pump chamber. Pressure in the plunger lowers, and fuel injection is completed.
   - Intake port ..... Closed
   - Distribution slot ..... Open
   - Spill valve ..... Open (Deenergized)







1	Intake
2	Injection
3	Injection end
4	Pump chamber
5	Roller
6	Cam plate
7	Plunger

8	Distribution slot
9	Pressure chamber
10	Injection nozzle
11	Intake port
12	Spill valve (closed)
13	Spill valve (open)

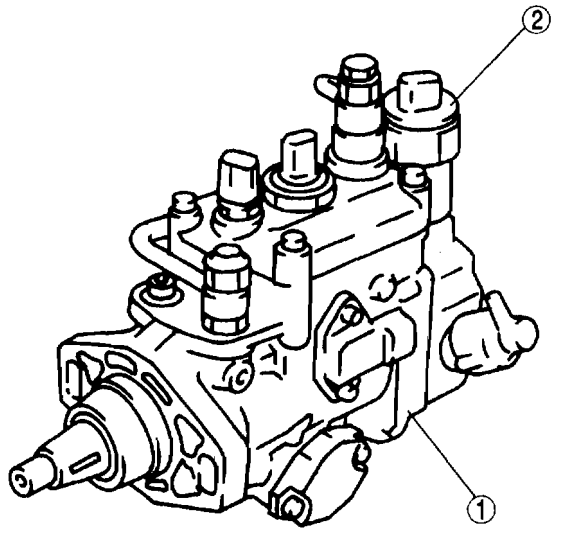
SPILL VALVE

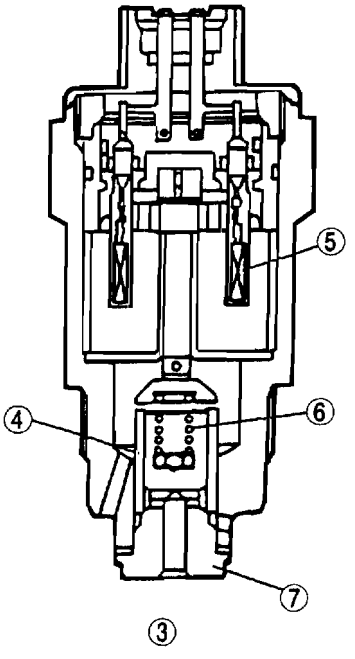
Function

- A direct acting, electromagnetic spill valve is adopted to obtain high withstanding pressure, quick response and a large spill amount.
- The fuel injection amount control signal is sent from the PCM to the injector driver module (IDM), and the IDM sends the signal to make the spill valve drive current flow, driving the spill valve and opening/closing the fuel passage (return passage).

Structure

- The spill valve is installed in the passage connecting the injection pump rotor chamber and pump chamber, and opens/closes the passage at fuel intake and injection end.



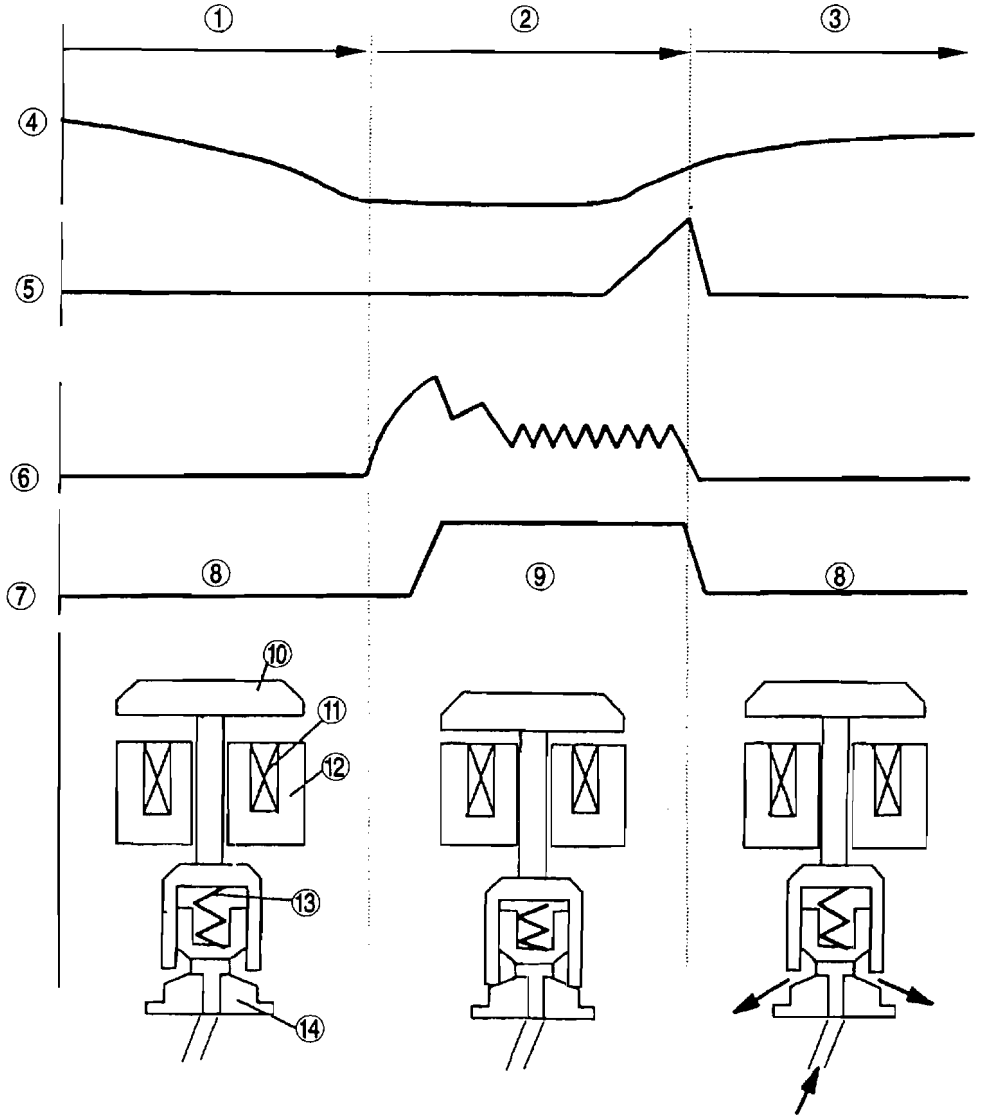


1	Injection pump
2	Spill valve
3	Spill valve cross-sectional view
4	Spool valve

5	Coil
6	Spring
7	Valve body

Operation

1. The spill valve is opened/closed by the spill valve drive signal from the IDM.
2. The spill valve is closed (the relief passage is closed) during the fuel force-feeding stage.
3. During the fuel injection end stage, the spill valve is open (the relief passage is open).
4. The pressure on the plunger changes according to the opening/closing of the relief passage.



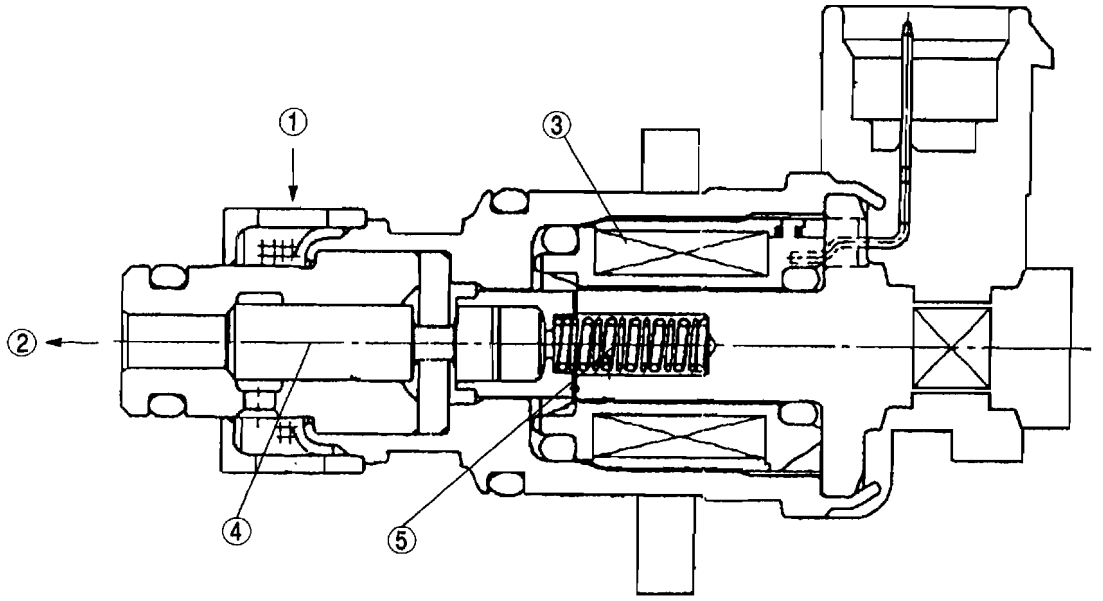
1	Intake
2	Force feed
3	Spill
4	Cam lift
5	Plunger pressure
6	Injector driver module (IDM) current
7	Spill valve operation

8	Valve is open
9	Valve is closed
10	Armature
11	Coil
12	Core
13	Spring
14	Valve body

TIMER CONTROL VALVE (TCV)

Outline

- The function and installation position of the TCV is the same as those of the Mazda 323 (BA) RF engine model.
- The sensor shape and the internal structure of the fuel line, etc. are different from those of the Mazda 323 (BA) RF engine model.



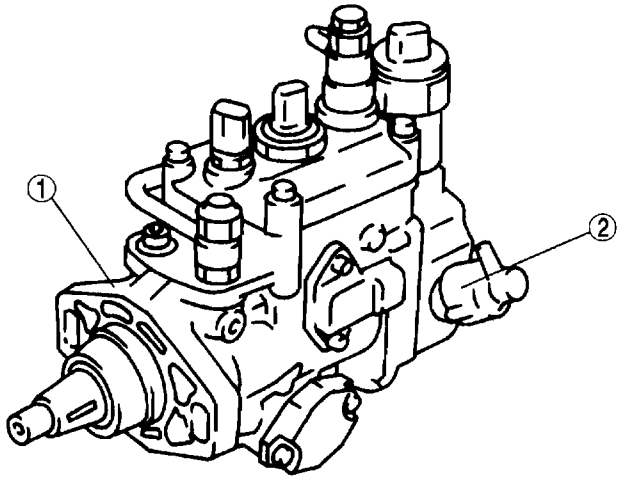
1	From pump chamber
2	To low-pressure chamber
3	Coil

4	Needle
5	Spring

FUEL SHUT OFF (FSO) SOLENOID

Outline

- The structure and the operation of the FSO solenoid is the same as those of the Mazda 323 (BA) RF engine model, but the installation position has been changed.



1	Injection pump	2	Fuel shut off (FSO) solenoid

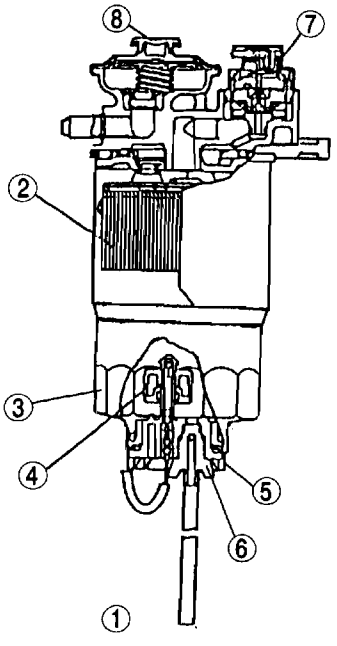
FUEL FILTER

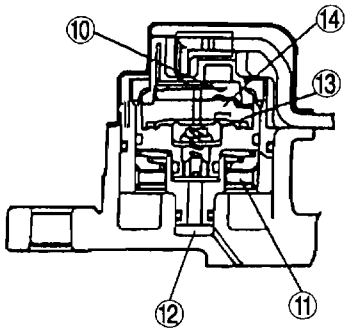
Outline

- The cartridge type fuel filter integrated with the sedimentor is adopted.
- When a certain volume of water is collected in the sedimentor, the sedimentor switch is turned on and the sedimentor warning light in the instrument cluster illuminates to notify the user that more than the allowable volume of water is collected and the water should be drained.
- A priming pump is equipped to drain the water easily from the sedimentor.

Structure/operation

- A heater, which dissolves the light oil (fuel) hardened when the engine is cold, and the vacuum switch for fuel pressure detection to operate the heater are integrated and installed in the filter cap.

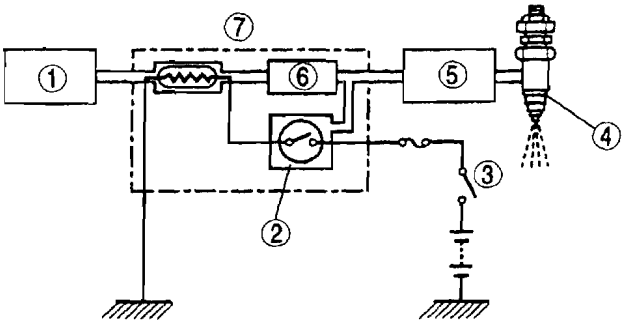


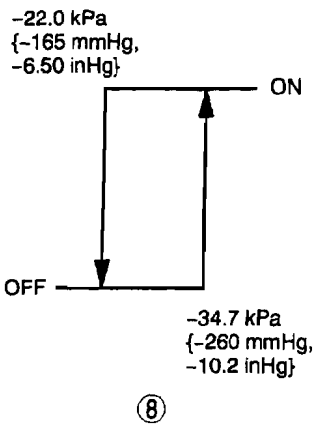


⑨

1	Fuel filter body cross-sectional view	8	Priming pump
2	Filter	9	Fuel warmer cross-sectional view
3	Sedimentor	10	Switch
4	Float	11	Heater element
5	Sedimentor switch	12	Filter outlet pressure
6	Drain	13	Diaphragm
7	Fuel warmer	14	Atmospheric pressure

- When driving while the engine is cold, the fuel component hardens to block the fuel filter and the fuel negative pressure after passing the filter is increased.
- When the negative pressure reaches -34.7 kPa {-260 mmHg, -10.2 inHg}, the vacuum switch for fuel pressure detection is turned on and the heater is energized. As a result, the heat is generated in the heater to dissolve the wax. When the wax is dissolved and the negative pressure drops below -22.0 kPa {-165 mmHg, -6.50 inHg}, the switch for fuel pressure detection is turned off, stopping the electrical current to the heater.





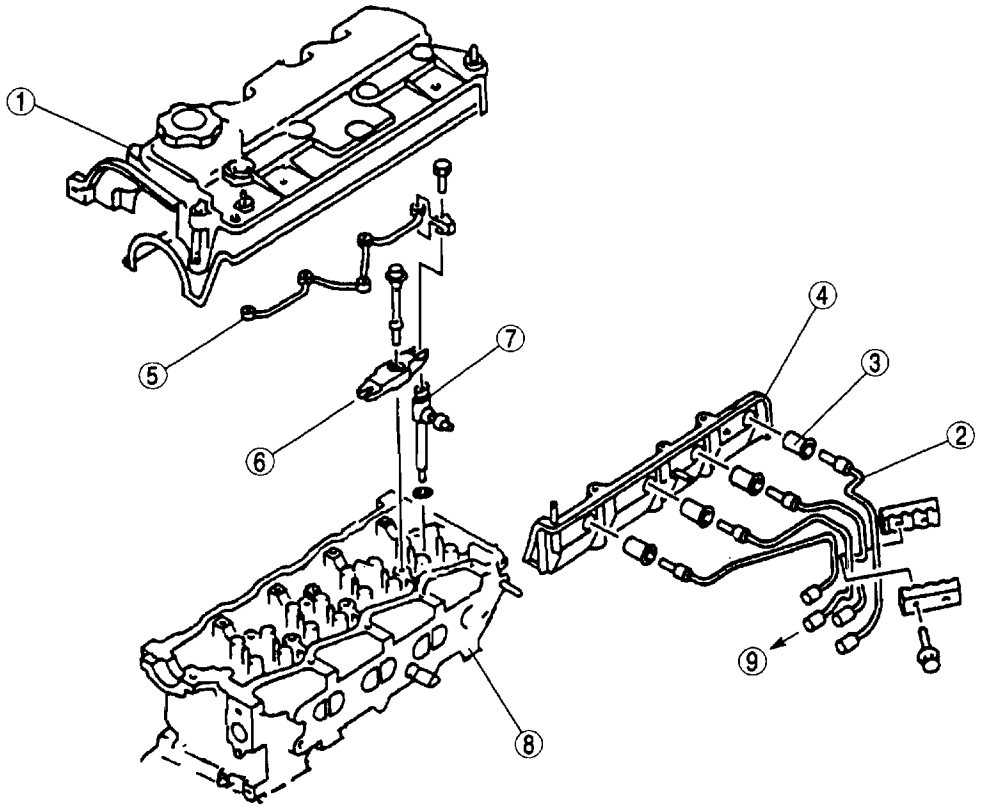
1	Fuel tank
2	Vacuum switch
3	Engine switch
4	Injection nozzle

5	Injection pump
6	Filter
7	Fuel filter
8	Vacuum switch operating pressure

INJECTION NOZZLE
Outline

Caution
- **Disassembling the injection nozzle can damage its function. Do not disassemble the injection nozzle.**

- The injection nozzle is installed in the cylinder head (in the head cover), and the nozzle head is located directly in the combustion chamber.
- The two-stages type nozzle, which suits the high-pressure injection, is adopted for the injection nozzle.
- There are five jets on the injection nozzle head, which is the conical suck type and the volume of the suction part is lessened to reduce HC.



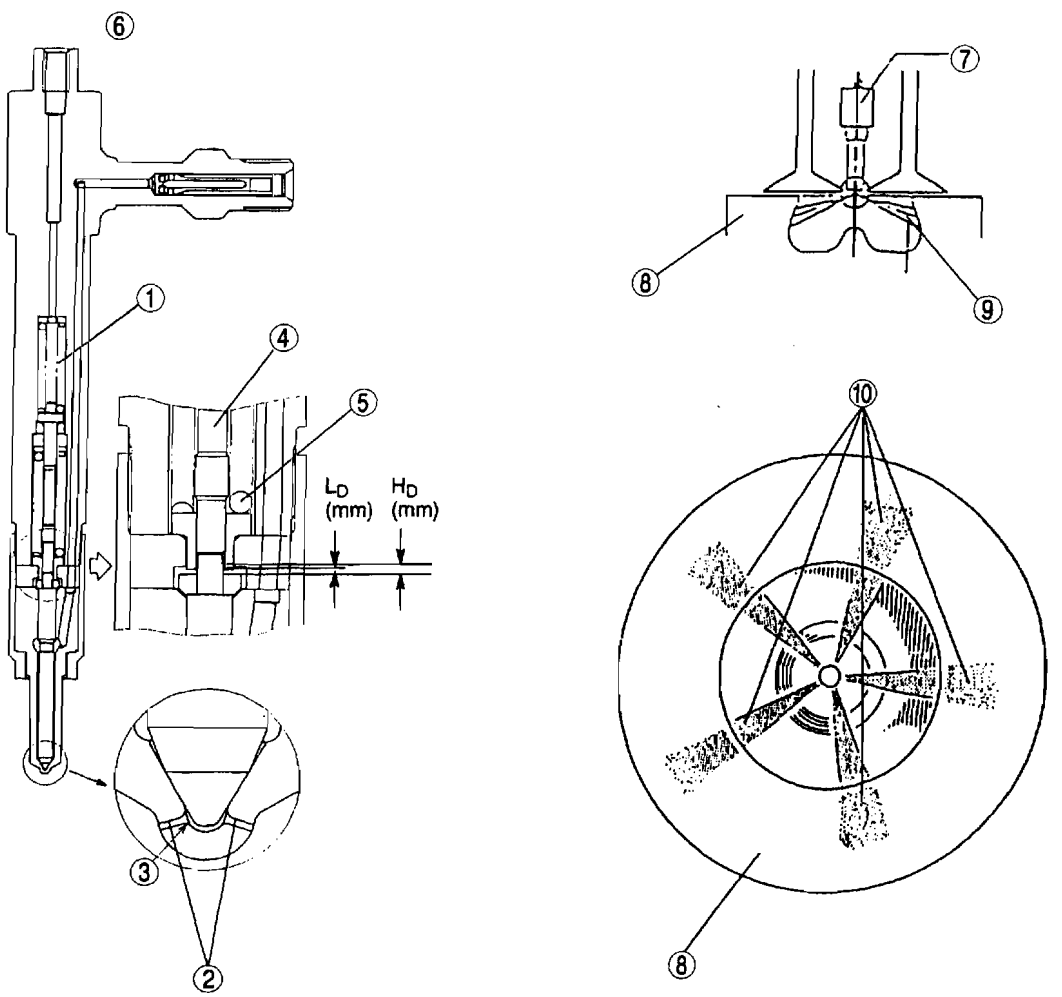
1	Cylinder head cover
2	Injection pipe
3	Nozzle seal
4	Side wall
5	Fuel leak pipe

6	Injection nozzle bracket
7	Injection nozzle
8	Cylinder head
9	To injection pump

Operation
- The two-stages type nozzle sets the injection-valve opening pressure and the needle lift amount to two stages.

First stage
This generally happens when the engine is running at low speed under light load. The injector nozzle opens at a pressure of 17.1—18.1 MPa {175—185 kgf/cm^2, 2489—2631 psi}. The needle lift is L_D (mm).

Second stage
This generally happens when the engine is running at high speed under heavy load. The injector nozzle opens at a pressure of 27.9—28.9 MPa {285—295 kgf/cm^2, 4053—4195 psi}. The nozzle lift is H_D (mm).



1	Spring No.1
2	Jets (Five)
3	Conical suck
4	Pressure pin
5	Spring No.2

6	Injection nozzle cross-sectional view
7	Injection nozzle
8	Piston
9	Fuel
10	Fuel mark (Five)

Caution
- **The two-stages type injection nozzle cannot be disassembled, and the valve opening pressure cannot be adjusted.**

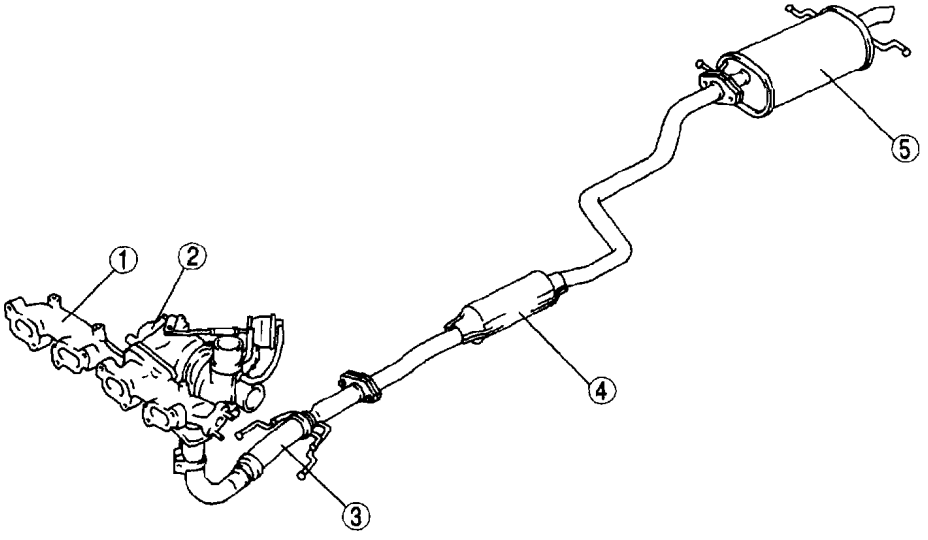
EXHAUST SYSTEM

OUTLINE

- The exhaust system consists of the parts shown in the figure below.
- Due to the adoption of the turbocharger, the following changes have been made compared to the Mazda 323 (BA) RF engine 4SD model.
  - The exhaust manifold has been modified to shorten the distance from the cylinder head to the turbocharger. Because of this, the exhaust resistance is reduced and the exhaust pressure is transmitted to the turbine wheel efficiently in a shorter time, improving the response of the turbocharger.
  - The front pipe has been eliminated and the joint pipe has been adopted.
- Due to the change in the body shape, the shape of each part has been changed.

STRUCTURAL VIEW

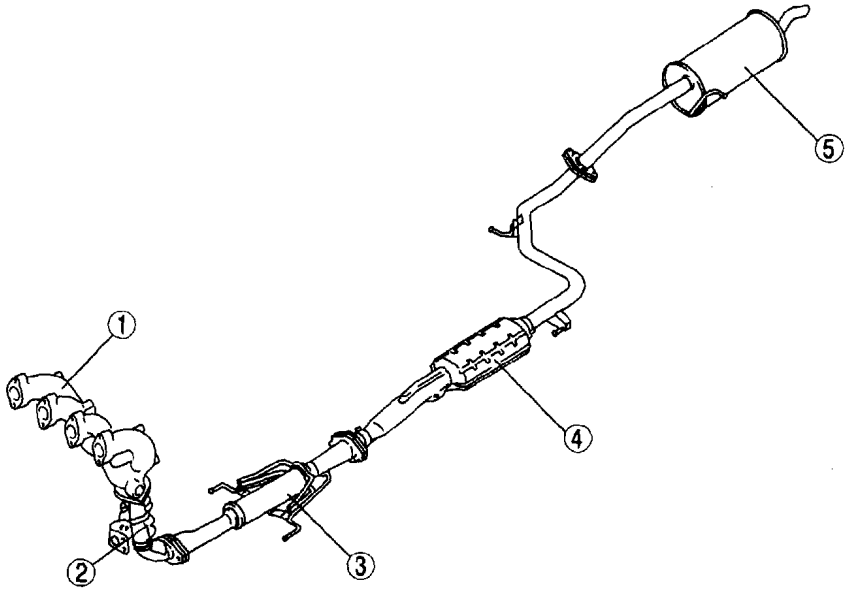
New model with RF-Turbo



1	Exhaust manifold
2	Joint pipe
3	Flexible pipe

4	Oxidation catalytic converter
5	Main Silencer

Mazda 323 (BA) RF 4SD



1	Exhaust manifold
2	Front pipe
3	Flexible pipe

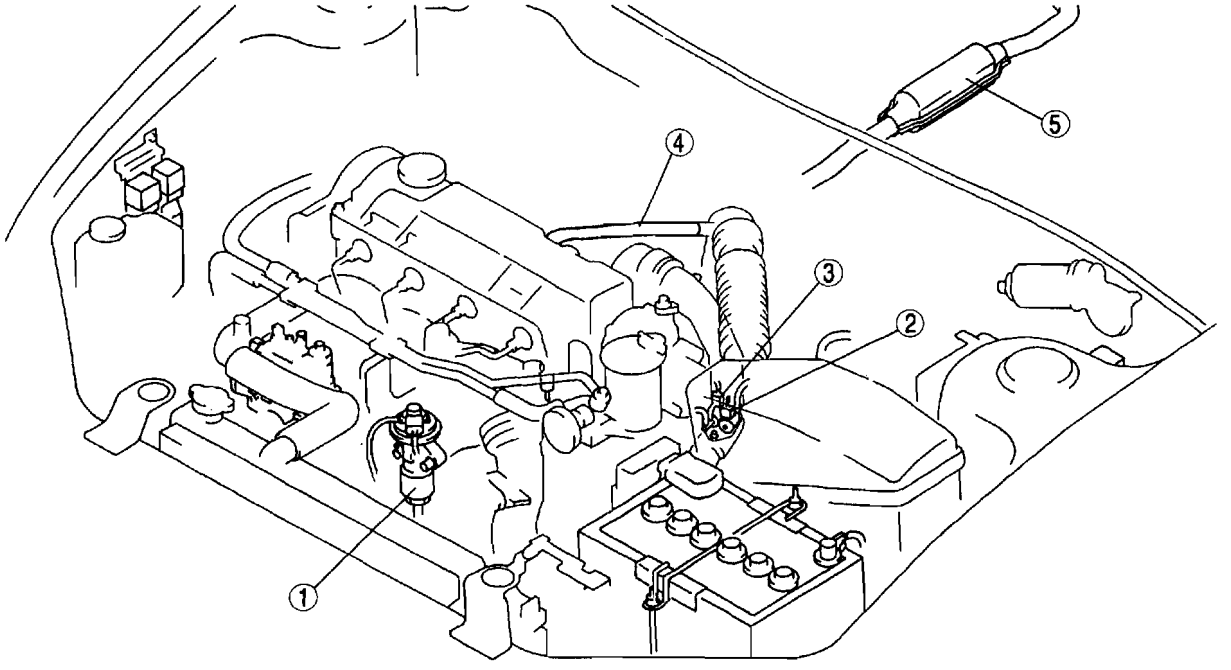
4	Oxidation catalytic converter
5	Main silencer

EMISSION SYSTEM

OUTLINE

- The EGR control, which is controlled by two duty valves, has been adopted.
- The ventilation hose, which leads the blowby gas to the intake manifold. And the oxidation catalytic converter are the same as those of the Mazda 323 (BA) RF engine model.

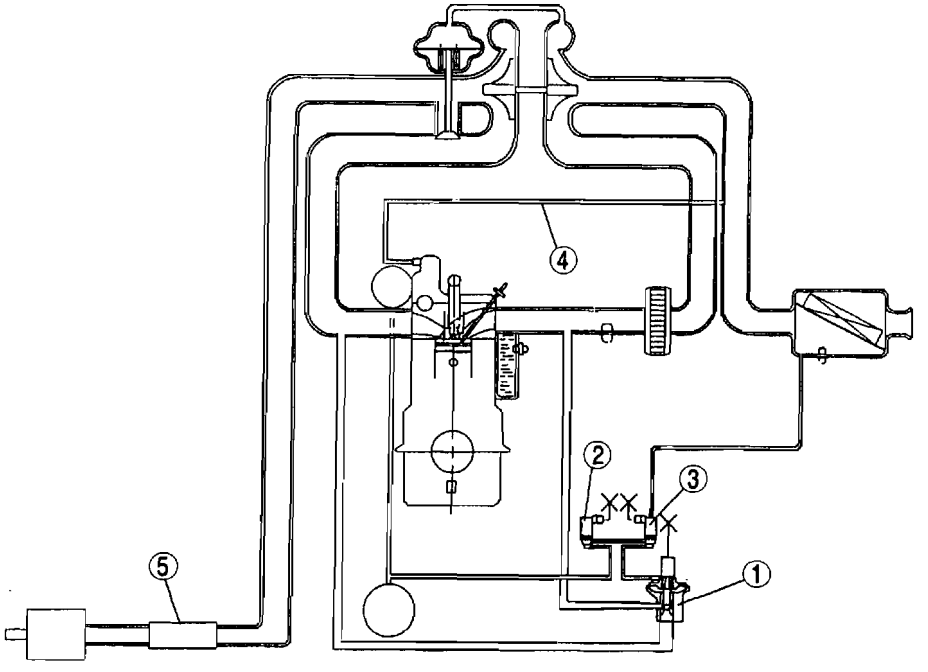
Structural View



1	EGR valve
2	EGR solenoid valve (vacuum)
3	EGR solenoid vavle (vent)

4	Blowby gas ventilation hose
5	Oxidation catalytic converter

System Diagram



1	EGR valve
2	EGR solenoid valve (vacuum)
3	EGR solenoid vavle (vent)

4	Blowby gas ventilation hose
5	Oxidation catalytic converter

CONTROL SYSTEM

OUTLINE

- The differences in the control system parts between the new model with RF-Turbo engine and 323 (BA) RF engine model are as follows.

Input Parts

×: Applied –: Not applied

Item	Signal	New model with RF Turbo engine	323 (BA) with RF engine	Remark
Engine coolant temperature (ECT) sensor	Engine coolant temperature	× (Installation position is different)	×	–
Accelerator position sensor	Accelerator pedal position	×		–
Idle switch	Accelerator pedal open or closed	×		–
Intake air temperature (IAT) sensor	Intake air temperature	× (Two IAT sensors are equipped to measure IAT before and after supercharging)	×	–
Neutral/Clutch switch	Load/No load condition	×		–
Pump speed sensor	Engine speed	× (Function is different)	×	• Sensor name has been changed from NE sensor to pump speed sensor
TDC sensor	Crank angle standard position	× (Function is different)	×	–
Fuel temperature sensor	Fuel temperature	× (Installation position and shape are different)	×	–
Boost sensor	Intake air pressure	×	–	–
Vehicle speed sensor (VSS)	Vehicle speed	×		–
A/C switch, Refrigerant pressure switch, Fan switch	A/C	×		–
PCM control relay	Power voltage	×		• Relay name has been changed from main relay to PCM control relay
Injection pump EPROM	Calibration	×		• Resistance name has been changed from corrected resistance to injection pump EPROM

×: Applied –: Not applied

Item	Signal	New model with RF Turbo engine	323 (BA) with RF engine	Remark
Immobilizer unit*1	Immobilizer system communication	×		–
EGR valve position sensor	EGR valve position	×	–	–
Control sleeve (CS) snsor	Sleeve position	–	×	–
Timer position sensor	Timer piston position	–	×	–

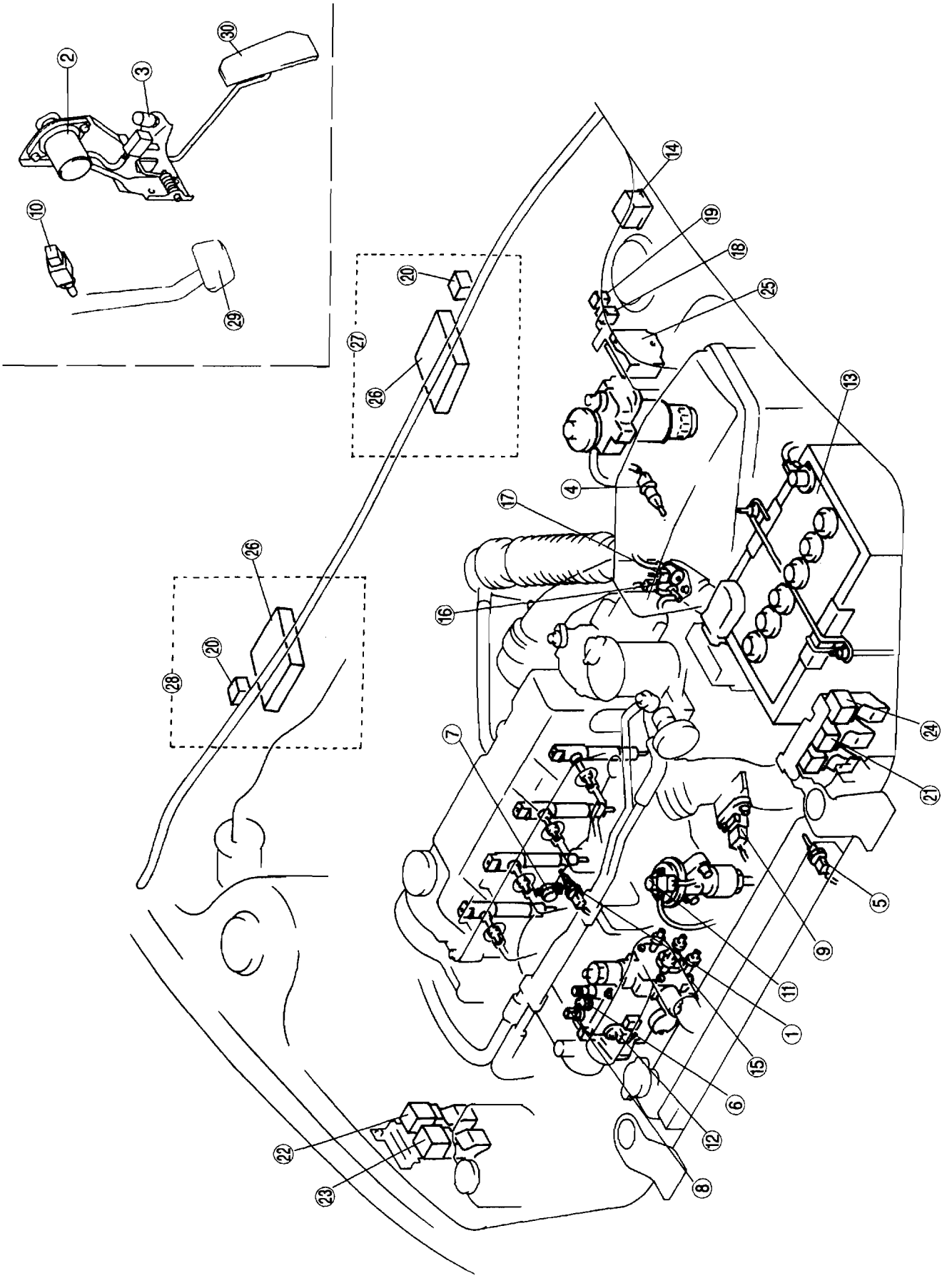
*1: Immobilizer unit is equipped.

Output Parts

×: Applied –: Not applied

Item	Signal	New model with RF Turbo engine	323 (BA) with RF engine	Remark
Timer control valve (TCV)	TCV control	×		–
Fuel shut off (FSO) solenoid relay	FSO solenoid drive	×	–	Power for driving FSO solenoid
Spill valve relay	IDM power	×	–	Power to IDM
Injector driver module (IDM)	Spill valve drive	×	–	Power for driving spill vavle
EGR solenoid valve (vacuum)	EGR valve drive	×		–
EGR solenoid valve (vent)	EGR valve drive	×	–	Opens/closes vacuum passage which acts on EGR valve diaphragm
Glow indicator light	Glow indicator light control	×		–
Glow plug relay	Glow plug drive	×		–
Electronic governor	–	–	×	Controls control sleeve position and adjusts ignition timing according to the control signal from PCM
A/C relay	A/C control	×		–
Condenser fan relay	Condenser fan control	×		–
Cooling fan relay	Cooling fan control	×		–

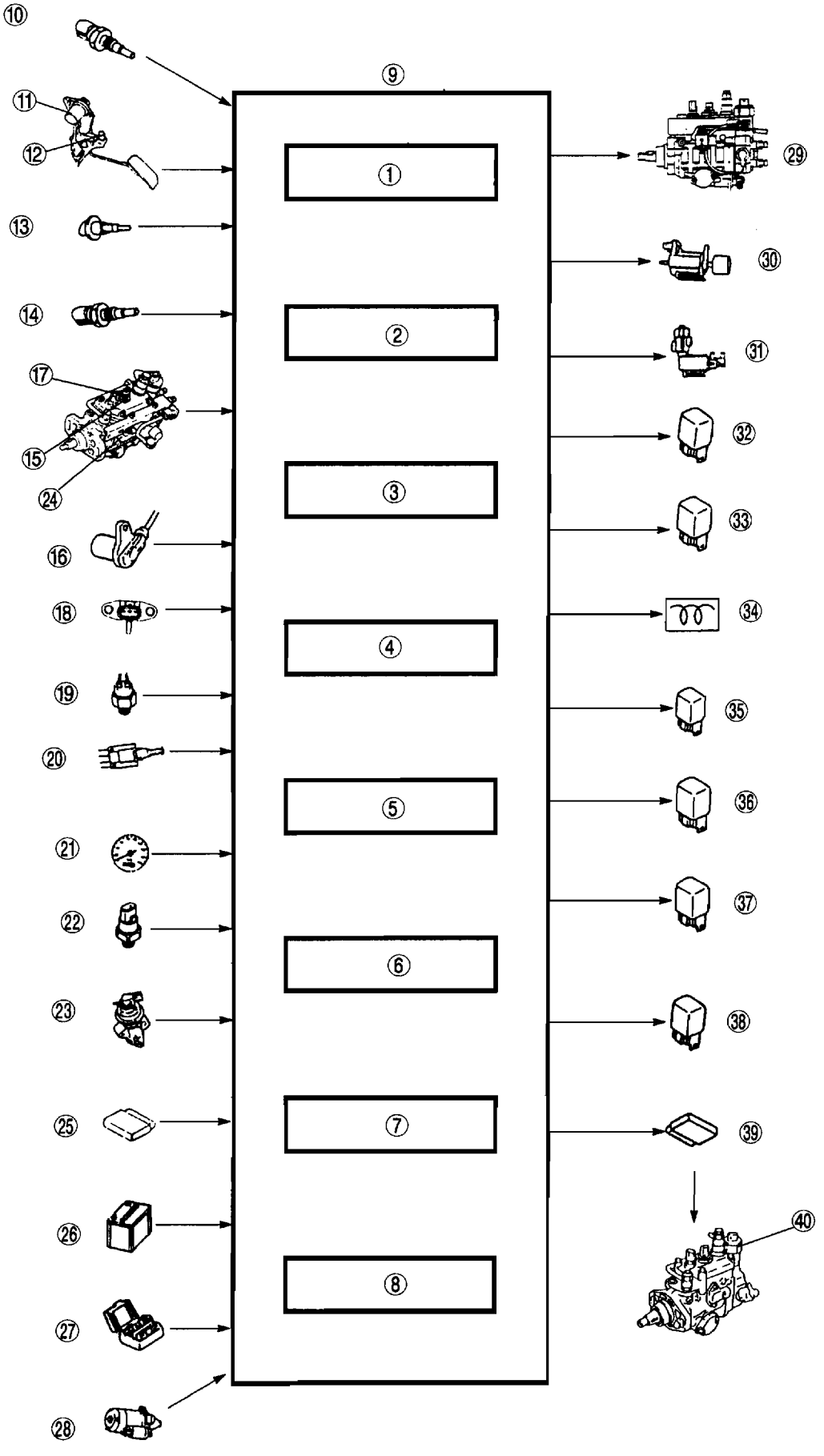
COMPONENT LOCATION



1	Engine coolant temperature (ECT) sensor
2	Accelerator position sensor
3	Idle switch
4	Intake air temperature (IAT) sensor No.1
5	Intake air temperature (IAT) sensor No.2
6	Pump speed sensor
7	TDC sensor
8	Fuel temperature sensor
9	Boost sensor
10	Clutch switch
11	EGR valve position sensor
12	Injection pump EPROM
13	Battery
14	Data link connector (DLC)
15	Timer control valve (TCV)

16	EGR solenoid valve (Vent)
17	EGR solenoid valve (Vacuum)
18	Spill valve relay
19	PCM control relay
20	Fuel shut off (FSO) solenoid relay
21	Glow plug relay
22	A/C relay
23	Condenser fan relay
24	Cooling fan relay
25	Injector driver module (IDM)
26	PCM
27	R.H.D.
28	L.H.D.
29	Clutch pedal
30	Accelerator pedal

BLOCK DIAGRAM



1	Fuel injection amount control
2	Fuel injection timing control
3	idle speed control
4	Glow control
5	EGR control
6	Electrical fan control
7	A/C cut-off control
8	Immobilizer system (Immobilizer unit equipped)
9	PCM
10	Engine coolant temperature (ECT) sensor
11	Accelerator position sensor
12	Idle switch
13	Intake air temperature (IAT) sensor No.1
14	Intake air temperature (IAT) sensor No.2
15	Pump speed sensor
16	TDC sensor
17	Fuel temperature sensor
18	Boost sensor
19	Neutral switch
20	Clutch switch
21	Vehicle speed sensor

22	Refrigerant pressure switch (A/C equipped)
23	EGR valve position sensor
24	Injection pump EPROM
25	Immobilizer unit (Immobilizer system equipped)
26	Battery
27	DLC
28	Starter (Starter signal)
29	Timer control valve (TCV)
30	EGR solenoid valve (vacuum)
31	EGR solenoid valve (vent)
32	Spill valve relay
33	Fuel shut off (FSO) solenoid relay
34	Glow indicator light (Instrument cluster)
35	Glow plug relay
36	A/C relay
37	Cooling fan relay
38	Condenser fan relay
39	Injector driver mobule (IDM)
40	Spill valve

CONTROL SYSTEM DEVICE AND CONTROL RELATIONSHIP CHART

×: Applied

	Device	Control item							
		Fuel injection amount control	Fuel injection timing control	Idle speed control	Glow control	EGR control	Electrical fan control	A/C cut-off control	Immobilizer system (Immobilizer equipped)
Input	Engine coolant temperature (ECT) sensor	×	×	×	×	×	×	×	
	Accelerator position sensor	×		×			×	×	
	Idle switch			×			×	×	
	Intake-air temperature (IAT) sensor No.1		×						
	Intake-air temperature (IAT) sensor No.2	×							
	Pump speed sensor	×	×	×		×	×	×	
	Fuel temperature sensor	×							
	Injection pump EPROM	×	×						
	TDC sensor		×						
	Boost sensor	×	×		×	×			
	Neutral/Clutch switch			×				×	
	Vehicle speed sensor	×		×	×				
	Refrigerant pressure switch (A/C equipped)			×			×	×	
	EGR valve position sensor					×			
	Immobilizer unit (Immobilizer equipped)								×
	Battery				×				
	Data link connector (DLC) (TEN terminal)						×		
	Starter signal	×	×						
Output	Timer control valve (TCV)		×						
	EGR solenoid valve (vacuum, vent)					×			
	Spill valve relay	×							×
	Fuel shut off (FSO) solenoid relay	×							×
	Glow indicator light				×				
	Glow plug relay				×				
	A/C relay						×	×	
	Cooling fan relay						×		
	Condenser fan relay (A/C equipped)						×		
	Injector driver module (IDM)	×		×					

PUMP SPEED SENSOR

Outline

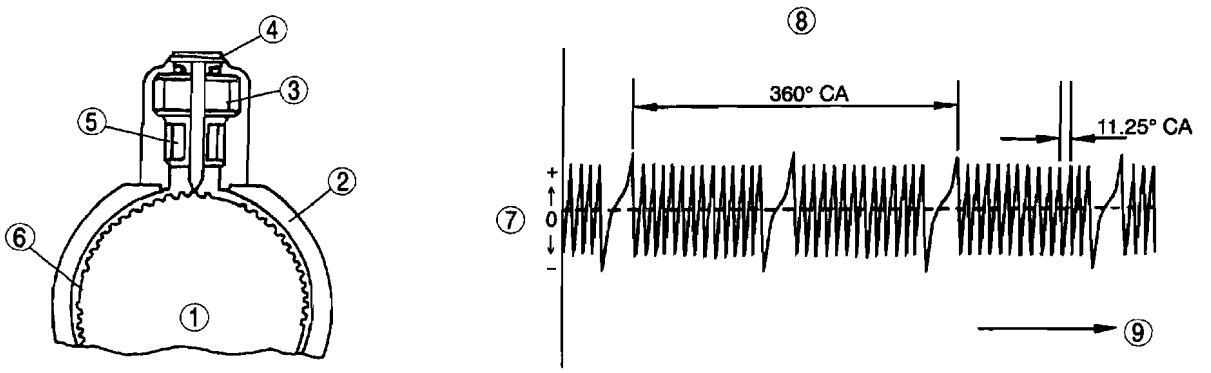
- The pump speed sensor is installed on the roller ring in the injection pump.
- The pump speed sensor is installed opposite to the teeth surfaces of the pulser that is pressed in the drive shaft in the injection pump.

Function

- The pump speed sensor detects the pulse (alternating voltage) generated by the pulser and outputs to the PCM as an engine speed signal.
- The detected engine speed is used to control the fuel injection amount and timing.

Operation

- The pump speed sensor has a magnet and a coil inside. When the pulsar rotates, the magnetic flux that passes the coil increases/decreases and the alternating voltage is generated. The PCM detects the engine speed by counting the pulses. The pulser has 52 teeth, missing three teeth in four locations, and detects the pulser rotating angle per 11.25° CA.



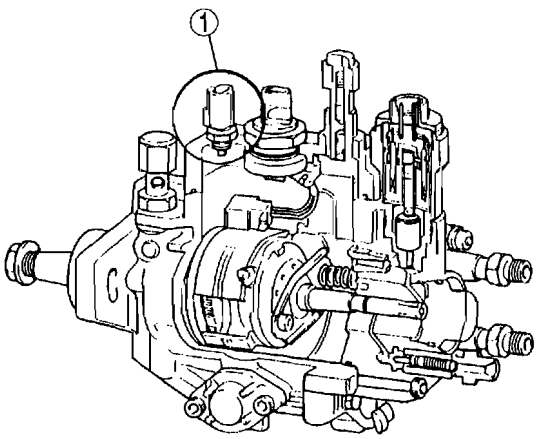
1	Pulser
2	Roller ring
3	Magnet
4	Pump speed sensor
5	Coil

6	No teeth
7	Output voltage
8	Output voltage characteristics
9	Time

FUEL TEMPERATURE SENSOR

Outline

- The function and detection method of the fuel temperature sensor are the same as those of the Mazda 323 (BA) RF engine model, but the installation position and the shape of the sensor are different.



1	Fuel temperature sensor

TDC SENSOR

Outline

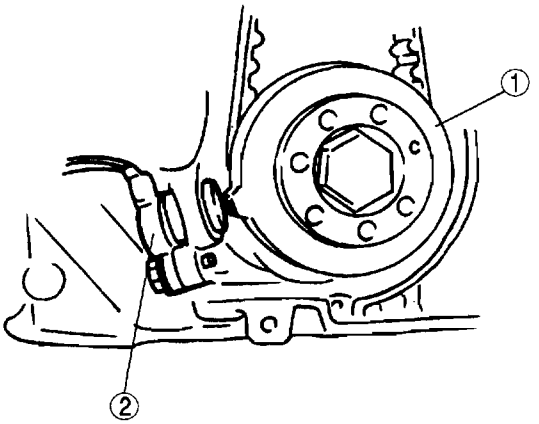
- The TDC sensor is installed near the crankshaft pulley in the timing belt cover.

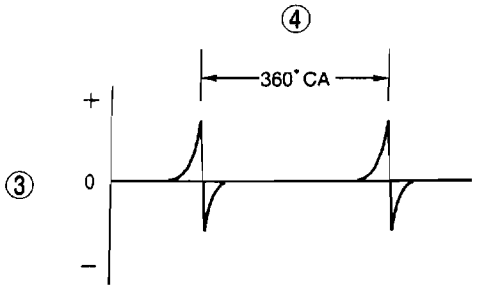
Function

- The TDC sensor detects the pulse (alternating voltage) generated by the projection on the pulser in the back of the crankshaft pulley and outputs to the PCM as a crank angle standard position signal.
- The detected crank angle standard position is used for the injection timing control (calculation of the actual injection timing).

Operation

- The TDC sensor has a magnet and a coil inside. When the pulser rotates, the magnetic flux that passes the coil increases/decreases and the alternating voltage is generated. The TDC sensor outputs a pulse to the PCM every engine rotation.





1	Pulser
2	TDC sensor

3	Output voltage (V)
4	Output voltage characteristics

ACCELERATOR POSITION SENSOR

Outline

- The structure and the function of the accelerator position sensor are the same as those of the 323 (BA) RF engine model.

IDLE SWITCH

Outline

- The structure and the function of the idle switch is the same as this of the 323 (BA) RF engine model.

ENGINE COOLANT TEMPERATURE (ECT) SENSOR

Outline

- The structure and the function of the ECT sensor are the same as those of the 323 (BA) RF engine model, but the installation position is different. (In this model, the ECT sensor is installed in the middle of the injection pump side cylinder head.)

INTAKE AIR TEMPERATURE (IAT) SENSOR

Outline

- The structure and the function of the IAT sensor are the same as those of the 323 (BA) RF engine model, but two IAT sensors are installed in this model to control the fuel injection timing and fuel injection amount accurately.

IAT Sensor No.1

Function

- The intake air sensor No.1 is installed in the air cleaner case. By utilizing a thermistor of which resistance varies with temperature, the sensor detects temperature in the air cleaner case.
- The detected intake air temperature is used for correction of fuel injection timing control.

IAT Sensor No.2

Function

- The intake air sensor No.2 is installed in the air pipe between the charge air cooler and the intake manifold. By utilizing a thermistor of which resistance varies with supercharged air temperature, the sensor detects temperature in the intake manifold.
- The detected intake air temperature is used for correction of fuel injection amount control.

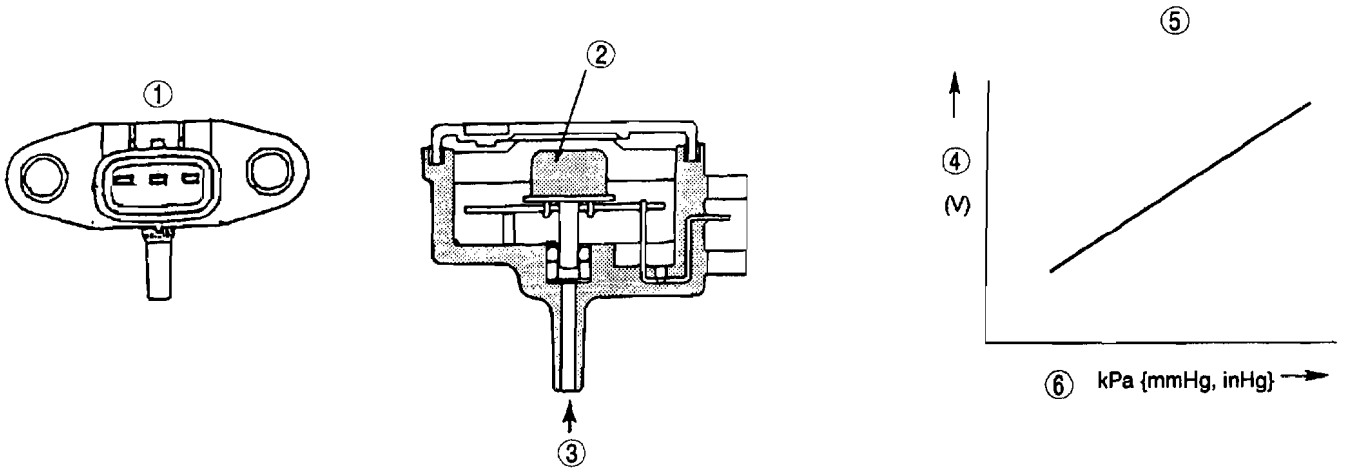
BOOST SENSOR

Function

- The boost sensor detects the intake air pressure as an absolute pressure, and sends it to the PCM as an intake air pressure signal.
- The boost sensor is installed in the air pipe between the charge air cooler and the intake manifold.

Operation

- The boost sensor is filled with crystal (silicon) and it is the semi-conductor pressure sensor which utilizes the characteristic of the electrical resistance that changes when the crystal is pressurized.
  *Absolute pressure is the pressure when vacuum is set as 0 kPa {0 mmHg, 0 inHg}.



1	Boost sensor
2	Vacuum chamber (Integrated with a silicon chip)
3	Supercharged pressure

4	Output voltage
5	Sensor output characteristic
6	Pressure

NEUTRAL/CLUTCH SWITCH

Outline

- The structure and the function of the neutral/clutch switch are the same as those of the 323 (BA) RF engine model.

PCM CONTROL RELAY

Outline

- The structure and the function of the PCM control relay are the same as those of the 323 (BA) RF engine model.

SPILL VALVE RELAY

Function

- The spill valve relay supplies/stops the power to drive the injector driver module (IDM). The structure of the spill valve relay is the same as that of the PCM control relay.

Operation

- The spill valve relay is energized (ON) when the engine switch is turned from off to on.
- The power supply to the spill valve relay stops (OFF) three seconds after turning the engine switch from on to off.
- The power supply to the spill valve relay is stopped under any of the following conditions. (The PCM detects the following conditions.)
  1. Spill valve control system is abnormal.
  2. Pump speed sensor is malfunctioning.
  3. FSO solenoid is malfunctioning.
  4. IDM is malfunctioning.
  5. Immobilizer control is operating. (During fuel injection inhibition)

FUEL SHUT OFF (FSO) SOLENOID RELAY

Function

- The FSO solenoid relay supplies/stops the power to drive the FSO solenoid. The structure of the FSO solenoid relay is the same as that of the PCM control relay.

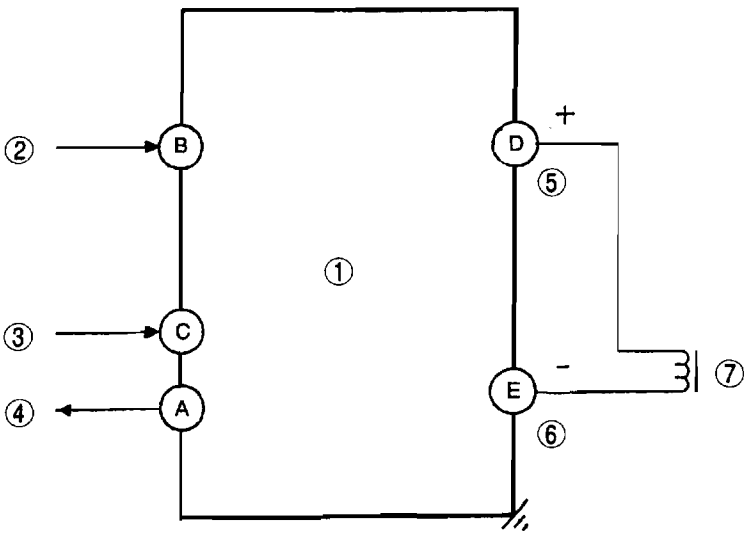
Operation

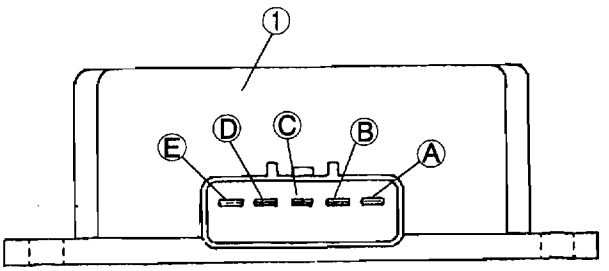
- The FSO solenoid relay is energized (ON) when the engine switch is turned from off to on.
- The electrical current flow to the FSO solenoid relay stops (OFF) when the engine switch is turned from on to off.

INJECTOR DRIVER MODULE (IDM)

Function

- The IDM is the unit which has the high voltage generating circuit for converting the battery positive voltage to a high voltage.
- The high voltage (approx. 150 V) output from the IDM is output to the spill valve as the driving signal, and controls the high speed driving of the spill valve and the high-accuracy injection amount.



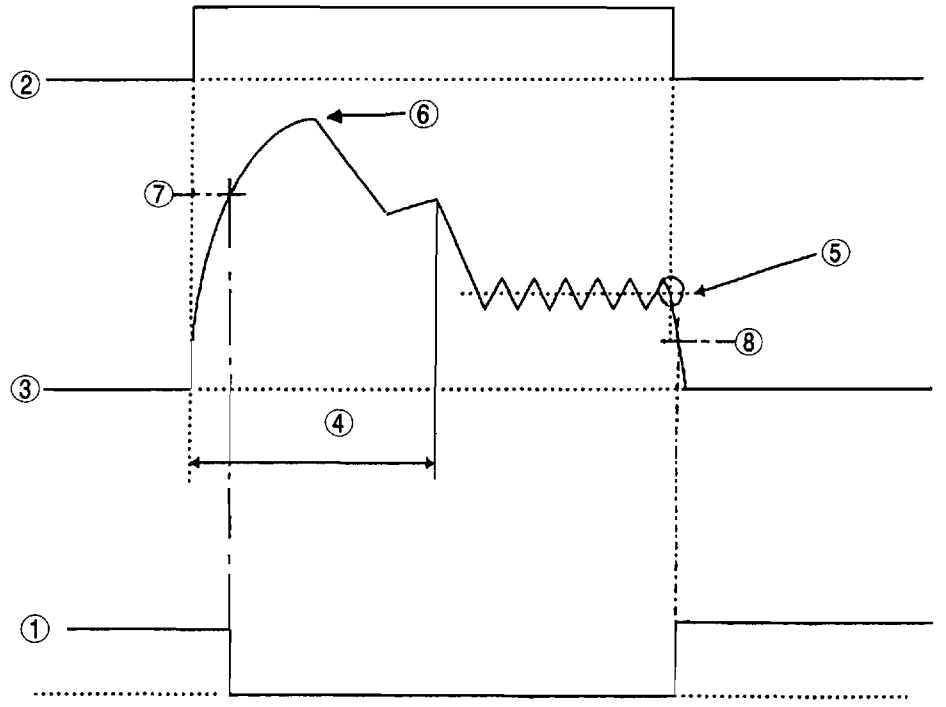


1	IDM
2	Spill valve relay (Battery positive voltage)
3	PCM (Injection signal)
4	PCM (Injection confirmation signal)

5	Spill valve (+) (Driving current)
6	Spill valve (-) (Driving current)
7	Spill valve

Operation

- The battery positive voltage (approx. 12V) from the spill valve relay is amplified and converted to a high voltage (approx. 150V), and output as an injection signal.
- When the injection signal is output to the spill valve, the injection confirmation signal is sent to the PCM from the IDM.
- The signals from each terminal of the IDM are as shown below.



1	PCM (Injection confirmation signal)
2	PCM (Injection signal)
3	Spill valve (+) (Driving current)
4	Holding current switching time: Approx. 1.0 ms

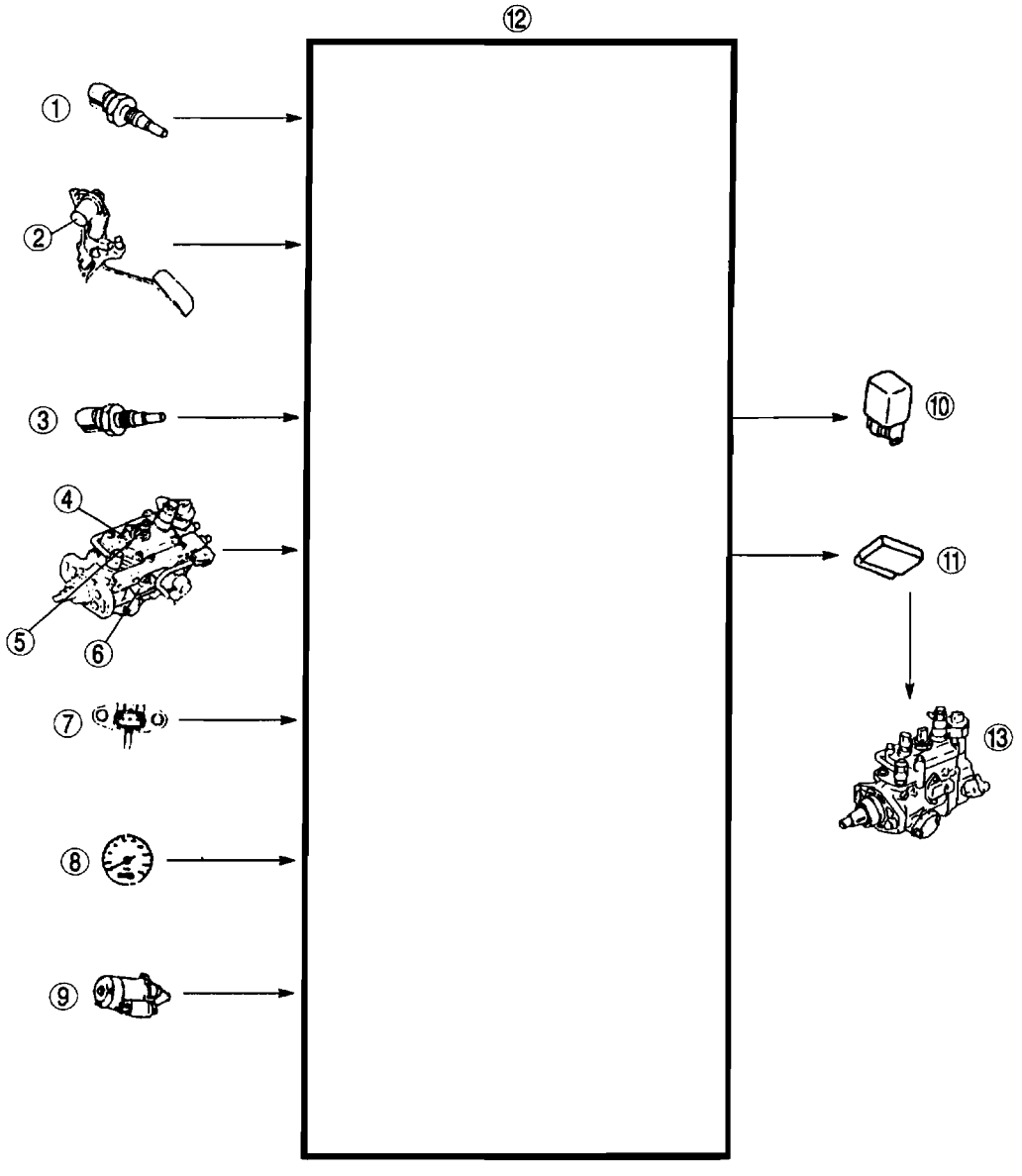
5	Holding current control value: Approx. 2.0 A
6	Spill valve driving current
7	Fail signal (High side)
8	Fail signal (Low side)

FUEL INJECTION AMOUNT CONTROL

Outline

- The fuel injection amount is controlled by opening the spill valve according to the signal from the PCM through the injector driver module (IDM) reducing the fuel pressure in the fuel force feed line, and finishing the fuel injection.

Block Diagram

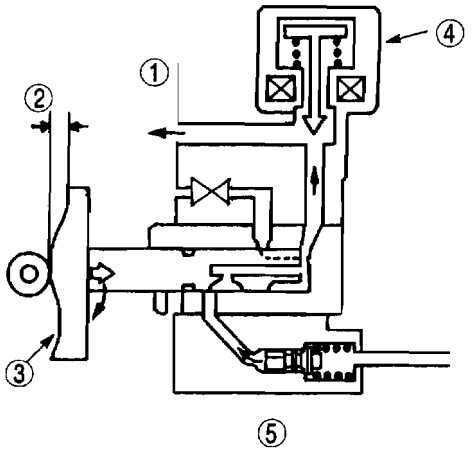


1	ECT sensor
2	Accelerator position sensor
3	IAT sensor No.2
4	Fuel temperature sensor
5	Pump speed sensor
6	Injection pump EPROM
7	Boost sensor

8	VSS
9	Starter
10	Spill valve relay
11	IDM
12	PCM
13	Spill valve

Operation

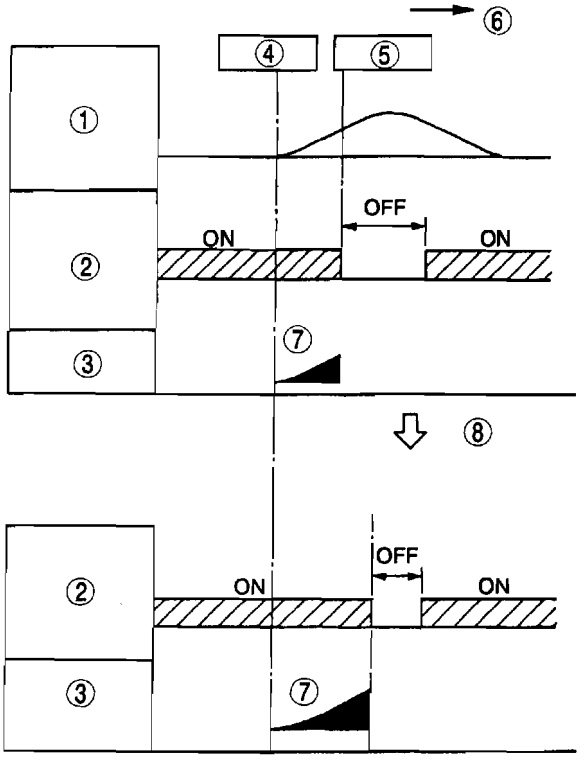
- The fuel injection start timing is determined by the cam plate position as conventional.



1	Pump chamber
2	Cam lift
3	Cam plate

3	Cam plate
4	Spill valve (open)

- To increase/reduce the injection amount is to control the injection end timing; the injection is finished when the spill valve opens and the high-pressure fuel is spilled into the pump room.
- The spill valve opening timing is controlled by the pump speed sensor, which detects the cam angle corresponding to the cam lift amount.
  The figure below shows the relations between the cam lift amount, spill valve opening timing, and the injection amount.



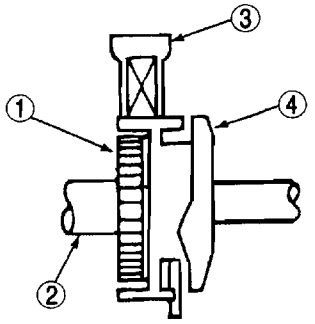
1	Cam lift
2	Spill valve
3	A cylinder
4	Start of injection

5	End of injection
6	Cam angle
7	Injection
8	Increased injection amount

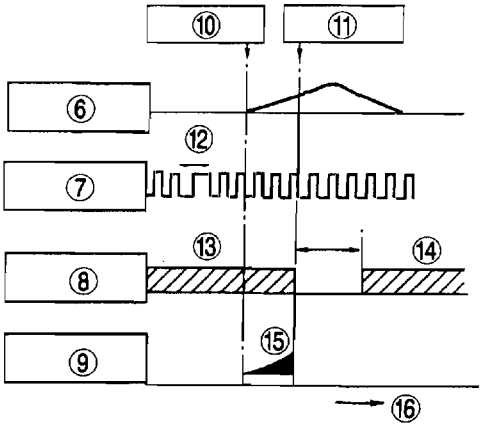
Spill valve opening timing

The spill valve opening timing is determined by the pump speed sensor signal.
The pump speed sensor detects the cam angle which corresponds to the cam lift amount.

1. The cam lift amount is determined by the rotating angle of the cam plate, which rotates together with the pulser opposite to the pump speed sensor.
2. The rotating angle of the cam plate is detected by the rotating angle of the pulser, i.e., the pump speed sensor output (per 11.25° CA).
3. The pump speed sensor detects the timing and number of pulser teeth beginning with a gap (no teeth) in the pulser. The PCM determines the spill valve opening timing (injection end) according to the detected pump speed sensor signal.



⑤



⑰

1	Pulser
2	Drive shaft
3	Pump speed sensor
4	Cam plate
5	Driving of cam plate
6	Cam lift
7	Pump speed sensor signal
8	Spill valve
9	A cylinder

10	Start of injection
11	End of injection
12	No teeth
13	Open
14	Close
15	Injection
16	Cam angle
17	Injection end control

Injection amount calculation

The PCM calculates the optimal injection amount according to the engine driving condition; the following two items.

1. Basic injection amount
   The theoretical necessary injection amount is calculated based on the accelerator opening angle and the engine speed.
2. Maximum injection amount
   The maximum injection amount while engine is rotating is calculated by adding the corrections of intake air pressure, intake air temperature, and fuel temperature, to the injection amount which is determined according to the engine speed.

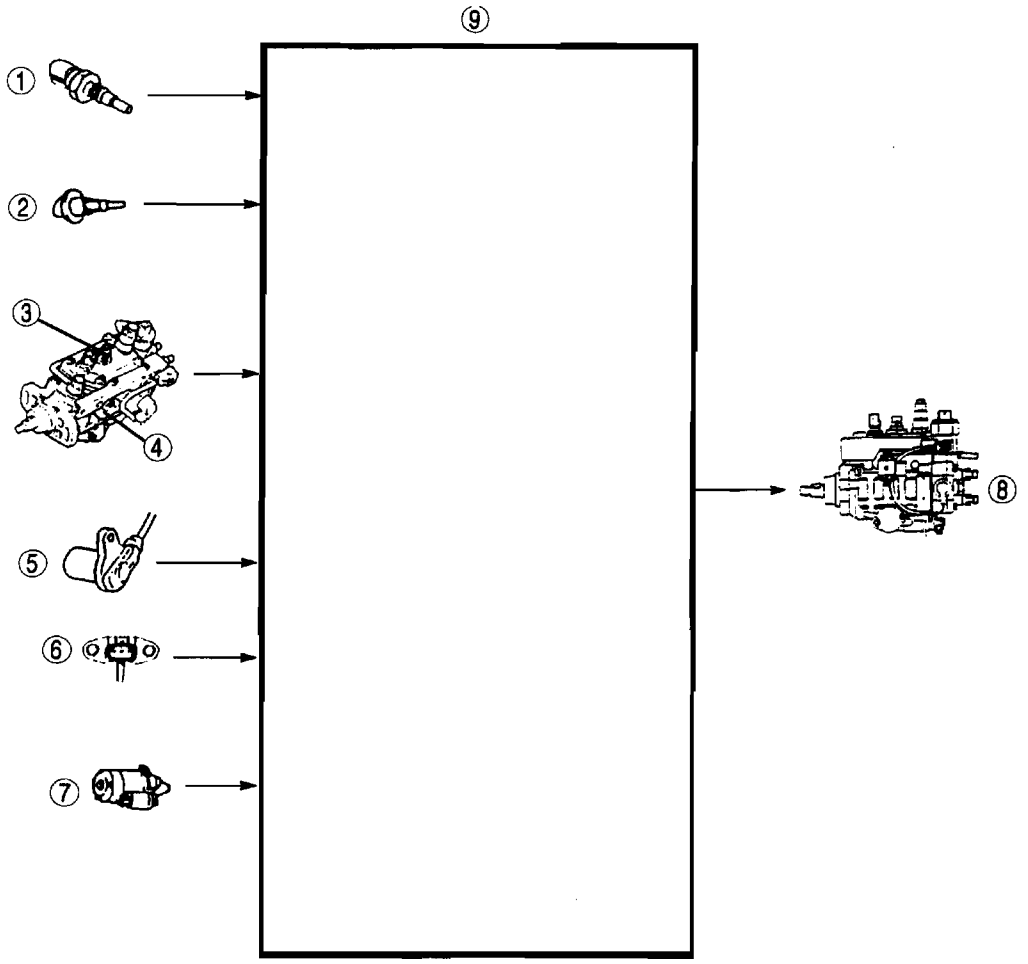
The values of items 1. and 2. above are compared, and the lesser amount is selected as the final injection amount.

FUEL INJECTION TIMING CONTROL

Outline

- The PCM detects the engine condition according to each sensor signal and calculates the optimum injection timing to control the injection timing by duty controlling the timer control valve (TCV).
- The actual injection timing was detected by the timer position sensor to control the fuel timing system in Mazda 323 (BA) RF engine models. In this new 626 RF-Turbo engine model, the timer position sensor has been eliminated, and the actual injection timing is calculated from the difference between the crank angle standard position signal and the pump speed signal.

Block Diagram

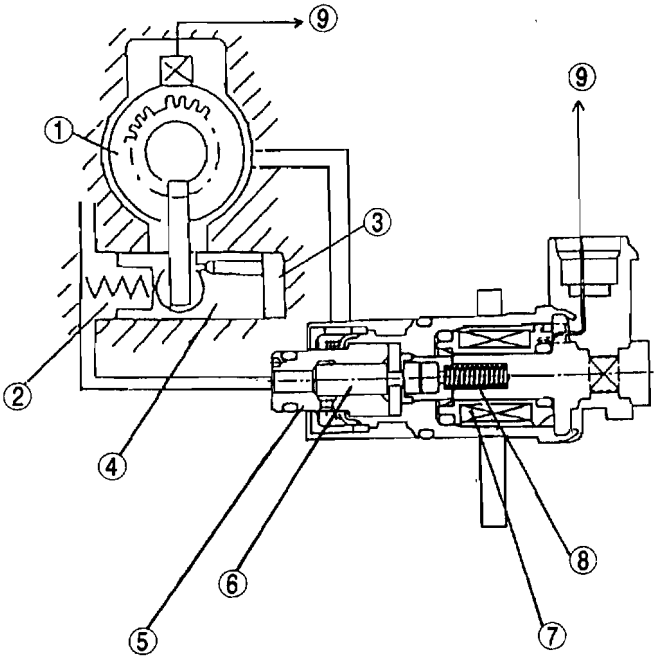


1	ECT sensor
2	IAT sensor No.1
3	Pump speed sensor
4	Injection pump EPROM
5	TDC sensor

6	Boost sensor
7	Starter
8	TCV
9	PCM

Operation

- The function of the TCV is the same as that of the Mazda 323 (BA) RF engine model, but the control method is different.
- The TCV in the new model with RF-Turbo engine change the fuel pressure (hydraulic pressure) in the low-pressure chamber of the TCV and controls the timer piston positon.
- When the TCV is open, the fuel pressure (hydraulic pressure) in the low-pressure and high-pressure chambers in the TCV are the same. The low-pressure chamber has a timer spring, which moves the timer piston to the high-pressure chamber side with the spring force when the fuel pressure (hydraulic pressure) in the low-pressure and high-pressure chambers are the same. This is called fuel injection retard direction. The fuel injection advance direction is the condition when the TCV is closed.



1	Roller ring
2	Low-pressure chamber
3	High-pressure chamber
4	Timer piston
5	Valve body

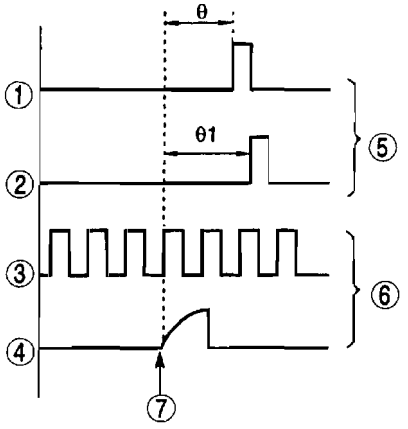
6	Needle
7	Coil
8	Spring
9	To PCM

Injection timing calculation
Based on the basic target injection timing and according to the signals from each sensor, the PCM calculates the optimal injection timing to the driving condition.
Then, the PCM calculates the actual injection timing using the crank angle standard position signal (TDC signal) from the TDC sensor for feedback operation to the target injection timing.

1. Target injection timing
   The target injection timing is calculated based on the fuel injection amount and the engine speed.
2. Injection timing correction
   The injection timing is corrected with the intake air pressure, and the engine coolant temperature, and the atmospheric pressure.
3. Injection timing at start
   When starting, the target injection timing is corrected with, engine coolant temperature and the engine speed.

Feedback control

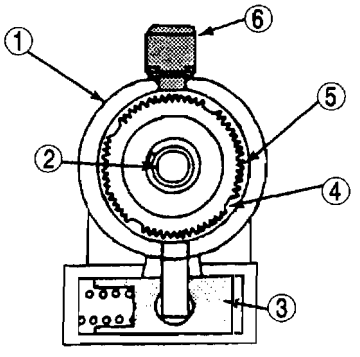
- The feedback control corrects the TCV duty ratio so that the actual injection timing correspond to the target injection timing.
- The feedback control is to control the crank angle θ between actual TDC and injection start as shown in the figure. However, the actual TDC and the injection wave-form are not detected as signals. The actual injection timing is calculated as follows.



1	Actual TDC
2	TDC signal
3	NE pulse
4	Injection wave-form

5	Engine side
6	Injection pump side
7	Injection start

(1) The actual TDC position and the signal of the TDC sensor are correlated.
(2) The injection timing and the NE pulse of the pump speed sensor are correlated.
(3) The actual injection timing can be obtained by calculating the phase difference θ1 between the TDC signal and the NE pulse.



1	Roller ring
2	Drive shaft
3	Timer piston

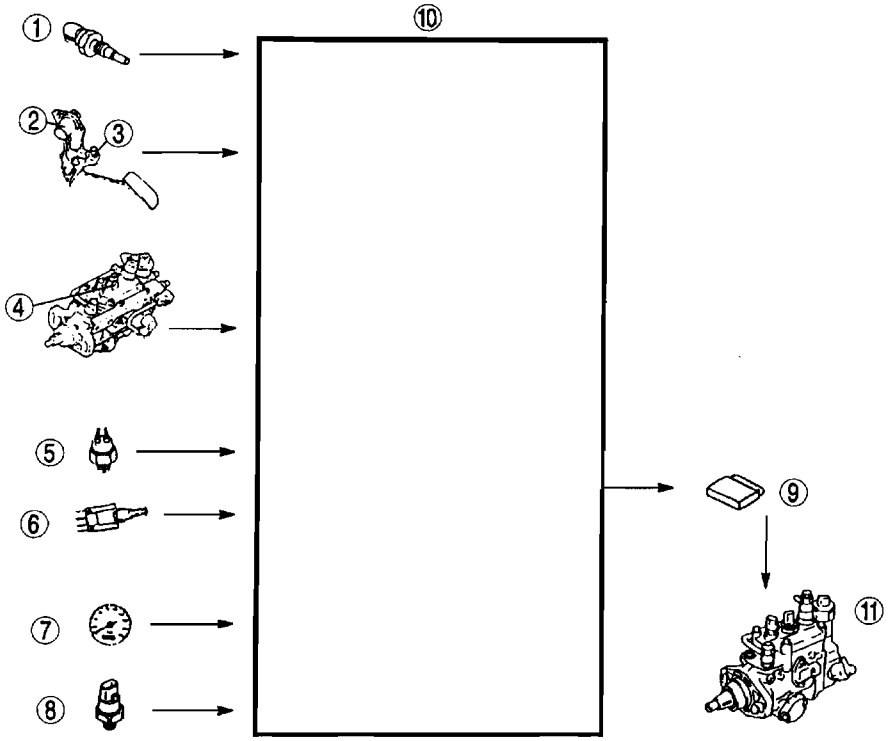
4	No teeth
5	Pulsar (52 teeth)
6	Pump speed sensor

IDLE SPEED CONTROL

Outline

- The PCM calculates the target speed according to the engine driving condition, and determines the injection amount to control the idle speed.

Block Diagram



1	ECT sensor
2	Accelerator position sensor
3	Idle switch
4	Pump speed sensor
5	Neutral switch
6	Clutch switch

7	Vehicle speed sensor
8	Refrigerant pressure switch (A/C equipped)
9	IDM
10	PCM
11	Spill valve

Feedback control

- The PCM compares the target idle speed with the actual idle speed (pump speed sensor) signal). When any difference is found, the PCM sends the signal to the spill valve to control the injection amount and adjusts to the target idle speed.

Idle speed
LOADED: 750—800 (775 ± 25) rpm
UNLOADED: 750—800 (775 ± 25) rpm

Idle speed control when warming up

- The idle speed is controlled to be the optimal fast idle speed at warm-up by the engine coolant temperature.

One-shot control

- After switching the A/C, a set injection amount is changed to prevent the idle speed from fluctuating with the engine load changes.

Rotation fluctuation prevention control for each cylinder

- The fluctuation of the engine rotation when idling is detected and the injection amount is corrected for each cylinder.
  Because of this, the injection amount differences between each cylinder owing to the uneven pumps (in each cylinder) and the injection nozzles are reduced, as well as the engine rotation fluctuation during idle and in low-speed, light load range.

Note

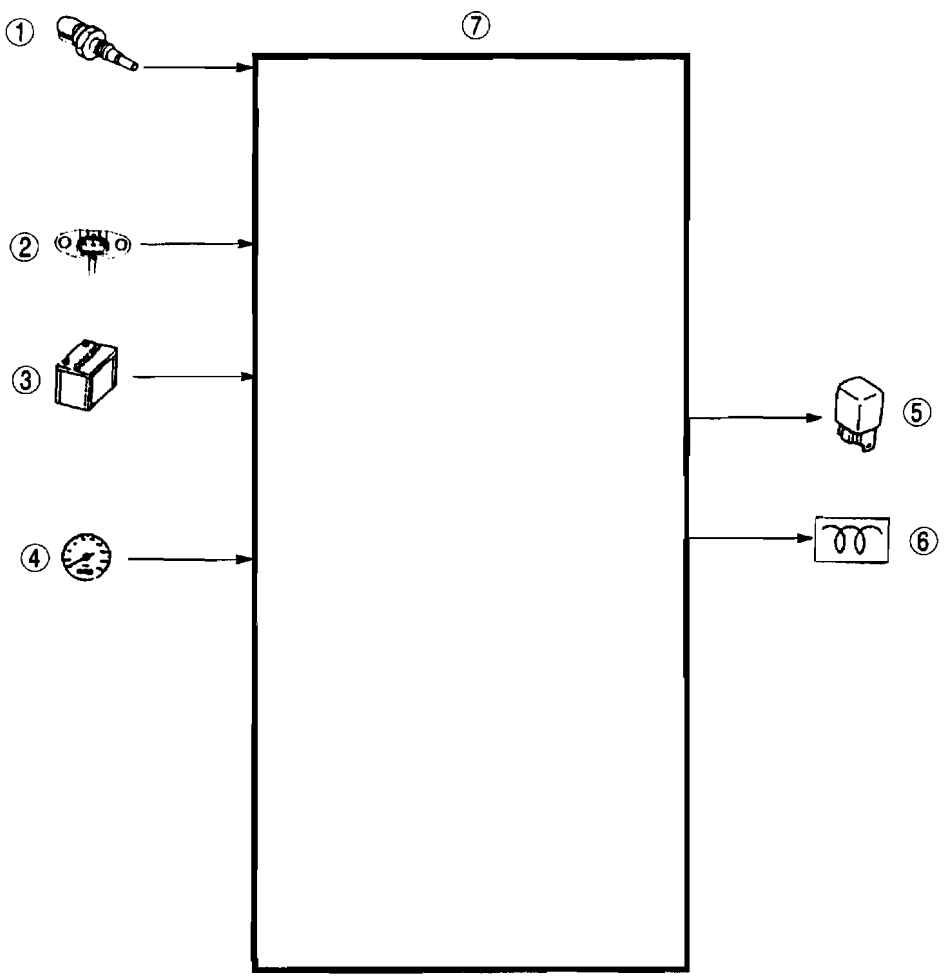
- This control is also used for the Mazda 323 (BA) RF engine moedel.

GLOW CONTROL

Outline

- To obtain the optimal startability according to the vehicle conditions, the PCM controls the operating time of the glow plug through glow plug through relay which raises the temperature in the combustion chamber (hot spot).
- When before starting the engine, the glow indicator light control is operated and shows the driver when the engine can be started by turning the glow indicator light on/off.
- The hold temperature control and the after-glow control are also operated to improve the vehicle condition when before starting the engine and stability after the engine is started.

Block Diagram



1	ECT sensor
2	Boost sensor
3	Battery
4	Vehicle speed sensor

5	Glow plug relay
6	Glow indicator light
7	PCM

Glow indicator light control

- When the engine switch is turned on, the PCM controls the illuminating time of the glow indicator light in the instrument cluster.
- The illuminating times of the glow indicator light are preset in the PCM as the engine coolant temperature and the atmospheric pressure.
- When a malfunction occurs in the input/output parts, etc., the glow indicator light flashes to notify the user that there is a malfunction.

Quick glow control

- Even when the engine switch is left at ON position after the glow indicator light goes off, power is supplied to the glow plug relay to hold the temperature in the combustion chamber and obtain startability when starting the engine.
- The power is supplied to the glow plug relay for 15 seconds at maximum when the engine coolant temperature is below 25 °C {77 °F}.

After-glow control

- To obtain efficient and stable combustion in the combustion chamber while engine is cold just after the engine started, the power is supplied to the glow plug relay for four minutes just after the engine is started.
- The after-glow control is inhibited under any of the following conditions to ensure the engine condition and drivability.
  ( ) indicates the related input/output device.

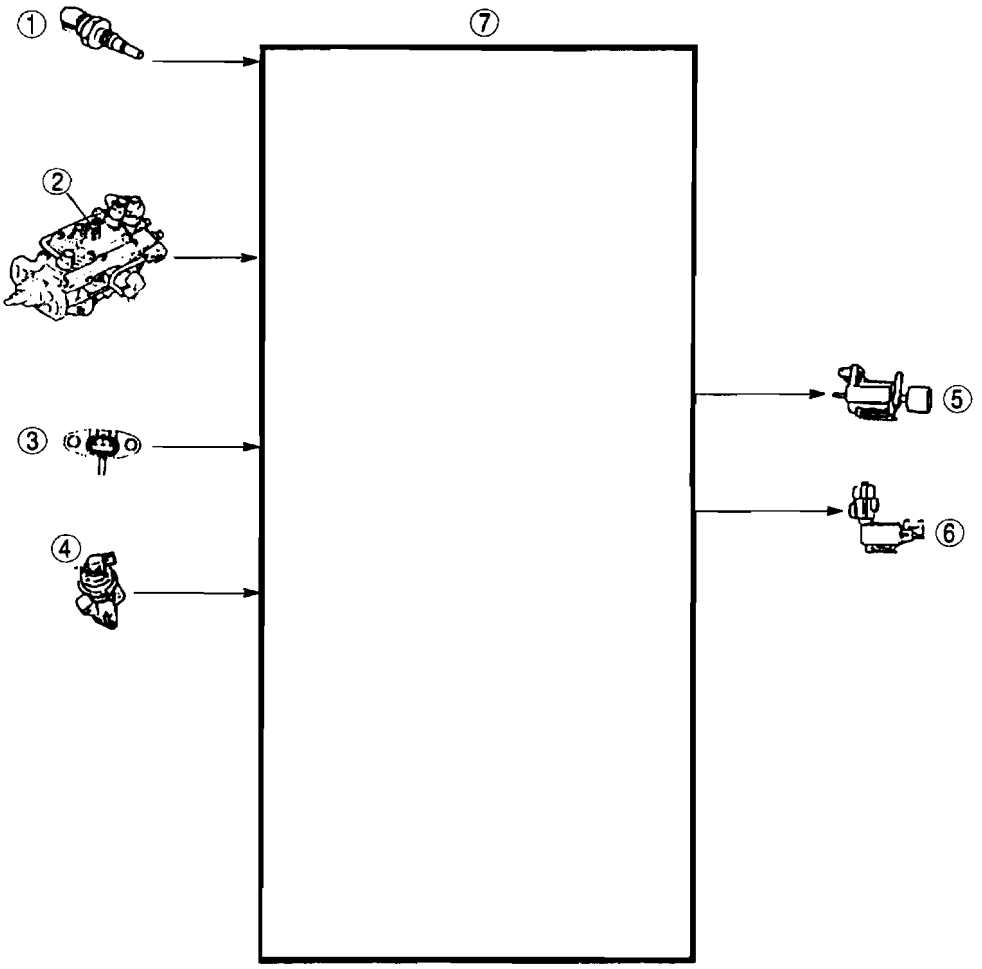
- Engine coolant temperature is above 10°C {50 °F}. (Engine coolant temperature sensor)

EGR CONTROL

Outline

- The PCM recirculates the exhaust gas, which is controlled to be optimal according to the engine condition, to the combustion chamber to slow the combustion and lower the combustion temperature, reducing the amount of NOx in exhaust gas.

Block Diagram



1	ECT sensor
2	Pump speed sensor
3	Boost sensor
4	EGR valve position sensor

5	EGR solenoid valve (vacuum)
6	EGR solenoid valve (vent)
7	PCM

Target EGR valve position

- The basic EGR valve position is determined in the PCM according to the engine speed and the fuel injection amount injected to each cylinder. The target EGR valve position is determined by adding corrections such as engine coolant temperature, atmospheric pressure, intake air temperature and accelerator opening angle to the basic EGR valve position.
- After the target EGR position is determined, the actual EGR position is detected by the EGR position sensor, and compared with the target EGR position. Then the PCM outputs the electrical current (duty signal) to the EGR solenoid valves (vent, vacuum) and changes the EGR position to reduce the deviation.
- The EGR control is Inhibited under any of the following conditions to ensure drivability and low-level emission.

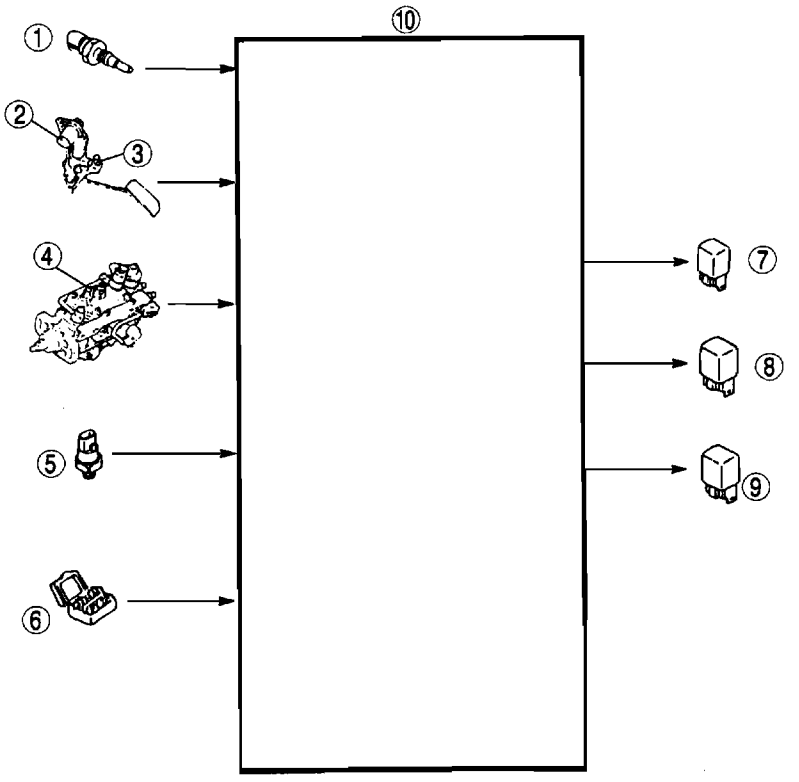
- Engine speed is below 500 rpm.
- Engine coolant temperature is below 60 °C {140 °F}.

ELECTRICAL FAN CONTROL

Outline

- By operating the cooling fan and condenser fan according to the condition of the vehicle, the electrical fan cools the engine and the condenser and thereby improves engine reliability and idling stability.

Block Diagram



1	ECT sensor
2	Accelerator position sensor
3	Idle switch
4	Pump speed sensor
5	Refrigerant pressure switch (A/C equipped)

6	DLC (TEN terminal)
7	A/C relay
8	Cooling fan relay
9	Condenser fan relay
10	PCM

Operating condition

- The operations of the cooling fan and the condenser fan are as follows.

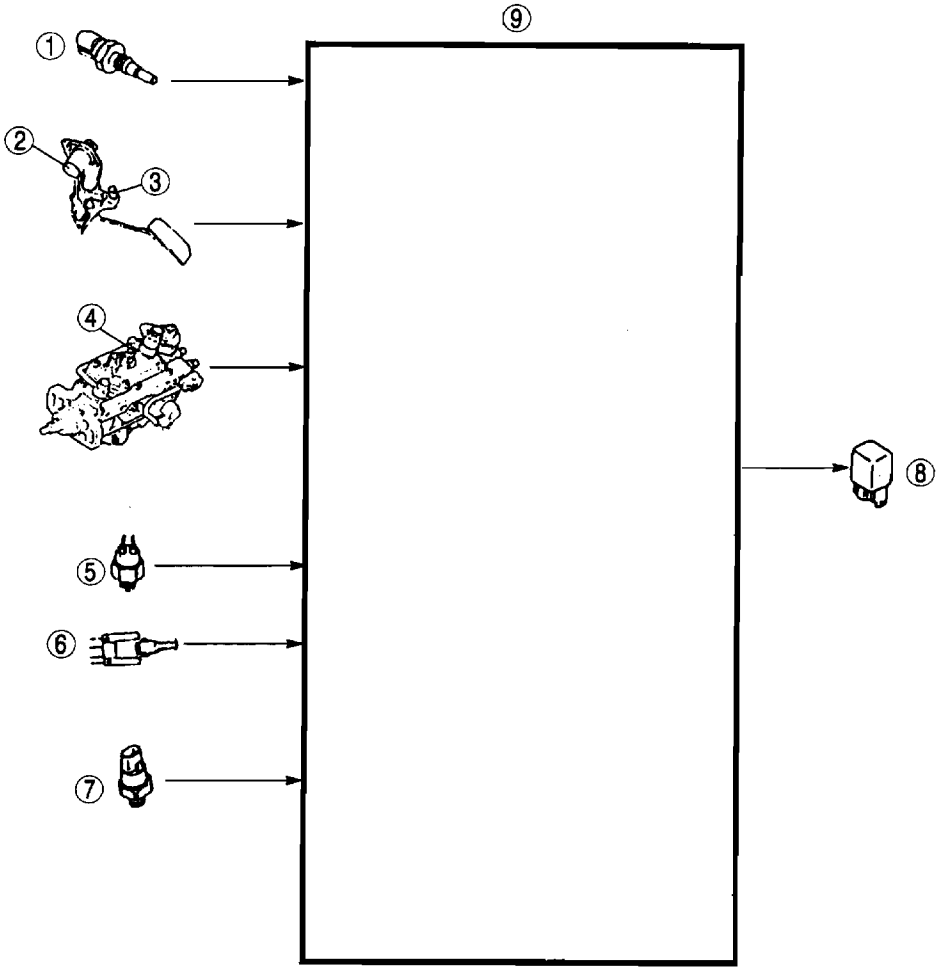
Relay	Operation	Condition
Cooling fan relay	ON	• Engine coolant temperature is above 100°C. • Engine coolant temperature sensor is malfunctioning. • TEN terminal is shorted and accelerator pedal is depressed.
	OFF	Except above
Condenser fan relay	ON	• Engine coolant temperature is above 105°C. • A/C switch is on. • Engine coolant temperature sensor is malfunctioning. • TEN terminal is shorted and accelerator pedal is depressed.
	OFF	Except above

A/C CUT-OFF CONTROL

Outline

- A/C is turned off under any of the following conditions to improve acceleration performance.

Block Diagram



1	ECT sensor
2	Accelerator position sensor
3	Idle switch
4	Pump speed sensor
5	Neutral switch

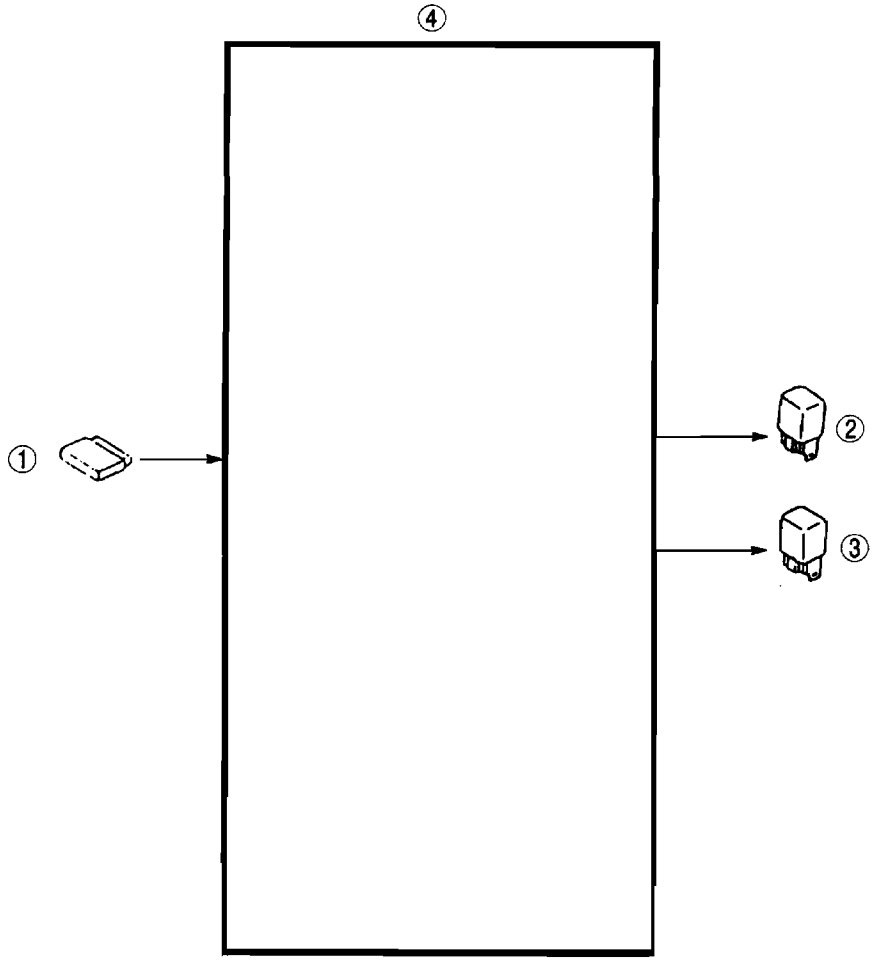
6	Clutch switch
7	Refrigerant pressure switch (A/C equipped)
8	A/C relay
9	PCM

Operating Condition

Engine condition	Condition	A/C cut time (second)
Under heavy load	Vehicle is in gear and accelerator opening angle is above 70%.	5 seconds
Engine coolant temperature is high.	Engine coolant temperature is above 110 °C.	Repeats ON/OFF until engine coolant temperature drops below 105°C

IMMOBILIZER SYSTEM
(If Equipped)

- When the immobilizer system is actuated, the following controls will also be carried out. (Refer to Section T).
  - Spill valve relay: OFF
  - Fuel shut off (FSO) solenoid relay: OFF



1	Immobilizer unit
2	Spill valve relay

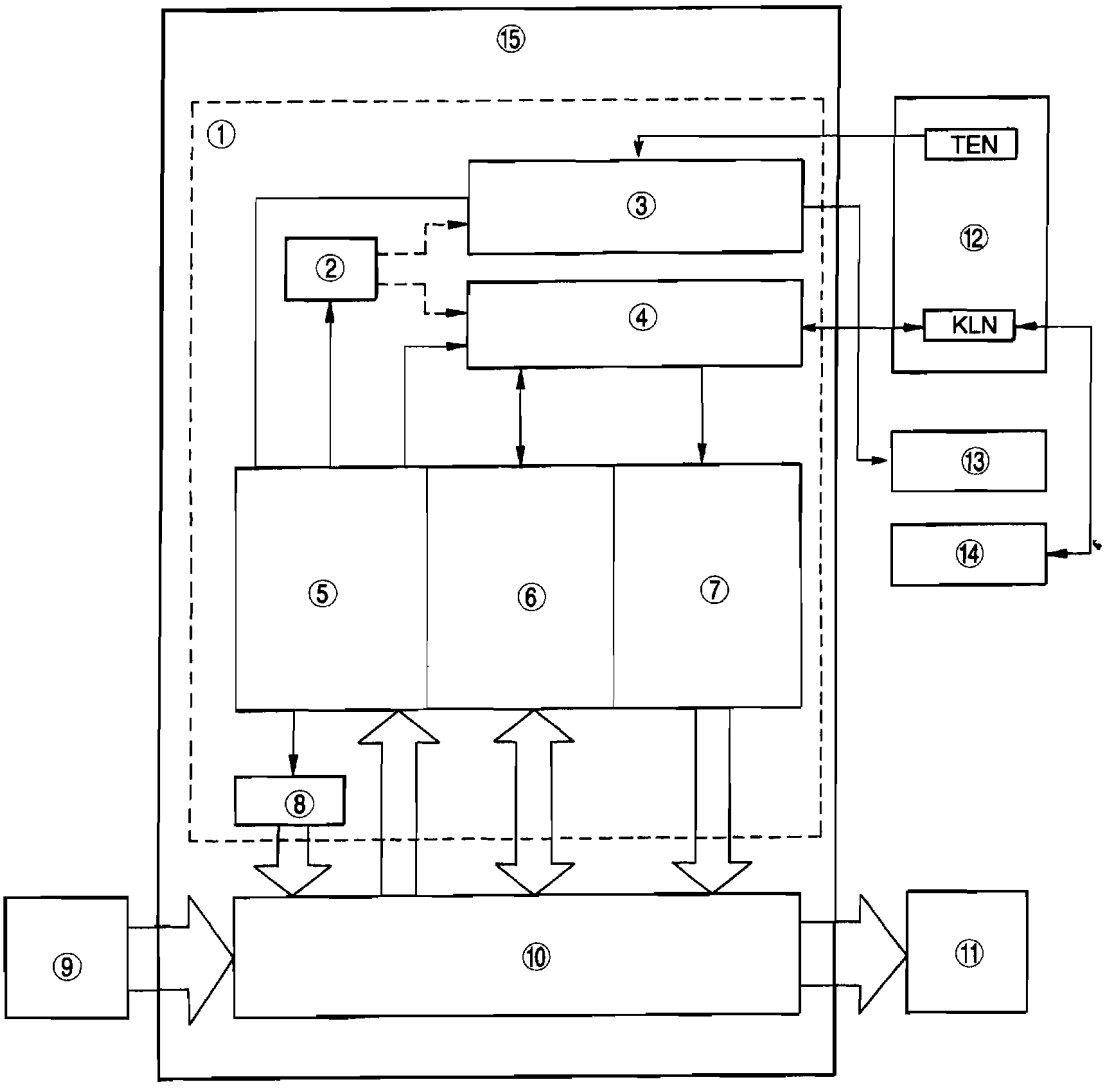
3	FSO solenoid relay
4	PCM

ON-BOARD DIAGNOSTIC SYSTEM

OUTLINE

- The on-board diagnostic system has the following functions:
  - Failure detection function: Detects input/output signal malfunctions
  - PID/DATA MONITOR AND RECORD function: Reads specified input/output signals
  - SIMULATION function: Drives output system parts
- The on-board diagnostic system can be used by connecting the NGS tester to the DLC.

Block diagram



1	Failure diagnosis function
2	Memory function
3	Failure indication function
4	Serial communication function
5	Failure detection function
6	PID/DATA monitor and record function
7	Simulation function
8	Fail-safe function

9	Input parts
10	Normal control range
11	Output parts
12	DLC
13	Glow indicator light
14	NGS tester
15	PCM

Failure detection function
- The failure detection function detects malfunctions in the input/output system (when the engine switch is on or while driving).
- When a failure is detected, the DTCs shown in the table below (Diagnostic Trouble Code (DTC) Table) are output through the failure indication function and the serial communication function to FEN and KLN terminals in the DLC. At the same time, the detection results are also sent to the fail-safe function and the memory function.

Fail-safe function
- The fail-safe function ensures the minimum vehicle driveability by switching the signal judged as a failure in the failure detection function to the preset value and limiting the PCM control.

Memory function
- The memory function memorizes the signal systems judged to be abnormal in the failure detection function. The memory cannot be erased even if the engine switch is turned off (LOCK position) or after recovering from the failure.
- To erase the failure information, disconnect the negative battery cable or use the NGS tester.

Diagnostic Trouble Code (DTC) Table
- The differences in the DTC compared to the Mazda 323 (BA) RF engine model (referred as 323 (BA) hereafter) are as follows:

1. The DTC numbers have been changed to four digits.
2. Though the diagnosed circuits of this model are the same as those of the 323 (BA), the DTC numbers are different from those of the 323 (BA), due to the adoption of fourdigit DTCs.

Note
- The DTC numbers with "*" in the DTC table below differ in the DTC numbers compared to the 323 (BA), though each diagnosed circuit is the same.
- The DTC numbers without "*" are adopted for the new model with RF-Turbo engine.

×: Applied : – Not applied

DTC No.	Output pattern	Diagnosed circuit	Detection condition	Fail-safe	Memory function
P0105		Boost signal circuit	• Input voltage from boost sensor is below 1.95 V or above 4.9 V when engine switch is turned on. • Voltage more than 1.95 V is inputted from boost sensor to PCM when engine speed is above 2400 rpm and accelerator opening angle is more than 52 %.	• Fixes intake air pressure at 760 mmHg (2.65 V).	×
P0110		Intake air temperature signal circuit	• Input voltage from IAT No.1 sensor is below 0.142 V or above 4.915 V.	• Fixes IAT at 40°C {104°F} (1.49 V).	×
P0115*		Engine coolant temperature signal circuit	• Input voltage from ECT sensor is below 0.142 V or above 4.915 V.	• Fixes ECT at 60°C {140°F}.	×
P0120*		Accelerator position signal circuit	• Input voltage from accelerator position sensor is below 0.3 V or above 4.7 V when continued for 0.06 sec. • Output voltage from accelerator position sensor is above 1.6 V for 0.3 sec. continuously when idle switch is turned on.	• Fixes fuel injection amount.	×

×: Applied : – Not applied

DTC No.	Output pattern	Diagnosed circuit	Detection condition	Fail-safe	Memory function
P0180*		Fuel temperature signal circuit	• Input voltage from frel temperature sensor is below 0.142 V or above 4.915 V.	• Fixes FT at 30°C (1.91 V).	×
P0216		Injection timing system	• The actual injection timing deviates from the target injection timing by 7° continuously after the engine warm-up or while driving continuously for 20 sec.	–	×
P0219		Spill valve control signal circuit	• The engine speed signal above 5600 rpm is inputted to the PCM for 1.0 sec. • PCM cannot control engine though accelerator pedal is released.	• Turns spill valve relay off. • Turns FSO solenoid relay off. • Turns spill valve control signal off.	×
P0335*		Crankshaft position signal circuit	• Crankshaft position signal is not inputted to the PCM when the engine speed is above 400 rpm.	• Fixes TCV control signal (duty signal) at 2%.	×
P0380		Glow plug relay signal circuit	• When the glow plug relay is on, the current voltage signal of the relay below 1.0 V is inputted to the PCM continuously for more than 1.0 sec. • When the glow plug relay is off, the current voltage signal of the relay above 4.0 V is inputted to the PCM continuously for more than 1.0 sec.	• Turns glow plug relay off.	×
P0403		EGR system	• Difference of more than 20% between EGR lift sensor output value and EGR command signal sent from PCM is inputted continuously to PCM for more than 20 seconds.	• Turns EGR solenoid valve (vacuum, vent) off.	×
P0500		Vehicle speed signal circuit	• Vehicle speed signal is less than 0 km/h {0 mph} for more than 5.0 sec. while driving in following condition: – Engine speed is over 2800 rpm. – Neutral switch is off.	• Sets vehicle speed 0 km/h {0 mph}. • Operates A/C cut control.	×
P0510*		Idle switch signal circuit	• PCM detects for more than 1.0 second that output voltage from accelerator position sensor is below 1.05 V with idle switch off.	–	×
P0606		PCM internal circuit	• PCM does not read DTC from output devices.	–	×
P1110		Intake air temperature signal circuit	• Input voltage from IAT No.2 sensor is below 0.142 V or above 4.915 V when continued for 0.5 sec.	• Fixes IAT at 40°C (1.49 V)	×

×: Applied : – Not applied

DTC No.	Output pattern	Diagnosed circuit	Detection condition	Fail-safe	Memory function
P1182*		Fuel shut off (FSO) solenoid signal circuit	• PCM 2D terminal voltage stays under the preset voltage for more than 2.0 sec. after turning engine switch off.	• Turns spill valve relay off.	×
P1189*		NE signal circuit	• PCM cannot detect NE signal though engine is rotating	–	×
P1196		Engine switch signal circuit	• Input signal from starter to PCM continues for more than 10 sec. while engine speed is over 1200 rpm.	• Turns starter signal off.	×
P1298		IDM internal circuit	• Command signal is output from PCM to IDM, but conformation signal is not output from IDM to PCM.	• Turns spill valve off. • Turns spill valve relay off.	×
P1402		EGR valve position signal circuit	• Input voltage from EGR valve position sensor is below 0.25 V or above 4.75 V when continued for 1.0 sec.	• Turns EGR solenoid valve (vacuum vent) off.	×
P1602* (with immobilizer system)		Immobilizer unit–PCM communication line	• Command transmission from PCM to immobilizer unit exceeds limit. No response from immobilizer unit.	–	–
P1603* (with immobilizer system)		ID number is unregistered. (Immobilizer)	• Code word is not registered in PCM.	–	–
P1604* (with immobilizer system)		Code word is unregistered. (Immobilizer)	• Key ID numbers are not registered in PCM.	–	–
P1621* (with immobilizer system)		Code words do not match. (Immobilizer)	• Code word stored in PCM and immobilizer unit do not match.	–	–
P1622* (with immobilizer system)		ID numbers do not match. (Immobilizer)	• ID numbers stored in immobilizer unit and PCM do not match. (This DTC is indicated only after immobilizer unit is replaced and reprogramming system.)	–	–
P1623* (with immobilizer system)		Code word/ID number writing and reading error (Immobilizer)	• PCM internal EEPROM malfunction.	–	–
P1624* (with immobilizer system)		PCM does not receive unlock signal from immobilizer unit. (PCM is okay.)	• PCM detects immobilizer system malfunction more than three times.	–	–

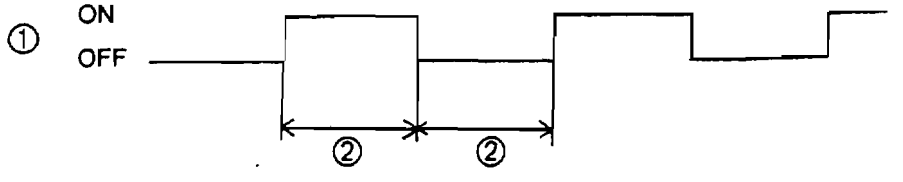
DTC No.	Output pattern	Diagnosed circuit	Detection condition	Fail-safe	Memory function
P1649*		PCM internal circuit	• PCM failed to communicate with injection pump EPROM. (User warning light flashes.)	–	×

Diagnostic trouble code and user's warning display (glow indicator light) table

×: Applied : – Not applied

DTC	Related part	Malfunction confirmation condition	User's warning display *2 (Glow indicate light)	
			Flash	Illuminate
P0105	Intake air pressure sensor	Engine is started or engine switch on.	×	–
P0110	Intake air temperature (1AT) sensor No.1	Engine is started or engine switch on.	×	–
P0115	Engine coolant temperature (ECT) sensor	Engine is started or engine switch on.	×	–
P0120	Accelerator position sensor	Engine is started or engine switch on.	×	–
P0180	Fuel temperature sensor	Engine is started or engine switch on.	×	–
P0216	Injection timing system	Engine is started.	×	–
P0219	Spill valve	Engine is started.	×	–
P0335	TDC sensor	Engine is started.	×	–
P0380	Glow plug relay	Engine is started or engine switch on.	×	–
P0403	EGR system	Engine is started.	×	–
P0500	Vehicle speed sensor	Engine is started.	×	–
P0510	Idle switch	Engine is started or engine switch on.	×	–
P0606	PCM	Engine is started or engine switch on.	×	–
P1110	Intake air temperature (1AT) sensor No.2	Engine is started or engine switch on.	×	–
P1182	Fuel shut off (FSO) solenoid	Engine is started or engine switch on.	×	–
P1189	Pump speed sensor	Engine is started.	×	–
P1196	Engine switch	Engine is started.	×	–
P1298	IDM	Engine is started.	×	–
P1402	EGR valve position sensor	Engine is started or engine switch on.	×	–
P1602*1	Immobilizer	Engine is started or engine switch on.	–	–
P1603*1	Immobilizer	Engine is started or engine switch on.	–	–
P1604*1	Immobilizer	Engine is started or engine switch on.	–	–
P1621*1	Immobilizer	Engine is started or engine switch on.	–	–
P1622*1	Immobilizer	Engine is started or engine switch on.	–	–
P1623*1	Immobilizer	Engine is started or engine switch on.	–	–
P1624*1	Immobilizer	Engine is started or engine switch on.	–	–
P1649	Injection pump EPROM	Engine is started or engine switch on.	×	–
–	PCM	Engine is started or engine switch on.	–	×

*1: With immobilizer system.
*2: User's warning will be indicated as shown, when DLC TEN terminal is OFF.



1	Glow indicator light	2	1 sec.

PID/DATA MONITOR AND RECORD function

- The Mazda 323 (BA) RF engine model does not have PID/DATA MONITOR items, but the following PID/DATA MONITOR items have been incorporated in the new model with RF-Turbo engine.

PID/DATA MONITOR Table

Monitor item (Display on NGS tester)	Monitoring item	Condition/unit		PCM terminal
A/C RLY	A/C relay	ON/OFF		1Q
A/C SW	A/C switch	ON/OFF		1S
B+	Battery positive voltage	V		1B
BARO	Barometric pressure	kPa	Hg	–
CTP SW	Idle switch	ON/OFF		1T
ECT	Engine coolant temperature	°C	°F	2G
ECT V	Engine coolant temperature signal voltage	V		2G
EGRP V	EGR valve position signal voltage	V		2J
EGRVAC	EGR solenoid valve (vacuum)	%		1K
EGRVENT	EGR solenoid valve (vent)	%		1O
FAN2	Condenser fan control	ON/OFF		1N
FAN3	Cooling fan control	ON/OFF		3Q
FLT	Fuel temperature sensor	°C	°F	2I
FLT V	Fuel temperature signal voltage	V		2I
IAT	Intake air temperature (IAT) sensor No.1	°C	°F	2E
IAT V	Intake air temperature (IAT) No.1 signal voltage	V		2E
IATDC	Intake air temperature (IAT) sensor No.2	°C	°F	2K
IATDC V	Intake air temperature (IAT) No.2 signal voltage	V		2K
IG SW	Engine switch	ON/OFF		1F
MAP	Boost sensor	kPa	Hg	2C
MAP V	Boost signal voltage	V		2C
NL SW	Load/no load condition signal	ON/OFF		1V
RPM	Engine speed	rpm		3G, 3H
TEN	TEN terminal (in DLC)	ON/OFF		3P
TP V	Accelerator position signal voltage	V		2F
VS	Vehicle speed	KMH	KPH	3L

SIMULATION function

- The Mazda 323 (BA) RF engine model does not have SIMULATION items, but the following SIMULATION items have been incorporated in the new model with RF-Turbo engine.

Simulation Test Table

×: Applied : - Not applied

Simulation item (Display on NGS tester)	Full name	Operation	Test condition		PCM terminal
			IG ON	IDLE	
A/C RLY	A/C relay	ON or OFF	×	×	1Q
EGRVAC	EGR solenoid valve (vacuum)	Actuates by any duty value (0–100%)	×	×	1K
EGRVENT	EGR solenoid valve (vent)	Actuates by any duty value (0–100%)	×	×	1O
FAN3	Cooling fan relay	ON or OFF	×	×	3Q
FSOVRLY	Fuel shut off (FSO) solenoid	OFF	×	–	2D, 3X
GLW LP	Glow indicator light	ON	×	×	1M
GLW RLY	Glow plug relay	ON	×	×	3W
SPV RLY	Spill valve relay	OFF	×	×	1D

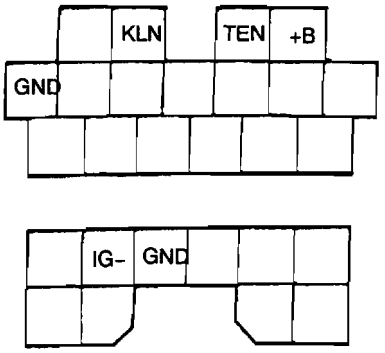
Data link connector (DLC)

Function

- The DLC is the concentrated connector for sending/receiving the aforementioned functions to each tester.

Terminal description

- The DLC consists of a 17–pin connector in which +B, and GND terminals are located.



Terminal	Function	Remark	
KLN	• Outputs diagnostic trouble codes related to PCM • PID/DATA MONITOR AND RECORD function • SIMULATION function	NGS communication line	Connected to **SST**
TEN	PCM test	Terminal grounded=Test mode	
+B	Battery positive voltage for **SST**	–	
IG–	For engine speed measurement	Connected to tachometer	
GND	Ground	–	

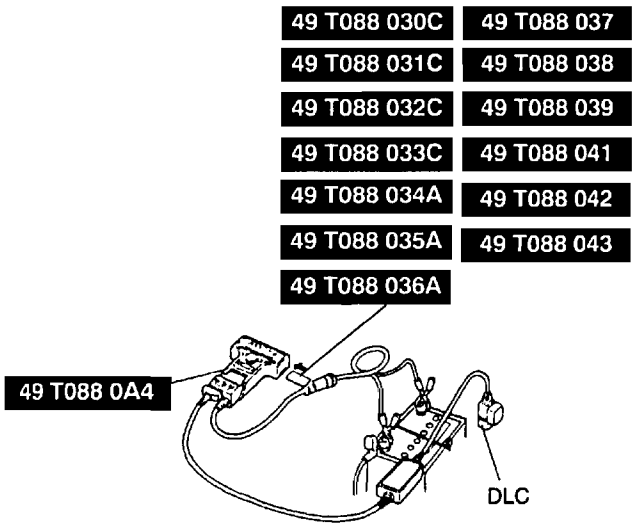
ENGINE TUNE-UP

ENGINE TUNE-UP PREPARATION

1. Warm up the engine to normal operating temperature.
2. Shift the transmission into neutral.
3. Turn off all electrical loads.
   - Headlight switch
   - Fan switch
   - Rear window defroster switch
   - A/C switch
4. Verify that the battery is fully charged. (Refer to section G, CHARGING SYSTEM, BATTERY INSPECTION).
5. Turn the engine switch on and let the engine idle.
6. Verify that no DTC is displayed. (Refer to ON-BOARD DIAGNOSTIC SYSTEM, DTC READING PROCEDURE.)

Using the SST (NGS tester)

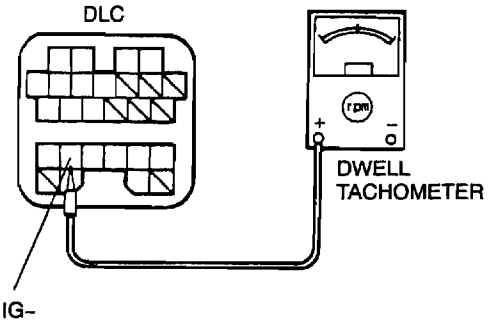
1. Connect the **SST** (NGS tester) to the data link connector (DLC) and select "PID/DATA MONITOR AND RECORD". (Refer to ON-BOARD DIAGNOSTIC SYSTEM, ON-BOARD DIAGNOSTIC TEST, New Generation Star (NGS) Tester Hook-up Procedure.)



2. Access RPM PID. Press the trigger key to enter this selection. (Refer to ON-BOARD DIAGNOSTIC SYSTEM, PID/DATA MONITOR AND RECORD PROCEDURE.)
3. Wait until the electrical fan stops.

Not Using the SST

1. Connect a dwell tachometer to the DLC terminal IG-.



2. Wait until the electrical fan stops.

IDLE SPEED INSPECTION

1. Perform "ENGINE TUNE-UP PREPARATION". (Refer to ENGINE TUNE-UP, ENGINE TUNE-UP PREPARATION.)
2. Verify that the value of the RPM PID or dwell tachometer is with in the specification.

   Specification
   750—800 (775 ± 25) rpm

3. If not as specified, inspect the following.
   - Accelerator position sensor
   - Engine coolant temperature (ECT) sensor
   - Vehicle speed sensor
   - Engine switch
   - Neutral switch
   - Clutch switch
   - Starter
4. If the devices are normal, replace the PCM.

IDLE-UP SPEED INSPECTION

1. Perform the "ENGINE TUNE-UP PREPARATION" and "IDLE SPEED INSPECTION". (Refer to ENGINE TUNE-UP, ENGINE TUNE-UP PREPARATION, IDLE SPEED INSPECTION.)
2. Turn the A/C switch or fan switch on.
3. Verify that the idle speed is within the specification.

   Specification
   750—800 (775 ± 25) rpm

4. If it does not idle up, inspect output voltage of the A/C switch and fan switch.
5. Verify that it runs at the idle speed when the A/C switch or the blower switch is turned to off.
6. If not within the specification, perform the "IDLE SPEED INSPECTION".

INJECTION TIMING INSPECTION

Note
- The injection timing adjustment of this engine is maintenance-free.
- The injection timing is adjusted by the PCM when the injection pump is installed according to the following procedure.

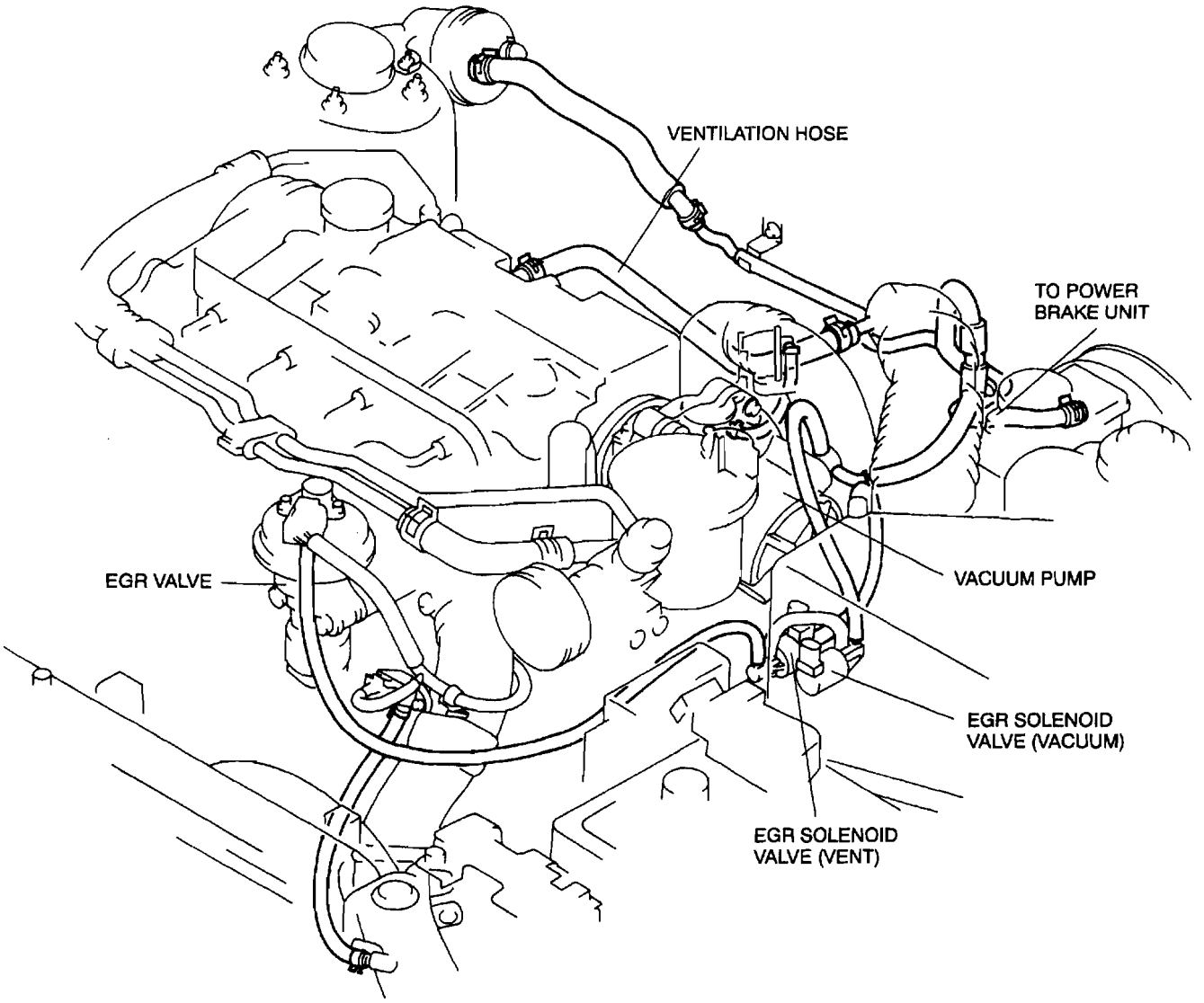
1. Loosen two injection pump mounting nuts and a bolt.
2. Install the injection pump so that the worked part of the injection pump bracket is fitted within the two marks on the injection pump flange. (Refer to FUEL SYSTEM, INJECTION PUMP REMOVAL/INSTALLATION.)
3. Tighten injection pump mounting nuts and bolt.

Tighten torque
19—25 N·m{1.9—2.6 kgf·m, 14—18 ft·lbf}

4. If the injection timing cannot be adjusted or is abnormal, the DTCs are indicated by the blinking of the indicator light. If the glow indicator light blinks, repair according to the "Diagnostic Trouble Code Troubleshooting." (Refer to ON-BOARD DIAGNOSTIC SYSTEM, ON-BOARD DIAGNOSTIC TROUBLE CODE INSPECTION, Diagnostic Trouble Code Troubleshooting.)

INTAKE-AIR SYSTEM

VACUUM HOSE ROUTING DIAGRAM

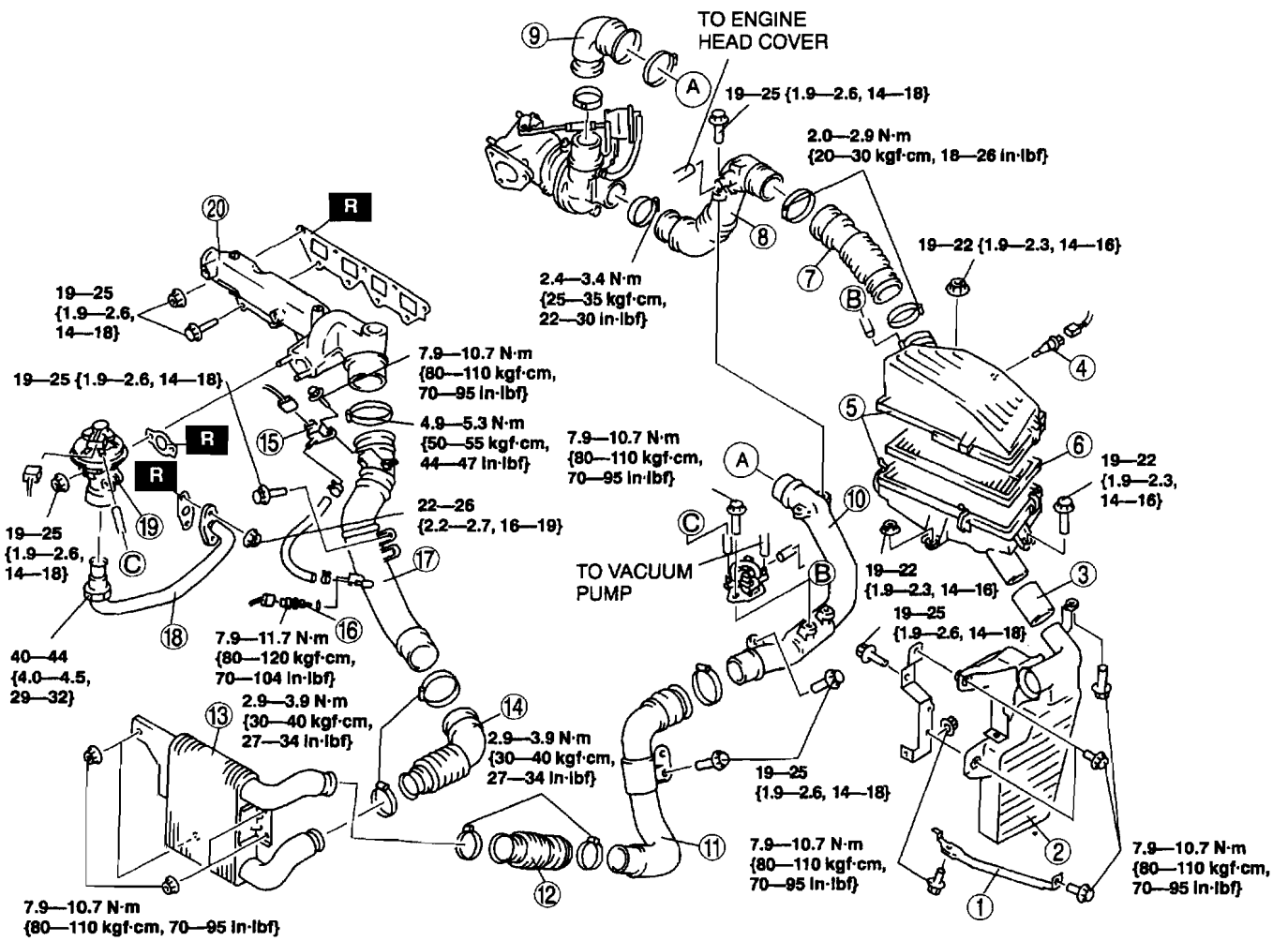


INTAKE-AIR SYSTEM REMOVAL/INSTALLATION

Warning

- **When the engine and intake-air system are hot, they can badly burn. Turn off the engine and wait until they are cool before removing or installing the intake-air system.**
- **Fuel vapor is hazardous. It can easily ignite, causing serious injury and damage. Always keep sparks and flames away from fuel.**
- **Fuel line spills and leakage are dangerous. Fuel can ignite and cause serious injuries or death and damage. Fuel can also irritate skin and eyes. To prevent this, always complete the following "Fuel Line Safety Procedure".**

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



N·m {kgf·m, ft·lbf}

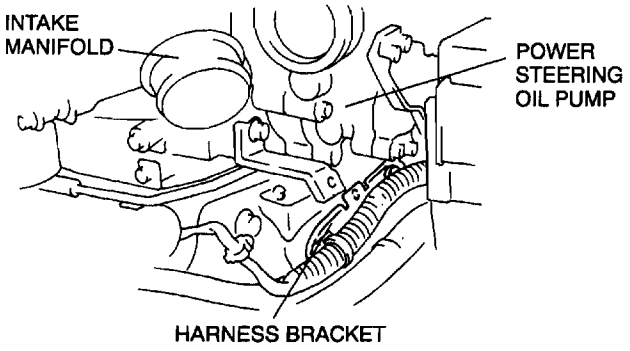
1	Fender stay
2	Fresh-air duct ☞ Removal Note
3	Joint hose
4	Intake air temperature sensor
5	Air cleaner
6	Air cleaner element
7	Air hose
8	Air pipe
9	Air hose
10	Air pipe ☞ Removal Note

11	Air pipe
12	Rubber joint
13	Charge air cooler
14	Air hose
15	Boost sensor
16	Intake air temperature sensor
17	Air pipe
18	EGR pipe ☞ Removal Note
19	EGR valve
20	Intake manifold ☞ Removal Note

Fresh-air Duct Removal Note
- Remove the front bumper before removing the fresh-air duct. (Refer to section S.)

Air Pipe Removal Note
- Remove the battely and the battery tray before removing the air pipe. (Refer to section G, CHARGING SYSTEM, BATTELY REMOVAL/INSTALLATION.)

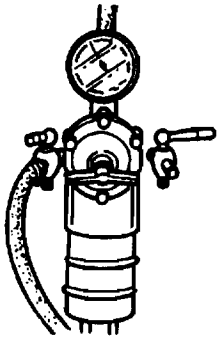
EGR Pipe Removal Note
- Put the harness bracket aside to prevent it from getting in the way during removal.



Intake Manifold Removal Note
- Remove the injection pump before removing the intake manifold. (Refer to FUEL SYSTEM, INJECTION PUMP REMOVAL/INSTALLATION.)
- Drain the engine coolant from the radiator before removing the intake manifold. (Refer to section E, COOLING SYSTEM SERVICE WARNINGS.) (Refer to section E, ENGINE COOLANT, ENGINE COOLANT REPLACEMENT.)

TURBOCHARGER INSPECTON
Wastegate Actuator Inspection

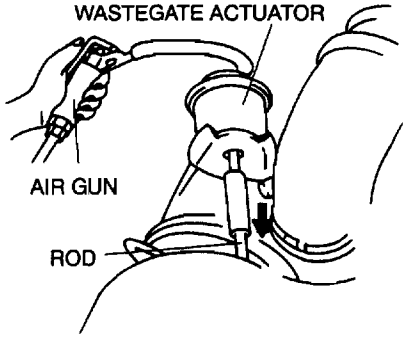
Caution
- **Compressed air used in the workshop is highly pressurized and can damage the actuator. Adjust the air pressure with a transformer, and inspect the actual pressure using an air gun before actual use. Stop blowing air if the rod moves.**



1. Disconnect the air hose of the wastegate actuator on the compressor housing side.
2. Connect an air gun to the wastegate actuator.
3. Apply the compressed air gradually and verify that the compressed air is within the specification when the rod of the wastegate actuator starts to move.

Note
- The following pressure indicates absolute pressure.

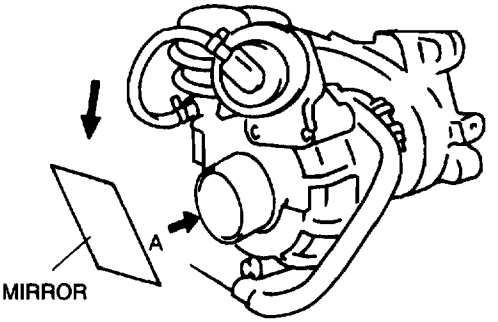
Specification
245.6—257.5 kPa
{2.505—2.625 kgf/cm^2, 35.63—37.32 psi}

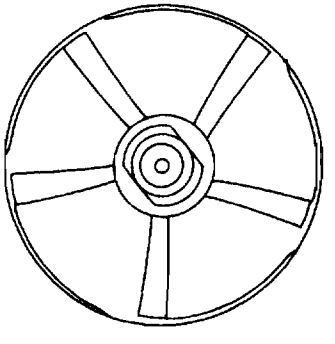


4. If not as specified, replace the turbocharger. (Refer to EXHAUST SYSTEM, EXHAUST SYSTEM REMOVAL/INSTALLATION.)

Compressor Wheels Inspection
1. Remove the air pipe between the air cleaner and the turbocharger. (Refer to INTAKE-AIR SYSTEM, INTAKE-AIR SYSTEM REMOVAL/INSTALLATION.)
2. Visually inspect the compressor wheel from view A and verify that all fins are free from damage, cracks or bends.

Note
- To make the inspection easier, set a small mirror as shown in the figure and use a penlight.
- If the compressor wheel is interfering with the compressor housing, it is likely that the fin edges are cracked, damaged, or bent.





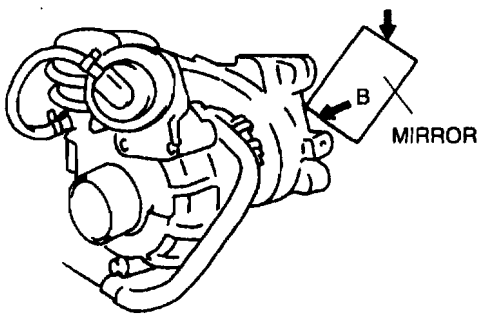
3. If there are damaged fins, cracks or bends, replace the turbocharger. (Refer to EXHAUST SYSTEM, EXHAUST SYSTEM REMOVAL/INSTALLATION.)

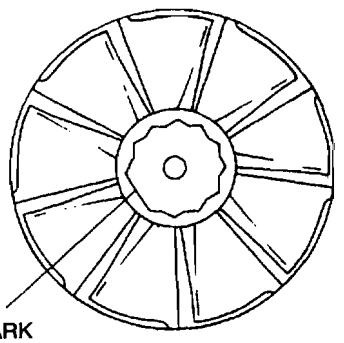
Turbine Wheels Inspection

1. Remove the joint pipe. (Refer to EXHAUST SYSTEM, EXHAUST SYSTEM REMOVAL/INSTALLATION.)
2. Visually inspect the turbine wheel from view B and verify that all fins are free from damage, cracks or bends.

Note

- To make the inspection easier, set a small mirror as shown in the figure and use a penlight.
- If the turbine wheel is interfering with the turbine housing, it is likely that the fin edges are cracked, damaged, or bent.





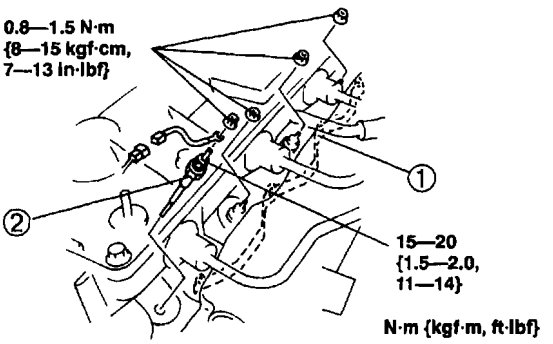
3. If there are damaged fins, cracks or bends, replace the turbocharger. (Refer to EXHAUST SYSTEM, EXHAUST SYSTEM REMOVAL/INSTALLATION.)

GLOW PLUG REMOVAL/INSTALLATION

Caution

- **Do not damage the heated section of the glow plug.**
- **Do not reuse a glow plug that has been dropped from a height of 10 cm {0.4 in} or more.**
- **When removing the glow plug, first loosen it at least one pitch using a tool, then loosen by hand.**

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



1	Glow plug lead
2	Glow plug

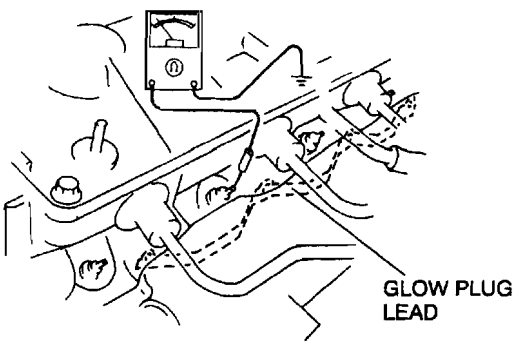
GLOW PLUG INSPECTION
Resistance Inspection

Note

- Perform the following test only when directed.

1. Carry out the "Glow System Inspection". (Refer to TROUBLESHOOTING, SYSTEM INSPECTION, Glow System Inspection.)
2. If not as specified, do as follows.
3. Remove the glow plug lead from the glow plug.
4. Inspect the resistance between the glow plug terminal and the cylinder head.

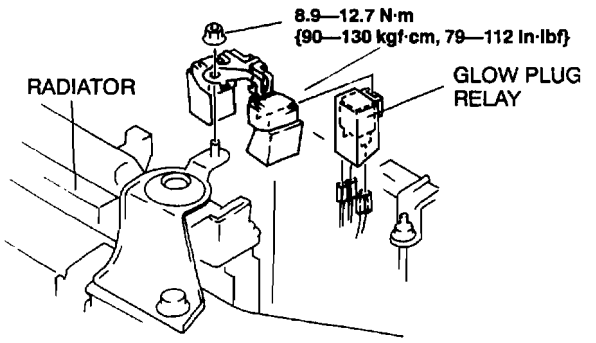
Specification
Glow plug resistance
Approx. 0.6Ω [20 °C {68 °F}]



5. If not as specified, replace the glow plug. (Refer to INTAKE-AIR SYSTEM, GLOW PLUG REMOVAL/INSTALLATION.)
6. Install the glow plug lead to the glow plug.

GLOW PLUG RELAY REMOVAL/INSTALLATION

1. Disconnect the negative battery cable.
2. Remove the glow plug relay.
3. Install the glow plug relay.



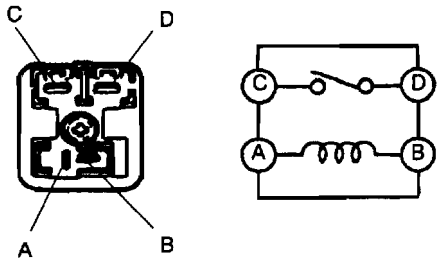
4. Connect the negative battery cable.

GLOW PLUG RELAY INSPECTION

Continuity Inspection

Note
- Perform the following test only when directed.

1. Carry out the "Glow System Inspection". (Refer to TROUBLESHOOTING, SYSTEM INSPECTION, Glow System Inspection.)
2. Remove the glow plug relay.
3. Inspect for continuity between terminals C and D of the glow plug relay under the following conditions.

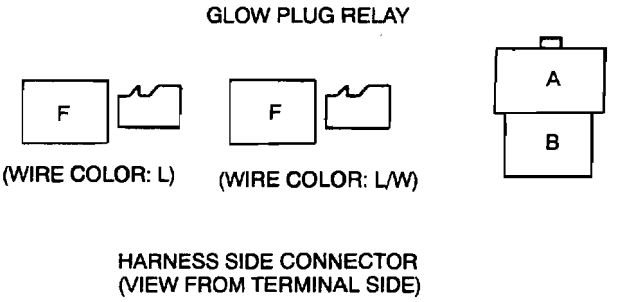


O—O : Continuity

Step	A	B	C	D
1	O—O			
2	B+	Ground	O—O	

4. If there is no continuity, replace the glow plug relay. If as specified but the System Inspection is failed, inspect the following:

Open circuit
- Power circuit (Glow plug relay connector terminal F (1-pin: L) and battery through common connector)
- Power circuit (Glow plug relay connector terminal A (2-pin) and PCM connector terminal 3W through common connector)
- Ground circuit (Glow plug relay connector terminal F (1-pin: L/W) and glow plug lead through common connector)
- Ground circuit (Glow plug relay connector terminal B (2-pin) and engine ground through common connector)
- Glow voltage circuit (Glow plug relay connector terminal F (1-pin: L/W) and PCM connector terminal 2M through common connector)



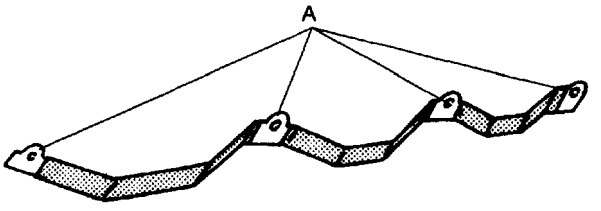
Short circuit
- Glow plug relay connector terminal F (1-pin: L) and battery through common connector to ground
- Glow plug relay connector terminal A (2-pin) and PCM connector terminal 3W through common connector to ground
- Glow plug relay connector terminal F (1-pin: L/W) and PCM connector terminal 2M througn common connector to ground

5. Repair or replace faulty areas.
6. Install the glow plug relay.

GLOW PLUG LEAD INSPECTION

1. Remove the glow plug lead from the glow plug. (Refer to INTAKE-AIR SYSTEM, GLOW PLUG REMOVAL/INSTALLATION.)
2. Verify that the glow plug lead is not broken or bent.
3. Verify there is continuity at both ends of the glow plug lead.

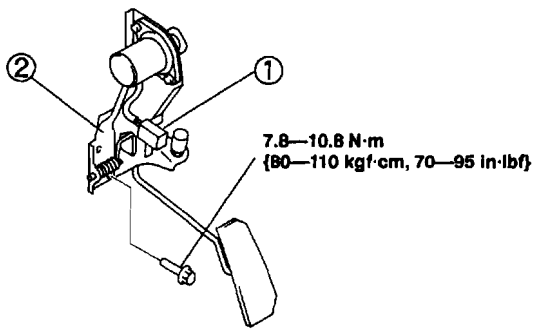
Note
- When inspecting for continuity in the glow plug lead, do not let the uncovered parts (A) come into contact with other parts and be shorted.



4. If there is no continuity, replace the glow plug lead.

ACCELERATOR PEDAL COMPONENT REMOVAL/INSTALLATION

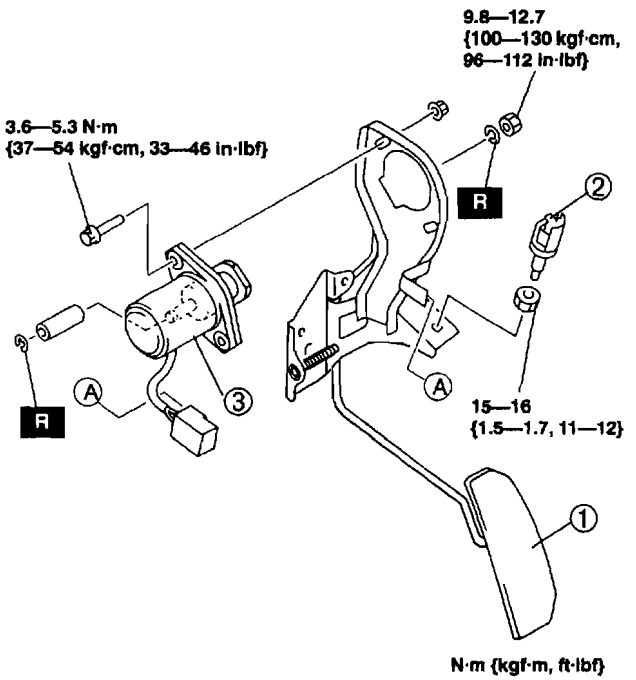
1. Disconnect the negative battery cable.
2. Remove in the order indicated in the table.
3. Install in the reverse order of removal.
4. Perform "IDLE SPEED INSPECTION" (Refer to ENGINE TUNE-UP, IDLE SPEED INSPECTION.)



1	Accelerator position sensor connector
2	Accelerator pedal component

ACCELERATOR PEDAL DISASSEMBLY/ASSEMBLY

1. Disassemble in the order indicated in the table.
2. Assemble in the reverse order of disassembly.
3. Perform "IDLE SPEED INSPECTION" (Refer to ENGINE TUNE-UP, IDLE SPEED INSPECTION.)



1	Accelerator pedal ☞ INTAKE-AIR SYSTEM, FULLY OPEN STOPPER ADJUSTMENT
2	Idle switch ☞ INTAKE-AIR SYSTEM, IDLE SWITCH ADJUSTMENT
3	Accelerator position sensor ☞ INTAKE-AIR SYSTEM, ACCELERATOR POSITION SENSOR ADJUSTMENT

ACCELERATOR POSITION SENSOR ADJUSTMENT

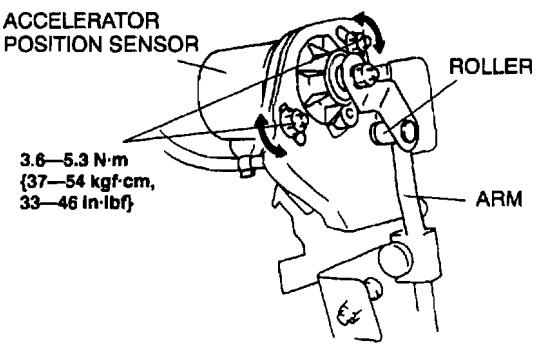
After assembling the accelerator position sensor and connecting the accelerator position sensor connector, perform the following.

1. Confirm that the accelerator pedal is not depressed.
2. Confirm that the voltage of the PCM 2F terminal (accelerator position sensor) is within specification.

   Specification
   0.75—0.95 V

3. If as specified, perform "IDLE SWITCH ADJUSTMENT". If not as specified, adjust the installation position by moving the accelerator position sensor so that the voltage is within specification.

   Note
   - Make sure there is no space between the arm and roller.

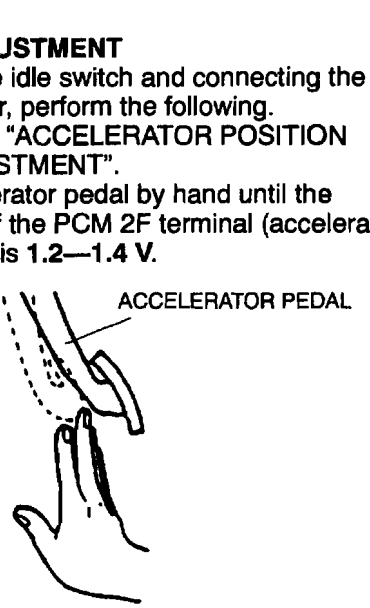


4. If as specified, perform "IDLE SWITCH ADJUSTMENT". If not as specified, perform "ACCELERATOR POSITION SENSOR INSPECTION". (Refer to CONTROL SYSTEM, ACCELERATOR POSITION SENSOR INSPECTION.)

IDLE SWITCH ADJUSTMENT

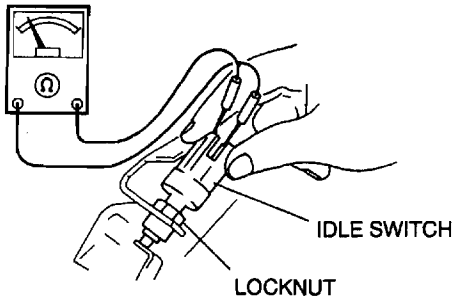
After assembling the idle switch and connecting the idle switch connector, perform the following.

1. Perform steps in "ACCELERATOR POSITION SENSOR ADJUSTMENT".
2. Press the accelerator pedal by hand until the output voltage of the PCM 2F terminal (accelerator position sensor) is **1.2—1.4 V**.



3. Move the idle switch with the accelerator pedal as described in Step 2, and install a locknut where there is continuity in the idle switch.

Tightening torque
15—16 N·m {1.5—1.7 kgf·m, 11—12 ft·lbf}



4. Press the accelerator pedal gradually by hand and verify that the output voltage of the PCM 2F terminal (accelerator position sensor) is within the specification when the output voltage of the PCM 1T terminal (idle switch) changes to B+ from below 1.0 V.

Specification
1.2—1.4 V

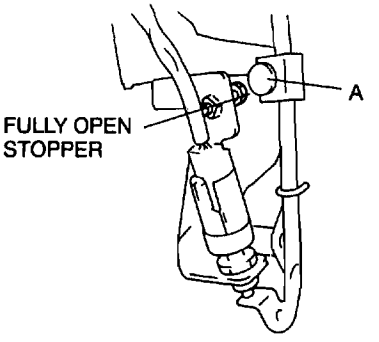
5. If not as specified, loosen the locknut, adjust the position of the idle switch, and verify again by following the procedure in Step 4.
6. If the output voltage of the PCM 2F terminal (accelerator position sensor) is still out of specification, perform the "IDLE SWITCH INSPECTION". (Refer to CONTROL SYSTEM, IDLE SWITCH INSPECTION.)
7. Release the accelerator pedal gradually and verify that the output voltage of the PCM 2F terminal (accelerator position sensor) is within the specification when the output voltage of the PCM 1T terminal (idle switch) changes to below 1.0 V from B+.

Specification
1.2—1.4 V

8. If not as specified, loosen the locknut, adjust the position of the idle switch, and verify again by following the procedure in Step 7.
9. If the output voltage of the PCM 2F terminal (accelerator position sensor) is still out of specifocation, perform the "IDLE SWITCH INSPECTION". (Refer to CONTROL SYSTEM, IDLE SWITCH INSPECTION.)

FULLY OPEN STOPPER ADJUSTMENT
After assembling the accelerator pedal, perform the following.

1. Press the accelerator pedal by hand until the fully open stopper comes in contact with A shown in the figure.



2. Confirm that the voltage of the PCM 2F terminal (accelerator position sensor) is within specification.

Specification
3.60—3.88 V

3. If not as specified, tighten the fully open stopper and adjust the position of the fully open stopper, so that the voltage of the PCM 2F terminal is within specification under the condition of Step 1.

Tightening torque
4.21—6.17 N·m
{43.0—62.9 kgf·cm, 37.4—54.5 in·lbf}

FUEL SYSTEM

BEFORE REPAIR PROCEDURE

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

- Fuel in the fuel system is under high pressure when the engine is not running.

Warning
- **Fuel line spills and leakage are dangerous. Fuel can ignite and cause serious injuries or death and damage. Fuel can also irritate skin and eyes. To prevent this, always complete the following "Fuel Line Safety Procedures".**

Fuel Line Safety Procedures
Avoid fuel line spills and leakage by completing the following procedures.
1. Remove the fuel-filler cap and release the pressure in the fuel tank.
2. When disconnecting a fuel hose, wrap a rag around it to protect against fuel leakage.
3. Plug the fuel hose after removal.

AFTER REPAIR PROCEDURE

Warning
- **Fuel line spills and leakage are dangerous. Fuel can ignite and cause serious injuries or death and damage. When installing the fuel hose, observe "Fuel Hose Installation" described below.**

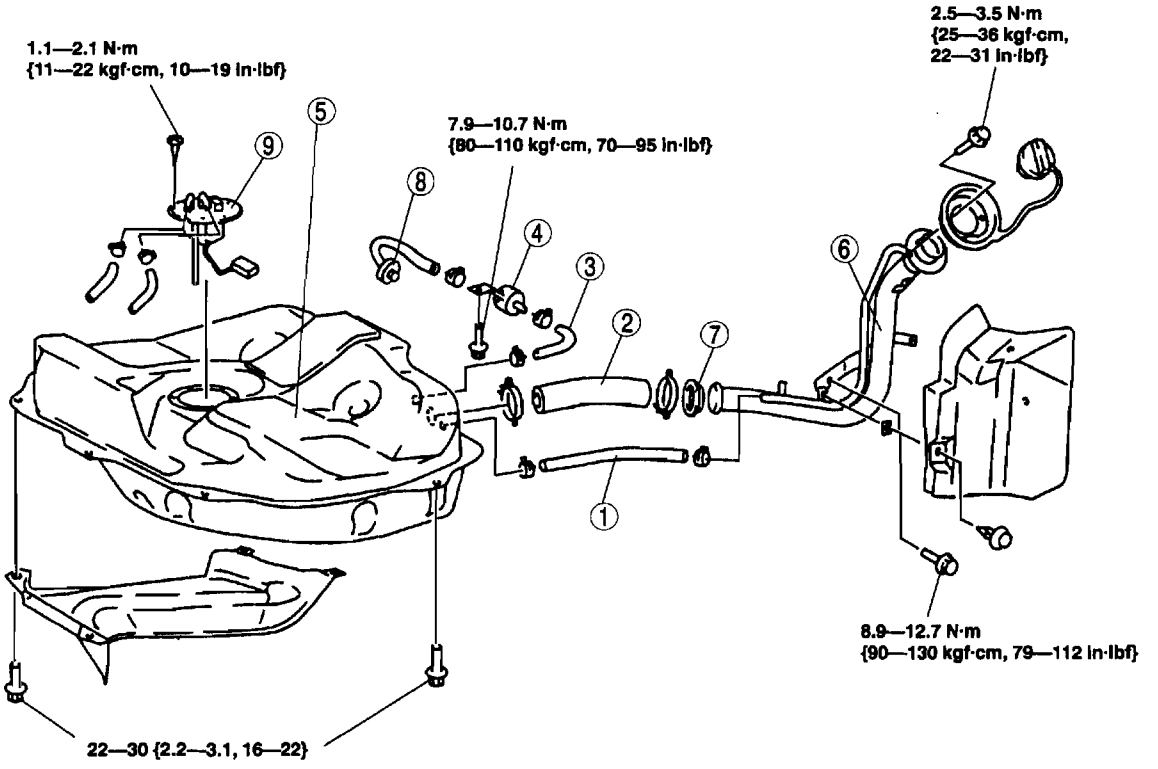
Fuel Hose Installation
- Verify that there is no damage or deform on the fuel hose and fuel pipe when installing.

FUEL TANK REMOVAL/INSTALLATION

Warning

- **Repairing a fuel tank that has not been properly steam cleaned can be dangerous. Explosion or fire may cause death or serious injuries. Always properly steam clean a fuel tank before repairing it.**

1. Complete the "BEFORE REPAIR PROCEDURE". (Refer to FUEL SYSTEM, BEFORE REPAIR PROCEDURE.)
2. Disconnect the negative battery cable.
3. Remove the rear seat cushion.
4. Level the vehicle.
5. Remove the service hole cover and disconnect the connector.
6. Disconnect the fuel hose from the fuel pump and remove the fuel pump.
7. Siphon the fuel from the service hole using a fuel drawing pump.
8. Remove the presilencer. (Refer to EXHAUST SYSTEM, EXHAUST SYSTEM REMOVAL/INSTALLATION.)
9. Remove in the order indicated in the table.
10. Install in the reverse order of removal.
11. Complete the "AFTER REPAIR PROCEDURE". (Refer to FUEL SYSTEM, AFTER REPAIR PROCEDURE.)

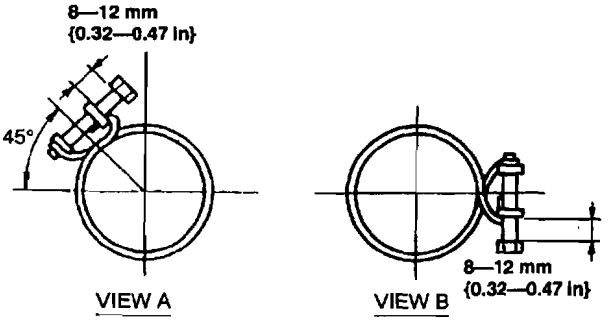


N·m {kgf·m, ft·lbf}

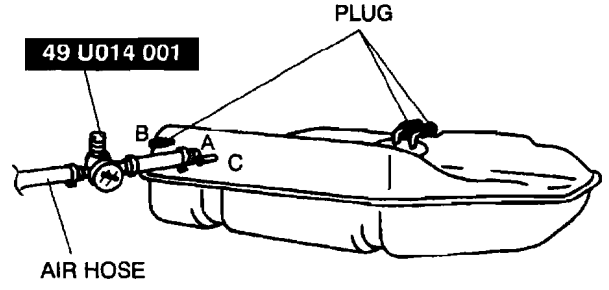
1	Breather hose
2	Joint hose ☞ Installation Note
3	Evaporative hose
4	Check valve (TWO-WAY)

5	Fuel tank
6	Fuel-filler pipe
7	Nonreturn valve
8	Evaporative chamber
9	Fuel gauge sender unit

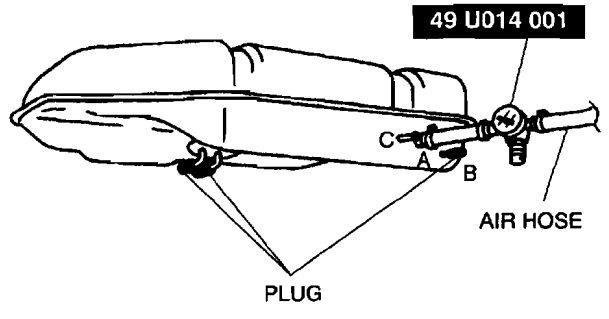
Joint Hose Installation Note
- Install clamps as shown.



FUEL TANK INSPECTION
1. Remove the fuel tank. (Refer to FUEL SYSTEM, FUEL TANK REMOVAL/INSTALLATION.)
2. Attach an air hose to the **SST**.
3. Plug the main and return fuel pipe on the fuel pump.
4. Set the **SST** to port A and plug port B as shown in the figure.

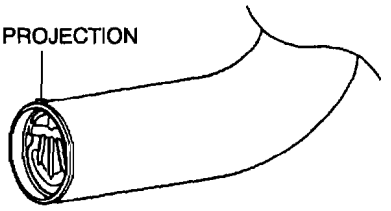


5. Verify that there is airflow from port C when pressure of **+0.98 kPa {+7.4 mmHg, +0.29 inHg}** is applied to port A.
6. If there is no airflow, replace the fuel tank.
7. Turn the fuel tank upside-down with port B plugged as shown in the figure.

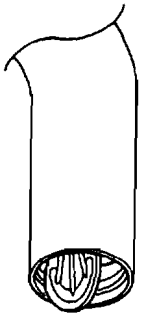


8. Verify that there is no airflow from port C when pressure of **+0.98 kPa {+7.4 mmHg, +0.29 inHg}** is applied to port A.
9. If there is airflow, replace the fuel tank.

NONRETURN VALVE INSPECTION
1. Remove the fuel-filler pipe. (Refer to FUEL SYSTEM, FUEL TANK REMOVAL/INSTALLATION.)
2. Verify that the projection on the nonreturn valve is aligned with the notch on the fuel-filler pipe.



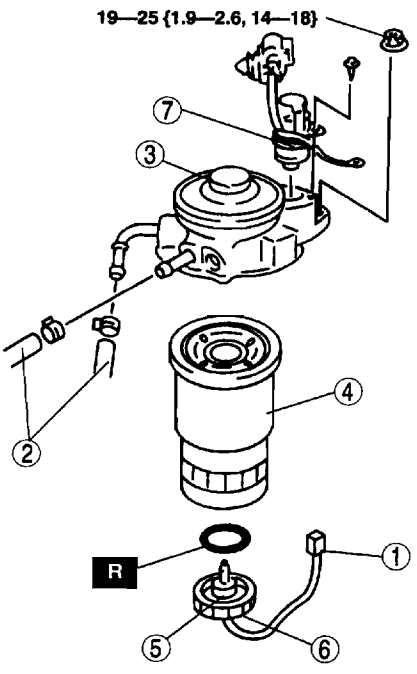
3. If not, remove the nonreturn valve and align the projection with the notch, then reinstall.
4. Verify that the nonreturn valve is closed when the fuel-filler pipe end is held up vertically.
5. If it opens, replace the nonreturn valve.
6. Verify that the nonreturn valve opens under its own weight when the fuel-filler pipe end is held down vertically.



7. If it does not open, replace the nonreturn valve.

FUEL GAUGE SENDER UNIT REMOVAL/INSTALLATION
(Refer to FUEL SYSTEM, FUEL TANK REMOVAL/INSTALLATION.)

FUEL FILTER REMOVAL/INSTALLATION
1. Disconnect the negative battery cable.
2. Complete the "BEFORE REPAIR PROCEDURE". (Refer to FUEL SYSTEM, BEFORE REPAIR PROCEDURE.)
3. Remove in the order indicated in the table.
4. Install in the reverse order of removal.
5. Complete the "AFTER REPAIR PROCEDURE". (Refer to FUEL SYSTEM, AFTER REPAIR PROCEDURE.)
6. Bleed air from the fuel filter. (Refer to FUEL SYSTEM, FUEL FILTER AIR BLEEDING.)
7. Start the engine and verify that fuel does not leak from the fuel system.
8. If fuel leaks, reassemble the fuel filter.

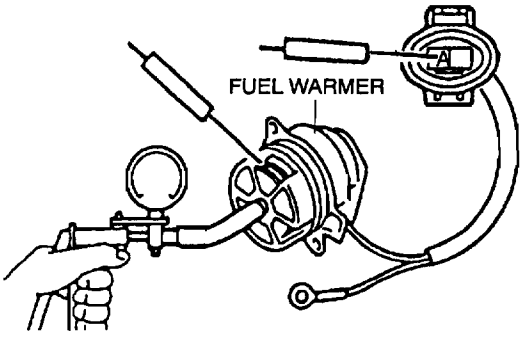


1	Connector
2	Fuel hose
3	Priming pump
4	Fuel filter ☞ Installation Note
5	Sedimentor switch ☞ Installation Note
6	Drain plug
7	Fuel warmer

Sedimentor Switch Installation Note
- Apply a small amount of fuel to a new O-ring. Tighten the sedimentor switch enough to the fuel filter by hand.

Fuel Filter Installation Note
- Apply a small amount of fuel to the fuel filter O-ring. Tighten the fuel filter approx. 3/4 by hand after the O-ring contacts the priming pump.

FUEL WARMER INSPECTION
1. Disconnect the negative battery cable.
2. Complete the "BEFORE REPAIR PROCEDURE". (Refer to FUEL SYSTEM, BEFORE REPAIR PROCEDURE.)
3. Remove the fuel warmer. (Refer to FUEL SYSTEM, FUEL FILTER REMOVAL/INSTALLATION)
4. Verify that the resistance between terminal A and the fuel warmer body is within the specification when vacuum of -26.6—-40.0 kPa {-200—-300 mmHg, -7.9—-11.8 inHg} is applied to port A of the fuel warmer.



Specification

Water temperature °C {°F}	Resistance (Ω)
20 {68}	0.5—1.5

5. If not as specified, replace the fuel warmer.

FUEL LINE AIR BLEEDING

Caution
- **Continuously cranking the engine for over 30 seconds can damage the battery and the starter.**

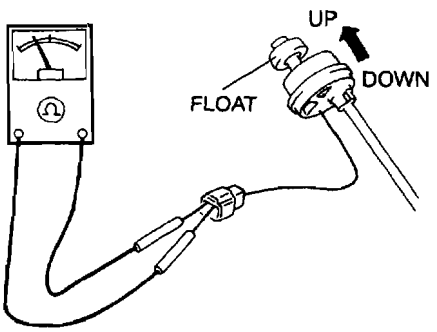
- Repeat cranking the engine for 30 seconds and stop for 5—10 seconds until the engine starts.

SEDIMENTOR WATER DRAINING
1. Disconnect the negative battery cable.
2. Complete the "BEFORE REPAIR PROCEDURE". (Refer to FUEL SYSETM, BEFORE REPAIR PROCEDURE.)
3. Loosen the drain plug located at the bottom of the fuel filter.
4. Pump the priming pump and drain the water.
5. After all the water has been drained, tighten the drain plug.
6. Complete the "AFTER REPAIR PROCEDURE". (Refer to FUEL SYSTEM, AFTER REPAIR PROCEDURE.)
7. Reconnect the negative battery cable.

SEDIMENTOR SWITCH INSPECTION
Continuity Inspection

Note
- Perform the following test only when directed.

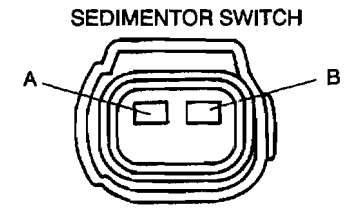
1. Disconnect the negative battery cable.
2. Drain fuel from the fuel filter. (Refer to FUEL SYSTEM, SEDIMENTOR WATER DRAINING.)
3. Remove the sedimentor switch.
4. Inspect continuity of the sedimentor switch using an ohmmeter.



Specification

Float	Continuity
Up	Yes
Down	No

5. If not as specified, replace the sedimentor switch.
   If as specified, inspect the following:
   Open circuit
   - Ground circuit (Sedimentor switch connector terminal B and body ground)
   - Power circuit (Sedimentor switch connector terminal A and instrument cluster connector terminal 3N)



   Short circuit
   - Power circuit (Sedimentor switch connector terminal A and Instrument cluster connector terminal 3N to ground)

6. Repair or replace faulty areas.
7. Install the sedimentor switch.
8. Reconnect the negative battery cable.
9. Bleed air from the fuel filter. (Refer to FUEL SYSTEM, FUEL FILTER AIR BLEEDING.)

INJECTION PUMP INSPECTION

Injection Pump Auxiliary Parts Inspection
(Refer to CONTROL SYSTEM, FUEL TEMPERATURE SENSOR, TIMER CONTROL VALVE (TCV), PUMP SPEED SENSOR, INJECTION PUMP EPROM.)

Injection Pump Inner Parts Inspection

Caution
- **Injection pump is sealed to maintain proper function. Special tools and testers are required when disassembling the injection pump. Disassembling the injection pump without special tools and testers will cause a malfunction.**

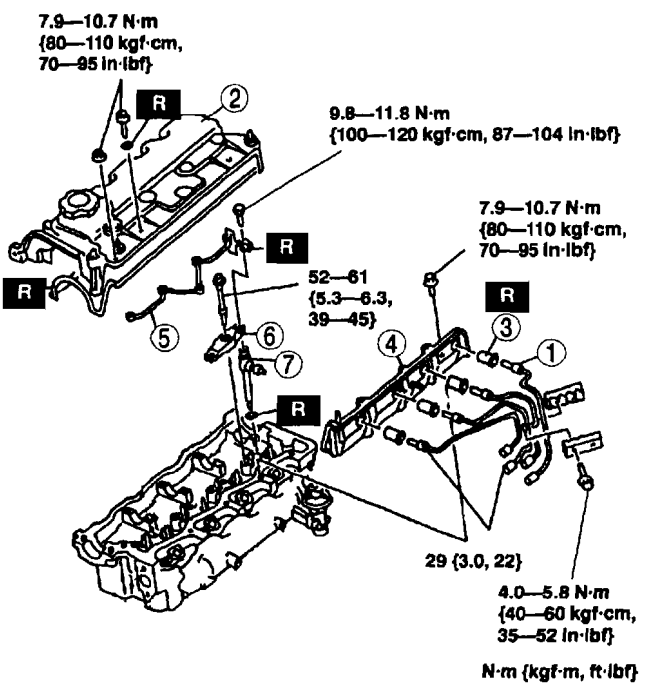
- Consult your distributor for disassembly if any injection pump internal parts are possibly malfunctioning.

INJECTION NOZZLE REMOVAL/INSTALLATION

Caution
- **Fuel line spills and leakage on the parts are dangerous. Fuel can ignite and also deteriorate the parts. To prevent this, always cover the mouths of the removed parts in the fuel system with rags to soak up the fuel.**

1. Disconnect the negative battery cable.
2. Complete the "BEFORE REPAIR PROCEDURE". (Refer to FUEL SYSTEM, BEFORE REPAIR PROCEDURE.)
3. Remove in the order indicated in the table.
4. Install in the reverse order of removal.
5. Complete the "AFTER REPAIR PROCEDURE". (Refer to FUEL SYSTEM, AFTER REPAIR PROCEDURE.)

Note
- When the leak pipe is removed, be sure to install a new gasket and perform the "LEAKAGE INSPECTION".

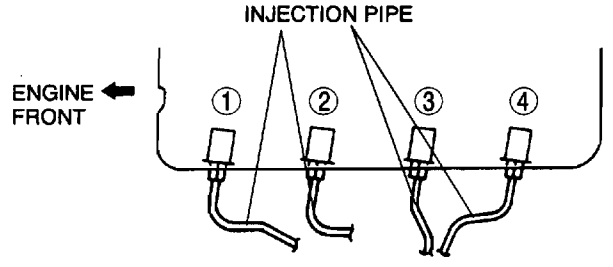


1	Injection pipe ☞ Installation Note
2	Cylinder head cover
3	Nozzle seal
4	Side wall
5	Fuel leak pipe ☞ Installation Note
6	Injection nozzle bracket
7	Injection nozzle

Fuel leak Pipe Installation Note

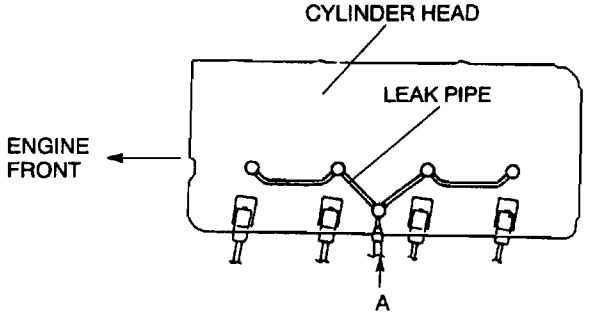
Caution
- **If the gasket is reused, fuel can leak in the cylinder head, contaminating the oil and causing conditions such as abnormal wear to the friction parts. When a gasket is removed, be sure to install a new gasket.**
- **Perform the leak pipe fuel "LEAKAGE INSPECTION".**

Injection Pipe Installation Note
- Install the injection pipe in the order shown.



LEAKAGE INSPECTION

1. Apply pressure of 98 kPa {1.0 kgf/cm^2, 14.22 psi} from the location marked A.



2. Apply soapy water to the joint area of the leak pipe and the injection nozzle, and verify that there is no leakage.

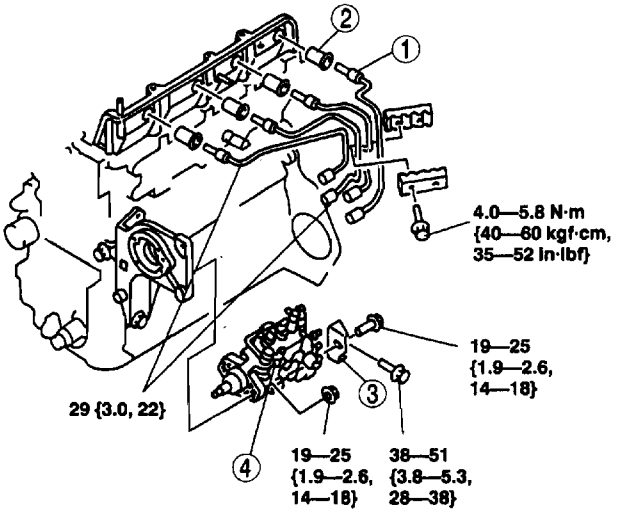
Specification
No pressure failure or leakage for 10 sec.

3. If not as specified, replace replace the washer, etc. and reassemble.

INJECTION PUMP REMOVAL/INSTALLATION

Caution
- **Fuel line spills and leakage on the parts are dangerous. Fuel can ignite and also deteriorate the parts. To prevent this, always cover the mouths of the removed parts in the fuel system with rags to soak up the fuel.**

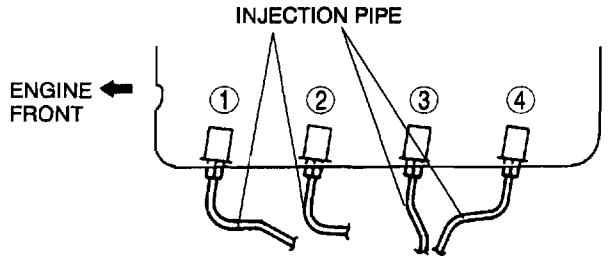
1. Disconnect the negative battery cable.
2. Complete the "BEFORE REPAIR PROCEDURE". (Refer to FUEL SYSTEM, BEFORE REPAIR PROCEDURE.)
3. Remove the cylinder head cover.
4. Remove in the order indicated in the table.
5. Install in the reverse order of removal.
6. Complete the "AFTER REPAIR PROCEDURE". (Refer to FUEL SYSTEM, AFTER REPAIR PROCEDURE.)



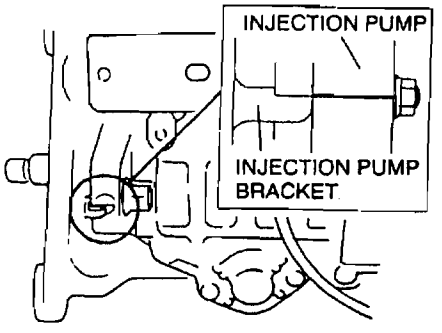
N·m {kgf·m, ft·lbf}

1	Injection pipe ☞ Installation Note
2	Nozzle seal
3	Stay ☞ Installation Note
4	Injection pump ☞ Section B2, CYLINDER HEAD GASKET REPLACEMENT, Injection Pump Pulley Removal Note

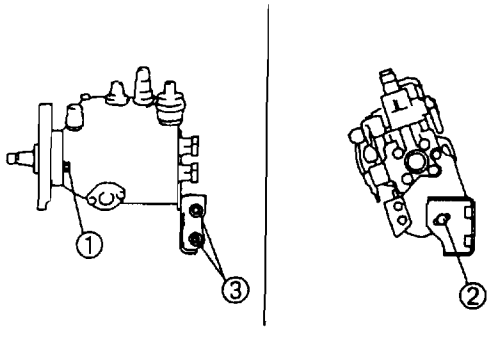
Injection Pipe Installation Note
- Install the injection pipe in the order shown.



Stay Installation Note
1. Align the marks of the injection pump and fuel injection pump bracket.



2. Tighten the bolts and nuts in the order shown.



INJECTION NOZZLE INSPECTION

Caution
- **Fuel and fuel tank used for the nozzle tester must be kept clean. Otherwise, foreign material may stick between the nozzle and the nozzle tester, causing damage.**
- **Injection nozzle is sealed to maintain its function, and specical tools are required for overhaul . Do not overhaul the injection nozzle by yoursely when a malfunction is observed, as the injection nozzle will not function normally.**

Note
- The starting pressure of the injection nozzle is maintenance-free.

Starting Pressure Inspection

Warning
- **The fuel vapor from the injection nozzle may penetrate deeply into the fingers and hands and damage tissue. Fuel vapor entering the blood may also cause blood poisoning. Do not touch the fuel vapor when using the nozzle tester.**

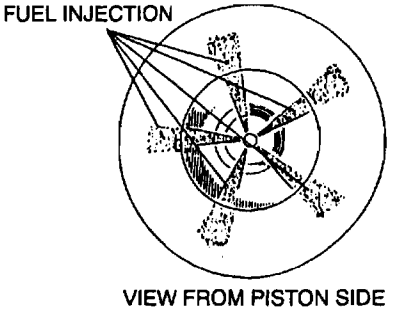
1. Connect the injection nozzle to nozzle tester.
2. Bleed the air by pumping the nozzle tester handle several times.
3. Slowly lower the nozzle tester handle and note the pressure when injection starts.

Injection starting pressure
17.1—18.2 MPa
{175—185 kgf/cm^2, 2489—2630 psi}

4. If the injection starting pressure is not within the specification, replace the injection nozzle.

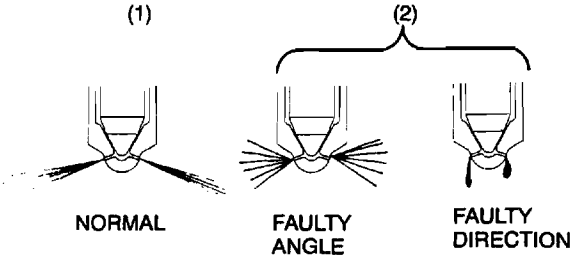
Atomization Condition Inspection
1. Connect the injection nozzle to the nozzle tester.
2. Bleed the air by pumping the nozzle tester handle several times.
3. Lower the handle several times as quickly as possible so that a pulsating whistling sound is heard, and note the atomization pattern.
   (1) Uniform, proper atomization
   (2) Incorrect injection angle and direction

Note
- The injection nozzle has five injection holes.



VIEW FROM PISTON SIDE

Specification



4. If the atomization condition is not within the specification, replace the injection nozzle.

FUEL SHUT OFF (FSO) SOLENOID INSPECTION

On-Vehicle Inspection

Note
- Perform the following test only when directed.

1. With the engine idling, disconnect the FSO solenoid connector and verify that the engine stops.
2. If the engine does not stop, carry out the following inspection.

Continuity Inspection

1. Disconnect the negative battery cable.
2. Disconnect the FSO solenoid.
3. Inspect for continuity between the terminals under the following condition.

COMPONENT SIDE CONNECTOR
(VIEW FROM TERMINAL SIDE)

4. When no continuity is detected, perform resistance inspection.

Resistance Inspection

1. Measure the resistance of the FSO solenoid using an ohmmeter.

COMPONENT SIDE CONNECTOR
(VIEW FROM TERMINAL SIDE)

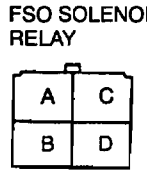
Specification

FCV temperature °C {°F}	Resistance (Ω)
20 {68}	8.5—13

2. If not as specified, replace the FSO solenoid. When the reading is out of specification, send FSO solenoid to a distributor to repair. If the FSO solenoid is okay, but PCM terminal voltage is out of specification, inspect as follows and repairor replace as necessary.

Open circuit

- Power supply circuit (FSO solenoid connector terminal A and FSO solenoid relay connector terminal D through common connector)
- Power supply circuit (FSO solenoid connector terminal B and PCM connector terminal 2D through common connector)
- Ground circuit (FSO solenoid body and ground).



HARNESS SIDE
CONNECTOR
(VIEW FROM
TERMINAL SIDE)

HARNESS SIDE
CONNECTOR
(VIEW FROM
TERMINAL SIDE)

Short circuit

- Power supply circuit (FSO solenoid connector terminal A and FSO solenoid relay connector terminal D through common connector to ground)
- Power supply circuit (FSO solenoid connector terminal B and PCM connector terminal 2D through common connector to ground)

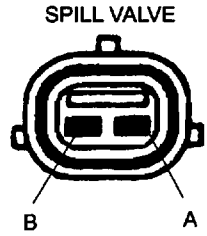
3. Repair or replace faulty areas.
4. Reconnect the FSO solenoid connector.

SPILL VALVE INSPECTION

Resistance Inspection

Note
- Perform the following test only when directed.

1. Disconnect the negative battery cable.
2. Disconnect the spill valve.
3. Inspect the resistance between the terminals under the following condition.



COMPONENT SIDE CONNECTOR
(VIEW FROM TERMINAL SIDE)

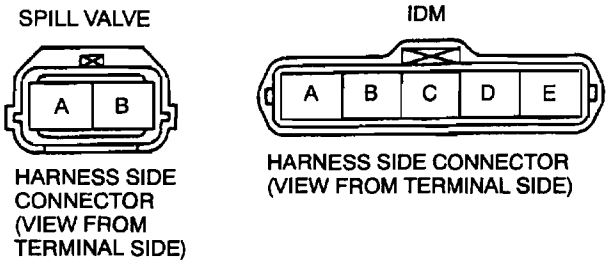
Specification

Terminal	Atmospheric temperature °C {°F}	Resistance (Ω)
A—B	20 {68}	10—14
A—Spill valve body	—	Above 10M

4. If not as specified, replace the spill valve. When the reading is out of specification, send spill valve to a distributor to repair. If the spill valve is okay, but PCM terminal voltage is out of specification, inspect as follows and repair or replace as necessary.

Open circuit

- Power supply circuit (Spill valve connector terminal A and Injector Driver Module (IDM) connector terminal D trough common connector)
- Ground circuit (Spill valve connector terminal B and Injector Driver Module (IDM) connector terminal E through common connector)



Short circuit

- Power supply circuit (Spill valve connector terminal A and Injector Driver Module (IDM) connector terminal D through common connector to ground)
- Ground circuit (Spill valve connector terminal B and Injector Driver Module (IDM) connector terminal E through common connector to ground)

EXHAUST SYSTEM

EXHAUST SYSTEM INSPECTION

1. Start the engine and inspect each exhaust system component for exhaust gas leakage.
2. If leakage is found, repair or replace as necessary.

EXHAUST SYSTEM REMOVAL/INSTALLATION

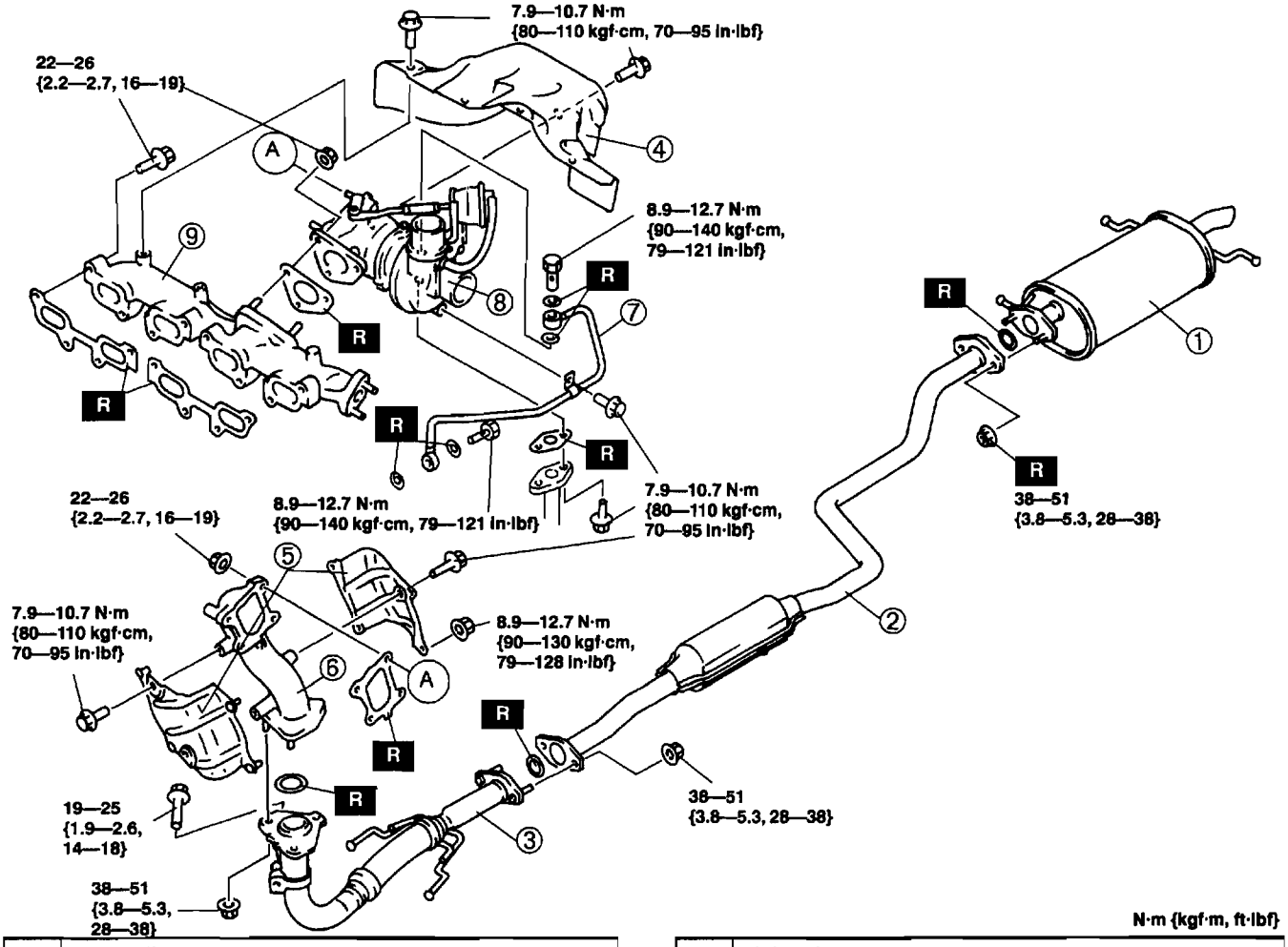
Warning

- **When the engine and exhaust system are hot, they can badly burn. Turn off the engine and wait until they are cool before removing or installing the exhaust system.**

Caution

- **The turbocharger will not function normally if the rod of the wastegate actuator is bent. Do not hit the wastegate actuator or hold the rod and the actuator hose when carrying the turbocharger.**
- **Contamination at the inlets/outlets of air, exhaust gas, and oil will cause a turbocharger malfunction. Cover the inlets/outlets with adhesive tape to keep foreign materials out.**
- **Use only the specified type of studs. Studs of unspecified material will extend under high heat and cause insufficient tightening.**
- **Turbocharger runs at high speed and high heat. Foreign material in the oil line and deformed oil pipe can cause turbocharger malfunction.**

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



N·m {kgf·m, ft·lbf}

1	Main silencer
2	Oxidation catalytic converter
3	Flexible pipe
4	Exhaust manifold insulator
5	Joint pipe insulator

6	Joint pipe
7	Oile pipe
8	Turbocharger ☞ Removal Note
9	Exhaust manifold ☞ Removal Note

Turbocharger Removal Note
- Remove the air pipe and air hose before removing the turbocharger. (Refer to INTAKE-AIR SYSTEM, INTAKE-AIR SYSTEM REMOVAL/iNSTALLATiON.)

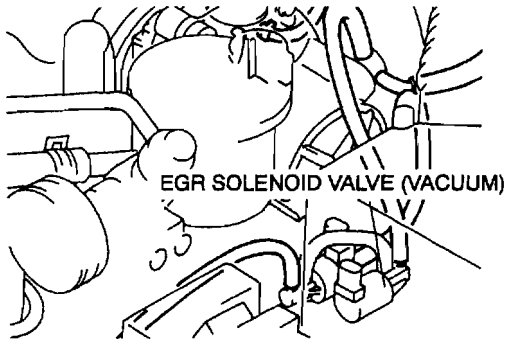
Exhaust Manifold Removal Note
- Remove the EGR pipe before removing the exhaust manifold. (Refer to INTAKE-AIR SYSTEM, INTAKE-AIR SYSTEM REMOVAL/INSTALLATION.)

EMISSION SYSTEM

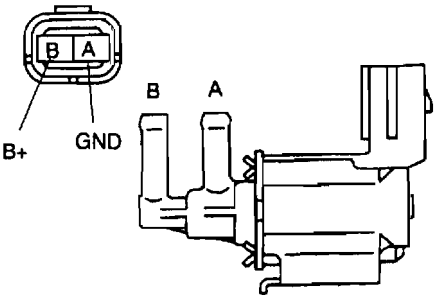
EGR SOLENOID VALVE (VACUUM) INSPECTION
Airflow Inspection

Note
- Perform the following test only when directed.

1. Disconnect the negative battery cable.
2. Remove the EGR solenoid valve (vacuum).



3. Inspect for airflow between each port under the following condition.



Specification

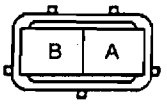
○—○ : Continuity ○═○ : Airflow

Step	Terminal		Port	
	A	B	A	B
1	○	○		
2	B+	Ground	○	○

4. If not as specified, replace the EGR solenoid valve (vacuum). If the EGR solenoid valve (vacuum) is okay, but PID value or PCM terminal voltage is out of specification, inspect as follows and repair or replace as necessary.
   - Vacuum hose improper routing, kinks or leakage.

Open circuit
- Power supply circuit (EGR solenoid valve (vacuum) connector terminal A and PCM control relay connector terminal D through common connector)
- Ground circuit (EGR solenoid valve (vacuum) connector terminal B and PCM connector terminal 1K through common connector)

EGR SOLENOID VALVE (VACUUM)



HARNESS SIDE CONNECTOR
(VIEW FROM TERMINAL SIDE)

Short circuit
- Power supply circuit (EGR solenoid valve (vacuum) connector terminal A and PCM control relay connector terminal D through common connector to ground)

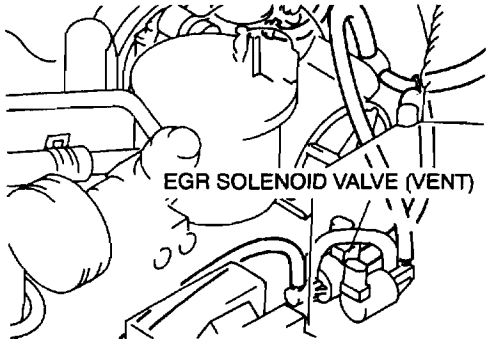
5. Repair or replace faulty areas.
6. Install the EGR solenoid valve (vacuum) connector.

EGR SOLENOID VALVE (VENT) INSPECTION

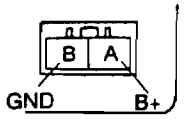
Airflow Inspection

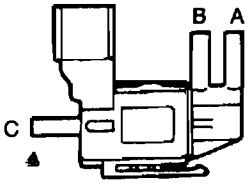
Note
- Perform the following test only when directed.

1. Disconnect the negative battery cable.
2. Remove the EGR solenoid valve (vent).



3. Inspect for airflow between each port under the following condition.





Specification

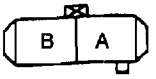
○—○ : Continuity ○═○ : Airflow

Step	Terminal		Port		
	A	B	A	B	C
1	○—○		○—○	○—○	○—○
2	B+	Ground	○═○		

4. If not as specified, replace the EGR solenoid valve (vent).
5. If the EGR solenoid valve (vent) is okay, but PID value or PCM terminal voltage is out of specification, inspect as follows and repair or replace as necessary.
   - Vacuum hose improper routing, kinks or leakage.

Open circuit
- Power supply circuit (EGR solenoid valve (vent) connector terminal A and PCM control relay connector terminal D through common connector)
- Ground circuit (EGR solenoid valve (vent) connector terminal B and PCM connector terminal 1O through common connector)

EGR SOLENOID VALVE (VENT)



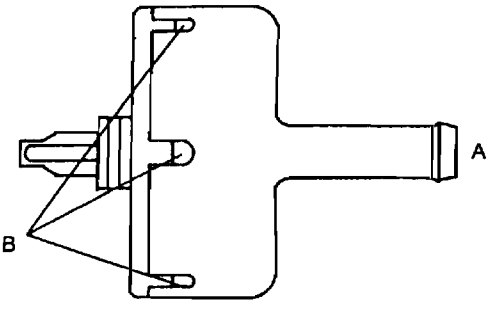
HARNESS SIDE CONNECTOR
(VIEW FROM TERMINAL SIDE)

Short circuit
- Power supply circuit (EGR solenoid valve (Vent) connector terminal A and PCM control relay connector terminal D through common connector to ground)

6. Repair or replace faulty areas.
7. Install the EGR solenoid valve (vent) connector.

EVAPORATIVE CHAMBER INSPECTION

1. Remove the evaporative chamber.
2. Blow air into port A and verify that air flows out from the holes B on the evaporative chamber.



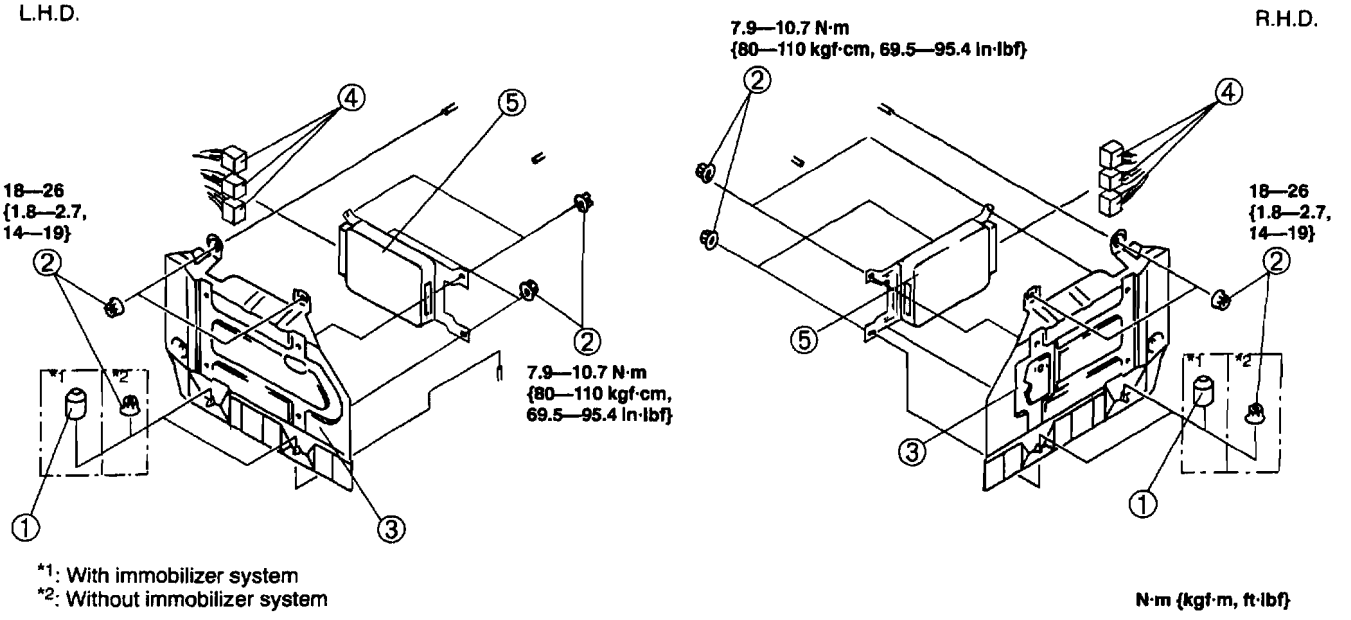
3. Visually inspect that there is no damage nor crack on the evaporative chamber.
4. If not as specified, replace the evaporative chamber.

CONTROL SYSTEM

PCM REMOVAL/INSTALLATION

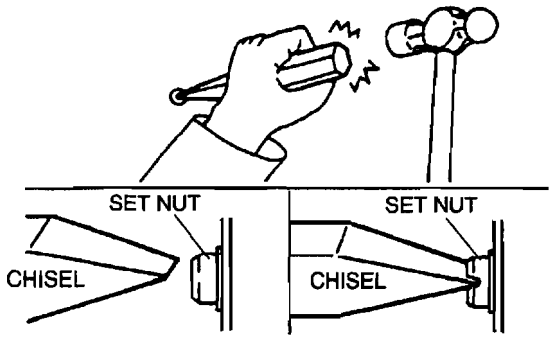
Note
- The PCM equipped on a vehicle with immobilizer system operates normally only when the correct ID number and code word are inputted it. (Refer to section T, IMMOBILIZER SYSTEM, KEY NUMBER INPUT PROCEDURE.)
- The PCM with the ID number and code word stored is only applicable to the vehicle that the PCM has originally been equipped.

1. Disconnect the negative battery cable.
2. Lift up the floor mat in front of the passenger's seat.
3. Remove in the order indicated in the table.
4. Install in the reverse order of removal.
5. Input the ID number and code word. (Refer to section T, IMMOBILIZER SYSTEM, KEY NUMBER INPUT PROCEDURE.)

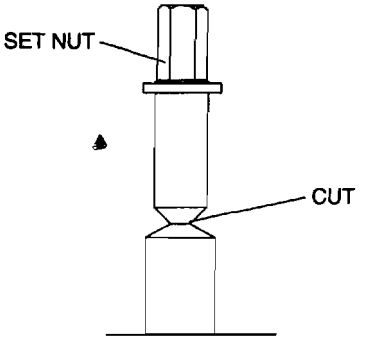


1	Set nut ☞ Removal Note ☞ Installation Note
2	Nut
3	Cover
4	PCM connector
5	PCM

Set Nut Removal Note
1. Using a chisel and a hammer, cut a groove on the head of the set nut so that a screwdriver can be inserted.
2. Loose the set nut using an impact screwdriver or pliers.



Set Nut Installation Note
- Install a new set nut and tighten it until the neck of the nut is cut.



PCM INSPECTION
Using SST (NGS tester)

Note
- PIDs for the following parts are not available on this model. Go to the appropriate part inspection page.
  1. Water temperature sender unit (integrated with engine coolant temperature (ECT) sensor) (Refer to CONTROL SYSTEM, ENGINE COOLANT TEMPERATURE (ECT) INSPECTION.)
  2. PCM control relay (Refer to CONTROL SYSTEM, PCM CONTROL RELAY INSPECTION.)
  3. FSO solenoid (Refer to CONTROL SYSTEM, FUEL SHUT OFF (FSO) SOLENOID INSPECTION.)
  4. Spill valve (Refer to CONTROL SYSTEM, SPILL VALVE INSPECTION.)
  5. Spill valve relay (Refer to CONTROL SYSTEM, SPILL VALVE RELAY INSPECTION.)

1. Connect the NGS tester to the DLC. (Refer to ON-BOARD DIAGNOSTIC SYSTEM, ON-BOARD DIAGNOSTIC TEST, New Generation Star (NGS) Tester Hook-up Procedure.)
2. Turn the engine switch on.
3. Select the "PID/DATA MONITOR AND RECORD" function on the NGS tester display and press TRIGGER. (Refer to ON-BOARD DIAGNOSTIC SYSTEM PID/DATA Monitor and Record Procedure.)
4. Select the appropriate PID on the NGS tester display and press START.
5. Measure the PID value.

Note
- When measuring the following PID value, inspect the following:
- TP V PID (Refer to CONTROL SYSTEM, PID/DATA MONITOR INSPECTION, Not Using **SST** (NGS tester) at Constant Voltage Terminal Inspection.) (Refer to CONTROL SYSTEM, PID/DATA MONITOR INSPECTION, Not Using **SST** (NGS tester) at Ground Terminal Inspection.)

6. If PID value is not within the specification, follow the instruction in ACTION column.

Note
- Perform the SIMULATION TEST for the output device (A/C RLY, FAN2, FAN3, EGR PV, GLW RLY, GLW LP) after PID/DATA measurement is completed.

PID MONITOR Table

Monitor item (Definition)	Unit/ Condition		Condition/Specification	Action	PCM terminal
A/C RLY (A/C relay)	ON/OFF		Engine switch is on: OFF A/C switch is on and fan switch is on at idle: ON	Inspect following PIDs: RPM, TP V, ECT V, A/C SW. Inspect A/C relay. ☞ section U	1Q
A/C SW (A/C switch)	ON/OFF		A/C switch and fan switch is on at engine switch on: ON A/C switch is off at engine switch on: OFF	Inspect refrigerant pressure switch. ☞ section U	1S
B+ (Battery positive voltage)	V		Engine switch is on: B+	Inspect main relay. ☞ PCM control RELAY INSPECTION Inspect battery. ☞ section G	1B
BARO (Barometric pressure In PCM)	kPa	Hg	Below 400m {0.25 mile} above sea level: 100—103 kPa {29.5—30.4 inHg}	DTC P0105 is indicated. Follow DTC Troubleshooting ☞ ON-BOARD DIAGNOSTIC SYSTEM, ON-BOARD DIAGNOSTIC TROUBLE CODE INSPECTION	-
CTP SW (Idle switch)	ON/OFF		Accelerator pedal is depressed:OFF Accelerator pedal is released: ON	Inspect idle switch. ☞ IDLE SWITCH INSPECTION	1T
ECT (Engine coolant temperature)	°C	°F	Engine coolant temperature is 20°C {68 °F}: 20 °C {68 °F} Engine coolant temperature is 60°C {140 °F}: 60 °C {140 °F}	Inspect ECT sensor. ☞ ENGINE COOLANT TEMPERATURE (ECT) SENSOR INSPECTION	2G
ECT V (Engine coolant temperature signal voltage)	V		Engine coolant temperature is 20 °C {68 °F}: 2.9—3.1 V After warm up: Below 1.0 V	Inspect ECT sensor. ☞ ENGINE COOLANT TEMPERATURE (ECT) SENSOR INSPECTION	2G

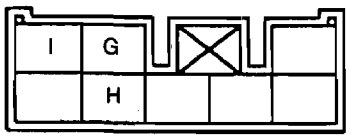
Monitor item (Definition)	Unit/ Condition		Condition/Specification	Action	PCM terminal
EGRP V (EGR valve position signal voltage)	V		Engine switch is on: 0.4—0.6 V Idle: 1.3—1.6 V	Inspect EGR valve position sensor. ☞ EGR VALVE POSITION SENSOR INSPECTION.	2J
EGRVAC (EGR solenoid valve (vacuum))	%		Engine switch is on: 0% Idle: 0—100%	Inspect EGR solenoid valve (vacuum). ☞ EGR SOLENOID VALVE (VACUUM) INSPECTION.	1K
EGRVENT (EGR solenoid valve (vent))	%		Engine switch is on: 0% Idle: 0—100%	Inspect EGR solenoid valve (vent). ☞ EGR SOLENOID VALVE (VENT) INSPECTION.	1O
FAN2 (Condenser fan control)	ON/OFF		Engine coolant temperature is above 108 °C {226 °F }: ON Terminal TEN (DLC) is shorted to ground and accelerator pedal is depressed: ON A/C is operating: ON Others: OFF	Inspect following PIDs: RPM, TP V, ECT V, A/C SW, TEN. Inspect condenser fan relay. ☞ section U	1N
FAN3 (Cooling fan control)	ON/OFF		Engine coolant temperature is above 100 °C {212 °F}: ON Terminal TEN (DLC) is shorted to ground and accelerator pedal is depressed: ON A/C is operating: ON Others: OFF	Inspect following PIDs: RPM, TP V, ECT V, A/C SW, TEN. Inspect cooling fan relay. ☞ section E	3Q
FLT (Fuel temperature sensor)	°C	°F	Fuel temperature is 20 °C {68 °F}: 20 °C {68 °F}	Inspect fuel temperature sensor. ☞ FUEL TEMPERATURE SENSOR INSPECTION.	2I
FLT V (Fuel temperature signal voltage)	V		Fuel temperature is 20 °C {68 °F}: 2.3 V Fuel temperature is 70 °C {158 °F}: 0.6 V	Inspect fuel temperature sensor. ☞ FUEL TEMPERATURE SENSOR INSPECTION	2I
IAT (Intake air temperature (IAT) sensor No.1)	°C	°F	Intake air temperature is 20 °C {68 °F}: 20 °C {68 °F}:	Inspect IAT sensor. ☞ INTAKE AIR TEMPERATURE (IAT) SENSOR No.1, No.2 INSPECTION	2E
IAT V (Intake air temperature (IAT) signal No.1 voltage)	V		Intake air temperature is 20 °C {68 °F}: 2.2—2.5 V Intake air temperature is 30 °C {86 °F}: 1.7—1.9 V	Inspect IAT sensor. ☞ INTAKE AIR TEMPERATURE (IAT) SENSOR No.1, No.2 INSPECTION	2E
IATDC (Intake air temperature (IAT) sensor No.2)	°C	°F	Intake air temperature is 20 °C {68 °F}: 20 °C {68 °F}	Inspect IAT sensor. ☞ INTAKEAIR TEMPERATURE (IAT) SENSOR No.1, No.2 INSPECTION.	2K
IATDC V (Intake air temperature (IAT) signal voltage No.2)	V		Intake air temperature is 20 °C {68 °F}: 2.2—2.5 V Intake air temperature is 30 °C {86 °F}: 1.7—1.9 V	Inspect IAT sensor. ☞ INTAKEAIR TEMPERATURE (IAT) SENSOR No.1, No.2 INSPECTION.	2K
IG SW (Engine switch)	ON/OFF		Engine switch is on: ON Cranking: ON	Inspect engine switch. ☞ section T	1F
MAP (Boost sensor)	kPa	Hg	Engine switch is on: 100—103 kPa {29.5—30.4 inHg} Idle: 100—103 kPa {29.5—30.4 inHg}	Inspect boost sensor. ☞ BOOST SENSOR INSPECTION.	2C
MAP V (Boost signal voltage)	V		Engine switch is on: 2.5—2.8 V Idle: 2.5—2.8 V	Inspect boost sensor. ☞ BOOST SENSOR INSPECTION.	2C

Monitor item (Definition)	Unit/ Condition	Condition/Specification	Action	PCM terminal
NL SW (Load/no load condition signal)	ON/OFF	Neutral position or clutch pedal is depressed: ON Others: OFF	Inspect neutral switch. ☞ NEUTRAL SWITCH INSPECTION Inspect clutch switch. ☞ CLUTCH SWITCH INSPECTION	1V
RPM (Engine speed)	rpm	Idle: 800—850 rpm	Inspect crankshaft position sensor. ☞ PUMP SPEED SENSOR INSPECTION	3G, 3H
TEN (TEN terminal (in DLC))	ON/OFF	Terminal TEN (DLC) is shorted to ground: ON Terminal TEN (DLC) is open: OFF	Inspect wiring from DLC terminal TEN to PCM terminal 3P.	3P
TP V (Accelerator position signal voltage)	V	Accelerator pedal is depressed: 3.1—3.5 V Accelerator pedal is released: 0.5—0.9 V	Inspect accelerator position sensor. ☞ ACCELERATOR POSITION SENSOR INSPECTION	2F
VS (Vehicle speed)	KMH KPH	Vehicle speed is 20 km/h {12.5 mph}: 20 km/h {12.5 mph} Vehicle speed is 40 km/h {25 mph}: 40 km/h {25 mph}	Inspect vehicle speed sensor. ☞ section T	3L

Not Using SST (NGS tester) at Constant Voltage Terminal Inspection

1. Turn the engine switch on.
2. Measure the voltage between the accelertor position sensor connector (vehicle side) terminal G and body ground using a voltmeter.
   (1) Measurement voltage is 0V.
   ① Turn the engine switch off.
   ② Disconnect the accelerator position sensor connector (applied constant voltage).
   ③ Verify there is no continuity between the accelerator position sensor connector (vehicle side) terminal G and body groud using an ohmmeter.

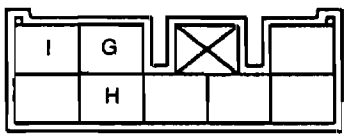
ACCELERATOR POSITION SENSOR



HARNESS SIDE CONNECTOR
(VIEW FROM TERMINAL SIDE)

④ If there is continuity, repair the related harnesses.
⑤ Inspect continuity between the PCM connector (vehicle side) terminal 2A and accelerator position sensor connector (vehicle side) terminal G (applied constant voltage using an ohmmeter).

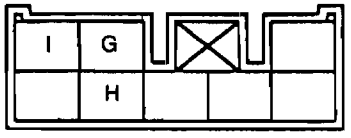
ACCELERATOR POSITION SENSOR



HARNESS SIDE CONNECTOR
(VIEW FROM TERMINAL SIDE)

⑥ If there is continuity, repair the related harness.
(2) Measurement voltage is B+.
① Turn the engine switch off.
② Disconnect the battery positive harness and battery negative harness.
③ Verify there is no continuity between the accelerator position sensor connector (vehicle side) terminal G and battery positive harness using an ohmmeter.

ACCELERATOR POSITION SENSOR



HARNESS SIDE CONNECTOR
(VIEW FROM TERMINAL SIDE)

④ If there is continuity, repair the related harnesses.
(3) Measurement voltage is approx. 5V.
- Constant voltage terminal of PCM is okay.

Not Using SST (NGS tester) at Ground Terminal Inspection

1. Turn the engine switch off.
2. Disconnect the PCM connectors.
3. Inspect for continuity between the PCM ground terminals and body ground using an ohmmeter.

PCM ground terminal
2B
3B
3Y

4. If not as specified, repair the related harnesses.

Not Using SST (NGS Tester) at Power Supply Terminal Inspection

1. Turn the engine switch off.
2. Disconnect the PCM connectors.
3. Measure the voltage between the PCM battery power terminal connectors and body ground using an ohmmeter.

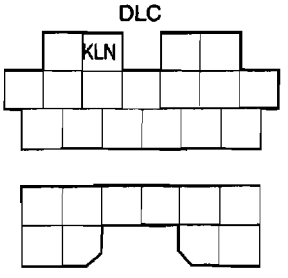
Power supply terminal
1A

Power supply terminal voltage:
B+

4. If not as specified, repair the related harnesses and fuses.

Not Using SST (NGS Tester) at Serial Communication Terminal Inspection

1. Turn the engine switch off.
2. Disconnect the PCM connectors.
3. Verify there is continuity between PCM connector terminal 3R and DLC KLN terminal.



COMPONENT SIDE CONNECTOR (VIEW FROM TERMINAL SIDE)

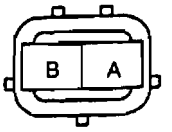
4. If not as specified, repair the related harnesses.

FUEL TEMPERATURE SENSOR INSPECTION
Resistance Inspection

Note
- Perform the following test only when directed.

1. Disconnect the negative battery cable.
2. Disconnect the fuel temperature sensor.
3. Inspect the resistance between the terminals under the following condition.

FUEL TEMPERATURE SENSOR



COMPONENT SIDE CONNECTOR (VIEW FROM TERMINAL SIDE)

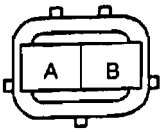
Specification

Terminal	Atmospheric temperature °C {°F}	Resistance (Ω)
A—B	20 {68}	2—3
	80 {76}	0.2—0.4

4. If not as specified, replace the fuel temprature sensor. When the reading is out of specification, send fuel temprature sensor to a distributor to repair. If the fuel temprature sensor is okay, but PID value or PCM terminal voltage is out of specification, inspect as follows and repair or replace as necessary.

Open circuit
- Power supply circuit (Fuel temprature sensor connector terminal B and PCM connector terminal 2I through common connector)
- Ground circuit (Fuel temprature sensor connector terminal A and PCM connector terminal 2B through common connector)

FUEL TEMPERATURE SENSOR



HARNESS SIDE CONNECTOR (VIEW FROM TERMINAL SIDE)

Short circuit
- Power supply circuit (Fuel temprature sensor connector terminal B and PCM connector terminal 2I through common connector to ground)

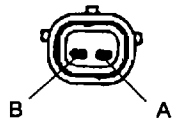
5. Repair or replace faulty areas.
6. Reconnect the fuel temprature sensor connector.

TIMER CONTROL VALVE (TCV) INSPECTION
Resistance Inspection

Note
- Perform the following test only when directed.

1. Disconnect the negative battery cable.
2. Disconnect the TCV.
3. Inspect the resistance between the terminals under the following condition.

TCV



COMPONENT SIDE CONNECTOR
(VIEW FROM TERMINAL SIDE)

Specification

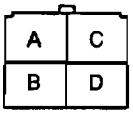
Terminal	Atmospheric temperature °C {°F}	Resistance (Ω)
A—B	20 {68}	10—14
A—Body	—	Above 10 M

4. If not as specified, replace the TCV.
   When the reading is out of specification, send TCV to a distributor to repair. If the TCV is okay, but PID value or PCM terminal voltage is out of specification, inspect as follows and repair or replace as necessary.

Open circuit

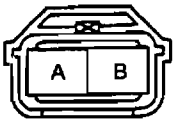
- Power supply circuit (TCV connector terminal A and PCM control relay connector terminal D through common connector)
- Ground circuit (TCV connector terminal B and PCM connector terminal 1C through common connector)

PCM CONTROL RELAY



HARNESS SIDE CONNECTOR (VIEW FROM TERMINAL SIDE)

TCV



HARNESS SIDE CONNECTOR (VIEW FROM TERMINAL SIDE)

Short circuit

- Power supply circuit (TCV connector terminal A and PCM control relay connector terminal D through common connector to ground)

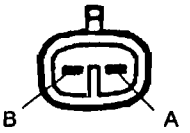
5. Repair or replace faulty areas.
6. Reconnect the TCV connector.

PUMP SPEED SENSOR INSPECTION
Resistance Inspection

Note
- Perform the following test only when directed.

1. Disconnect the negative battery cable.
2. Disconnect the pump speed sensor.
3. Inspect the resistance between the terminals under the following condition.

PUMP SPEED SENSOR



CONPONENT SIDE CONNECTOR
(VIEW FROM TERMINAL SIDE)

Specification

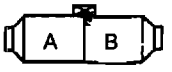
Terminal	Atmospheric temperature °C {°F}	Resistance (Ω)
A—B	-10—50 {-50—122}	185—275
A—Sensor body	—	Above 10 M

4. If not as specified, replace the pump speed sensor. When the reading is out of specification, send pump speed sensor to a distributor to repair. If the pump speed sensor is okay, but PID value or PCM terminal voltage is out of specification, inspect as follows and repair or replace as necessary.

Open circuit

- Power circuit (Pump speed sensor connector terminal B and PCM connector terminal 3G through common connector)
- Ground circuit (Pump speed sensor connector terminal A and PCM connector terminal 3H through common connector)

PUMP SPEED SENSOR



HARNESS SIDE CONNECTOR
(VIEW FROM TERMINAL SIDE)

Short circuit

- Power circuit (Pump speed sensor connector terminal B and PCM connector terminal 3G through common connector to ground)

5. Repair or replace faulty areas.
6. Reconnect the pump speed sensor connector.

INJECTION PUMP EPROM INSPECTION

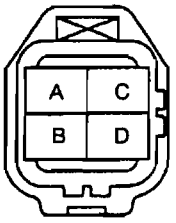
Caution
- **Do not input voltage to B terminal in the injection pump EPROM. Doing so will cause a malfunction of the injection pump EPROM.**

Note
- Perform the following test only when directed.

1. Disconnect the negative battery cable.
2. Disconnect the injection pump EPROM.

Open circuit
- Power Circuit (Injection pump EPROM connector terminal D and PCM connector terminal 3K through common connector)
- Power Circuit (Injection pump EPROM connector terminal A and PCM connector terminal 3N through common connector)
- Ground circuit (Injection pump EPROM connector terminal C and PCM connector terminal 2B through common connector)

INJECTION PUMP EPROM



HARNESS SIDE CONNECTOR
(VIEW FROM TERMINAL SIDE)

Short circuit
- Power Circuit (Injection pump EPROM connector terminal D and PCM connector terminal 3K through common connector to ground)
- Power Circuit (Injection pump EPROM connector terminal A and PCM connector terminal 3N through common connector to ground)

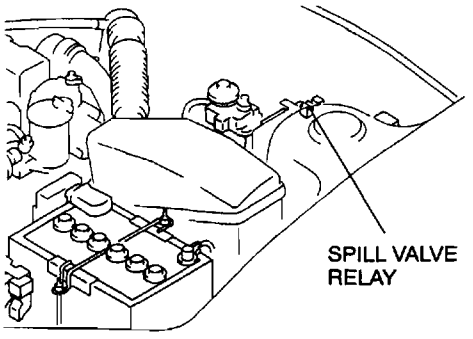
3. Repair or replace faulty areas.
4. Reconnect the injection pump EPROM connector.

SPILL VALVE RELAY INSPECTION

Continuity Inspection

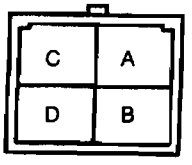
Note
- Perform the following test only when directed.

1. Disconnect the negative battery cable.
2. Remove the spill valve relay.



3. Inspect for continuity between terminals of the relay using an ohmmeter.

SPILL VALVE RELAY



CONPONENT SIDE CONNECTOR
(VIEW FROM TERMINAL SIDE)

Specification

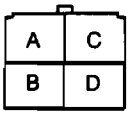
○—○ : Continuity

Step	Terminal			
	A	B	C	D
1	○	○		
2	B+	Ground	○	○

4. If not as specified, replace the spill valve relay. If the spill valve relay is okay, but PID value or PCM terminal voltage is out of specification, inspect as follows and repair or replace as necessary.

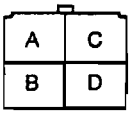
Open circuit
- Power supply circuit (Spill valve relay connector terminal C and PCM control relay connector terminal D through common connector)
- Power supply circuit (Spill valve relay connector terminal A and PCM control relay connector terminal D through common connector)
- Ground circuit (Spill valve relay connector terminal B and PCM connector terminal 1D through common connector)

PCM CONTROL RELAY



HARNESS SIDE CONNECTOR
(VIEW FROM TERMINAL SIDE)

SPILL VALVE RELAY



HARNESS SIDE CONNECTOR
(VIEW FROM TERMINAL SIDE)

Short circuit
- Power supply circuit (Spill valve relay connector terminal C and PCM control relay connector terminal D through common connector to ground)
- Power supply circuit (Spill valve relay connector terminal A and PCM control relay connector terminal D through common connector to ground)

5. Repair or replace faulty areas.
6. Install the spill valve relay.

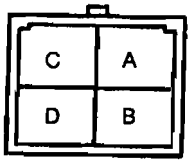
FUEL SHUT OFF (FSO) SOLENOID RELAY INSPECTION

Continuity Inspection

Note
- Perform the following test only when directed.

1. Disconnect the negative battery cable.
2. Remove the FSO solenoid relay located on the side of the PCM. (Refer to PCM REMOVAL/INSTALLATION.)
3. Inspect for continuity between terminals of the relay using an ohmmeter.

FSO SOLENOID RELAY



CONPONENT SIDE CONNECTOR
(VIEW FROM TERMINAL SIDE)

Specification

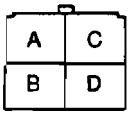
○—○ : Continuity

Step	Terminal			
	A	B	C	D
1	○	○		
2	B+	Ground	○	○

4. If not as specified, replace the FSO solenoid relay If the FSO solenoid relay is okay, but PID value or PCM terminal voltage is out of specification, inspect as follows and repair or replace as necessary.

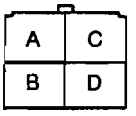
Open circuit
- Power supply circuit (FSO solenoid relay connector terminal C and PCM control relay connector terminal D through common connector)
- Power supply circuit (FSO solenoid relay connector terminal A and PCM control relay connector terminal D through common connector)
- Ground circuit (FSO solenoid relay connector terminal B and PCM connector terminal 3X through common connector)

PCM CONTROL RELAY



HARNESS SIDE
CONNECTOR (VIEW
FROM TERMINAL SIDE)

FSO SOLENOID RELAY



HARNESS SIDE
CONNECTOR (VIEW
FROM TERMINAL SIDE)

Short circuit
- Power supply circuit (FSO solenoid relay connector terminal C and PCM control relay connector terminal D through common connector to ground)
- Power supply circuit (FSO solenoid relay connector terminal A and PCM control relay connector terminal D through common connector to ground).

5. Repair or replace faulty areas.
6. Install the FSO solenoid relay

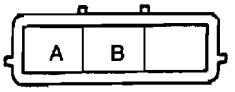
TDC SENSOR INSPECTION

Resistance Inspection

Note
- Perform the following test only when directed.

1. Disconnect the negative battery cable.
2. Disconnect the TDC sensor.
3. Inspect the resistance between the terminals under the following condition.

TDC SENSOR



COMPONENT SIDE CONNECTOR
(VIEW FROM TERMINAL SIDE)

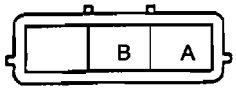
Specification

Terminal	Atmospheric temperature °C {°F}	Resistance (kΩ)
A—B	20 {68}	1.8—2.45

4. If not as specified, replace the TDC sensor valve. If the TDC sensor is okay, but PCM terminal voltage is out of specification, inspect as follows and repair or replace as necessary.

Open circuit
- Power circuit (TDC sensor connector terminal A and PCM connector terminal 3I through common connector)
- Ground circuit (TDC sensor connector terminal B and PCM connector terminal 3J trough common connector)

TDC SENSOR



HARNESS SIDE CONNECTOR
(VIEW FROM TERMINAL SIDE)

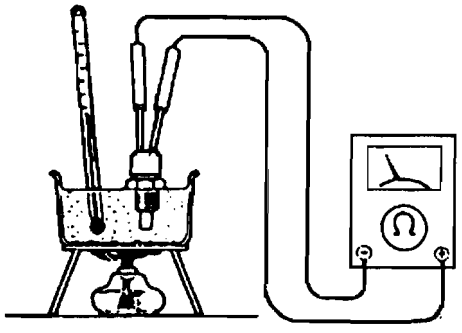
Short circuit
- Power circuit (TDC sensor connector terminal A and PCM connector terminal 3I through common connector to ground)
- Ground circuit (TDC sensor connector terminal B and PCM connector terminal 3J through common connector to ground)

5. Repair or replace faulty areas.
6. Reconnect the TDC sensor connector.

INTAKE AIR TEMPERATURE (IAT) SENSOR No.1, No.2 INSPECTION
Resistance Inspection

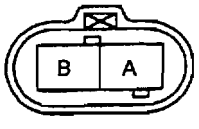
Note
- Perform the following test only when directed.

1. Disconnect the negative battery cable.
2. Remove the IAT No.1 or No.2 sensor.
3. Place the IAT sensor in water with a thermometer, and heat the water gradually.



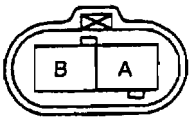
4. Measure the resistance of the IAT sensor using an ohmmeter.

IAT SENSOR No.1



CONPONENT SIDE CONNECTOR (VIEW FROM TERMINAL SIDE)

IAT SENSOR No.2



CONPONENT SIDE CONNECTOR (VIEW FROM TERMINAL SIDE)

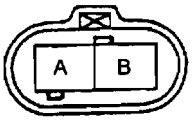
Specification

Water temperature °C {°F}	Resistance (kΩ)
20 {68}	2.09—2.81
80 {176}	0.274—0.802

5. If not as specified, replace the sensor. If IAT sensor is okay, but PID value is out of specification, inspect as follows and repair or replace as necessary.

IAT sensor No.1
Open circuit
- IAT signal circuit (IAT sensor No.1 connector terminal A and PCM connector terminal 2E)
- Ground circuit (IAT No.1 sensor connector terminal B and PCM connector terminal 2B)

IAT SENSOR No.1



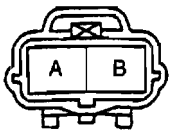
HARNESS SIDE CONNECTOR ◄
(VIEW FROM TERMINAL SIDE)

Short circuit
- INT signal circuit (IAT sensor No.1 connector terminal A and PCM connector terminal 2E to ground)

6. Install the 1AT sensor No.1.
7. Repair or replace faulty areas.

IAT sensor No.2
Open circuit
- IAT signal circuit (IAT sensor No.2 connector terminal A and PCM connector terminal 2K)
- Ground circuit (IAT sensor No.2 connector terminal B and PCM connector terminal 2B)

IAT SENSOR No.2



HARNESS SIDE CONNECTOR
(VIEW FROM TERMINAL SIDE)

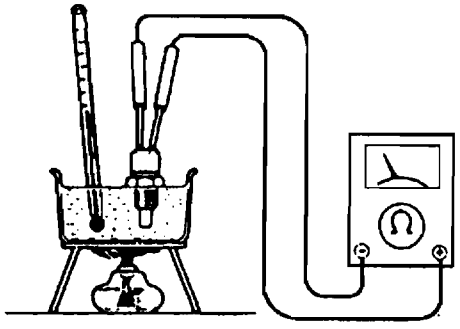
Short circuit
- IAT signal circuit (IAT sensor No.2 connector terminal A and PCM connector terminal 2K to ground)

8. Repair or replace faulty areas.
9. Install the IAT sensor No.2.

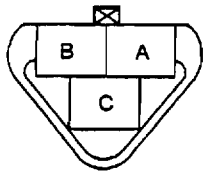
ENGINE COOLANT TEMPERATURE (ECT) SENSOR INSPECTION
Resistance Inspection

Note
- Perform the following test only when directed.

1. Disconnect the negative battery cable.
2. Drain the engine coolant. (Refer to section E, COOLING SYSTEM SERVICE WARNINGS.) (Refer to section E, ENGINE COOLANT REPLACEMENT.)
3. Remove the ECT sensor.
4. Place the ECT sensor in water with a thermometer, and heat the water gradually.



5. Measure the resistance between the engine coolant temperature sensor terminals A and B using an ohmmeter.



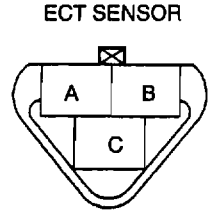
CONPONENT SIDE CONNECTOR
(VIEW FROM TERMINAL SIDE)

Specification

Water temperature °C {°F}	Resistance (Ω)
20 {68}	2.36—2.53
60 {140}	0.56—0.64

6. If not as specified, replace the ECT sensor. If the ECT sensor is okay, but PID value is out of specification, inspect as follows and repair or replace as necessary:

Open circuit
- ECT signal circuit (ECT sensor connector terminal B and PCM connector terminal 2G through common connector)
- Ground circuit (ECT sensor connector terminal A and PCM connector terminal 2B through common connector)

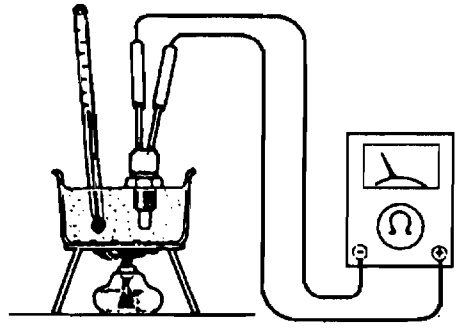


HARNESS SIDE CONNECTOR
(VIEW FROM TERMINAL SIDE)

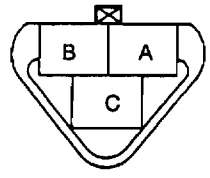
Short circuit
- ECT signal circuit (ECT sensor connector terminal B and PCM connector terminal 2G through common connector to ground)

7. Repair or replace faulty areas.
8. Install the ECT sensor.

Water Temperature Sender Unit Inspection
1. Drain the engine coolant. (Refer to section E, COOLING SYSTEM SERVICE WARNINGS.) (Refer to section E, ENGINE COOLANT REPLACEMENT.)
2. Remove the ECT sensor.
3. Place the ECT sensor in water with a thermometer, and heat the water gradually.



4. Measure the resistance between ECT sensor terminal C and body ground using an ohmmeter.



CONPONENT SIDE CONNECTOR
(VIEW FROM TERMINAL SIDE)

Specification

Water temperature °C {°F}	Resistance (Ω)
50 {122}	152—242

5. If not as specified, replace the ECT sensor.

IDLE SWITCH INSPECTION

On-vehicle Inspection

Note
- Perform the following test only when directed.

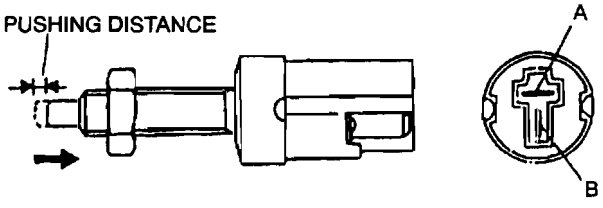
1. Verify that the accelerator pedal and idle switch are properly installed. (Refer to INTAKE-AIR SYSTEM, ACCELERATOR PEDAL DISASSEMBLY/ASSEMBLY)
2. Turn the engine switch on.
3. Monitor the voltage of PCM terminal 1T. Accelerate the accelerator pedal gradually and hold it at B+. Verify that the voltage of PCM terminal 2F is within the specification.

Specification
1.12—1.80 V

4. If not as specified, carry out the accelerator position sensor inspection or idle switch off-vehicle inspection.

Off-Vehicle Inspection

1. Disconnect the negative battery cable.
2. Disconnect connector from the idle switch, located above the accelerator pedal.
3. Inspect for continuity between the idle switch terminals using an ohmmeter.



Specification

Pushing distance (mm {in})	Continuity
Below 1.75 {0.069}	No (OFF)
Above 3.25 {0.127}	Yes (ON)

4. If not as specified, replace the idle switch. If the idle switch is okay, but PID valve or PCM terminal voltage is out of specification, inspect as follows and repair or replace as necessary.

Open circuit
- Power circuit (Idle switch connector terminal A and PCM connector terminal 1T through common connector)
- Ground circuit (Idle switch connector terminal B and body ground)

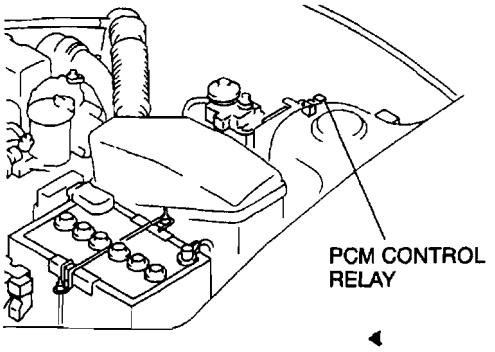
Short circuit
- Power circuit (Idle switch connector terminal A and PCM connector terminal 1T through common connector to ground)

5. Repair or replace faulty areas.
6. Reconnect the idle switch.

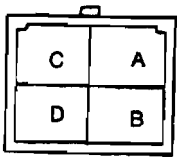
PCM CONTROL RELAY INSPECTION

Note
- Perform the following test only when directed.

1. Disconnect the negative battery cable.
2. Remove the PCM control relay.



3. Inspect for continuity between terminals of the relay using an ohmmeter.



CONPONENT SIDE CONNECTOR
(VIEW FROM TERMINAL SIDE)

Specification

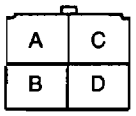
○—○ : Continuity

Step	Terminal			
	A	B	C	D
1	○	○		
2	B+	Ground	○	○

4. If not as specified, replace the PCM control relay. If the PCM control relay is okay, inspect as follows and repair or replace as necessary:

Open circuit
- Power supply circuit (PCM control relay connector terminal A and INJ fuse through common connector)
- Power supply circuit (PCM control relay terminal C and INJ fuse through common connector)
- Ground circuit (PCM control relay connector terminal B and PCM connector terminal 1E through common connector)

PCM CONTROL RELAY



HARNESS SIDE CONNECTOR
(VIEW FROM TERMINAL SIDE)

Short circuit
- Power supply circuit (PCM control relay connector terminal A and INJ fuse through common connector to ground)
- Power supply circuit (PCM control relay connector terminal C and INJ fuse through common connector to ground)

5. Repair or replace faulty areas.
6. Install the PCM control relay.

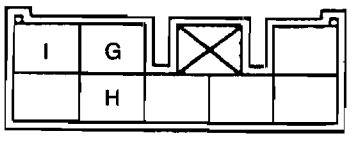
ACCELERATOR POSITION SENSOR INSPECTION

Note
- Perform the following test only when directed.

1. Verify that the accelerator pedal is properly installed and accelerator position sensor is adjusted. (Refer to INTAKE-AIR SYSTEM, ACCELERATOR PEDAL DISASSEMBLY/ASSEMBLY)
2. If as specified but PID value or PCM terminal voltage is out of specification, inspect as follows and repair or replace as necessary:

Open circuit
- Constant voltage circuit (Accelerator position sensor connector terminal G and PCM connector terminal 2A)
- Accelerator position signal circuit (Accelerator position sensor connector terminal H and PCM connector terminal 2F)
- Ground circuit (Accelerator position sensor connector terminal I and PCM connector terminal 2B)

ACCELERATOR POSITION SENSOR



HARNESS SIDE CONNECTOR
(VIEW FROM TERMINAL SIDE)

Short circuit
- Constant voltage circuit (Accelerator position sensor connector terminal G and PCM connector terminal 2A)
- Accelerator position signal circuit (Accelerator position sensor connector terminal H and PCM connector terminal 2F)

3. Repair or replace faulty areas.
4. Reconnect the accelerator position sensor connector.

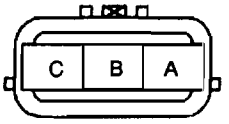
EGR VALVE POSITION SENSOR INSPECTION

Resistance Inspection

Note
- Perform the following test only when directed.

1. Disconnect the negative battery cable.
2. Disconnect the EGR valve position sensor.
3. Inspect the resistance between the terminals under the following condition.

EGR VALVE POSITION SENSOR



COMPONENT SIDE CONNECTOR
(VIEW FROM TERMINAL SIDE)

Specification

Terminal	Atmospheric temperature °C {°F}	Resistance (kΩ)
B—C	20 {68}	4—6

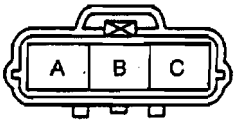
4. Verify that the resistance between terminals A and B changes as specified when the EGR valve is fully closed after being fully open.

Specification
Resistance increases in proportion to the EGR valve lift amount.

5. If not as specified, replace the EGR valve position sensor. If the EGR valve position sensor is okay, but PID value or PCM terminal voltage is out of specification, inspect as follows and repair or replace as necessary.

Open circuit
- EGR valve position signal (EGR valve position sensor connector terminal C and PCM connector terminal 2J through common connector)
- Constant voltage circuit (EGR valve position sensor connector terminal B and PCM connector terminal 2A through common connector)
- Ground circuit (EGR valve position sensor connector terminal A and PCM connector terminal 2B through common connector).

EGR VALVE POSITION SENSOR



HARNESS SIDE CONNECTOR
(VIEW FROM TERMINAL SIDE)

Short circuit
- EGR valve position signal (EGR valve position sensor connector terminal C and PCM connector terminal 2J through common connector to ground)
- Constant voltage circuit (EGR valve position sensor connector terminal B and PCM connector terminal 2A through common connector to ground).

6. Repair or replace faulty areas.
7. Reconnect the EGR valve position sensor connector.

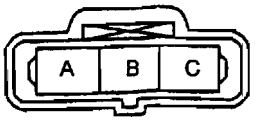
BOOST SENSOR INSPECTION

Note
- Perform the following test only when detected.

1. Inspect the boost sensor for damage and cracks.
2. Inspect vacuum hose for improper routing, kinks or leakage.
3. If the inspections above inspect, are okay as follows:

Open circuit
- Boost circuit (Boost sensor connector terminal B and PCM connector terminal 2C.)
- Constant voltage circuit (Boost sensor connector terminal C and PCM connector terminal 2A)
- Ground circuit (Boost sensor connector terminal A and PCM connector terminal 2B through common connector)

BOOST SENSOR



HARNESS SIDE CONNECTOR
(VIEW FROM TERMINAL SIDE)

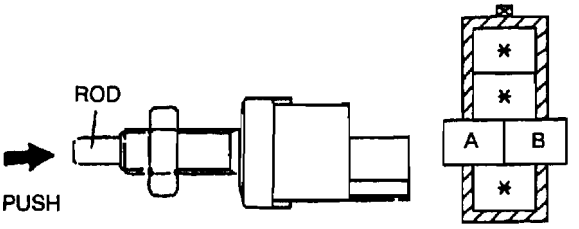
Short circuit
- Boost circuit (Boost sensor connector terminal B and PCM connector terminal 2C through common connector to ground)
- Constant voltage circuit (Boost sensor connector terminal C and PCM connector 2A through common connector to ground)

4. Repair or replace faulty areas.
5. Reconnect the boost sensor connector.

CLUTCH SWITCH INSPECTION
Continuity Inspection

Note
- Perform the following test only when detected.

1. Verify that the clutch switch is installed properly. (Refer to CLUTCH PEDAL REMOVAL/INSTALLATION.)
2. Disconnect the negative battery cable.
3. Remove the clutch switch. (Refer to CLUTCH PEDAL REMOVAL/INSTALLATION.)
4. Inspect continuity between the clutch switch terminals using an ohmmeter.



COMPONENT
SIDE CONNECTOR
(VIEW FROM
TERMINAL SIDE)

Specification

○—○ : Continuity

Condition	Terminal	
	A	B
Push the rod	○	○
Except above		

5. If not as specified, replace the clutch switch. If clutch switch is okay, but PID value is out of specification, inspect as follows:

Open circuit
- Power circuit (Clutch switch connector terminal A and PCM connector terminal 1V through common connector)
- Ground circuit (Clutch switch connector terminal B and ground)

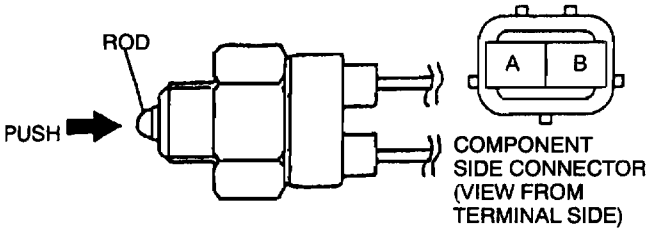
Short circuit
- Power circuit (Clutch switch connector terminal A and PCM connector terminal 1V through common connector to ground)

6. Repair or replace faulty areas.
7. Reconnect the clutch switch connector.

NEUTRAL SWITCH INSPECTION
Continuity Inspection

Note
- Perform the following test only when detected.

1. Disconnect the negative battery cable.
2. Remove the neutral switch.
3. Inspect for continuity between the neutral switch terminals using an ohmmeter.



Specification

○—○ : Continuity

Measuring Condition	Terminal	
	A	B
Push the rod	○—	—○
Except above		

4. If not as specified, replace the neutral switch. If neutral switch is okay but PID value is out of specification, inspect as follows:

Open circuit

- Power circuit (Neutral switch connector terminal A and PCM connector terminal 1V through common connector)
- Ground circuit (Neutral switch connector terminal B and ground through common connector)

Short circuit

- Power circuit (Neutral switch connector terminal A and PCM connector terminal 1V through common connector to ground)

5. Repair or replace faulty areas.
6. Reconnect the neutral switch connector.

ON-BOARD DIAGNOSTIC SYSTEM

READ/CLEAR DIAGNOSTIC TEST RESULTS
- This retrieves all stored DTCs in the PCM and clears the DTC.

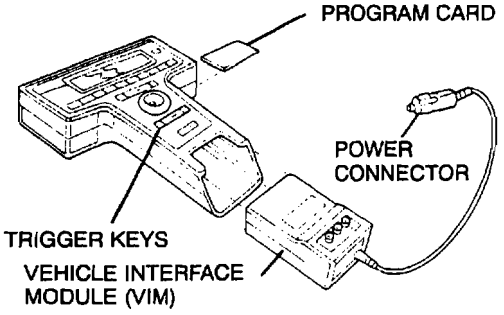
PARAMETER IDENTIFICATION (PID) ACCESS
- The PID mode allows access to certain data values, analog and digital inputs and outputs, calculated values and system status information. Since PID values for output devices are PCM internal data values, perform the Simulation Test to identify which output devices are malfunctioning.

SIMULATION TEST
- Output devices can be turned on and off by sending simulation command signals from the NGS tester to the Powertrain Control Module. The "Idling Test" and "Ignition ON Test" are available in this test. These tests will verify the PCM status, output devices, and related circuit wiring harnesses.

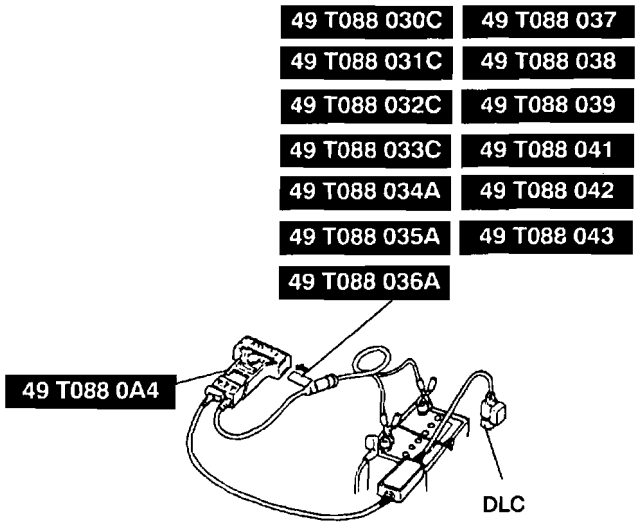
ON-BOARD DIAGNOSTIC TEST
New Generation Star (NGS) Tester Hook-up Procedure

Note
- Make sure the engine switch is at LOCK position.

1. Insert the vehicle interface module and latest program card into the hand-held NGS control unit.



2. Plug the adapter harness connector into the vehicle interface module and the data link connector (DLC) located at the engine compartment.
3. Plug the NGS tester power connector into the cigarette lighter. Alternatively, enable to use a battery hook-up adapter.

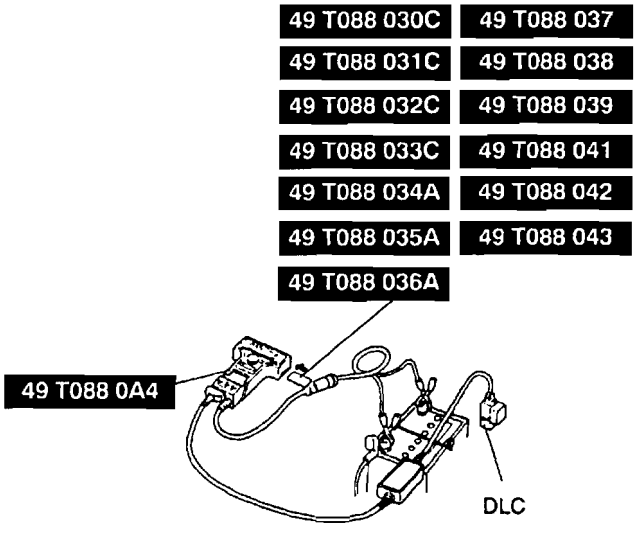


4. Listen to the double beep. The NGS tester is now initialized. Begin the powertrain control system functional test.

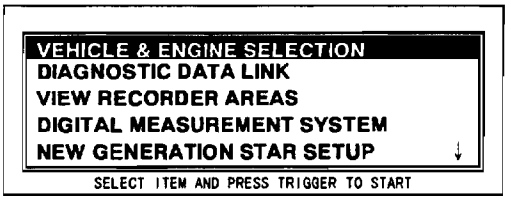
DTC READING PROCEDURE
Using the SSTs (NGS Tester)

Note
- Start engine and keep it running. If engine won't start, turn the engine switch on during the procedure.

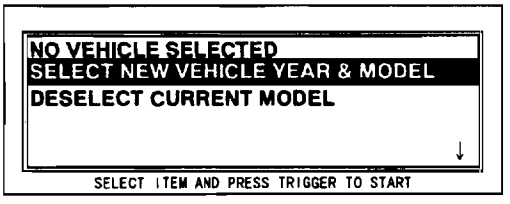
1. Perform the necessary vehicle preparation and visual inspection. Hook the NGS tester up to the vehicle.

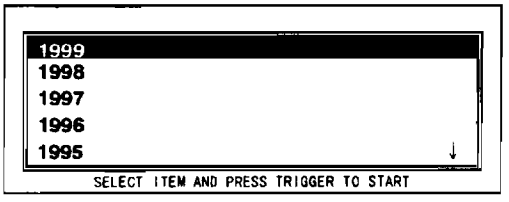


2. Move the cursor to **VEHICLE & ENGINE SELECTION**. Press the **TRIGGER** key to enter this function.

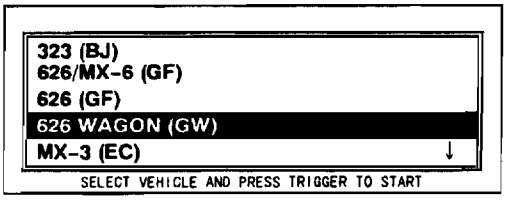


3. Move the cursor to **SELECT NEW VEHICLE YEAR & MODEL**. Press the **TRIGGER** key to enter this selection.





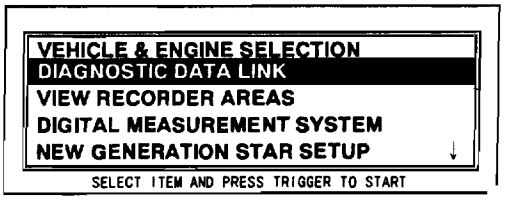
4. Move the cursor to **626 (GF) or 626 WAGON (GW)**. Press the **TRIGGER** key to enter this selection.



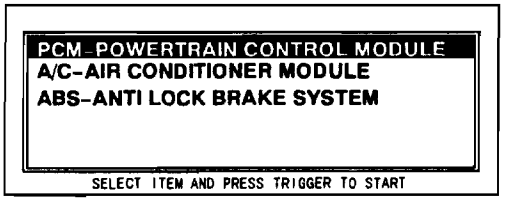
Note

- Make sure the selected vehicle is correct.

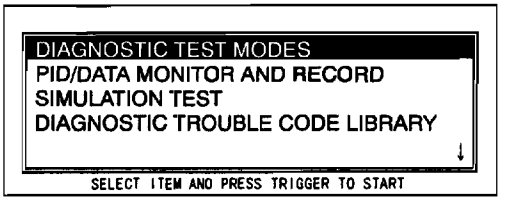
5. A vehicle selection screen showing the selected vehicle will be displayed. Move the cursor to the vehicle selected. Press the **TRIGGER** key.
6. Move the cursor to **DIAGNOSTIC DATA LINK** on the main menu screen. Press the **TRIGGER** key to enter into menu system diagnostics.



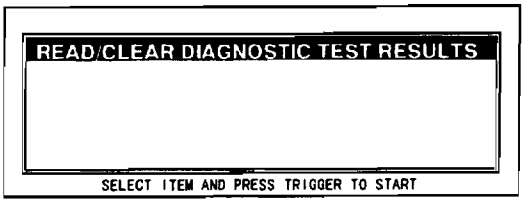
7. Move the cursor to **PCM-POWERTRAIN CONTROL MODULE**. Press the **TRIGGER** key to enter this selection.



8. Move the cursor **DIAGNOSTIC TEST MODES**. Press the **TRIGGER** key to enter this selection.



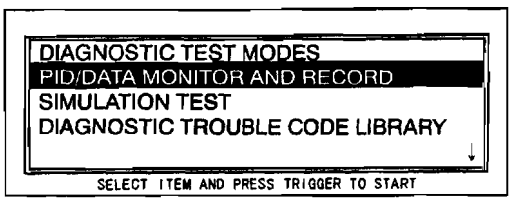
9. Move the cursor to **READ/CLEAR DIAGNOSTIC TEST RESULTS**. Press the **TRIGGER** key to enter this selection.



10. Press **START**.
11. Retrieve DTCs.

PID/DATA MONITOR AND RECORD PROCEDURE

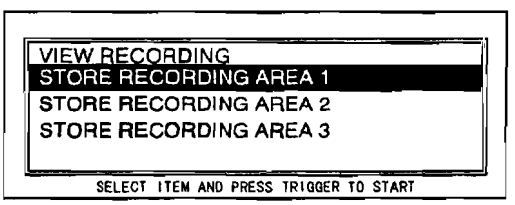
1. Perform the NGS Tester Hook-up Procedure.
2. Perform Steps 1 through 8 from the DTC READING PROCEDURE.
3. Turn the engine switch on or run the engine.
4. Move the cursor to **PID/DATA MONITOR AND RECORD**. Press the **TRIGGER** key to enter this selection.



5. Move the cursor to PID values to view. Press the **TRIGGER** key. A star symbol will appear next to the item when it is selected.

Note
- Press the **TRIGGER** key once again to deselect a PID.
- Press the **CLEAR** to deselect all PIDs.

6. Press **START** to begin.
7. When ready to capture and store the selected PIDs, press the **TRIGGER** key.
8. Press the **TRIGGER** key again when ready to save information.
9. Move the cursor to **STORE RECORDING IN AREA 1**. Press the **TRIGGER** key.

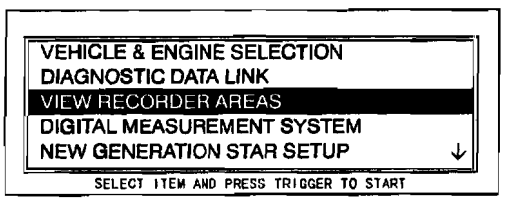


10. Follow the instructions displayed on the NGS tester to save the recording data.

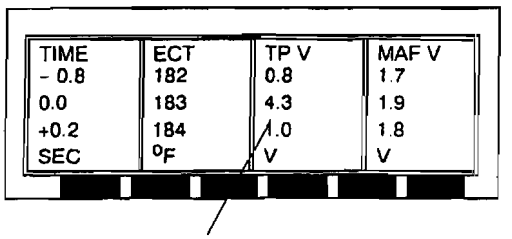
PLAYBACK OF STORED PIDS PROCEDURE

Note
- Look for abnormal behavior or values that are clearly incorrect. Inspect the signals for abrupt or unexpected changes.
- Look for agreement in related signals.
- Make sure signals act in proper sequence.

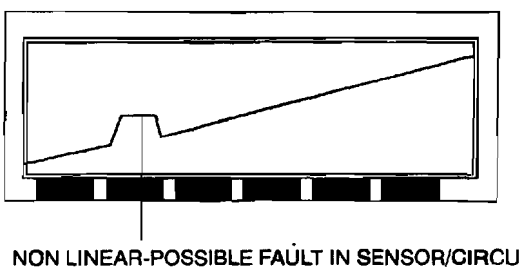
1. Select **VIEW RECORDER AREAS**.



2. Select a view areas.
3. Select up to the four PIDs to review in the table format or two PIDs to review in the graph mode.
   (1) Table format: Scroll through the PID data while analyzing the information. Look for sudden drops or spikes in the values.



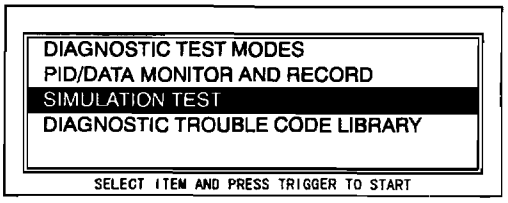
   (2) Graph format: Scroll through the PID data while analyzing the information. Look for sudden drops or spikes in the linear lines showing the transformation of values to the line graph.



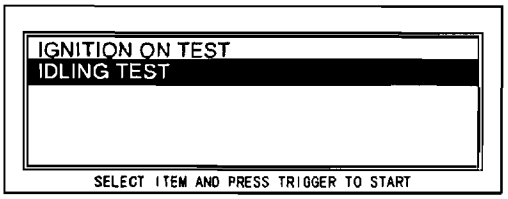
SIMULATION TEST PROCEDURE

Idling Test

1. Perform the NGS Tester Hook-up Procedure.
2. Perform the Steps 1 through 8 from the DTC READING PROCEDURE.
3. Start the engine and run it at idle.
4. Move the cursor to **SIMULATION TEST**. Press the **TRIGGER** key to enter this selection.



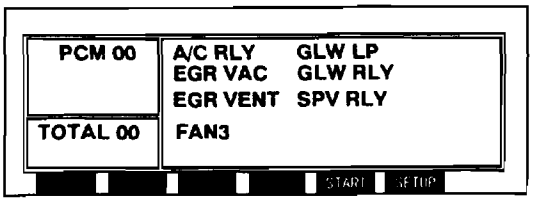
5. Move the cursor to **IDLING TEST**. Press the **TRIGGER** key to enter this selection.



6. The screen will display a list of simulation item. Select the appropriate simulation item for testing, then pass the **TRIGGER** key.

Note

- Only one simulation item can be selected at a time.

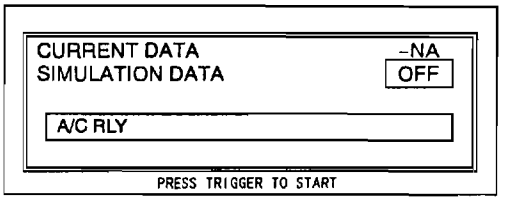


7. Press **START**.

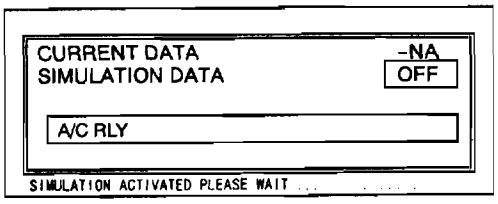
Note

- If the screen displays "**TEST CONDITION NOT CORRECT**", inspect the following signal conditions and determine whether or not they are normal:
  - NL SW: ON
  - RPM: above 775

8. Press the **TRIGGER** key.



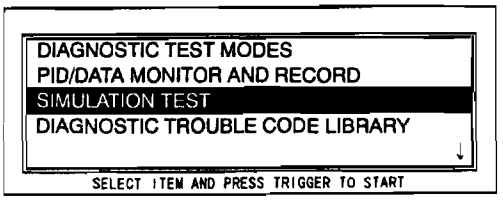
9. The simulation is performed **for 3 seconds**, and a **"SIMULATION ACTIVATED PLEASE WAIT"** message is displayed during those 3 seconds.



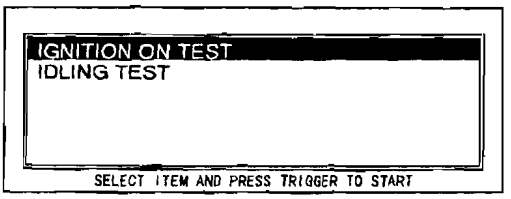
10. To perform the simulation again, press the **TRIGGER** key. To exit the idling test, press the **CANCEL** key.

Ignition ON Test

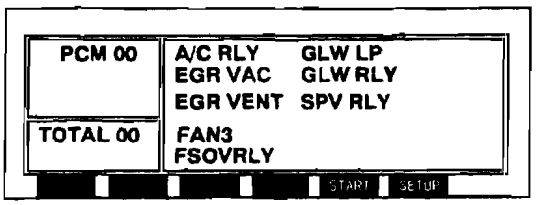
1. Perform Steps 1 through 8 from the DTCs READING PROCEDURE.
2. Turn the engine switch on. Move the cursor to **SIMULATION TEST**. Press the **TRIGGER** key to enter this selection.



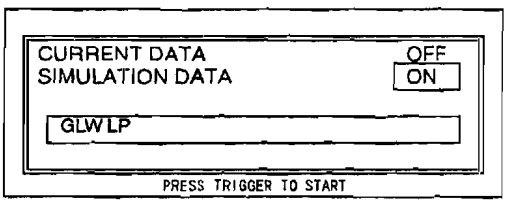
3. Move the cursor to **IGNITION ON TEST**. Press the **TRIGGER** key to enter this selection.



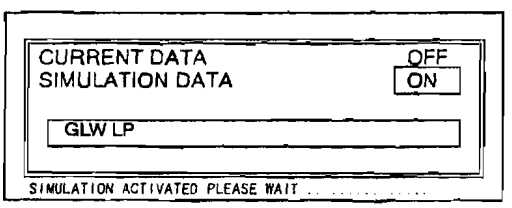
4. The screen will display a list of simulation item. Select the appropriate simulation item for testing, then press the **TRIGGER** key.



5. Press **START**.
6. Press the **TRIGGER** key.



7. The simulation is performed **for 3 seconds**, and a **"SIMULATION ACTIVATED PLEASE WAIT"** message is displayed during those 3 seconds.



8. To perform the simulation again, press the **TRIGGER** key. To exit the ignition on test, press the **CANCEL** key.

AFTER REPAIR PROCEDURE

Using the SSTs (NGS Tester)

1. After repairs have been made, perform the DTCs READING PROCEDURE.
2. Press **CLEAR**.
3. Press the **TRIGGER** key.
4. Press the **CANCEL** key.
5. Ensure that the customer's concern has been resolved.

Not Using the SSTs (NGS Tester)

1. After repairs, disconnect the negative battery cable for at least 20 seconds, and depress the brake pedal. Reconnect the negative battery cable.
2. Warm up the engine to normal operating temperature.

   Note
   - If the engine will not start, keep the starter operated for 5-6 seconds.

3. Perform the "DTC READING PROCEDURE" again.
4. Verify that the DTC is not detected.

ON-BOARD DIAGNOSTIC TROUBLE CODE INSPECTION

Diagnostic Trouble Code Table

DTC No.	Indicator Pattern	Display on the NGS	Condition
P0105		MAP/BP-CIRCUIT MALFUNCTION	Boost sensor malfunction
P0110		IAT-CIRCUIT MALFUNCTION	IAT sensor No.1 malfunction
P0115		ECT-CIRCUIT MALFUNCTION	ECT sensor malfunction
P0120		TP-CIRCUIT MALFUNCTION	Accelerator position sensor malfunction
P0180		FLT SENSOR(A)-CIRCUIT MALFUNCTION	Fuel temperature sensor malfunction
P0216		INJ TIMING CTRL-CIRCUIT MALFUNCTION	Injection timing system malfunction
P0219		ENGINE OVERSPEED CONDITION	Spill valve system malfunction
P0335		CRANKSHAFT POS SENSOR-CKT MALFUNCTION	TDC sensor malfunction
P0380		GLOW PLUG-CKT MALFUNCTION	Glow plug relay malfunction
P0403		EGR-CIRCUIT MALFUNCTION	EGR system malfunction
P0500		VEHICLE SPEED SENSOR-MALFUNCTION	Vehicle speed sensor malfunction
P0510		CLOSED THROTTLE POS SWITCH MALFUNCTION	Idle switch malfunction
P0606		PCM-PROCESSOR FAULT	PCM malfunction
P1110		IATS(D/C)-OPEN OR SHORT	IAT sensor No.2 malfunction
P1182		FUEL SHUT OFF SOLENOID-MALFUNCTION	FSO solenoid malfunction
P1189		PUMP SPEED SIGNAL-FAULT	Pump speed sensor malfunction
P1196		STA SW-OPEN OR SHORT	Engine switch malfunction
P1298		IDM FAILURE	IDM malfunction
P1402		EGRS-OPEN OR SHORT	EGR valve position sensor malfunction
P1602		IMMOBILIZER UNIT-PCM COMM ERROR	Immobilizer unit-PCM communication error
P1603		ID NUMBER-UNREGISTERED	ID number is unregistered. (Immobilizer)

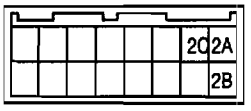
DTC No.	Indicator Pattern	Display on the NGS	Condition
P1604		CODE WORD-UNREGISTERED	Code word is unregistered. (Immobilizer)
P1621		CODE WORDS-DO NOT MATCH	Code words do not match. (Immobilizer)
P1622		ID NUMBERS-DO NOT MATCH	ID numbers do not match. (Immobilizer)
P1623		CODE WORD/ID NUMBER-WRITE/READ ERROR	Code word/ID number wiring and reading error (Immobilizer)
P1624		IMMOBILIZER COMMUNICATION COUNTER=0	PCM does not receive unlock signal from immobilizer unit. (PCM is okay.)
P1649		INJECTION PUMP EPROM-MALFUNCTION	Injection pump EPROM malfunction

DTC Troubleshooting

DTC P0105	BOOST SENSOR MALFUNCTION
DETECTION CONDITION	• Input voltage from boost sensor is above 4.90 V when engine switch is turned on. • Voltage more than 1.95 V is inputted from boost sensor to PCM when engine speed is above 2400 rpm and accelerator opening angle is more than 52%.
POSSIBLE CAUSE	• Boost sensor malfunction • Open or short circuit in wiring from PCM terminal 2C to boost sensor terminal B • Open or short circuit in wiring from PCM terminal 2A to boost sensor terminal C • Open circuit in wiring from PCM terminal 2B to boost sensor terminal A

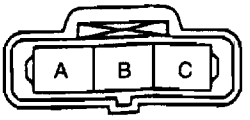
STEP	INSPECTION		ACTION
1	Does boost sensor connector or PCM connector have poor connection?	Yes	Repair or replace connector, then go to step 7.
		No	Go to next step.
2	Implement PID/DATA MONITOR AND RECORD (MAP V) of DIAGNOSTIC DATA LINK using NGS. Is the voltage as specified?	Yes	Go to Step 6.
		No	Go to next step.
3	Disconnect boost sensor connector. Turn engine switch on. Is there 5 V at connector terminal C?	Yes	Go to next step.
		No	Inspect for open or short circuit in wiring harness. (PCM terminal 2A–boost sensor terminal C)
4	Is there continuity between connector terminal A and PCM terminal 2B?	Yes	Go to next step.
		No	Repair or replace wiring harness, then go to Step 7.
5	Is boost sensor okay? ☞ CONTROL SYSTEM, BOOST SENSOR INSPECTION	Yes	Go to next step.
		No	Replace boost sensor, then go to Step 7.
6	Clear diagnostic trouble code from memory. Is same code No. Present after performing "After Repair Procedure"?	Yes	Go to Step 1.
		No	Intermittent poor connection in harness or connector. Repair connector and/or harness, then go to next step.
7	Clear diagnostic trouble code from memory. Is there any diagnostic trouble code present after performing "After Repair Procedure"?	Yes	Go to applicable DTC inspection.
		No	Troubleshooting completed.

PCM



HARNESS SIDE 16 PIN CONNECTOR
(VIEW FROM HARNESS SIDE)

BOOST SENSOR

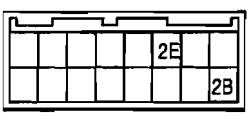


HARNESS SIDE CONNECTOR
(VIEW FROM TERMINAL SIDE)

DTC P0110	INTAKE AIR TEMPERATURE (IAT) SENSOR No.1
DETECTION CONDITION	• Input voltage from IAT No.1 sensor is below 0.142 V or above 4.915 V.
POSSIBLE CAUSE	• IAT sensor malfunction • Open or short circuit in wiring from IAT sensor (air cleaner) terminal A to PCM terminal 2E • Open or short circuit in wiring from IAT sensor (air cleaner) terminal B to PCM terminal 2B

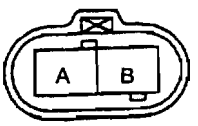
STEP	INSPECTION		ACTION
1	Does IAT sensor connector or PCM connector have poor connection?	Yes	Repair or replace connector, then go to step 7.
		No	Go to next step.
2	Implement PID/DATA MONITOR AND RECORD (IAT V) of DIAGNOSTIC DATA LINK using NGS. Is the voltage as specified?	Yes	Go to Step 6.
		No	Go to next step.
3	Disconnect IAT sensor connector. Turn engine switch on. Is there 5 V at connector terminal A?	Yes	Go to next step.
		No	Inspect for open or short circuit in wiring harness. (PCM terminal 2E–IAT sensor terminal A)
4	Is there continuity between connector terminal B and PCM terminal 2B?	Yes	Go to next step.
		No	Repair or replace wiring harness, then go to Step 7.
5	Is IAT sensor (air cleaner) okay? ☞ CONTROL SYSTEM, INTAKE AIR TEMPERATURE SENSOR INSPECTION.	Yes	Go to next step.
		No	Replace IAT sensor (air cleaner), then go to Step 7.
6	Clear diagnostic trouble code from memory. Is same code No. Present after performing "After Repair Procedure"?	Yes	Go to Step 1.
		No	Intermittent poor connection in harness or connector. Repair connector and/or harness, then go to next step.
7	Clear diagnostic trouble code from memory. Is there any diagnostic trouble code present after performing "After Repair Procedure"?	Yes	Go to applicable DTC inspection.
		No	Troubleshooting completed.

PCM



HARNESS SIDE 16 PIN CONNECTOR
(VIEW FROM HARNESS SIDE)

IAT SENSOR No.1

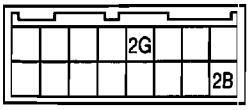


HARNESS SIDE CONNECTOR
(VIEW FROM TERMINAL SIDE)

DTC P0115	ENGINE COOLANT TEMPERATURE (ECT) SENSOR
DETECTION CONDITION	• Input voltage from ECT sensor is below 0.142 V or above 4.915 V.
POSSIBLE CAUSE	• ECT section malfunction • Open or short circuit in wiring from ECT sensor terminal A to PCM terminal 2B • Open or short circuit in wiring from ECT sensor terminal B to PCM terminal 2G

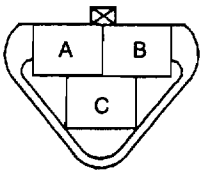
STEP	INSPECTION		ACTION
1	Does ECT sensor or PCM connector have poor connection?	Yes	Repair or replace connector, then go to step 7.
		No	Go to next step.
2	Implement PID/DATA MONITOR AND RECORD (ECT V) of DIAGNOSTIC DATA LINK using NGS. Is the voltage as specified?	Yes	Go to Step 5.
		No	Go to next step.
3	Disconnect ECT sensor connector. Turn engine switch to on. Is there 5 V at connector terminal B?	Yes	Go to next step.
		No	Inspect for open or short circuit in wiring harness. (PCM terminal 2G–ECT sensor terminal B)
4	Is there continuity between connector terminal A and PCM terminal 2B?	Yes	Go to next step.
		No	Repair or replace wiring harness, then go to Step 7.
5	Is ECT sensor okay? ☞ CONTROL SYSTEM, ENGINE COOLANT TEMPERATURE SENSOR INSPECTION	Yes	Go to next step.
		No	Replace ECT sensor, then go to Step 7.
6	Clear diagnostic trouble code from memory. Is same code No. Present after performing "After Repair Procedure"?	Yes	Go to Step 1.
		No	Intermittent poor connection in harness or connector. Repair connector and/or harness, then go to next step.
7	Clear diagnostic trouble code from memory. Is there any diagnostic trouble code present after performing "After Repair Procedure"?	Yes	Go to applicable DTC inspection.
		No	Troubleshooting completed.

PCM



HARNESS SIDE 16 PIN CONNECTOR
(VIEW FROM HARNESS SIDE)

ECT SENSOR

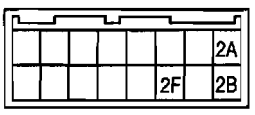


HARNESS SIDE CONNECTOR
(VIEW FROM TERMINAL SIDE)

DTC P0120	ACCELERATOR POSITION SENSOR
DETECTION CONDITION	• Input voltage from accelerator position sensor is below 0.3 V or above 4.7 V when continued for 0.06 sec. • Input voltage from accelerator position sensor is above 1.6 V when engine switch turned on for 0.3 sec.
POSSIBLE CAUSE	• Accelerator position sensor malfunction • Open circuit in wiring from throttle position sensor terminal E to PCM terminal 2B • Open or short circuit in wiring from throttle position sensor terminal C to PCM terminal 2A • Open or short circuit in wiring from throttle position sensor terminal D to PCM terminal 2F • Idle switch malfunction • Accelerator position sensor or idle switch misadjustment

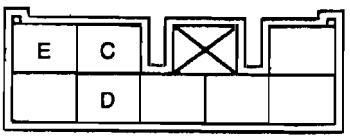
STEP	INSPECTION		ACTION
1	Does throttle position sensor connector or PCM connector have poor connection?	Yes	Repair or replace connector, then go to Step 9.
		No	Go to next step.
2	Implement PID/DATA MONITOR AND RECORD (TP V) of DIAGNOSTIC DATA LINK using NGS. Is the voltage as specified?	Yes	Go to next step.
		No	Go to Step 4.
3	Verify that the accelerator pedal and idle switch are properly installed. ☞ INTAKE-AIR SYSTEM, ACCELERATOR PEDAL DISASSEMBLY/ASSEMBLY	Yes	Go to Step 7.
		No	Go to Step 9.
4	Disconnect accelerator position sensor connector. Turn engine switch on. Is there 5 V at connector terminal C?	Yes	Go to next step.
		No	Inspect for open or short circuit in wiring harness. (PCM terminal 2A–accelerator position sensor terminal C)
5	Is there continuity between connector terminal D and PCM terminal 2F?	Yes	Go to next step.
		No	Repair or replace wiring harness, then go to Step 9.
6	Is there continuity between connector terminal E and PCM terminal 2B?	Yes	Replace throttle position sensor, then go to Step 9.
		No	Repair or replace wiring harness, then go to Step 9.
7	Is idle switch okay? ☞ CONTROL SYSTEM, IDLE SWITCH INSPECTION	Yes	Go to next step.
		No	Replace idle switch, then go to Step 9.
8	Clear diagnostic trouble code from memory. Is same code No. present after performing "After Repair Procedure"?	Yes	Go to Step 1.
		No	Intermittent poor connection in harness or connector. Repair connector and/or harness, then go to next step.
9	Clear diagnostic trouble code from memory. Is there any diagnostic trouble code present after performing "After Repair Procedure"?	Yes	Go to applicable DTC inspection.
		No	Troubleshooting completed.

PCM



HARNESS SIDE 16 PIN CONNECTOR
(VIEW FROM HARNESS SIDE)

ACCELERATOR POSITION SENSOR

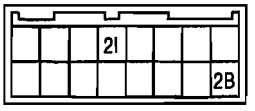


HARNESS SIDE CONNECTOR
(VIEW FROM TERMINAL SIDE)

DTC P0180	FUEL TEMPERATURE SENSOR
DETECTION CONDITION	• Input voltage from fuel temperature sensor is below 0.142 V or above 4.915 V.
POSSIBLE CAUSE	• Fuel temperature sensor malfunction • Open or short circuit in wiring from fuel temperature sensor terminal B to PCM terminal 2I • Open circuit in wiring from fuel temperature sensor terminal A to PCM terminal 2B

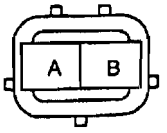
STEP	INSPECTION		ACTION
1	Does fuel temperature sensor connector or PCM connector have poor connection?	Yes	Repair or replace connector.
		No	Go to next step.
2	Disconnect fuel temperature sensor connector. Turn engine switch on. Is there 5V at connector terminal B?	Yes	Go to next step.
		No	Inspect for open or short circuit in wiring harness (PCM terminal 2I–Fuel temperature sensor terminal B)
3	Is there continuity between connector terminal A and PCM terminal 2B?	Yes	Go to next step.
		No	Repair or replace wiring harness.
4	Is fuel temperature sensor okay? ☞ CONTROL SYSTEM, FUEL TEMPERATURE SENSOR INSPECTION	Yes	Go to next step.
		No	Repair fuel temperature sensor.
5	Clear diagnostic trouble code from memory. Is same code No. Present after performing "After Repair Procedure"?	Yes	Go to Step 1.
		No	Intermittent poor connection in harness or connector. Repair connector and/or harness, then go to next step.
6	Clear diagnostic trouble code from memory. Is there any diagnostic trouble code present after performing "After Repair Procedure"?	Yes	Go to applicable DTC inspection.
		No	Troubleshooting completed.Troubleshooting completed.

PCM



HARNESS SIDE 16 PIN CONNECTOR
(VIEW FROM HARNESS SIDE)

FUEL TEMPERATURE SENSOR

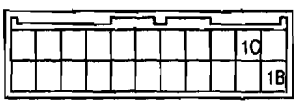


HARNESS SIDE CONNECTOR
(VIEW FROM TERMINAL SIDE)

DTC P0216	INJECTION TIMING SYSTEM MALFUNCTION
DETECTION CONDITION	• The actual injection timing deviates from the target injection timing by 7° continuously after the engine warm-up or while driving cotinuously for 20 sec.
POSSIBLE CAUSE	• Timer control valve (TCV) malfunction • Injection pump malfunction • Open or short circuit in wiring from PCM terminal 1C to TCV terminal A • Open or short circuit in wiring from TCV terminal B to spill valve relay terminal D

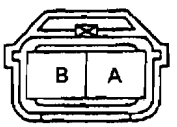
STEP	INSPECTION		ACTION
1	Does timer control valve (TCV) or PCM connector have poor connection?	Yes	Repair or replace connector, then go to Step 4.
		No	Go to next step.
2	Disconnect TCV connector. Is there continuity between connector terminal A and PCM terminal 1C?	Yes	Go to next step.
		No	Inspect for open circuit in wiring harness.
3	Is TCV okay? ☞ CONTROL SYSTEM, TIMER CONTROL VALVE (TCV) INSPECTION	Yes	Go to next step.
		No	Consult your distributor for repair.
4	Clear diagnostic trouble code from memory. Is same code No. Present after performing "After Repair Procedure"?	Yes	Consult your distributor for repair.
		No	Intermittent poor connection in harness or connector. Repair connector and/or harness, then go to next step.
5	Clear diagnostic trouble code from memory. Is there any diagnostic trouble code present after performing "After Repair Procedure"?	Yes	Go to applicable DTC inspection.
		No	Troubleshooting completed.

PCM



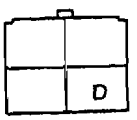
HARNESS SIDE 22 PIN CONNECTOR
(VIEW FROM HARNESS SIDE)

TCV



HARNESS SIDE CONNECTOR
(VIEW FROM TERMINAL SIDE)

SPILL VALVE RELAY

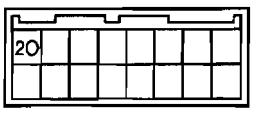


HARNESS SIDE CONNECTOR
(VIEW FROM TERMINAL SIDE)

DTC P0219	SPILL VALVE SYSTEM MALFUNCTION
DETECTION CONDITION	• The engine speed signal above 5600 rpm is inputted to the PCM for 1.0 seconds. • PCM cannot control engine though accelerator pedal is released.
POSSIBLE CAUSE	• Spill valve malfunction • IDM malfunction • PCM malfunction

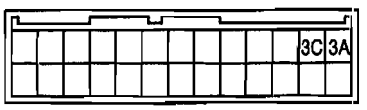
STEP	INSPECTION		ACTION
1	Does spill valve or EDU connector have poor connection?	Yes	Repair or replace connector, then go to Step 5.
		No	Go to next step.
2	Disconnect the IDM connector. Turn engine switch on. Is there 10–14V at connector terminal B?	Yes	Go to next step.
		No	Check for open or short circuit in wiring harness. (Spill valve relay terminal D–IDM terminal B).
3	Is there continuity between IDM and body ground?	Yes	Go to next step.
		No	Remove the IDM, and reinstall it.
4	Is there resistance of approx. 1.2 Ω at the harness side connector from terminal E to D?	Yes	Go to next step.
		No	Inspect spill valve ☞ CONTROL SYSTEM, SPILL VALVE INSPECTION.
5	Clear diagnostic trouble code from memory. Is same code No. Present after performing "After Repair Procedure"?	Yes	Consult your distributor for repair.
		No	Intermittent poor connection in harness or connector. Repair connector and/or harness, then go to next step.
6	Clear diagnostic trouble code from memory. Is there any diagnostic trouble code present after performing "After Repair Procedure"?	Yes	Go to applicable DTC inspection.
		No	Troubleshooting completed.

PCM



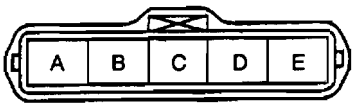
HARNESS SIDE 16 PIN CONNECTOR
(VIEW FROM HARNESS SIDE)

PCM



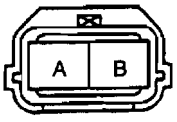
HARNESS SIDE 26 PIN CONNECTOR
(VIEW FROM HARNESS SIDE)

IDM



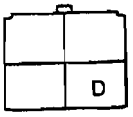
HARNESS SIDE CONNECTOR
(VIEW FROM TERMINAL SIDE)

SPILL VALVE



HARNESS SIDE CONNECTOR
(VIEW FROM TERMINAL SIDE)

SPILL VALVE RELAY

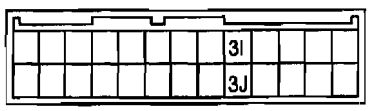


HARNESS SIDE CONNECTOR
(VIEW FROM TERMINAL SIDE)

DTC P0335	TDC SENSOR MALFUNCTION
DETECTION CONDITION	• Crankshaft position signal is not inputted to the PCM when the engine speed is above 400 rpm.
POSSIBLE CAUSE	• TDC sensor malfunction • TDC sensor misadjustment • Open or short circuit in wiring from PCM terminal 3I to TDC sensor terminal A • Open or short circuit in wiring from PCM terminal 3J to TDC sensor terminal B

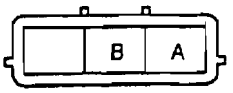
STEP	INSPECTION		ACTION
1	Does TDC sensor connector or PCM connector have poor connection?	Yes	Repair or replace connector, then go to Step 5.
		No	Go to next step.
2	Disconnect the TDC sensor connector. Is there continuity between connector terminal B and PCM terminal 3J? Is there continuity between connector terminal A and PCM terminal 3I?	Yes	Go to next step.
		No	Repair or replace wiring harness, then go to Step 5.
3	Is TDC sensor okay? ☞ CONTROL SYSTEM, CRANKSHAFT POSITION SENSOR INSPECTION	Yes	Go to next step.
		No	Replace TDC sensor, then go to Step 5.
4	Clear diagnostic trouble code from memory. Is same code No. Present after performing "After Repair Procedure"?	Yes	Go to Step 1.
		No	Intermittent poor connection in harness or connector. Repair connector and/or harness, then go to next step.
5	Clear diagnostic trouble code from memory. Is there any diagnostic trouble code present after performing "After Repair Procedure"?	Yes	Go to applicable DTC inspection.
		No	Troubleshooting completed.

PCM



HARNESS SIDE 26 PIN CONNECTOR
(VIEW FROM HARNESS SIDE)

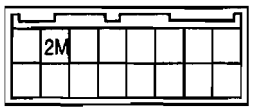
TDC SENSOR



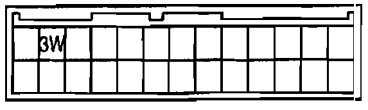
HARNESS SIDE CONNECTOR
(VIEW FROM TERMINAL SIDE)

DTC P0380	GLOW PLUG RELAY MALFUNCTION
DETECTION CONDITION	• When the glow plug relay is on, the current voltage signal of the relay below 1.0 V is inputted to the PCM continuously for more than 1.0 seconds. • When the glow plug relay is off, the signal of the relay current voltage above 4.0 V is inputted to the PCM continuously for more than 1.0 seconds.
POSSIBLE CAUSE	• Glow plug relay malfunction • Open or short circuit in wiring from PCM terminal 3W to glow plug relay terminal A (L/G) • Open or short circuit in wiring from PCM terminal 2M to glow plug relay terminal D (L/W) • Open or short circuit in wiring from glow plug relay terminal C (L) to glow fuse

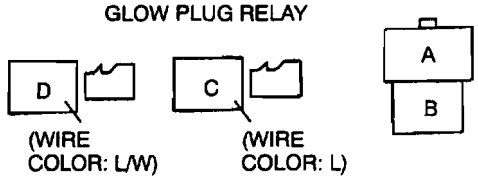
STEP	INSPECTION		ACTION
1	Does glow plug relay connector or PCM connector have poor connection?	Yes	Repair or replace connector, then go to Step 5.
		No	Go to next step.
2	Remove glow plug relay. Is there continuity between connector terminal A and PCM terminal 3W? Is there continuity between connector terminal D (L/W) and PCM terminal 2M?	Yes	Go to next step.
		No	Repair or replace wiring harness.
3	Is there continuity between connector terminal B and body ground?	Yes	Go to next step.
		No	Repair or replace wiring harness.
4	Is there continuity between connector terminal C (L) and glow fuse?	Yes	Go to next step.
		No	Repair or replace wiring harness.
5	Is glow plug relay okay? ☞ CONTROL SYSTEM, INTAKE-AIR SYSTEM, GLOW PLUG RELAY INSPECTION	Yes	Go to next step.
		No	Replace glow plug relay.
6	Clear diagnostic trouble code from memory. Is same code No. Present after performing "After Repair Procedure"?	Yes	Go to Step 1.
		No	Intermittent poor connection in harness or connector. Repair connector and/or harness, then go to next step.
7	Clear diagnostic trouble code from memory. Is there any diagnostic trouble code present after performing "After Repair Procedure"?	Yes	Go to applicable DTC inspection.
		No	Troubleshooting completed.



HARNESS SIDE 16 PIN CONNECTOR
(VIEW FROM HARNESS SIDE)



HARNESS SIDE 26 PIN CONNECTOR
(VIEW FROM HARNESS SIDE)



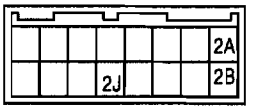
HARNESS SIDE CONNECTOR
(VIEW FROM TERMINAL SIDE)

DTC P0403	EGR SYSTEM MALFUNCTION
DETECTION CONDITION	Difference of more than 20 % between EGR valve position sensor output valve and EGR command signal sent from PCM is inputted continuously to PCM for more than 20 seconds.
POSSIBLE CAUSE	• EGR valve position sensor malfunction • Open or short circuit in wiring from EGR valve position sensor terminal C to PCM terminal 2J • Open or short circuit in wiring from EGR valve position sensor terminal B to PCM terminal 2A • Open circuit in wiring from EGR valve position sensor terminal A to PCM terminal 2B • EGR solenoid valve (vent) malfunction • EGR solenoid valve (vacuum) malfunction • Vacuum hose damage or looseness between EGR valve and EGR solenoid valve (vent) • Vacuum hose damage or looseness between EGR valve and EGR solenoid valve (vacuum) • Vacuum hose damage or looseness between EGR solenoid valve (vent) and vacuum pump • Vacuum hose damage or looseness between EGR solenoid valve (vacuum) and vacuum pump • Open or short circuit in wiring from EGR solenoid valve (vent) terminal B and PCM terminal 1O. • Open or short circuit in wiring from EGR solenoid valve (vacuum) terminal B and PCM terminal 1K.

STEP	INSPECTION		ACTION
1	Does EGR valve position sensor connector or PCM connector have poor connection?	Yes	Repair or replace connector, then go to Step 5.
		No	Go to next step.
2	Disconnect EGR valve position sensor. Turn engine switch on. Is there 5V at connector terminal B?	Yes	Go to next step.
		No	Inspect for open or short circuit in wiring harness.
3	Is there continuity between connector terminal C and PCM terminal 2J? Is there continuity between connector terminal A and PCM terminal 2B?	Yes	Go to next step.
		No	Repair or replace wiring harness, then go to Step 5.
4	Is EGR valve position sensor okay? ☞ CONTROL SYSTEM, EGR VALVE POSITION SENSOR INSPECTION	Yes	Go to next step.
		No	Replace EGR valve.
5	Is EGR solenoid valve (vent) okay? ☞ EMISSION SYSTEM, EGR SOLENOID VALVE (VENT) INSPECTION	Yes	Go to next step.
		No	Replace EGR solenoid valve (vent).
6	Is EGR solenoid valve (vacuum) okay? ☞ EMISSION SYSTEM, EGR SOLENOID VALVE (VACUUM) INSPECTION	Yes	Go to next step.
		No	Replace EGR solenoid valve (vacuum).
7	Inspect damage or looseness for following vacuum hoses. • Between EGR solenoid valve (vent) and EGR valve • Between EGR solenoid valve (vacuum) and EGR valve • Between EGR solenoid valve (vent) and vacuum pump • Between EGR solenoid valve (vacuum) and vacuum pump Is there damage or looseness?	Yes	Repair or replace faulty part.
		No	Go to next step.
8	Is there continuity between EGR solenoid valve (vent) terminal B and PCM terminal 1O?	Yes	Go to next step.
		No	Inspect for open or short circuit in wiring harness.
9	s there continuity between EGR solenoid valve (vacuum) terminal B and PCM terminal 1K?	Yes	Go to next step.
		No	Inspect for open or short circuit in wiring harness.
10	Clear diagnostic trouble code from memory. Is same code No. Present after performing "After Repair Procedure"?	Yes	Go to Step 1.
		No	Intermittent poor connection in harness or connector. Repair connector and/or harness, then go to next step.

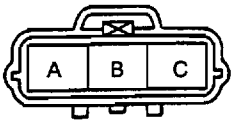
STEP	INSPECTION		ACTION
11	Clear diagnostic trouble code from memory. Is there any diagnostic trouble code present after performing "After Repair Procedure"?	Yes	Go to applicable DTC inspection.
		No	Troubleshooting completed.

PCM



HARNESS SIDE 16 PIN CONNECTOR
(VIEW FROM HARNESS SIDE)

EGR VALVE POSITION SENSOR

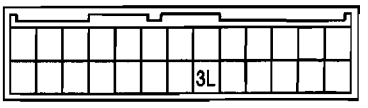


HARNESS SIDE CONNECTOR
(VIEW FROM TERMINAL SIDE)

DTC P0500	VEHICLE SPEED SENSOR MALFUNCTION
DETECTION CONDITION	• Vehicle speed signal is 0 km/h {0 mph} for more than 5.0 sec. while driving in following condition: • Engine speed is over 2,800 rpm. • Neutral switch is off.
POSSIBLE CAUSE	• Speedometer sensor malfunction • Open or short circuit in wiring from ignition switch to speedometer sensor • Open or short circuit in wiring from speedometer sensor to GND • Open or short circuit in wiring from speedometer sensor to vehicle speed sensor • Open or short circuit in wiring from vehicle speed sensor to PCM terminal 3L

STEP	INSPECTION		ACTION
1	Does vehicle speed sensor connector or PCM connector have poor connection?	Yes	Repair or replace connector, then go to Step 8.
		No	Go to next step.
2	Implement PID/DATA MONITOR AND RECORD (VS) of DIAGNOSTIC DATA LINK using NGS. Does it operate normally?	Yes	Go to Step 6.
		No	Go to next step.
3	Is there continuity between vehicle speed sensor terminal and PCM terminal 3L?	Yes	Go to next step.
		No	Repair or replace wiring harness, then go to Step 8.
4	Is there continuity between vehicle speed sensor and speedometer sensor terminals?	Yes	Go to next step.
		No	Repair or replace speedometer sensor and wiring harness, then go to Step 8.
5	Is vehicle speed sensor okay?	Yes	Go to next step.
		No	Repair or replace as necessary, then go to Step 8.
6	Clear diagnostic trouble code from memory. Is same code No. present after performing "After Repair Procedure"?	Yes	Go to Step 1.
		No	Intermittent poor connection in harness or connector. Repair connector and/or harness, then go to next step.
7	Clear diagnostic trouble code from memory. Is there any diagnostic trouble code present after performing "After Repair Procedure"?	Yes	Go to applicable DTC inspection.
		No	Troubleshooting completed.

PCM

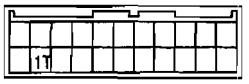


HARNESS SIDE 26 PIN CONNECTOR
(VIEW FROM HARNESS SIDE)

DTC P0510	IDLE SWITCH MALFUNCTION
DETECTION CONDITION	• PCM detects for more than 1.0 second that output voltage from accelerator position sensor is below 1.05 V with idle switch off.
POSSIBLE CAUSE	• Idle switch malfunction • Accelerator position sensor and idle switch misadjustment • Idle switch misadjustment • Open or short circuit in wiring from idle switch terminal A to PCM terminal 1T • Open in wiring from idle switch terminal B to body ground

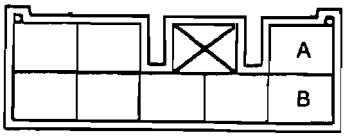
STEP	INSPECTION		ACTION
1	Does idle switch connector or PCM connector have poor connection?	Yes	Repair or replace connector.
		No	Go to next step.
2	Disconnect idle switch connector. Turn engine switch on. Is there 5V at idle switch terminal A?	Yes	Go to next step.
		No	Check for open or short circuit in wiring harness. (PCM terminal 1T–Idle switch terminal)
3	Is there continuity between idle switch connector terminal B and body earth?	Yes	Go to next step.
		No	Replace idle switch.
4	Inspect installation condition of idle switch and accelerator position sensor. Are they okay?	Yes	Go to next step.
		No	Adjust installation position of idle switch and accelerator position sensor.
4	Clear diagnostic trouble code from memory. Is same code No. Present after performing "After Repair Procedure"?	Yes	Go to Step 1.
		No	Intermittent poor connection in harness or connector. Repair connector and/or harness, then go to next step.
5	Clear diagnostic trouble code from memory. Is there any diagnostic trouble code present after performing "After Repair Procedure"?	Yes	Go to applicable DTC inspection.
		No	Troubleshooting completed.

PCM



HARNESS SIDE 22 PIN CONNECTOR
(VIEW FROM HARNESS SIDE)

IDLE SWITCH



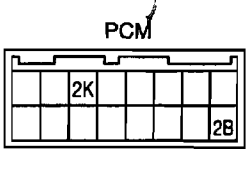
HARNESS SIDE CONNECTOR
(VIEW FROM TERMINAL SIDE)

DTC P0606	PCM MALFUNCTION
DETECTION CONDITION	• PCM does not read DTC from output devices.
POSSIBLE CAUSE	• PCM internal malfunction

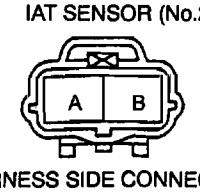
STEP	INSPECTION		ACTION
1	–	–	Replace PCM and reprogram immobilizer system. ☞ Section T, IMMOBILIZER SYSTEM, KEY NUMBER INPUT PROCEDURE.

DTC P1110	INTAKE AIR TEMPERATURE (IAT) SENSOR No.2
DETECTION CONDITION	• Input voltage from IAT No.2 sensor is below 0.142 V or above 4.915 V when continued for 0.5 sec.
POSSIBLE CAUSE	• IAT sensor malfunction • Open or short circuit in wiring from IAT sensor (intake-air pipe) terminal A to PCM terminal 2K. • Open or short circuit in wiring from IAT sensor (intake-air pipe) terminal B to PCM terminal 2B.

STEP	INSPECTION		ACTION
1	Does IAT sensor connector or PCM connector have poor connection?	Yes	Repair or replace connector, then go to Step 7.
		No	Go to next step.
2	Implement PID/DATA MONITOR AND RECORD (IAT V) of DIAGNOSTIC DATA LINK by using NGS. Is the voltage as specified?	Yes	Go to Step 6.
		No	Go to next step.
3	Disconnect IAT sensor connector. Turn engine switch on. Is there 5 V at connector terminal A?	Yes	Go to next step.
		No	Inspect for open or short circuit in wiring harness. (PCM terminal 2K–IAT sensor terminal A)
4	Is there continuity between connector terminal B and PCM terminal 2B?	Yes	Go to next step.
		No	Repair or replace wiring harness, then go to Step 7.
5	Is IAT sensor (intake-air pipe) okay? ☞ CONTROL SYSTEM, INTAKE AIR TEMPERATURE SENSOR INSPECTION.	Yes	Go to next step.
		No	Replace IAT sensor (intake-air pipe), then go to Step 7.
6	Clear diagnostic trouble code from memory. Is same code No. Present after performing "After Repair Procedure"?	Yes	Go to Step 1.
		No	Intermittent poor connection in harness or connector. Repair connector and/or harness, then go to next step.
7	Clear diagnostic trouble code from memory. Is there any diagnostic trouble code present after performing "After Repair Procedure"?	Yes	Go to applicable DTC inspection.
		No	Troubleshooting completed.



HARNESS SIDE 16 PIN CONNECTOR
(VIEW FROM HARNESS SIDE)

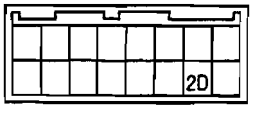


HARNESS SIDE CONNECTOR
(VIEW FROM TERMINAL SIDE)

DTC P1182	FUEL SHUT OFF (FSO) SOLENOID MALFUNCTION
DETECTION CONDITION	PCM 2D terminal voltage stays under the preset voltage for more than 2.0 sec. after turning engine switch off.
POSSIBLE CAUSE	• Open or short circuit wiring from FSO solenoid terminal A to FSO solenoid relay terminal D

STEP	INSPECTION		ACTION
1	Does FSO solenoid connector or PCM connector have poor connection?	Yes	Repair or replace connector.
		No	Go to next step.
2	Is PCM terminal 2D voltage okay?	Yes	Go to Step 4.
		No	Go to next step.
3	Disconnect FSO solenoid connector. Turn engine switch on. Is there battery positive voltage at connector terminal 2D?	Yes	Go to next step.
		No	Inspect for open or short circuit in wiring harness. (FSO solenoid terminal B–PCM terminal 2D)
4	Is there continuity between connector terminal B and PCM terminal 2D?	Yes	Go to next step.
		No	Repair or replace wiring harness.
5	Is FSO solenoid okay? ☞ FUEL SUSTEM, FUEL SHUT OFF (FSO) SOLENOID INSPECTION	Yes	Go to next step.
		No	Repair or replace FSO solenoid.
6	Is FSO solenoid relay okay? ☞ FUEL SUSTEM, FUEL SHUT OFF (FSO) SOLENOID RELAY INSPECTION	Yes	Go to next step.
		No	Repair or replace FSO solenoid relay.
7	Clear diagnostic trouble code from memory. Is same code No. Present after performing "After Repair Procedure"?	Yes	Go to Step 1.
		No	Intermittent poor connection in harness or connector. Repair connector and/or harness, then go to next step.
8	Clear diagnostic trouble code from memory. Is there any diagnostic trouble code present after performing "After Repair Procedure"?	Yes	Go to applicable DTC inspection.
		No	Troubleshooting completed.

PCM



HARNESS SIDE 16 PIN CONNECTOR
(VIEW FROM HARNESS SIDE)

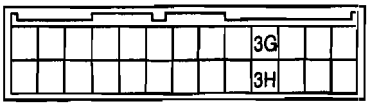
FSO SOLENOID

HARNESS SIDE CONNECTOR
(VIEW FROM TERMINAL SIDE)

DTC P1189	PUMP SPEED SENSOR MALFUNCTION
DETECTION CONDITION	• PCM cannot detect NE signal though engine is rotating
POSSIBLE CAUSE	• Pump speed sensor malfunction • Open or short circuit in wiring from PCM terminal 3G to pump speed sensor terminal B • Open or short circuit in wiring from PCM terminal 3H to pump speed sensor terminal A

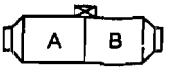
STEP	INSPECTION		ACTION
1	Does pump speed sensor connector or PCM connector have poor connection?	Yes	Repair or replace connector.
		No	Go to next step.
2	Disconnect pump speed sensor connector. Is there continuity between connector terminal B and PCM terminal 3G? Is there continuity between connector terminal A and PCM terminal 3H?	Yes	Go to next step.
		No	Repair or replace wiring harness.
3	Is pump speed sensor okay? ☞ CONTROL SYSTEM, PUMP SPEED SENSOR INSPECTION	Yes	Go to next step.
		No	Consult your distributor for repair.
4	Clear diagnostic trouble code from memory. Is same code No. Present after performing "After Repair Procedure"?	Yes	Consult your distributor for repair.
		No	Intermittent poor connection in harness or connector. Repair connector and/or harness, then go to next step.
5	Clear diagnostic trouble code from memory. Is there any diagnostic trouble code present after performing "After Repair Procedure"?	Yes	Go to applicable DTC inspection.
		No	Troubleshooting completed.

PCM



HARNESS SIDE 26 PIN CONNECTOR
(VIEW FROM HARNESS SIDE)

PUMP SPEED SENSOR

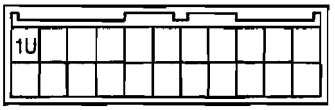


HARNESS SIDE CONNECTOR
(VIEW FROM TERMINAL SIDE)

DTC P1196	ENGINE SWITCH MALFUNCTION
DETECTION CONDITION	• Input signal from starter to PCM continues for more than 10 seconds while engine speed is over 1200 rpm
POSSIBLE CAUSE	• Starter malfunction • Open or short circuit in wiring from starter terminal S to PCM terminal 1U

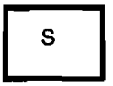
STEP	INSPECTION		ACTION
1	Does starter connector or PCM connector have poor connection?	Yes	Repair or replace connector, then go to Step 5.
		No	Go to next step
2	Implement PID/DATA MONITOR AND RECORD (IG SW) of DIAGNOSTIC DATA LINK using NGS. Does it operate normally?	Yes	Go to Step 4.
		No	Go to next step.
3	Disconnect starter connector. Is there continuity between connector terminal S and PCM terminal 1U?	Yes	Replace starter, then go to Step 5.
		No	Repair or replace, then go to Step 5.
4	Clear diagnostic trouble code from memory. Is same code No. Present after performing "After Repair Procedure"?	Yes	Go to Step 1.
		No	Intermittent poor connection in harness or connector. Repair connector and/or harness, then go to next step.
5	Clear diagnostic trouble code from memory. Is there any diagnostic trouble code present after performing "After Repair Procedure"?	Yes	Go to applicable DTC inspection.
		No	Troubleshooting completed.

PCM



HARNESS SIDE 22 PIN CONNECTOR
(VIEW FROM HARNESS SIDE)

STARTER

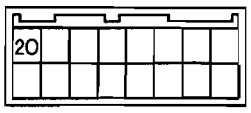


HARNESS SIDE CONNECTOR
(VIEW FROM TERMINAL SIDE)

DTC P1298	IDM MALFUNCTION
DETECTION CONDITION	• Command signal is output from PCM to IDM, but conformation signal is not output from IDM to PCM.
POSSIBLE CAUSE	• IDM malfunction. • Spill valve malfunction • Open or short circuit in wiring from PCM terminal 2O to IDM terminal A • Open or short circuit in wiring from PCM terminal 3A, 3C to IDM terminal C • Open or short circuit in wiring from IDM terminal B to spill valve relay D • Open or short circuit in wiring from spill valve terminal A to IDM terminal D • Open circuit in wiring from spill valve terminal B to IDM terminal E

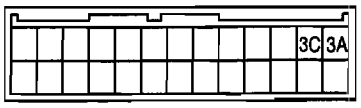
STEP	INSPECTION		ACTION
1	Does PCM or IDM connector have poor connection?	Yes	Repair or replace connector, then go to Step 7.
		No	Go to next step.
2	Disconnect the IDM connector. Turn engine switch on. Is there 10–14 V at connector terminal B?	Yes	Go to next step.
		No	Inspect for open or short circuit in wiring harness. (Spill valve relay terminal D–IDM terminal B).
3	Is there continuity between IDM and body ground?	Yes	Go to next step.
		No	Remone the IDM and reinstall it.
4	Is there continuity between connector terminal A and PCM terminal 2O? Is there continuity between connector terminal C and PCM terminal 3A (with immobilizer), 3C (without immobilizer)?	Yes	Go to next step.
		No	Repair or replace wiring harness, then go to step.
5	Is spill valve relay okay? ☞ CONTROL SYSTEM, SPILL VALVE RELAY INSPECTION	Yes	Go to next step.
		No	Replace spill valve relay.
6	Is spill valve okay? ☞ FUEL SYSTEM, SPILL VALVE INSPECTION	Yes	Go to next step.
		No	Consult your distributor for repair.
7	Clear diagnostic trouble code from memory. Is same code No. Present after performing "After Repair Procedure"?	Yes	Go to Step 1.
		No	Intermittent poor connection in harness or connector. Repair connector and/or harness, then go to next step.
8	Clear diagnostic trouble code from memory. Is there any diagnostic trouble code present after performing "After Repair Procedure"?	Yes	Go to applicable DTC inspection.
		No	Troubleshooting completed.

PCM



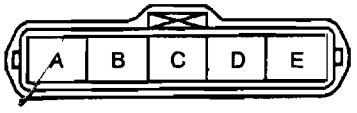
HARNESS SIDE 16 PIN CONNECTOR
(VIEW FROM HARNESS SIDE)

PCM



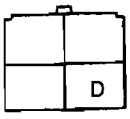
HARNESS SIDE 26 PIN CONNECTOR
(VIEW FROM HARNESS SIDE)

IDM



HARNESS SIDE CONNECTOR
(VIEW FROM TERMINAL SIDE)

SPILL VALVE RELAY

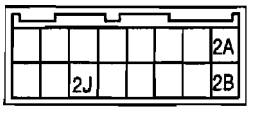


HARNESS SIDE CONNECTOR
(VIEW FROM TERMINAL SIDE)

DTC P1402	EGR VALVE POSITION SENSOR MALFUNCTION
DETECTION CONDITION	• Input voltage from EGR valve position sensor is below 0.25 V or above 4.75 V when continued for 1.0 sec.
POSSIBLE CAUSE	• EGR valve position sensor malfunction • Open or short circuit in wiring from EGR valve position sensor terminal C to PCM terminal 2J. • Open or short circuit in wiring from EGR valve position sensor terminal B to PCM terminal 2A. • Open circuit in wiring from EGR valve position sensor terminal A to PCM terminal 2B.

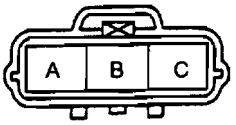
STEP	INSPECTION		ACTION
1	Does EGR valve position sensor connector or PCM connector have poor connection?	Yes	Repair or replace connector, then go to Step 8.
		No	Go to next step.
2	Implement PID/DATA MONITOR AND RECORD (EGRP V) of DIAGNOSTIC DATA LINK using NGS. Is the voltage as specified?	Yes	Go to Step 7.
		No	Go to next step.
3	Disconnect EGR valve position sensor connector. Turn engine switch on. Is there 5 V at connector terminal B?	Yes	Go to next step.
		No	Check for open or short circuit in wiring harness. (PCM terminal 2A–EGR valve position sensor terminal B)
4	Is there continuity between connector terminal A and PCM terminal 2B?	Yes	Go to next step.
		No	Repair or replace wiring harness, then go to Step 8.
5	Is there continuity between connector terminal C and PCM terminal 2J?	Yes	Go to next step.
		No	Repair or replace wiring harness, then go to Step 8.
6	Is resistance of EGR valve position sensor okay? ☞ CONTROL SYSTEM, EGR VALVE POSITION SENSOR INSPECTION	Yes	Go to next step.
		No	Replace EGR valve, then go to Step 8.
7	Clear diagnostic trouble code from memory. Is same code No. Present after performing "After Repair Procedure"?	Yes	Go to Step 1.
		No	Intermittent poor connection in harness or connector. Repair connector and/or harness, then go to next step.
8	Clear diagnostic trouble code from memory. Is there any diagnostic trouble code present after performing "After Repair Procedure"?	Yes	Go to applicable DTC inspection.
		No	Troubleshooting completed.

PCM



HARNESS SIDE 16 PIN CONNECTOR
(VIEW FROM HARNESS SIDE)

EGR VALVE POSITION SENSOR

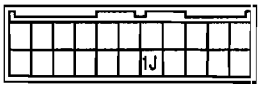


HARNESS SIDE CONNECTOR
(VIEW FROM TERMINAL SIDE)

DTC P1602	**Immobilizer unit-PCM communication error**
DETECTION CONDITION	• Command transmission from PCM to immobilizer unit exceeds limit. • No response from immobilizer unit.
POSSIBLE CAUSE	• Immobilizer unit malfunction • Coil (immobilizer system) malfunction • Key (transponder) malfunction • PCM malfunction • Open or short circuit in wiring from immobilizer unit terminal A to PCM terminal 1J • Open circuit in wiring from immobilizer unit terminal C to ground • Open circuit in wiring from immobilizer unit terminal J to battery • Open circuit in wiring from immobilizer unit terminal L to engine switch • Short circuit in wiring from immobilizer unit terminal F to coil • Short circuit in wiring from immobilizer unit terminal D to coil

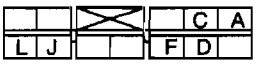
STEP	INSPECTION		ACTION
1	Clear DTC from memory. Is DTC 1602 present after performing "AFTER REPAIR PROCEDURE"?	Yes	Go to next step.
		No	**Different DTC is present:** Go to applicable DTC inspection. **No DTC is present:** Troubleshooting completed.
2	Is there immobilizer system DTC 01 or 03 present? ☞ section T	Yes	Go to immobilizer system DTC 01 or 03 inspection.
		No	Go to next step.
3	Is there other DTC present except 1624?	Yes	Go to applicable DTC inspection.
		No	Go to next step.
4	Is there open circuit in the following wiring harnesses? • Immobilizer unit terminal A to PCM terminal 1J • Immobilizer unit terminal C to ground • Immobilizer unit terminal J to battery • Immobilizer unit terminal L to engine switch	Yes	Repair or replace wiring harness, then go to step 6.
		No	Go to next step.
5	Is there short circuit in the following wiring harnesses? • Immobilizer unit terminal A to PCM terminal 1J • Immobilizer unit terminal F to coil • Immobilizer unit terminal D to coil	Yes	Repair or replace wiring harness, then go to next step.
		No	Replace immobilizer unit and reprogram immobilizer system. ☞ Section T, IMMOBILIZER SYSTEM, KEY NUMBER INPUT PROCEDURE
6	Does engine start after replacing immobilizer unit and clearing DTC?	Yes	Troubleshooting completed.
		No	Replace PCM and reprogram immobilizer system. ☞ Section T, IMMOBILIZER SYSTEM, KEY NUMBER INPUT PROCEDURE

PCM



HARNESS SIDE 22 PIN CONNECTOR
(VIEW FROM HARNESS SIDE)

IMMOBILIZER UNIT



HARNESS SIDE CONNECTOR
(VIEW FROM HARNESS SIDE)

DTC P1603	ID number is unregistered. (Immobilizer)
DETECTION CONDITION	Key ID numbers are not registered in PCM.
POSSIBLE CAUSE	• Immobilizer system reprogram procedure was not performed correctly after replacing PCM.

STEP	INSPECTION		ACTION
1	Clear DTC from memory. Is there DTC 1603 present after cranking?	Yes	Perform immobilizer system reprogram procedure again. ☞ Section T, IMMOBILIZER SYSTEM, KEY NUMBER INPUT PROCEDURE
		No	**Different DTC is present:** Go to applicable DTC inspection. **No DTC is present:** Troubleshooting completed.

DTC P1604	Code word is unregistered. (Immobilizer)
DETECTION CONDITION	Code word is not registered in PCM.
POSSIBLE CAUSE	• Immobilizer system reprogram procedure was not performed correctly after replacing PCM.

STEP	INSPECTION		ACTION
1	Clear DTC from memory. Is there DTC 1604 present after cranking?	Yes	Perform immobilizer system reprogram procedure again. ☞ Section T, IMMOBILIZER SYSTEM, KEY NUMBER INPUT PROCEDURE
		No	**Different DTC is present:** Go to applicable DTC inspection. **No DTC is present:** Troubleshooting completed.

DTC P1621	Code word do not match. (Immobilizer)
DETECTION CONDITION	Code word stored in PCM and immobilizer unit do not match.
POSSIBLE CAUSE	• Transformation of code word is stored in immobilizer unit. • Transformation of cord word is stored in PCM.

STEP	INSPECTION		ACTION
1	Clear DTC from memory. Is DTC 1621 present after performing "AFTER REPAIR PROCEDURE"?	Yes	Go to next step.
		No	**Different DTC is present:** Go to applicable DTC inspection. **No DTC is present:** Troubleshooting completed.
2	Is DTC 1602 present?	Yes	Go to DTC 1602 inspection.
		No	Replace immobilizer unit and reprogram immobilizer system, then go to next step. ☞ Section T, IMMOBILIZER SYSTEM, KEY NUMBER INPUT PROCEDURE
3	Does engine start after replacing immobilizer unit and clearing DTC?	Yes	Troubleshooting completed.
		No	Replace PCM and reprogram immobilizer system. ☞ Section T, IMMOBILIZER SYSTEM, KEY NUMBER INPUT PROCEDURE

DTC P1622	ID numbers do not match. (Immobilizer)
DETECTION CONDITION	ID number stored in immobilizer unit and PCM do not match. (Symptom only after immobilizer unit is replaced and key ID number reprogramming is registered.)
POSSIBLE CAUSE	• Unregistered key is used in Step 3 of immobilizer system reprogram procedure (immobilizer unit replacement). • Transformation of key ID number is stored in PCM.

STEP	INSPECTION		ACTION
1	Clear DTC from memory. Is DTC 1622 present after performing "AFTER REPAIR PROCEDURE"?	Yes	Go to next step.
		No	**Difference DTC is present:** Go to applicable DTC inspection. **No DTC is present:** Troubleshooting completed.
2	Does engine start normally with another registered key?	Yes	Previous key is defective. Discard it.
		No	Replace PCM and reprogram immobilizer system. ☞ Section T, IMMOBILIZER SYSTEM, KEY NUMBER INPUT PROCEDURE

Note
- Do not use PCM on other vehicle for testing. DTC 1622 will be presented again.

DTC P1623	Code word/ID number writing and reading error (Immobilizer)
DETECTION CONDITION	PCM internal EEPROM malfunction
POSSIBLE CAUSE	• PCM internal EEPROM malfunction

STEP	INSPECTION		ACTION
1	Clear DTC from memory. Is DTC 1623 present after performing "AFTER REPAIR PROCEDURE"?	Yes	Replace PCM and reprogram immobilizer system. ☞ Section T, IMMOBILIZER SYSTEM, KEY NUMBER INPUT PROCEDURE
		No	**Different DTC is present:** Go to applicable DTC inspection. **No DTC is present:** Troubleshooting completed.

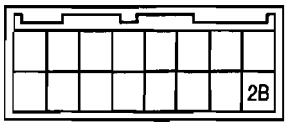
DTC P1624	PCM does not receive unlock signal from immobilizer unit. (PCM is okay.)
DETECTION CONDITION	PCM detected immobilizer system malfunction more than three times.
POSSIBLE CAUSE	• Engine was attempted to start more than three times under malfunction. • Battery terminal is disconnected.

STEP	INSPECTION		ACTION
1	Clear DTC from memory. Turn engine switch on for 1—2 seconds. Is there any DTC present after performing "AFTER REPAIR PROCEDURE"?	Yes	Go to next step.
		No	Troubleshooting completed.
2	Is there another DTC present?	Yes	Go to applicable DTC inspection.
		No	Go to ENGINE SYMPTOM TROUBLESHOOTING No.5. ☞ TROUBLESHOOTING, ENGINE SYMPTOM TROUBLESHOOTING

DTC P1649	INJECTION PUMP EPROM MALFUNCTION
DETECTION CONDITION	• PCM failed to communicate with injection pump EPROM.(User warning Light flashes.)
POSSIBLE CAUSE	• Poor connection of connectors at injection pump EPROM and/or PCM • Open or short circuit wiring from POM terminal A to injection pump EPROM terminal 3N • Open or short circuit wiring from POM terminal C to injection pump EPROM terminal 2B • Open or short circuit wiring from POM terminal D to injection pump EPROM terminal 3K

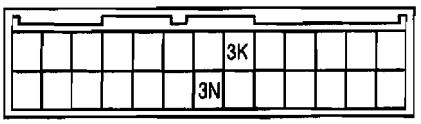
STEP	INSPECTION		ACTION
1	Does injection pump EPROM or PCM connector have poor connection	Yes	Repair or replace connector, then go to Step 3.
		No	Go to next step.
2	Disconnect the injection pump EPROM connector. Is there continuity between connector terminal A and PCM terminal 3N? Is there continuity between connector terminal C and PCM terminal 2B? Is there continuity between connector terminal D and PCM terminal 3K?	Yes	Go to next step.
		No	Repair or replace connector, then go to step3.
3	Clear diagnostic trouble code from memory. Is same code No. Present after Performing "after Repair Procedure"?	Yes	Consult your distributor for repair.
		No	Intermittent poor connection in harness or connector. Repair connector and/or harness, then go to next step.
4	Clear diagnostic trouble code from memory. Is there any diagnostic trouble code present after performing "After Repair Procedure"?	Yes	Go to applicable DTC inspection.
		No	Troubleshooting completed

PCM



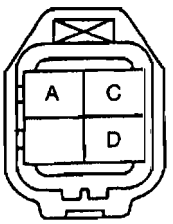
HARNESS SIDE 16 PIN CONNECTOR
(VIEW FROM HARNESS SIDE)

PCM



HARNESS SIDE 26 PIN CONNECTOR
(VIEW FROM HARNESS SIDE)

Injection pump EPROM



HARNESS SIDE CONNECTOR
(VIEW FROM TERMINAL SIDE)

TROUBLESHOOTING

FOREWORD

Before processing with the following troubleshooting, refer to section GI to understand the basic troubleshooting procedure.

TROUBLESHOOTING ITEM TABLE

- Confirm trouble symptom by using the following diagnostic index, then go to appropriate troubleshooting chart.
- If a diagnostic trouble code is displayed, proceed with inspection steps for the code.

No.	TROUBLESHOOTING ITEMS		DESCRIPTION
1	Melting main or other fuses		—
2	Will not crank		Starter does not work.
3	Hard to start/long crank/erratic start/erratic crank		Starter cranks engine at normal speed but engine requires excessive cranking.
4	Engine stalls.	After start	Engine stops unexpectedly at idle and/or after start.
		At idle	
5	Cranks normally but will not start		Starter cranks engine at normal speed but engine will not run.
6	Slow return to idle/fast idle		Engine takes more time than normal to return to idle speed. Engine speed continues at fast idle after warm-up.
7	Engine runs rough/rolling idle		Engine speed fluctuates between specified idle speed and lower speed and engine shakes excessively. Idle speed is too slow and engine shakes excessively.
8	Runs on		Engine runs after engine switch is turned off.
9	Engine stalls/quits.	Acceleration/cruise	Engine stops unexpectedly at beginning of acceleration, during acceleration or while cruising.
	Engine runs rough.	Acceleration/cruise	Engine speed fluctuates during acceleration or cruising.
	Misses	Acceleration/cruise	Engine misses during acceleration or cruising.
	Buck/jerk	Acceleration/cruise/ deceleration	Vehicle bucks/jerks during acceleration, cruising, or deceleration.
	Hesitation/stumble	Acceleration	Momentary pause at beginning of acceleration or during acceleration
	Surges	Acceleration/cruise	Momentary minor irregularity in engine output
10	Lack /loss of power	Acceleration/cruise	Performance poor is under load (e.g., power down when climbing hills).
11	Poor fuel economy		Fuel economy is unsatisfactory.
12	High oil consumption/leakage		Oil consumption is excessive.
13	Cooling system concerns	Overheating	Engine runs at higher than normal temperature/overheats.
14	Cooling system concerns	Runs cold	Engine does not reach normal operating temperature.
15	Excessive black smoke		Excessive black smoke is observed in exhaust gas.
16	Engine noise		Engine noise from under hood
17	Vibration concerns (engine)		Vibration from under hood or driveline
18	A/C does not work.		A/C compressor magnetic clutch does not engage when A/C is turned on.
19	A/C is always on and/or A/C compressor runs continuously.		A/C compressor magnetic clutch does not disengage.
20	Intermittent concerns		Symptom occurs randomly and is difficult to diagnose.
21	Constant voltage		Incorrect constant voltage

QUICK DIAGNOSTIC CHART

Troubleshooting item			Possible factor: Malfunction of starter motor (mechanical or electrical)	Starter circuit including ignition switch open	Improper engine oil level	Low or dead battery	Malfunction of charging system	Improper engine compression	Improper valve timing	Hydrolocked engine	Improper engine oil viscosity	Improper dipstick	Malfunction of base engine	Flywheel seized	Turbocharger malfunction	Improper tension or damaged drive belts	Improper engine coolant level	Water and anti-freeze mixture improperly	Malfunction of cooling system include thermostat
1	Melting main or other fuses																		
2	Will not crank		○	○		○	○			○			○	○					
3	Hard to start/long crank/erratic start/erratic crank		○	○				○	○				○						
4	Engine stalls	After start						○	○				○						
		At idle																	
5	Cranks normally but will not start							○	○				○						
6	Slow return to idle/fast idle																		○
7	Engine runs rough/rolling idle							○	○				○						
8	Runs on																		
9	Engine stalls/quits.	Acceleration/cruise																	
	Engine runs rough.	Acceleration/cruise																	
	Misses	Acceleration/cruise																	
	Buck/jerk	Acceleration/cruise/ deceleration						○	○				○		○				
	Hesitation/stumble	Acceleration																	
	Surges	Acceleration/cruise																	
10	Lack/loss of power	Acceleration/cruise						○	○				○		○				
11	Poor fuel economy							○	○				○		○		○		○
12	High oil consumption/leakage				○			○			○	○	○		○				
13	Cooling system concerns	Overheating											○			○	○	○	○
14	Cooling system concerns	Runs cold																	○
15	Excessive black smoke							○	○				○						
16	Engine noise								○				○		○	○			
17	Vibration concerns (engine)															○			
18	A/C does not work																		
19	A/C is always on and/or A/C compressor runs continuously.																		
20	Intermittent concerns																		
21	Constant voltage																		

	Troubleshooting Item / Possible factor		Malfunction of cooling fan system	Engine or transmission mounted improperly	Condenser fan or main cooling fan seat improperly	Adjustment of accelerator cable free-play incorrect	Fuel quality	Engine overheating	Air cleaner element clogging or restriction	Restriction in intake-air system	Air leaks from intake-air system (tube loose, crack, gaskets breaken	Incorrect idle speed	Incorrect injection timing	Malfunction of injection pump	Fuel filter restriction or clogged	Restriction in fuel system	Malfunction of fuel injection nozzle and/or gasket	Fuel leakage from fuel system	Restriction in exhaust system
1	Melting main or other fuses																		
2	Will not crank																		
3	Hard to start/long crank/erratic start/erratic crank						○			○		○	○	○	○	○	○	○	○
4	Engine stalls	After start					○	○		○		○	○	○	○	○	○	○	
		At idle																	
5	Cranks normally but will not start						○			○			○	○	○	○	○	○	
6	Slow return to idle/fast idle					○						○	○						
7	Engine runs rough/rolling idle						○	○		○		○	○	○	○	○	○	○	
8	Runs on																		
9	Engine stalls/quits.	Acceleration/cruise																	
	Engine runs rough.	Acceleration/cruise																	
	Misses	Acceleration/cruise																	
	Buck/jerk	Acceleration/cruise/ deceleration						○	○	○	○	○	○	○	○	○	○		○
	Hesitation/stumble	Acceleration																	
	Surges	Acceleration/cruise																	
10	Lack/loss of power	Acceleration/cruise						○	○	○	○	○	○	○	○	○	○		○
11	Poor fuel economy						○		○			○	○	○			○	○	○
12	High oil consumption/leakage																		
13	Cooling system concerns	Overheating	○		○			○											
14	Cooling system concerns	Runs cold	○		○														
15	Excessive black smoke								○				○	○			○		
16	Engine noise												○	○			○		
17	Vibration concerns (engine)			○	○														
18	A/C does not work																		
19	A/C is always on and/or A/C compressor runs continuously.																		
20	Intermittent concerns		○										○						
21	Constant voltage																		

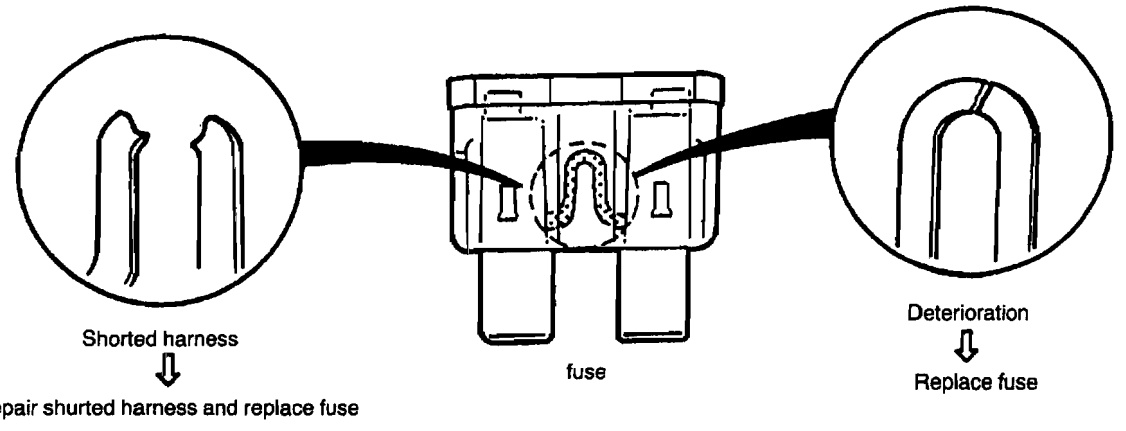
	Troubleshooting item		Possible factor: EGR system malfunction	PCM control relay malfunction	Pump speed sensor malfunction	Boost sensor malfunction	EGR position sensor malfunction	Idle switch malfunction	Accelerator position sensor malfunction	Engine coolant temperature sensor malfunction	Intake air temperature sensor No.1 malfunction	Intake air temperature sensor No.2 malfunction	Vehicle speed sensor malfunction	Improper starting signal	TDC sensor malfunction	A/C switch malfunction	Glow system malfunction	Injection pump EPROM malfunction	IDM malfunction	Fuel temperature sensor malfunction
1	Melting main or other fuses																			
2	Will not crank																			
3	Hard to start/long crank/erratic start/erratic crank									○				○	○		○	○		
4	Engine stalls	After start	○	○	○		○	○	○	○			○	○	○		○			○
		At idle																		
5	Cranks normally but will not start		○		○		○			○				○			○		○	
6	Slow return to idle/fast idle																			
7	Engine runs rough/rolling idle		○				○	○	○	○			○		○		○			○
8	Runs on																			
9	Engine stalls/quits.	Acceleration/cruise	○		○	○	○	○	○	○	○	○			○	○	○			○
	Engine runs rough.	Acceleration/cruise																		
	Misses	Acceleration/cruise																		
	Buck/jerk	Acceleration/cruise/ deceleration																		
	Hesitation/stumble	Acceleration																		
	Surges	Acceleration/cruise																		
10	Lack/loss of power	Acceleration/cruise	○			○	○	○	○	○					○	○		○		○
11	Poor fuel economy		○			○				○		○			○					○
12	High oil consumption/leaks																			
13	Cooling system concerns	Overheating	○							○						○				
14	Cooling system concerns	Runs cold																		
15	Excessive black smoke		○			○	○			○	○	○			○	○				○
16	Engine noise		○							○	○	○								
17	Vibration concerns (engine)																			
18	A/C does not work															○				
19	A/C is always on and/or A/C compressor runs continuously.															○				
20	Intermittent concerns		○	○	○	○	○		○	○	○	○	○		○	○	○	○		○
21	Constant voltage																			

	Troubleshooting item		Possible factor	Timer control valve solenoid malfunction	Fuel shut-off solenoid valve and/or relay malfunction	Spill valve and/or relay malfunction	Neutral switch malfunction	Immobilizer system activation	A/C system malfunction (include improper refrigerant amount)	Clutch slippage	Brake dragging	Loosen parts	Improper balance of wheels & tires	Malfunction of drive line	Malfunction of suspension
1	Melting main or other fuses														
2	Will not crank														
3	Hard to start/long crank/erratic start/erratic crank			○		○									
4	Engine stalls	After start		○	○	○		○	○						
		At idle													
5	Cranks normally but will not start			○	○	○		○							
6	Slow return to idle/fast idle			○											
7	Engine runs rough/rolling idle			○		○	○		○						
8	Runs on				○										
9	Engine stalls/quits.	Acceleration/cruise		○		○			○	○					
	Engine runs rough.	Acceleration/cruise													
	Misses	Acceleration/cruise													
	Buck/jerk	Acceleration/cruise/ deceleration													
	Hesitation/stumble	Acceleration													
	Surges	Acceleration/cruise													
10	Lack/loss of power	Acceleration/cruise		○	○				○	○	○				
11	Poor fuel economy										○				
12	High oil consumption/leaks														
13	Cooling system concerns		Overheating						○						
14	Cooling system concerns		Runs cold												
15	Excessive black smoke			○		○									
16	Engine noise			○								○			
17	Vibration concerns (engine)											○	○	○	○
18	A/C does not work								○						
19	A/C is always on and/or A/C compressor runs continuously								○						
20	Intermittent concerns			○	○	○	○								
21	Constant voltage														

SYMPTOM TROUBLESHOOTING

1	MELTING MAIN OR OTHER FUSES

TROUBLESHOOTING HINTS
Inspect condition of fuses.



Damaged fuse	Related wiring harness
MAIN (100 A)	MAIN fuse — BTN fuse IG KEY fuse
BTN (40 A)	BTN fuse — ROOM fuse
IG KEY (40 A)	IG KEY fuse — Engine switch — ENGINE fuse
ROOM (10 A)	ROOM fuse — PCM
ENGINE (10 A)	ENGINE fuse — PCM
INJ (30 A)	INJ fuse — PCM control relay — PCM Spill vavle relay — PCM, IDM Fuel shut off (FSO) solenoid relay — PCM, Fuel shut off solenoid (FSO) Timer control valve EGR solenoid valve (vacuum) EGR solenoid vavle (vent)
GLOW (40 A)	GLOW (40 A) fuse — Glow plug relay — Glow plug GLOW (10 A) fuse
GLOW (10 A)	GLOW (10 A) fuse — PCM terminal 2M

2	**Will not crank**
DESCRIPTION	Starter does not work.
POSSIBLE CAUSE	• Open starter circuit between battery and starter through engine switch • Starter malfunction • Seized/hydrolocked engine

STEP	INSPECTION		ACTION
1	Verify following: • Battery condition • Battery connection • Fuses Are all items okay?	Yes	Go to next step.
		No	Service as necessary and repeat Step 1.
2	Turn engine switch to START. Is clicking sound heard from starter?	Yes	Go to next step.
		No	Go to Step 6.
3	Do any other electrical accessories work?	Yes	Go to next step.
		No	Inspect charging system. ☞ section G
4	Disconnect battery negative cable. Disconnect engine switch and starter connectors. Inspect for electrical connections, loose wire, bent or corroded terminals. Inspect for continuity on following circuits: • Engine switch connector terminal and starter terminal B+ • Battery B+ cable and starter magnet switch terminal . Are all circuits okay?	Yes	Go to next step.
		No	Repair or replace open circuits.
5	Inspect engine switch. ☞ section T Is engine switch okay?	Yes	Go to next step.
		No	Replace engine switch.
6	Inspect starting system. Is starting system okay?	Yes	Inspect for seized/hydrolocked engine. ☞ section B
		No	Service as required. ☞ section G
7	Verify test results. If okay, return to diagnostic index to service any additional symptoms.		

3	HARD TO START/LONG CRANK/ERRATIC START/ERRATIC CRANK
DESCRIPTION	Starter cranks engine at normal speed but engine requires excessive cranking. Battery is in normal condition.
POSSIBLE CAUSE	• Poor fuel quality • Starting system malfunction • Intake-air system restriction • Incorrect idle speed • Engine overheating • Glow system malfunction • Fuel filter clogs • Fuel line restriction • Fuel leakage • Restriction in exhaust system • Incorrect fuel injection timing • Injection pump malfunction • Fuel injection nozzle malfunction • Low engine compression • Injection pump EPROM malfunction • EGR system malfunction

STEP	INSPECTION		ACTION
1	Inspect for following: • Fuel quality including water contamination • Fuel line/fuel filter clogs • Intake-air system restriction Are all items okay?	Yes	Go to next step.
		No	Service as necessary and repeat Step 1.
2	Is engine overheating?	Yes	Go to flowchart No.13 for "COOLING SYSTEM CONCERNS OVERHEATING".
		No	Go to next step.
3	Connect NGS tester to DLC. Turn engine switch on. Retrieve any DTC. Is "NO CODES RECEIVED/SYSTEM PASSED" displayed?	Yes	No DTC is displayed: Go to next step.
		No	DTC is displayed: Go to appropriate DTC test.
4	Does engine start normally after warm-up?	Yes	Inspect glow system operation. ☞ TROUBLESHOOTING, ENGINE SYSTEM INSPECTION, Glow System Inspection Replace any defective parts as necessary. If glow system is okay, go to next step.
		No	Go to next step.
5	Is idle speed correct?	Yes	Go to next step.
		No	Adjust idle speed. ☞ ENGINE TUNE-UP, IDLE SPEED INSPECTION
6	Is there any restriction in exhaust system?	Yes	Repair or replace as necessary.
		No	Go to next step.
7	Inspect for fuel leakage from fuel pipe. Is any fuel leakage found on fuel pipe?	Yes	Repair or replace as necessary.
		No	Go to next step.
8	Measure engine compression. Is compression okay?	Yes	Go to Step 10.
		No	Go to next step.
9	Inspect timing belt for the following: • Chipping of gear teeth • Low tension • Breakage, damage or cracks Is timing belt okay?	Yes	Inspect for following: • Burnt valve • Worn piston, piston ring or cylinder • Damaged cylinder head gasket • Damaged valve seat • Worn valve stem or valve guide Repair or replace as necessary
		No	If timing is incorrect, adjust timing. If timing belt is not okay, replace timing belt.
10	Inspect injection timing. Is injection timing okay?	Yes	Go to next step.
		No	Inspect for TCV. ☞ CONTROL SYSTEM, TIMER CONTROL VAVLE (TCV) INSPECTION If TCV is okay, adjust injection timing.

STEP	INSPECTION		ACTION
11	Remove and inspect injection nozzle as following: • Clogged nozzle • Incorrect valve opening pressure • Faulty nozzle gasket Is injection nozzle okay?	Yes	Inspect for following ☞ CONTROL SYSTEM, BOOST SENSOR INSPECTION • Starting signal (PCM terminal) • Spill valve ☞ FUEL SYSTEM, SPILL VALVE INSPECTION If okay, remove and inspect for fuel injection pump.
		No	Repair or replace injection nozzle.
12	Verify test results. If okay, return to diagnostic index to service any additional symptoms.		

4	ENGINE STALLS —AFTER START/AT IDLE
DESCRIPTION	Engine stops unexpectedly at idle and/or after start.
POSSIBLE CAUSE	• Poor fuel quality • Intake-air system restriction • Incorrect idle speed • Engine overheating • A/C system improper operation • Immobilizer system activation or malfunction • Fuel shut off (FSO) solenoid malfunction • PCM control relay malfunction • Glow system malfunction • Fuel leakage • Fuel line restriction • Fuel filter clogged • Incorrect fuel injection timing • Injection pump malfunction • Fuel injection nozzle malfunction • Low engine compression • EGR system malfunction • Intake air temperature sensor malfunction • Vehicle speed sensor malfunction

STEP	INSPECTION		ACTION
1	**Note** • The following test should be performed on vehicle with immobilizer systems. Go to Step 12 for non-immobilizer system equipped vehicles. Connect NGS tester to DLC. Do following conditions appear? • Engine is not completely started. • DTC P1624 is displayed.	Yes	Both conditions appear Go to Step 4.
		No	Either or other condition appear Go to next step.
2	Does engine stall after approx. 2 seconds since engine is started?	Yes	Go to next step.
		No	Immobilizer system is okay. Go to Step 12.
3	Is immobilizer unit connector securely connected to immobilizer unit?	Yes	Go to next step.
		No	Connect immobilizer unit connector securely. Return to Step 2.
4	Does immobilizer indicator light flash and indicate following immobilizer system DTC? DTC: 01, 02, 03, 11, 21	Yes	Go to "ON-BOARD DIAGNOSTIC FUNCTION" of immobilizer system. ☞ Section T
		No	Go to next step.
5	Does immobilizer indicator light illuminate?	Yes	Go to Step 8.
		No	Go to next step.
6	Does immobilizer indicator light flash and indicate following immobilizer system DTC after more than 135 seconds after engine switch is turned on? DTC: 24, 30	Yes	Go to "ON-BOARD DIAGNOSTIC FUNCTION" of immobilizer system. ☞ Section T
		No	Go to next step.
7	Turn engine switch off. Disconnect immobilizer unit connector. Connect jumper wire between immobilizer unit connector terminal M and ground. Turn engine switch on. Does immobilizer indicator light illuminate?	Yes	Reconnect immobilizer unit connector. Go to next step.
		No	Inspect for open circuit between immobilizer unit connector terminal M and instrument cluster. If okay, inspect immobilizer indicator light bulb. Repair or replace if necessary. Reconnect immobilizer unit connector, then return to Step 4.
8	Connect NGS tester to DLC and retrieve DTC. Is following DTC displayed? DTC: P1602, P1603, P1604, P1621, P1622, P1624	Yes	Go to appropriate DTC test.
		No	Go to next step.

STEP	INSPECTION		ACTION
9	Disconnect accelerator position sensor connector. Inspect for continuity between ground terminal at accelerator position sensor vehicle harness connector and body ground. Is there continuity?	Yes	Go to next step.
		No	Access PCM connector. Inspect for continuity from PCM connector 3B terminal to body ground and from 3Y terminal to body ground. Repair or replace as necessary.
10	Turn engine switch on. Access B+ PID. Is B+ PID okay? B+ PID: Battery voltage	Yes	Go to next step.
		No	Repair or replace wiring harness.
11	Disconnect immobilizer unit connector. Turn engine switch on. Is there battery voltage at immobilizer unit connector terminal J?	Yes	Inspect for open circuit between PCM connector terminal 3F and immobilizer unit connector terminal A.
		No	Repair or replace wiring harness between immobolizer unit connector terminal J and fuse panel.
12	Inspect for following: • Fuel quality including water contamination • Fuel line restriction • Loose bands on intake-air system • Cracks on intake-air system parts • Intake-air system restriction Are all items okay?	Yes	Go to next step.
		No	Service as necessary and repeat Step 12.
13	Is engine overheating?	Yes	Go to flowchart No.13 for "COOLING SYSTEM CONCERNS OVERHEATING".
		No	Go to next step.
14	Turn engine switch on. Disconnect accelerator position sensor connector. Measure voltage at accelerator position sensor connector constant voltage terminal. Voltage: 4.5 —5.5 V Is voltage okay? **Note** • Ignore DTC P0120 while performing this test.	Yes	Go to next step.
		No	Go to symptom troubleshooting No. 21 "CONSTANT VOLTAGE".
15	Connect NGS tester to DLC. Turn engine switch on. Retrieve any DTC. Is "NO CODES RECEIVED/SYSTEM PASSED" displayed?	Yes	No DTC is displayed: Go to next step.
		No	DTC is displayed: Go to appropriate DTC test. If communication error message is displayed on NGS tester, inspect for following: • Open circuit between PCM control relay and PCM terminal 1B • Open PCM control relay ground circuit • PCM control relay is stuck open. • Open PCM ground circuit (terminal 3B or 3Y) • Poor connection of vehicle body ground
16	Does engine run normally after warm-up?	Yes	Go to next step.
		No	Go to Step 18.
17	Inspect for glow system operation. ☞ TROUBLESHOOTING ENGINE SYSTEM INSPECTION, Glow System Inspection Is glow system operation normal?	Yes	Go to next step.
		No	Repair or replace any malfunctioning parts according to glow system operation results. ☞ TROUBLESHOOTING ENGINE SYSTEM INSPECTION, Glow system inspection
18	Access RPM PID. Is RPM PID indicating engine speed during cranking engine?	Yes	Go to next step.
		No	Inspect for following: • Open or short circuit in pump speed sensor • Open or short circuit in pump speed sensor harnesses • Open or short circuit between pump speed sensor and PCM terminals 3G and 3H

STEP	INSPECTION		ACTION
19	**Note** • **Following test should be performed on vehicle with A/C system. If following test cannot be performed due to engine stalls, go to next step.** • **Go to next step for non-A/C system equipped vehicle.** Connect pressure gauge to A/C lines. Turn blower switch on. Is pressure within specification? ☞ section U	Yes	Go to next step.
		No	If A/C is always on, go to symptom troubleshooting No.19 "A/C is always on and/or A/C compressor runs continuously". For other symptoms, inspect following: • Refrigerant charging amount • Cooling fan and condenser fan operation. (Refer to TROUBLESHOOTING ENGINE SYSTEM INSPECTION, Cooling Fan Control System Inspection)
20	Depress accelerator pedal slightly. Crank engine. Does engine start now?	Yes	Inspect and adjust idle speed. ☞ ENGINE TUNE-UP, IDLE SPEED INSPECTION If symptom still appears, go to next step.
		No	Go to next step.
21	Perform fuel shut off (FSO) solenoid inspection. ☞ FUEL SYSTEM, FUEL SHUT OFF SOLENOID (FSO) INSPECTION Is fuel shut off (FSO) solenoid okay?	Yes	Go to next step.
		No	Inspect following: • Stuck FSO solenoid • Open circuit in FSO solenoid • Poor ground of FSO solenoid. • Stuck to open FSO solenoid relay • Open circuit between engine switch and FSO solenoid relay. • Open circuit between FSO solenoid relay and FSO solenoid • Open circuit between FSO solenoid relay and PCM connector terminal 3X Repair or replace any malfunctioning part.
22	Inspect for fuel leakage from fuel pipe. Is any fuel leakage found on fuel pipe?	Yes	Repair or replace as necessary.
		No	Go to next step.
23	Access EGR PID. Read EGR PID during cranking engine. ☞ CONTROL SYSTEM, PID/DATA MONITOR INSPECTION Is EGR PID okay?	Yes	Go to next step.
		No	Inspect for following: • EGR solenoid valve (vent) • EGR solenoid valve (vacuum) • EGR valve • Vacuum hose connections • Wiring harness between EGR solenoid valve (vacuum) and PCM terminal 1K Repair or replace as necessary.
24	Inspect injection timing. Is injection timing okay?	Yes	Go to next step.
		No	Inspect TCV. ☞ CONTROL SYSTEM TIMER CONTROL VALVE (TCV) INSPECTION If TCV is okay, adjust injection timing.
25	Inspect fuel filter for cloging. Is fuel filter okay?	Yes	Go to next step.
		No	Replace fuel filter cartridge.
26	Remove injection nozzle. Inspect injection nozzle for following: • Clogged nozzle • Seized needle valve • Incorrect valve opening pressure • Faulty nozzle gasket Is injection nozzle okay?	Yes	Go to next step.
		No	Repair or replace injection nozzle.
27	Measure engine compression. Is compression okay?	Yes	Go to Step 29.
		No	Go to next step.

STEP	INSPECTION		ACTION
28	Inspect timing belt for following: • Chipping of gear teeth • Low tension • Breakage, damage or cracks Is timing belt okay?	Yes	Inspect for folllwing: • Burnt valve • Worn piston, piston ring or cylinder • Damaged cylinder head gasket • Damaged valve seat • Worn valve seat or valve guide Repair or replace as necessary.
		No	If timing is incorrect, adjust timing. If timing belt is not okay, replace timing belt.
29	Is valve clearance correct?	Yes	Inspect following: • Idle switch • Neutral switch • Starting signal (PCM terminal) • Intake air temperature sensor ☞ INTAKE AIR TEMPERATURE (IAT) SENSOR No.1, No.2 INSPECTION • Vehicle speed sensor ☞ Section T • Pump speed sensor ☞ CONTROL SYSTEM, PUMP SPEED SENSOR INSPECTION • Spill valve ☞ FUEL SYSTEM, SPILL VALVE INSPECTION If okay, remove and inspect for fuel injection pump.
		No	Adjust valve clearance.
30	Verify test results. If okay, return to diagnostic index to service any additional symptoms.		

5	CRANKS NORMALLY BUT WILL NOT START
DESCRIPTION	• Starter cranks engine at normal speed but engine will not run. • Refer to "ENGINE STALLS." if this symptom appears after engine stall. • Fuel in tank. • Battery is in normal condition.
POSSIBLE CAUSE	• Poor fuel quality • Intake-air system restriction • Fuel line restriction • EGR system malfunction • FSO solenoid malfunction • Glow system malfunction • Fuel leakage • Fuel filter clogging • Incorrect fuel injection timing • Injection pump malfunction • Fuel injection nozzle malfunction • Immobilizer system activation or malfunction • Low engine compression • IDM malfunction • PCM control relay malfunction

STEP	INSPECTION		ACTION
1	**Note** • Following test should be performed on vehicle with immobilizer systems. Go to Step 12 for non-immobilizer system equipped vehicles. Connect NGS tester to DLC. Do following conditions appear? • Engine is not completely started. • DTC P1624 is displayed.	Yes	Both conditions are appeared: Go to Step 4.
		No	Either or other condition appear: Go to next step.
2	Does engine stall after approx. 2 seconds since engine is started?	Yes	Go to next step.
		No	Immobilizer system is okay. Go to Step 12.
3	Is immobilizer unit connector securely connected to immobilizer unit?	Yes	Go to next step.
		No	Connect immobilizer unit connector securely. Return to Step 2.
4	Does immobilizer indicator light flash and indicate following immobilizer system DTC? DTC: 01, 02, 03, 11, 21	Yes	Go to "ON-BOARD DIAGNOSTIC FUNCTION" of immobilizer system. ☞ Section T
		No	Go to next step.

STEP	INSPECTION		ACTION
5	Does immobilizer indicator light illuminate?	Yes	Go to Step 8.
		No	Go to next step.
6	Does immobilizer indicator light flash and indicate following immobilizer system DTC after more than 135 seconds after engine switch is turned on? DTC: 24, 30	Yes	Go to "ON-BOARD DIAGNOSTIC FUNCTION" of immobilizer system. ☞ Section T
		No	Go to next step.
7	Turn engine switch off. Disconnect immobilizer unit connector. Connect jumper wire between immobilizer unit connector terminal M and ground. Turn engine switch on. Does immobilizer indicator light illuminate?	Yes	Reconnect immobilizer unit connector. Go to next step.
		No	Inspect for open circuit between immobilizer unit connector terminal M and instrument cluster. If okay, inspect immobilizer indicator light bulb. Repair or replace if necessary. Reconnect immobilizer unit connector, then return to Step 4.
8	Connect NGS tester to DLC and retrieve DTC. Is following DTC displayed? DTC: P1602, P1603, P1604, P1621, P1622, P1624	Yes	Go to appropriate DTC test.
		No	Go to next step.
9	Disconnect accelerator position sensor connector. Inspect for continuity between ground terminal at throttle position sensor vehicle harness connector and body ground. Is there continuity?	Yes	Go to next step.
		No	Access PCM connector. Inspect for continuity from PCM connector 3B terminal to body ground and from 3Y terminal to body ground. Repair or replace as necessary.
10	Turn engine switch on. Access B+ PID. Is B+ PID okay? B+ PID: Battery voltage	Yes	Go to next step.
		No	Repair or replace wiring harness.
11	Disconnect immobilizer unit connector. Turn engine switch on. Is there battery voltage at immobilizer unit connector terminal J?	Yes	Inspect for open circuit between PCM connector terminal 3F and immobilizer unit connector terminal J.
		No	Repair or replace wiring harness between immobolizer unit connector terminal J and fuse panel.
12	Inspect for following: • Fuel quality including water contamination • Fuel line restriction • Loose bands on intake-air system • Cracks on intake-air system parts • Intake-air system restriction • Fuses Are all items okay?	Yes	Go to next step.
		No	Service as necessary and repeat Step 12.
13	Turn engine switch on. Disconnect accelerator position sensor connector. Measure voltage at accelerator position sensor connector constant voltage terminal. Voltage: 4.5—5.5V Is voltage okay? **Note** • Ignore DTC P0120 while performing this test.	Yes	Go to next step.
		No	Go to symptom troubleshooting No.21 "CONSTANT VOLTAGE".
14	Connect NGS tester to DLC. Turn engine switch on. Retrieve any DTC. Is "NO CODES RECEIVED/SYSTEM PASSED" displayed?	Yes	No DTC displayed: Go to next step.
		No	DTC is displayed: Go to appropriate DTC test.

STEP	INSPECTION		ACTION
15	Turn engine switch to ON. Is FSO solenoid operating sound heard?	Yes	Go to next step.
		No	Inspect for following • Stuck FSO solenoid • Open circuit in FSO solenoid • Poor ground of FSO solenoid • Stuck open FSO solenoid relay • Open circuit between engine switch and FSO solenoid relay • Open circuit between FSO solenoid relay and FSO solenoid • Open circuit between FSO solenoid relay and PCM connector terminal 3X Repair or replace any malfunctioning parts.
16	Inspect for glow system operation. (Refer to TROUBLESHOOTING ENGINE SYSTEM INSPECTION, Glow System Inspection) Is glow system operation normal?	Yes	Go to next step.
		No	Repair or replace any malfunctioning parts according to glow system operation results. ☞ TROUBLESHOOTING, ENGINE SYSTEM INSPECTION, Glow system inspection
17	Crank engine. Is spill valve relay operation sound heard?	Yes	Go to next step.
		No	Inspect follows: • Stuck to open spill vavle relay • Open circuit between engine switch and spill valve relay • Open circuit between spill valve relay and PCM connector terminal 1D Repair or replace any malfunctioning part.
18	Inspect for fuel leakage from fuel pipe. Is any fuel leakage found on fuel pipe?	Yes	Repair or replace as necessary.
		No	Go to next step.
19	Measure engine compression. Is compression okay?	Yes	Go to Step 21.
		No	Go to next step.
20	Inspect timing belt for following: • Chipping of gear teeth • Low tension • Breakage, damage or cracks Is timing belt okay?	Yes	Inspect for following: • Burnt valve • Worn piston, piston ring or cylinder • Damaged cylinder head gasket • Damaged valve seat • Worn valve stem or valve guide Repair or replace as necessary.
		No	If timing is incorrect, adjust timing. If timing belt is not okay, replace timing belt.
21	Inspect injection timing. Is injection timing okay?	Yes	Go to next step.
		No	Inspect TCV ☞ CONTROL SYSTEM, TIMER CONTROL VALVE (TCV) INSPECTION If TCV is okay, adjust injection timing.
22	Inspect fuel filter for clog. Is fuel filter okay?	Yes	Go to next step.
		No	Replace fuel filter cartridge.
23	Access EGR PID. Read EGR PID during cranking the engine. ☞ CONTROL SYSTEM, PID/DATA MONITOR INSPECTION Is PID value okay?	Yes	Go to next step.
		No	Inspect for following: • EGR solenoid valve (vent) • EGR solenoid valve (vacuum) • EGR valve • Vacuum hose connections • Wiring harness between EGR solenoid valve (vacuum) and PCM terminal 1K Repair or replace as necessary.

STEP	INSPECTION		ACTION
24	Remove injection nozzle. Inspect injection nozzle for following: • Clogged nozzle • Seized needle valve • Incorrect valve opening pressure • Faulty nozzle gasket Is injection nozzle okay?	Yes	Go to next step.
		No	Repair or replace injection nozzle.
25	Is valve timing correct?	Yes	Inspect for following: • Pump speed sensor ☞ CONTROL SYSTEM, PUMP SPEED SENSOR INSPECTION • Spill valve ☞ FUEL SYSTEM, SPILL VALVE INSPECTION If okay, remove and inspect for injection pump.
		No	Adjust valve clearance.
26	Verify test results. If okay, return to diagnostic index to service any additional symptoms.		

6	SLOW RETURN TO IDLE/FAST IDLE
DESCRIPTION	Engine takes more time than normal to return to idle speed. Engine speed continues at fast idle after warm-up.
POSSIBLE CAUSE	• Accelerator cable incorrect adjustment • Engine coolant temperature (ECT) sensor malfunction • Thermostat is stuck open. • Air leakage from intake-air system • Fuel injection timing is incorrect. • Incorrect adjustment of accelerator position sensor free play. • Idle speed adjustment is incorrect.

STEP	INSPECTION		ACTION
1	Connect NGS tester to DLC. Turn engine switch on. Retrieve any DTC. Is "NO CODES RECEIVED/SYSTEM PASSED" displayed?	Yes	No DTC is displayed: Go to next step.
		No	DTC is displayed: Go to appropriate DTC test.
2	Inspect accelerator position sensor. ☞ CONTROL SYSTEM, ACCELERATOR POSITION SENSOR INSPECTION Is free play okay?	Yes	Go to next step.
		No	Adjust accelerator position sensor.
3	Inspect injection timing. ☞ ENGINE TUNE-UP, INJECTION TIMING INSPECTION Is injection timing okay?	Yes	Go to next step.
		No	Inspect TCV. ☞ CONTROL SYSTEM, TIMER CONTROL VALVE (TCV) INSPECTION If TCV is okay, adjust injection timing. ☞ ENGINE TUNE-UP, INJECTION TIMING INSPECTION
4	Inspect for air leakage from intake-air system components while racing engine to higher speed. Is there any air leakage?	Yes	Repair or replace as necessary.
		No	Go to next step.
5	Remove thermostat and inspect operation. ☞ Section E Is thermostat okay?	Yes	Inspect and adjust idle speed. ☞ ENGINE TUNE-UP, IDLE SPEED INSPECITON
		No	Replace thermostat.
6	Verify test results. If okay, return to diagnostic index to service any additional symptoms.		

7	ENGINE RUNS ROUGH/ROLLING IDLE
DESCRIPTION	Engine speed fluctuates between specified idle speed and lower speed and engine shakes excessively. Idle speed is too slow and engine shakes excessively.
POSSIBLE CAUSE	• Poor fuel quality • Air leakage from intake-air system • Restriction in intake-air system • Incorrect idle speed • Engine overheating • A/C system improper operation • EGR system malfunction • Glow system malfunction • Fuel leakage • Fuel filter clogging • Restriction in fuel line • Incorrect fuel injection timing • Injection pump malfunction • Injection nozzle malfunction • Low engine compression

STEP	INSPECTION		ACTION
1	Inspect for following: • Fuel quality including water contamination • Loose bands on intake-air system • Cracks on intake-air system parts • Intake-air system restriction Are all items okay?	Yes	Go to next step.
		No	Service as necessary and repeat Step 1.
2	Is engine overheating?	Yes	Go to flowchart No.13 for "COOLING SYSTEM CONCERNS OVERHEATING".
		No	Go to next step.
3	Connect NGS tester to DLC. Turn engine switch on. Retrieve any DTC. Is "NO CODES RECEIVED/SYSTEM PASSED" displayed?	Yes	No DTC is displayed: Go to next step.
		No	DTC is displayed: Go to appropriate DTC test.
4	Does engine run normally after warm-up?	Yes	Go to next step.
		No	Go to Step 6
5	Inspect for glow system operation. ☞ TROUBLESHOOTING, ENGINE SYSTEM INSPECTION, Glow System Inspection Is glow system operation normal?	Yes	Go to Step 7.
		No	Repair or replace any malfunctioning parts according to glow system operation results. ☞ TROUBLESHOOTING, ENGINE SYSTEM INSPECTION, Glow System Inspection
6	**Note** • Following test should be performed on vehicle with A/C system. If following test cannot be performed due to engine stalls, go to next step. • Go to next step for non-A/C system equipped vehicle. Connect pressure gauge to A/C lines. Turn blower switch on. Is pressure within specification? ☞ Section U	Yes	Go to next step.
		No	If A/C is always on, go to symptom troubleshooting No.19 "A/C is always on and/or A/C compressor runs continuously". For other symptoms, inspect following: • Refrigerant charging amount • Cooling fan and condenser fan operation
7	Depress accelerator pedal slightly. Crank engine. Does engine start now?	Yes	Inspect and adjust idle speed. ☞ ENGINE TUNE-UP, IDLE SPEED INSPECTION If symptom still appears, go to next step.
		No	Go to next step.
8	Inspect for fuel leakage from fuel pipe. Is any fuel leakage found on fuel pipe?	Yes	Repair or replace as necessary.
		No	Go to next step.
9	Perform EGR system inspection ☞ TROUBLESHOOTING, ENGINE SYSTEM INSPECTION, EGR System Inspection Is EGR system okay?	Yes	Go to next step.
		No	Inspect following: • EGR solenoid valve (vent) • EGR solenoid valve (vacuum) • EGR valve • Vacuum hose connections • Wiring harness between EGR solenoid valve (vacuum) and PCM terminal 1K Repair or replace as necessary.

STEP	INSPECTION		ACTION
10	Measure engine compression. Is compression okay?	Yes	Go to Step13.
		No	Go to next step.
11	Inspect timing belt for following: • Chipping of gear teeth • Low tension • Breakage, damage or cracks Is timing belt okay?	Yes	Inspect for following: • Burnt valve • Worn piston, piston ring or cylinder • Damaged cylinder head gasket • Damaged valve seat • Worn valve stem or valve guide Repair or replace as necessary.
		No	If timing is incorrect, adjust timing. If timing belt is not okay, replace timing belt.
12	Inpsect injection timing. Is injection timing okay?	Yes	Go to next step.
		No	Inspect TCV. ☞ CONTROL SYSTEM, TIMER CONTROL VALVE (TCV) INSPECTION If TCV is okay, adjust injection timing.
13	Inspect fuel filter for clogging. Is fuel filter okay?	Yes	Go to next step.
		No	Replace fuel filter cartridge.
14	Inspect fuel line for restriction. Is any restriction found in fuel line?	Yes	Repair or replace as necessary.
		No	Go to next step.
15	Remove injection nozzle. Inspect injection nozzle for following: • Clogged nozzle • Seized needle valve • Incorrect valve opening pressure • Faulty nozzle gasket Is injection nozzle okay?	Yes	Go to next step.
		No	Repair or replace injection nozzle.
16	Is valve clearance correct?	Yes	Inpsect for following: • Vehicle speed sensor ☞ section T • Pump speed sensor ☞ CONTROL SYSTEM, PUMP SPEED SENSOR INSPECTION • Spill valve ☞ CONTROL SYSTEM, SPILL VALVE RELAY INSPECTION If okay, remove and inspect fuel injection pump.
		No	Adjust valve clearance.
16	Verify test results. If okay, return to diagnostic index to service any additional symptoms.		

8	RUNS ON
DESCRIPTION	Engine runs after engine switch is turned off.
POSSIBLE CAUSE	FSO solenoid malfunction

STEP	INSPECTION		ACTION
1	Run engine at idle speed. Disconnect FSO solenoid connector. Make sure engine stops. Does engine stop?	Yes	Inspect following: • Stuck close FSO solenoid relay • Short to power line between engine switch and FSO solenoid • Circuit between FSO solenoid relay and PCM terminal 3X Repair or replace wiring harness.
		No	Inspect for FSO solenoid stuck open.
2	Verify test results. If okay, return to diagnostic index to service any additional symptoms.		

9	**ENGINE STALLS/QUITS-ACCELERATION/CRUISE** **ENGINE RUNS ROUGH-ACCELERATION/CRUISE** **MISSES-ACCELERATION/CRUISE** **BUCK/JERK-ACCELERATION/CRUISE/DECELERATION** **HESITATION/STUMBLE-ACCELERATION** **SURGES-ACCELERATION/CRUISE**
DESCRIPTION	• Engine stops unexpectedly at beginning of acceleration, during acceleration or while cruising. • Engine speed fluctuates during acceleration or cruising. • Engine misses during acceleration or cruising. • Vehicle bucks/jerks during acceleration, cruising, or deceleration. • Momentary pause at beginning of acceleration or during acceleration. • Momentary minor irregularity in engine output.
POSSIBLE CAUSE	• Poor fuel quality • Glow system malfunction • Air leakage from intake-air system • Intake-air system restriction • Air cleaner restriction • Engine overheating • A/C system improper operation • Turbocharger malfunction • EGR system malfunction • Fuel line restriction • Fuel filter clogging • Incorrect fuel injection timing • Incorrect idle speed • Injection pump malfunction • Injection nozzle malfunction • Low engine compression • Exhaust system restriction • Clutch slippage

STEP	INSPECTION		ACTION
1	Is idle speed stable?	Yes	Go to next step.
		No	Go to flowchart No.7 "ENGINE RUNS ROUGH/ROLLING IDLE".
2	Is engine overheating?	Yes	Go to flowchart No.13 "COOLING SYSTEM CONCERNS OVERHEATING".
		No	Go to next step.
3	Connect NGS tester to DLC. Turn engine switch on. Retrieve any DTC. Is "NO CODES RECEIVED/SYSTEM PASSED" displayed?	Yes	No DTC is displayed: Go to next step.
		No	DTC is displayed: Go to appropriate DTC test.
4	Does symptom disappear after warm-up?	Yes	Go to next step.
		No	Go to Step 6.
5	Inspect glow system operation. ☞ TROUBLESHOOTING, ENGINE SYSTEM INSPECTION, Glow System Inspection Is glow system operation normal?	Yes	Go to next step.
		No	Repair or replace any malfunctioning parts according to glow system operation results. ☞ TROUBLESHOOTING, ENGINE SYSTEM INSPECTION, Glow System Inspection
6	**Note** • Following test should be performed on vehicle with A/C system. Go to next step for non-A/C system equipped vehicle. Connect pressure gauge to A/C lines. Turn blower switch on. Is pressure within specification? ☞ Section U	Yes	Go to next step.
		No	If A/C is always on, go to symptom troubleshooting No.19 "A/C is always on and/or A/C compressor runs continuously". For other symptoms, inspect following: • Refrigerant charging amount • Cooling fan and condenser fan operation
7	Inspect air cleaner and/or intake-air system for clogging or restriction. Are air cleaner and intake-air system okay?	Yes	Go to next step.
		No	Clean or replace as necessary.
8	Inspect hose bands between following parts: • Turbocharger compressor housing and air cleaner • Turbocharger compressor housing and charge air cooler Are hose bands loose?	Yes	Retighten hose bands. If concern is resolved, complete inspection.
		No	Go to next step.

STEP	INSPECTION		ACTION
9	Inspect for improper operation, kinks, clogging or disconnection on the wastegate actuator. ☞ INTAKE-AIR SYSTEM, TURBOCHARGER INSPECTION, Wastegate Actuator Inspection Is actuator okay?	Yes	Turbocharger is okay. Go to next step.
		No	Repair or replace as necessary. If concern is resolved, complete inspection.
10	Perform EGR system inspection. ☞ TROUBLESHOOTING, ENGINE SYSTEM INSPECTION, EGR System Inspection Is EGR system okay?	Yes	Go to next step.
		No	Inspect following: • EGR solenoid (vent) • EGR solenoid (vacuum) • EGR valve • Vacuum hose connections • Wiring harnesses between EGR solenoids and PCM terminals Repair or replace as necessary.
11	Is there any restriction in exhaust system?	Yes	Repair or replace as necessary.
		No	Go to next step.
12	Remove injection nozzle. Inspect injection nozzle for following: • Clogged nozzle • Seized needle valve • Incorrect valve opening pressure • Faulty nozzle gasket Is injection nozzle okay?	Yes	Go to next step.
		No	Repair or replace injection nozzle.
13	Inspect fuel line for restriction. Is any restriction found in fuel line ?	Yes	Repair or replace as necessary.
		No	Go to next step.
14	Inspect fuel filter for clogging. Is fuel filter okay?	Yes	Go to next step.
		No	Replace fuel filter cartridge.
15	Measure engine compression. Is compression okay?	Yes	Go to Step 16.
		No	Go to next step.
16	Inspect timing belt for following: • Chipping of gear teeth • Low tension • Breakage, damage or cracks Is timing belt okay?	Yes	Inspect for following: • Burnt valve • Worn piston, piston ring or cylinder • Damaged cylinder head gasket • Damaged valve seat • Worn valve stem and valve guide Repair or replace as necessary.
		No	If timing is incorrect, adjust timing. If timing belt is not okay, replace timing belt.
17	Inspect injection timing. Is injection timing okay?	Yes	Inspect following: • Clutch for slippage • Pump speed sensor • Spill valve If okay, remove and inspect for fuel injection pump.
		No	Inspect for TCV. ☞ CONTROL SYSTEM, TIMER CONTROL VALVE (TCV) INSPECTION If TCV is okay, adjust injection timing.
18	Verify test results. If okay, return to diagnostic index to service any additional symptoms.		

9	LACK/LOSS OF POWER-ACCELERATION/CRUISE
DESCRIPTION	Performance is poor under load (e.g., power down when climbing hills).
POSSIBLE CAUSE	• Poor fuel quality • Air leakage from intake-air system • Intake air-system restriction • Air cleaner restriction • Engine overheating • A/C system improper operation • EGR system malfunction • Clutch slippage • Restriction in exhaust system • Restriction in fuel line • Fuel filter clogging • Incorrect fuel injection timing • Incorrect idle speed • Injection pump malfunction • Injection nozzle malfunction • Low engine compression pressure • Turbocharger malfunction • Brake system drags.

STEP	INSPECTION		ACTION
1	Is idle speed stable?	Yes	Go to next step.
		No	Go to flowchart No.7 "ENGINE RUNS ROUGH/ROLLING IDLE".
2	Is engine overheating?	Yes	Go to flowchart No. 13 "COOLING CONCERNS OVERHEATING".
		No	Go to next step.
3	Connect NGS tester to DLC. Turn engine switch on. Retrieve any DTC. Is "NO CODES RECEIVED/SYSTEM PASSED" displayed?	Yes	No DTC is displayed: Go to next step.
		No	DTC is displayed: Go to appropriate DTC test.
4	**Note** • Following test should be performed on vehicle with A/C system. Go to Step 8 for non-A/C system equipped vehicle. Connect pressure gauge to A/C lines. Turn the blower switch on. Is pressure within specification? ☞ section U	Yes	Go to next step.
		No	If A/C is always on, go to symptom troubleshooting No.19 "A/C is always on and/or A/C compressor runs continuously". For other symptoms, inspect following: • Refrigerant charging amount • Cooling fan and condenser fan operation
5	Inspect A/C cut off operation. ☞ TROUBLESHOOTING, ENGINE SYSTEM INSPECTION, A/C Control System Inspection Does A/C cut-off work properly?	Yes	Go to next step.
		No	Inspect A/C cut-off system components.
6	Connect pressure gauge to A/C lines. Turn blower switch on. Is pressure within specification? ☞ section U	Yes	Go to next step.
		No	If A/C is always on, go to symptom troubleshooting No.19 "A/C is always on and/or A/C compressor runs continuously". For other symptoms, inspect following: • Refrigerant charging amount • Cooling fan and condenser fan operation
7	Inspect air cleaner and/or intake-air system for clogging or restriction. Are air cleaner and intake-air system okay?	Yes	Go to next step.
		No	Clean or replace as necessary.
8	Inspect hose bands between following parts: • Turbocharger compressor housing and air cleaner • Turbocharger compressor housing and charge air cooler Is the hose band loose?	Yes	Retighten hose bands. If concern is resolved, complete inspection.
		No	Go to next step.
9	Inspect for improper operation, kinks, clogging or disconnection on the wastegate actuator. ☞ INTAKE-AIR SYSTEM, TURBOCHARGER INSPECTION, Wastegate Actuator Inspection is actuator okay?	Yes	Go to next step.
		No	Repair or replace as necessary. If concern is resolved, complete inspection.

STEP	INSPECTION		ACTION
10	Remove parts necessary to inspect turbocharger. Do not remove turbocharger. Inspect if turbocharger compressor wheel is bent, damaged, or interfering with housing on vehicle. Is there any problem?	Yes	Replace turbocharger.
		No	Go to next step.
11	Inspect if turbocharger compressor wheel lock nut is loose or has fallen down inside turbocharger. Is there any problem?	Yes	Replace turbocharger.
		No	Go to next step.
12	Turn turbocharger compressor wheel by hand. Does the wheel turn easily and smoothly?	Yes	Go to next step.
		No	Replace turbocharger.
13	Inspect if turbocharger turbine wheel is damaged, cracked or interfering with housing on vehicle. **Note** • Inspect all fins on each turbine wheel. Is there any problem?	Yes	Replace turbocharger.
		No	Go to next step.
14	Is any engine oil found inside turbocharger turbine housing?	Yes	If excessive amount of engine oil is found, replace turbocharger. If small amount of engine oil is found, wipe oil out. Then, go to next step.
		No	Go to next step.
15	Is any engine oil found inside turbocharger compressor housing?	Yes	Wipe oil out and Install all removed parts in Step 10. Then, go to next Step.
		No	Turbocharger is okay. Install all removed parts in Step 10. Then, go to next step.
16	Perform EGR system inspection. ☞ TROUBLESHOOTING, ENGINE SYSTEM INSPECTION, EGR System Inspection Is EGR system okay?	Yes	Go to next step.
		No	Inspect following: • EGR solenoid (vent) • EGR solenoid (vacuum) • EGR valve • Vacuum hose connections • Wiring harnesses between EGR solenoids and PCM terminals Repair or replace as necessary.
17	Is there any restriction in exhaust system?	Yes	Repair or replace as necessary.
		No	Go to next step.
18	Remove injection nozzle. Inspect injection nozzle for following • Clogged nozzle • Seized needle valve • Incorrect valve opening pressure • Faulty nozzle gasket Is injection nozzle okay?	Yes	Go to next step.
		No	Repair or replace injection nozzle.
19	Inspect fuel filter for clogging. Is fuel filter okay?	Yes	Go to next step.
		No	Replace fuel filter cartridge.
20	Measure engine compression. Is compression okay?	Yes	Go to Step 22.
		No	Go to next step.

STEP	INSPECTION		ACTION
21	Inspect timing belt for following: • Chipping of gear teeth • Low tension • Breakage, damage or cracks Is timing belt okay?	Yes	Inspect following: • Burnt valve • Worn piston, piston ring or cylinder • Damaged cylinder head gasket • Damaged valve seat • Worn valve stem and valve guide Repair or replace as necessary.
		No	If timing is incorrect, adjust timing. If timing belt is not okay, replace timing belt.
22	Inspect injection timing. Is injection timing okay?	Yes	Inspect following: • Boost sensor • Brake system for dragging • Clutch for slippage If okay, remove and Inspect fuel injection pump
		No	Inspect TCV. ☞ CONTROL SYSTEM, TIMER CONTROL VALVE (TCV) INSPECTION If TCV is okay, adjust injection timing.
23	Verify test results. If okay, return to diagnostic index to service any additional symptoms.		

11	POOR FUEL ECONOMY
DESCRIPTION	Fuel economy is unsatisfactory.
POSSIBLE CAUSE	• Idle speed incorrect adjustment • Incorrect adjustment of accelerator cable free play • Air cleaner restriction • Engine cooling system malfunction • Poor fuel quality • Improper coolant level • Turbocharger malfunction • Improper engine compression • Exhaust system clogging • Injection timing is incorrect. • Injection nozzle malfunction • Injection pump malfunction • Fuel leakage • Brake dragging • EGR system malfunction

STEP	INSPECTION		ACTION
1	Inspect for following: • Fuel quality including water contamination • Air cleaner element restriction • Coolant level Are all items okay?	Yes	Go to next step.
		No	Service as necessary and repeat Step 1.
2	Connect NGS tester to DLC. Turn engine switch on. Retrieve any DTC. Is "NO CODES RECEIVED/SYSTEM PASSED" displayed?	Yes	No DTC is displayed: Go to next step.
		No	DTC is displayed: Go to appropriate DTC test.
3	Access ECT PID. Drive vehicle while monitoring PID. ☞ CONTROL SYSTEM, PIDA/DATA MONITOR INSPECTION Is PID within specification?	Yes	Go to next step.
		No	Inspect for coolant leakage, cooling fan and condenser fan operations or thermostat operation. ☞ ENGINE SYSTEM INSPECTION, Cooling Fan Control System Inspection
4	Inspect idle speed. ☞ ENGINE TUNE-UP, IDLE SPEED INSPECTION Is idle speed okay?	Yes	Go to next step.
		No	Go to flowchart No.6 "SLOW RETURN TO IDLE/FAST IDLE".

STEP	INSPECTION		ACTION
5	Perform EGR system inspection ☞ TROUBLESHOOTING, ENGINE SYSTEM INSPECTION, EGR System Inspection Is EGR system okay?	Yes	Go to next step.
		No	Inspect following: • EGR solenoid (vent) • EGR solenoid (vacuum) • EGR valve • Vacuum hose connections • Wiring harnesses between EGR solenoids and PCM terminals Repair or replace as necessary.
6	Inspect fuel leakage from pipe. Is any fuel leakage found on fuel pipe?	Yes	Repair or replace as necessary.
		No	Go to next step.
7	Remove injection nozzle. Inspect injection nozzle for the following • Clogged nozzle. • Seized needle valve • Incorrect valve opening pressure. • Faulty nozzle gasket. Is injection nozzle okay?	Yes	Go to next step.
		No	Repair or replace the injection nozzle.
8	Perform turbocharger on-vehicle inspection. ☞ INTAKE-AIR SYSTEM, TURBOCHARGER INSPECTION Is turbocharger okay?	Yes	Go to next step.
		No	Replace turbocharger.
9	Is there restriction in exhaust system?	Yes	Inspect exhaust system.
		No	Go to next step.
10	Is brake system functioning properly?	Yes	Go to next step.
		No	Inspect for cause.
11	Measure engine compression. Is compression okay?	Yes	Go to Step 13.
		No	Go to next step.
12	Inspect timing belt for following: • Chipping of gear teeth • Low tension • Breakage, damage or cracks Is timing belt okay?	Yes	Inspect following: • Burnt valve • Worn piston, piston ring or cylinder • Damaged cylinder head gasket • Damaged valve seat • Worn valve stem and valve guide Repair or replace as necessary.
		No	If timing is incorrect, adjust timing. If timing belt is not okay, replace timing belt.
13	Inspect injection timing. Is injection timing okay?	Yes	Inspect following: • Boost sensor • Injection pump
		No	Adjust Injection timing.
14	Verify test results. If okay, return to diagnostic index to service any additional symptoms.		

12	HIGH OIL CONSUMPTION/LEAKAGE
DESCRIPTION	Oil consumption is excessive.
POSSIBLE CAUSE	• Improper engine oil level • Improper dipstick • Improper engine oil viscosity • Engine internal parts malfunction • Oil leakage • Turbocharger malfunction

STEP	INSPECTION		ACTION
1	Inspect following: • Proper dipstick • Proper engine viscosity • Engine oil level Are all items okay?	Yes	Go to next step.
		No	Service as necessary and repeat Step 1.

STEP	INSPECTION		ACTION
2	Remove parts necessary to inspect turbocharger. Do not remove turbocharger. Inspect if turbocharger primary compressor wheel is bent, damaged, or interfering with housing on vehicle. Is there any problem?	Yes	Replace turbocharger.
		No	Go to next step.
3	Inspect if turbocharger compressor wheel lock nut is loose or has fallen down inside turbocharger. Is there any problem?	Yes	Replace turbocharger.
		No	Go to next step.
4	Turn turbocharger compressor wheel by hand. Does wheel turn easily and smoothly?	Yes	Go to next step.
		No	Replace turbocharger.
5	Inspect if turbocharger turbine wheel is damaged, cracked or interfering with housing on vehicle. **Note** • Inspect all fins on each turbine wheel. Is there any problem?	Yes	Replace turbocharger.
		No	Go to next step.
6	Is any engine oil found inside turbocharger turbine housing?	Yes	If excessive amount of engine oil is found, replace turbocharger. If small amount of oil is found, wipe oil out. Then, go to next step.
		No	Go to next step.
7	Is any engine oil found inside turbocharger compressor housing?	Yes	Wipe oil out. Then, go to next step.
		No	Go to next step.
8	Is any engine oil found around oil pipes attached on turbocharger center housing?	Yes	If oil leaked from the damaged pipe, replace oil pipe. Then, go to next step.
		No	Go to next step.
9	Is any engine oil found inside air intake pipes or hoses?	Yes	Wipe the engine oil out.
		No	Turbocharger is okay. Install all removed parts in Step 2. Then go to next step.
10	Measure engine compression. Is compression okay?	Yes	Inspect oil leakage from outside of engine.
		No	Inspect following: • Damaged valve seat • Worn valve stem and valve guide • Worn or stuck piston ring • Worn piston, piston ring or cylinder Service as necessary.
11	Verify test results. If okay, return to diagnostic index to service any additional symptoms.		

13	COOLING SYSTEM CONCERNS-OVERHEATING
DESCRIPTION	Engine runs at higher than normal temperature/overheats.
POSSIBLE CAUSE	• Main cooling fan malfunction • Condenser fan malfunction • Low drive belt tension • Drive belt damage • Improper coolant level • Thermostat malfunction • Radiator clogging • Improper water/anti-freeze mixture • Improper or damaged radiator cap • Radiator hose damage • Coolant leakage (engine internal, turbocharger, external) • A/C system malfunction • EGR system malfunction

STEP	INSPECTION		ACTION
1	Inspect following: • Engine coolant level • Coolant leakage • Water/anti-freeze mixture • Radiator condition • Collapsed or restricted radiator hoses • Radiator pressure cap • Drive belt tension • Drive belt • Fan rotational direction Are all items okay?	Yes	Go to next step.
		No	Service as necessary and repeat Step 1.
2	Connect NGS tester to DLC. Turn engine switch on. Retrieve any DTC. Is "NO CODES RECEIVED/SYSTEM PASSED" displayed?	Yes	No DTC is displayed: Go to next step.
		No	DTC is displayed: Go to appropriate DTC test.
3	**Note** • Following test should be performed on vehicle with A/C system. Go to step next step for the non-A/C system equipped vehicle. Start engine and run it at idle speed. Turn A/C switch off. Can A/C compressor be disengaged?	Yes	Go to next step.
		No	Go to symptom troubleshooting No.19 "A/C is always on and/or A/C compressor runs continuously".
4	Start engine and run it at idle speed. Turn A/C switch on if equipped. Do condenser fan and/or main cooling fan operate?	Yes	Go to next step.
		No	If condenser fan does not operate, inspect for following: • Condenser fan relay is stuck open. • Condenser fan motor malfunction • Condenser fan motor ground open • Open circuit between condenser fan motor and relay • Open circuit between condenser fan relay and PCM terminal 1N • Open battery power circuit for condenser fan relay If main cooling fan motor does not operate, inspect following: • Main cooling fan relay is stuck open. • Main cooling fan motor malfunction • Main cooling fan motor ground open • Open circuit between cooling fan motor and relay • Open circuit between cooling fan relay and PCM terminal 3Q • Open battery power circuit for cooling fan relay
5	Is drive belt okay?	Yes	Go to next step.
		No	Replace drive belt.
6	Is there any leakage around heater unit in passenger compartment?	Yes	Inspect and service heater for leakage.
		No	Go to next step.
7	Is there any leakage at coolant hoses and/or radiator?	Yes	Replace malfunctioning parts.
		No	Go to next step.

STEP	INSPECTION		ACTION
8	Perform EGR system inspection. ☞ TROUBLESHOOTING, ENGINE SYSTEM INSPECTION, EGR System Inspection Is EGR system okay?	Yes	Go to next step.
		No	Inspect following: • EGR solenoid (vent) • EGR solenoid (vacuum) • EGR valve • Vacuum hose connections • Wiring harnesses between EGR solenoids and PCM terminals Repair or replace as necessary.
9	Cool down engine. Remove thermostat and inspect operation. Is water temperature gauge okay?	Yes	Thermostat is okay. Inspect engine block for leakage or blockage.
		No	Replace thermostat.
10	Verify test results. If okay, return to diagnostic index to service any additional symptoms.		

14	COOLING SYSTEM CONCERNS-RUNS COLD
DESCRIPTION	Engine does not reach normal operating temperature.
POSSIBLE CAUSE	• Thermostat malfunction • Malfunction of condenser fan system • Malfunction of main cooling fan system

STEP	INSPECTION		ACTION
1	Is customer complaint "Lack of passenger compartment heat" only?	Yes	Inspect A/C and heater control system.
		No	Go to next step.
2	Does engine speed continue at fast idle?	Yes	Go to symptom troubleshooting No.6 "Slow return to idle/fast idle".
		No	Go to next step.
3	Remove thermostat from vehicle. Inspect thermostat. ☞ Section E Is thermostat okay?	Yes	Inspect condenser fan and main fan operation. ☞ ENGINE SYSTEM INSPECTION, Cooling Fan Control System Inspection If both or either fan operate abnormally, inspect for following: • Main cooling fan relay is stuck closed. • Short to ground between main cooling fan relay and PCM terminal 3Q • Circuit between main cooling fan relay and fan motor shorts to battery supply line • Condenser fan relay is stuck closed. • Short to ground between condenser fan relay and PCM terminal 1N • Circuit between condenser fan relay and fan motor shorts to battery supply line
		No	Replace thermostat.
4	Verify test results. If okay, return to diagnostic index to service any additional symptoms.		

15	EXCESSIVE BLACK SMOKE
DESCRIPTION	Excessive black smoke is observed in exhaust gas.
POSSIBLE CAUSE	• Air cleaner element restriction • Incorrect fuel injection timing • Injection nozzle malfunction • Injection pump malfunction • Low engine compression

STEP	INSPECTION		ACTION
1	Connect NGS tester to DLC. Turn engine switch on. Retrieve any DTC. Is "NO CODES RECEIVED/SYSTEM PASSED" displayed?	Yes	No DTC is displayed: Go to next step.
		No	DTC is displayed: Go to appropriate DTC test.
2	Does any other symptom exist?	Yes	Go to appropriate flow chart.
		No	Go to next step.
3	Inspect air cleaner element for clogging. Is air cleaner element okay?	Yes	Go to next step.
		No	Repair or replace air cleaner element.
4	Inspect injection timing. ☞ ENGINE TUNE-UP, INJECTION TIMING INSPECTION Is injection timing okay?	Yes	Go to next step.
		No	Inspect TCV. ☞ CONTROL SYSTEM, TIMER CONTROL VALVE (TCV) INSPECTION If TCV is okay, adjust injection timing. ☞ ENGINE TUNE-UP, INJECTION TIMING INSPECTION
5	Remove injection nozzle. Inspect injection nozzle for following: • Clogged nozzle • Seized needle valve • Incorrect valve opening pressure • Faulty nozzle gasket Is injection nozzle okay?	Yes	Go to next step.
		No	Repair or replace injection nozzle.
6	Perform EGR system inspection. ☞ TROUBLESHOOTING, ENGINE SYSTEM INSPECITON, EGR System Inspection Is EGR system okay?	Yes	Go to next step.
		No	Inspect following: • EGR solenoid (vent) • EGR solenoid (vacuum) • EGR valve • Vacuum hose connections • Wiring harnesses between EGR solenoids and PCM terminals Repair or replace as necessary.
7	Measure engine compression. Is compression okay?	Yes	Inspect following: • Boost sensor • Spill valve • Injection pump
		No	Inspect following: • Damaged valve seat • Worn valve stem and valve guide • Worn or stuck piston ring • Worn piston, piston ring or cylinder Service as necessary.
8	Verify test results. If okay, return to diagnostic index to service any additional symptoms.		

16	ENGINE NOISE
DESCRIPTION	Engine noise from under hood
POSSIBLE CAUSE	• Engine internal damage • Timing belt displacement • Injection nozzle malfunction • Loose attaching bolts or worn parts • Improper drive belt tension • Air leakage from intake-air system • Turbocharger operating noise • Improper injection timing • Malfunction of engine coolant temperature sensor • EGR system malfunction • Intake air temperature sensor malfunction • Injection pump malfunction

STEP	INSPECTION		ACTION
1	Is squeal, click or chirp sound present?	Yes	Inspect engine oil level or drive belt.
		No	Go to next step.
2	Is rumble or grind sound present?	Yes	Inspect drive belt.No
		No	Go to next step.
3	Is rattle sound present?	Yes	Inspect location of rattle for loose parts.
		No	Go to next step.
4	Is hiss sound present?	Yes	Inspect for vacuum leakage.
		No	Go to next step.
5	Is rap or roar sound present?	Yes	Inspect exhaust system for loose parts.
		No	Go to next step.
6	Connect NGS tester to DLC. Turn engine switch on. Retrieve any DTC. Is "NO CODES RECEIVED/SYSTEM PASSED" displayed?	Yes	No DTC is displayed: Go to next step.
		No	DTC is displayed: Go to appropriate DTC test.
7	Turn engine switch on. Access ECT PID on NGS tester. Inspect ECT PID while warming up the engine. Is PID value correct?	Yes	Go to next step.
		No	Inspect engine coolant temperature sensor and related wiring harnesses.
8	Access IAT PID. Inspect IAT PID while running engine. Is PID value correct?	Yes	Go to next step.
		No	Inspect for intake air temperature sensor and related wiring harnesses.
9	Inspect injection timing. ☞ ENGINE TUNE-UP, INJECTION TIMING INSPECTION Is injection timing okay?	Yes	Go to next step.
		No	Inspect TCV. ☞ CONTROL SYSTEM, TIMER CONTROL VALVE (TCV) INSPECTION If TCV is okay, adjust injection timing. ☞ ENGINE TUNE-UP, INJECTION TIMING INSPECTION
10	Perform EGR system inspection. ☞ ENGINE SYSTEM INSPECTION, EGR System Inspection Is EGR system okay?	Yes	Go to next step.
		No	Inspect following: • EGR solenoid (vent) • EGR solenoid (vacuum) • EGR valve • Vacuum hose connections • Wiring harnesses between EGR solenoids and PCM terminals Repair or replace as necessary.

STEP	INSPECTION		ACTION
11	Remove parts necessary to inspect turbocharger. Inspect if turbocharger compressor wheel is bent, damaged, or interfering with casing on vehicle. Is there any problem?	Yes	Replace the turbocharger.
		No	Go to next step.
12	Inspect if turbocharger compressor wheel lock nut is loose or has fallen down inside turbocharger. Is there any problem?	Yes	Replace turbocharger.
		No	Go to next step.
13	Turn turbocharger compressor wheel by hand. Does wheel turn easily and smoothly?	Yes	Go to next step.
		No	Replace turbocharger.
14	Inspect if turbocharger turbine wheel is damaged, cracked or interfering with housing on vehicle. Is there any problem?	Yes	Replace turbocharger.
		No	Go to next step.
15	Is any engine oil found inside turbocharger turbine housing?	Yes	If excessive amount of engine oil is found on vehicle, replace turbocharger. If small amount of oil is found, wipe oil out. Then, go to next step.
		No	Go to next step.
16	Is any engine oil found inside turbocharger compressor housing?	Yes	Wipe oil out. Then, go to next step.
		No	Go to next step.
17	Is any exhaust gas leakage found around location where turbocharger is attached to exhaust manifold?	Yes	Remove turbocharger. Inspect cracks on center housing inlet surface. If cracks are found, replace turbocharger.
		No	Go to next step.
18	Are any center housing and turbine housing attaching bolts loose?	Yes	Retighten the loose bolts. ☞ INTAKE-AIR SYSTEM, INTAKE-AIR SYSTEM REMOVAL/INSTALLATION If bolt is found to be missing, attach appropriate new bolt.
		No	Turbocharger is okay. Install all removed parts in Step11. Go to next step.
19	Remove injection nozzle. Inspect for following: • Clogged nozzle • Seized needle valve • Incorrect valve opening pressure • Faulty nozzle gasket • After-dripping Is injection nozzle okay?	Yes	Inspect for following: • Metal flow • Bent connecting rod • Damaged valve seat
		No	Replace injection nozzle or gasket.
20	Verify test results. If okay, return to diagnostic index to service any additional symptoms.		

17	VIBRATION COCNERNS (ENGINE)
DESCRIPTION	Vibration from under hood or driveline
POSSIBLE CAUSE	• Loose attaching bolts or worn parts • Components malfunction such as worn parts

STEP	INSPECTION		ACTION
1	Inspect following components for loose attaching bolts or worn parts: • Cooling fan • Drive belt and pulley • Engine mounts • Exhaust system All items okay?	Yes	Inspect following: • Wheels • Transmission and mounts • Driveline • Suspension Service as necessary.
		No	Readjust or retighten engine mount installation position. Service as necessary for other parts.
2	Verify test results. If okay, return to diagnostic index to service any additional symptoms.		

18	A/C DOES NOT WORK.
DESCRIPTION	A/C compressor magnetic clutch does not engage when A/C is turned on.
POSSIBLE CAUSE	• Improper refrigerant charging amount • Open A/C magnetic clutch • Open circuit in related wiring harnesses • Poor ground of A/C magnetic clutch • A/C low/high pressure switch is stuck open. • A/C relay is stuck open. • Seized A/C compressor • Engine coolant temperature sensor malfunction • Improper magnetic clutch clearance • Throttle position sensor malfunction

STEP	INSPECTION		ACTION
1	Connect NGS tester to DLC. Turn engine switch on. Retrieve any DTC. Is "NO CODES RECEIVED/SYSTEM PASSED" displayed?	Yes	No DTC is displayed: Go to next step.
		No	DTC is displayed: Go to appropriate DTC test.
2	Disconnect A/C compressor connector. Start engine and turn A/C switch on. Is there correct voltage at terminal of A/C compressor magnetic clutch connector? Specification: More than 10.5 volts	Yes	Inspect for ground condition of magnetic clutch on A/C compressor. If ground condition is okay, inspect for open circuit of magnetic clutch coil.
		No	Go to next step.
3	Disconnect A/C pressure switch connector. Connect jumper wire between terminals of A/C pressure switch connector. Connect NGS tester to data link connector. Access A/C SW PID on NGS tester. Turn engine switch on. Turn A/C switch on. Does A/C SW PID read on?	Yes	Inspect A/C pressure switch operation. Replace malfunctioning switch. If switch is okay, go to next step.
		No	Inspect for following: • A/C switch is stuck open. • Open circuit between A/C pressure switch and PCM terminal 1S • Evaporator temperature sensor and amplifier Repair or replace as necessary.
4	Remove jumper wire from switch connector. Reconnect connector to A/C pressure switch. Start engine and turn A/C switch on. Verify fan operation. Does fan operate?	Yes	Inspect for stuck open A/C relay. Replace as necessary.
		No	Inspect following and repair or replace as necessary: • Refrigerant charging amount • Seized A/C compressor.
5	Verify test results. If okay, return to diagnostic index to service any additional symptoms.		

19	A/C IS ALWAYS ON AND/OR A/C COMPRESSOR RUNS CONTINUOUSLY.
DESCRIPTION	A/C compressor magnetic clutch does not disengage.
POSSIBLE CAUSE	• Improper magnetic clutch clearance • Short to ground circuit between PCM and A/C relay • Short to ground circuit between PCM and A/C switch • Short to power line between A/C relay and pressure switch • A/C low/high pressure switch stuck close. • A/C relay is stuck close.

STEP	INSPECTION		ACTION
1	Connect NGS tester to DLC. Turn engine switch on. Retrieve any DTC. Is "NO CODES RECEIVED/SYSTEM PASSED" displayed?	Yes	No DTC is displayed: Go to next step.
		No	DTC is displayed: Go to appropriate DTC test.
2	Start engine and turn A/C switch on. Access A/C SW PID on NGS tester. Read A/C SW PID while disconnecting the pressure switch connector. **Note** • A/C SW PID should read OFF when disconnecting connector. If A/C SW PID reading remains ON, short to ground circuit may be present. Does A/C SW PID reading remain ON?	Yes	Inspect for short to ground circuit between pressure switch and PCM terminal 1S.
		No	Go to next step.
3	Reconnect pressure switch connector. Read A/C SW PID while turning A/C switch off. **Note** • A/C SW PID should read OFF when turning A/C switch off. If A/C SW PID reading remains ON, short to ground circuit may be present. Does A/C SW PID reading remain ON?	Yes	Inspect for short to ground circuit between pressure switch and A/C switch. If circuit is okay, inspect A/C switch for being stuck closed.
		No	Go to next step.
4	Start engine and run it at idle. Turn A/C switch on. Remove A/C relay. Does A/C magnetic clutch disengage?	Yes	Inspect following: • A/C relay is stuck closed. • Short to ground circuit between A/C relay and PCM terminal 1Q
		No	Inspect if circuit between A/C relay and magnet is clutch shorts to battery power circuit. If circuit is okay, inspect for magnet is clutch stuck engagement or clearance.
5	Verify test results. If okay, return to diagnostic index to service any additional symptoms.		

20	INTERMITTENT CONCERNS
DESCRIPTION	Symptom occurs randomly and is difficult to diagnose.

STEP	INSPECTION		ACTION
1	Talk to customer. Retrieve vehicle service history. Does vehicle have a number of previous repairs and components replaced for certain symptom?	Yes	Go to next step.
		No	Go to symptom index.
2	Key is off. If input is switch-type component, turn on manually. Turn engine switch on. Access suspect PID. Lightly tap on suspect component, wiggle and pull each wire/connector at suspect component or PCM. Is any PID value out of range, or suddenly change and go back into range?.	Yes	Inspect each wire for corrosion, bent or loose terminal crimps.
		No	Go to next step.

STEP	INSPECTION		ACTION
3	Start engine and run it at idle speed. Lightly tap on suspect component, wiggle and pull each wire/connector at suspect component or PCM. Is any PID value out of range, or suddenly change and go back into range?	Yes	Inspect each wire for corrosion, bent or loose terminal crimps.
		No	Go to next step.
4	Accurately spray water on suspect component wire, component or vacuum line related to possible faulty area. Is any PID value out of range, or suddenly change and go back into range, or was there a noticeable engine stumble?	Yes	Fault area is identified. If fault occurred while spraying on component: Replace part and verify repair. If fault occurred while spraying water: Inspect each wire for corrosion, bent or loose terminals and poor wire terminal crimps. If fault occurred while spraying vacuum line: Repair vacuum hoses.
		No	Inspect wire and connector at suspect component for corrosion, bent or loose terminals, poor wire terminal crimps and high tension wire. Repair as necessary.

21	CONSTANT VOLTAGE
DESCRIPTION	Incorrect constant voltage
POSSIBLE CAUSE	Constant voltage circuit malfunction **Note** Throttle position sensor, boost sensor and EGR position sensor use constant voltage.

STEP	INSPECTION		ACTION
1	Disconnect throttle position sensor connector. Turn engine switch on. Measure voltage between following throttle position sensor connector terminals: • Constant voltage terminal-ground terminal Is constant voltage greater than 6.0 V ?	Yes	Inspect a constant voltage circuit for short to battery power supply circuit.
		No	Go to next step.
2	Turn engine switch on. Measure voltage across battery terminals? Is voltage greater than 10.5 V ?	Yes	Go to next step.
		No	Inspect charging system.
3	Turn engine switch off. Disconnect sensor where constant voltage inspection failed. Measure voltage between battery positive post and ground circuit at appropriate sensor vehicle harness connector. Is voltage greater than 10.5 volts and within 1.0 volt of battery voltage?	Yes	Go to next step.
		No	Go to Step 9.
4	Turn engine switch on. Connect NGS tester to DLC. Attempt to access ECT PID. Can ECT PID be accessed?	Yes	Inspect for open constant voltage supply circuit between PCM connector terminal 2A and suspect sensor connector.
		No	Go to next step.
5	Turn engine switch off. Disconnect throttle position sensor connector. Disconnect EGR solenoid (vacuum) connector. Turn engine switch on. Measure voltage between power supply circuit at EGR solenoid (vacuum) vehicle harness connector and the battery negative post. Is voltage greater than 10.5 volts?	Yes	Reconnect EGR solenoid (vacuum). Go to next step.
		No	Battery power is not present. Inspect following: • Main fuse and/or PCM fuse • PCM control relay • Open circuit between main fuse and PCM control relay • Open circuit between PCM control relay and EGR solenoid (vacuum) • Open circuit between PCM control relay and PCM terminal 1E • Open circuit between PCM control relay and PCM terminal 1B

STEP	INSPECTION		ACTION
6	Turn engine switch off. Leave throttle position sensor disconnected. Disconnect EGR position sensor connector. Turn engine switch on. Measure voltage between following throttle position sensor connector terminals: • Constant voltage terminal-ground terminal Is voltage between 4.0 and 6.0 volts?	Yes	Replace EGR position sensor.
		No	Go to next step.
7	Turn engine switch off. Leave throttle position sensor and EGR position sensor connectors disconnected. Disconnect boost sensor connector. Turn engine switch on. Measure voltage between constant voltage and ground terminals at throttle position sensor connector. Is voltage between 4.0—6.0 volts?	Yes	Replace boost sensor.
		No	Go to next step.
8	Turn engine switch off. Leave accelerator position sensor disconnected. Disconnect the EGR position sensor and boost sensor connectors. Turn engine switch on. Connect NGS tester to DLC. Access B+ PID. Is B+PID greater than 10.5 volts?	Yes	Inspect constant voltage circuit for short to ground.
		No	Inspect for open battery power supply circuit between PCM control relay and PCM terminal B.
9	Turn engine switch on. Connect NGS tester to DLC. Attempt to access ECT PID. Can ECT PID be accessed?	Yes	Go to next step.
		No	Go to Step 11.
10	Are DTCs present for two or more following sensors connected to PCM 2B terminal ? • Boost sensor • EGR valve position sensor • Accelerator position sensor • ECT sensor • IAT sensor • Fuel temperature sensor	Yes	Go to next step.
		No	Inspect for poor ground circuit for sensor where constant voltage inspection failed.
11	Turn engine switch off. Disconnect NGS tester from DLC. Disconnect sensor where constant voltage inspection failed. Inspect for continuity between ground circuit at appropriate sensor connector and body ground. Is there continuity?	Yes	Go to next step.
		No	Infpect for open ground circuit between following terminals: • PCM connector 3B/3Y terminals and ground. • PCM connector 3B/3Y and 2B terminals.

ENGINE SYSTEM INSPECTION
Cooling Fan Control System Inspection
Cooling fan and condenser fan operation

Engine condition	Cooling fan relay	Condenser fan relay
Engine coolant temp. is above 108 °C.	ON	ON
Engine coolant temp. is above 100 °C.	ON	OFF
Engine coolant temp. sensor malfunction	ON	ON
A/C switch is on.	OFF	ON

Note
- Both fan relays are turned on when idle switch is turned off and a jumper wire is connected between the DLC TEST terminal and ground.

Cooling fan
1. Connect the NGS tester to the DLC.
2. Turn engine switch on.
3. Access ECT PID.
4. Verify that the PID value is less than 100 °C.
5. Verify that the cooling fan is not operating.
6. If the cooling fan is operating, inspect for the following:
   - DTC P0115 (ECT sensor malfunction)
   - Cooling fan relay is stuck in closed position.
   - Short to ground in circuit between cooling fan relay and PCM terminal 3Q
   - Short to power in circuit between cooling fan relay and cooling fan
7. Start the engine.
8. Warm the engine up until ECT PID value exceeds 100 °C.
9. Verify that the cooling fan operates when PID value is above 100 C.
10. If the cooling fan does not operate, inspect for the following:
    - Cooling fan relay is stuck open.
    - Open circuit in cooling fan motor
    - Poor cooling fan ground
    - Open circuit between cooling fan relay and cooling fan
    - Open circuit between cooling fan relay and PCM terminal 3Q

Condenser fan
1. Connect the NGS tester to the DLC.
2. Turn A/C switch off.
3. Turn engine switch on.
4. Access ECT and A/C SW PIDs.
5. Verify that the ECT PID is less than 108 °C and A/C SW PID is off.
6. Verify that the cooling fan is not operating.
7. If the cooling fan is operating, inspect for the following:
   - DTC P0115 (ECT sensor malfunction)
   - Condenser fan relay is stuck in closed position.
   - Short to ground in circuit between condenser fan relay and PCM terminal 1N
   - Short to power in circuit between condenser fan relay and condenser fan
8. Start the engine, then turn A/C switch on.
9. Verify A/C SW PID is on.
10. Verify the condenser fan is operating.
11. Turn A/C switch off.
12. Warm the engine up until ECT PID value exceeds 108 °C.
13. Verify that the condenser fan is operating when PID value is above 108 °C.
14. If the condenser fan does not operate, inspect for the following:
    - Condenser fan relay is stuck open.
    - Open circuit in condenser fan motor
    - Poor condenser fan ground
    - Open circuit between condenser fan relay and condenser fan
    - Open circuit between condenser fan relay and PCM terminal 1N

A/C Cut-off Control System Inspection
Note
If the engine coolant temperature is above 113 °C, the A/C compressor magnetic clutch continuously engages and disengages approx. every 9—10 seconds until the engine coolant temperature decreases below 100 °C.
1. Start the engine.
2. Turn A/C switch on.
3. Verify that the A/C compressor magnetic clutch engages. If it does not engage, go to symptom troubleshooting No. 18 "A/C does not work".
4. Verify that the A/C compressor magnetic clutch disengages while the accelerator pedal is fully depressed.
5. If it does not disengage, inspect the throttle position sensor.

EGR System Inspection
1. Make sure that all hoses are securely connected in the proper position.
2. Connect the NGS tester to the DLC.
3. Turn the engine switch on.
4. Access EGR PV PID.
5. Verify that the PID value is within specification.
   Specification: 0.7—0.8 V
6. If it is not, inspect if EGR valve is stuck open.
7. Start the engine and run it at idle speed.
8. Verify that the EGR PV PID is within specification.
   Specification: 0.7—0.8 V
9. If it is not, inspect the following:
   - EGR solenoid valve (vacuum)
   - EGR solenoid valve (vent)
10. Disconnect the vacuum hose from the EGR valve.
11. Connect the vacuum pump to the EGR valve.
12. Apply vacuum to the EGR valve and inspect if the engine speed becomes unstable or the engine stalls.
13. If the engine speed does not change, stop the engine and inspect EGR valve.

Glow System Inspection

STEP	INSPECTION		ACTION
1	Connect NGS tester to DLC. Turn engine switch on and retrieve DTC. Are any of following DTCs displayed? • P0340 (Pump speed sensor) • P0115 (ECT sensor) • P0120 (Accelerator position sensor) • P0380 (Glow relay)	Yes	Go to appropriate DTC test. After repair is completed, go to next step.
		No	If other DTCs are displayed, go to appropriate DTC test. If "NO CODES DISPLAYED/SYSTEM PASSED" is displayed, go to next step.
2	Turn engine switch ON. Access ECT and B+ PIDs. Make sure that PID values are as follows: • ECT PID is below 60 °C. • B+PID is below 15 V. **Note** • If engine is hot and ECT PID is above 60 °C, cool engine down to below 53 °C. • If B+PID is above 15V, inspect charging system. Turn engine switch off. Then, turn engine switch on again. Does glow indicator light illuminate for approx. 1.6—7 sec, then go out?	Yes	Go to Step 4.
		No	Go to next step.
3	Access GLOW LAMP and GLOW RELAY PIDs. Turn engine switch off, then turn engine switch on again. Does each PID indication are as follows? • GLOW LAMP PID indicates ON for approx. 1.6—7 sec, then turns to OFF. • GLOW RELAY PID indicates ON for approx. 1.6 sec.	Yes	Both PIDs are okay; inspect for following: If light does not go out: • Short circuit between glow indicator light and PCM connector terminal 1M • Short circuit in instrument cluster print plate If light does not illuminate: • Open circuit in glow indicator light • Open circuit between glow indicator light and PCM connector terminal 1M • Open circuit in instrument cluster print plate Repair or replace as necessary.
		No	Replace PCM.
4	Turn engine switch off, then turn engine switch on again. Does glow plug voltage indicate B+ for approx. 1-2 sec.?	Yes	Go to next step.
		No	1. Inspect for open or short circuit in harnesses and connectors between battery, glow plug relay, and glow plug. 2. Inspect if glow plug relay is stuck open or closed. 3. Inspect glow plug relay ground circuit. 4. Inspect for open circuit between relay and PCM terminal 3W.
5	Does glow plug voltage indicate B+ while cranking engine?	Yes	Go to next step.
		No	Inspect for open or short to ground circuit in harness and connectors between engine switch (Starter) and PCM connector terminal 1U.
6	Is power supplied to glow plug for approx. 60 sec. after engine is started when engine is cold?	Yes	Go to next step.
		No	Inspect for intermittent open or short circuit in harnesses, and connectors between engine coolant temperature sensor and PCM connector terminal 2G.
7	Remove glow plug wires from glow plugs. Measure resistance between glow plug and body ground. Is glow plug resistance approx. 1 ohm or less?	Yes	Glow system is okay.
		No	Replace glow plug.

ENGINE ELECTRICAL SYSTEM

FEATURES

SERVICE

G

OUTLINE

OUTLINE OF CONSTRUCTION

With the addition of the RF Turbo and RF Turbo (Hi-power) engines, the electrical system of the new engines features:

- A 95D31L or 115D31L type battery
- A generator with a built-in voltage regulator
- A reduction-type starter

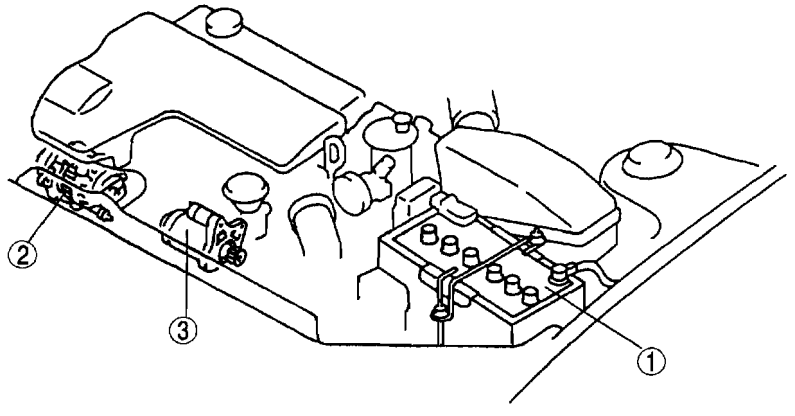
SPECIFICATIONS

Item			Engine type	
			RF Turbo	RF Turbo (Hi-power)
Battery	Voltage	(V)	12	
	Type and capacity (5-hour rate)	(A·h)	95D31L (64), 115D31L (70)*1	
Generator	Output	(V-A)	12—80	
	Regulated voltage	(V)	14.1—14.7	
	Self-diagnosis function		Equipped	
Starter	Type		Reduction, Coaxial reduction*1	
	Output	(kW)	2.0, 2.2 *1	

*1: Cold area

▭ Indicates new specification

STRUCTURAL VIEW



1	Battery
2	Generator
3	Starter

SUPPLEMENTAL SERVICE INFORMATION

The following changes and/or additions have been made since publication of the Mazda 626 Workshop Manual (1577-10-97D).

Battery
- Removal/Installation procedure has been added.
- Inspection procedure has been added.
- Recharging procedure has been added.

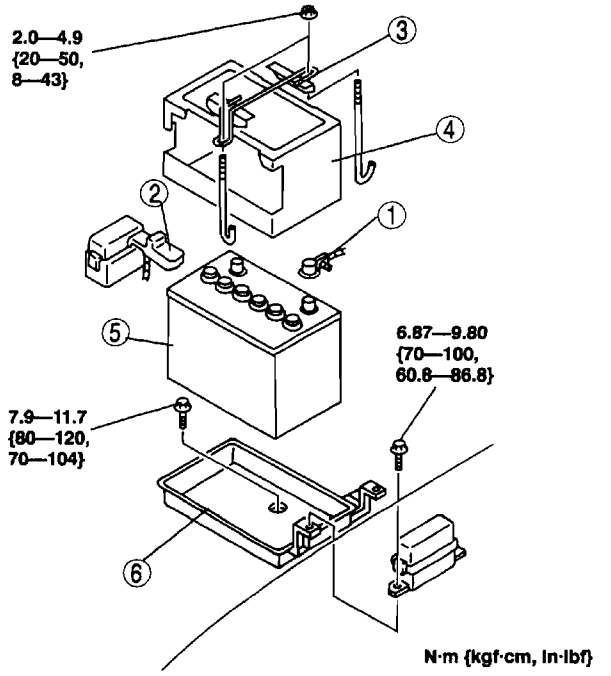
Generator
- Removal/Installation procedure has been added.
- Inspection procedure has been added.

Starter
- Removal/Installation procedure has been added.
- Inspection procedure has been added.

CHARGING SYSTEM

BATTERY REMOVAL/INSTALLATION

1. Remove in the order indicated in the table.
2. Install in the reverse order of removal.



1	Negative battery cable
2	Positive battery cable
3	Battery clamp
4	Battery box
5	Battery
6	Battery tray

BATTERY INSPECTION

Battery

- Inspect the battery in the following procedure.

Step	Inspection		Action
1	Measure open circuit voltage of battery.	Above 12.4 V	Go to step 3.
		Below 12.4 V	Go to next step.
2	Quick charge for 30 minutes and recheck voltage.	Above 12.4 V	Go to next step.
		Below 12.4 V	Replace battery.
3	Apply test load (see test load chart) to battery using a battery load tester and record battery voltage after 15 seconds. Is voltage more than specification?	Yes	Battery is okay.
		No	Replace battery.

Test load chart

Battery	Load (A)
95D31L	250
115D31L	320

Battery positive voltage with load

Approximate battery temp.	Minimum voltage (V)
21 °C {70 °F}	9.6
15 °C {60 °F}	9.5
10 °C {50 °F}	9.4
4 °C {40 °F}	9.3
-1 °C {30 °F}	9.1
-7 °C {20 °F}	8.9
-12 °C {10 °F}	8.7
-18 °C {0 °F}	8.5

Dark Current

1. Verify that the engine switch is at the OFF position and that the engine key has been removed.
2. Disconnect the negative battery cable.

Caution

- **Operating electrical loads while measuring the dark current can damage the circuit tester.**

3. Measure the dark current between the negative battery terminal and the negative battery cable.

Dark current
20 mA max.

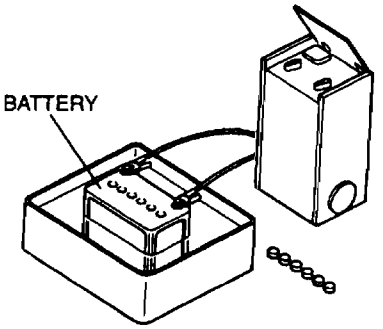
4. If the current exceeds the maximum, remove the fuse in the main fuse block and the fuse block one by one while measuring the dark current.
5. Inspect and repair harnesses and connectors of the fuse at which the current reduces.

BATTERY RECHARGING

Caution

- **When disconnecting the battery, remove the negative cable first and install it last to prevent damage to electrical components or the battery.**
- **To avoid deformation or damage to the battery, remove the battery plugs while charging the battery. (Without the maintenance-free battery)**
- **Do not quick charge for over 30 minutes. It will damage the battery.**

1. Place a battery in a pan of water to prevent it from overheating. The water level should come up about halfway on the battery. Keep water off the top of the battery.



2. Connect a battery charger to the battery.
3. Adjust the charging current as follows.

Battery type (5-hour rate)	Slow charge (A)	Quick charge (A)/(30 min.)
95D31L (64)	6.5—8.0	40
115D31L (70)	7.0—8.5	45

4. After the battery has been recharged, measure the battery positive voltage and verify that the battery keeps specified voltage for more than 1 hour.

Specification
Above 12.4 V

5. If not as specified, replace the battery.

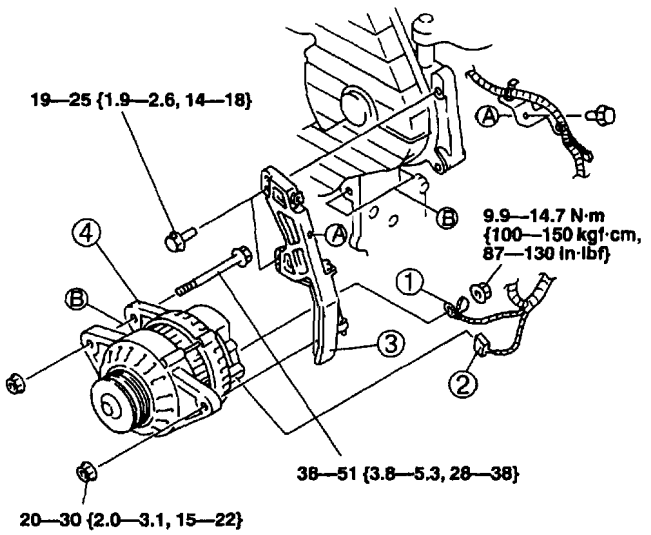
G

GENERATOR REMOVAL/INSTALLATION

Warning

- **When the battery cable are connected, touching the vehicle body with generator terminal B will generate sparks. This can cause personal injury, fire, and damage to the electrical components. Always disconnect the battery before performing the following operation.**

1. Disconnect the negative battery cable.
2. Remove the drive belt.
3. Remove in the order indicated in the table.
4. Install in the reverse order of removal.
5. Inspect the drive belt deflection and/or tension. (Refer to section B2, DRIVE BELT, DRIVE BELT INSPECTION.)



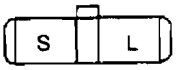
N·m {kgf·m, ft·lbf}

1	Terminal B wire
2	Connector
3	Strap
4	Generator

GENERATOR INSPECTION

Generator Warning Light

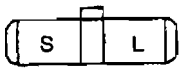
1. Verify that the battery is fully charged.
2. Verify that the drive belt deflection and/or tension is correct. (Refer to section B2, DRIVE BELT, DRIVE BELT INSPECTION.)
3. Turn the engine switch on and verify that the generator warning light comes on.
4. If not, inspect the generator warning light and wiring harnesses from the battery to generator warning light and from the battery to generator terminal L.



5. Verify that the generator warning light goes out after engine started.
6. If not, inspect the generator.

Voltage

1. Verify that the battery is fully charged.
2. Verify that the drive belt deflection and/or tension is within the specification. (Refer to section B2, DRIVE BELT, DRIVE BELT INSPECTION.)
3. Turn off all electrical loads.
4. Turn the engine switch to start the engine and verify that the generator turns smoothly without any noise while the engine is running.
5. Measure the voltage at the terminals shown in the table.



Standard voltage

Terminal	engine switch ON (V)		Idle [20 °C {68 °F }] (V)	
	RF Turbo	RF Turbo (Hi-power)	RF Turbo	RF Turbo (Hi-power)
B	B+		14.1—14.7	
L	Approx. 1		14.1—14.7	
S	B+		14.1—14.7	

6. If not as specified, disassemble and inspect the generator.

Current

1. Verify that the battery is fully charged.
2. Verify that the drive belt deflection and/or tension is correct. (Refer to section B2, DRIVE BELT, DRIVE BELT INSPECTION.)
3. Disconnect the negative battery cable.
4. Connect a circuit tester, capable of reading 120 A or over, between generator terminal B and the wiring harness.
5. Connect the negative battery cable.
6. Turn all electrical loads off.
7. Start the engine and increase the engine speed to 2,000—2,500 rpm.
8. Turn the following electrical loads on and verify that the current reading increases.
   - Headlights
   - Blower motor
   - Rear window defroster

Note

- Current required for generating power varies with electrical loads applied.

Standard current (Reference)

Measuring conditions
Room temperature: 20 °C {68 °F }
Voltage: 13.5 V
Engine: hot

Engine speed (rpm)	Terminal B current (A)	
	RF Turbo	RF Turbo (Hi-power)
1,000	Approx. 0—44 (must not be 0)	
2,000	Approx. 0—69 (must not be 0)	

9. If generator terminal B current will not increase, disassemble and inspect the generator.

G

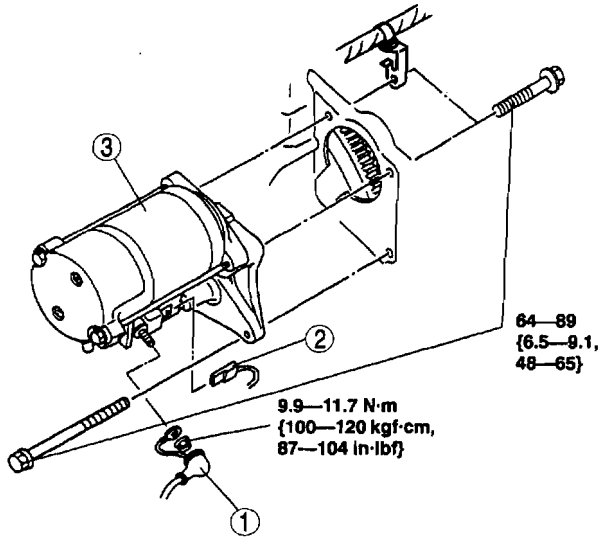
STARTING SYSTEM

STARTER REMOVAL / INSTALLATION

Warning

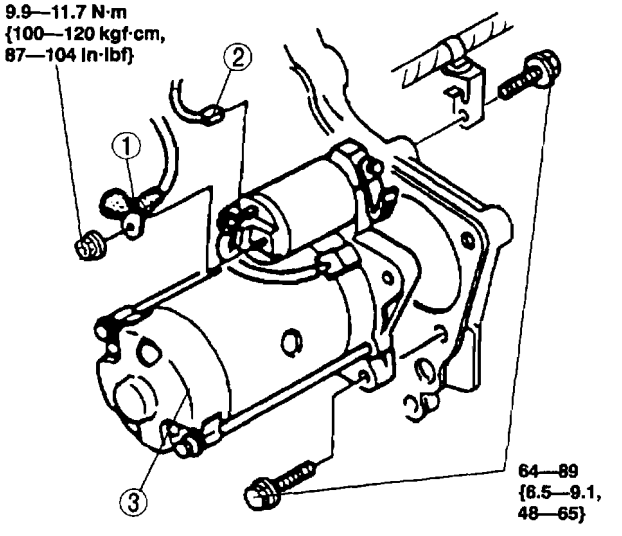
- **When the battery cable are connected, touching the vehicle body with starter terminal B will generate sparks. This can cause personal injury, fire, and damage to the electrical components. Always disconnect the battery before performing the following operation.**

1. Remove the battery.
2. Remove in the order indicated in the table.
3. Install in the reverse order of removal.



N·m {kgf·m, ft·lbf}

COLD AREA



N·m {kgf·m, ft·lbf}

1	Terminal B wire
2	Terminal S wire
3	Starter

STARTER INSPECTION

On-Vehicle Inspection

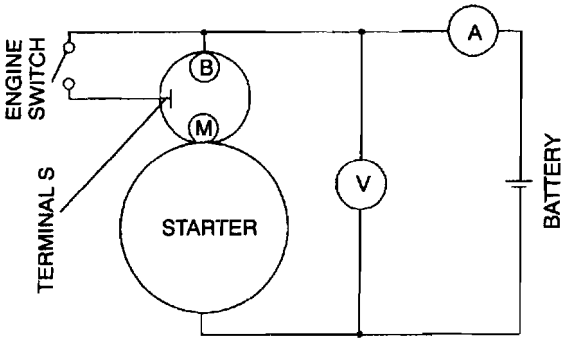
1. Verify that the battery is fully charged.
2. Crank the engine and verify that the starter turns smoothly without any noise.
3. If not as specified, measure the voltage at terminals S and B when the engine switch at START position.

Specification
Above 8 V

4. If the voltage is within the specification, remove the starter and inspect the magnetic switch and the starter.
5. If the voltage is not as specified, inspect the wiring harness and engine switch.

No-load Test

1. Verify that the battery is fully charged.
2. Connect the starter, battery, voltmeter and ammeter as shown.



3. Operate the starter and verify that it turns smoothly.
4. Measure the voltage and current while the starter is operating.

Specification

Item	Engine type	
	RF Turbo	RF Turbo (HI-power)
Voltage (V)	11.5 11*1	
Current (A)	Below 100 Below 130*1	

*1 Cold area

5. If not as specified, repair or replace the inner parts as necessary.

CLUTCH

FEATURES

SERVICE

OUTLINE

OUTLINE OF CONSTRUCTION

- The clutch mechanism is the same as that of the current Mazda 626 models. (Refer to 626 Training Manual 3303-10-97D)
- However, set load of clutch cover has been changed to 5690 N {580 kgf, 1280 lbf}.

SUPPLEMENTAL SERVICE INFORMATION

- The following changes and/or additions have been made since publication of the Mazda 626 Workshop Manual (1577-10-97D).

Pilot Bearing

- Removal/Installation procedure has been added.

H

FLYWHEEL

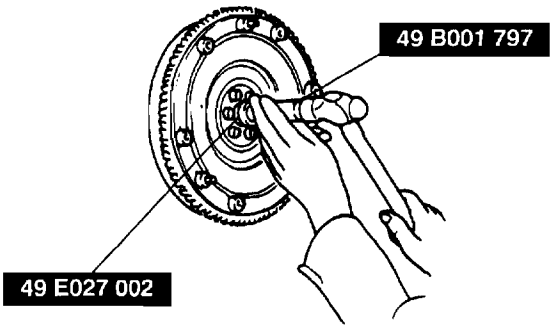
PILOT BEARING

Pilot Bearing Installation Note

RF Turbo

- Install a new pilot bearing using the **SST**.

Bearing installation depth
3.0—5.0 mm {0.12—0.19 in}



MANUAL TRANSAXLE

FEATURES

SERVICE

OUTLINE

OUTLINE OF CONSTRUCTION

- Due to the addition of the RF Turbo engine, the Removal/Installation procedures of the manual transaxle has been added.
- The basic construction and operation of the manual transaxle are the same as those of the current 626 with petrol engine. (Refer to Mazda 626 Training Manual 3303-10-97D.) However the 1st, 5th, reverse, and final gear ratio have been changed.

J

SPECIFICATIONS

Item			Engine	
			RF Turbo	RF Turbo (Hi-power)
Transaxle type			G25M-R	
Transaxle control			Floor-shift	
Operation system			Rod	
Shift assist			Forward: Synchromesh Reverse: Selective sliding and synchromesh	
Gear ratio	1st		3.454	
	2nd		1.833	
	3rd		1.310	
	4th		0.970	
	5th		0.717	
	Reverse		3.454	
Final gear ratio			Except wagon: 3.409 Wagon : 3.619	
Oil	Grade		API Service GL-4 or GL-5	
	Viscosity	All season	SAE 75W-90	
		Above 10 °C {50 °F}	SAE 80W-90	
	Capacity (L {US qt, Imp qt})		2.7 {2.9, 2.4}	

Indicates new specification.

SUPPLEMENTAL SERVICE INFORMATION

The following changes and/or additions have been made since publication of the Mazda 626 Workshop Manual (1577-10-97D), and Mazda 626 Station Wagon Workshop Manual Supplement (1603-10-97J).

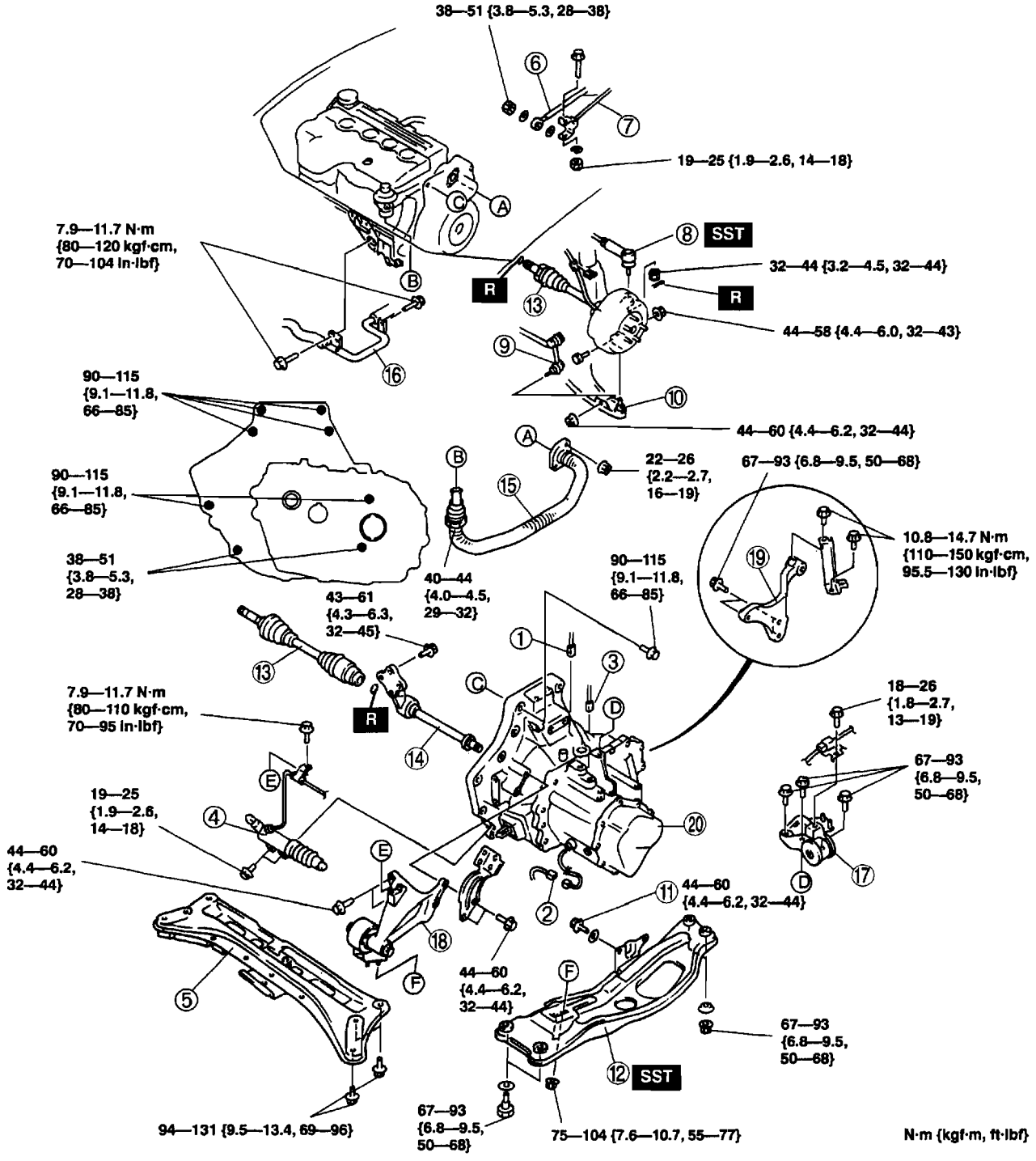
Manual transaxle

- Removal/Installation procedure has been added.

MANUAL TRANSAXLE

MANUAL TRANSAXLE REMOVAL/INSTALLATION

1. Drain the transaxle oil.
2. Remove the battery and battery tray.
3. Remove the air cleaner component.
4. Remove the wheel, tire, and splash shield.
5. Remove the air pipe. (Refer to section F2, INTAKE-AIR SYSTEM, INTAKE-AIR SYSTEM REMOVAL/INSTALLATION.)
6. Remove the middle pipe. (Refer to section F2, EXHAUST SYSTEM, EXHAUST SYSTEM REMOVAL/INSTALLATION.)
7. Remove the starter. (Refer to section G, STARTING SYSTEM, STARTER REMOVAL/INSTALLATION.)
8. Remove in the order indicated in the table.
9. Install in the reverse order of removal.
10. Add the specified amount and type of transaxle oil. (Refer to section J.)
11. Warm up the engine and transaxle, inspect for oil leakage, and check the transaxle operation.



1	Neutral switch connector
2	Back-up light switch connector
3	Vehicle speedometer sensor connector
4	Clutch release cylinder
5	Transverse member
6	Extension bar
7	Change control rod
8	Tie-rod end ball joint
9	Stabilzer control link
10	Lower arm ball joint
11	No.5 engine mount bolt
12	Engine mount member ☞ section J
13	Drive shaft ☞ section M
14	Joint shaft ☞ section M, DRIVE SHAFT, JOINT SHAFT REMOVAL/INSTALLATION
15	EGR pipe
16	Water pipe
17	No.4 engine mount rubber
18	No.2 engine mount
19	No.1 engine mount bracket
20	Transaxle ☞ section J

FRONT AND REAR AXLES

FEATURES

SERVICE

OUTLINE

OUTLINE OF CONSTRUCTION

- The contruction, operation and specification of the front and rear axles are the same as those of the current 626 with petrol engine (Refer to Mazda 626 Training Manual 3303-10-97D), however, the joint shaft bracket is different.

M

SUPPLEMENTAL SERVICE INFORMATION

The following changes and/or additions have been made since publication of the Mazda 626 Workshop Manual (1577-10-97D) and 626 Station Wagon Workshop Manual Supplement (1603-10-97J).

Joint shaft
- Removal/Installation procedures modified.

GENERAL PROCEDURES

Wheel and tire removal/installation
- The removal and installation procedure for the wheels and tires are not mentioned in this section. When a wheel is removed, tighten it to **89—117 N·m {9.0—12.0 kgf·m , 66—86 ft·lbf}**.

Suspension arm removal/installation
- Tighten any part of the suspension that uses rubber bushings only after vehicle has been lowered and unloaded.*

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

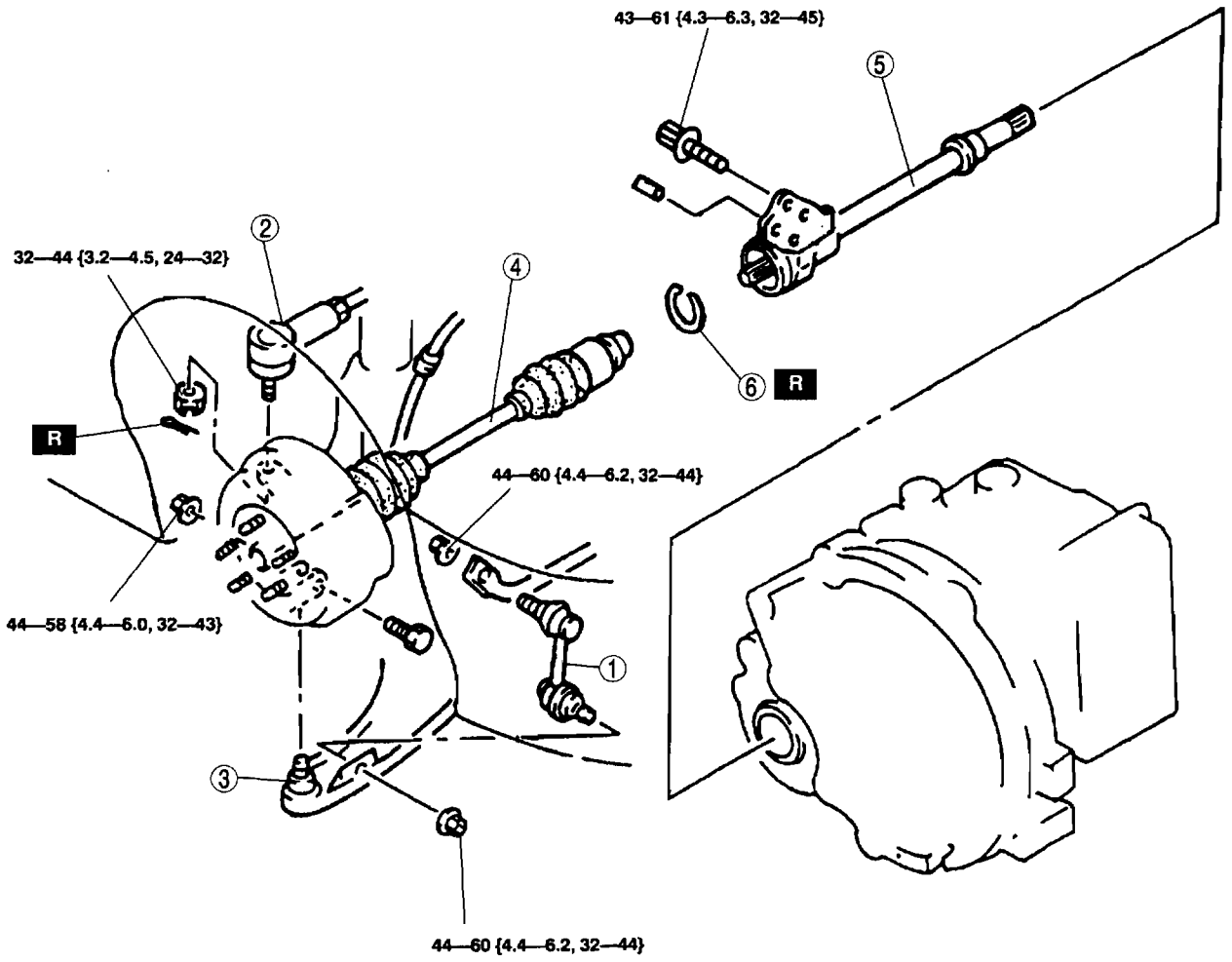
DRIVE SHAFT

JOINT SHAFT REMOVAL/INSTALLATION

Caution

- **Performing the following procedures without first removing the ABS wheel-speed sensor may possibly cause an open circuit in the harness if it is pulled by mistake. Before performing the following procedures, remove the ABS wheel-speed sensor (axle side) and fix it to an appropriate place where the sensor will not be pulled by mistake while servicing the vehicle.**

1. Drain the transaxle oil. (Refer to section J.)
2. Remove in the order indicated in the table.
3. Install in the reverse order of removal.



N·m {kgf·m, ft·lbf}

1	Stabilizer control link
2	Tie-rod end ball joint ☞ section N
3	Lower arm ball joint
4	Right drive shaft and axle ☞ section M

5	Joint shaft ☞ Installation Note
6	Clip ☞ section M

STEERING SYSTEM

FEATURES

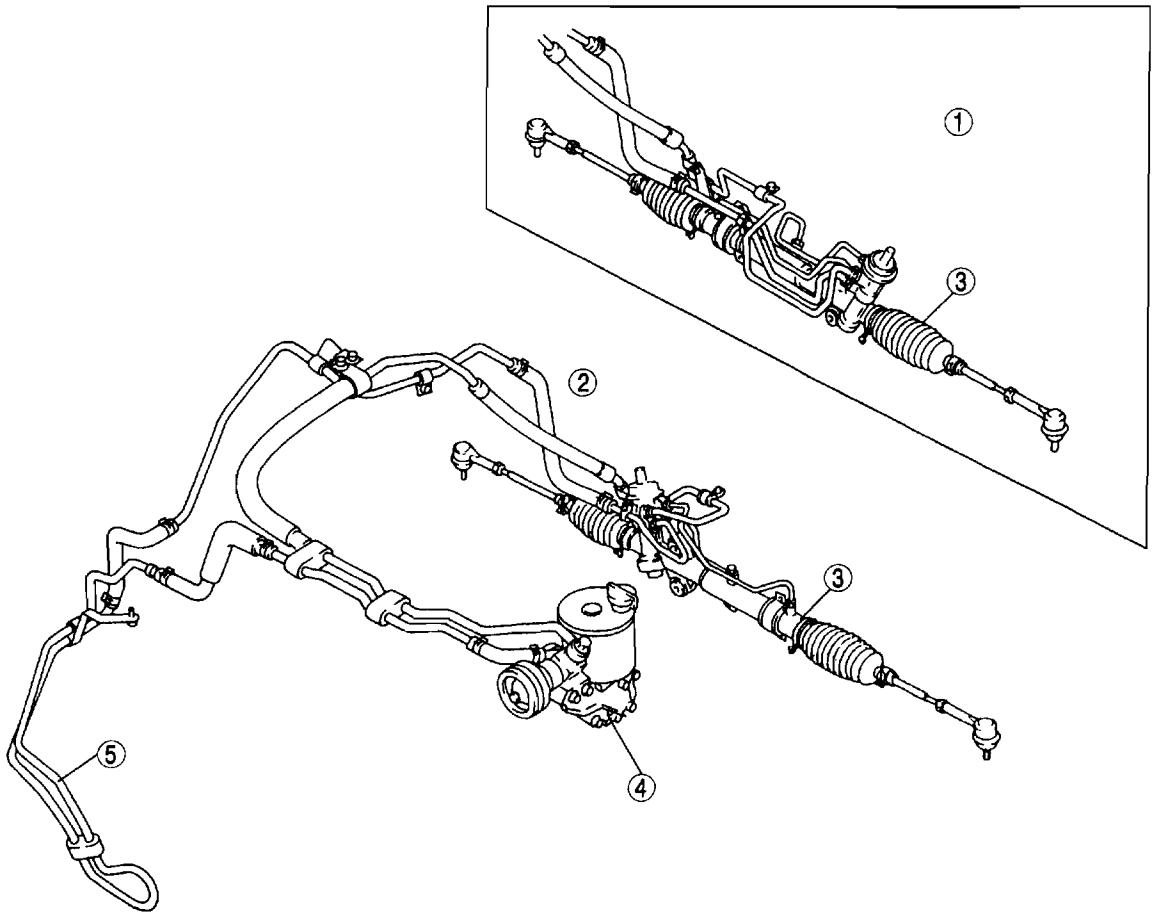
SERVICE

OUTLINE

OUTLINE OF CONSTRUCTION

- Due to the addition of the RF Turbo engine, the power steering oil pump and pipes have been changed.

STRUCTURAL VIEW



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

4	Power steering oil pump
5	Cooling pipe (R.H.D. only)

OUTLINE, ENGINE SPEED SENSING POWER STEERING

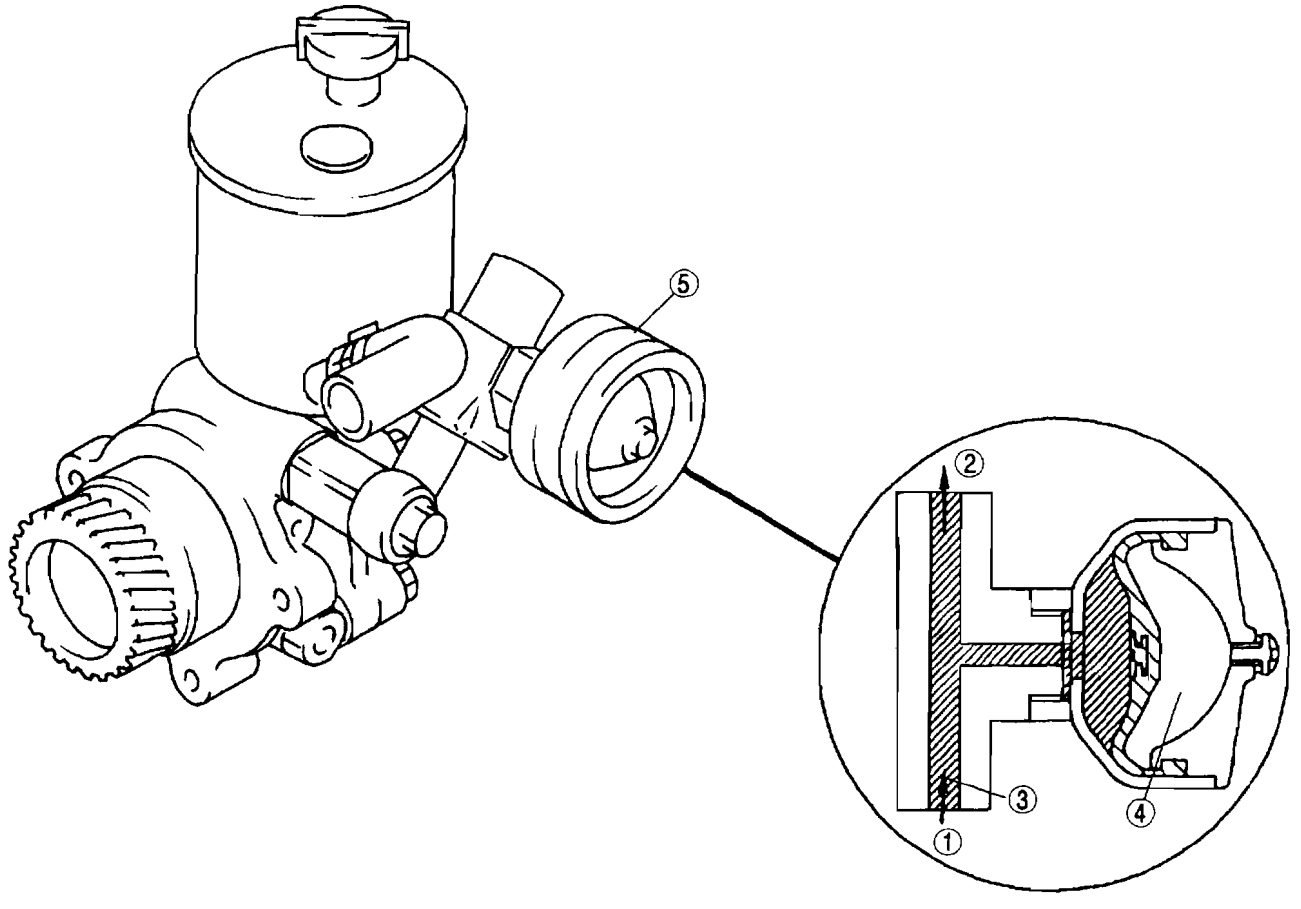
SPECIFICATION

Item			Specification
Steering wheel	Outer diameter	(mm {in})	380 {15.0}
	Lock-to-lock	(turns)	3.1
Steering column and shaft	Shaft type		Collapsible
	Joint type		2-cross joint
	Tilt stroke	(mm {in})	40 {1.6}
Steering gear and linkage	Type		Rack-and-pinion
	Rack stroke	(mm {in})	130—132 {5.12—5.19}
Power steering system	Power assist type		Engine speed sensing
	Power steering fluid	Type	ATF M-III or equivalent (e.g. Dexron® II)
		Fluid capacity (L {US qt, Imp qt})	0.80 {0.85, 0.70} [L.H.D.], 0.91 {0.96, 0.80} [R.H.D.]

[ ] Indicates new specification.

ENGINE SPEED SENSING POWER STEERING

POWER STEERING OIL PUMP



1	From power steering oil pump
2	To steering gear
3	Power steering fluid

4	Gas
5	Accumulator

- A fluid reservoir-equipped oil pump is used.
- A gas-charged accumulator is newly employed on the oil pump pressure pipe. It muffles the fluid pressure pulsation to reduce steering wheel vibration.

SUPPLEMENTAL SERVICE INFORMATION

The following changes and/or additions have been made since publication of the Mazda 626 Workshop Manual (1577-10-97D) and 626 Station Wagon Workshop Manual Supplement. (1603-10-97J)

Power steering fluid
- Fluid leakage inspection procedure has been added.
- Fluid pressure inspection procedure has been added.

Power steering oil pump
- Removal/Installation procedure has been added.
- Disassembly/Assembly procedure has been added.

Accumulator
- Disposal procedure has been added.

GENERAL PROCEDURES

Power steering components removal/installation
- If a power steering fluid line(s) has been disconnected anytime during the procedure, add ATF M-III or equivalent (e.g. Dexron® II), bleed the fluid line(s), and inspect for leakage after the procedure has been completed.

ENGINE SPEED SENSING POWER STEERING

POWER STEERING FLUID INSPECTION

Fluid Leakage Inspection

Caution

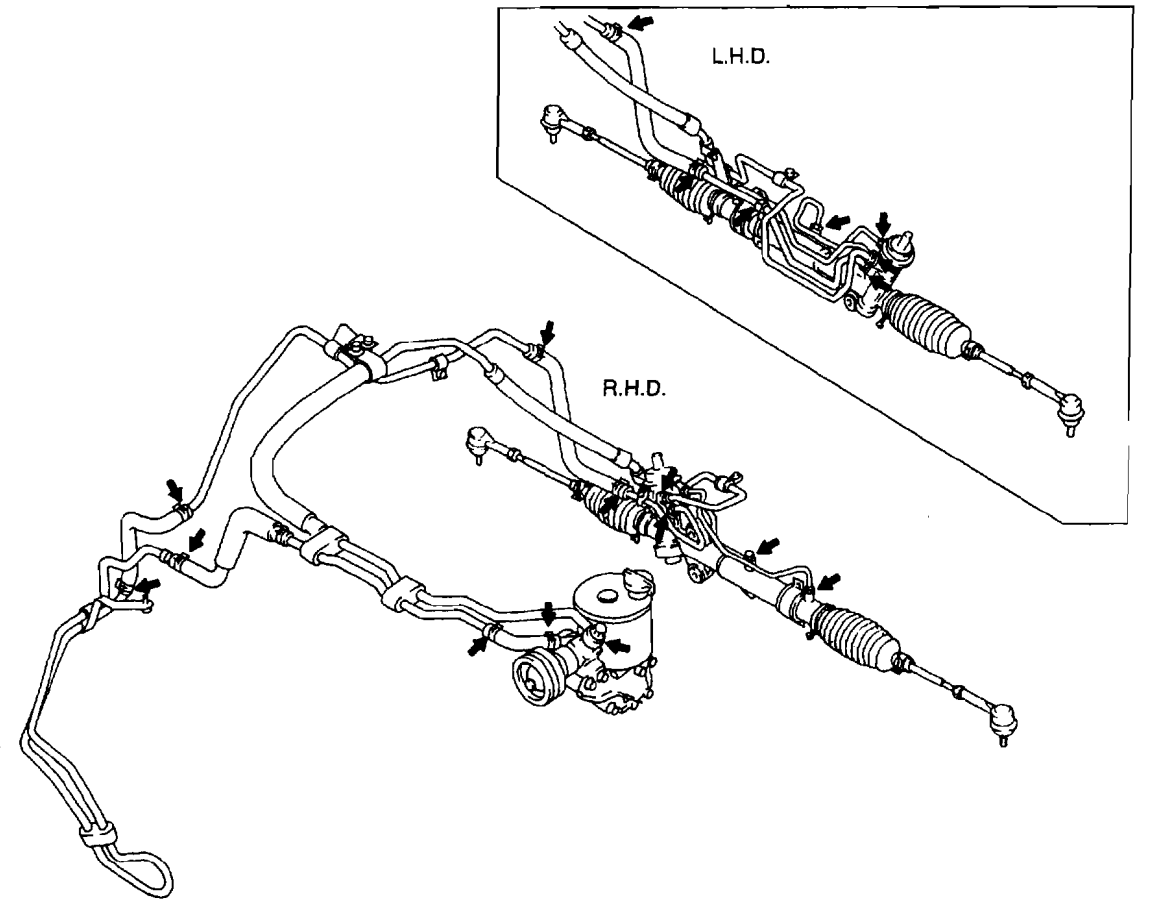
- **If the steering wheel is kept in the fully turned position for more than 5 seconds, the fluid temperature will rise excessively and adversely affect the oil pump.**

1. Start the engine and let it idle. Turn the steering wheel fully to the left and right to apply fluid pressure.

Note

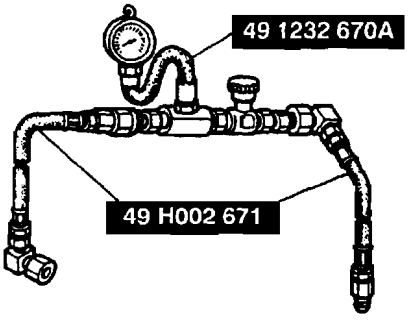
- The points where fluid leakage may occur are indicated in the figure.

2. Inspect for fluid leakage.



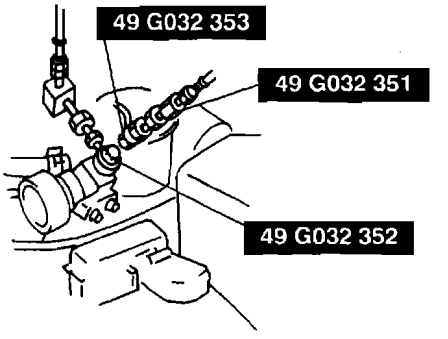
Fluid Pressure Inspection

1. Assemble the **SSTs** as shown in the figure.



2. Disconnect the pressure pipe from the oil pump, and connect the **SST**.

Tightening torque
30—44 N·m {3.0—4.5 kgf·m, 22—32 ft·lbf}

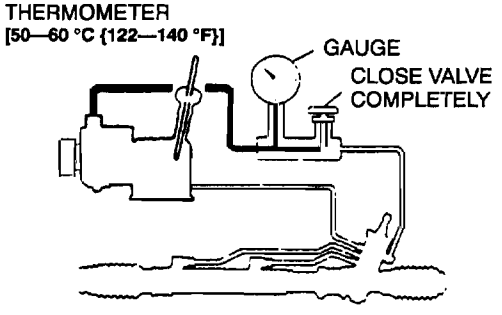


3. Bleed the air from the system.
4. Open the gauge valve fully. Start the engine and turn the steering wheel fully left and right to raise the fluid temperature to **50—60 °C {122—140 °F}**.

Caution
- **If the valve is left closed for more than 5 seconds, the fluid temperature will increase excessively and adversely affect the oil pump.**

5. Close the gauge valve completely. Increase the engine speed to **1,000—1,500 rpm** and measure the fluid pressure generated by the oil pump. If the pressure is not within the specification, repair or replace the oil pump component.

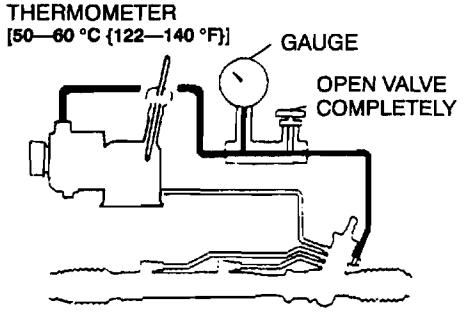
Oil pump fluid pressure
8.34—8.82 MPa
{85.0—90.0 kgf/cm^2, 1209—1279 psi}



Caution
- **If the steering wheel is kept in the fully turned position for more than 5 seconds, the fluid temperature will rise excessively and adversely affect the oil pump.**

6. Open the gauge valve fully and increase the engine speed to **1,000—1,500 rpm**.
7. Turn the steering wheel fully to the left and right, then measure the fluid pressure generated at the gear housing. If the pressure is not within the specification, repair or replace the steering gear component.

Gear housing fluid pressure
8.34—8.82 MPa
{80.0—95.0 kgf/cm^2, 1209—1279 psi}



8. Remove the gauge set. Install and tighten the pressure pipe to the specified torque.

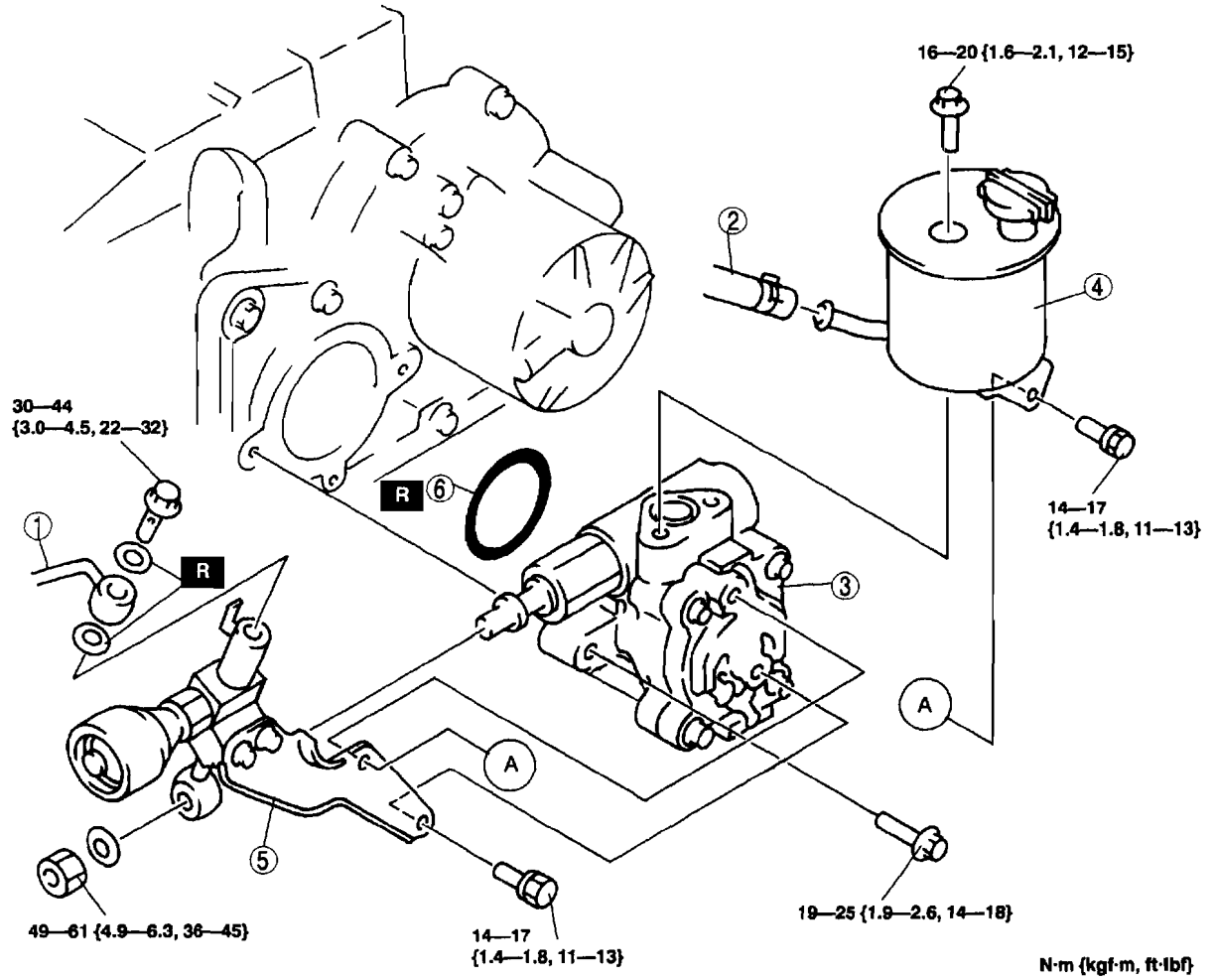
Tightening torque
30—44 N·m {3.0—4.5 kgf·m, 22—32 ft·lbf}

9. Bleed the air from the system.

N

POWER STEERING OIL PUMP REMOVAL/INSTALLATION

1. Remove the air cleaner. (Refer to section F2, INTAKE-AIR SYSTEM, INTAKE-AIR SYSTEM REMOVAL/INSTALLATION.)
2. Remove the battery. (Refer to section G, CHARGING SYSTEM, BATTERY REMOVAL/INSTALLATION.)
3. Remove the air hose. (Refer to section F2, INTAKE-AIR SYSTEM, INTAKE-AIR SYSTEM REMOVAL/INSTALLATION.)
4. Remove in the order indicated in the table.
5. Install in the reverse order of removal.



1	Pressure pipe		4	Fluid Reservoir	
2	Return hose		5	Accumlator	
3	Power steering oil pump		6	O-ring	

ACCUMULATOR DISPOSAL

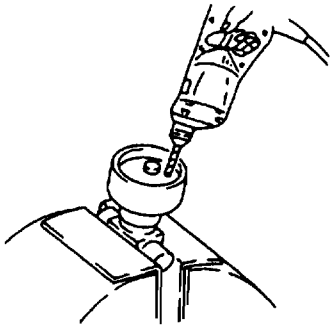
Warning

- **The gas in the accumulator is pressurized, and could spray metal chips into the eyes and face when drilling. Whenever drilling into an accumulator, wear protective eye wear.**

Note

- Accumulator gas is nitrogen gas.

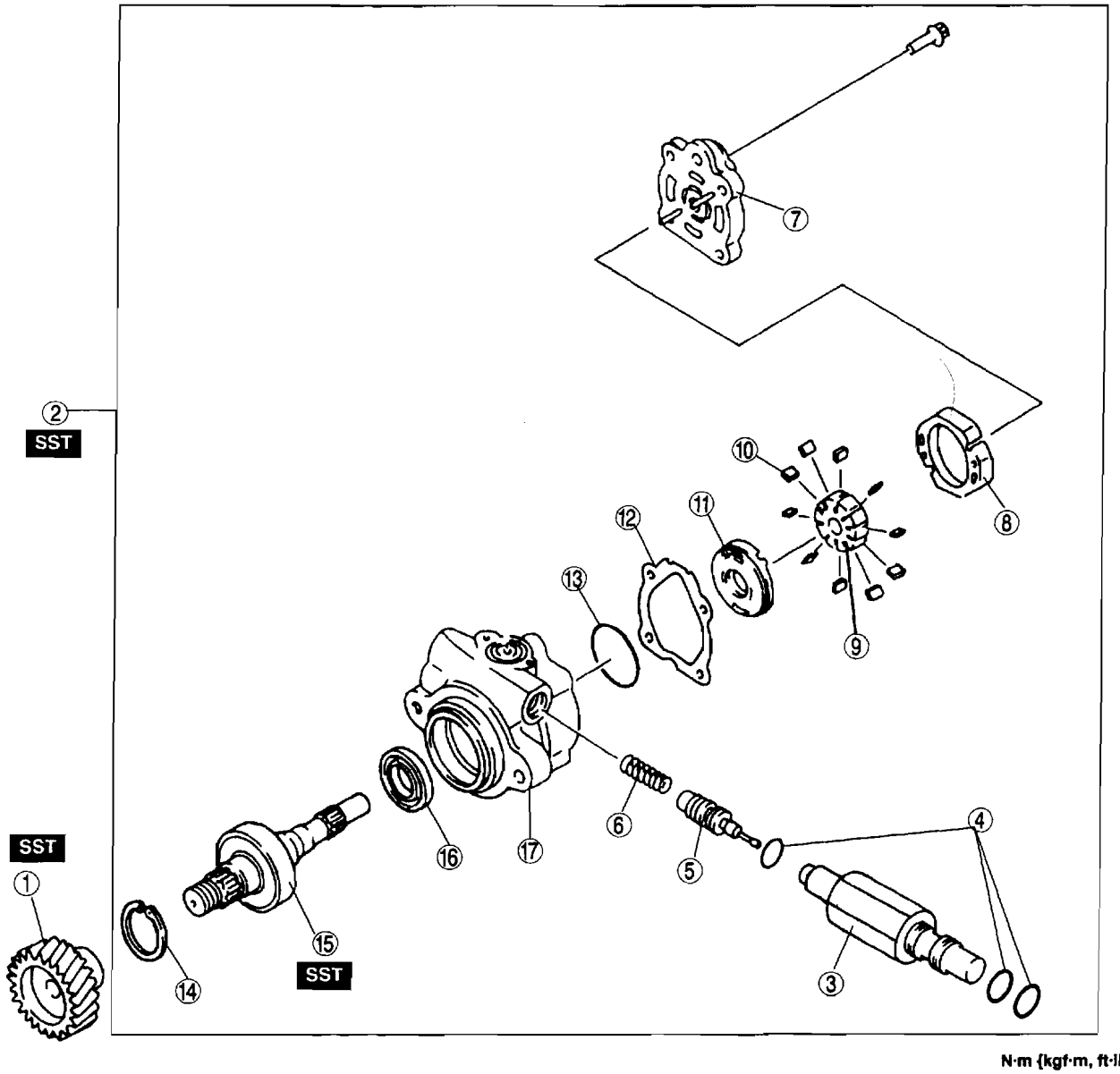
1. Hold the accumulator in a vise.
2. Drill a hole as shown in the figure.



3. Allow the gas to escape from the accumulator.
4. Dispose the accumulator.

POWER STEERING OIL PUMP DISASSEMBLY

1. The following procedure is for replacement of the O-ring and gasket only. Replace the pump component if other repairs are necessary.
2. Disassemble in the order indicated in the table.

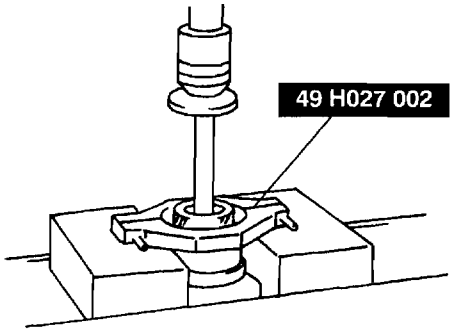


N·m {kgf·m, ft·lbf}

1	Gear ☞ Disassembly Note
2	Power steering oil pump ☞ Disassembly Note
3	Connector
4	O-ring
5	Control valve
6	Spring
7	Rear pump body
8	Cam ring
9	Rotor

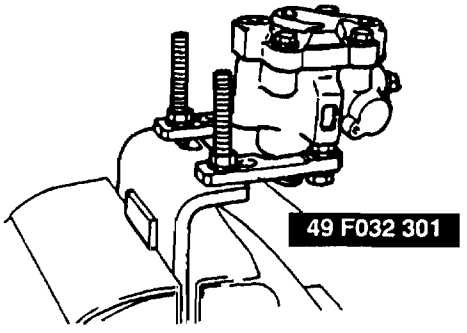
10	Vane
11	Side plate
12	Gasket
13	O-ring
14	C-ring
15	Shaft and bearing ☞ Disassembly Note
16	Oil seal ☞ Disassembly Note
17	Front pump body

Gear Disassembly Note
- Disassemble the gear using the **SST**.

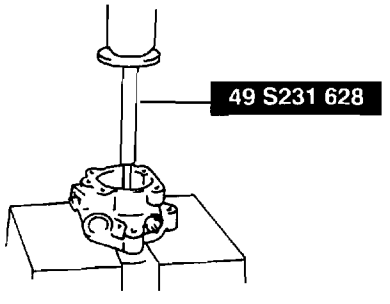


Power Steering Oil Pump Disassembly Note

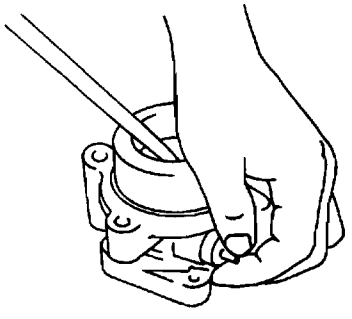
Caution
- **To secure the oil pump in a vise, use the SST as shown to prevent damage to the pump.**



Shaft And Bearing Disassembly Note
- Disassemble the shaft and bearing using the **SST** and a press.



Oil Seal Disassembly Note
- Disassemble the oil seal using a screwdriver.



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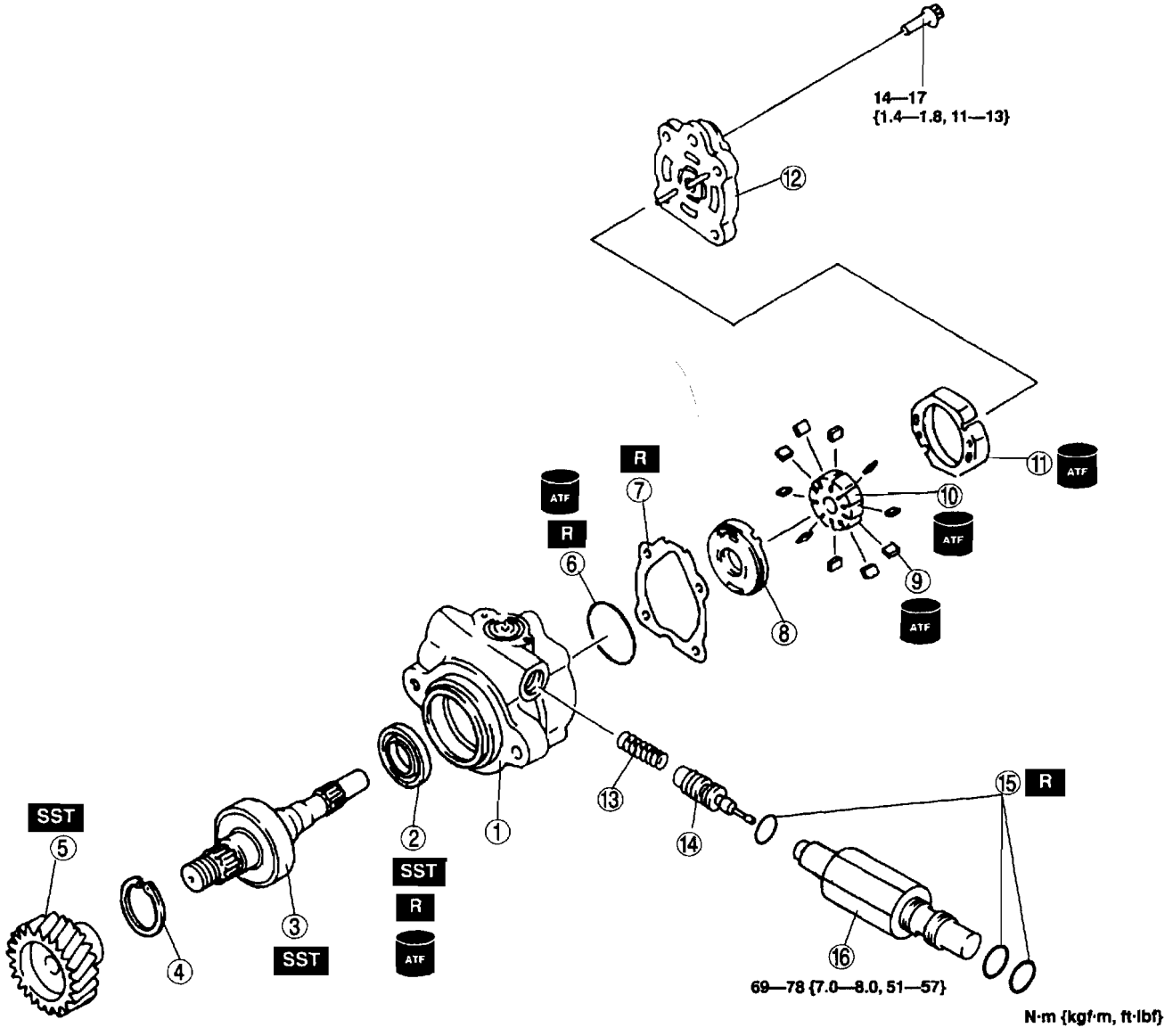
POWER STEERING OIL PUMP ASSEMBLY

- Assemble in the order indicated in the table.

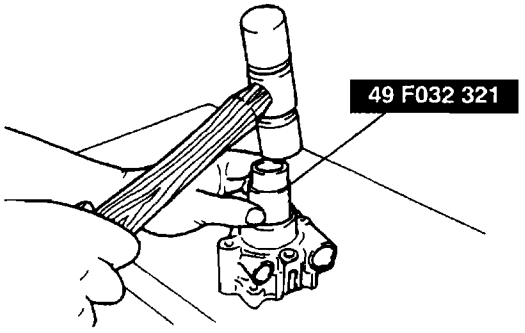


1	Front pump body
2	Oil seal ☞ Assembly Note
3	Shaft and bearing ☞ Assembly Note
4	C-ring
5	Gear ☞ Assembly Note
6	O-ring
7	Gasket
8	Side plate

9	Vane ☞ Assembly Note
10	Rotor
11	Cam ring ☞ Assembly Note
12	Rear pump body ☞ Assembly Note
13	Spring
14	Control valve
15	O-ring
16	Connector

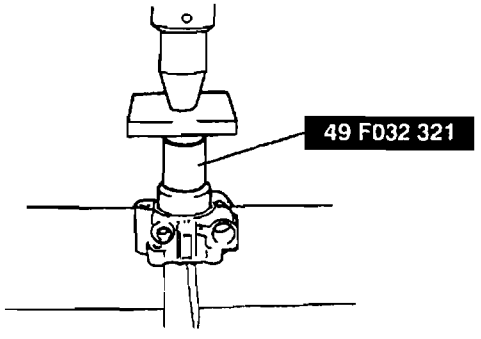
Oil Seal Assembly Note

- Tap the oil seal into the front pump body by using the **SST**.



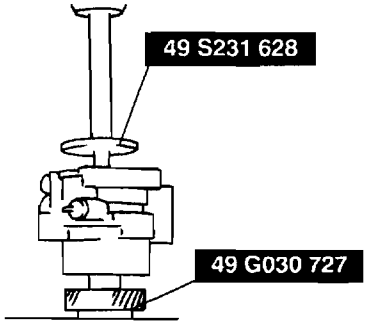
Shaft And Bearing Assembly Note

- Press the shaft and bearing onto the front pump body using the **SST**.



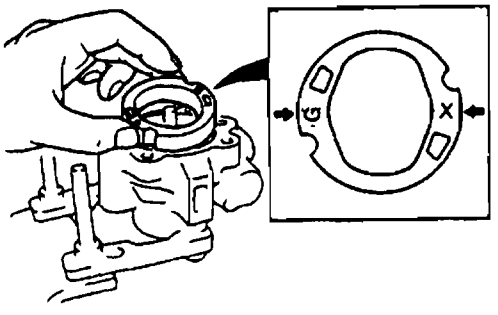
Gear Assembly Note

- Install the gear using the **SST**.

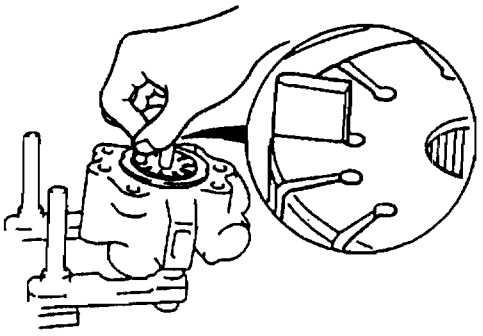


Cam Ring, Vane Assembly Note

1. Install the cam ring in the front pump body with the mark facing upward.



2. Install the vanes in the rotor with the rounded edges outward.



Rear Pump Body Assembly Note

- After installing the rear pump body, manually turn the shaft to verify that it rotates smoothly.

BRAKING SYSTEM

FEATURES

SERVICE

OUTLINE

OUTLINE OF CONSTRUCTION

- Due to the addition of the RF Turbo engine, the vacuum pump and vacuum tank, which supplies vacuum to the power brake unit, have been adopted. The vacuum pump is directly driven by the camshaft.
- The construction and operation of the conventional braking system and ABS for RF Turbo engine models are basically the same as those of the current 626 with gasoline engine. (Refer to the Mazda 626 Training Manual (3303-10-97D) and Mazda 626 Station Wagon Workshop Manual Supplement (1603-10-97J). However, a large front brake has been adopted for the station wagon.

P

SPECIFICATIONS

Item		Specification
Brake pedal	Type	Suspended
	Pedal lever ratio	3.7
	Max. stroke (mm {in})	116 {4.57}
Master cylinder	Type	Tandem (with level sensor)
		ABS model: Port-less, Non ABS model: Conventional
	Cylinder inner diameter (mm {in})	23.8 {0.937}
Front disc brake	Type	Ventilated disc
	Cylinder bore (mm {in})	57.15 {2.250}
	Pad dimensions (area x thickness) (mm^2 {in^2} × mm {in})	Sedan, 5HB: 4800 {7.44} × 10 {0.39}
		Station Wagon: 5300 {8.21} × 10 {0.39}
	Disc plate dimensions (outer diameter × thickness) (mm {in})	Sedan, 5HB: 258 × 24 {10.16 × 0.94}
		Station Wagon: 274 × 24 {10.79 × 0.94}
Rear disc brake	Type	Solid disc
	Cylinder bore (mm {in})	34.93 {1.375}
	Pad dimensions (area × thickness) (mm^2 {in^2} × mm {in})	3210 {4.97} × 8.0 {0.31}
	Disc plate dimensions (outer diameter × thickness) (mm {in})	Sedan, 5HB: 261 × 10 {9.88 × 0.39}
		Station Wagon: 280 × 10 {11.02 × 0.39}
Power brake unit	Type	Vacuum multiplier
		Single diaphragm
	Diameter (mm {in})	239 {9.41}
Braking force control device	Type	*Dual proportioning valve
Brake fluid		SAE J1703, FMVSS116 DOT-3 or DOT-4
Parking brake	Type	Mechanical two-rear-wheel control
	Operation system	Center lever

□ indicates new specification.

*: Dual proportioning valve for Station Wagon is integrated within ABS hydraulic unit.

SUPPLEMENTAL SERVICE INFORMATION

The following changes and/or additions have been made since publication of the Mazda 626 Workshop Manual (1577-10-97D) and Mazda 626 Station Wagon Workshop Manual Supplement (1603-10-97J).

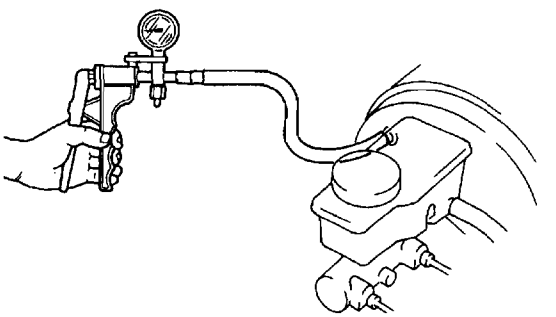
Vacuum switch
- Inspection procedure has been added.
- Removal/Installation procedure has been added.

Vacuum pump
- Inspection procedure has been added.
- Removal/Installation procedure has been added.

CONVENTIONAL BRAKE SYSTEM

VACUUM SWITCH INSPECTION

1. Remove the vacuum hose from the power brake unit.
2. Set the vacuum pump hose (commercially available on the market) onto the power brake unit as shown.



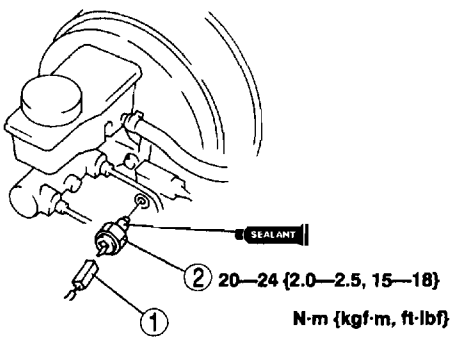
3. Turn the ignition switch on.
4. Release the parking brake.
5. Apply vacuum to the power brake unit using the vacuum pump (commercially available on the market) and verify the operating condition of the brake light warning light.

Vacuum kPa {mmHg, inHg}	Brake warning light
below 10.7 ± 1.3 {80 ± 10, 3.2 ± 0.4}	ON
above 10.7 ± 1.3 {80 ± 10, 3.2 ± 0.4}	OFF

6. The vacuum switch is functioning normally if it corresponds to the above specifications. Replace the vacuum switch if necessary.

VACUUM SWITCH REMOVAL/INSTALLATION

1. Remove in the order indicated in the table.
2. Install in the reverse order of removal.



1	Connector
2	Vacuum switch ☞ Installation Note

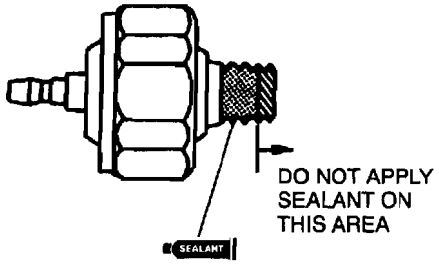
Vacuum Switch Installation Note

1. Remove the old sealant.

Caution
- **Do not apply sealant to the tip of the vacuum switch as a malfunction may occur.**

2. Apply sealant to the area shown before installation of the vacuum switch onto the power brake unit, and then tighten it to the specified torque.

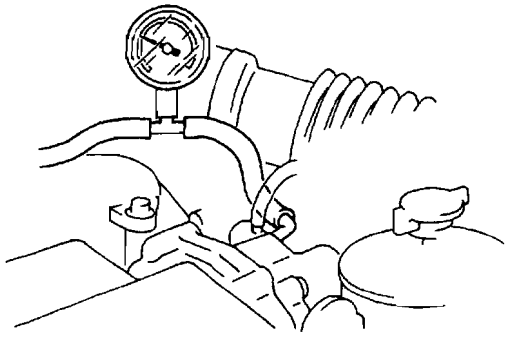
Tightening torque
20—24 N·m {2.0—2.5 kgf·m, 15—18 ft·lbf}



VACUUM PUMP INSPECTION

1. Warm up the engine.
2. Disconnect the vacuum hose from the vacuum pump and connect a vacuum gauge as shown in the figure, then check the vacuum.

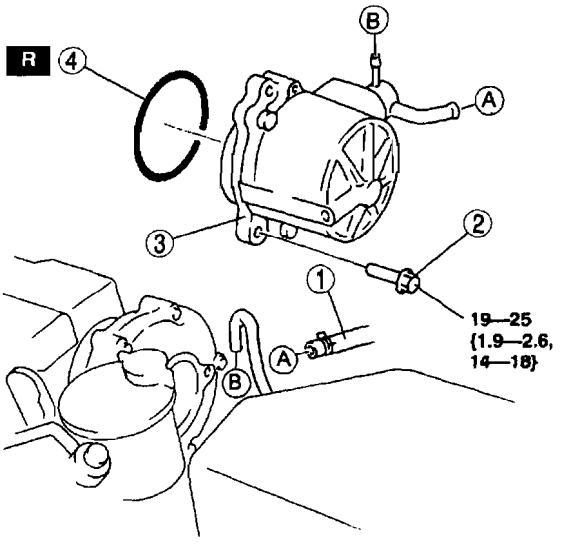
Vacuum specification (In 8 seconds)
Engine speed 1,270 rpm
66.6 kPa {500 mmHg, 19.7 inHg}
Maximum vacuum
Engine speed 2,450 rpm
93.3 kPa {700 mmHg, 27.6 inHg}



3. If the pressure is less than specified, check for the following.
   (1) Malfunction of the vacuum pump
   (2) Shortage of the lubrication oil pressure

VACUUM PUMP REMOVAL/INSTALLATION

1. Remove in the order indicated in the table.
2. Install in the reverse order of removal.



N·m {kgf·m, ft·lbf}

1	Vacuum hose
2	Bolt
3	Vacuum pump ☞ Installation Note
4	O-ring

Vacuum Pump Installation Note

- Install the vacuum pump being careful not to catch the O-ring.

BODY ELECTRICAL SYSTEM

FEATURES

SERVICE

OUTLINE

Improved marketability
- Instrument cluster

T

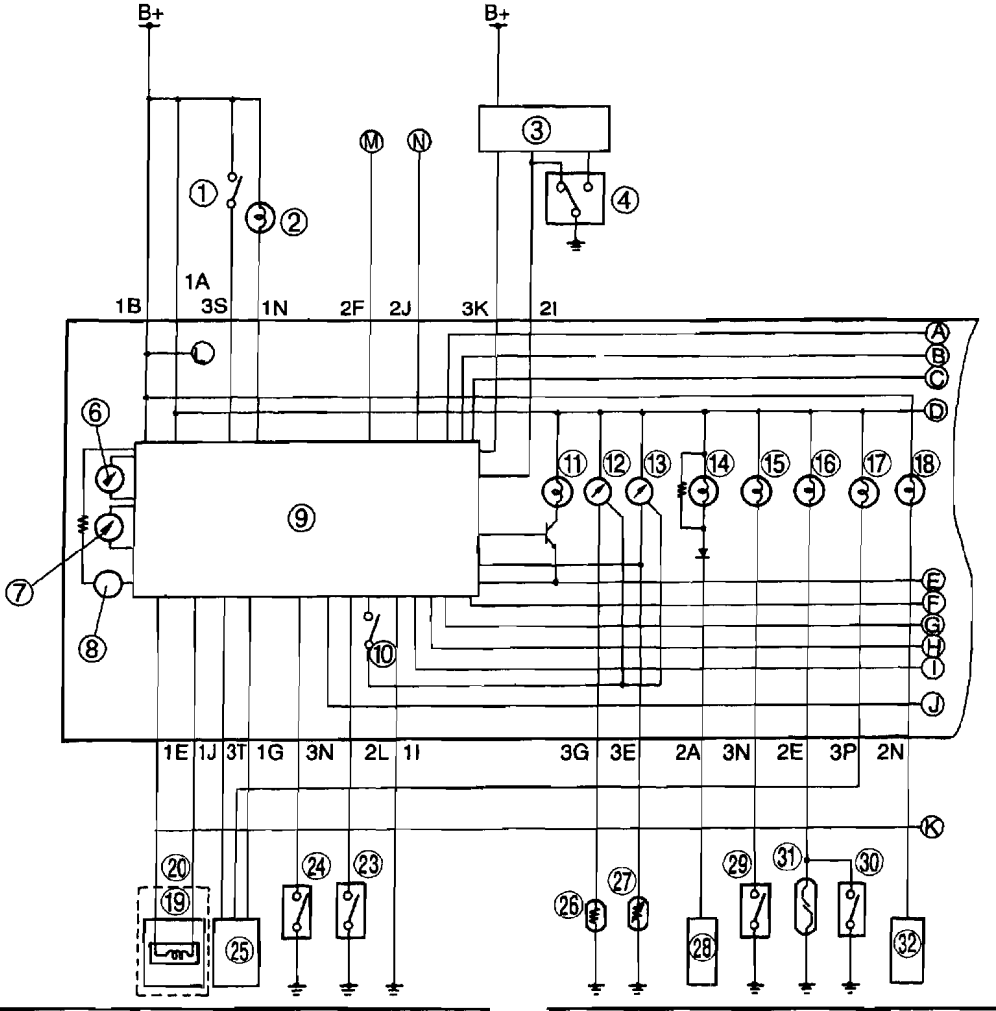
WARNING AND INDICATOR SYSTEM

OUTLINE

- The sedimentor warning light and the glow indicator light in the instrument cluster have been added to the vehicles with a diesel engine.

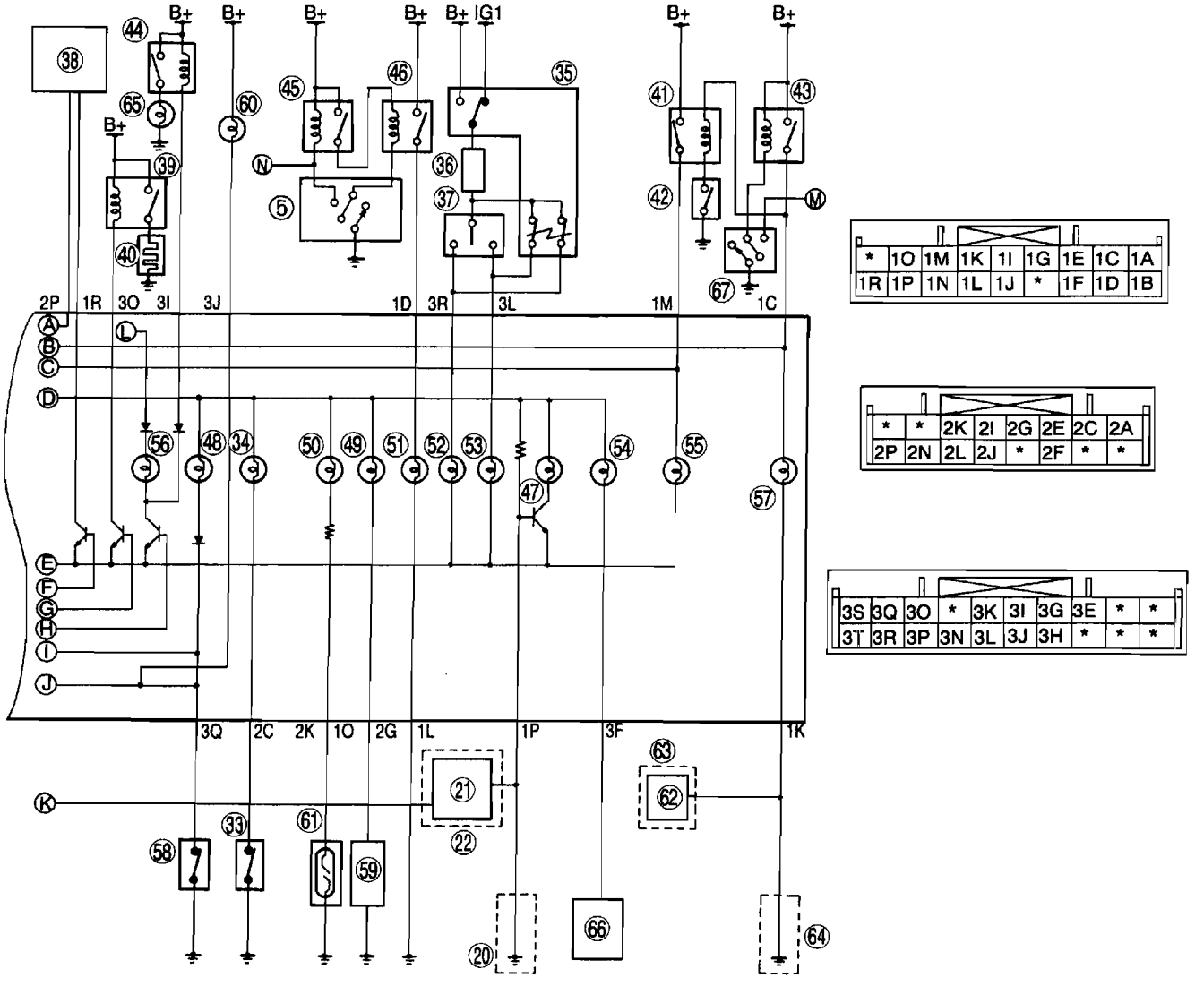
INSTRUMENT CLUSTER

System Diagram



1	Key reminder switch
2	Ignition key illumination
3	Door lock timer unit
4	Door lock-link switch
5	Headlight switch (Hi-Low)
6	Speedometer
7	Tachometer
8	Buzzer
9	Microcomputer
10	Odometer/Tripmeter switch
11	Fuel-level warning light
12	Water temperature gauge
13	Fuel gauge
14	Generator warning light
15	Sedimentor warning light
16	Brake system warning light
17	Glow indicator light

18	Security light
19	Vehicle speedometer sensor
20	Without ABS
21	ABS control module
22	With ABS
23	Rear fog light switch
24	Door outer handle switch
25	PCM
26	Water temperature sender unit
27	Fuel gauge sender unit
28	Generator
29	Sedimentor switch
30	Parking brake switch
31	Brake fluid level sensor
32	Immobilizer unit
33	Oil pressure switch
34	Oil pressure warning light



35	Hazard warning switch
36	Flasher unit
37	Turn switch
38	Heater control unit
39	Rear window defroster relay
40	Filament
41	Front fog light relay
42	Front fog light switch
43	TNS relay
44	Rear fog light relay
45	Headlight low relay
46	Headlight high relay
47	ABS warning light
48	Door ajar warning light
49	Air bag system warning light
50	Washer fluid-level warning light
51	High beam indicator light

52	Turn indicator light (LH)
53	Turn indicator light (RH)
54	Passenger-side air bag cut-off indicator light
55	Front fog light indicator light
56	Rear fog light indicator light
57	Instrument cluster illumination
58	Door switch
59	SAS unit
60	Interior light
61	Washer fluid-level sensor
62	Panel light control switch
63	With panel light control switch
64	Without panel light control switch
65	Rear fog light
66	SAS unit
67	Headlight switch (TNS-Headlight)

T

SUPPLEMENTAL SERVICE INFORMATION

The following changes and/or additions have been made since publication of the Mazda 626 Workshop Manual (1577-10-97D), Mazda 626 Station Wagon Workshop Manual Supplement (1603-10-97J).

Fuel gauge

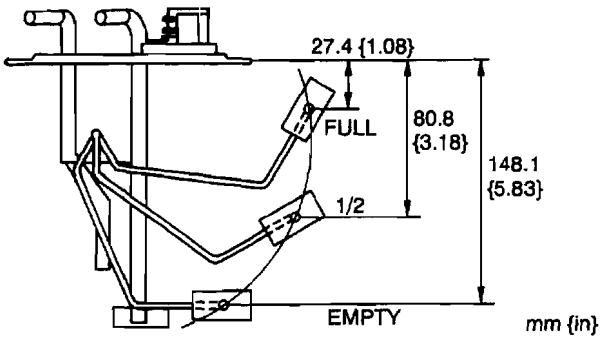
- Inspection procedure has been modified.

WARNING AND INDICATOR SYSTEM

FUEL GAUGE SENDER UNIT INSPECTION

1. Remove the fuel gauge sender unit. (Refer to section F, FUEL SYSTEM, FUEL TANK REMOVAL/INSTAL LATION.)
2. Using an ohmmeter, measure and verify that the resistance between the fuel gauge sender unit terminals is as indicated in the following chart while slowly moving the unit arm from EMPTY to FULL.

Measuring point	Resistance (Ω)
FULL	2—4
1/2	31.5—33.5
EMPTY	109—111



3. If not as specified, replace the fuel gauge sender unit.

HEATER AND AIR CONDITIONER SYSTEMS

FEATURES

SERVICE

OUTLINE

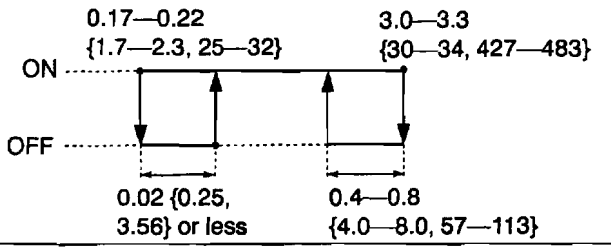
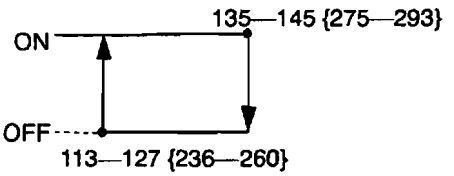
- Construction and operation principles are basically the same as current 626 gasoline engine. (Refer to Mazda 626 Training Manual 3303-10-97D.)

SPECIFICATIONS

Item			Specification
Heating capacity	(kW {kcal/h})		5.116 {4400}
Airflow volume (during heater operation)	Blower motor	(m^3/h)	300
Electricity consumption (during heater operation)	Blower motor	(W)	191
Cooling capacity	(kW {kcal/h})		4.244 {3650}
Airflow volume (during air conditioner operation)	Blower motor	(m^3/h)	435
Electricity consumption (during air conditioner operation)	Blower motor	(W)	252
	Magnetic clutch	(W)	32
	Condenser fan	(W)	80
Fan type	Blower motor		Sirocco fan
	Condenser fan		Axial flow fan
Refrigerant	Type		R-134a
	Regular amount	(g {oz})	625 {22.1}
A/C compressor	Type		Vane-rotary : H12A0
	Discharge capacity (ml {cc, fl oz})		120 {120, 4.06}
	Max. allowable speed (rpm)		6400
	Lubricating oil	Type	ATMOS GU10
		Sealed volume (ml {cc, fl oz})	150 {150, 5.07}
	Magnetic clutch clearance (mm {in})		0.4—0.6 {0.016—0.023}
Condenser	Type		Multiflow
	Radiated heat (kW {kcal/h})		4.826 {4150}

Indicates new specification.

U

Item		Specification
Receiver/drier	Capacity (ml {cc, fl oz})	310 {310, 10.5}
	Desiccant	Synthetic zeolite
Expansion valve	Type	External pressure equalizer
Evaporator	Type	Single-tank drawn cup
Refrigerant pressure switch	Type	Dual-pressure type
	Operating pressure (MPa {kgf/cm^2, psi})	
Thermal protector	Type	Bimetallic
	Operating temperature (°C {°F})	
Fusible plug	Melting point (°C {°F})	100—107 {212—224}
Solar radiation sensor	Type	Photodiode
Ambient temperature sensor	Type	Thermistor
Cabin temperature sensor	Type	
Evaporator temperature sensor	Type	
Water temperature sensor	Type	
Air intake actuator	Type	Sliding contact type
Air mix actuator	Type	Potentiometer type
Airflow mode actuator	Type	
Temperature control		Reheat full air mix type

SUPPLEMENTAL SERVICE INFORMATION

The following changes and/or additions have been made since publication of the Mazda 626 Workshop Manual (1577-10-97D), Mazda 626 Workshop Manual Supplement Station Wagon (1603-10-97J).

Heater unit
- Disassembly/assembly procedure modified

Refrigerant lines
- Removal/installation procedure modified

Air mix actuator
- Removal/installation procedure modified
- Inspection procedure modified

Condenser fan
- Removal/installation procedure modified
- Inspection procedure modified

Resistor
- Inspection procedure modified

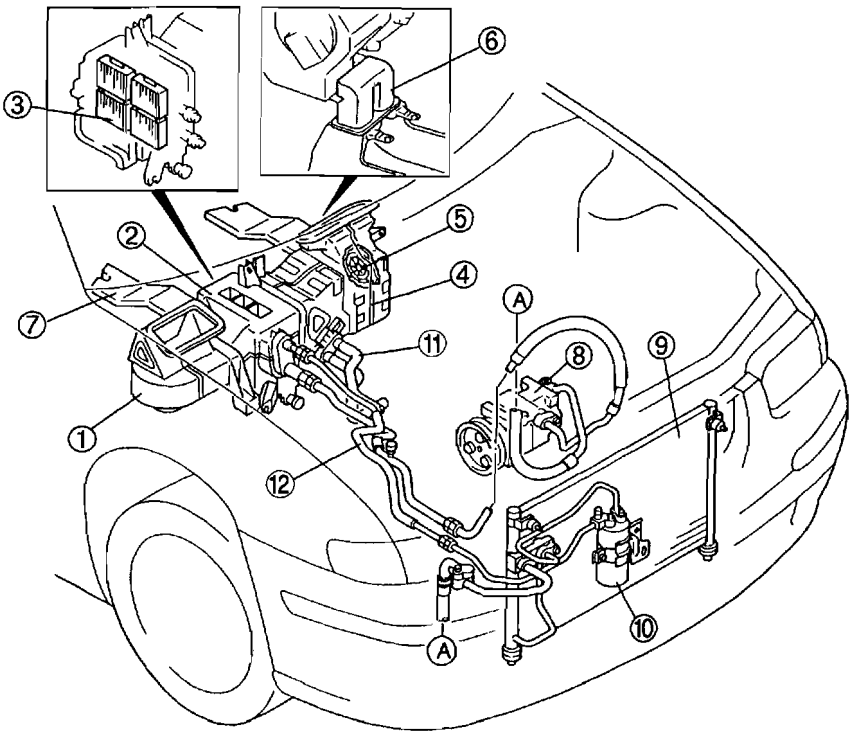
Water temperature sensor
- Removal/installation procedure modified

Heater control unit
- Inspection procedure modified

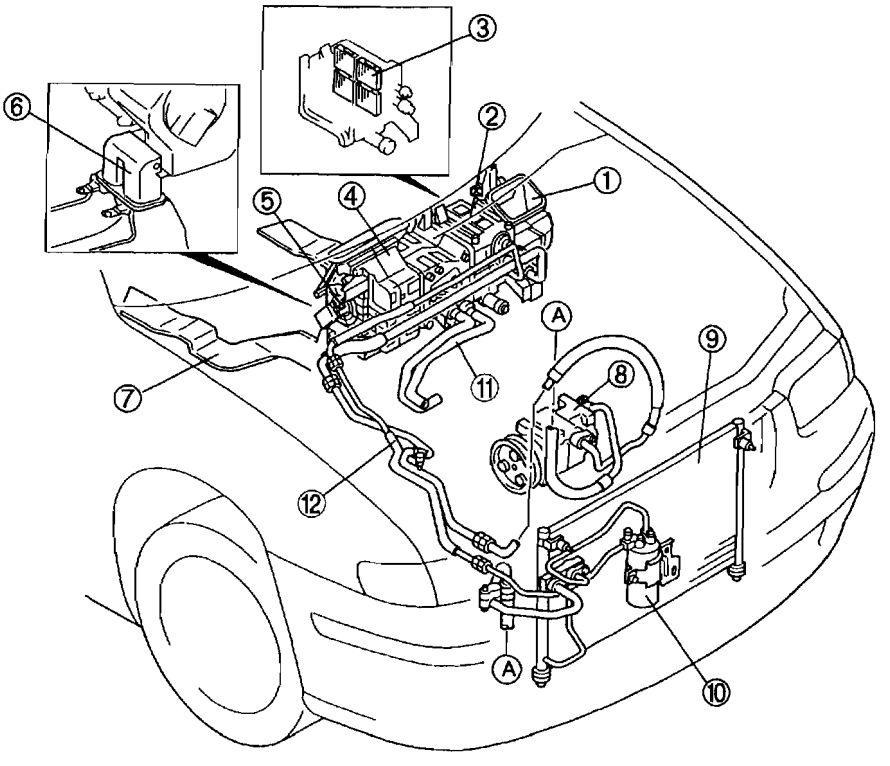
BASIC SYSTEM

STRUCTURAL VIEW

L.H.D.



R.H.D.

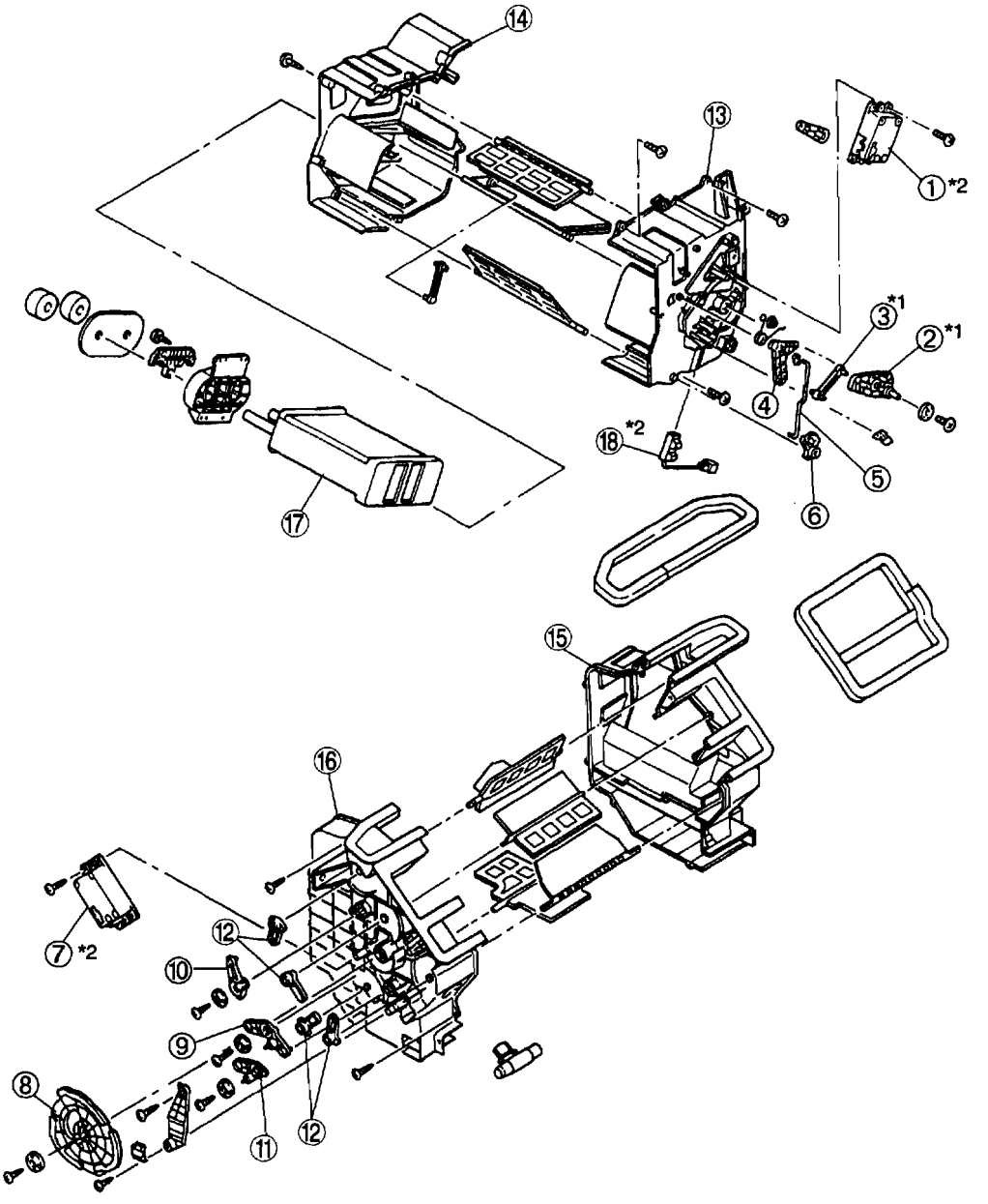


1	Blower unit
2	Cooling unit
3	Air filter
4	Heater unit
5	Airflow mode main link
6	Rear duct

7	Rear heat duct
8	A/C compressor
9	Condenser
10	Receiver/drier
11	Heater hose
12	Refrigerant lines

HEATER UNIT DISASSEMBLY/ASSEMBLY

1. Disassemble in the order indicated in the table.
2. Assemble in the reverse order of disassembly.



*1 Manual air conditioner only

*2 Full-auto air conditioner only

1	Air mix actuator
2	Air mix link
3	Air mix rod (2)
4	Air mix crank (1)
5	Air mix rod (1)
6	Air mix crank (2)
7	Airflow mode actuator
8	Airflow mode main link ☞ Section U
9	Airflow mode sub link (1)

10	Airflow mode sub link (2)
11	Airflow mode sub link (3)
12	Airflow mode crank
13	Heater case (1)
14	Heater case (2)
15	Heater case (3)
16	Heater case (4)
17	Heater core
18	Water temperature sensor

REFRIGERANT LINES REMOVAL/INSTALLATION

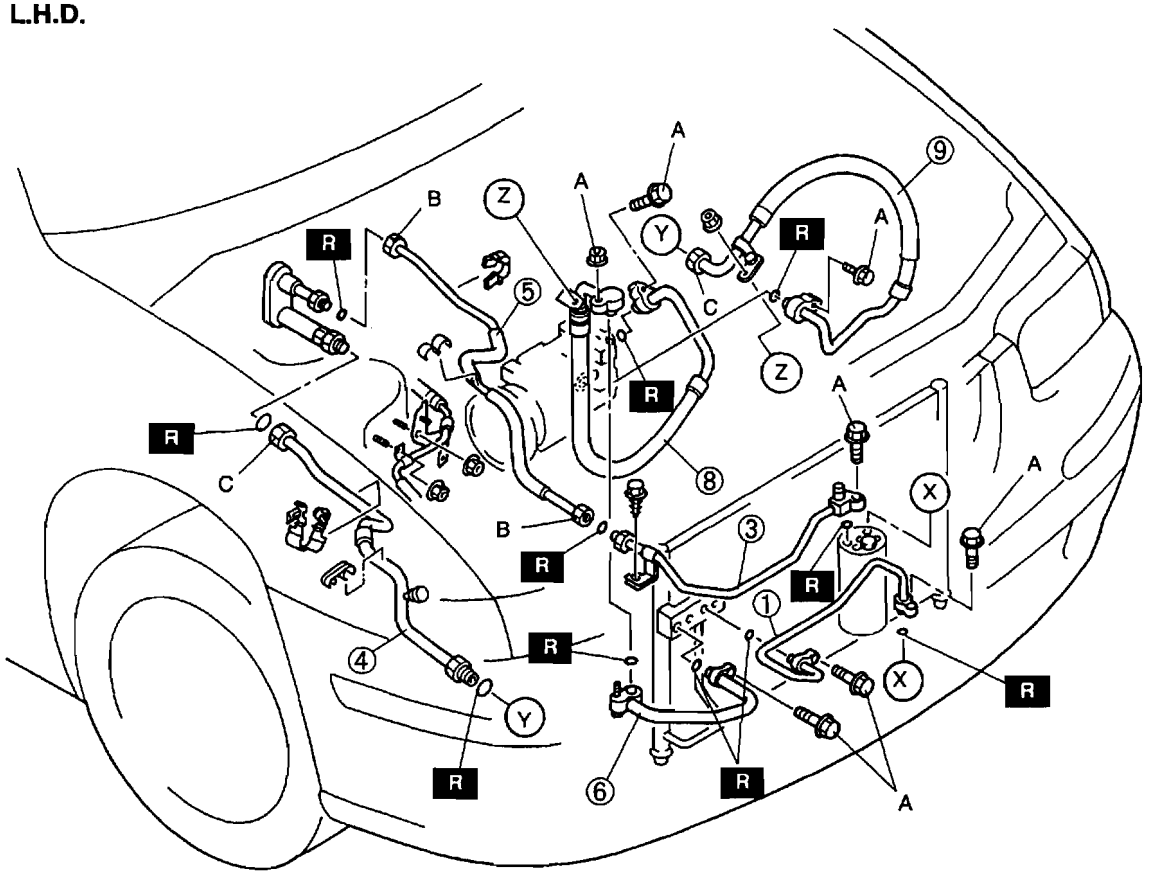
1. Disconnect the negative battery cable.
2. Discharge the refrigerant from the system. (Refer to Section U.)

Caution

- **If moisture or foreign material enters the refrigeration cycle, cooling ability will be lowered and abnormal noise will occur. Always immediately plug all open fittings after removing any refrigeration cycle parts to keep moisture or foreign material out of the cycle.**

3. Remove the horn (upper side), coolant reservoir, theft-deterrent horn.
4. Remove as indicated in the table. Do not allow compressor oil to spill.
5. Install in the reverse order of removal.
6. Perform the refrigerant system performance test. (Refer to Section U.)

L.H.D.

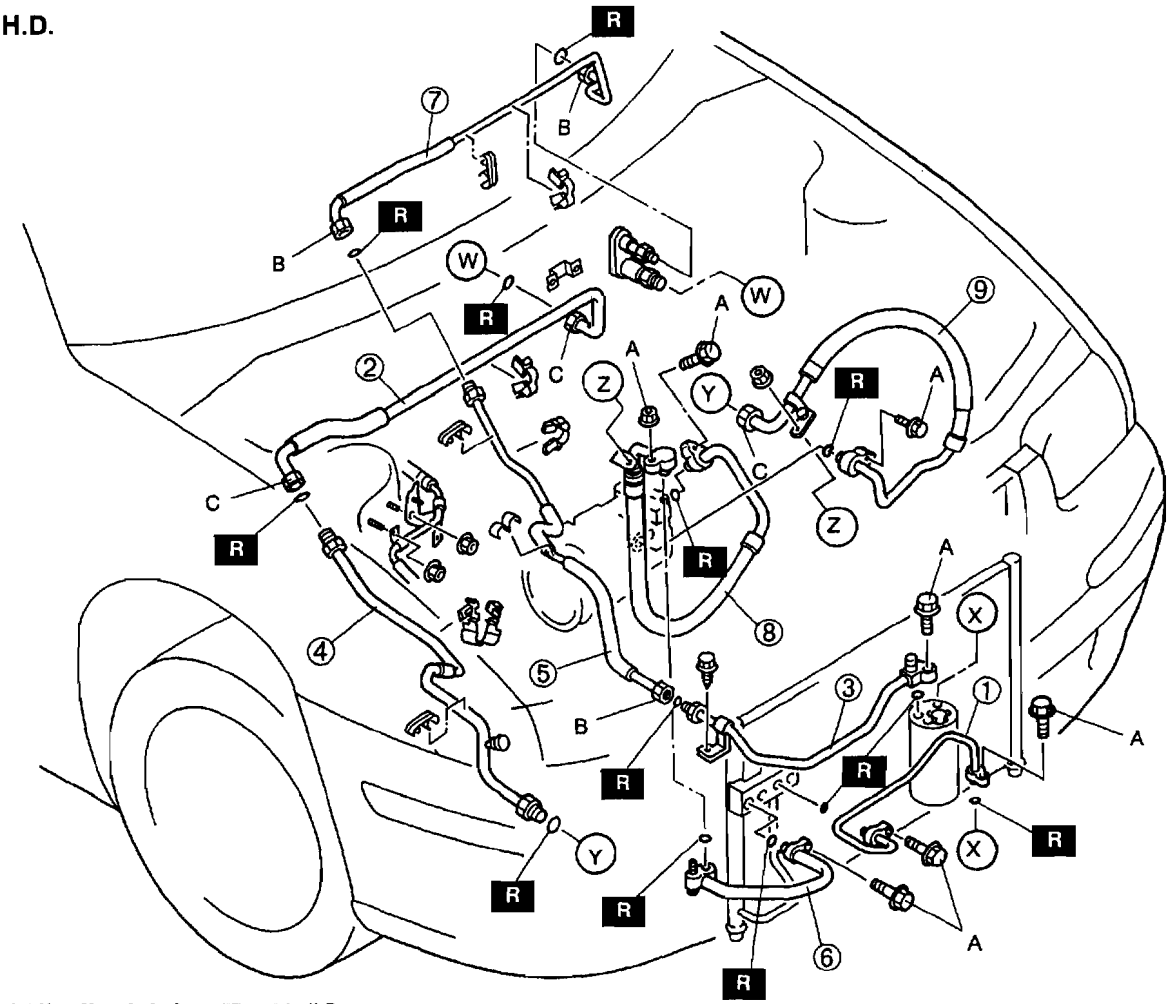


A: 6.4—9.3 N·m {65—95 kgf·cm, 57—82 in·lbf}

B: 7.9—19.6 N·m {80—200 kgf·cm, 70—173 in·lbf}

C: 26—39 N·m {2.6—4.0 kgf·m, 19—28 ft·lbf}

R.H.D.



A: 6.4—9.3 N·m {65—95 kgf·cm, 57—82 In·lbf}
B: 7.9—19.6 N·m {80—200 kgf·cm, 70—173 In·lbf}
C: 26—39 N·m {2.6—4.0 kgf·m, 19—28 ft·lbf}

1	Cooler pipe No.1 ☞ Refrigerant Lines Installation Note
2	Cooler pipe No.2 ☞ Refrigerant Lines Removal Note ☞ Refrigerant Lines Installation Note
3	Cooler pipe No.3 ☞ Refrigerant Lines Removal Note ☞ Refrigerant Lines Installation Note
4	Cooler pipe No.4 ☞ Refrigerant Lines Removal Note ☞ Refrigerant Lines Installation Note
5	Cooler pipe No.5 ☞ Refrigerant Lines Removal Note ☞ Refrigerant Lines Installation Note
6	Cooler pipe No.6 ☞ Refrigerant Lines Installation Note
7	Cooler pipe No.7 ☞ Refrigerant Lines Removal Note ☞ Refrigerant Lines Installation Note
8	Cooler hose (high) ☞ Refrigerant Lines Installation Note
9	Cooler hose (low) ☞ Refrigerant Lines Removal Note ☞ Refrigerant Lines Installation Note

Refrigerant Lines Removal Note

- Loosen the nut with 2 spanners, then remove the cooler pipe or hose.

Refrigerant Lines Installation Note

1. When installing a new cooler pipe or hose (except cooler pipe No.1, No.3, No.5, No.6, No.7)add a supplemental amount of ATMOS GU10 compressor oil into the refrigeration cycle.

   Supplemental amount
   5 ml {5 cc, 0.2 fl oz}

2. Apply compressor oil to the O-rings and connect the joints.
3. Tighten the joints.
   (1) Tighten the nut or bolt of the joint by hand.
   (2) Tighten the joint to the specified torque. If it is a nut joint, tighten the nut with a spanner and torque wrench.

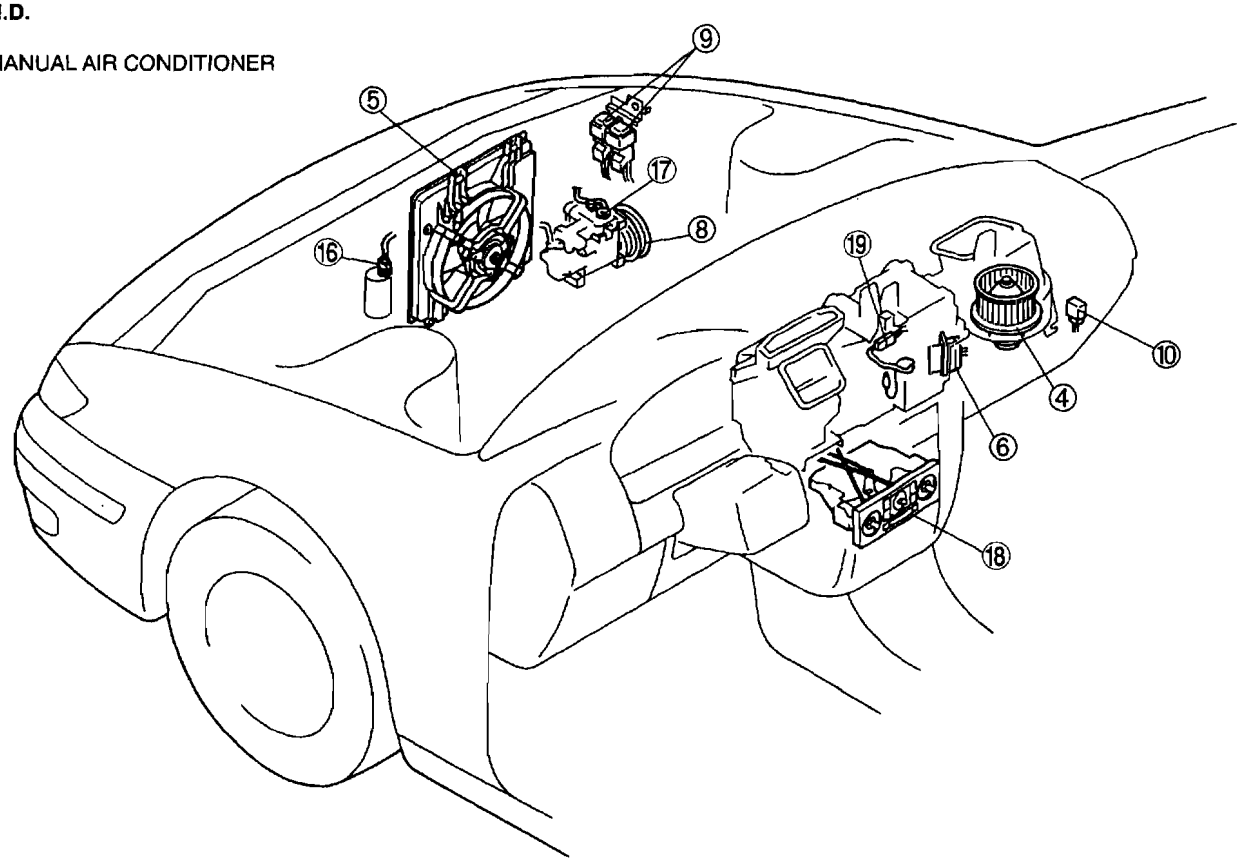
U

CONTROL SYSTEM

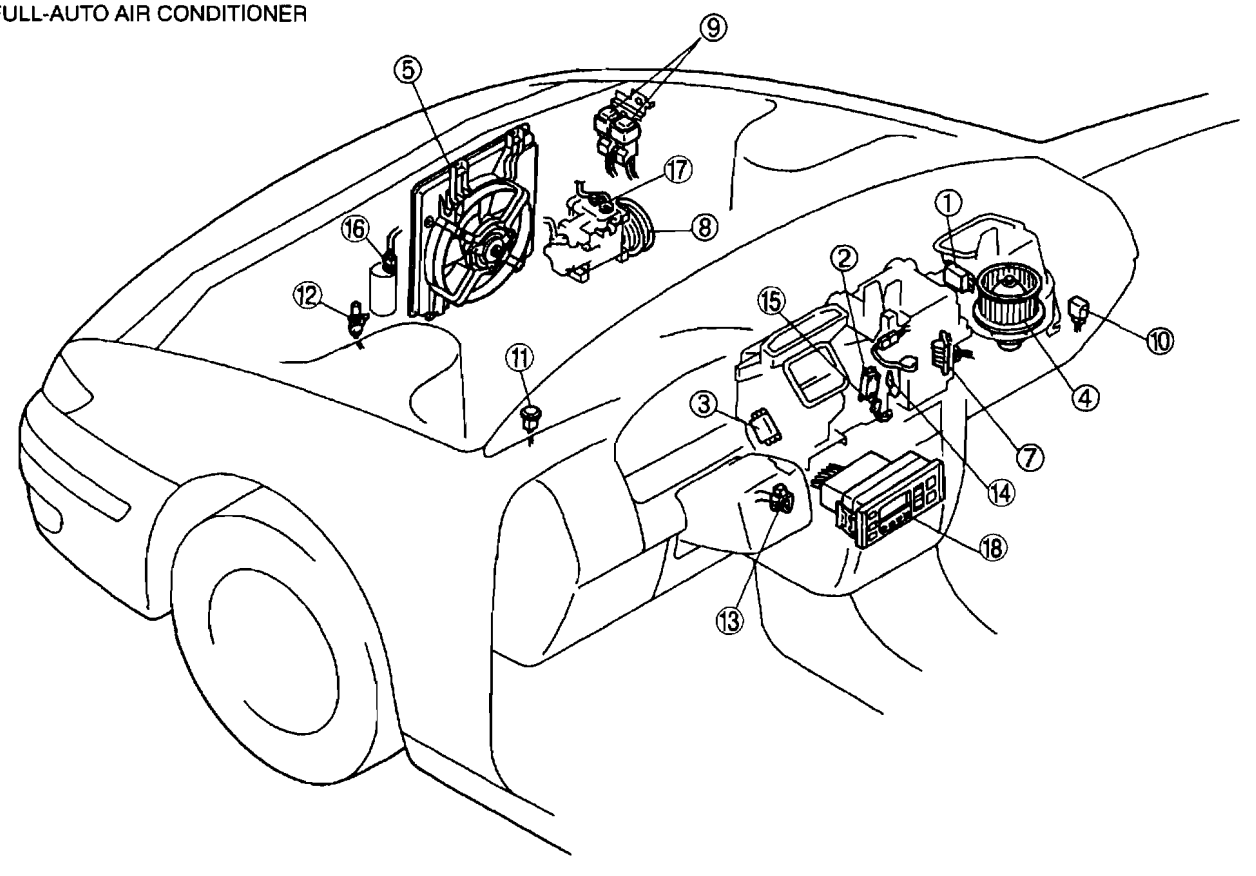
STRUCTURAL VIEW

L.H.D.

MANUAL AIR CONDITIONER

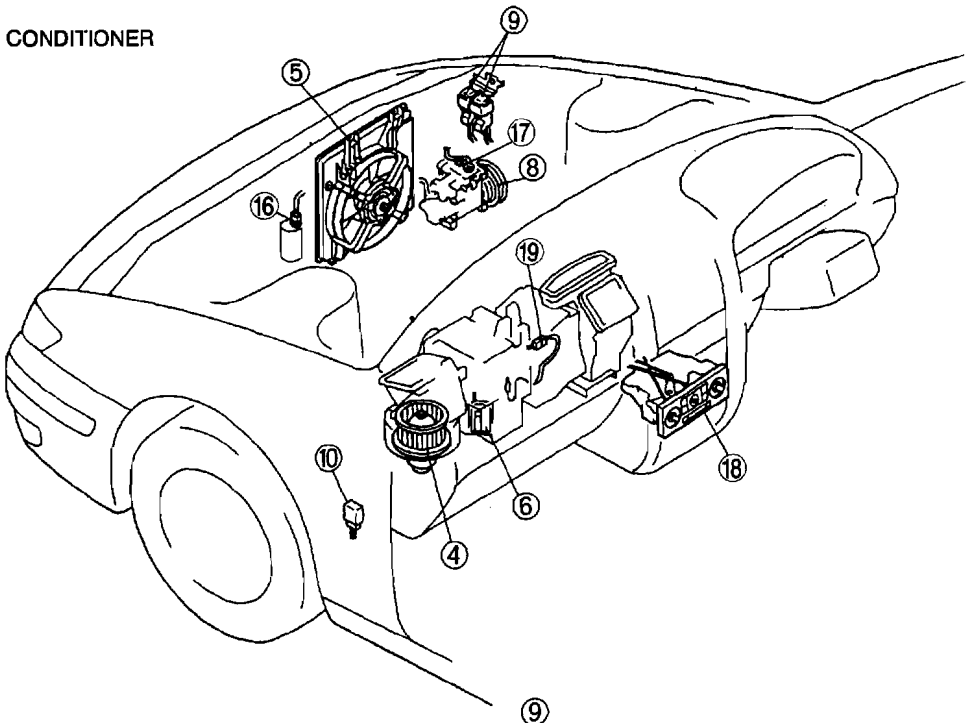


FULL-AUTO AIR CONDITIONER

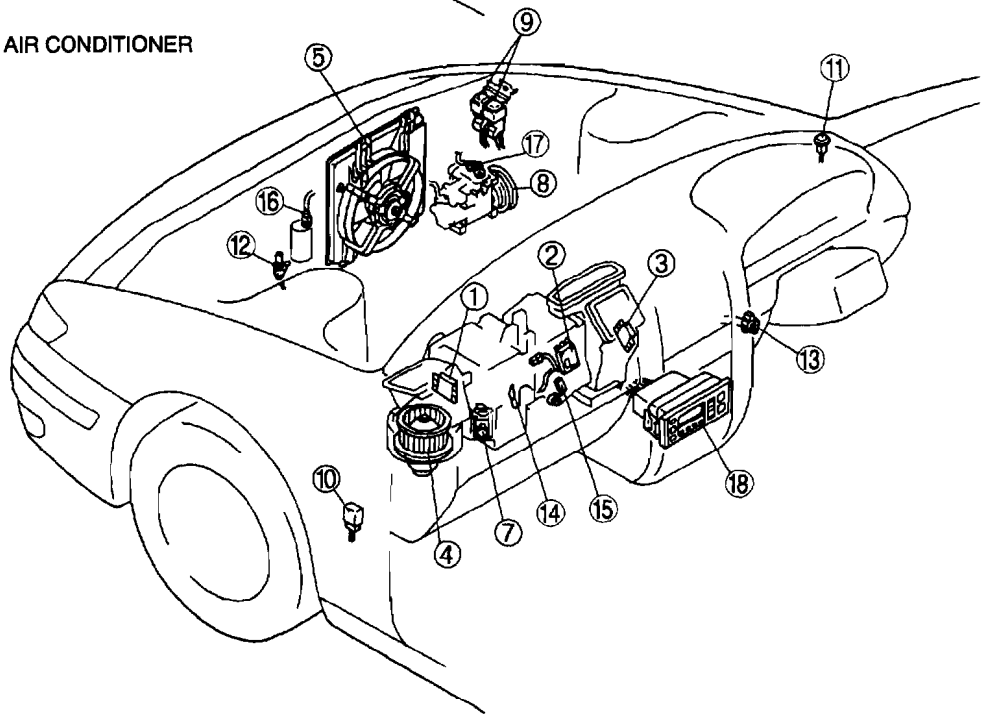


R.H.D.

MANUAL AIR CONDITIONER



FULL-AUTO AIR CONDITIONER



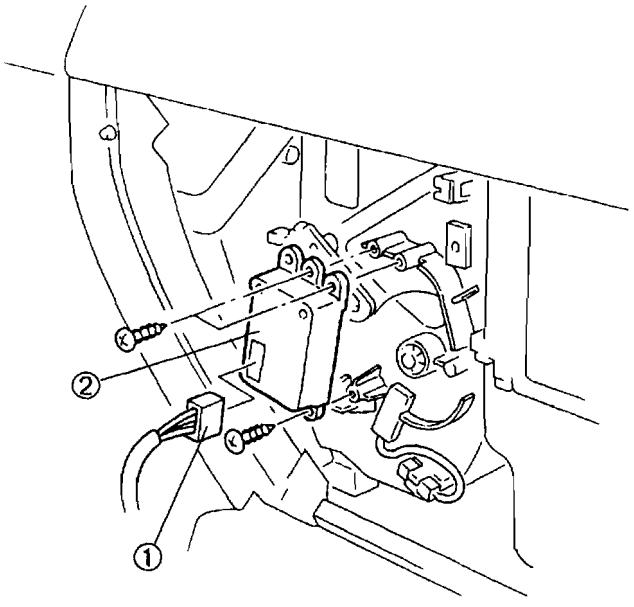
1	Air intake actuator
2	Air mix actuator
3	Airflow mode actuator
4	Blower motor
5	Condenser fan
6	Resistor
7	Power MOS FET
8	Magnetic clutch
9	A/C relay and condenser fan relay
10	Blower relay

11	Solar radiation sensor
12	Ambient temperature sensor
13	Cabin temperature sensor
14	Evaporator temperature sensor
15	Water temperature sensor
16	Refrigerant pressure switch
17	Thermal protector
18	Heater control unit
19	A/C amplifier

U

AIR MIX ACTUATOR REMOVAL/INSTALLATION

1. Disconnect the negative battery cable.
2. Remove the glove compartment and under cover.
3. Remove in the order indicated in the table.
4. Install in the reverse order of removal.



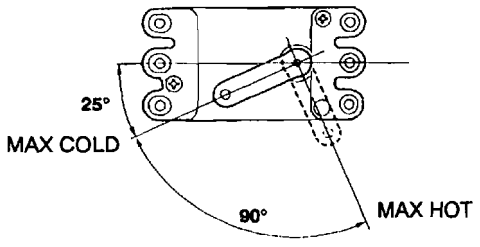
1	Connector
2	Air mix actuator

AIR MIX ACTUATOR INSPECTION

Note

- Except for operating angle (L.H.D.) inspection has not changed.

L.H.D.



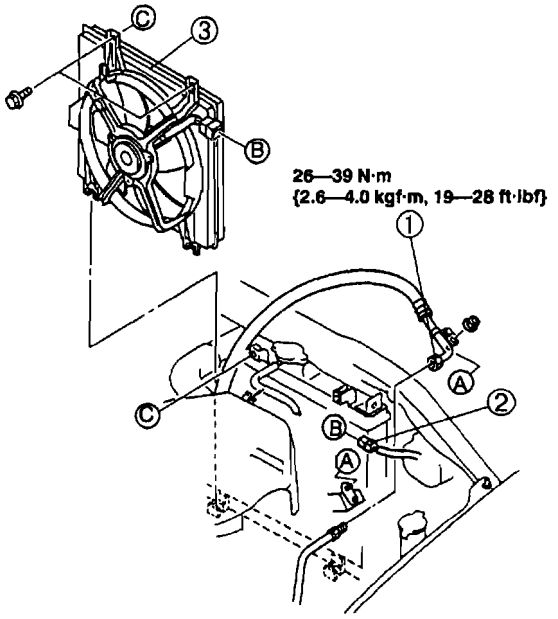
CONDENSER FAN REMOVAL/INSTALLATION

1. Disconnect the negative battery cable.
2. Discharge the refrigerant from the system. (Refer to section U.)
3. Remove the radiator reservoir tank and radiator bracket.

Caution

- **If moisture or foreign material enters the refrigeration cycle, cooling ability will be lowered and abnormal noise will occur. Always immediately plug all open fittings after removing any refrigeration cycle parts to keep moisture or foreign material out of the cycle.**

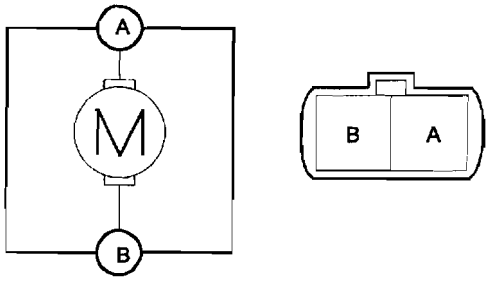
4. Remove in the order indicated in the table. Do not allow compressor oil to spill.
5. Install in the reverse order of removal.
6. Perform the refrigerant system performance test. (Refer to section U.)



1	Cooler hose (low) ☞ BASIC SYSTEM, REFRIGERANT LINES REMOVAL/INSTALLATION, Refrigerant Lines Removal Note ☞ BASIC SYSTEM, REFRIGERANT LINES REMOVAL/INSTALLATION, Refrigerant Lines Installation Note
2	Connector
3	Condenser fan

CONDENSER FAN INSPECTION

1. Disconnect the condenser fan connector.
2. Connect battery positive voltage to terminal A and ground to terminal B of the condenser fan and verify its operation.



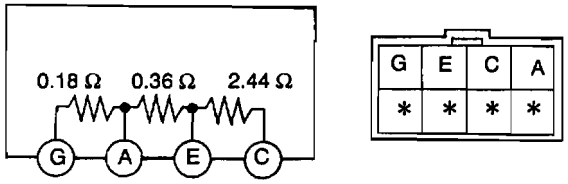
3. If not as specified, replace the condenser fan.

RESISTOR INSPECTION

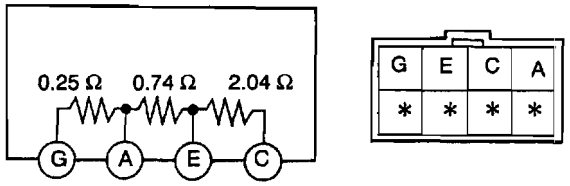
1. Disconnect the resistor connector.
2. Verify that the resistance between the terminals of the resistor is as shown in the table.

Terminal	Resistance (Ω)	
	L.H.D.	R.H.D.
G-A	0.17—0.19	0.24—0.27
G-E	0.51—0.58	0.93—1.06
G-C	2.80—3.21	2.85—3.27

L.H.D.



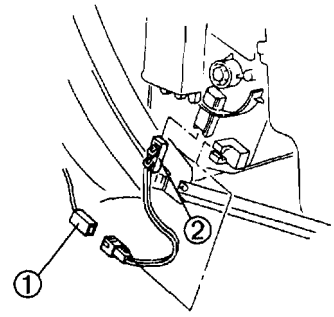
R.H.D.



3. If not as specified, replace the resistor.

WATER TEMPERATURE SENSOR REMOVAL/ INSTALLATION

1. Disconnect the negative battery cable.
2. Remove the glove compartment and under cover.
3. Remove in the order indicated in the table.
4. Install in the reverse order of removal.

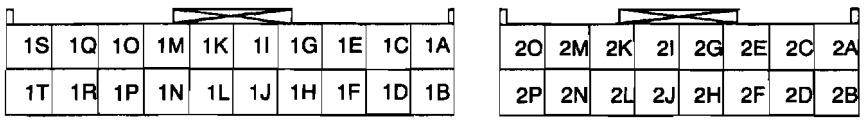


1	Connector
2	Water temperature sensor

HEATER CONTROL UNIT INSPECTION
Full-auto Air Conditioner

Note
- Except for 1E terminal, inspection order and terminal voltage have not changed.

Terminal voltage list



Terminal	Signal	Connection	Test condition	Continuity	Inspection area
1E	GND	Ground	1. Turn IG SW to LOCK. 2. Disconnect heater control unit connector. 3. Constant: inspect for continuity to ground.	Yes	Continuity (Heater control unit-Ground: 1E—GND)

TECHNICAL DATA

TECHNICAL DATA

ENGINE

Item			Engine	
			RF Turbo	RF Turbo (Hi-power)
Drive belt deflection (mm {in}/98 N {10 kgf})	Generator without A/C	New	8.0—9.5 {0.32—0.37}	
		Used	13—14 {0.52—0.55}	
		Limit	15 {0.59}	
	Generator with A/C	New	8.0—9.5 {0.32—0.37} (Measuring point a) 8.5—10.0 {0.34—0.39} (Measuring point b)	
		Used	14—15 {0.56—0.59} (Measuring point a) 13—14 {0.52—0.55} (Measuring point b)	
		Limit	16 {0.63} (Measuring point a) 15 {0.59} (Measuring point b)	
Drive belt tension (N {kgf, lbf})	Generator without A/C	New	442—539 {45—55, 99—121}	
		Used	260—294 {26.5—30.0, 59—66}	
		Limit	225 {23, 50}	
	Generator with A/C	New	393—490 {40—50, 88—110}	
		Used	260—294 {26.5—30.0, 59—66}	
		Limit	226 {23, 51}	
Valve clearance [Engine cold] (mm {in})	IN		0.12—0.18 {0.005—0.007} (0.15 ± 0.03 {0.006 ± 0.001})	
	EX		0.32—0.38 {0.013—0.014} (0.35 ± 0.03 {0.014 ± 0.001})	
Compression pressure (kPa {kgf/cm^2, psi})	Standard		2,893 {29.5, 419} [260 rpm]	
	Minimum		2,599 {26.5, 377} [260 rpm]	
Auto tensioner rod projection (mm {in})			12.9—14.6 {0.508—0.574}	
Pushing distance of camshaft oil seal (from edge of cylinder head) (mm {in})			0.5—1.5 {0.020—0.059}	
Pushing distance of front oil seal (from edge of oil pump body) (mm {in})			0—0.5 {0—0.019}	
Pushing distance of rear oil seal (from edge of rear cover) (mm {in})			0—0.5 {0—0.019}	
Cylinder head bolt length (mm {in})	Standard		115.5—116.1 {4.548—4.570}	
	Maximum		116.8 {4.598}	

LUBRICATION SYSTEM

Item		Engine	
		RF Turbo	RF Turbo (Hi-power)
Oil pressure (kPa {kgf/cm^2, psi})		147 {1.5, 21} min. [1000 rpm] 343 {3.5, 50} min. [3000 rpm]	
Oil capacity (L {US qt, Imp qt})	Oil replacement	4.5 {4.8, 4.0}	
	Oil and oil filter replacement	4.7 {5.0, 4.1}	
	Total (dry engine)	5.4 {5.7, 4.8}	
Engine oil		API service CD	
Viscosity	Above -15°C—40°C {-5°F—104°F}	SAE 10W-30	
	Below 10 °C {50 °F}	SAE 5W-30	

COOLING SYSTEM

Item		Engine	
		RF Turbo	RF Turbo (Hi-power)
Coolant capacity (L {US qt, Imp qt})		9.0 {9.5, 7.9}	
Radiator cap valve opening pressure (kPa {kgf/cm^2, psi})		94—122 {0.95—1.25, 13.5—17.7}	
Thermostat	Initial-opening temperature (°C {°F})	80—84 {176—183}	
	Full-open temperature (°C {°F})	95 {203}	
	Full-open lift (mm {in})	8.5 {0.33} min.	
Cooling fan motor current (A)		5.7—7.7	

FUEL AND EMISSION CONTROL SYSTEMS

Item		Engine	
		RF Turbo	RF Turbo (Hi-power)
Idle speed (rpm)		750—800 (775 ± 25)	
Ignition timing		ATDC 7°	
Boost relief pressure (kPa {kgf/cm^2, psi})		245.6—257.5 {2.505—2.625, 35.63—37.32}	
Idle-up speed (rpm)	When A/C is operated	750—800 (775 ± 25)	
	When P/S is operated	—	
	When engine is cold	—	
Fuel injection pump	Cam lift (mm {in})	3.5 {0.14}	
Injection nozzle	Injection starting pressure (MPa {kgf/cm^2, psi})	1 Stage 17.64 {180, 2559.6} 2 Stage 28.42 {290, 4123.8}	
	Nozzle leakage (MPa {kgf/cm^2, psi})	—	
Diesel smoke (%)		—	

ENGINE ELECTRICAL SYSTEM

Item					Engine type	
					RF Turbo	RF Turbo (Hi-power)
Battery	Electrolyte gravity				1.27—1.29	
	Dark current*1 (mA)				20 max.	
	Test load chart (A)	Battery type	95D31L		250	
			115D31L		320	
	Slow charge (A)	Battery type (5-hour rate)	95D31L (64)		6.5—8.0	
			115D31L (70)		7.0—8.5	
	Quick charge (A/30 min)	Battery type (5-hour rate)	95D31L (64)		40	
			115D31L (70)		45	
Generator	Rotor resistance (Between slip rings) (Ω)				2.5—2.9	
	Brush length	Standard (mm {in})			18.5 {0.73}	
		Minimum (mm {in})			5.0 {0.20}	
	Brush spring force	Standard (N {kgf, lbf})			5.2 {0.53, 1.17}	
		Minimum (N {kgf, lbf})			2.3 {0.23, 0.51}	
	Standard voltage (V)	engine switch ON	Terminal	B	B+	
				L	Approx. 1	
				S	B+	
		Idle [20°C {68°F}]	Terminal	B	14.1—14.7	
				L	14.1—14.7	
				S	14.1—14.7	
	Generated current (Reference) (A)	Engine speed (rpm)	1000	Terminal B current	Approx. 0—44 (must not be 0)	
			2000	Terminal B current	Approx. 0—69 (must not be 0)	
Starter	Commutator diameter	Standard (mm {in})			35.0 {1.38}, 32.0 {1.26}*2	
		Minimum (mm {in})			34.0 {1.34}, 31.4 {1.24}*2	
	Brush length	Standard (mm {in})			15.0 {0.60}, 18.0 {0.71}*2	
		Minimum (mm {in})			9.0 {0.35}, 11.0 {0.43}*2	
	Brush spring force	Standard (N {kgf, lbf})			21.6—27.4 {2.2—2.8, 4.84—6.16}, 30.4 {3.1, 6.82}*2	
		Minimum (N {kgf, lbf})			12.7 {1.3, 2.86}, 14.7 {1.5, 3.3}*2	
	Pinion gap (mm {in})				0.5—2.0 {0.020—0.078}*2	
	No load test	Voltage (V)			11.5, 11*2	
		Current (A)			Below 100, Below 130*2	

*1 Dark current is the constant flow of current present (for the audio unit, clock, PCM, etc.) when the engine switch is off and with the engine key removed.

*2 Cold area

TD

STEERING SYSTEM

Item			Specification
Steering gear	Gear housing fluid pressure (MPa {kgf/cm^2, psi})		8.4—8.8 {85.0—90.0, 1209—1279}
Power steering system	Power steering fluid	Type	ATF M-III or equivalent (e.g. Dexron®II)
		capacity (L {US qt, Imp qt})	0.94 {1.00, 0.83} [R.H.D.] 0.82 {0.87, 0.72} [L.H.D.]
	Oil pump fluid pressure (MPa {kgf/cm^2, psi})		8.4—8.8 {85.0—90.0, 1209—1279}

BRAKING SYSTEM

Item	Specification
Vacuum pump	
Vacuum specification (In 8 seconds) [when engine speed 1,270 rpm] kPa {mmHg, in Hg}	66.6 {500, 19.7}
Maximum vacuum [when engine speed 2,450 rpm] kPa {mmHg, in Hg}	93.3 {700, 27.6}

SUSPENSION

Wheel and Tires

Item	Sedan
Tire size	195/65R14 89H, 185/65R15 88H, 195/60R15 88V

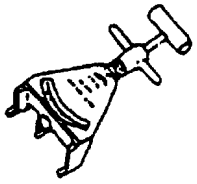
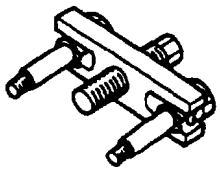
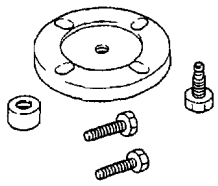
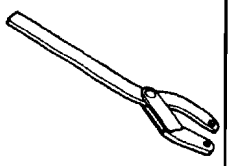
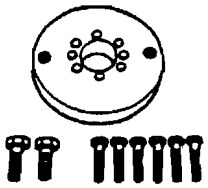
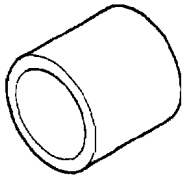
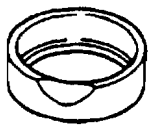
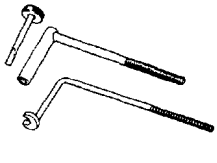
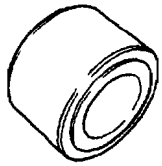
BODY ELECTRICAL SYSTEM

Item		Specification
Warning and indicator light bulb capacity (W)	Sedimentor warning light	1.4 × 1
	Glow indicator light	1.4 × 1

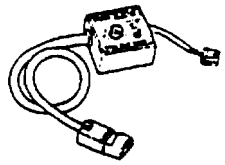
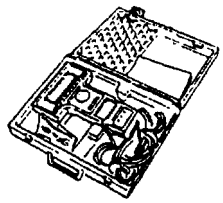
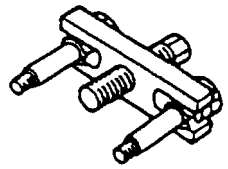
SPECIAL TOOLS

SPECIAL TOOLS

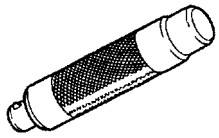
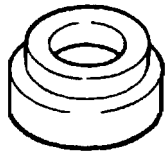
ENGINE

49 9200 020A V-ribbed belt tension gauge 	49 S013 1A1 Compression gauge set 	49 G017 5A0 Engine support 
49 S120 215B Puller pulley 	49 G011 106 Camshaft pulley puller 	49 S120 710 Coupling flange holder 
49 G011 105 Crankshaft lock tool 	49 U027 003 Oil seal installer 	49 G033 107A Dust cover installer 
49 G012 0A0 Tappet adjust wrench set 	49 B010 002 Oil seal installer 	—

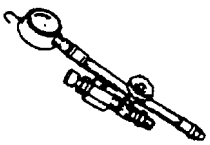
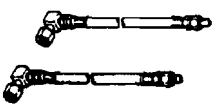
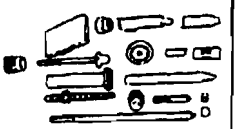
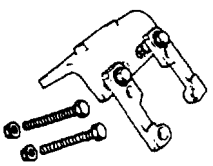
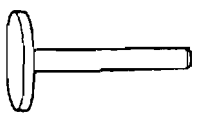
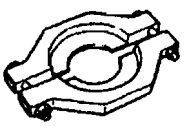
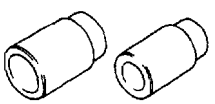
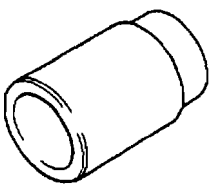
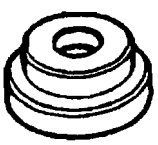
FUEL AND EMISSION CONTROL SYSTEMS

Program card 	SST No. for Program card varies with language • 49 T088 030C (English/French) • 49 T088 031C (English/German) • 49 T088 032C (English/Dutch) • 49 T088 033C (English/Swedish) • 49 T088 034A (English/Spanish) • 49 T088 035A (English/Portuguese)	• 49 T088 036A (English/Italian) • 49 T088 037 • 49 T088 038 • 49 T088 039 • 49 T088 041 • 49 T088 042 • 49 T088 043
49 B019 9A0 System selector 	49 T088 0A4 NGS set 	49 S120 215B Puller pulley 

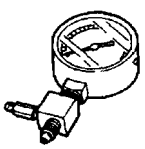
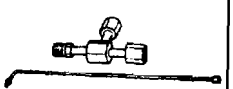
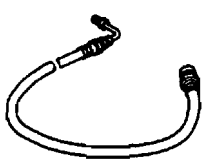
CLUTCH

49 B001 797 Handle (Part of 49 B001 795) 	49 E027 002 Attachment 	—

STEERING SYSTEM

49 1232 670A Power steering gauge set 	49 1232 672 Gauge (Part of 49 1232 670A) 	49 1232 673 Valve body (Part of 49 1232 670A) 
49 H002 671 Power steering gauge adapter 	49 G032 3A4 Power steering Gauge adapter set 	49 G032 3A0 Power steering repair set 
49 G032 308 Oil seal installer (Part of 49 G032 3A0) 	49 F032 301 Power steering pump hanger 	49 S231 628 Guide 
49 H027 002 Bearing remover 	49 F032 3A2 Installer set 	49 F032 321 Installer B (Part of 49 F032 3A2) 
49 G030 727 Attachment A 	—	—

BRAKING SYSTEM

49 U043 0A0 Oil pressure gauge set 	49 U043 004 Oil pressure gauge (Part of 49 U043 0A0) 	49 U043 005 Joint (Part of 49 U043 0A0) 
49 U043 006 Hose (Part of 49 U043 0A0) 	—	—

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