ISUZU

KB - SERIES

WORKSHOP MANUAL

SECTION 6

PETROL ENGINE DIAGNOSIS

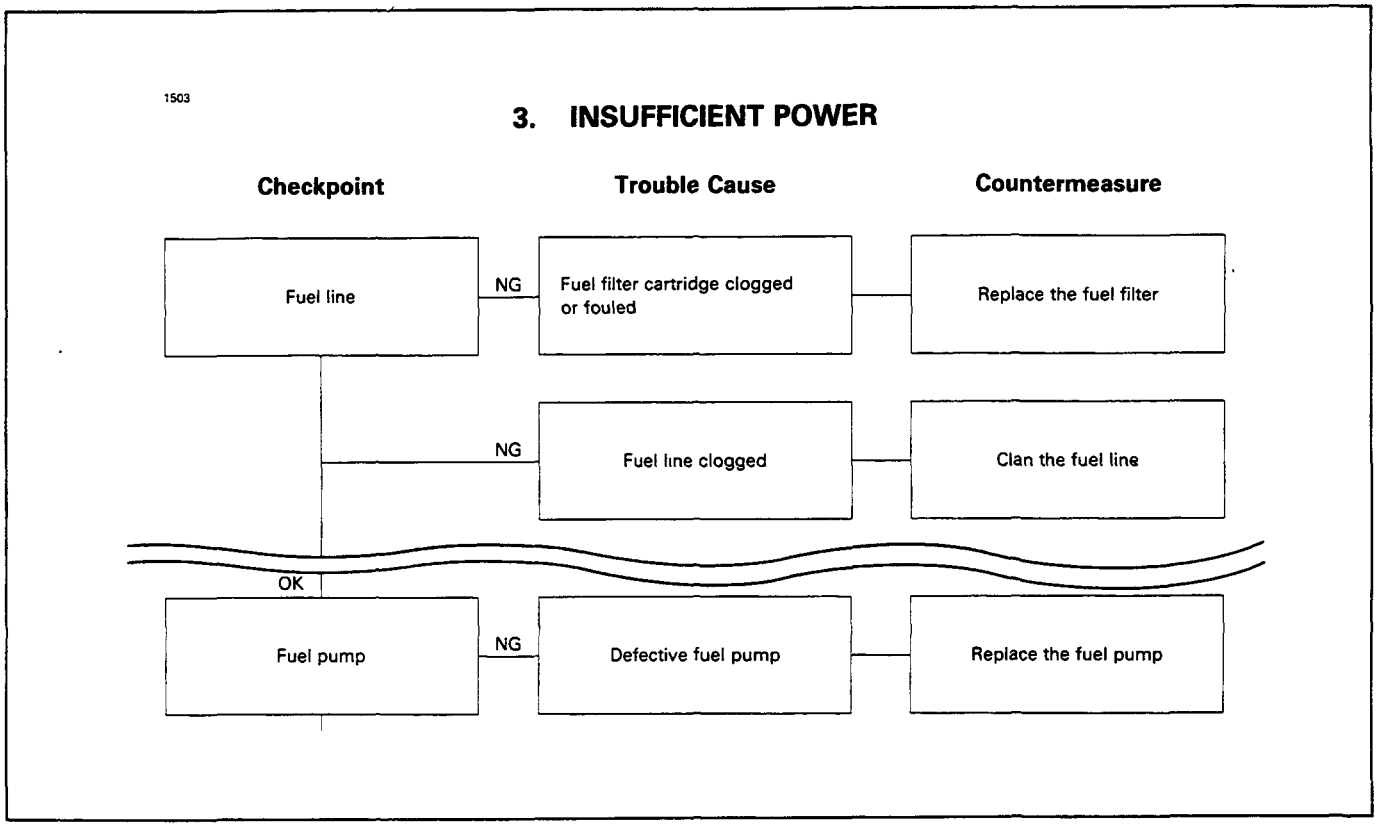
SECTION 6
TROUBLESHOOTING

TABLE OF CONTENTS

Refer to the following troubleshooting charts to quickly pinpoint and repair engine problems.

1. This Section is divided into ten Sub-Sections.
2. Each troubleshooting chart has three headings arranged from left to right.

Example:



3. Easily checked areas are presented at the beginning of the troubleshooting chart. Procedures become more complex as the chart progresses.
4 It is suggested that you work from the beginning of the troubleshooting chart. Do not start from the middle.
5. It is possible that a seemingly apparent engine problem is not related to the engine.

   For example, the engine may appear to have insufficient power. This could be caused by dragging brakes or a slipping clutch instead of an engine malfunction.

   Refer to the other troubleshooting charts if required.
6. Optional equipment and variations are included in the troubleshooting charts.

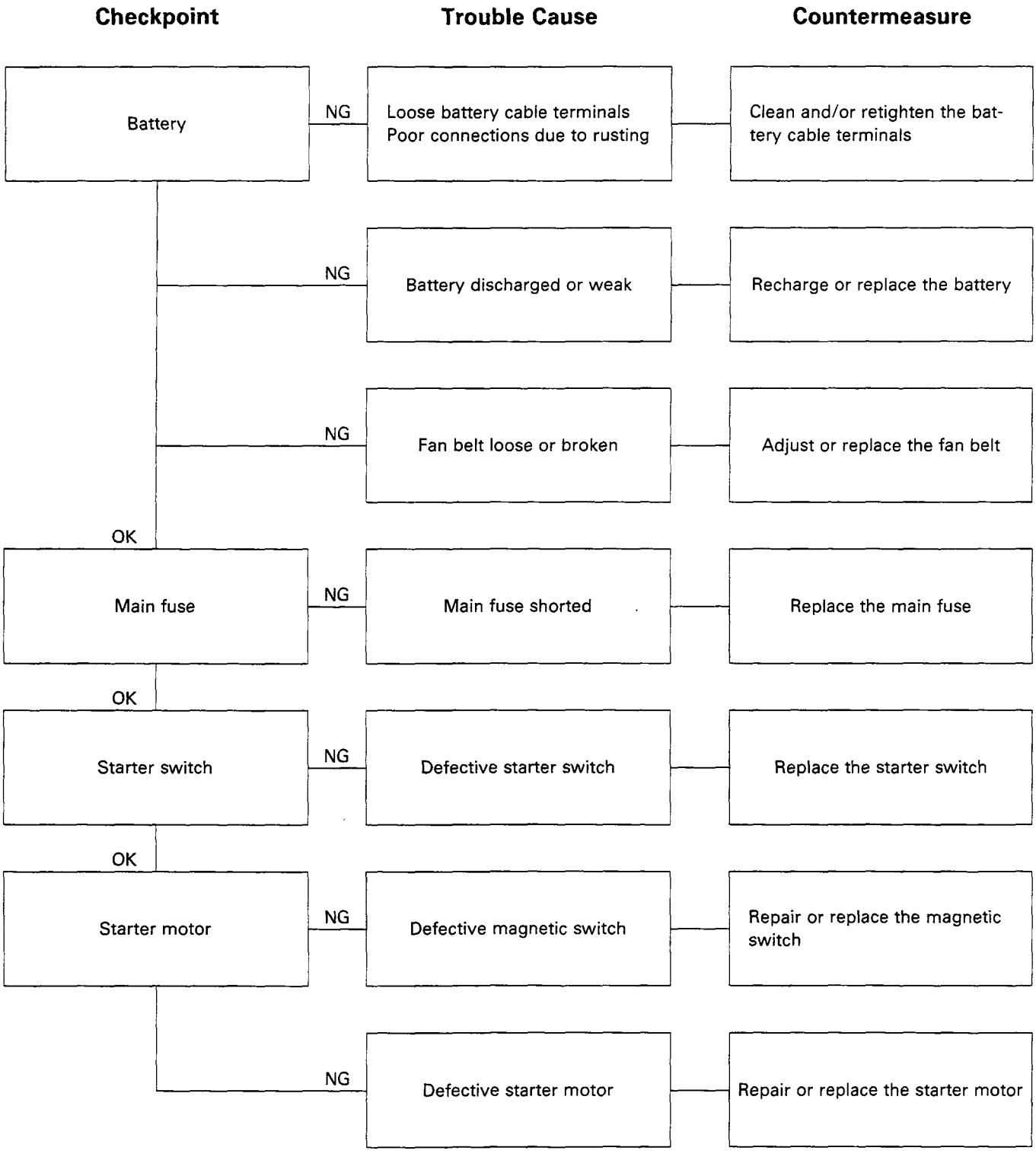
   If the vehicle you are servicing is not equipped with a particular option or variation noted in the "Checkpoint" frame, disregard the frame and move on to the next one.

1501

150101

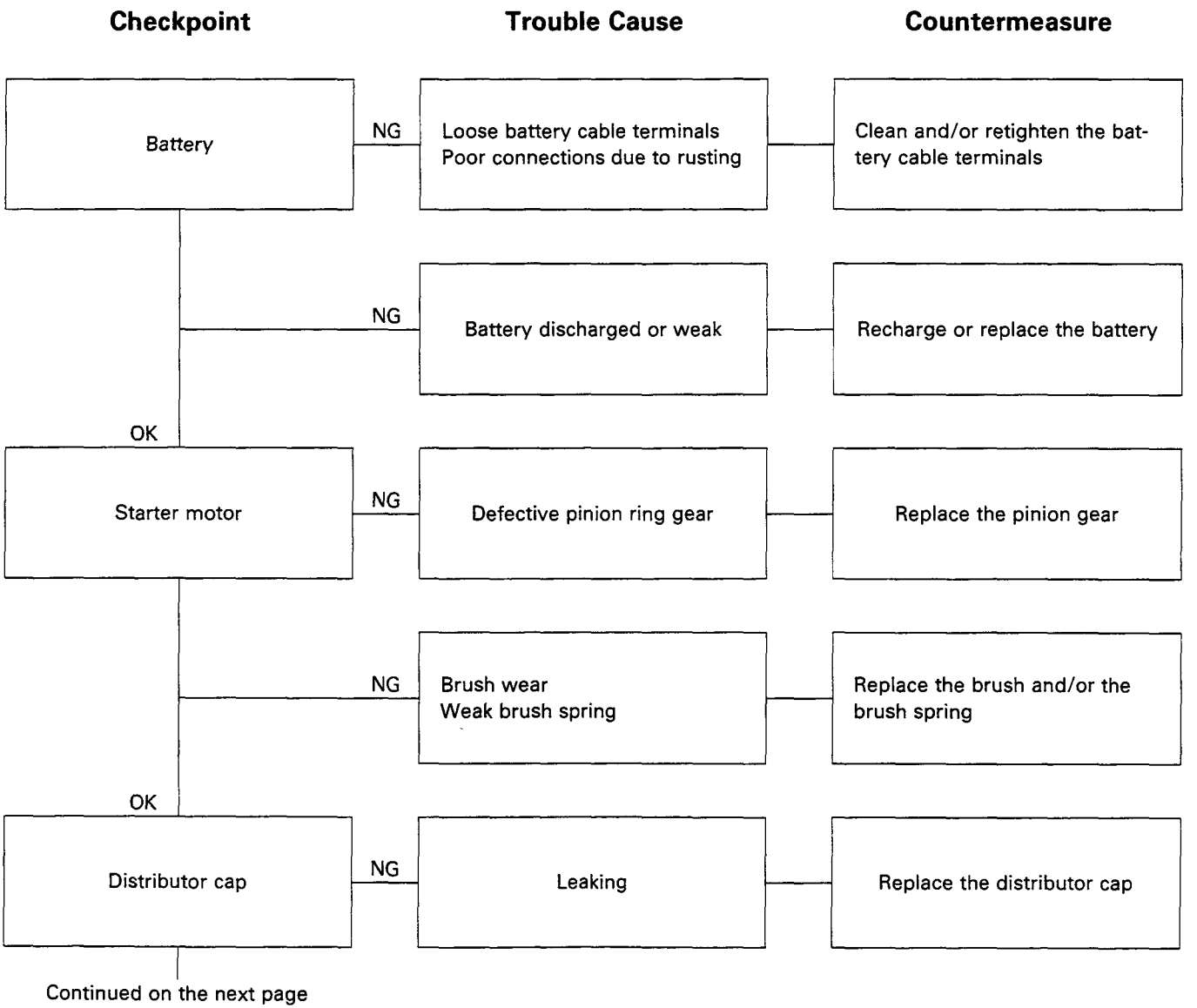
1. HARD STARTING

1. STARTER INOPERATIVE



150102

2. STARTER MOTOR OPERATES BUT ENGINE DOES NOT TURN OVER



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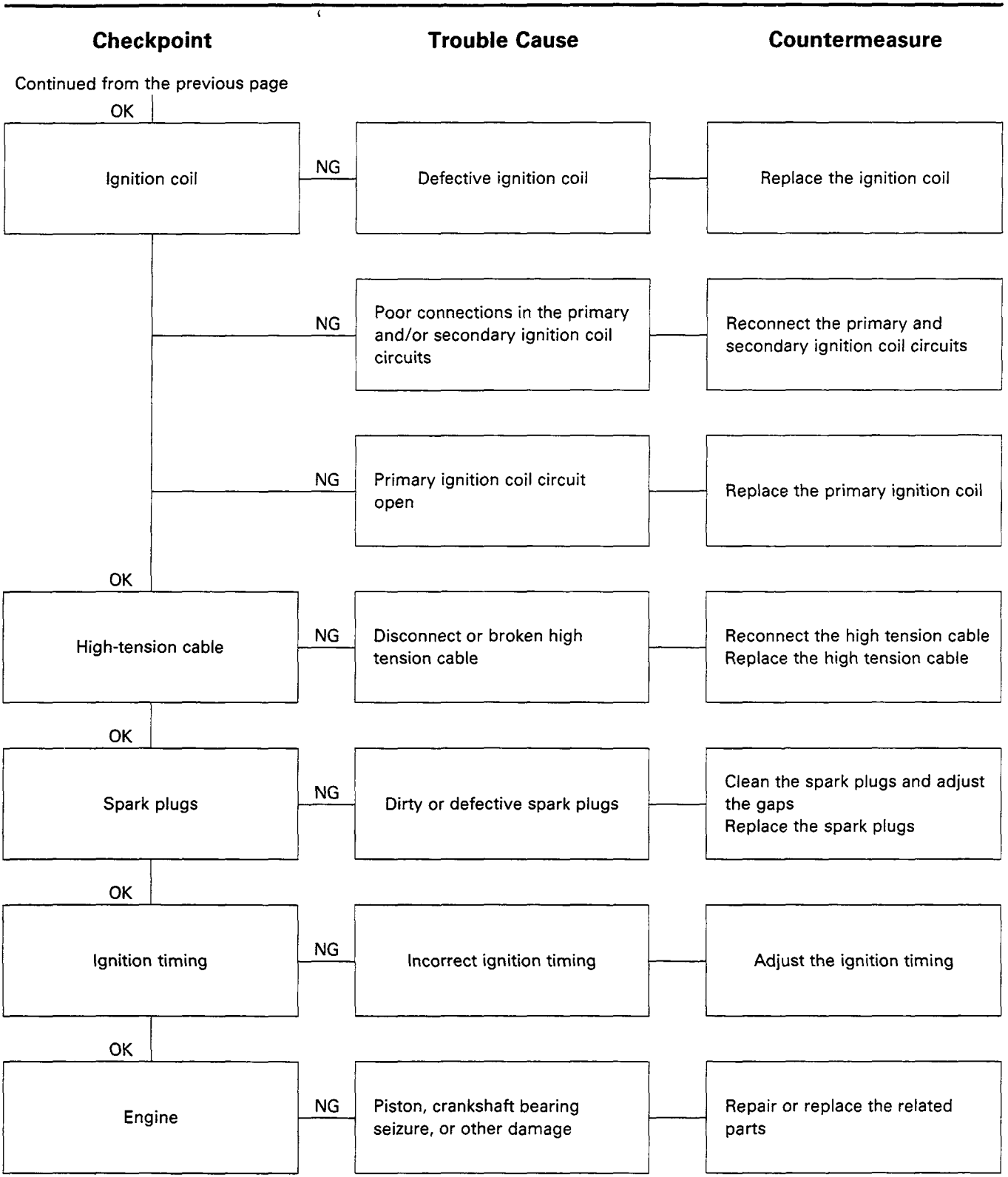
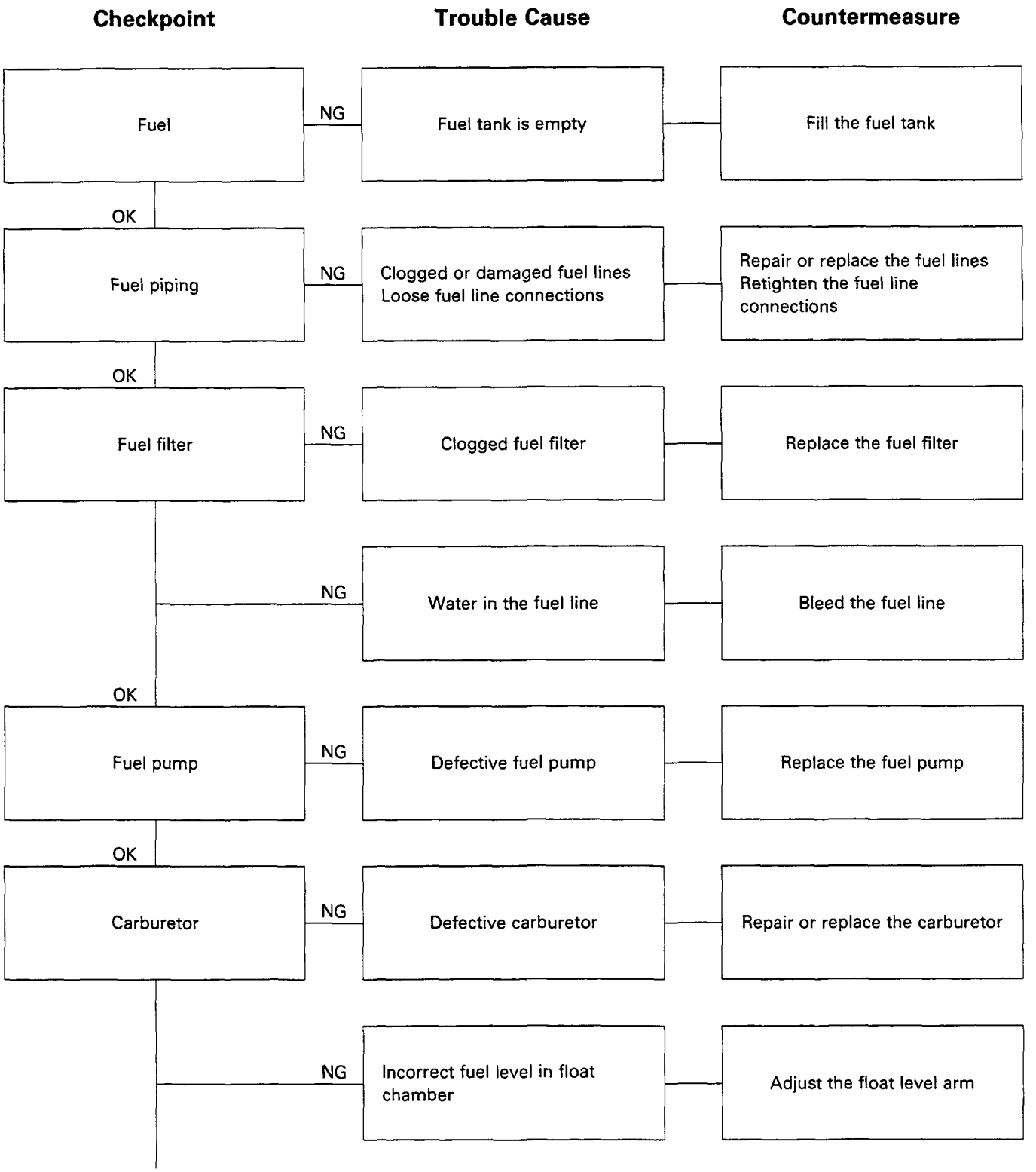

Checkpoint
Trouble Cause
Countermeasure
Continued from the previous page
OK
Ignition coil
NG
Defective ignition coil
Replace the ignition coil
NG
Poor connections in the primary and/or secondary ignition coil circuits
Reconnect the primary and secondary ignition coil circuits
NG
Primary ignition coil circuit open
Replace the primary ignition coil
OK
High-tension cable
NG
Disconnect or broken high tension cable
Reconnect the high tension cable
Replace the high tension cable
OK
Spark plugs
NG
Dirty or defective spark plugs
Clean the spark plugs and adjust the gaps
Replace the spark plugs
OK
Ignition timing
NG
Incorrect ignition timing
Adjust the ignition timing
OK
Engine
NG
Piston, crankshaft bearing seizure, or other damage
Repair or replace the related parts

150103

3. ENGINE TURNS OVER BUT DOES NOT START

FUEL IS NOT BEING DELIVERED TO THE CARBURETOR



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Checkpoint		Trouble Cause	Countermeasure
Continued from the previous page			
Carburetor	NG	Choke valve inoperative	Adjust or replace the choke mechanism

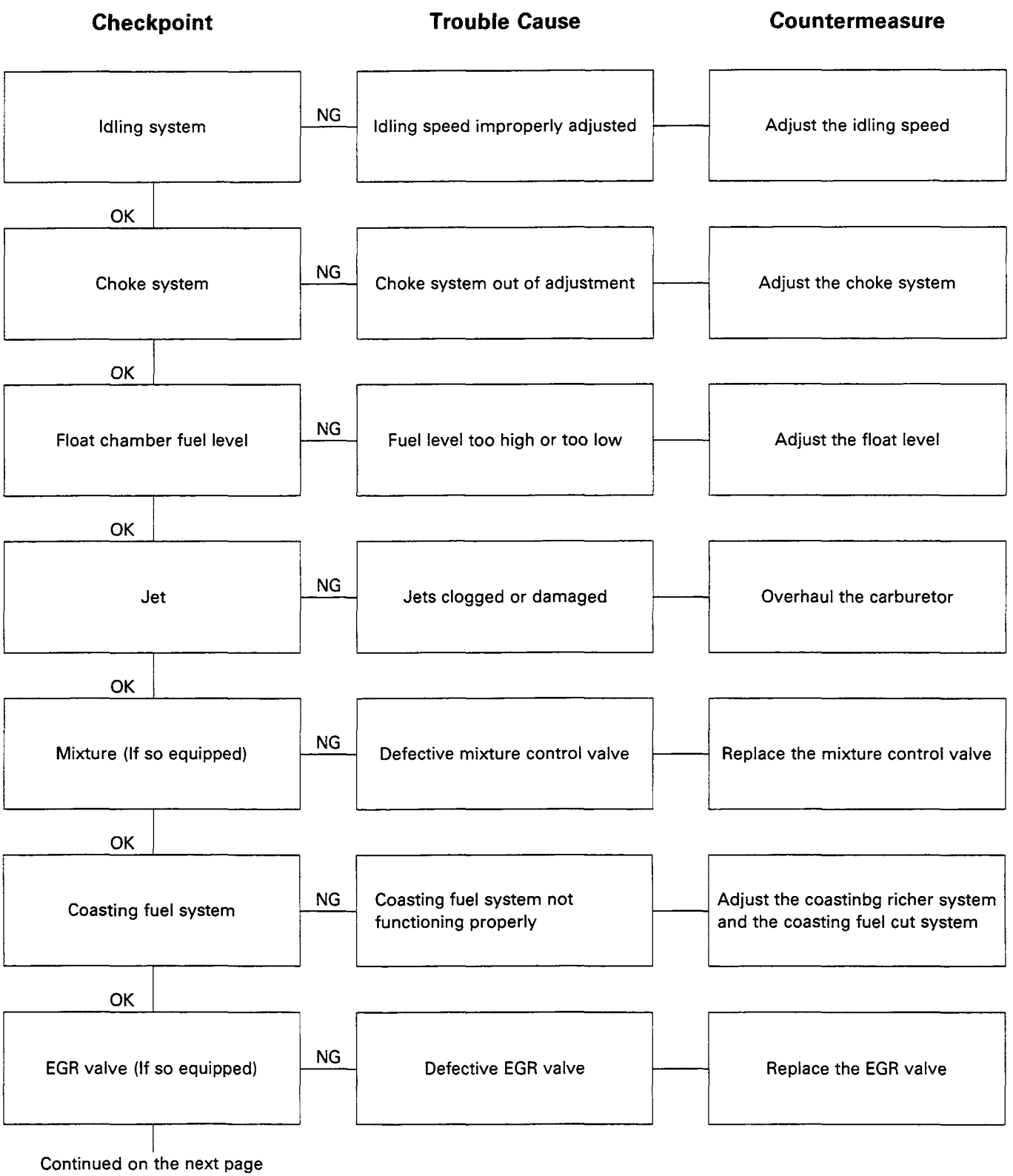
1500010302

FUEL IS BEING DELIVERED TO THE CARBURETOR

Fuel	NG	Use of the wrong fuel	Use the correct fuel
	NG	Water particles in the fuel	Charge the fuel

1502

2. UNSTABLE IDLING



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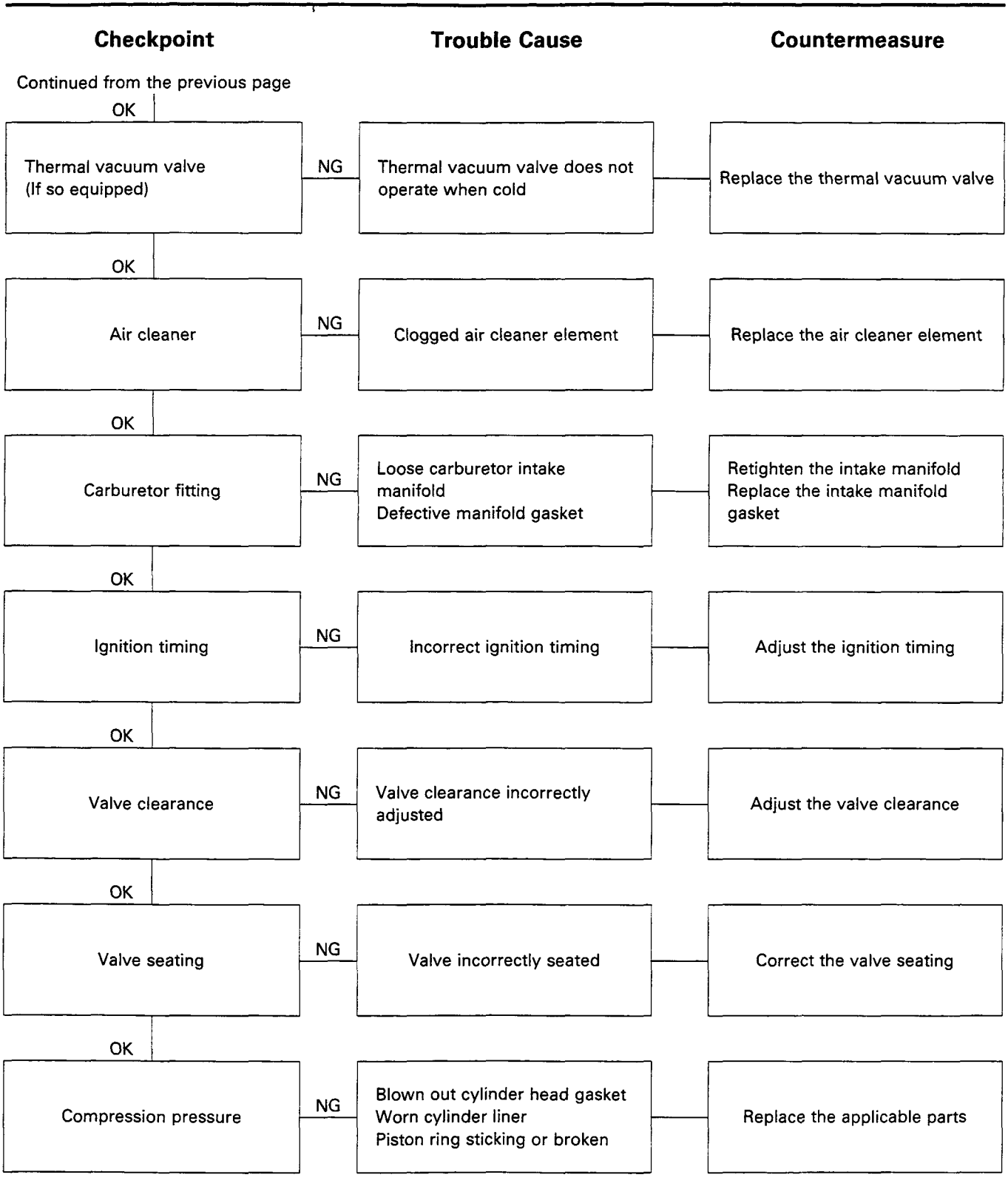
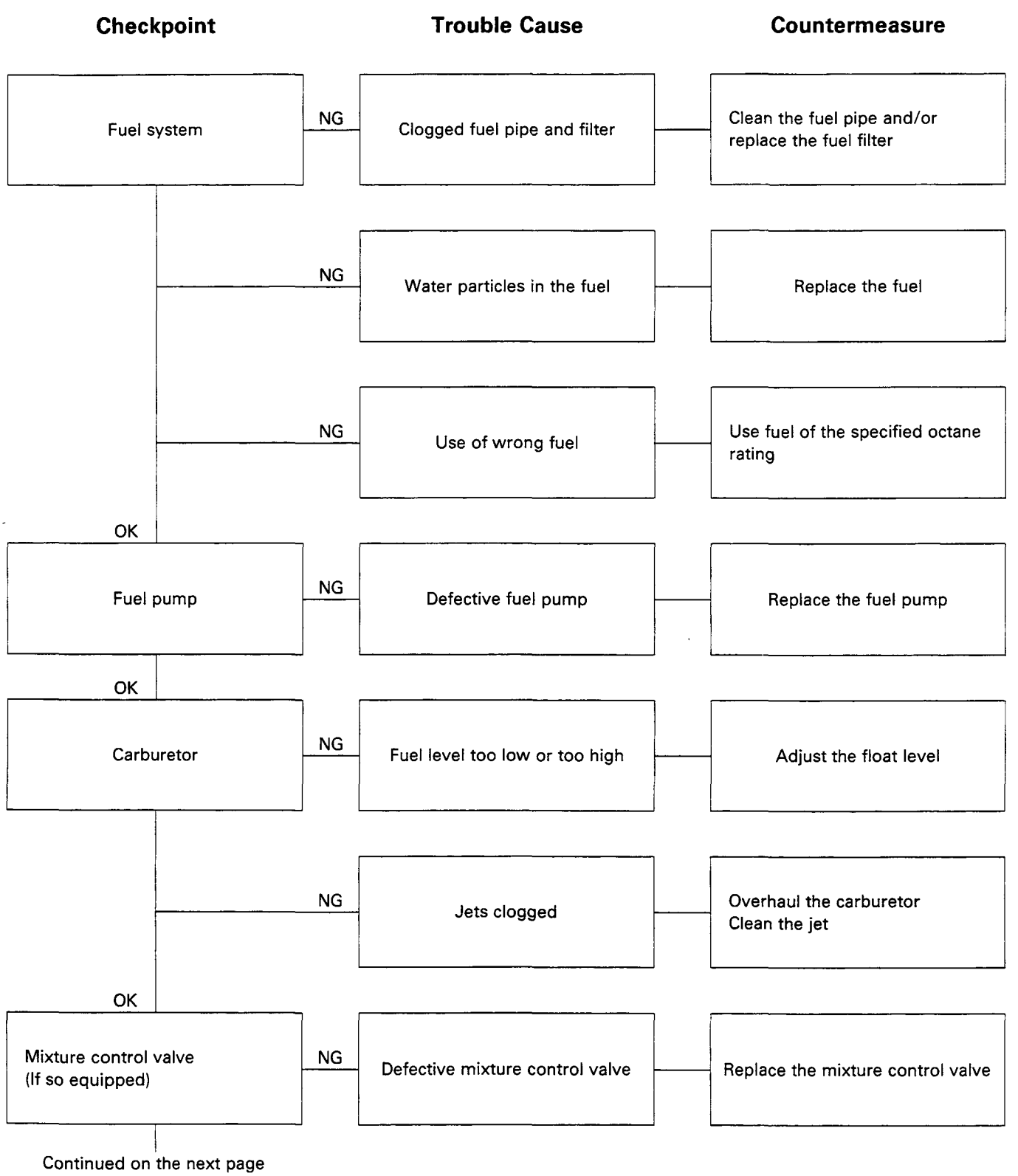

Checkpoint
Trouble Cause
Countermeasure
Continued from the previous page
OK
Thermal vacuum valve (If so equipped)
NG
Thermal vacuum valve does not operate when cold
Replace the thermal vacuum valve
OK
Air cleaner
NG
Clogged air cleaner element
Replace the air cleaner element
OK
Carburetor fitting
NG
Loose carburetor intake manifold
Defective manifold gasket
Retighten the intake manifold
Replace the intake manifold gasket
OK
Ignition timing
NG
Incorrect ignition timing
Adjust the ignition timing
OK
Valve clearance
NG
Valve clearance incorrectly adjusted
Adjust the valve clearance
OK
Valve seating
NG
Valve incorrectly seated
Correct the valve seating
OK
Compression pressure
NG
Blown out cylinder head gasket
Worn cylinder liner
Piston ring sticking or broken
Replace the applicable parts

1503

3. INSUFFICIENT POWER



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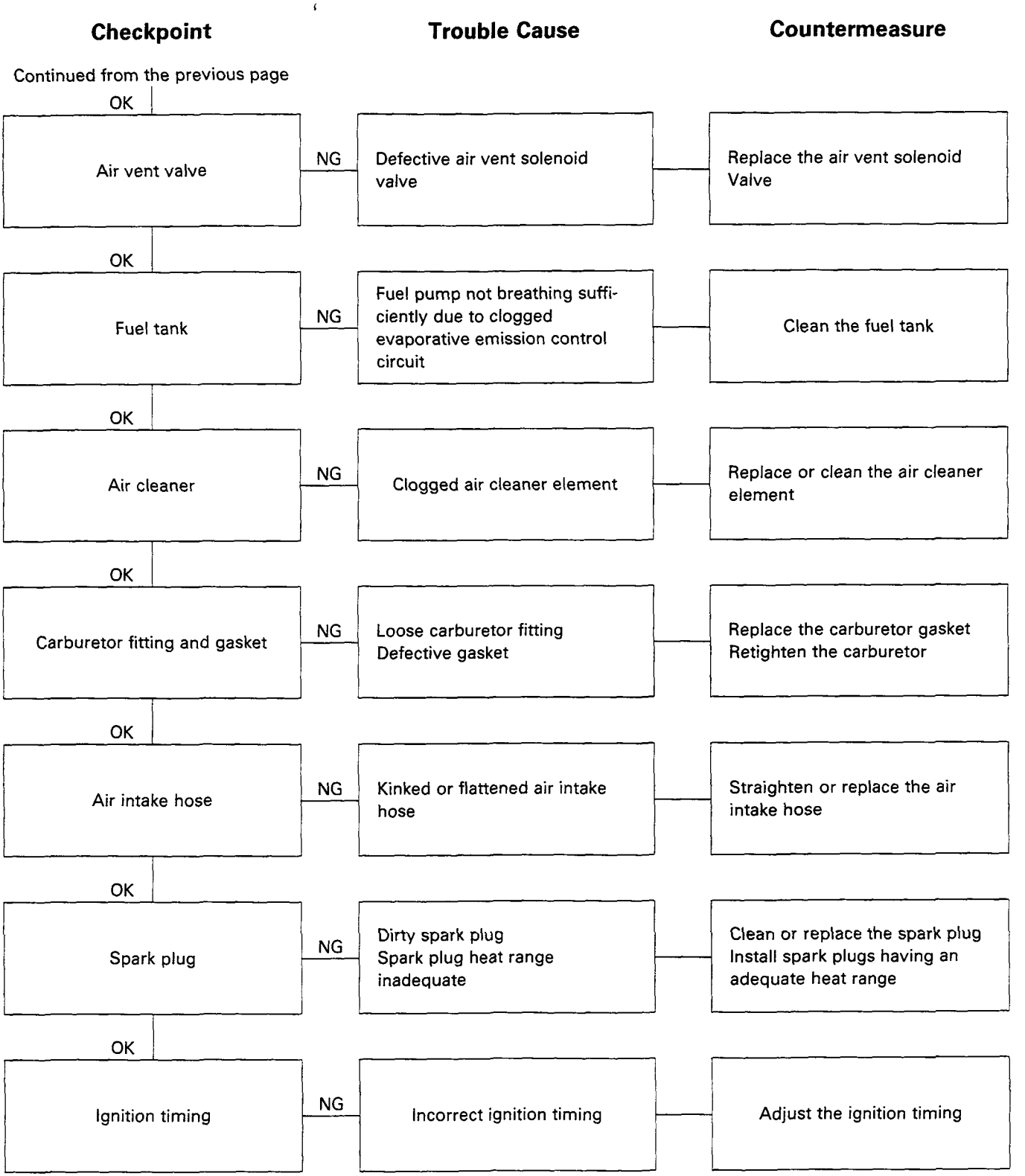
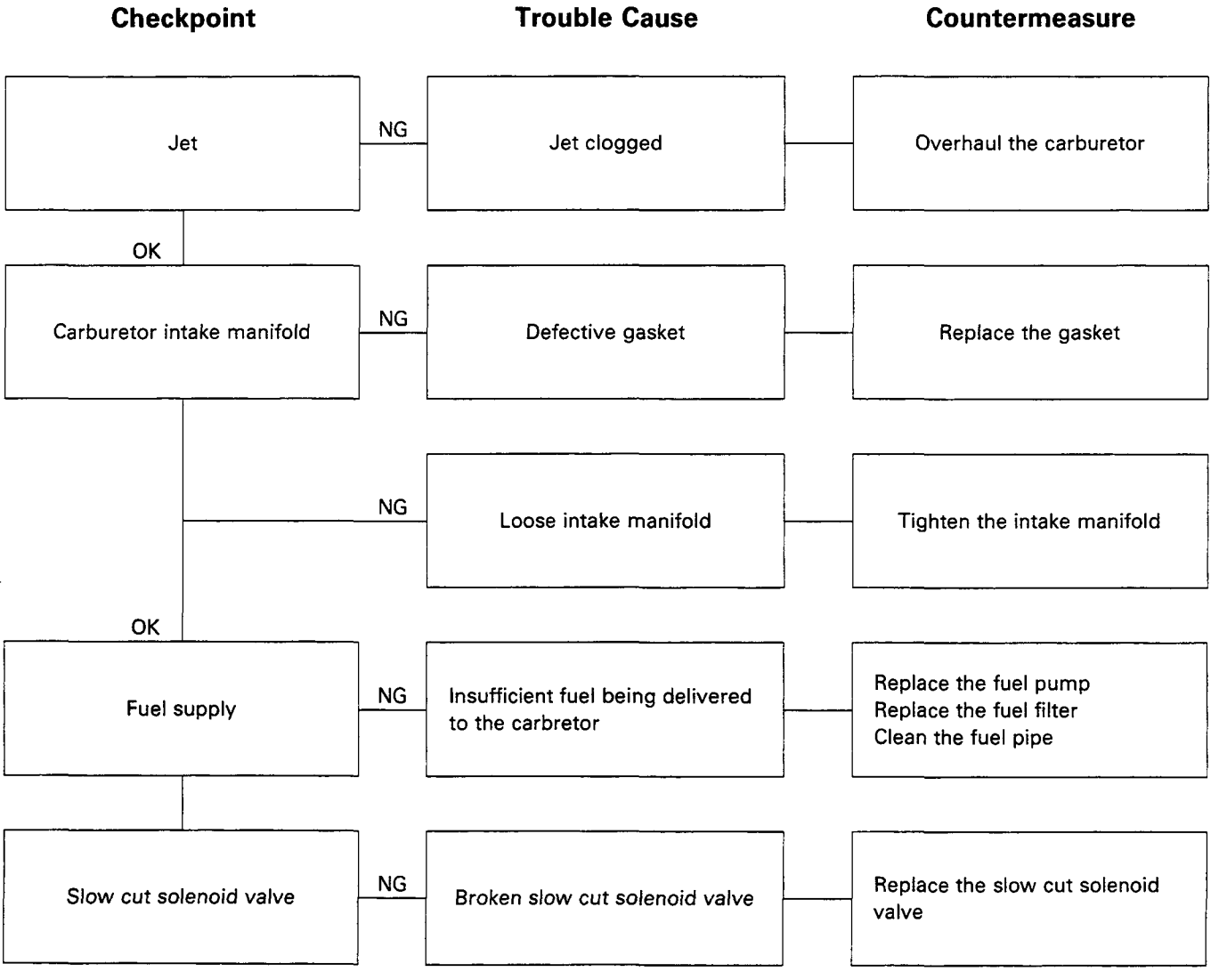

Checkpoint
Trouble Cause
Countermeasure
Continued from the previous page
OK
Air vent valve
NG
Defective air vent solenoid valve
Replace the air vent solenoid Valve
OK
Fuel tank
NG
Fuel pump not breathing sufficiently due to clogged evaporative emission control circuit
Clean the fuel tank
OK
Air cleaner
NG
Clogged air cleaner element
Replace or clean the air cleaner element
OK
Carburetor fitting and gasket
NG
Loose carburetor fitting
Defective gasket
Replace the carburetor gasket
Retighten the carburetor
OK
Air intake hose
NG
Kinked or flattened air intake hose
Straighten or replace the air intake hose
OK
Spark plug
NG
Dirty spark plug
Spark plug heat range inadequate
Clean or replace the spark plug
Install spark plugs having an adequate heat range
OK
Ignition timing
NG
Incorrect ignition timing
Adjust the ignition timing

1504

150401

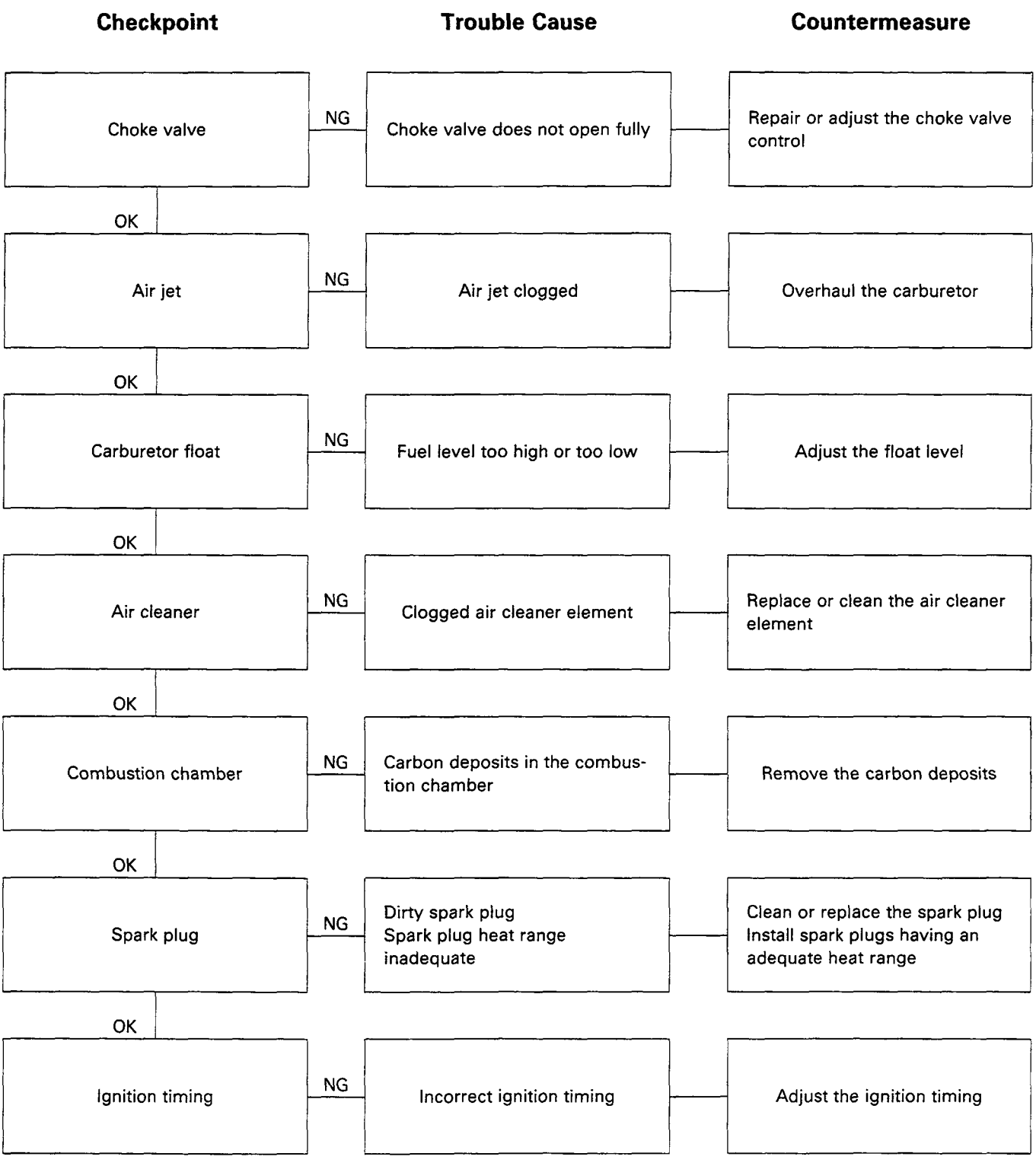
4. ABNORMAL COMBUSTION

1. MIXTURE TOO LEAN



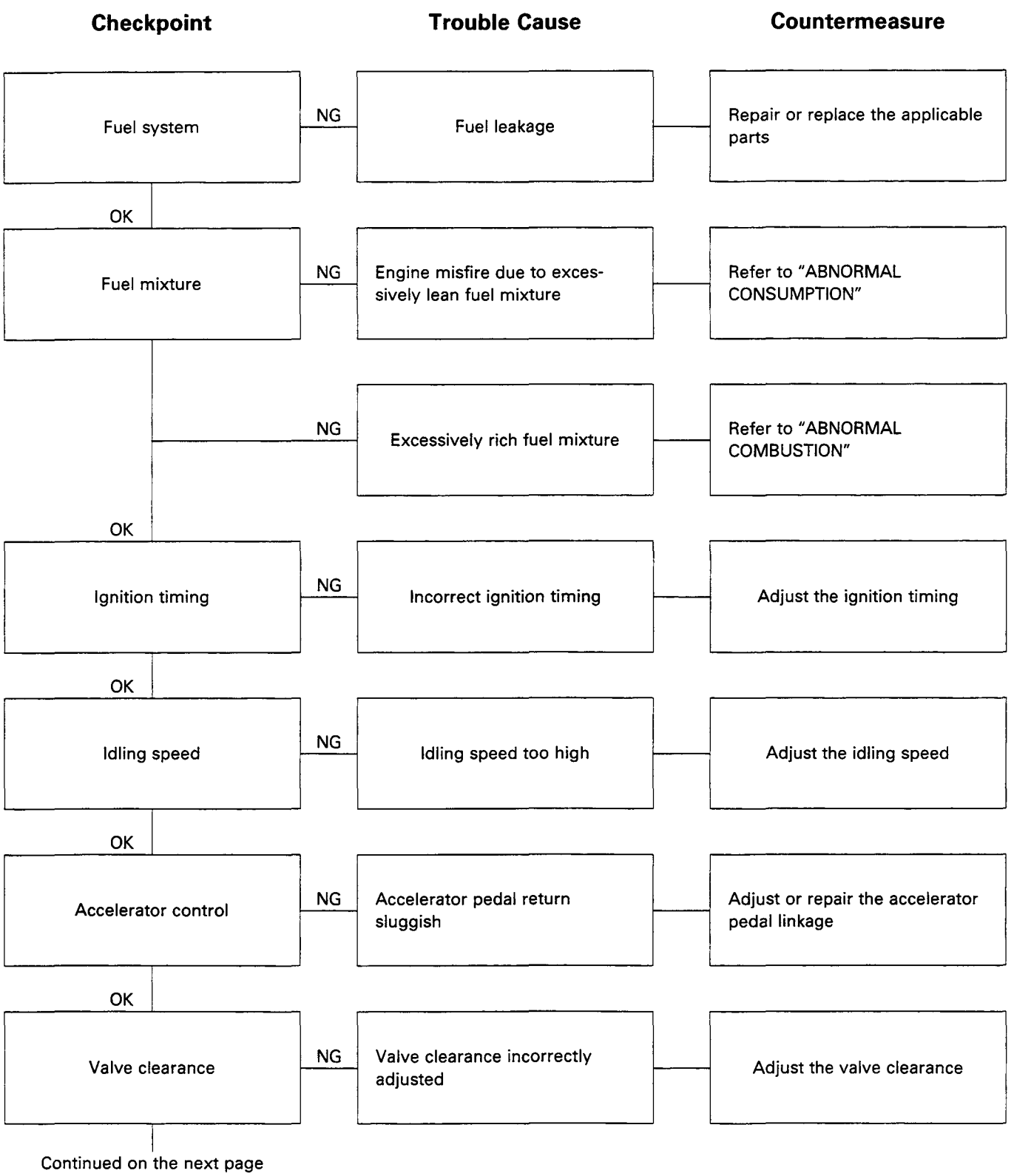
150402

2. MIXTURE TOO RICH



1505

5. EXCESSIVE FUEL CONSUMPTION



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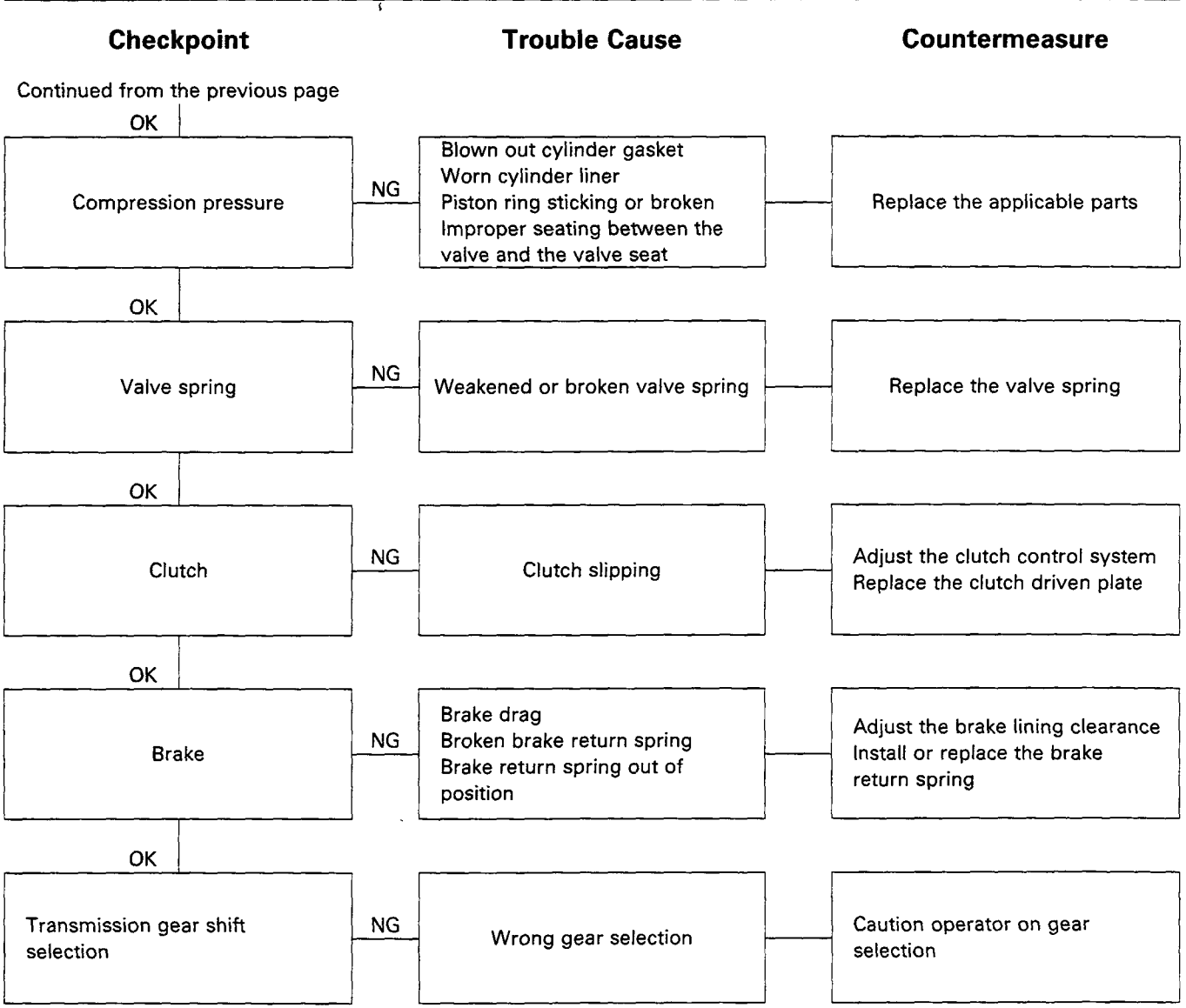
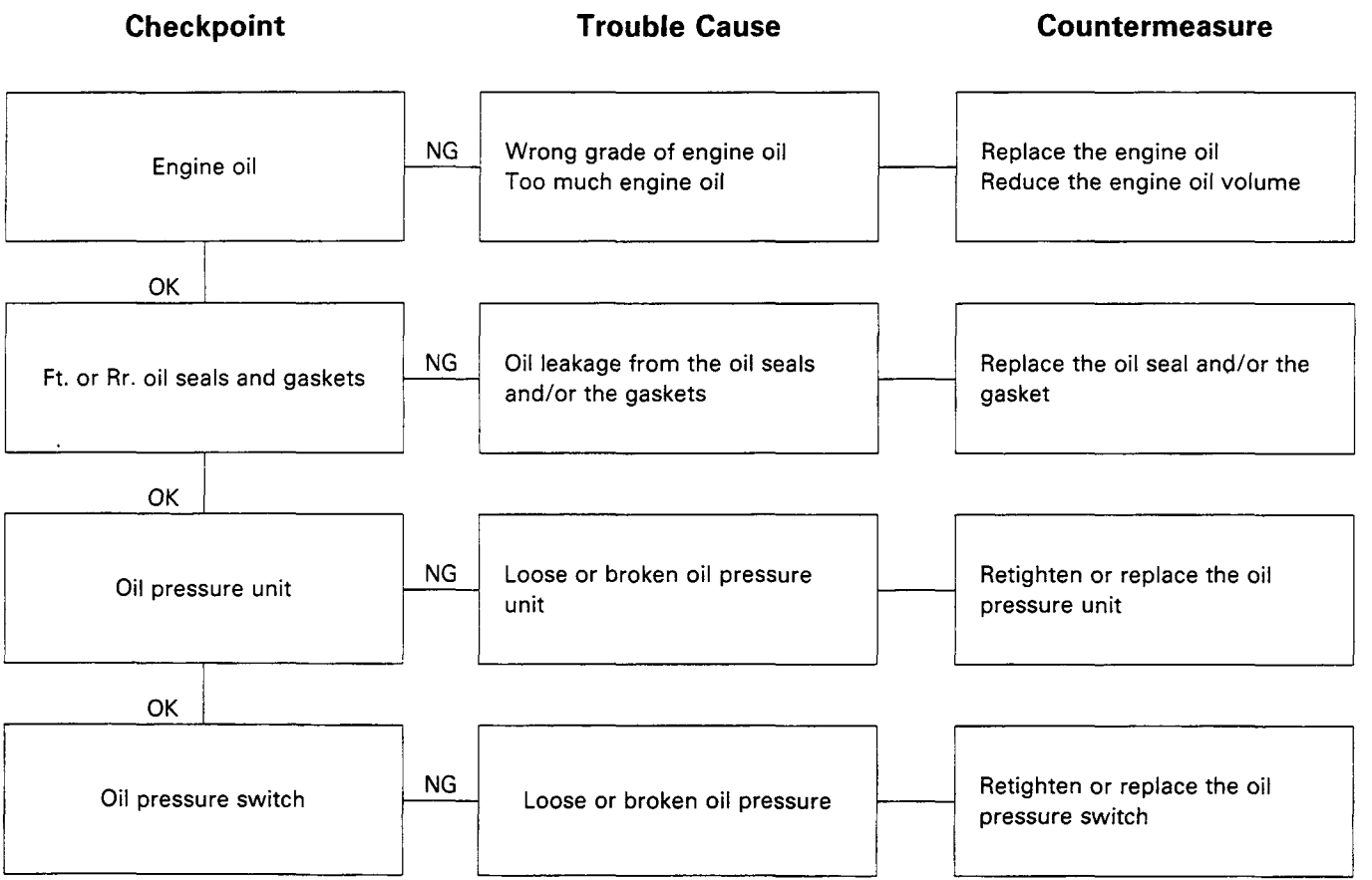

Checkpoint
Trouble Cause
Countermeasure
Continued from the previous page
OK
Compression pressure
NG
Blown out cylinder gasket
Worn cylinder liner
Piston ring sticking or broken
Improper seating between the valve and the valve seat
Replace the applicable parts
OK
Valve spring
NG
Weakened or broken valve spring
Replace the valve spring
OK
Clutch
NG
Clutch slipping
Adjust the clutch control system
Replace the clutch driven plate
OK
Brake
NG
Brake drag
Broken brake return spring
Brake return spring out of position
Adjust the brake lining clearance
Install or replace the brake return spring
OK
Transmission gear shift selection
NG
Wrong gear selection
Caution operator on gear selection

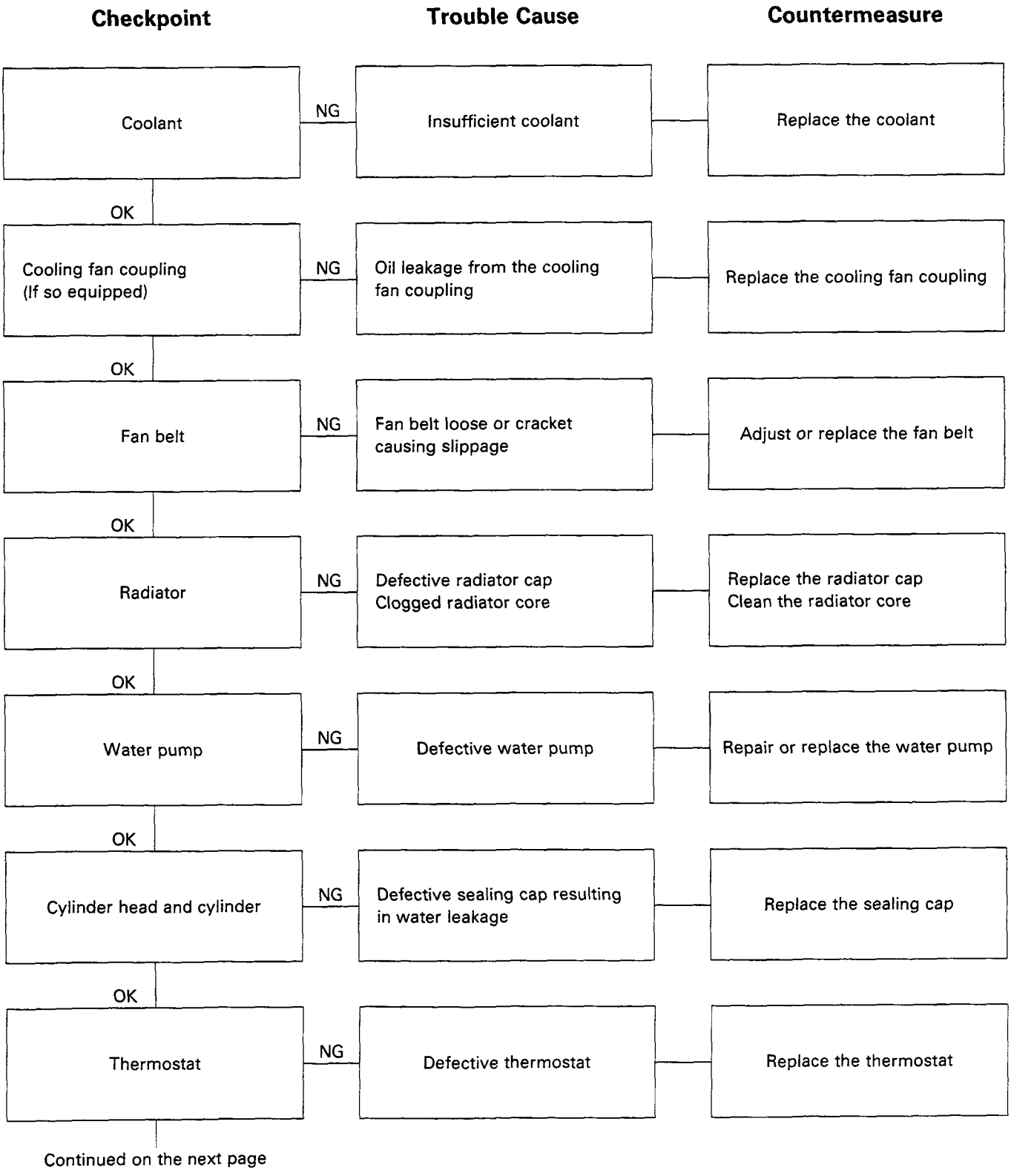
1506

6. EXCESSIVE OIL CONSUMPTION



1507

7. OVERHEATING



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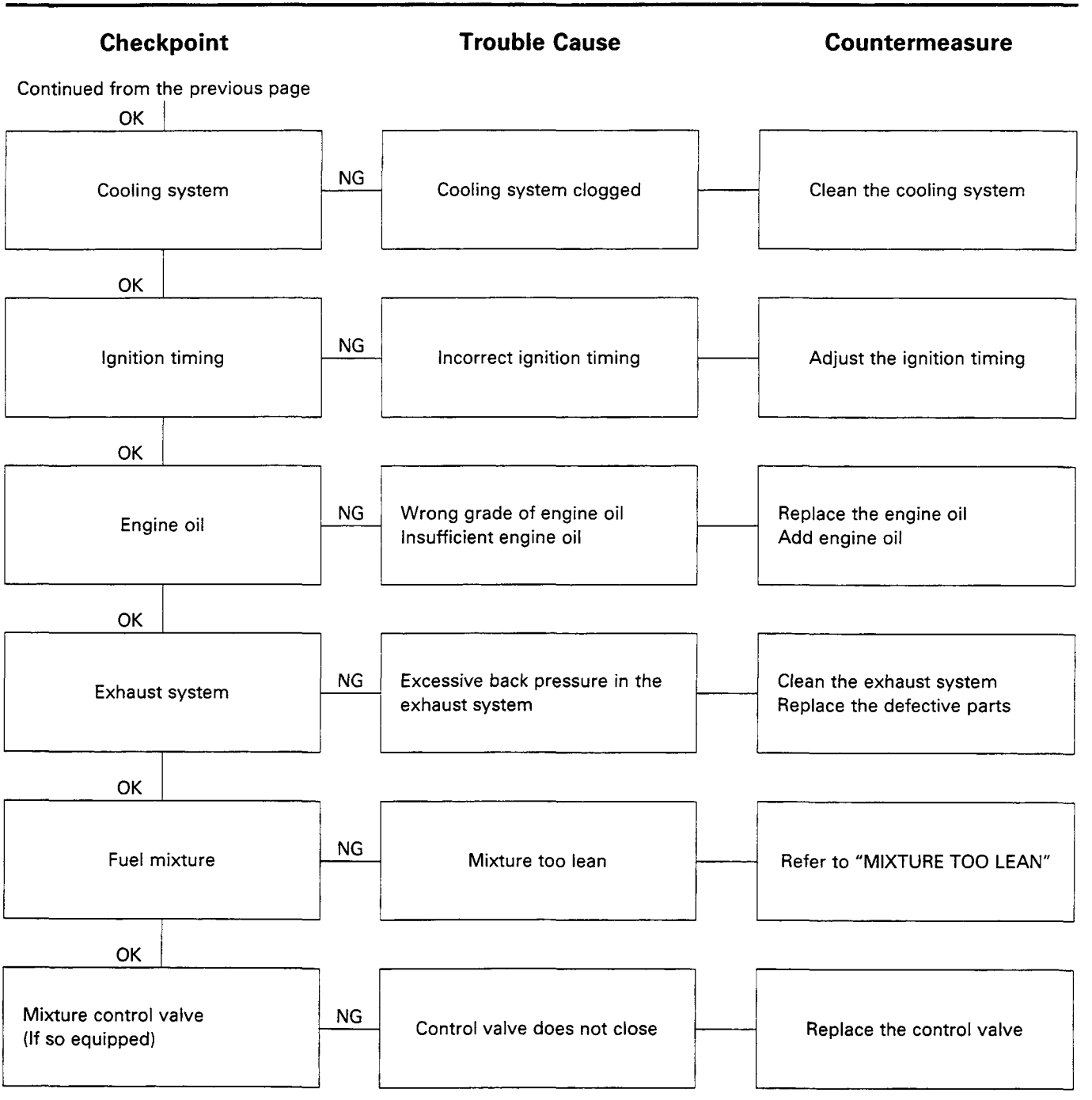
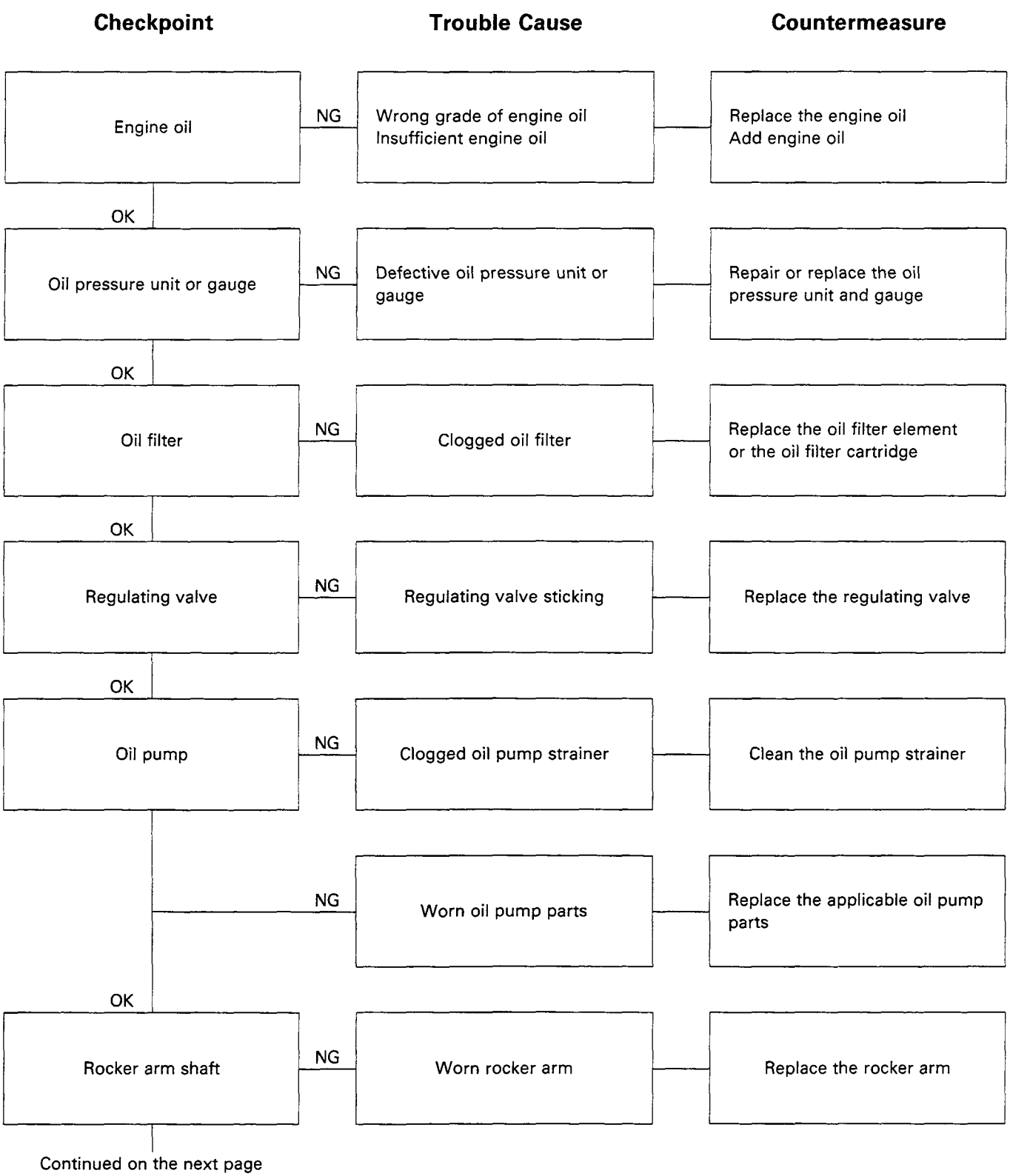

Checkpoint
Trouble Cause
Countermeasure
Continued from the previous page
OK
Cooling system
NG
Cooling system clogged
Clean the cooling system
OK
Ignition timing
NG
Incorrect ignition timing
Adjust the ignition timing
OK
Engine oil
NG
Wrong grade of engine oil
Insufficient engine oil
Replace the engine oil
Add engine oil
OK
Exhaust system
NG
Excessive back pressure in the exhaust system
Clean the exhaust system
Replace the defective parts
OK
Fuel mixture
NG
Mixture too lean
Refer to "MIXTURE TOO LEAN"
OK
Mixture control valve (If so equipped)
NG
Control valve does not close
Replace the control valve

1508

8. OIL PRESSURE DOES NOT RISE



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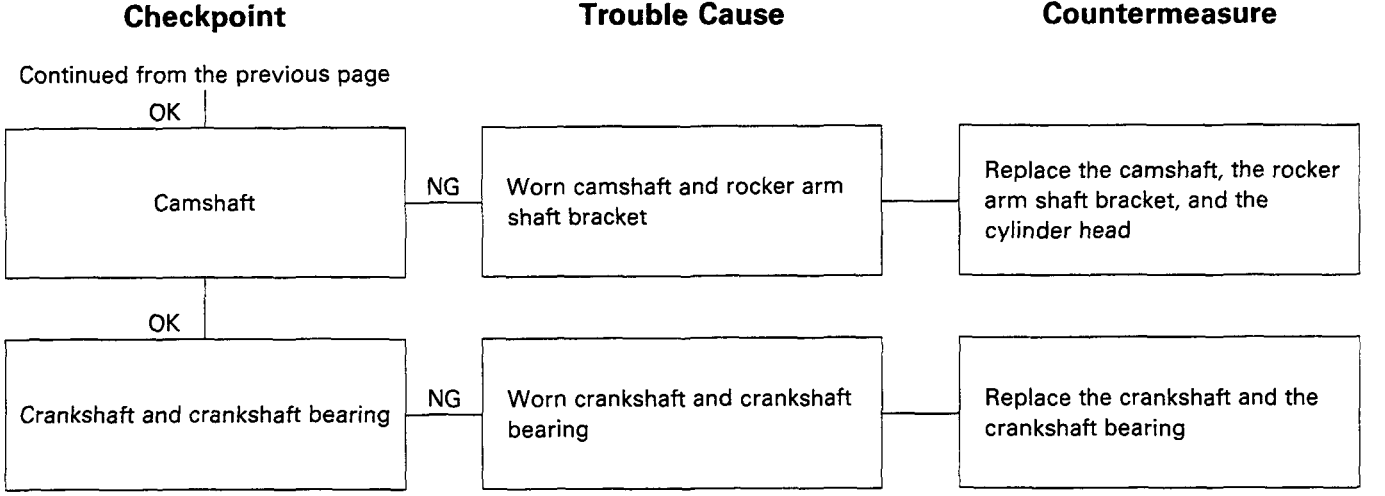

Checkpoint
Trouble Cause
Countermeasure
Continued from the previous page
OK
Camshaft
NG
Worn camshaft and rocker arm shaft bracket
Replace the camshaft, the rocker arm shaft bracket, and the cylinder head
OK
Crankshaft and crankshaft bearing
NG
Worn crankshaft and crankshaft bearing
Replace the crankshaft and the crankshaft bearing

1509

150901

9. ABNORMAL ENGINE NOISE

1. ENGINE KNOCKING

Checkpoint		Trouble Cause	Countermeasure
Fuel	NG	Octane rating too low	Replace the fuel
OK			
Ignition timing	NG	Incorrect ignition timing	Adjust the ignition timing
OK			
Spark plug	NG	Spark plug heat range inadequate	Install spark plugs having an adequate heat range
OK			
Compression pressure	NG	Broken piston ring Blown out head gasket	Replace the head gasket and/or the piston ring along with the related parts
OK			
Combustion chamber	NG	Carbon deposits in the combustion chamber	Remove the carbon deposits

Allow the engine to warm up before beginning the troubleshooting procedure.

150902

2. GAS LEAKAGE NOISE

Checkpoint		Trouble Cause	Countermeasure
Exhaust pipe	NG	Loosely connected exhaust pipe Broken exhaust pipe	Tighten the exhaust pipe connection Replace the exhaust pipe
OK			
Exhaust manifold	NG	Loosely connected exhaust manifold Loose spark plug	Tighten the exhaust manifold connection Tighten the spark plug
OK			
Cylinder head gasket	NG	Damaged cylinder head gasket	Replace the cylinder head gasket

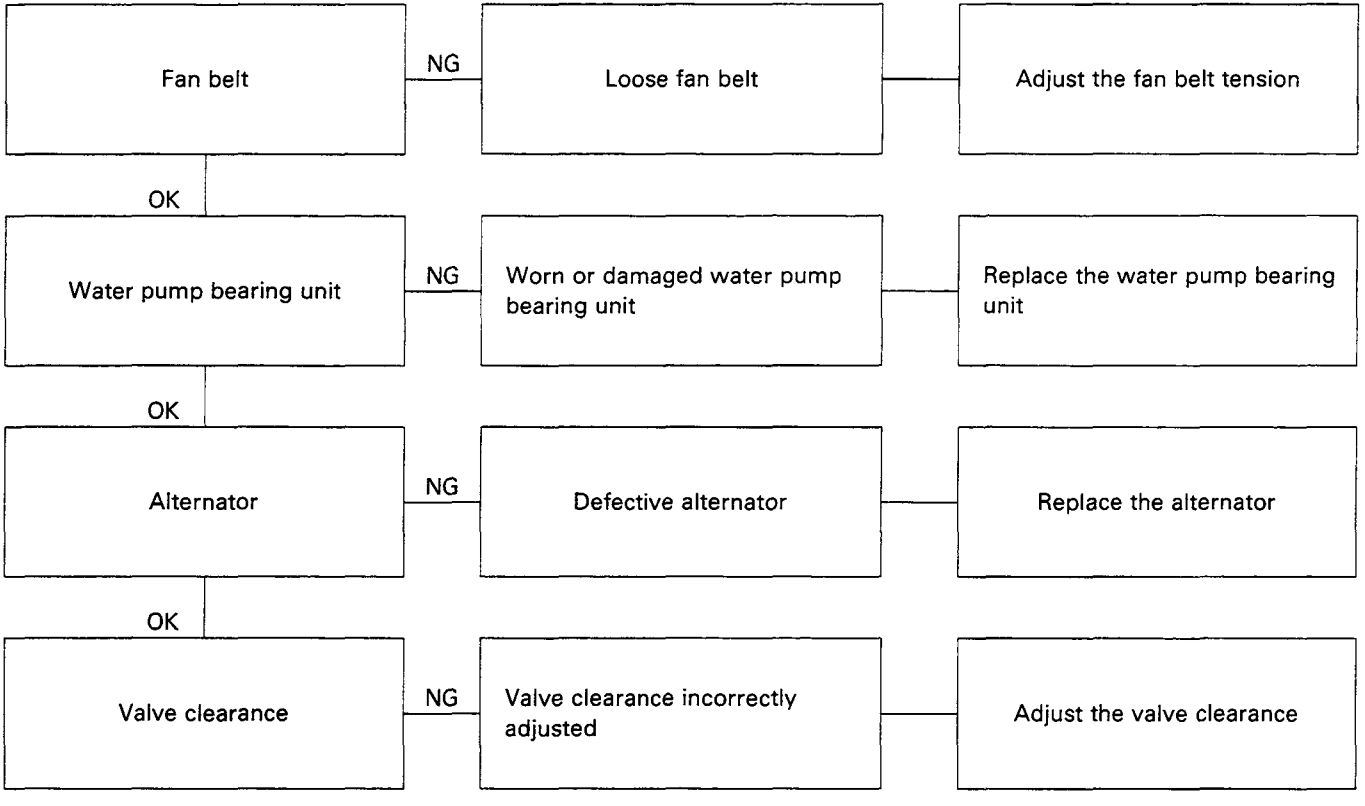
Allow the engine to warm up before beginning the troubleshooting procedure.

150903

3. CONTINUOUS NOISE

Checkpoint	Trouble Cause	Countermeasure

Allow the engine to warm up before beginning the troubleshooting procedure.



150904

4. SLAPPING NOISE

Checkpoint		Trouble Cause	Countermeasure
Valve clearance	NG	Valve clearance incorrectly adjusted	Adjust the valve clearance
OK			
Rocker arm	NG	Damaged rocker arm	Replace the rocker arm
OK			
Valve stem and valve guide	NG	Seized valve stem	Replace the valve stem and the valve guide
OK			
Valve spring	NG	Broken valve spring	Replace the valve spring
OK			
Valve seat	NG	Incorrect valve seating	Lap the valve seat Replace the velve seat
OK			
Rocker arm and camshaft contact faces	NG	Worn or pitted contact faces	Replace the camshaft and the rocker arm
OK			
Flywheel	NG	Loose flywheel bolt	Retighten the flywheel bolt

Allow the engine to warm up before beginning the troubleshooting procedure.

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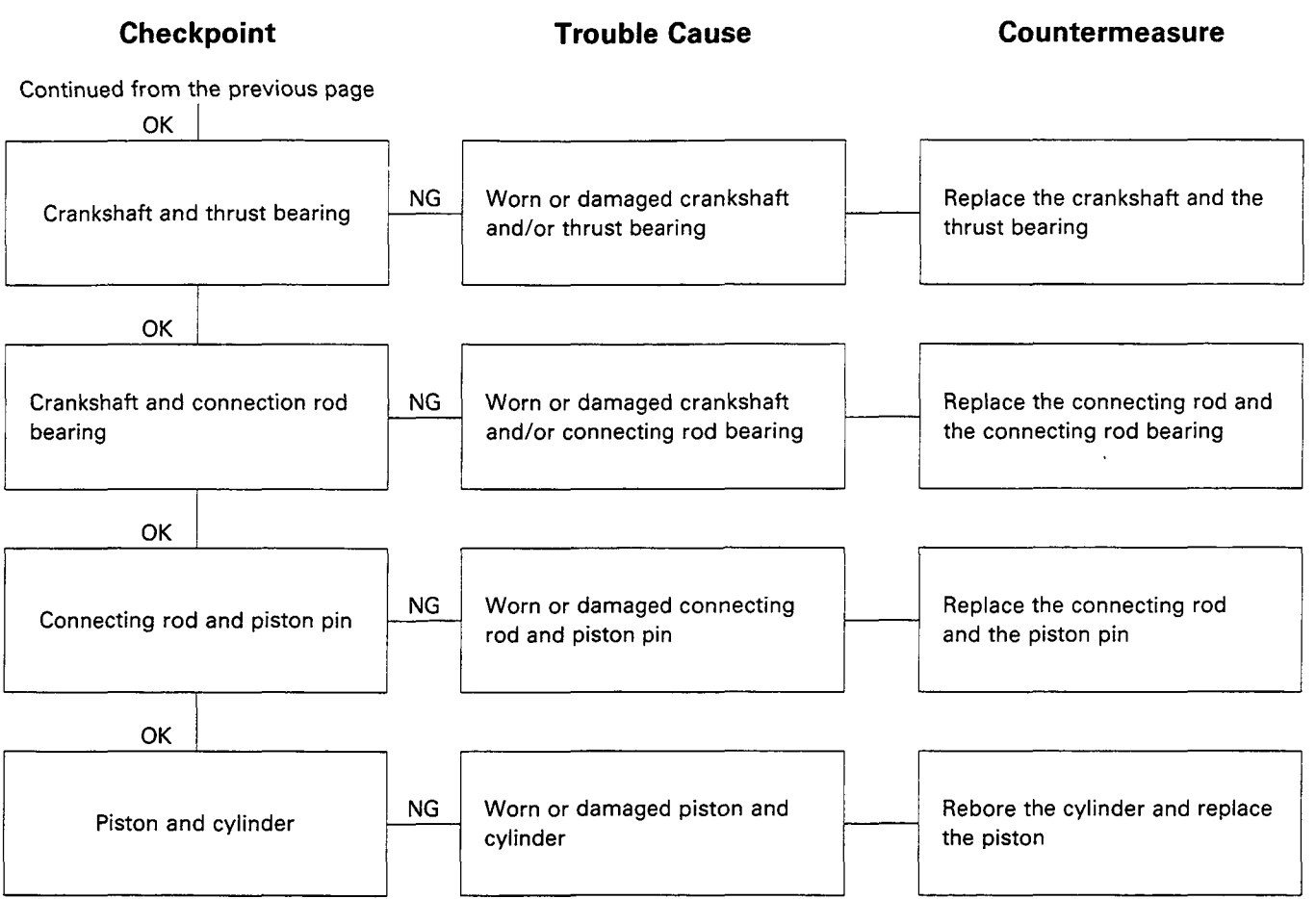

Checkpoint
Trouble Cause
Countermeasure
Continued from the previous page
OK
Crankshaft and thrust bearing
NG
Worn or damaged crankshaft and/or thrust bearing
Replace the crankshaft and the thrust bearing
OK
Crankshaft and connection rod bearing
NG
Worn or damaged crankshaft and/or connecting rod bearing
Replace the connecting rod and the connecting rod bearing
OK
Connecting rod and piston pin
NG
Worn or damaged connecting rod and piston pin
Replace the connecting rod and the piston pin
OK
Piston and cylinder
NG
Worn or damaged piston and cylinder
Rebore the cylinder and replace the piston

150905

5. OTHER NOISE

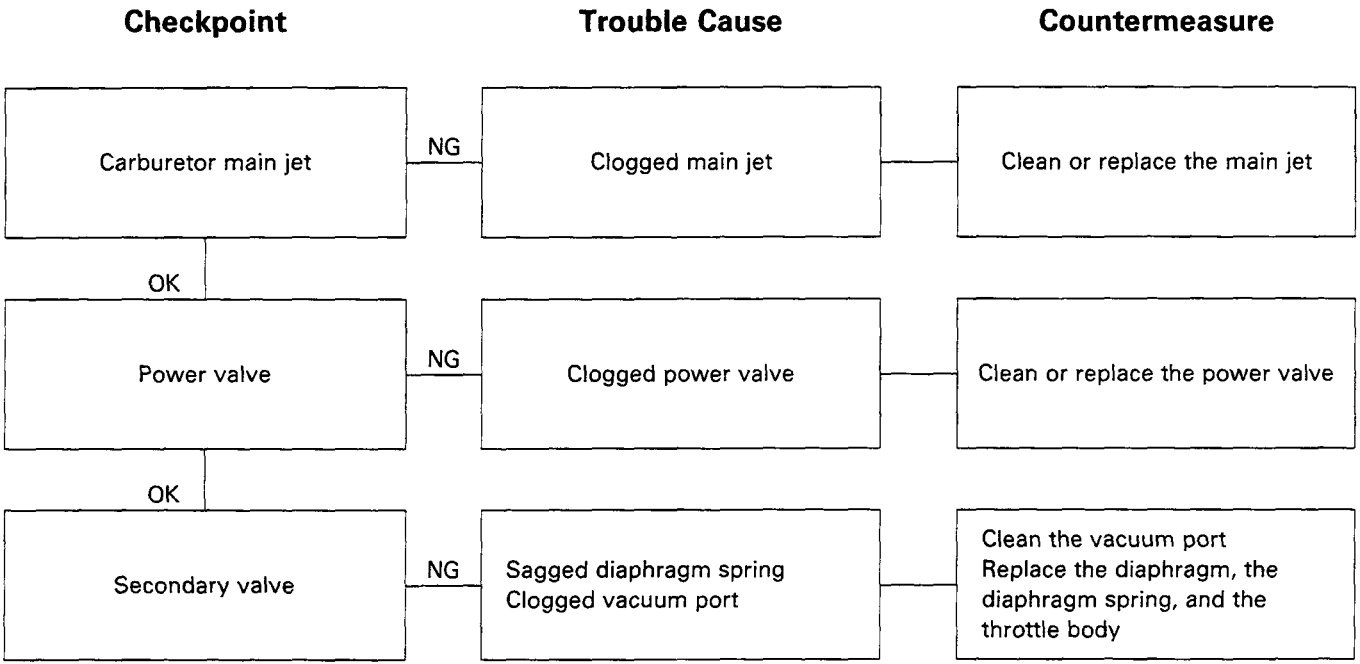
Checkpoint		Trouble Cause	Countermeasure
Allow the engine to warm up before beginning the troubleshooting procedure.			
Water pump	NG	Defective water pump bearing unit	Replace the bearing unit
OK			
Air pump (If so equipped)	NG	Mechanical trouble in the air pump	Replace the air pump
	NG	Relief valve leakage	Replace the relief valve
OK			
Air pump drive belt	NG	Air pump drive belt slipping	Adjust the drive belt tension

1510

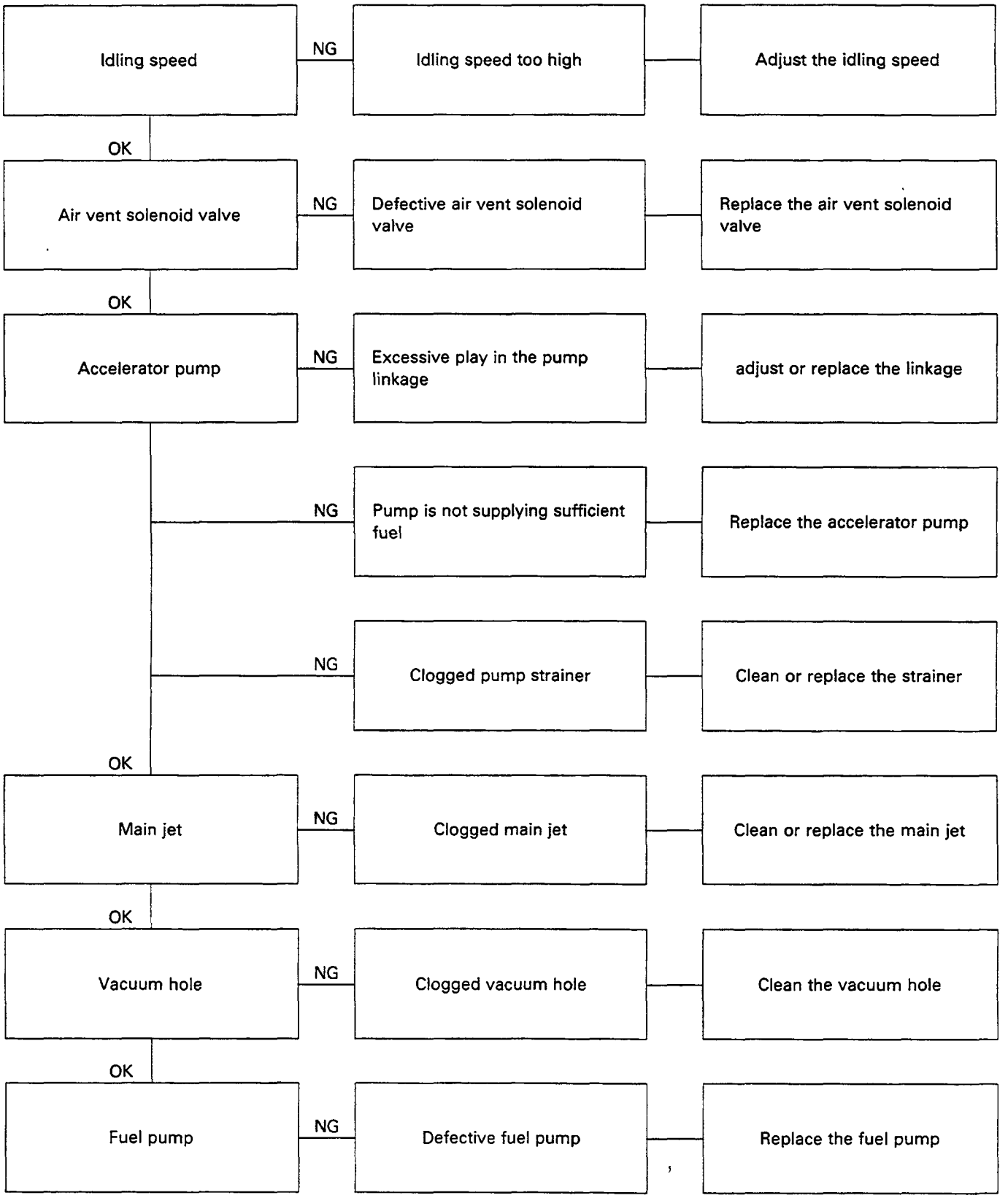
151001

10. FLAT SPOT

1. FLAT SPOT DURING HIGH SPEED OPERATION



2. FLAT SPOT DURING ACCELERATION



SECTION 6A
ENGINE MECHANICAL

TABLE OF CONTENTS

MAIN DATA AND SPECIFICATIONS
(CARBURETTOR TYPE)

Item \ Engine model			4ZC1	4ZE1
Engine type			Four-cycle, water cooled, crossflow with single overhead camshaft	
Combustion chamber type			Hemispherical	
Timing train system			Belt drive	
No. of cylinders - bore x stroke			4-88.0x82.0 (3.46x3.23)	4-92.6x95.0 (3.64x3.74)
No. of piston rings			Compression rings: 2/Oil ring:1	
Total piston displacement		cc(in^3)	1,994 (121.7)	2,559 (156.2)
Compression ratio (to 1)			8.0	8.3
Compression pressure		kg/cm^2(psi/kPa)	12.0 (170.6/1,177.2)	
Engine weight (Dry)		kg(lb)	Approx. 135 (297.7)	Approx. 149 (328.5)
Firing order			1 - 3 - 4 - 2	
Ignition timing (BTDC)		deg/rpm	10/800	6/800
Idling speed		rpm	800	800
Valve clearance (At cold)	Intake	mm(in)	0.15 (0.006)	
	Exhaust	mm(in)	0.25 (0.010)	
Valve clearance (At hot)	Intake	mm(in)	0.20 (0.008)	
	Exhaust	mm(in)	0.30 (0.012)	
Intake valves	Open at (BTDC)	deg	21	
	Close at (ABDC)	deg	65	
Exhauxt valves	Open at (BBDC)	deg	55	
	Close at (ATDC)	deg	20	
Ignition system			Fully transistorized battery ignition	
Distributor type			Contract pointless	
Diatributor advance type			Centrifugal and vacuum	
Spark plug type			BPR6ES-11 ,or BP6ES or W20EXR-U or BPR6ES	
Spark lug gap		mm(in)	1.0-1.1 (0.040-0.043) for catalytic conventer vehicle 0.7-0.8 (0.028-0.031) Except catalytic conventer vehicle	

Item \ Engine model		4ZC1	4ZE1
Lubricating system			
Lubricating method		Full flow pressure circulation	
Specified engine oil (API grade)		SE, or SF	
Oil pressure	kg/cm²(psi/kPa)rpm	4.0-5.0 (56.9-71.1/392.4-490.5)/4,000 [SAE 10W-30/API SC grade] engine oil after warm-up	
Oil pump type		Trochoid	
Oil filter type		Cartridge, full flow	
Oil capacity	lit. (US/UK gal.)	4.9 (1.24, 1.08)	5.5 (1.45, 1.21)
Cooling system			
Radiator type		Corrugated fin with reserve tank	
Coolant capacity	lit. (US/UK gal.)	8.6 92.2, 1.9)	9.0 (2.3, 2.0)
Water pump type		Centrifugal	
Thermostat type		Wax pellet with jiggle valve	
Fuel system			
Carburetor type		Stomberg 2-barrel 2-stage	
Fuel pump type		Mechanical	
Fuel pressure	kg/cm²(psi/kPa)rpm	0.25 (3.56/24.50) for HITACHI CARB 0.24 (3.4/23.5) for NIPPON KIKAI CARB	
Fuel filter type		Cartridge paper element	
Air cleaner type		Dry paper element or Oil wetted (viscous) paper element	
Battery	Type/V-A x No. of units	34B19R (12/33) 46B24R (12/45)	50D20R (12/50)
Alternator capacity	V-A(W)	12-55 (660)	
Starter motor output	V-kW	12-1.0	12-1.2

TORQUE SPECIFICATION

STANDARD BOLTS

The torque values given in the following table should be applied whenever a particular torque is not specified.

kg·m(lb.ft/N·m)

Strength Class / Bolt Identification / Bolt Diameter× Pitch (mm)	4.8 (4T)	(7T)	8.8 Refined	8.8 Non-Refined	9.8 (9T)
					
	 No mark	—			
M 6 × 1.0	0.60±0.20 (4.33±1.44/5.88±1.96)	0.75±0.25 (5.43±1.80/7.35±2.45)			–
M 8 × 1.25	1.30±0.50 (9.40±3.62/12.74±4.90)	1.75±0.55 (12 66±4.00/17.15±5.39)			2.40±0.70 (17.36±5.06/23.52±6.86)
M10 × 1.25	2.80±0.70 (20.25±5.06/27.44±6.86)	3.75±0.95 (27 12±6.87/36.75±9.31)			5.10±1.30 (36.89±9.40/49.98±12.74)
M12 × 1.25	6.25±1.25 (45.21±9.04/61.25±12.25)	7 75±1.55 (56.06±11.21/75.95±15.19)			9.65±1.95 (69.80±14.10/94.57±19.11)
M14 × 1.5	9.75±1.95 (70.52±14.10/95.55±19.11)	11.85±2.35 (85.71±17.00/116.13±23.03)			14.50±2.90 (104.88±21.00/142.10±28.42)
M16 × 1.5	13.30±2.70 (96.20±19.53/130 34±26.46)	17.30±3.50 (125.13±25.32/169.54±34.30)			20.40±4.10 (147.55±29.66/199.92±40.18)
M18 × 1.5	19.20±3.80 (138.87±27.49/188.16±37.24)	24.90±5.00 (180.10±36.17/244.02±49.00)			29.30±5.90 (211.93±42.67/287.14±57.82)
M20 × 1.5	26.30±5.30 (190.23±38.33/257.74±51.94)	34 40±6.90 (248.82±49.41/337.12±67.62)			40.40±8.10 (292.21±58.59/395.92±79.38)
M22 × 1.5	33.90±8.30 (245.20±60.03/332.22±81 34)	46.25±9.25 (334.53±66.91/453.25±90.65)			54.10±10.80 (391.30±78.12/530.18±105.84)
M24 × 2.0	45.80±9.20 (331.27±66.54/448.84±90.16)	58.20±14.30 (420.96±103.43/570.36±140.14)			70.60±14.10 (510.65±101.99/691.88±138.18)
*M10 × 1.5	2.70±0.70 (19.53±5.06/26.46±6.86)	3.70±0.90 (26.76±6.50/36.26±8.82)			4.90±1.20 (35.44±8.68/48.02±11.76)
*M12 × 1.5	5.80±1.20 (41.95±8.68/56.84±11 76)	7.20±1.40 (52.08±10.13/70.56±13.72)			9.10±1.80 (65.82±13.02/89.18±17.64)
*M14 × 2.0	9.10±1.80 (65.82±13.02/89.18±17.64)	11.20±2.20 (81.01±15.91/109.76±21.56)			13.60±2.70 (98.37±19.53/133.28±26.46)
*M16 × 2.0	12.70±2.50 (91.86±18.08/124 46±24.50)	16.50±3.30 (119.34±23.87/161.70±32.34)			19.50±3.90 (141.04±28.21/191.10±38.22)

An asterisk (*) indicates that the bolts are used for female threaded parts that are made of soft materials such as casting. Those shown in parentheses in the strength class indicate the classification by the old standard.

FLARE NUTS

kg·m(lb.ft/N·m)

Pipe diameter mm(in)	Torque	Pipe diameter mm(in)	Torque
4.76 (0.187)	1.55±0.25 (11.2± 1.8/15.2±2.45)	10.00 (0.394)	5.50±0.5 (39.7±3.6/53.95±4.90)
6.35 (0.250)	2 70±0.30 (19.5±2.1/26.48±2.94)	12.00 (0.472)	9.00±1.0 (65.0±7.2/88.29±9.80)
8.00 (0.315)	4.50±0.50 (32.5±3.6/44 14±4.90)	15.00 (0.591)	10 75±1 25 (77 7±9.0/105.45±12.26)

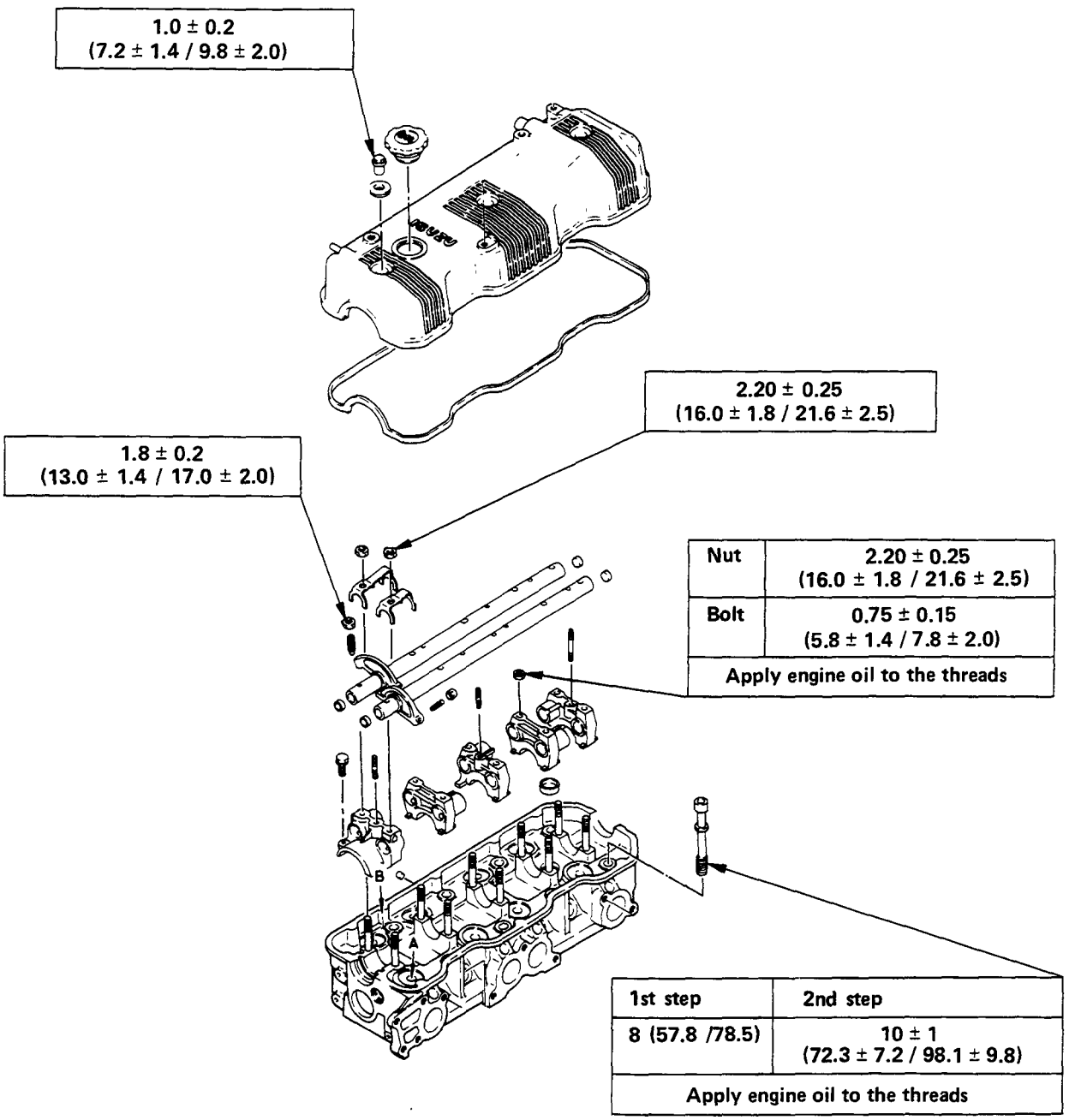
0204

SPECIAL PARTS FIXING NUTS AND BOLTS

020401

Cylinder Head Cover, Cylinder Head, and Rocker Arm Shaft Bracket

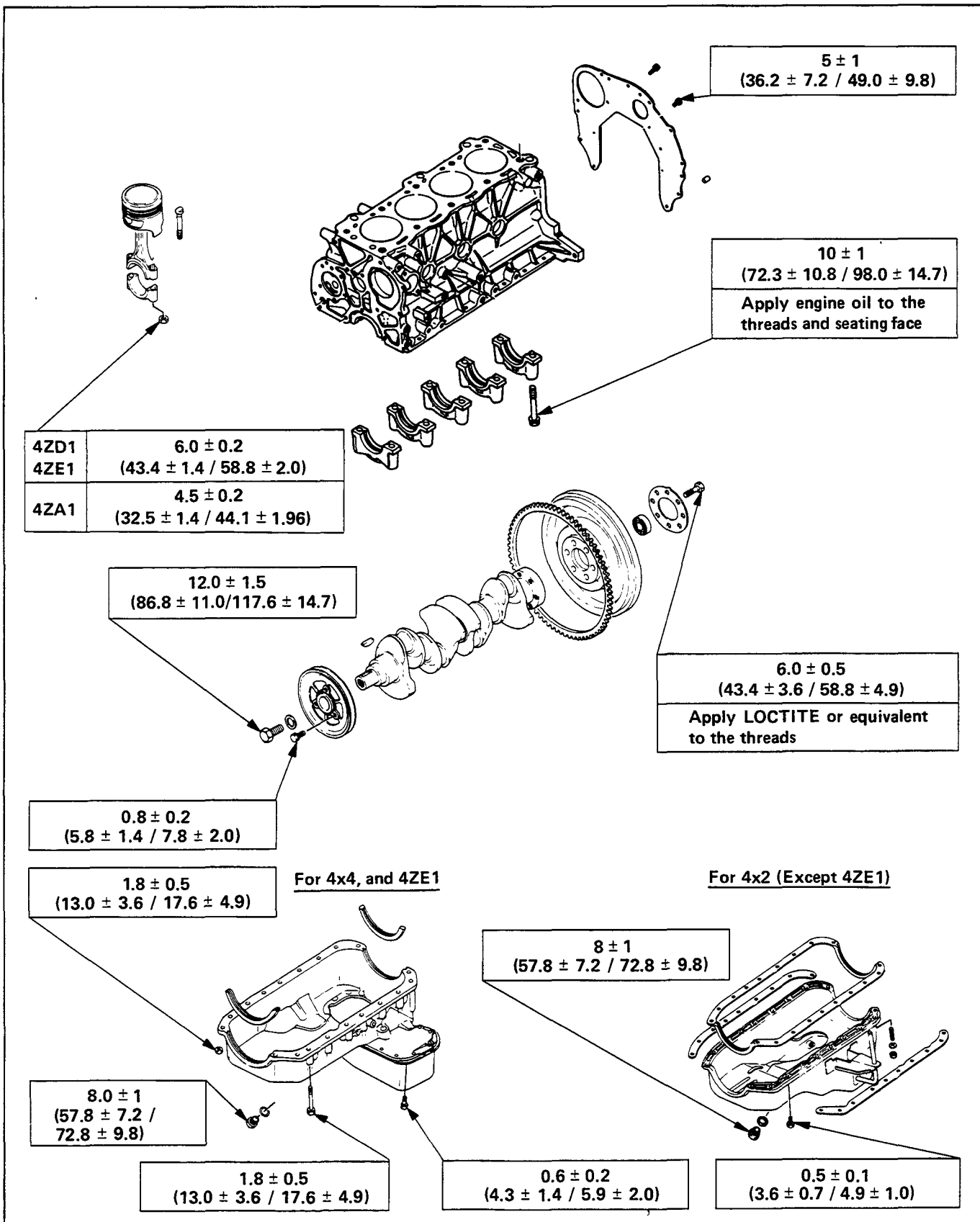
kg·m(lb.ft/N·m)



020402

Crankshaft Bearing Cap, Connecting Rod Bearing Cap, Crankshaft Damper Pulley, Flywheel, and Oil Pan

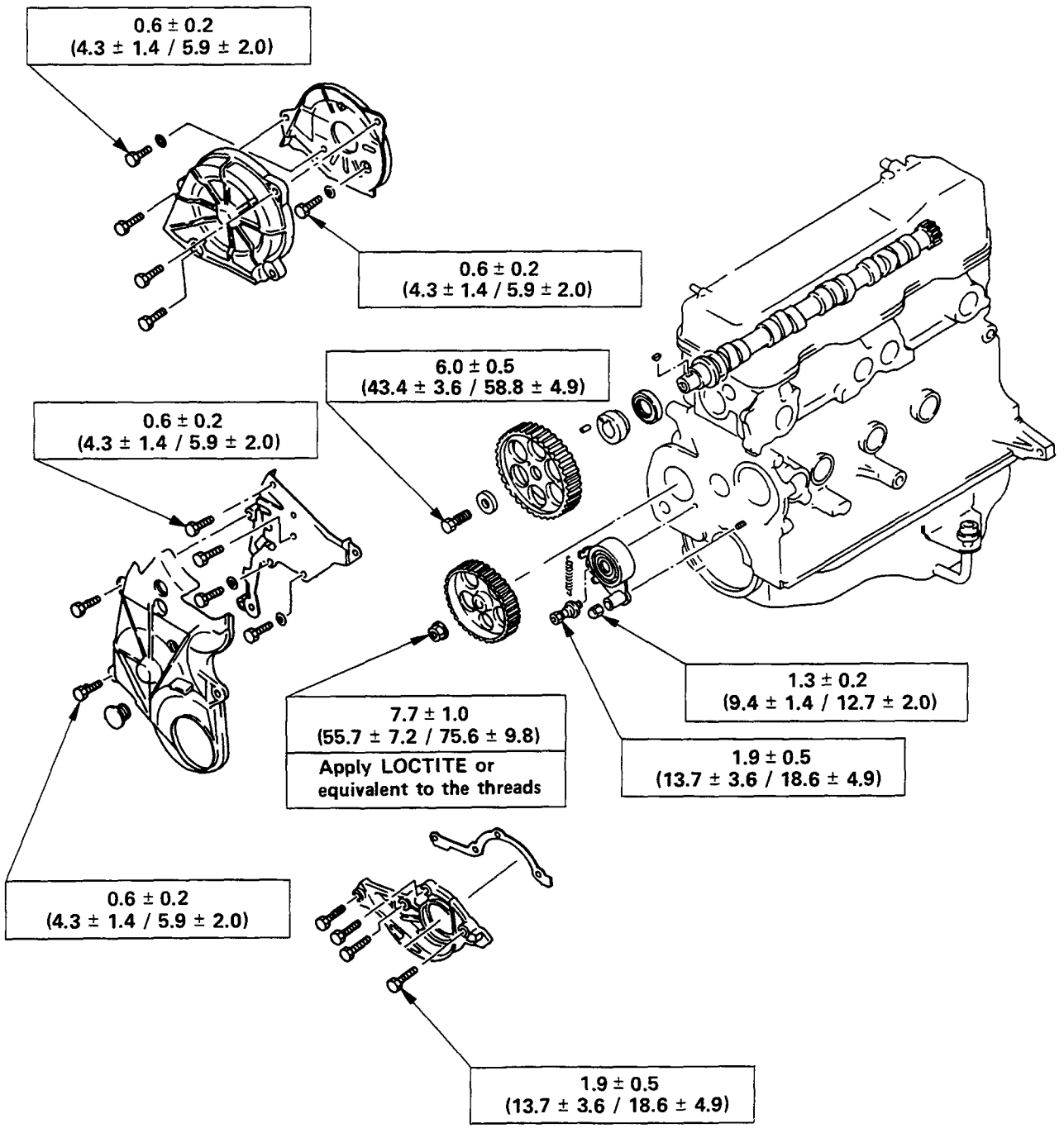
kg-m(lb.ft/N-m)



02040302

Timing Cover, Camshaft, and Timing Pulley

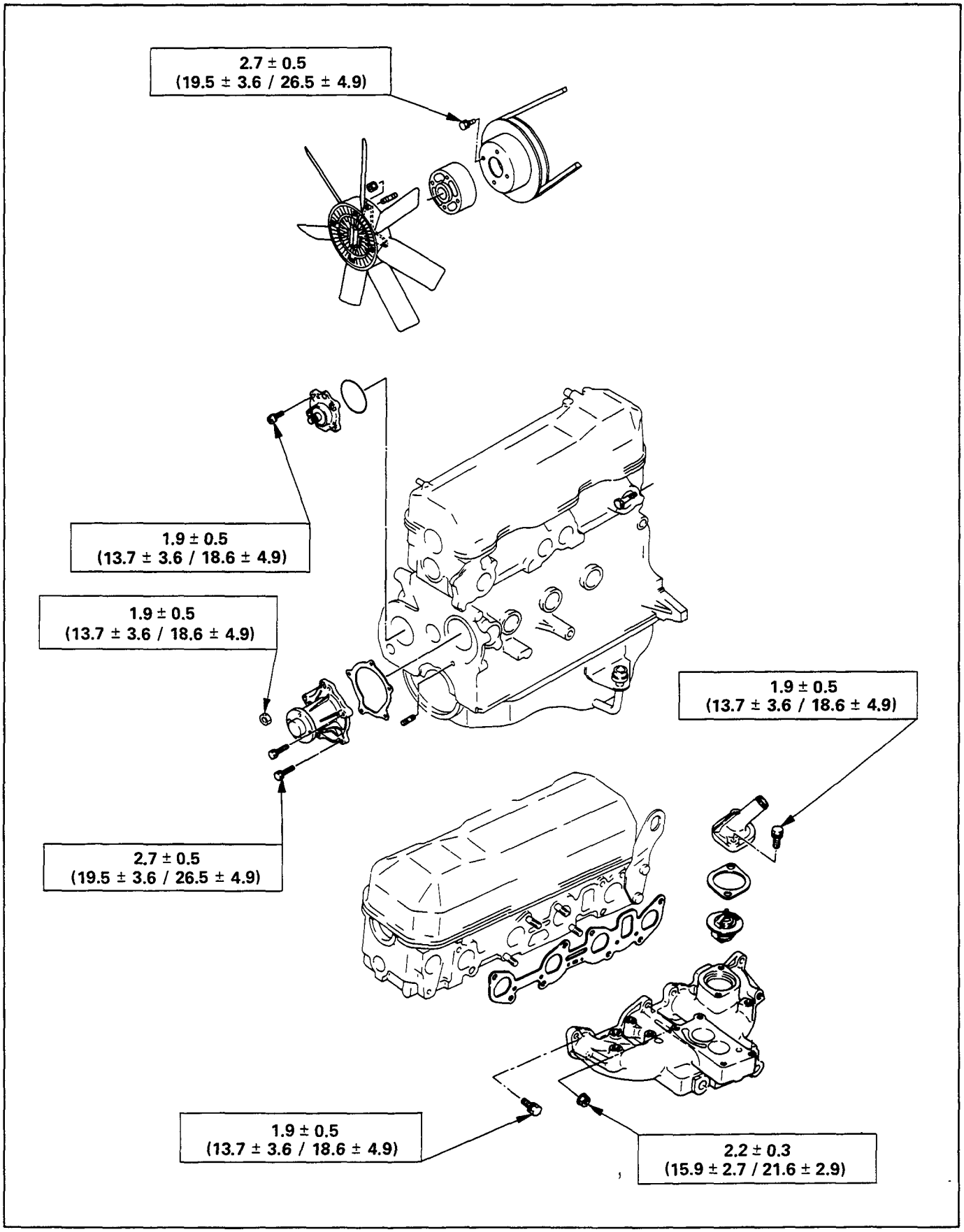
kg·m(lb.ft/N·m)



020404

Cooling and Lubricating System

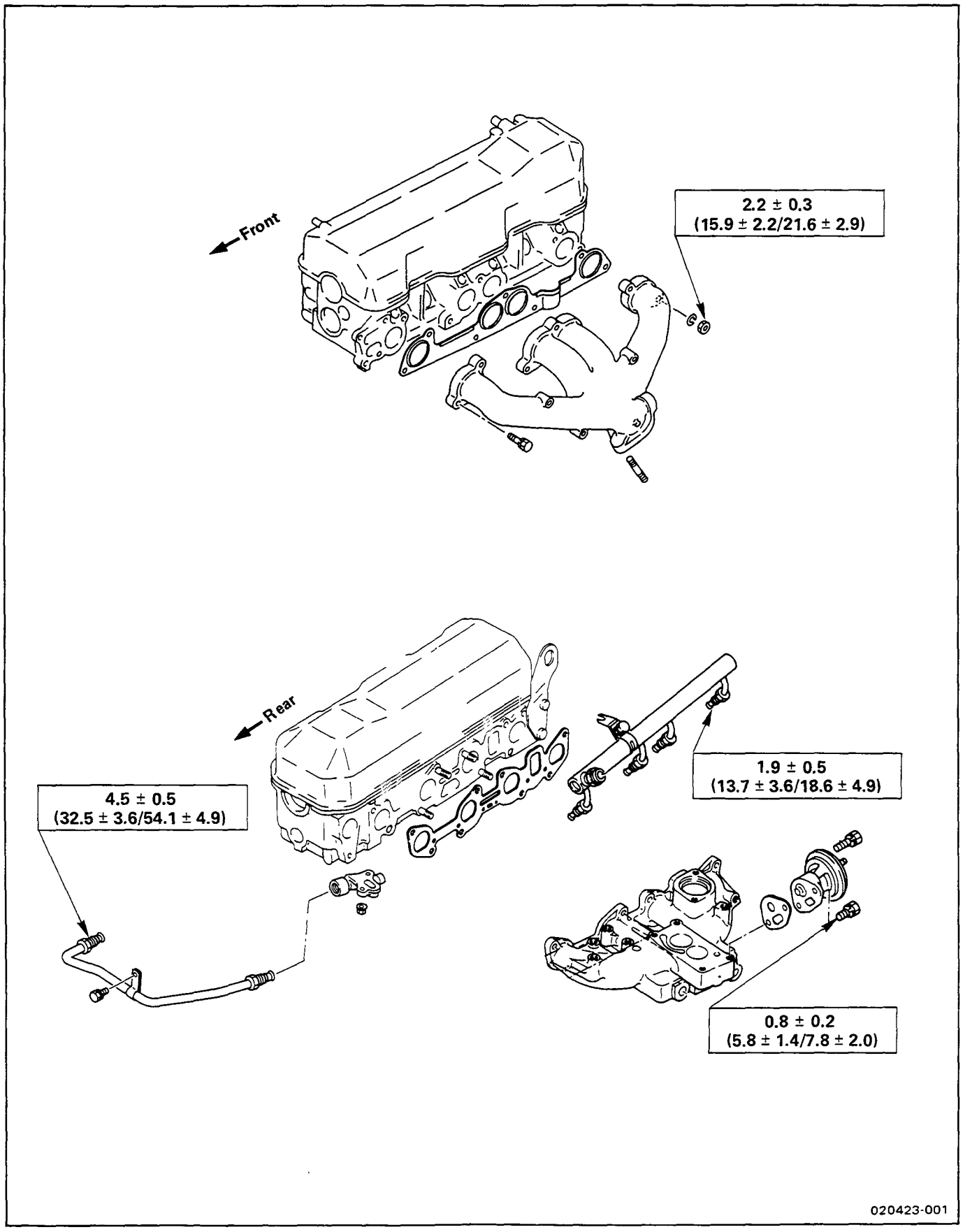
kg·m(lb.ft/N·m)



02040501

Intake and Exhaust System

kg·m(lb.ft/N·m)

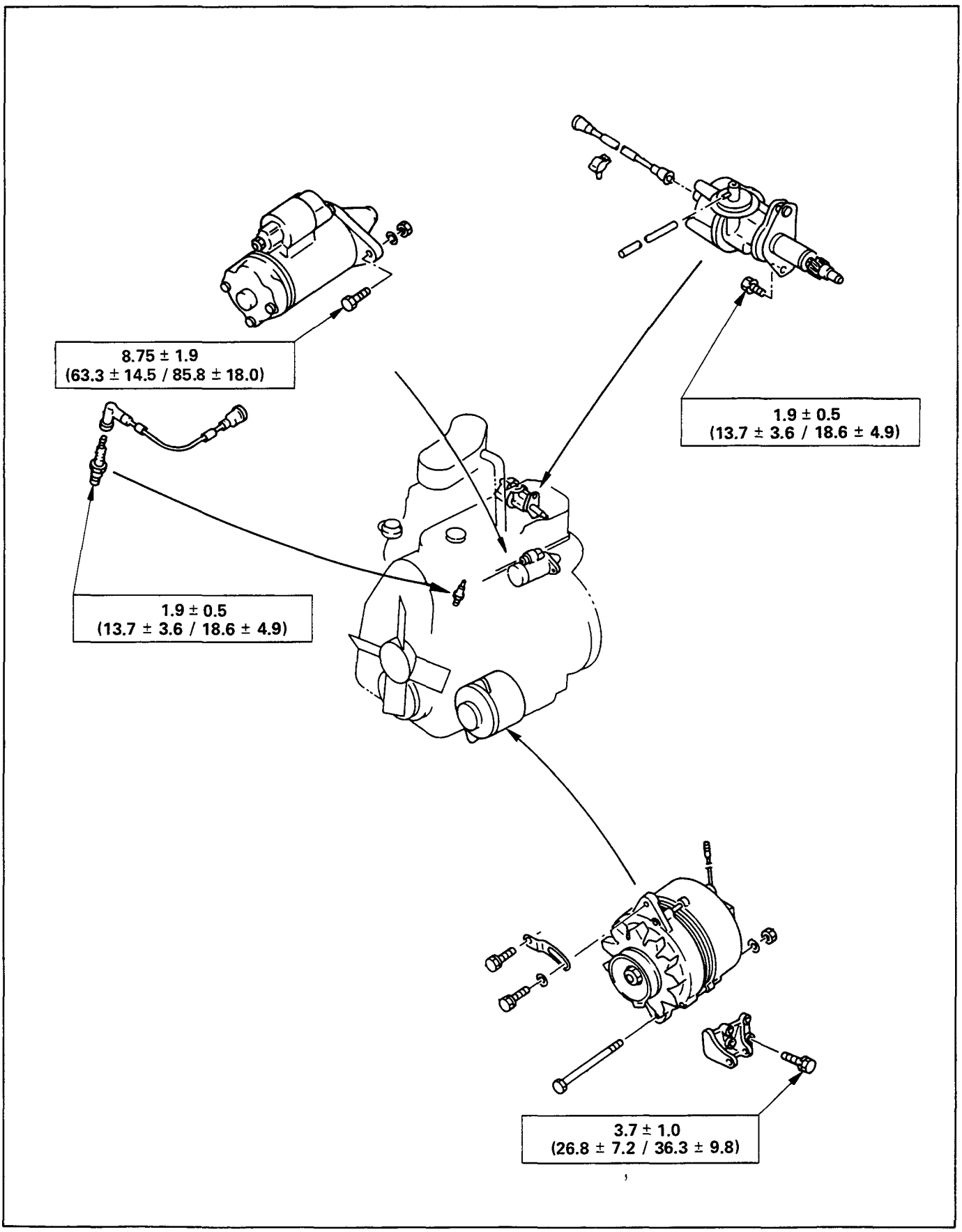


020423-001

020407

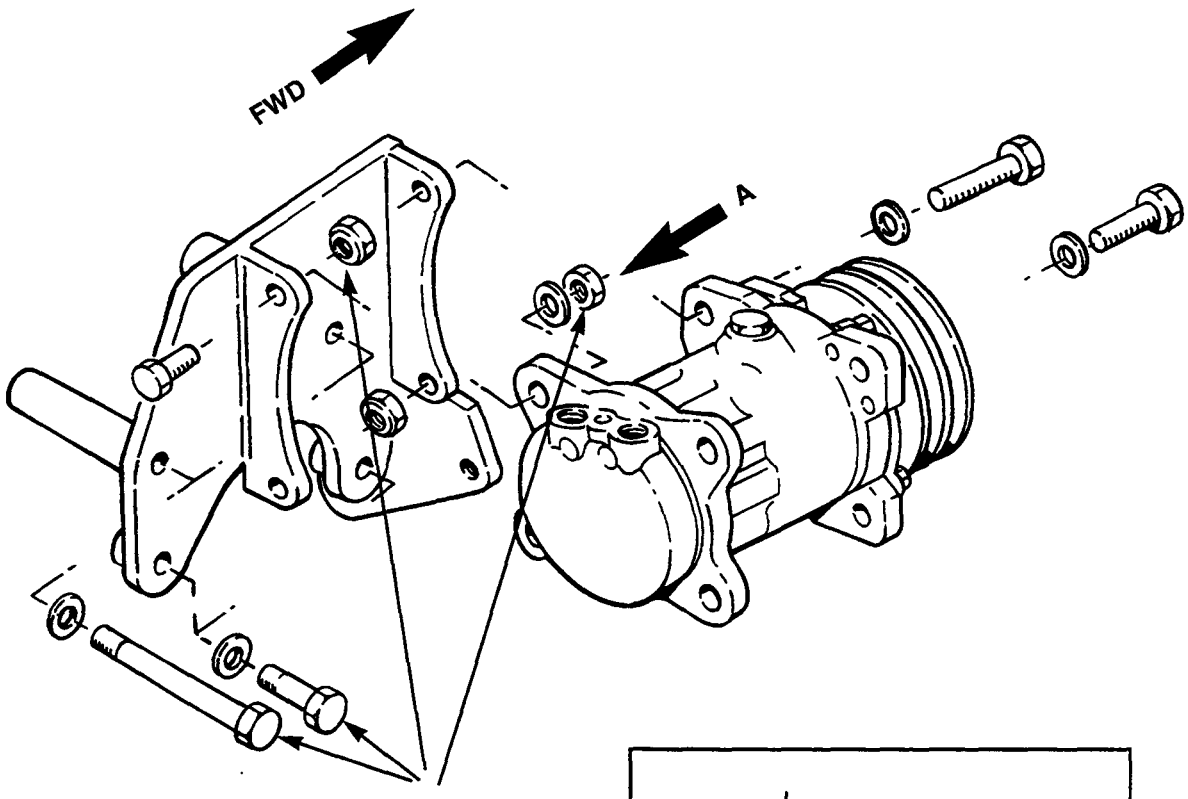
Engine Electricals

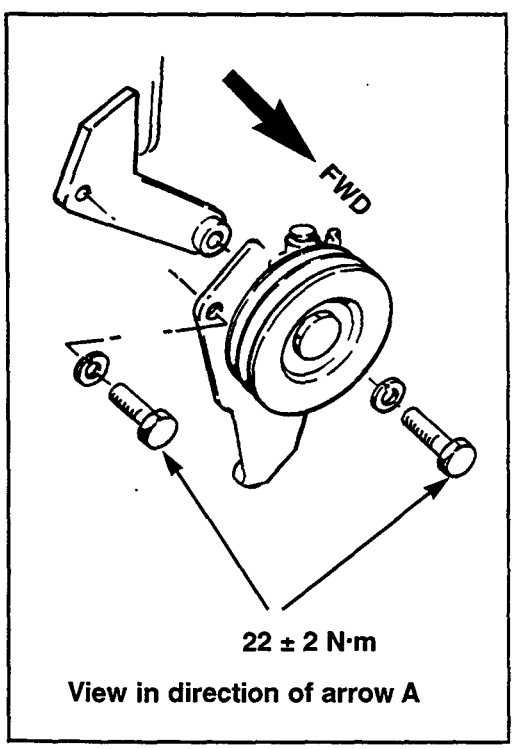
kg·m(lb.ft/N·m)



Compressor Bracket and Oil Pump Bracket

kg•m(lb•ft/N•m)

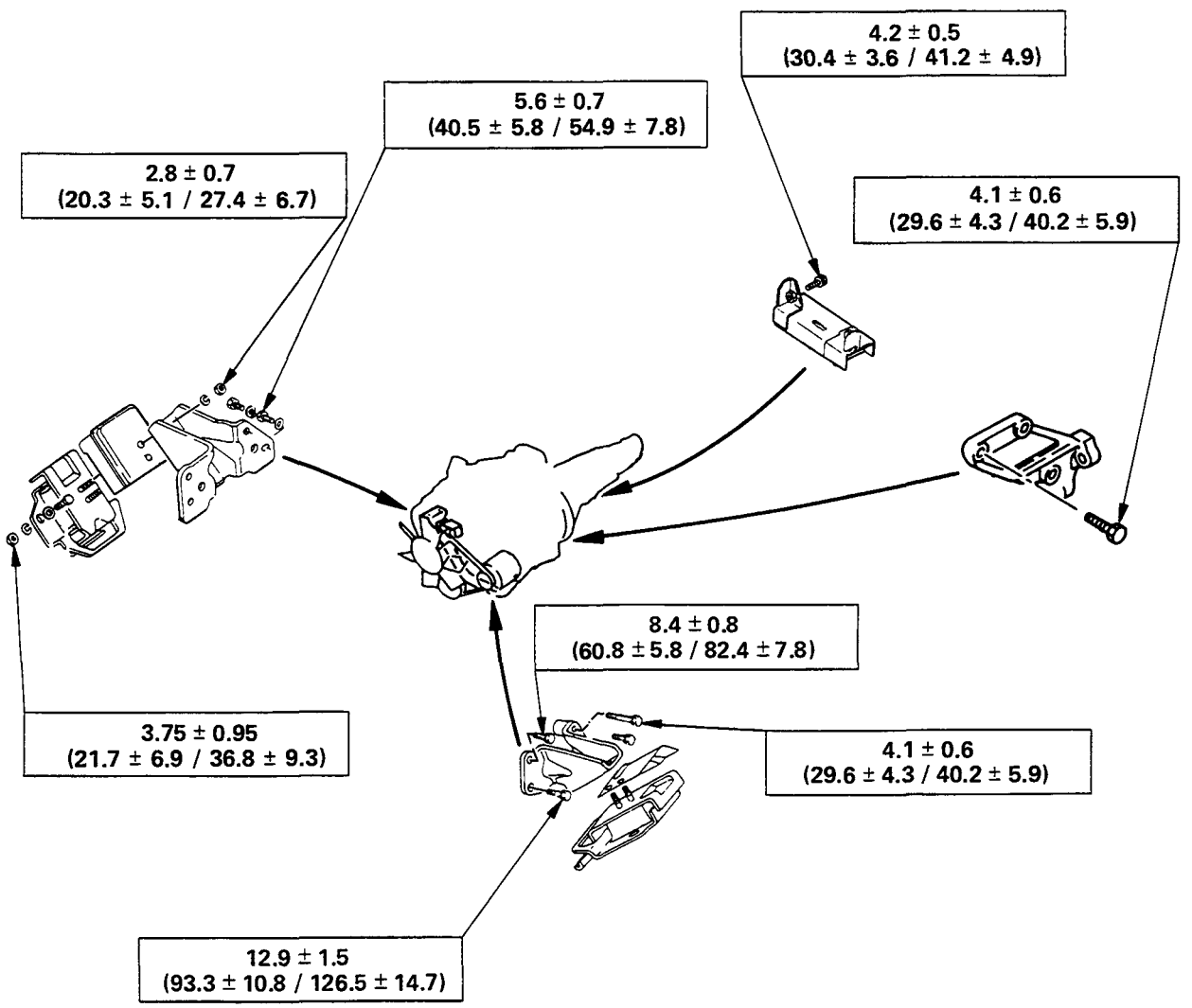




02041001

Engine Mounting Bracket and Engine Stiffener

kg·m(lb.ft/N·m)



1600

RECOMMENDED LIQUID GASKET

Type	Brand Name	Manufacturer	Remarks
RTV* Silicon Base	ThreeBond 1207B ThreeBond 1207C	Three Bond Three Bond	
Water Base	ThreeBond 1141E	Three Bond	
Solvent	ThreeBond 1104 BelcoBond 4 BelcoBond 401 BelcoBond 402	Three Bond Isuzu Isuzu Isuzu	
Anaerobic	LOCTITE 515 LOCTITE 518	Loctite Loctite	Recommended for transaxle repairs

* RTV : Room Temperature Vulcanizer

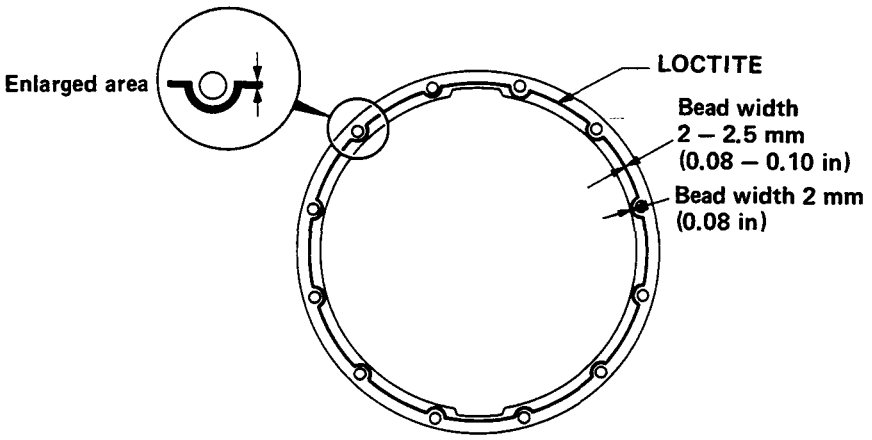
Note:

1. **It is very important that the liquid gaskets listed above or their exact equivalent be used on the vehicle.**
2. **Be careful to use the specified amount of liquid gasket.**
   Follow the manufacturer's instructions at all times.
3. **Be absolutely sure to remove all lubricants and moisture from the connecting surfaces before applying the liquid gasket.**
   The connecting surfaces must be perfectly dry.
4. **LOCTITE 515 and LOCTITE 518 harden upon contact with a metal surface.**
   Do not apply LOCTITE 515 or LOCTITE 518 between two metal surfaces having a clearance of greater than 0.25 mm (0.01 in). Poor adhesion will result.

1700

LOCTITE APPLICATION PROCEDURE

<table>
<tr><th>LOCTITE Type</th><th>LOCTITE Color</th><th>Application Steps</th></tr>
<tr><td>LOCTITE 242</td><td>Blue</td><td rowspan="3">1. Completely remove all lubricant and moisture from the bolts and the female threaded surfaces of the parts to be joined.
The surfaces must be perfectly dry.
2. Apply LOCTITE to the bolts.
 

3. Tighten the bolts to the specified torque.
4. Wait at least one hour before continuing the installation procedure.</td></tr>
<tr><td>LOCTITE 262</td><td>Red</td></tr>
<tr><td>LOCTITE 270</td><td>Green</td></tr>
<tr><td>LOCTITE 271</td><td>Red</td><td rowspan="2">1. Completely remove lubricant and moisture from the connecting surfaces.
The surfaces must be perfectly dry.
2. Apply a 2.0 — 2.5 mm (0.08 — 0.10 in.) bead of LOCTITE to one of the connecting surfaces.
There must be no gaps in the bead.
 

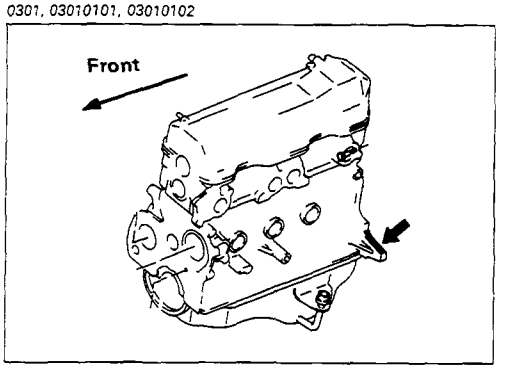
3. Tighten the bolts to the specified torque.
4. Let the joined parts set for at least thirty minutes.</td></tr>
<tr><td>LOCTITE 515</td><td>Violet</td></tr>
</table>

0300

SERVICING

Servicing refers to general maintenance procedures to be performed by qualified service personnel.

0301, 03010101, 03010102

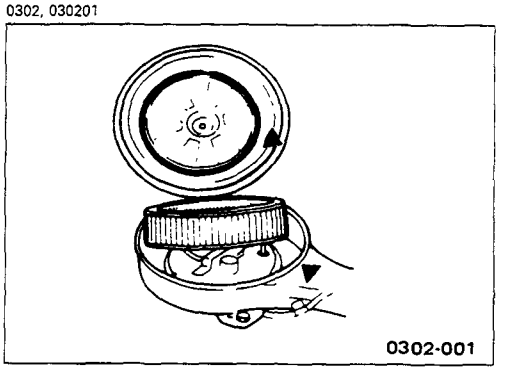


MODEL IDENTIFICATION

Engine Number

The engine number is stamped on the protrusion at the rear left hand side of the cylinder block.

0302, 030201



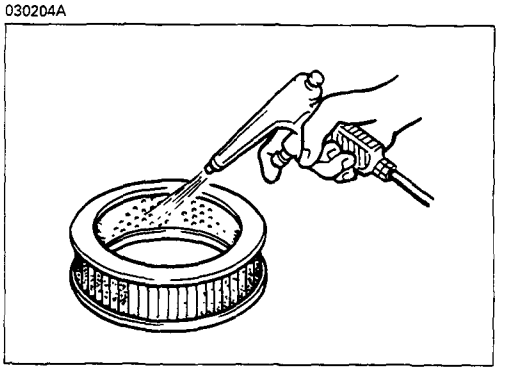
AIR CLEANER

Oil Wetted (Viscous) Type Paper Element

The air cleaner has an oil wetted paper element. No servicing is required until the replacement interval is reached.

Never attempt to clean the element, no matter how dirty it may appear. The element is designed to provide normal filtering efficiency until it becomes due for replacement.

030204A

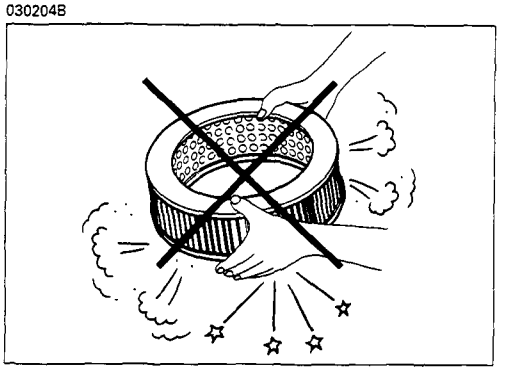


Dry Type Paper Element

Apply compressed air to the inside of the element as you rotate it with your hand. This will blow the dust free.

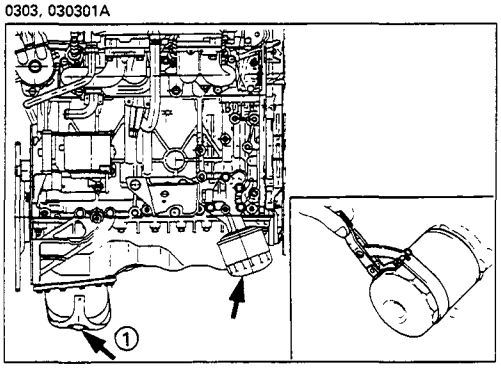
Compressed Air Pressure	kg/cm²(psi/kPa)
4–5 (56.9–71.1/392.3–490.3)	

030204B



Do not bang the element against another object in an attempt to clean it. Damage to the element will result.

0303, 030301A



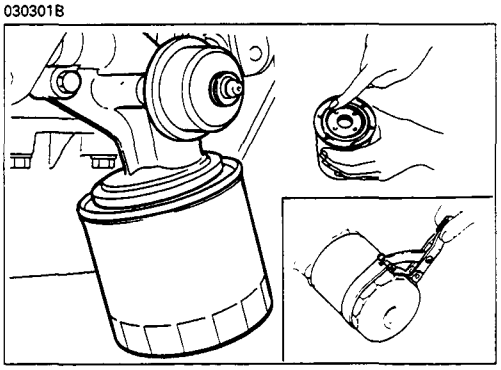
LUBRICATING SYSTEM

Oil Filter

Replacement Procedure

1. Loosen the drain plug ① to drain the engine oil.
2. Wait a few minutes and then retighten the drain plug with new gasket.
3. Loosen the used oil filter by turning it counterclockwise with the filter wrench.

030301B

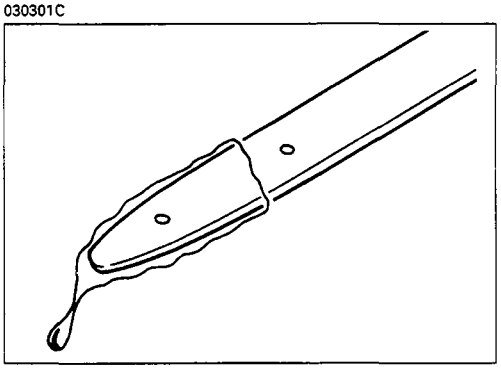


4. Clean the oil filter adapter fitting face.

   This will allow the new oil filter to seat properly.
5. Apply a light coat of engine oil to the O-ring.
6. Turn in the new oil filter until the filter O-ring is fitted against the sealing face.
7. Use the filter wrench to turn in the filter an additional 1 turn.

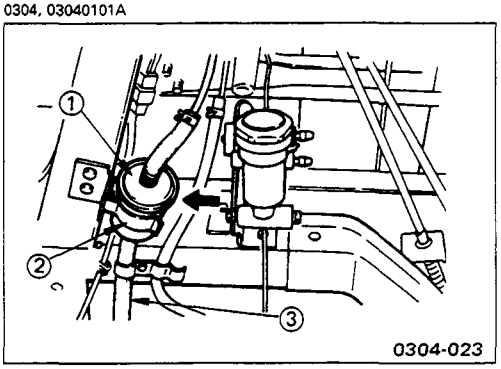
   Filter Wrench : 5-8840-0203-0

030301C



8. Check the engine oil level and replenish to the specified level if required.
9. Start the engine and check for oil leakage from the drain plug and main oil filter, then turn it off. After several minutes, recheck the engine oil level.

0304, 03040101A

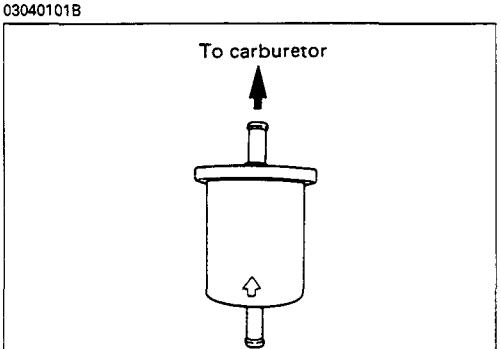


FUEL SYSTEM

Fuel Filter Replacement

1. Remove the fuel filter ① from the filter clip ②.
2. Disconnect the inlet and outlet fuel hoses ③ from the fuel filter.

03040101B

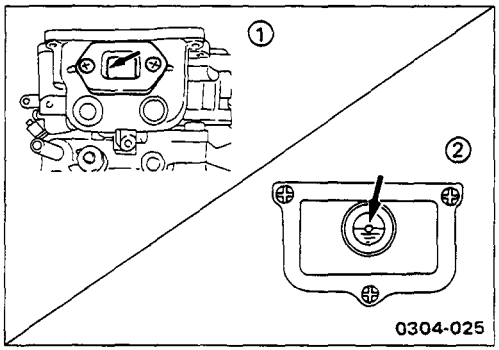


3. Connect the inlet and outlet fuel hoses to the new fuel filter.

   Be sure to connect the fuel hoses in their correct positions.
4. Install the fuel filter to the filter clip.
5. Start the engine.

   Check for fuel leakage from the fuel hoses.

030409, 03040901A



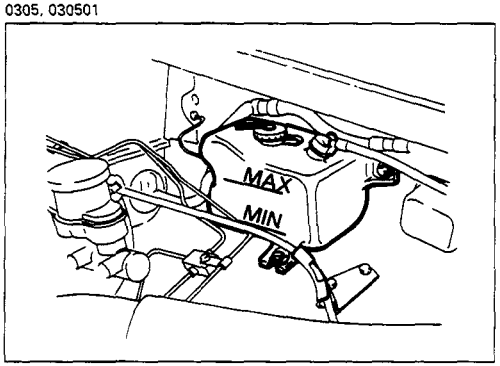
Carburetor

Float Level Inspection and Adjustment

Check the float level against the float level mark on the float chamber (Nikki) ①, and float level glass (Hitachi) ②.

If required, adjust the float level by carefully bending the float seat.

0305, 030501



COOLING SYSTEM

Coolant Level

Check the coolant level and replenish the radiator surge tank as necessary.

If the coolant level falls below the "MIN" line, carefully check the cooling system for leakage. Then add enough coolant to bring the level up to the "MAX" line.

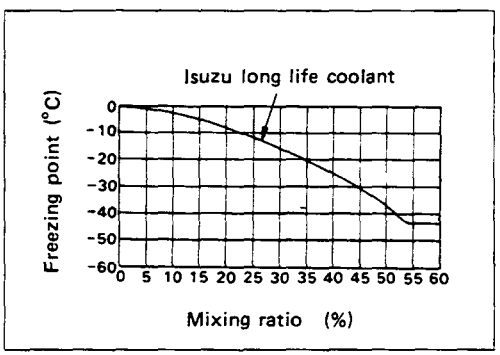
Note:

Do not overfill the reserve tank.

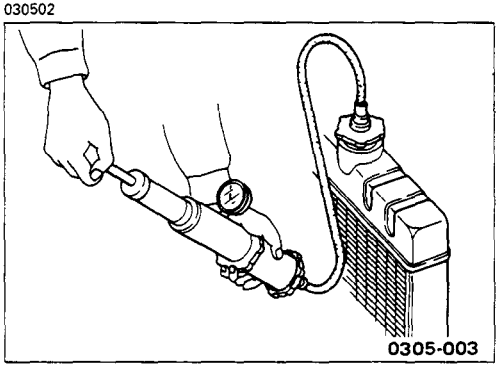
Remove the radiator filler cap only when absolutely necessary.

Always check the coolant level when the engine is cold.

Always refer to the chart at the left to determine the correct cooling water to antifreeze solution mixing ratio.



030502

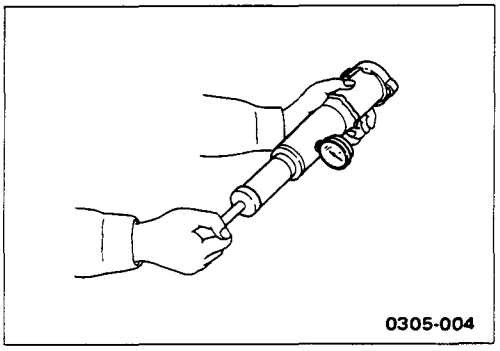


Cooling System Inspection

Install a radiator filler cap tester to the radiator. Apply testing pressure to the cooling system to check for leakage. The testing pressure must not exceed the specified pressure.

Testing Pressure	kg/cm^2 (psi/kPa)
	2 (28.45/196)

030503



Radiator Cap Inspection

The radiator filler cap is designed to maintain coolant pressure in the cooling system at 1.05 kg/cm² (15 psi/ 103 kPa).

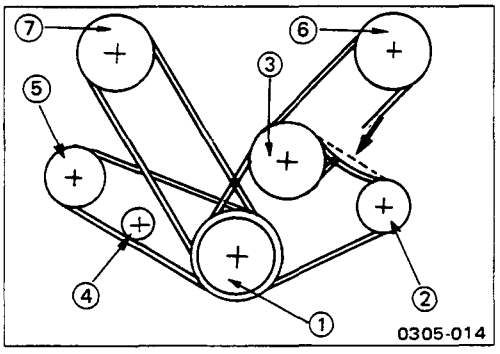
Check the radiator filler cap with a radiator filler cap tester. The radiator filler cap must be replaced if it fails to hold the specified pressure during the test procedure.

Radiator Filler Cap Pressure

Pressure Valve	kg/cm² (psi/kPa)
0.9 – 1.2 (12.8 – 17.1/88 – 118)	

Negative Valve (Reference)	kg/cm² (psi/kPa)
0.01 – 0.04 (0.14 – 0.57/0.98 – 3.90)	

03050402



Drive Belt Adjustment

Check the drive belt tension.

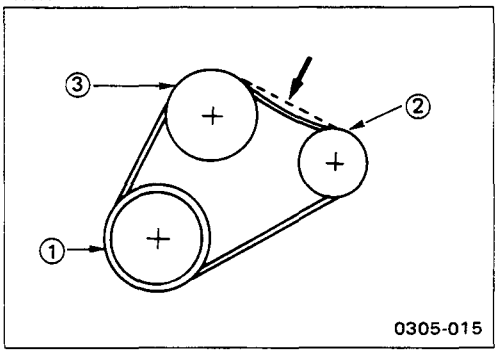
Depress the drive belt mid-portion with a 10 kg (22 lb/ 98 N) force.

Drive Belt Deflection	mm(in)
Except power steering	10 (0.39)
Only power steering	14 (0.55)

Check the drive belt for cracking and other damage.

① Crankshaft pulley
② Alternator pulley
③ Cooling fan pulley
④ Compressor idler pulley
⑤ Compressor pulley
⑥ Air pump pulley
⑦ Power steering oil pump pulley

030505



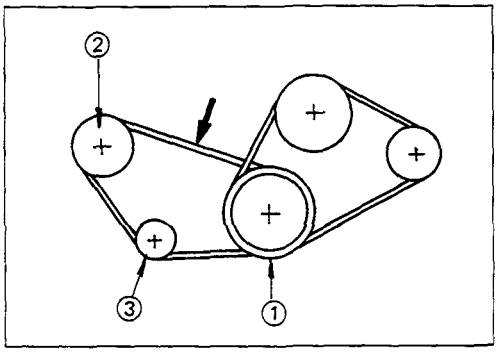
Cooling Fan Pulley Drive Belt

Fan belt tension is adjusted by moving the alternator.

Depress the drive belt mid-portion with a 10 kg (22 lb/ 98 N) force.

① Crankshaft pulley
② Alternator pulley
③ Cooling fan pulley

03050602



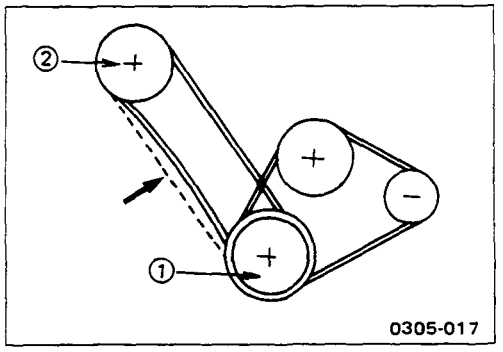
Compressor Pulley Drive Belt

Move the idler pulley to adjust the compressor drive belt tension.

Depress the drive belt mid-portion with a 10 kg (22 lb/ 98 N) force.

① Crankshaft pulley
② Compressor pulley
③ Idler pulley

03050702



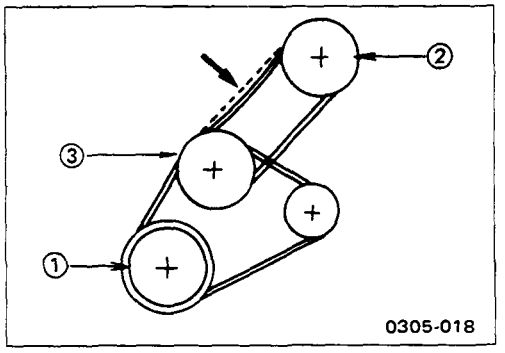
Power Steering Oil Pump Pulley Drive Belt

Move the oil pump to adjust the oil pump pulley drive belt tension.

Depress the drive belt mid-portion with a 10 kg (22 lb/ 98 N) force.

① Crankshaft pulley
② Oil pump pulley

030508

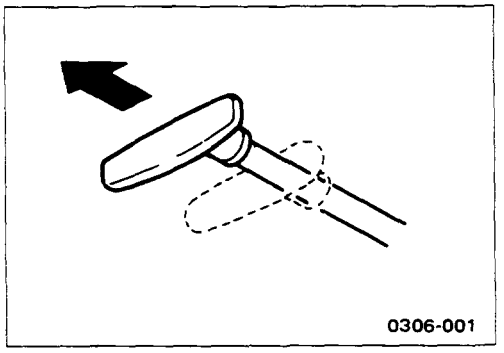


Air Pump Pulley Drive Belt

Move the air pump to adjust the air pump pulley drive belt tension.

① Crankshaft pulley
② Air pump pulley
③ Cooling fan pulley

0306



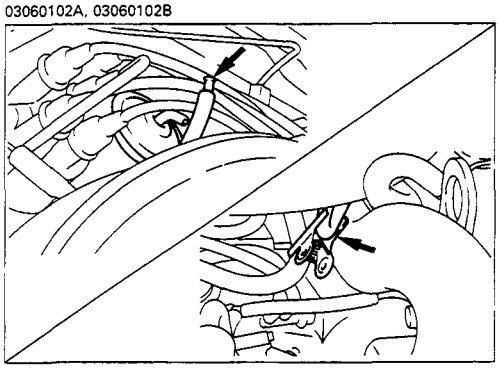
ENGINE CONTROL

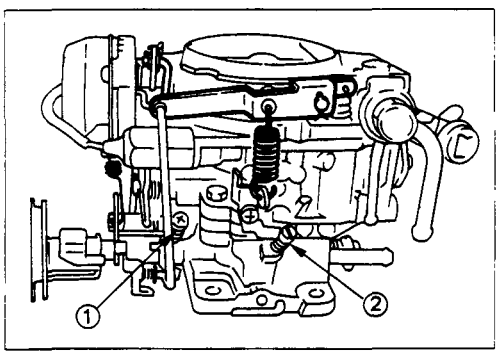
Idling Speed and Mixture Adjustment Preparation

1. Set the parking brake and chock the drive wheels.
2. Place the transmission in neutral.
3. Start the engine and allow it to warm up.
4. Check that all the accessory switches are off and that the choke valve is fully open.
5. Set a tachometer to the engine.
6. Check the ignition timing and adjust it if required.

Ignition Timing (BTDC)	deg/rpm
From '91, switzerland & Sweden (4ZD1)	6/900
Other	6/800

03060102A, 03060102B





Idling Speed Adjustment (Nikki Carburetor)

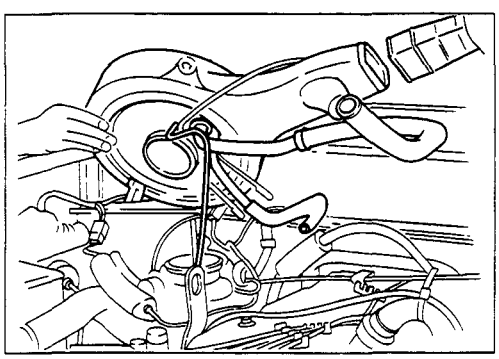
1. Disconnect the distributor vacuum hose and plug the hose end.
2. Bend the attached rubber hose to close off the thermo valve vacuum line.
3. Set the throttle adjusting screw ① to the specified idling speed.
4. Turn the idle adjusting screw ② to peak the engine speed.

Idle screw adjuster (If required); 8-9421-6632-0

5. Reset the throttle adjusting screw to lower the idling speed to 20 rpm below the specified level.
6. Turn the idle adjusting screw counterclockwise to raise the idling speed to the specified level.

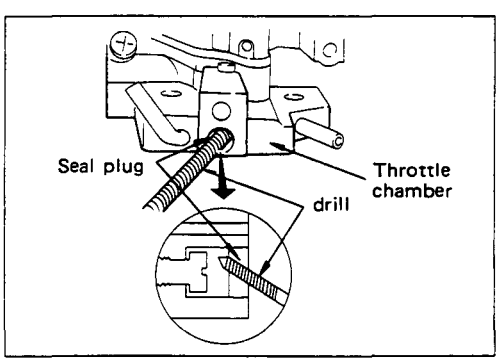
Engine Idling Speed	rpm
800	

7. Reconnect the distributor vacuum hose and the idle compensator vacuum hose to the carburetor after completing the adjustment procedure.

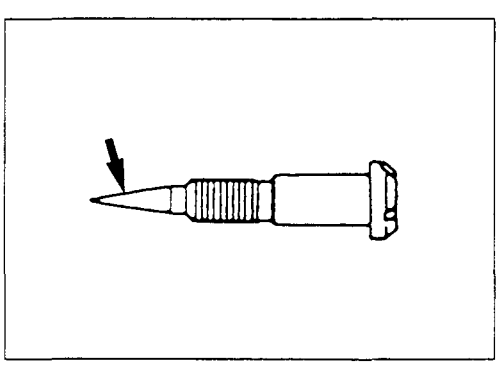


Idle Mixture Adjustment (Hitach carburetor) (Until '90 Swiss & Sweden, and From '92 Chili models)

1. Remove the air cleaner.
2. Tag each of the vacuum hoses leading to the carburetor.
3. Disconnect the harness connectors and the vacuum hoses at the carburetor.



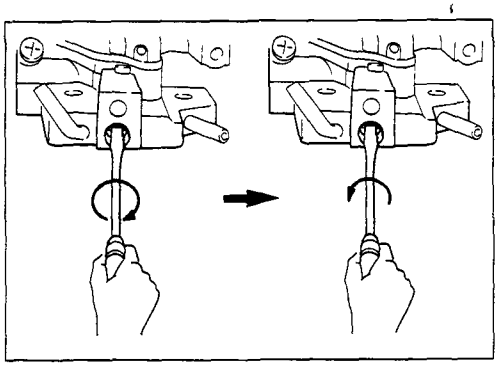
4. Remove the carburetor assembly. Drill a hole in seal plug with proper tool.



5. Remove the idle adjusting screw from the throttle chamber.
6. Inspect the idle adjusting screw.

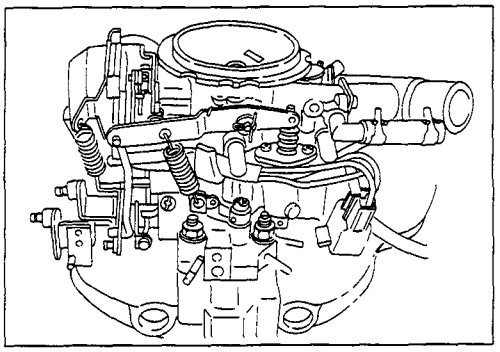
   If the adjusting screw head has been damaged by the drill, the screw must be replaced with a new one.

   If the adjusting screw taper is excessively worn or stepped, the screw must be replaced with a new one.



7. Reinstall the idle adjusting screw to the throttle chamber.
8. Fully screw the idle adjusting screw into the throttle chamber.

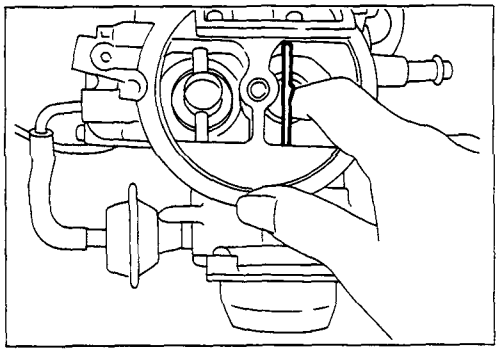
   Do not overtighten the screw.
9. Back off the idle adjusting screw 3 turns.



10. Reinstall the carburetor.
11. Reconnect the vacuum hoses and the harness connectors to the carburetor.

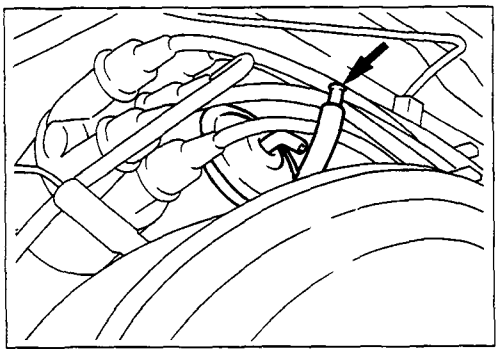
    Pay close attention to the tags applied at removal.

    Refer to "REMOVAL AND INSTALLATION" of the carburetor 6C.

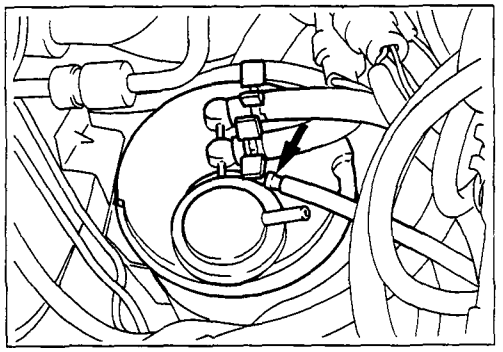


12. Reinstall the air cleaner.
13. Start the engine and allow it to idle until the cooling water reaches normal temperature.
14. Make sure that the choke valve is fully open.

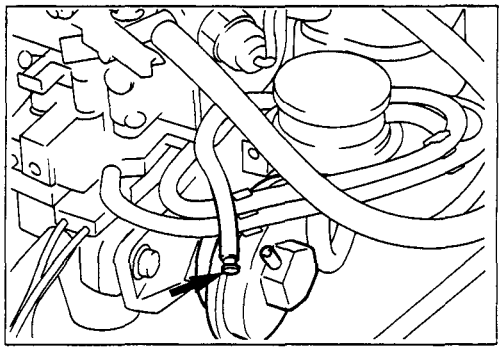
    If the choke valve is not fully open, open it.



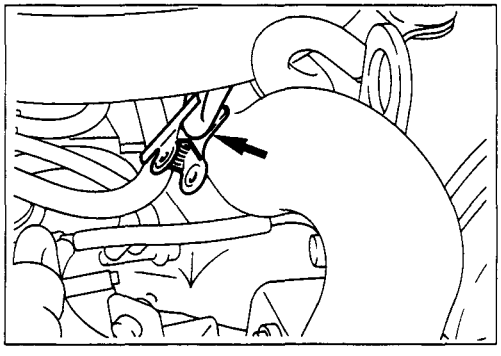
15. Make sure that the air conditioning system is off (if so equipped).
16. Move the front wheels to the straight ahead position (power steering equipped vehicle only).
17. Disconnect and plug the distributor line.



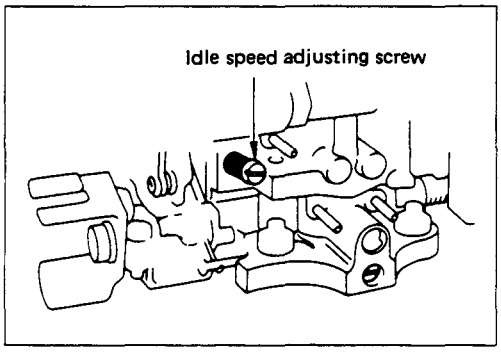
18. Disconnect and plug the canister purge line.



19. Disconnect and plug the EGR vacuum line.

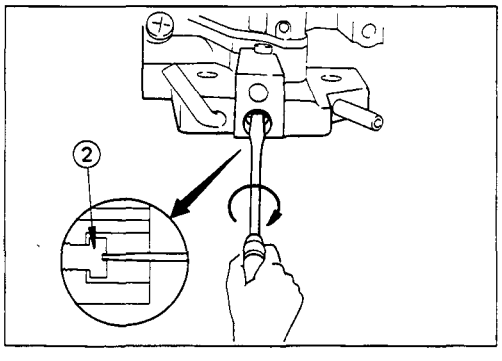


20. Bend the attached rubber hose to close off the idle compensator vacuum line.

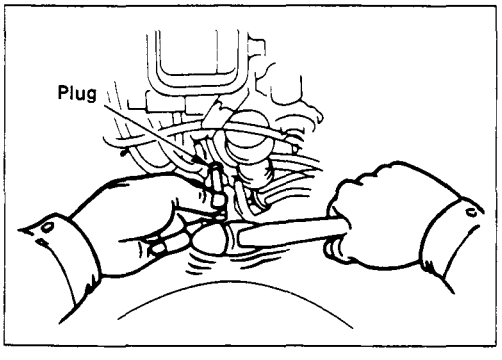


21. Use the throttle adjusting screw to adjust the idling.

Engine Idling Speed	rpm
800	

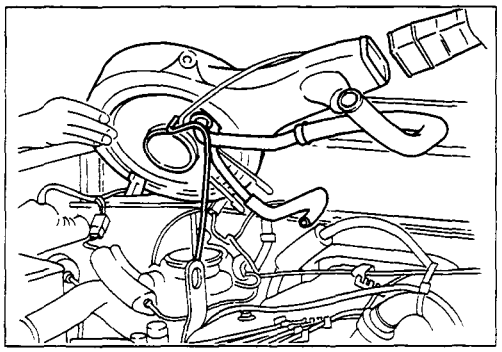


22. Adjust the setting of the idle adjusting screw ② to obtain the maximum speed.
23. Reset the throttle adjusting screw to 850 rpm.
24. Turn the idle adjusting screw clockwise (lean) until the engine idle speed is down to 800 rpm.



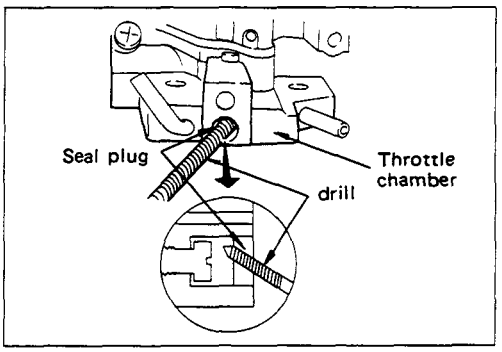
25. Remove the air cleaner.
26. Replace the idle adjusting screw plug.

    Tap the new plug in until it is flush with the carburetor surface.
27. Reinstall the air cleaner.

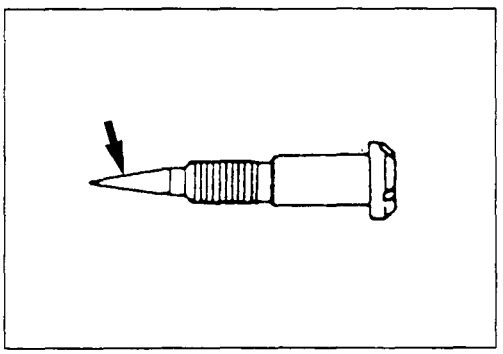


Idle Speed and Mixture Adjustment (Hitach carburetor)
(From '91 Swiss, Sweden & From '92 Germany models)

1. Remove the air cleaner.
2. Tag each of the vacuum hoses leading to the carburetor.
3. Disconnect the harness connectors and the vacuum hoses at the carburetor.

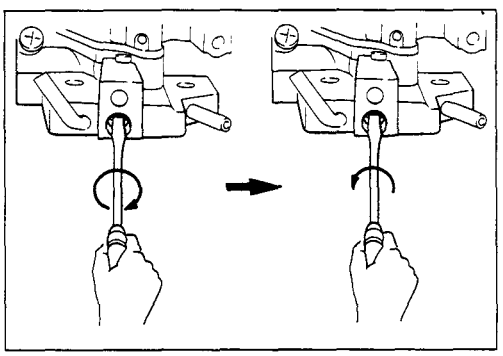


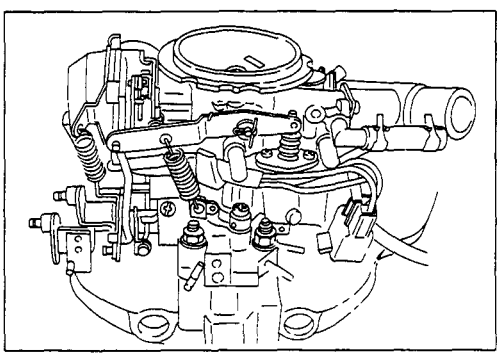
4. Remove the carburetor assembly. Drill a hole in seal plug with proper tool.



5. Remove the idle adjusting screw from the throttle chamber.
6. Inspect the idle adjusting screw.
   - If the adjusting screw head has been damaged by the drill, the screw must be replaced with a new one.
   - If the adjusting screw taper is excessively worn or stepped, the screw must be replaced with a new one.
7. Reinstall the idle adjusting screw to the throttle chamber.
8. Fully screw the idle adjusting screw into the throttle chamber.

   Do not overtighten the screw.
9. Back off the idle adjusting screw 3 turns.

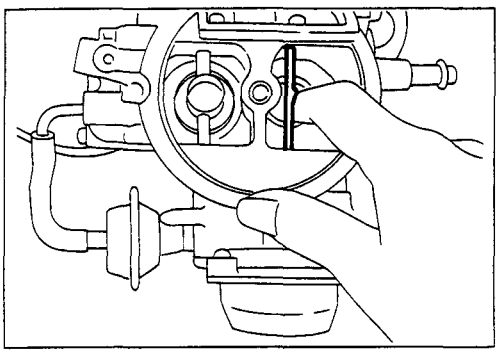




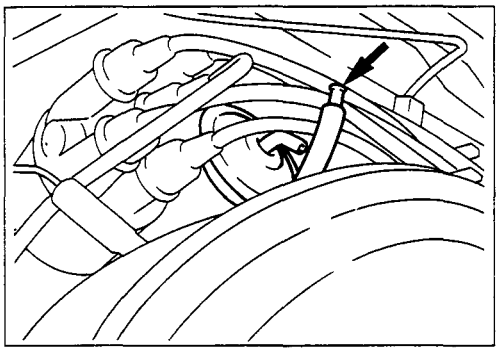
10. Reinstall the carburetor.
11. Reconnect the vacuum hoses and the harness connectors to the carburetor.

    Pay close attention to the tags applied at removal.

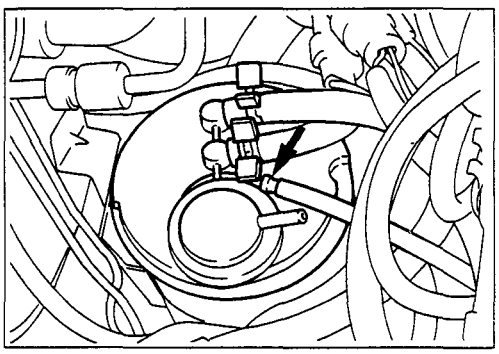
    Refer to "REMOVAL AND INSTALLATION" of the carburetor 6C.



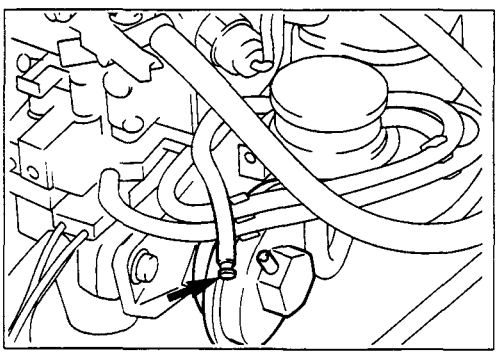
12. Reinstall the air cleaner.
13. Start the engine and allow it to idle until the cooling water reaches normal temperature.
14. Make sure that the choke valve is fully open.
    If the choke valve is not fully open, open it.



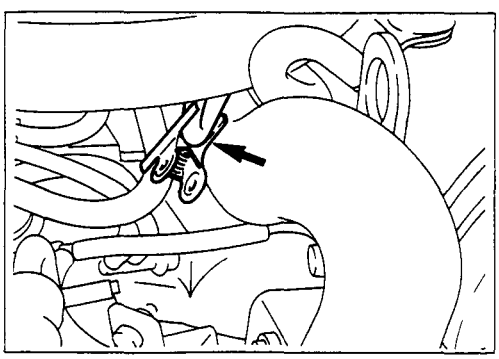
15. Make sure that the air conditioning system is off (if so equipped).
16. Move the front wheels to the straight ahead position (power steering equipped vehicle only).
17. Disconnect and plug the distributor line.



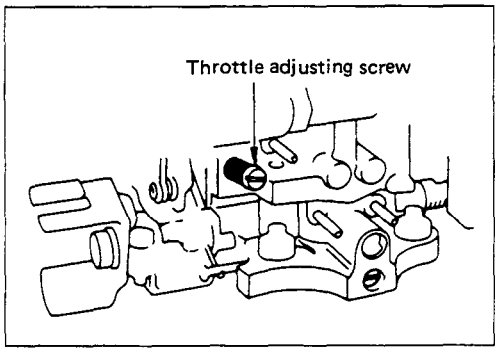
18. Disconnect and plug the canister purge line.



19. Disconnect and plug the EGR vacuum line.

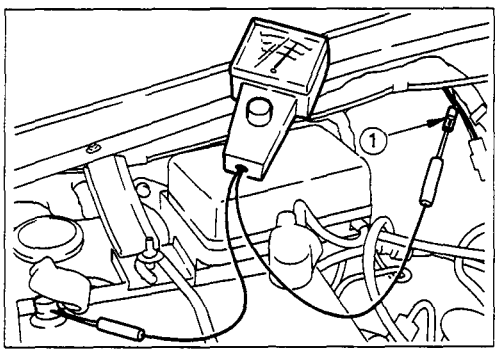


20. Bend the attached rubber hose to close off the idle compensator vacuum line.



21. Use the throttle adjusting screw to adjust the idling.

Engine Idling Speed	rpm
900	

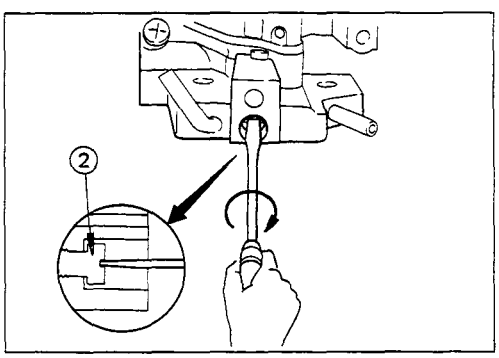


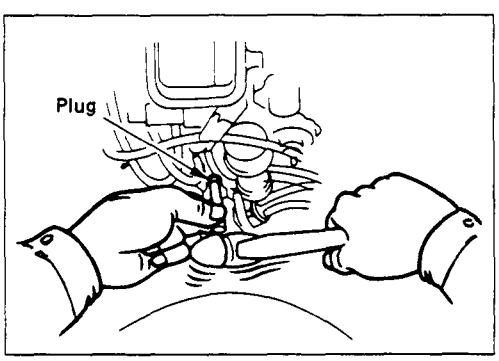
22. Use a dwell meter to measure the dwell.

    Connect the positive side of the meter to the monitor lead ① and the negative side of the meter to ground. After confirming dwell or duty to vary, adjust setting of idle adjusting screw ② to obtain an average dwell or duty as specified.

Dwell	Deg.
	Dwell Meter Reading (4-Cylinder Scale)
Average	36

    The dwell reading specified is the average of the most constant vibration.



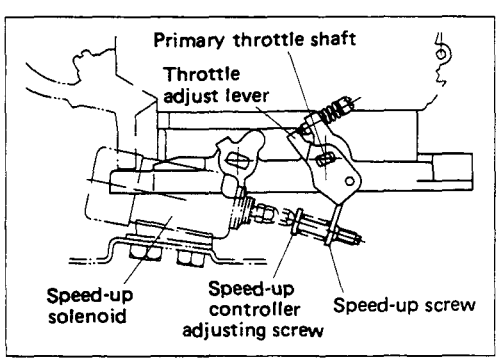


23. Use the throttle adjusting screw to reset the engine idling speed.

Engine Idling Speed	rpm
900	

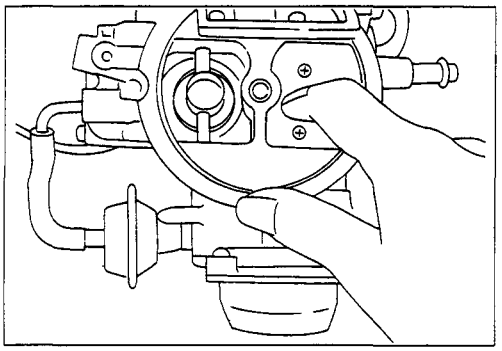
24. Remove the air cleaner.
25. Replace the idle adjusting screw plug.

    Tap the new plug in until it is flush with the carburetor surface.
26. Reinstall the air cleaner.

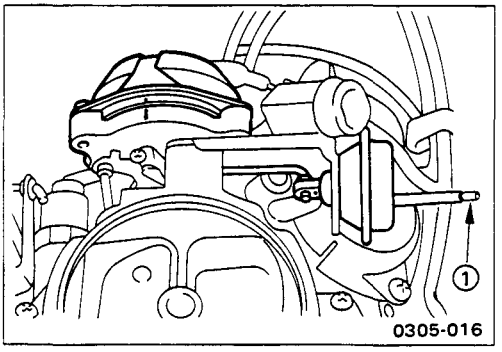


Idle Up Adjustment (If equipped)

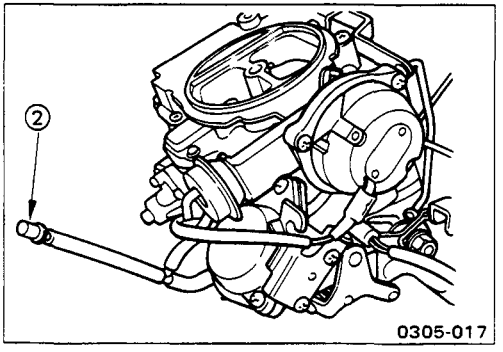
1. Start the engine and allow it to warm up.
2. Turn "ON" airconditioner.
3. Turn the speed-up screw to 900 rpm.



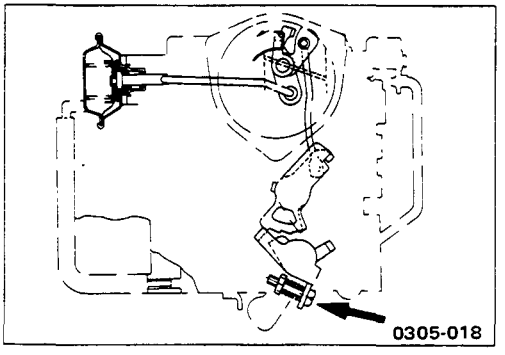
030608A



030608B



03060202



Fast Idling Speed Adjustment Preparation

1. Set the parking brake and chock the drive wheels.
2. Place the transmission in neutral.
3. Remove the air cleaner and while holding the throttle slightly open, push the choke the valve closed, and hold it closed as you release.
4. Disconnect the vacuum hose ① from the choke piston and plug the hose end.
5. Disconnect the EGR system thermal vacuum hose ② from the carburetor and plug the hose end.
6. Check that all the accessory switches are off.

Fast Idling Speed Adjustment

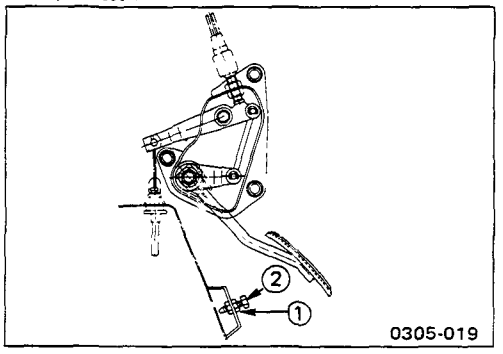
1. Start the engine and allow it to warm up.
   Do not depress the accelerator pedal.
2. Set a tachometer to the engine.
3. Check the fast idling speed.

Fast Idling Speed	rpm
2,700 – 3,000	

If the fast idling speed is outside the specified range, adjust it with the fast idle adjusting screw.

4. Reconnect the vacuum hose to the choke piston and install the air cleaner after completing the adjustment procedure.

030609, 03060901A



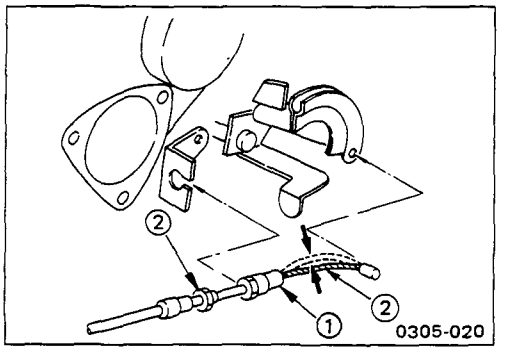
Engine Control Adjustment

Accelerator Pedal Adjustment

Adjustment of the accelerator pedal height is not required.

1. Loosen the pedal stopper bolt lock nut ①.
2. Tighten the pedal stopper bolt ② to prevent it from interfering with the accelerator pedal.

03060901B

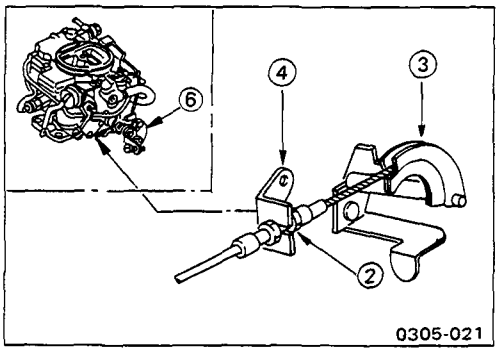


Engine Control Cable Adjustment

1. Fully close the throttle valve.
2. Turn the adjusting nut ① to adjust the engine control inner cable play ②.

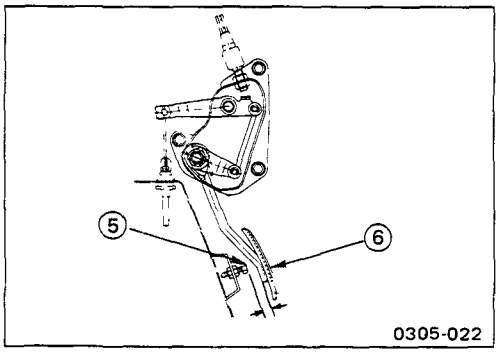
Engine Control Inner Cable Play	mm(in)
Approximately 2 — 3 (0.079 — 0.120)	

03060901C



3. Connect the engine control cable to the throttle holder ③.
4. Install the engine control cable to the bracket ④.
5. Tighten the lock nut ②.

03060901D



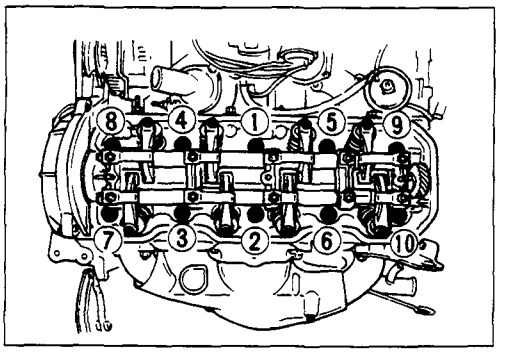
6. Fully open the throttle valve.
7. Adjust the clearance between the stopper bolt pad ⑤ and the accelerator pedal ⑥.

Accelerator Pedal and Bolt Pad Clearance	mm(in)
0 — 3 (0 — 0.12)	

8. Fully depress the accelerator pedal.

   Check that the throttle valve is fully open when the pedal is fully depressed.

0307, 030701



CYLINDER HEAD BOLT

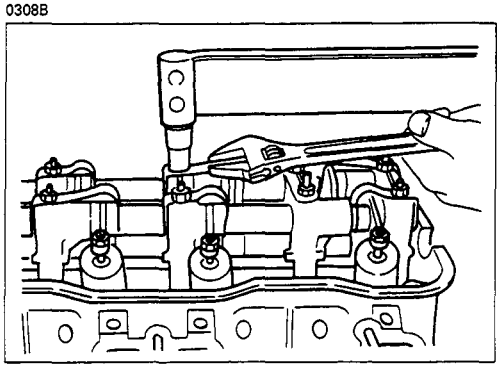
Cylinder Head Bolt Tightening Torque Inspection

Use the torque wrench to check the cylinder head bolt tightening torque in the sequence shown in the illustration before adjusting the valve clearances.

Head Bolt Wrench: 9-8511-4209-0

Cylinder Head Bolt Torque	kg·m(ft.lbs/N·m)
10 ± 1 (72.3 ± 7.2/98.0 ± 9.8)	

0308B



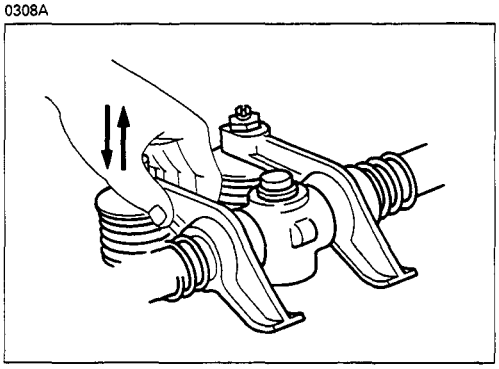
VALVE CLEARANCE ADJUSTMENT

1. Check the rocker arm shaft bracket nuts for looseness.

   Tighten any loose rocker arm shaft bracket nuts before adjusting the valve clearance.

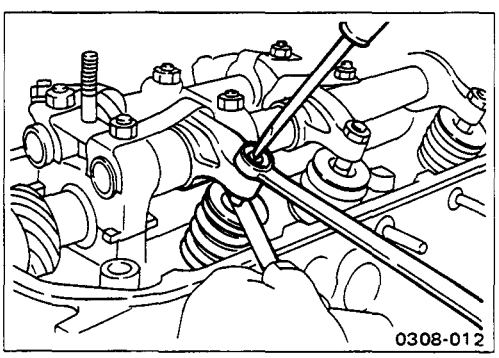
Rocker Arm Shaft Bracket Nut Torque	kg·m(lb.ft/N·m)
2.2 ± 0.25 (16.0 ± 1.8/21.6 ± 2.5)	

0308A



2. Bring the piston in either the No. 1 cylinder to TDC on the compression stroke by turning the crankshaft until the crankshaft pulley TDC line is aligned with the timing mark.

   If the No. 1 cylinder is at TDC, there will be play in the No. 1 cylinder valve rocker arms.

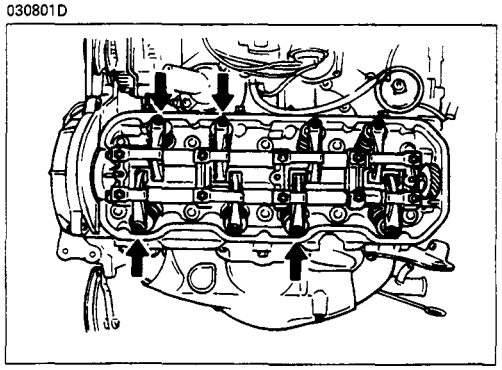


3. Adjust the valve clearances in the following manner using a feeler gauge.

   Feeler gauge should move with a very slight drag.

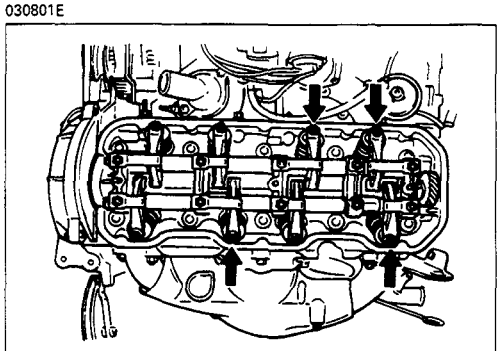
Valve Clearance	mm(in)	
	At Cold	At Hot
Intake	0.15 (0.006)	0.20 (0.008)
Exhaust	0.25 (0.010)	0.30 (0.012)

030801D



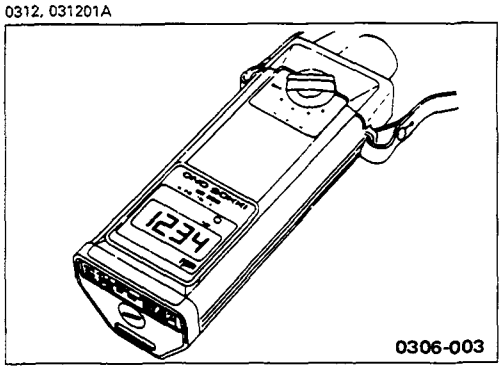
4. Adjust the clearance of the valve (arrowed).

030801E



5. Turn the crankshaft one full turn (360 degrees) and adjust the clearances of the valves (arrowed).

0312, 031201A



IGNITION TIMING

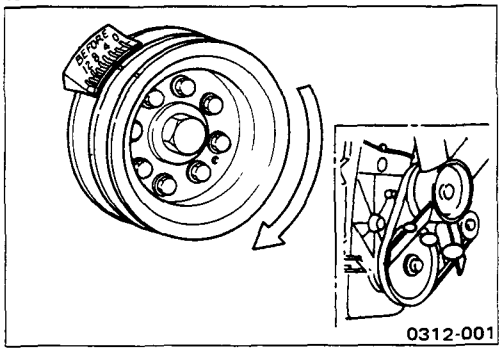
Ignition Timing Inspection

1. Start the engine and allow it to idle for warm up.
2. Set the engine tachometer.
3. Check that the engine is running stably at the specified idling speed.

   If the vehicle is equipped with an air conditioner, the air conditioner switch must be in the "OFF" position.

Engine Idling Speed	rpm
From '91, Switzerland, Sweden & From '92, Germany	900
Other	800

031201B

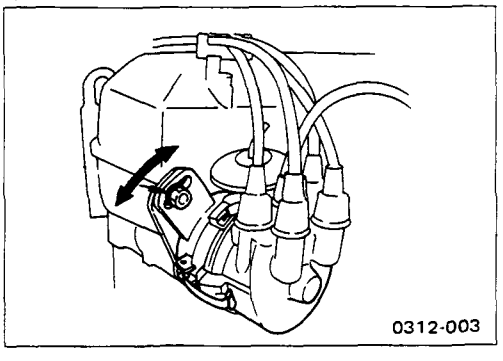


4. Disconnect the vacuum hose.
5. Attach the timing light cord to either the No. 1 or the No. 4 cylinder.
6. Aim the timing light at the crankshaft pulley notched line to check the ignition timing.

Ignition Timing (BTDC)	deg/rpm
From '91, Switzerland, Sweden & From '92, Germany	6/900
Other	6/800

If the ignition timing differs from the specification, adjust it by moving the distributor.

031201C



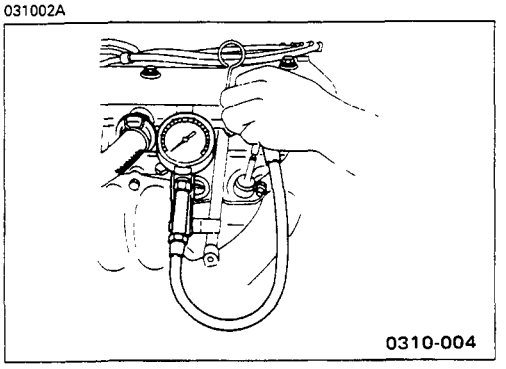
Ignition Timing Adjustment

1. Loosen the distributor fixing bolt.
2. Aim the timing light at the crankshaft pulley notched line to check the ignition timing.

   Moving the distributor to the left will advance the timing.

   Moving the distributor to the right will retard the timing.

031002A



COMPRESSION PRESSURE MEASUREMENT

1. Start the engine and allow it to idle for warm up.
2. Set the engine tachometer.
3. Stop the engine.
4. Remove all of the spark plugs.
5. Engage the starter and check that the cranking speed is at least 300 rpm.

   If the cranking speed is less than 300 rpm, the battery must be replaced.
6. Set a compression gauge to the No. 1 cylinder spark plug hole.
7. Turn the engine over with the starter motor and take the compression reading.

Compression Pressure kg/cm^2(psi/kPa) at 300 rpm

Standard	Limit
12.0 (170.6/1,177.2)	8.0 (113.7/784.5)

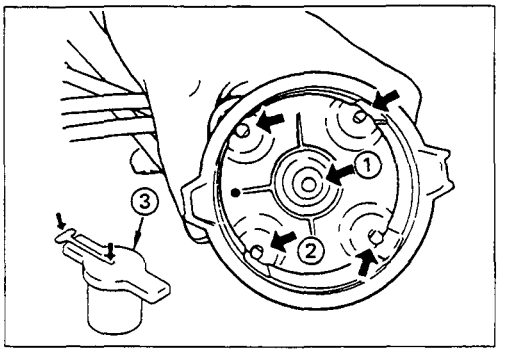
8. Repeat the procedure (Steps 6 and 7) for the remaining cylinders.

0313

IGNITION SYSTEM

If a problem in the ignition system is believed to be the cause of engine trouble, perform the following checks and make the required adjustments, repairs, and part replacements.

031303

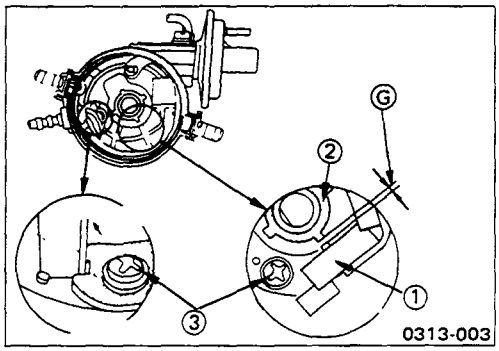


Distributor

1. Distributor Cap and Rotor
   Remove the distributor cap and check the following:
   1) Check the center electrode ① and the side electrode ② for burning and corrosion.
   2) Check the rotor ③ for excessive wear and burning.

   Replace the parts as required.

0313030B



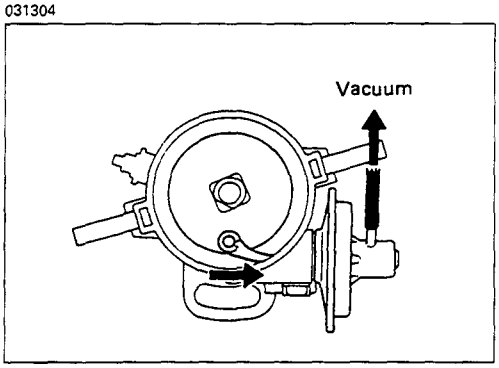
2. Air Gap

   Use a feeler gauge to measure the clearance between the signal generator ① and the distributor cam ②.

   If the measured value is outside the specified value, adjust the air gap by loosening the two screws ③ and moving the bracket.

Air Gap Ⓖ	mm(in)
0.2 – 0.4 (0.008 – 0.016)	

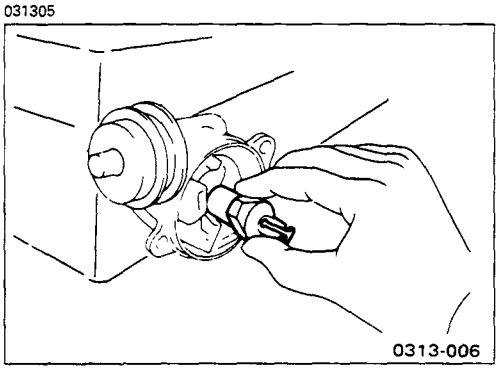
031304



Vacuum Adavancer

1. Disconnect the vacuum hose from the vacuum advancer.
2. Connect a vacuum pump to the vacuum advancer diaphragm.
3. Apply a vacuum and check that the vacuum advancer moves.
   If the vacuum advancer does not move, repair or replace as necessary.

031305



Governor

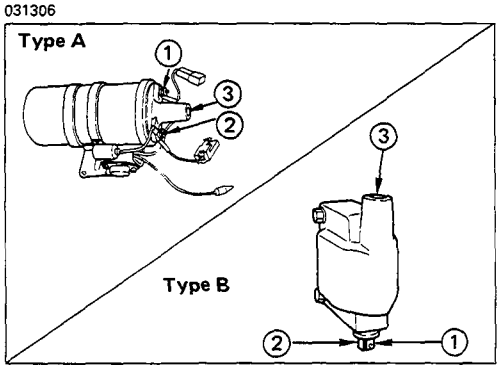
1. Check the rotor shaft for excessive looseness.

   If the shaft is excessively loose, the governor is defective and must be replaced.
2. Turn the rotor shaft clockwise 1/4 of a turn and release it.

   The rotor shaft should spring back.

   If the shaft does not spring back, the governor is defective and must be replaced.

031306



Ignition Coil

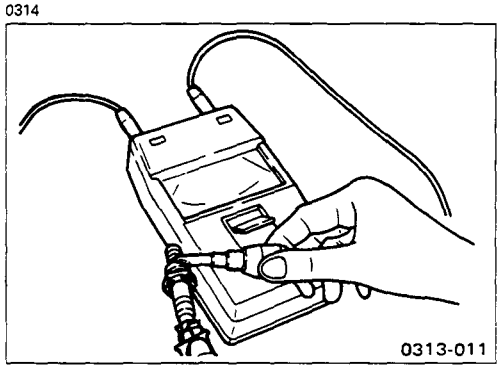
Use a circuit tester to measure the resistance of the primary coil and the secondary coil.

If either of the measured values is outside the specified value, the ignition coil must be replaced.

Ignition Coil Resistance

	Type A	Type B
Primary Coil ① – ②	1.1 – 1.4Ω	1.2 – 1.4Ω
Secondary Coil ① – ③	12.2 – 14.9 Ω	8.6 – 13.0 Ω

0314



SPARK PLUG

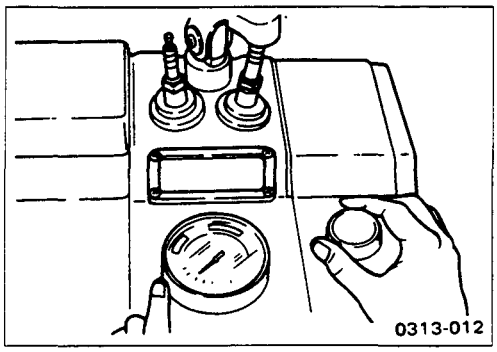
Insulation Resistance Inspection

Use an ohmmeter to measure the insulation resistance.

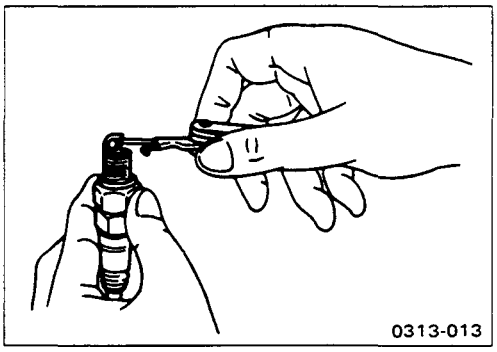
If the measured value is less than the specified value, the spark plug must be replaced.

Insulation Resistance	MΩ
More than 5	

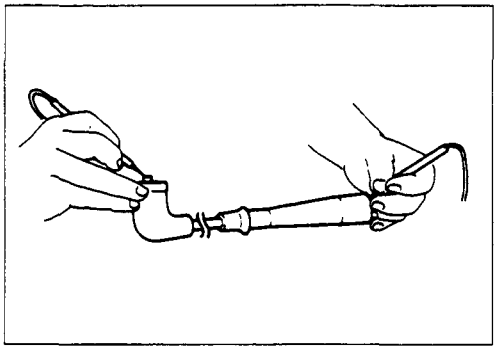
031401B



031401C



0315A



0315B

Insulation Resistance Inspection (Using a Spark Plug Tester)

Use the spark plug tester to check for excessive carbon deposits, cracked insulation resulting in short circuiting, and terminal abrasion resulting in voltage surging.

If any of these conditions are discovered, the spark plug must be replaced.

Spark Plug Gap Adjustment

Measure the spark plug gap and inspect the spark plugs.

Adjust the spark plug gap if required.

Spark Plug Gap	mm(in)
Without catalytic converter vehicle	0.7—0.8 (0.028—0.031)
With catalytic converter vehicle	1.0—1.1 (0.040—0.043)

HIGH TENSION CABLE

1. Check the cable for broken insulation.

   If there is broken insulation, the cable must be replaced.

2. Check the terminals for corrosion and looseness.

   If the terminals are corroded or loose, the cable must be replaced.

3. Measure the cable resistance.

   If the measured resistance deviates from the specified value, the cable must be replaced.

Cable Resistance	KΩ/m
9.6 – 22.4	

Note:

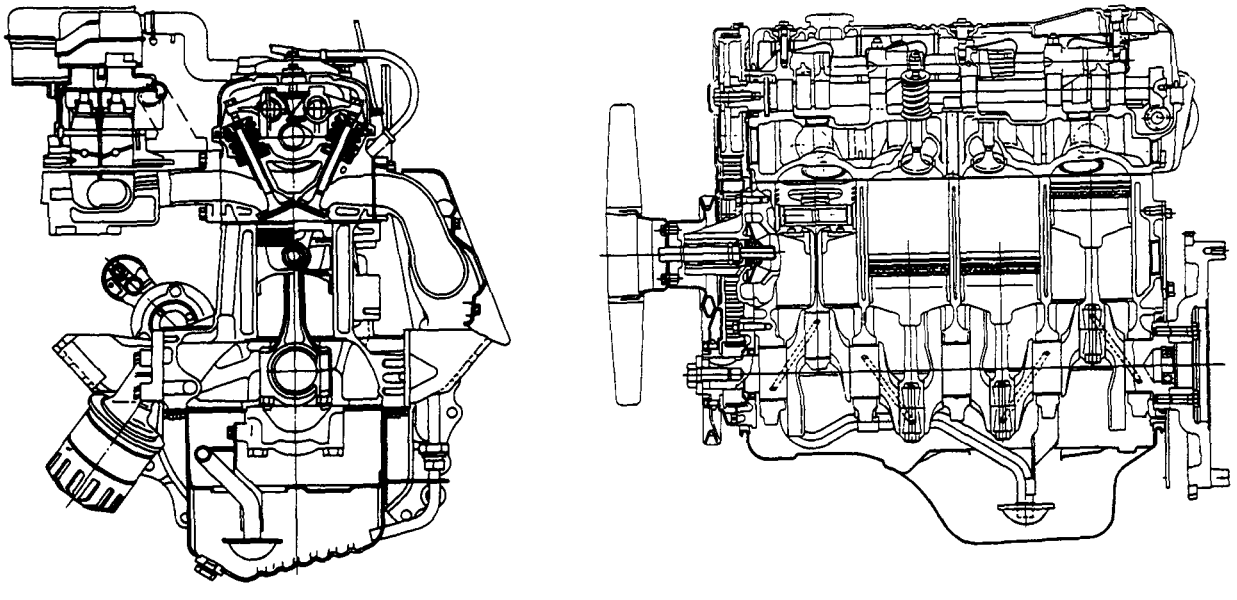
The cable contains a synthetic conductor which is easily damaged.

Never stretch or kink the cable.

Never stick a needle or the pointed end of a probe into the cable during a timing check. An increase in resistance will occur at that point, causing the cable to burn.

050102A

GENERAL DESCRIPTION



050100-003

050102B, 050102C

The 4Z Series model engine, designed to meet the strictest emission control regulations, is used on TFR and TFS vehicles.

This engine features aluminum alloy cylinder heads and hemispherical combustion chambers. The cross-flow intake and exhaust port valves have a "V" configuration.

A one-piece cast iron cylinder body is used. The oil pump and the water pump are built into the upper front of the cylinder body.

The crankshaft is supported by five bearings for optimum stiffness. The counter weights are forged as part of the crankshaft.

The timing train consists of the timing belt and the single overhead camshaft (SOHC).

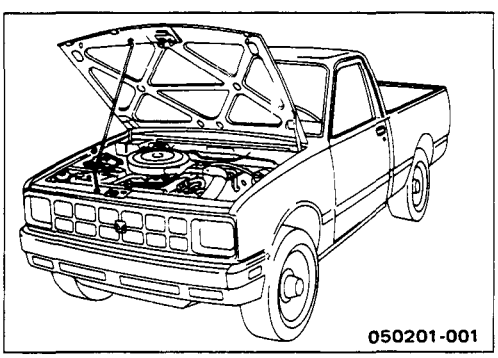
050201

REMOVAL AND INSTALLATION

Read this Section carefully before performing any removal and installation procedure. This Section gives you important points as well as the order of operation. Be sure that you understand everything in this Section before you begin.

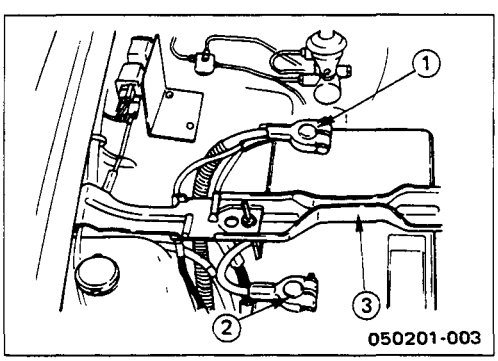
Important Operations – Removal

- Carefully remove the piping, hoses, wiring harness connectors, engine control cables, and control rods from the engine.
- Remove the clutch control line, the back up light switch connector, and the speedometer cable from the transmission.



Engine and Transmission

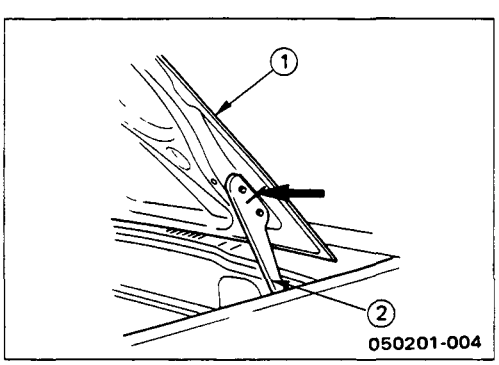
The engine and transmission must be removed from the engine separately.



Battery

1. Disconnect the battery cable ① and the grounding cable ② from the battery terminals.
2. Remove the battery clamp ③.

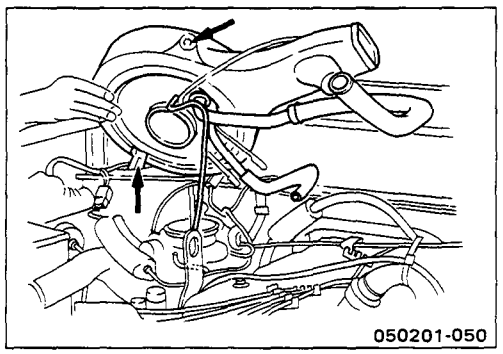
   Take care not to accidentally short the battery with the spanner or some other tool.
3. Remove the battery.
4. Disconnect the battery cable at the starter motor and the ground cable at the cylinder body.



Engine Hood

Apply setting marks to the engine hood ① and the engine hood hinges ② before removing the engine hood.

This will facilitate installation of the engine hood to its original position.

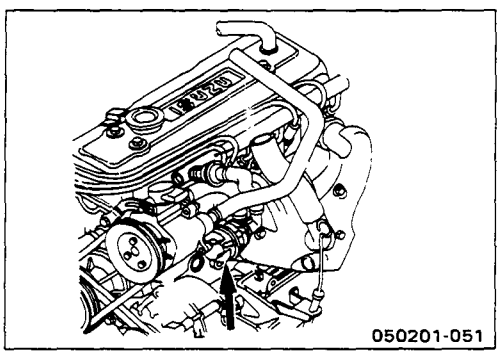

050201-050

Air Cleaner

Remove the air cleaner from the engine.

Note:

Cover the air cleaner intake port to prevent the entry of foreign material.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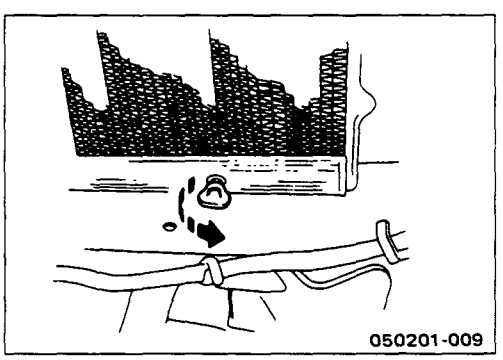
Coolant

Remove the coolant drain plug (at the lower left of the engine) and the radiator drain plug.

Allow the engine coolant to drain completely.

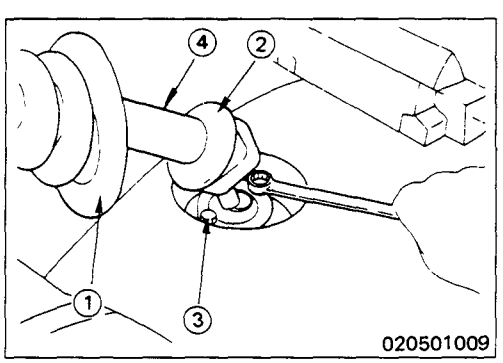

050201-009

If long life coolant is used, drain the coolant into a clean plastic connector for reuse.

Radiator

1. Remove the radiator grill from the deflector panel.
2. Remove the radiator undercover from the sidemembers (For 4 × 4).
3. Disconnect the radiator upper and lower hoses from the engine side.
4. Remove the radiator fan shroud and the cooling fan.
5. Remove the radiator.

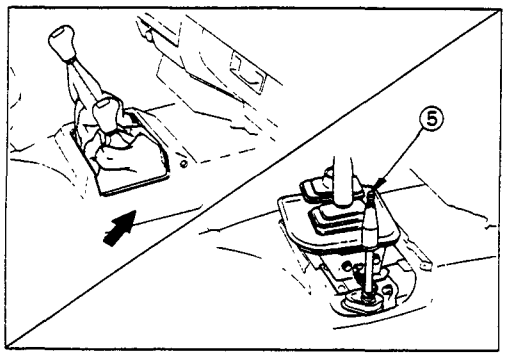
   Be careful not to damage the radiator core.



020501009

Gear Shift Lever

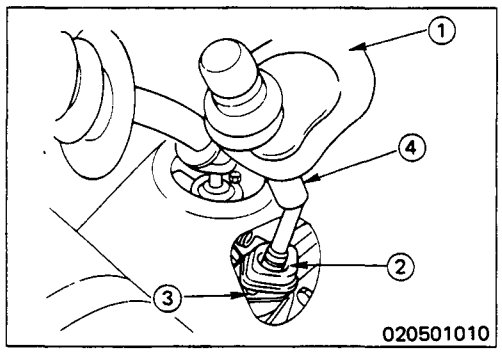
1. Place the gear shift lever in the neutral position.
2. Remove the front console from the floor panel.
3. Pull the gear shift lever grommet ① and the dust cover ② to the top of the gear shift lever.
4. Remove the gear shift lever cover bolt ③.
5. Remove the gear shift lever ④.



6. Remove the change lever hole cover ⑤ or the center console from the front floor.
7. Remove the quadrant box ⑥ from the transmission rear cover.

Note:

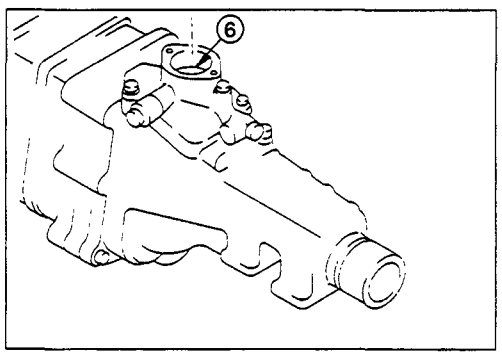
Cover the quadrant box hole to prevent the entry of foreign material into the transmission.



Transfer Change Lever (For 4 ×4)

Perform this procedure after removing the gear shift lever.

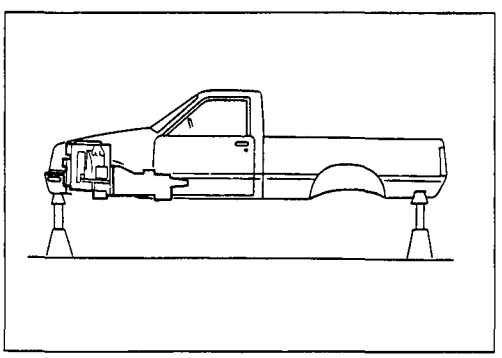
1. Place the transfer change lever in the "H" position.
2. Pull the transfer change lever grommet ① and the dust cover ② to the top of the transfer change lever.
3. Remove the retainer bolts ③.
4. Remove the transfer change lever ④ along with the retainer and ball seat cover.



5. Remove the change lever hole cover ⑤ or the center console from the front floor.
6. Remove the quadrant box ⑥ from the transfer case adapter.

Note:

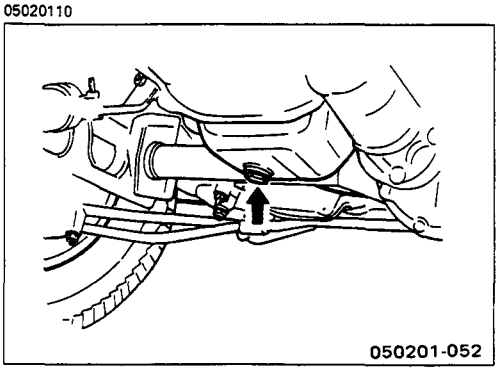
Cover the quadrant box hole and the transfer change lever hole to prevent the entry of foreign material into the transmission.



05020110

Lifting the Vehicle

1. Jack up the vehicle.
2. Place chassis stands at the front and the rear of the vehicle.
3. Remove the wheels from the chassis.

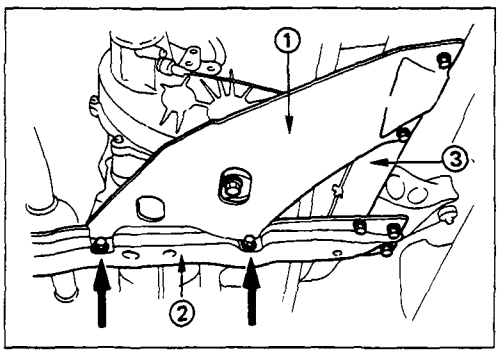


Engine Oil Draining

Remove the oil pan drain plug to drain the engine oil.

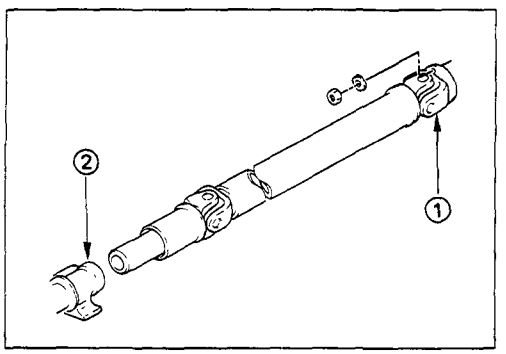
Do this while the engine is hot.

Do not forget to reinstall the drain plug after draining the engine oil.



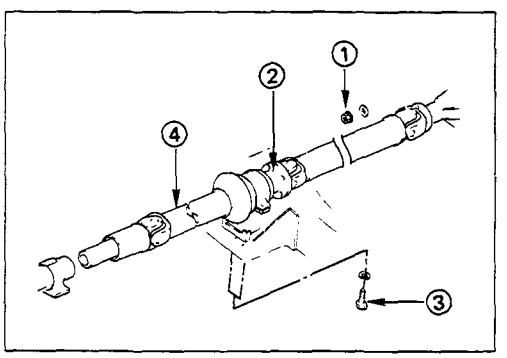
Transfer Case Protector

Remove the transfer case protector ① from the transmission mounting member ② and the side member ③.



Rear Propeller Shaft (Single Shaft Type)

1. Remove the propeller shaft flange yoke at the drive pinion side ①.
2. Remove the propeller shaft from the transmission main shaft spline ②.

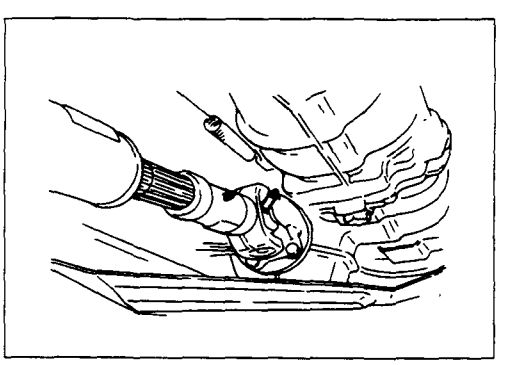


Rear Propeller Shaft (Dual Shaft Type)

1. Apply setting marks to the center coupling flange yoke and the 2nd propeller shaft flange yoke.

   This will prevent mispositioning during the installation procedure.
2. Remove the 2nd propeller shaft flange yoke bolts at the drive pinion side ①.
3. Remove the 2nd propeller shaft flange yoke bolts ② at the center coupling side.
4. Remove the center bearing retainer bolts ③.
5. Remove the 1st propeller shaft ④ with the center bearing.

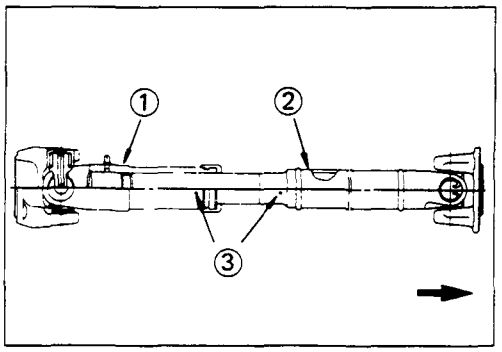
   Pull the 1st propeller shaft toward the rear of the vehicle until the spline yoke is free of the transmission main shaft.



Front Propeller Shaft (For 4 × 4)

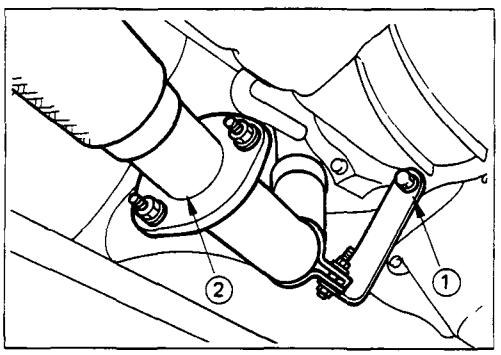
Remove the splined yoke flange bolt at the transfer case side.

Do not allow the splined yoke to fall away from the front propeller shaft.



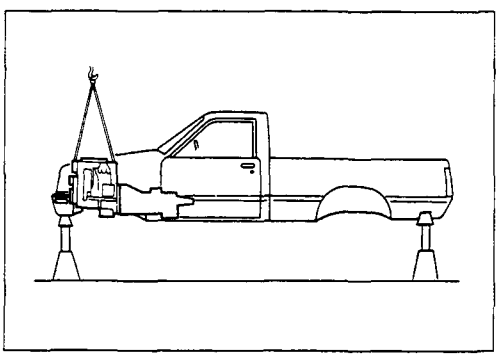
If the splined yoke should fall away from the front propeller shaft, align the setting marks ③ on the splined yoke ① and the front propeller shaft ② to reassemble the two parts.

The setting marks are punched circles approximately 3 mm (0.12 in) in diameter.



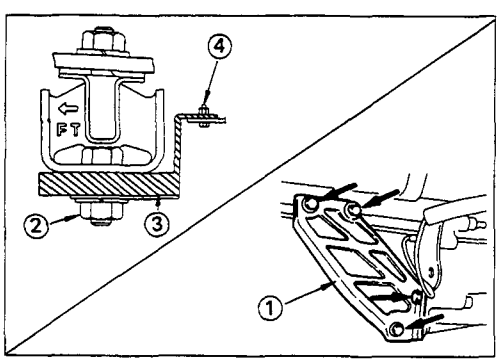
Exhaust Pipe

1. Remove the exhaust pipe bracket ① from the transmission case.
2. Disconnect the front exhaust pipe from the exhaust manifold and the 2nd exhaust pipe ②.



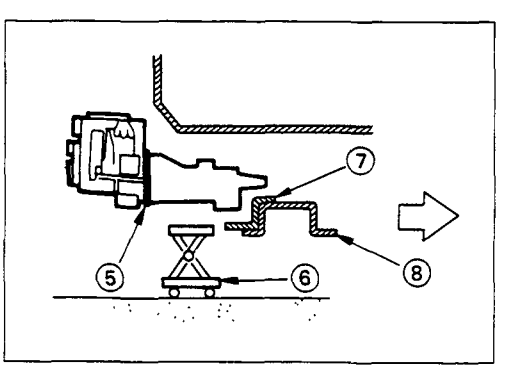
Engine Lifting Hanger

1. Attach the engine lifting hanger to the rear portion of the exhaust manifold.
2. Attach the lifting wire to both ends of the engine lifting hanger.



Transmission (For 4 × 2)

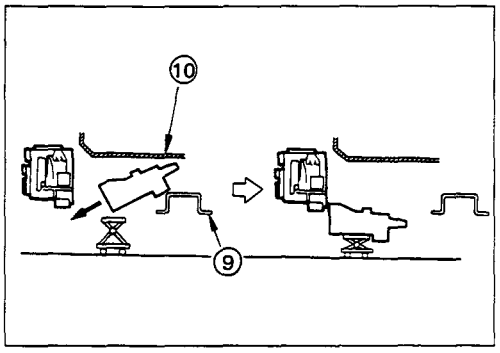
1. Support the transmission with a transmission jack.
2. Disconnect the engine stiffener ① from the cylinder body and the engine rear plate.
3. Remove the engine rear mounting rubber nuts ② from the mounting rubber bracket ③.
4. Loosen the mounting rubber bracket bolts ④.



5. Remove the transmission from the engine.

   The removal of the transmission will require the cooperative efforts of two mechanics.

   1) Remove the transmission nuts and bolts ⑤ from the engine rear plate.
   2) Operate the transmission jack ⑥ to slightly raise the transmission.
   3) Remove the rear mounting rubber bracket ⑦ from the mounting rubber from the No. 3 crossmember ⑧.



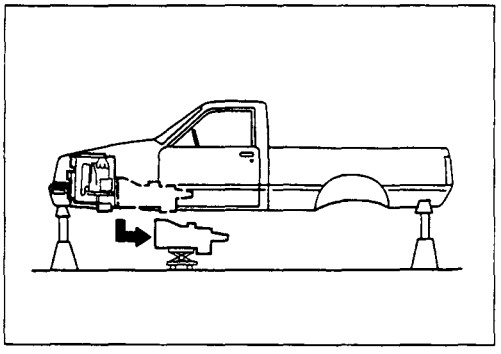
4) Manually move the transmission as far as possible toward the rear of the vehicle (into the space between the No. 3 crossmember ⑨ and the floor panel ⑩.
5) Lower the clutch housing end of the transmission toward the transmission jack.

   The rear of the transmission is supported by the No. 3 crossmember at this time.
6) Firmly grasp the transmission rear cover (1st mechanic).

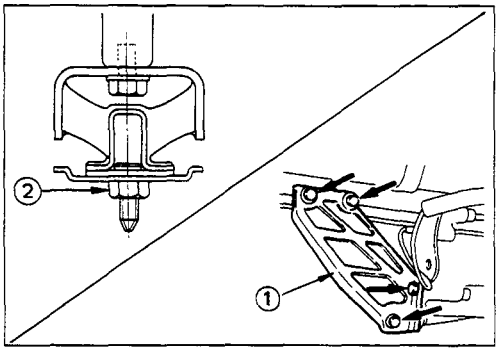
   Raise the transmission jack toward the transmission (2nd mechanic).

   Carefully lower the transmission onto the transmission jack.

   The transmission must be centered on the transmission jack.

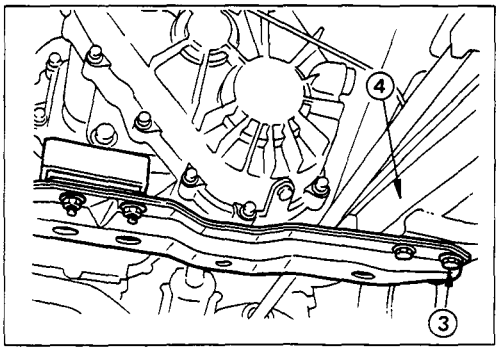


6. Carefully pull the transmission jack with the transmission from beneath the vehicle.

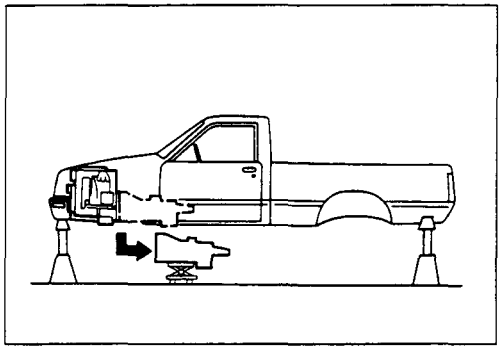


Transmission with Transfer Case (For 4 × 4)

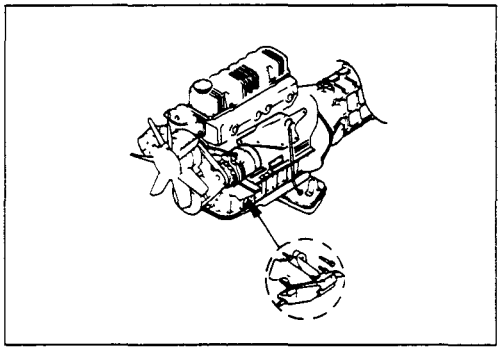
1. Support the transmission with a transmission jack.
2. Disconnect the engine stiffener ① from the cylinder body and the engine rear plate.
3. Remove the engine rear mounting nuts ②.



4. Loosen the mounting member bolts ③.
5. Remove the mounting member from the sidemembers ④.

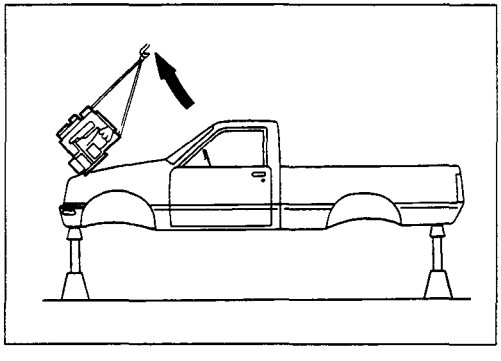


6. Remove the transmission with the transfer case from the engine.
   1) Remove the transmission nuts and bolts from the engine rear plate.
   2) Carefully pull the transmission with the transmission jack toward the rear of the vehicle.
   3) Operate the transmission jack to slowly lower the transmission.



Engine

1. Remove the engine mounting rubber nuts attaching the mounting rubbers to the sidimembers.

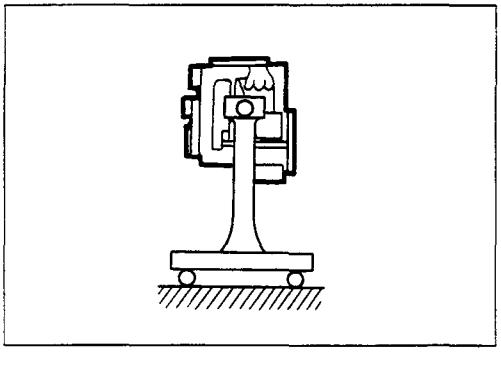


2. Operate the hoist to slightly raise the engine.

   The front of the engine should be held slightly higher than the rear.

   Be careful not to damage the brake pipe and the fuel pipe.
3. Continue to slowly raise the engine from the engine compartment.

   Hold the front of the engine higher than the rear.



4. Place the engine on an engine stand.

Important Operations — Installation

Follow the removal procedure in the reverse order to perform the installation procedure. Pay careful attention to the important points during the installation procedure.

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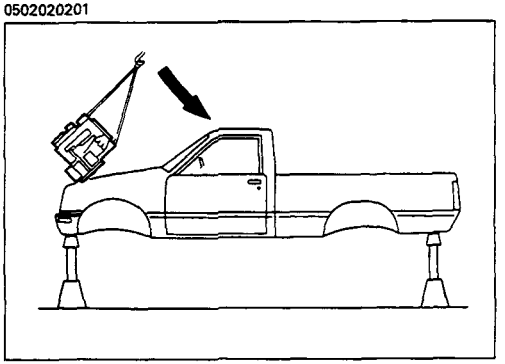
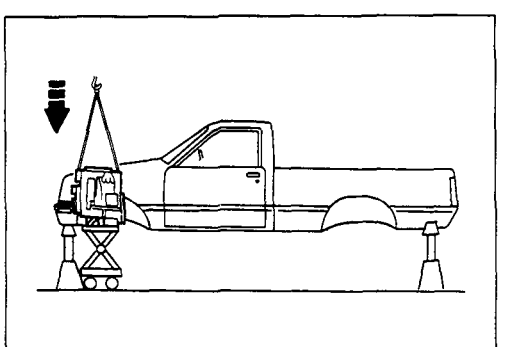


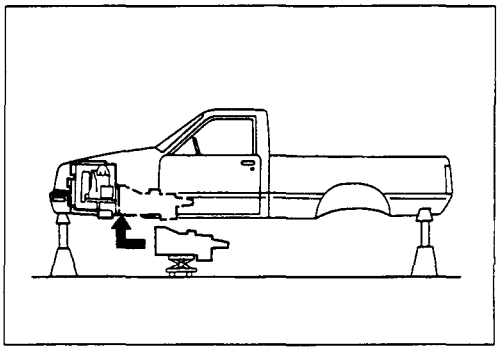


Engine

1. Attach a lifting wire to the engine lifting hangers.
2. Operate the hoist to position the engine above the engine compartment.

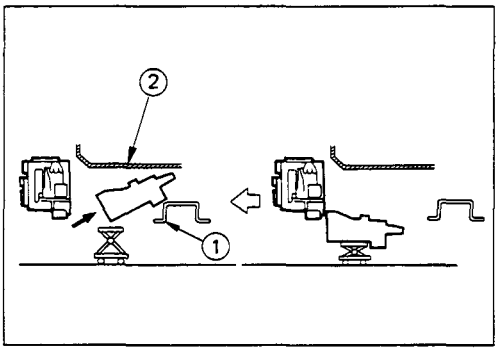
   The front of the engine should be held slightly higher than the rear.
3. Lower the engine slowly into the engine compartment.

   Be careful not to damage the brake pipe, the fuel pipe, and the air breather.
4. Support the oil pan with a jack.
5. Temporarily tighten the engine mounting rubber nuts.



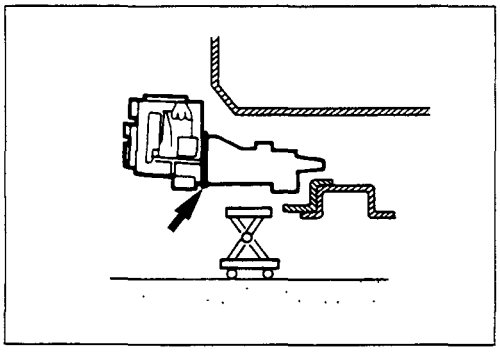
Transmission (For 4 ×2)

1. Apply a thin coat of molybdenum disulfide grease to the top gear shaft spline.
2. Place the transmission with the mounting rubbers on a transmission jack.
3. Carefully move the transmission jack and transmission into position behind the engine.



4. Slowly operate the transmission jack to raise the transmission until the rear of the transmission is at the same level as the No. 3 crossmember ①.
5. Manually support the transmission rear cover.

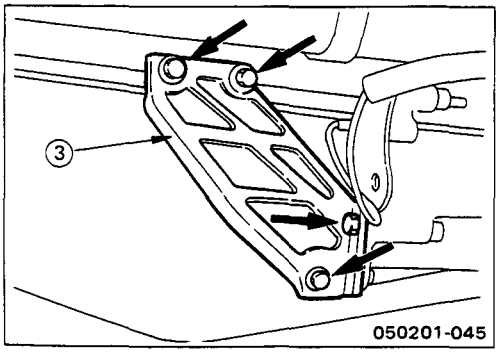
   Move the transmission into position between the No. 3 crossmember and the floor panel ②.



6. Slowly raise the transmission jack until the front of the transmission is aligned with the rear of the engine.

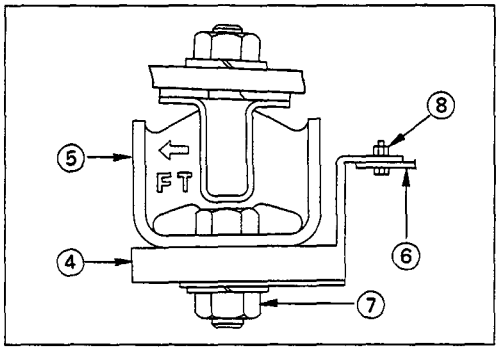
   The slope of the engine and the transmission must be the same.
7. Align the top gear shaft spline with the clutch drive plate spline.
8. Install the transmission to the engine.
9. Tighten the transmission nuts and bolts to the specified torque.

Transmission Nut and Bolt Torque	kg·m(lb.ft/N·m)
3.8 ± 0.8 (27.5 ± 5.8/37.2 ± 7.8)	



10. Connect the engine stiffener ③ to the cylinder body and the engine rear plate.
11. Tighten the stiffener bolts to the specified torque.

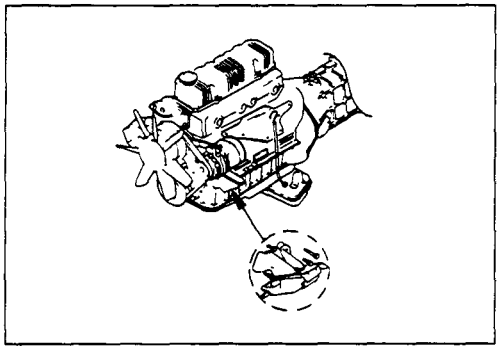
Stiffener Bolt Torque	kg·m(lb.ft/N·m)
4.1 ± 0.6 (29.7 ± 4.3/40.2 ± 5.9)	



12. Install the rear mounting rubber bracket ④ to the mounting rubber ⑤ and the No. 3 crossmember ⑥.
13. Tighten the rear mounting rubber nuts ⑦ and the mounting bracket bolts ⑧ to the specified torque.

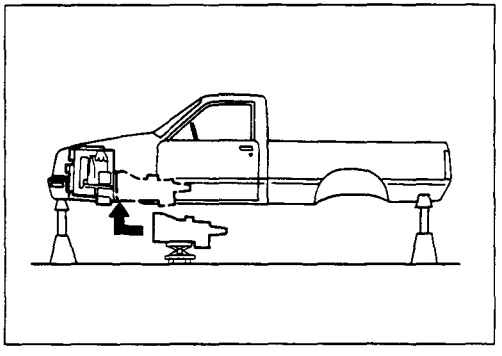
Rear Mounting Rubber Nut Torque	kg·m(lb.ft/N·m)
8.5 ± 0.5 (61.5 ± 3.6/83.3 ± 4.9)	

Mounting Bracket Bolt Torque	kg·m(lb.ft/N·m)
3.8 ± 0.1 (27.1 ± 6.9/36.8 ± 9.3)	



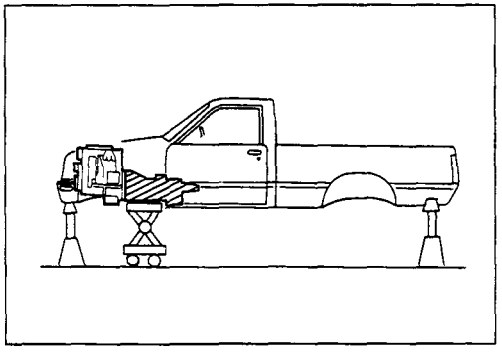
14. Tighten the engine mounting rubber nuts to the specified torque.

Engine Mounting Rubber Nut Torque	kg·m(lb.ft/N·m)
4.2 ± 0.5 (30.4 ± 3.6/41.2 ± 4.9)	



Transmission with Transfer (For 4 ×4)

1. Apply a thin coat of molybdenum disulfide grease to the top gear shaft spline.
2. Place the transmission with the mounting rubbers on a transmission jack.
3. Carefully move the transmission jack and transmission into position behind the engine.

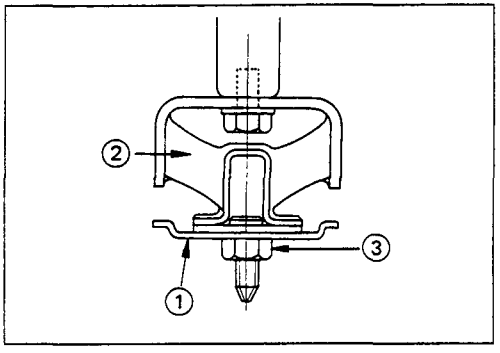


4. Slowly raise the transmission jack until the front of the transmission is aligned with the rear of the engine.

   The slope of the engine and the transmission must be the same.
5. Align the top gear shaft spline with the clutch driven plate spline.
6. Install the transmission to the engine.

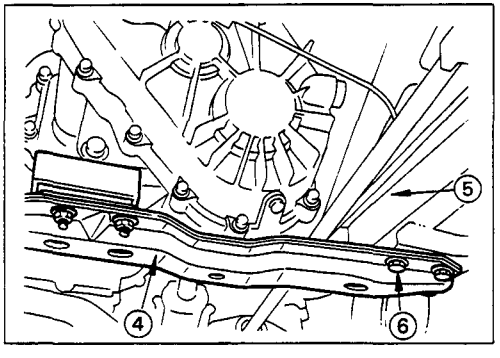
   Tighten the transmission nuts and bolts to the specified torque.

Transmission Nut and Bolt Torque	kg·m(lb.ft/N·m)
3.8 ± 0.8 (27.5 ± 5.8/37.2 ± 7.8)	



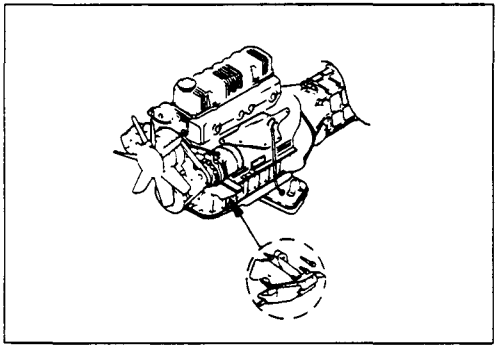
7. Install the mounting member ① to the mounting rubber ②.
8. Tighten the mounting member nuts ③ to the specified torque.

Mounting Rubber Nut Torque	kg·m(lb.ft/N·m)
4.2 ± 0.5 (30.4 ± 3.6/41.2 ± 4.9)	



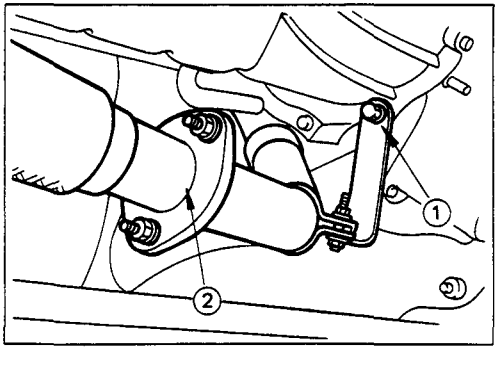
9. Install the mounting member ④ to the sidemembers ⑤.
10. Tighten the mounting member bolts ⑥ to the specified torque.

Mounting Member Bolt Torque	kg·m(lb.ft/N·m)
7.8 ± 1.6 (56.1 ± 11.2/76.0 ± 15.2)	



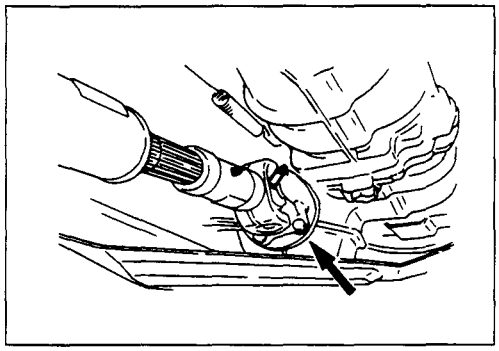
11. Tighten the engine mounting rubber nuts to the specified torque.

Engine Mounting Rubber Nut Torque	kg·m(lb.ft/N·m)
4.2 ± 0.5 (30.4 ± 3.6/41.2 ± 4.9)	



Exhaust Pipe

1. Connect the exhaust pipe to the exhaust manifold and the 2nd exhaust pipe ①.
2. Install the exhaust pipe bracket ② to the transmission case.



Front Propeller Shaft (For 4 ×4)

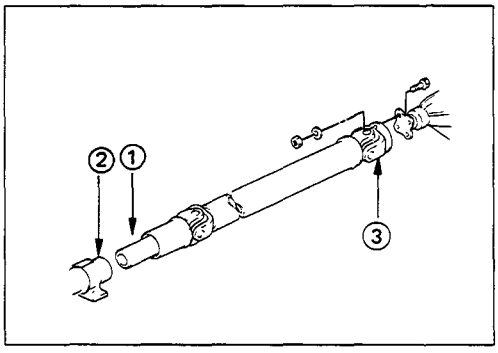
1. Connect the propeller shaft flange yoke to the matching flange.
2. Tighten the propeller shaft flange yoke bolt to the specified torque.

Propeller Shaft Flange Yoke Bolt Torque	kg·m(lb.ft/N·m)
Only 4ZE1 eng.	6.4 ± 0.4 (46.3 ± 2.9/62.8 ± 3.9)
Other	3.6 ± 0.3 (26.0 ± 2.2/35.3 ± 2.9)

Note:

If the splined yoke and the front propeller shaft have accidentally separated, align their setting marks and recouple them.

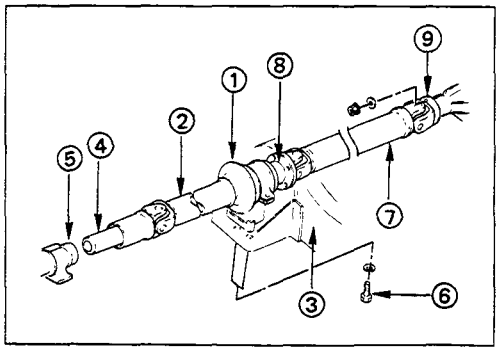
Refer to "FRONT PROPELLER SHAFT REMOVAL".



Rear Propeller Shaft (Single Shaft Type)

1. Insert the splined yoke ① with the propeller shaft into the transmission main shaft spline ②.
2. Install the propeller shaft flange yoke ③ to the drive pinion side.
3. Tighten the propeller shaft flange yoke bolt to the specified torque.

Propeller Shaft Flange Yoke Bolt Torque	kg·m(lb.ft/N·m)
Only 4ZE1 eng.	6.4 ± 0.4 (46.3 ± 2.9/62.8 ± 3.9)
Other	3.6 ± 0.3 (26.0 ± 2.2/35.3 ± 2.9)



Rear Propeller Shaft (Dual Shaft Type)

1. Place the center bearing and retainer ① together with the 1st propeller shaft ② on the No. 4 cross-member ③.
2. Insert the splined yoke ④ into the transmission main shaft spline ⑤.
3. Tighten the center bearing retainer bolts ⑥ to the specified torque.

Center Bearing Retainer Bolt Torque	kg·m(lb.ft/N·m)
6.2 ± 0.2 (44.8 ± 1.5/60.8 ± 2.0)	

4. Connect the 2nd propeller shaft ⑦ to the center coupling ⑧ and the drive pinion ⑨.

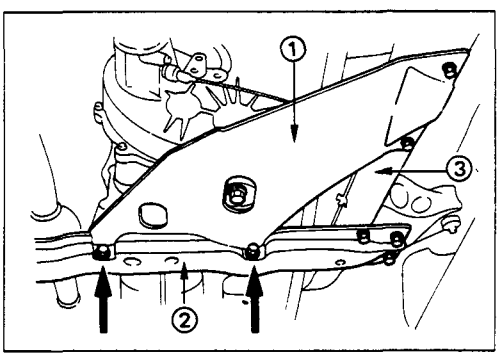
   Be sure to align the setting marks applied at disassembly.

5. Tighten the coupling bolts to the specified torque.

Propeller Shaft Flange Yoke Bolt Torque	kg·m(lb.ft/N·m)
Only 4ZE1 eng.	6.4 ± 0.4 (46.3 ± 2.9/62.8 ± 3.9)
Other	3.6 ± 0.3 (26.0 ± 2.2/35.3 ± 2.9)

Note:

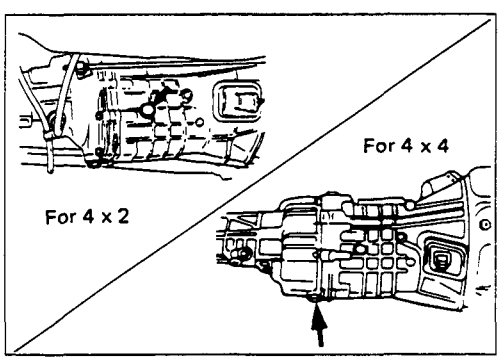
At the propeller shaft installation, the three universal yoke's spider pin center Ⓐ, Ⓑ and Ⓒ (shown in the illustration) must be aligned on the straight line to couple them in the proper universal joint phase.



Transfer Case Protector (For 4 x 4)

1. Install the transfer case protector ① to the mounting member ② and the sidemembers ③.
2. Tighten the transfer case protector bolts to the specified torque.

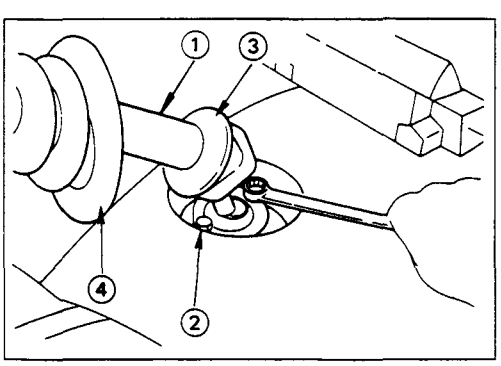
Protector Bolt Torque	kg·m(lb.ft/N·m)
3.7 ± 1.0 (26.8 ± 7.2/36.3 ± 9.8)	



Gear Shift Lever

1. Replenish the transmission case and the transfer case with the specified engine oil.

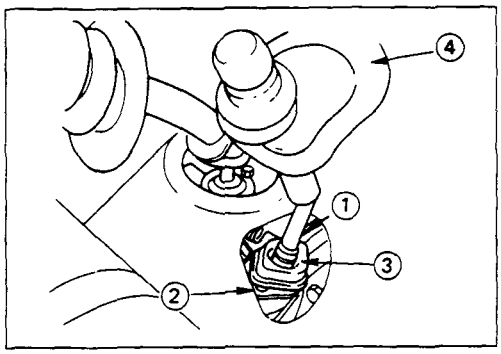
Transmission and Transfer Case Oil	lit(US/UK gal)	
	4 × 2	4 × 4
MSG 4	1.25 (0.33/0.28)	4.40 (1.16/0.99)
MSG 5	1.55 (0.41/0.34)	
MUA	2.95 (0.77/0.64)	T/M: 2.95 (0.97/0.64) T/F: 1.45 (0.38/0.31)



2. Install the quadrant box to the transmission rear cover.
3. Install the gear shift lever ① to the transmission case.
4. Tighten the gear shift lever cover ② bolts to the specified torque.

Shift Lever Cover Bolt Torque	kg·m(lb.ft/N·m)
2.0 ± 0.2 (14.5 ± 1.5/19.6 ± 2.0)	

5. Install the dust cover ③ and the grommmet ④.

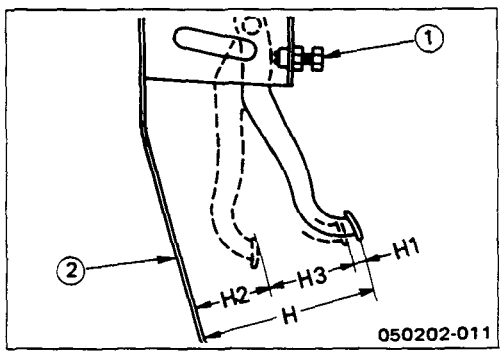


Transfer Change Lever (For 4 × 4)

1. Insert the transfer change lever ① into the transfer side case.
2. Install the ball seat cover along with the change lever retainer ②.
3. Tighten the change lever retainer bolts to the specified torque.

Change Lever Retainer Bolt Torque	kg·m(lb.ft/N·m)
2.0 ± 0.2 (14.5 ± 1.5/19.6 ± 2.0)	

4. Install the dust cover ③ and the grommet ④.



Clutch Pedal Adjustment

1. Reconnect the clutch control cable to the shift fork.
2. Adjust the clutch pedal height "H" with the stopper bolt or pedal switch ①.
3. Check the clutch pedal travel "H3".

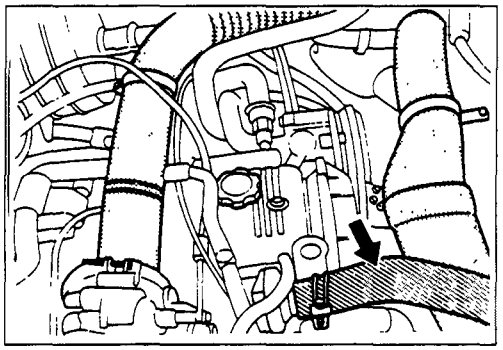
Clutch Pedal Travel mm(in)

	RHD	LHD
H	194 – 204 (7.6 – 8.0)	185 – 195 (7.3 – 7.7)
H1	15–20 (0.6–0.8) for Cable type	
	5–10 (0.2–0.6) for Hydraulic type	
H2	35 (1.4)	30 (1.2)

H: Pedal height from the pedal board ②
H1: Pedal free play
H2: Clearance between the clutch pedal and the pedal board ② with the clutch disengaged.

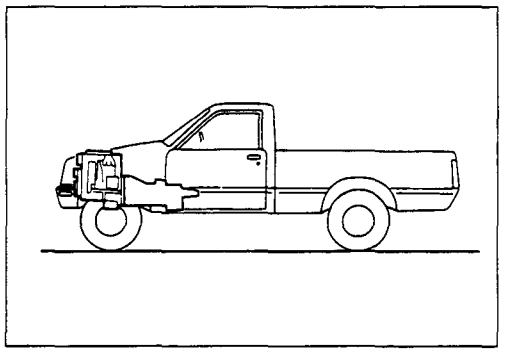
Engine Control Cable

Reconnect the engine control cable to the carburetor control lever.



Radiator

1. Install the radiator.
   Be careful not to damage the retainer core.
2. Install the cooling fan and the fan shroud.
3. Connect the radiator upper and lower hoses.
4. Carefully reconnect the components tagged at removal.
5. Install the radiator undercover to the sidemembers.
6. Install the radiator grill to the deflector panel.



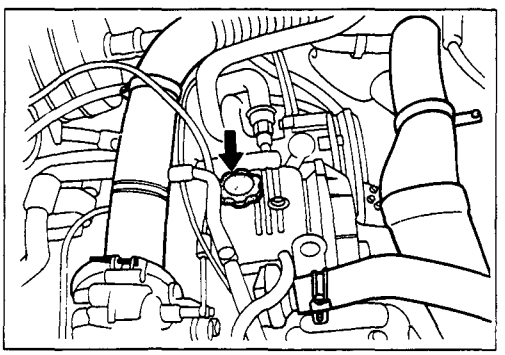
Lowering the Vehicle

1. Install the wheels to the vehicle.
2. Place a jack beneath the vehicle.
3. Raise the jack to remove the chassis stands.
4. Lower the vehicle to the ground.

Coolant Replenishment

Replenish the cooling system with coolant.

Coolant Capacity	lit(US/UK gal)
4ZC1	8.6 (2.27/1.89)
4ZD1/4ZE1	9.0 (2.38/1.98)

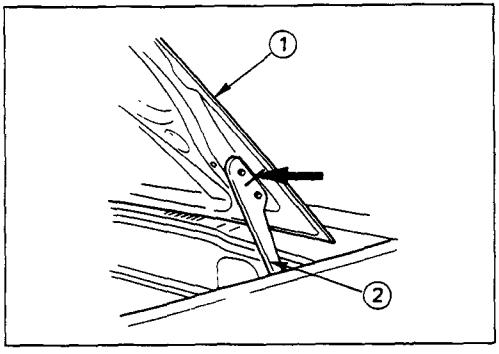


Engine Oil Replenishment

1. Fill the engine through the new filler port with new engine oil of the specified grade.

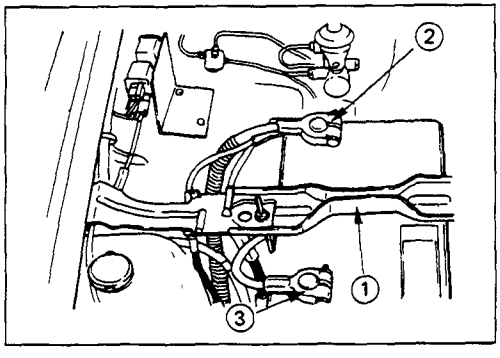
Engine Oil Capacity and Grade	lit(US/UK gal)
Capacity	4ZC1/4ZD1 : 4.9 (1.29/1.08) 4ZE1 : 5.5 (1.45/1.21)
Grade	SE, SF

2. Start the engine and allow it to idle for several minutes.
3. Stop the engine and wait five minutes for the oil to settle.
4. Recheck the oil level and replenish if necessary.



Engine Hood

Align the setting marks (applied at removal) on the engine hood ① and the engine hood hinges ② to install the engine hood.



Battery

1. Check the battery fluid level and the specific gravity.
2. Secure the battery with the battery clamp ①.

   Do not overtighten the battery clamp.
3. Connect the battery cable ② and the ground cable ③ to the battery.
4. Connect the battery cable to the starter motor and the ground cable to the cylinder body.
5. Apply grease to the battery terminals.

Engine Warm-Up

After completing the required maintenance procedures, start the engine and allow it to idle until it is warm.

Check the following:

1. Engine idling speed

   Refer to "SERVICING" for the idling speed adjustment procedure.
2. Engine noise level
3. Engine lubricating system and cooling system

   Carefully check for oil and coolant leakage.
4. Engine control cable operation
5. Clutch engagement
6. Indicator warning light operation

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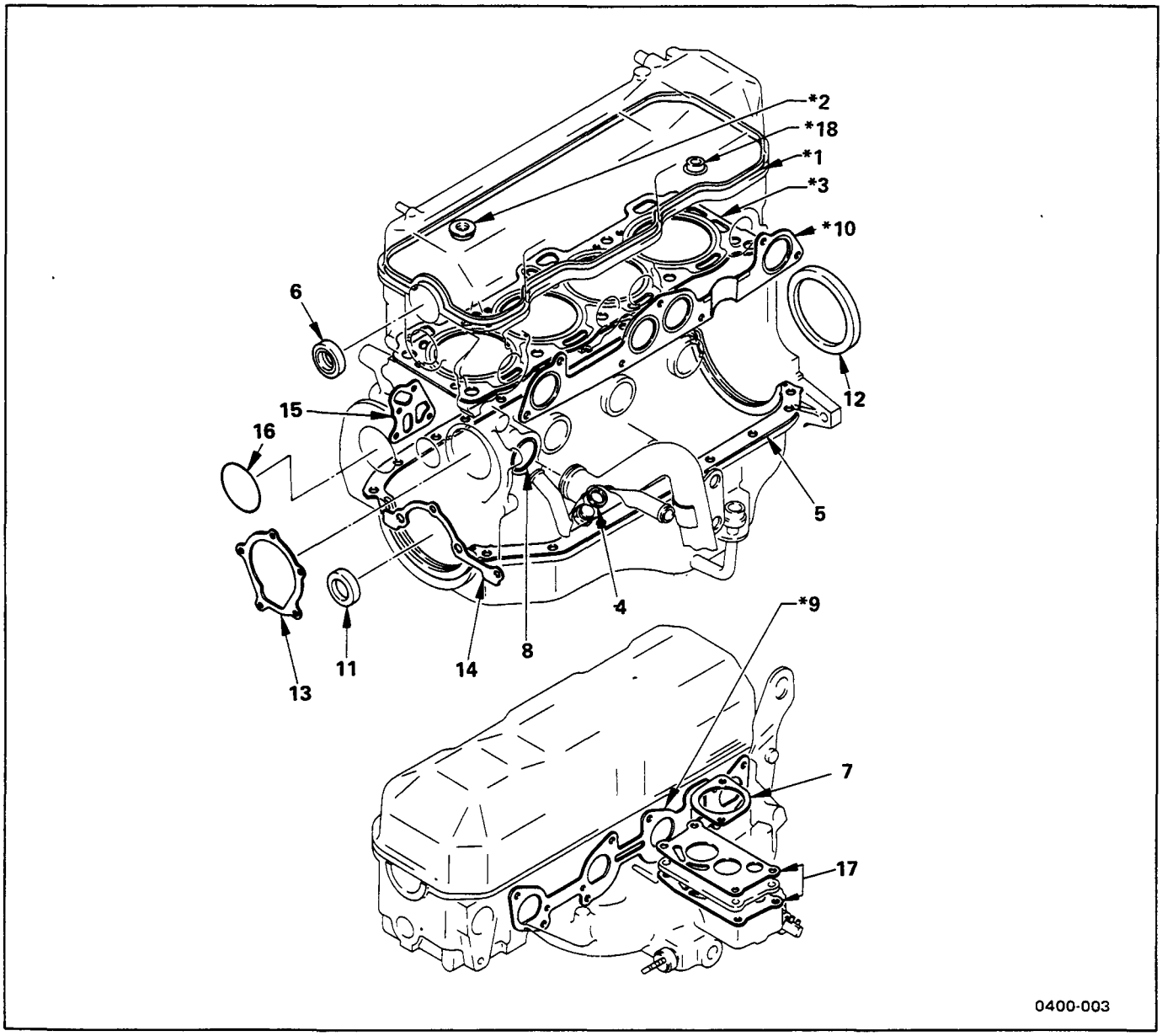
ENGINE REPAIR KIT

All of the numbered parts listed below are included in the Engine Repair Kit.
The gaskets marked with an asterisk (*) are also included in the Top Overhaul Kit.



040002B, 040002C

* 1. Cylinder head cover gasket
* 2. Cylinder head cover bolt gasket
* 3. Cylinder head gasket
4. Oil pan drain plug gasket
5. Oil pan gasket
6. Camshaft front oil seal
7. Intake manifold outlet pipe gasket
8. Water pipe O-ring
* 9. Intake manifold gasket
* 10. Exhaust manifold gasket
11. Crankshaft front oil seal
12. Crankshaft rear oil seal
13. Water pump gasket
14. Retainer gasket
15. Oil filter adapter gasket
16. Oil Pump O-ring
17. Heat insulator gasket
* 18. Valve stem oil seal

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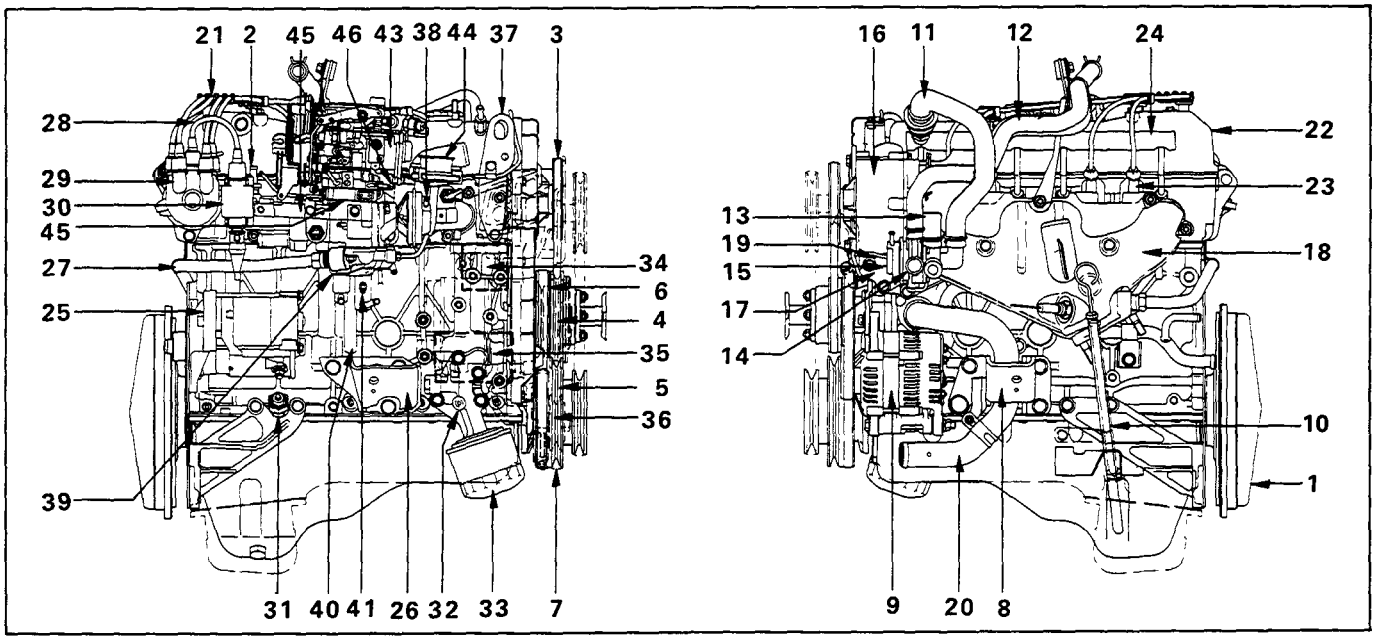
ENGINE OVERHAUL

DISASSEMBLY

EXTERNAL PARTS



Disassembly Steps

- ▲ 1. Clutch pressure plate assembly and driven plate assembly
- 2. Condenser [V]
- 3. Air pump drive belt [V]
- 4. Compressor drive belt [V]
- 5. Cooling fan drive belt
- 6. Cooling fan pulley
- 7. Crankshaft pulley
- 8. Engine foot with mounting rubber
- 9. Alternator and bracket
- 10. Dipstick and guide tube
- 11. Rubber hose (A.S.V. to check valve) [V]
- 12. Rubber hose (Air pump to air cleaner) [V]
- 13. Rubber hose (Air pump to A.S.V.) [V]
- 14. Rubber hose (A.S.V. to air intake duct bracket) [V]
- 15. Air switching valve or air bypass valve [V]
- 16. Air pump [V]
- 17. Air pump bracket "B" [V]
- 18. Exhaust manifold
- 19. Air pump bracket "A" [V]
- 20. Water intake pipe
- 21. High tension cable
- 22. Cylinder head cover
- 23. Spark plug
- 24. Air manifold with check valve [V]
- 25. Starter motor
- 26. Engine foot with mounting rubber
- 27. EGR pipe [V]
- 28. High tension cable (Ignition coil to distributor)
- 29. Distributor
- 30. Ignition coil [V]
- 31. Oil pressure switch
- 32. Oil pressure unit [V]
- 33. Oil filter adapter with oil filter
- 34. Power steering oil pump and bracket [V]
- 35. Compressor and bracket [V]
- 36. Compressor idler pulley and bracket [V]
- 37. Front engine hanger
- 38. EGR valve [V]
- 39. EGR adapter [V]
- 40. Fuel damper
- 41. Fuel pump
- 42. Water outlet pipe
- ▲ 43. Carburetor
- 44. BP transducer and bracket [V]
- 45. Intake manifold
- 46. Fast idle solenoid (with A/C)

[V] : Optional on some models

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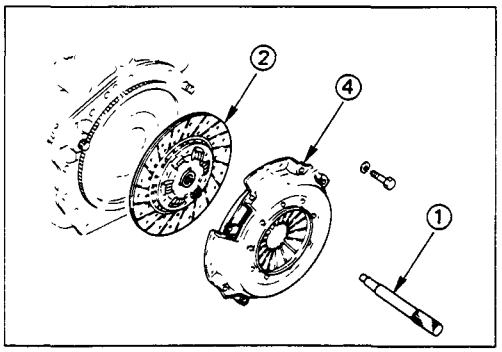
Important Operations

Emission Control Vacuum Hoses

Tag each of the emission control vacuum hoses before disassembly.

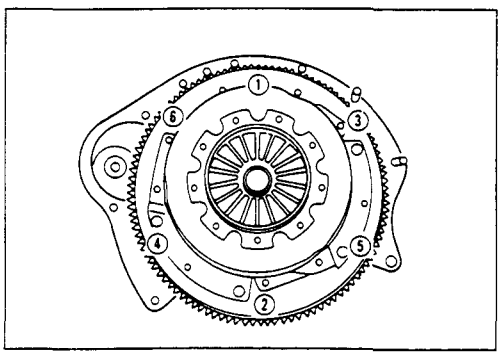
This will ensure that the hoses are reconnected correctly.



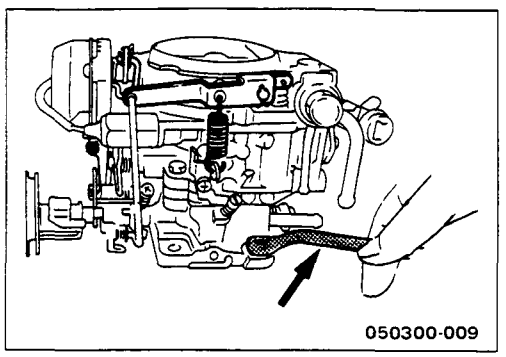
1. Clutch Pressure Plate Assembly and Driven Plate Assembly

1) Use the clutch pilot aligner ① to prevent the driven plate assembly ② from falling free.

   Clutch Pilot Aligner: 5-8525-3001-0 (J-24547)



2) Loosen the clutch cover bolts in the numerical order shown in the illustration.
3) Remove the pressure plate assembly ③ from the flywheel.
4) Remove the driven plate from the flywheel.



43. Carburetor

1) Disconnect the PCV hose, the fuel rubber hose, and the switch valve from the carburetor.
2) Use the carburetor wrench to remove the carburetor.

   Carburetor Wrench: 5-8511-9003-0 (J-26510)

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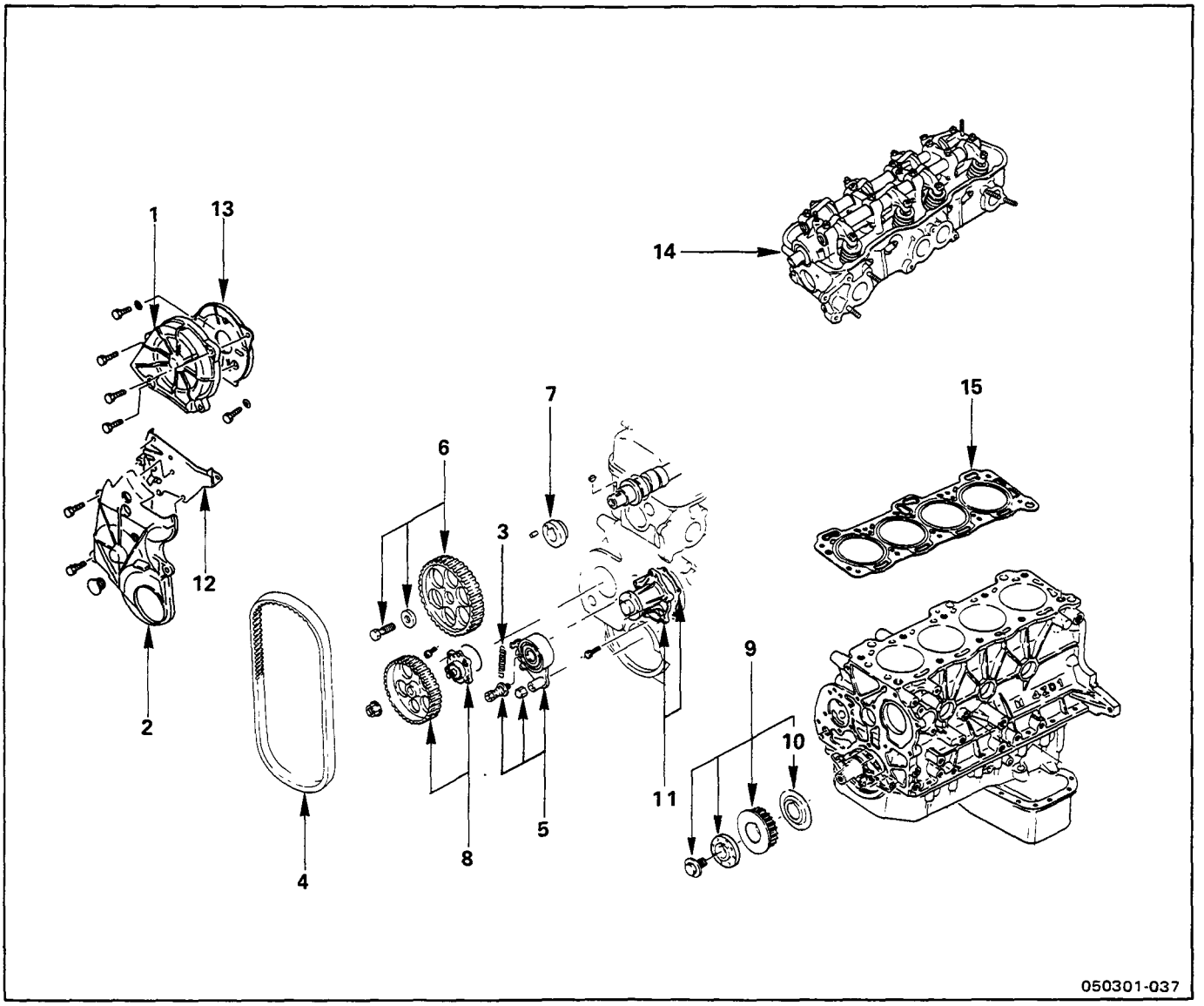
INTERNAL PARTS

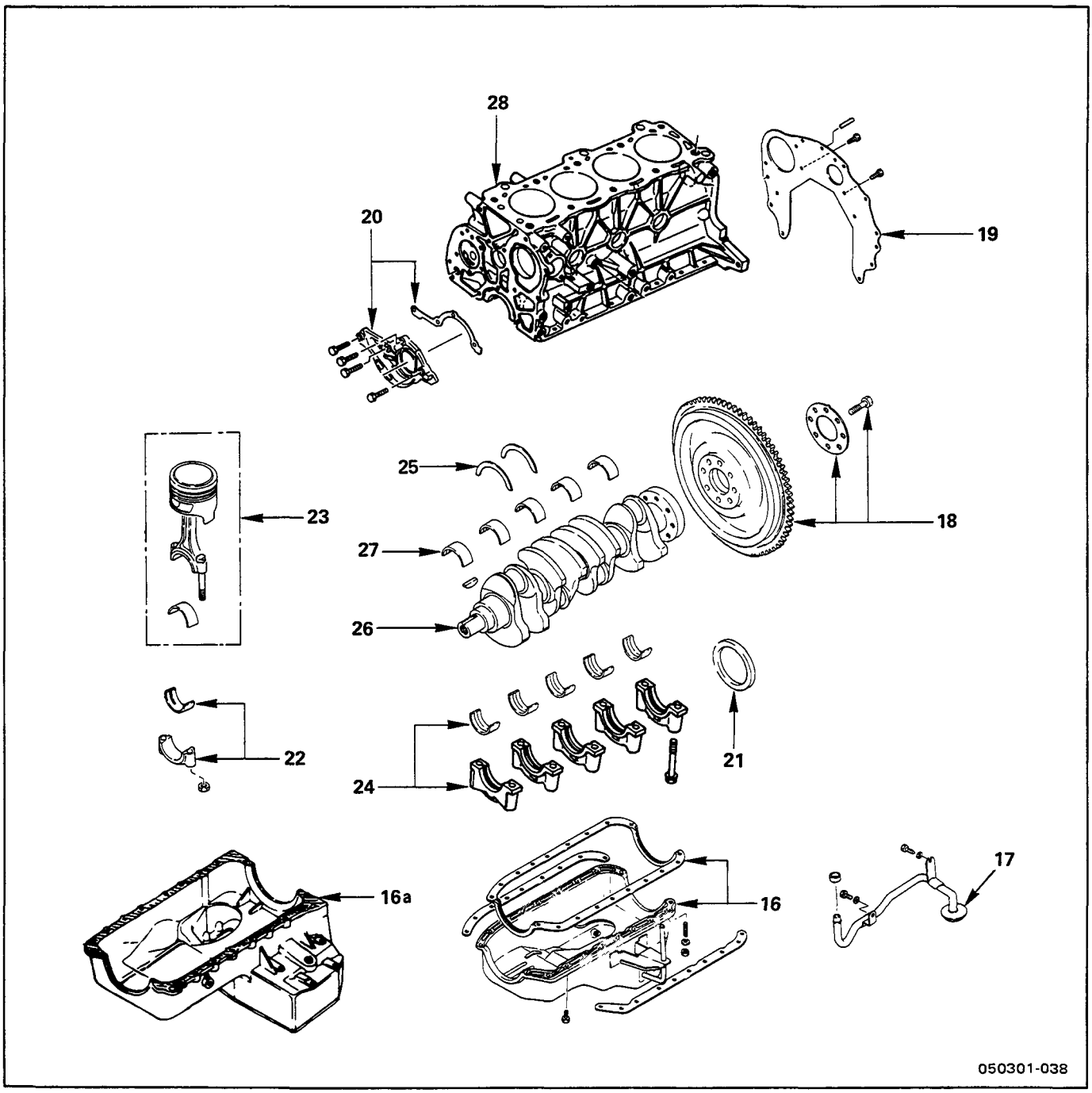
MAJOR COMPONENTS



Disassembly Steps-1

1. Timing belt upper cover
2. Timing belt lower cover
3. ▲ Tension spring
4. ▲ Timing belt
5. ▲ Tension pulley
6. ▲ Camshaft timing pulley
7. Camshaft boss
8. ▲ Oil pump with timing pulley
9. Crankshaft timing pulley
10. Timing belt guide plate
11. Water pump
12. Cylinder body front plate (Lower)
13. Cylinder head front plate (Upper)
14. ▲ Cylinder head with rocker arm shaft and camshaft
15. Cylinder head gasket

Inverted Engine



0503060002D, 0503060002E

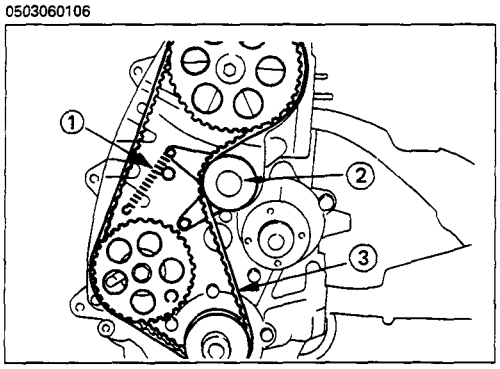
Disassembly Steps-2

16. Oil pan (For 4 × 2 except 4ZE1)
16a. Oil pan (For 4 × 4 and 4ZE1)
17. Oil strainer
▲ 18. Flywheel and bolt
19. Cylinder body rear plate
20. Crankshaft front oil seal retainer
21. Crankshaft rear oil seal
▲ 22. Connecting rod bearing cap with lower bearing
▲ 23. Piston and connecting rod with upper bearing
▲ 24. Crankshaft bearing cap with lower bearing
25. Crankshaft thrust bearing
26. Crankshaft
▲ 27. Crankshaft upper bearing
28. Cylinder body

05030601

Important Operations

0503060106



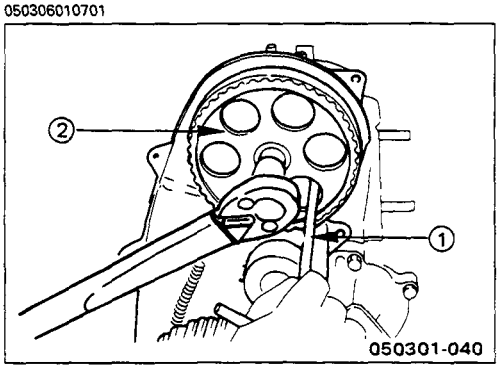
3. Tension Spring

4. Timing Belt

5. Tension Pulley

1) Remove the tension spring.
2) Loosen bolt ①, draw the tension pulley ② fully to the water pump side.
3) Remove the timing belt ③.
4) Remove the tension pulley.

050306010701

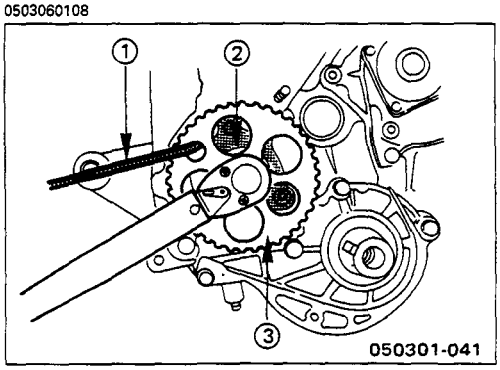


6. Camshaft Timing Pulley

1) Set a T-bar wrench ① to one of the timing cover bolts through a timing pulley hole.

   This will prevent the timing pulley ② from turning.
2) Loosen the timing pulley bolt and remove the timing pulley.

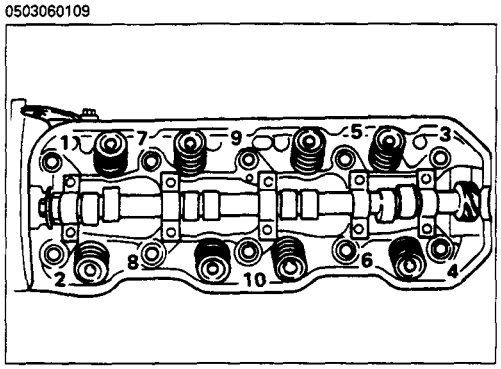
0503060108



8. Oil Pump with Timing Pulley

Use a 6 mm (0.24 in) Allen wrench ① to remove the oil pump ② along with the oil pump timing pulley ③ and the rotor.

0503060109



14. Cylinder Head with Rocker Arm Shaft and Camshaft

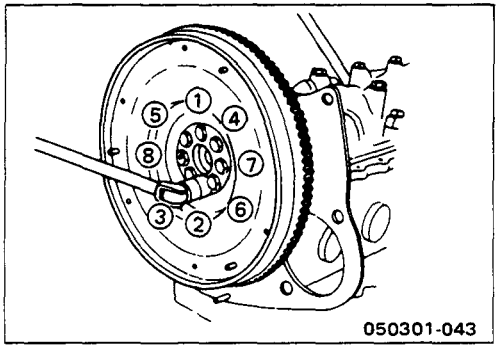
Use the extension bar wrench to loosen the cylinder head bolts in numerical order a little at a time.

Extension Bar Wrench: 9-8511-4209-0 (J-24239-01)

Note:

Head warpage could result from bolts removing in incorrect order.

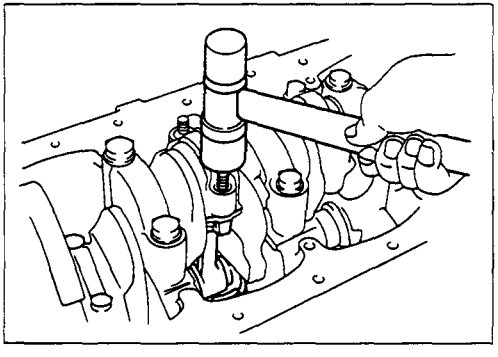
0503010107



18. Flywheel

1) Block the crankshaft with a piece of hard wood to prevent the flywheel from turning.
2) Loosen the flywheel bolts in numerical order a little at a time.

050301011501



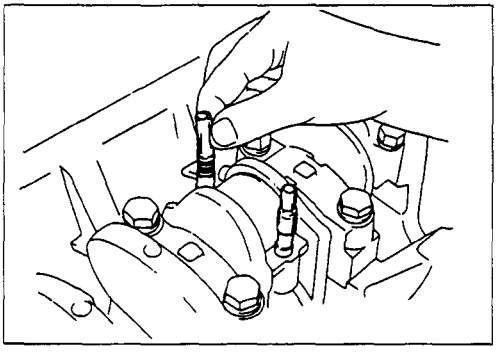
22. Connecting Rod Bearing Cap with Lower Bearing

Remove the connecting rod cap nuts.

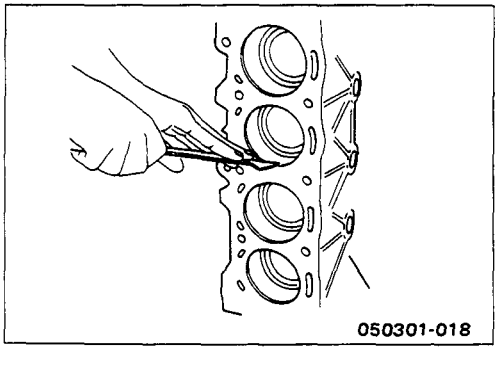
Using a plastic-faced hammer, ligtly tap the connecting rod bolts and lift off the rod connecting cap.

Note:

Keep the lower bearing insert with the connecting rod cap.



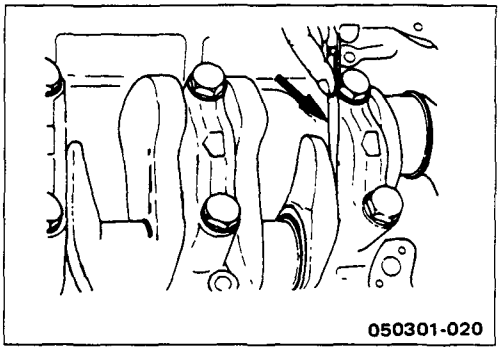
Cover the connecting rod bolts with a short piece of hose to protect the crankshaft from damage.



23. Piston and Connecting Rod with Upper Bearing

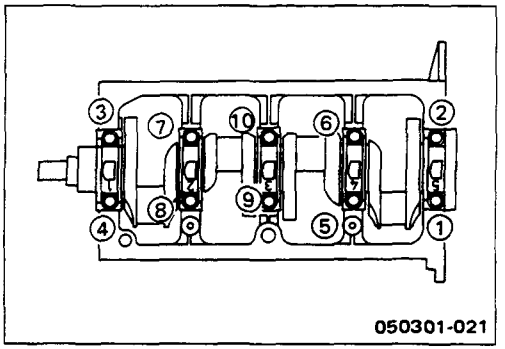
1) Remove carbon deposits from the upper portion of the cylinder wall with a scraper before removing the piston and connecting rod.
2) Move the piston to the top of the cylinder and tap it with a hammer grip or similar object from the connecting rod lower side to drive it out.

0503010114A



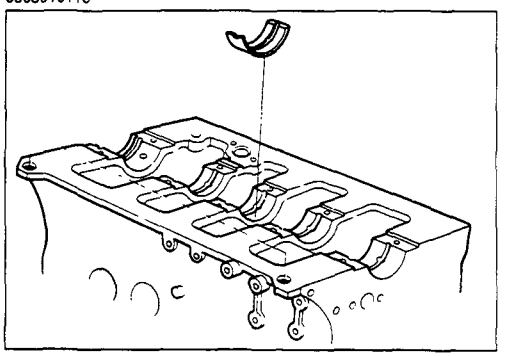
050301-020

0503010114B



050301-021

0503010116



24. *Crankshaft Bearing Cap with Lower Bearing*

1) Measure the crankshaft end play at the center journal of the crankshaft.

   If the measured value exceeds the specified limit, the crankshaft thrust bearing must be replaced.

Crankshaft End Play mm(in)

Standard	Limit
0.06 — 0.25 (0.0024 — 0.0099)	0.3 (0.012)

2) Loosen the bearing cap bolts in numerical order a little at a time.

Note:

- **Keep the lower bearing and bearing cap together.**
- **Arrange the bearing caps and lower thrust washers in correct order.**

27. Crankshaft Upper Bearing

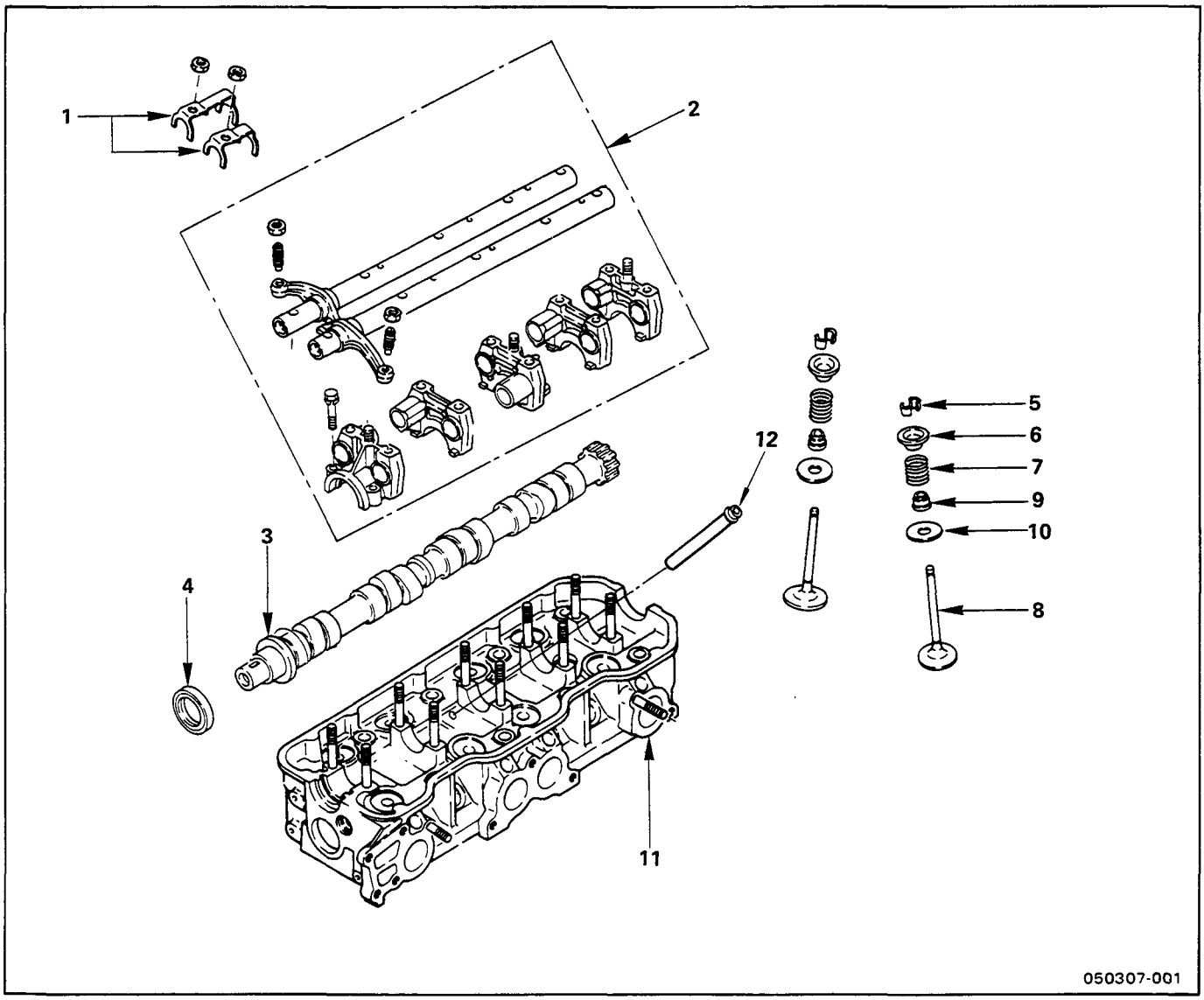
Note:

- **Keep the upper bearing and upper thrust washer to gether with the cylinder block.**

0503030001A

MINOR COMPONENTS

CYLINDER HEAD WITH ROCKER ARM SHAFT AND CAMSHAFT



0503030001B

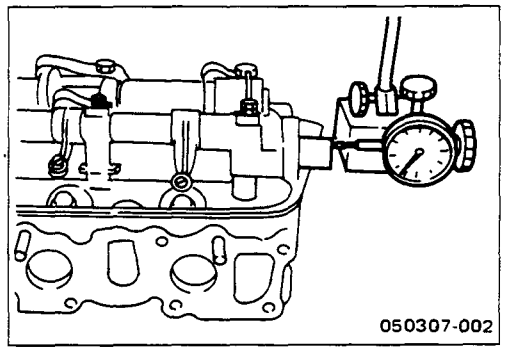
Disassembly Steps

- ▲ 1. Rocker arm shaft bracket nut and spring (No.1 - No.4)
- ▲ 2. Rocker arm shaft, rocker arm, and bracket
- ▲ 3. Camshaft
- 4. Camshaft front oil seal
- ▲ 5. Split collar
- 6. Valve spring upper seat
- 7. Valve spring
- ▲ 8. Intake and exhaust valve
- 9. Valve stem oil seal
- 10. Valve spring lower seat
- 11. Cylinder head
- 12. Fuel pump push rod

05030301

Important Operations

0503030103



1. Rocker Arm Shaft Bracket Nut and Spring (No.1 - No.4)

2. Rocker Arm Shaft, Rocker Arm, and Bracket

3. Camshaft

1) Measure the camshaft end play before removing the rocker arm shaft, the bracket, and the camshaft.

2) Camshaft End Play Measurement

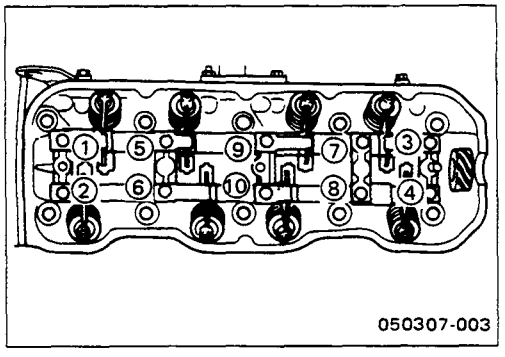
Use a dial indicator to measure the camshaft end play.

If the measured value exceeds the specified limit, the camshaft and/or the cylinder head must be replaced.

Camshaft End Play mm(in)

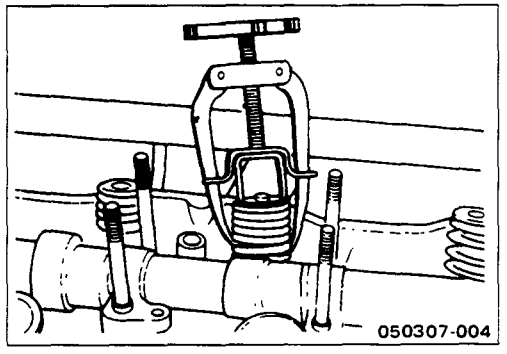
Standard	Limit
0.050 – 0.114 (0.0020 – 0.0044)	0.2 (0.008)

050306011



3) Loosen the rocker arm shaft bracket bolts in numerical order a little at a time.

05030301



5. Split Collar

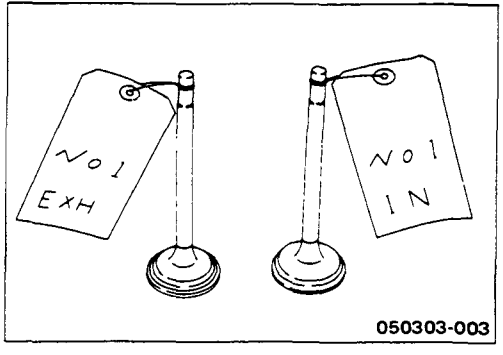
1) Place the cylinder head on a flat wooden surface.

2) Use the spring compressor to remove the split collars.

Do not allow the valve to fall from the cylinder head.

Spring Compressor: 5-8840-0205-0 (J-26513-A)

050303102



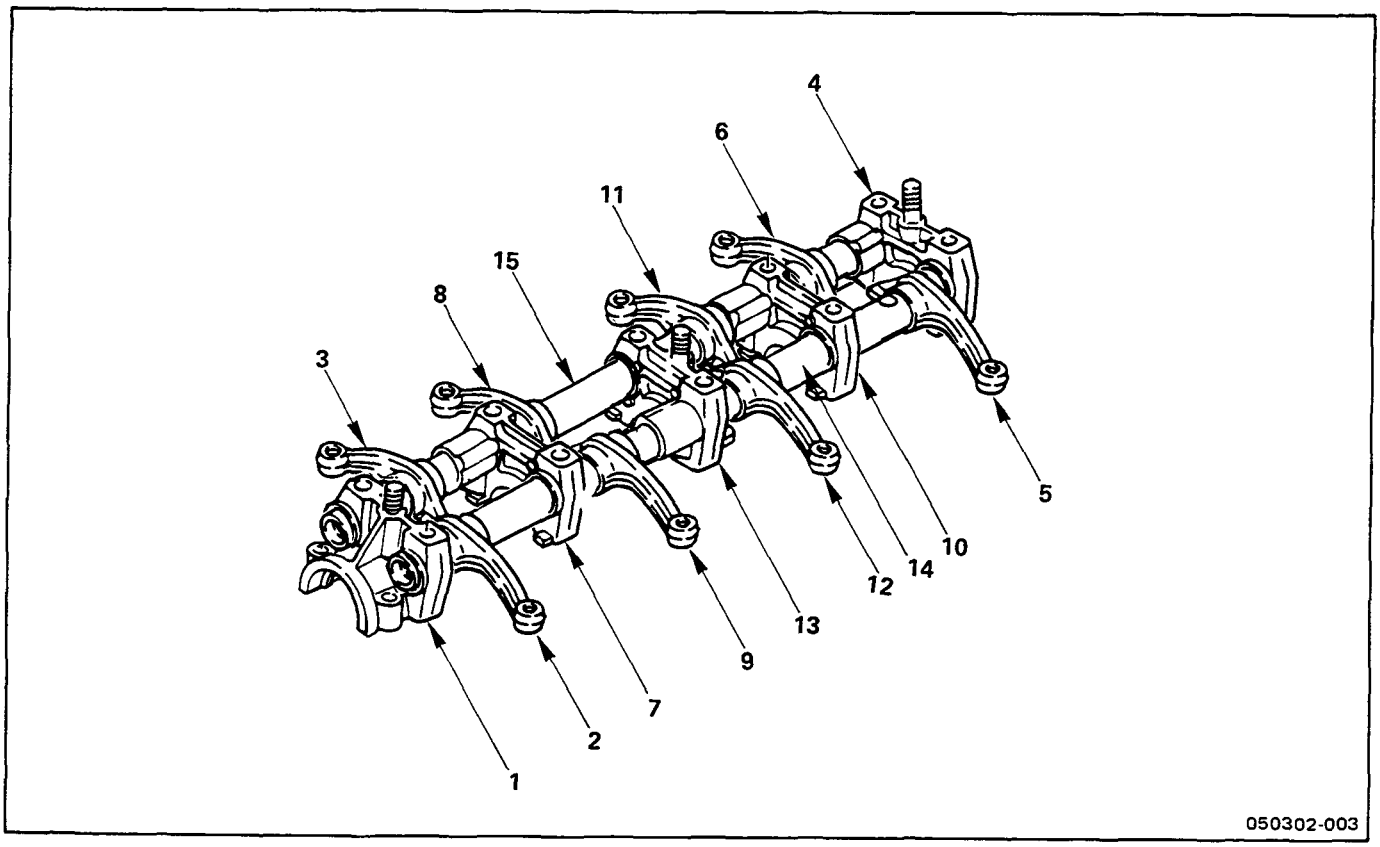
8. Intake and Exhaust Valve

Note:

Arrenge the intake and exhaust valves.

0503020001A

ROCKER ARM SHAFT AND ROCKER ARM

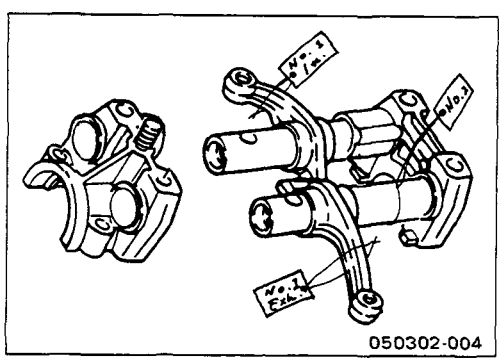


0503020001B

Disassembly Steps

1. No. 1 rocker arm shaft bracket
2. No. 1 exhaust valve rocker arm
3. No. 1 intake valve rocker arm
4. No. 5 rocker arm shaft bracket
5. No. 4 exhaust valve rocker arm
6. No. 4 intake valve rocker arm
7. No. 2 rocker arm shaft bracket
8. No. 2 intake valve rocker arm
9. No. 2 exhaust valve rocker arm
10. No. 4 rocker arm shaft bracket
11. No. 3 intake valve rocker arm
12. No. 3 exhaust valve rocker arm
13. No. 3 rocker arm shaft bracket
14. Rocker arm shaft (Exhaust side)
15. Rocker arm shaft (Intake side)

Important Operations



▲ Rocker Arm Shaft Bracket

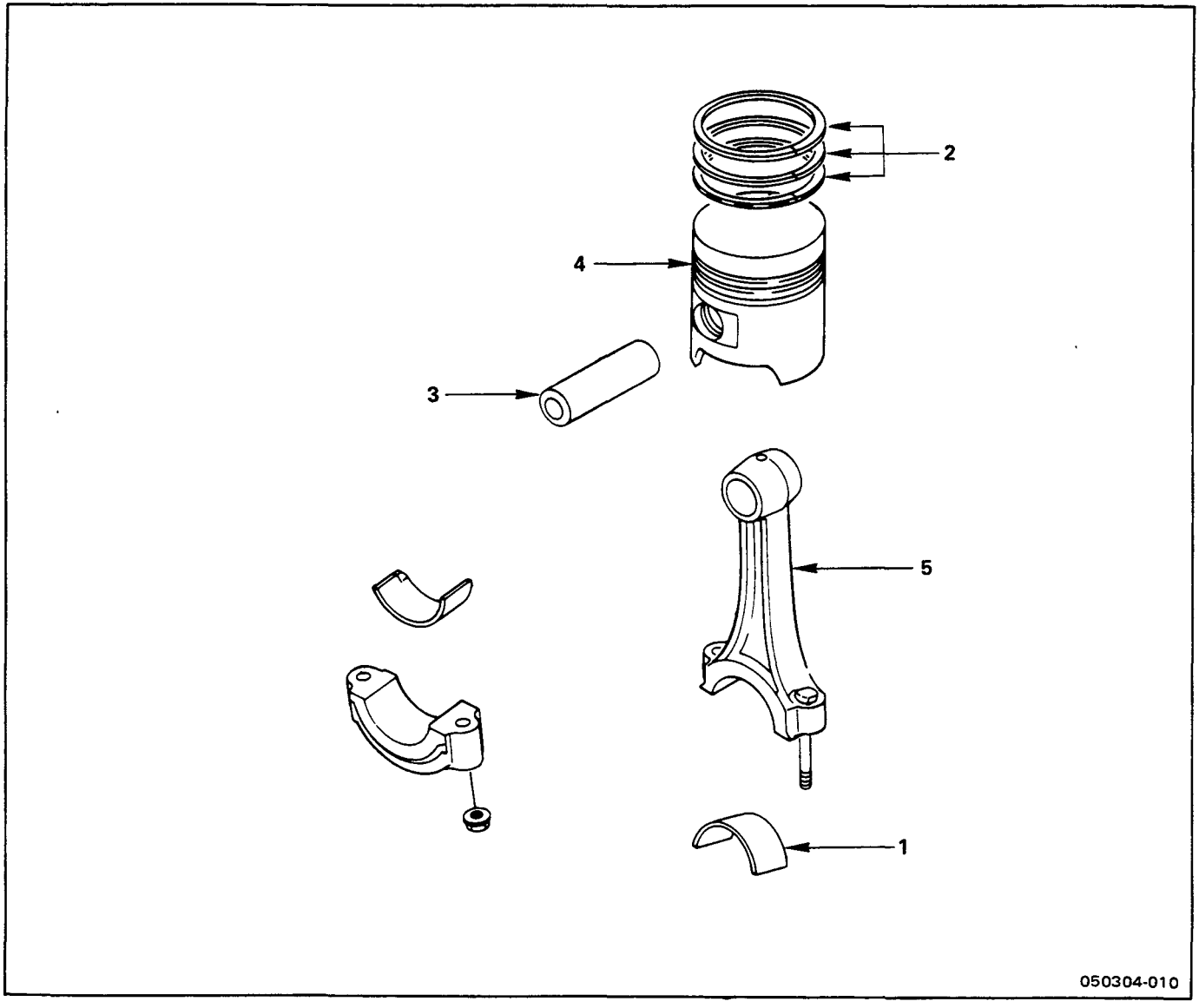
▲ Rocker Arm

If the rocker arms and rocker arm shaft brackets are to be reused, they must be installed to their original positions.

Tag each rocker arm with the cylinder number from which it was removed.

Tag each rocker arm shaft bracket with the position from which it was removed (1, 2, 3, 4 and 5 from front to back).

050304A
PISTON AND CONNECTING ROD



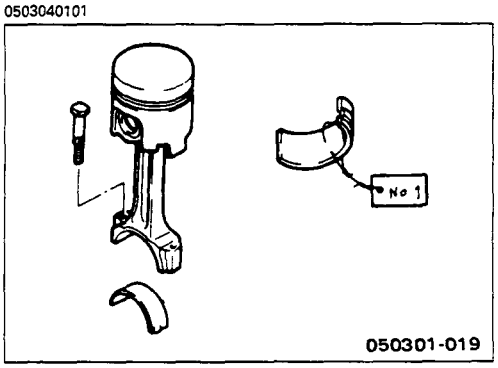
0503040001B
Disassembly Steps

▲ 1. Connecting rod bearing
▲ 2. Piston ring
▲ 3. Piston pin
▲ 4. Piston
▲ 5. Connecting rod

05030401

Important Operations

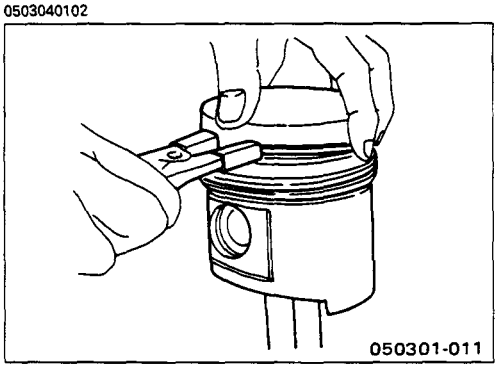
0503040101



1. Connecting Rod Bearing

If the connecting rod bearings are to be reinstalled, mark their fitting positions by tagging each bearing with the cylinder number from which it was removed.

0503040102



2. Piston Ring

1) Clamp the connecting rod in a vise.

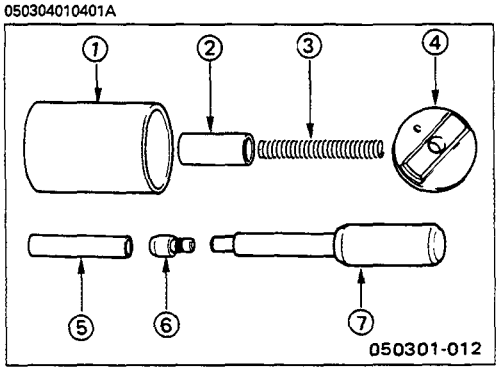
   Take care not to damage the connecting rod.

2) Use a piston ring replacer to remove the piston rings.

   Piston Ring Replacer:

   Do not attempt to use some other tool to remove the piston rings. Piston ring stretching will result in reduced piston ring tension.

050304010401A



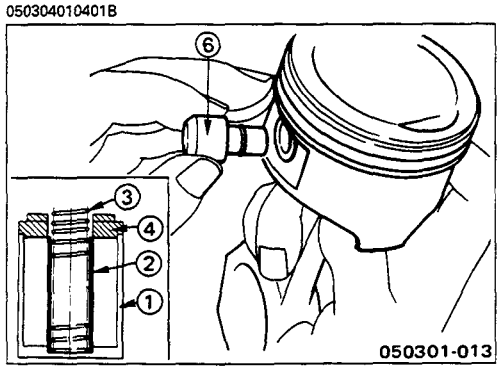
3. Piston Pin
4. Piston
5. Connecting Rod

Piston Pin Replacement Using The Special Tool

Piston Pin Replacer: 5-8840-0359-0 for 4ZC1
5-8840-0361-0 for 4ZD1/4ZE1

① Body
② Spring guide
③ Spring
④ Adapter
⑤ Installation guide
⑥ Removal guide
⑦ Driver handle

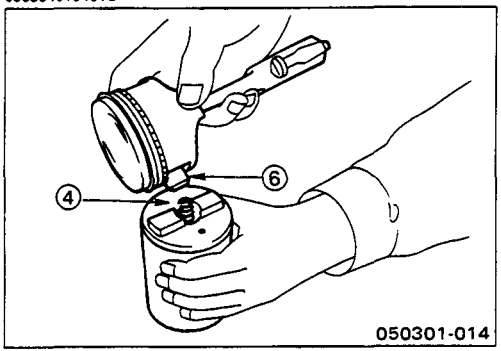
050304010401B



Piston Pin Removal Procedure

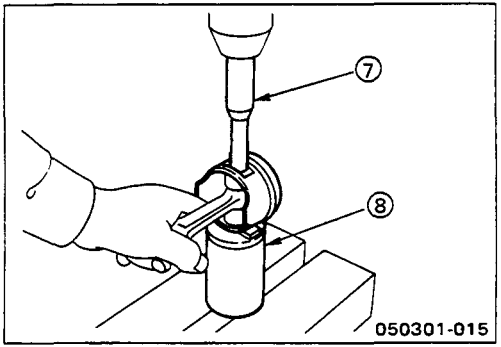
1) Set the spring guide ②, the spring ③, and the adapter ④ to the body ①.
2) Install the removal guide ⑥ to the piston pin.

050304010401C



3) Set the piston with the removal guide ⑥ to the top side of the adapter ④.

050304010401D



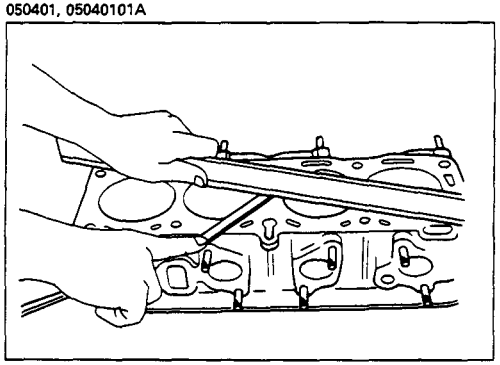
4) Place the piston pin replacer ⑧ (now holding the piston) on a bench press.
5) Use the bench press and the driver handle ⑦ to slowly force out the piston pin.
6) Remove the connecting rod from the piston.

0504

INSPECTION AND REPAIR

Make the necessary adjustments, repairs, and part replacements if excessive wear or damage is discovered during inspection.

050401, 05040101A



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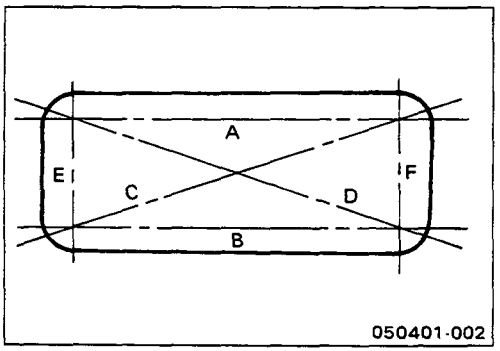
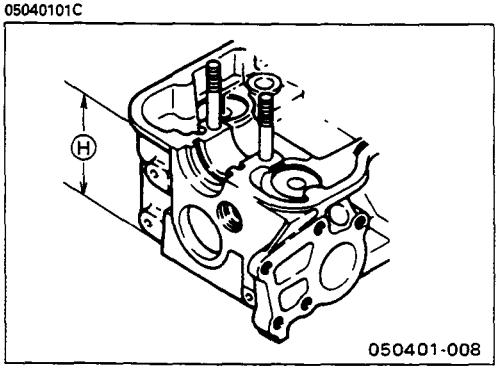


05040101C



CYLINDER HEAD

Cylinder Head Lower Face Warpage

1. Use a straight edge and a feeler gauge to measure the four sides and the two diagonals of the cylinder head lower face.
2. Regrind the cylinder head lower face if the measured values are greater than the specified limit but less than the maximum grinding allowance.

   If the measured values exceed the maximum grinding allowance, the cylinder head must be replaced.

Cylinder Head Lower Face Warpage mm(in)

Standard	Limit	Maximum Grinding Allowance
0.05 (0.002) or less	0.2 (0.008)	0.4 (0.016)

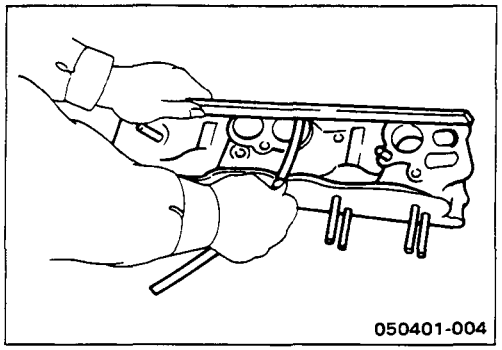
Cylinder Head Height Ⓗ (Reference) mm(in)

Standard
93.15 – 93.25 (3.667 – 3.671)

Note:

If the cylinder head lower face is reground, valve depression must be checked.

05040102



Manifold Fitting Face Warpage

Use a straight edge and a feeler gauge to measure the manifold cylinder head fitting face warpage.

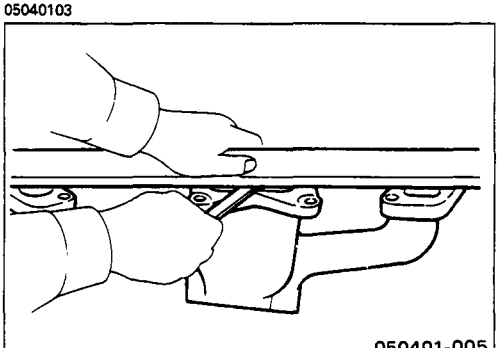
Regrind the manifold cylinder head fitting faces if the measured values are greater than the specified limit but less than the maximum grinding allowance.

If the measured values exceed the maximum grinding allowance, the cylinder head must be replaced.

Manifold Fitting Face Warpage mm(in)

Standard	Limit	Maximum Grinding Allowance
0.05 (0.002) or less	0.20 (0.008)	0.40 (0.016)

05040103



Exhaust Manifold Warpage

Use a straight edge and a feeler gauge to measure the manifold cylinder head fitting face warpage.

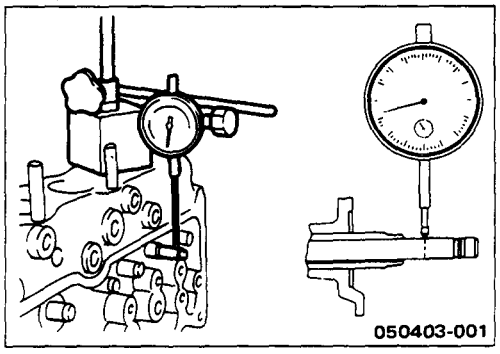
Regrind the exhaust manifold cylinder head fitting faces if the measured values are between the specified limit and the standard.

If the measured values exceed the specified limit, the manifold must be replaced.

Exhaust Manifold Warpage mm(in)

Standard	Limit
0.05 (0.002) or less	0.20 (0.008)

050403, 05040301A



VALVE GUIDE

Valve Stem and Valve Guide Clearance

Measuring Method

1. With the valve stem inserted in the valve guide, set the dial indicator needle to "0".
2. Move the valve head from side to side.

   Read the dial indicator.

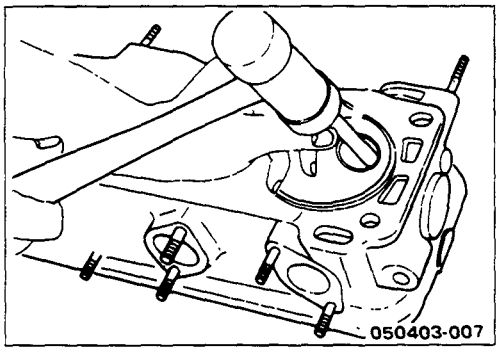
   Note the highest dial indication.

   If the measured values exceed the specified limit, the valve and the valve guide must be replaced as a set.

Valve Stem Clearance mm(in)

	Standard	Limit
Intake Valve	0.023—0.056 (0.0009—0.0022)	0.200 (0.0080)
Exhaust Valve	0.038—0.070 (0.0015—0.0028)	0.250 (0.0098)

05040301B



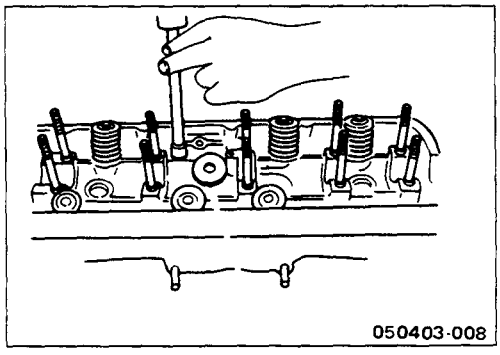
Valve Guide Replacement

Valve Guide Removal

Use a hammer and the valve guide replacer to drive out the valve guide from the cylinder head lower face.

Valve Guide Replacer: 5-8523-0002-0 (J-26512-1)

0504030202A

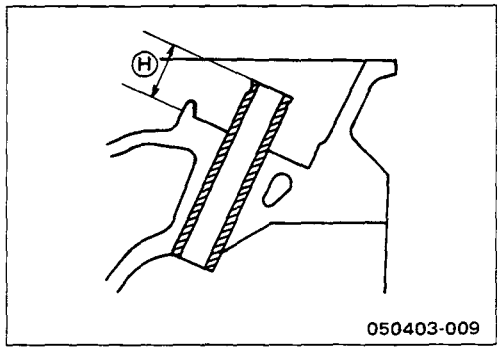


Valve Guide Installation

1. Apply engine oil to the valve guide outer circumference.
2. Attach the valve guide installer to the valve guide.
3. Use a hammer to drive the valve guide into position from the cylinder head upper face.

   Valve Guide Installer: 5-8523-0002-0 (J-26512-2)

0504030202B



4. Measure the height of the valve guide upper end from the upper face of the cylinder head.

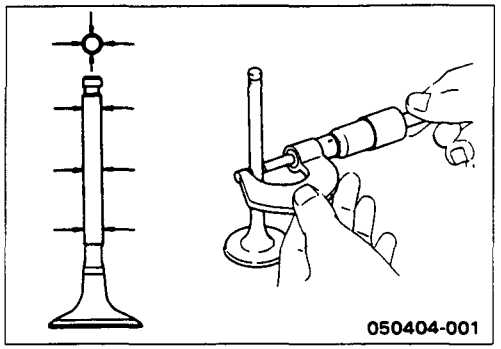
Valve Guide Upper End Height Ⓗ (Reference) mm(in)

16.1 — 16.3 (0.634 — 0.642)

Note:

If the valve guide has been removed, both the valve and the valve guide must be replaced as a set.

050404, 05040401



VALVE AND VALVE SEAT INSERT

Valve Stem Outside Diameter

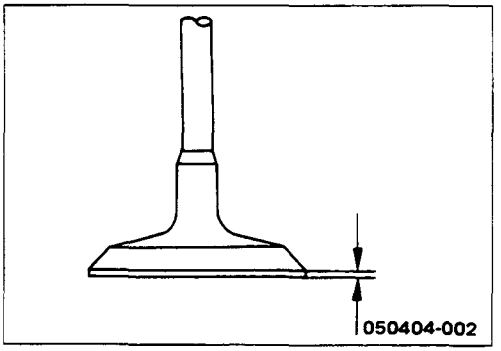
Measure the valve stem diameter at three points.

If the measured value is less than the specified limit, the valve and the valve guide must be replaced as a set.

Valve Stem Outside Diameter mm(in)

	Standard	Limit
Intake Valve	7.949 – 7.961 (0.3129 – 0.3134)	7.88 (0.3102)
Exhaust Valve	7.932 – 7.946 (0.3118 – 0.3124)	7.85 (0.3090)

05040402, 0504040201



Valve Thickness

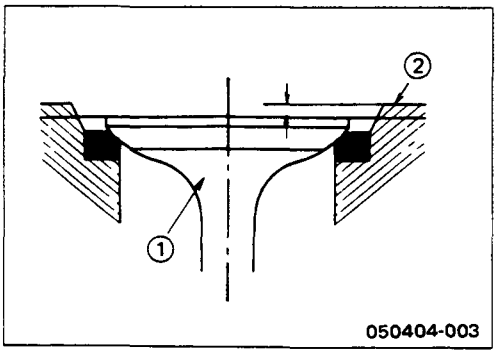
Measure the valve thickness.

If the measured value is less than the specified limit, the valve and the valve guide must be replaced as a set.

Intake and Exhaust Valve Thickness mm(in)

	Standard	Limit
Intake Valve	1.1 (0.043)	0.8 (0.031)
Exhaust Valve	1.3 (0.051)	1.0 (0.040)

05040403



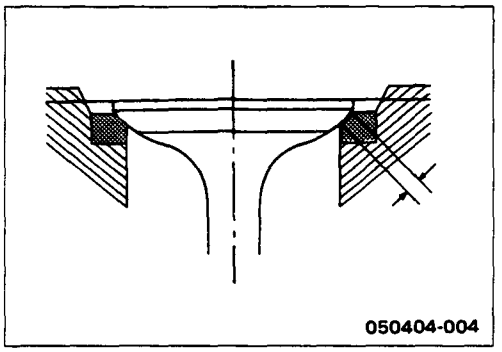
Valve Depression

1. Install the valve ① to the cylinder head ②.
2. Use a depth gauge or a straight edge with steel rule to measure the valve depression from the cylinder head lower surface.
   If the measured value exceeds the specified limit, the valve seat insert must be replaced.

Valve Depression mm(in)

Standard	Limit
1.0 (0.040)	1.7 (0.067)

05040404



Valve Contact Width

1. Check the valve contact faces for roughness and unevenness.

   Make smooth the valve contact surfaces.

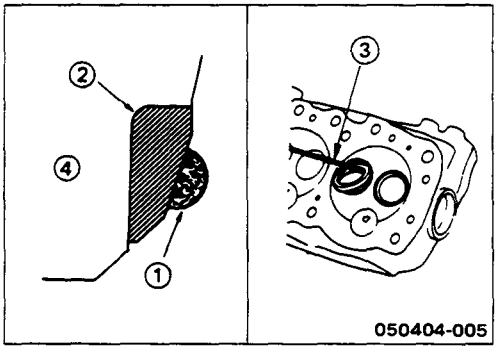
2. Measure the valve contact width.

   If the measured value exceeds the specified limit, the valve seat insert must be replaced.

Valve Contact Width mm(in)

Standard	Limit
1.2 — 1.5 (0.05 — 0.06)	2.0 (0.08)

05040405, 0504040501



Valve Seat Insert Replacement

Valve Seat Insert Removal

1. Arc weld the entire inside circumference ① of the valve seat insert ②.
2. Allow the valve seat insert to cool for a few minutes.

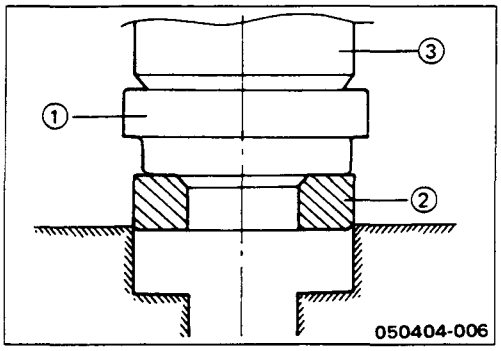
   This will invite contraction and make removal of the valve seat insert easier.

3. Use a screwdriver ③ to pry the valve seat insert free.

   Take care not to damage the cylinder head ④.

4. Carefully remove carbon and other foreign material from the cylinder head insert bore.

0504040502



Valve Seat Insert Installation

1. Carefully place the attachment ① (having a smaller outside diameter than the valve seat insert) on the valve seat insert ②.

Note:

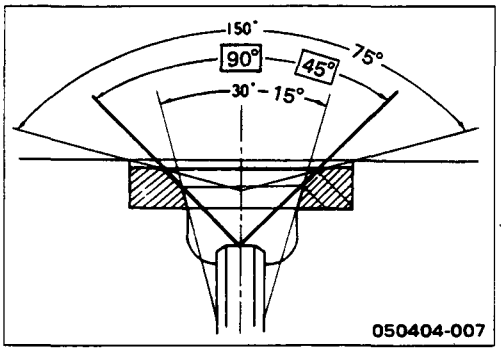
The smooth side of the attachment must contact the valve seat insert.

2. Use a bench press ③ to gradually apply pressure to the attachment and press the valve seat insert into place.

Note:

Do not apply an excessive amount of pressure with the bench press. Damage to the valve seat insert will result.

05040406A

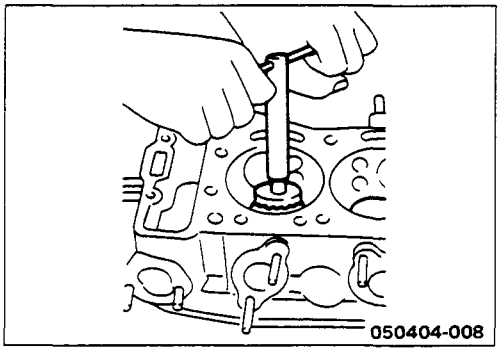


Valve Seat Insert Correction

1. Remove the carbon from the valve seat insert surface.
2. Use a valve cutter (15°, 45°, and 75° blades) to minimize scratches and other rough areas. This will bring the contact width back to the standard value.

   Remove only the scratches and rough areas. Do not cut away too much. Take care not to cut away unblemished areas of the valve seat surface.

05040406B



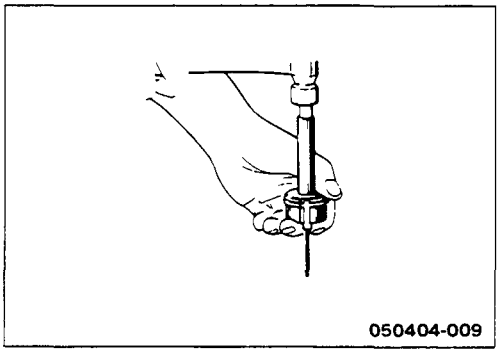
Valve Seat Angle	degree
45°	

Note:

Use an adjustable valve cutter pilot.

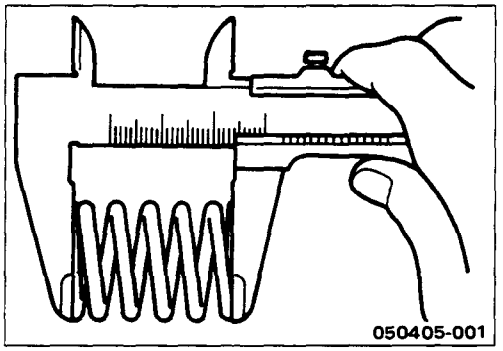
Do not allow the valve cutter pilot to wobble inside the valve guide.

05040406C



3. Apply abrasive compound to the valve seat insert surface.
4. Insert the valve into the valve guide.
5. Turn the valve while tapping it to fit the valve seat insert.
6. Check that the valve contact width is correct.
7. Check that the valve seat insert surface is in contact with the entire circumference of the valve.

05040405, 0504040501



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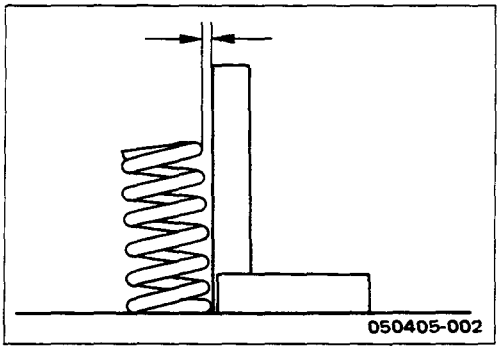

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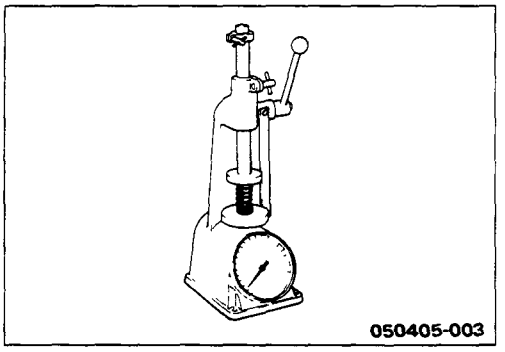
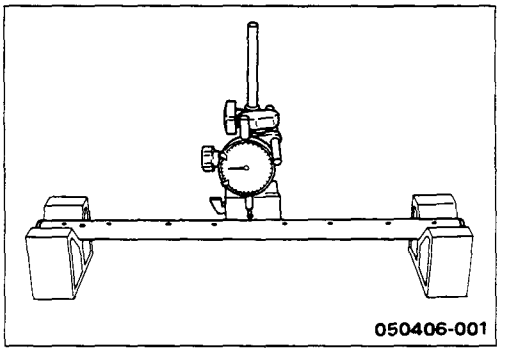


050406, 05040601



VALVE SPRING

Valve Spring Free Height

Use a vernier caliper to measure the valve spring free height.
If the measured value is less than the specified limit, the valve spring must be replaced.

Inner Spring and Outer Spring Free Height mm(in)

Standard	Limit
48.1 (1.894)	46.5 (1.83)

Valve Spring Squareness

Use a surface plate and a square to measure the valve spring squareness.

If the measured value exceeds the specified limit, the valve spring must be replaced.

Inner and Outer Spring Squareness mm(in)

2.1 (0.08)

Valve Spring Tension

Use a spring tester to measure the valve spring tension.

If the measured value is less than the specified limit, the valve spring must be replaced.

Valve Spring Tension kg(lb/N)

Compressed Height	Standard	Limit
41.0 mm (1.61 in)	23.1–27.1 (50.8–59.6/ 226.38–265.58)	22.0 (48.4/ 215.60)

ROCKER ARM SHAFT AND ROCKER ARM

Rocker Arm Shaft Run-Out

1. Place the rocker arm shaft on a V-block.
2. Use a dial indicator to measure the rocker arm shaft central portion run-out.

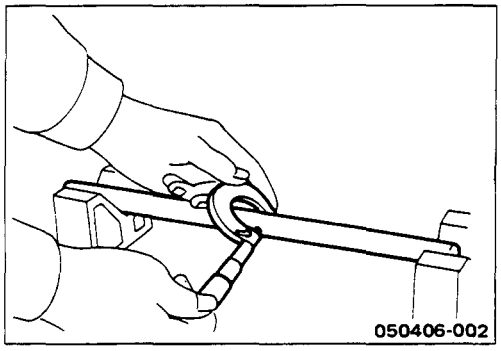
   If the run-out is very slight, correct the rocker arm shaft run-out with a bench press. The rocker arm must be at cold condition.

   If the measured rocker arm shaft run-out exceeds the specified limit, the rocker arm shaft must be replaced.

Rocker Arm Shaft Run-Out mm(in)

Standard	Limit
0.2 (0.008) or less	0.4 (0.016)

05040602



Rocker Arm Shaft Outside Diameter

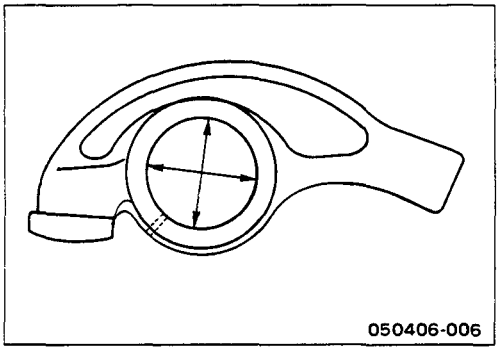
Use a micrometer to measure the rocker arm fitting portion outside diameter.

If the measured value is less than the specified limit, the *rocker arm shaft must be replaced.*

Rocker Arm Shaft Outside Diameter mm(in)

Standard	Limit
20.5 (0.807)	20.35 (0.801)

0504060302A



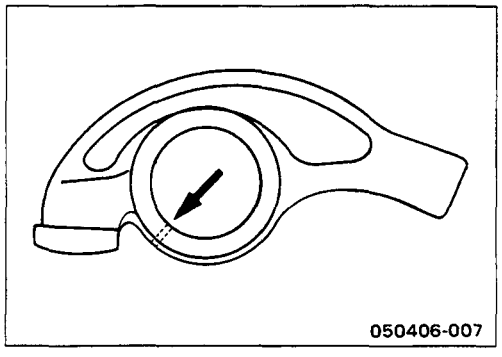
Rocker Arm Shaft and Rocker Arm Clearance

1. If the clearance between the rocker arm shaft inside diameter and the rocker arm shaft outside diameter (rocker arm fitting position diameter) exceeds the limit, the rocker arm and the rocker arm shaft must be replaced.

Rocker Arm and Rocker Arm Shaft Clearance mm(in)

Standard	Limit
0.005–0.045 (0.002–0.0018)	0.2 (0.008)

05040603B



2. Check that the rocker arm oil port is free of obstructions.

   If necessary, use compressed air to clean the rocker arm oil port.

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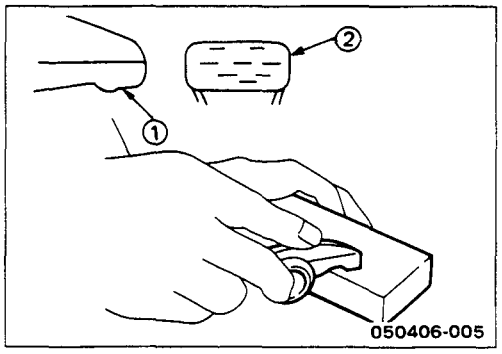


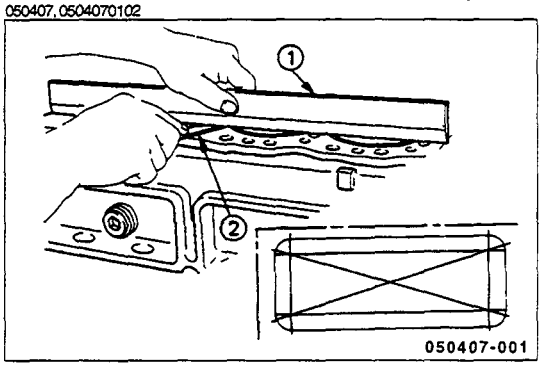
Rocker Arm Correction

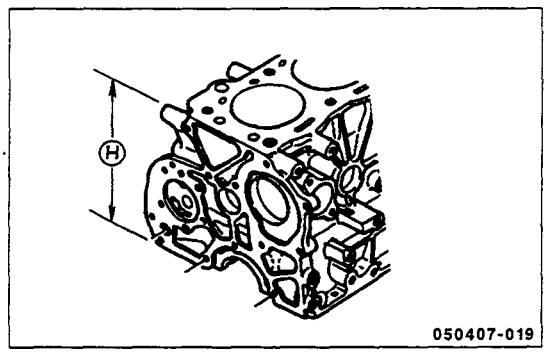
Inspect the rocker arm valve stem contact surfaces for step wear ① and scoring ②.

If the contact surfaces have light step wear or scoring, they may be honed with an oil stone.

If the step wear or scoring is severe, the rocker arm must be replaced.

050407, 0504070102





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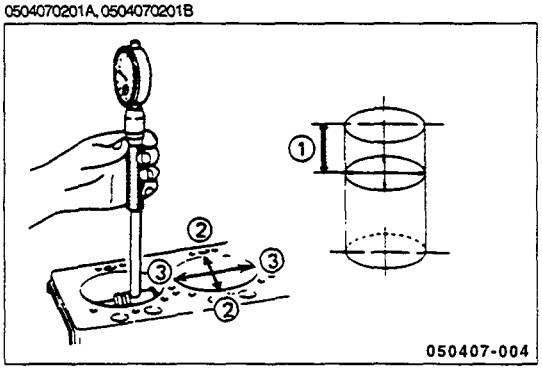


CYLINDER BODY

Cylinder Body Upper Face Warpage

Use a straight edge ① and a feeler gauge ② to measure the four sides and the two diagonals of the cylinder body upper face.

If the measured value is more than the limit, the cylinder body must be replaced.

Cylinder Body Upper Face Warpage mm(in)

Standard	Limit
0.05 or less	0.2 (0.008)

Cylinder Body HeightⒽ (Reference) mm(in)

Standard	
4ZC1	214.5 (8.445)
4ZE1	237.0 (9.390)

Note:

Never attempt to regrinding the cylinder body if the upper face warpage exceeds the limit.

Cylinder Bore Measurement

Use a cylinder indicator to measure the cylinder bore at measuring point ① in the thrust ② - ② and axial ③ - ③ directions of the crankshaft.

Measuring Point ① : Approximately 10 mm (0.39 in)

If the measured value exceeds the specified limit, the cylinder must be rebored.

Cylinder Bore mm(in)

	Standard	Limit
4ZC1	88.0 (3.465)	88.2 (3.472)
4ZE1	92.6 (3.645)	92.8 (3.653)

If there is scarring or scorching, the cylinder must be rebored.

Refer to "Cylinder Reboring Procedure".

If the measured cylinder bore exceeds the boring limit, the cylinder body must be replaced.

Boring Limit mm(in)

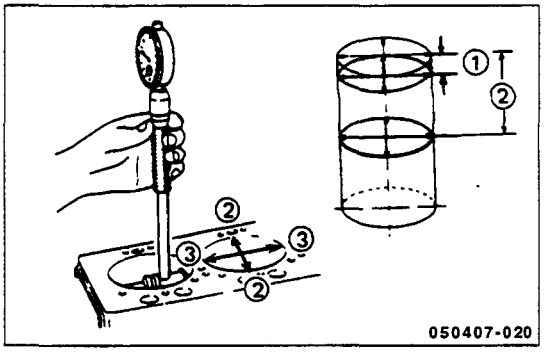
4ZC1	89.04 (3.506)
4ZE1	93.640 (3.6860)

Cylinder Reboring

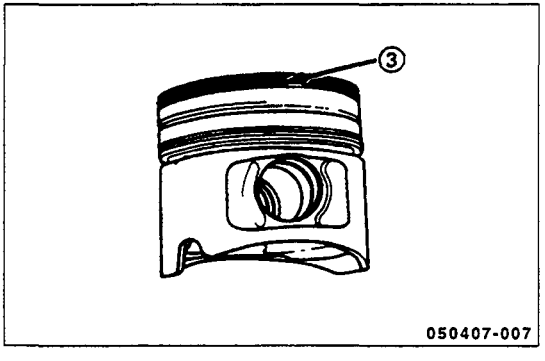
If even one cylinder measurement exceeds the specified limit, all the cylinders must be rebored. Never rebore only one cylinder.

Step wear and carbon deposits on the upper portion of the cylinder wall can be removed with a ridge reamer before reboring.

05040704A



05040704B



Cylinder Reboring Procedure

1. Preparation

   (1) Oversize Piston Selection

   Measure each cylinder bore.

   Measuring Point ①: 10 mm (0.39 in)
   Measuring Point ②: 70 mm (2.76 in)

   Oversize pistons are available in two sizes. Select the correct size after determining the largest cylinder bore.

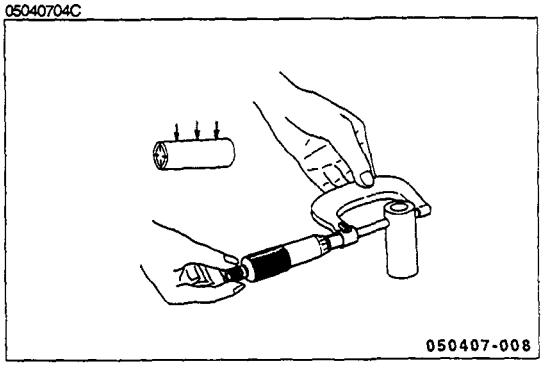
Piston Oversize (Reference) mm(in)

	Standard	Limit
4ZC1	88.445-88.464 (3.4821-3.4828)	88.945-88.965 (3.5018-3.5026)
4ZE1	93.065-93.105 (3.6639-3.6655)	93.565-93.605 (3.6836-3.6852)

Oversize pistons have the "O/S" mark ③ at the topland.

Rebore the cylinders to fit the selected oversize piston outside diameter.

05040704C



05040704D

(2) Cylinder Bore Selection

Measure the outside diameter of the selected oversize pistons at measuring point (at a right angle to the piston pin).

Piston Measuring Point: 40 mm (1.57 in: 4ZC1)
40 mm (1.57 in: 4ZE1)

Formula

Boring inside diameter = P + C – H
P = Piston outside diameter (Measured Oversize Piston)
C = Piston and cylinder bore clearance

Piston and Cylinder Bore Clearance	mm(in)
4ZC1	0.035-0.055 (0.0014-0.0022)
4ZE1	0.025-0.045 (0.0010-0.0018)

H = Honing allowance
0.03 (0.0012) or less

2. Reboring

Refer to "Cylinder Reboring".

3. Honing

All cylinders must be honed after reboring.

05040909

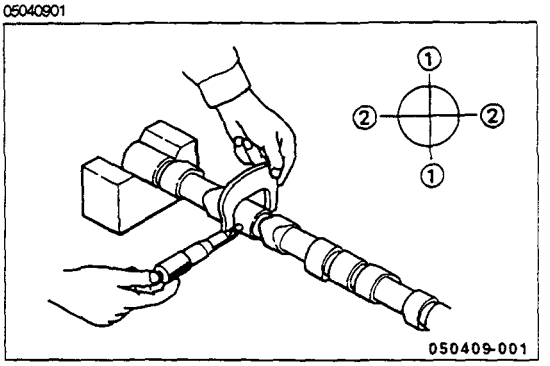
CAMSHAFT

Visually inspect the journals, the cams, the distributor drive gear, and the rocker arm shaft bracket for excessive wear and damage. The camshaft, the rocker arm shaft bracket, and the cylinder head must be replaced if these conditions are discovered during inspection.

Note:

The camshaft, the rocker arm shaft bracket, and the cylinder head must always be replaced as a set.

05040901



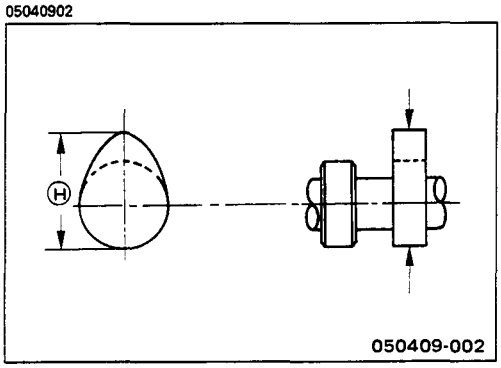
Camshaft Journal Diameter

Use a micrometer to measure each camshaft journal diameter in two directions (① and ②). If the measured value is less than the specified limit, the camshaft must be replaced.

Camshaft Journal Diameter mm(in)

Standard	Limit
33.940 – 33.955 (1.336 – 1.337)	33.900 (1.334)

05040902



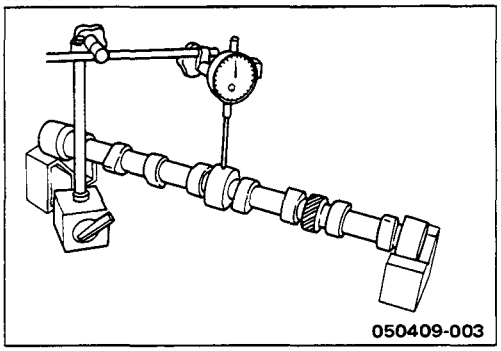
Cam Height

Measure the cam height Ⓗ with a micrometer. If the measured value is less than the specified limit, the camshaft must be replaced.

Cam Height Ⓗ — mm(in)

Standard	Limit
36.9 (1.45)	36.4 (1.43)

05040903



Camshaft Run-Out

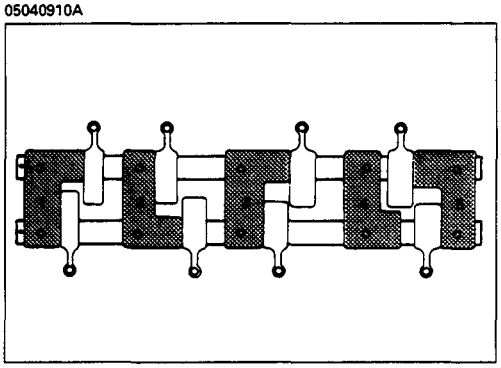
1. Mount the camshaft on V-blocks.
2. Measure the run-out with a dial indicator.

   If the measured value exceeds the specified limit, the camshaft must be replaced.

Camshaft Run-Out — mm(in)

Standard	Limit
0.05 (0.002)	0.10 (0.004)

05040910A



Camshaft Journal and Rocker Arm Shaft Bracket Clearance

1. Install the rocker arm shaft bracket to the cylinder head and tighten it to the specified torque.

Rocker Arm Shaft Bracket Nut Torque — kg·m(lb.ft/N·m)

Standard
2.2 ± 0.25 (16.0 ± 1.8/21.5 ± 2.5)

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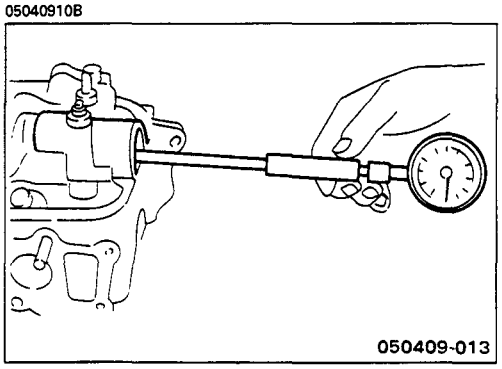

2. Use an inside dial indicator to measure the rocker arm shaft bracket inside diameter.

Rocker Arm Shaft Bracket Inside Diameter — mm(in)

Standard
34.020 – 34.050 (1.3394 – 1.3405)

If the clearance between the rocker arm shaft bracket inside diameter and the journal exceeds the specified limit, the camshaft and/or the cylinder head must be replaced.

Camshaft Journal and Rocker Arm Shaft Bracket Clearance — mm(in)

Standard	Limit
0.065 – 0.110 (0.0026 – 0.0043)	0.150 (0.006)

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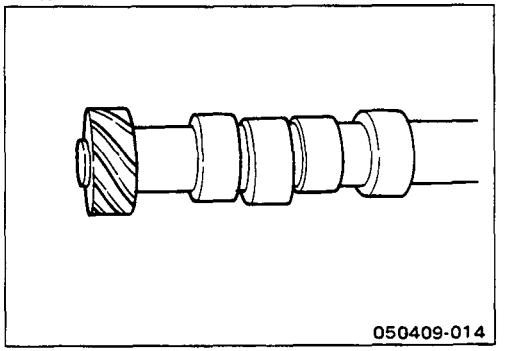


05041001

Distributor Drive Gear

Drive Gear Inspection

Visually inspect the drive gear for excessive wear and damage.

If excessive wear or damage is discovered during inspection, the camshaft must be replaced.

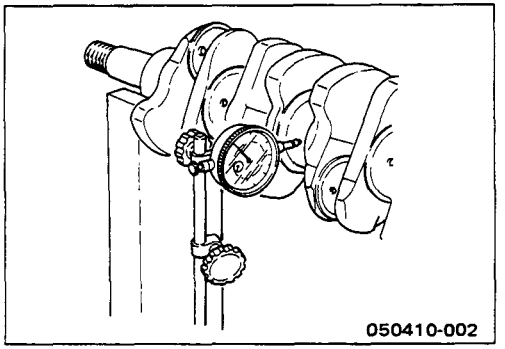
CRANKSHAFT AND BEARING

Inspect the surface of the crankshaft journals and crankpins for excessive wear and damage.

Inspect the oil seal fitting surfaces for excessive wear and damage.

Inspect the oil ports for obstructions.

05041002



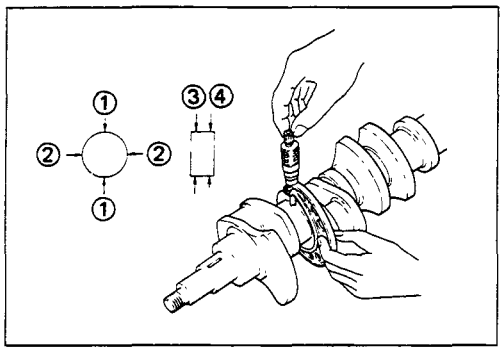
Crankshaft Run-Out

1. Set a dial indicator to the center of the crankshaft journal.
2. Gently turn the crankshaft in the normal direction of rotation.

   Read the dial indicator as you turn the crankshaft.
   If the measured value exceeds the specified limit, the crankshaft must be replaced.

Crankshaft Run-Out mm(in)

Standard	Limit
0.03 (0.012) or less	0.10 (0.004)



Crankshaft Journal and Crankpin Diameter

1. Use a micrometer to measure the crankshaft journal diameter across points ① – ① and ② – ②.
2. Use the micrometer to measure the crankshaft journal diameter at the two points (③ and ④).
3. Repeat Steps 1 and 2 to measure the crankpin diameter.

   If the measured values are less than the specified limit, the crankshaft must be reground or replaced.

Crankshaft Journal Diameter mm(in)

Standard	Limit
55.920 – 55.935 (2.2016 – 2.2022)	55.420 (2.1819)

Crankpin Diameter mm(in)

Standard	Limit
48.925 – 48.940 (1.9262 – 1.9268)	48.425 (1.9065)

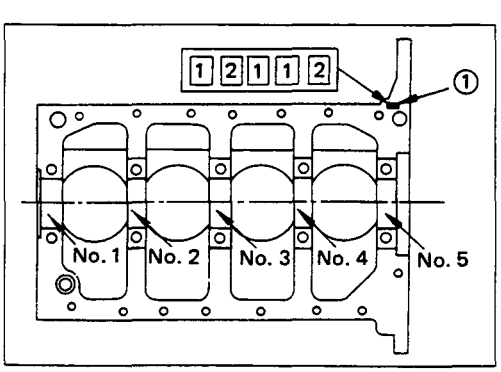
Crankshaft Journal and Crankpin Uneven Wear mm(in)

Limit
0.05 (0.002)

Crankshaft Bearing Selection

Crankshaft bearing selection is based on the measured diameters of the crankshaft journals and the bearing housings.

Match the crankshaft bearing housing grade marks and the crankshaft journal grade marks in the table below to determine the correct crankshaft bearing size.

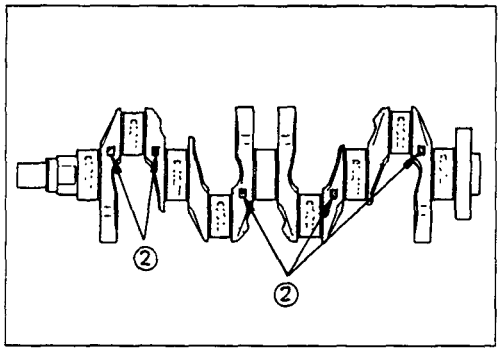


Crankshaft Bearing Housing Grade Mark

Crankshaft bearing housing grade marks 1 or 2 are stamped on the rear left-hand side of the cylinder body.

Example:

1	2	1	1	2
No. 1 Bearing Housing	No. 2 Bearing Housing	No. 3 Bearing Housing	No. 4 Bearing Housing	No. 5 Bearing Housing



Crankshaft Journal Grade Mark

The crankshaft journal grade marks (1 or 2) are stamped on each crankshaft journal wave.

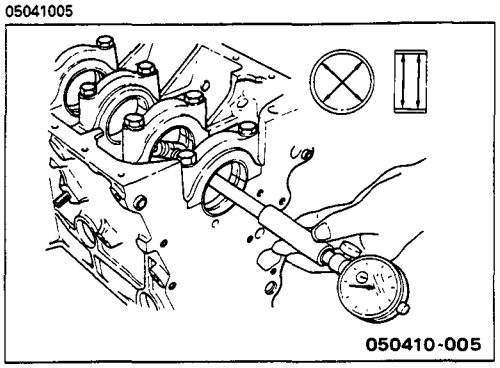
The crankshaft journal and bearing clearance must be the same for each position after installation of the crankshaft and the crankshaft bearings.

Crankshaft Bearing Selection Table

mm(in.)

① Size Mark	Cylinder Body Journal Diameter	Crankshaft Journal		Crankshaft Bearing	
		② Size Mark	Diameter	Thickness	Size Mark (Upper & Lower)
1	59.990–60.000 (2.3618–2.3622)	– – or 2	55.920–55.927 (2.2016–2.2018)	2.015–2.019 (0.0793–0.0795)	Blue
		– or 1	55.928–55.935 (2.2019–2.2022)	2.011–2.015 (0.0792–0.0793)	Black
2	59.980–59.989 (2.3614–2.3618)	– – or 2	55.920–55.927 (2.2016–2.2018)		
		– or 1	55.928–55.935 (2.2019–2.2022)	2.007–2.011 (0.0790–0.0792)	Brown
Under size 0.25	59.980–60.000 (2.3614–2.3622)		55.670–55.685 (2.1917–2.1923)	2.123–2.135 (0.0836–0.0841)	Stamp of size
Under size 0.50			55.420–55.435 (2.1819–2.1825)	2.248–2.260 (0.0885–0.0890)	

05041005

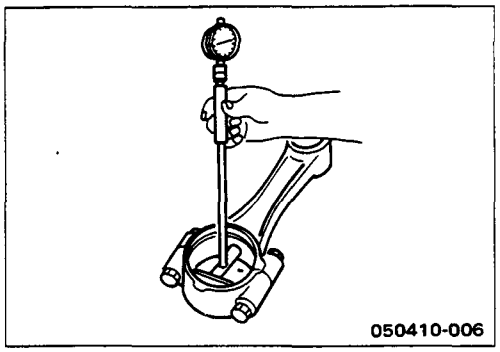


Crankshaft Journal and Bearing Clearance

If the clearance between the measured bearing inside diameter and the crankshaft journal diameter exceeds the specified limit, the crankshaft must be reground and undersize bearing installed or replaced.

Crankshaft Journal and Bearing Clearance mm(in)

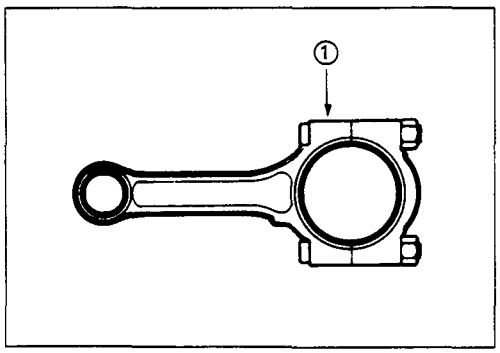
Standard	Limit
0.023 – 0.050 (0.0009 – 0.0020)	0.12 (0.0047)



Connecting Rod Bearing Selection

Refer to the following table when installing or replacing the connecting rod bearings.

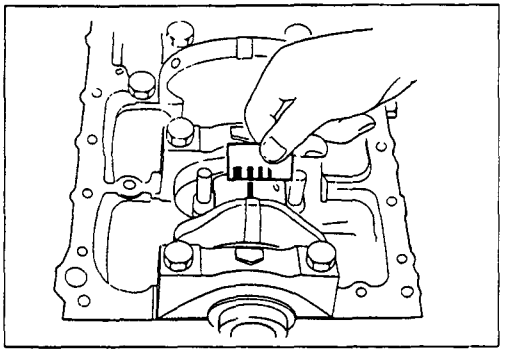
Pay close attention to the connecting rod big end grade mark ①.



Connecting Rod Bearing Selection Table

mm(in.)

① Size Mark	Big end Bore Diameter	Crankshaft Pin Diameter	Connecting Rod Bearing	
			Thickness	Size Mark
A	51.996–52.000 (2.0471–2.0472)	48.925–48.940 (1.9262–1.9268)	1.509–1.513 (0.0594–0.0596)	Blue
B	51.988–51.995 (2.0468–2.0470)		1.505–1.509 (0.0592–0.0594)	Black
C	51.983–51.987 (2.0466–2.0467)		1.501–1.505 (0.0591–0.0592)	Brown
Under Size 0.25	51.983–52.000 (2.0466–2.0472)	48.675–48.690 (1.9163–1.9169)	1.623–1.635 (0.0639–0.0644)	Stamp of Size Mark
Under Size 0.50		48.425–48.440 (1.9065–1.9071)	1.748–1.760 (0.0688–0.0693)	



Crankpin and Bearing Clearance

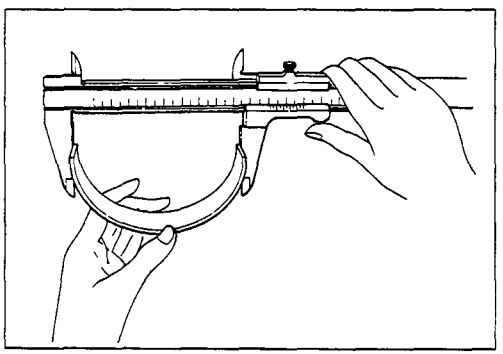
If the clearance between the bearing inside diameter and the crankpin is greater than the standard but less than the limit, the crankshaft is serviceable.

If the clearance exceeds the limit, the crankshaft must be either reground or replaced.

If the crankshaft is reground, undersize bearings must also be installed.

Crankpin and Bearing Clearance mm(in)

Standard	Limit
0.030 – 0.060 (0.0012 – 0.0023)	0.12 (0.0047)



Bearing Spread

Use a vernier caliper to measure the bearing spread.
If the measured value is less than the specified limit, the bearing must be replaced.

Bearing Spread mm(in)

	Limit
Crankshaft Bearing	59.25 (2.333)
Connecting Rod Bearing	52.25 (2.057)

Check the bearing play.

Crankshaft Regrinding

To ensure crankshaft reliability, pay close attention to the following items during and after the crankshaft journal and crankpin regrinding procedure.

Undersize Bearing Availability mm(in)

0.25 (0.01) & 0.50 (0.02)

Crankshaft Journal and Crankpin Grinding Limit (Reference) mm(in)

Crankshaft Journals	55.435 (2.1825)
Crankpins	48.440 (1.9071)

Crankshaft Regrinding Procedure

1. Regrind the crankshaft journals and the crankpins.
2. Fillet the crankshaft journal radiuses to a minimum of R 2.7 ± 0.2 mm (0.1063 ± 0.0079 in).

   There must be no stepping around the fillet area.
3. Finish the crankshaft journals, the crankpins, and the oil port corners to a smooth surface having a chamfer radius of 1 mm (0.04 in).

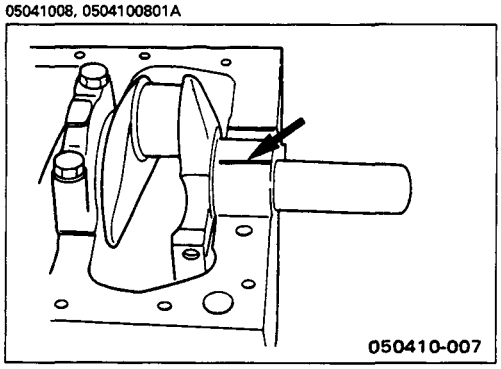
Crankshaft Journal and Crankpin Roughness	mm(in)
0.001 (0.00004) or less	

4. Check the crankshaft journal and crankpin clearance.

   Refer to "Crankshaft Journal and Bearing Clearance" and "Crankpin and Bearing Clearance".
5. Check the crankshaft run-out.

   Refer to "Crankshaft Run-Out".

05041008, 0504100801A

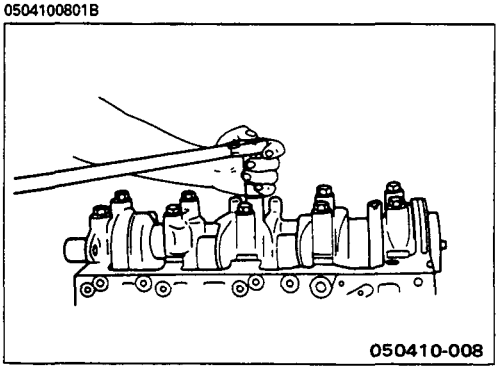


Clearance Measurements (With Plastigage)

Crankshaft Journal and Bearing Clearance

1. Clean the cylinder body, the journal bearing fitting surface, the bearing caps, and the bearings.
2. Install the bearings to the cylinder body.
3. Carefully place the crankshaft on the bearings.
4. Rotate the crankshaft approximately 30° to seat the bearing.
5. Place the Plastigage (arrow) over the crankshaft journal across the full width of the bearing.
6. Install the bearing caps with the bearing.

0504100801B



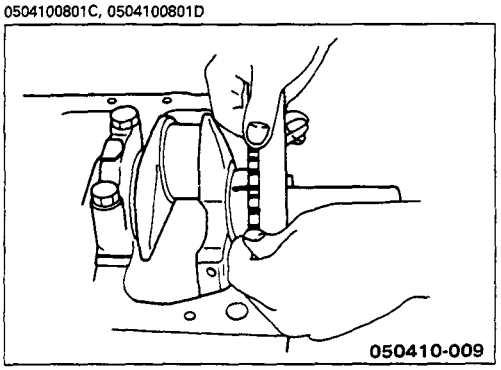
7. Tighten the bearing caps to the specified torque.

Crankshaft Bearing Cap Bolt Torque	kg·m(lb.ft/N·m)
10.0 ± 1.5 (72.3 ± 10.8/98.0 ± 14.7)	

Do not allow the crankshaft to turn during bearing cap installation and tightening.

8. Remove the bearing cap.

0504100801C, 0504100801D



9. Compare the width of the Plastigage attached to either the crankshaft or the bearing against the scale printed on the Plastigage container.

   If the measured value exceeds the limit, perform the following additional steps.

   1) Use a micrometer to measure the crankshaft outside diameter.
   2) Use an inside dial indicator to measure the bearing inside diameter.

      If the crankshaft journal and bearing clearance exceeds the limit, the crankshaft and/or the bearing must be replaced.

Crankshaft Journal and Bearing Clearance mm(in)

Standard	Limit
0.023 – 0.050 (0.0009 – 0.0020)	0.12 (0.0047)

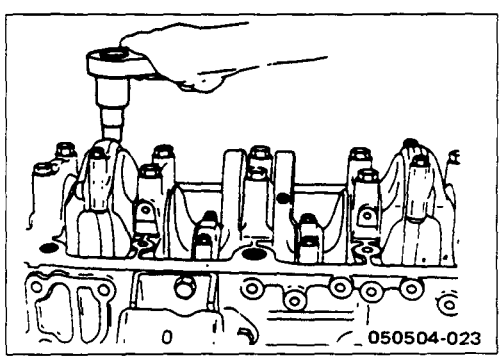
0504100802A, 0504100802B, 0504100802C

Crankpin and Bearing Clearance

1. Clean the crankshaft, the connecting rod, the bearing cap, and the bearings.
2. Install the bearing to the connecting rod and the bearing cap.

   Do not allow the crankshaft to move when installing the bearing cap.
3. Prevent the connecting rod from moving.
4. Attach the Plastigage to the crankpin.

   Apply engine oil to the Plastigage to keep it from falling.



5. Install the bearing cap and tighten it to the specified torque.
   Do not allow the connecting rod to move when installing and tightening the bearing cap.

Connecting Rod Bearing Cap Bolt
Torque kg·m(lb.ft/N·m)

4ZC1/4ZD1/4ZE1	6.0±0.2 (43.4±1.4/58.9±2.0)

6. Remove the bearing cap.

7. Compare the width of the Plastigage attached to either the crankshaft or the bearing against the *scale printed on the Plastigage container.*

   If the measured value exceeds the specified limit, perform the following additional steps.

   1) Use a micrometer to measure the crankpin outside diameter.
   2) Use an inside dial indicator to measure the bearing inside diameter.

      If the crank pin and bearing clearance exceeds the specified limit, the crankshaft and/or the bearing must be replaced.

Crankpin and Bearing Clearance mm(in)

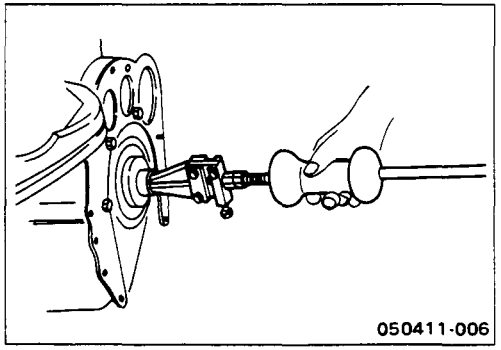
Standard	Limit
0.030 – 0.060 (0.0012 – 0.0023)	0.12 (0.0047)

050411

CRANKSHAFT PILOT BEARING

Check the crankshaft pilot bearing for excessive wear and damage and replace it if necessary.

05041101, 0504110101



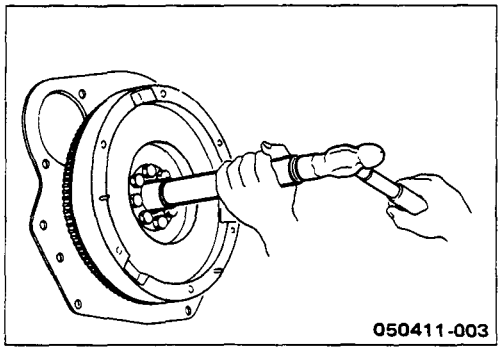
Crankshaft Pilot Bearing Replacement

Crankshaft Pilot Bearing Removal

Use the pilot bearing remover to remove the crankshaft pilot bearing.

Pilot Bearing Remover: 5-8840-2000-0 (J-5822)
Sliding Hammer: 5-8840-0019-0 (J-23907)

0504110102

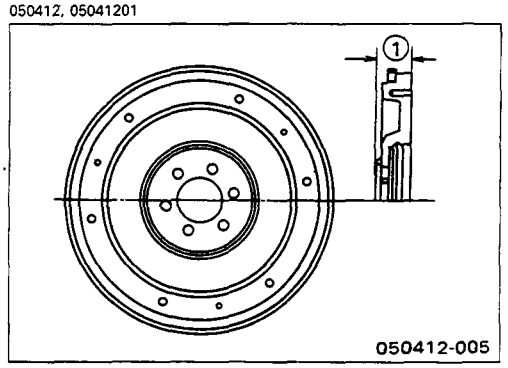


Crankshaft Pilot Bearing Installation

1. Place the crankshaft pilot bearing horizontally across the crankshaft bearing installation hole.
2. Tap around the edges of the crankshaft pilot bearing outer races with a brass hammer to drive the bearing into the crankshaft bearing installation hole.

   Pilot Bearing Installer: 5-8522-0125-0 (J-26516-A)

050412, 05041201



FLYWHEEL AND RING GEAR

Flywheel

1. Inspect the flywheel friction surface for excessive wear and heat cracks.
2. Measure the flywheel width.

   If the measured value is between the standard and the specified limit, the flywheel may be reground.

   If the measured value exceeds the specified limit, the flywheel must be replaced.

Flywheel Width ①	mm(in)
Standard	Limit
43.45 (1.711)	42.45 (1.671)

Flywheel Friction Surface Roughness	mm(in)
Less than 0.006 (0.00024)	

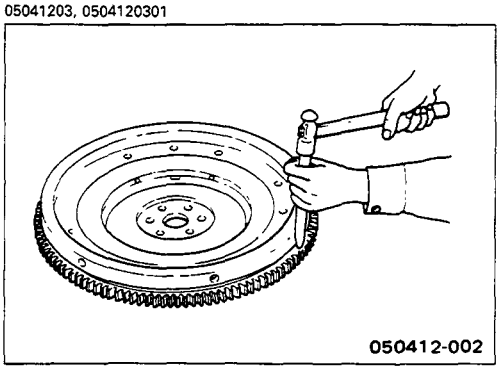
05041202

Ring Gear

Inspect the ring gear.

If the ring gear teeth are broken or excessively worn, the ring gear must be replaced.

05041203, 0504120301

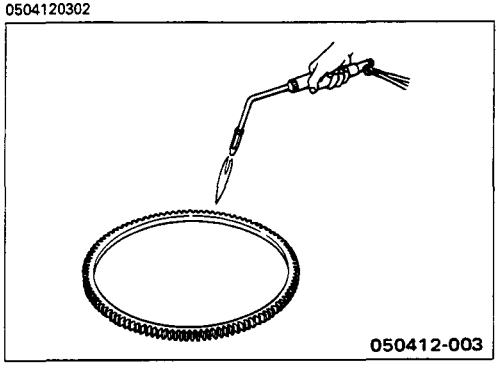


Ring Gear Replacement

Ring Gear Removal

Strike around the edges of the ring gear with a hammer and chisel to remove it.

0504120302



Ring Gear Installation

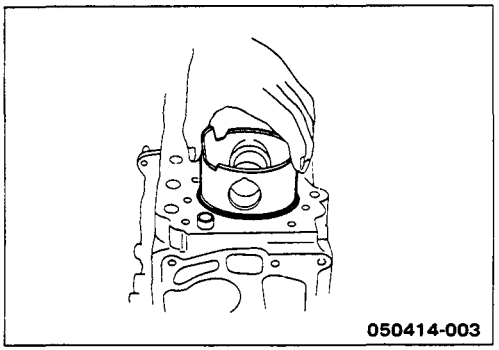
1. Heat the ring gear evenly with a gas burner to expand it.

   Do not allow the temperature of the gas burner to exceed 200°C (390°F).

2. Install the ring gear when it is sufficiently heated.

   The ring gear must be installed with the chamfer facing the clutch.

050414, 05041401A

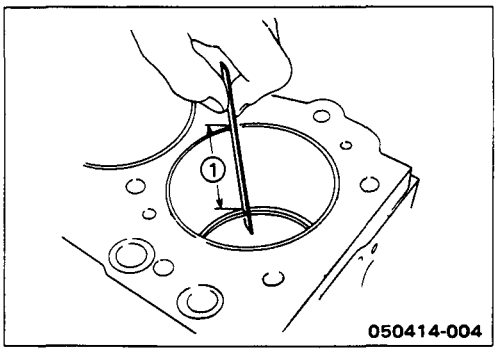


PISTON RING

Piston Ring Gap

1. Insert the piston ring horizontally (in the position it would assume if it were installed to the piston) into the cylinder bore.

05041401B



05041401C

2. Push the piston ring into the cylinder bore until it reaches the point ① where the cylinder bore is the smallest.

   Do not allow the piston ring to slant to one side or the other. It must be perfectly horizontal.

   Measuring Point ①: 70 mm (2.76 in)

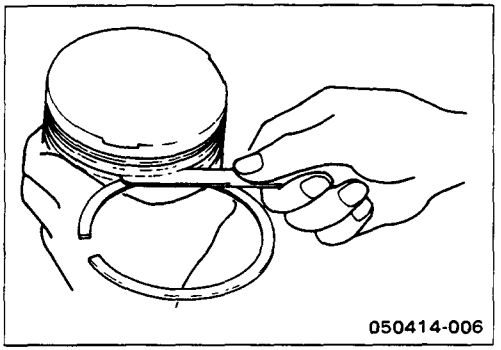
3. Use a feeler gauge to measure the piston ring gap.

   If the measured value exceeds the specified limit, the piston ring must be replaced.

Piston Ring Gap mm(in)

	Standard	Limit
1st Compression Ring	0.30—0.45 (0.012—0.018)	1.50 (0.059)
2nd Compression Ring	0.25—0.40 (0.010—0.016)	
Oil Ring	0.20—0.70 (0.008—0.028)	

05041402A



Piston Ring and Piston Ring Groove Clearance

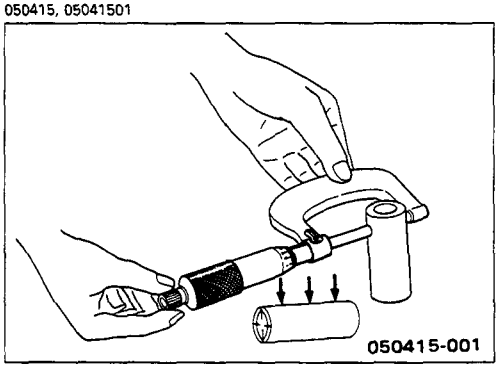
Use a feeler gauge to measure the clearance between the piston ring and the piston ring groove at several points around the piston.

If the clearance between the piston ring and the piston ring groove exceeds the specified limit, the piston ring must be replaced.

Piston Ring and Piston Ring Groove Clearance mm(in)

	Standard	Limit
1st Compression Ring	0.025–0.060 (0.0010–0.0024)	0.150 (0.0059)
2nd Compression Ring	0.020–0.055 (0.0008–0.0022)	0.150 (0.0059)

050415, 05041501



PISTON PIN

Piston Pin Diameter

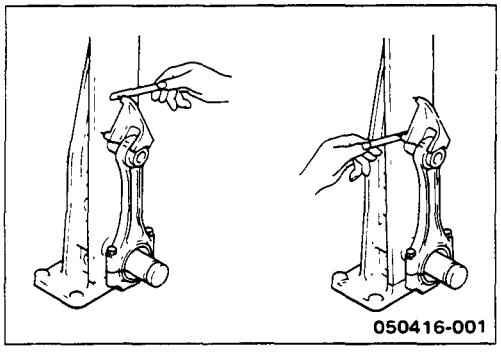
Use a micrometer to measure the piston pin outside diameter at several points.

If the measured value is less than the specified limit, the piston pin must be replaced.

Piston Pin Diameter mm(in)

Standard		Limit
4ZD1/4ZE1	22.997–23.005 (0.9054–0.9057)	22.970 (0.9043)
4ZC1	21.997–22.005 (0.8660–0.8663)	21.970 (0.8650)

050416, 05041601



050416-001

CONNECTING ROD

Connecting Rod Alignment

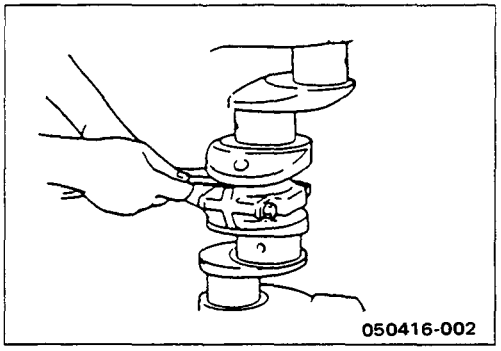
Use a connecting rod aligner to measure the distortion and the parallelism between the connecting rod big end hole and the connecting rod small end hole.

If either the measured distortion or parallelism exceed the specified limit, the connecting rod must be replaced.

Per Length of 100 mm (3.94 in) mm(in)

	Standard	Limit
Distortion	0.05 (0.002)	0.20 (0.008)
Parallelism	0.05 or Less (0.002)	0.15 (0.006)

05041602



050416-002

Connecting Rod Side Face Clearance

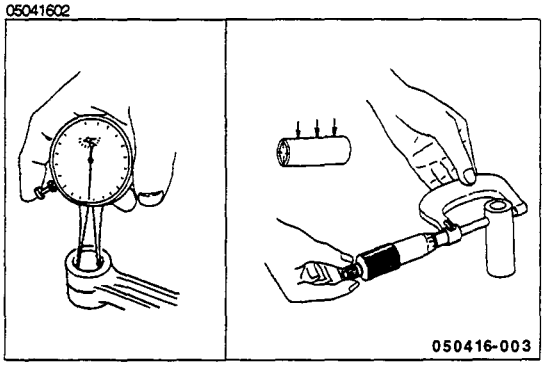
1. Install the connecting rod to the crankpin.
2. Use a feeler gauge to measure the clearance between the connecting rod big end side face and the crankpin side face.

   If the measured value exceeds the specified limit, the connecting rod must be replaced.

Connecting Rod Big End and Crankpin Side Face Clearance mm(in)

Standard	Limit
0.20 – 0.33 (0.008 – 0.013)	0.35 (0.014)

05041602



Piston Pin and Connecting Rod Small End Interference

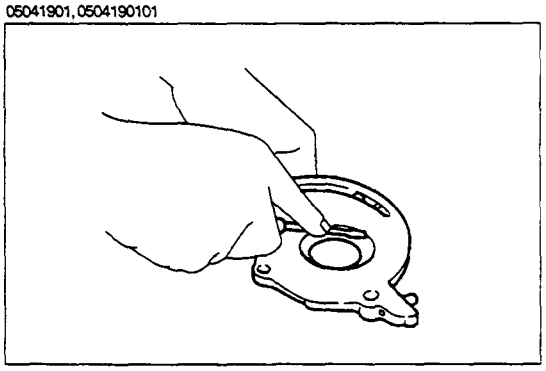
1. Use a calliper calibrator and a dial indicator to measure the connecting rod small end diameter.

Connecting Rod Small End Diameter	mm(in)
4ZE1	22.964-22.977 (0.9041-0.9046)
4ZC1	21.964-21.977 (0.8647-0.8652)

2. Determine the piston pin and connecting rod small end interference.

Piston Pin and Connecting Rod Small End Interference	mm(in)
0.020 – 0.041 (0.008 – 0.0016)	

05041901, 0504190101

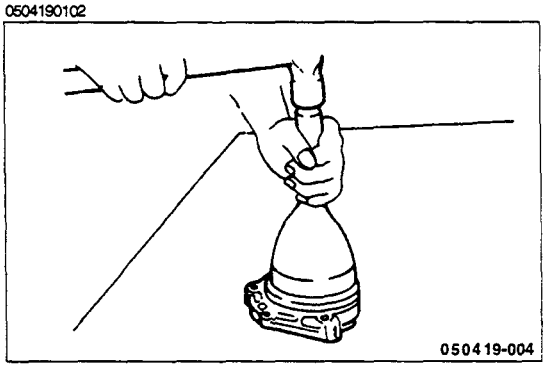


FRONT OIL SEAL RETAINER

Crankshaft Front Oil Seal Replacement Oil Seal Removal

Use a screwdriver to pry the oil seal free from the front oil seal retainer.

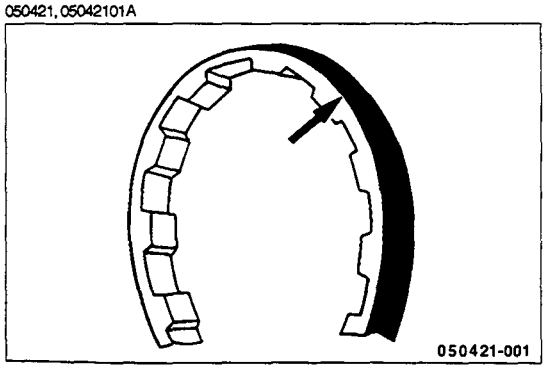
0504190102



Oil Seal Installation

Apply engine oil to new oil seal and install it using installer.

050421, 05042101A



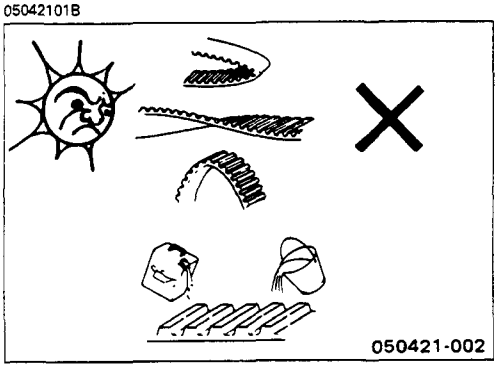
TIMING BELT

Timing Belt Handling Precautions

1. Do not bend the belt to a radius of less than 20 mm (0.79 in).

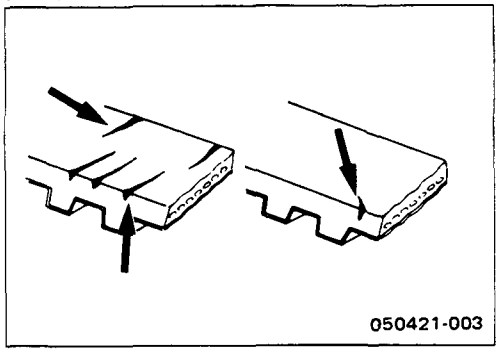
   Do not violently twist or bend the belt. Doing so will damage the glass fibre imbedded in the belt. Timing belt precision will be adversely affected.

05042101B



2. Do not store the belt in direct sunlight or in an area where it will be exposed to high temperatures.
3. Do not allow the stored belt to become dirty.
4. Do not use sharp metal tools to stretch or force the belt into position during installation.

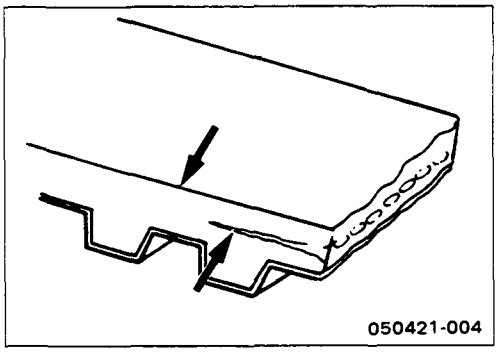
05042101C



Timing Belt Inspection

1. Replace the belt if cracks are found in the side and rear face gum.

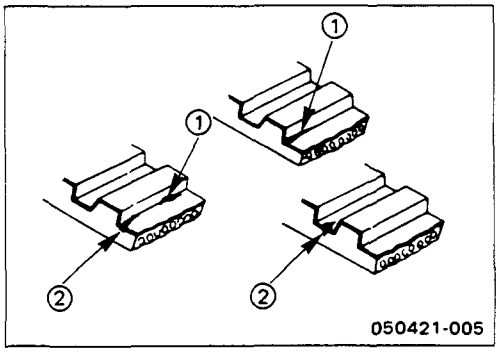
05042101D



2. Replace the belt if the side faces are excessively worn.

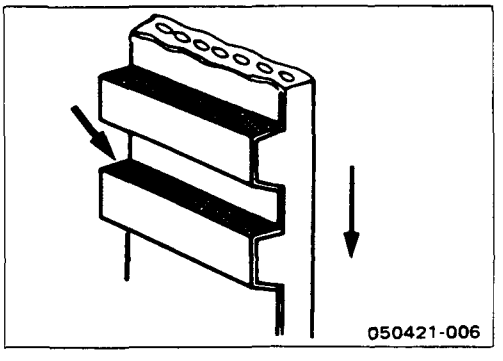
   Check also for manufacturing defects, rounded belt edges, and loose glass fiber.

05042101E



3. Replace the belt if the fabric is cracked ① or disintegrated ②.

05042101F



4. Replace the belt if the cogs are excessively worn.

   Check the loaded side of the cogs for fuzzing, discoloration, and baldness.

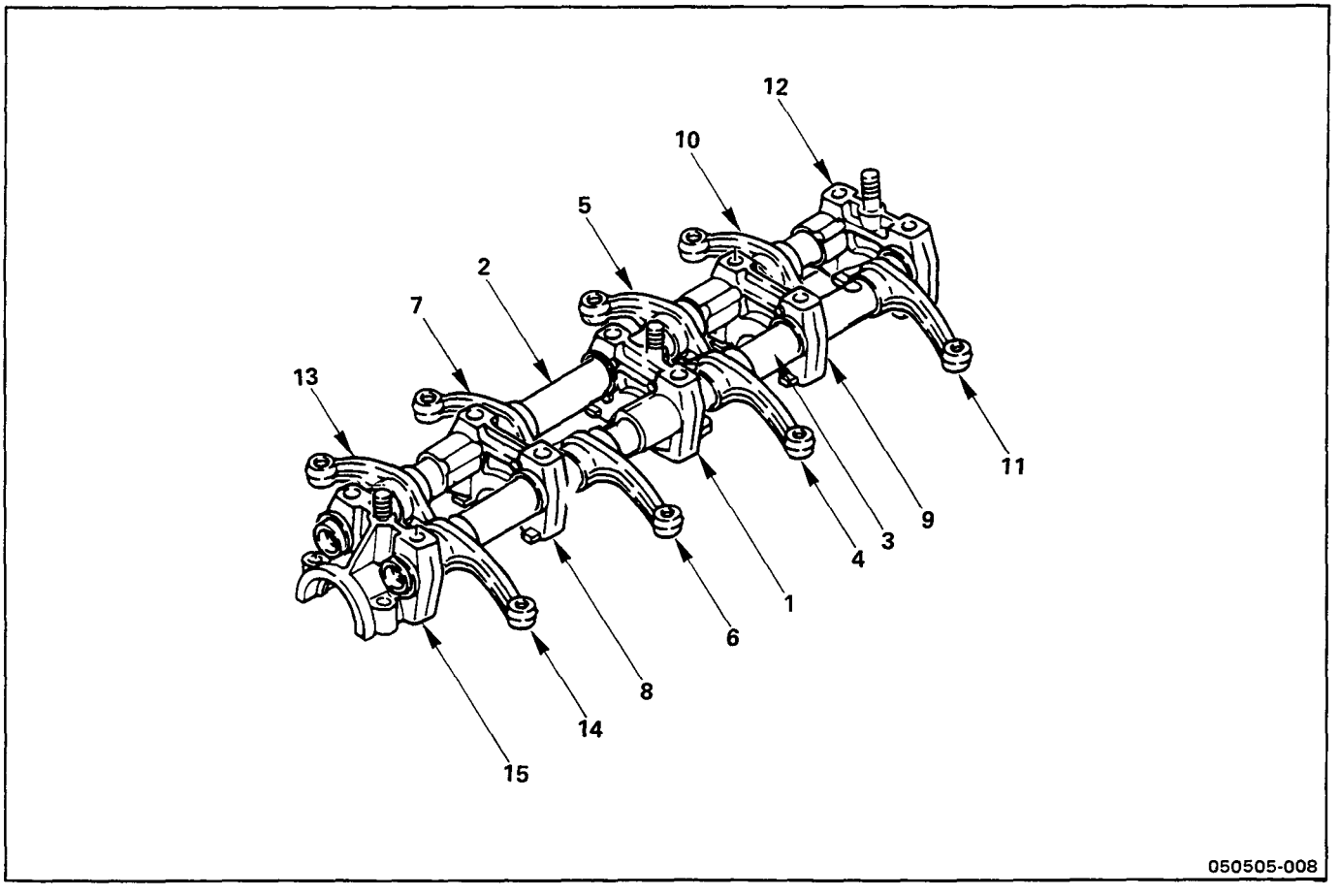
05050501

REASSEMBLY

INTERNAL PARTS

MINOR COMPONENTS

ROCKER ARM SHAFT AND ROCKER ARM

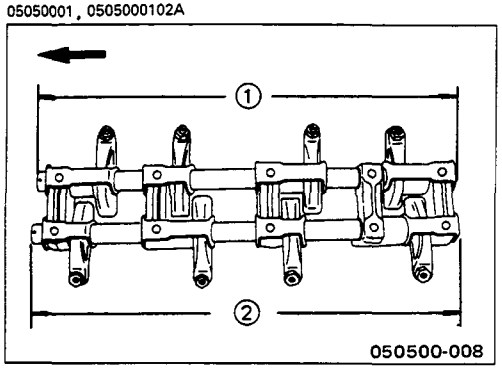


0505000002B

Reassembly Steps

- ▲ 1. No. 3 rocker arm shaft bracket
- ▲ 2. Rocker arm shaft (Intake side)
- ▲ 3. Rocker arm shaft (Exhaust side)
- ▲ 4. No. 3 exhaust valve rocker arm
- 5. No. 3 intake valve rocker arm
- 6. No. 2 exhaust valve rocker arm
- 7. No. 2 intake valve rocker arm
- 8. No. 2 rocker arm shaft bracket
- 9. No. 4 rocker arm shaft bracket
- 10. No. 4 intake valve rocker arm
- 11. No. 4 exhaust valve rocker arm
- 12. No. 5 rocker arm shaft bracket
- 13. No. 1 intake valve rocker arm
- 14. No. 1 exhaust valve rocker arm
- 15. No. 1 rocker arm shaft bracket

05050001, 0505000102A



Important Operations

1. Rocker Arm Shaft Bracket

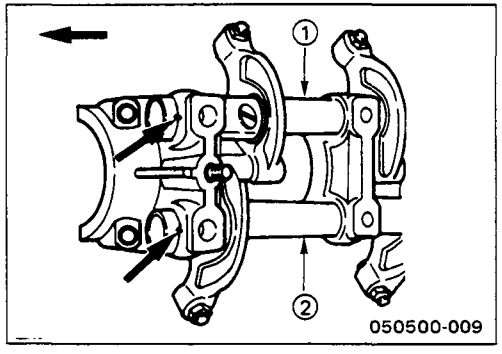
2., 3. Rocker Arm Shaft (Intake and Exhaust)

1) Apply a coat of engine oil to the rocker arm shafts, the shaft brackets, and the rocker arms.
2) Install the shorter rocker arm shaft to the No. 3 bracket intake side.

   The punch mark must be facing the front of the engine.

   ① Intake Side Shaft (1): 388 mm (15.28 in)

0505000102C



3) Install the longer rocker arm shaft to the No. 3 bracket exhaust side.

   The punch mark must be facing the front of the engine.

   ② Exhaust Side Shaft (2): 391 mm (15.40 in)

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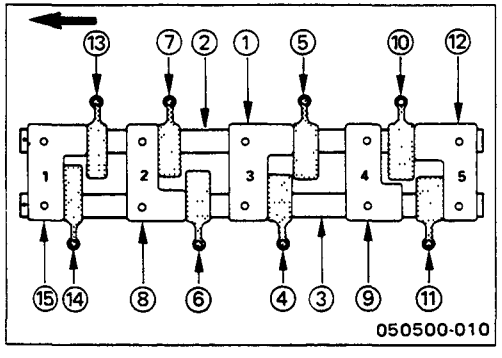
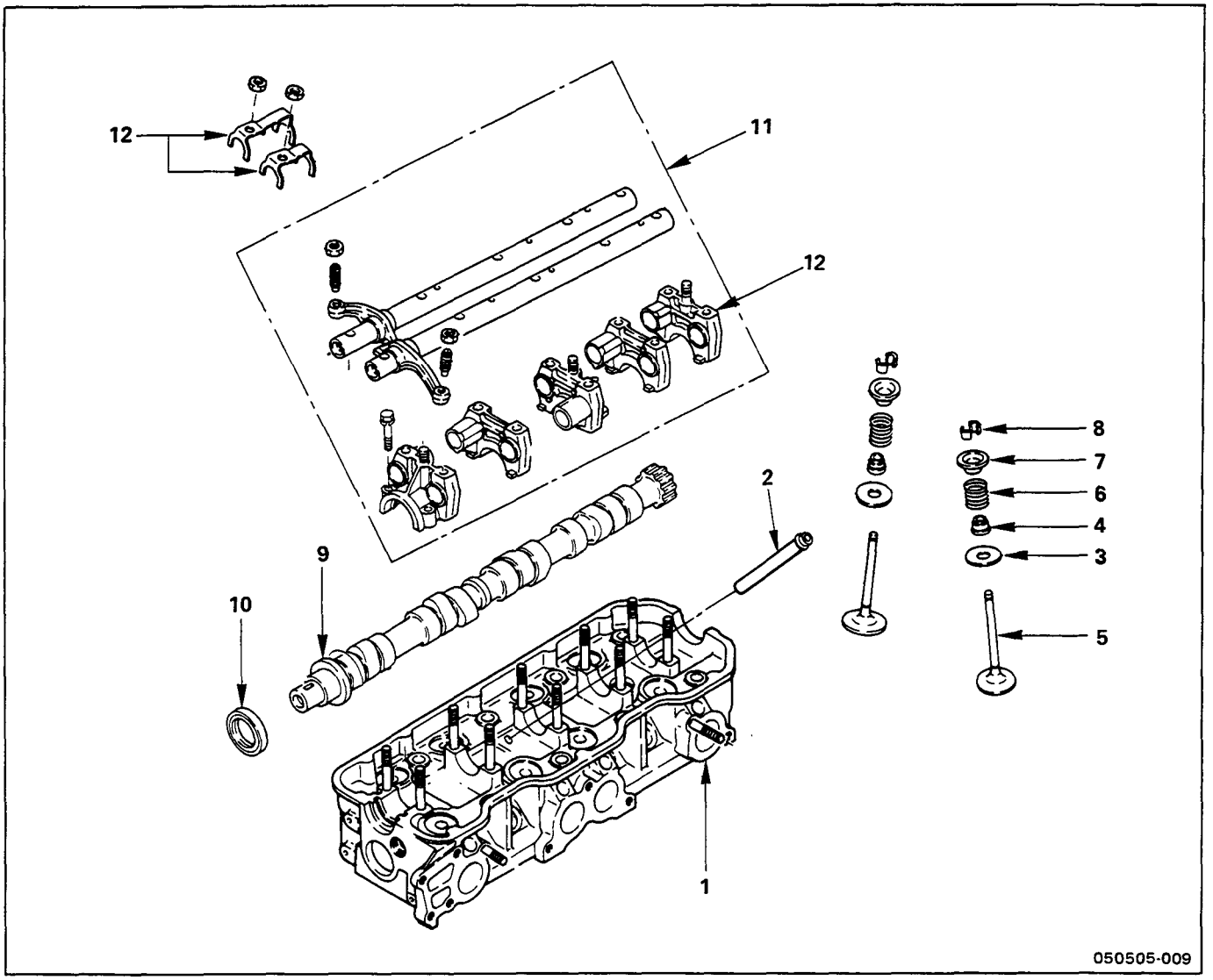


4. Rocker Arm

Install the brackets and the rocker arms to the rocker arm shafts in the sequence as shown in the illustration.

05050502

CYLINDER HEAD WITH ROCKER ARM SHAFT AND CAMSHAFT



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Reassembly Steps

1. Cylinder head
2. Fuel pump push rod
3. Valve spring lower seat
▲ 4. Valve stem oil seal
▲ 5. Intake and exhaust valve
▲ 6. Valve spring
7. Valve spring upper seat
▲ 8. Split collar
▲ 9. Camshaft
▲ 10. Camshaft front oil seal
11. Rocker arm shaft and rocker arm
▲ 12. Rocker arm shaft bracket nut and spring (No.1 - No.4)

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Important Operations

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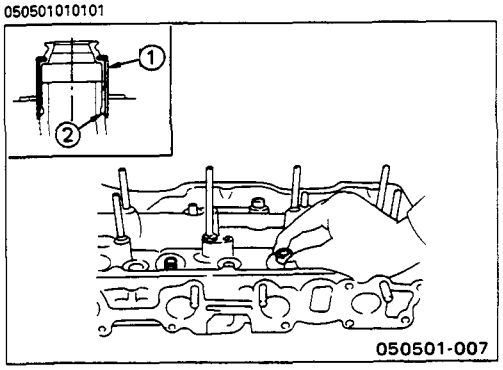

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4. Valve Stem Oil Seal

1) Apply a coat of engine oil to the oil seal inner face.
2) Carefully insert the oil seal ① to the valve guide ② groove.

5. Intake and Exhaust Valve

1) Apply a coat of engine oil to each valve stem before installation.
2) Install the intake and exhaust valves.
3) Turn the cylinder head up to install the valve springs.

   Take care not to allow the installed valves to fall free.

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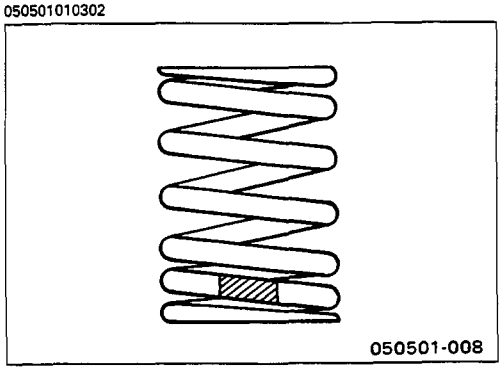

6. Valve Spring

Install the valve spring with the fine pitched end (painted) facing down.

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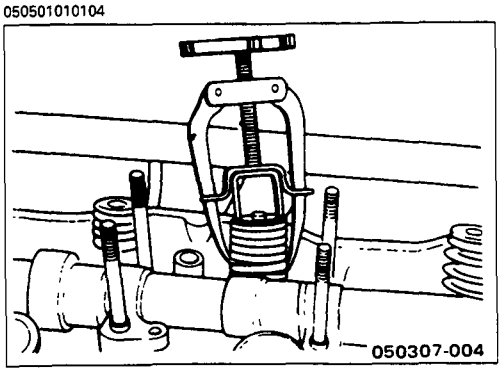
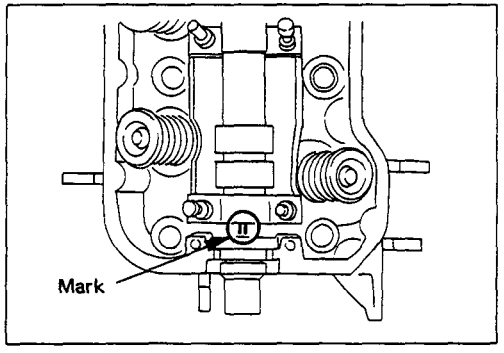


8. Split Collar

1) Use the spring compressor to compress the valve spring into position.

   Spring Compressor: 5-8840-0205-0 (J-26513-A)
2) Install the split collar to the valve stem.
3) Set the split collar by tapping around the collar head with a rubber hammer.



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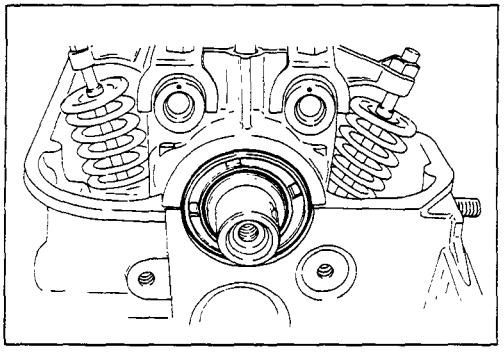
9. Camshaft

1) Apply engine oil to the cylinder head and camshaft journals.
2) Set the camshaft to the cylinder head.
   The camshaft mark must be facing up.



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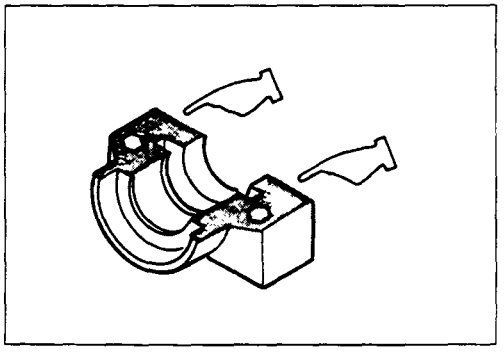
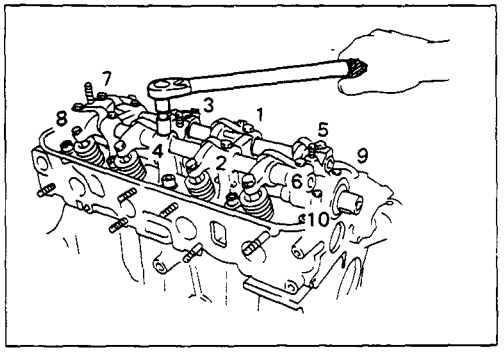
10. Camshaft Front Oil Seal

1) Apply engine oil to the oil seal lip circumference.
2) Use the oil seal installer to install the oil seal.
   Oil Seal Installer: 5-8840-0144-0 (J-33183)



12. Rocker Arm Shaft Bracket Nut and Spring

1) Apply silicon gasket beforehand to the front side of the fitting surface of No. 1 rocker arm bracket with the cylinder head.



2) Apply engine oil to the rocker arm bracket stud bolts and nuts.
3) Tighten the rocker arm shaft bracket bolts in the numerical order shown in the illustration.

Rocker Arm Shaft Bracket Nut Torque	kg·m(lb.ft/N·m)
No. 1 – 8	2.2 ± 0.25 (16.0 ± 1.8/21.6 ± 2.5)
No. 9 & 10	0.75 ± 0.15 (4.3 ± 1.1/5.9 ± 1.5)

After assembly apply lubricate the rocker arm shaft and valves with engine oil.

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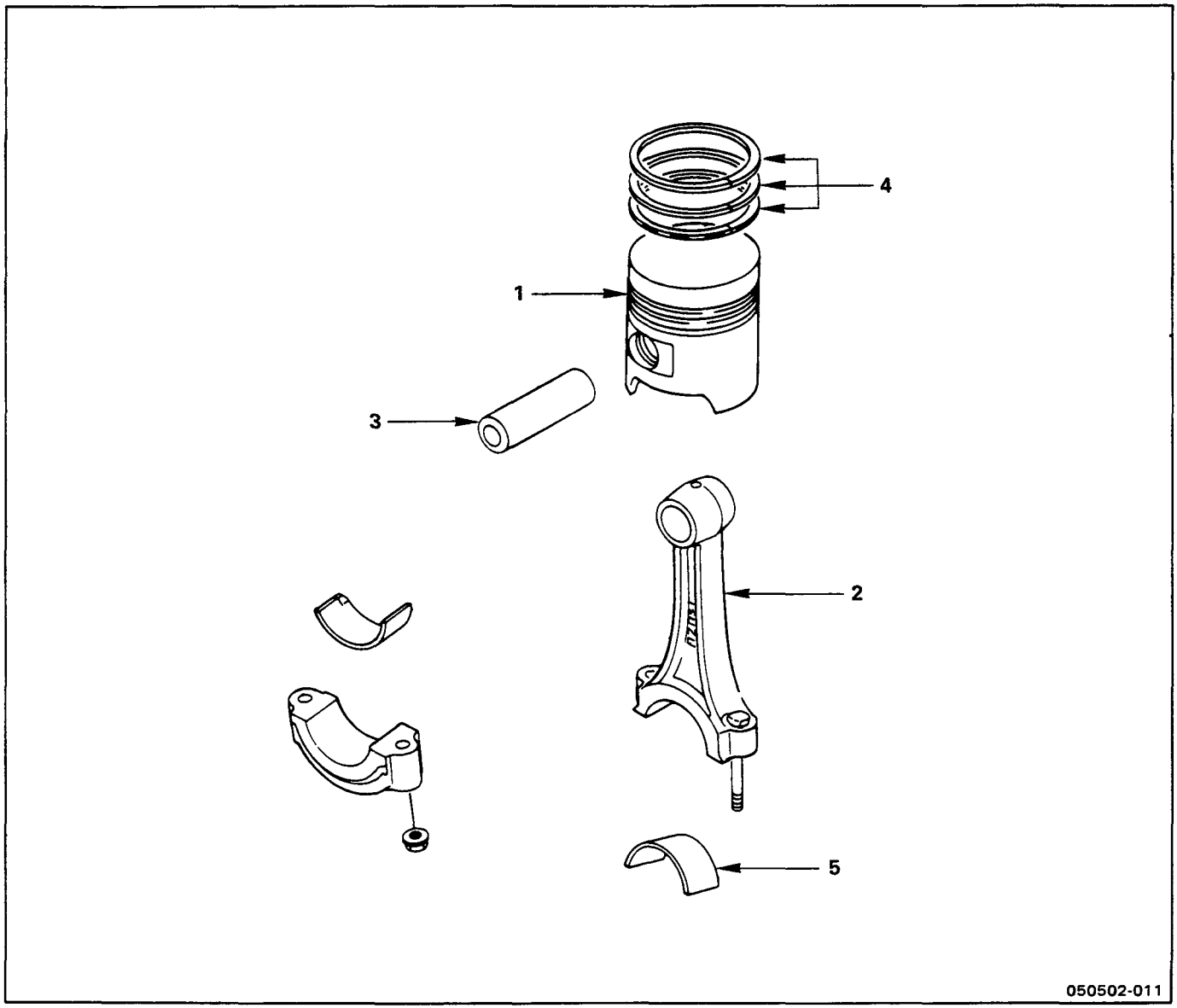
PISTON AND CONNECTING ROD



05050201B

Reassembly Steps

- ▲ 1. Piston
- ▲ 2. Connecting rod
- ▲ 3. Piston pin
- ▲ 4. Piston ring
- ▲ 5. Connecting rod bearing

Important Operations

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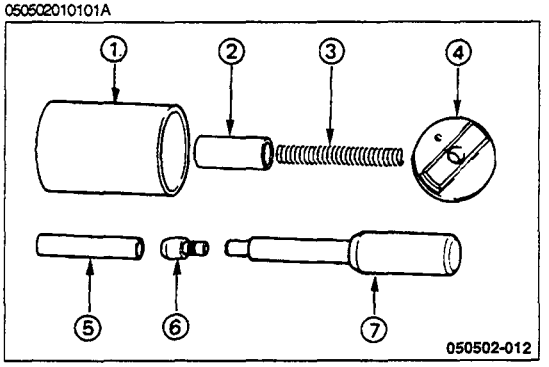

1. Piston
2. Connecting Rod
3. Piston Pin

Piston Pin Replacement Using The Special Tool
Piston Pin Replacer: 5-8840-0361-0 (4ZE1)

① Body	⑤ Installation
② Spring guide	⑥ Removal guide
③ Spring	⑦ Driver handle
④ Adapter	

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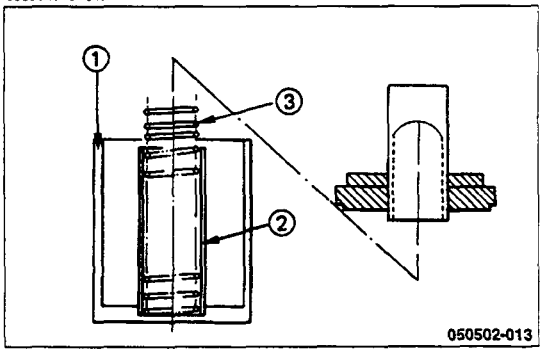

Piston Pin Installation Procedure

1) Apply a coat of engine oil to the piston pin, the piston, and the connecting rod.
2) Set the spring guide ② and the spring ③ to the body ①.
3) Insert the installation guide ⑤ from the bottom of the adapter ④.
4) Set the adapter together with the installation guide to the top of the body.

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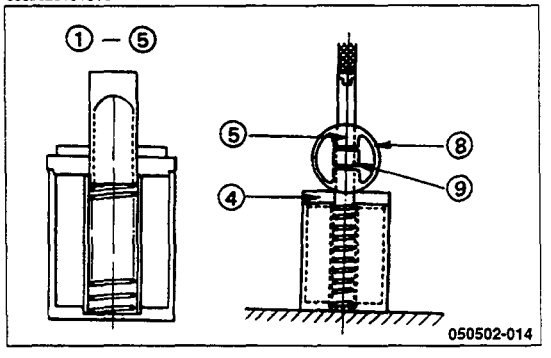
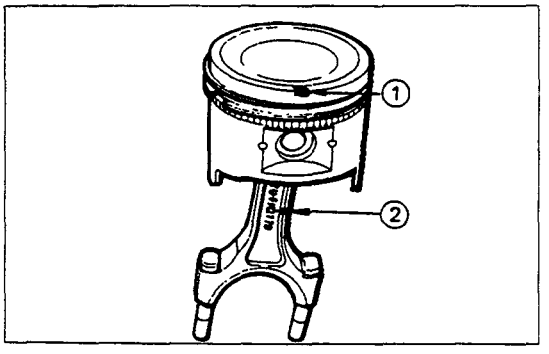


5) Place the assembled tools ① - ⑤ on a bench press.
6) Set the piston ⑧ and the connecting rod ⑨ to the portion of the installation guide ⑤ protruding from the adapter ④.



Align the piston head front mark ① and the connecting rod "ISUZU" casting mark ②. Both marks must be facing the same direction.

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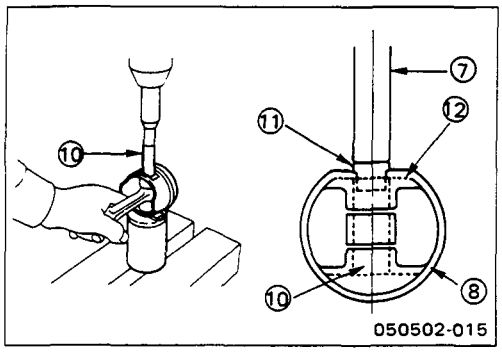
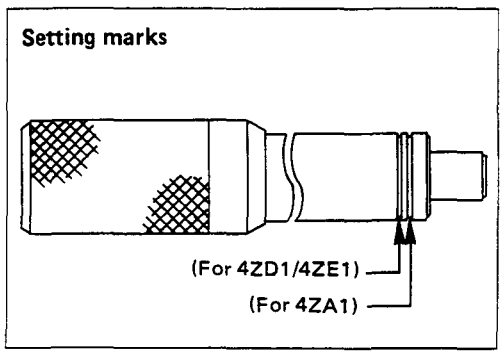


7) Set the piston pin ⑩ against the piston pin hole.
8) Set the driver handle ⑦ against the piston pin.
9) Use the bench press to slowly force the piston pin into the piston pin hole until the driver handle setting mark ⑪ is perfectly flush with the piston boss outside surface ⑫.
10) Check that the connecting rod moves smoothly.



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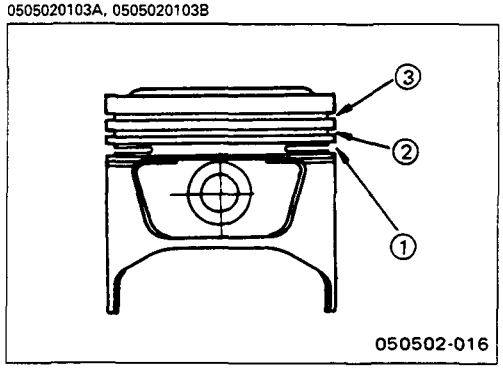


4. Piston Ring

1) Use a piston ring replacer to install the three piston rings.

   Piston Ring Replacer

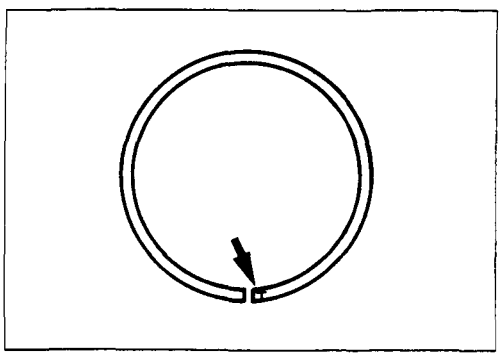
   Install the piston rings in the order shown in the illustration.

   ① Oil ring
   ② 2nd compression ring
   ③ 1st compression ring

Note:

Install the compression rings with the stamped side facing up. (1st ring is T, 2nd ring is 2T)

2) Apply engine oil to the piston ring surfaces.
3) Check that the piston rings rotate smoothly in the piston ring grooves.



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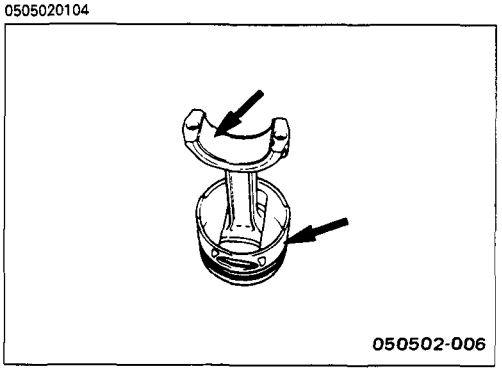

5. Connecting Rod Bearing

Carefully wipe any oil or other foreign material from the connecting rod bearing back face and the connecting rod bearing fitting surface.

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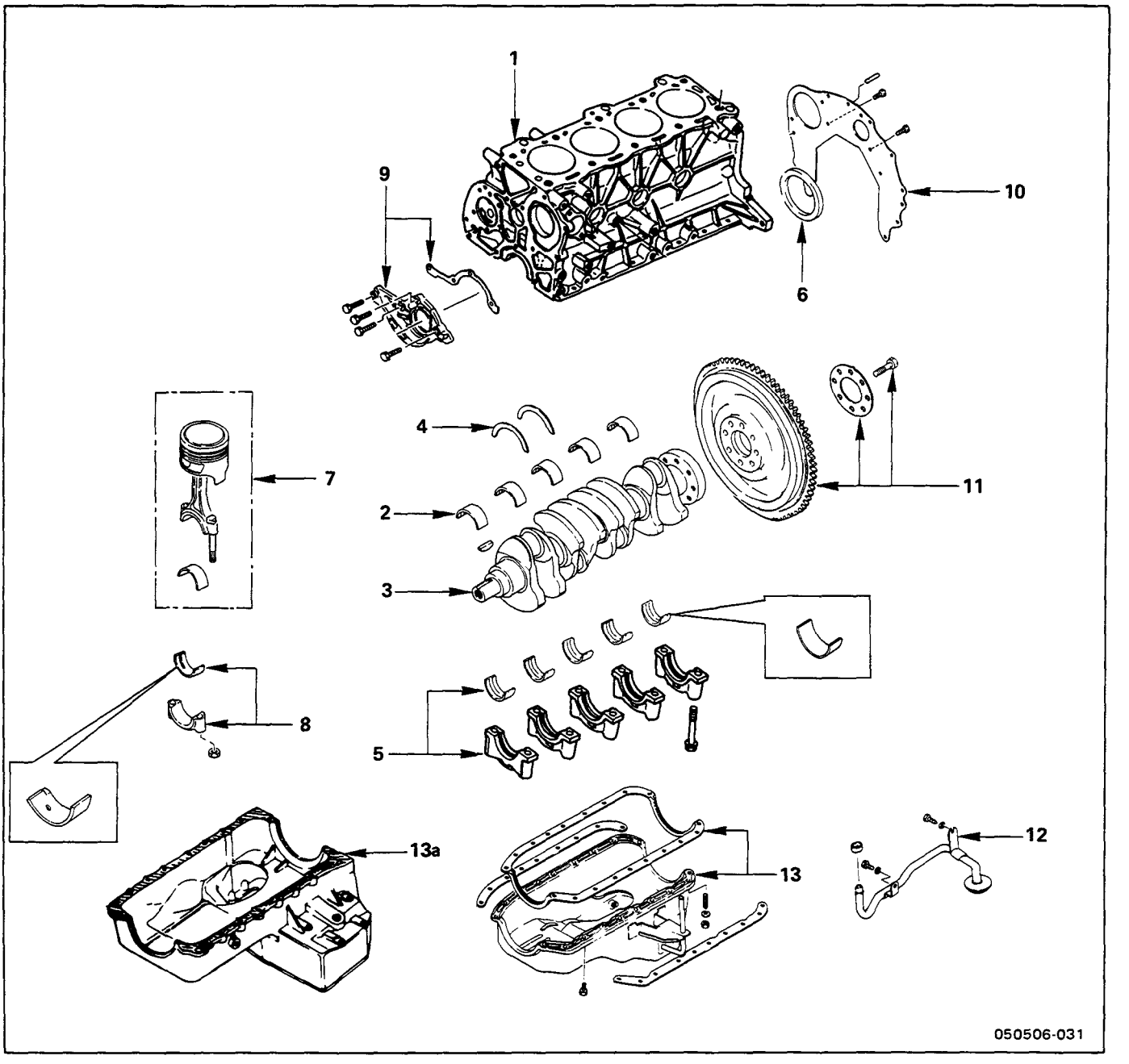
MAJOR COMPONENTS

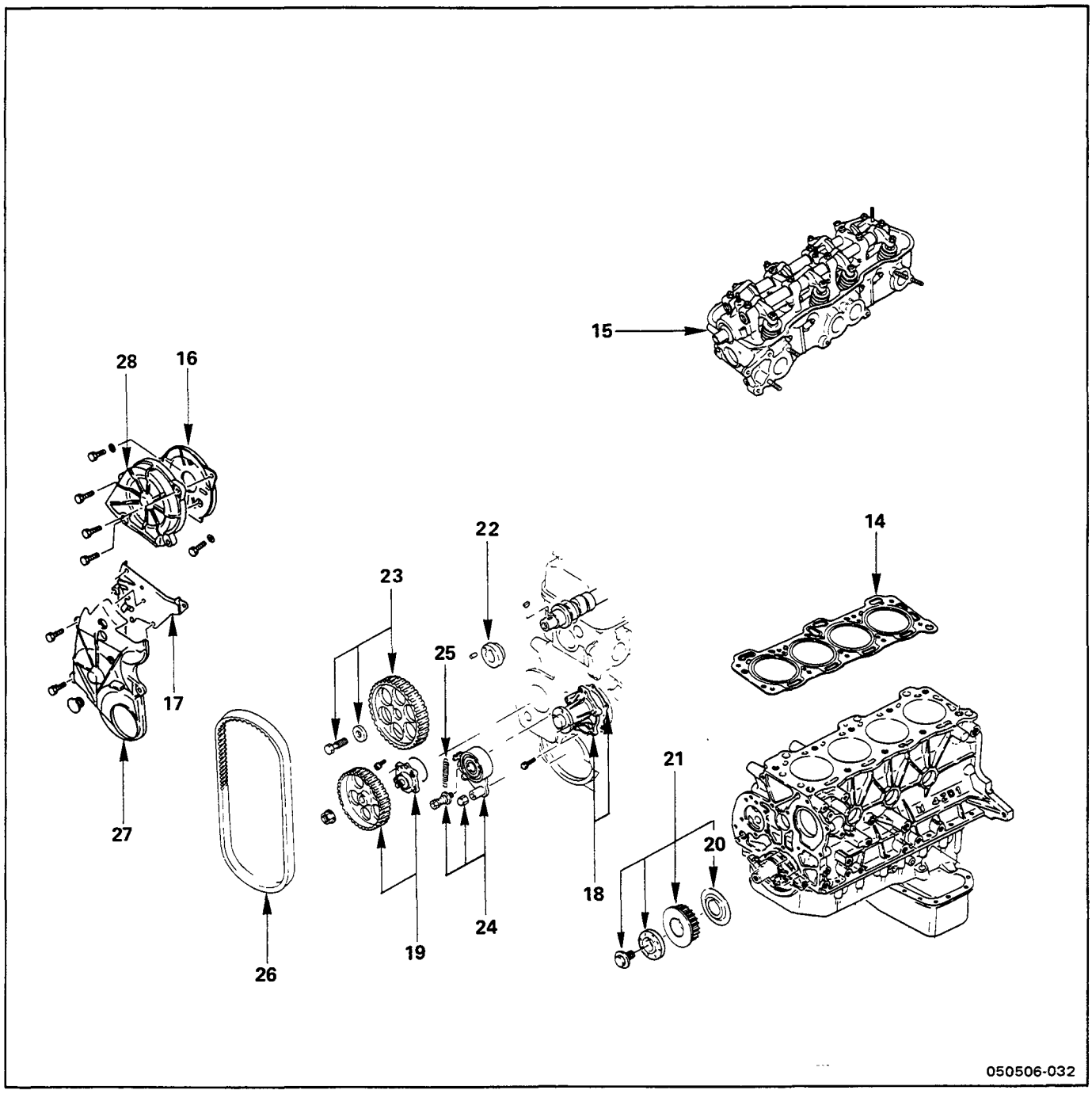


0505060002B, 0505060002C

Reassembly Steps-1

- ▲ 1. Cylinder body
- ▲ 2. Crankshaft upper bearing
- ▲ 3. Crankshaft
- ▲ 4. Crankshaft thrust bearing
- ▲ 5. Crankshaft bearing cap with lower bearing
- ▲ 6. Crankshaft rear oil seal
- ▲ 7. Piston and connecting rod with upper bearing
- ▲ 8. Connecting rod bearing cap with lower bearing
- ▲ 9. Crankshaft front oil seal retainer
- ▲ 10. Cylinder body rear plate
- ▲ 11. Flywheel
- ▲ 12. Oil pipe with strainer
- ▲ 13. Oil pan (For 4 × 2)
- ▲ 13a. Oil pan (For 4 × 4)

Inverted engine



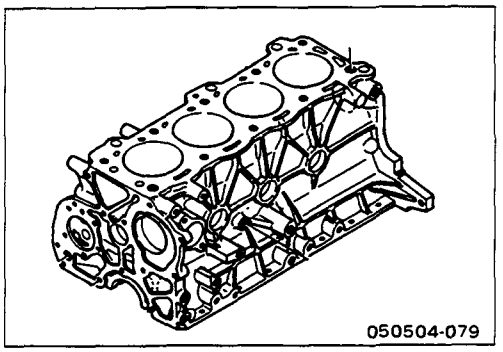
0505060002D, 0505060002E

Reassembly Steps-2

- ▲ 14. Cylinder head gasket
- ▲ 15. Cylinder head with rocker arm shaft and camshaft
- ▲ 16. Cylinder head front plate (Upper)
- ▲ 17. Cylinder body front plate (Lower)
- ▲ 18. Water pump
- ▲ 19. Oil pump with timing pulley
- ▲ 20. Timing belt guide plate
- ▲ 21. Crankshaft timing pulley
- 22. Camshaft boss
- ▲ 23. Camshaft timing pulley
- ▲ 24. Tension pulley
- ▲ 25. Tension spring
- ▲ 26. Timing belt
- 27. Timing belt lower cover
- 28. Timing belt upper cover

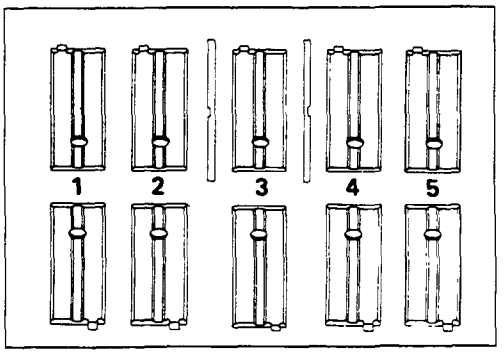
05050601

Important Operations



1. Cylinder Body

Use compressed air to thoroughly clean the inside and outside surfaces of the cylinder body, the oil holes, and the water jackets.

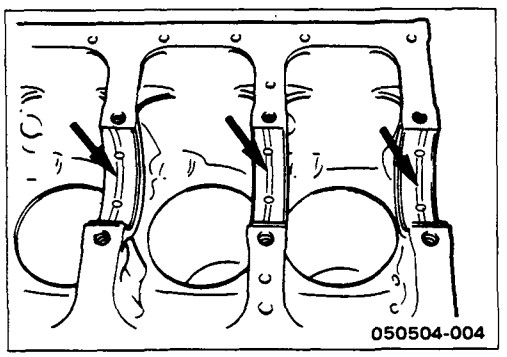


2. Crankshaft Upper Bearing

Crankshaft bearings are selected according to cylinder body and crankshaft grade.

Refer to "INSPECTION AND REPAIR", "Crankshaft Bearing Selection".

1) Carefully wipe any foreign material from the upper bearing.



Note:

Do not apply engine oil to the bearing back faces and the cylinder body bearing fitting surfaces.

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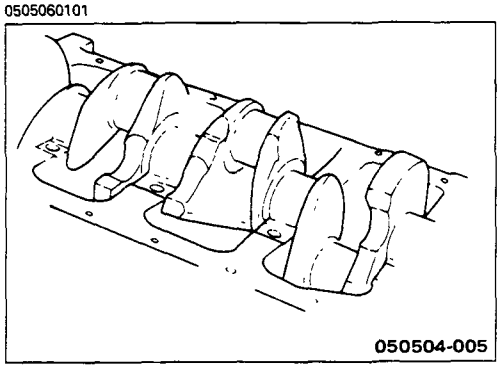

3. Crankshaft

Apply an ample coat of engine oil to the crankshaft journals and the crankshaft bearing surfaces before installing the crankshaft.

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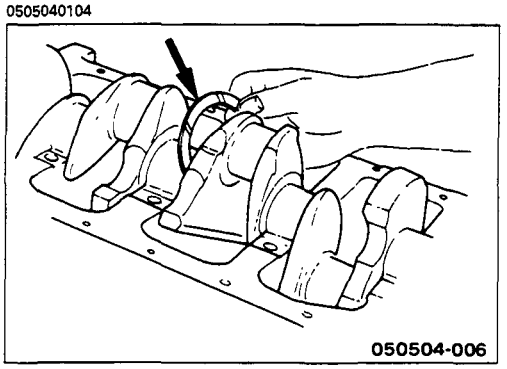

4. Crankshaft Thrust Bearing

Apply an ample coat of engine oil to the thrust bearings before installation.

Install the thrust bearings to the crankshaft center journal.

The thrust bearing oil grooves must be facing the sliding faces.

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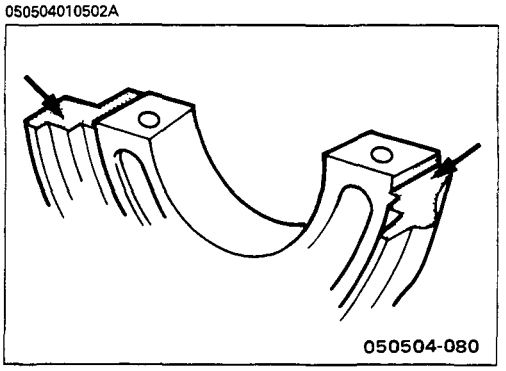

5. Crankshaft Bearing Cap with Lower Bearing

1) Apply the recommended liquid gasket or its equivalent to the cylinder body fitting surfaces of the No. 5 crankshaft bearing cap.

Note:

Lower bearing are as follows;
4ZE1 engine without oil groove of bearing.
4ZC1/4ZD1 engine with oil groove of bearing.

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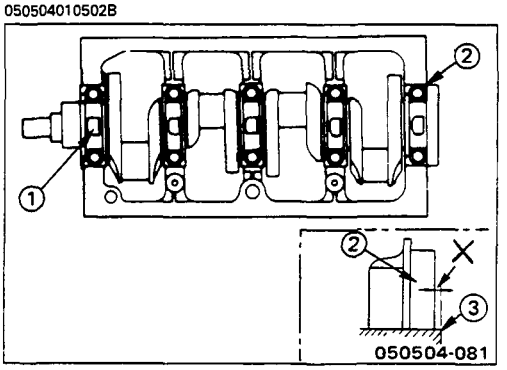

2) Install the bearing caps with the bearing cap head mark ① facing forward.

Note:

The No. 5 bearing cap ② must be perfectly flush with the cylinder body rear face ③.

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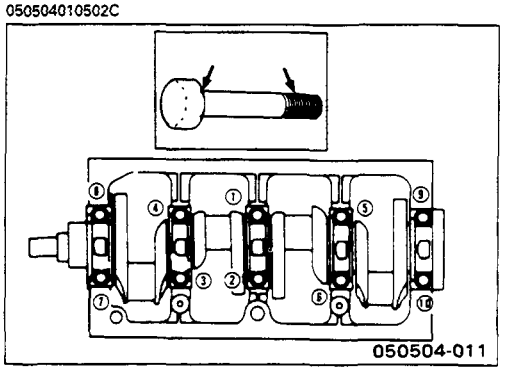

3) Apply a coat of engine oil to the bearing cap bolts.

4) Tighten the bearing cap bolts to the specified torque a little at a time in the sequence shown in the illustration.

Crankshaft Bearing Cap Bolt Torque	kg·m(lb.ft/N·m)
10.0 ± 1.5 (72.3 ± 10.5/98.0 ± 14.7)	

5) Check to see that the crankshaft turns smoothly by rotating it manually.

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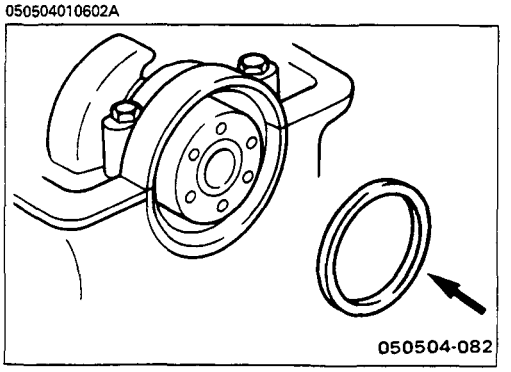

6. Crankshaft Rear Oil Seal

1) Apply engine oil to the oil seal lip circumference and the oil seal outer circumference.

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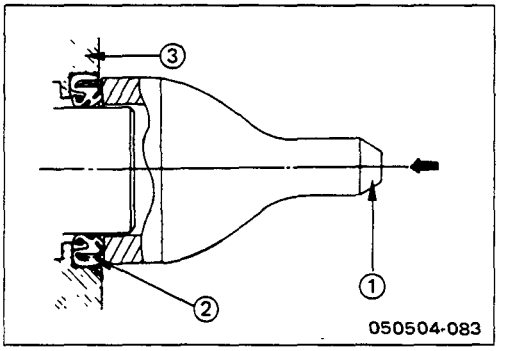
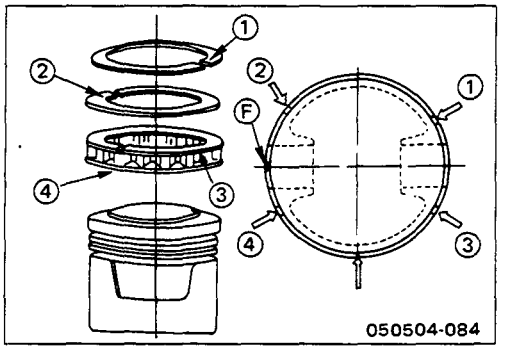


2) Use the oil seal installer ① to install the oil seal ② to the cylinder body ③.

Oil Seal Installer: 5-8840-2286-0 (J-39201)

0505040112A



7. Piston and Connecting Rod with Upper Bearing

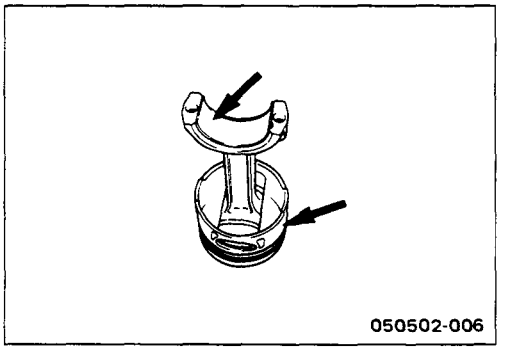
8. Connecting Rod Bearing Cap with Lower Bearing

1) Apply a coat of engine oil to the circumference of each piston ring and piston.

2) Position the piston ring gaps as shown in the illustration.

① 1st compression ring
② 2nd compression ring
③ Oil ring (Upper side rail)
④ Oil ring (Lower side rail)

0505040112B



3) Apply a coat of molybdenum disulfide grease to the two piston skirts.

This will facilitate smooth break-in when the engine is first started after reassembly.

4) Apply a coat of engine oil to the upper bearing surfaces.

5) Apply a coat of engine oil to the cylinder wall.

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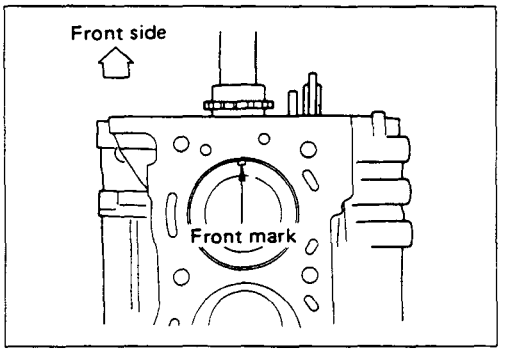

6) Position the piston head front mark so that it is facing the front of engine.

7) Use the piston ring compressor to compress the piston rings.

Piston Ring Compressor: 5-8840-9018-0 (J-8037)

8) Use a hammer grip to push the piston in until the connecting rod makes contact with the crankpin.

At the same time, rotate the crankshaft until the crankpin is at BDC.

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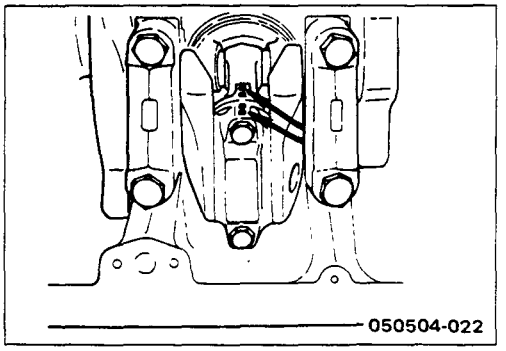


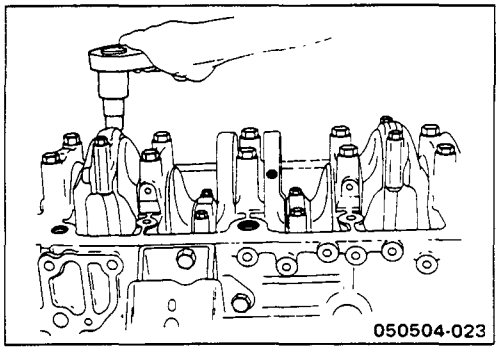
9) Install the connecting rod bearing caps.

Align the bearing cap cylinder number marks and the connecting rod cylinder number marks.

Note:

Lower bearing are as follows;
4ZE1 engine without oil groove of bearing.
4ZC1/4ZD1 engine with half oil groove of bearing.

0505040112E



10) Apply a coat of engine oil to the threads and setting faces of each connecting rod cap bolt.

11) Tighten the connecting rod caps to the specified torque.

Connecting Rod Bearing Cap Bolt

Torque	kg·m(lb.ft/N·m)
4ZC1/4ZD1/4ZE1 M10	6.0±0.2 (43.4±1.5/58.8±2.0)

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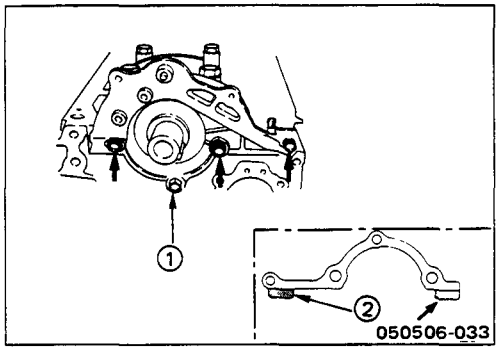


9. Crankshaft Front Oil Seal Retainer

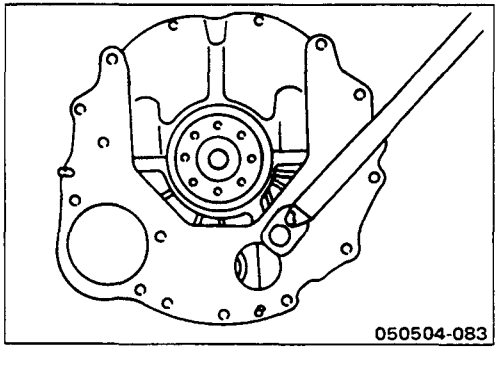
1) Apply engine oil to the oil seal lip circumference and the oil seal outer circumference.

2) Apply the recommended liquid gasket or its equivalent to the oil seal retainer gasket.

3) Tighten the oil seal retainer bolts ① to the specified torque.

Oil Seal Retainer Bolt Torque	kg·m(lb.ft/N·m)
1.9 ± 0.5 (13.7 ± 3.6/18.6 ± 4.9)	

4) Cut away any gasket protruding ② from the area where the oil pan is to be installed.



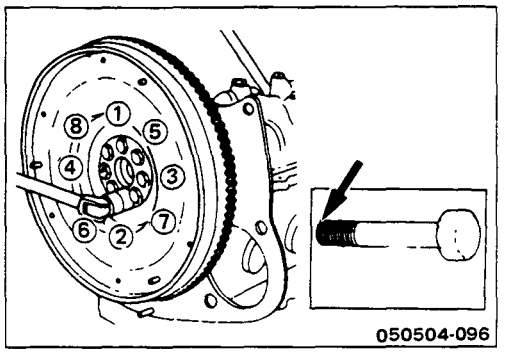
10. Cylinder Body Rear Plate

1) Install the rear plate to the cylinder body.

Align the rear plate with the cylinder body knock pin.

2) Tighten the rear plate bolts to the specified torque.

Rear Plate Bolt Torque	kg·m(lb.ft/N·m)
5 ± 1 (36.2 ± 7.2/49.0 ± 9.8)	



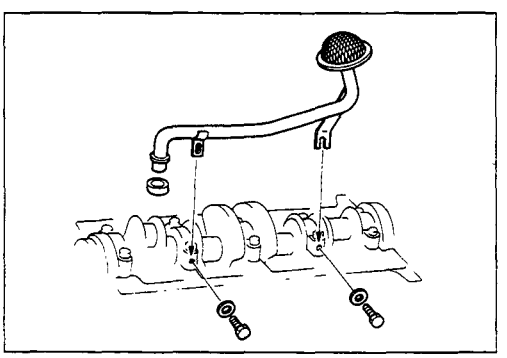
11. Flywheel

1) Apply the LOCTITE or its equivalent to the new bolts.
2) Block the crankshaft with a piece of hard wood to prevent it from turning.
3) Tighten the flywheel bolts in the numerical order shown in the illustration.

Flywheel Bolt Torque	kg·m(lb.ft/N·m)
6.0 ± 0.5 (43.4 ± 3.6/58.8 ± 4.9)	

Note:

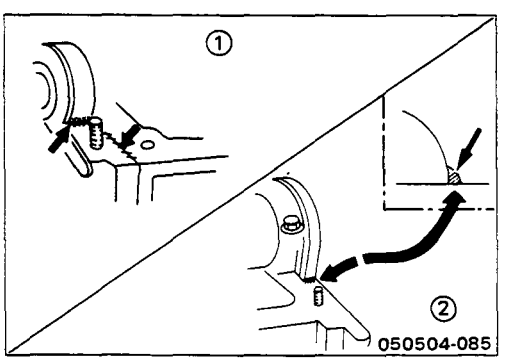
When reinstalling the crankshaft which has been in use, remove all traces of LOCTITE from the bolt holes in the crankshaft by turning in the new bolt, then clean the crankshaft with cleaner before installing the flywheel.



12. Oil Pipe with Strainer

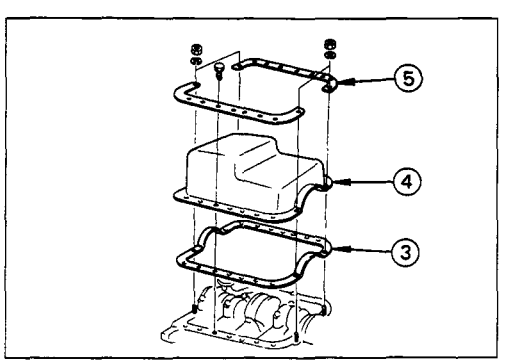
1) Install the rubber hose to the oil pipe.
2) Install the oil pipe to the bearing caps.
3) Tighten the oil pipe bolts to the specified torque.

Oil Pipe Bolt Torque	kg·m(lb.ft/N·m)
1.9 ± 0.5 (13.7 ± 3.6/18.6 ± 4.9)	



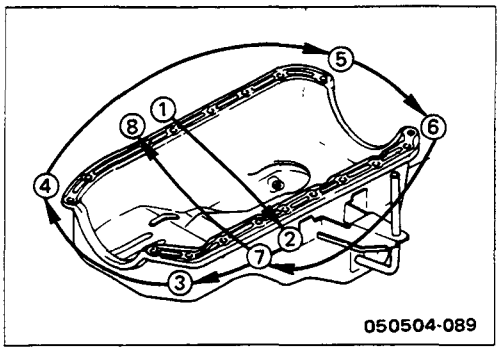
13. Oil Pan (For 4 × 2)

1) Apply the recommended liquid gasket or its equivalent to the gap between the oil seal retainer and the cylinder body at the positions shown in the illustration ①.
2) Apply the recommended liquid gasket or its equivalent to the No. 5 bearing cap at the positions shown in the illustration ②.



3) Install the oil pan gasket ③ and the oil pan ④ to the cylinder body.
4) Install the damper plates ⑤ to the oil pan.

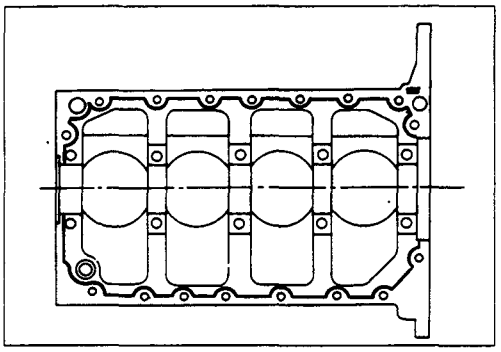
   The damper plate rubber side must be oil pan side.



050504-089

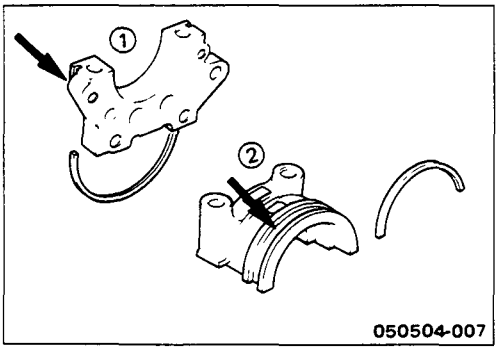
5) Tighten the oil pan bolts and nuts to the specified torque a little at a time in the sequence shown in the illustration.

Oil Pan Bolt and Nut Torque	kg·m(lb.ft/N·m)
0.5 ± 0.1 (3.6 ± 0.7/4.9 ± 1.0)	



13a. Oil Pan (For 4 × 4)

1) Apply the recommended liquid gasket or its equivalent to the oil pan fitting surfaces of the cylinder body.



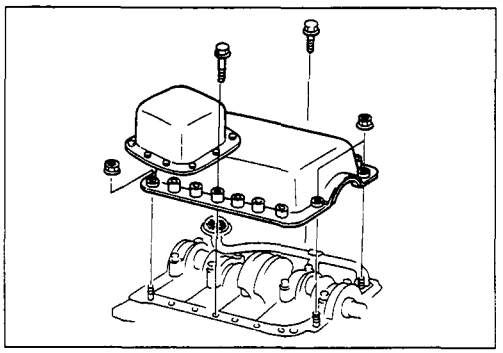
050504-007

2) Install an arch gasket to both the No. 1 ① and the No. 5 ② crankshaft bearing caps.

Apply liquid gasket to the end of the arch gasket.

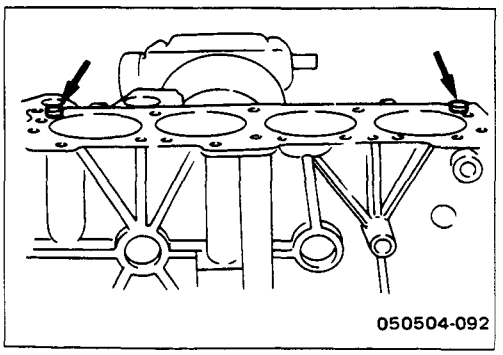
Use your fingers to push the arch gasket into the groove.

Take care not to scratch the outer surface of the arch gasket.


0505040117

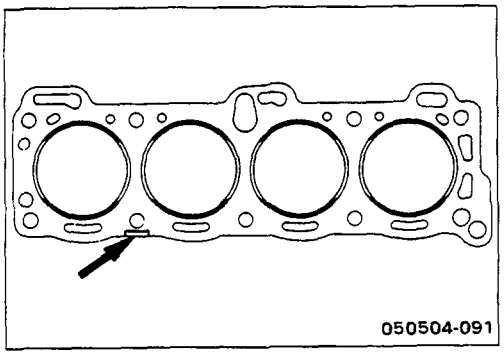
3) Tighten the oil pan bolts and nuts to the specified torque a little at a time.

Oil Pan Bolt Torque	kg·m(lb.ft/N·m)
1.8 ± 0.5 (13.0 ± 3.6/17.6 ± 4.9)	


050504-092

14. Cylinder Head Gasket

1) Clean the cylinder body upper side and the cylinder head lower side and attach the dowels.



2) Install the gasket with the "TOP" mark facing up and to the front.

Align the cylinder head dowels and the cylinder head gasket holes.

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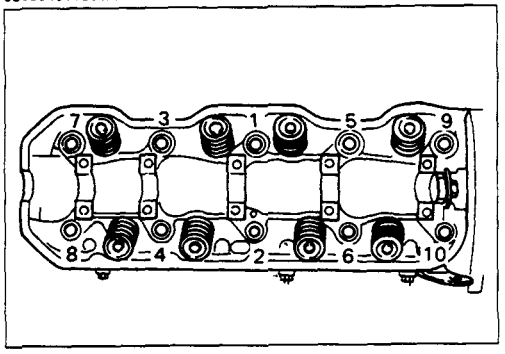

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15. Cylinder Head with Rocker Arm Shaft and Camshaft

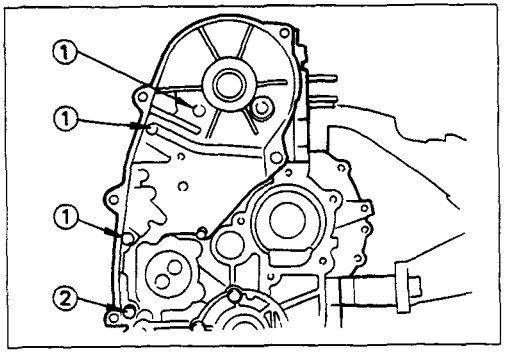
1) Apply a coat of engine oil to the cylinder head bolt threads and setting faces.

2) Use the cylinder head bolt wrench to tighten the cylinder head bolts to the specified torque.

Follow the numerical sequence shown in the illustration.

Head Bolt Wrench: 9-8511-4209-0 (J-2423-01)

Cylinder Head Bolt Torque	kg·m(lb.ft
1st Step	2nd Step
8 (57.8/78.4)	10 ± 1 (72.3 ± 7.2/98.0 ± 9.8)



16. Cylinder Head Front Plate

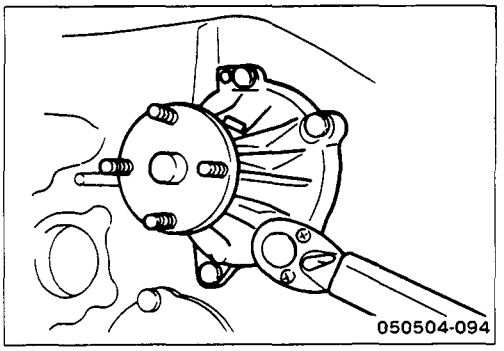
17. Cylinder Body Front Plate

1) Install the cylinder head front plate to the cylinder head.

2) Install the cylinder body front plate to the cylinder body.

3) Tighten the front plate bolts to the specified torque.

Front Plate Bolt Torque	kg·m(lb.ft/N·m)
① M6 × 1.0 (4T)	0.6 ± 0.2 (4.3 ± 1.4/5.9 ± 2.0)
② M8 × 1.25 (4T)	1.3 ± 0.5 (9.4 ± 3.6/9.8 ± 4.9)

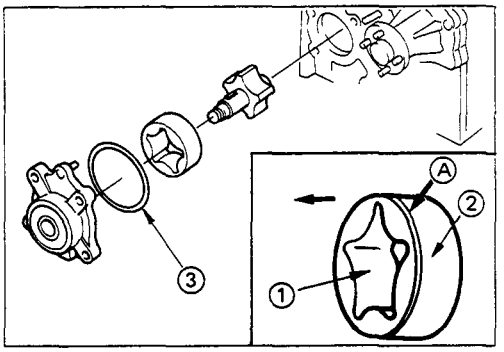


18. Water Pump

Tighten the water pump bolts to the specified torque.

Water Pump Bolt Torque	kg·m(lb.ft/N·m)
2.7 ± 0.5 (19.5 ± 3.6/26.5 ± 4.9)	

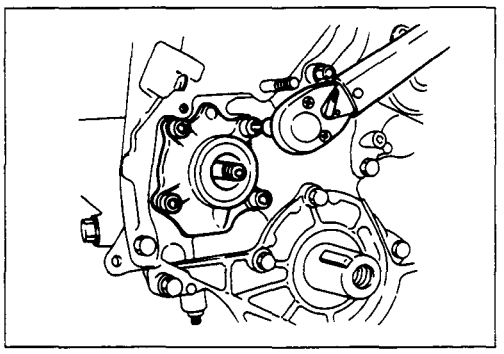
Water Pump Nut Torque	kg·m(lb.ft/N·m)
1.9 ± 0.5 (13.7 ± 3.6/18.6 ± 4.9)	



19. Oil Pump and Timing Pulley

1) Apply engine oil to the cylinder body outer rotor fitting surfaces and the inner ① and the outer ② rotor.
2) Install the rotors to the oil pump.

   The chamfered side Ⓐ of the rotors turned to the cylinder body.
3) Install the O-rings ③ to the oil pump body.



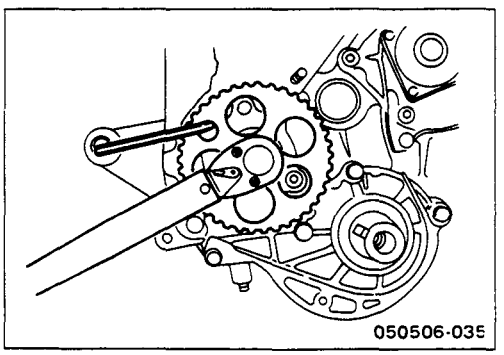
4) Install the oil pump assembly to the cylinder body.

Note:

Take care not to twist the O-rings during the installation procedure.

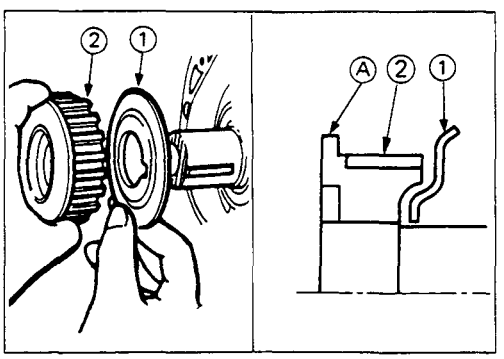
5) Use the inner hexagon wrench to tighten the oil pump bolts to the specified torque.
   Inner Hexagon Wrench: 6 mm (0.24 in)

Oil Pump Bolt Torque	kg·m(lb.ft/N·m)
1.9 ± 0.5 (13.7 ± 3.6/18.6 ± 4.9)	



6) Check that the oil pump rotor turns smoothly.
7) Install the timing pulley to the oil pump.
8) Apply the LOCTITE or its equivalent to the pulley nut.
9) Tighten the timing pulley nut to the specified torque.

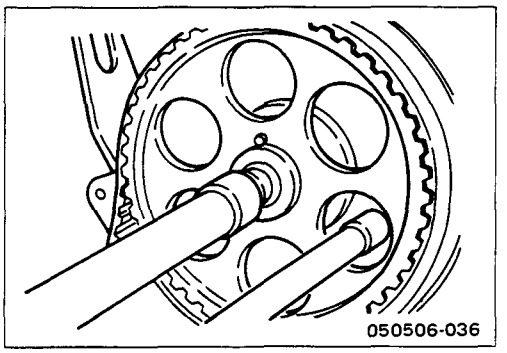
Timing Pulley Nut Torque	kg·m(lb.ft/N·m)
7.7 ± 1.0 (55.7 ± 7.2/75.5 ± 9.8)	



20. Timing Belt Guide Plate

21. Crankshaft Timing Pulley

Install the crankshaft timing pulley with the guide plate ① projecting side facing the timing pulley ② and the timing pulley flanged portion Ⓐ facing forward.



23. Camshaft Timing Pulley

Tighten the camshaft timing pulley bolts to the specified torque.

Camshaft Timing Pulley Bolt Torque	kg·m(lb.ft/N·m)
6.0 ± 0.5 (43.4 ± 3.6/58.8 ± 4.9)	

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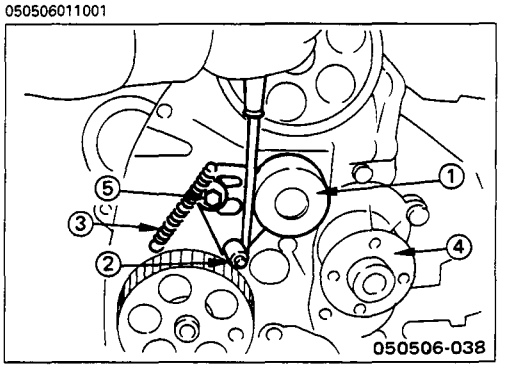

24. Tension Pulley

25. Tension Spring

1) Install the tension pulley ① to the tension stud ②.
2) Install the tension spring ③.
3) Using the tension stud ② as a fulcrum, push the tension pulley ① as far as possible in the direction of the water pump ④.
4) Temporarily tighten the tensioner bolt ⑤.

   The bolt must be tightened enough to hold the spring in place.

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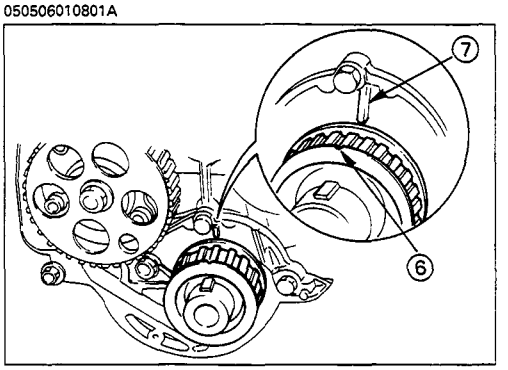

26. Timing Belt

1) Align the crankshaft timing pulley mark ⑥ with the oil seal retainer setting mark ⑦.

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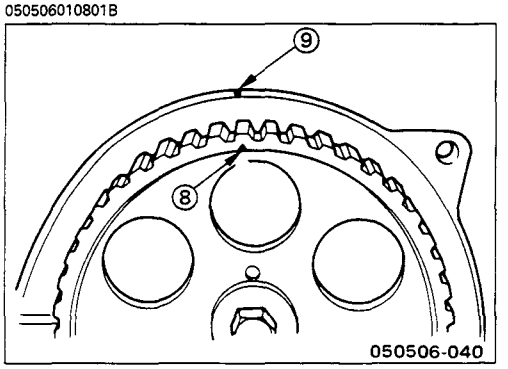

2) Check that the camshaft timing pulley setting mark ⑧ and the front plate setting mark ⑨ are aligned.

Note:

At this point the No. 4 cylinder comes to its compression, top dead center.

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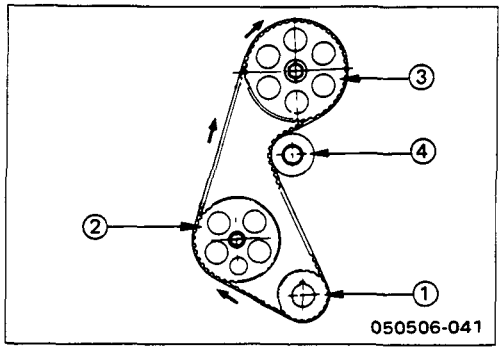

3) Install the timing belt to the crankshaft timing pulley ①, the oil pump timing pulley ②, the camshaft timing pulley ③, and the tension pulley ④ in that order.

Note:

1) Take care not to twist the timing belt.

2) Be sure that the timing belt cleanly fits over the pulley gear teeth.

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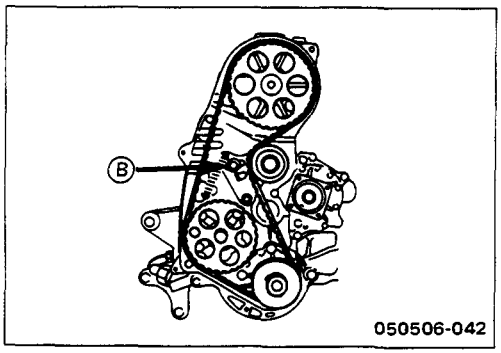

4) Loosen the tensioner bolt Ⓑ.

5) Allow the tension spring to pull the timing belt as far as possible.

6) Once again, temporarily tighten the tensioner bolt Ⓑ.

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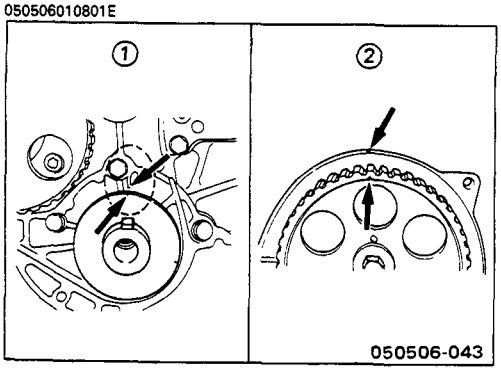

7) Rotate the crankshaft counterclockwise two full turns (720°).

① Check that the crankshaft timing pulley mark is aligned with the oil seal retainer setting mark.

② Check that the camshaft timing pulley setting mark is aligned with the front cover setting mark.

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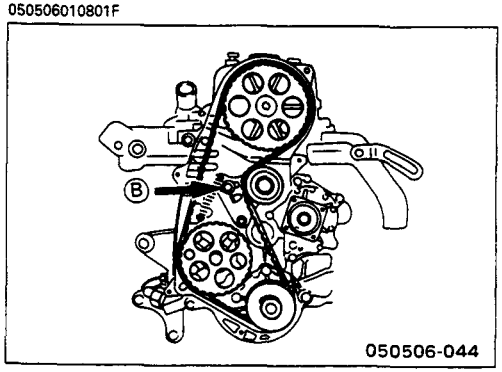


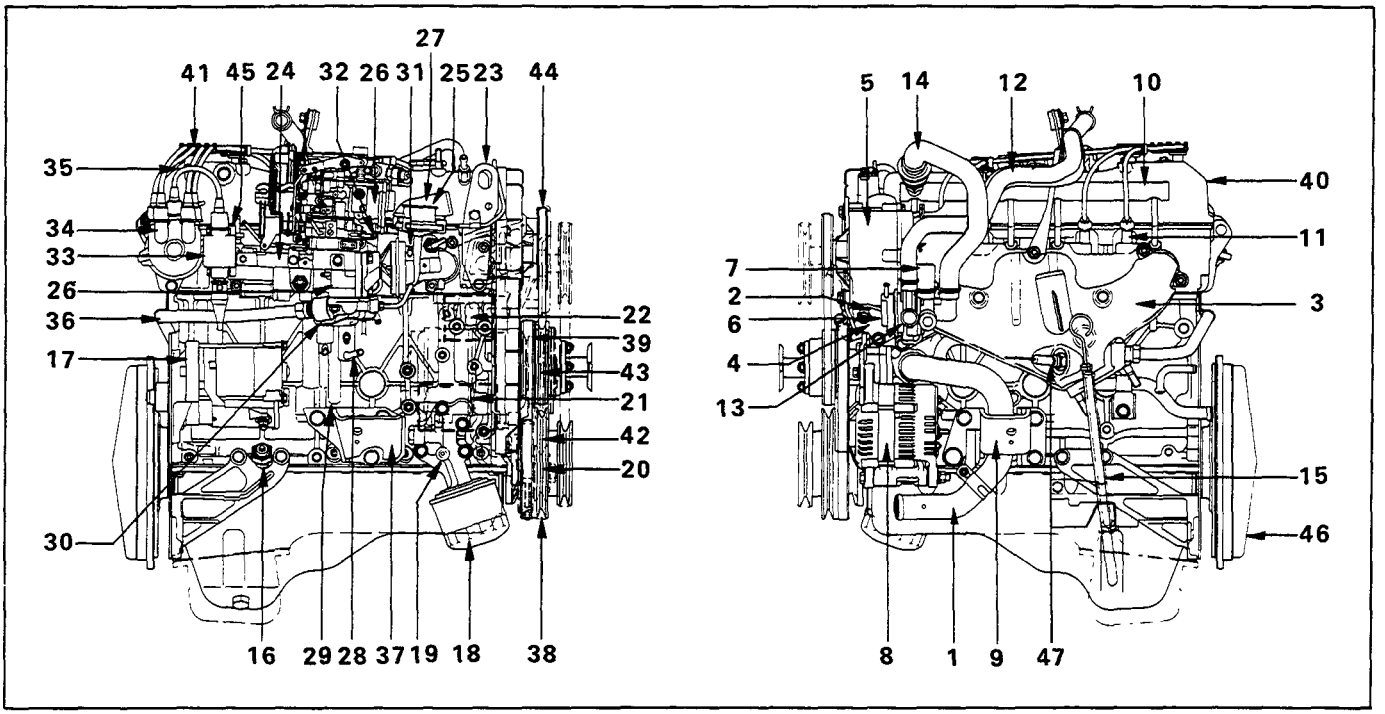
8) Loosen the tensioner bolt "Ⓑ".

9) Allow the tension spring to pull the timing belt as far as possible.

10) Tighten the tensioner bolt "B" to the specified torque.

Tensioner Bolt "B" Torque	kg·m(lb.ft/N·m)
1.9 ± 0.5 (13.7 ± 3.6/18.6 ± 4.9)	

EXTERNAL PARTS



Reassembly Steps

- ▲ 1. Water intake pipe
- ▲ 2. Air pump bracket "A" [V]
- ▲ 3. Exhaust manifold
- ▲ 4. Air pump bracket "B" [V]
- ▲ 5. Air pump [V]
- ▲ 6. Air switching valve [V]
- ▲ 7. Rubber hose (Air pump to A.S.V.) [V]
- ▲ 8. Alternator and bracket
- ▲ 9. Engine foot with mounting rubber
- ▲ 10. Air manifold with check valve [V]
- ▲ 11. Spark plug
- 12. Rubber hose (Air pump to air cleaner) [V]
- 13. Rubber hose (A.S.V. to air intake duct bracket) [V]
- ▲ 14. Rubber hose (A.S.V. to check valve) [V]
- 15. Dipstick and guide tube
- 16. Oil pressure switch
- ▲ 17. Starter motor
- ▲ 18. Oil filter adapter with oil filter
- ▲ 19. Oil pressure unit [V]
- 20. Compressor idler pulley and bracket [V]
- ▲ 21. Compressor and bracket [V]
- ▲ 22. Power steering oil pump and bracket [V]
- 23. Front engine hanger
- ▲ 24. Intake manifold
- ▲ 25. BP transducer and bracket [V]
- ▲ 26. Carburetor
- 27. Water outlet pipe
- ▲ 28. Fuel pump
- ▲ 29. Fuel damper
- ▲ 30. EGR adapter [V]
- ▲ 31. EGR valve [V]
- ▲ 32. Fast idle solenoid (with A/C) [V]
- ▲ 33. Ignition coil [V]
- ▲ 34. Distributor
- ▲ 35. High tension cable (Ignition coil to distributor) [V]
- ▲ 36. EGR pipe [V]
- ▲ 37. Engine foot with mounting rubber
- ▲ 38. Crankshaft pulley
- ▲ 39. Cooling fan pulley
- ▲ 40. Cylinder head cover
- 41. High tension cable
- ▲ 42. Cooling fan drive belt
- ▲ 43. Compressor drive belt [V]
- ▲ 44. Air pump drive belt [V]
- ▲ 45. Condenser [V]
- ▲ 46. Clutch pressure plate assembly and driven plate assembly

[V] : Optional on some models

Important Operations – Installation

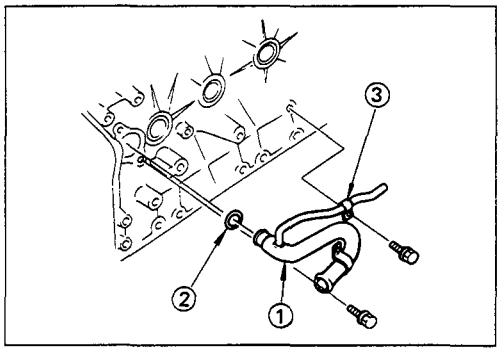
Emission Control Vacuum Hoses

Refer to the tags attached at disassembly to reinstall the emission control vacuum hose.

Follow the external parts installation step order.

If there are no tags attached, refer to the "VACUUM HOSE ROUTING DIAGRAM" in the section 6E.

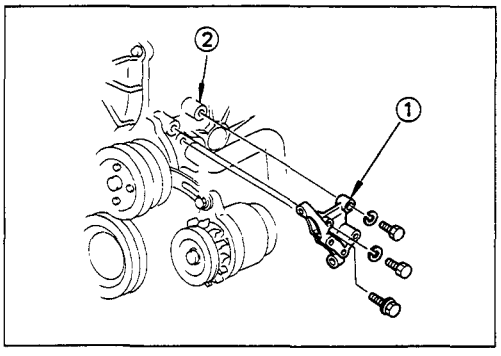
It is very important that the hose be installed correctly.



1. Water Intake Pipe

1) Install the intake pipe ① together with the O-ring ② and the clip ③ to the cylinder body.
2) Tighten the intake pipe bolts to the specified torque.

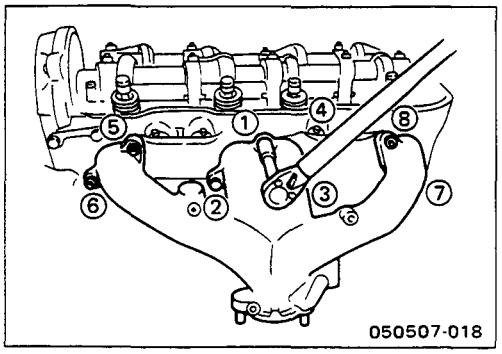
Intake Pipe Bolt Torque	kg·m(lb.ft/N·m)
1.9 ± 0.5 (13.7 ± 3.6/18.6 ± 4.9)	



2. Air Pump Bracket "A" [V]

1) Install the air pump bracket "A" ① to the cylinder body ②.
2) Tighten the bracket bolts to the specified torque.

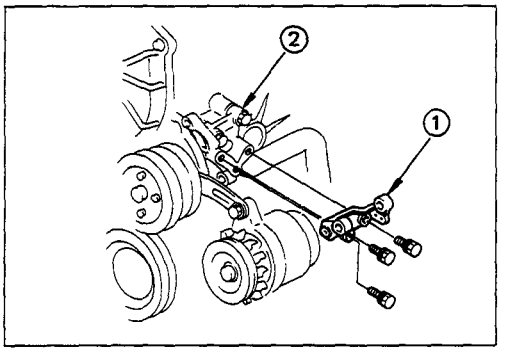
Air Pump Bracket "A" Bolt Torque	kg·m(lb.ft/N·m)
5.6 ± 0.8 (40.5 ± 5.8/54.9 ± 7.8)	



3. Exhaust Manifold

1) Install the manifold gasket with the stamped mark facing outward.
2) Tighten the exhaust manifold bolts to the specified torque a little at a time in the numerical order shown in the illustration.

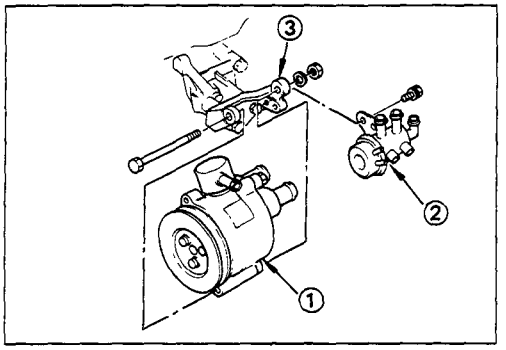
Exhaust Manifold Bolt Torque	kg·m(lb.ft/N·m)
2.2 ± 0.3 (15.9 ± 2.2/21.6 ± 2.9)	



4. Air Pump Bracket "B" [V]

1) Install the air pump bracket "B" ① to the air pump bracket "A" ②.
2) Tighten the bracket bolts to the specified torque.

Air Pump Bracket "B" Bolt Torque	kg·m(lb.ft/N·m)
1.9 ± 0.5 (13.7 ± 3.6/18.6 ± 4.9)	



5. Air Pump [V]

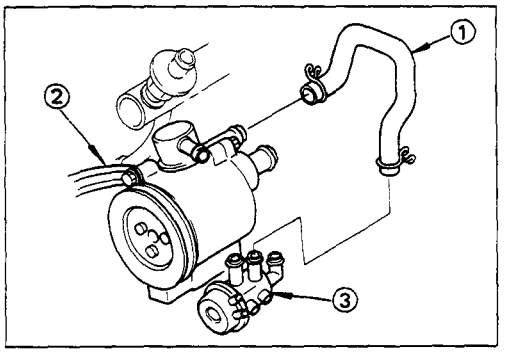
6. Air Switching Valve [V]

1) Install the air pump ① and the air switching valve ② to the pump bracket "B" ③.
2) Tighten the air pump nuts to the specified torque.

Air Pump Nut Torque	kg·m(lb.ft/N·m)
1.9 ± 0.5 (13.7 ± 3.6/18.6 ± 4.9)	

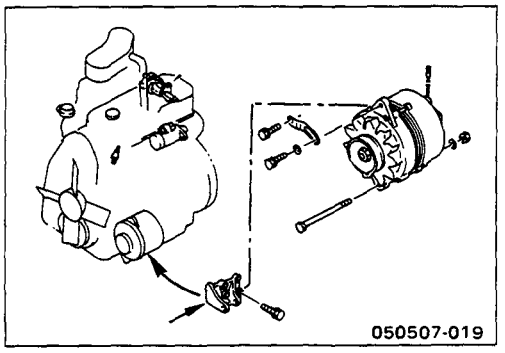
3) Tighten the air switching valve bolts to the specified torque.

Air Switching Valve Torque	kg·m(lb.ft/N·m)
1.9 ± 0.5 (13.7 ± 3.6/18.6 ± 4.9)	



7. Rubber Hose (Air Pump to Air Switching V [V]

Connect the rubber hose ① between the air pum and the air switching valve ③.

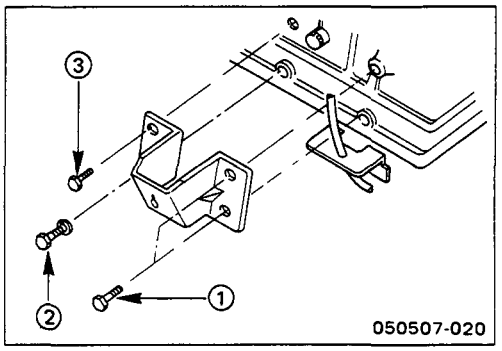


8. Alternator and Bracket

1) Install the alternator bracket to the cylinder body and tighten the bracket bolts to the specified torque.

Transmission Nut and Bolt Torque	kg·m(lb.ft/N·m)
3.8 ± 1.0 (27.5 ± 7.2/37.3 ± 9.8)	

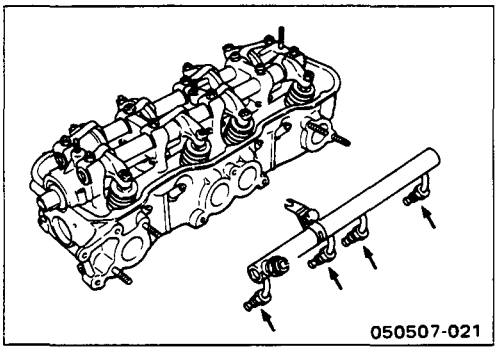
2) Install the alternator to the bracket.
   Tighten the through bolt.
3) Temporarily tighten the adjusting bolt.



9. Engine Foot with Mounting Rubber

Tighten the engine left side foot bolts to the specified torque.

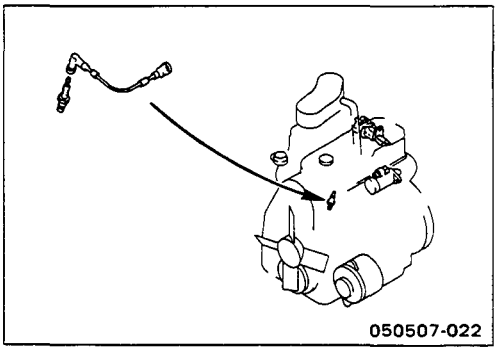
Engine Foot Bolt Torque	kg·m(lb.ft/N·m)
①	8.4 ± 0.8 (60.8 ± 5.8/82.4 ± 7.8)
②	12.9 ± 1.5 (93.3 ± 10.8/126.5 ± 14.7)
③	4.1 ± 0.6 (29.7 ± 4.3/40.2 ± 5.9)



10. Air Manifold with Check Valve [V]

1) Hand-tighten the four sleeve bolts.
2) Use a wrench to tighten the sleeve nuts to the specified torque.

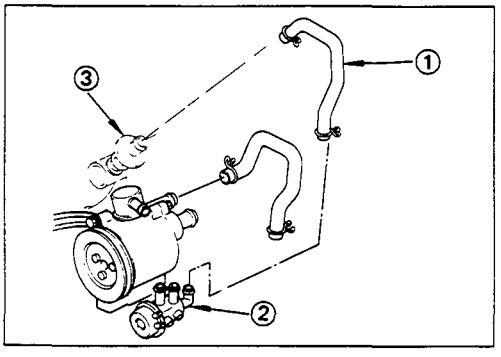
Air Manifold Sleeve Nut Torque	kg·m(lb.ft/N·m)
1.9 ± 0.5 (13.7 ± 3.6/18.6 ± 4.9)	



11. Spark Plug

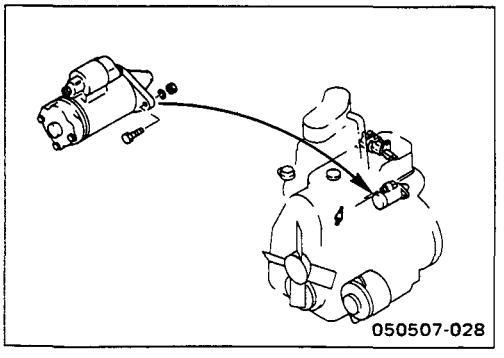
Tighten the spark plugs to the specified torque.

Spark Plug Torque	kg ·m(lb.ft/N·m)
1.9 ± 0.5 (13.7 ± 3.6/18.6 ± 4.9)	



14. Rubber Hose (ASV to Air Manifold Check Valve) [V]

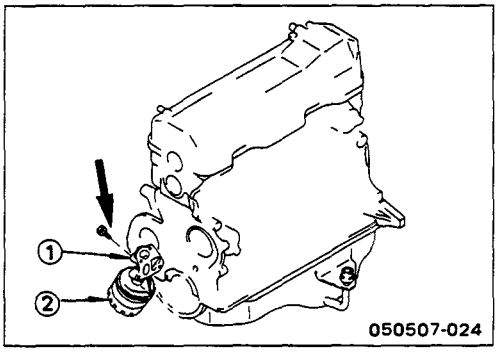
Connect the rubber hose ① between the air switching valve ② and the air manifold check valve ③.



17. Starter Motor

1) Install the starter motor to the rear plate.
2) Tighten the starter motor bolts to the specified torque.

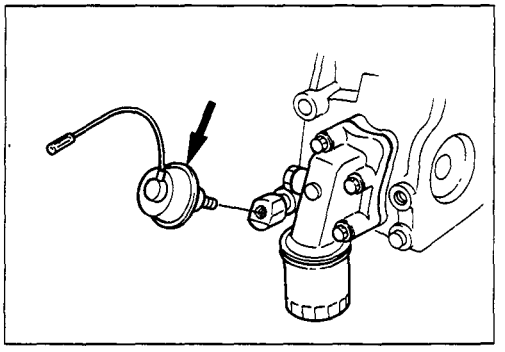
Starter Motor Torque	kg·m(lb.ft/N·m)
8.8 ± 1.9 (63.7 ± 13.7/86.2 ± 18.6)	



18. Oil Filter Adapter with Oil Filter

1) Install the oil filter adapter ① and the oil filter ② to the cylinder body.
2) Tighten the oil filter adapter bolts to the specified torque.

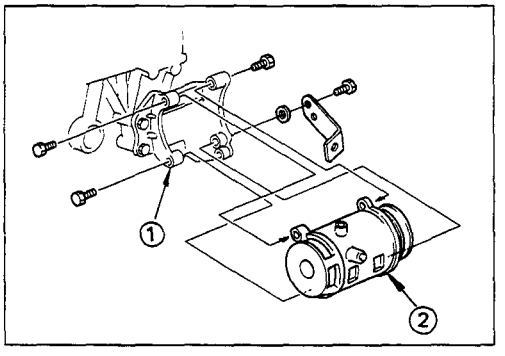
Oil Filter Adapter Bolt Torque	kg·m(lb.ft/N·m)
1.9 ± 0.5 (13.7 ± 3.6/18.6 ± 4.9)	



19. Oil Pressure Unit [V]

1) Install the oil pressure unit to the oil filter adapter.
2) Tighten the unit to the specified torque.

Oil Pressure Unit Torque	kg·m(lb.ft/N·m)
0.75 ± 0.15 (4.3 ± 1.1/5.9 ± 1.5)	



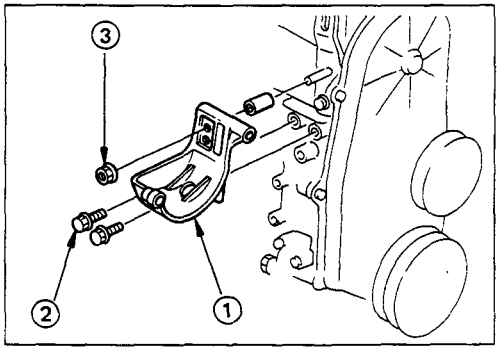
21. Compressor and Bracket [V]

1) Install the compressor bracket ① to the cylinder body.
2) Tighten the compressor bracket bolts to the specified torque.

Compressor Bracket Bolt Torque	kg·m(lb.ft/N·m)
4.1 ± 0.6 (29.7 ± 4.3/40.2 ± 5.9)	

3) Install the compressor ② to the compressor bracket.
4) Hand-tighten the compressor bolts.
5) Tighten the compressor bolts at the front side of the compressor to the specified torque.
6) Tighten the compressor bolts at the rear side of the compressor to the specified torque.

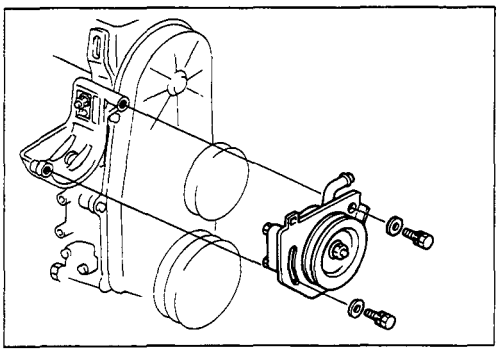
Compressor Bolt Torque	kg·m(lb.ft/N·m)
4.1 ± 0.6 (29.7 ± 4.3/40.2 ± 5.9)	



22. Power Steering Oil Pump and Bracket [V]

1) Install the power steering oil pump bracket ① to the cylinder body.
2) Tighten the oil pump bracket nuts ② and bolts ③ to the specified torque.

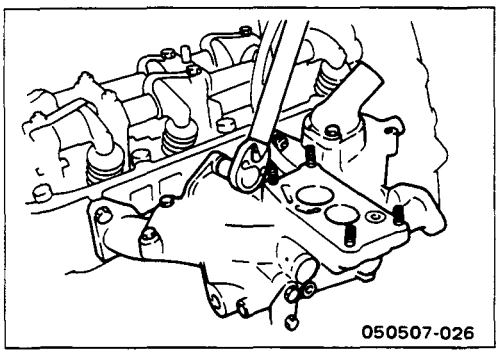
Power Steering Oil Pump Bracket Torque	kg·m(lb.ft/N·m)
Nut	2.7 ± 0.5 (19.5 ± 3.6/26.5 ± 4.9)
Bolt	4.1 ± 0.6 (29.7 ± 4.3/40.2 ± 5.9)



3) Install the power steering oil pump to the oil pump bracket.
4) Temporarily tighten the oil pump bolts.

   The oil pump bolts will be tightened to the specified torque after the drive belt tension is adjusted.

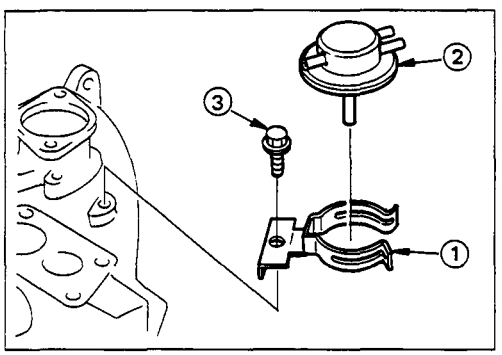
Power Steering Oil Pump Bolt Torque	kg·m(lb.ft/N·m)
3.8 ± 1.0 (27.5 ± 7.2/37.2 ± 9.8)	



24. Intake Manifold

Install the intake manifold and tighten the bolts to the specified torque.

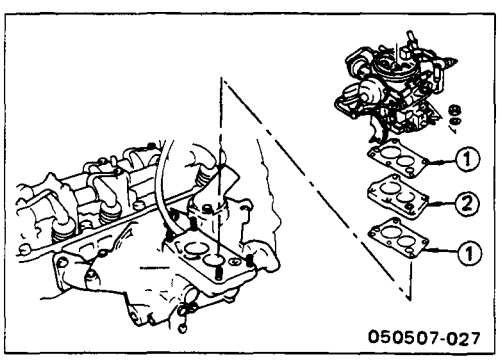
Intake Manifold Bolt Torque	kg·m(lb.ft/N·m)
2.2 ± 0.3 (15.9 ± 2.2/21.6 ± 2.9)	



25. B.P. Transducer and Bracket [V]

1) Install the back prèssure transducer bracket ① and the back pressure transducer ② to the intake manifold.
2) Tighten the bracket bolts ③ to the specified torque.

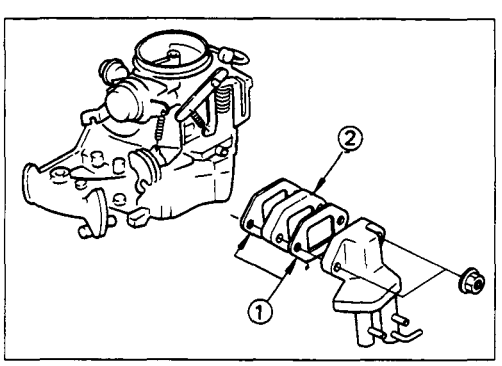
B.P. Transducer Bracket Bolt Torque	kg·m(lb.ft/N·m)
1.3 ± 0.5 (9.4 ± 3.6/12.7 ± 4.9)	



26. Carburetor

1) Install the gaskets ① and the heat insulator ② (if so equipped) to the intake manifold.
2) Install the carburetor to the intake manifold.
3) Use the carburetor wrench to tighten the carburetor nuts to the specified torque.
   Carburetor Wrench: 5-8511-9003-0 (J-26510)

Carburetor Nut Torque	kg·m(lb.ft/N·m)
1.3 ± 0.5 (9.4 ± 3.6/12.7 ± 4.9)	

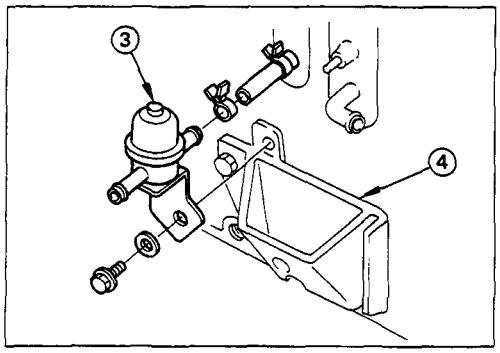


28. Fuel Pump

29. Fuel Damper

1) Install the fuel pump together with the gaskets ① and the heat insulator ② to the cylinder body.
2) Tighten the fuel pump nuts to the specified torque.

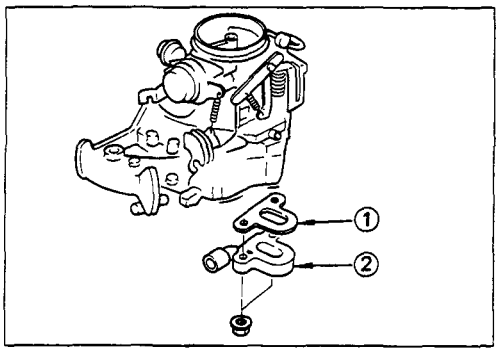
Fuel Pump Nut Torque	kg·m(lb.ft/N·m)
2.7 ± 0,5 (19.5 ± 3.6/26.5 ± 4.9)	



3) Install the fuel damper ③ to the cylinder body ④.
4) Tighten the damper bolts to the specified torque.

Fuel Damper Bolt Torque	kg·m(lb.ft/N·m)
1.9 ± 0.5 (13.7 ± 3.6/18.6 ± 4.9)	

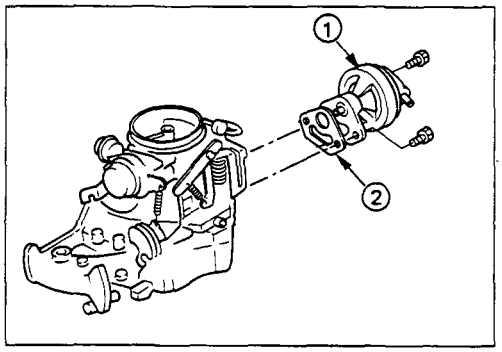
5) Connect the fuel hose between the fuel pump and the damper.



30. EGR Adapter [V]

1) Install the EGR adapter ① together with the gasket ② to the intake manifold.
2) Tighten the adapter nuts to the specified torque.

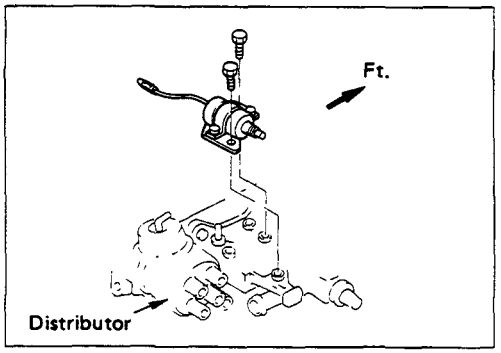
EGR Adapter Nut Torque	kg·m(lb.ft/N·m)
2.7 ± 0.5 (19.5 ± 3.6/26.5 ± 4.9)	



31. EGR Valve [V]

1) Install the EGR valve ① together with the gasket ② to the intake manifold.
2) Tighten the EGR valve bolts to the specified torque.

EGR Valve Bolt Torque	kg·m(lb.ft/N·m)
1.9 ± 0.5 (13.7 ± 3.6/18.6 ± 4.9)	



32. Fast Idle Solenoid (For with A/C) [V]

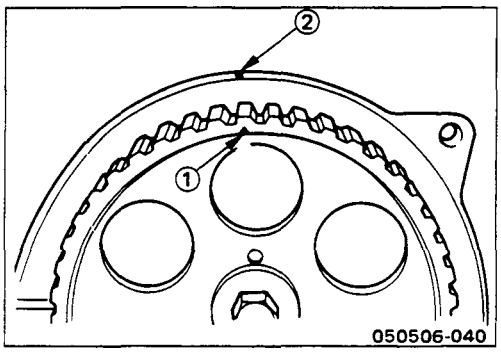
1) Install the fast idle solenoid to the cylinder head.
2) Tighten the solenoid bracket bolts to the specified torque.

Solenoid Bracket Bolt Torque	kg·m(lb.ft/N·m)
1.3 ± 0.5 (9.4 ± 3.6/12.7 ± 4.9)	

33. Ignition Coil [V]

1) Install the ignition coil to the intake manifold.
2) Tighten the ignition coil bolts to the specified torque.

Ignition Coil Bolt Torque	kg·m(lb.ft/N·m)
0.75 ± 0.25 (5.4 ± 1.8/7.4 ± 2.5)	

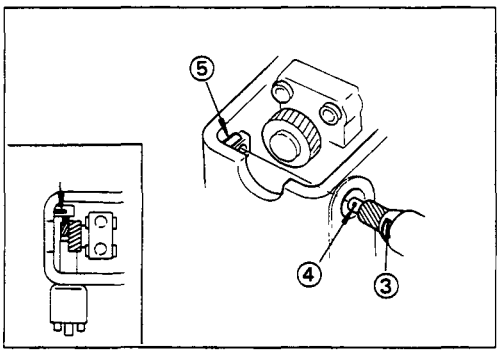


34. Distributor

1) Move the No. 4 cylinder to TDC on the compression stroke.

   Align the camshaft pulley setting mark ① with the front plate setting mark ②.

2) Apply engine oil to the O-rings.

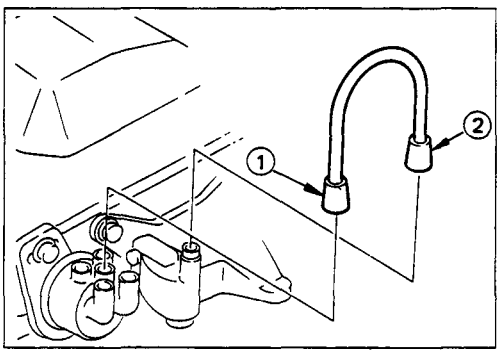


3) Align the distributor case setting mark ③ with the distributor shaft setting mark ④.
4) Install the distributor to the cylinder head.

   Align the distributor shaft setting mark with the cylinder head setting mark ⑤.

5) Tighten the distributor bolts to the specified torque.

Distributor Bolt Torque	kg·m(lb.ft/N·m)
1.9 ± 0.5 (13.7 ± 3.6/18.6 ± 4.9)	

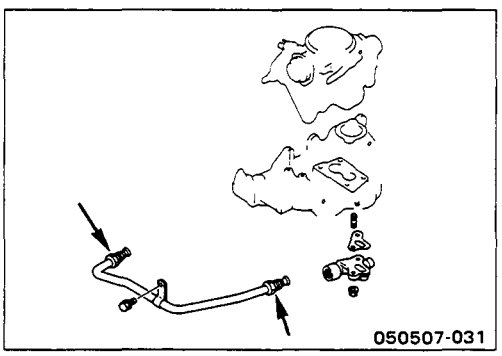


35. High Tension Cable (Ignition Coil to Distributor) [V]

1) Connect the high tension cable red end ① to the distributor.
2) Connect the high tension cable black end ② to the ignition coil.

Note:

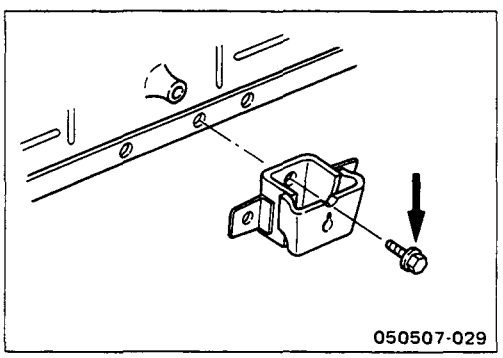
Take care not to reverse cable polarity.



36. EGR Pipe [V]

1) Connect the EGR pipe between the EGR adapter and the exhaust manifold.
2) Tighten the pipe nuts to the specified torque.

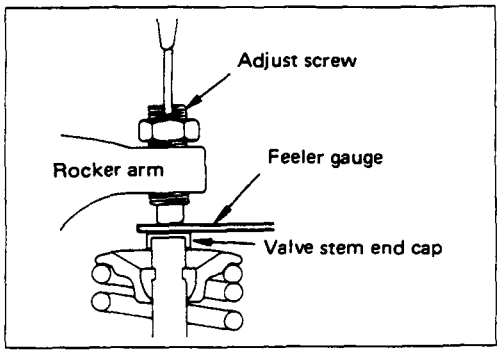
EGR Pipe Nut Torque	kg·m(lb.ft/N·m)
4.5 ± 0.5 (32.5 ± 3.6/44.1 ± 4.9)	



37. Engine Foot with Mounting Rubber

Tighten the engine right side foot bolts to the specified torque.

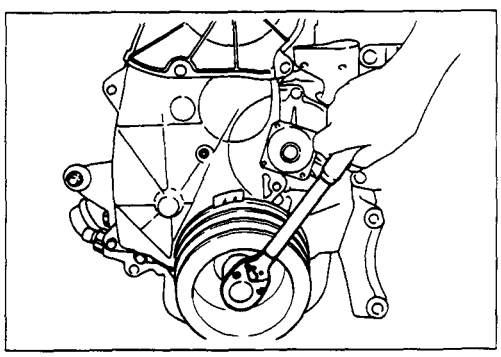
Engine Foot Bolt Torque	kg·m(lb.ft/N·m)
8.4 ± 0.8 (60.8 ± 5.8/82.4 ± 7.8)	



Note on Valve Clearance Adjustment

Valve clearances must be adjusted before the cylinder head cover is reinstalled.

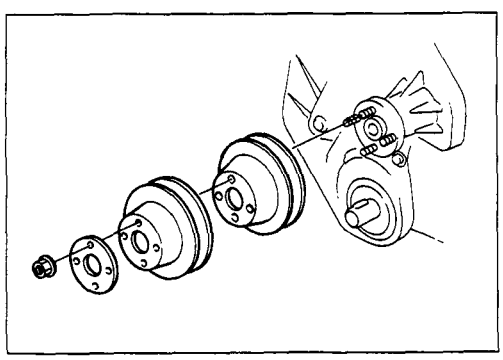
Refer to "VALVE CLEARANCE ADJUSTMENT" in the "SERVICING" Section of this Manual.



38. Crankshaft Pulley

Install the crankshaft pulley and tighten the pulley bolt to the specified torque.

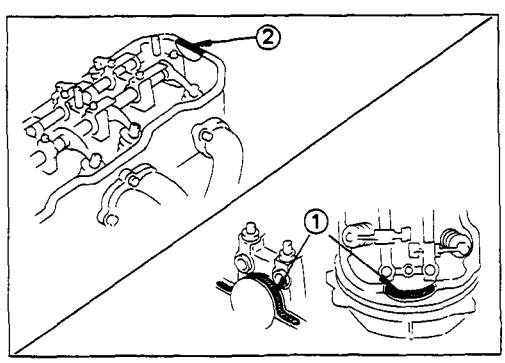
Crankshaft Pulley Bolt Torque	kg·m(lb.ft/N·m)
12.0 ± 1.5 (86.8 ± 10.8/117.6 ± 14.7)	



39. Cooling Fan Pulley

1) Install the cooling fan pulley to the water pump.
2) Tighten the pulley nut to the specified torque.

Cooling Fan Pulley Nut Torque	kg·m(lb.ft/
2.7 ± 0.5 (19.5 ± 3.6/26.5 ± 4.9)	

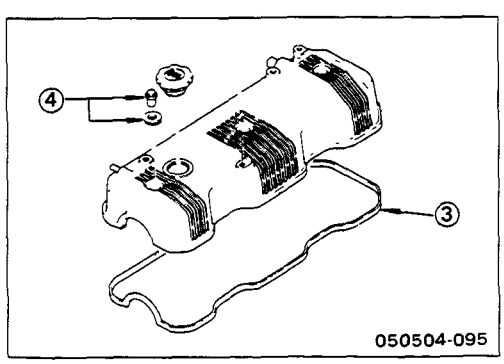


40. Cylinder Head Cover

1) Apply the recommended liquid gasket or its equivalent to the cylinder head No. 1 camshaft bracket arch ① and the rear side of the cylinder plug ②.

   Refer to the illustration.

2) Apply engine oil to the rocker arms and the valve springs.



3) Install the cylinder head cover gasket ③ to the cylinder head cover.

   Be absolutely sure that the gasket is correctly positioned.

   There must be no loose areas.

4) Tighten the cylinder head cap nuts ④ to the specified torque.

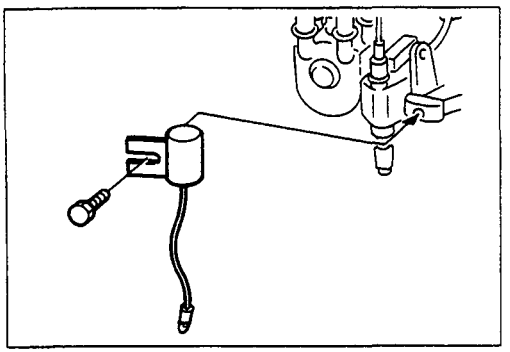
Cylinder Head Cap Nut Torque	kg·m(lb.ft/N·m)
1.0 ± 0.2 (7.2 ± 1.4/9.8 ± 1.98)	

42. Cooling Fan Drive Belt

43. Compressor Drive Belt

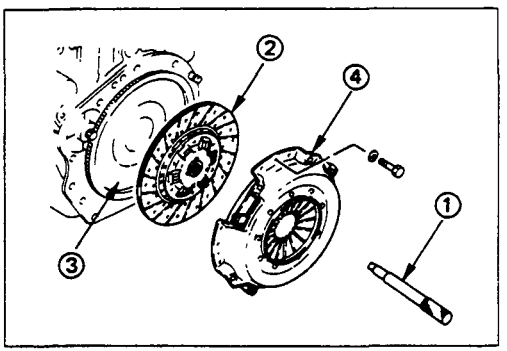
44. Air Pump Drive Belt [V]

1) Install each of the drive belts.
2) Adjust the tension of each of the drive belts.
   Refer to "SERVICING — DRIVE BELT ADJUSTMENT" in this Manual.



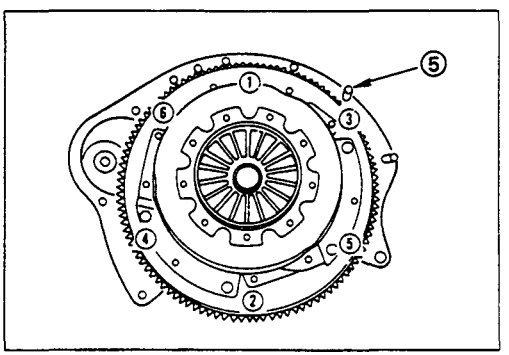
45. Condenser [V]

The condenser must be positioned horizontally.



46. Clutch Pressure Plate Assembly and Driven Plate Assembly

1) Clean the flywheel surface.
2) Clean the driven plate facing surface.
3) Use the clutch pilot aligner ① to install the driven plate assembly ② to the flywheel ③.
   Clutch Pilot Aligner: 5-8525-3001-0 (J-24547)



4) Clean the pressure plate surfaces.
5) Align the pressure plate assembly ④ with the flywheel knock pin ⑤.
6) Install the pressure plate assembly to the flywheel.
7) Tighten the clutch cover bolts to the specified torque a little at a time in the numerical order shown in the illustration.

Clutch Cover Bolt Torque	kg·m(lb.ft/N·m)
1.9 ± 0.5 (13.7 ± 3.6/18.6 ± 4.9)	

0600

LUBRICATING SYSTEM

06010102

MAIN DATA AND SPECIFICATIONS

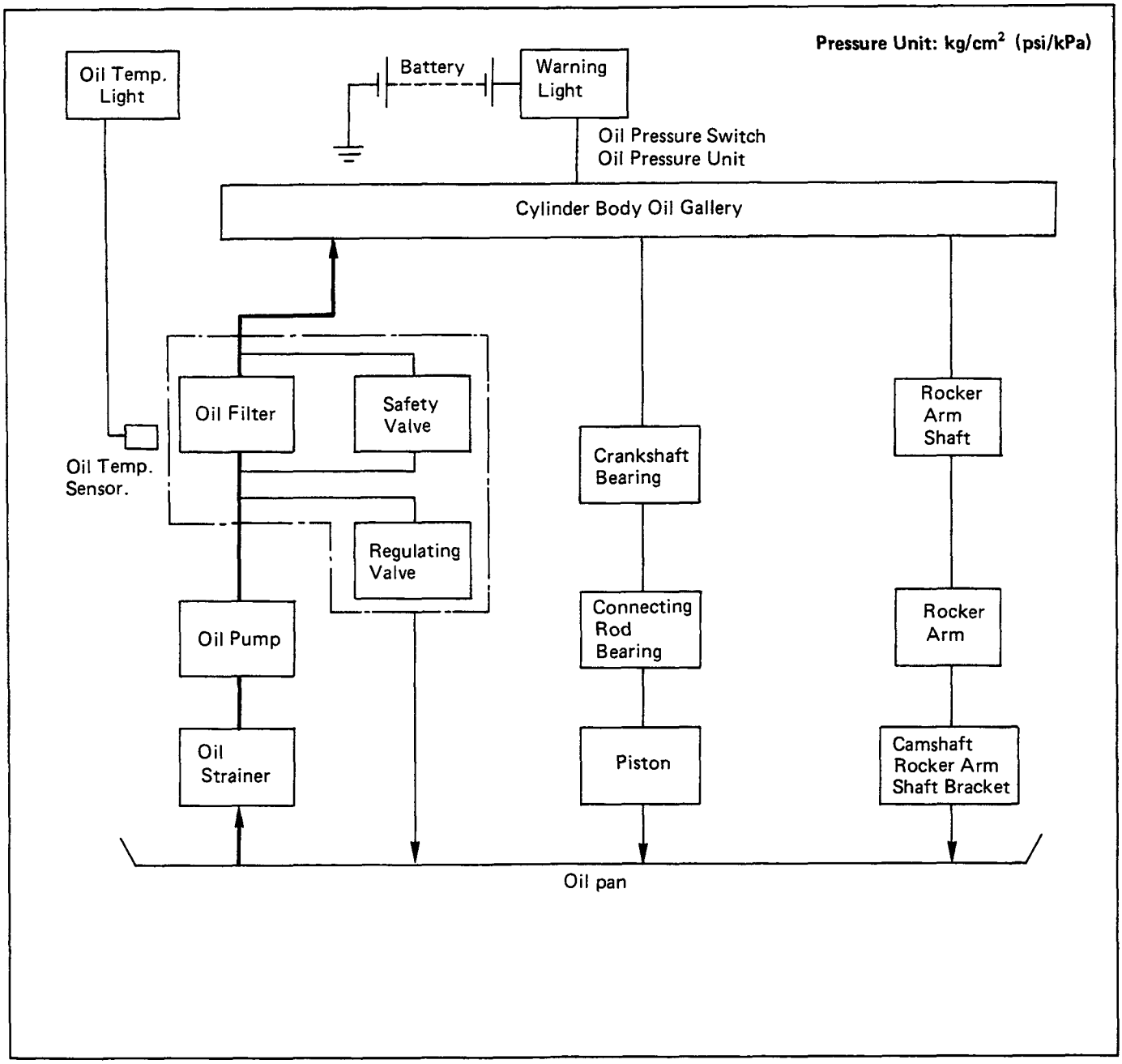
Item	Description
Oil pump type	Trochoid
Oil pressure switch operating pressure kg/cm²(psi/kPa)	0.2 — 0.5 (2.8 — 7.1/19.6 — 49.0)
Oil filter type	Full flow with cartridge paper element
Regulating valve opening pressure kg/cm²(psi/kPa)	4 — 5 (56.9 — 71.1/392.4 — 490.5)
Safety valve opening pressure kg/cm²(psi/kPa)	0.8 — 1.2 (11.4 — 17.1/78.4 — 117.6)

0602

GENERAL DESCRIPTION

06020102

LUBRICATING OIL FLOW



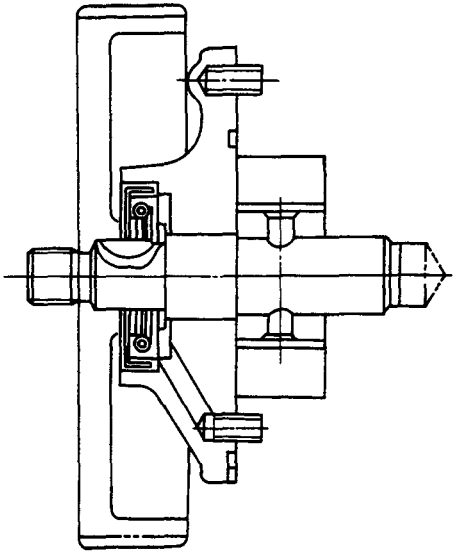
The 4Z Series engine lubricating system is a full flow pressurized circulation type.

Lubricating oil is pumped from the oil pump to the cylinder body oil gallery through the oil filter. It is then delivered to the vital parts of the engine from the cylinder body oil gallery.

Only Saudi Arabia;

The OIL TEMP. indicator light on the instrument panel illuminates when the engine oil temperature becomes high (approx. 135°C).

06020202
OIL PUMP AND OIL FILTER



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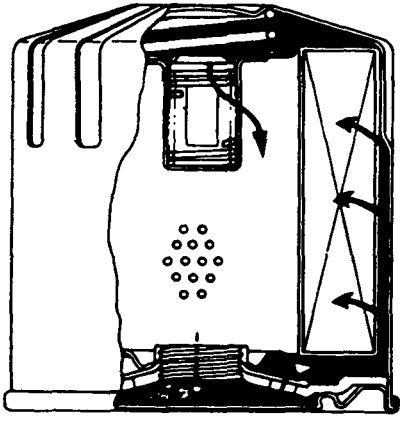


The trochoid oil pump is built in to the front of the cylinder body. It is driven by the timing pulley and the timing belt.

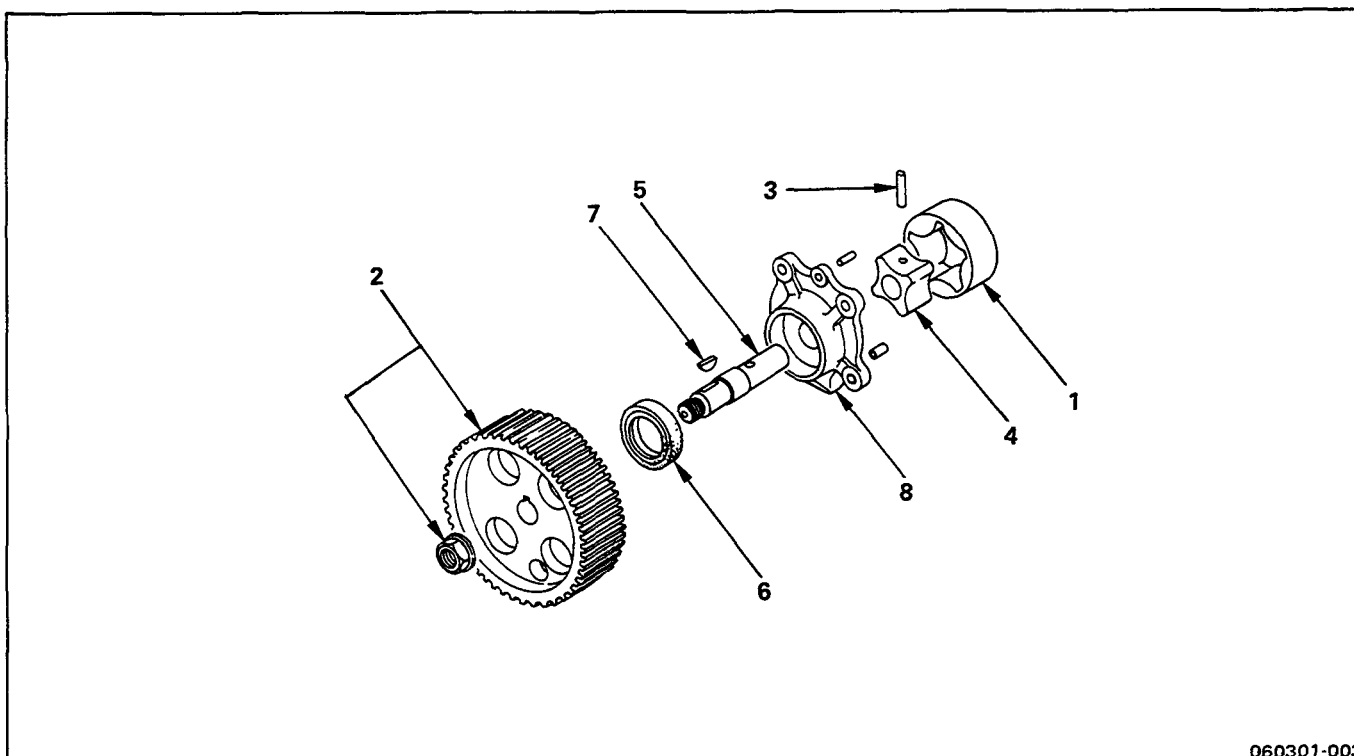
The oil filter with easily replaceable cartridge paper element is at the lower right front side of the engine.

06030002

OIL PUMP

06030102A

DISASSEMBLY



06030102B

Disassembly Steps

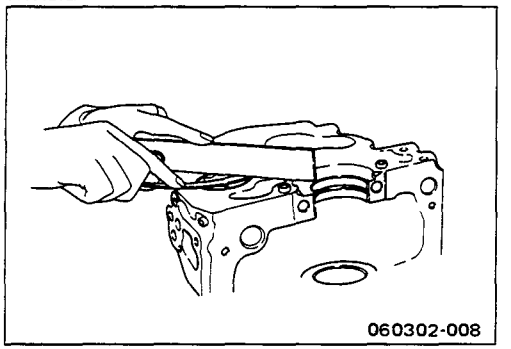
1. Oil pump outer rotor
2. Oil pump drive pulley
3. Inner rotor pin
4. Oil pump inner rotor
5. Oil pump shaft
6. Oil seal
7. Oil pump shaft key
8. Oil pump body

060302

INSPECTION AND REPAIR

Make the necessary adjustments, repairs, and part replacements if excessive wear or damage is discovered during inspection.

06030202A



Outer Rotor and Cylinder Body Clearance

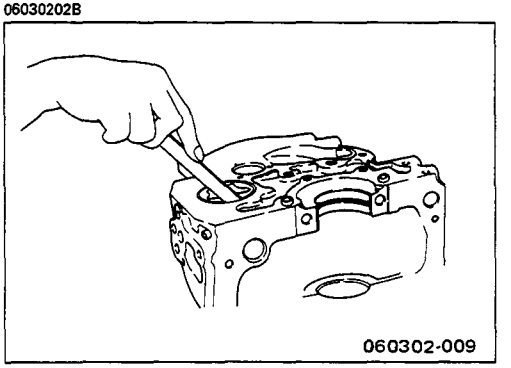
1. Install the outer rotor to the cylinder body.
2. Use a feeler gauge and straight edge to measure the clearance between the outer rotor surface and the cylinder body.

   If the clearance between the outer rotor surface and the cylinder body exceeds the specified limit, the oil pump gear set (outer rotor, rotor pin, inner rotor, and oil pump shaft) must be replaced.

Outer Rotor Surface and Cylinder Body Clearance — mm(in)

Standard	Limit
0.04 — 0.09 (0.0016 — 0.0035)	0.15 (0.0059)

06030202B



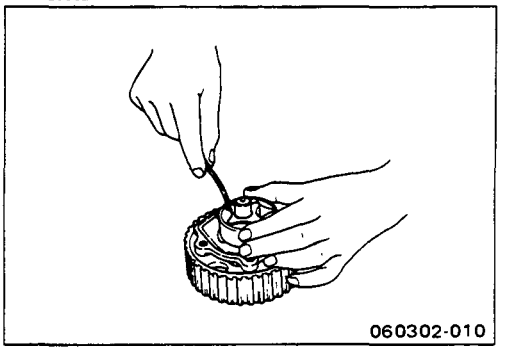
3. Use a feeler gauge to measure the clearance between the outer rotor sliding face and the cylinder body.

   If the clearance between the outer rotor sliding face and the cylinder body exceeds the specified limit, the oil pump gear set (outer rotor, rotor pin, inner rotor, and oil pump shaft) and/or the cylinder body must be replaced.

Outer Rotor Sliding Face and Cylinder Body Clearance — mm(in)

Standard	Limit
0.24 — 0.36 (0.009 — 0.014)	0.40 (0.016)

0603020302



Outer and Inner Rotor Clearance

Use a feeler gauge to measure the clearance between the outer and inner rotor.

If the clearance between the outer and inner rotor exceeds the specified limit, the oil pump gear set (outer rotor, rotor pin, inner rotor, and oil pump shaft) must be replaced.

Outer and Inner Rotor Clearance mm(in)

Standard	Limit
0.13 – 0.15 (0.005 – 0.006)	0.20 (0.008)

New Inner Rotor Installation

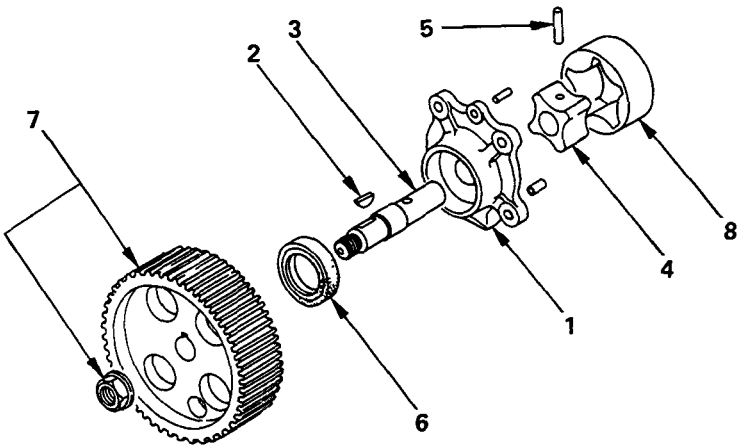
1. Install the new inner rotor to the oil pump shaft.
2. Insert the rotor pin into the pin hole.
3. Caulk both sides of the rotor pin.

Note:

Do not allow the rotor pin caulking to project from the rotor.

060303A

REASSEMBLY



060303-005

0603030002

Reassembly Steps

1. Oil pump body
2. Oil pump shaft key
3. Oil pump shaft
4. Oil pump inner rotor
5. Inner rotor pin
▲ 6. Oil seal
▲ 7. Oil pump drive pulley
8. Oil pump outer rotor

06030301

Important Operations

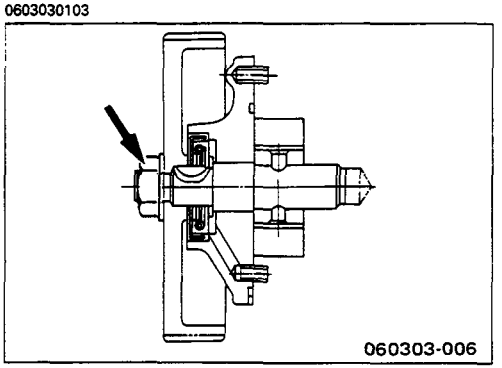
0603030102

6. Oil Seal

1) Apply engine oil to the oil seal lip circumference and the oil seal outer circumference and install it using installer.

   Installer: J-26587

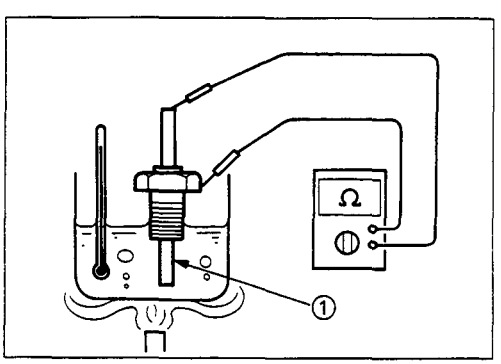
0603030103



7. Oil Pump Drive Pulley

Tighten the oil pump drive pulley bolt to the specified torque.

Drive Pulley Nut Torque	kg·m(lb.ft/N·m)
7.7 ± 1.0 (55.7 ± 7.2/75.5 ± 9.8)	



Oil Temperature Sensor (Only Saudi Arabia)

1. Submerge the oil temperature sensor sensing portion ① in water.
2. Connect a circuit tester to the oil temperature sensor.
3. Use a burner to heat the water.
4. Check the oil temperature sensor resistance at the specified temperature.

Oil Temperature Sensor Resistance	kΩ
at 25°C (77°F)	Approximately 10
at 100°C (212°F)	Approximately 1

SECTION 6B
ENGINE COOLING

TABLE OF CONTENTS

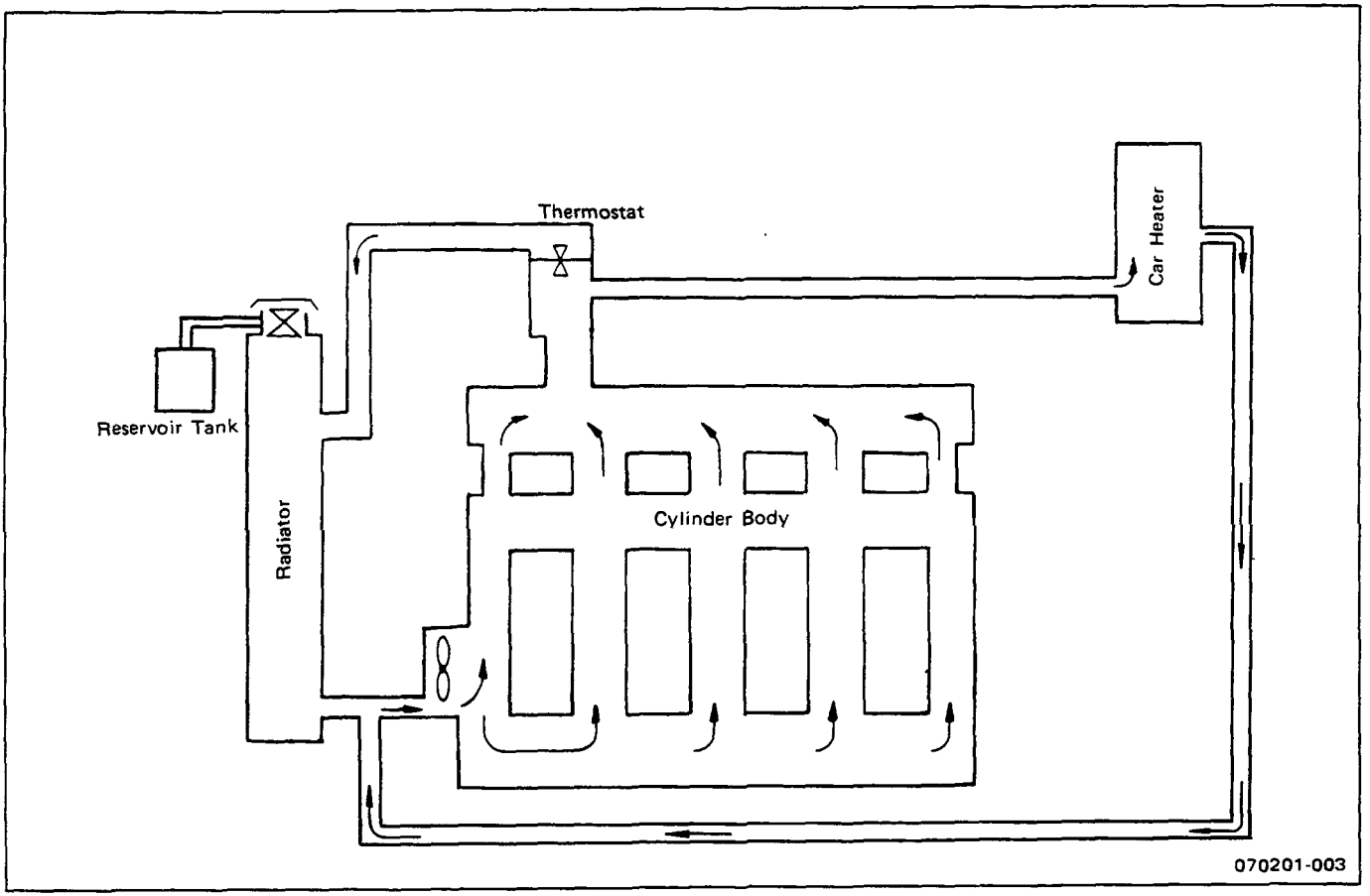
MAIN DATA AND SPECIFICATIONS

Item		Description	
		4ZC1	4ZE1
Water pump type		Centrifugal impeller	
Pump to crankshaft speed ratio (to 1)		1.22	1.23
Delivery volume	lit(US/UK gal)/min	155 (41.0/34.8)	190 (50.2/41.8)
Pump speed at 6000 rpm			
Pump bearing type		Double row shaft	
Thermostat type		Wax pellet with jiggle valve	
Valve initial opening temperature	°C(°F)	82 (180)	
Valve full opening temperature	°C(°F)	95 (203)	
Valve lift at fully open position	mm(in)	8 (0.31)	

0702

GENERAL DESCRIPTION

07020102
COOLANT FLOW



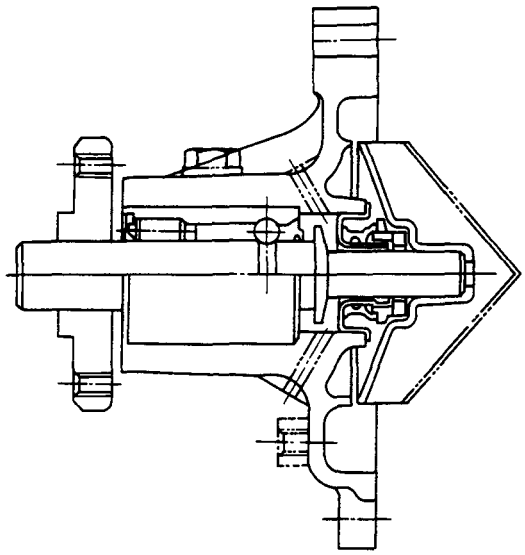
The engine cooling system consists of the radiator, the water pump, the cooling fan, and the thermostat.

To quickly increase cold engine coolant temperature for smooth engine operation, the coolant is circulated by the water pump and thermostat through the bypass hose and back to the cylinder body. The coolant does not circulate through the radiator.

When the coolant temperature reaches the specified level 82°C (180°F), the thermostat will begin to open and a gradually increasing amount of coolant will circulate through the radiator.

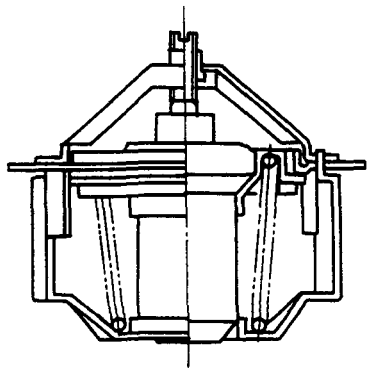
The thermostat will be fully open when the coolant temperature reaches the specified upper level 95°C (203°F). All of the coolant is now circulating through the radiator for effective engine cooling.

070202A
WATER PUMP



070202-004

070202B
THERMOSTAT



070202-005

A centrifugal type water pump force fully circulates the coolant through the cooling system.

A wax pellet type thermostat is used.

The jiggle valve accelerates engine warm-up.

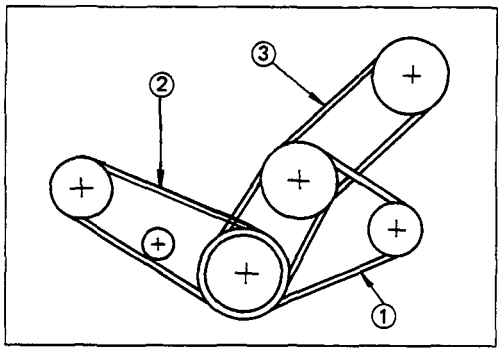
WATER PUMP

REMOVAL AND INSTALLATION

Read this Section carefully before performing any removal and installation procedure. This Section gives you important points as well as the order of operation. Be sure that you understand everything in this Section before you begin.

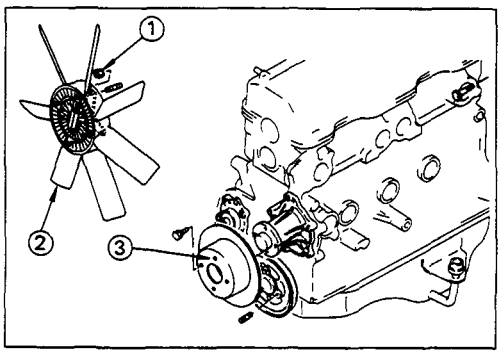
Important Operations — Removal

[V] : Optional on some models



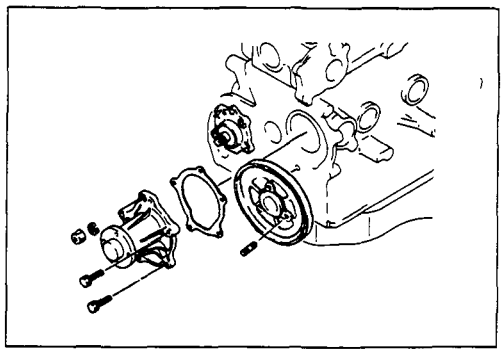
Drive Belt

Remove the cooling fan belt ①, the compressor belt ② [V] , and the air pump drive belt ③ [V] .



Cooling Fan and Cooling Fan Pulley

1. Loosen the cooling fan, and the fan pulley nuts ①.
2. Remove the cooling fan ② together with the fan pulley ③.

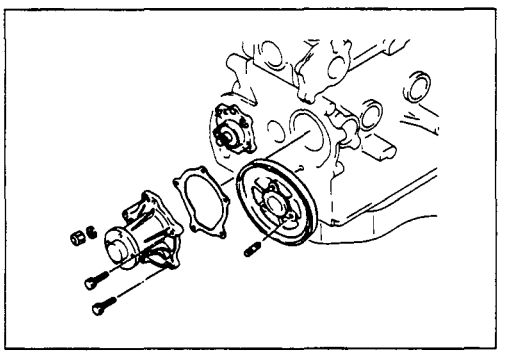


Water Pump

1. Remove the water pump nuts and bolts.
2. Remove the water pump.

Important Operations — Installation

Follow the removal procedure in the reverse order to perform the installation procedure. Pay careful attention to the important points during the installation procedure.

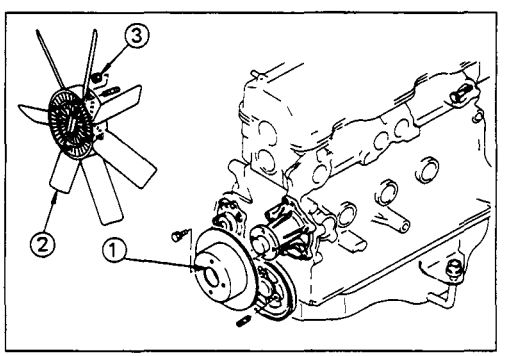


Water pump

1. Install the water pump to the cylinder body.
2. Tighten the water pump nuts and bolts to the specified torque.

Water Pump Bolt Torque	kg·m(lb.ft/N·m)
2.7 ± 0.5 (19.5 ± 3.6/26.5 ± 4.9)	

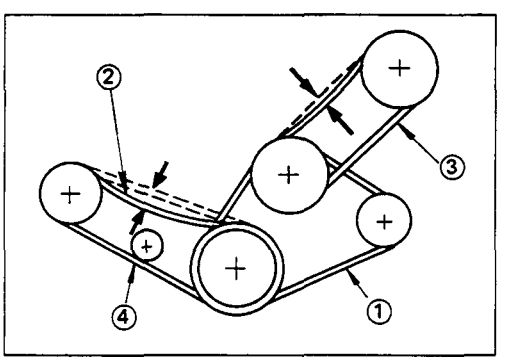
Water Pump Nut Torque	kg·m(lb.ft/N·m)
1.5 ± 0.5 (13.7 ± 3.6/18.6 ± 4.9)	



Cooling Fan Pulley and Cooling Fan

1. Install the fan pulley ① together with the cooling fan ②.
2. Tighten the fun pulley nuts ③ to the specified torque.

Fan Pulley Nut Torque	kg·m(lb.ft/N·m)
2.7 ± 0.5 (19.5 ± 3.6/26.5 ± 0.5)	



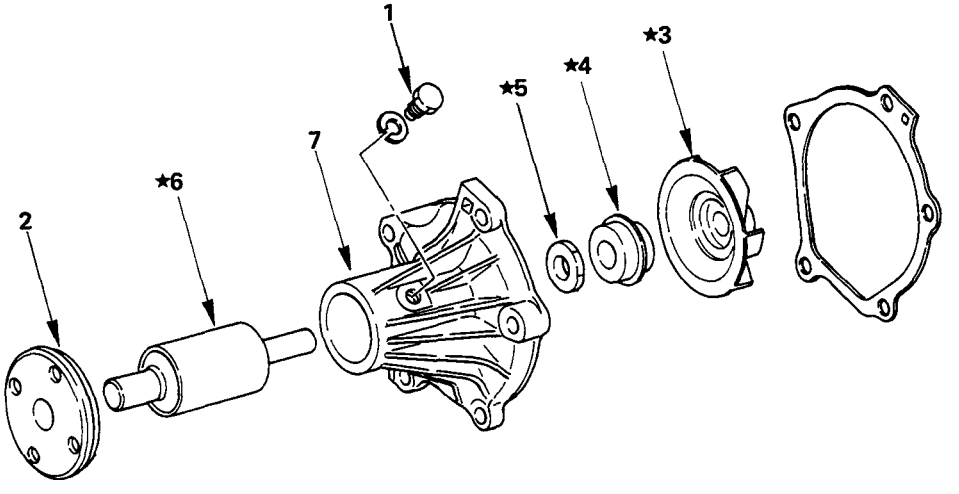
Drive Belt

1. Install the cooling fan belt ①, the compressor belt ② V , and the air pump belt ③ V .
2. Apply tension to each drive belt by moving the alternator, the compressor idler pulley ④, and the air pump.
3. Apply a force of 10 kg (22 lb/98 N) to the drive belt mid-portion to check the drive belt deflection.

Cooling Fan Drive Belt Deflection	mm(in)
10 (0.39)	

07030002A

DISASSEMBLY



★ Repair kit

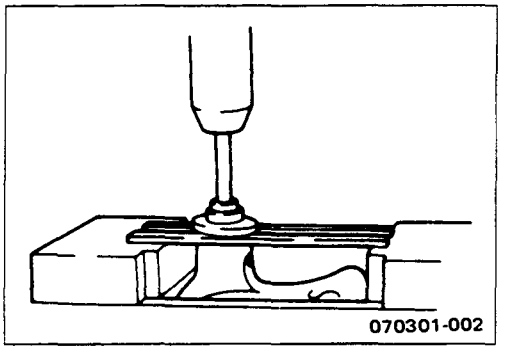
070301-006

07030002B

Disassembly Steps

1. Set screw
▲ 2. Cooling fan center
▲ 3. Impeller
▲ 4. Seal unit
5. Thrower
▲ 6. Bearing unit
7. Water pump body

07030101, 0703010101

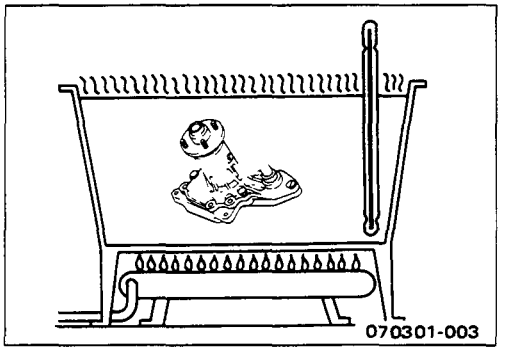


Important Operations

2. Cooling Fan Center

Remove the fan center with a bench press and a bar.

070301010202



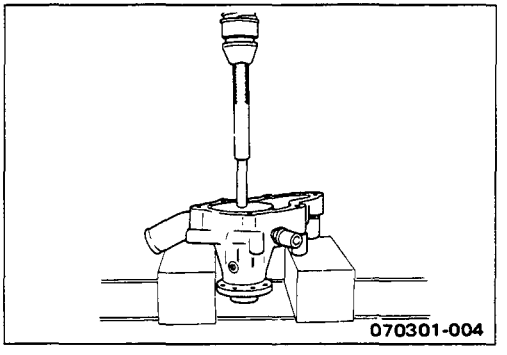
3. Impeller

4. Seal Unit

6. Bearing Unit

1) Heat the pump body in hot water (80 — 90°C/176 — 194°F).

0703010102B



2) Remove the impeller, the seal unit, and the bearing unit with a bench press and a bar.

Note:

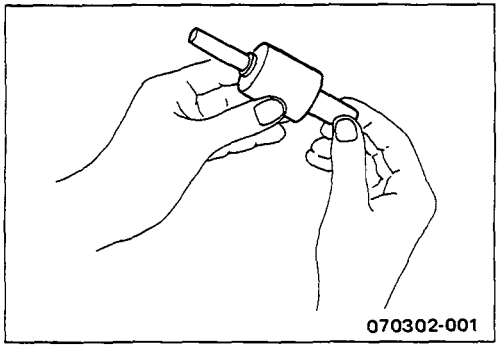
Do not drive out the impeller with a hammer. Damage to the impeller will result.

070302

INSPECTION AND REPAIR

Make the necessary adjustments, repairs, and part replacements if excessive wear or damage is discovered during inspection.

07030201

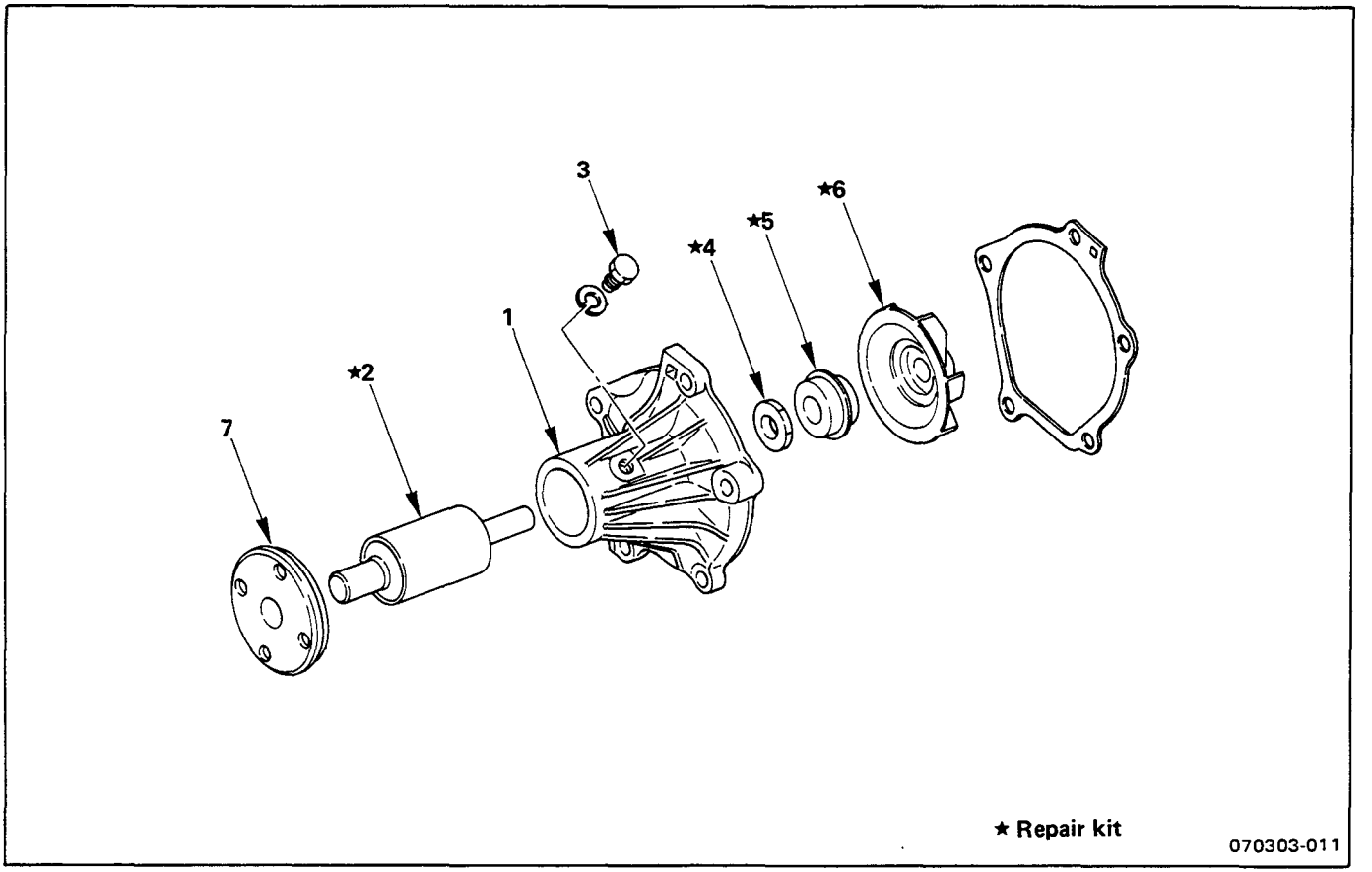


Bearing Unit

Check the bearing for abnormal noise, binding, and other abnormal conditions.

070303A

REASSEMBLY



0703030001B

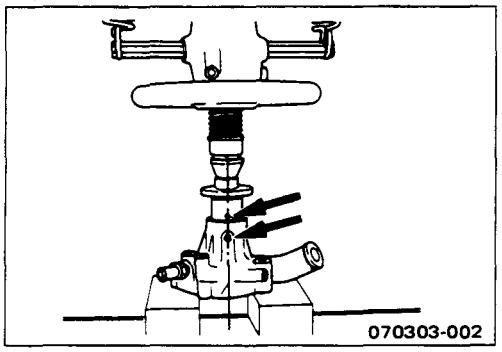
Reassembly Steps

1. Water pump body
▲ 2. Bearing unit
▲ 3. Set screw
4. Thrower
▲ 5. Seal unit
▲ 6. Impeller
▲ 7. Cooling fan center

07030301

Important Operations

0703030101

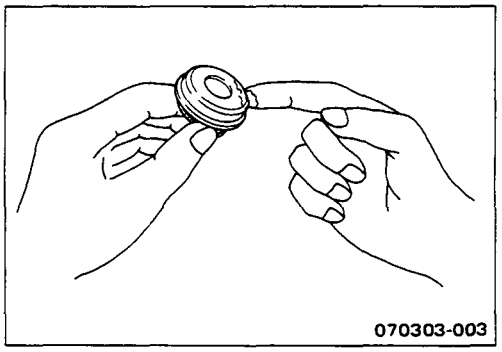


2. Bearing Unit

3. Set Screw

1) Align the bearing set screw hole with the pump body set screw hole.
2) Press the bearing unit into place.
3) Secure the bearing with the set screw.

0703030102A



5. Seal Unit

6. Impeller

1) Apply the recommended liquid gasket or its equivalent to the seal unit outer periphery.
2) Install the seal unit.

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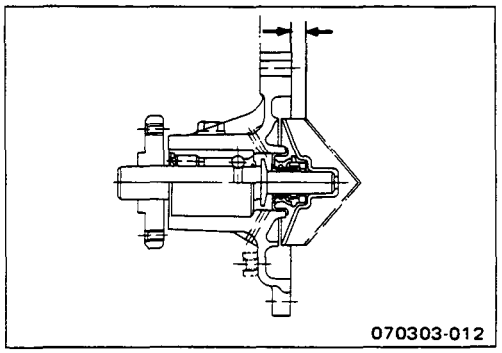

3) Use a bench press to slowly force the impeller into place until the impeller installed distance from the water pump body face is equal to the specified value.

Impeller Projection (Reference) mm(in)

	Standard
4ZC1	8.5 – 8.9 (0.33 – 3.66)
4ZE1	5.5 – 5.9 (0.21 – 0.23)

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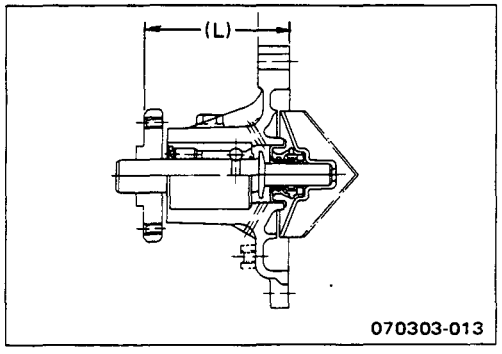


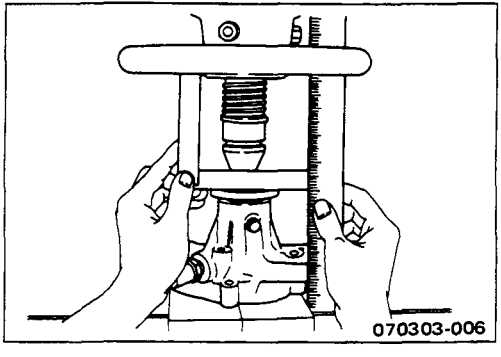
7. Cooling Fan Center

Measure the distance between the cooling fan fitting face and the rear cover fitting face.

Cooling Fan Center Distance (L) mm(in)

	Standard
4ZC1	92.3 – 92.9 (3.63 – 3.66)
4ZE1	99.2 – 99.8 (3.90 – 3.93)

0703030103B



Notes:

1. **The fan center and the impeller are installed to the water pump shaft with a press.**

   Never attempt to remove and reinstall the fan center and the impeller a second time. Replace the entire water pump assembly.

   Removing and reinstalling the fan center and the impeller a second time may result in the breakdown of the water pump during engine operation and subsequent serious overheating problems.

2. **The water pump assembly must be replaced whenever the fan center and impeller pressure force falls below 200 kg (441 lb/1,960 N).**

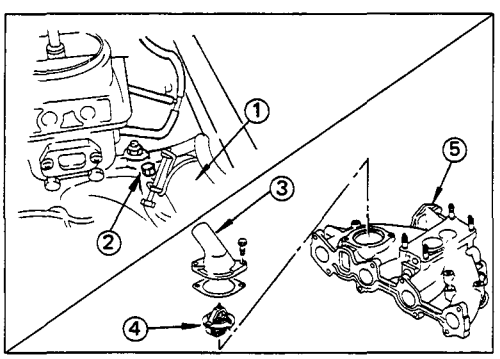
3. **Do not attempt to strike the bearing into position with a hammer or similar object. Damage to the bearing will result.**

THERMOSTAT

REMOVAL AND INSTALLATION

Read this Section carefully before performing any removal and installation procedure. This Section gives you important points as well as the order of operation. Be sure that you understand everything in this Section before you begin.

Important Operations — Removal

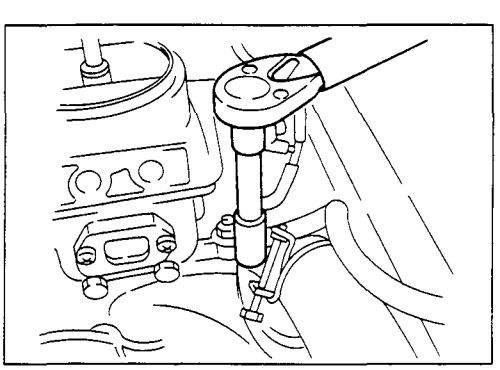


Thermostat

1. Partially drain the engine coolant.
2. Disconnect the radiator upper hose ① from the water outlet side ②.
3. Remove the outlet pipe ③, and the thermostat ④ from the intake manifold ⑤.

Important Operations — Installation

Follow the removal procedure in the reverse order to perform the installation procedure. Pay careful attention to the important points during the installation procedure.



Water Outlet Pipe

1. Install the outlet pipe with thermostat to the intake manifold.
2. Tighten the outlet pipe bolts to the specified torque.

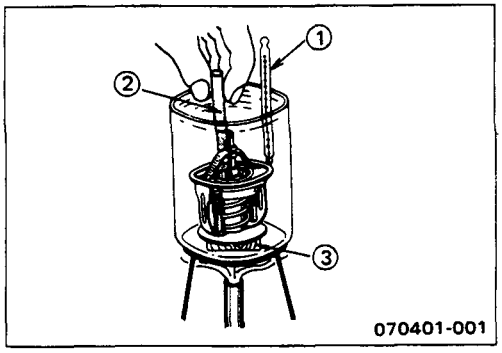
Outlet Pipe Bolt Torque	kg·m(lb.ft/N·m)
1.9 ± 0.5 (13.7 ± 3.6/18.6 ± 4.9)	

070401

INSPECTION AND REPAIR

Make the necessary adjustments, repairs, and part replacements if excessive wear or damage is discovered during inspection.

07040102



Operating Test

1. Completely submerge the thermostat in water.
2. Heat the water.

   Stir the water constantly to avoid direct heat being applied to the thermostat.
3. Check the thermostat initial opening temperature.

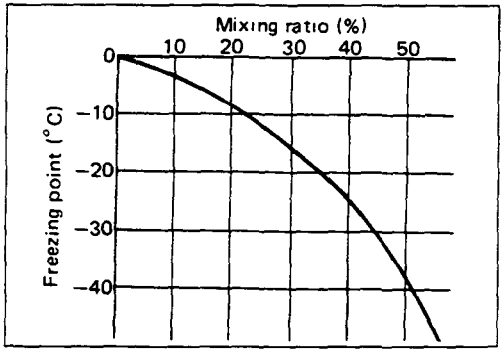
Thermostat Initial Opening Temperature	°C(°F)
82 (180)	

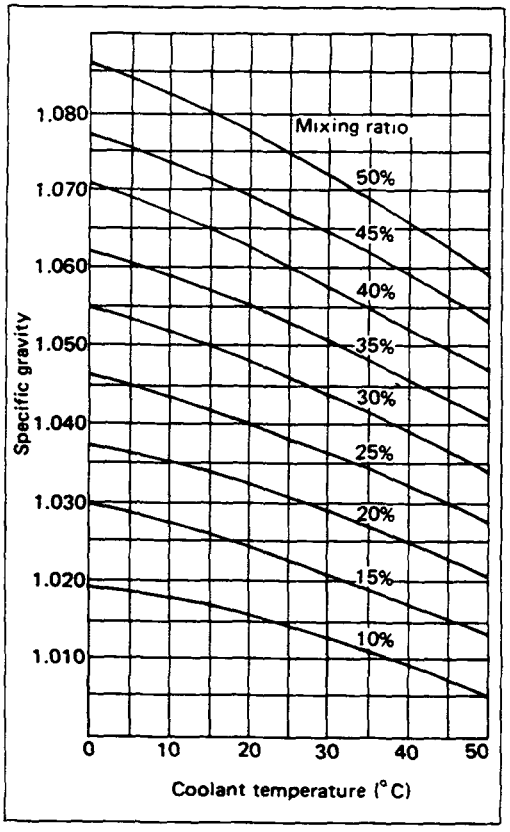
4. Check the thermostat full opening temperature.

Thermostat Full Opening Temperature	°C(°F)
95 (203)	

Valve Lift as Full Open Position	mm(in)
8 (0.31)	

① Thermometer
② Agitating rod
③ Wooden piece





ANTI-FREEZE SOLUTION

1. Relation between Mixing Ratio and Freezing Point

Freezing temperature of the engine coolant varies with the ratio of anti-freeze solution in water.

Proper mixing ratio can be determined by referring to the chart. Supplemental inhibitors or additives claiming to increase cooling capability that have not been specifically approved by Isuzu are not recommended for addition to the cooling system.

2. Calculation on Mixing Ratio

$$\text{Mixing Ratio} = \frac{\text{Anti-freeze solution (lit/gal.)}}{\text{Anti-freeze solution (lit/gal.)} + \text{Water (lit/gal.)}}$$

Note:

Anti-freeze solution + Water = 8.6 lit. (2.2 US gal./1.9 UK gal.) for 4ZC1 or 9.0 lit. (2.3 US gal./2.0 UK gal.) for 4ZD1/4ZE1.

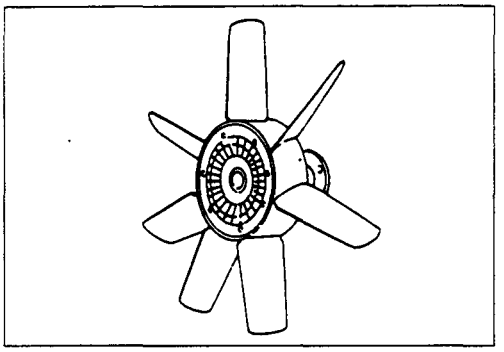
3. Mixing Ratio

Check the specific gravity of engine coolant in the cooling system at temperature ranges from 0°C (32°F) to 50°C (122°F) using a suction type hydrometer, then determine the density of the coolant by referring to the table at the left.

FAN CLUTCH WITH COOLING FAN

INSPECTION AND REPAIR

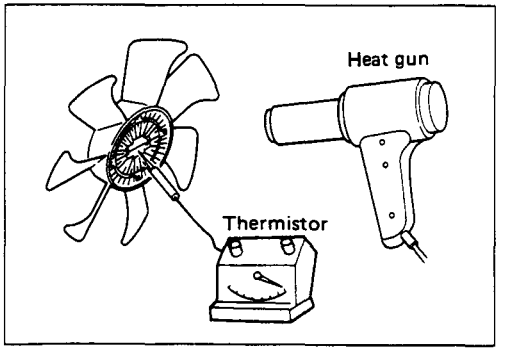
Make necessary correction or parts replacement if wear, damage or any other abnormal condition are found through inspection.



Visually inspect for damage, leak (silicon grease) or other abnormal conditions.

1. Inspection (on-vehicle)

1) Turn the fan clutch by hand when in a low temperature condition before starting the engine, and confirm that it can be turned readily.
2) Start the engine to warm it up until the temperature at the fan clutch portion gets to around 80°C. Then stop the engine and confirm that the fan clutch can be turned with considerable effort (clutch torque) when turned by hand.
   If the fan clutch rotates more readily, however, this indicates that the silicon grease is leaking internally. Replace the fan clutch with a new one.



2. Inspection (in unit)

Warm up the bimetal of the fan clutch by using the heat gun until the temperature gets to about 80°C when measured with the thermistor. Then confirm that the fan clutch can be turned with considerable effort (clutch torque).
If the fan clutch retates more readily at this time, this indicates that the silicon grease is leaking internally.
Replace the fan clutch with a new one.

SECTION 6C
FUEL SYSTEM

TABLE OF CONTENTS

MAIN DATA AND SPECIFICATIONS

Item		Description 4ZD1
Carburettor model		21E304-M82
Manufacturer		Nippon Kikai
Type		Stromberg 2-barrel 2-stage
Fuel pressure	kg/cm²(psi/kPa)	0.24 (3.4/23.5)
Jet orifice diameters		
Main jet	(P) mm(in)	1.16 (0,046)
	(S) mm(in)	1.70 (0,067)
Main air bleed	(P) mm(in)	0.60 (0.024)
	(S) mm (in)	0.60 (0.024)
Slow jet	(P) mm(in)	0.52 (0.020)
	(S) mm(in)	0.80 (0.031)
Slow air bleed	(P1) mm(in)	0.80 (0.031)
	(S) mm(in)	1.20 (0.047)
	(P2) mm(in)	1.65 (0.065)
Slow economizer	mm(in)	1.60 (0.063)
Power jet	mm(in)	0.55 (0.022)
Air jet	mm(in)	2.40 (0.094)
Fuel pump		Mechanical diaphragm
Fuel filter		Paper (Cartridge type)

NOTES:

(P) = Primary

(S) = Secondary

MAIN DATA AND SPECIFICATIONS

Item		Description 4ZE1
Carburettor model		DCR384-205, DCR384-206
Manufacturer		Hitachi
Type		Stromberg 2-barrel 2-stage
Fuel pressure	kg/cm²(psi/kPa)	0.25 (3.6/24.5)
Jet orifice diameters		
Main jet	(P)	#133
	(S)	#180
Main air bleed	(P)	#85
	(S)	#60
Slow jet	(P)	#50
	(S)	#100
Slow air bleed	(P1)	#160
Slow economizer		#1.80
Power jet		#50
Fuel pump		Mechanical diaphragm
Fuel filter		Paper (Cartridge type)

NOTES:

(P) = Primary

(S) = Secondary

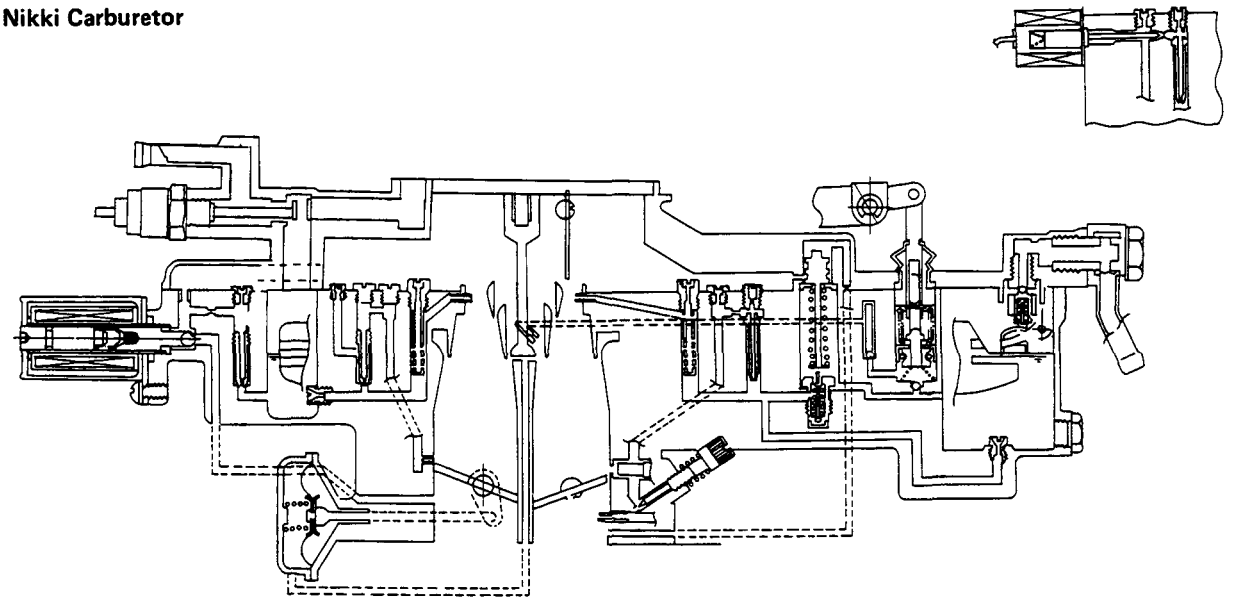
0802

GENERAL DESCRIPTION

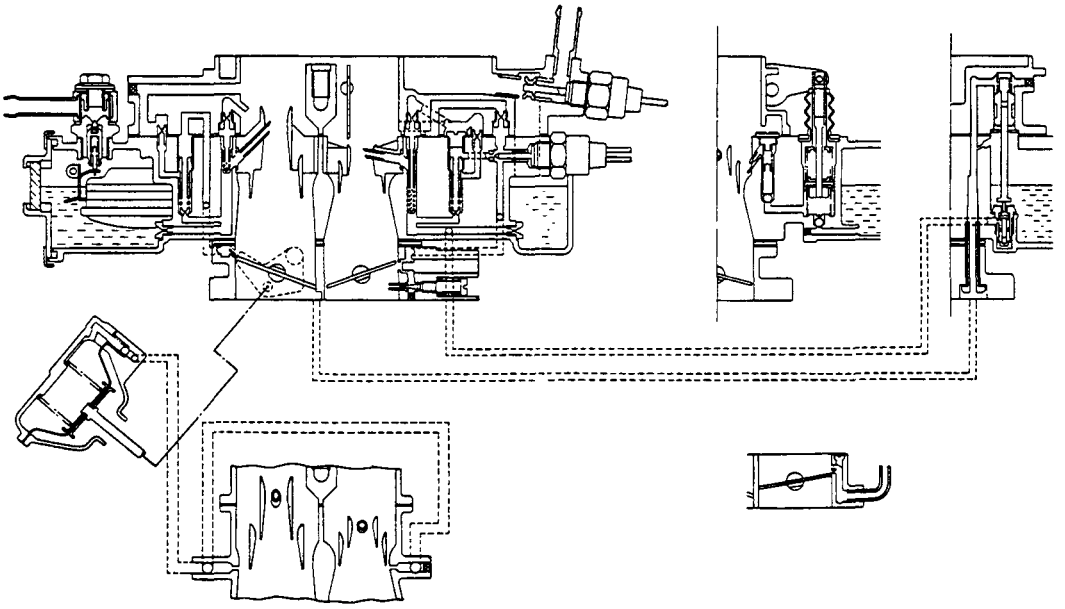
080206

CARBURETOR

Nikki Carburetor



Hitachi Carburetor

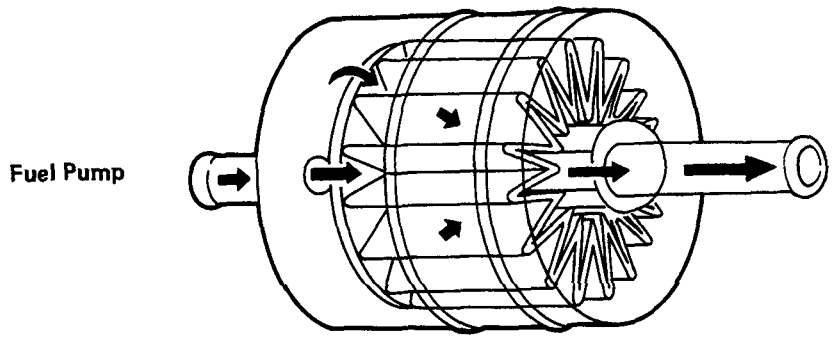


The 4Z Series engine uses a Stromberg 2-barrel, 2-stage carburetor. There are seven circuits.

1. Float chamber circuit
2. Slow speed circuit
3. Main circuit
4. Acceleration circuit
5. Step circuit
6. Power enrichment circuit
7. Choke circuit

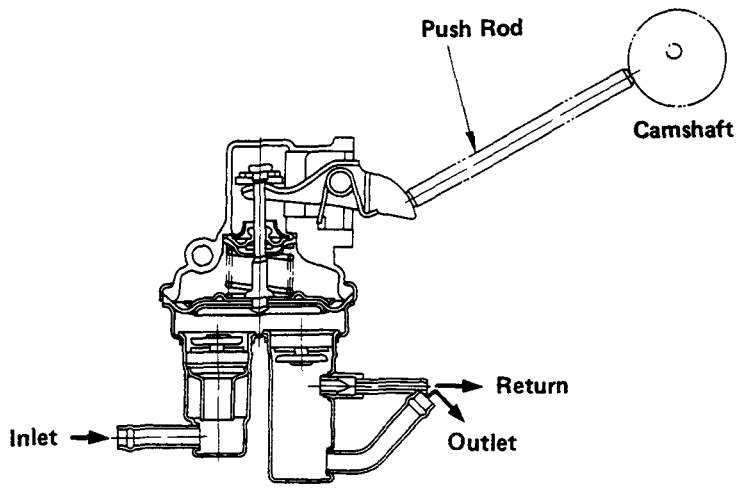
The circuits operate either independently or in tandem. The best air-fuel mixture is delivered to the cylinders over a wide range of operating conditions.

FUEL FILTER



The fuel filter uses a large scale disposable cartridge type element.

FUEL PUMP



The 4Z Series engine use a mechanical fuel pump.

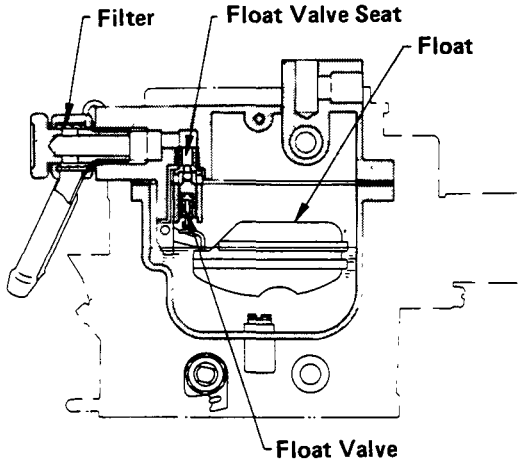
A push rod from the camshaft eccentric moves the pump lever to operate the pump.

080208

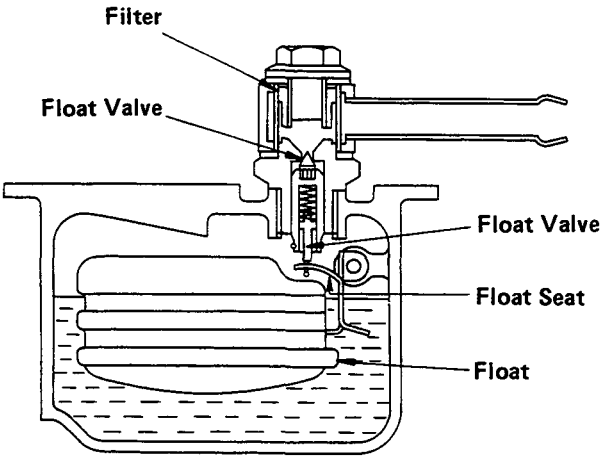
CARBURETOR CONSTRUCTION

08020801
FLOAT CHAMBER

NIKKI CARB.



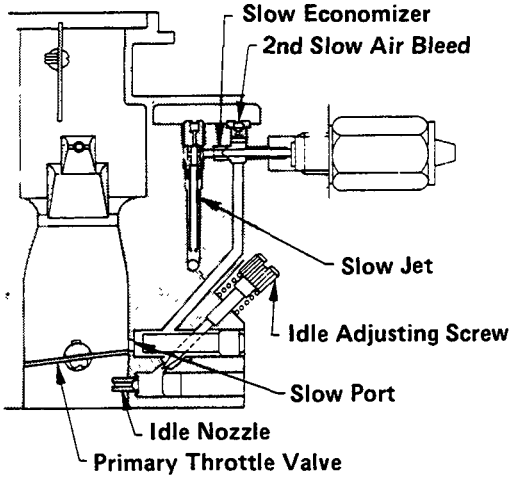
HITACHI CARB.



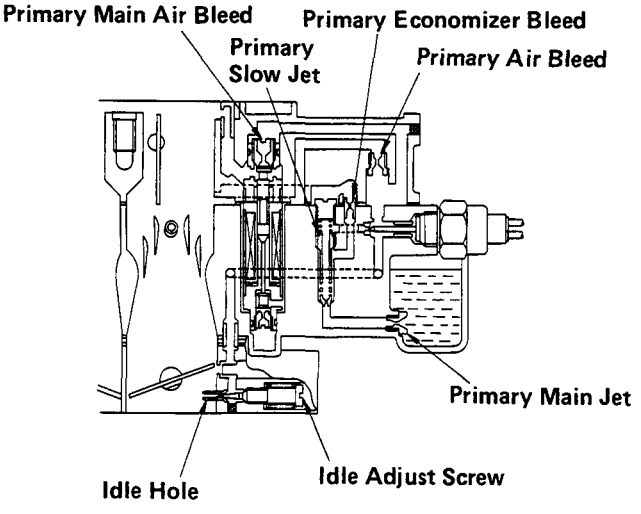
The float chamber maintains the fuel delivered by the fuel pump at a constant level.

08020802
SLOW SPEED CIRCUIT

NIKKI CARB.

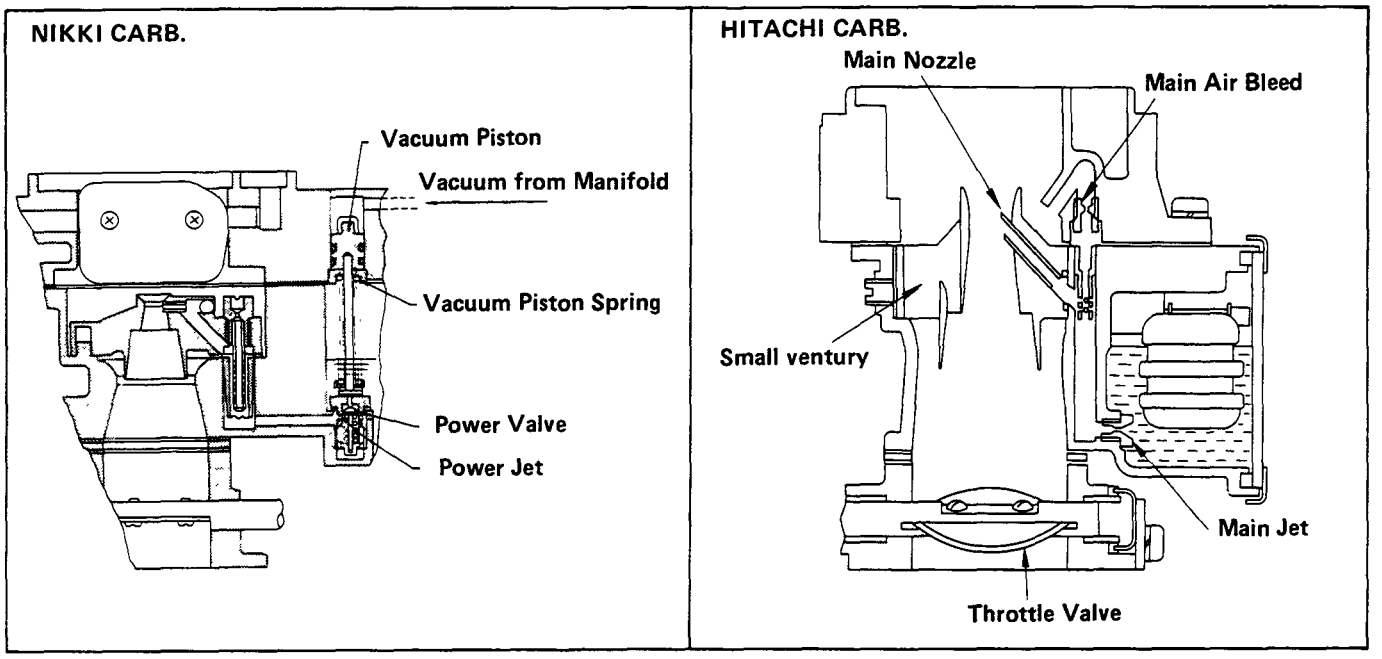


HITACHI CARB.



During idling and slow speed operation, the throttle valve is almost completely closed. A minimum amount of air is flowing through the venturi. Negative pressure is very low. The main nozzle tip is above the fuel level in the float chamber. The main nozzle is unable to draw fuel resulting in greater fuel economy at low operating speeds.

08020803
MAIN CIRCUIT



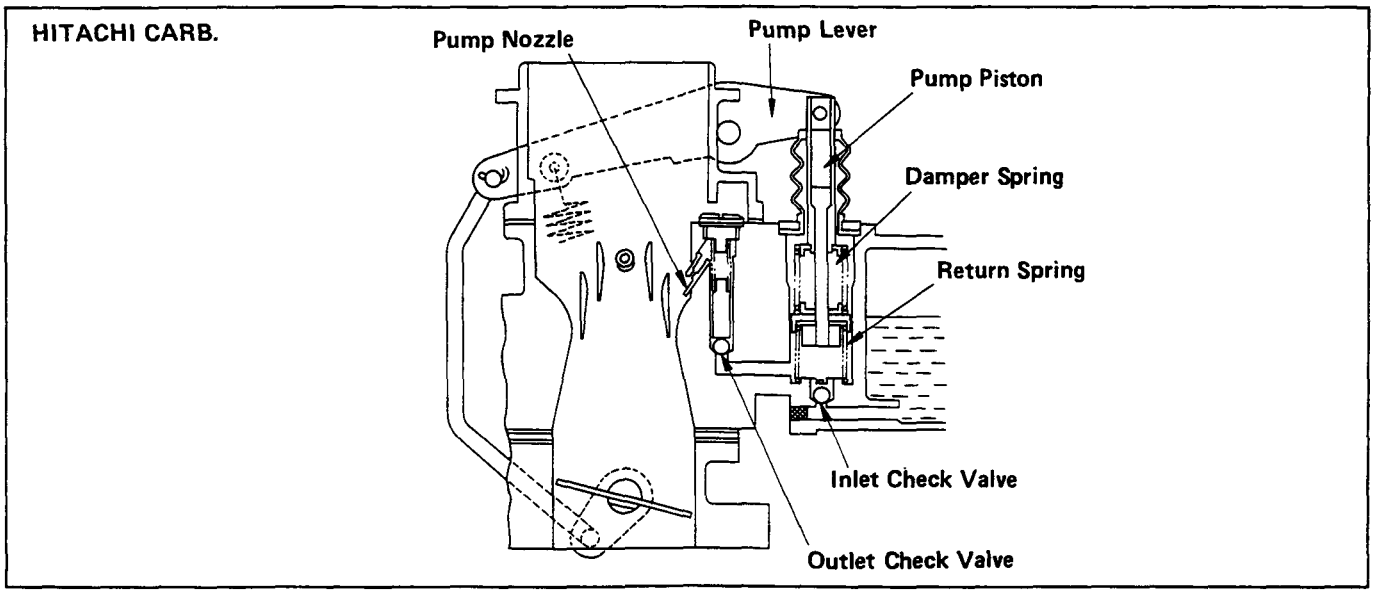
The main circuit is most often used during ordinary vehicle operation.

Opening the throttle valve beyond the specified angle increases the speed and volume of the air passing through the venturi. This results in a greater negative pressure.

The greater negative pressure draws fuel from the float chamber through the main air bleed into the emulsion tube. The emulsion tube mixes the fuel and air.

The air-fuel mixture then passes into the venturi through the main nozzle.

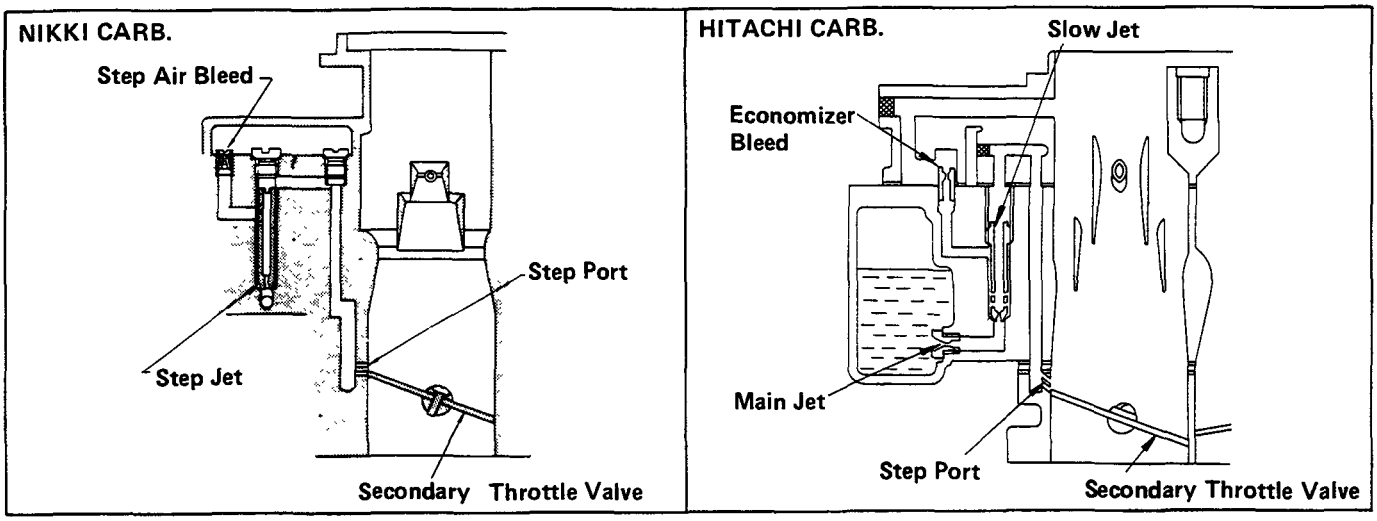
08020804
ACCELERATION CIRCUIT



During rapid acceleration, the throttle valve rapidly opens completely to draw in a large volume of air. Because there is insufficient fuel in the air horn, the resulting air-fuel mixture will be too lean. A flat spot will occur.

To prevent this flat spot, the accelerator pump forces fuel into the large venturi to produce a richer air-fuel mixture.

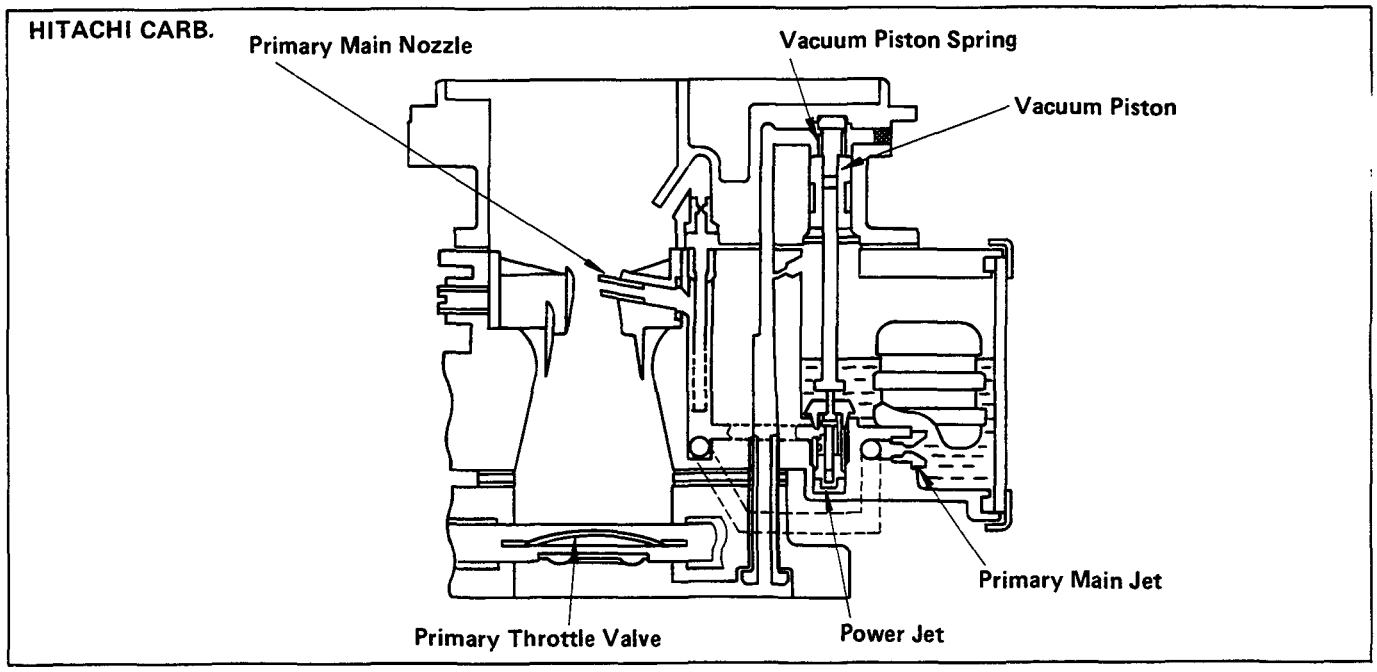
STEP CIRCUIT



When the carburetor secondary side begins operation, there is an insufficient amount of air passing through the secondary side venturi. The resulting vacuum will not be strong enough to draw the required fuel from the secondary main nozzle. A momentary power loss will occur.

The step circuit acts to supplement the fuel mixture and maintain smooth engine performance.

POWER ENRICHMENT CIRCUIT



The power enrichment circuit prevents flat spots during rapid acceleration from a low speed.

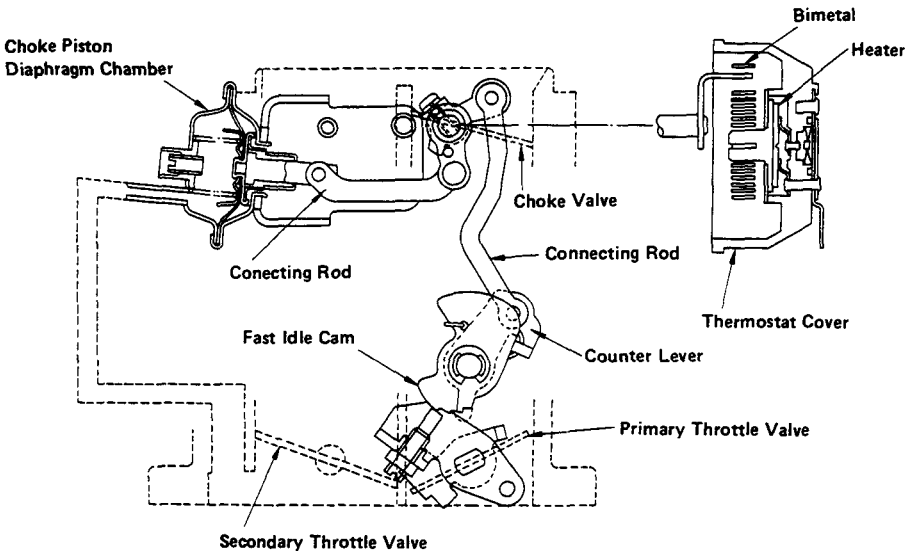
During light-load running, the throttle valve is only slightly open. This results in a high intake manifold vacuum.

The high manifold vacuum pulls the vacuum piston upward to overcome the force of the vacuum piston spring and hold the power valve closed.

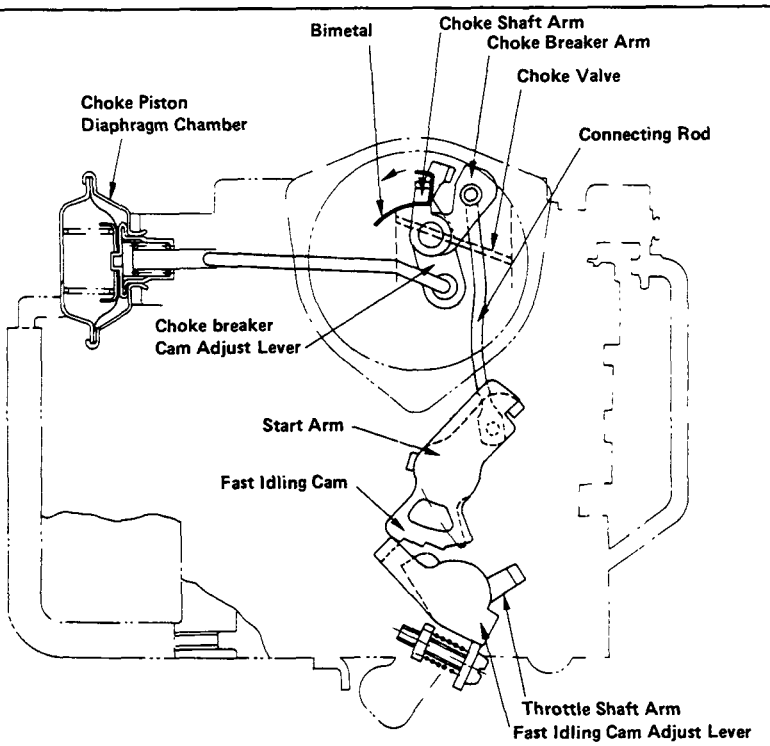
Suddenly opening the throttle valve during rapid acceleration causes the intake manifold vacuum to fall. The vacuum piston spring force is now greater than the force of the intake manifold vacuum. The vacuum piston is pushed down to open the power valve and allow additional fuel to reach the combustion chambers.

08020807
CHOKE CIRCUIT

HITACHI CARB.



NIKKI CARB.



The auto choke consists of the eccentric choke valve, the spiral bimetal, the choke diaphragm, and the control rods.

The bimetal closes the choke valve.

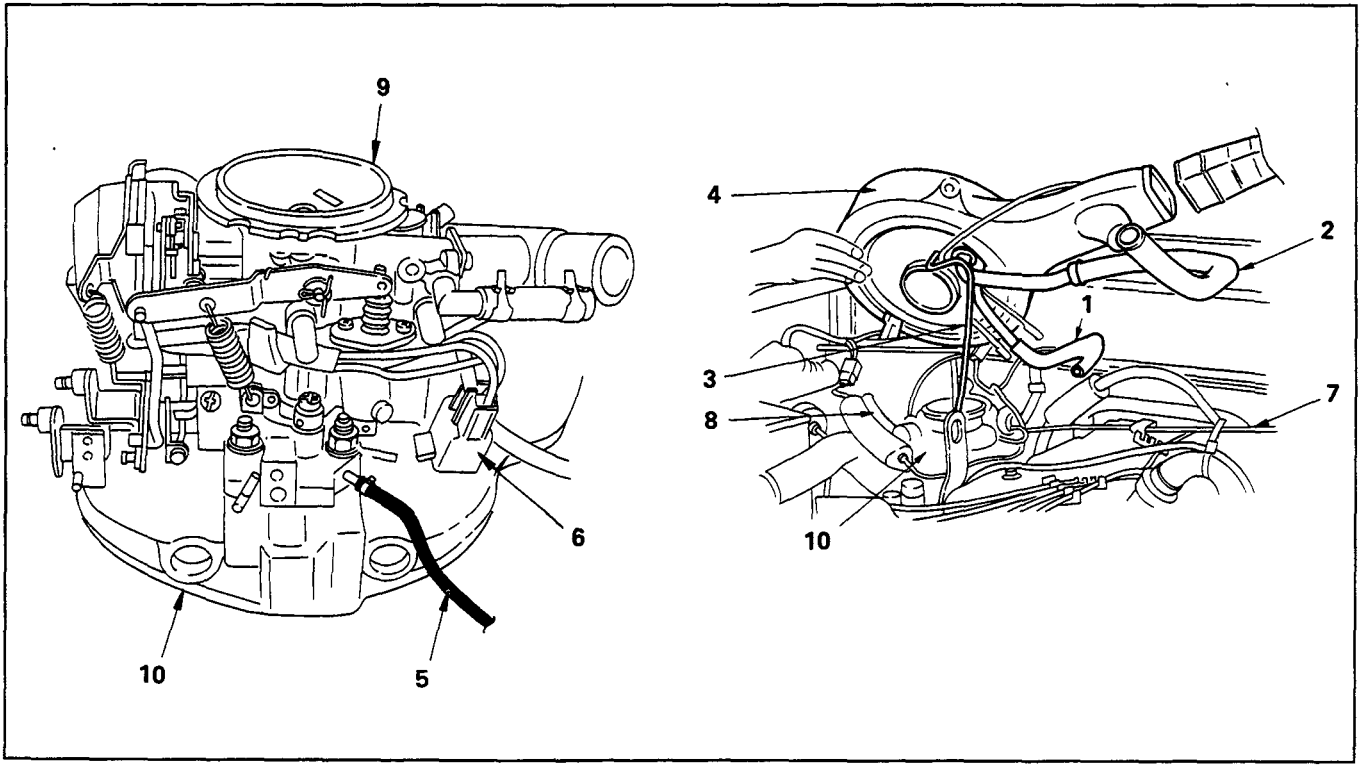
The bimetal tension is inversely proportional to the surrounding temperatures. When the engine is cold, the bimetal tension forces the choke valve and the choke diaphragm closed. As the engine warms up, the bimetal tension drops and the choke valve opens.

The choke valve maintains the proper balance between the intake manifold negative pressure and the air horn air flow at all times. This assures stable engine operation.

CARBURETOR

REMOVAL AND INSTALLATION

Read this Section carefully before performing any removal and installation procedure. This Section gives you important points as well as the order of operation. Be sure that you understand everything in this Section before you begin.

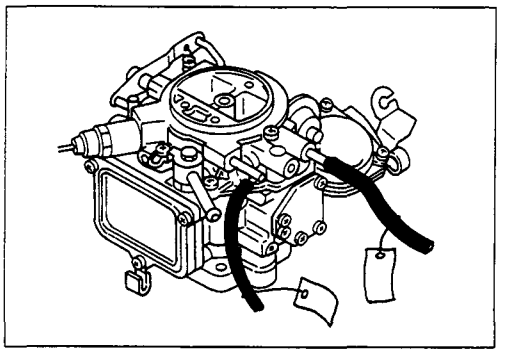


Removal Steps

1. PCV hose
2. Air hose
3. TCA hose
4. Air cleaner
5. ▲ Emission control vacuum hose
6. Lead wire connector
7. Engine control cable
8. Fuel hose
9. ▲ Carburetor
10. Carburetor gasket

Installation Steps

10. ▲ Carburetor gasket
9. ▲ Carburetor
8. Fuel hose
7. ▲ Engine control cable
6. Lead wire connector
5. ▲ Emission control vacuum hose
4. Air cleaner
3. TCA hose
2. Air hose
1. PCV hose

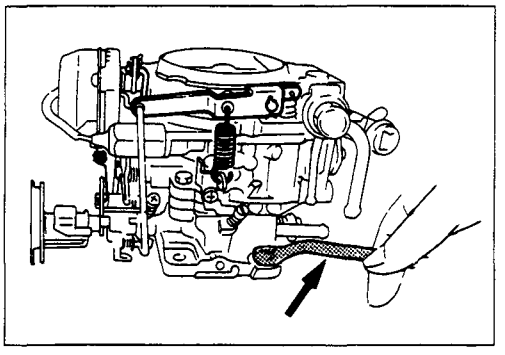


Important Operations – Removal

5. Emission Control Vacuum Hoses

Tag each of the emission control vacuum hoses before disassembly.

This will ensure that the hoses are reconnected correctly.



9. Carburetor

Use the carburetor wrench to remove the carburetor.

Carburetor Wrench: 5-8511-9003-0 (J-26510)

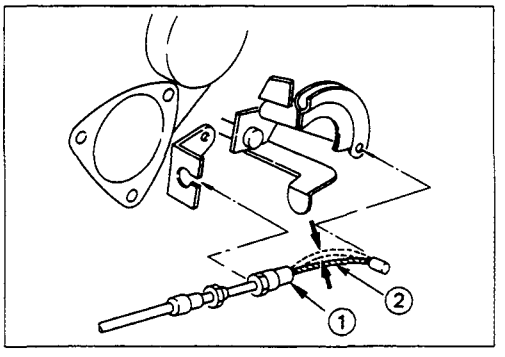
Important Operations – Installation

5. Emission Control Vacuum Hoses

Refer to the tags attached at disassembly to reinstall the emission control vacuum hose.

Follow the external parts installation step order.

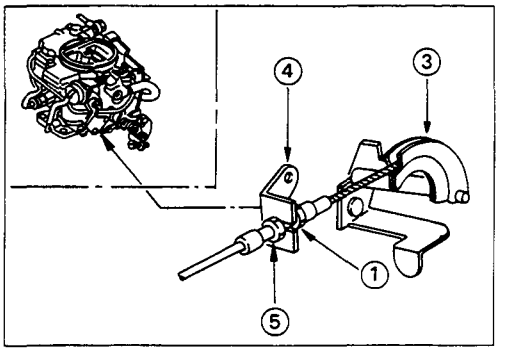
It is very important that the hose be installed correctly.



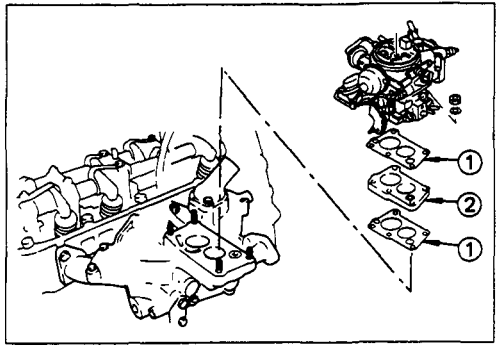
7. Engine Control Cable

1) Fully close the throttle valve.
2) Turn the adjusting nut ① to adjust the engine control inner cable ② play.

Engine Control Inner Cable Play	mm(in)
2 – 3 (0.079 – 0.120)	



3) Connect the engine control cable to the throttle holder ③.
4) Install the engine control cable to the bracket ④.
5) Tighten the lock nut ⑤.



9. Carburetor Gasket

10. Carburetor

1) Install the gasket ①, heat insulator ② (If equipped), and the carburetor to the intake manifold.

2) Use the carburetor wrench to tighten the carburetor nuts to the specified torque.

   Carburetor Wrench: 5-8511-9003-0 (J-26510)

Carburetor Nut Torque	kg·m(lb.ft/N·m)
	1.3 ± 0.5 (9.4 ± 3.6/12.7 ± 4.9)

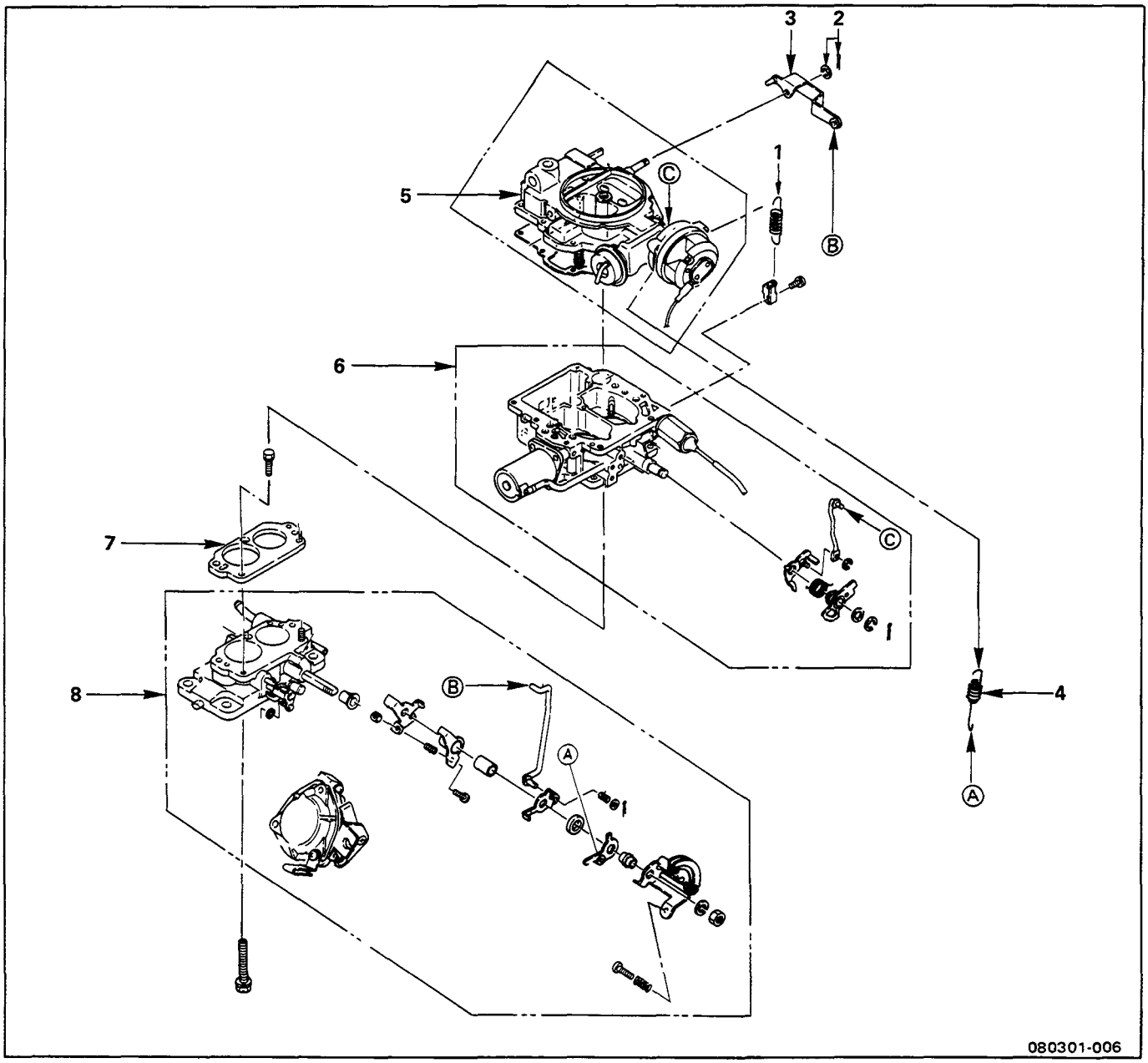
0803

DISASSEMBLY

(Nippon Kikai-Carburetor)

0803030002A

MAJOR COMPONENTS



0803030002B

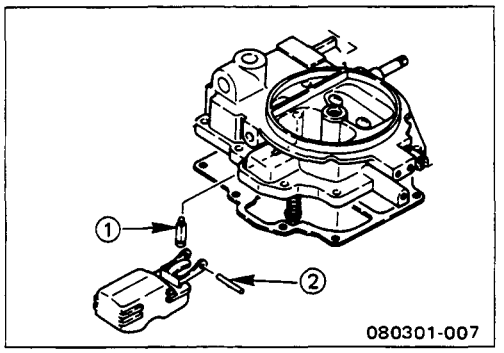
Disassembly Steps

1. Throttle sub-return spring
2. Split pin and retaining ring
3. Accelerator pump arm
4. Primary to secondary spring
▲ 5. Air horn
▲ 6. Carburetor body
7. Carburetor insulator
▲ 8. Flange

08030101

Important Operations

0803010103

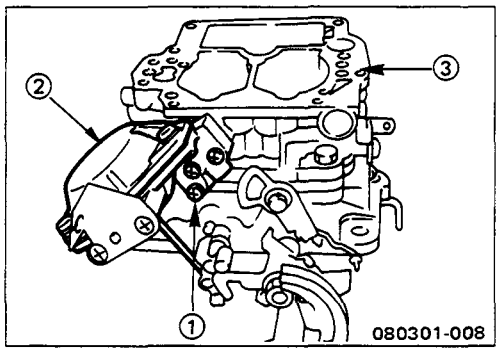


5. Air Horn

Do not allow the float valve seat ① and the float pin ② to fall free when separating the air horn from the carburetor flange.

These parts are very small and are easily lost. Handle them with care.

0803010104A

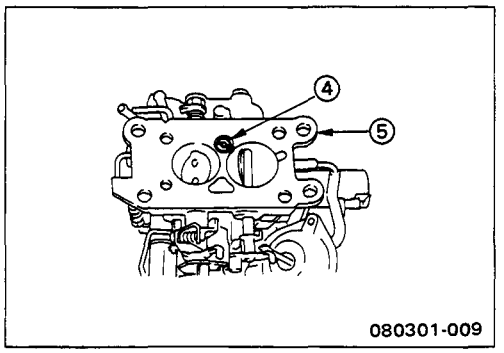


6. Carburetor Body

8. Flange

1) Loosen the three screws ①.
2) Remove the 2nd diaphragm chamber ② from the carburetor body ③.

0803010104B

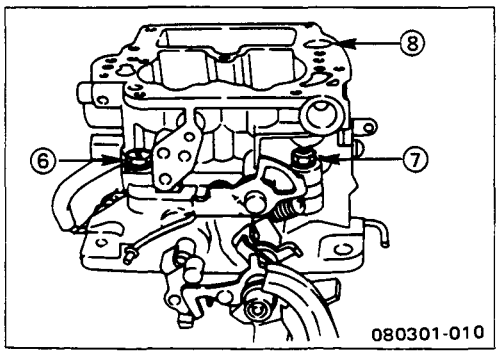


3) Loosen the flange set screw ④ at the lower part of the flange ⑤.

Note:

The hollow flange set screw also serves as the power valve negative pressure intake. Take care not to damage the screw and intake during the disassembly procedure.

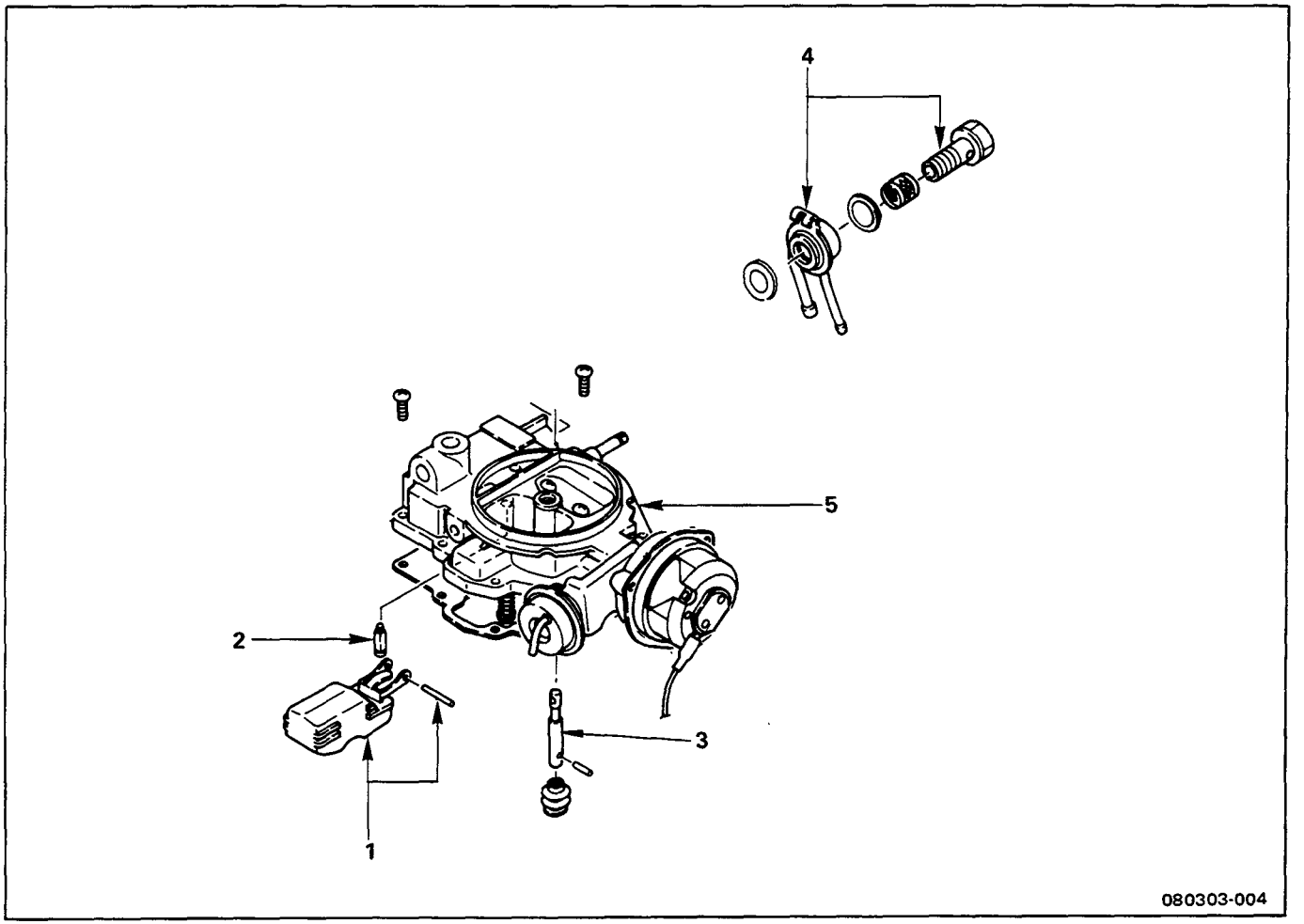
0803010104C



4) Loosen the bolt ⑥ and the nut ⑦ on the carburetor body ⑧.

0803030003
MINOR COMPONENTS

0803030000301A
AIR HORN

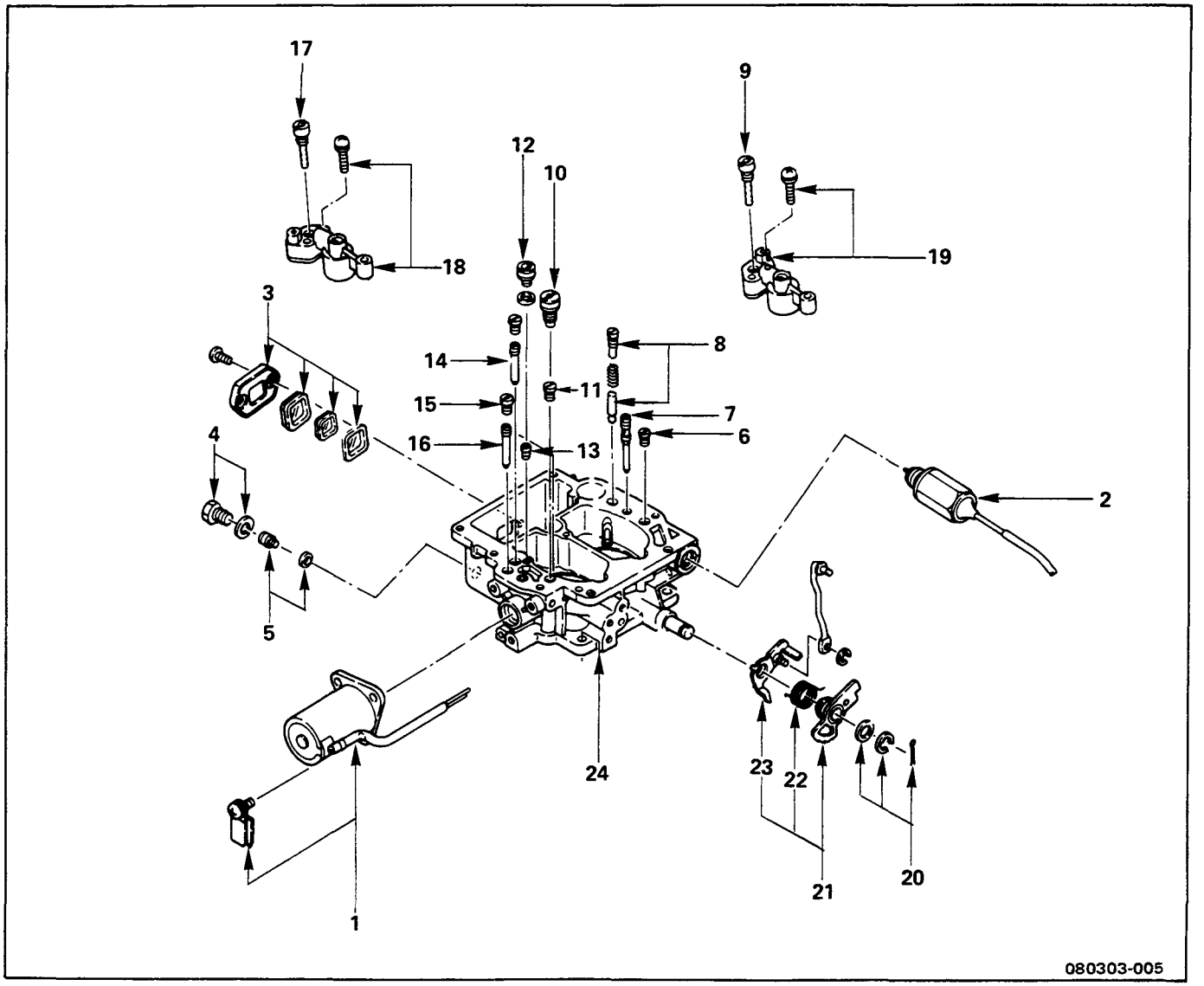


0803030000301B
Disassembly Steps

1. Float pin and float
2. Float valve
3. Accelerator plunger
4. Fuel connector
5. Air horn body with coil housing and choke piston

0803030000302A

CARBURETOR BODY



0803030000302B

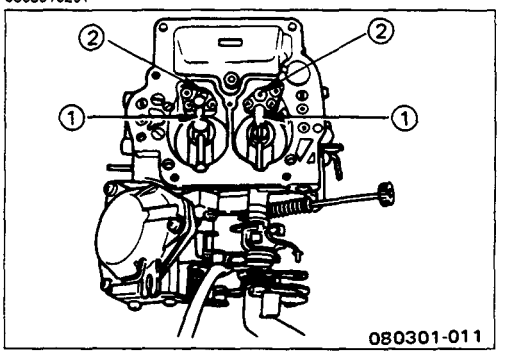
Disassembly Steps

1. Coasting solenoid
2. Solenoid valve
3. Fuel level gauge cover and glass
4. Main passage plug
5. 2nd main jet
6. Slow air bleed jet
7. Slow jet
8. Carburetor pump spring and check valve seat
9. 1st main air bleed jet
10. Power jet
11. Slow passage plug
12. 1st main jet
13. Step air bleed jet
14. Step jet
15. 1st idle air bleed jet
16. Coasting jet
17. 2nd main air bleed jet
- ▲ 18. 2nd small venturi
- ▲ 19. 1st small venturi
20. Split pin and clip
21. Fast idling cam
22. Fast idling cam spring
23. Starting arm
24. Carburetor body

08030102

Important Operations

0803010201



18. 2nd Small Venturi

19. 1st Small Venturi

Remove the small venturis ① after removing the 2nd and 1st main air bleed jets ②.

080302

INSPECTION AND REPAIR (NIKKI)

Make the necessary adjustments, repairs, and part replacements if excessive wear or damage is discovered during inspection.

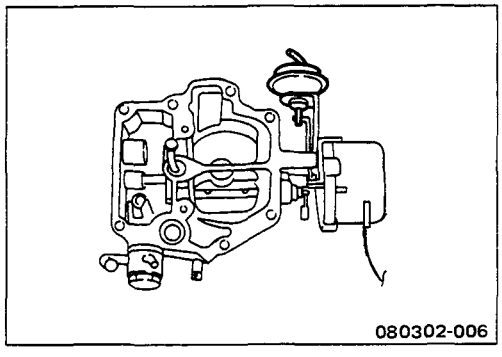
08030204

Cleaning

1. Carefully clean all of the disassembled parts (excluding the O-rings, the packing, the gaskets, and the electrical parts) with carburetor cleaner.

   The parts are very delicate. Handle them with care.
2. Use dry air to blow each of the carburetor passages free of foreign material.

08030205



080302-006

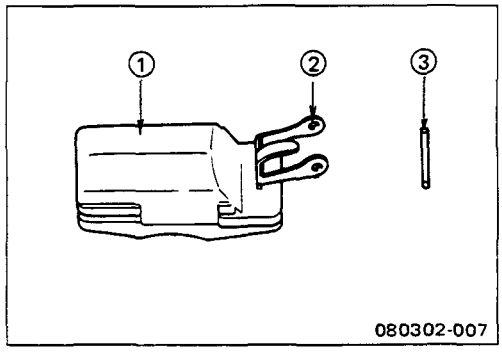
Air Horn, Carburetor Body, and Flange

1. Inspect the air horn, carburetor body, and flange fitting surfaces for cracks and other flaws.

   If there are cracks or other flaws, the parts must be replaced.
2. Inspect the shafts, the links, and the bushings for deformation and excessive wear.

   If there is deformation or excessive wear, the parts must be replaced.

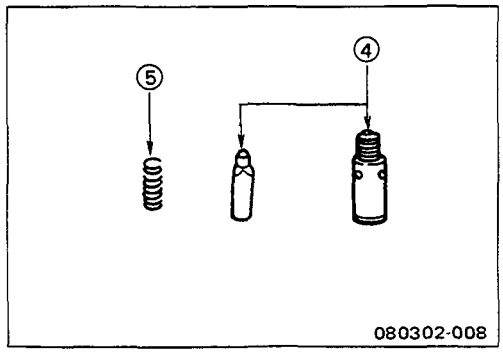
08030206



080302-007

Float and Float Valve

1. Immerse the float in gasoline to clean it.
2. Check the following parts for excessive wear and other damage.
   - ① Float
   - ② Float pin hole
   - ③ Float pin

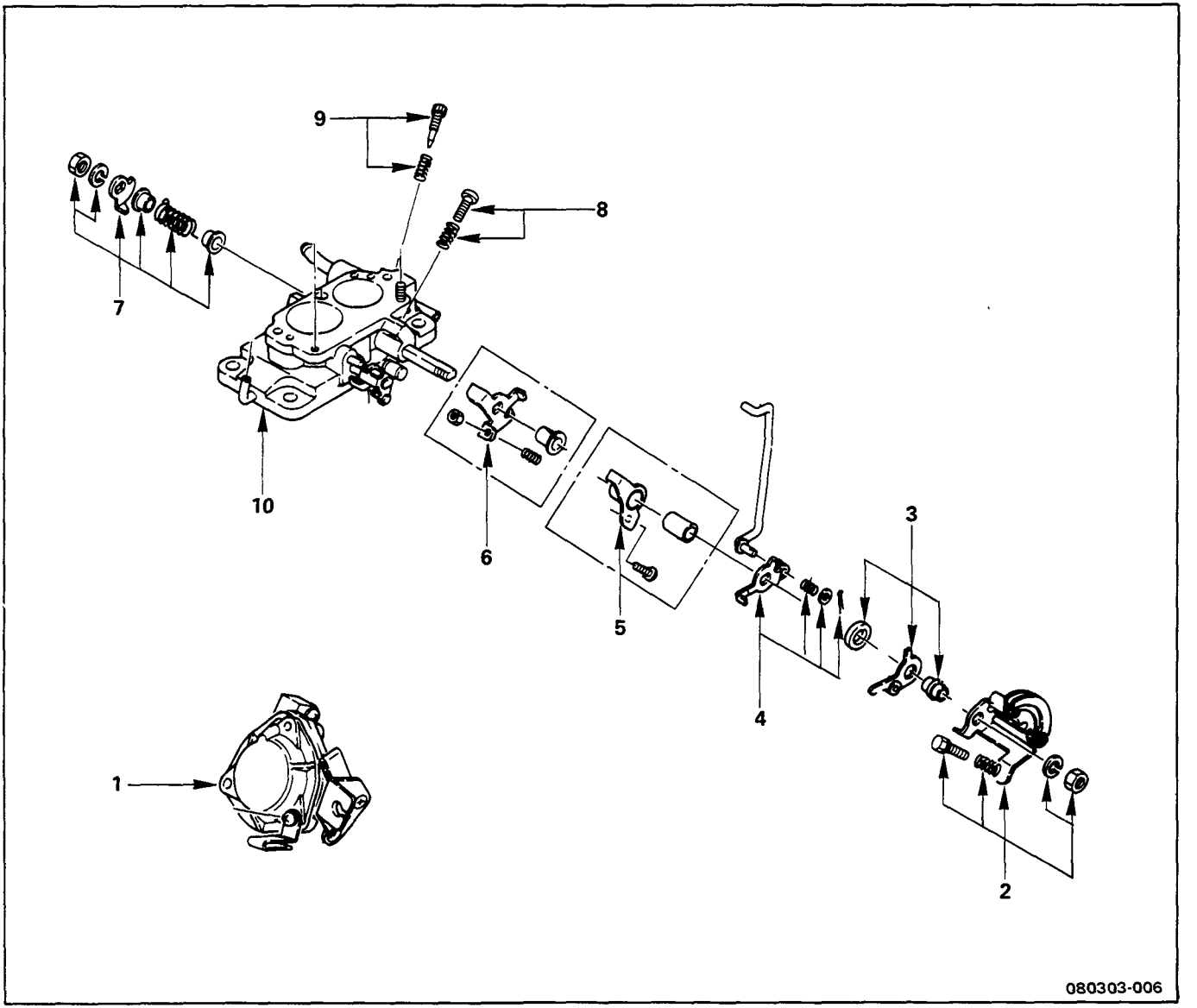


080302-008

   - ④ Float valve seat and strainer
   - ⑤ Spring (Resilience)

080303000303A

FLANGE

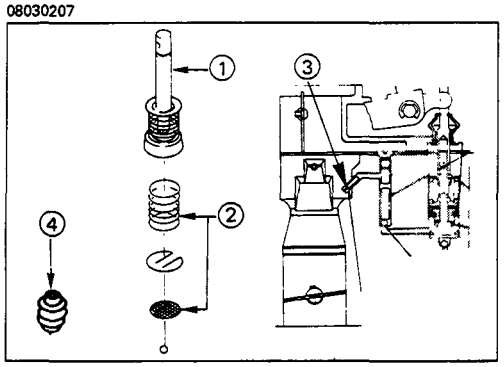


080303000303B

Disassembly Steps

1. 2nd diaphragm chamber
2. Throttle lever
3. Primary to secondary arm
4. Pump connector arm
5. Fast idling cam adjusting arm
6. Throttle shaft arm
7. Throttle return spring arm
8. Throttle adjusting screw
9. Idling adjusting screw
10. Flange

08030207

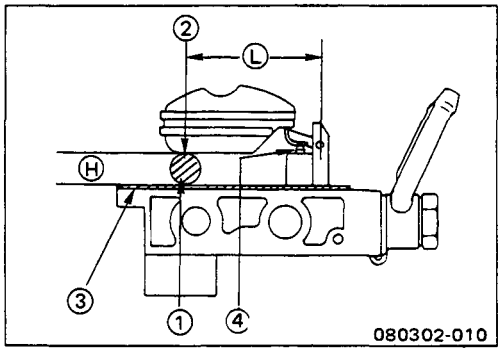


Accelerator Pump Plunger

Check the following accelerator pump plunger parts for excessive wear and other damage.

① Plunger
② Springs and strainer
③ Pump nozzle
④ Plunger boots

08030208



Float Level Adjustment

Place the test bar ① between the float tip ② and the air horn gasket ③ as shown in the illustration.

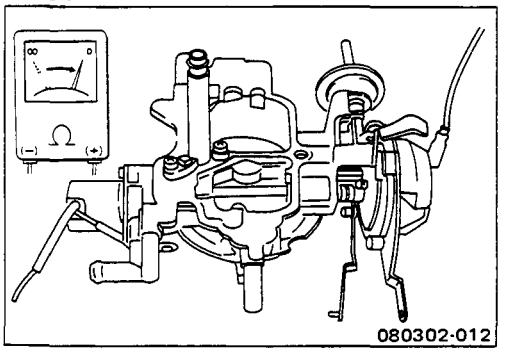
The test bar should just fit into the space Ⓗ between the float and the air horn gasket.

If the float level height is outside the specified range, adjust it by carefully bending the float arm ④ with your hands.

Float Arm Height Ⓗ	mm(in)
8.5 – 9.5 (0.33 – 0.37)	

Float Pin Center to Float Tip Ⓛ (Reference)	mm(in)
57 (2.24)	

08030210



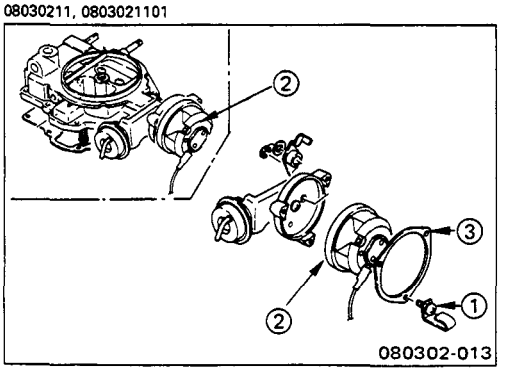
Auto Choke Coil Housing

Use an ohmmeter to measure the resistance between the choke coil wire and the coil housing.

If the measured value is outside the specified value, the coil housing must be replaced.

Auto Choke Coil Housing Resistance	Ohms
6 ± 5 at 25°C (77°F)	

08030211, 0803021101



Auto Choke Coil Housing Replacement

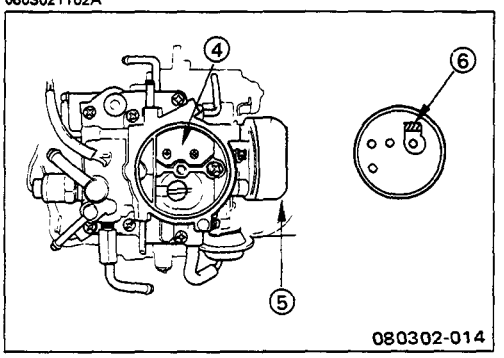
Coil Housing Removal

1. Loosen the three coil housing installation screws ①.
2. Remove the coil housing ② together with the bimetal set case plate ③.

Note:

Do not remove the auto choke coil housing unless it is to be replaced.

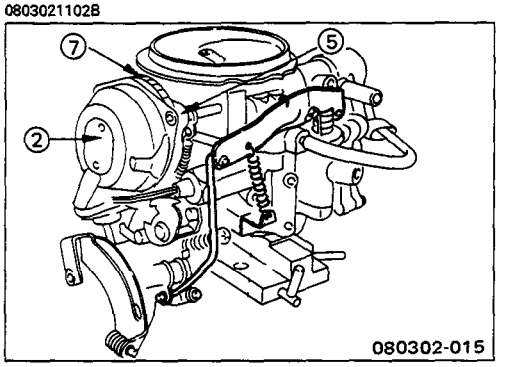
0803021102A



Coil Housing Installation

1. Fully close the choke valve ④.
2. Set the coil housing plate ⑤ choke shaft arm catch ⑥ perfectly horizontal.

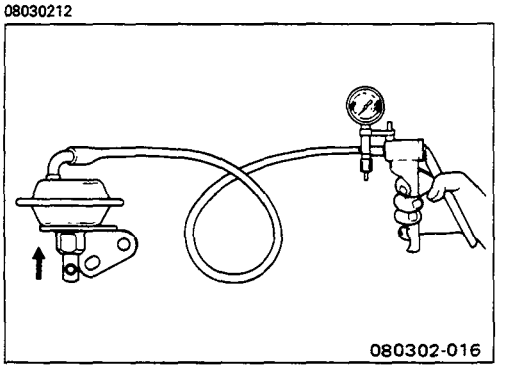
08030211028



3. Set the bimetal with coil housing ② to the choke shaft arm.

   Refer to the illustration.
4. Align the setting marks ⑦ on the coil housing plate ⑤ and the coil housing ②.
5. Install the coil housing together with the bimetal set case plate.

08030212



Choke Piston

Apply a vacuum to the choke piston diaphragm.

The diaphragm should hold the vacuum for several seconds.

If it does not, the choke piston diaphragm must be replaced.

08030213, 0803021301A

Choke Piston Replacement

Choke Piston Removal

1. Remove the coil housing.
2. Remove the coil housing plate.
3. Disconnect the choke piston rod clip from the choke shaft.

Note:

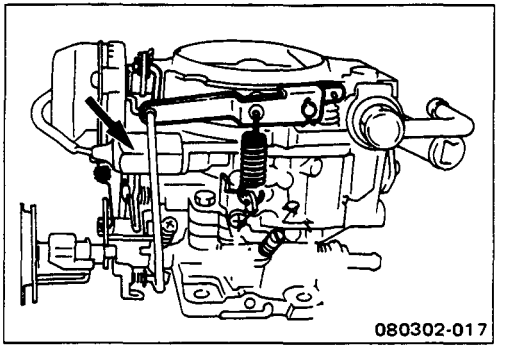
Do not remove the choke piston unless it is to be replaced.

0803021301B

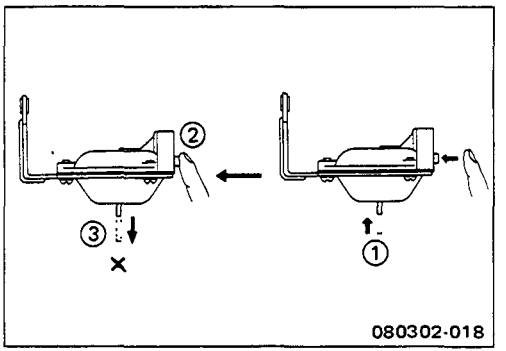
Choke Piston Installation

Follow the removal procedure in the reverse order to install the choke piston.

08030214



08030215



Slow Cut Solenoid Valve

1. Check the slow cut solenoid valve body and spring spool for excessive wear and other damage.
2. Install the solenoid valve to the carburetor body.
3. Apply 12 Volts to the solenoid valve.

   Check that the valve operates smoothly.

   If the valve does not operate smoothly, it must be replaced.

2nd Diaphragm Chamber

1. Use your hand to push in the diaphragm chamber rod ①.

   Block the diaphragm chamber hole ② with a finger at the same time.
2. Remove your finger from the hole.

   The rod should not move.

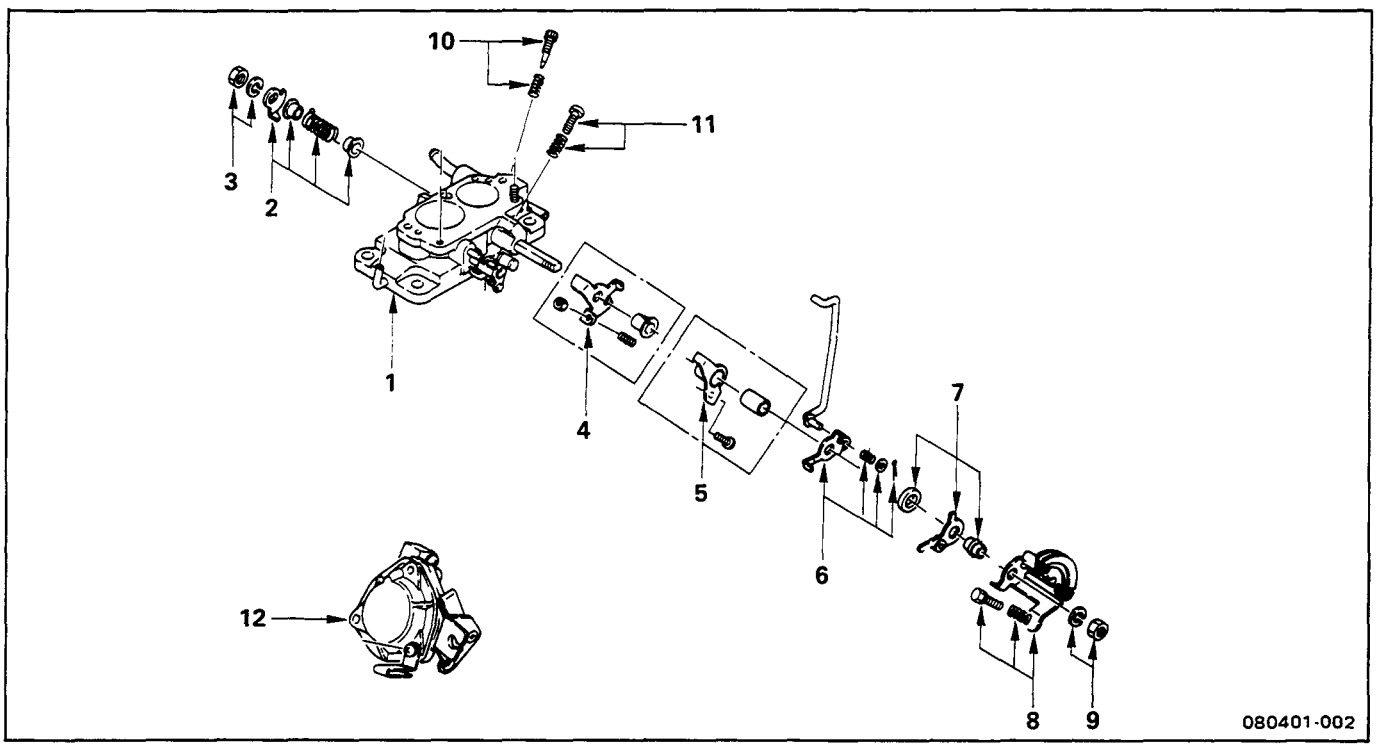
   If the rod moves, the diaphragm is damaged and must be replaced.

0804

REASSEMBLY

080401A
MINOR COMPONENTS

FLANGE

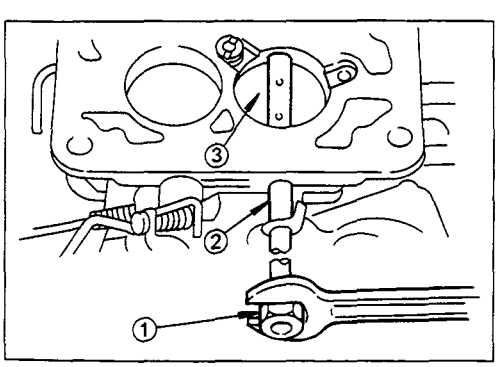


080401B

Reassembly Steps

1. Flange
2. ▲ Spring arm nut
3. Throttle return spring arm
4. Throttle shaft arm
5. Fast idling cam adjusting arm
6. Pump connector arm
7. Primary to secondary arm
8. Throttle lever
9. ▲ Throttle lever nut
10. Idling adjusting screw
11. Throttle adjusting screw
12. 2nd diaphragm chamber

Important Operations



2. Spring Arm Nut

9. Throttle Lever Nut

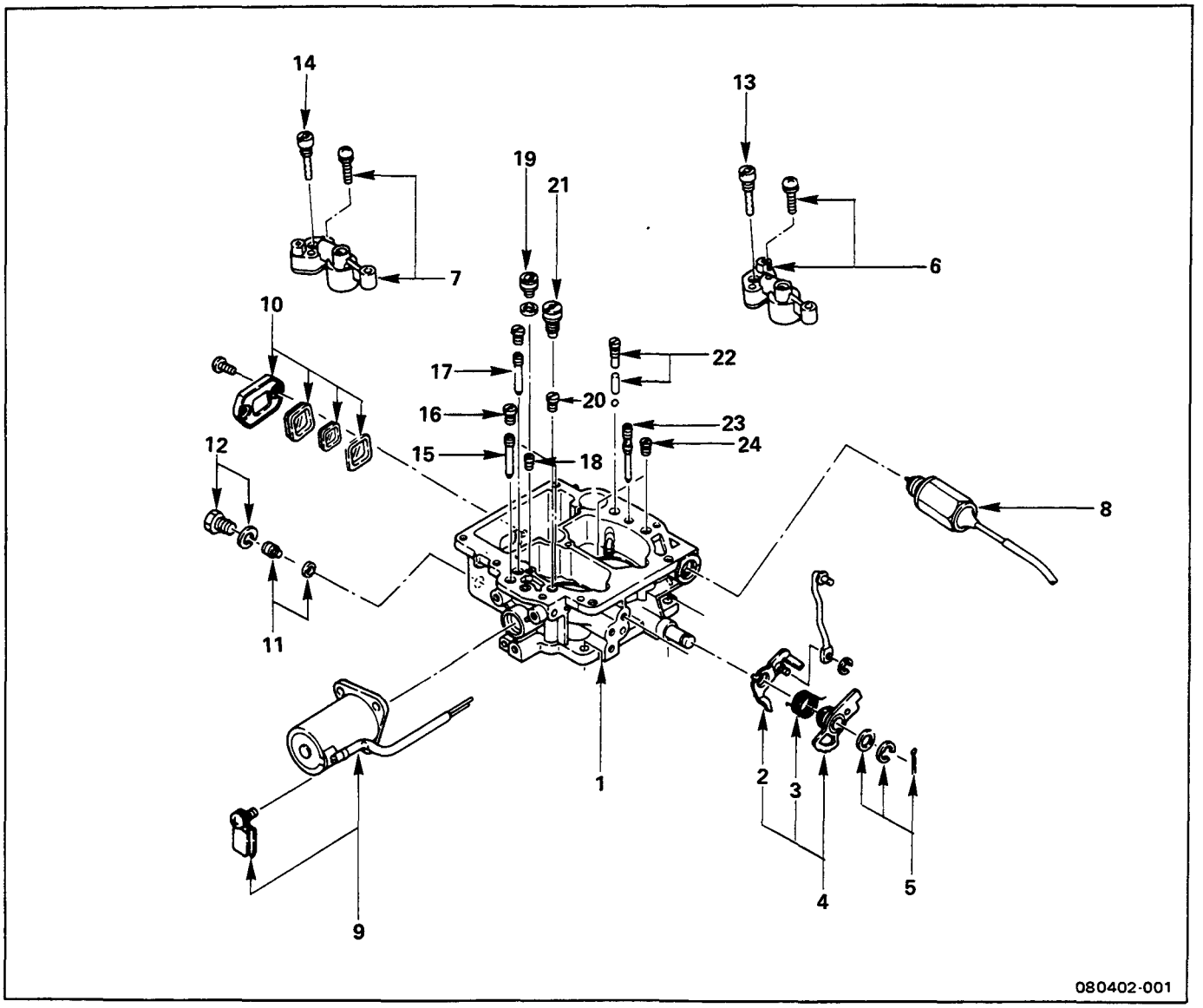
1) Install the throttle lever nut ① to the throttle valve shaft ②.
2) Tighten the throttle lever nut to the related parts.
   Prevent the throttle valve shaft ② from turning.

Note:

Failure to hold the throttle valve shaft stationary while tightening the throttle valve nut will result in damage to the throttle valve ③.

080402A

CARBURETOR BODY



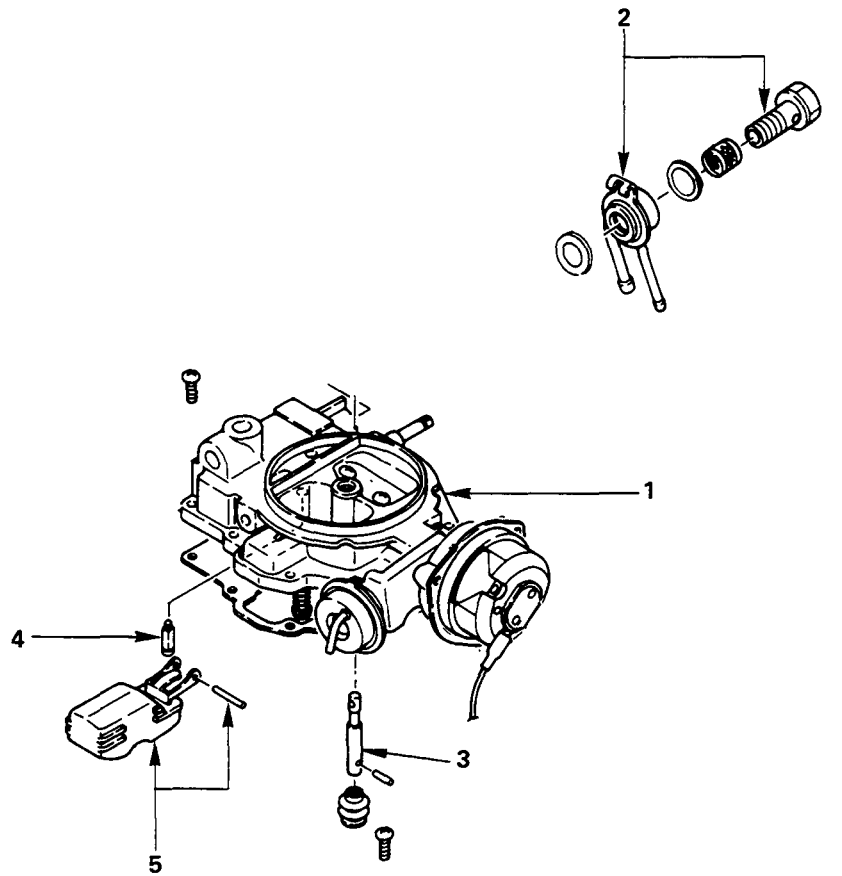
080402B

Reassembly Steps

1. Carburetor body
2. Starting arm
3. Fast idling cam spring
4. Fast idling cam
5. Split pin and clip
6. 1st small venturi
7. 2nd small venturi
8. Solenoid valve
9. Coasting solenoid
10. Fuel level gauge cover and glass
11. 2nd main jet
12. Main passage plug
13. 1st main air bleed jet
14. 2nd main air bleed jet
15. Coasting jet
16. 1st idle air bleed jet
17. Step jet
18. Step air bleed jet
19. 1st main jet
20. Slow passage plug
21. Power jet
22. Carburetor pump spring and check valve
23. Slow jet
24. Slow air bleed jet

080403A

AIR HORN



080403-001

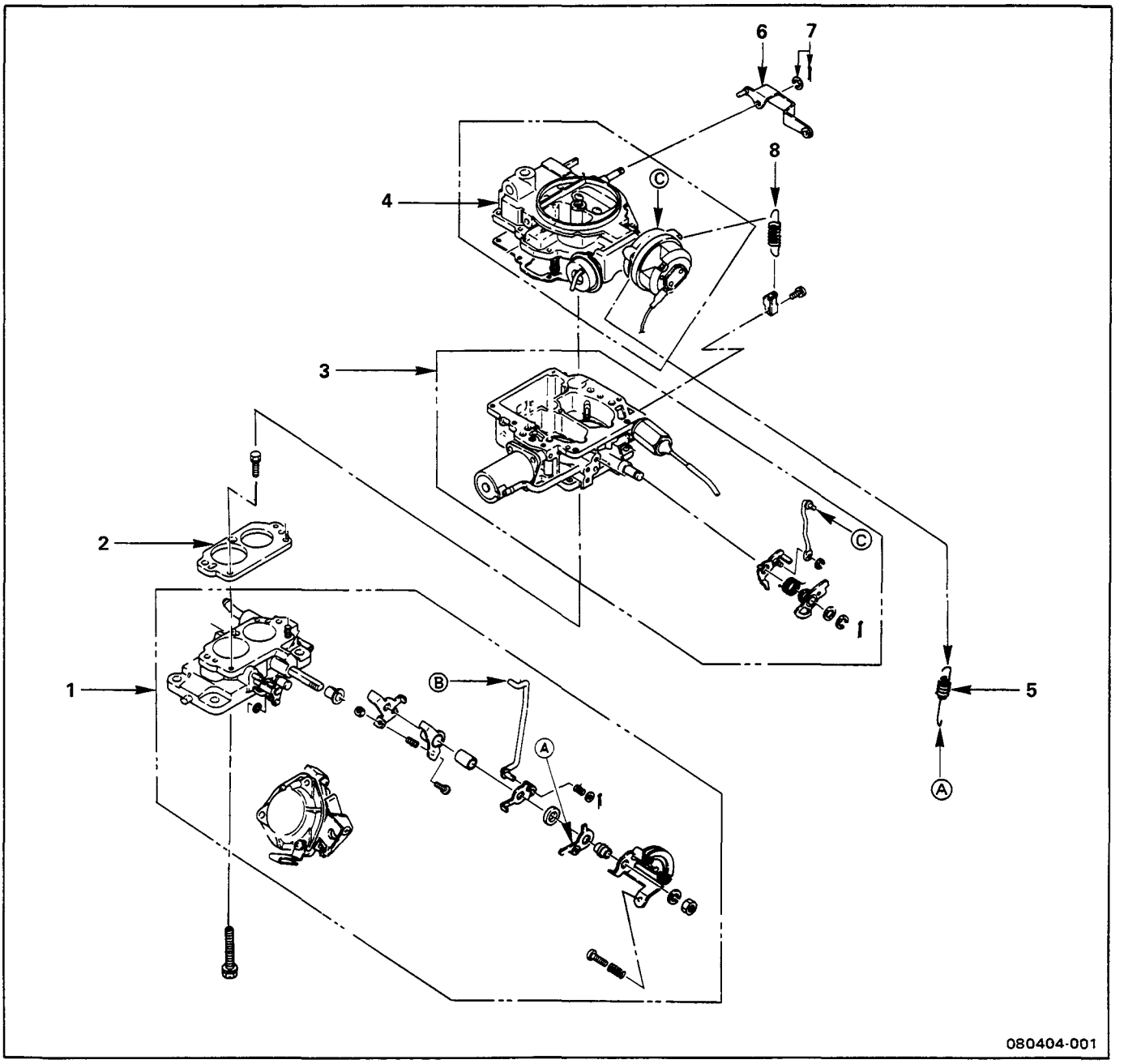
080402B

Reassembly Steps

1. Air horn body with coil housing and choke piston
2. Fuel connector
3. Accelerator plunger
4. Float valve
5. Float pin and float

080404A

MAJOR COMPONENTS

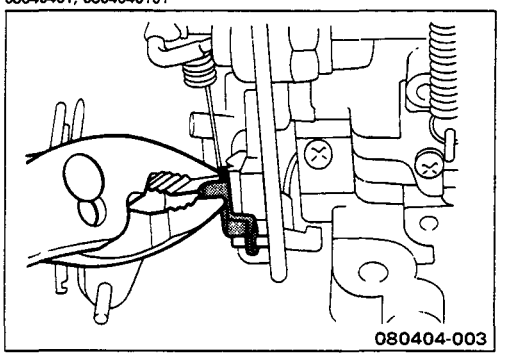


080402B

Reassembly Steps

1. Flange
2. Carburetor insulator
3. Carburetor body
4. Air horn
5. Primary to secondary spring
6. Accelerator pump arm
7. Split pin and retaining ring
8. Throttle sub-return spring

08040401, 0804040101



CARBURETOR ADJUSTMENT

Secondary Throttle Valve Touch Angle

Inspect the primary throttle valve full opening when the secondary throttle valve is starting to open.

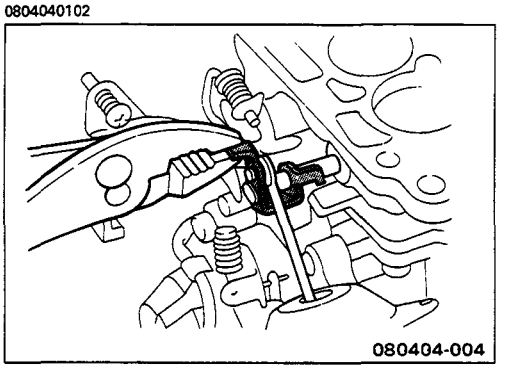
Use the throttle valve angle set gauge to check the primary throttle valve angle.

Valve Angle Set Gauge: 5-8840-2133-0

The throttle valve angle must match the gauge angle.

If the throttle valve angle does not match the gauge angle, adjust it by carefully bending the connecting pump arm.

0804040102

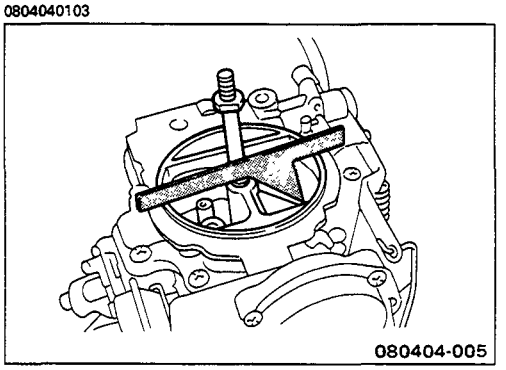


Kick-Up Angle

Check that the secondary valve opens just slightly (0° — 2°) when the primary valve is fully open.

If the secondary valve opens too little or too much, adjust it by carefully bending the connecting pump arm.

0804040103



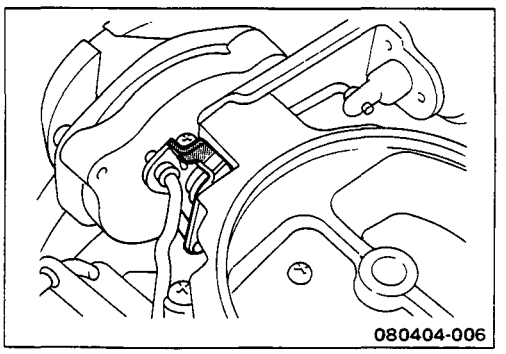
Choke Valve Angle

1. Fully open the primary throttle valve.
2. Use the choke valve angle set gauge to check the choke valve angle.

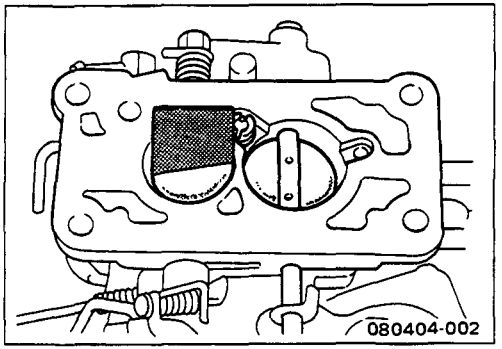
Choke Valve Angle Set Gauge: 5-8840-2132-0

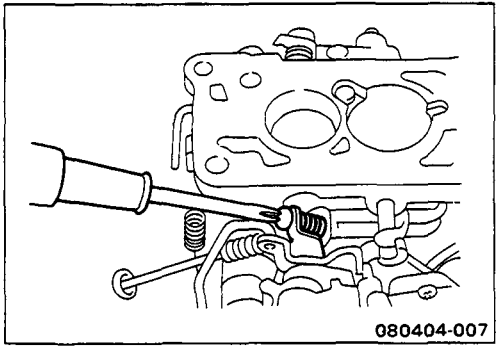
The choke valve angle must match the gauge angle.

If the choke valve angle does not match the gauge angle, adjust it by carefully bending the choke valve adjusting lever.



08040104





Fast Idling Setting

1. Set the throttle shaft lever to the first step of the fast idle cam.
2. Fully close the choke valve.
3. Use the fast idling set gauge to check the primary throttle valve angle.

Fast Idling Set Gauge: 5-8840-2131-0

The primary throttle valve angle must match the gauge angle.

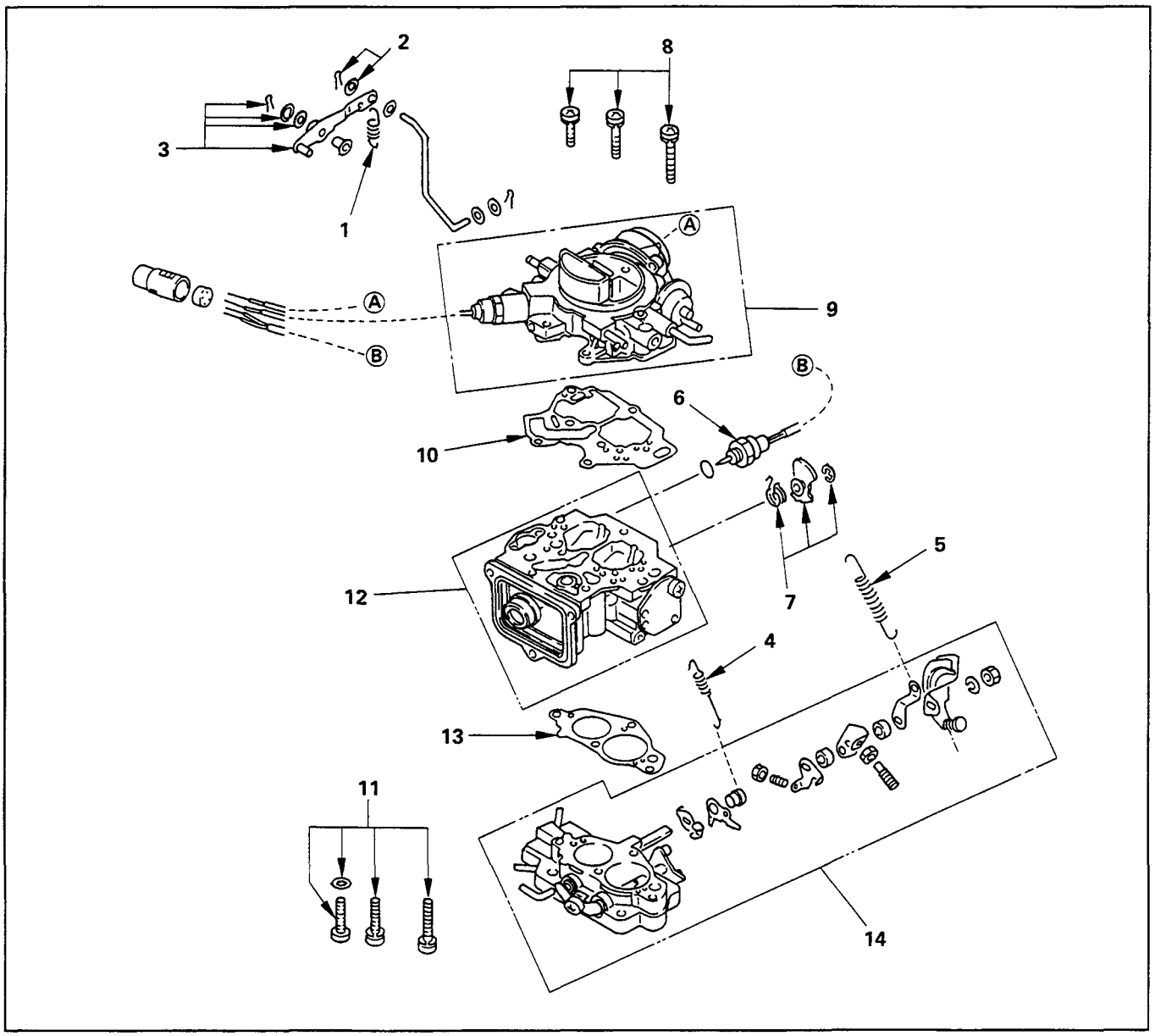
If the primary throttle valve angle does not match the gauge angle, adjust it with the fast idling adjusting screw.

0803

DISASSEMBLY

(Hitachi-Carburettor, 4ZE1 Engine)

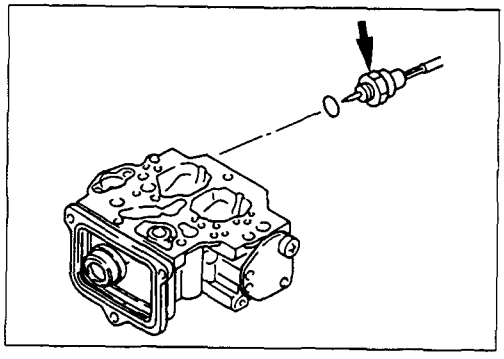
MAJOR COMPONENTS



Disassembly Steps

1. Assist spring
2. Pump rod split pin with washer
3. Pump lever and split pin with washer
4. Return spring
5. Main spring
▲ 6. Slow cut solenoid valve
▲ 7. Fast idler cam and spring
8. Choke chamber screw and washer
▲ 9. Choke chamber assembly
10. Choke and float chamber gasket
11. Throttle chamber screw and washer
12. Float chamber assembly
13. Float and throttle chamber gasket
14. Throttle chamber assembly

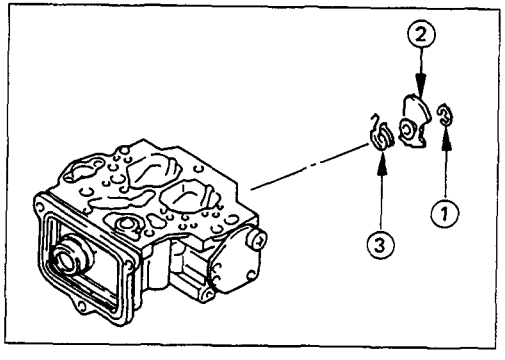
Important Operations



6. Slow Cut Solenoid Valve

Disconnect the slow cut solenoid valve before disassembling the choke chamber.

Take care not to damage the solenoid valve tip.

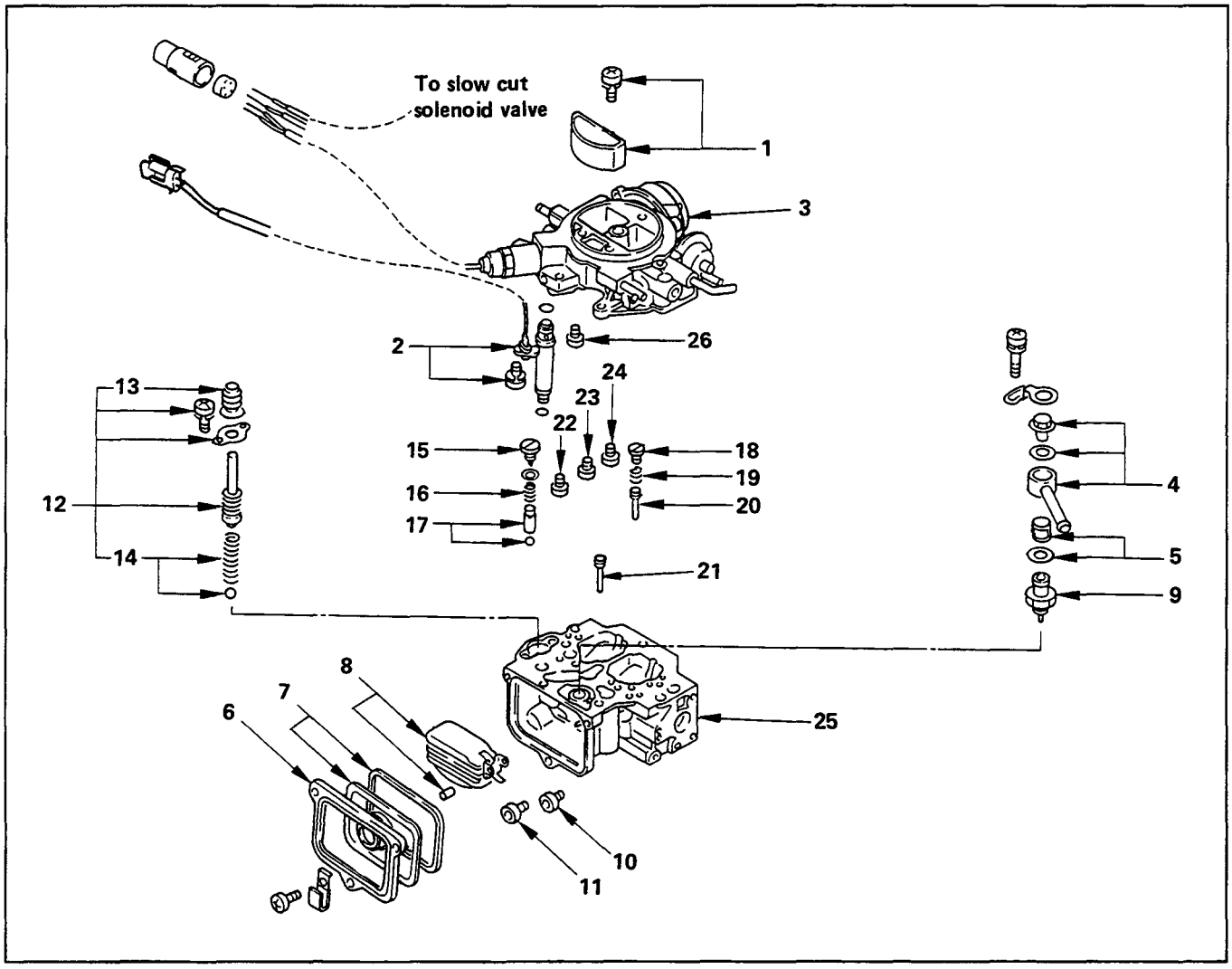


7. Fast Idler Cam and Spring
9. Choke Chamber Assembly

Remove the split pin ①, the fast idler cam ②, and the cam spring ③ from the float chamber shaft.

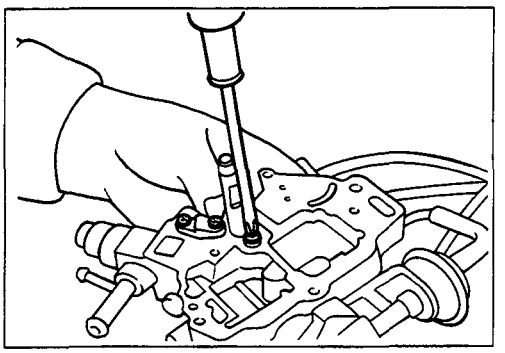
MINOR COMPONENTS

CHOKE CHAMBER AND FLOAT CHAMBER ASSEMBLY



Disassembly Steps

1. Vent cover
▲ 2. Duty solenoid valve
3. Choke chamber
4. Fuel nipple
5. Fuel filter
6. Level gauge cover
7. Level gauge and rubber seal
▲ 8. Float and collar
▲ 9. Needle valve
10. Secondary main jet
11. Primary main jet
▲ 12. Piston
13. Pump cover
14. Piston return spring
15. Pump set screw
16. Injector spring
17. Injector weight
18. Taper plug
19. Slow jet spring
20. Primary slow jet
21. Secondary slow jet
22. Primary main air bleed
23. Secondary main air bleed
24. Primary slow air bleed
25. Float chamber
▲ 26. Power jet



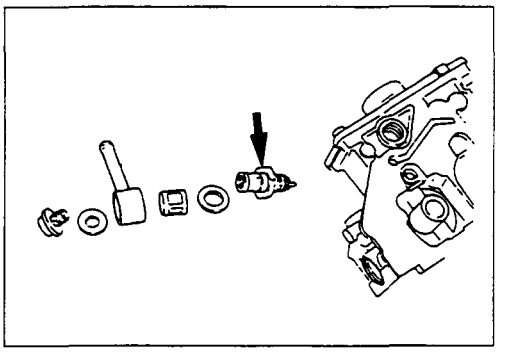
Important Operations

2. Duty Solenoid Valve ('91 Swiss, Sweden & '92 Germany models)

1) Cut the solenoid valve cord.
2) Loosen the three screws holding the valve in place.
3) Pull the valve from the choke chamber.

Note:

Do not remove the duty solenoid valve unless repair or replacement is required.



8. Float and Collar

9. Needle Valve

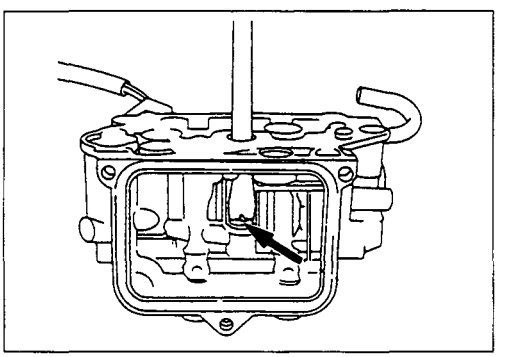
Take care not to lose the collar.

Do not allow the needle valves to fall free.

Take care not to damage the needle valve.

12. Piston

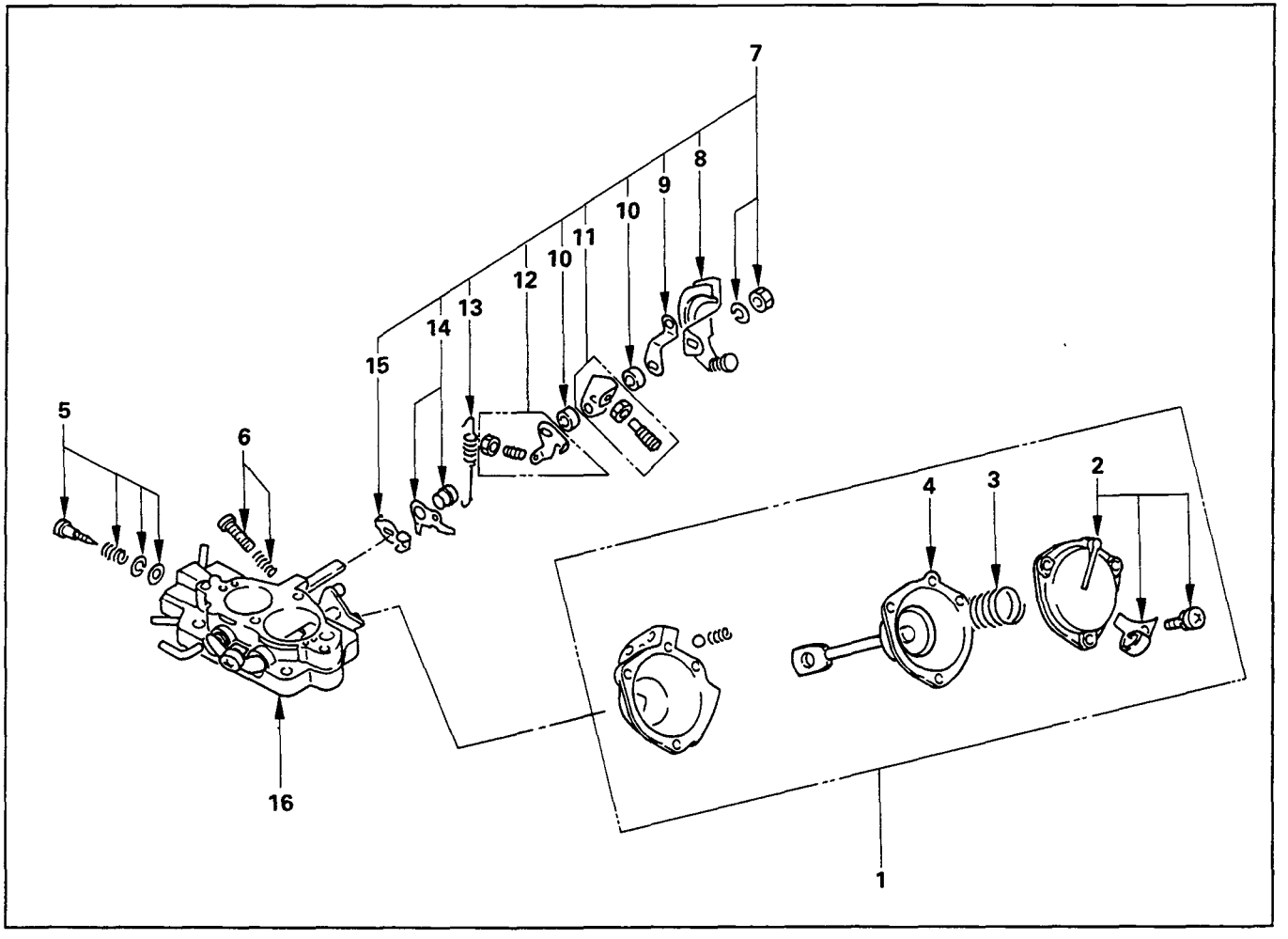
Take care not to lose the check ball.



26. Power Jet (Except '91 model, Swiss & Sweden, '92 model, Germany)

Be sure to place a screwdriver properly into the slot to prevent valve rod damage.

THROTTLE CHAMBER ASSEMBLY



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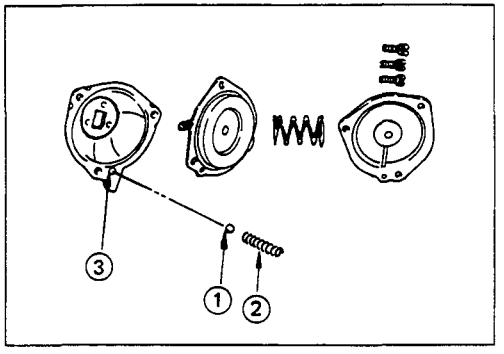
Disassembly Steps

1. Diaphragm chamber assembly
▲ 2. Diaphragm chamber cover
▲ 3. Diaphragm spring
▲ 4. Diaphragm
▲ 5. Idler adjusting screw
6. Throttle adjusting screw
▲ 7. Throttle shaft nut and washer
▲ 8. Throttle lever
▲ 9. Spring hanger
▲ 10. Shaft collar
▲ 11. Fast idler adjusting lever and screw
▲ 12. Kick lever
▲ 13. Return spring
▲ 14. Return plate and sleeve
▲ 15. Adjusting lever
16. Throttle chamber

Important Operations



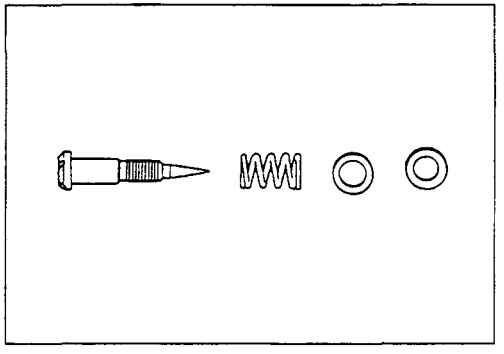
2. Diaphragm Chamber Cover

3. Diaphragm Spring

4. Diaphragm

Do not allow the ball ① and the spring ② to fall from the diaphragm chamber vacuum hole ③ during the disassembly procedure.

Take care not to lose or misplace the disassembled parts.



5. Idler Adjusting Screw

Take care not to damage the adjusting screw tip after disassembly.

7. Throttle Shaft Nut and Washer

Remove the steps number 7 to 15 parts only if repair or replacement is required.

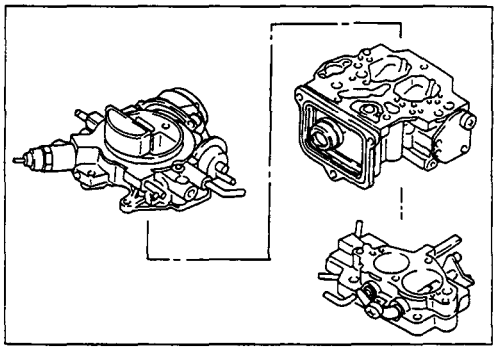
INSPECTION AND REPAIR (HITACHI)

Make the necessary adjustments, repairs, and part replacements if excessive wear or damage is discovered during inspection.

Cleaning

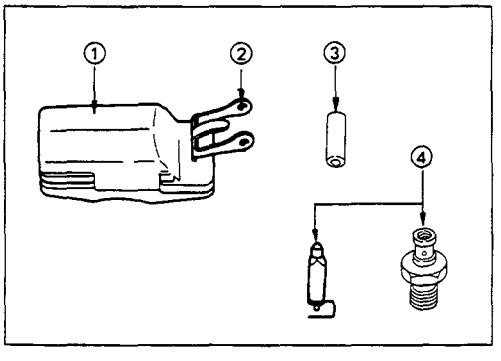
1. Carefully clean the disassembled parts (excluding the O-rings, the gaskets, and the electrical parts) with carburetor cleaner.

   Carburetor parts are extremely delicate. Handle them carefully to avoid damage.
2. Use dry air to blow each of the carburetor passages free of foreign material.



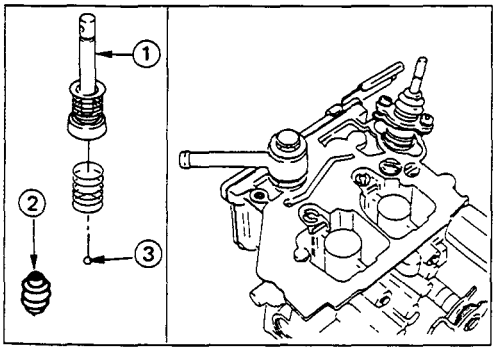
Choke Chamber, Float Chamber, and Throttle Chamber

1. Insert the choke chamber, the float chamber, and the throttle chamber fitting surfaces for cracks or other flaws.
   If there are cracks or other flaws, the parts must be replaced.
2. Inspect the shafts and the links for deformation and excessive wear.
   If there is deformation and excessive wear, the parts must be replaced.



Float and Needle Valve

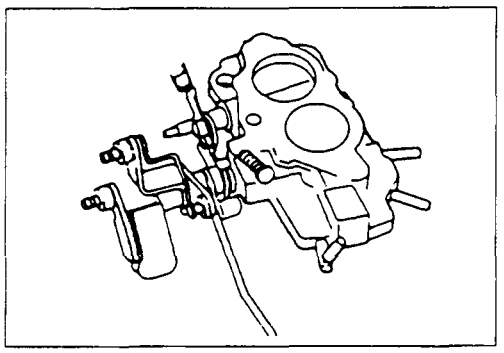
1. Immerse the float and needle valve in gasoline to clean them.
2. Check the following parts for excessive wear and damage.
   - ① Float
   - ② Float pin hole
   - ③ Float pin dollar
   - ④ Needle valve and seat



Piston

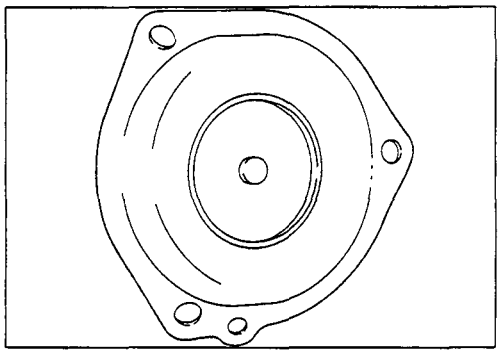
Inspect the piston ① and the piston boot ② for excessive wear and damage.

Take care not to lose the check ball ③.



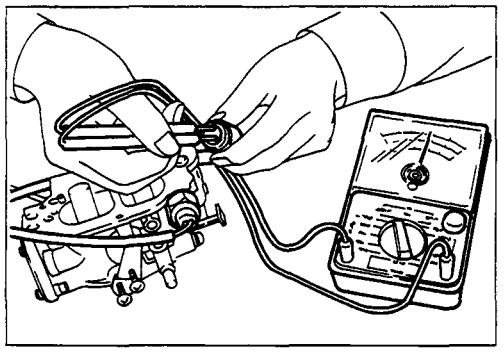
Throttle Chamber

1. Inspect the slow port, the idle port, and the other throttle chamber openings for restrictions.
2. Inspect the primary throttle valve and the secondary throttle valve for carbon deposits and excessive wear.
3. Inspect the throttle valve shaft for wear.
4. Inspect the idler adjusting screw seating faces for step wear.
   Inspect the threads for damage.



Diaphragm

Inspect the diaphragm for deterioration and damage.

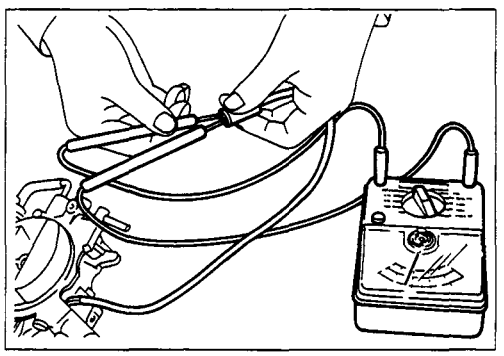


Slow Cut Solenoid Valve

1. Inspect the slow cut solenoid valve body and spring spool for excessive wear and damage.
2. Use an ohmmeter to measure the resistance between the solenoid valve positive terminal and negative terminal.

   If the measured resistance is outside the specified range, the slow cut solenoid valve must be replaced.

Slow Cut Solenoid Valve Resistance	Ohms
31.9 – 43.3 at 20°C (68°F)	

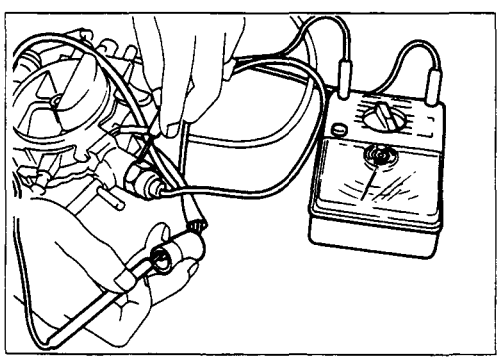


Duty Solenoid Valve (From '91 Swiss & Sweden, '92 Germany models)

Use an ohmmeter to measure the resistance between the solenoid valve positive terminal and negative terminal.

If the measured resistance is outside the specified range, the rear holder and the connectors) must be replaced.

Duty Solenoid Valve Resistance	Ohms
34.7 – 46.9 at 20°C (68°F)	

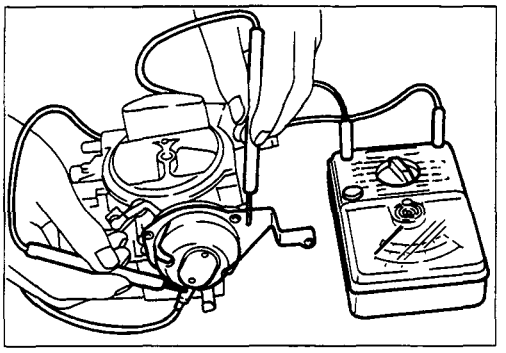


Switch Vent Solenoid Valve (If equipped)

Use an ohmmeter to measure the resistance between the solenoid valve positive terminal and ground (valve body).

If the measured resistance is outside the specified range, the switch vent solenoid valve must be replaced.

Switch Vent Solenoid Valve Resistance	Ohms
25.1 – 34.1 at 20°C (68°F)	

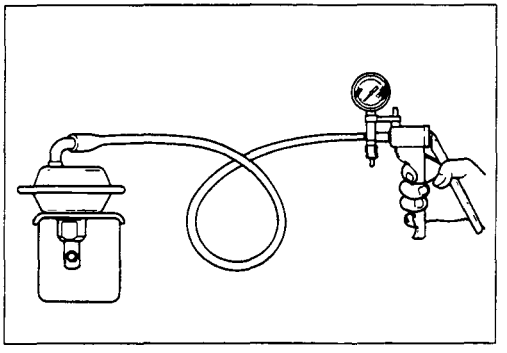


Thermostat

Use an ohmmeter to measure the resistance between the thermostat positive terminal and ground (thermostat body).

If the measured resistance is outside the specified range, the thermostat must be replaced.

Thermostat Resistance	Ohms
1.1 – 3.1 at 20°C (68°F)	

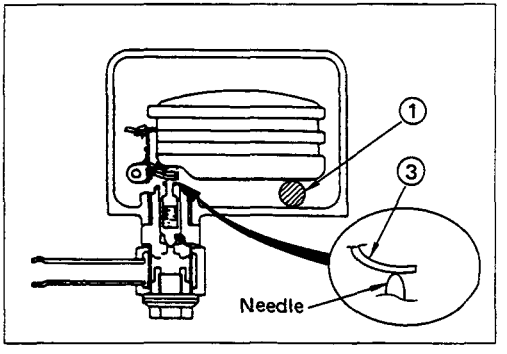


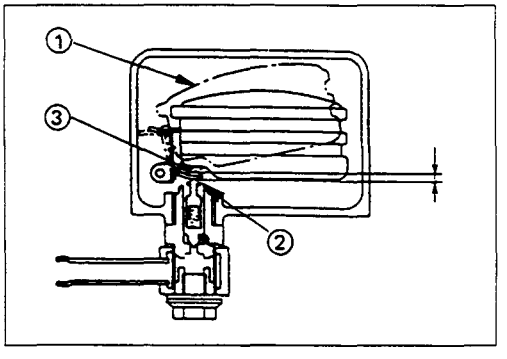
Choke Piston

Apply a vacuum to the choke piston diaphragm.

The diaphragm must maintain the vacuum for several seconds.

If it does not, the choke chamber assembly must be replaced.





MEASUREMENT AND ADJUSTMENT

1. Float Level Adjustment

Place the test bar ① between the float tip and the upper face of float chamber as shown in the illustration.
If the float level height is outside the specified range, adjust it by carefully bending the float seat ③ with your hands.

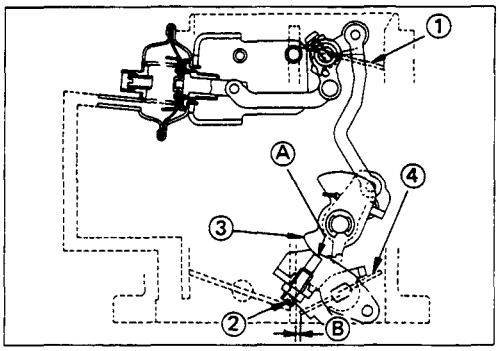
Float Level Height	mm (in)
7.2 (0.28)	

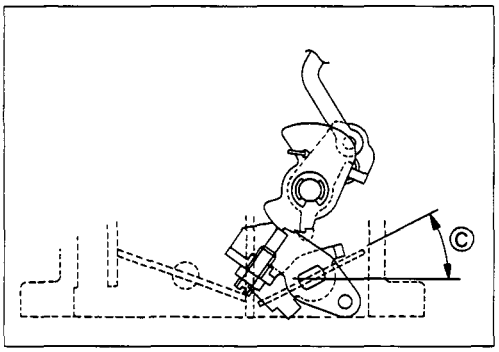
2. Needle Valve Stroke Adjustment

1) Hold the carburetor upside down.
2) Fully riase the float ①.
3) Measure the clearance between the valve stem ② (resting at the bottom position) and the float seat ③.

If the needle valve stroke is outside the specified value, adjust the needle valve stroke by carefully bending the float stopper.

Valve Stem and Float Seat Clearance	mm (in)
1.5 (0.059)	





Fast Idling

1. Fully close the choke valve ①.
2. Align the fast idling screw ② with the fast idling cam ③ first step Ⓐ.
3. Measure the clearance Ⓑ between the primary throttle valve ④ and the throttle valve chamber wall.

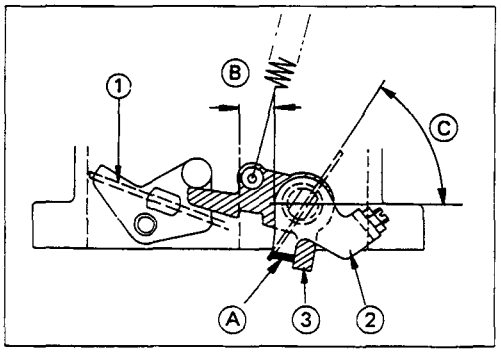
   If the measured clearance is outside the specified range, adjust it with the idling adjusting screw ②.

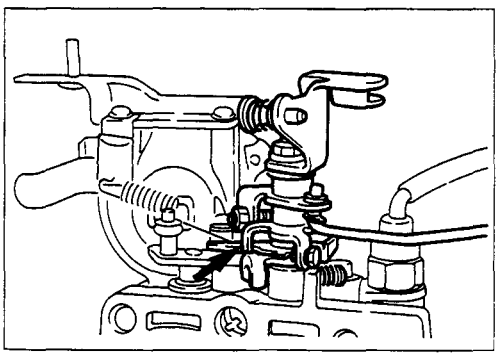
Throttle Valve and Throttle Valve Chamber Wall Clearance	mm(in)
1.23 – 1.48 (0.048 – 0.058)	

(Reference)

Primary Throttle Valve Angle ©	Deg.
25	

* When the clearance between the throttle valve and the throttle valve chamber wall is within the specified range.





Primary Throttle Valve and Secondary Throttle Valve Interlock

1. Slowly open the primary throttle valve ① until the kick lever ② tang Ⓐ contacts the return plate ③.
2. Measure the clearance Ⓑ between the throttle valve and the throttle valve chamber wall.

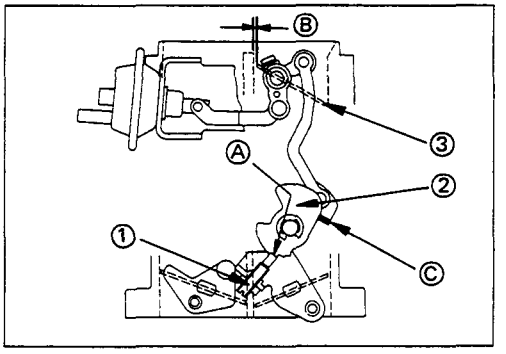
   If the measured clearance is outside the specified range, adjust it by carefully bending the kick lever tang.

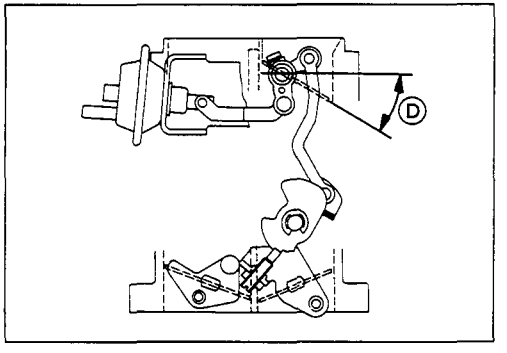
Throttle Valve and Throttle Valve Chamber Wall Clearance Ⓑ	mm(in)
6.9 – 8.4 (0.27 – 0.33)	

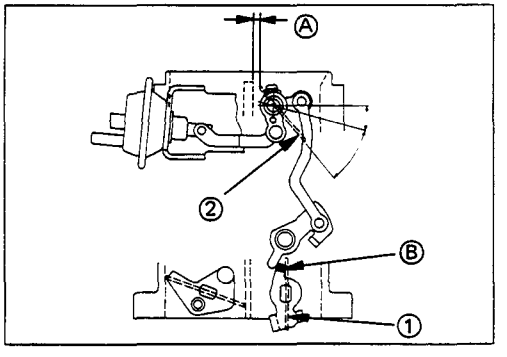
(Reference)

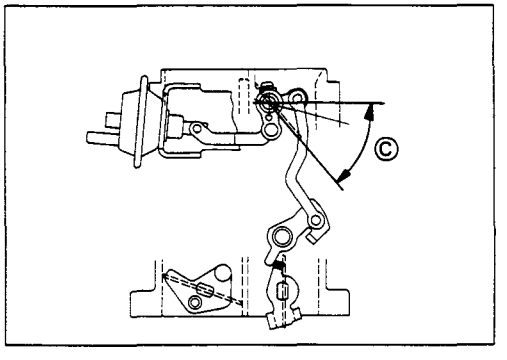
Primary Throttle Valve Angle ©	Deg.
57	

* When the clearance between the primary throttle valve and the throttle valve chamber wall is within the specified range.









Choke Valve Opening

1. Move the fast idling screw ① tip against the fast idling cam ② second step Ⓐ.
2. Measure the clearance Ⓑ between the choke valve ③ and the choke valve chamber wall.

   If the measured clearance is outside the specified range, adjust it by carefully bending the counter lever tang Ⓒ.

Choke Valve and Choke Valve Chamber Wall Clearance	mm(in)
0.8 — 1.3 (0.03 — 0.05)	

(Reference)

Choke Valve Angle Ⓓ	Deg.
30	

* When the clearance between the choke valve and the choke valve chamber wall is within the specified range.

Unloader

1. Fully open the primary throttle valve ①.
2. Measure the clearance Ⓐ between the choke valve ② and the choke valve chamber wall.

   If the measured clearance is outside the specified range, adjust it by carefully bending the adjusting lever tang Ⓑ.

Choke Valve and Choke Valve Chamber Wall Clearance	mm(in)
2.7 — 3.3 (0.11 — 0.13)	

(Reference)

Choke Valve Angle Ⓒ	Deg.
50	

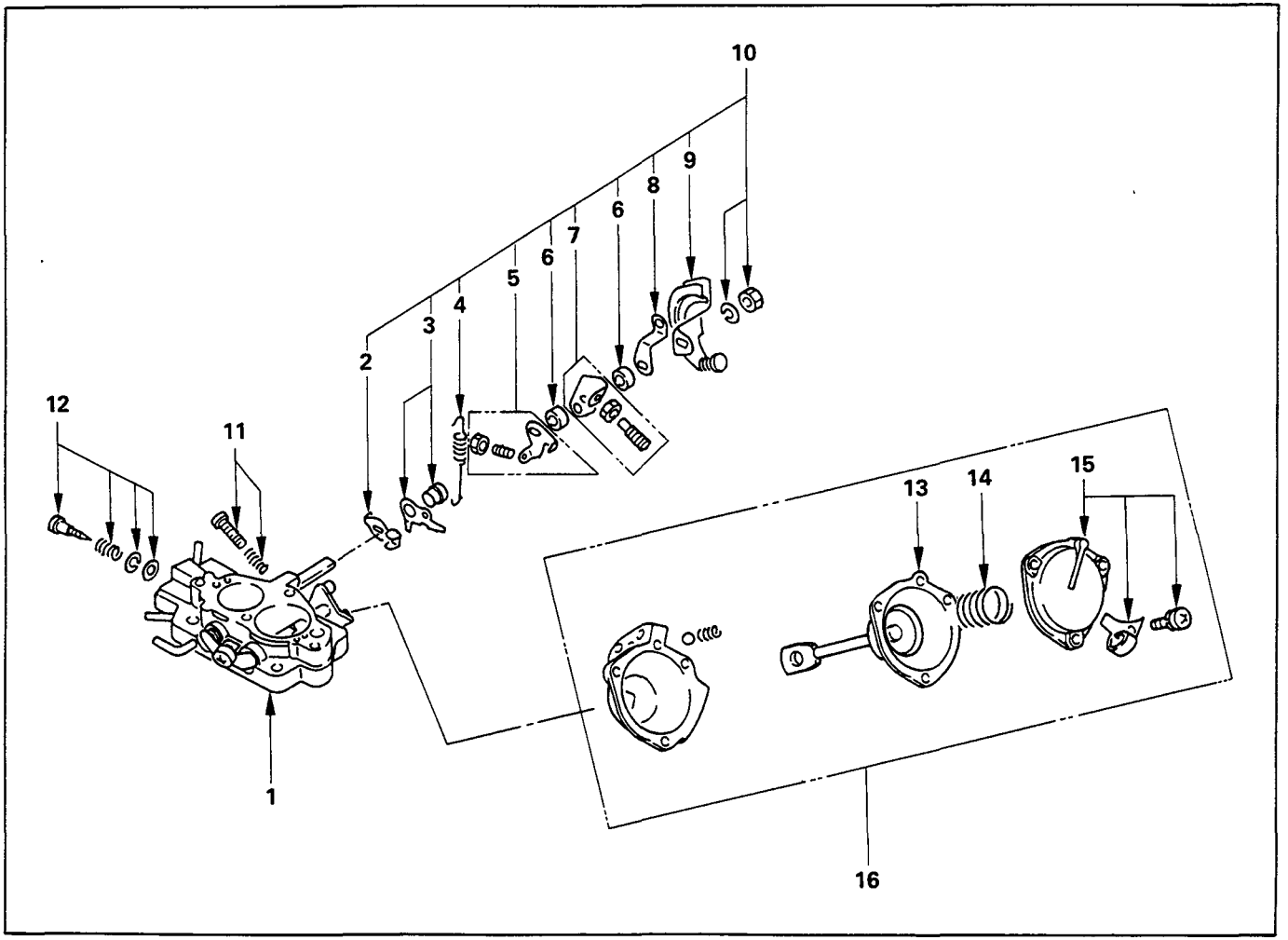
* When the clearance between the choke valve and the choke valve chamber wall is within the specified range.

0804

REASSEMBLY

MINOR COMPONENTS

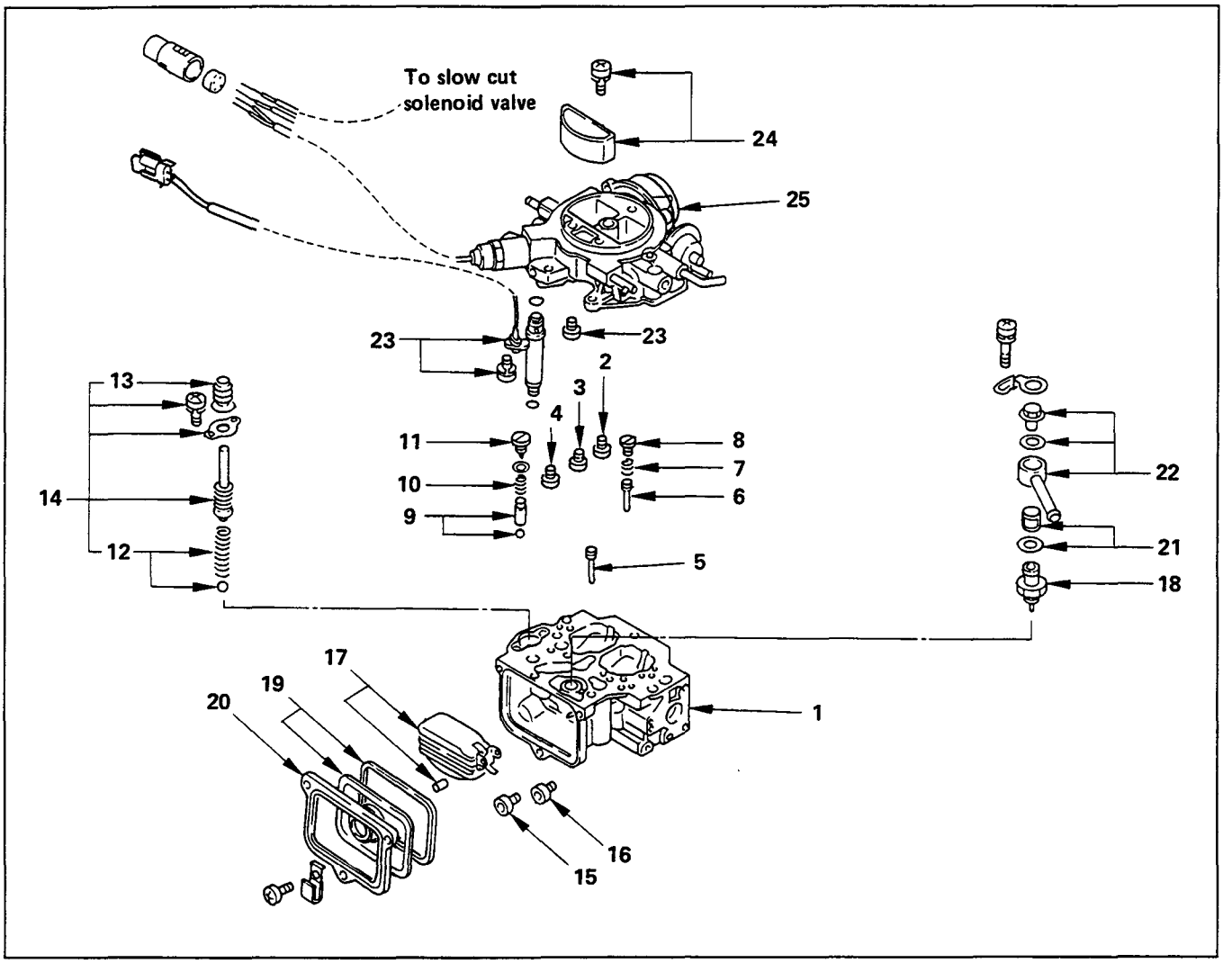
THROTTLE CHAMBER ASSEMBLY



Reassembly Steps

1. Throttle chamber
2. Adjusting lever
3. Return plate and sleeve
4. Return spring
5. Kick lever
6. Shaft collar
7. Fast idler adjusting lever and screw
8. Spring hanger
9. Throttle lever
10. Throttle shaft nut and washer
11. Throttle adjusting screw
12. Idler adjusting screw
13. Diaphragm
14. Diaphragm spring
15. Diaphragm chamber cover
16. Diaphragm chamber assembly

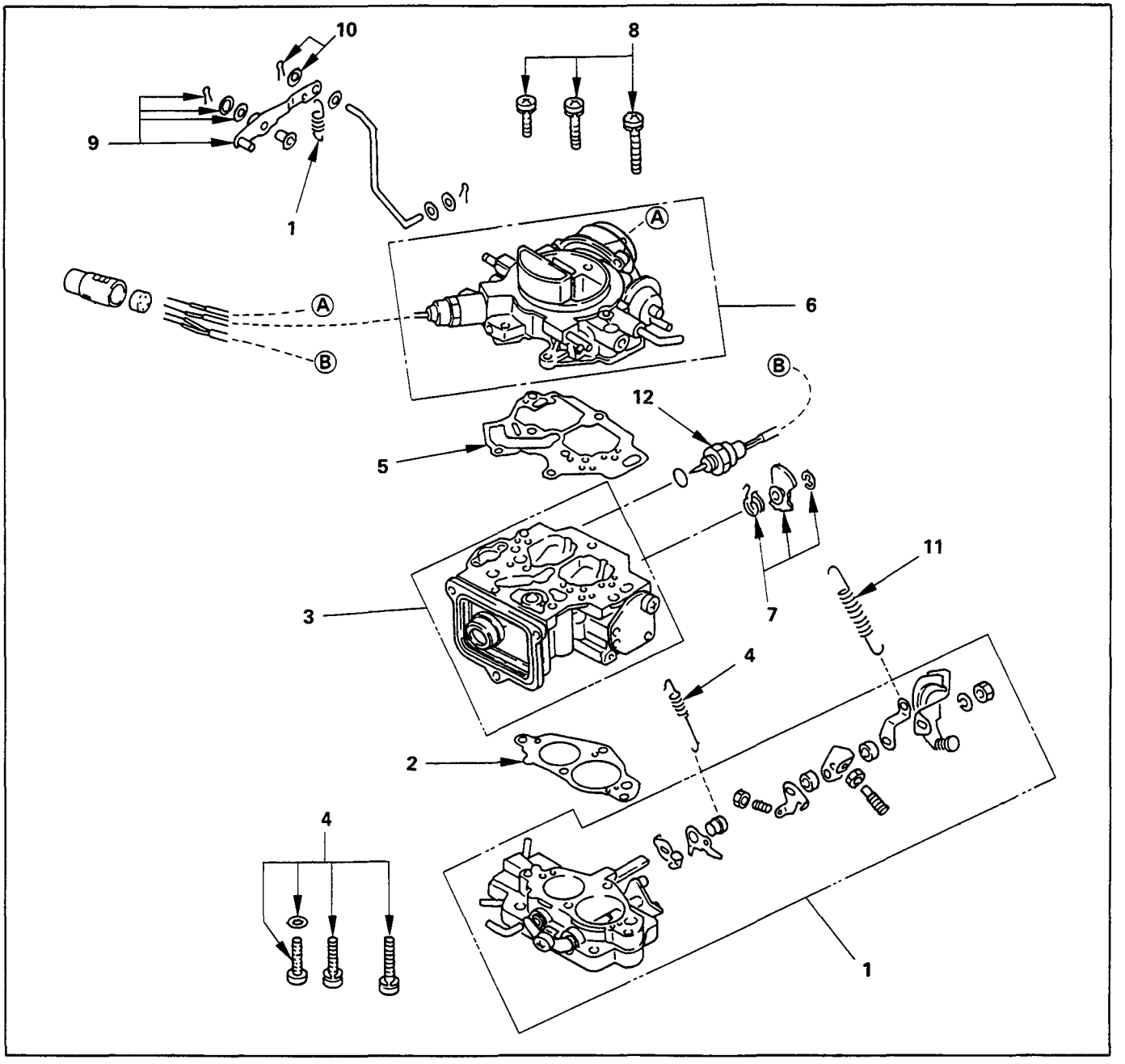
CHOKE CHAMBER AND FLOAT CHAMBER ASSEMBLY



Reassembly Steps

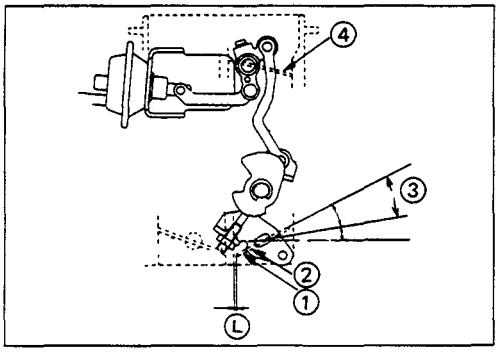
1. Float chamber
2. Primary slow air bleed
3. Secondary main air bleed
4. Primary main air bleed
5. Secondary slow jet
6. Primary slow jet
7. Slow jet spring
8. Taper plug
9. Injector weight
10. Injector spring
11. Pump set screw
12. Piston return spring
13. Pump cover
14. Piston
15. Primary main jet
16. Secondary main jet
17. Float and collar
18. Needle valve
19. Level gauge and rubber seal
20. Level gauge cover
21. Fuel filter
22. Fuel nipple
23. Duty solenoid valve or power jet
24. Vent cover
25. Choke chamber

MAJOR COMPONENTS



Reassembly Steps

1. Throttle chamber assembly
2. Float and throttle chamber gasket
3. Float chamber assembly
4. Throttle chamber screw and washer
5. Choke and float chamber gasket
6. Choke chamber assembly
7. Fast idler cam and spring
8. Choke chamber screw and washer
9. Pump lever and split pin with washer
10. Pump rod split pin with washer
11. Main spring
12. Slow cut solenoid valve



CARBURETOR ADJUSTMENT (Hitachi-Carburetor)

Primary Throttle Valve

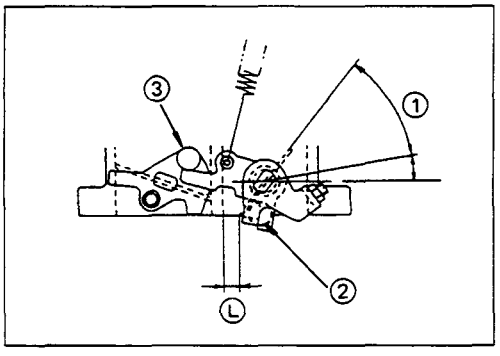
The fast idling adjusting screw ① should open the primary throttle valve ② to an angle of 15° ③ when the choke valve ④ is completely closed.

Check and adjust the primary throttle valve opening angle as follows:

1) Close the choke valve ④ completely.
2) Turn the throttle stop screw all the way in.
3) Measure the clearance between the primary throttle valve and the throttle valve chamber wall at the center of the throttle valve.

Throttle Valve and Throttle Valve Chamber Wall Clearance Ⓛ	mm(in)
1.28 — 1.51 (0.05 — 0.06)	

4) If required, use the fast idling adjusting screw to adjust the clearance.



Linkage

When the primary throttle valve is opened to an angle of 47° ①, the adjusting plate (interlocked with the primary throttle valve) makes contact with the kick lever at point ②.

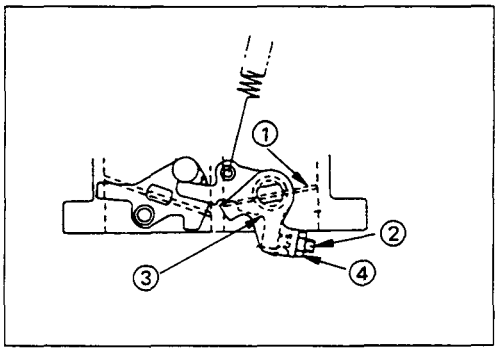
Further opening the primary throttle valve pulls the return plate away from the stopper ③, allowing the secondary throttle valve to open.

Check and adjust the secondary throttle valve opening point as follows:

1) Measure the clearance between the primary throttle valve and the throttle valve chamber wall at the center of the throttle valve.
   The adjusting plate must be contacting the kick lever at point ②.

Throttle Valve and Throttle Valve Chamber Wall Clearance Ⓛ	mm(in)
6.1 — 7.6 (0.24 — 0.30)	

2) If required, adjust the clearance by carefully bending the kick lever at point ②.



Kick Lever

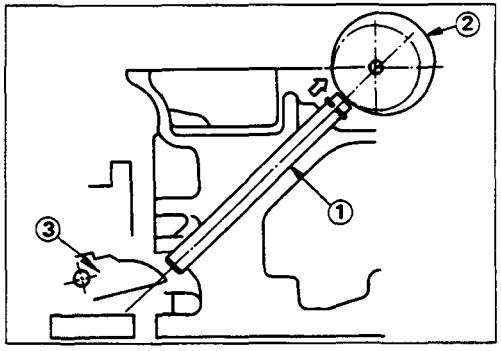
1) Turn out the throttle adjusting screw until the primary throttle valve ① is completely closed.
2) Loosen the lock nut on the kick lever screw ②.
3) Turn the kick lever screw until it makes contact with the return plate ③.
4) Tighten the lock nut ④.

FUEL PUMP

REMOVAL AND INSTALLATION

Read this Section carefully before performing any removal and installation procedure. This Section gives you important points as well as the order of operation. Be sure that you understand everything in this Section before you begin.

Important Operations — Installation



▲ **Fuel Pump**

1) Remove the cylinder head cover.
2) Place the No. 4 piston at top dead center.
3) Lift the push rod ① toward the camshaft ②.
   Hold the push rod in the raised position.
4) Install the fuel pump ③.
5) Tighten the fuel pump bolts to the specified torque.

Fuel Pump Bolt Torque	kg·m(lb.ft/N·m)
2.7 ± 0.5 (19.5 ± 3.6/26.5 ± 4.9)	

Note:

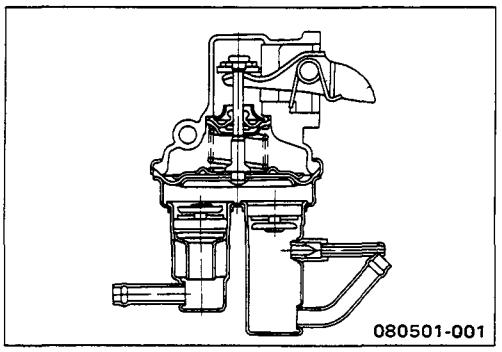
Start the engine and check for oil leakage around the gaskets and fuel leakage from the hose joints.

080501

INSPECTION AND REPAIR

Make the necessary adjustments, repairs, and part replacements if excessive wear or damage is discovered during inspection.

08050101



08050102

Fuel Pump External Inspection

1. Check the outside of the fuel pump for cracks and other damage.

   Replace the fuel pump if cracks or other damage are discovered.

2. Check for excessive wear between the rocker arm and the camshaft contact faces.

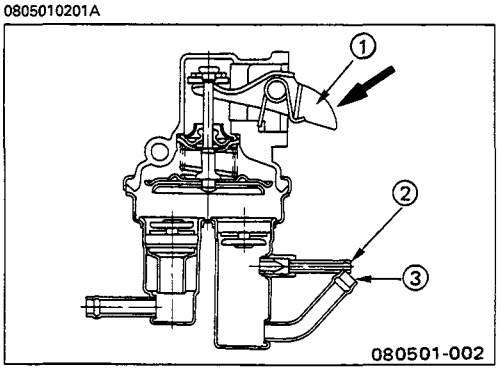
   If there is excessive wear, the fuel pump must be replaced.

Fuel Pump Internal Inspection

Perform following steps before beginning the inspection procedure.

1. Pour a small amount of clean fuel into the fuel pump.
2. Moisten the valve seal with clean fuel.

0805010201A



Inlet Valve

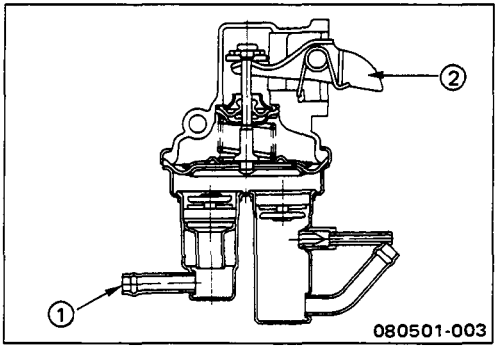
1. Move the rocker arm ① toward the pump and hold it in that position.
2. Block the return pipe ② and the outlet pipe ③ with your fingers.
3. Carefully push the rocker arm back to its original position.

   Your fingers must be blocking the pipes at this time.

   There should be a marked increase in rocker arm play after the rocker arm is returned to its original position.

   If there is not a marked increase in rocker arm play, the fuel pump must be replaced.

0805010201B



Outlet Valve

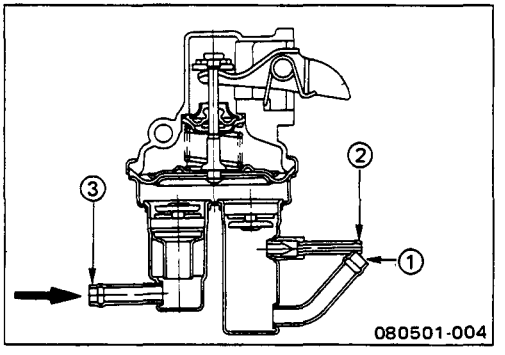
1. Block the inlet pipe ① with your fingers.
2. Move the rocker arm ② to check for excessive play.

   The fuel pump must be replaced if there is excessive play.

Note:

Do not apply too much force to the rocker arm.

0805010201C



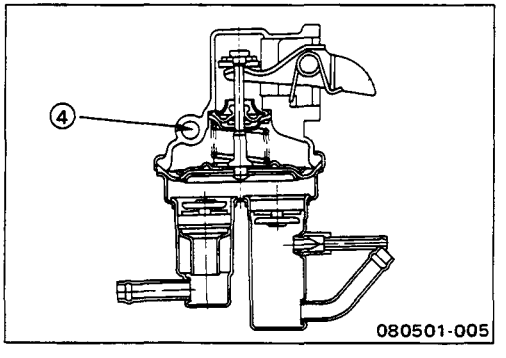
Diaphragm

1. Block the outer pipe ① and the return pipe ②.
2. Use a leak tester to apply 0.3 kg/cm^2 (4.3 psi/29.4 kPa) of air pressure to the inlet pipe ③.
3. Release the leak tester handle.

   There should be no sudden drop in air pressure.

   If there is a sudden drop in air pressure, the fuel pump must be replaced.

0805010201D



Oil Seal

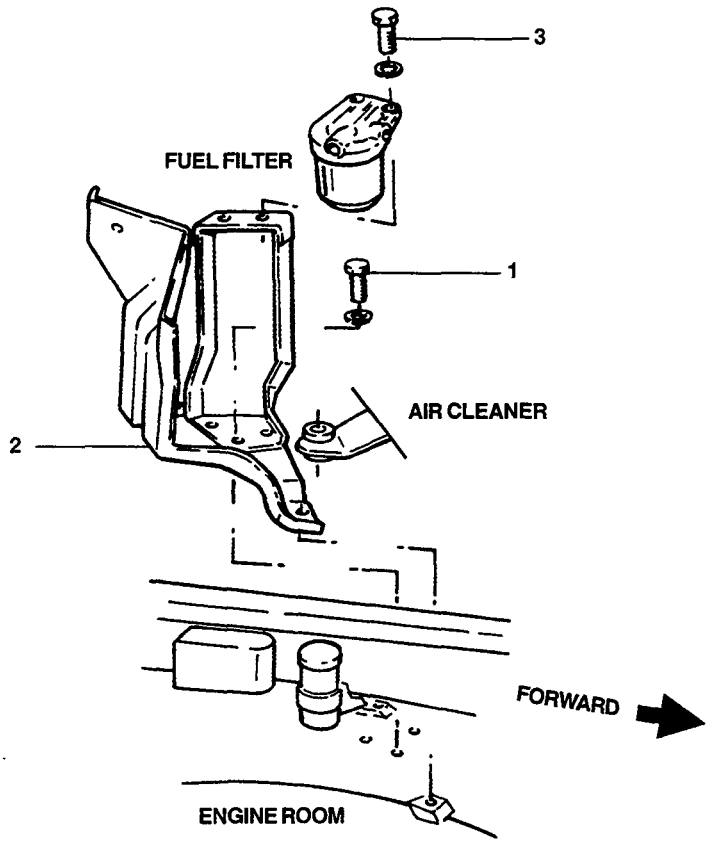
1. Use a leak tester to apply 0.1 kg/cm^2 (1.4 psi/9.8 kPa) of air pressure to the air pipe ④.
2. Release the leak tester handle.

   There should be no sudden drop in air pressure.

   If there is a sudden drop in air pressure, the fuel pump must be replaced.

FUEL FILTER

REMOVAL AND INSTALLATION



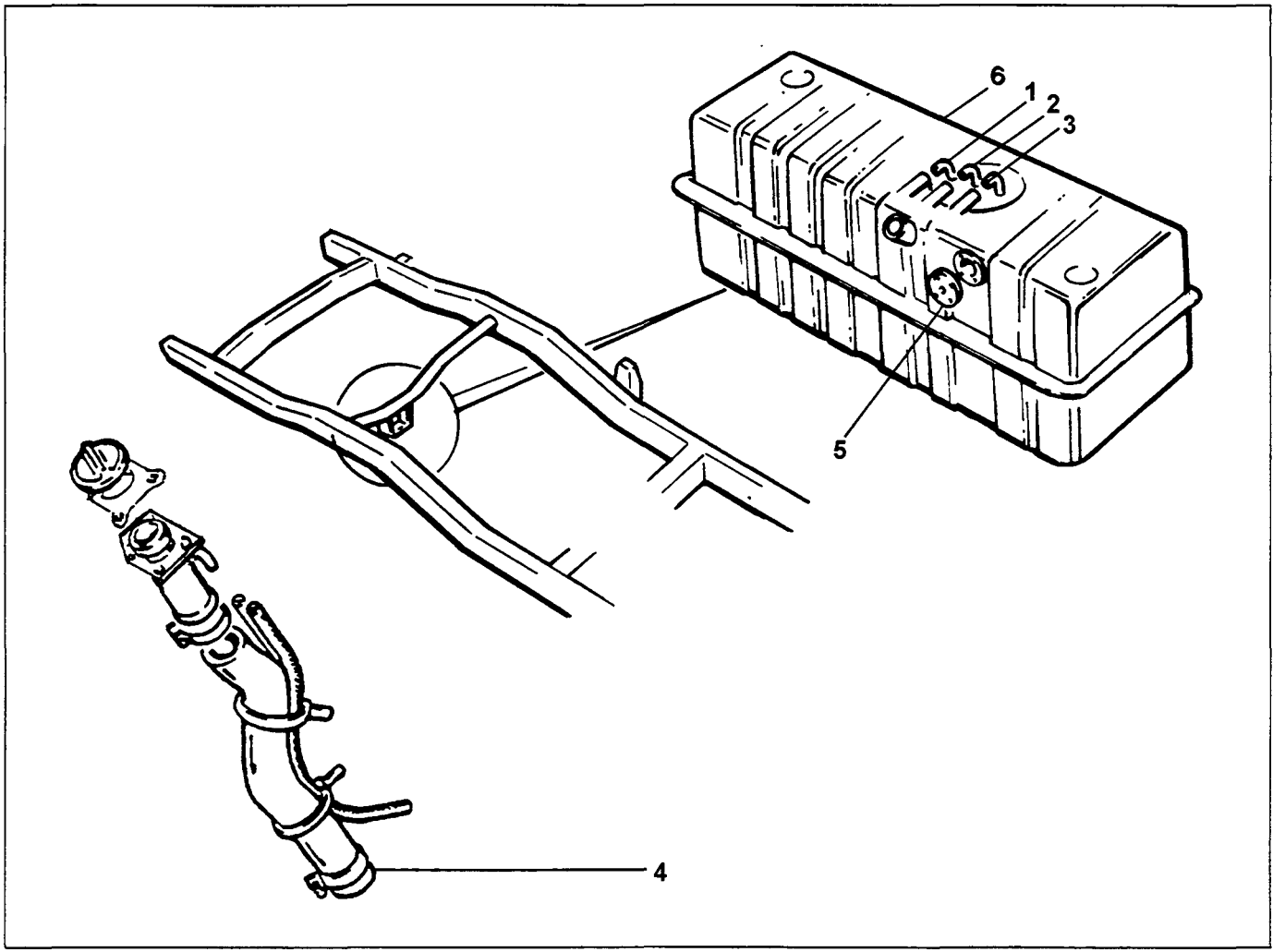
Removal Steps

1. Bolt; Bracket to body
2. Bracket; Fuel filter
3. Bolt; Fuel filter

Installation Steps

3. Bolt; Fuel filter
2. Bracket; Fuel filter
1. Bolt; Fuel filter

FUEL TANK
REMOVAL AND INSTALLATION



Removal Steps

1. Breather hose
2. Fuel delivery hose
3. Fuel return hose
4. Filler neck hose
5. Fuel tank unit
6. Tank ASM

Installation Steps

6. Tank ASM
5. Fuel tank unit
4. Filler neck hose
3. Fuel return hose
2. Fuel delivery hose
1. Breather hose

INSPECTION AND REPAIR

Make all necessary adjustments, repairs, and part replacements if wear, damage, or other problems are discovered during inspection.

- Fuel rubber hose
- Evaporator rubber hose
- Fuel filter hose

Visual Check

Check the parts listed at the left for excessive wear and damage.

TROUBLESHOOTING

Refer to this Section to quickly diagnose and repair fuel system problems. Each troubleshooting chart has three headings arranged from left to right.

(1) Checkpoint (2) Trouble Cause (3) Countermeasure

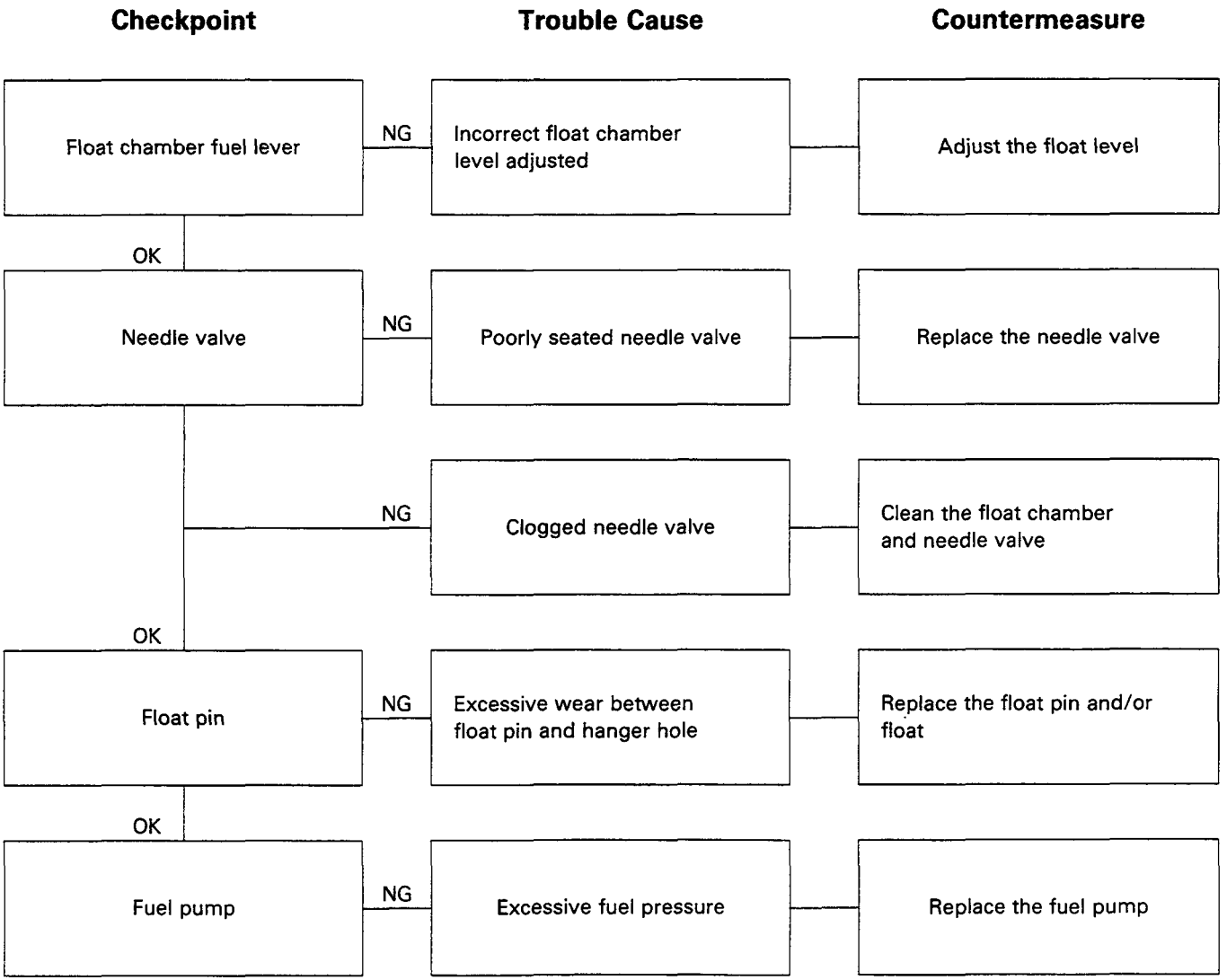
This Section is divided into seven sub-sections:

1. Fuel Over Flowing
2. Fuel Not Reaching Float Chamber
3. Unstable Idling
4. Excessive Fuel Consumption
5. Insufficient Power
6. Flat Spot on Accereleration
7. Flat Spot on High Speed Operation

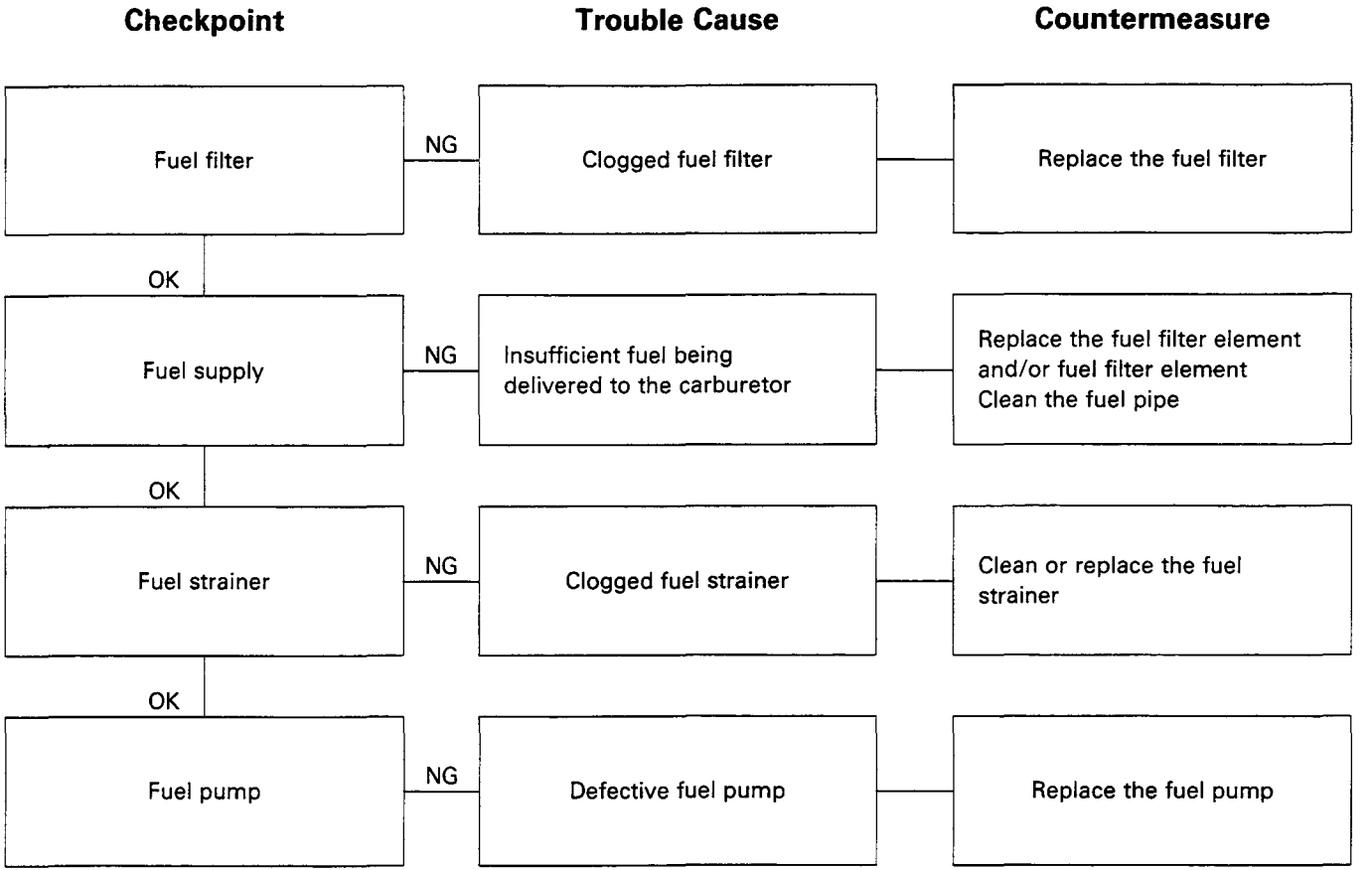
Note:

[V] : Variation (Optional on some models)

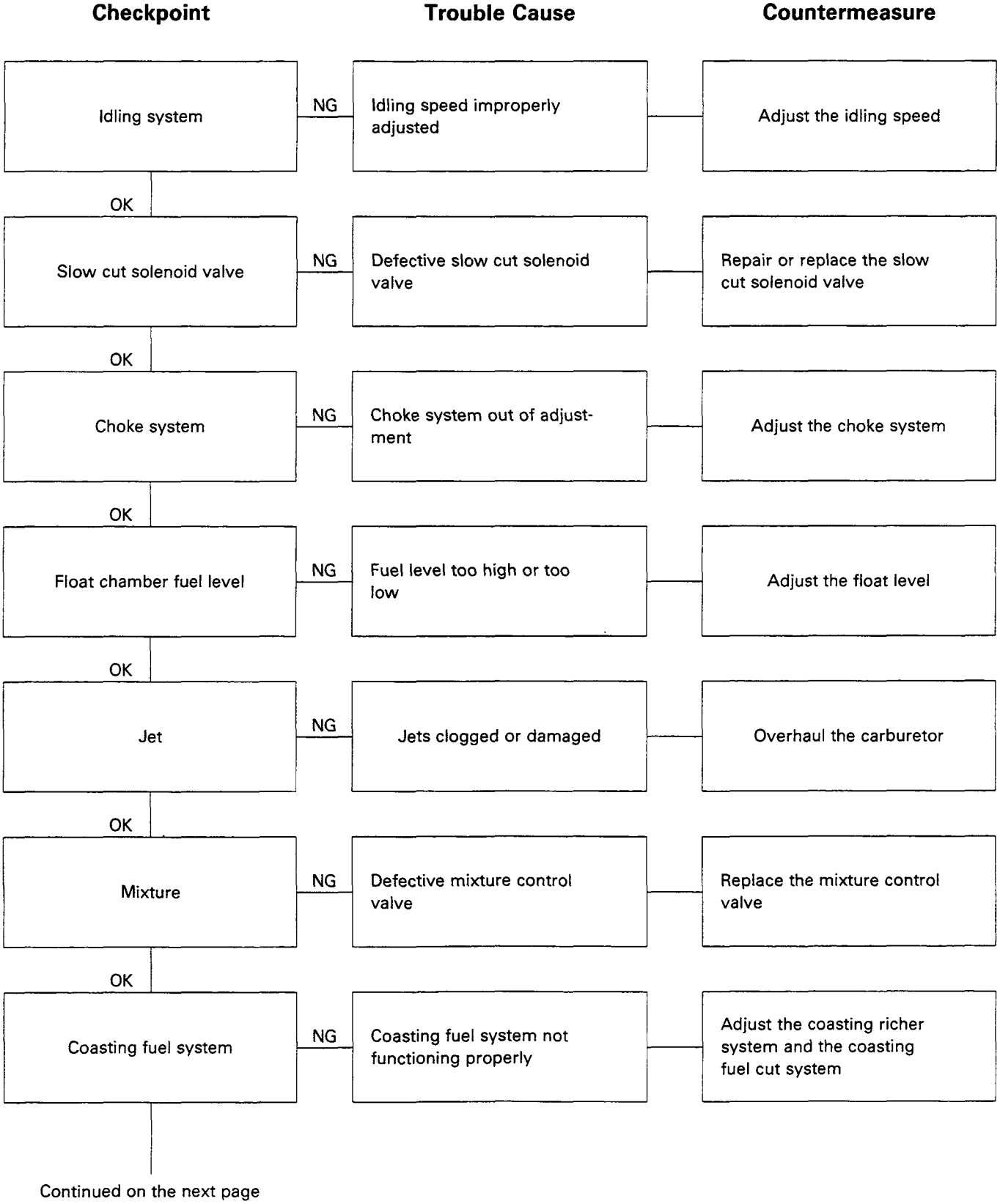
FUEL OVER FLOWING



FUEL NOT REACHING FLOAT CHAMBER



UNSTABLE IDLING



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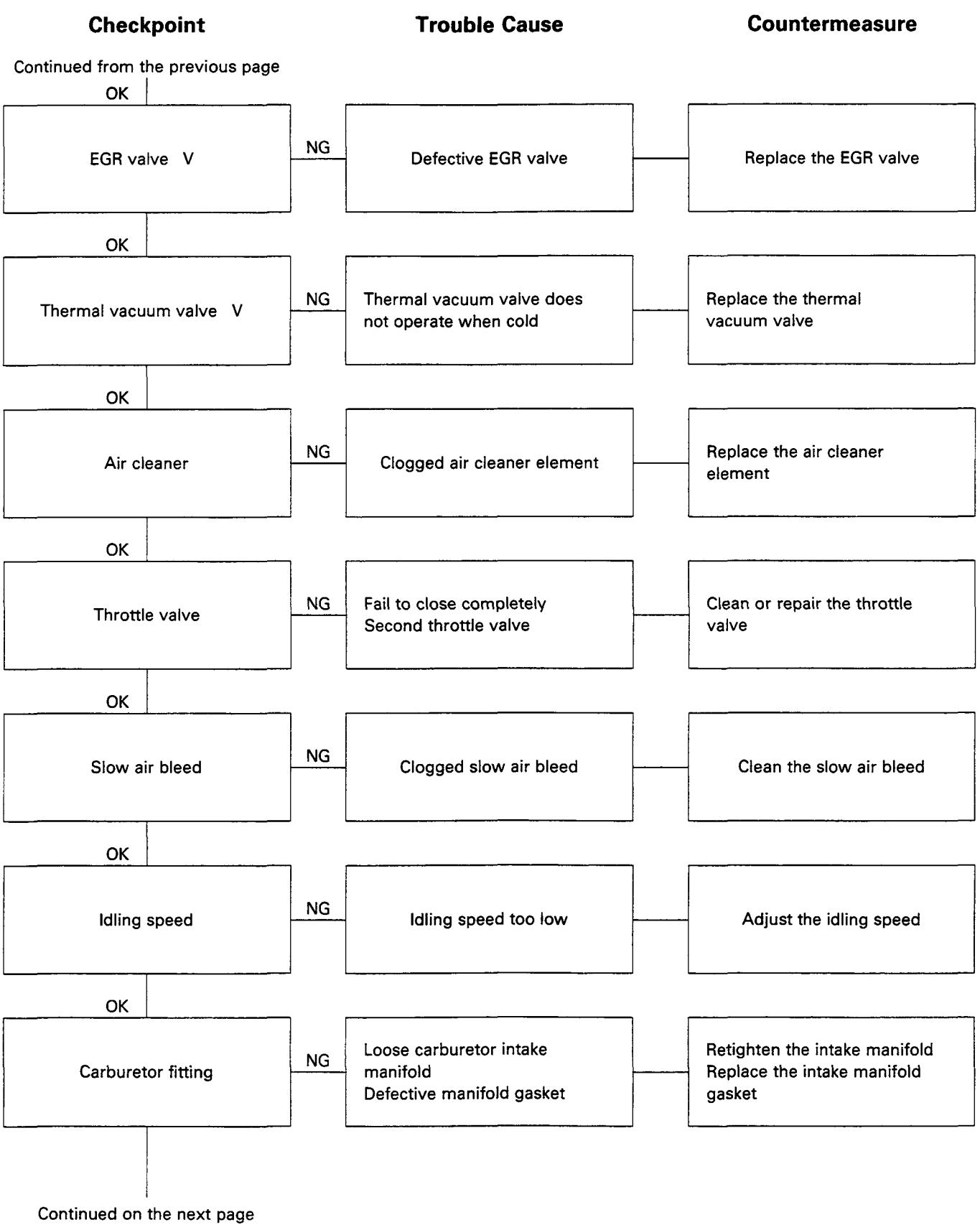
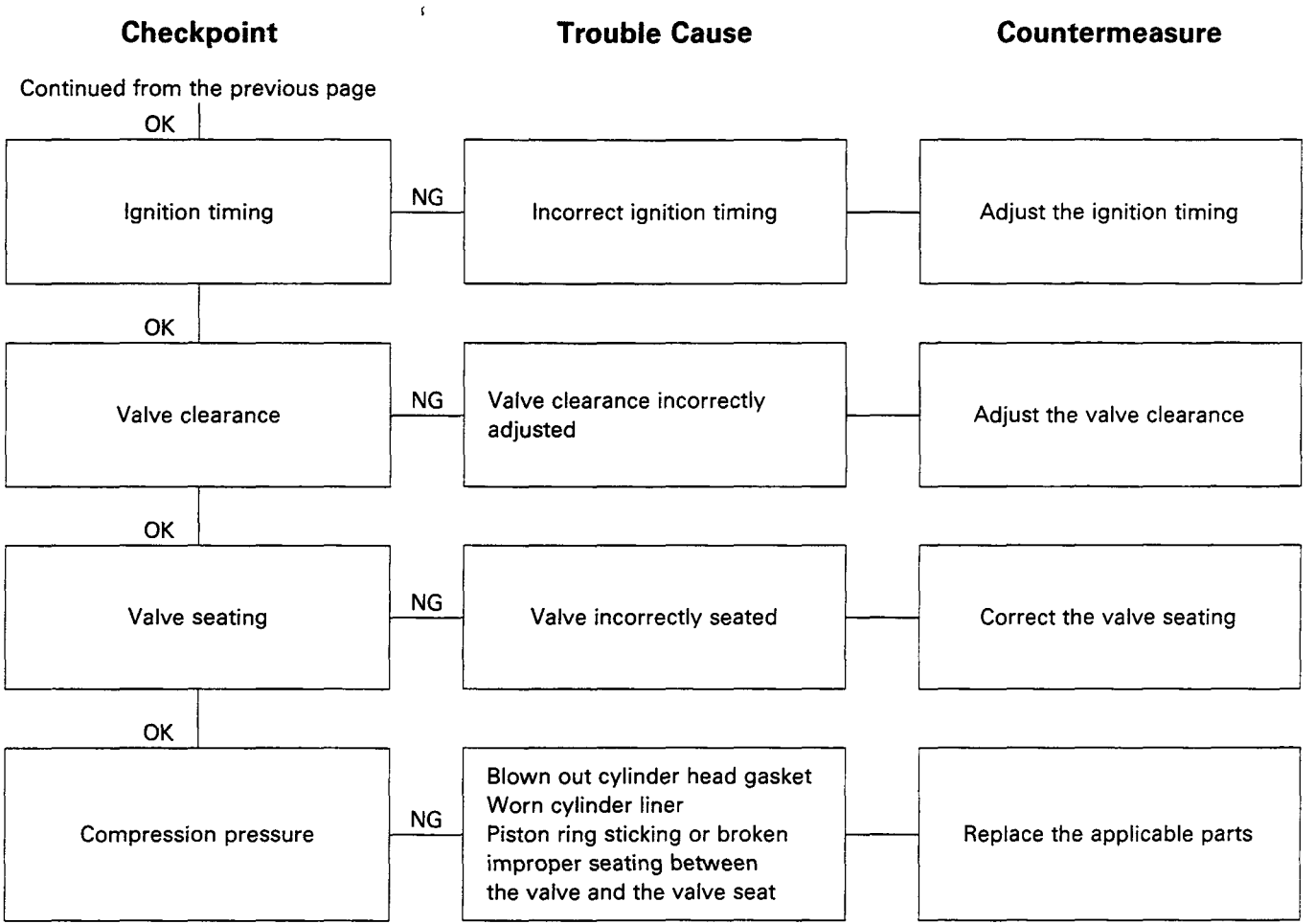
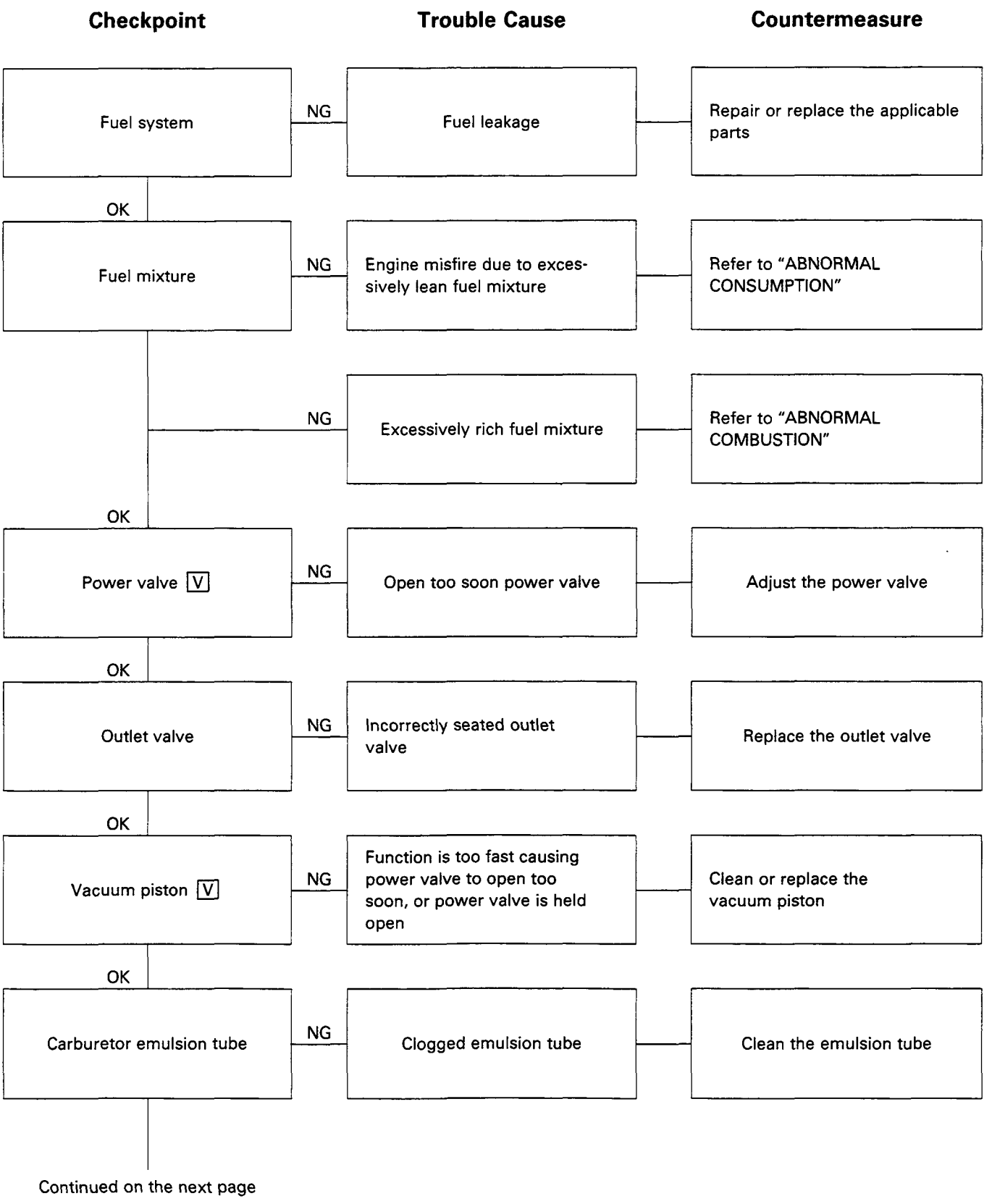

Checkpoint
Trouble Cause
Countermeasure
Continued from the previous page
OK
EGR valve V
NG
Defective EGR valve
Replace the EGR valve
OK
Thermal vacuum valve V
NG
Thermal vacuum valve does not operate when cold
Replace the thermal vacuum valve
OK
Air cleaner
NG
Clogged air cleaner element
Replace the air cleaner element
OK
Throttle valve
NG
Fail to close completely
Second throttle valve
Clean or repair the throttle valve
OK
Slow air bleed
NG
Clogged slow air bleed
Clean the slow air bleed
OK
Idling speed
NG
Idling speed too low
Adjust the idling speed
OK
Carburetor fitting
NG
Loose carburetor intake manifold
Defective manifold gasket
Retighten the intake manifold
Replace the intake manifold gasket
Continued on the next page


Checkpoint
Trouble Cause
Countermeasure
Continued from the previous page
OK
Ignition timing
NG
Incorrect ignition timing
Adjust the ignition timing
OK
Valve clearance
NG
Valve clearance incorrectly adjusted
Adjust the valve clearance
OK
Valve seating
NG
Valve incorrectly seated
Correct the valve seating
OK
Compression pressure
NG
Blown out cylinder head gasket
Worn cylinder liner
Piston ring sticking or broken
improper seating between the valve and the valve seat
Replace the applicable parts

EXCESSIVE FUEL CONSUMPTION



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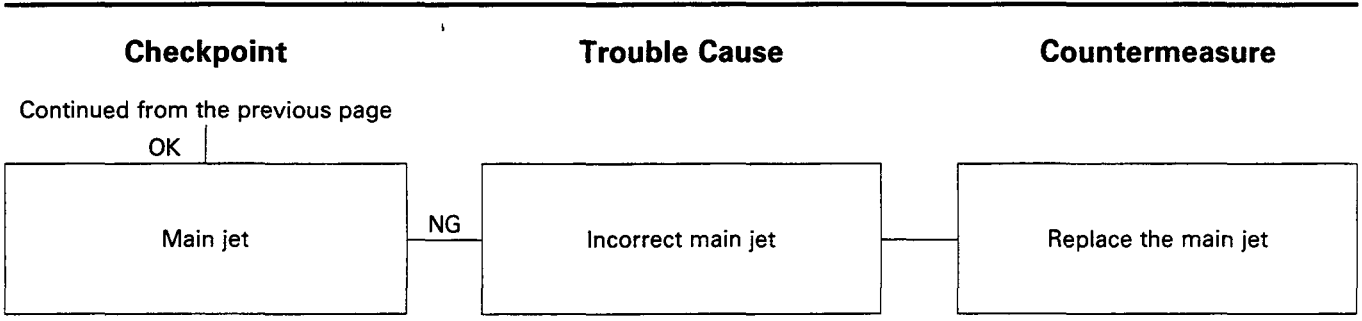
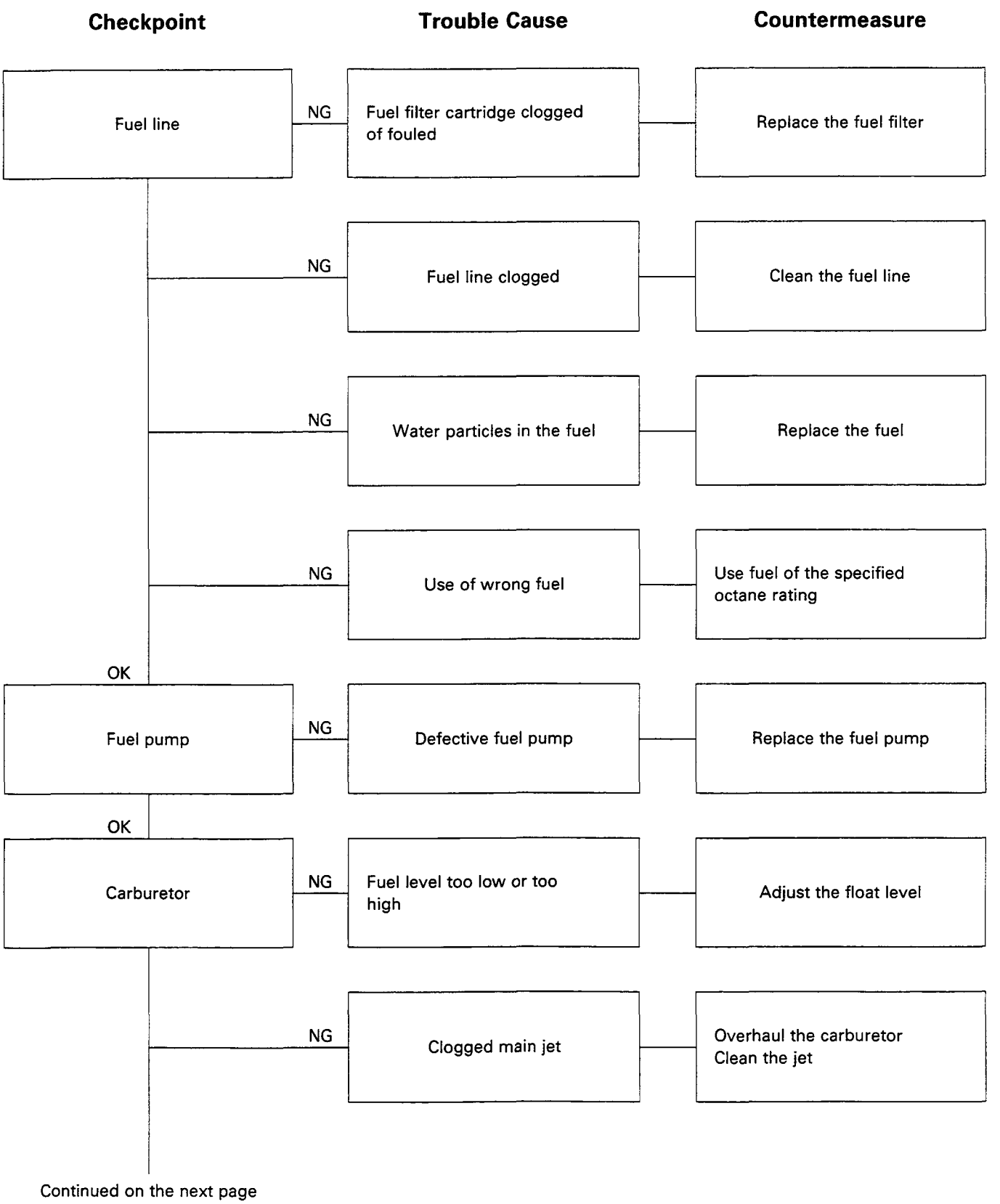

Checkpoint
Trouble Cause
Countermeasure
Continued from the previous page
OK
Main jet
NG
Incorrect main jet
Replace the main jet

INSUFFICIENT POWER



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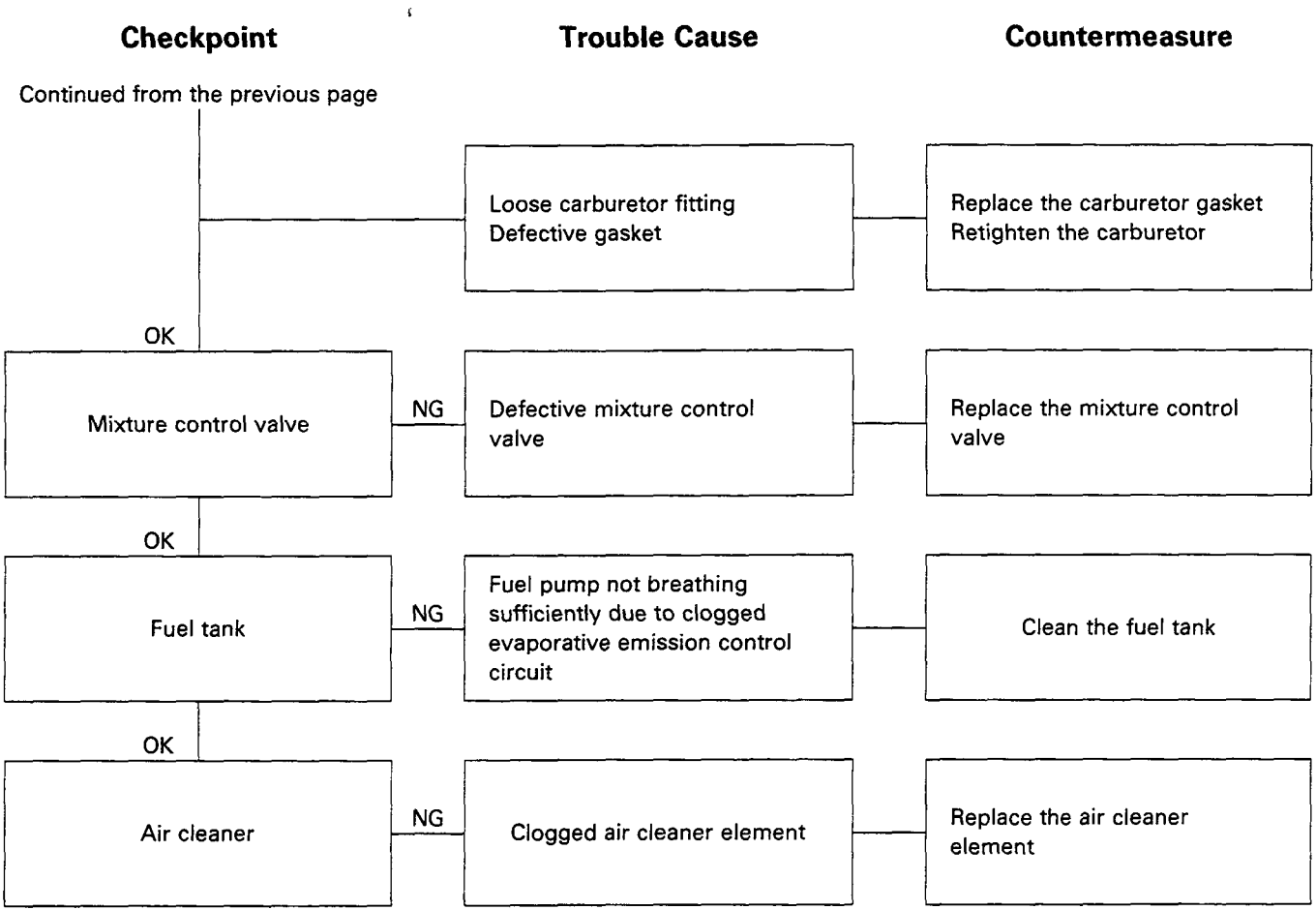
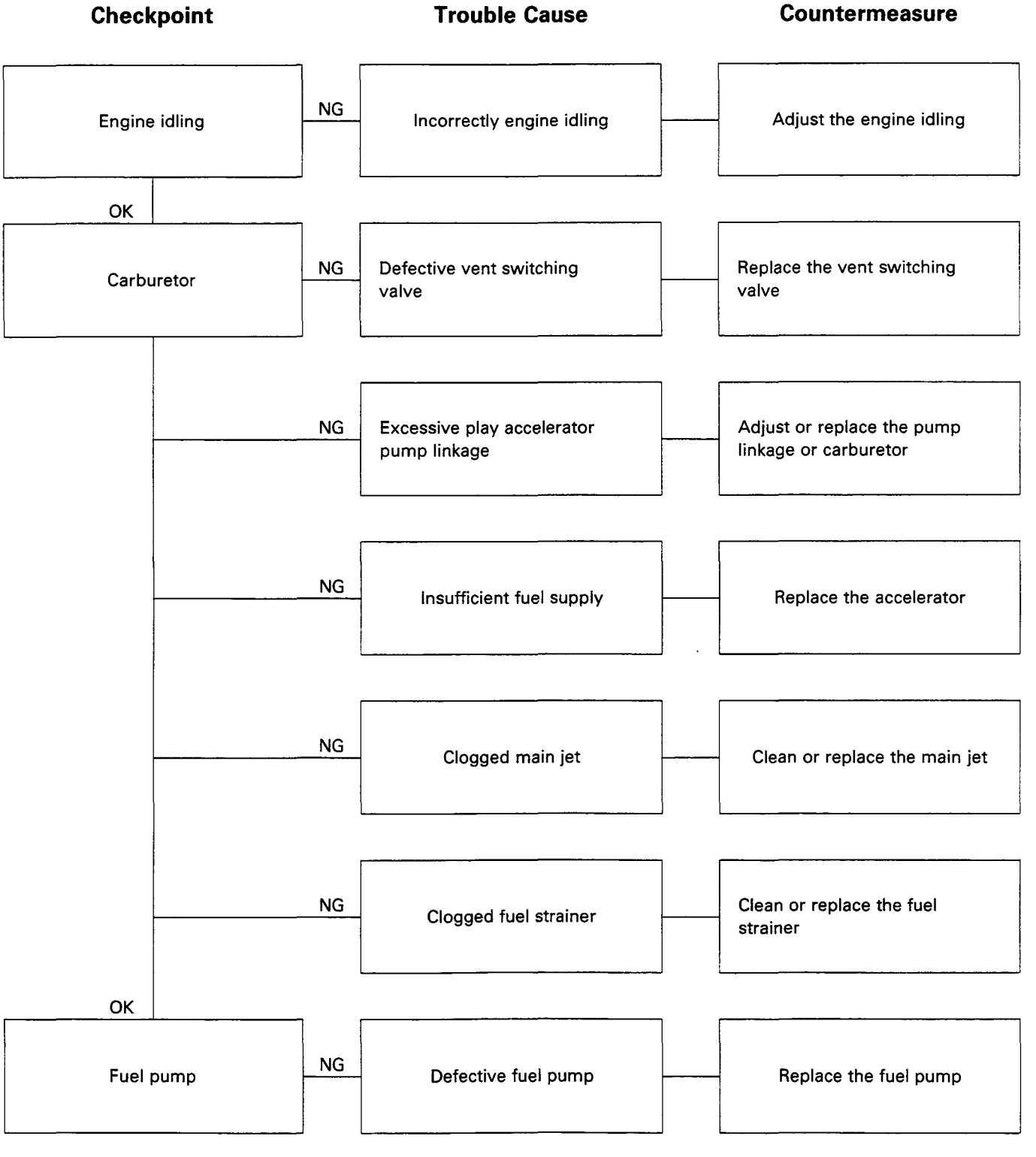
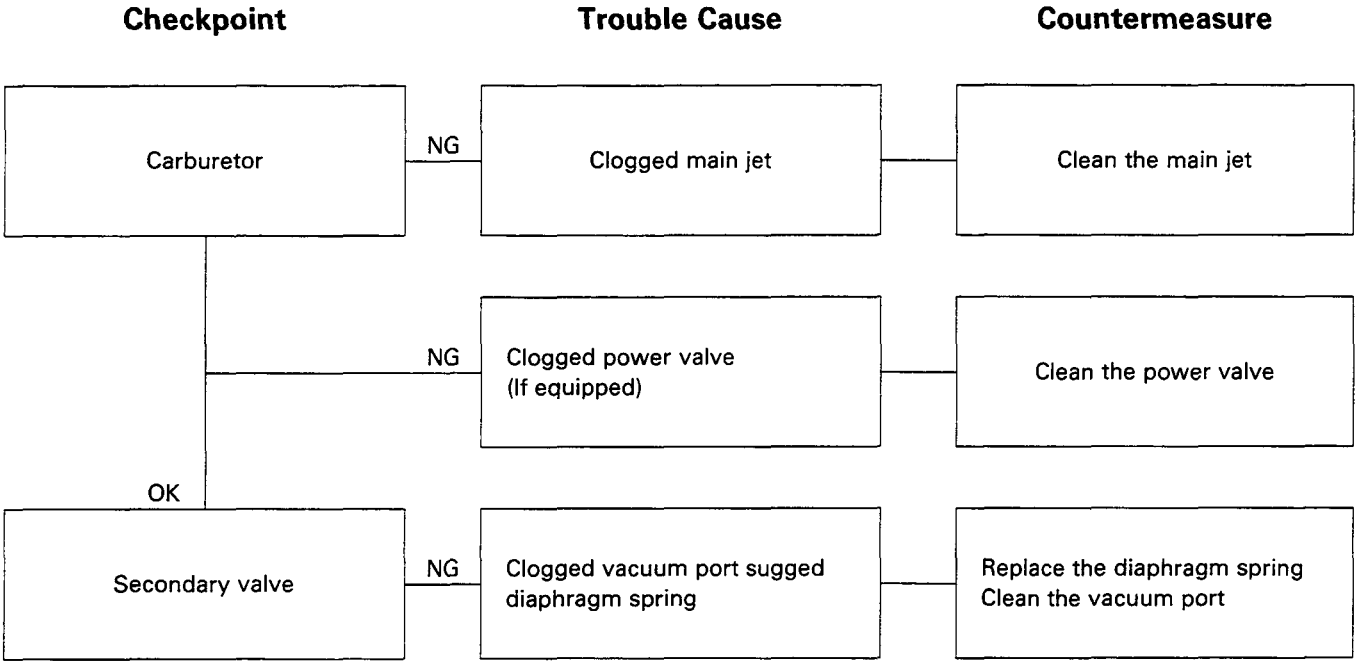

Checkpoint
Trouble Cause
Countermeasure
Continued from the previous page
Loose carburetor fitting
Defective gasket
Replace the carburetor gasket
Retighten the carburetor
OK
Mixture control valve
NG
Defective mixture control valve
Replace the mixture control valve
OK
Fuel tank
NG
Fuel pump not breathing sufficiently due to clogged evaporative emission control circuit
Clean the fuel tank
OK
Air cleaner
NG
Clogged air cleaner element
Replace the air cleaner element

FLAT SPOT ON ACCELERATION



FLAT SPOT ON HIGH SPEED OPERATION



SECTION 6D

ENGINE ELECTRICAL

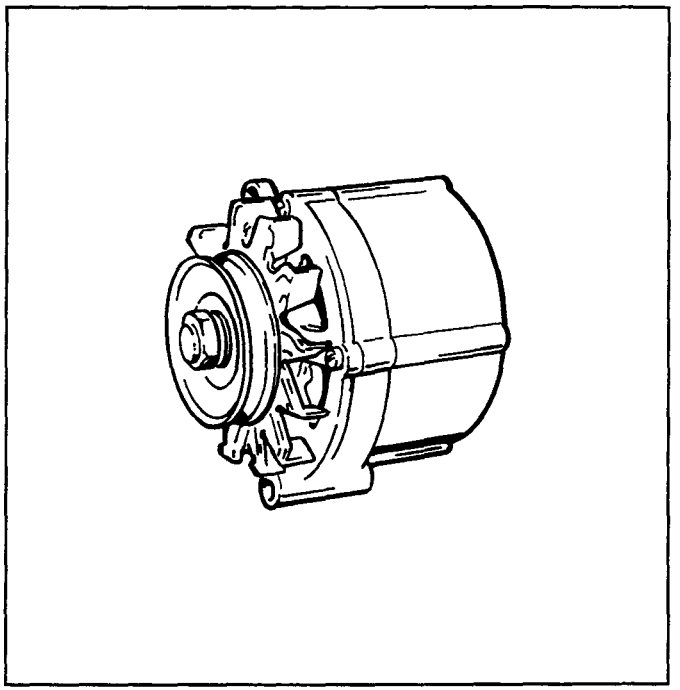
TABLE OF CONTENTS

MAIN DATA AND SPECIFICATIONS

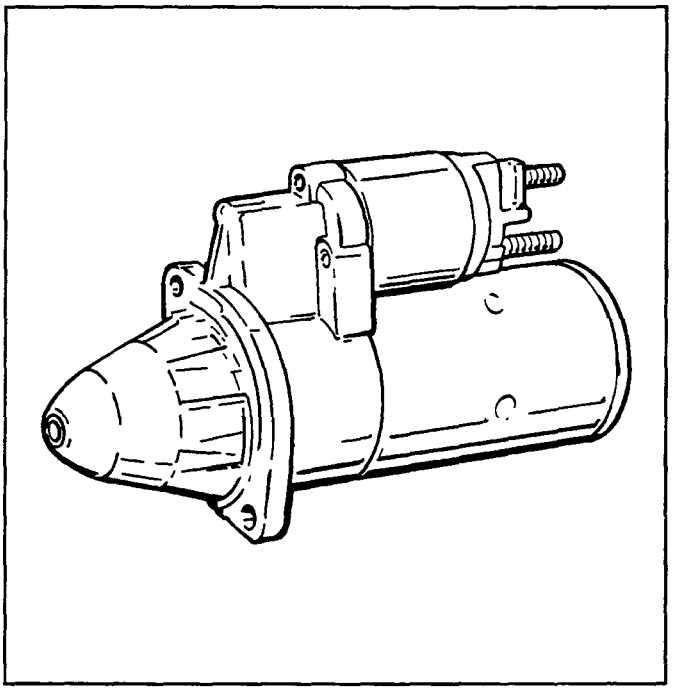
Item		Description
STARTER MOTOR		
Type		Magnet shift, Reduction type
Rated voltage	V	12
Rated out-put	kW	1.4 kW
Terminal voltage - with load	V	8
ALTERNATOR		
Type	V	Stator diode rectified
Voltage	V	12
Drive & rotation		V-belt, clockwise viewed from front
Ground polarity		Negative
Maximum out-put Amperameter	A	55
REGULATOR		
Type		IC regulator
DISTRIBUTOR		
Type		Full Transistor type (Contact pointless)
Ignition interval		89° - 91°
Direction of rotation		Clockwise (as viewed from capside)
SPARK PLUG		
Model		BPR6ES or BPR6ES11
Size	mm(in)	M14, P = 1.25 (0.049)
Spark gap	mm(in)	
without catalytic converter vehicle		0.7 - 0.8 (0.028 - 0.031)
with catalytic converter vehicle		1.0 - 1.1 (0.040 - 0.043)

GENERAL DESCRIPTION

ALTERNATOR



STARTER MOTOR



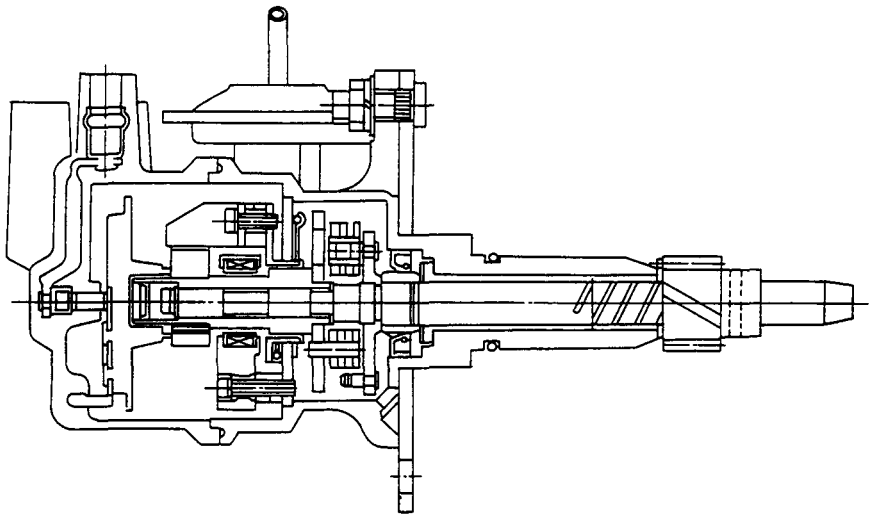
ALTERNATOR

The basic charging system is the IC integral regulator charging system.
The generator features a solid state regulator that is mounted inside the generator. All regulator components are enclosed into a solid mold, and this unit along with the brush holder assembly is attached to the slip ring end frame. The generator voltage setting cannot be adjusted.

STARTER

The starter motor circuit is composed of a 4-pole 4-brush type direct current series motor, ignition switch with safety lock, etc. The starter motor circuit utilizes negative ground polarity.
The starter engagement mechanism is of an integral type with the main switch fitted into the magnetic switch that controls shifting of the starter pinion. The pinion incorporates an overrunning clutch.

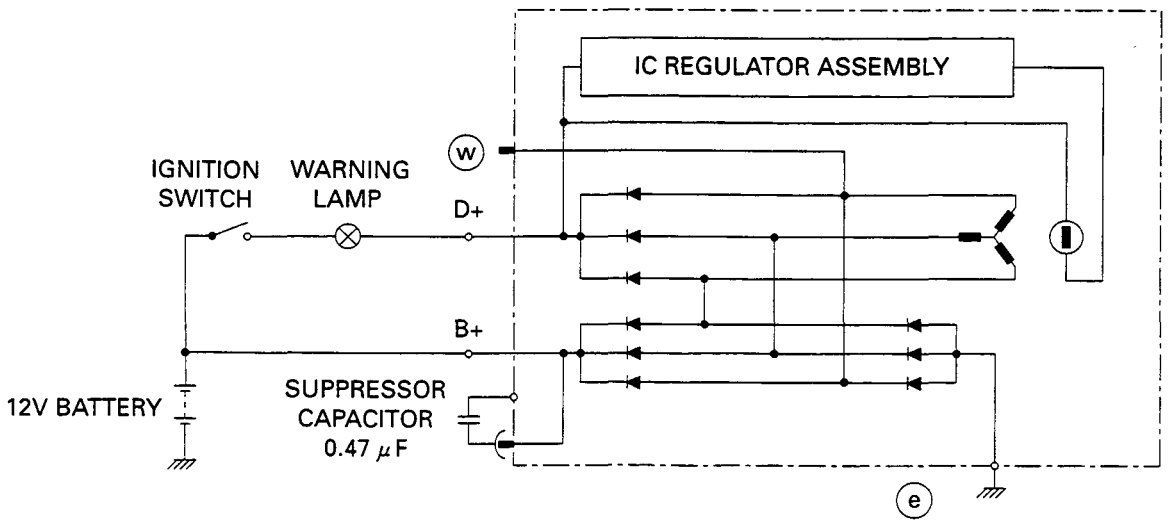
DISTRIBUTOR



The 4Z series engine uses a full transisterized type. (Contact pointless type).

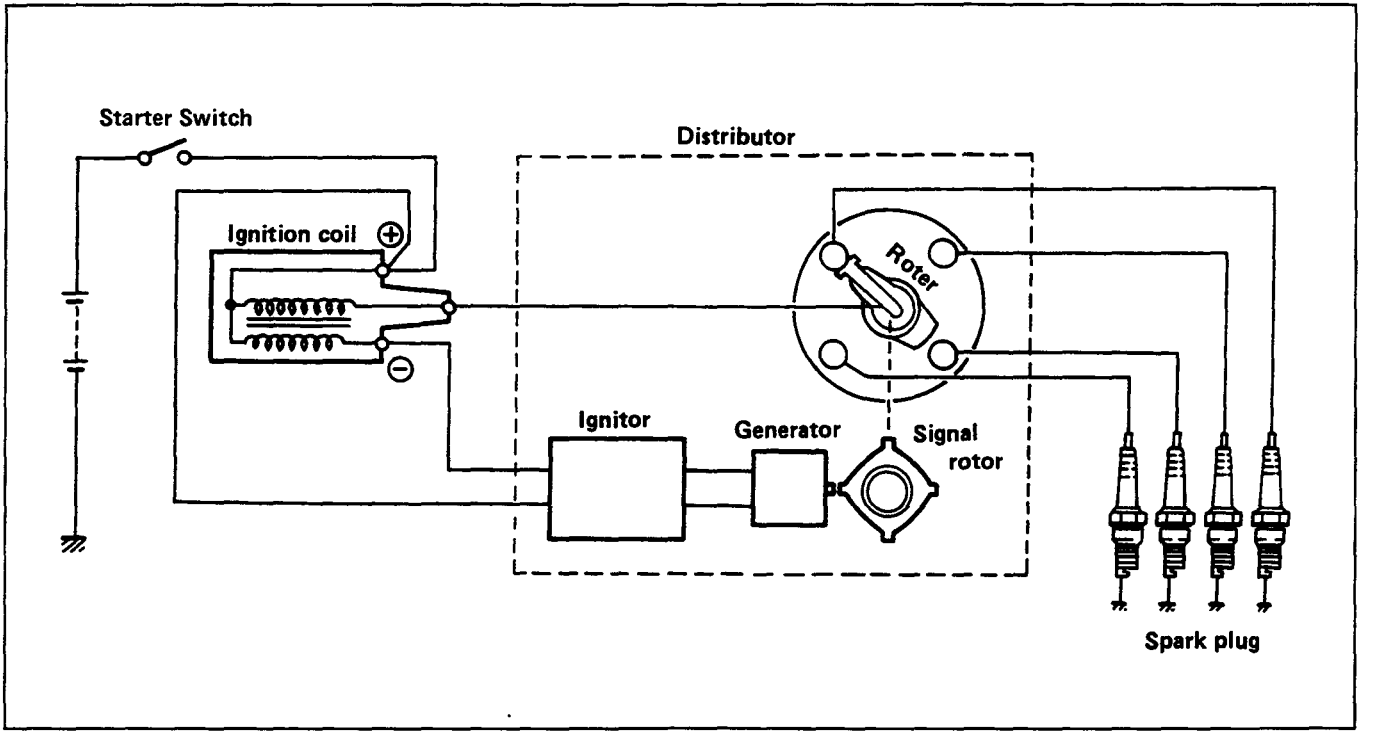
The distributor consists of the distributor shaft, the rotor shaft, the rotor head, the breaker assembly, the reluctor, the governor flyweight, the pinion gear, and the vacuum control.

CHARGING CIRCUIT DIAGRAM



D06LV003

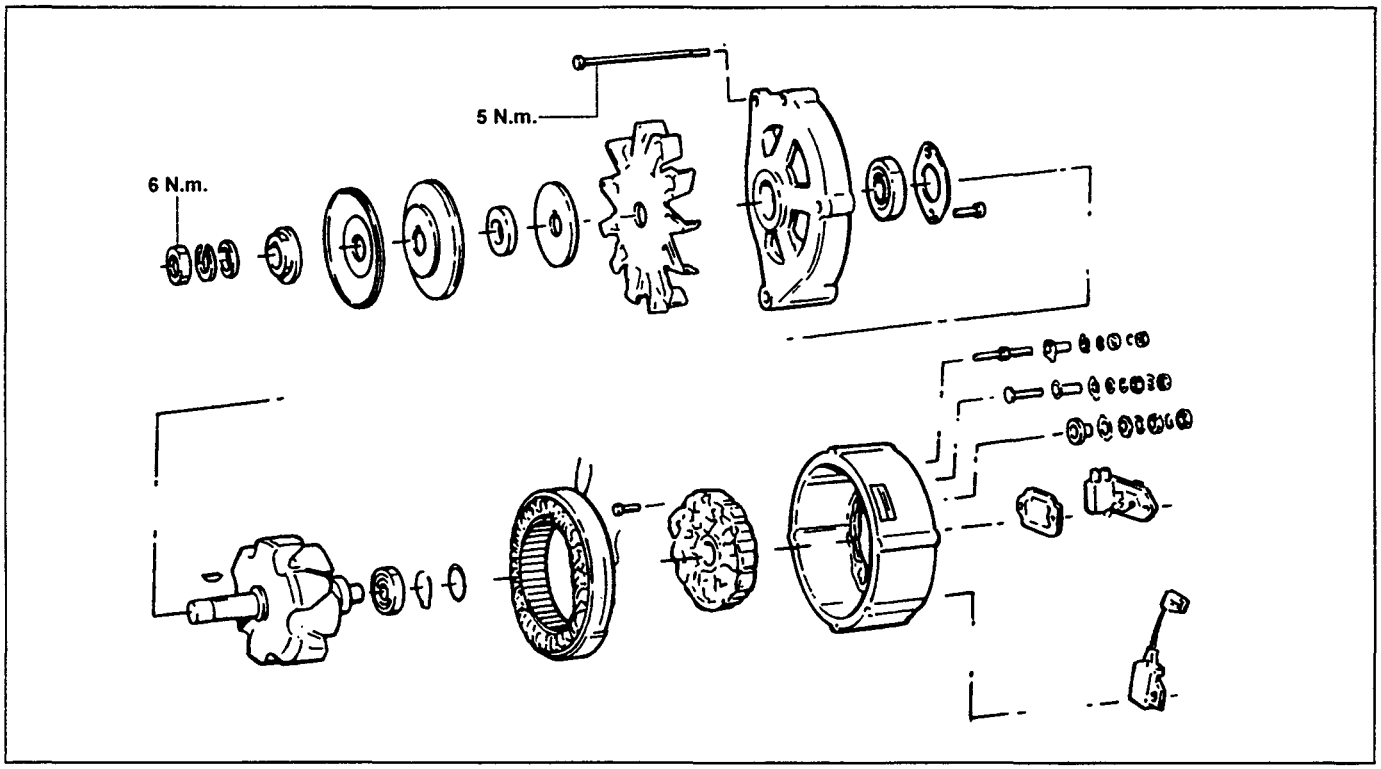
IGNITION CIRCUIT



TORQUE SPECIFICATIONS

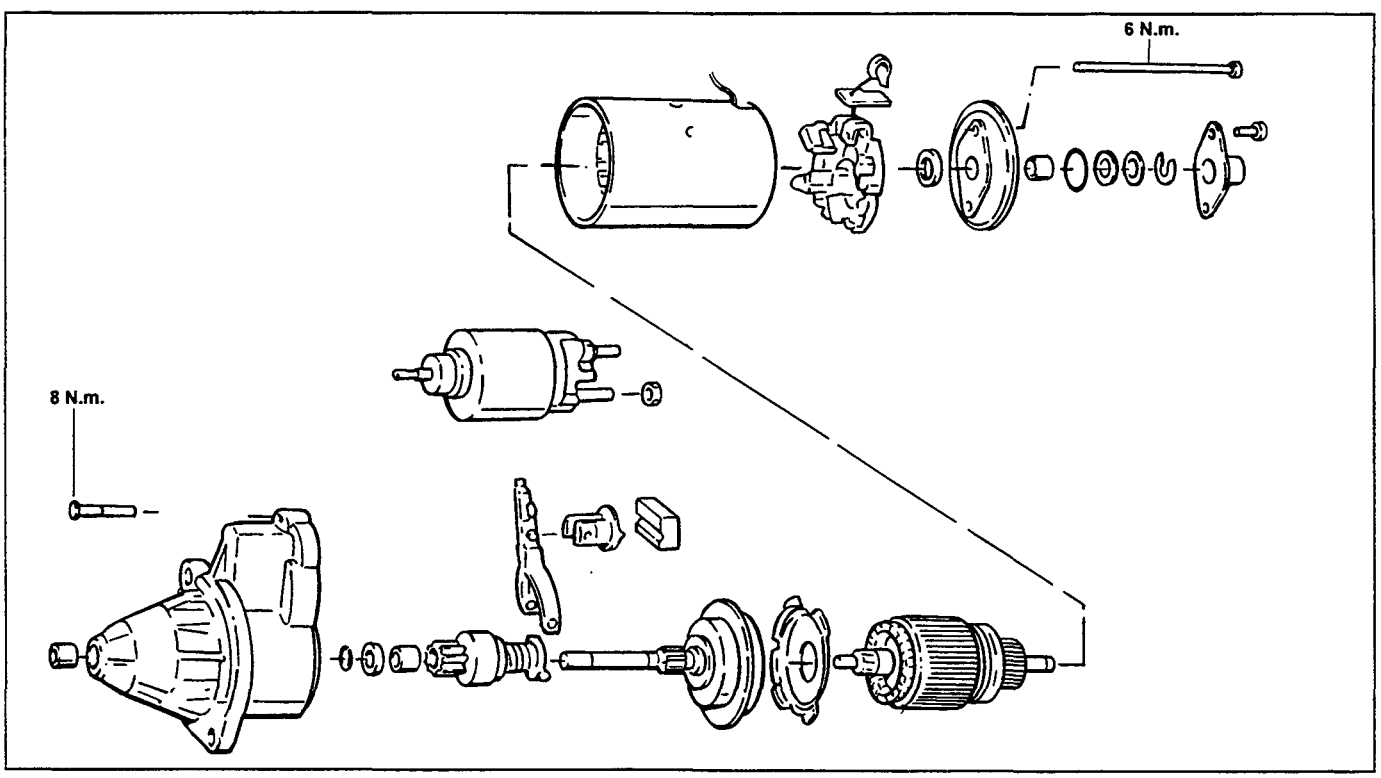
ALTERNATOR

N•m



STARTER MOTOR

N•m



ALTERNATOR

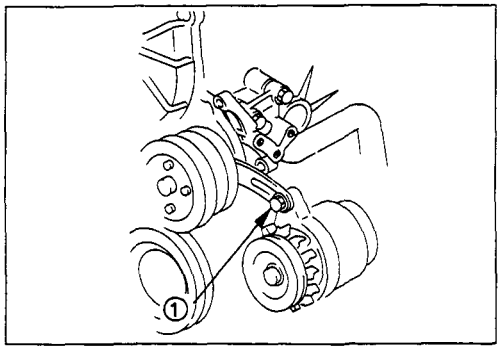
REMOVAL AND INSTALLATION

Read this Section carefully before performing any removal and installation procedure. This Section gives you important points as well as the order of operation. Be sure that you understand everything in this Section before you begin.

Important Operations – Removal

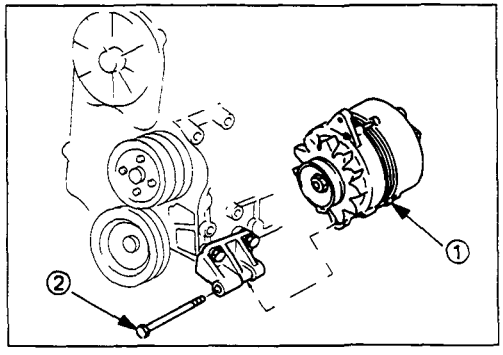
Use a circuit tester to inspect the charging circuit before removal.

Refer to "INSPECTION AND REPAIR" "CHARGING CIRCUIT ON THE VEHICLE".



▲ Cooling Fan Belt

1) Loosen and remove the fan belt adjusting plate bolts ①.
2) Remove the fan belt from the alternator drive pulley.

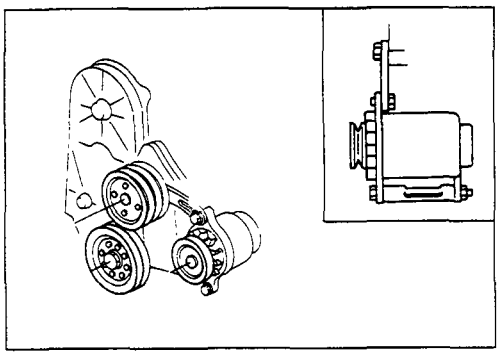


▲ Alternator

Remove the alternator bolt ① and the alternator ② from the bracket.

Important Operations – Installation

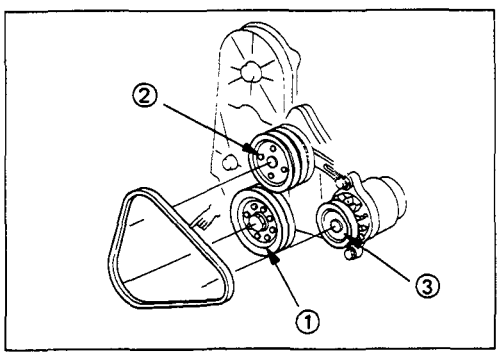
Follow the removal procedure in the reverse order to perform the installation procedure. Pay careful attention to the important points during the installation procedure.



▲ Alternator

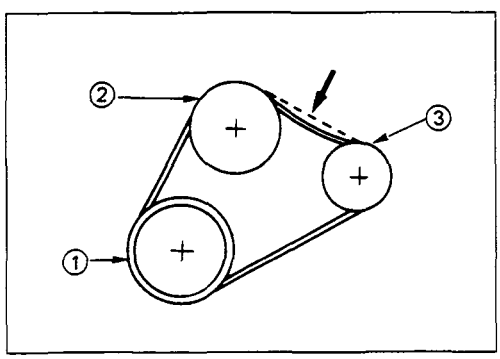
1. Install the alternator to the bracket.
2. Tighten the alternator bolt to the specified torque.

Alternator Bolt Torque	kg·m(lb.ft/N·m)
3.8 ± 1.0 (27.5 ± 7.2/37.2 ± 9.8)	



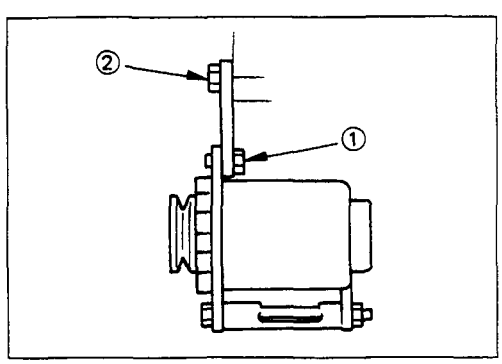
▲ Cooling Fan Belt

1) Hold the alternator toward the engine.
2) Install the fan belt to the three pulleys.
   ① Crankshaft pulley
   ② Water pump pulley
   ③ Alternator pulley



3) Adjust the fan belt tension.
   ① Use a bar to pull the alternator away from the engine as far as possible.
   ② Use your hand to apply a pressure of 10 kg (22 lb/98 N) to the area of the fan belt indicated by the arrow in the illustration.

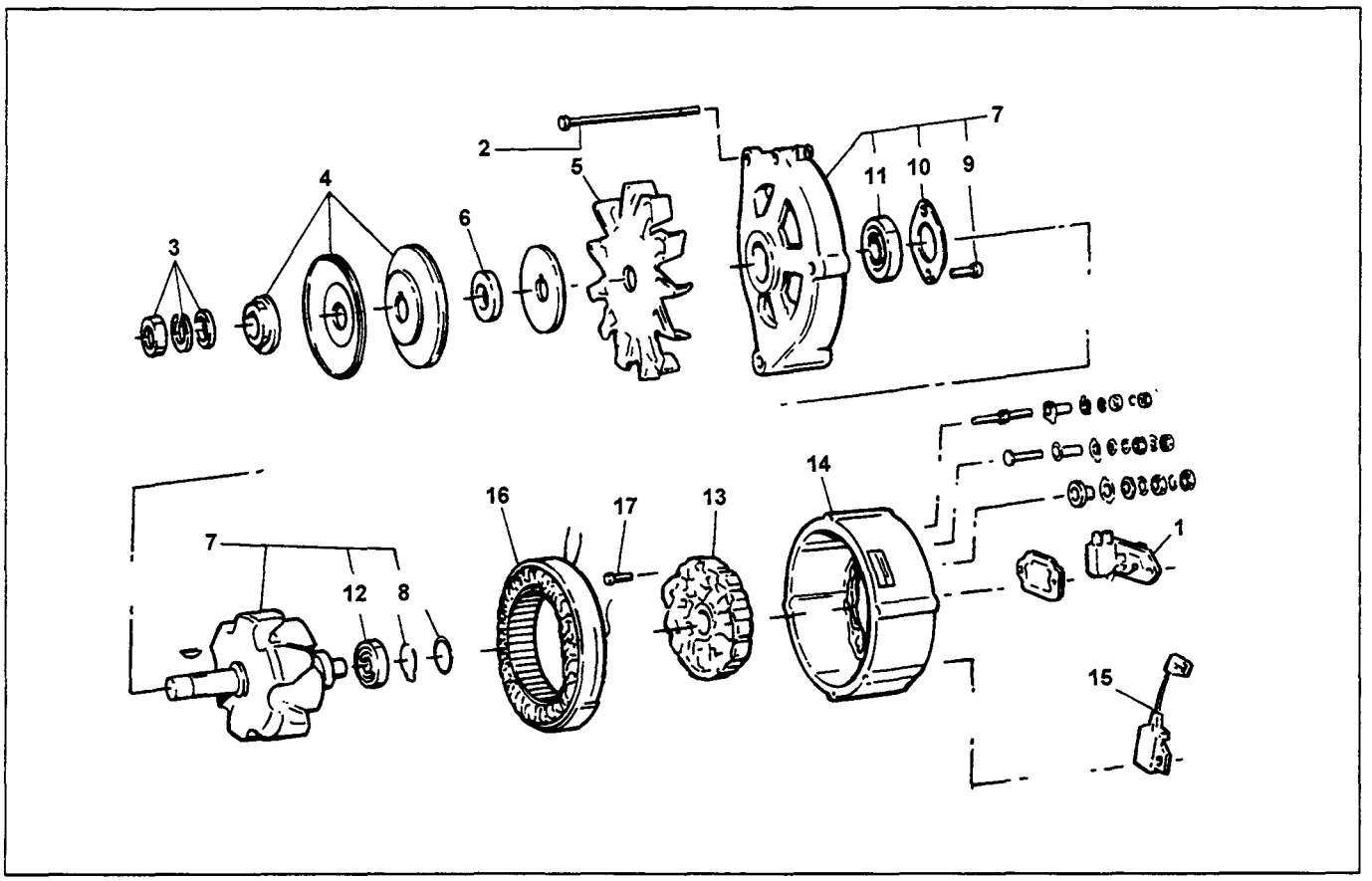
   There should be from 8 – 12 mm (0.31 – 0.47 in) of belt deflection.



4) Tighten the adjusting plate bolts to the specified torque a little at a time in the numerical order shown in the illustration.

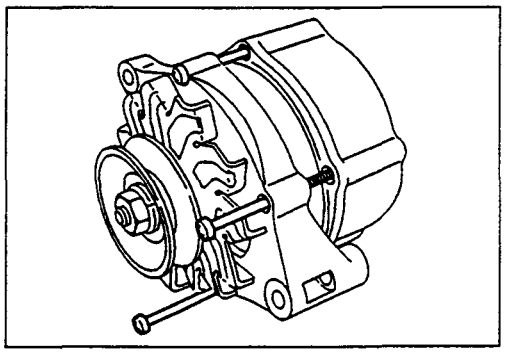
Adjusting Plate Bolt Torque	kg·m(lb.ft/N·m)
1.9 ± 0.5 (13.7 ± 3.6/18.6 ± 4.9)	

ALTERNATOR



Disassembly Steps

1. Blush and EE regulator
2. Through bolt
3. Pulley nut, cup and washer
4. Pulley
5. Fan
6. Spacer
7. Rotor assembly
8. Wave washers
9. Screw
10. Bearing retainer
11. Front bearing
12. Rear bearing
13. Front cover
14. Rear cover
15. Condenser
16. Stator
17. Battery terminal
18. Diode bridge

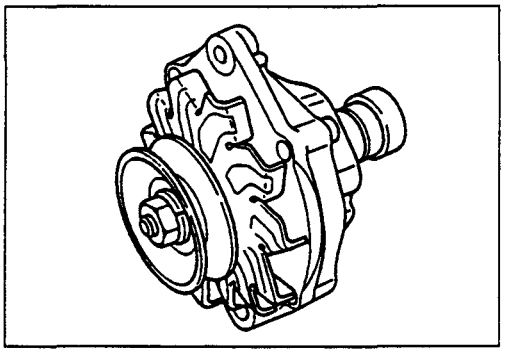


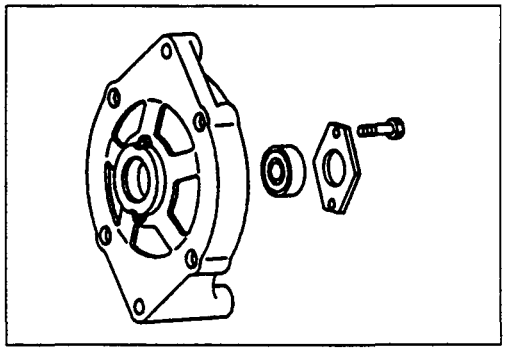
DISASSEMBLY

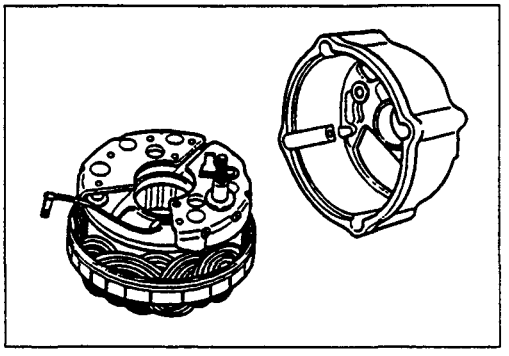
1. **Blush and EE regulator**
2. **Through Bolt**
   - Remove the through bolt.
   - Insert the tip of a pry bar into the gaps between the front cover and the stator core. Pry apart and separate the front cover and rotor and the rear cover and stator.

CAUTION:
Take care not to scratch or otherwise damage the stator coil with pry bar.

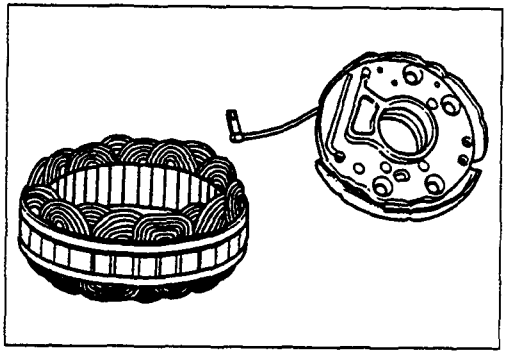
3. **Pulley Nut Clip and Washer**
4. **Pulley**
5. **Fan**
6. **Spacer**
7. **Rotor Assembly**
   - Remove the rotor assembly from front cover.
8. **Wave Washers**
9. **Screw**
10. **Bearing Retainer**
11. **Front Bearing**
12. **Rear Bearing**
13. **Front Cover**







14. **Rear Cover**
    - Remove the three retaining screws and the BAT terminal
    - Separate the rear cover from the stator.
17. **Condenser**



16. Stator

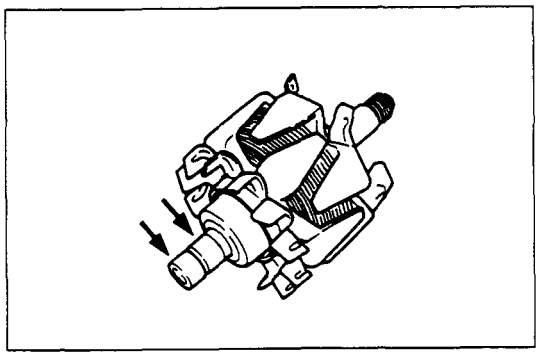
- Cut the diode soldering points, then remove the stator.

17. Battery Terminal

18. Diode Bridge

INSPECTION AND REPAIR

Make the necessary adjustments, repairs, and part replacements if excessive wear or damage is discovered during inspection.

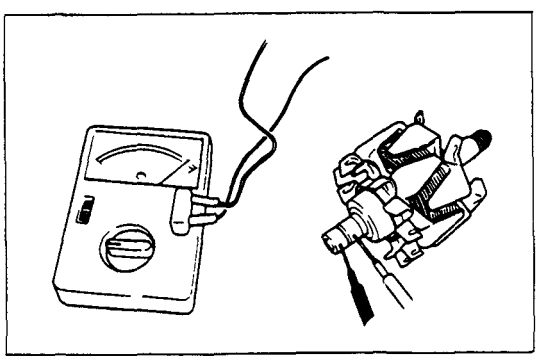


ROTOR ASSEMBLY

1. Inspection the slip ring faces for dirt and pitting.
   Wipe away any dirt with a clean cloth soaked in alcohol.
   Use a hand grinder to remove pitting.
2. Measure the slip ring diameter.
   If the slip ring diameter is less than the specified limit, the slip rings must be replaced.

Slip Ring Diameter — mm(in)

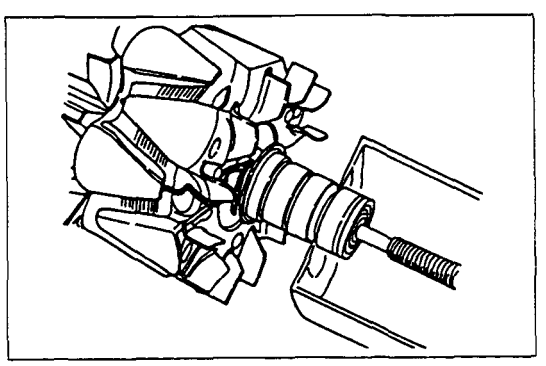
Standard	Limit
27.0 (1.063)	26.0 (1.024)



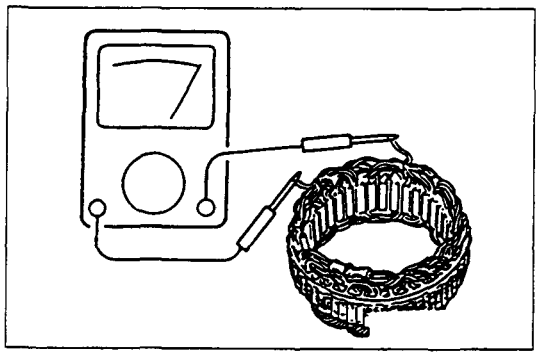
3. Measure the rotor coil resistance.

Rotor Coil Resistance at 20°C (68°F) — Ohms

Standard
2.69



4. Check for continuity between the slip rings and the rotor core or shaft.
   If there is continuity, the entire rotor assembly must be replaced.

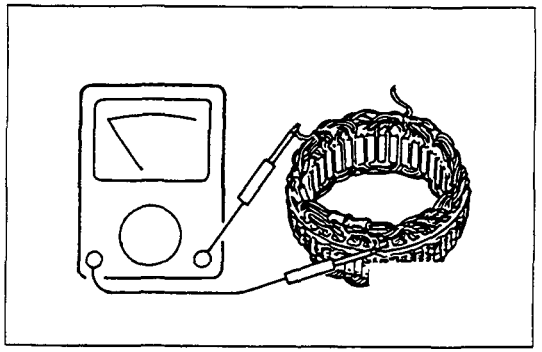


STATOR COIL ASSEMBLY

1. Check for continuity across the stator coils.

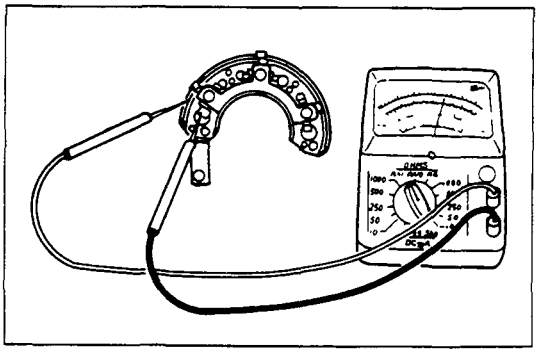
   If there is no continuity, the stator coils must be replaced.

Resistance Between The Terminal "N" and The Coil Ends (Reference)	Ohms
Standard	
0.14	



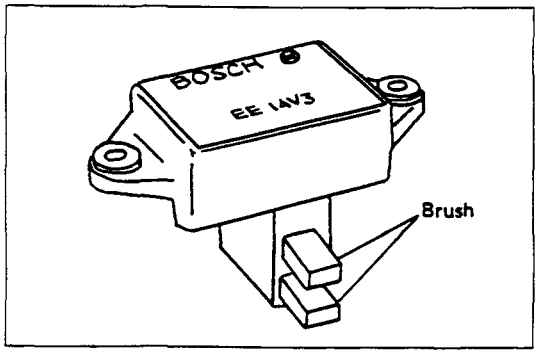
2. Check for continuity between each stator coils and the stator core.

   If there is continuity, the stator coils must be replaced.



DIODE

1. Measure the resistance between each diode terminal and holder in forward and reverse directions with the connection of the tester leads switched. The diodes are normal if resistance is nearly zero ohms in one direction and is infinitely high in the other direction.
2. If a diode has no resistance or equal resistance in both directions, it is defective and should be replaced together with the holder.



BRUSH

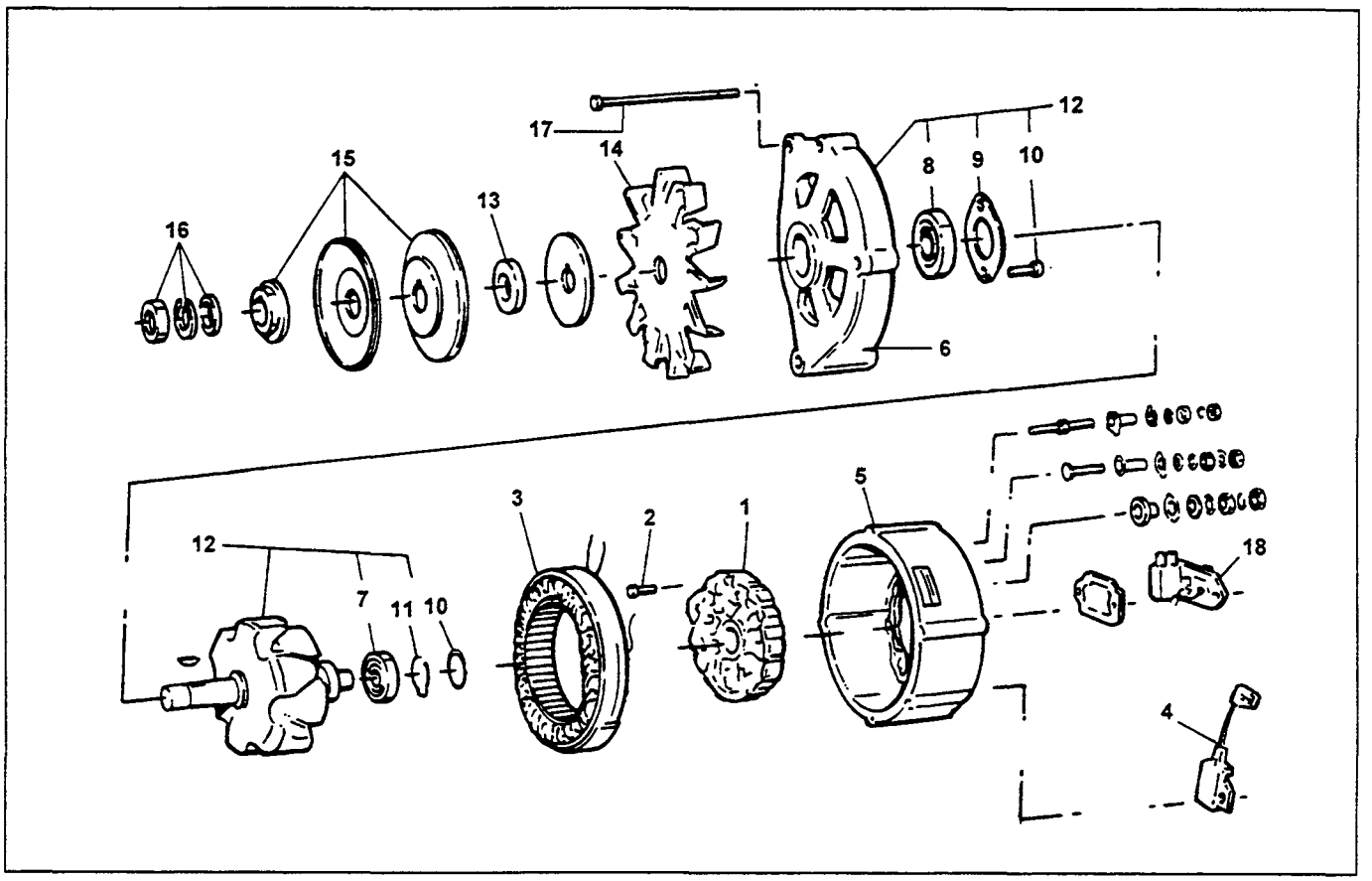
1. Measure the brush length.
2. If the measured brush length is less than 5.5 mm, the brush and the brush holder assembly must be replaced.

   There is a minimum brush length limit line stamped into the brush.

Length	mm(in)
Limit	
3.8 (0.150)	

3. Brush soldering precautions.
   - Be sure to use 60/40 resin cored solder.

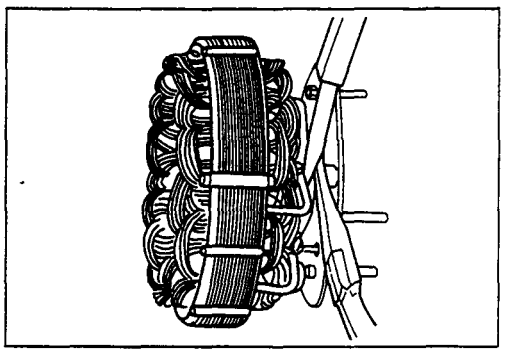
ALTERNATOR



Reassembly Steps

▲ 1. Diode bridge
2. Battery terminal
▲ 3. Stator
4. Condenser
5. Rear cover
6. Front cover
7. Rear bearing
8. Front bearing
9. Bearing retainer
10. Screw
11. Wave washers
▲ 12. Rotor assembly
13. Spacer
14. Fan
15. Pulley
16. Pulley nut, clip and washer
17. Through bolt
18. Blush and EE regulator

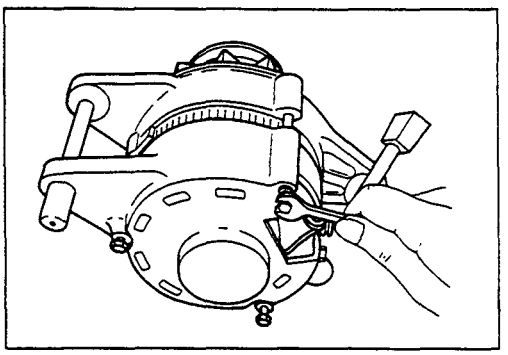
Important Operations



1. Diode Bridge
3. Stator

1) Solder together the rectifier and stator leads.
   Hold the diode lead near the rectifier with a pair of long-nose pliers to protect the rectifier from heat.
   Complete the soldering procedure as quickly as possible.

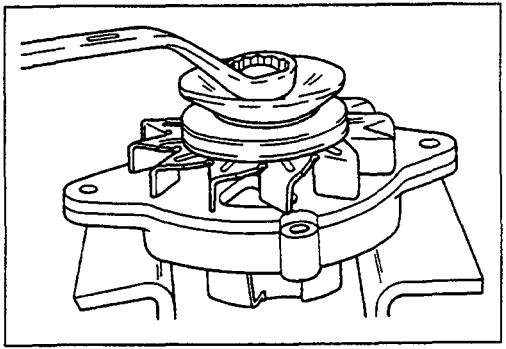
2) Install the rectifier/stator assemblies to the rear cover.
   Be absolutely sure that the washers and the insulators are reinstalled to their original positions.
   Hold the stator coil against the rear cover.
   Do not allow the stator coil to fall free.



12. Rotor Assembly with Rear Bearing
17. Through Bolt

1) Install the front cover and rotor assembly to the rear cover.
   Take care not to damage the rotor, the coil leads, and the coil seal lip, and the splines.
2) Place the guide bar to the rear cover bracket hole.
3) Align the front cover bracket hole with the guide bar.
   Install the through bolt.
4) Tighten the through bolts to the specified torque.

Through Bolt Torque	N•m
5.0	



15. Pulley

16. Pulley Nut and Washer

1) Carefully clamp the rotor in a vise.
2) Install the pulley and the pulley nut.
3) Tighten the pulley to the specified torque.

Pulley Nut Torque	N•m
6	

Note:

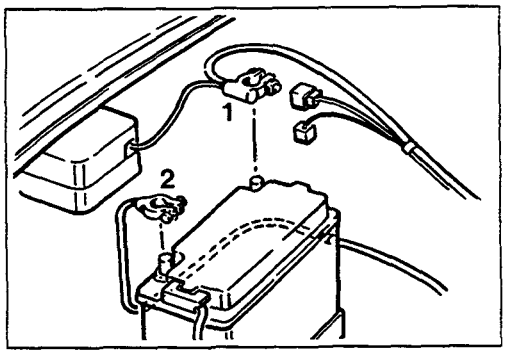
Take care not to damage the rotor when clamping it in the vise.

STARTER MOTOR

REMOVAL AND INSTALLATION

Read this Section carefully before performing any removal and installation procedure. This Section gives you important points as well as the order of operation. Be sure that you understand everything in this Section before you begin.

Important Operations - Removal



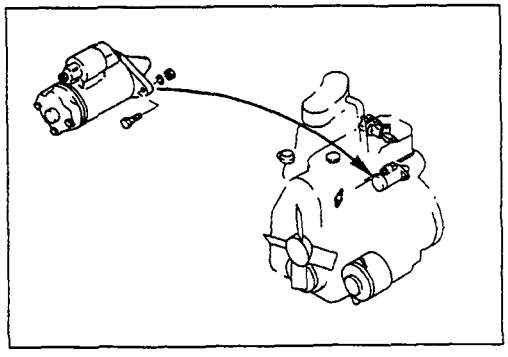
▲ **Starter Motor**

▲ **Magnetic Switch Cable**

1. Disconnect the battery cable (1) and the grounding cable (2) from the battery terminals.
2. Disconnect the magnetic switch cable from the terminal bolts.
3. Disconnect the battery cable at the starter motor and the ground cable at the cylinder body.
4. Remove the starter motor from the engine.

Important Operations - Installation

Follow the removal procedure in the reverse order to perform the installation procedure. Pay careful attention to the important points during the installation procedure.

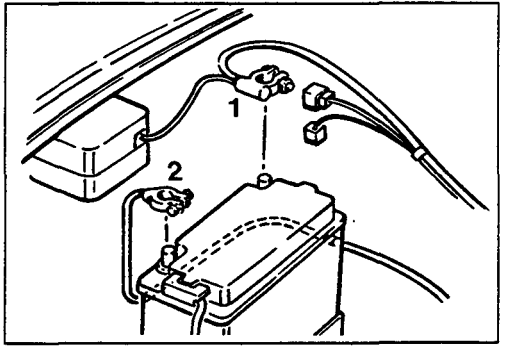


▲ **Starter Motor**

1. Install the starter motor to the rear plate.
2. Tighten the starter motor bolts to the specified torque.

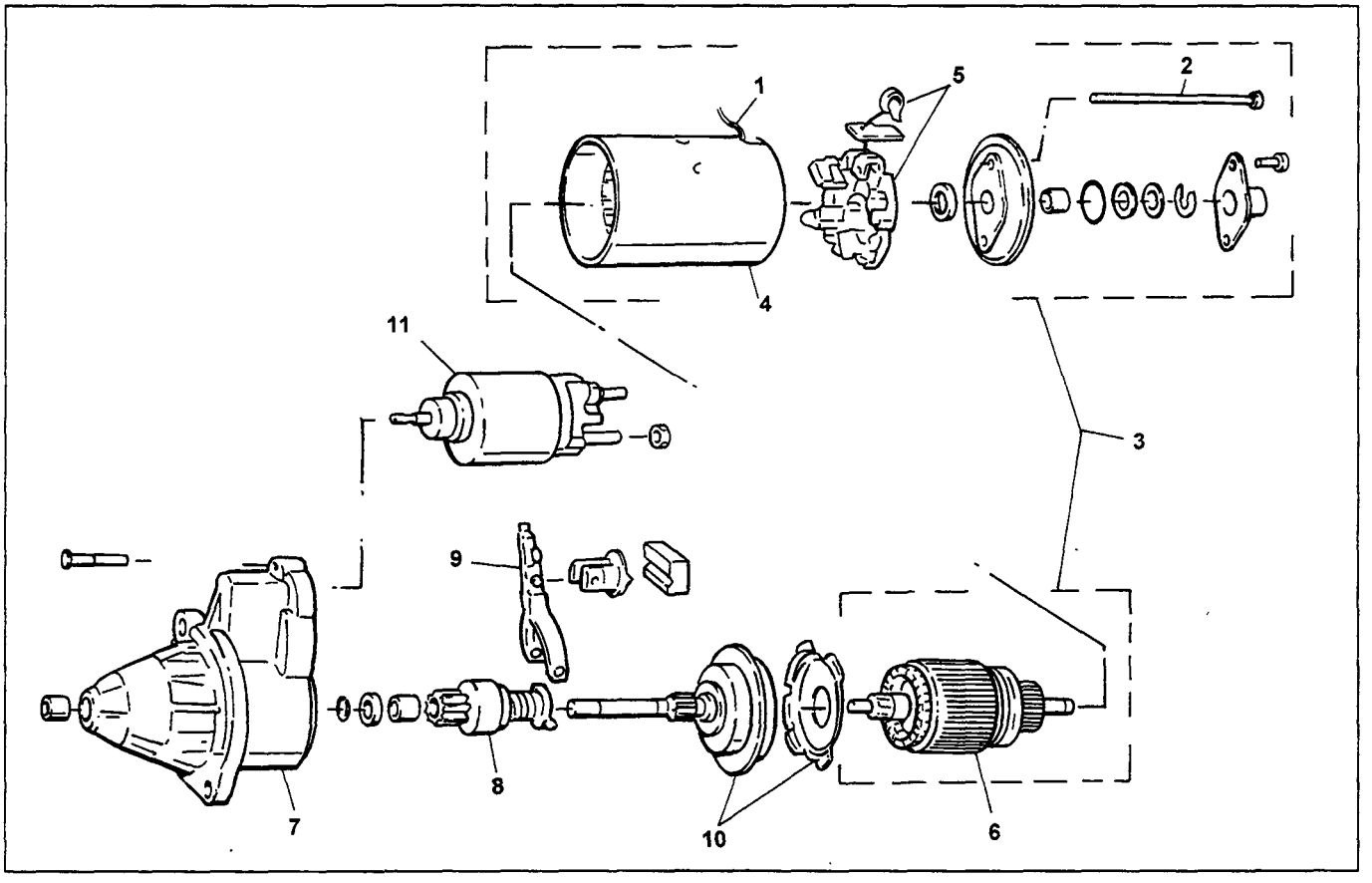
Starter Motor Bolt Torque	kg•m(lb.ft/N•m)
8.8 ± 1.9 (63.6 ± 16.6/86.2 ± 18.6)	

3. Reconnect the battery cable at the starter motor and the grounding cable at the cylinder body.



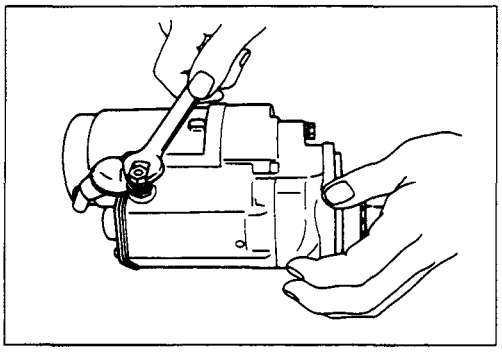
4. Reconnect the battery cable (1) and the grounding cable (2).

STARTER MOTOR



Disassembly Steps

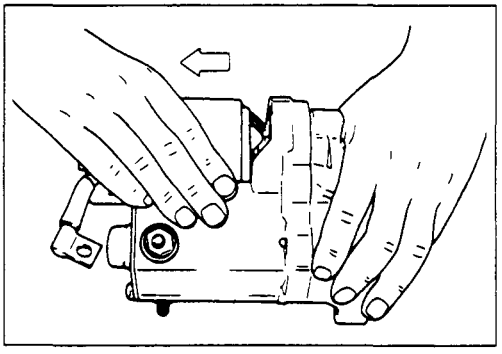
- ▲ 1. Lead wire
- 2. Through bolt
- ▲ 3. Yoke assembly
- 4. Field coil
- ▲ 5. Brush and brush holder
- ▲ 6. Armature
- ▲ 7. Drive side housing
- 8. Bendix drive
- 9. Fork lever
- 10. Planet gear set
- 11. Solenoid



Important Operations

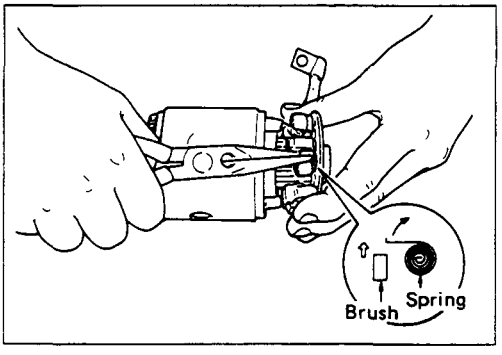
1. Lead Wire

Disconnect the lead wire at the magnetic switch.



3. Yoke Assembly

Pull the magnetic switch from the yoke.

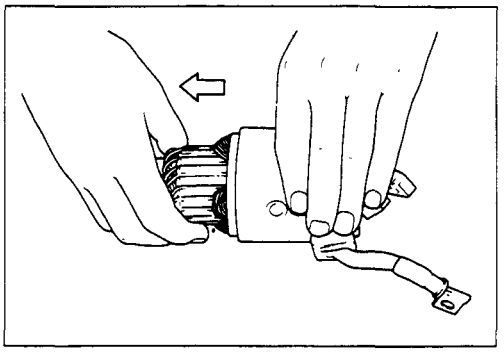


5. Brush and Brush Holder

1) Use a pair of long-nose pliers to compress the spring end.

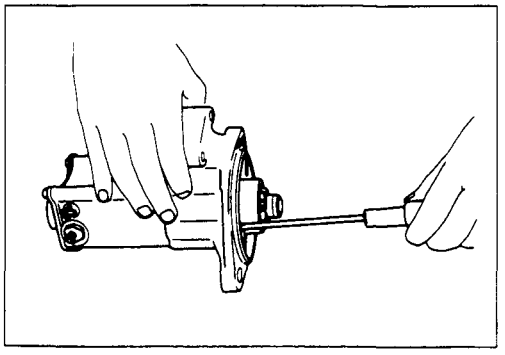
   Remove the brushes from the yoke.

2) Remove the brush holder from the yoke.



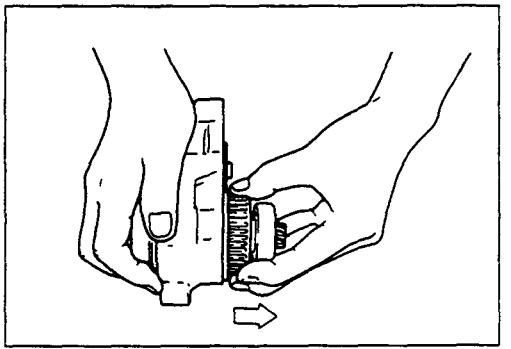
6. Armature

Tap on the yoke end with a soft mallet to remove the armature from the yoke.



7. Drive Side Housing

1) Remove the two screws from the drive housing.
2) Pull the drive housing from the magnetic switch.

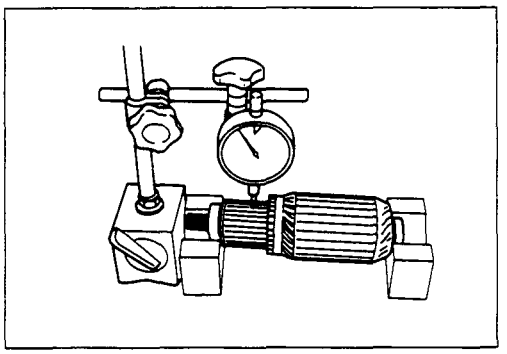


8. Bendix Drive

Remove the Bendix Drive from the drive side housing.

INSPECTION AND REPAIR

Make necessary correction or parts replacement if wear, damage or any other abnormal condition is found through inspection.



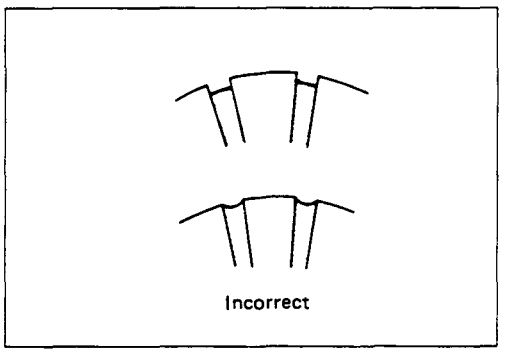
ARMATURE

1. Measure the commutator run-out.

   Replace the commutator if the measured run-out exceeds the specified limit.

Commutator Run-out — mm(in)

Standard	Limit
0.02 (0.0008)	0.05 (0.0020)



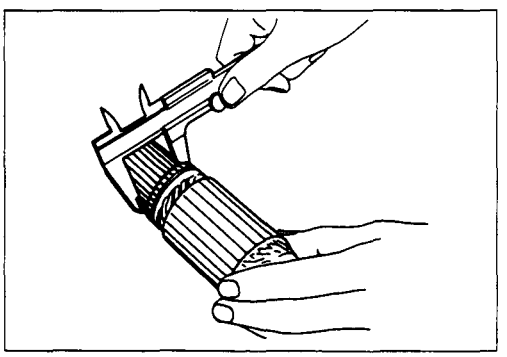
2. Check the commutator mica segments for excessive wear.
3. Measure the mica segment depth.

Mica Segment Depth — mm(in)

Standard	Limit
0.5—0.8 (0.028—0.035)	0.2 (0.008)

If the mica segment depth is less than the standard but more than the limit, the commutator may be reground.

If the mica segment depth is less than the limit, the commutator must be replaced.

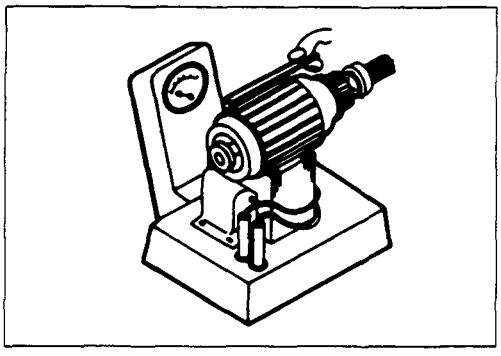


4. Measure the commutator outside diameter.

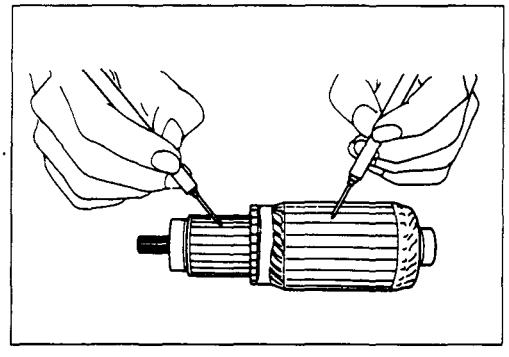
Commutator Outside Diameter — mm(in)

Standard	Limit
35 (1.378)	34 (1.339)

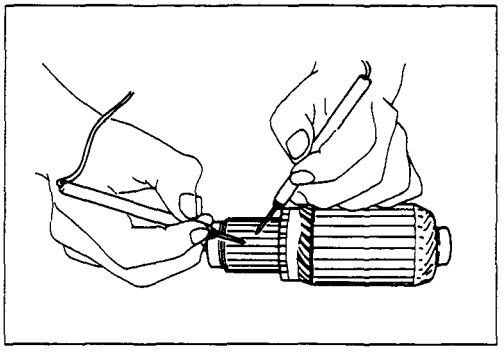
If the measured outside diameter is less than the specified limit, the commutator must be replaced.



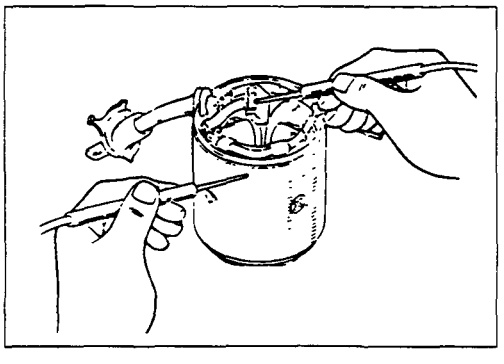
5. Test the armature for short circuiting.
   1) Place the armature in a growler tester.
   2) Hold a hacksaw blade against the armature core.
      Slowly rotate the armature.
      If the armature has a short circuit, the hacksaw blade will vibrate.
      Replace the armature if there is a short circuit.



6. Use a circuit tester to check the armature for grounding.
   1) Hold one probe of the circuit tester against the commutator segment.
   2) Hold the other circuit tester probe against the armature core.
      If the circuit tester indicates continuity, the armature is grounded.
      The armature must be replaced.

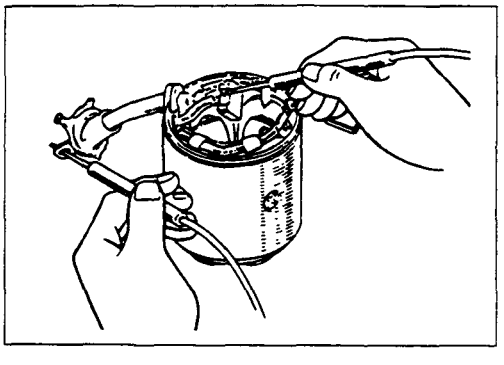


7. Use the circuit tester to check the armature for continuity.
   1) Hold the circuit tester probes against two armature core segments.
   2) Repeat Step 1 at different segments of the armature core.
      There should be continuity between all segments of the armature core.
      If there is not, the armature must be replaced.

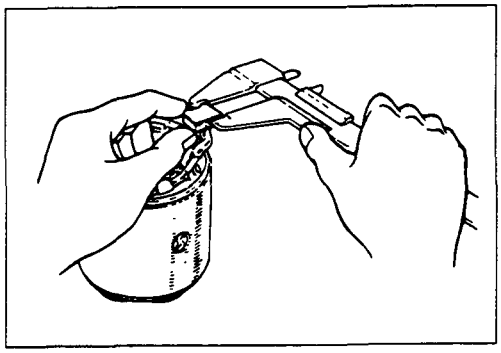


YOKE

1. Use a circuit tester to check the field winding ground.
   1) Hold one circuit tester probe against the field winding end or brush.
   2) Hold the other circuit tester probe against the bare surface of the yoke body.
      There should be no continuity.
      If there is continuity, the field coil is grounded.
      The yoke must be replaced.



2. Use the circuit tester to check the field winding continuity.
   1) Hold one circuit tester probe against the "C" terminal lead wire.
   2) Hold the other circuit tester probe against the field winding brush.
      There should be continuity.
      If there is no continuity, the yoke must be replaced.



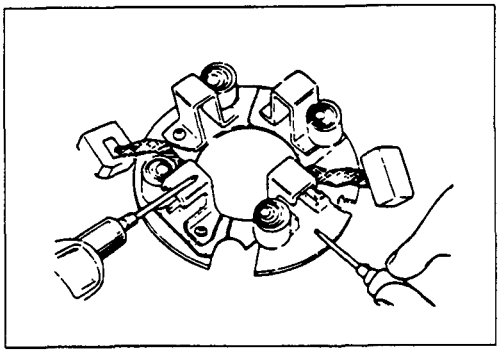
BRUSH AND BRUSH HOLDER

1. Use a vernier caliper to measure the brush length (four brushes).

   Replace the brushes as a set if one or more of the brush lengths is less than the specified limit.

Brush Length mm(in)

	Standard	Limit
Other	15.0 (0.590)	10.0 (0.394)



2. Use a circuit tester to check the brush holder insulation.

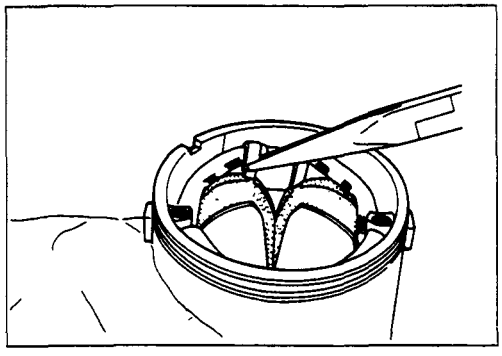
   Touch one probe to the holder plate and the other probe to the positive brush holder.

   There should be no continuity.

3. Inspect the brushes for excessive wear.

   If the negative brushes have excessive wear, the entire brush holder assembly must be replaced.

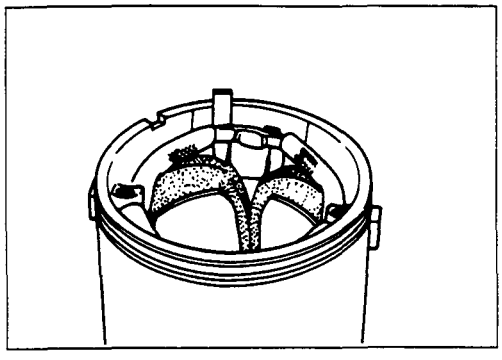
   If the positive brushes have excessive wear, only the brushes must be replaced.



Brush Replacement

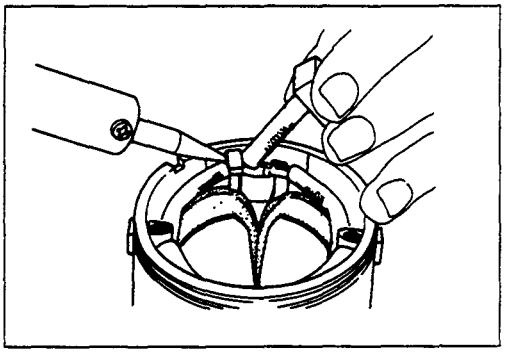
Brush Removal

1. Use a pair of side cutters to cut the lead wire from the brush.
2. File away any foreign matter clinging to the edge of the lead wire.
3. Remove the brushes from the brush holder.

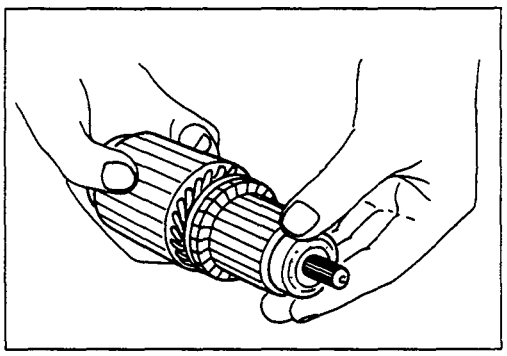


Brush Installation

1. Install the new brushes.
2. Straighten the bent portion of the clip.
3. File away any foreign matter clinging to the clip surface.



4. Place the lead wire in the clip.
5. Bend the clip shut.
6. Solder the brush lead.
7. Repeat the procedure for each of the brushes.



BEARING

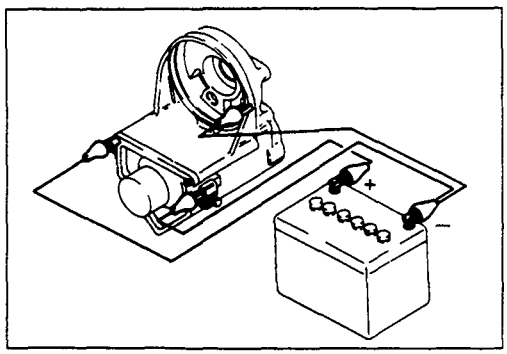
Inspect the bearings for excessive wear and damage. Replace the bearings if necessary.

MAGNET SWITCH

The following tests must be performed with the starter motor fully assembled.

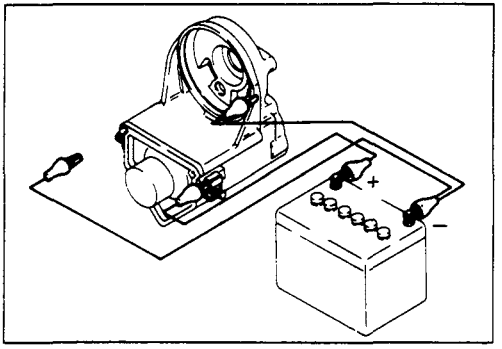
The yoke lead wire must be disconnected from the "C" terminal.

To prevent coil burning, complete each test as quickly as possible (within three to five seconds).



Pull-Out Test

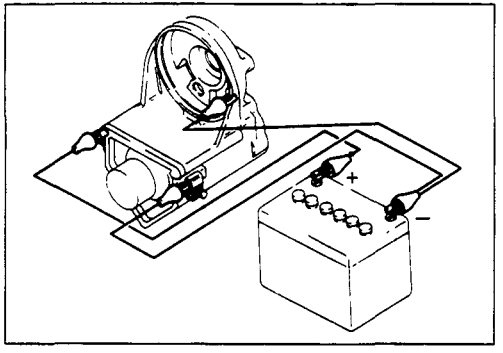
1. Connect the battery negative test leads to the starter motor body and the "C" terminal.
2. Touch the battery positive test lead to the "50" terminal. If the magnetic switch function is satisfactory, there will be a strong magnetic force moving the pinion away from its home position.



Hold-In Test

1. Connect the battery negative test lead to the starter motor body.
2. Touch the battery positive test lead to the "50" terminal.

   If the magnetic switch function is satisfactory, there will be a strong magnetic force moving the pinion away from its home position.

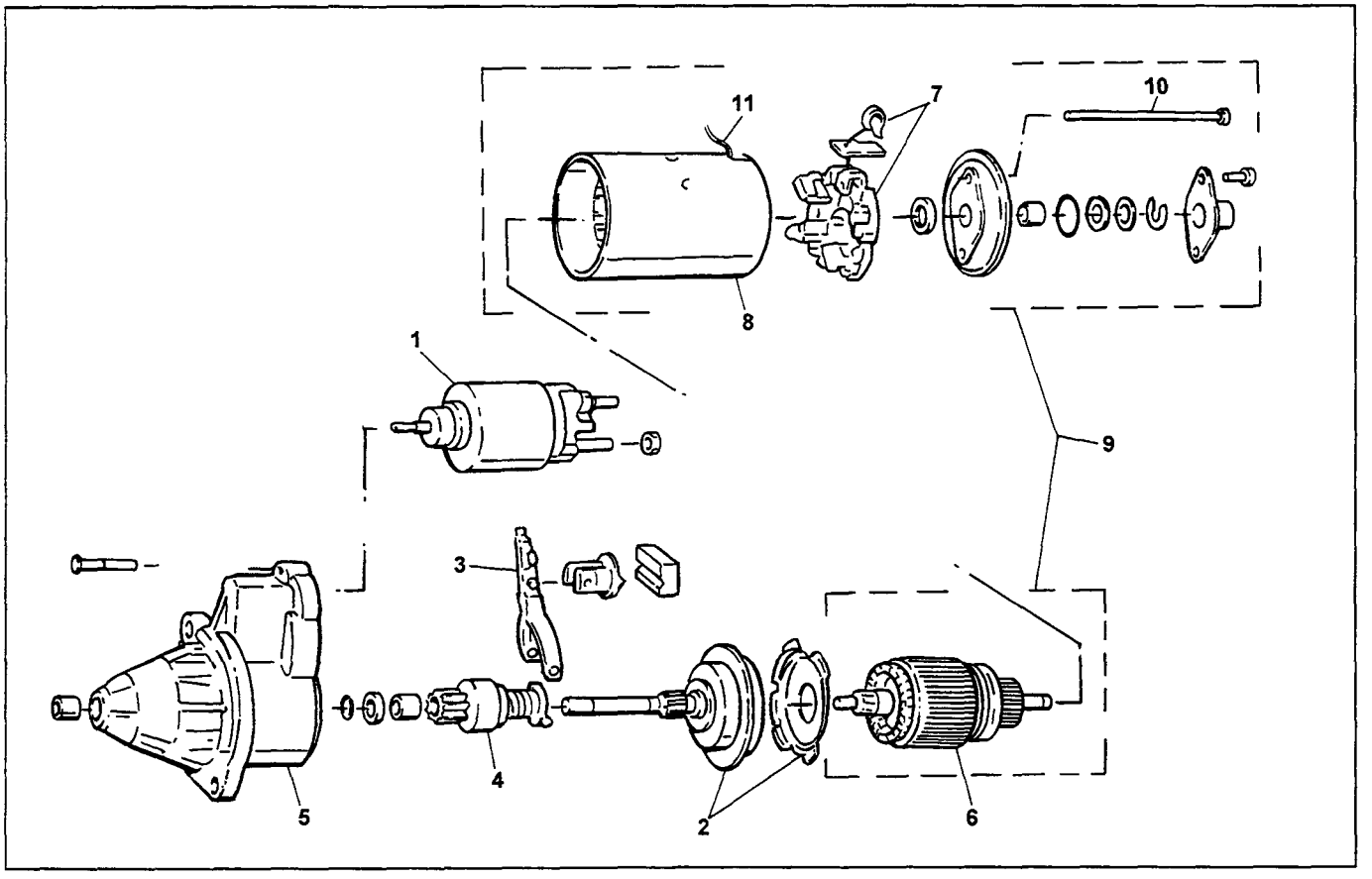


Return Test

1. Connect the battery negative test lead to the starter motor body and the "50" terminal.
2. Touch the battery positive test lead to the "C" terminal.

   If the magnetic switch function is satisfactory, there will be a strong magnetic force moving the pinion toward its home position.

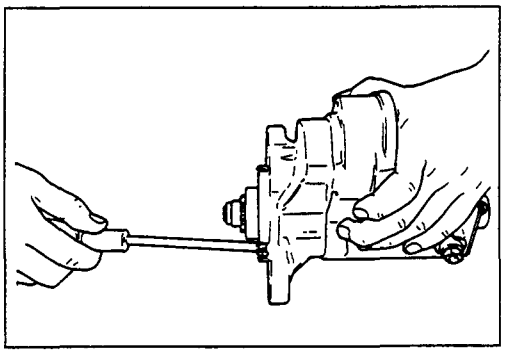
STARTER MOTOR



Reassembly Steps

1. Solenoid
2. Planet gear set
3. Fork lever
4. Bendix drive
- ▲ 5. Drive side housing
- ▲ 6. Armature
- ▲ 7. Brush and brush holder
8. Field coil
- ▲ 9. Yoke assembly
- ▲ 10. Through bolt
11. Lead wire

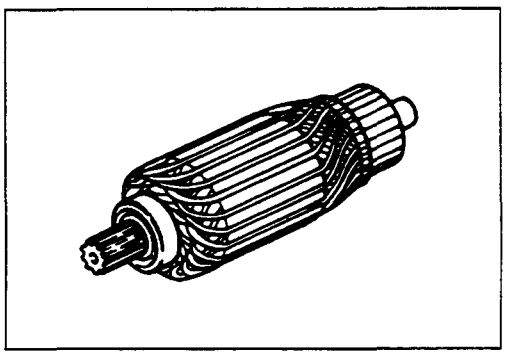
Important Operations



5. Drive Side Housing

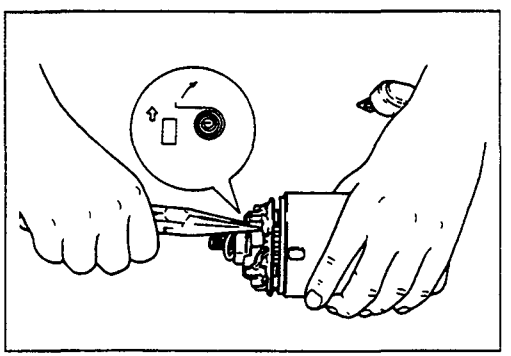
Tighten the drive housing screws to the specified torque.

Drive Housing Screw Torque	N•m
8	



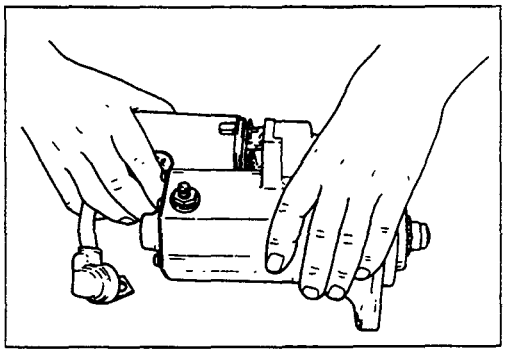
6. Armature

Apply grease to the armature shaft bearings.
Do not allow the grease to touch the armature.
Grease on the armature will result in power loss and damage.



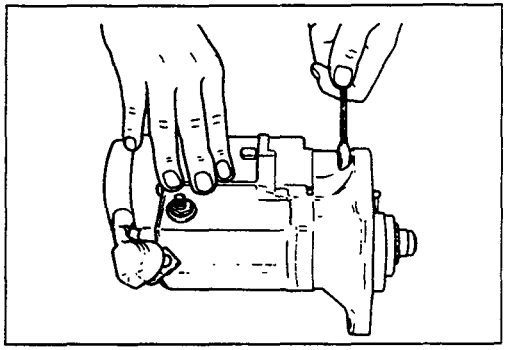
7. Bush and Brush Holder

Install the brushes and the brush holder to the yoke and the armature.
Keep the brushes free of grease and other foreign material.



9. YOKE ASSEMBLY

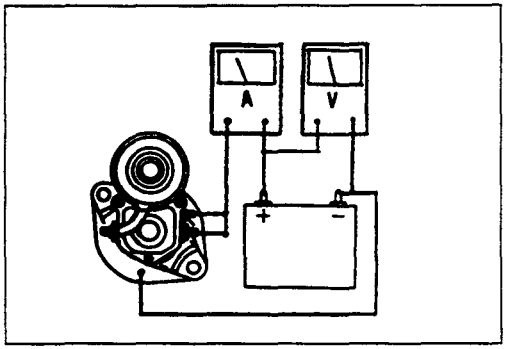
Install the yoke assembly to the magnetic switch.
Be sure to use a new O-ring.
Do not attempt to reuse the old O-ring.



10. Through Bolt

Tighten the through bolts to the specified torque.

Drive Housing Screw Torque	N•m
6.0	



Operating Test

Perform the operating test after assembly of the starter motor.

1. Clamp the assembled starter motor securely in a vise.
2. Connect a standard 12-volt battery, a voltmeter, and an ammeter to the starter motor.
3. Apply battery voltage to the starter motor.
   Pinion position should change immediately.
   The starter motor should operate smoothly.

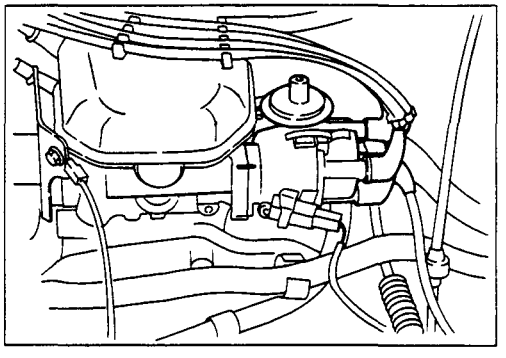
Test Conditions

Applied Voltage	(V)	11.5
Amperage	(A)	Less than 90
Starter Motor Operating Speed	(rpm)	More than 3,000

DISTRIBUTOR

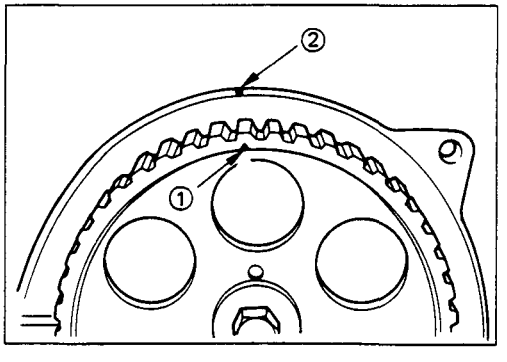
REMOVAL AND INSTALLATION

Read this Section carefully before performing any removal and installation procedure. This Section gives you important points as well as the order of operation. Be sure that you understand everything in this Section before you begin.



Important Operations

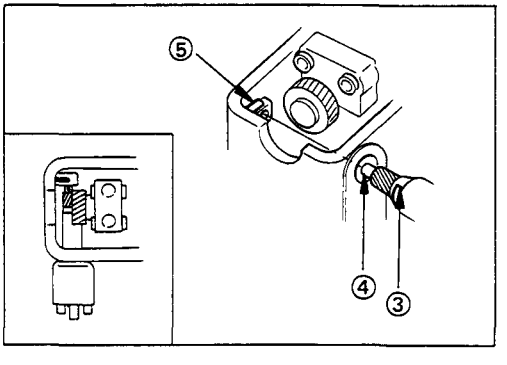
Mark the distributor flange and cylinder head side. then remove the distributor.



▲ **Distributor**

1) Move the No. 4 cylinder to TDC on the compression stroke.

   Align the camshaft pulley setting mark ① with the front plate setting mark ②.



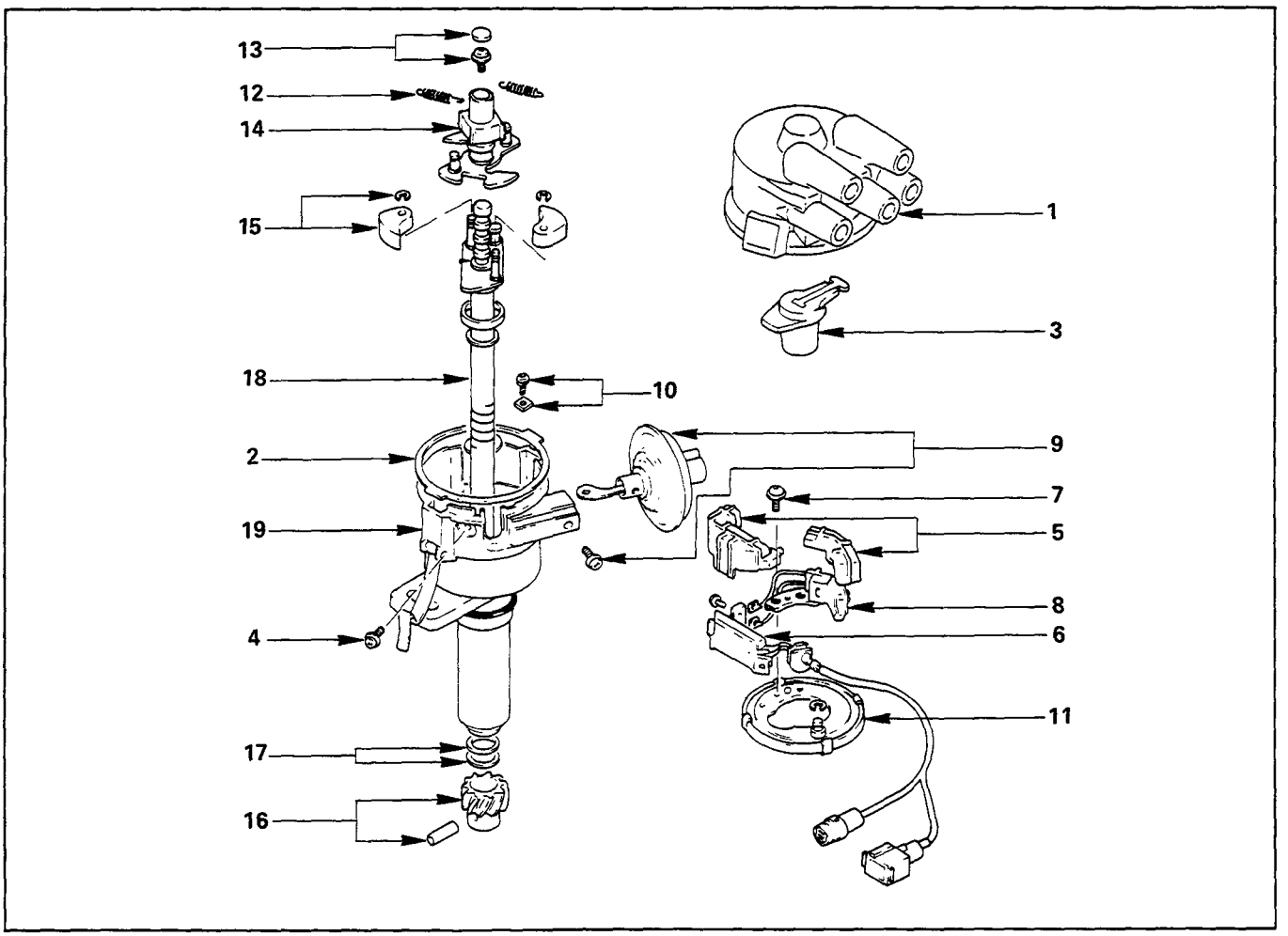
2) Apply engine oil to the O-rings.
3) Align the distributor case setting mark ③ with the distributor shaft setting mark ④.
4) Install the distributor to the cylinder head.

   Align the distributor shaft setting mark with the cylinder head setting mark ⑤.
5) Tighten the distributor bolts to the specified torque.

Distributor Bolt Torque	kg·m(lb.ft/N·m)
1.9 ± 0.5 (13.7 ± 3.6/18.6 ± 4.9)	

DISASSEMBLY/ REASSEMBLY

(Except Switzerland, Sweden & Germany, Chili (From '92))

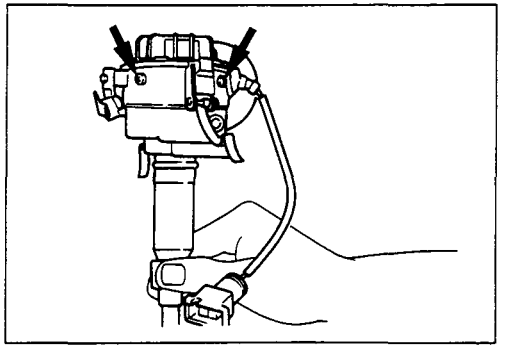


Disassembly Steps

1. Distributor cap
2. Gasket
3. Rotor
▲ 4. Ignitor screw
5. Dust proof cover
6. Ignitor
▲ 7. Signal generator screw
8. Signal generator
▲ 9. Vacuum advancer
10. Breaker plate screw
11. Breaker plate
12. Flyweight spring
13. Pad and screw
14. Signal roter shaft
15. Flyweight and clip
▲ 16. Gear and pin
17. Washer
18. Shaft
19. Housing

Reassembly

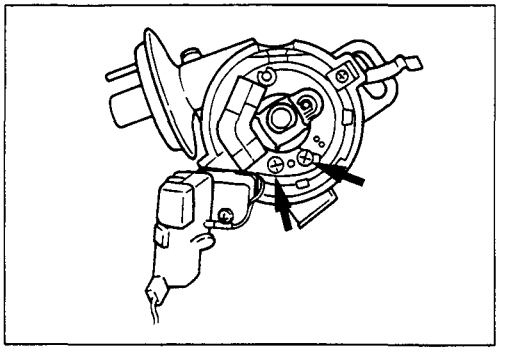
To install the distributor, follow the removal procedure in reverse order.



Important Operations

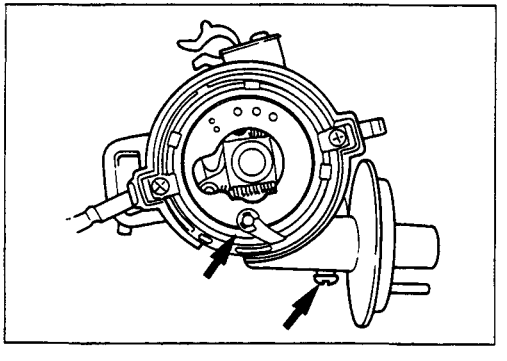
4. Ignitor screw

Remove the ignitor screws from housing.



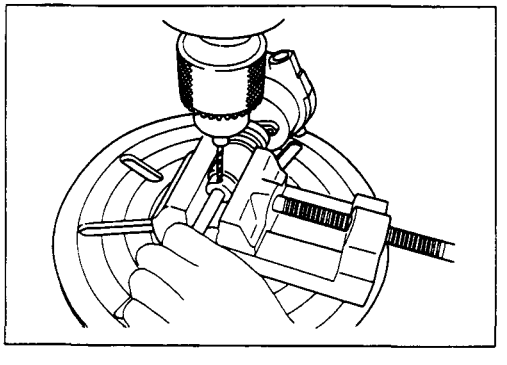
7. Signal generator screw

Remove the signal generator from breaker plate.



9. Vacuum advancer

Remove the circlip fixing the vacuum advancer rod and remove the vacuum advancer.

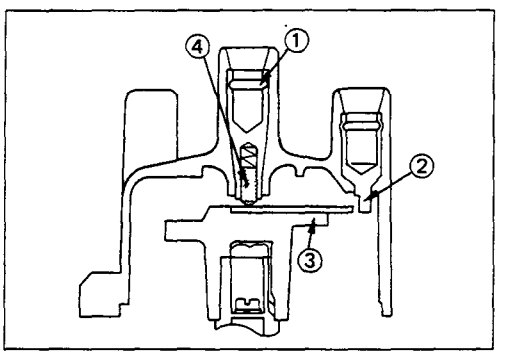


16. Gear and pin

Break away caulking on the gear and remove the pin.

INSPECTION AND REPAIR

Make the necessary adjustments, repairs, and part replacements if excessive wear or damage is discovered during inspection.



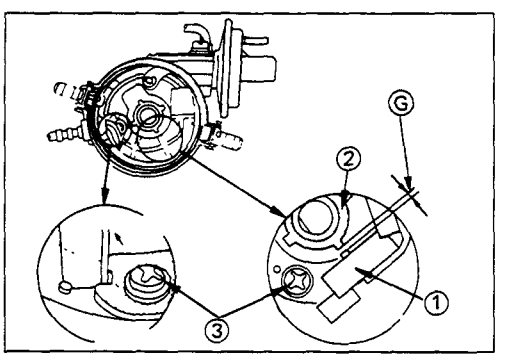
Distributor

1. Distributor Cap

   Remove the distributor cap and check the following:

   1) Check the center electrode ① and the side electrode ② for burning and corrosion.
   2) Check the rotor ③ for excessive wear and burning.
   3) Check the center carbon ④ for excessive wear and cracking.

   Replace the parts as required.

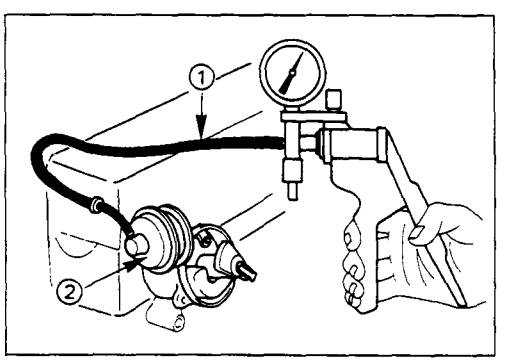


2. Air Gap

   Use a feeler gauge to measure the clearance between the signal generator ① and the distributor cam ②.

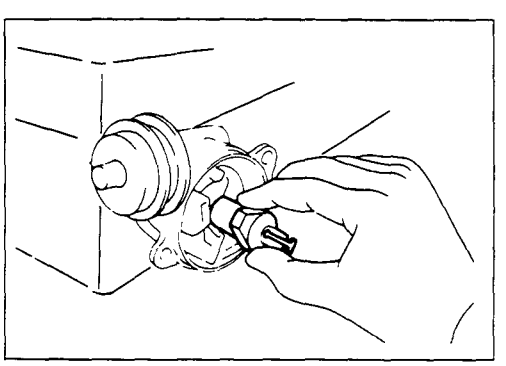
   If the measured value is outside the specified value, adjust the air gap by loosening the two screws ③ and moving the bracket.

Air Gap	mm(in)
0.2 – 0.4 (0.008 – 0.016)	



Vacuum Advancer

1. Remove the distributor cap and the igniter cover.
2. Disconnect the high tension cable from the distributor side terminal.
3. Move the high tension cable end to the coil fixing screw and keep the clearance about 5 mm.



Governor

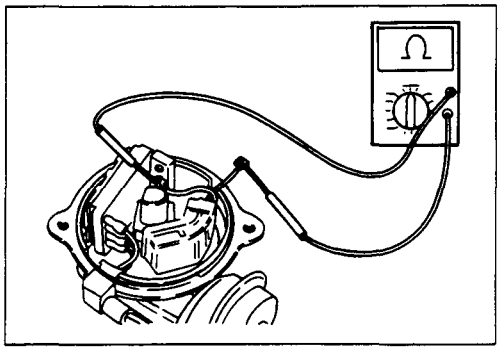
1. Check the rotor shaft for excessive looseness.

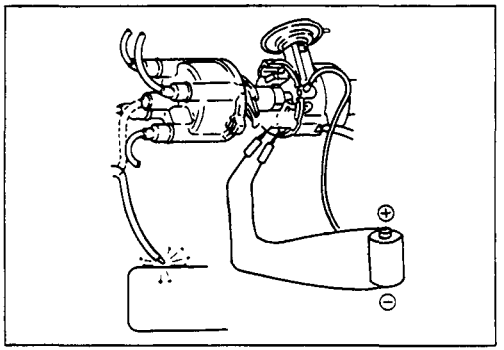
   If the shaft is excessively loose, the governor is defective and must be replaced.

2. Turn the rotor shaft clockwise 1/4 of a turn and release it.

   The rotor shaft should spring back.

   If the shaft does not spring back, the governor is defective and must be replaced.





INSPECTION ON THE VEHICLE

Signal Generator

- Set the key switch to "OFF" position.
- Remove the distributor cap.
- Measure resistance across the signal generator terminals between red and white.

Ω

Standard resistance	140 — 180

Ignitor

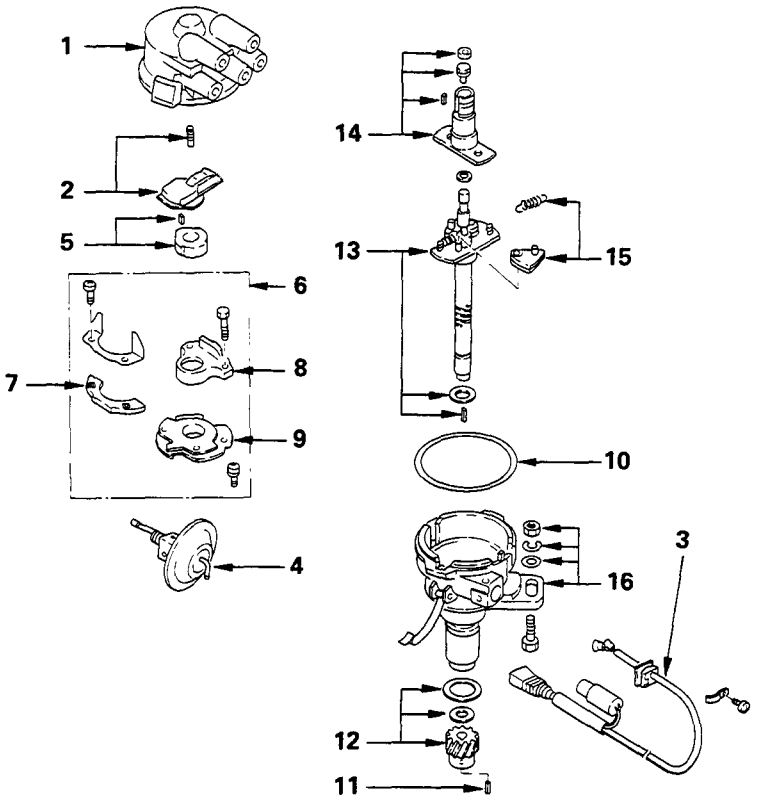
1. Remove the distributor cap.
2. Disconnect the ignition coil high-tension cable at the distributor side, and maintain a 5 to 6 mm gap between the cable end and the ground.
3. Connect a 1.5-volt dry cell battery to the red terminal ignitor at its (+) side and to the white terminal of ignitor at its (—) side.
4. Turn the key switch to the "ON" position.

- The ignitor is considered normal when spark are generated between the high-tension cable and the ground when one connected is disconnected.

Do not apply voltage to the ignitor for more than 3 seconds.

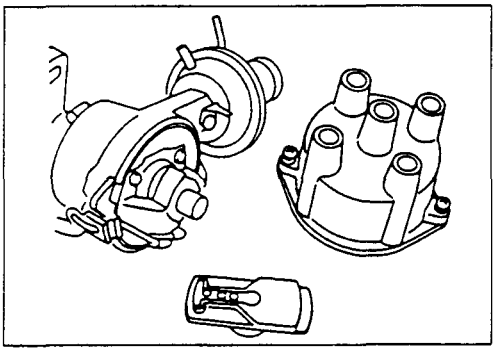
DISASSEMBLY (For 4ZD1)

(For Switzerland, Sweden, Germany and Chili (From '92))



Disassembly Steps

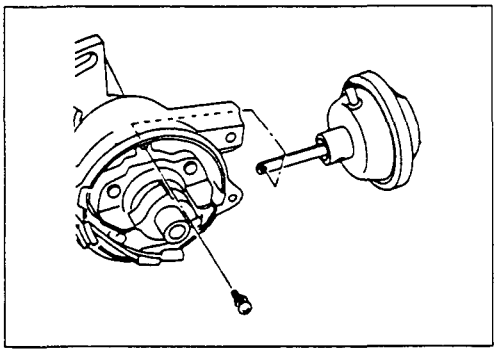
- ▲ 1. Distributor cap
- 2. Distributor rotor
- 3. Distributor lead wire
- ▲ 4. Vacuum control
- ▲ 5. Retractor
- 6. Breaker plate, magnet and unit
- 7. Distributor magnet
- 8. Distributor unit
- 9. Breaker plate
- 10. Housing gasket
- ▲ 11. Roll pin
- ▲ 12. Pinion gear and gasket
- 13. Distributor shaft
- 14. Rotor shaft
- ▲ 15. Governor flyweight and spring
- 16. Distributor housing



Important Operations

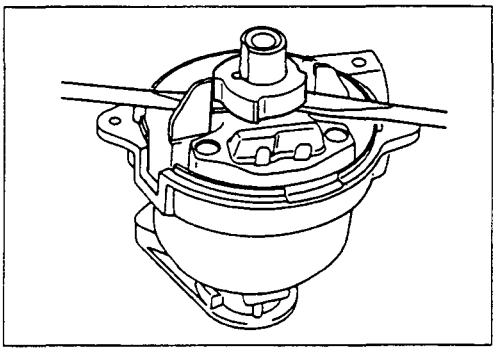
1. Distributor Cap

1. Remove the distributor cap fixing screw.
2. Remove the distributor cap and the rotor.
3. Pull the carbon points from the distributor cap.



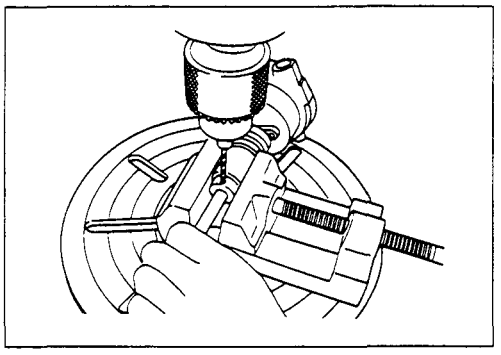
4. Vacuum Control

Remove the ground terminal and vacuum control mounting screw.



5. Retractor

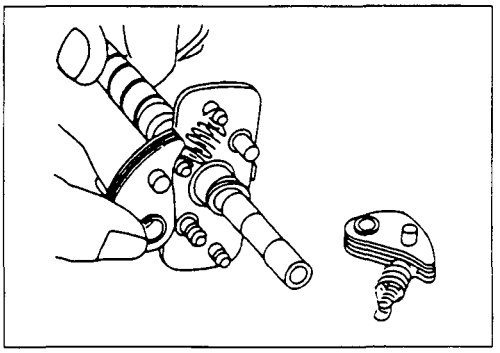
1. Pry loose the retractor outer cover.
2. Insert a screwdriver into the lower side of the retractor.
3. Pull the retractor free.



11. Roll Pin

12. Pinion Gear and Gasket

Break away the staking on the gear set and remove the pin.
File off staked end of the roll pin, then drive out the roll pin toward the opposite side.

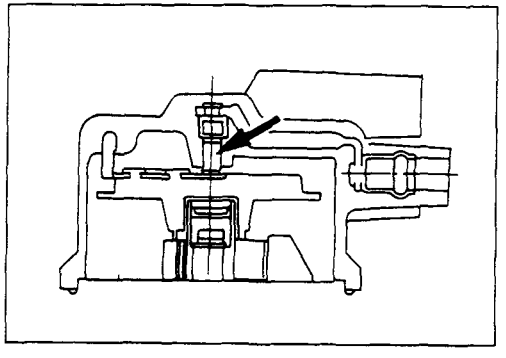


15. Governor Flyweight and Spring

Remove the governor weight and the springs from the shaft.

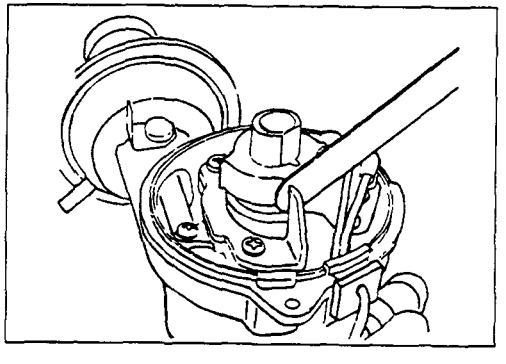
INSPECTION AND REPAIR

Make the necessary adjustments, repairs, and part replacements if excessive wear or damage is discovered during inspection.



Distributor Cap

Check the distributor cap and rotor for cracks and carbon tracks. Check the distributor cap center contact for wear. Center contact should be 2.2 mm (0.087 in) or longer.

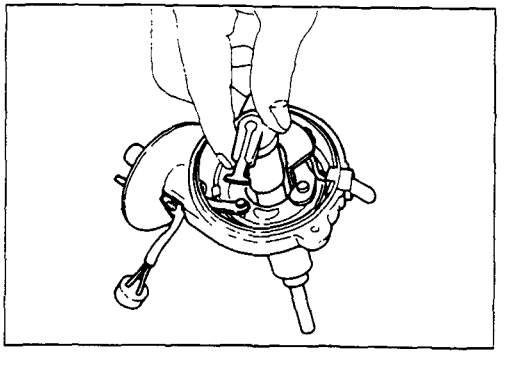


Air Gap

Using a feeler gauge, measure the air gap between the pick-up coil projections.

Air Gap	mm(in)
0.3 — 0.5 (0.012 — 0.020)	

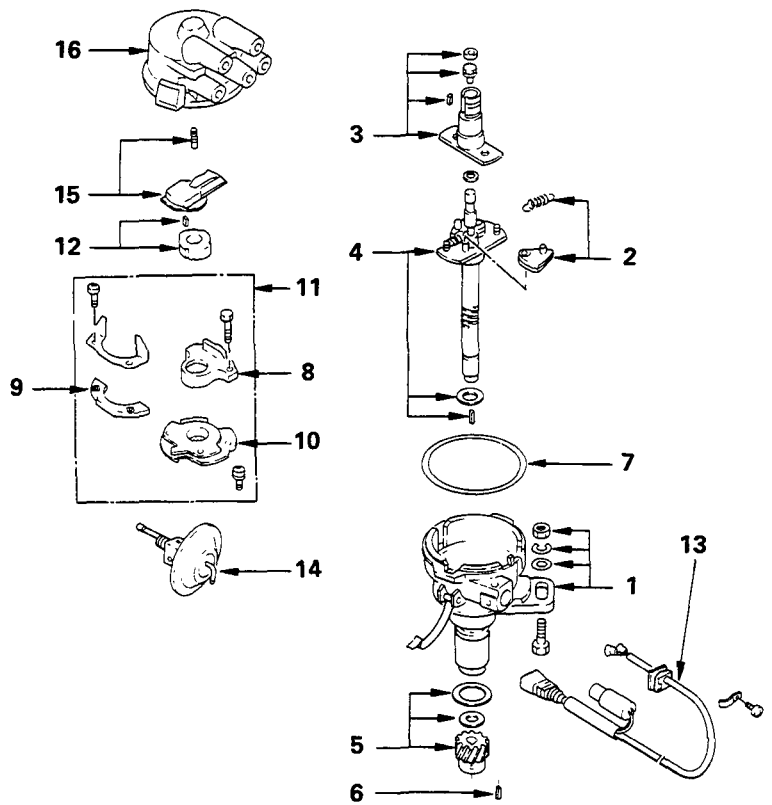
Adjust air gap if necessary.
Loosen the two screws and move the ignitor until the gap is correct. Tighten the two screws and check the air gap.



Governor Control

Turn the rotor shaft counter-clockwise, release it, and check that the rotor returns slightly clockwise.

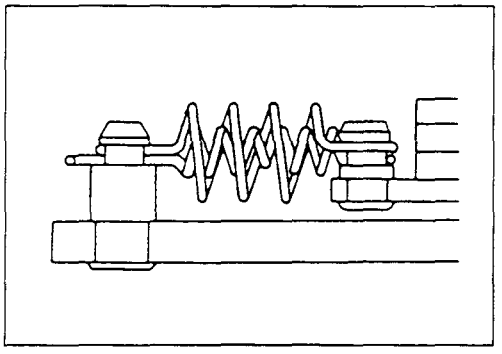
REASSEMBLY



Reassembly Steps

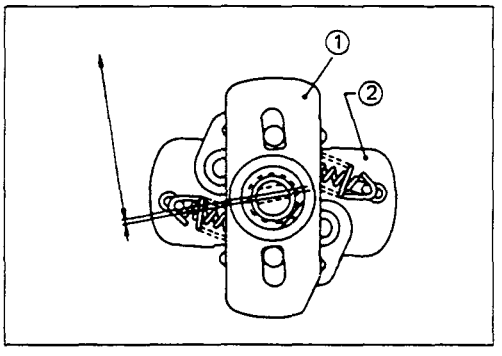
1. Distributor housing
▲ 2. Governor flyweight and spring
▲ 3. Rotor shaft
4. Distributor shaft
▲ 5. Pinion gear and gasket
▲ 6. Roll pin
7. Housing gasket
8. Distributor unit
9. Distributor magnet
10. Breaker plate
▲ 11. Breaker plate, magnet, and unit
▲ 12. Retractor
13. Distributor lead wire
▲ 14. Vacuum control
15. Distributor rotor
16. Distributor cap

Important Operations



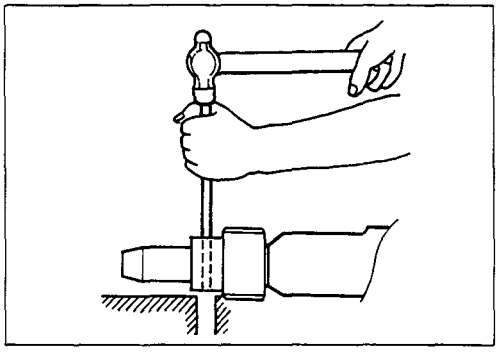
2. Governor Flyweight and Spring

Attach the governor spring to the shaft spring hanger pin. The smaller tapered ends of the spring (both ends) should be secured to the lower side of the hook.



3. Rotor Shaft

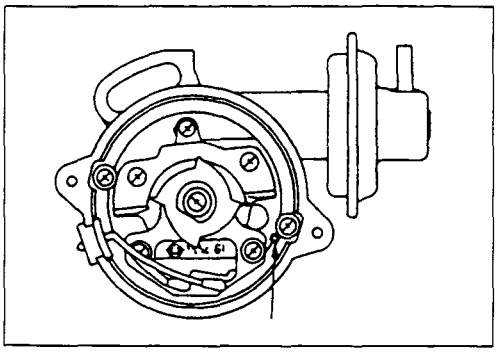
Carefully align the rotor shaft ① notches and the distributor shaft ② notches when installing the rotor shaft.



5. Pinion Gear and Gasket

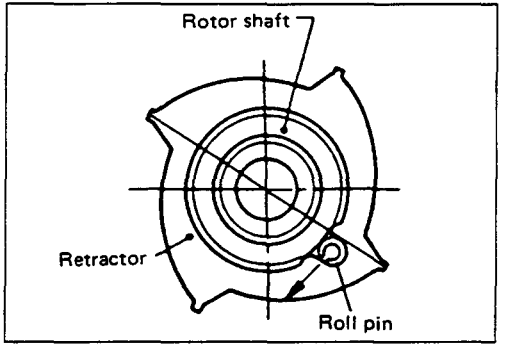
6. Roll Pin

1. Carefully align the pinion gear pin hole and distributor shaft pin hole.
2. Set the pinion gear with gasket to the distributor shaft.
3. Insert the roll pin into the pin hole.
4. Caulk the roll pin both side.



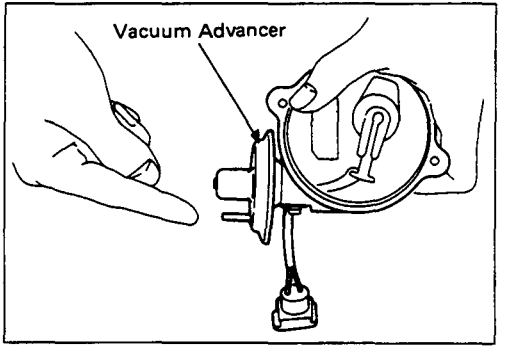
11. Breaker Plate, Magnet, and Unit

Carefully align the scribe marks on the breaker plate and the housing.



12. Retractor

The roll pin notch and the retractor notch must be parallel when the roll pin is inserted into the retractor.



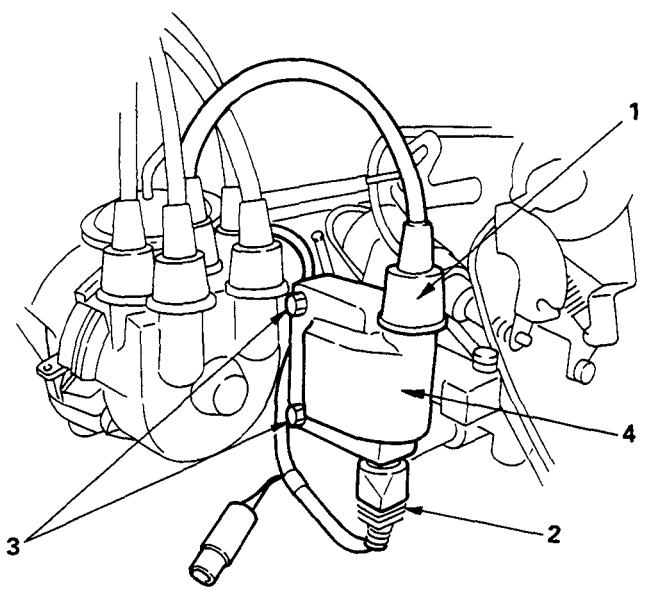
14. Vacuum Control

Apply vacuum and check that the vacuum advancer moves.

IGNITION COIL

REMOVAL AND INSTALLATION

Read this Section carefully before performing any removal and installation procedure. This Section gives you important points as well as the order of operation. Be sure that you understand everything in this Section before you begin.



Removal Steps

1. High-tension cable
2. Lead (positive and negative terminals)
3. Attaching bolt
4. Ignition coil

Installation Steps

To install, follow the removal procedure in the reverse order.

TROUBLESHOOTING

Refer to this Section to quickly troubleshoot and repair engine electrical problems. Each troubleshooting chart has three headings arranged from left to right.

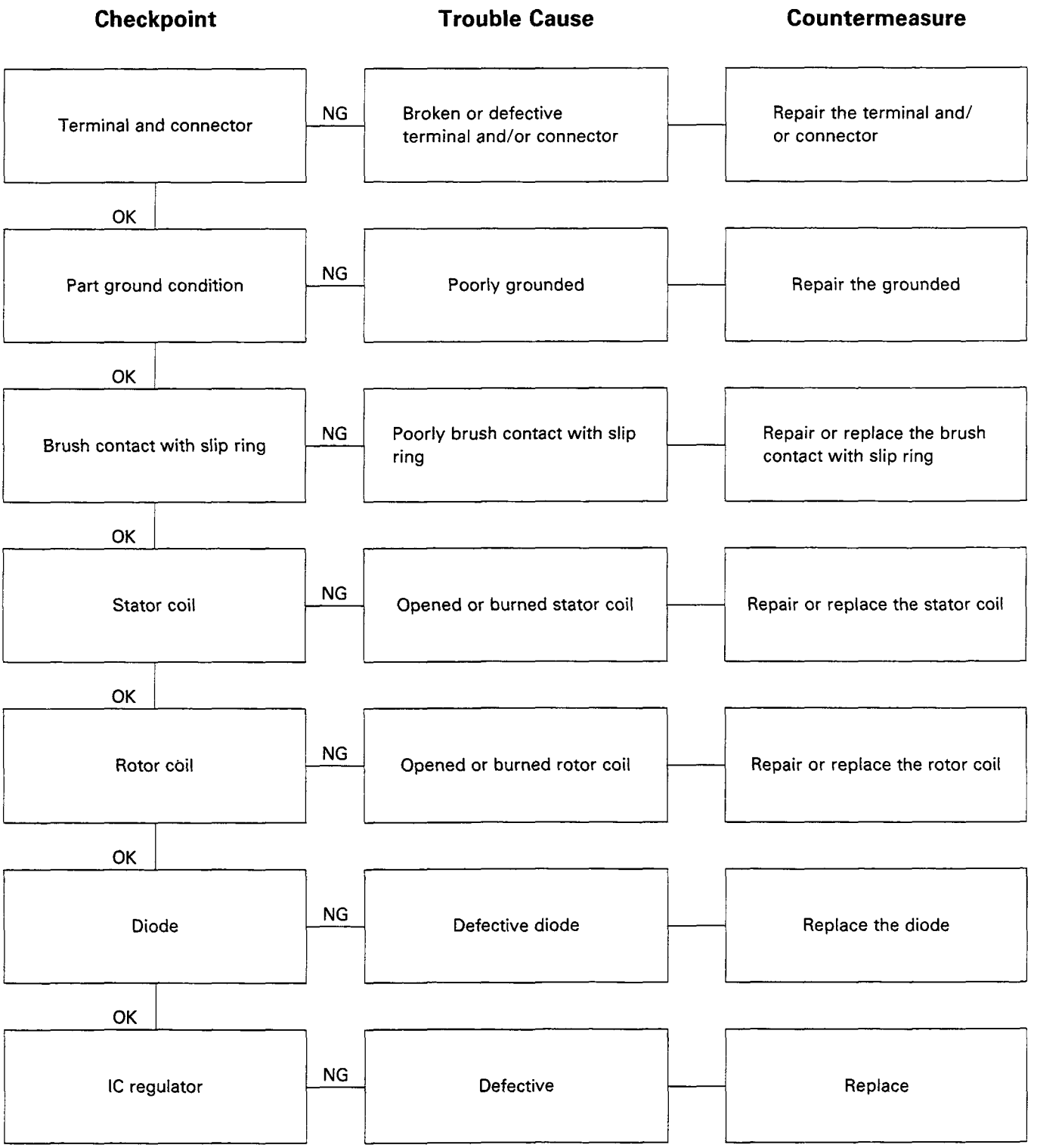
(1) Checkpoint (2) Trouble Cause (3) Countermeasure

This Section is divided into five sub-sections:

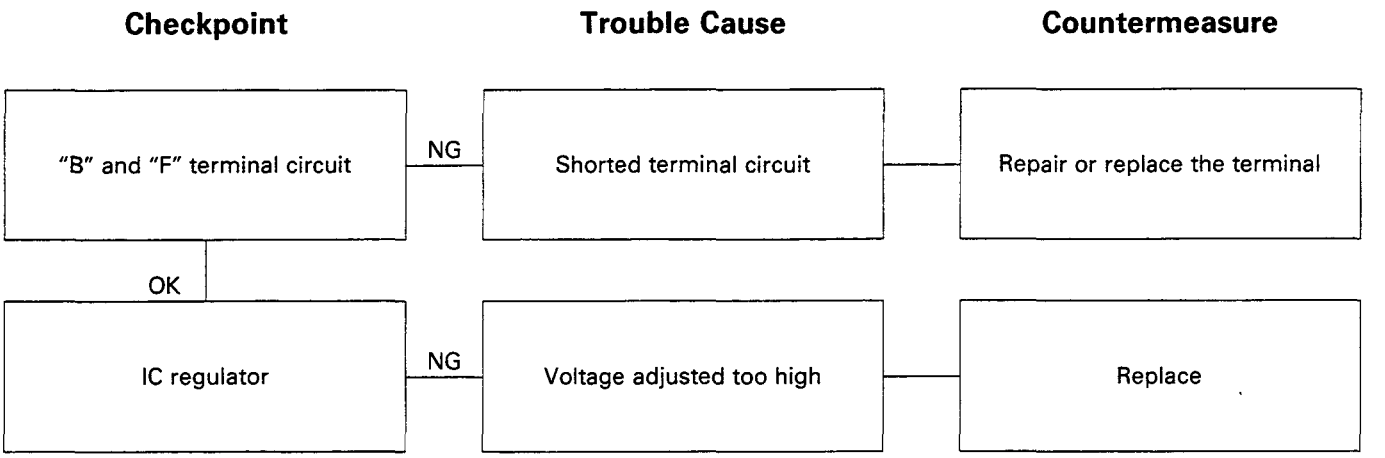
1. Charging and Noise Problem
   1) Noise charging takes place.
   2) Battery overcharging
   3) Battery undercharging
   4) Charging current unstable
   5) Noise
2. Starter Switch and Starter Motor Faulty
   1) Solenoid switch does not work when starter switch is turned on.
   2) Pinion engages ring gear properly, but engine will not turn over.
   3) Pinion gear does not properly engage ring gear.
   4) Starter motor does not stop when starter switch is turned off.
   5) Excessive sparking at commutator
3. Ignition Faulty
   1) No spark occurs.
   2) Spark occurs irregularly or jump across gap of only 1 to 2 mm (0.04 to 0.08 in).
   3) Spark jumps across gap of 5 mm (0.2 in) or more.
4. Rough Engine Running
   1) Engine misfires regularly.
   2) Engine knocks regularly.
   3) Engine lacks power.

1. CHARGING AND NOISE PROBLEM

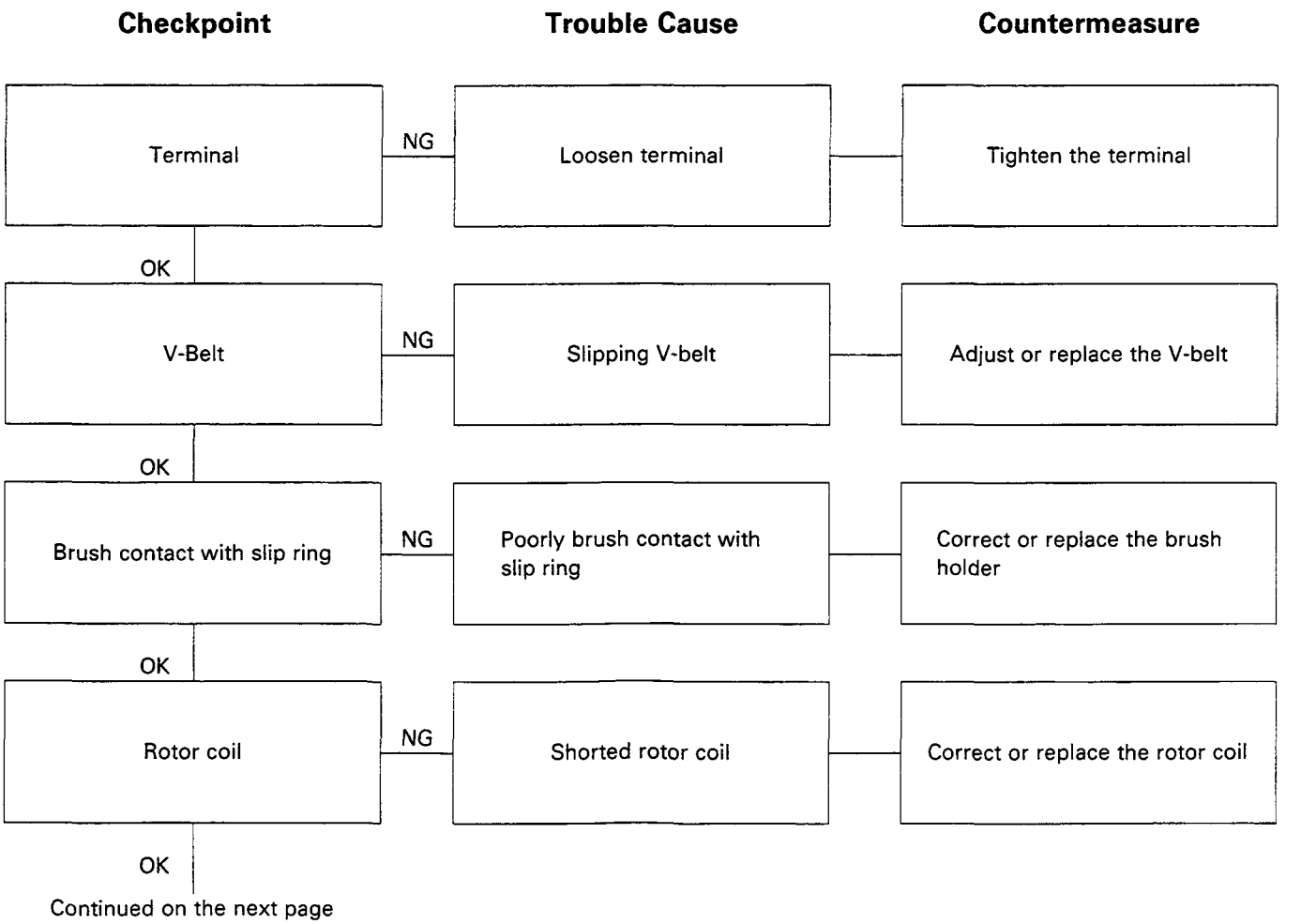
1) NO CHARGING TAKES PLACE



2) BATTERY OVERCHARGING



3) BATTERY UNDERCHARGING



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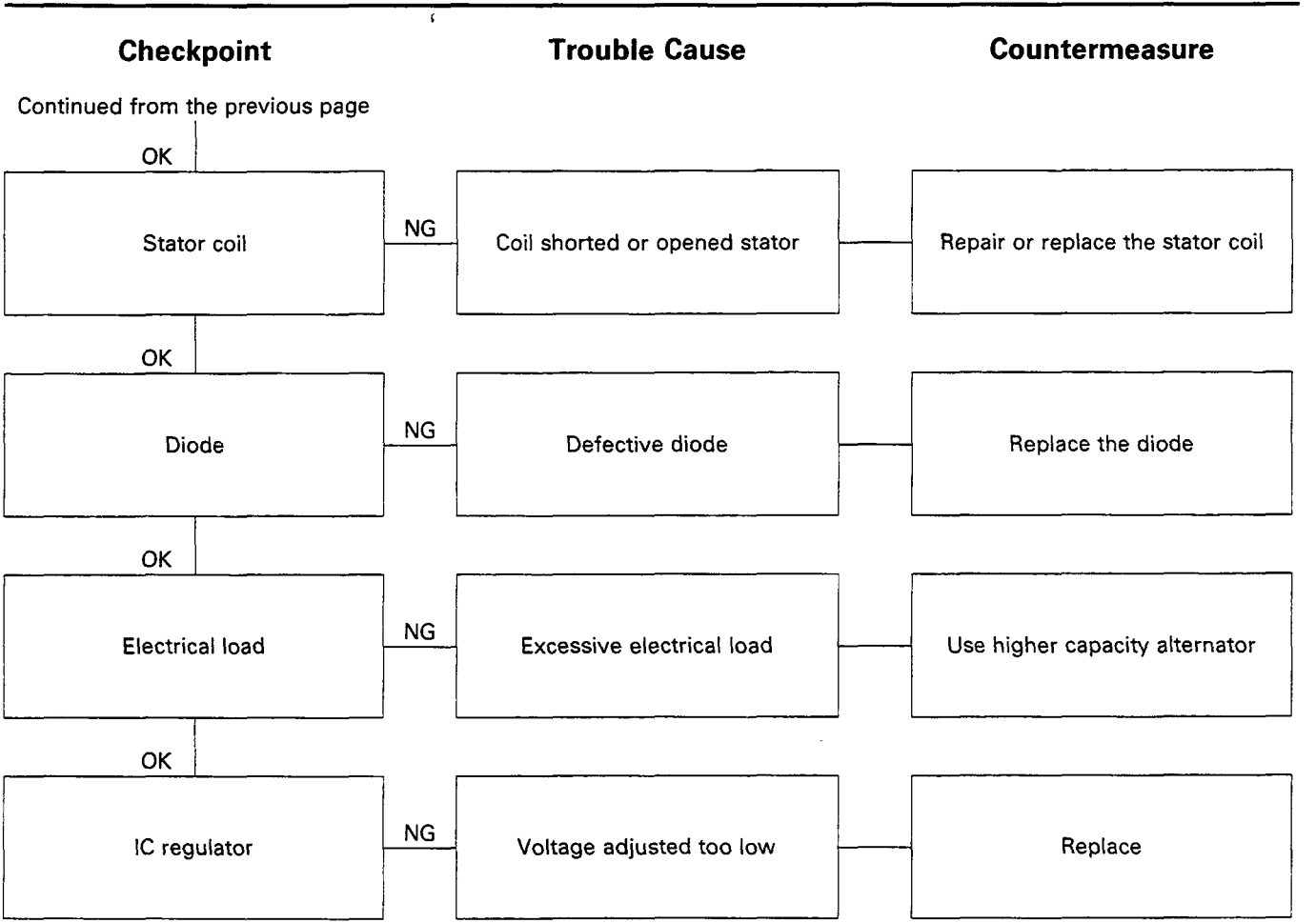
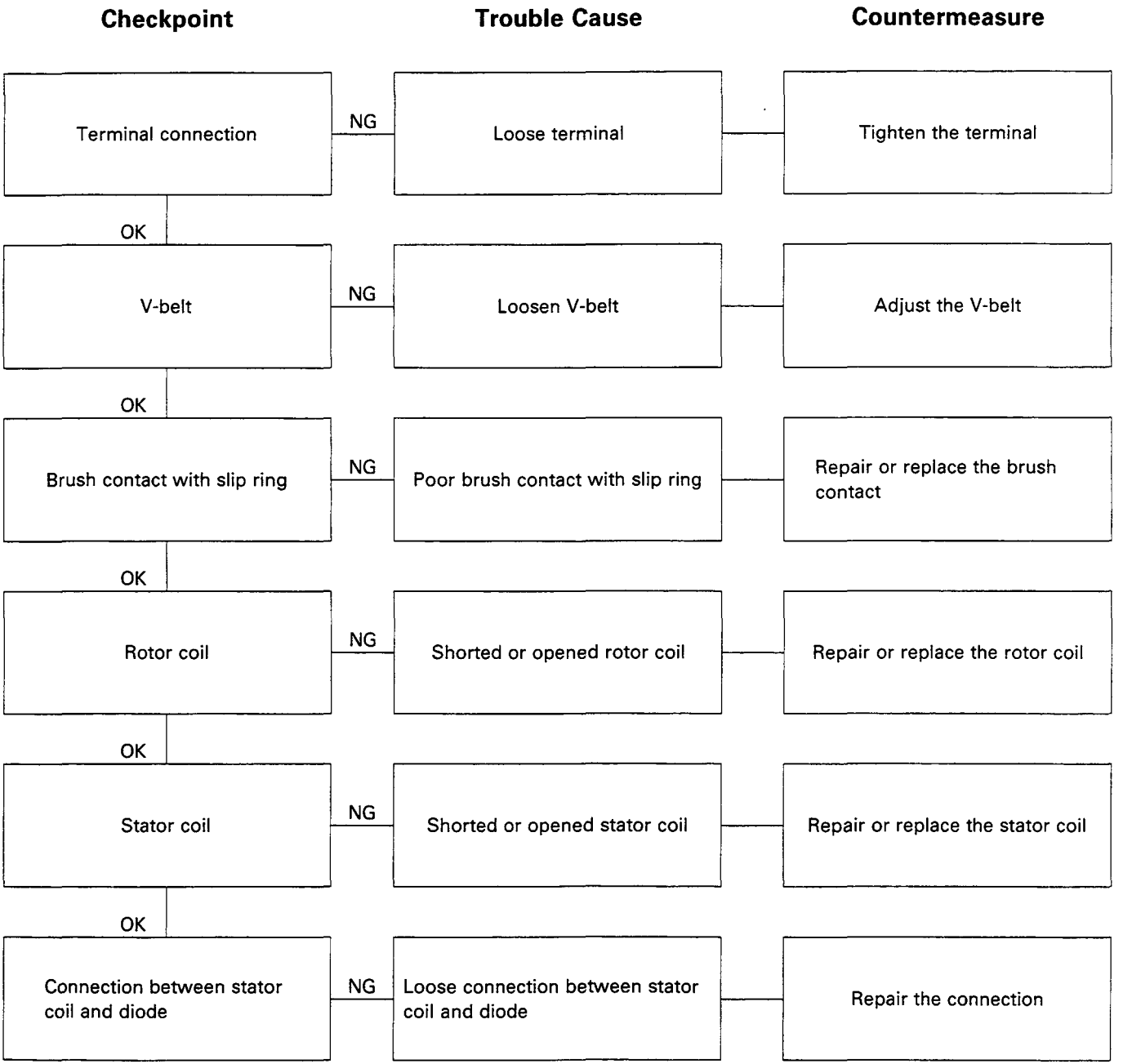
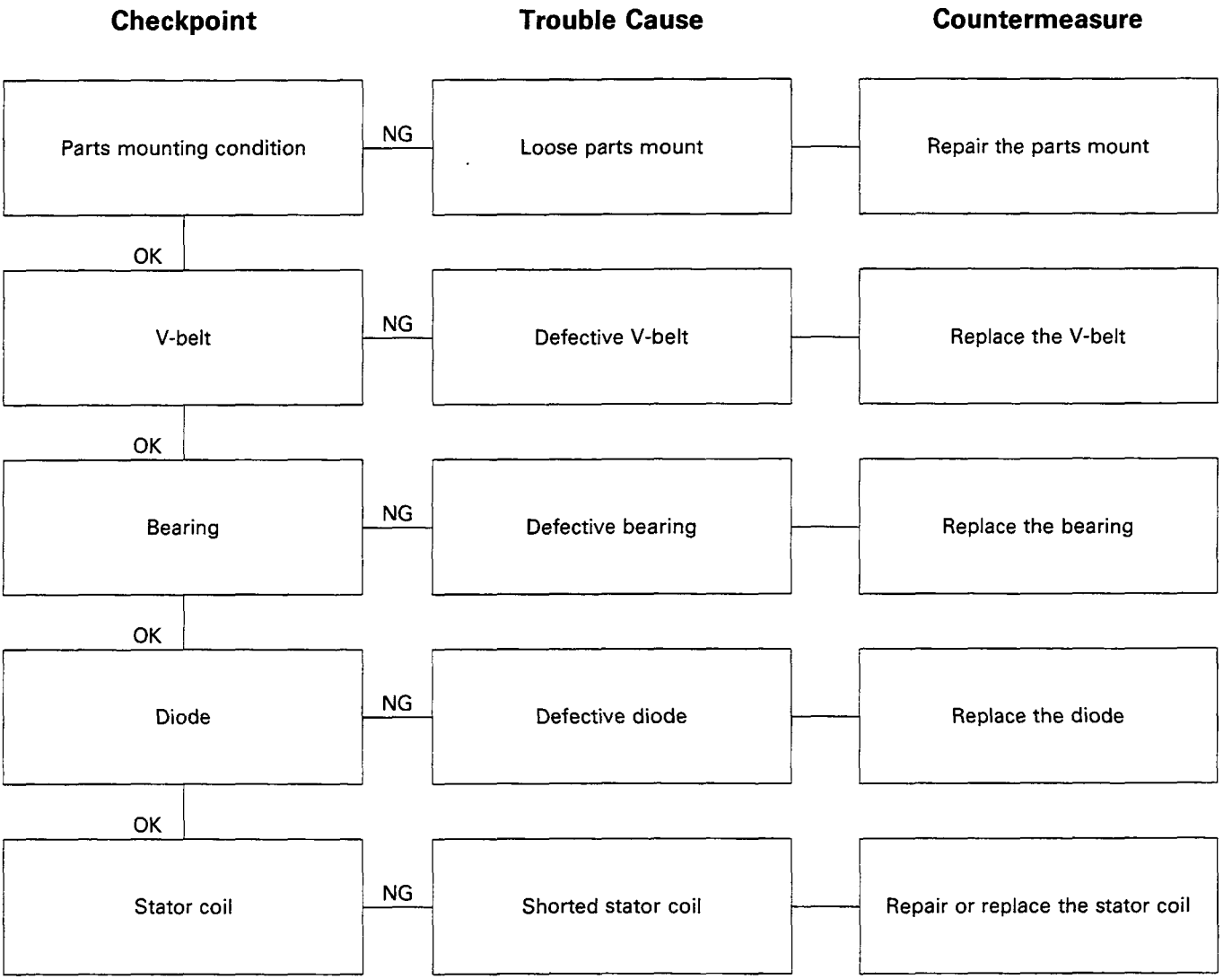

Checkpoint
Trouble Cause
Countermeasure
Continued from the previous page
OK
Stator coil
NG
Coil shorted or opened stator
Repair or replace the stator coil
OK
Diode
NG
Defective diode
Replace the diode
OK
Electrical load
NG
Excessive electrical load
Use higher capacity alternator
OK
IC regulator
NG
Voltage adjusted too low
Replace

4) CHARGING CURRENT UNSTABLE

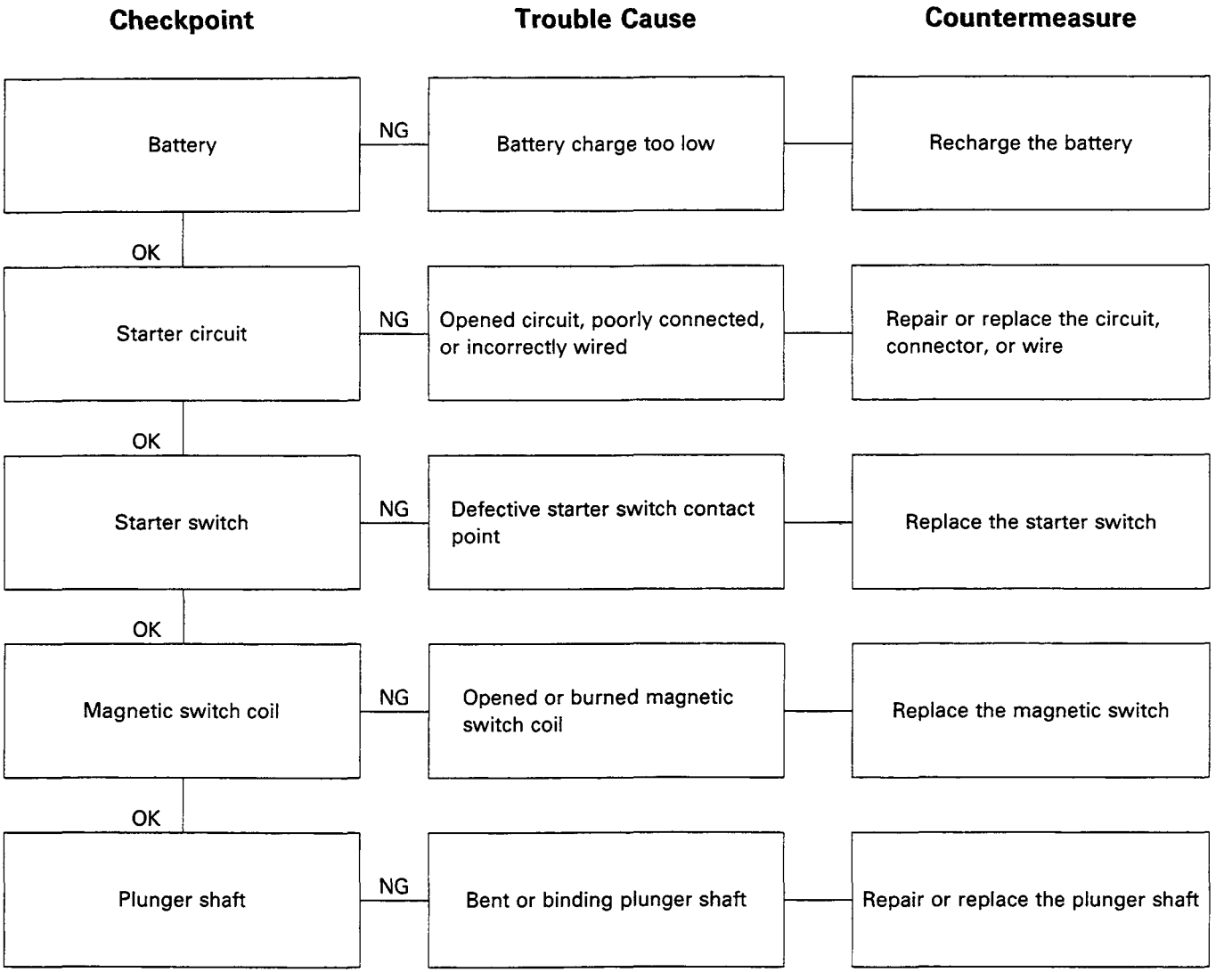


5) NOISE

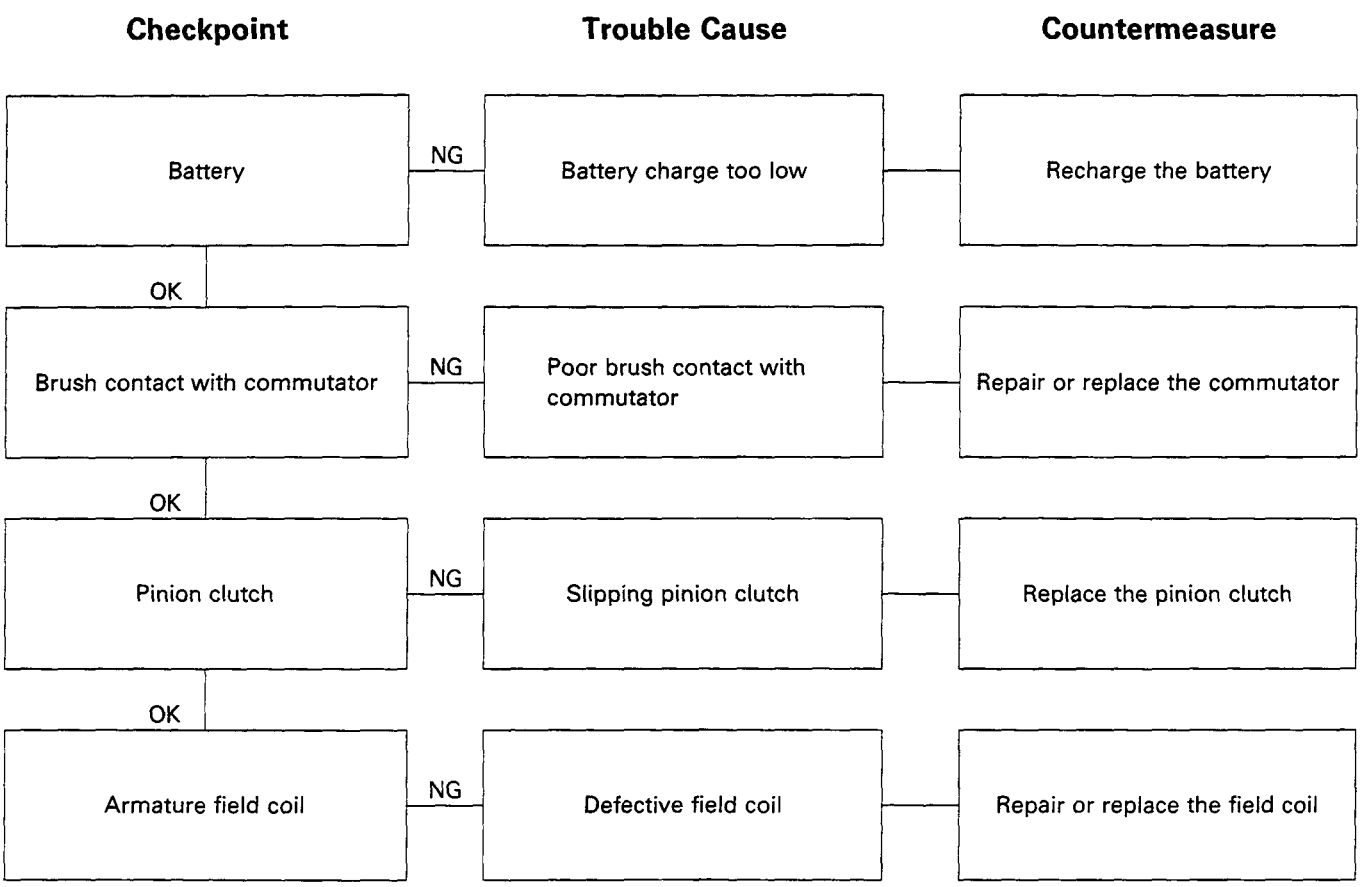

Checkpoint
Trouble Cause
Countermeasure
Parts mounting condition
NG
Loose parts mount
Repair the parts mount
OK
V-belt
NG
Defective V-belt
Replace the V-belt
OK
Bearing
NG
Defective bearing
Replace the bearing
OK
Diode
NG
Defective diode
Replace the diode
OK
Stator coil
NG
Shorted stator coil
Repair or replace the stator coil

2. STARTER SWITCH AND STARTER MOTOR FAULTY

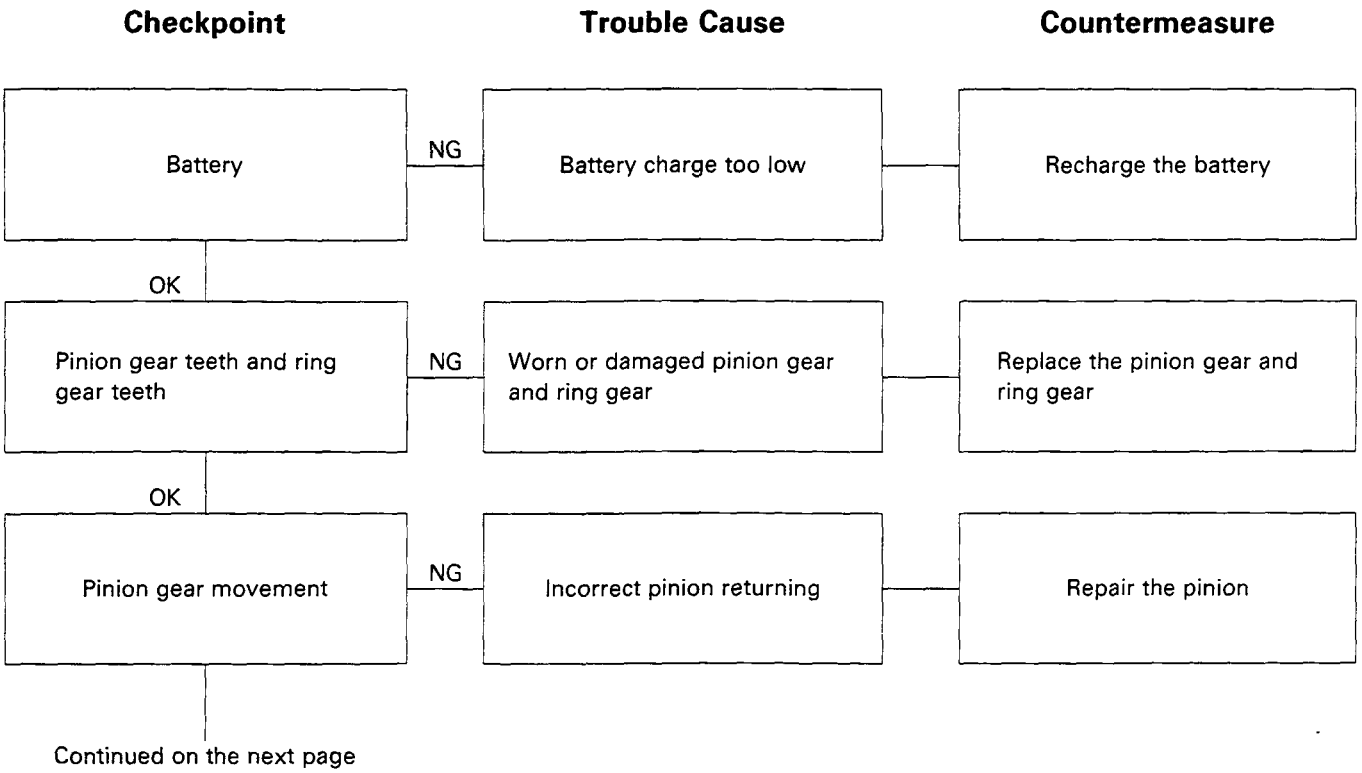
1) SOLENOID SWITCH DOES NOT WORK WHEN STARTER SWITCH IS TURNED ON



2) PINION ENGAGES RING GEAR PROPERLY BUT ENGINE WILL NOT TURN OVER



3) PINION GEAR DOES NOT PROPERLY ENGAGE RING GEAR



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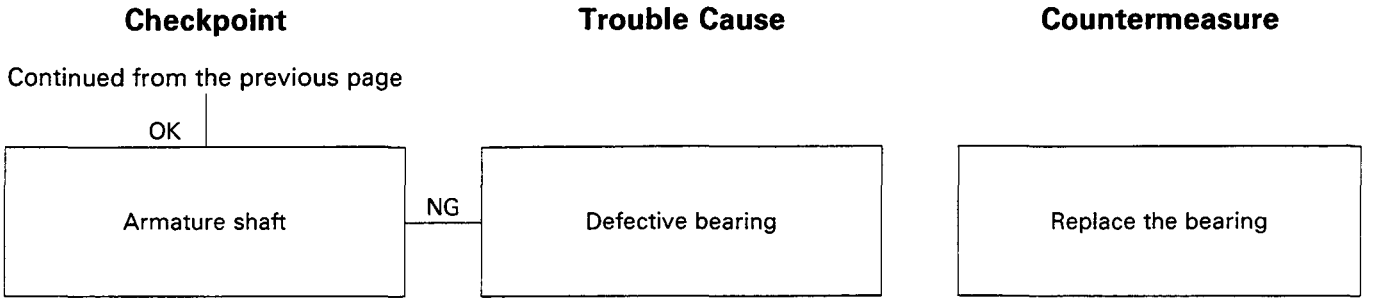
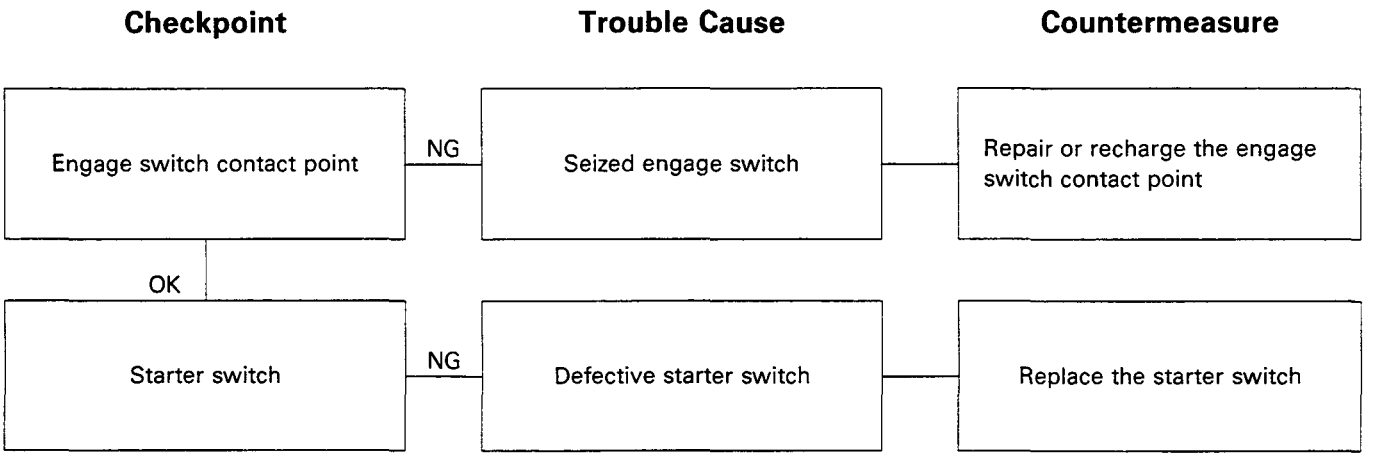
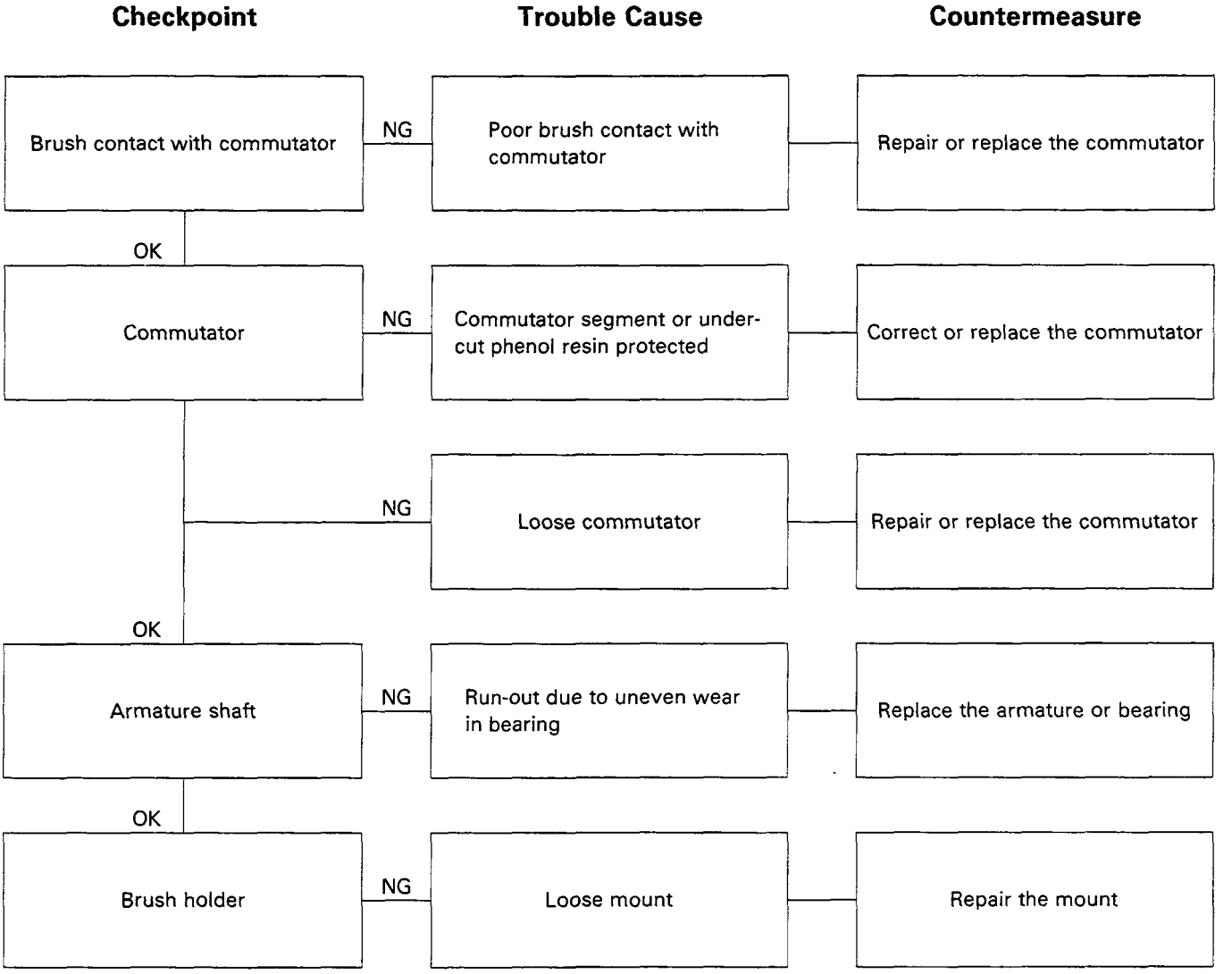


4) STARTER MOTOR DOES NOT STOP WHEN STARTER SWITCH IS TURNED OFF

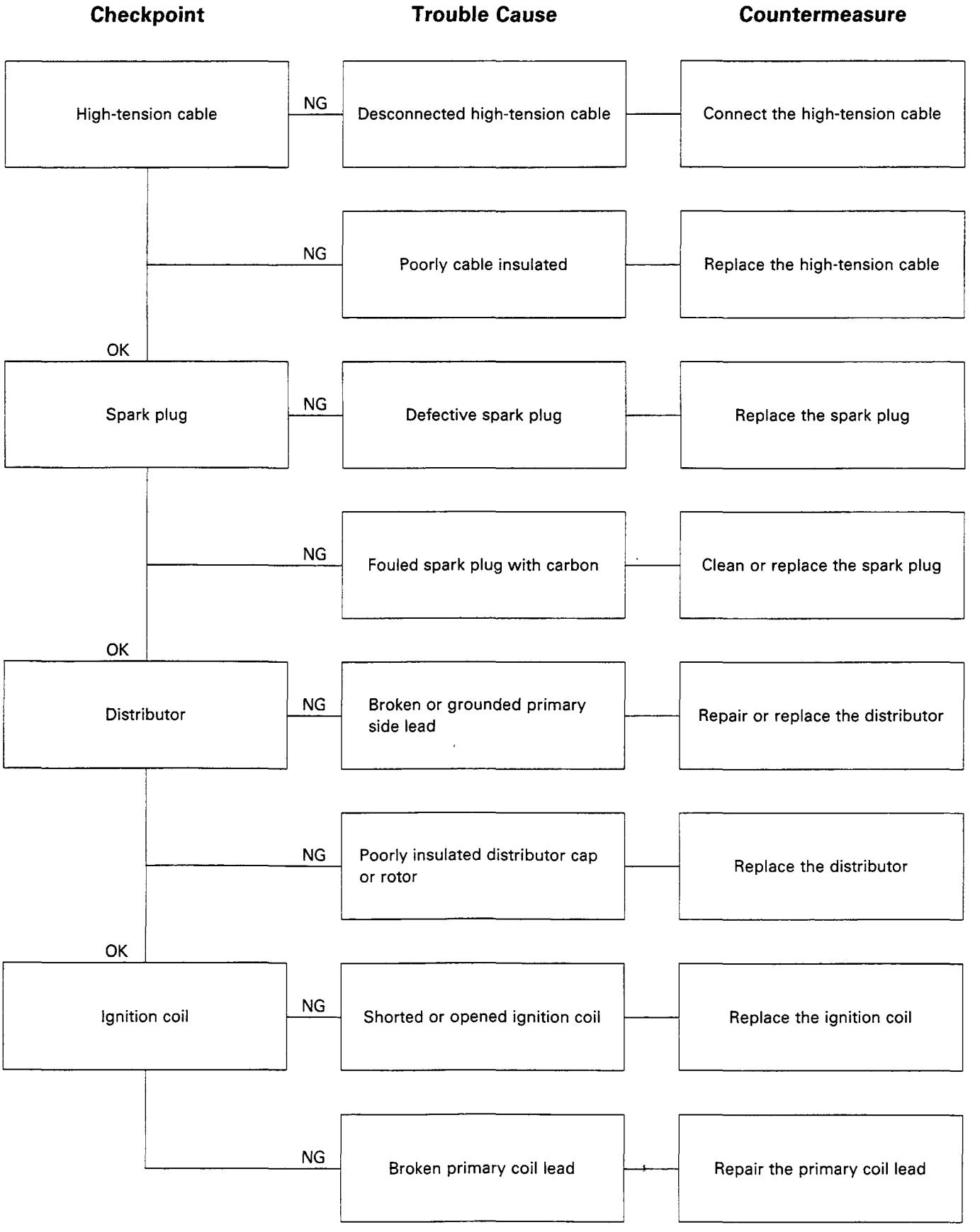


5) EXCESSIVE SPARKING AT COMMUTATOR



3. IGNITION FAULTY

1) NO SPARK OCCURS



2) SPARK OCCURS IRREGULARLY OR JUMPS ACROSS GAP OF ONLY 1 to 2 mm (0.04 to 0.08 in)

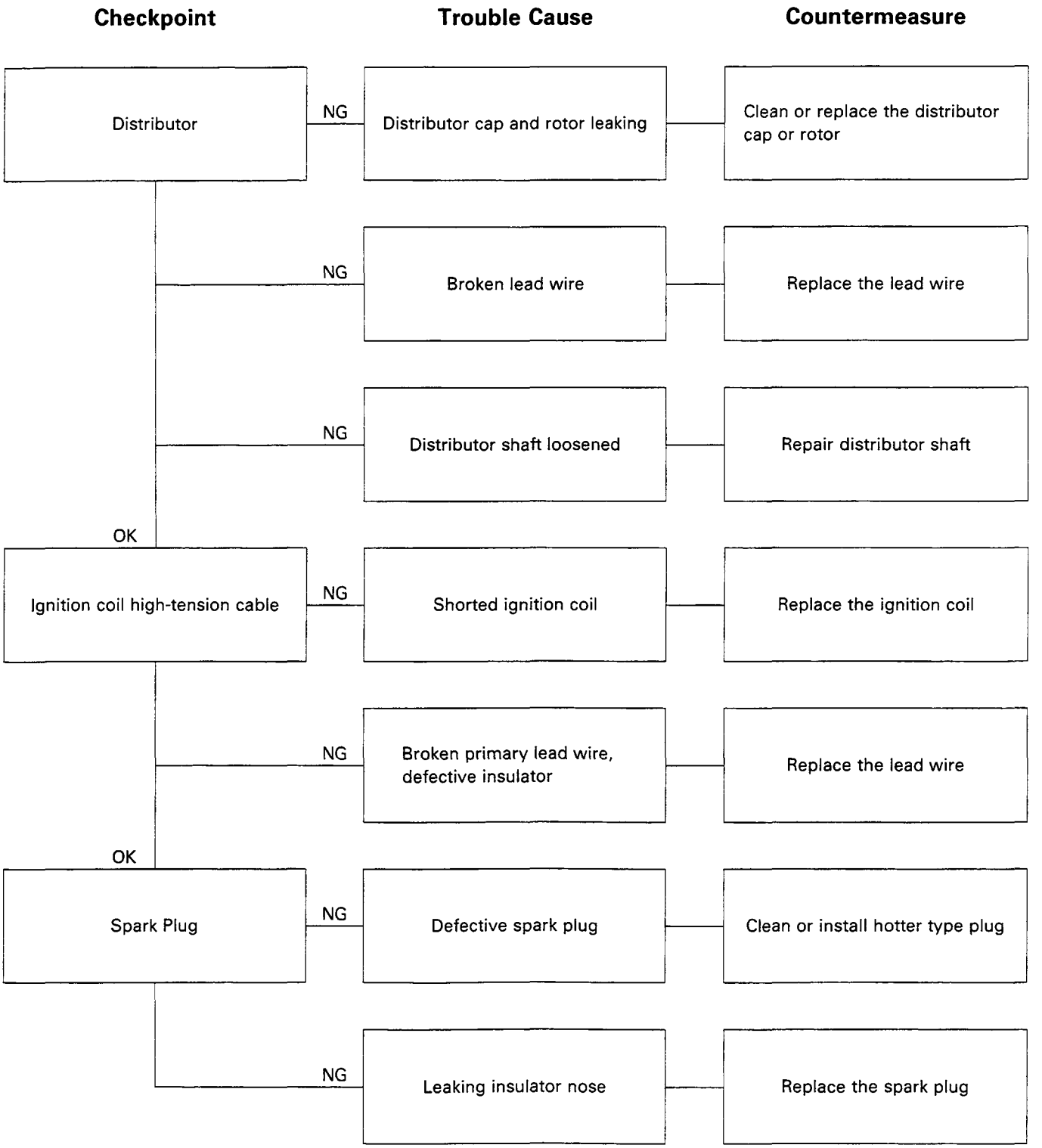
Checkpoint		Trouble Cause	Countermeasure
Ignition coil	NG	Shorted ignition coil	Replace the ignition coil

3) SPARK JUMPS ACROSS GAP OF 5 mm (0.2 in) OR MORE

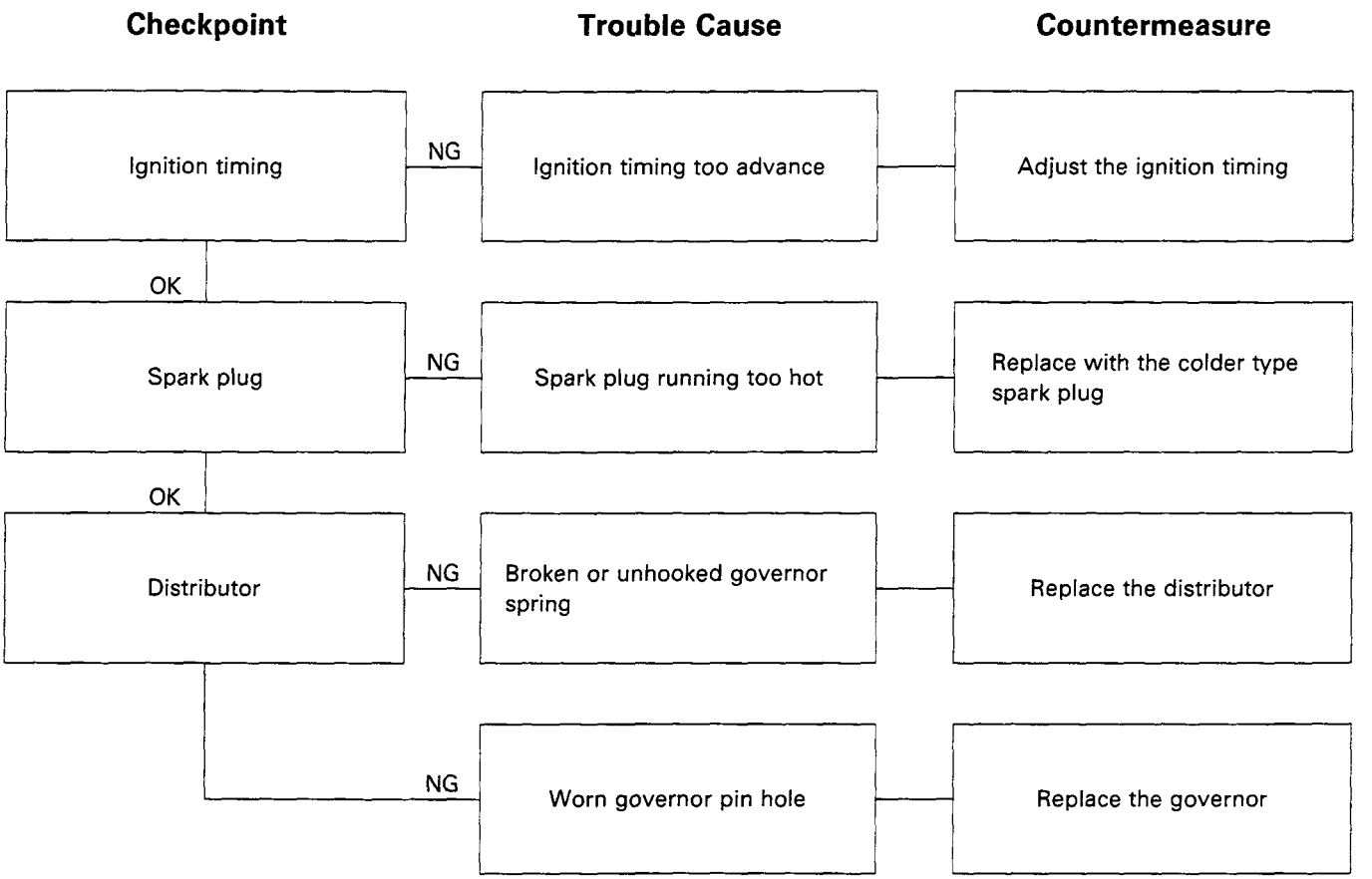
Checkpoint		Trouble Cause	Countermeasure
Spark plug	NG	Excessive spark plug gap	Adjust or replace the spark plug
	NG	Fouled spark plug with carbon	Clean or replace the hotter type spark plug
	NG	Broken porcelain insulator	Replace the spark plug
	NG	Worn out spark plug electrode	Replace the spark plug

4. ROUGH ENGINE RUNNING

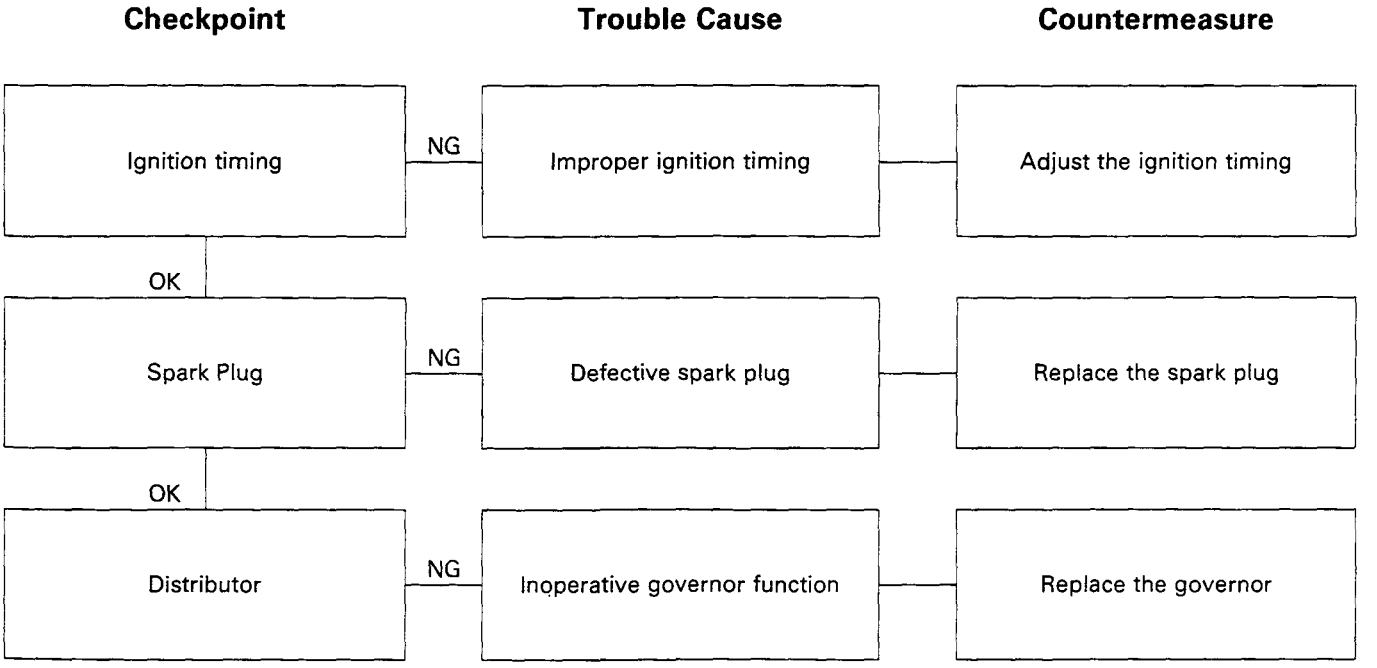
1) ENGINE MISFIRES REGULARLY



2) ENGINE KNOCKS REGULARLY



3) ENGINE LACKS POWER



SECTION 6F

ENGINE EXHAUST

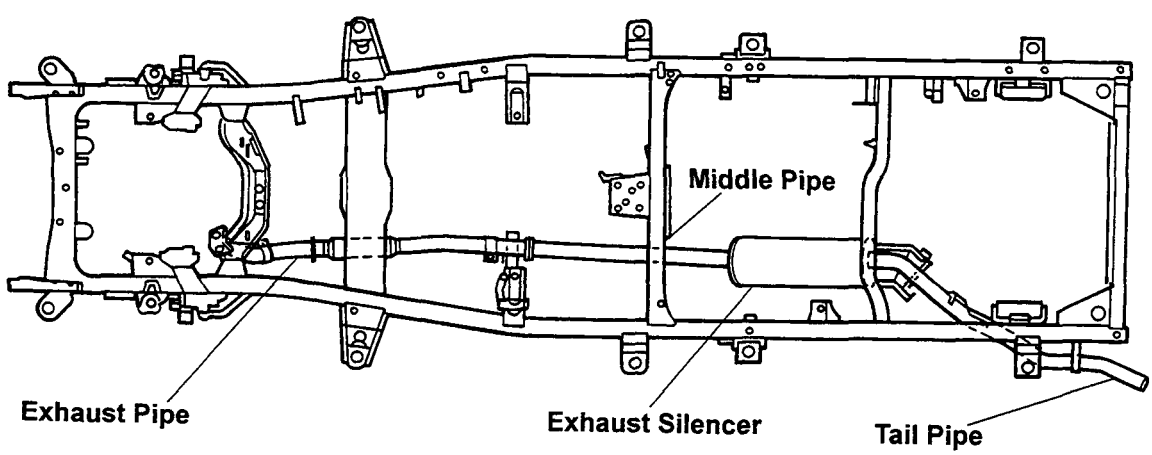
TABLE OF CONTENTS

PAGE

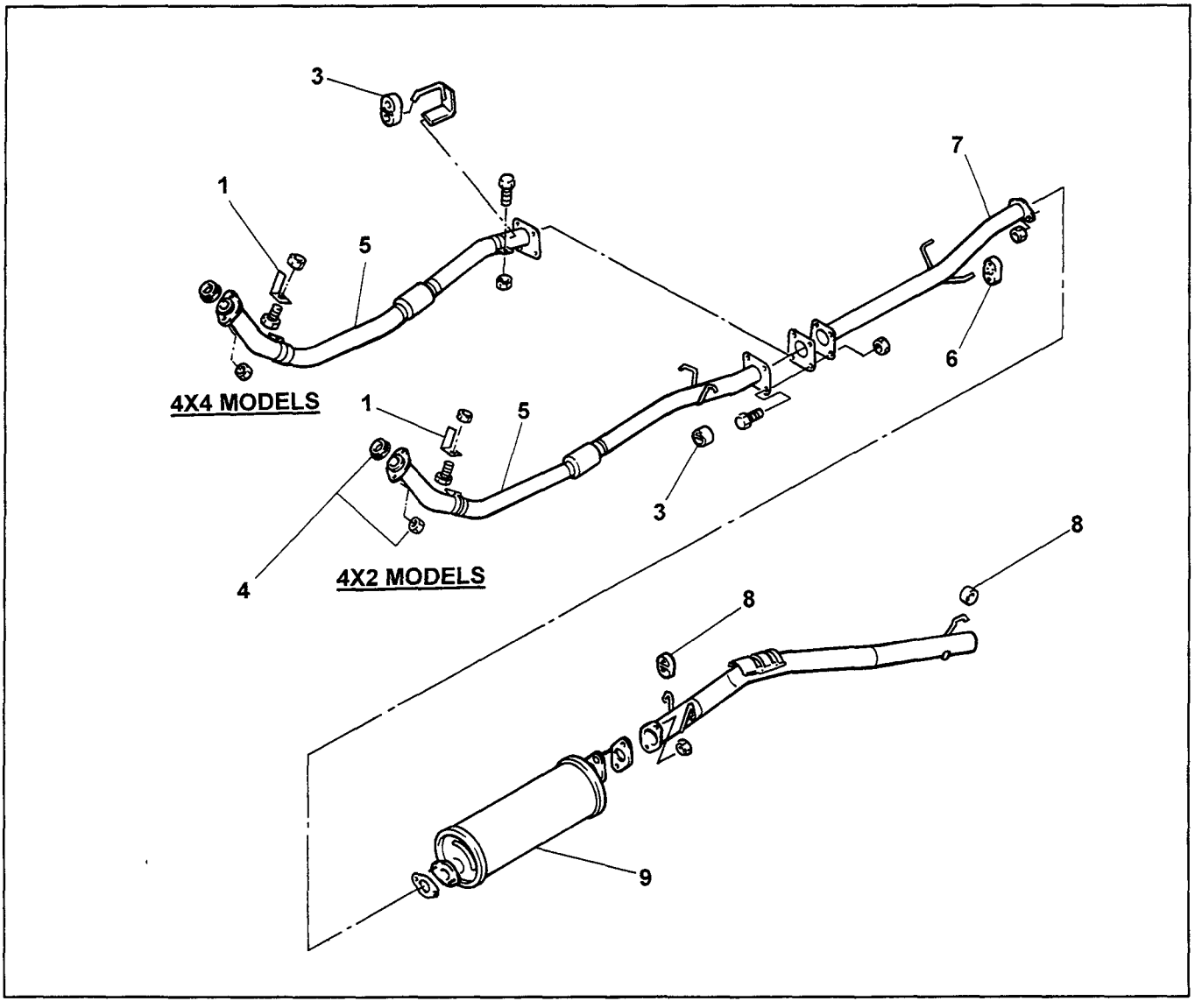
MAIN DATA AND SPECIFICATIONS

Exhaust system		
Pipe outside diameter × thickness		
Front pipe	mm(in)	50.8 × 1.5 (2.0 × 0.059)
Middle pipe	mm(in)	50.8 × 1.5 (2.0 × 0.059)
Rear pipe	mm(in)	50.8 × 1.6 (2.0 × 0.063)
Silencer		
Type		Circular section-shell construction of triple skin and end plates, internal construction of baffles and perforated tubes.
Inside diameter	mm(in)	Approximately 180 (7.09)
Length	mm(in)	Approximately 525 (20.67)
Mounting		
Number of suspension points		5
Type		Rubber and metal
Catalytic converter type		Oxidizing catalytic (Until '90 model)
(For Switzerland and Sweden)		Three-way catalytic (From '91 model)

GENERAL DESCRIPTION



REMOVAL AND INSTALLATION



Removal Steps

1. Front exhaust pipe bracket nut (Transmission side)
2. Front exhaust pipe mounting bracket nut (4x4 model)
3. Front exhaust pipe damper ring
4. Front exhaust pipe flange nut with gasket
5. Front exhaust pipe
6. Center exhaust pipe damper ring
7. Center exhaust pipe
8. Rear exhaust pipe damper rings
9. Exhaust silencer with rear exhaust pipe

Installation Steps

9. Exhaust silencer with rear exhaust pipe
8. Rear exhaust pipe damper rings
7. Center exhaust pipe
6. Center exhaust pipe damper ring
5. Front exhaust pipe
▲ 4. Front exhaust pipe flange nut with gasket
3. Front exhaust pipe damper ring
2. Front exhaust pipe mounting bracket nut (4x4 model)
1. Front exhaust pipe bracket nut (Transmission side)

Important – Installation

9. Exhaust Silencer with Rear Exhaust Pipe

Apply muffler sealer to the joining portion of the pipes.

4. Front Exhaust Pipe Flange Nut

Connect the exhaust pipe to the exhaust manifold.

Front exhaust pipe to manifold nut.

Torque	kg·m(lb.ft/N·m)
	6.8 ± 0.5 (49 ± 3.6/66 ± 5)

INSPECTION AND REPAIR

Make the necessary adjustments, repairs, and part replacements if excessive wear or damage is discovered during inspection.

Front Exhaust Pipe

Center Exhaust Pipe and Catalytic Converter Flange Nut

Exhaust Pipe Damper Ring

Exhaust Silencer with Rear Exhaust Pipe

Check the pipes for corrosion, cracking, damage or misalignment and repair if required.
Check the rubber rings for deterioration or damage and repair if required.