INTRODUCTION

This service manual has been prepared to provide necessary information concerning the maintenance and repair work on the NISSAN FORKLIFT F05 series.

Any changes effected in the series after publication of this service manual will be announced in a technical bulletin. It is, therefore, recommended that each relevant technical bulletin be inserted in front of each section and be used together with the service manual as a reference.

If a new model requires different service method or has undergone a major change, revised sections will be issued to replace the applicable sections. Each revised section will include the description of how to service the parts for the former specifications. The publication of a revised section will be announced in the technical bulletin.

This service manual consists of twenty-one sections as shown in the following table, which gives the updated symbols. When a revised service manual is issued, this "INTRODUCTION" sheet should be replaced with a revised one.

Section	Symbol
GENERAL INFORMATION	(GI)
MAINTENANCE	(MA)
ENGINE TUNE-UP (FD6 ENGINE)	(ET)
ENGINE MECHANICAL (FD6 ENGINE)	(EM)
ENGINE LUBRICATION SYSTEM (FD6 ENGINE)	(EL)
COOLING SYSTEM (FD6 ENGINE)	(CO)
ENGINE FUEL (FD6 ENGINE)	(EF)
GOVERNOR SYSTEM (FD6 ENGINE)	(GO)
ENGINE ELECTRICAL (FD6 ENGINE)	(EE)
ENGINE REMOVAL	(ER)
AUTOMATIC TRANSMISSION	(AT)
PROPELLER SHAFT & DIFFERENTIAL CARRIER	(PD)
FRONT AXLE	(FA)
REAR AXLE	(RA)
BRAKE SYSTEM	(BR)
STEERING SYSTEM	(ST)
HYDRAULIC SYSTEM	(HD)
LOADING MECHANISM	(LM)
ENGINE CONTROL, FUEL & EXHAUST SYSTEMS	(FE)
BODY & FRAME	(BF)
BODY ELECTRICAL	(BE)

Edition: October 1983
Printing: March 1994 (09)
Publication No. SM4E-0F05G0

Printed in Japan

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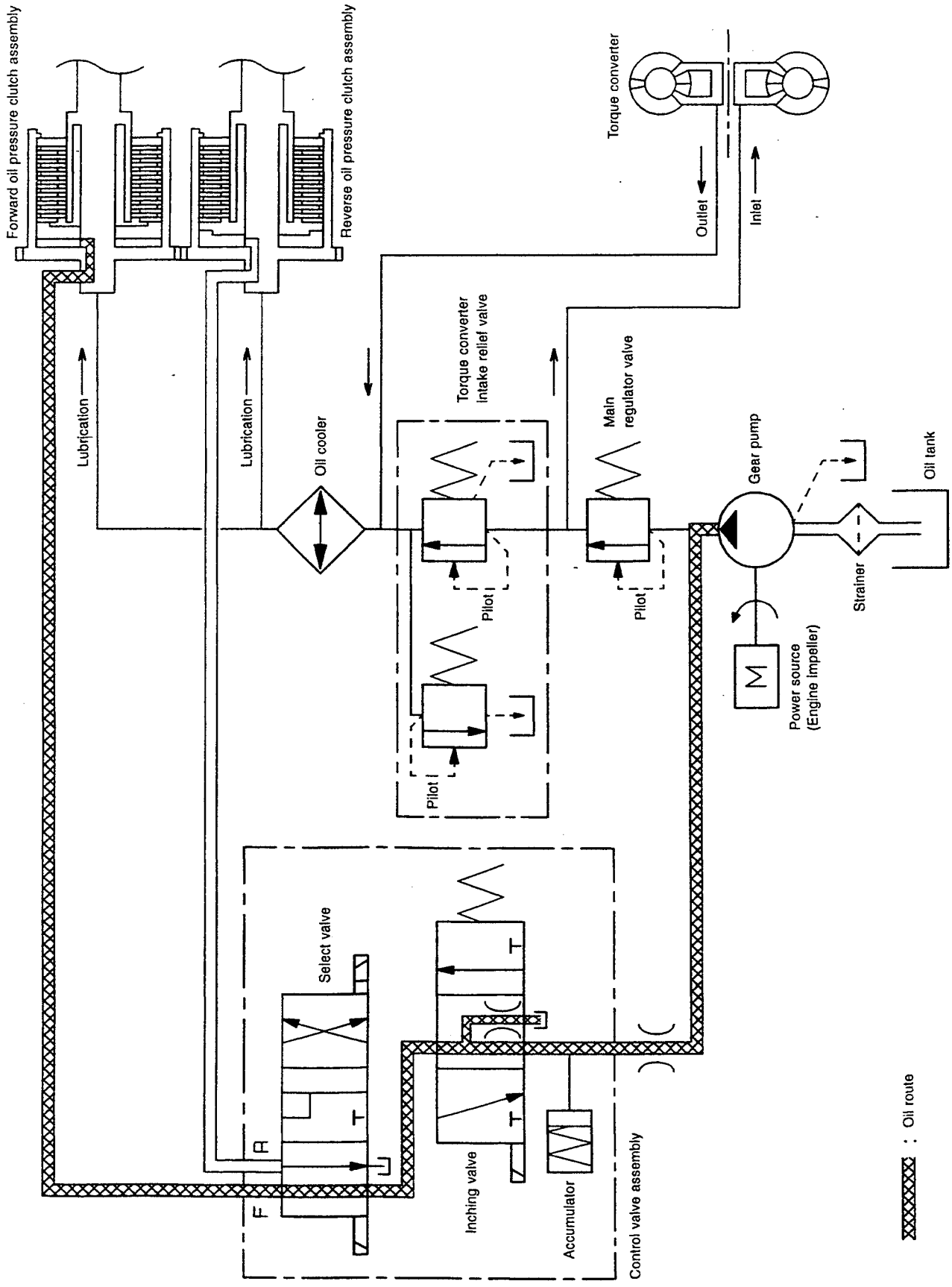
FORWARD INCHING

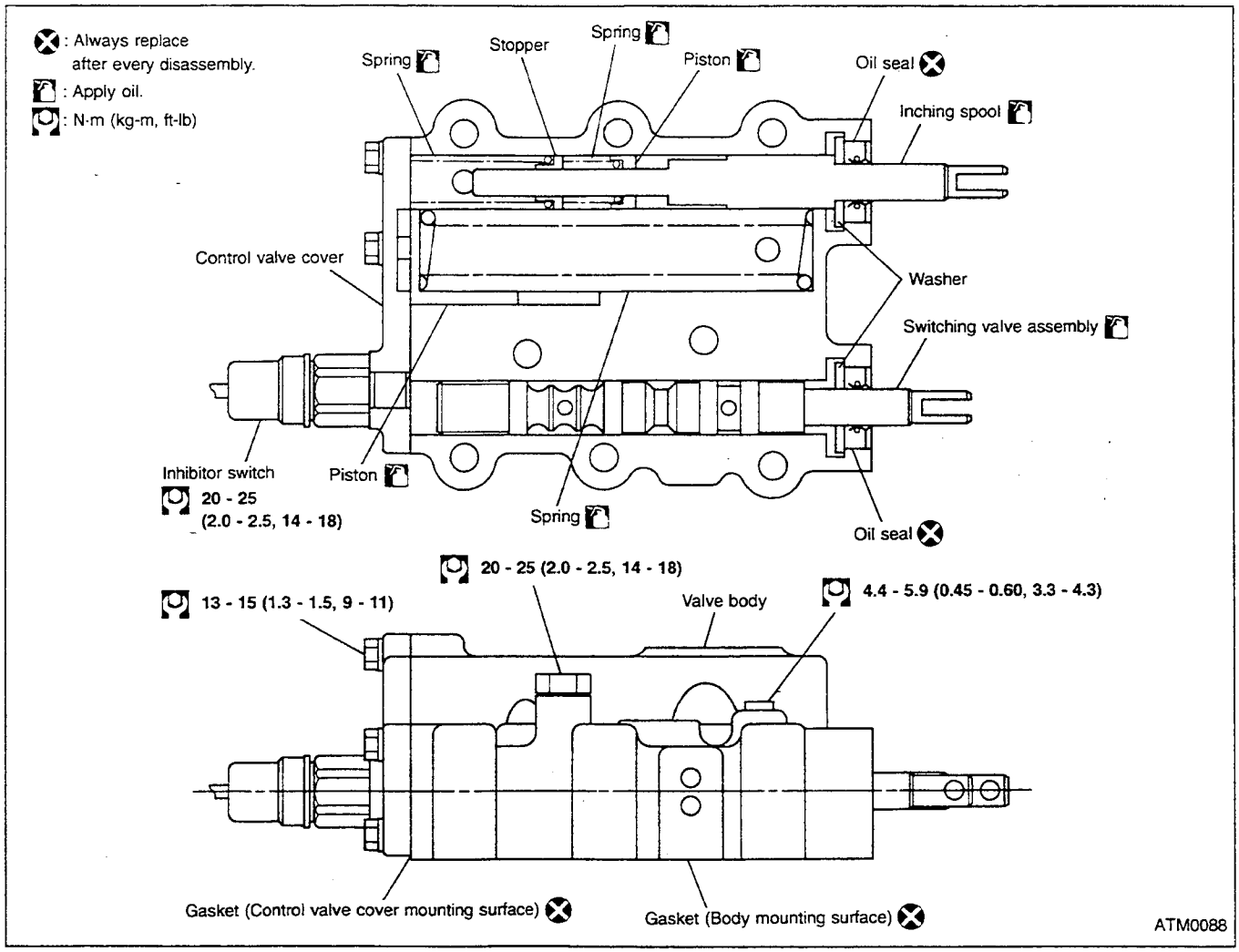
When inching during reverse, oil pressure into clutch is routed through reverse switching valve.



ATM0057

Control Valve

CONSTRUCTION

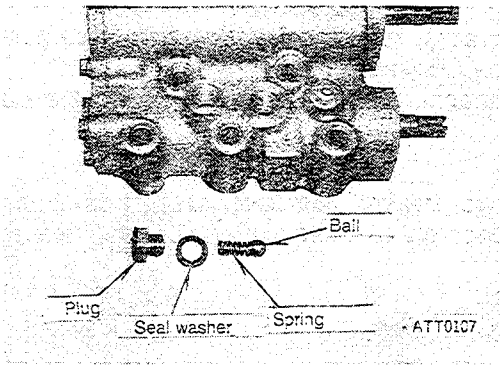


DISASSEMBLY

CAUTION:

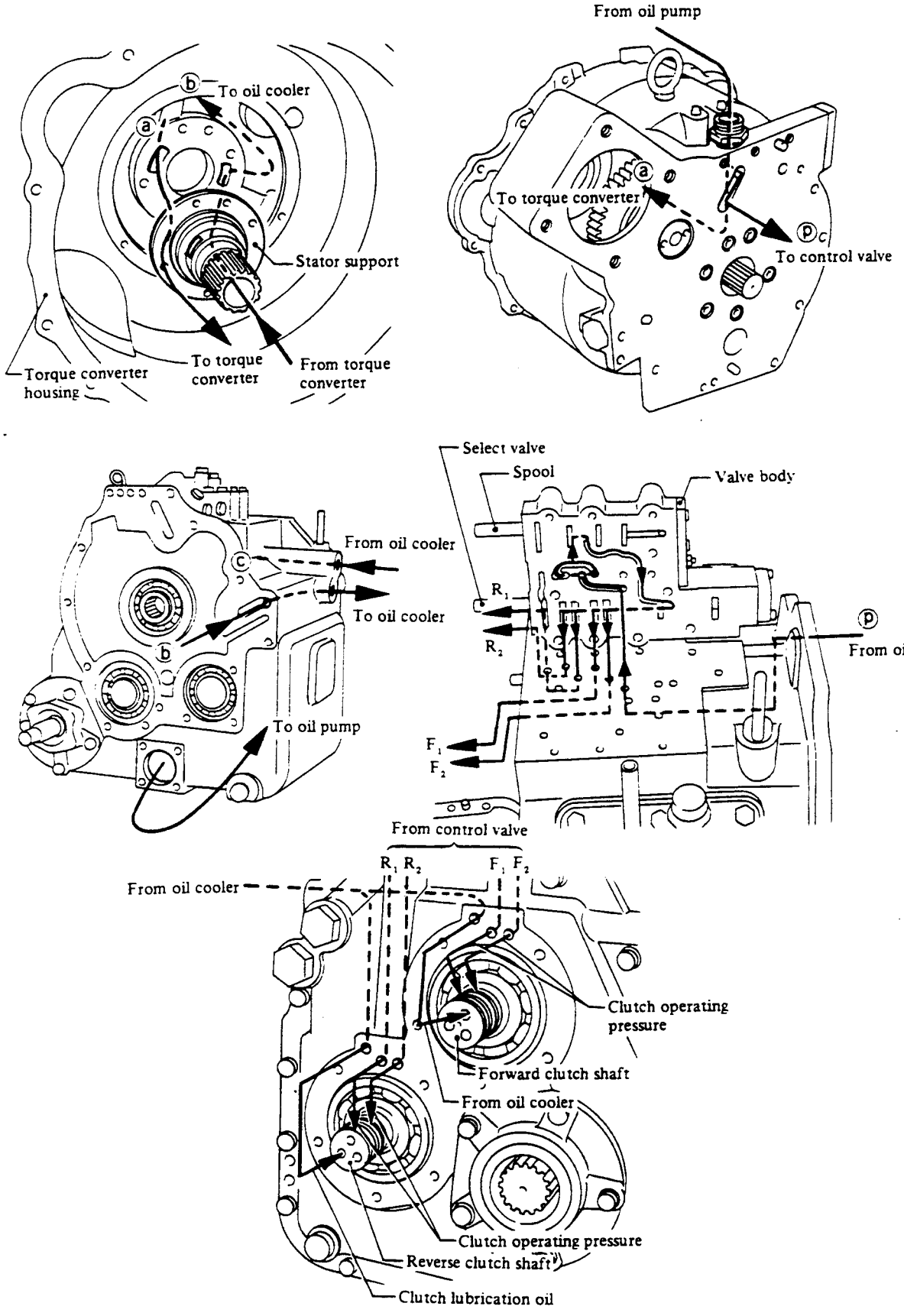
- **Avoid unnecessary disassembly. When disassembly is unavoidable, clean area surrounding control valve before disassembly, and disassemble in a cleaned environment.**
- **Do not damage piston and cylinder during disassembly.**
- To remove control valve, refer to "Transmission Assembly with Dual Stator Torque Converter".

1. Remove reverse lamp switch and inhibitor switch.



2. Remove plug, seal washer and ball. Then remove spring.

OIL CIRCUIT

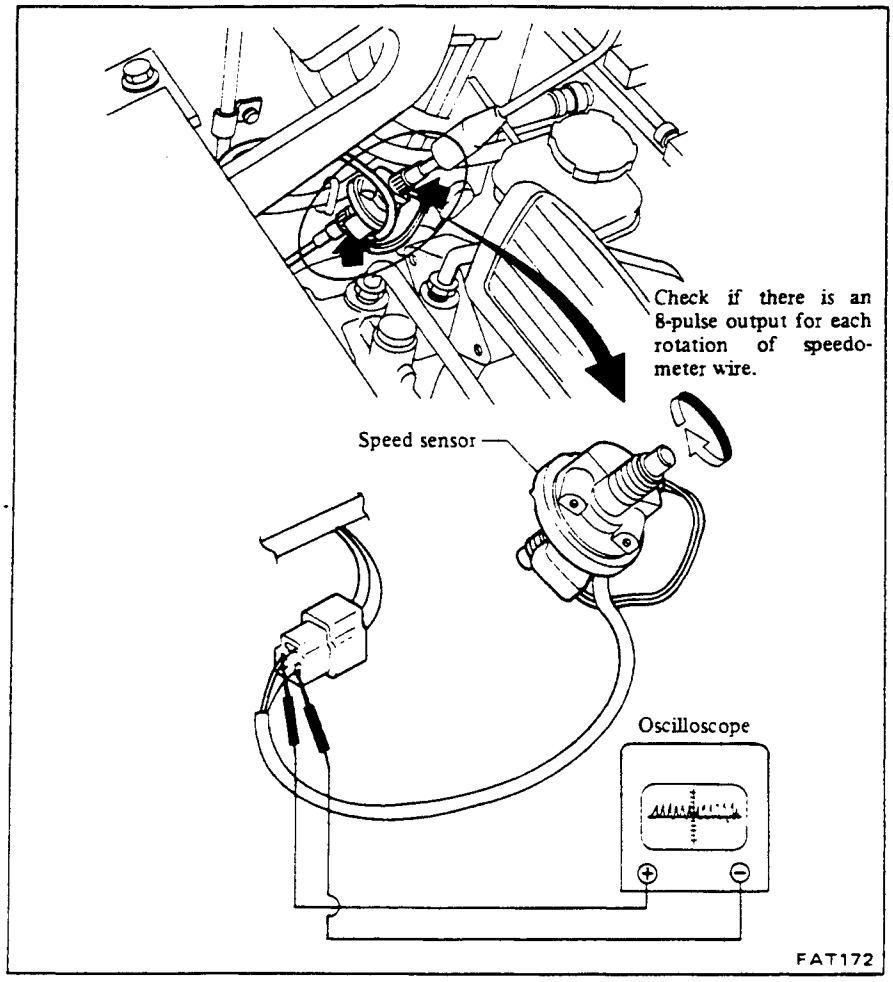


FAT145

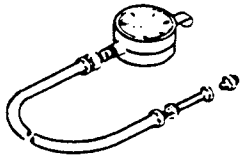
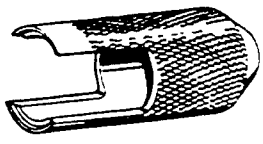
SPEED SENSOR

Inspection

- Detach speed sensor.



SPECIAL SERVICE TOOLS

Tool number	Tool name
ST0221S000	Oil pressure gauge 
KV31101000	Clutch spring compressor 

TECHNICAL BULLETIN

NISSAN MOTOR CO., LTD.
Industrial Machinery Division
Overseas Sales Department
Tokyo, Japan

Body Electrical System
FBE 98-F01

APPLIED MODEL : F05 series (D, V F05H*)**
APPLIED FROM : January, 1998

BODY ELECTRICAL SYSTEM

MODIFICATION NOTICE:

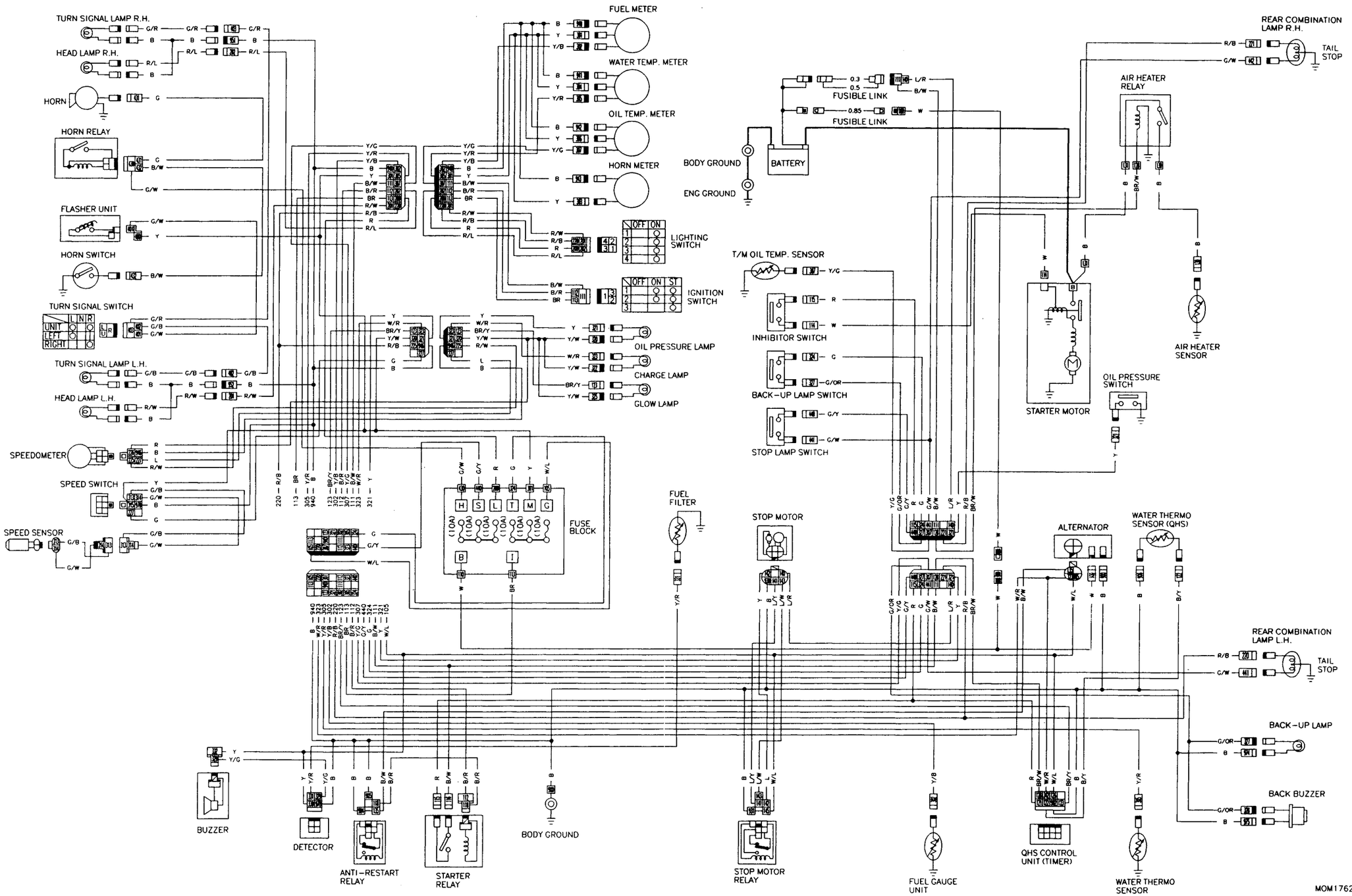
To accommodate minor changes made on the F05 series forklift trucks, FE6 type engine has been adopted.

The information in this bulletin should not be interpreted as the basis for claims unless so designated. Whenever you order spare parts, refer to the Spare Parts Bulletin, not to this Technical Bulletin.

Printed in Japan

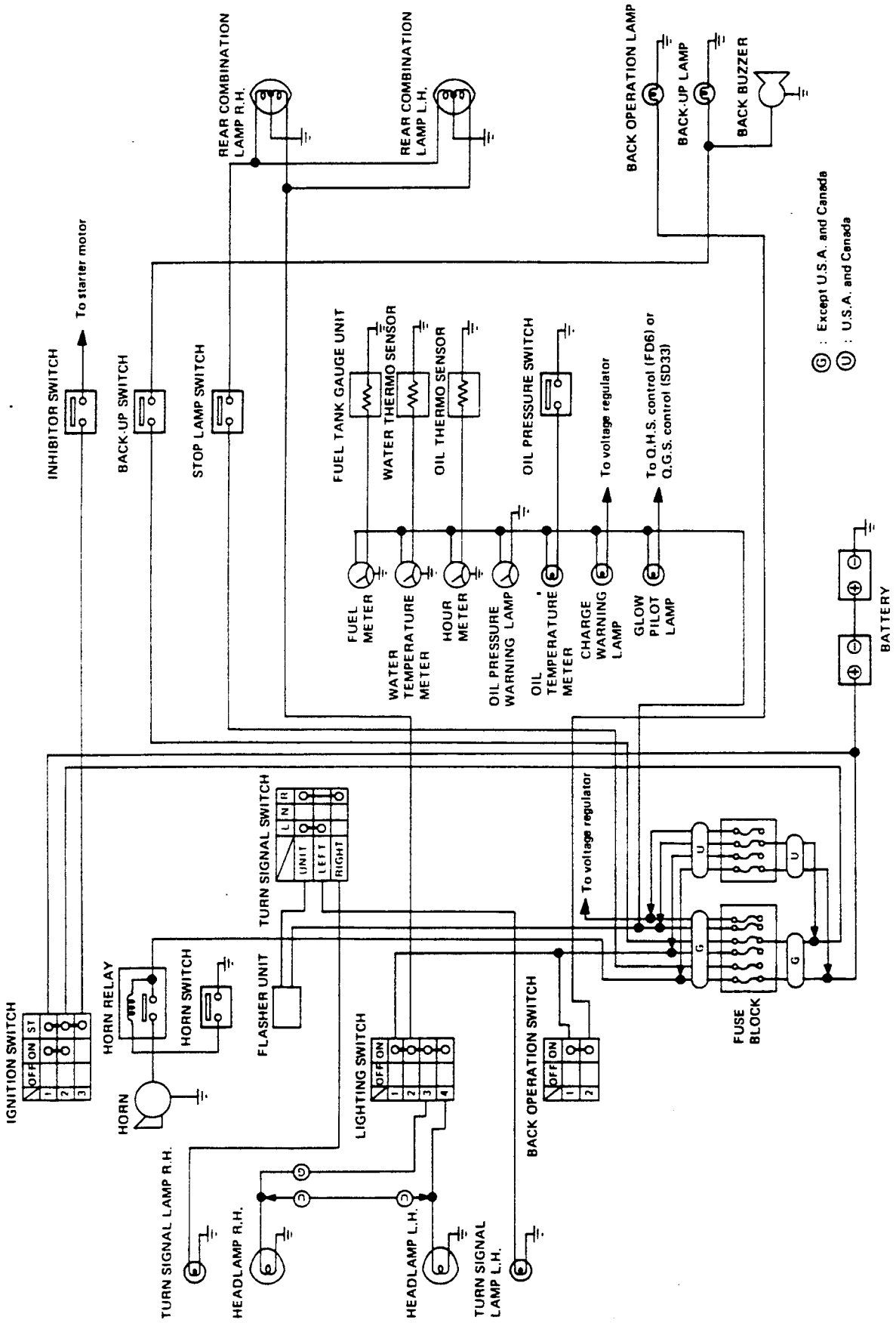
Issue date : May 28, 1998 (01)
Publication No. TF8E-F01FG0

FE6 ENGINE MODEL "UL" TYPE



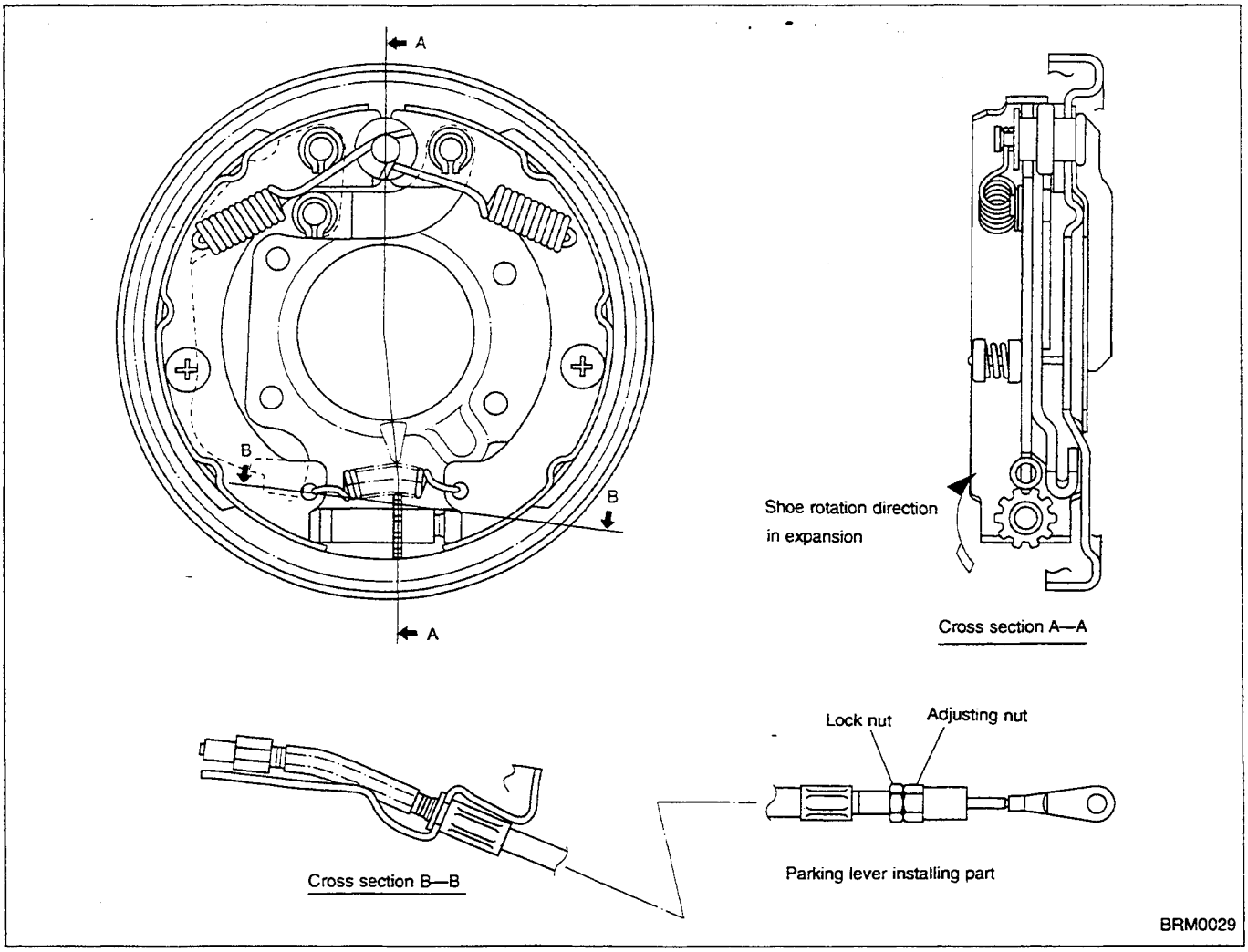
CIRCUIT DIAGRAM

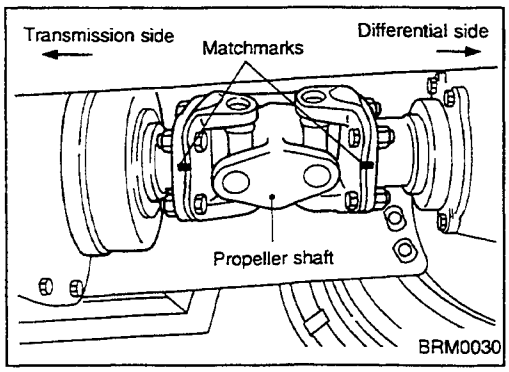
DIESEL ENGINE MODEL



FBE303

Construction

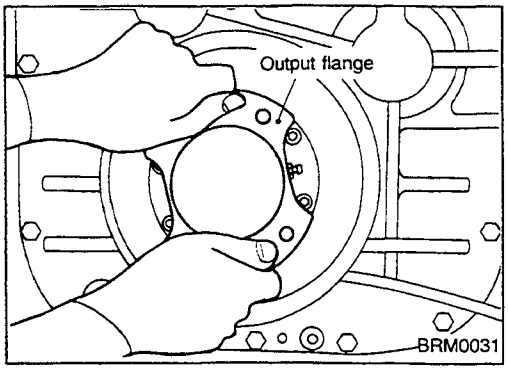




Removal

1. Lift up the vehicle. (Refer to GI section.)
2. Remove propeller shaft.

CAUTION:
Before removing propeller shaft, make matchmarks on the flange on both differential and transmission sides.



3. Pull out output flange.

CAUTION:
Before pulling out the output flange, make matchmarks on output flange and cover assembly.

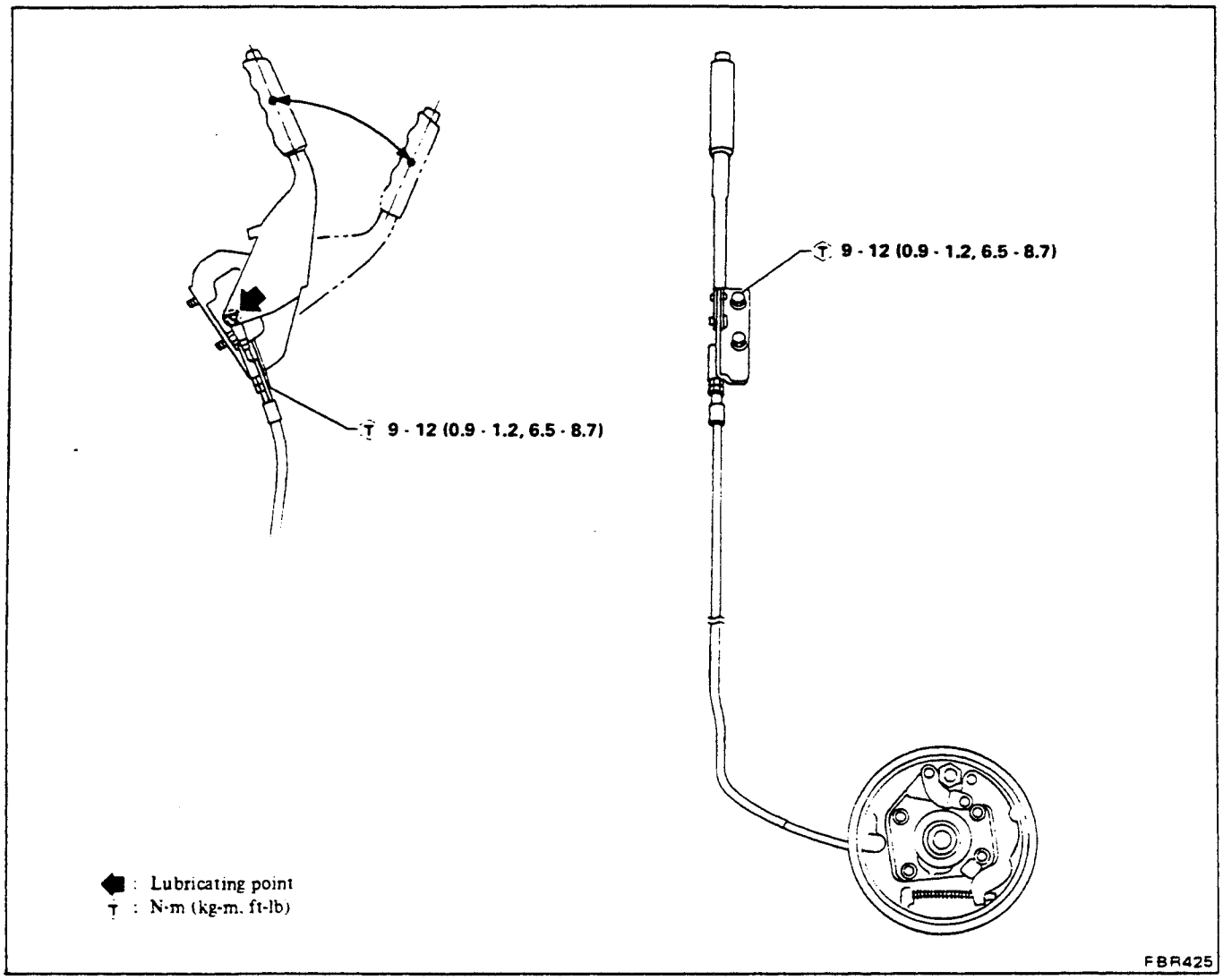
Condition	Probable cause	Corrective action
Brake dragging	Clogged oil lines	Clean.
	Wheel bearing out of adjustment	Adjust or replace.
	Improper functioning of brake booster	Correct or replace.
Brake squeaking	Brake drag	Refer to above.
	Improper returning of piston	Replace.
	Worn linings	Replace.
	Deteriorated lining surfaces	Grind or replace.
	Improper contact of shoes with linings	Replace.
	Excessively worn shoes or back plates	Clean and apply brake grease.
	Foreign particles on frictional surfaces of drums	Clean.
	Frictional surfaces of drums worn runout	Replace.
	Deformed or improperly installed shoes	Replace or correct.
	Loose back plate bolts	Tighten.
	Worn anchors	Replace.
	Improper contact of linings	Correct or replace.
	Improperly installed anti-rattle springs	Correct.
Brake noise	Rough frictional surfaces of drums	Grind or replace.
	Drum out of center or excessively warped drum	Replace.
	Rough lining surfaces	Grind or replace.
Large pedal stroke	Brake out of adjustment	Adjust.
	Air in oil lines	Bleed air.
	Oil leakage or insufficient oil	Check and correct.
	Worn linings	Replace.
	Dislocation or improper returning of shoes	Correct.
	Improper contact of linings	Correct.

HAND BRAKE

Condition	Probable cause	Corrective action
Insufficient braking force	Large control stem stroke	Adjust.
	Worn or damaged control ratchet	Replace.
	Open or elongated wire	Replace.
	Water or oil on linings.	Clean or replace.
	Uneven wear or contact of brake linings	Grind or replace.
	Worn linings	Replace.

HAND BRAKE

HAND BRAKE CONTROL



CAUTION:

- **When servicing the cooling system, make sure that engine and coolant is cooled.**
- **When servicing the cooling system, drain coolant. After servicing, make sure to fill the coolant to the rated level. (Refer to MA section.)**
- **When servicing the cooling system (removal and disassembly), remove radiator cover first. Make sure to install it after servicing. (Refer to BF section.)**
- **After installing fan belt after removal, make sure to adjust the tension. (Refer to MA section.)**
- **Items not covered in CO section should be referred to relevant sections, and be thoroughly understood.**
- For removal and installation of each unit, refer to "Construction".
- When adding coolant after the removal of radiator hose, make sure to bleed air from the hose.

INSTALLATION

1. Position thermostat on thermostat housing.
2. Install water outlet with new gasket.
3. Connect radiator upper hose and fill radiator with coolant.
4. Run engine for a few minutes, and check for leaks.

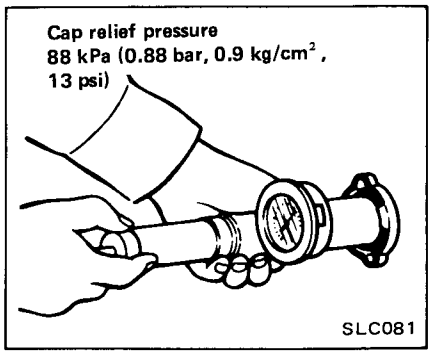
RADIATOR

INSPECTION

Checking radiator cap

Using cap tester, check the radiator cap relief pressure.

If the pressure gauge drops rapidly and excessively, replace the radiator cap.



Checking cooling system for leaks

Attach pressure tester to the radiator filler neck, then pump tester to the specified pressure.

Check for drop in pressure.

Test pressure:
157 kPa
(1.57 bar, 1.6 kg/cm², 23 psi)

If the pressure drops, check for leaks from hoses, radiator, or water pump.

If no external leaks are found, check block and head.

REMOVAL AND INSTALLATION

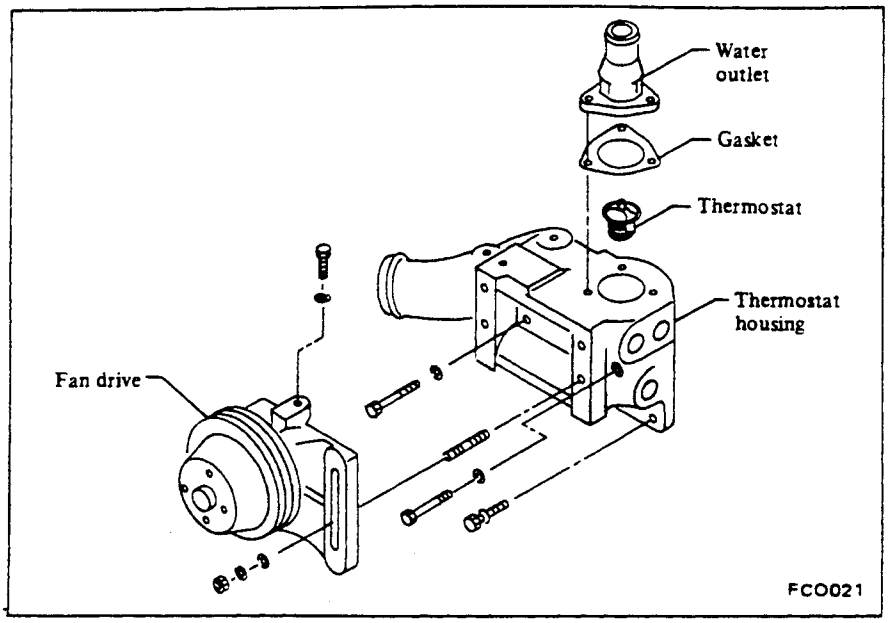
1. Open radiator drain cock and allow to drain into a suitable container.

WARNING:
To avoid the danger of being scalded, never attempt to drain the coolant when the engine is hot.

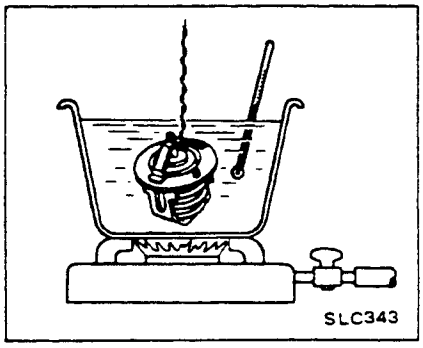
2. Remove radiator cover.
3. Remove radiator shroud attaching screws and place radiator shroud close to engine.
4. Disconnect radiator upper and lower hoses and torque converter oil cooler pipes.
5. Remove radiator.
6. Installation is in reverse order of removal.
7. Fill radiator with coolant.
8. Run engine for a few minutes, and check for leaks.

Refer to Changing Engine Coolant in Section MA.

THERMOSTAT

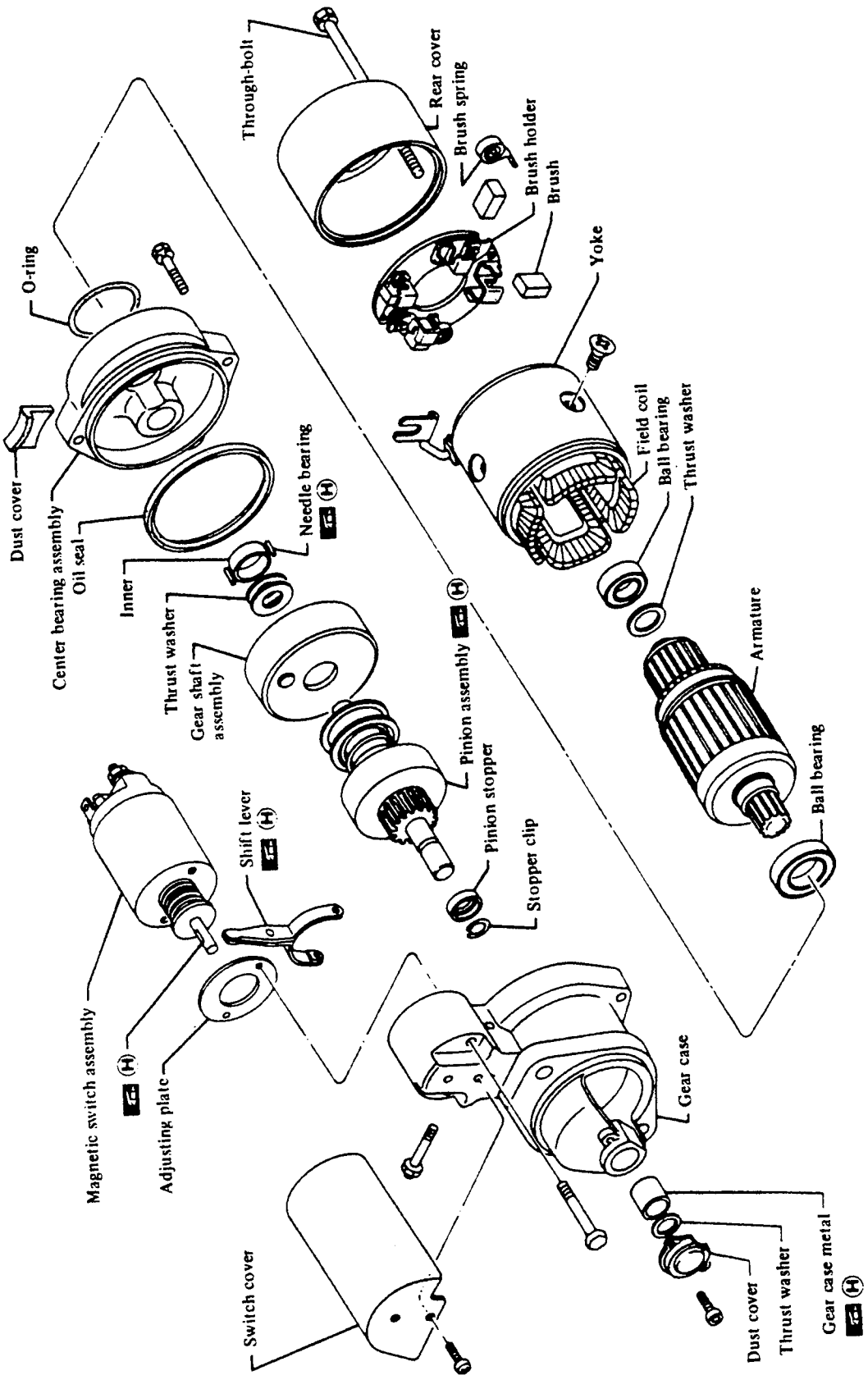


INSPECTION



Valve operating temperature:
82°C (180°F)
Max. valve lift:
8 mm/95°C (0.31 in/203°F)

Valve closes at 5°C (9°F) below valve operating temperature.

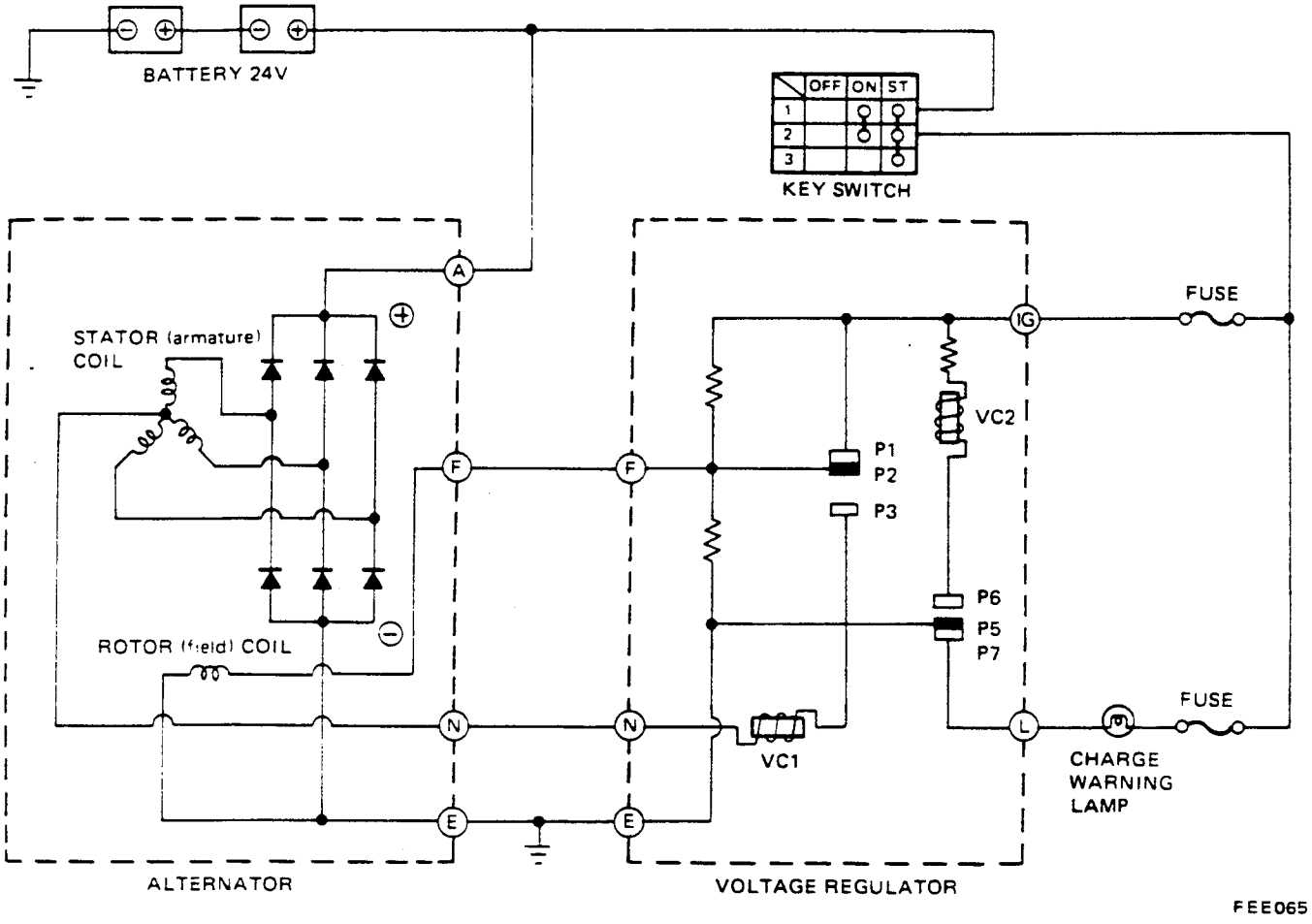


(H) : High-temperature grease points

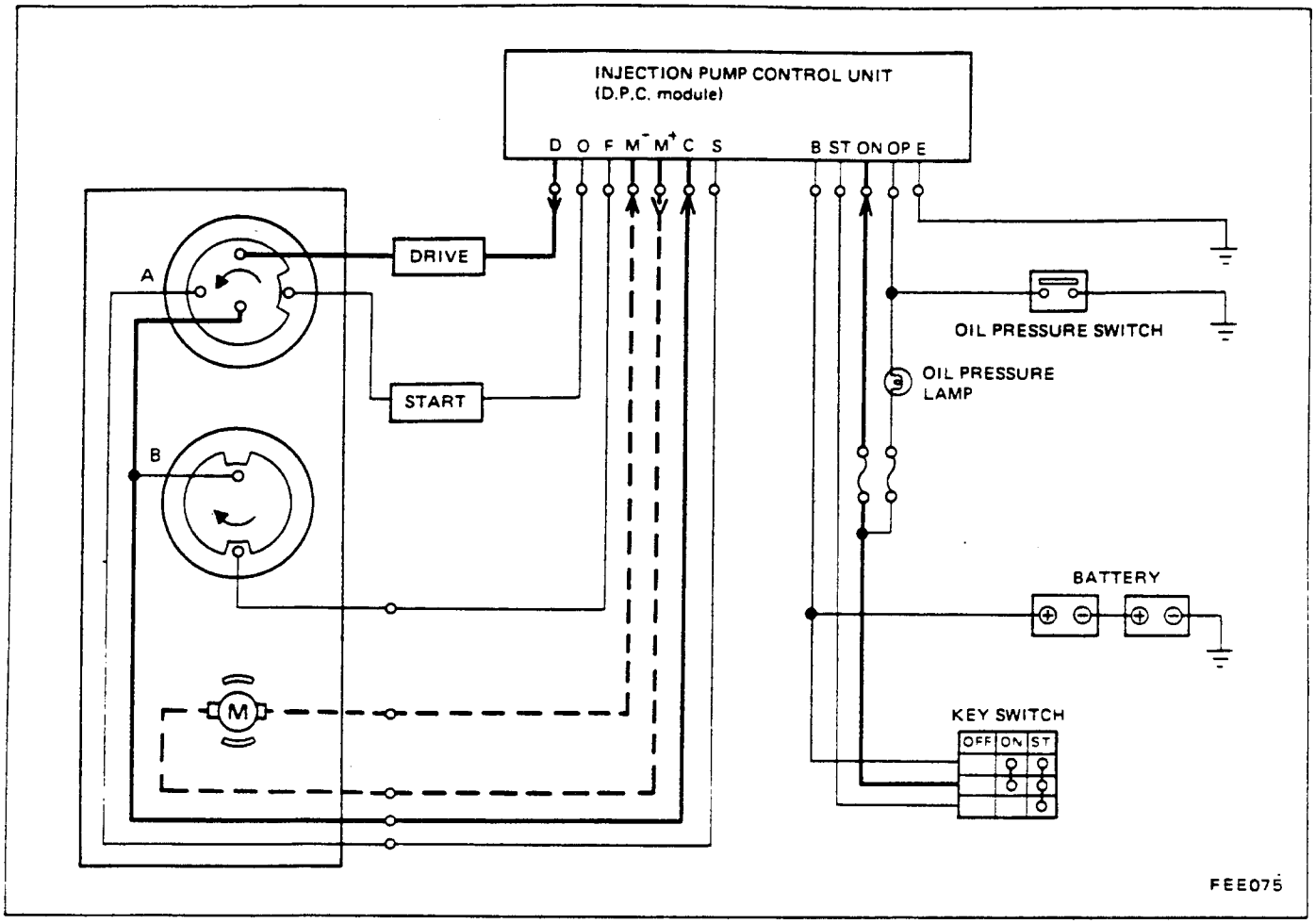
SEL949

CHARGING SYSTEM

Before starting to work on any part of electrical system, be sure to turn key switch "OFF" and then disconnect battery ground cable.



DRIVE OPERATION



When the key switch turned from "START" to "ON", the fuel injection pump control unit activates. This permits an electrical current to flow in sequence via rotor A of the fuel injection pump controller, from terminal D to rotor A and terminal C, causing the fuel injection controller motor to run. As the motor runs, rotor A rotates and, when it reaches its drive position, current flow between terminal D and C is broken, which stops the motor's operation. Thus, the controller is set at its DRIVE position.

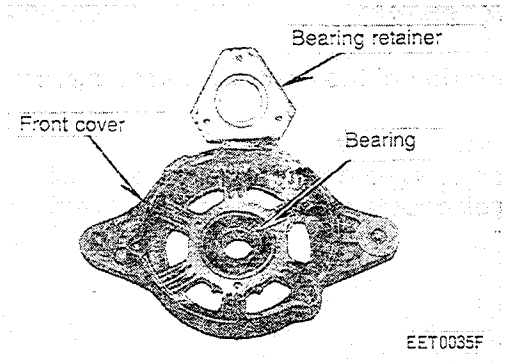
STARTER MOTOR

Symptom	Probable Cause	Remedy
• Starter motor does not rotate.	• Insufficient battery capacity	• Replace or charge the battery.
	• Break in the starter circuit	• Repair or replace harnesses, terminals, relays, etc.
	• Defective magnet switch	• Repair or replace the magnet switch.
	• Defective mating of the pinion and ring gear	• Repair or replace the gear shaft assembly. • Repair or replace the shift lever and the return spring.
	• Poor brush contact	• Clean the contact surface and inspect the brush springs.
	• Brush wear	• Repair or replace the brushes.
	• Break in armature coil	• Replace the armature coil.
• The crank does not rotate even though the starter motor does.	• Defective pinion assembly	• Replace the pinion assembly.
	• Damaged gear shaft assembly	• Repair or replace the gear shaft assembly.

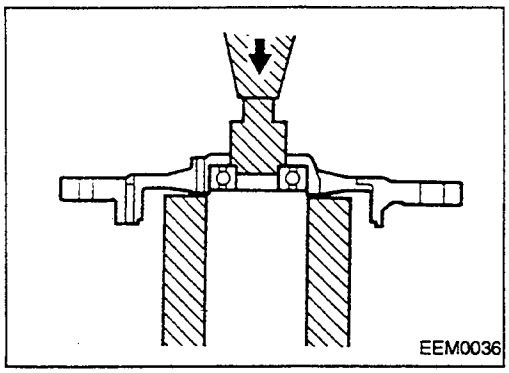
ALTERNATOR

Symptom		Probable Cause	Remedy
Charge lamp ON	• Charging current does not flow.	• Defective regulator	• Replace the regulator.
		• Defective stator coil	• Replace the stator coil.
		• Defective field coil	• Replace the field coil.
		• Defective diode	• Replace the heat sink.
		• Break or poor connection in lead wires (plate, support, etc.)	• Repair or replace.
		• Break in harness or fuse	• Replace.
	• Voltmeter reads over 29V.	• Defective regulator	• Replace the regulator.
		• Defective securing in voltage detection circuit (support, etc.)	• Repair or replace.
	• Charging current is flowing normally.	• Defective regulator	• Replace the regulator.
Charge lamp OFF	• Charging current is unusually low. (Battery dies much quicker than usual.)	• Defective stator coil	• Replace the stator coil.
		• Defective diode	• Replace the heat sink.
		• Break or poor connection in lead wires (plate, support, etc.)	• Repair or replace.
		• Too much electricity being used (Poor load balance)	• Reduce the amount of electrical usage.
		• Defective belt tension	• Adjust.
	• Charging current is unusually large.	• Defective regulator	• Replace the regulator.
		• Defective securing in voltage detection circuit region (supports etc.)	• Repair or replace.
	• Level of battery fluid drops remarkably.	• Defective battery	• Adjust or replace the battery.
Others	• Unusual noises can be heard.	• Defective stator coil	• Replace the stator coil.
		• Components coming into contact internally (Defective bearings or brackets)	• Repair or replace.
		• Defective belt tension	• Adjust.

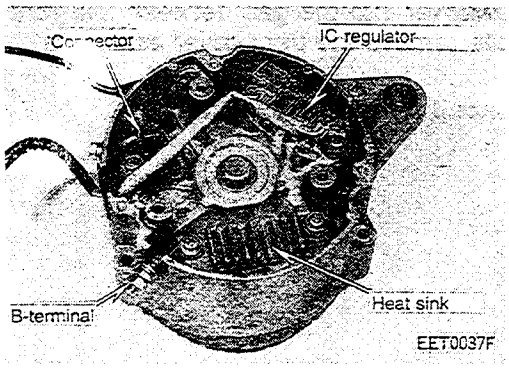
Disassembly (Cont'd)



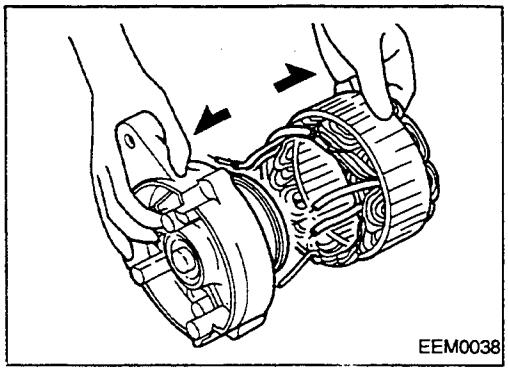
5. Remove the bearing retainer from the front cover.



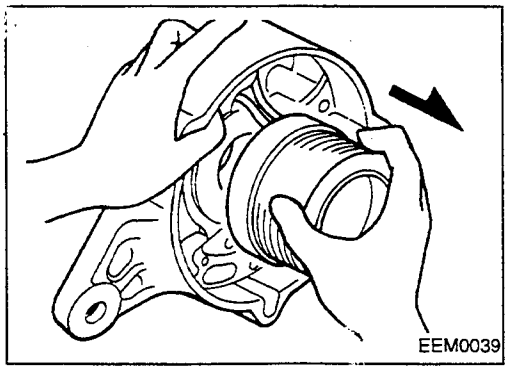
6. Apply the tool to the inner bearing. Press to draw the bearing out.



7. Remove the rear cover. Then remove the IC regulator, the heat sink, the connector, and the B-terminal.



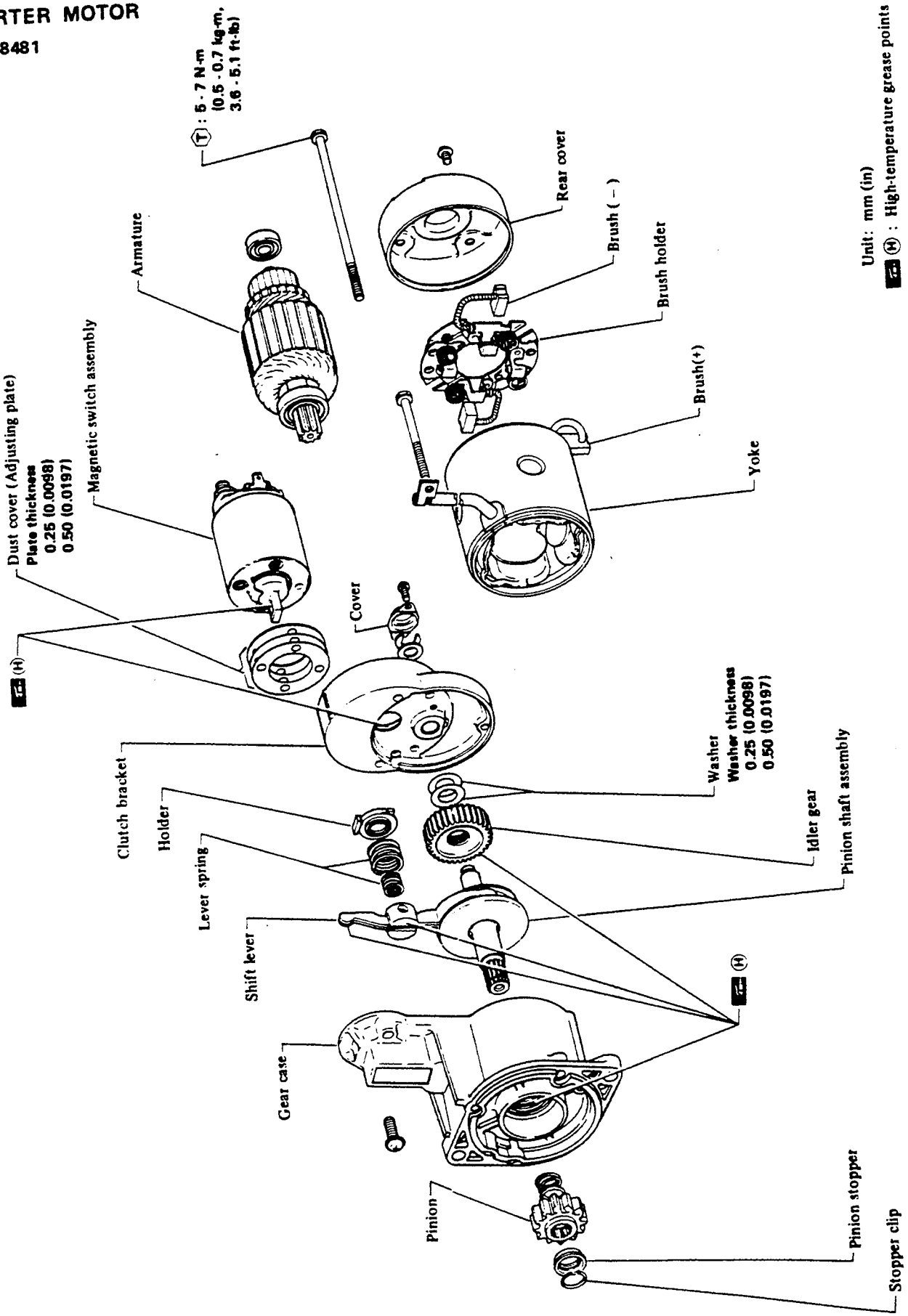
8. Remove the stator coil assembly.



9. Remove the three screws and then the field coil assembly.

STARTER MOTOR

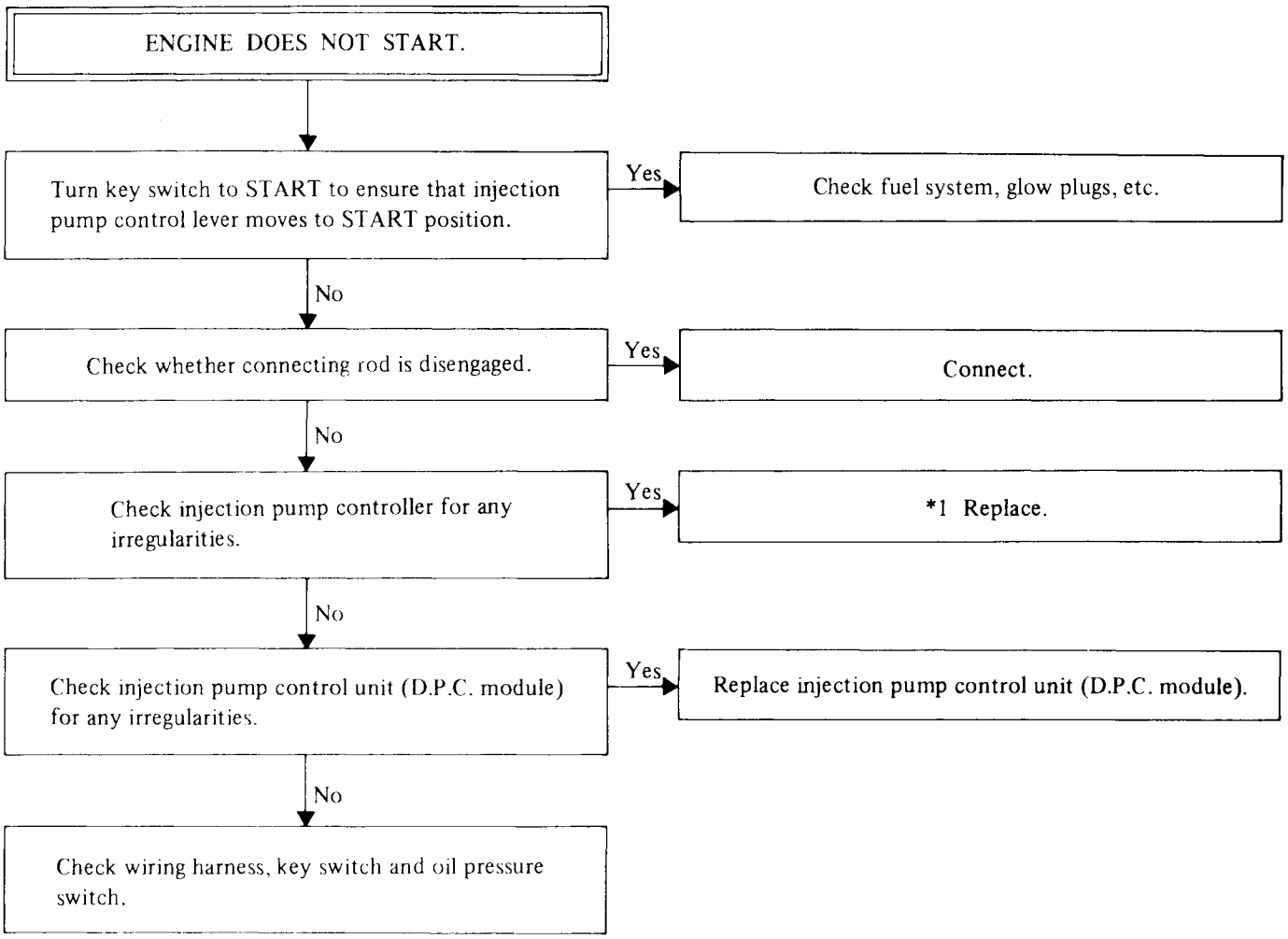
M2T58481



TROUBLE DIAGNOSES AND CORRECTIONS

TROUBLE-SHOOTING CHART

Case 1



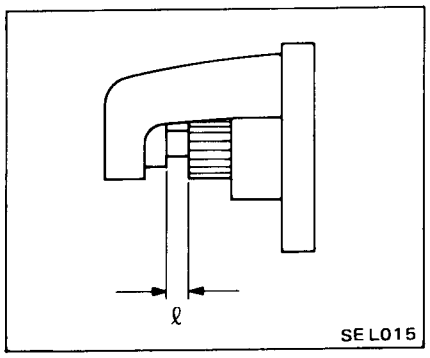
*1: Whenever injection pump controller is replaced, disconnect 6-pin connector from injection pump control unit (D.P.C. module) and connect again, then check operation of injection pump controller.

ASSEMBLY

- Apply grease to gear case and rear cover bearing metal, and apply oil to pinion slightly.

With the switch on, push pinion back to remove all slack and measure the clearance "ℓ" between pinion front edge and pinion stopper.

Clearance "ℓ"
0.3 - 2.5 mm
(0.012 - 0.098 in)



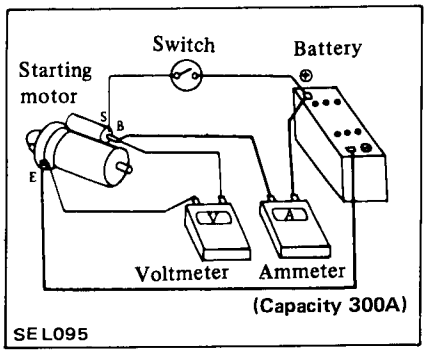
- Not in the specified value ... Adjust by adjusting washer(s).

Adjusting washer thickness:
0.5 mm (0.020 in)
0.8 mm (0.031 in)

TESTING

Performance test

No-load test



Specifications

Refer to S.D.S.

Diagnosis of test

1. Low speed with no-load and high current draw.

(1) Tight, dirty or worn bearings.
(2) Bent armature shaft or loosened field probe.
(3) Shorted armature coil.
(4) A grounded armature of field coil.

2. Failure to operate with high current draw.

(1) A grounded or open field coil.
(2) Burned out commutator bar.

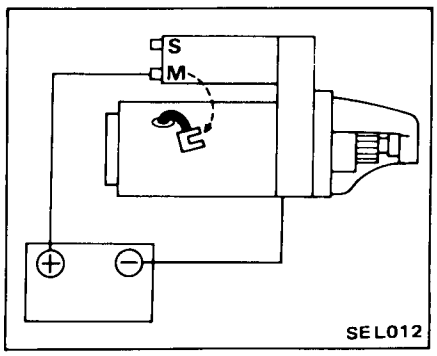
- Weak brush spring tension
- Thrust out of mica in commutator
- Loose contact between brush and commutator.

3. Low current draw and low noload speed.

(1) Loose connections.
(2) Dirty commutator.
(3) Burned out commutator bar.

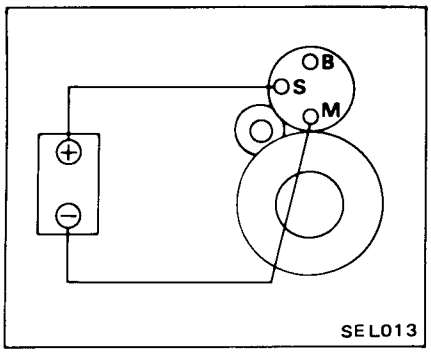
Magnetic switch returnability

1. Disconnect lead wire from terminal "M" of magnetic switch.
2. Connect terminal "M" and positive ⊕ terminal of battery with a jumper lead wire.
3. Connect starter motor body and negative ⊖ terminal of battery with a jumper lead wire.
4. Pull pinion gear all the way out with your hands.
5. Release your hands from pinion gear.
6. If pinion gear returns to its original position, magnetic switch is properly functioning.



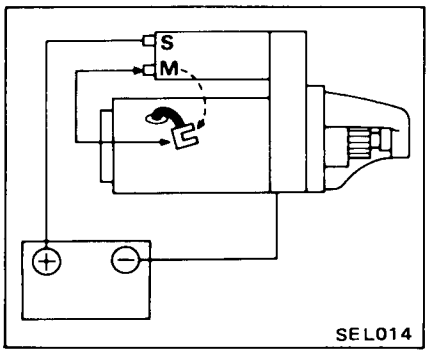
Series coil

1. Connect terminal "M" of magnetic switch and negative ⊖ terminal of battery with a jumper lead wire.
2. Connect terminal "S" of magnetic switch and positive ⊕ terminal of battery with a jumper wire.
3. With these connections having been made, if plunger is pulled in by force, series coil is properly functioning.



Shunt coil

1. Disconnect lead wire which connect terminal "M" of magnetic switch and starter motor terminal, and connect a jumper wire in its place.
2. Connect terminal "S" of magnetic switch and positive ⊕ terminal of battery with a jumper wire.
3. Connect negative ⊖ terminal of battery and starter motor body with a jumper wire. Plunger should be pulled in by force.
4. Disconnect jumper wire from terminal "M".
5. If plunger continues to be pulled in with jumper wire disconnected from terminal "M", shut coil is properly functioning.



TECHNICAL BULLETIN

NISSAN MOTOR CO., LTD.
Industrial Machinery Division
Overseas Sales Department
Tokyo, Japan

Engine Electrical System

FEE 88-F01

APPLIED MODEL : F05 series
APPLIED FROM : BF05-001001
WF05-001001
DF05-000639

Technical Bulletins relevant to the face-lift			
FGI88-F01	FMA88-F01	FET88-F01	FET88-F02
FEM88-F01	FEM88-F02	FEL88-F01	FEL88-F02
FCO88-F01	FCO88-F02	FEF88-F01	FEF88-F02
FEE88-F01	FEE88-F02	FBE88-F01	

ENGINE ELECTRICAL

The information in this bulletin should not be interpreted as the basis for claims unless so designated.
Whenever you order spare parts, refer to the Spare Parts Bulletin, not to this Technical Bulletin.

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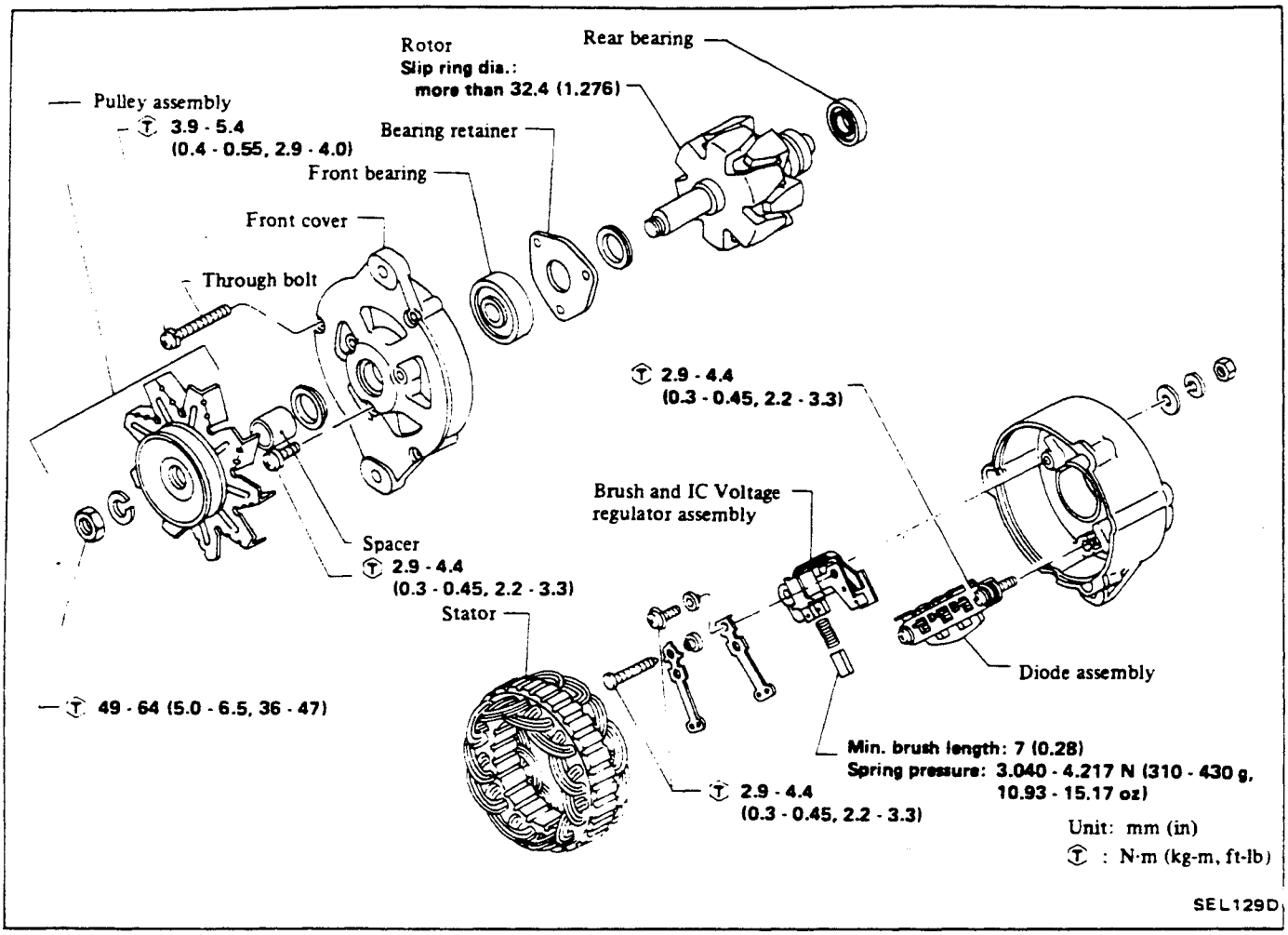
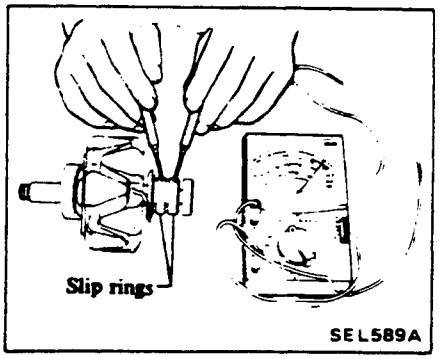
ALTERNATOR



INSPECTION

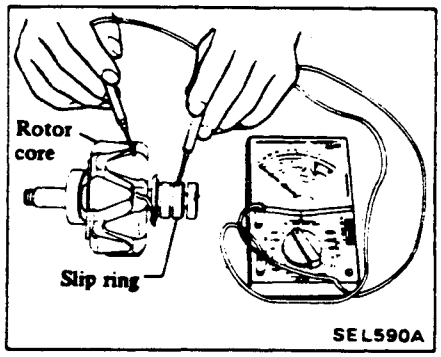
Rotor

1. Continuity test.



- No continuity ... Replace rotor.

2. Insulation test.



- Continuity exists ... Replace rotor.

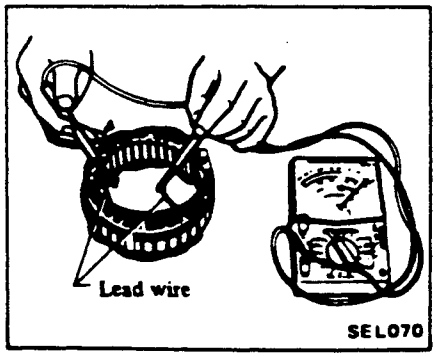
3. Check slip ring for wear.

Slip ring outer diameter:
Refer to S.D.S.

If necessary, replace rotor assembly.

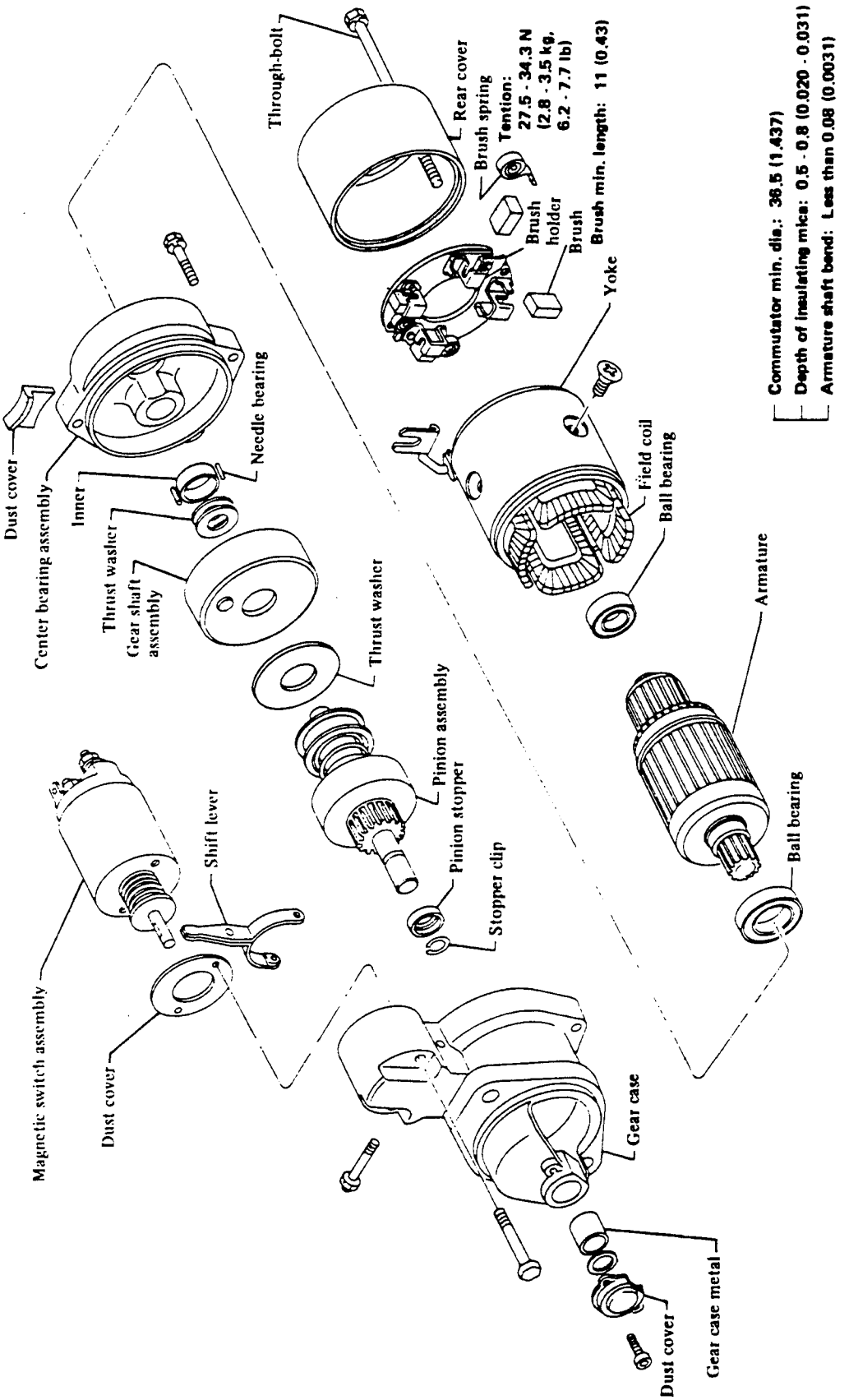
Stator

1. Continuity test



- No continuity ... Replace stator.

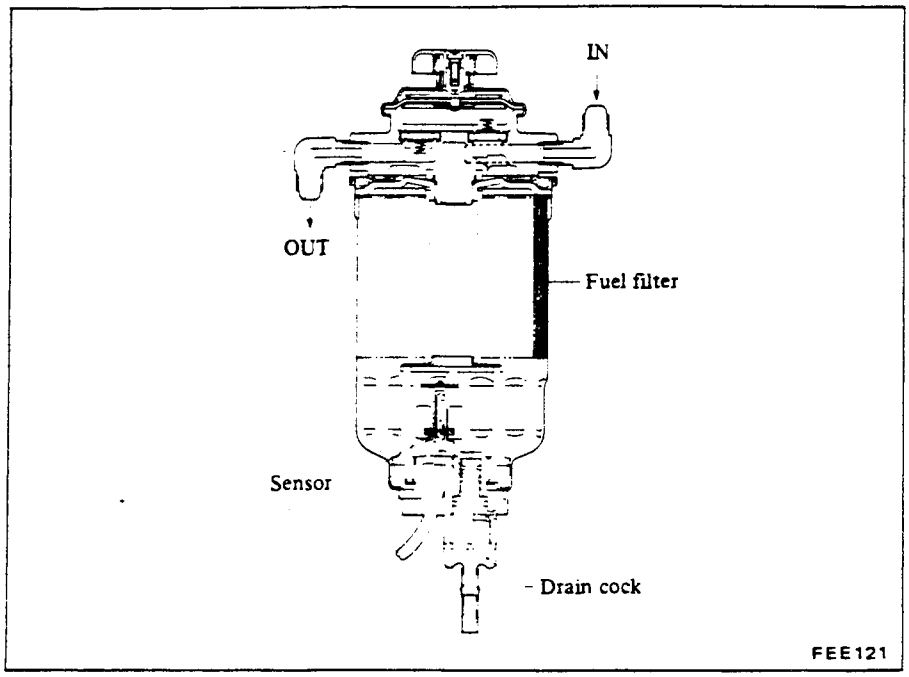
STARTER MOTOR



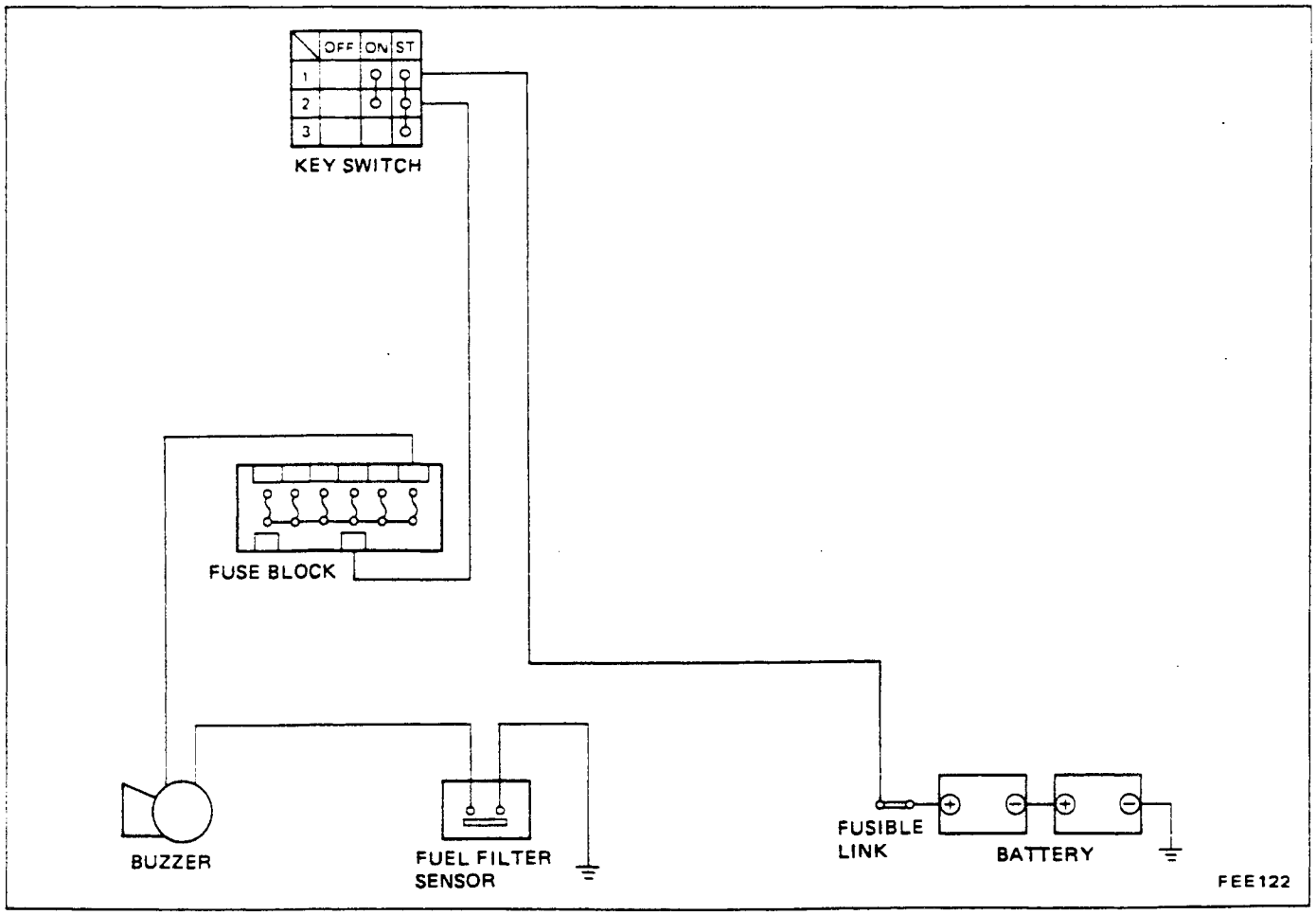
Unit: mm (in)

WARNING SYSTEM

WATER SEPARATOR

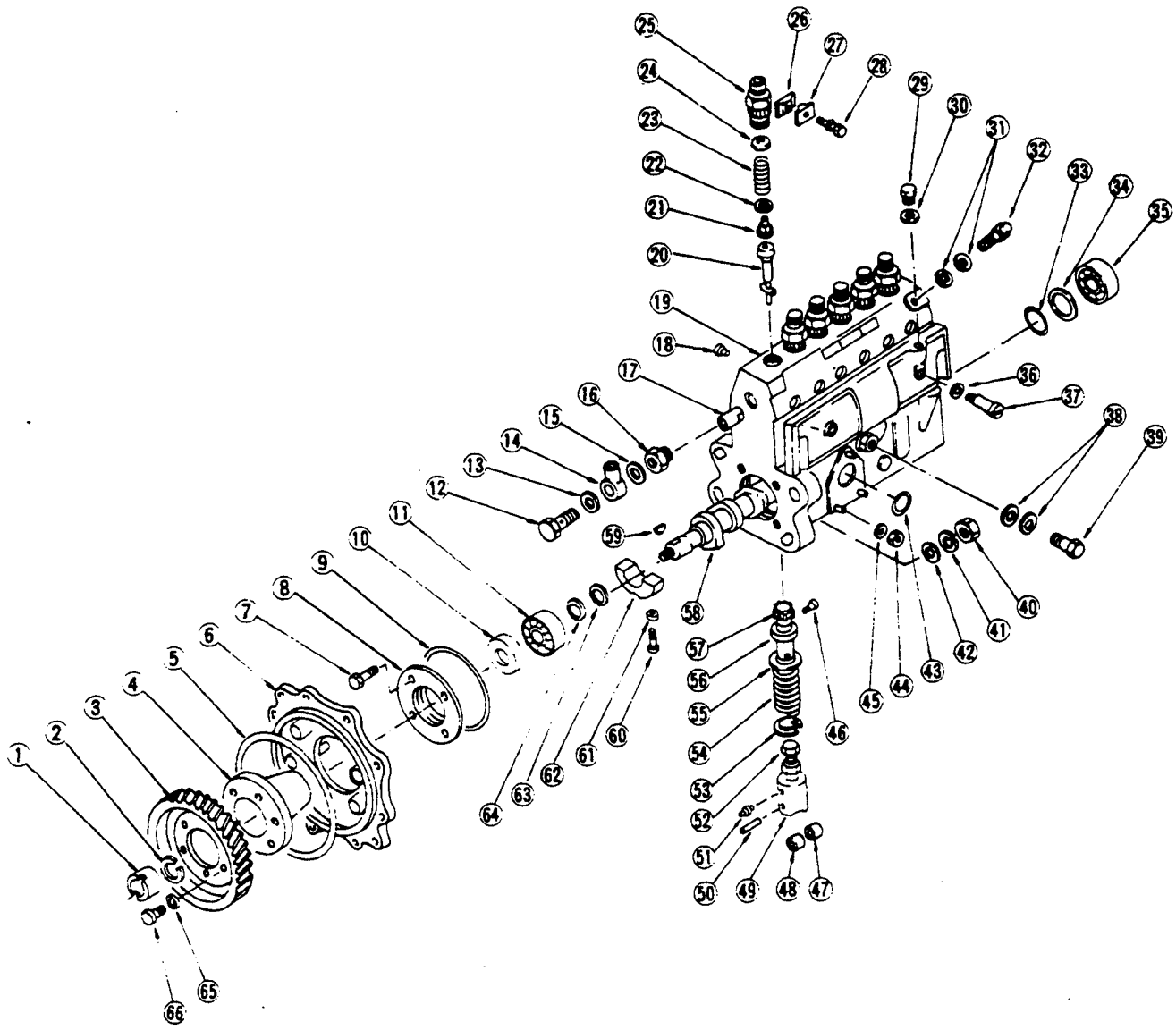


SCHEMATIC



INJECTION PUMP PROPER

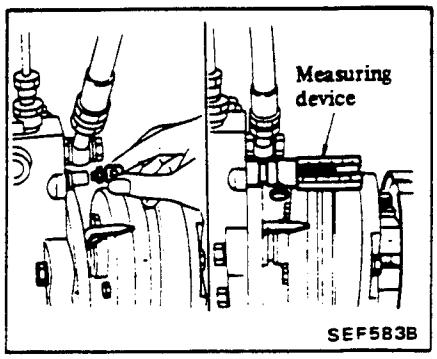
DISASSEMBLY



1 Round nut
2 Lock washer
3 Gear
4 Coupling
5 O-ring
6 Bracket
7 Bolt
8 Bearing cover
9 O-ring
10 Oil seal
11 Taper roller bearing
12 Pipe joint bolt
13 Gasket
14 Connector
15 Gasket
16 Joint adapter
17 Control rack
18 Rack guide screw
19 Pump housing
20 Plunger assembly
21 Delivery valve
22 Gasket
23 Delivery valve spring
24 Gasket
25 Delivery valve holder
26 Lock plate
27 Lock plate
28 Bolt
29 Plug
30 Gasket
31 Gasket
32 Air bleeder
33 Camshaft ring
34 Adjusting shim
35 Taper roller bearing
36 Gasket
37 Screw
38 Gasket
39 Plug
40 Nut
41 Lock washer
42 Plain washer
43 O-ring
44 Nut
45 Lock washer
46 Pinion clamp screw
47 Roller
48 Bushing
49 Tappet
50 Pin
51 Guide
52 Lock nut
53 Lower spring seat
54 Plunger spring
55 Upper spring seat
56 Control sleeve
57 Control pinion
58 Camshaft
59 Key
60 Bolt
61 Gasket
62 Center bearing
63 Camshaft ring
64 Adjusting shim
65 Lock washer
66 Bolt

SEF470B

3. Install the injection pump to the bed of the pump tester through the fixing stand. Then, install the gear mentioned in item 2. above. After that, connect the coupling with the chucking device of the pump tester.
4. Connect the nozzle pipe and flexible hose.
5. Remove the cap of the control rack and install the measuring device.



PRECAUTIONS WHEN ADJUSTING THE GOVERNOR

1. Fixing the control rack

In fixing the control rack when adjusting the injection quantity of the injection pump to which the governor with a torque cam is loaded, the control lever is fixed to the idling position, the injection pump is accelerated to above 500 rpm the control lever is manipulated to the full speed position, the control rack position is assigned to full load position + about 3 mm (0.12 in) by the full load stopper, and either the control rack or the control pinion is controlled, to be fixed to each control rack position to obtain the injection quantity.

2. Method of operating the control lever.

In manipulating the control lever of the governor with the torque cam to the full speed position, this manipulation should be conducted after the pump speed is increased to above 500 rpm at the idling lever position.

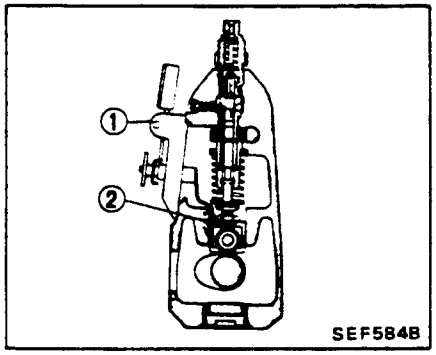
3. Fix the adjusting nut for adjusting the torque cam with the lock screw without fail.

INITIAL INJECTION TIMING

The start of injection is considered as the time at which the top of the plunger covers the fuel intake hole of the barrel. The pump tester must be capable of developing a pressure in the range of 2,540 kPa (25.40 bar, 25.9 kg/cm^2, 368 psi) in order to overcome tension of the delivery valve spring (to force the delivery valve open).

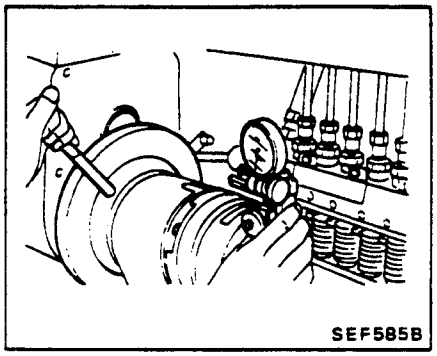
ADJUSTING THE INJECTION TIMING OF THE STANDARD CYLINDER

1. Fix the control rack to full rack position.
2. Install the measuring device to the tappet of the No. 1 cylinder as viewed from the drive side.

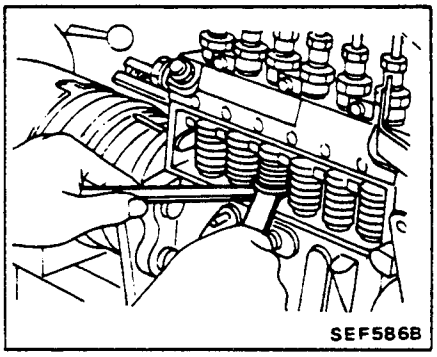


3. Set the tappet to top dead center of the camshaft and set the scale of the dial gauge to "0".
4. Loosen the bleeder screw of the pump and bleed the air from the fuel system.
5. When the drive shaft of the tester is slowly turned in the drive direction while feeding fuel to the fuel inlet of the pump, the fuel will stop flowing from the pipe of the test use nozzle holder. This is the injection start position. The injection timing is normal if the tappet has risen by the specified value from bottom dead center.

Specified value:
3.0±0.05 mm (0.118±0.0020 in)



6. When the flow of fuel does not stop when the tappet has been lifted within 2.95 to 3.05 mm (0.1161 to 0.1201 in) from bottom dead center, adjust by turning the adjusting bolt.



7. When the flow of fuel has not stopped even through the tappet has been lifted 3.05 mm (0.1201 in) or more, loosen the lock nut and raise the position of the plunger by turning the adjusting bolt to the left. If the flow of fuel has stopped when the tappet has been lifted 2.95 mm (0.1161 in) or less, lower the position of the plunger by turning the adjusting bolt to the right.

General Specifications

Injection timing (impressed mark)		15° BTDC
Ignition method		Compression ignition
Ignition sequence		1-4-2-6-3-5
Injection pump	Pump type	Bosch type
	Governor type	Centrifugal
	Timer type	None (Mechanical)
	Fuel supply pump	Piston type
	Injection timing adjustment	Fixed
	Manufacturer	Zexel Co., Ltd.
Injection nozzle	Nozzle type	Closed porous
	Nozzle hole number/diameter No./mm (in)	6/0.27 (0.0106)
	Injection valve opening pressure kPa (kg/cm^2, psi)	19,614 (200, 2,844)
	Valve lift mm (in)	0.30 (0.0118)
Fuel filter	Filter type	Cartridge
	Overflow valve opening pressure kPa (kg/cm^2, psi)	147 - 177 (1.5 - 1.8, 21 - 26)
Fuel filter with water separator	Filter type	Cartridge
	Water containment volume cm^3 (cu in)	150 (9.15)
Fuel tank volume	ℓ (Imp gal)	120 (26-3/8)

Service Data

ADJUSTMENT VALUES

		Standard
Injection nozzle injection pressure	kPa (kg/cm^2, psi)	20,104 - 20,595 (205 - 210, 2,915 - 2,986)
Idling speed	rpm	650 - 700
Black smoke density	%	Less than 35

TIGHTENING TORQUE

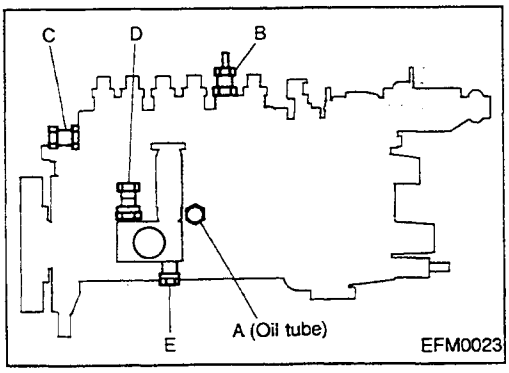
N·m (kg-m, ft-lb)

Injection spill tube eye bolt			10 - 15 (1.0 - 1.5, 7 - 11)
Injection nozzle return tube eye bolt			10 - 15 (1.0 - 1.5, 7 - 11)
Overflow valve assembly			25 - 29 (2.5 - 3.0, 18 - 22)
Injection nozzle tube (both nozzle and pump sides)			20 - 25 (2.0 - 2.5, 14 - 18)
Injection pump fuel tube eye bolt (pump side)			25 - 41 (2.5 - 4.2, 18 - 30)
Fuel filter tube eye bolt (pump side)			25 - 41 (2.5 - 4.2, 18 - 30)
Fuel suction tube eye bolt (pump side)			25 - 41 (2.5 - 4.2, 18 - 30)
Injection nozzle	Cap nut		39 - 49 (4.0 - 5.0, 29 - 36)
	Retaining nut		59 - 78 (6.0 - 8.0, 43 - 58)
	Inlet connector		59 - 69 (6.0 - 7.0, 43 - 51)
Injection nozzle holder mounting bolt			25 - 29 (2.5 - 3.0, 18 - 22)
Injection pump mounting bolt		M8	8 - 11 (0.8 - 1.1, 5.8 - 8.0)
		M10	16 - 22 (1.6 - 2.2, 12 - 16)
Injection pump oil tube eye bolt (pump side)			10 - 18 (1.0 - 1.8, 7 - 13)

Installation

Install in the reverse order of removal while observing the following:

- Always replace O-rings and gaskets with new ones.
- Install the injection pump with the No. 1 cylinder at compression TDC. (Confirm the alignment of all pointers before installation.)
- Injection pump bracket mounting bolt
  Tightening torque:
  M10
  [O]: 8 - 11 N·m (0.8 - 1.1 kg-m, 5.8 - 8.0 ft-lb)
  M8
  [O]: 16 - 22 N·m (1.6 - 2.2 kg-m, 12 - 16 ft-lb)

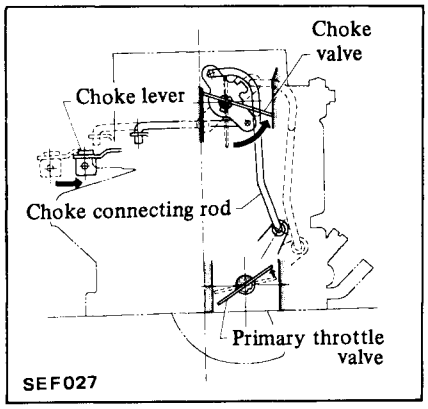


- Oil tube (A) mounting eye bolt
  Tightening torque:
  [O]: 10 - 18 N·m (1.0 - 1.8 kg-m, 7 - 13 ft-lb)
- Injection nozzle tube nut (B)
  Tightening torque:
  [O]: 20 - 25 N·m (2.0 - 2.5 kg-m, 14 - 18 ft-lb)
- Eye bolt (C to E)
  Tightening torque:
  [O]: 25 - 41 N·m (2.5 - 4.2 kg-m, 18 - 30 ft-lb)

- Always adjust the engine stop motor wire before installation. (Refer to EE section.)
- Bleed air from the fuel system after installation. (Refer to MA section.)
- Fill coolant to the specified level. (Refer to MA section.)
- Start up the engine. Check for fuel leakages. Confirm that the engine operation is stable.
- Confirm the engine idling speed and maximum speed. Refer to MA section whenever adjustment is required.

2. Fast idle mechanism

The fast idle mechanism linked to the choke valve determines the opening of the primary throttle valve so as to obtain the proper amount of mixture for starting and warming-up.



SECONDARY SYSTEM

Secondary main system

Fuel-air mixture produced by the functions of the main jet, main air bleed and emulsion tube, in the same manner as in the primary system, is pulled out through the main nozzle into the small venturi.

Secondary slow system

This system functions to fill the gap properly when the fuel supply is transferred from the primary system to the secondary system. The construction of this system may correspond to the idling and slow system of the primary system.

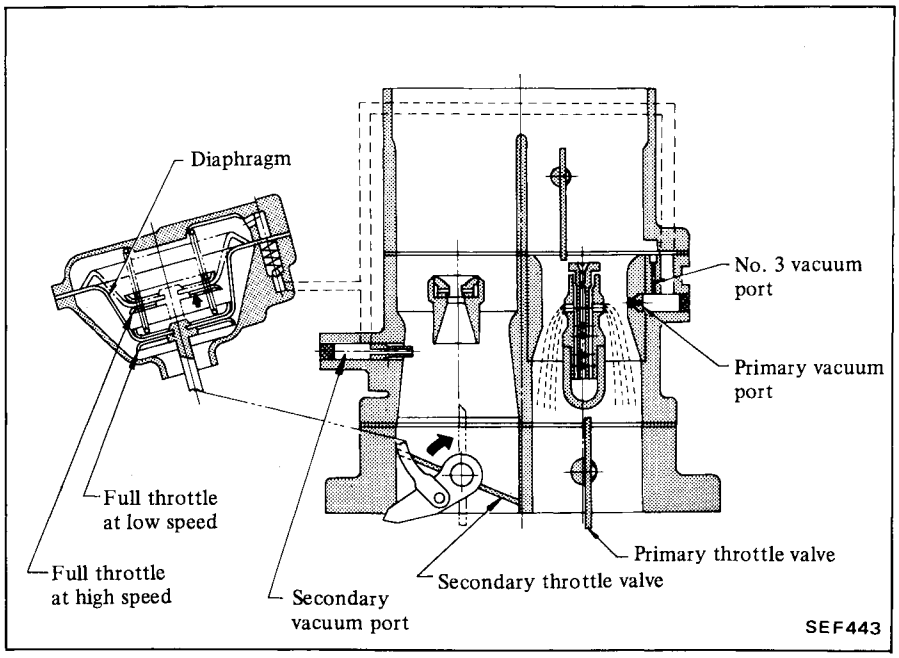
Secondary switchover mechanism

The secondary throttle valve is linked to the diaphragm which is actuated by the vacuum created in the venturi. A vacuum jet is provided at each of the primary and secondary venturis, and the composite vacuum of these jets actuates the diaphragm.

During high speed, heavy load running, as the vacuum at the venturi is increased, the diaphragm is pulled against the diaphragm spring force, and then secondary throttle valve is opened.

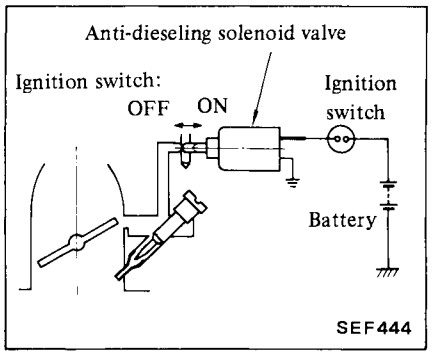
The other side, during low speed running (as the primary throttle valve opening does not reach the predetermined value), the secondary throttle valve is locked to close completely by the locking arm which is interlocked with primary throttle arm by linkage.

When the primary throttle valve opening reaches position wider than the predetermined value, the secondary throttle valve is ready to open, because the locking arm rotates and leaves from the secondary throttle arm.



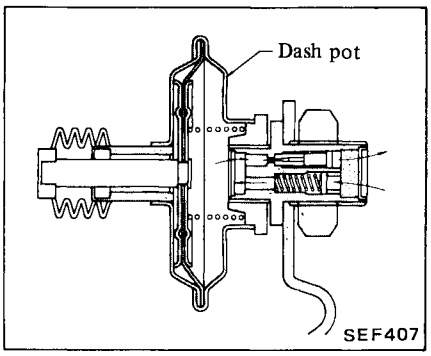
ANTI-DIESELING SYSTEM

As the ignition switch is turned off, the valve is brought into operation, shutting off the supply of fuel to the slow circuit.



DASH POT SYSTEM

When accelerator pedal is released, throttle lever strikes against dash pot stem, then throttle valve gradually closes as air in diaphragm chamber leaks.



INSPECTION AND ADJUSTMENT

IDLE RPM AND MIXTURE RATIO

Refer to Section ET or MA for Inspection and adjustment of idle rpm and mixture ratio.

FUEL LEVEL

To adjust fuel level, proceed as follows:

1. Remove carburetor from engine and remove float chamber cover.

INJECTION PUMP ASSEMBLY (DIESEL KIKI-Bosch VE-type)

DESCRIPTION

1. Disassembly and assembly of this VE-pump should be done only in service shops authorized by NISSAN or by the pump manufacturer.
2. Before removing fuel injection pump from lifttruck, check closely to make sure that it is apparently malfunctioning.
Refer to Trouble-shooting in ET section.

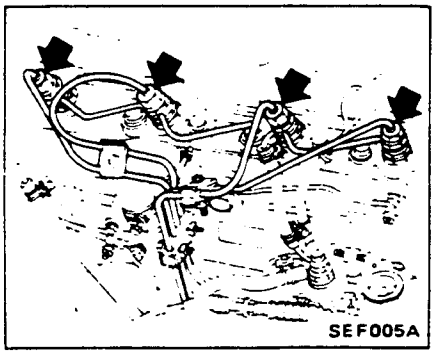
⚠ WARNING:

a. Be sure to turn ignition switch "off".
b. Before starting to work on any part of fuel system, disconnect battery ground cable from battery.
c. Arcs, sparks, flames and lit cigarettes should be kept away from any part of fuel system.

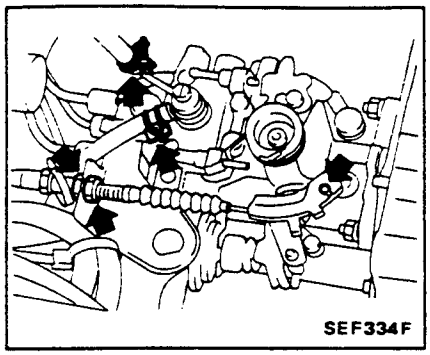
REMOVAL

1. Remove injection tube.

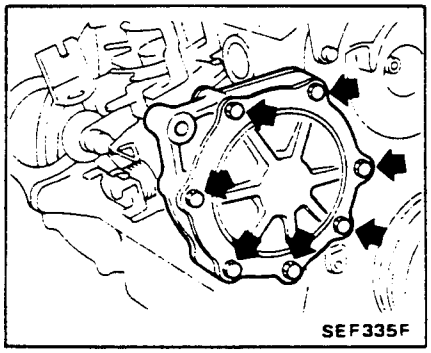
Cover the injection nozzle assembly with a plug to block the entry of dirt.


SEF005A

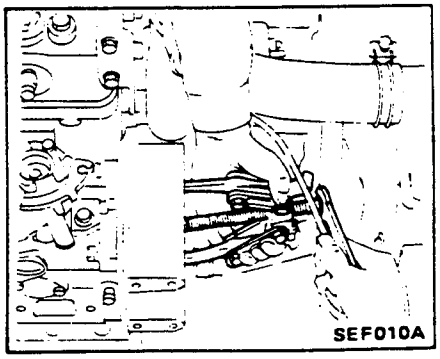
2. Remove fuel cut solenoid wire.
3. Remove accelerator wire and disconnect overflow hose, fuel inlet hose and fuel return hose.


SEF334F

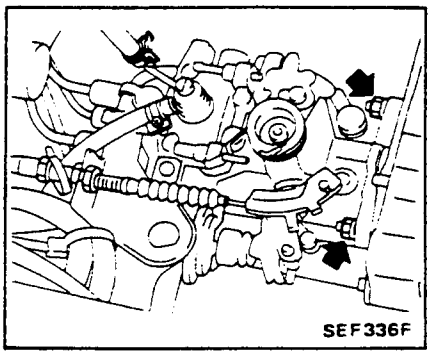
4. Remove injection pump drive gear cover.


SEF335F

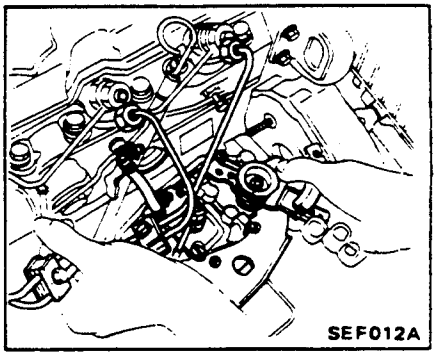
5. Loosen injection pump drive gear nut and remove drive gear by using puller.


SEF010A

6. Remove injection pump fixing nuts and bolts.


SEF336F

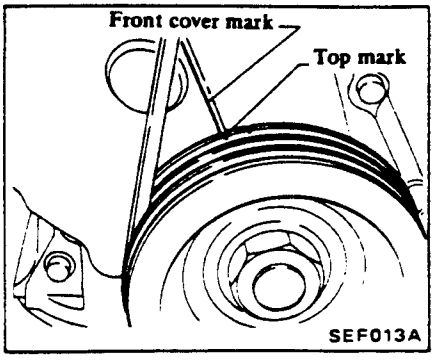
7. Take out injection pump with injection tubes.


SEF012A

Disconnect injection tube from pump once it is removed.

INSTALLATION

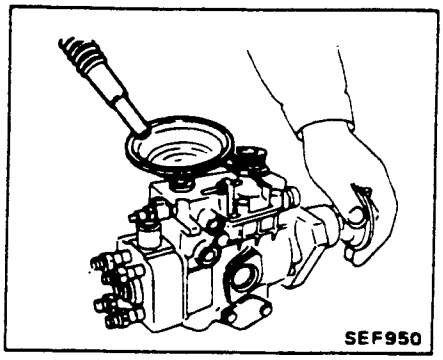
1. Align front cover and crank pulley mark for setting No. 1 piston at T.D.C.



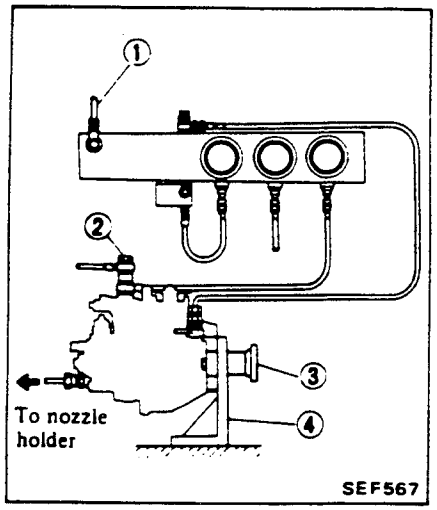
SEF013A

2. Pour test oil into fuel injection pump.

Test oil should be ISO 4113, SAE Standard Test Oil (SAE J967d) or its equivalent.

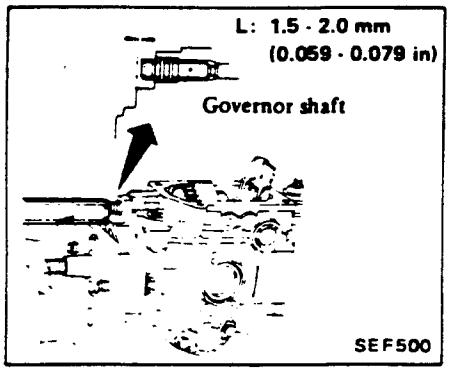


3. Install fuel injection pump to pump tester.
4. Connect necessary piping.



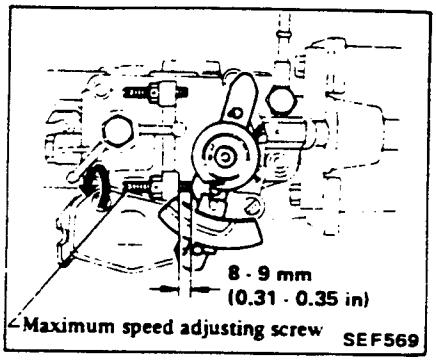
1 Fuel supply inlet from pump tester
2 Overflow valve
3 Coupling
4 Fixing stand

5. Make sure that governor shaft is properly installed.



6. Run in fuel injection pump as follows:
(1) Maintain test oil in tank to 45 to 50°C (113 to 122°F).
(2) Set control lever at "full load" using a spring.

Set maximum speed adjusting screw in position shown, by turning counterclockwise.



(3) Furnish specified voltage of 12 volts to fuel cut solenoid valve to activate it.
(4) Rotate fuel injection pump by hand to see if it moves smoothly.
(5) Rotate fuel injection pump at 300 rpm to make sure that all air inside pump chamber is discharged through overflow valve.
(6) Set feed oil pressure at 20 kPa (0.20 bar, 0.2 kg/cm², 2.8 psi).
(7) Run in fuel injection pump by rotating it at 1,000 rpm for ten minutes.

If fuel leakage, fuel injection failure or unusual noise is noticed, immediately halt pump tester operation and check fuel injection pump for abnormalities.

ADJUSTMENT

Preadjust full-load delivery

1. Set control lever at "full load" using a spring.

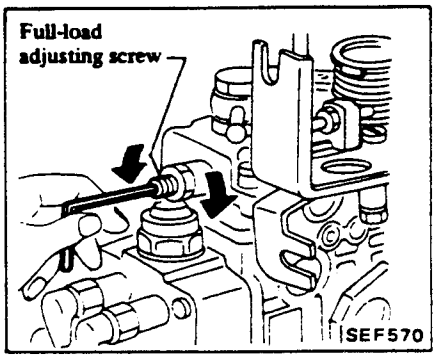
Set maximum speed adjusting screw in position shown, by turning counterclockwise. Refer to step 6–(2) in Preparation.

2. Furnish specified voltage of 12 volts to activate fuel cut solenoid valve.
3. Rotate fuel injection pump at 1,000 rpm, and measure amount of fuel injection.

Standard fuel injection:
Refer to S.D.S.

4. If fuel injection is less than standard, adjust it with full-load adjusting screw.

Turn adjusting screw clockwise to increase fuel injection.

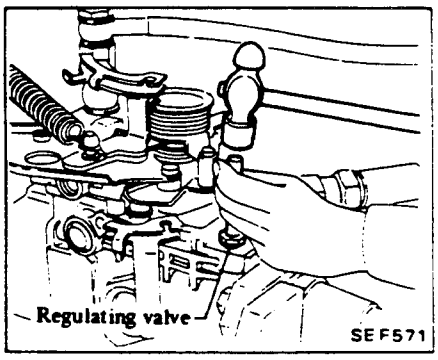


Adjustment of feed pump pressure

1. Repeat steps 1 and 2 outlined under heading "Preadjust Full-Load Delivery".
2. Measure feed pump pressure at specified fuel injection pump rpm.

Feed pump pressure:
Refer to S.D.S.

a. When measured pressure is lower than specifications.



Push in plug that is driven into regulating valve body.

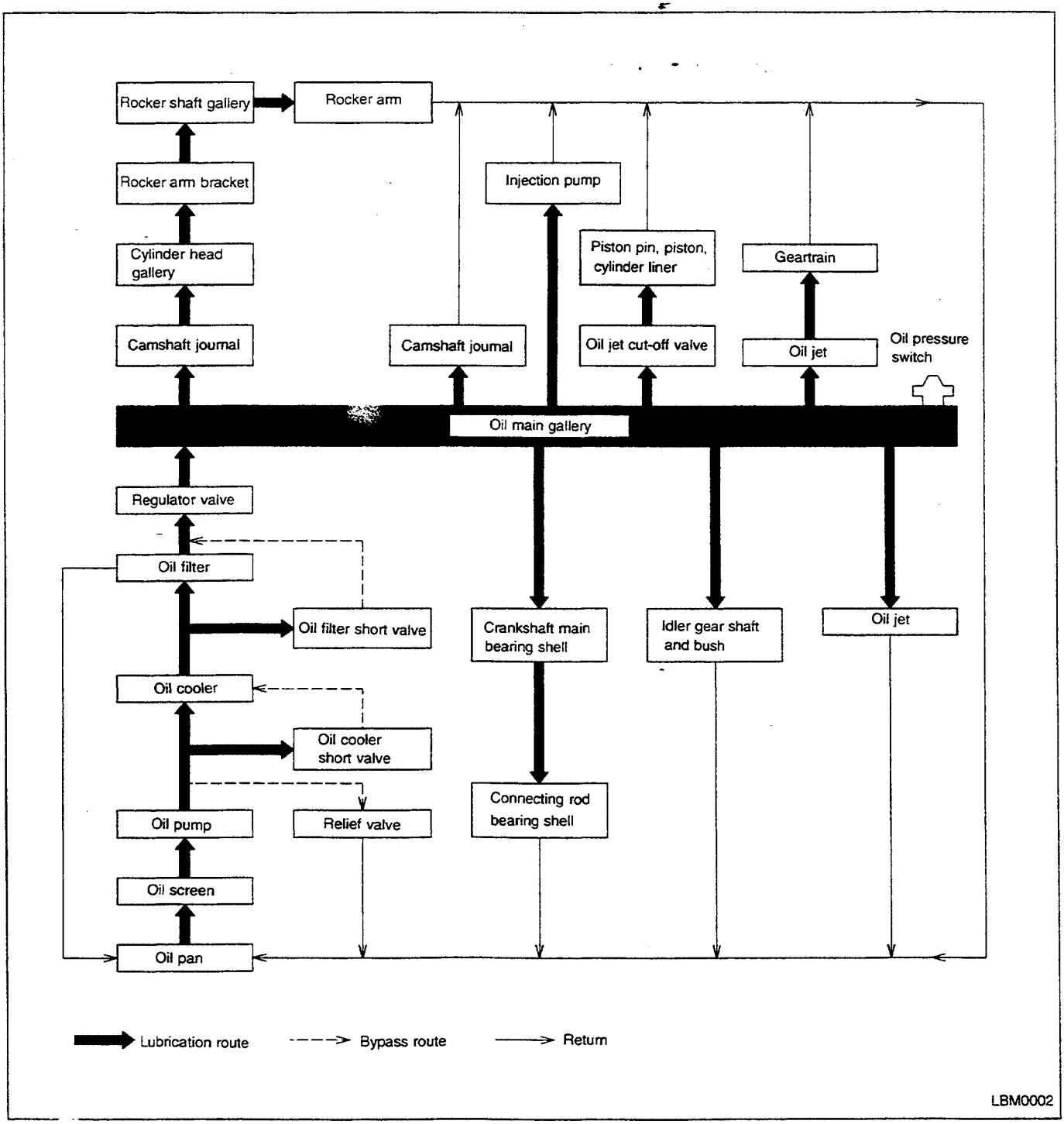
Be careful not to push plug in too far.

Section \ Item	Norminal dimension mm (in)	Maintenance standard mm (in)	Repair limit mm (in)	Wear limit mm (in)	Remarks
Piston cooling oil jet					
Valve opening pressure kPa (bar, kg/cm², psi)	196 (1.96, 2.0, 28)	177 - 216 (1.77 - 2.16, 1.8 - 2.2, 26 - 31)	–	–	
Valve spring free length	15.9 (0.626)	–	–	–	
Spring tension N (kg, lb)	–	7.26 - 8.04 (0.74 - 0.82, 1.63 - 1.81)	–	–	When compressed to 13 mm (0.51 in)
Oil pressure switch operating pressure kPa (bar, kg/cm², psi)	–	39 - 59 (0.39 - 0.59, 0.4 - 0.6, 6 - 9)	–	–	

TIGHTENING TORQUE

Tightening point	Tightening torque N·m (kg-m, ft-lb)	Remarks
Oil pump cover mounting bolt	14 - 20 (1.4 - 2.0, 10 - 14)	
Oil filter short valve	59 - 78 (6 - 8, 43 - 58)	
Oil filter regulator valve	59 - 78 (6 - 8, 43 - 58)	
Oil filter	29 - 39 (3 - 4, 22 - 29)	
Oil filter drain plug	23 - 26 (2.3 - 2.7, 17 - 20)	
Piston cooling oil jet	29 - 39 (3 - 4, 22 - 29)	

ENGINE LUBRICATION SYSTEM

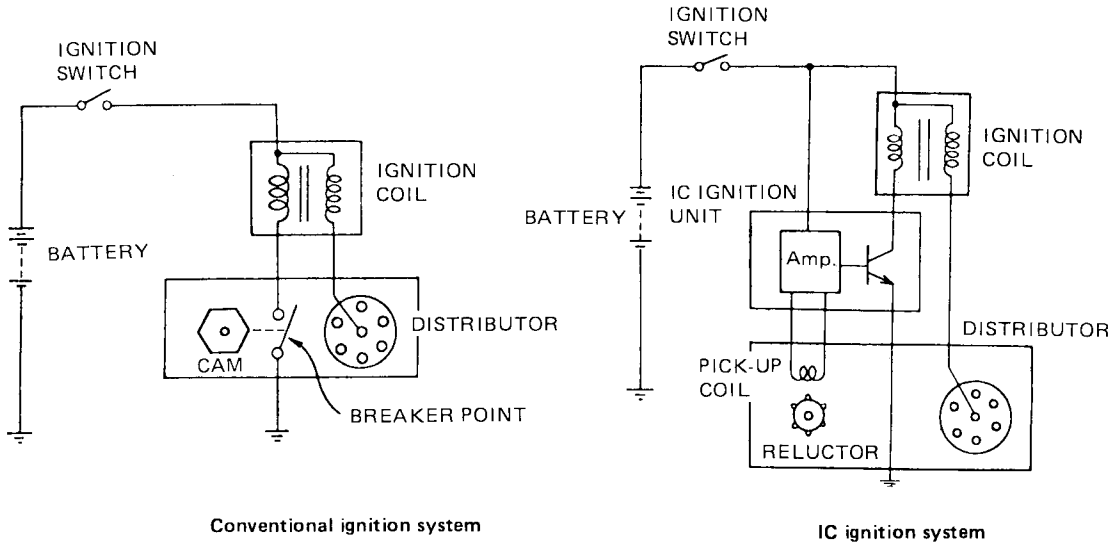


IC IGNITION SYSTEM

WARNING:

When current is flowing, never touch with bare hand high-tension cables or any other parts with high voltage. If parts are moist, touching them could cause an electric shock, even if they are insulated. Always wear dry, well-insulated gloves or wrap affected parts with dry cloth before handling.

DESCRIPTION



Conventional ignition system

IC ignition system

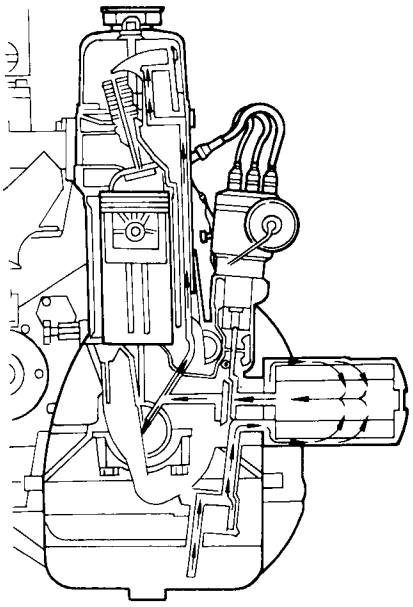
In the conventional ignition system, the primary current flowing through the ignition coil is regulated by the breaker point which makes and breaks the circuit. The high induction voltage induced in the secondary coil when the circuit is broken, is utilized for producing a spark across the spark plug electrodes.

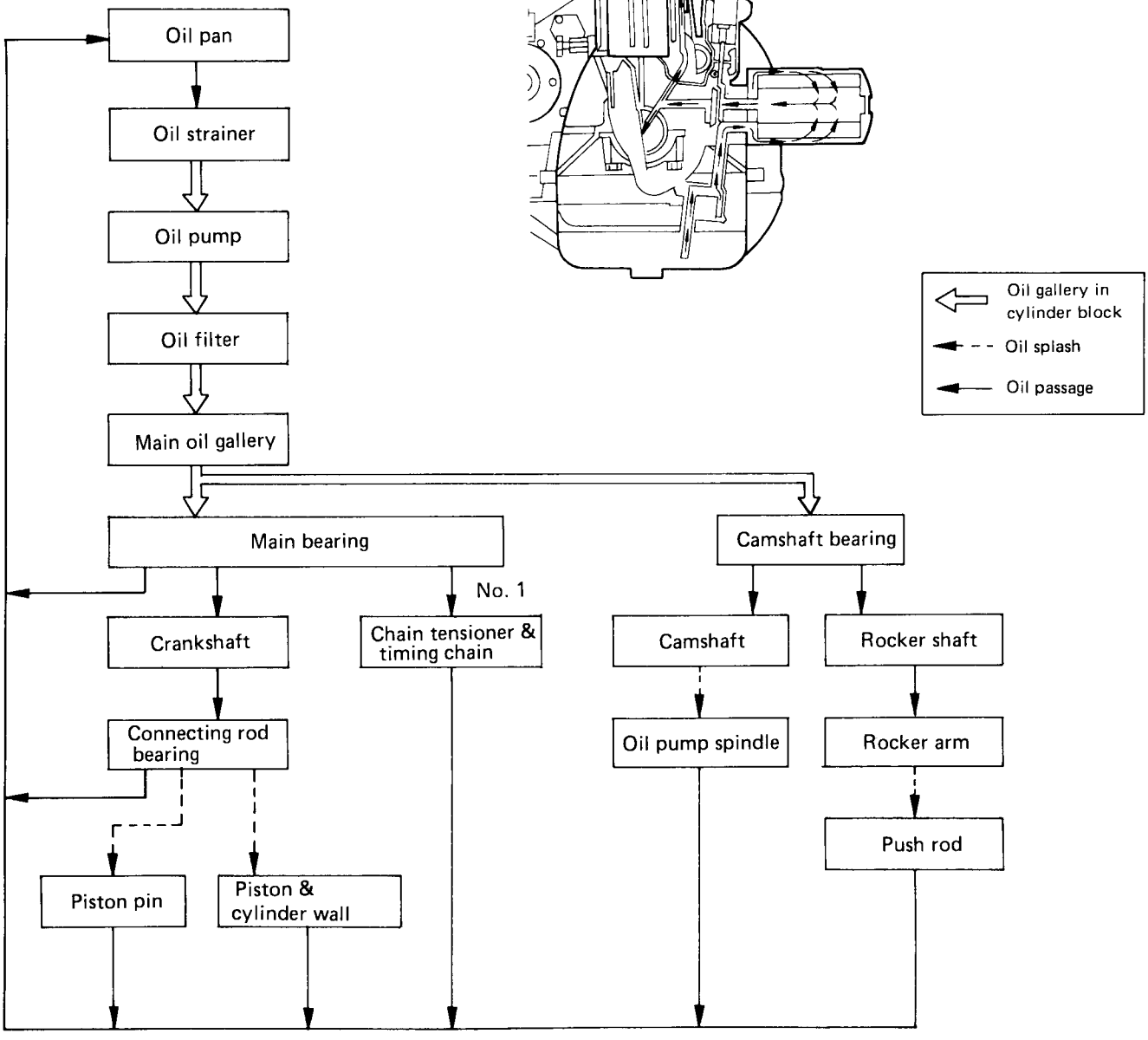
Because of this operating principle, this system cannot eliminate those problems which originate with the contact point, such as variation in the point gap, variations in ignition timing, variations in spark firing performance (reduced in low-speed range due to formation of contact arc, reduced in high-speed range due to chattering contacts), etc. Therefore, point adjustment, point replacement and other maintenance procedures are essential for keeping the conventional ignition system in good operating condition.

In the IC ignition system, transistors are used to make and break the primary winding circuit of the ignition coil. The ignition timing is determined by a signal generator (consisting of a reluctor, a magnet, a stator and a pick-up coil) rather than by the rotation of the cam. In other words, the conventional ignition system utilizes cam rotation to determine the ignition timing and, at the same time, utilizes contact points to make and break the primary winding circuit of the ignition coil, thus providing the spark. The IC ignition system utilizes a signal generator to monitor a spark signal, and an amplifier (consisting of an IC and semi-conductor devices) to amplify the signal, thereby activating the transistors, and thus making or breaking the ignition primary winding circuit.

ENGINE LUBRICATION SYSTEM

LUBRICATION CIRCUIT





SLC132

ENGINE LUBRICATION SYSTEM (EL)

—TD42 ENGINE—

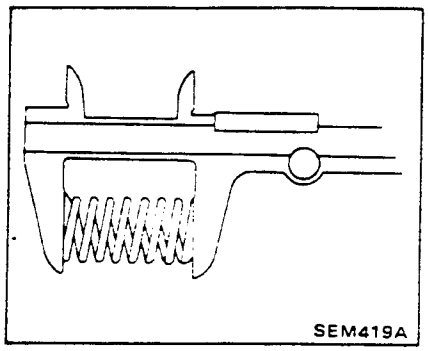
CONTENTS

Section	Item	Nominal dimension mm (in)	Maintenance standard mm (in)	Repair limit mm (in)	Wear limit mm (in)	Remarks
Cylinder head	Cylinder head height	90 (3.54)	–	–	89.7 (3.531)	
	Flatness					
	Length	–	Less than 0.05 (0.0020)	0.20 (0.0079)	0.30 (0.0118)	
	Width	–	Less than 0.05 (0.0020)	0.20 (0.0079)	0.30 (0.0118)	
	Cylinder head gasket thickness	1.3 (0.051)	1.25 - 1.35 (0.0492 - 0.0531)	–	–	When the bolts are tightened to the specified torque.
Valve insert	Seating face angle					
	Intake	30°	30°00' - 30°30'	–	–	
	Exhaust	45°	45°00' - 45°30'	–	–	
	Width of contact between valve and valve insert					
	Intake	–	2.2 - 2.5 (0.087 - 0.098)	3.5 (0.138)	–	
	Exhaust	–	2.0 - 2.2 (0.079 - 0.087)	3.5 (0.138)	–	
Valves	Valve face angle					
	Intake	30°	29°30' - 30°00'	–	–	
	Exhaust	45°	44°30' - 45°00'	–	–	
	Valve head thickness					
	Intake	2.0 (0.079)	–	–	1.8 (0.071)	
	Exhaust	1.5 (0.059)	–	–	1.3 (0.051)	
	Valve stem outside diameter					
	Intake	9 (0.35)	8.97 - 8.98 (0.3531 - 0.3535)	–	8.83 (0.3476)	
	Exhaust	9 (0.35)	8.93 - 8.95 (0.3516 - 0.3524)	–	8.83 (0.3476)	
Valve guides	Valve guide inside diameter					
	Intake	9 (0.35)	9.0 - 9.02 (0.3543 - 0.3551)	–	–	
	Exhaust	9 (0.35)	9.0 - 9.02 (0.3543 - 0.3551)	–	–	
	Clearance between valve stem					
	Intake	–	0.02 - 0.05 (0.0008 - 0.0020)	–	0.15 (0.0059)	
	Exhaust	–	0.05 - 0.09 (0.0020 - 0.0035)	–	0.20 (0.0079)	
	Projection above cylinder head	15 (0.59)	–	–	–	

3. Examine the valve rocker spring and inside spring for breakes or other damage. If faulty, replace the spring.
4. Measure the free length of the inside spring and record the results.

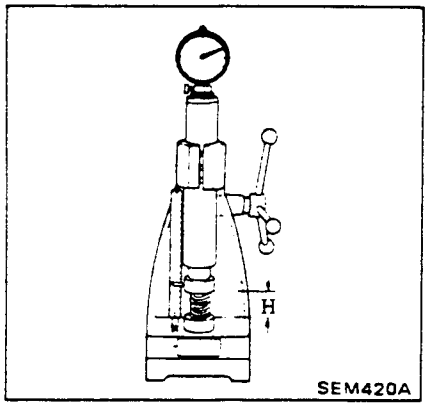
The value of the free length is mentioned for reference. Judge the need for replacement of the valve spring by measuring its spring tension.

Nominal dimension:
60 mm (2.36 in)



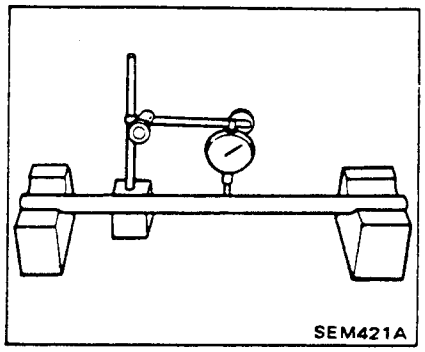
5. Measure the tension of the inside spring and record the results. If the limit is exceeded, replace the spring.

[When compressed to 33.5 mm (1.319 in)]:
Maintenance standard
21.6 - 31.4 N
(2.2 - 3.2 kg, 4.9 - 7.1 lb)
Wear limit
16.7 N (1.7 kg, 3.7 lb)



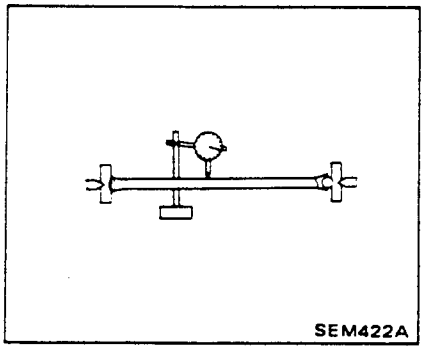
6. Measure the rocker shaft runout, and record the results. If the measured value exceeds the repair limit, repair or replace the rocker shaft.

Maintenance standard:
Less than 0.06 mm (0.0024 in)
Repair limit
0.10 mm (0.0039 in)



7. Check the rocker shaft bracket for bends, cracks or other damage, and the oil passages for clogging. If necessary, repair, replace or clean.
8. Check the contacting surface of the adjusting bolt and push rod for wear or damage, and the threaded portions for damage. If necessary, replace faulty part(s).
9. Measure the push rod runout, and record the measurement. If the repair limit is exceeded, repair or replace the push rod.

Maintenance standard:
Less than 0.3 mm (0.012 in)
Repair limit:
0.5 mm (0.020 in)



10. Measure the outside diameter of the cam follower and record the results. If the measured value exceeds the wear limit, replace the cam follower.

Maintenance standard:
19.96 - 19.98 mm
(0.7858 - 0.7866 in)
Wear limit:
19.85 mm (0.7815 in)

11. Measure the outside diameter of the cam follower and the cam follower bore in the cylinder block, and record results. Calculate the clearance using the measurements obtained. If it exceeds the wear limit, replace the cam follower.

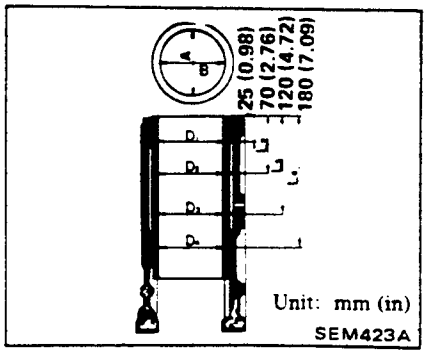
Clearance between cam follower and cam follower bore:
Maintenance standard
0.02 - 0.06 mm
(0.0008 - 0.0024 in)
Wear limit
0.12 mm (0.0047 in)

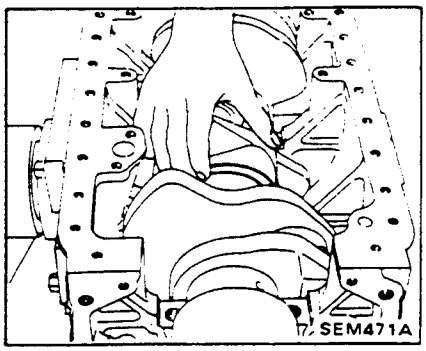
12. Check the contacting surface of the cam profile and cam follower for damage or uneven wear. If faulty, repair or replace.

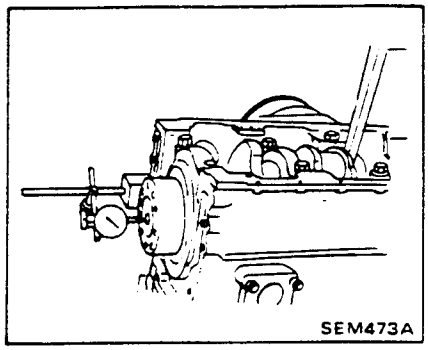
CYLINDER BLOCK

1. Check each portion of the cylinder block for damage and cracks. If faulty, repair or replace the cylinder block.
2. Inspect each stud bolt for bend and damage on the threaded portion. If faulty, replace the stud bolt.
3. Measure and record the inside diameter of the cylinder liner with the main bearing cap tightened to the specified torque. From the measured data, obtain the maximum inside diameter, out-of-roundness (difference between the dimension A and dimension B in the figure), and taper (difference between the dimension D_1 and dimension D_4) of the liner. If the inside diameter exceeds the wear limit, or if the out-of-roundness or taper exceeds the maintenance standard, replace the liner.

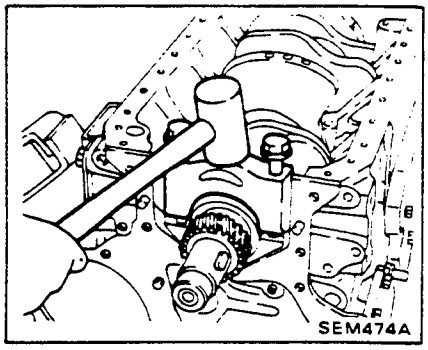
: 167 - 172 N·m
(17.0 - 17.5 kg-m, 123 - 127 ft-lb)
Inside diameter:
Wear limit
100.40 mm (3.9527 in)
Taper and out-of-roundness:
Maintenance standard
Less than 0.02 mm
(0.0008 in)



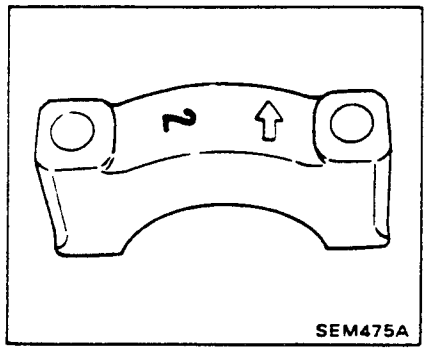

SEM471A


SEM473A

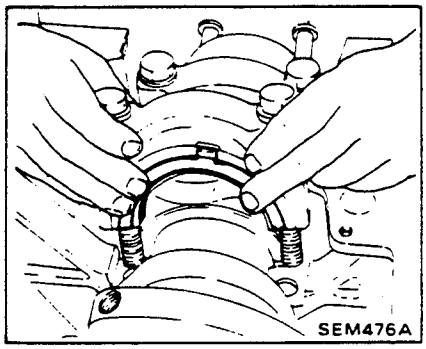
8. Install the lower shell to the main bearing cap and attach the cap to the block. Be sure to install the lower thrust washer on each side of the No. 6 main bearing cap.


SEM474A

a. **Apply a coat of engine oil to the sliding surface of the main bearing shells and install them in their original positions.**
b. **There is ➡ mark embossed in the main bearing cap as shown in the figure below. The bearing cap must be installed with this mark facing the fan side.**

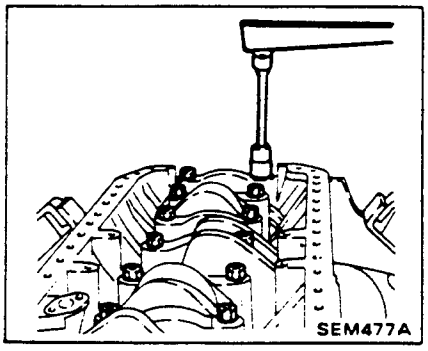

SEM475A

c. **Be sure to install thrust washers with the mark facing the bearing cap. Do not confuse the front of the thrust washer with the rear.**


SEM476A

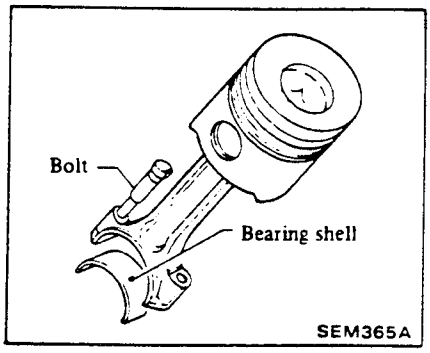
9. Tighten the main bearing cap bolt.

T : **167 - 172 N·m (17 - 17.5 kg-m, 123 - 127 ft-lb)**


SEM477A

10. Install the upper bearing shell and bolts to the connecting rod.

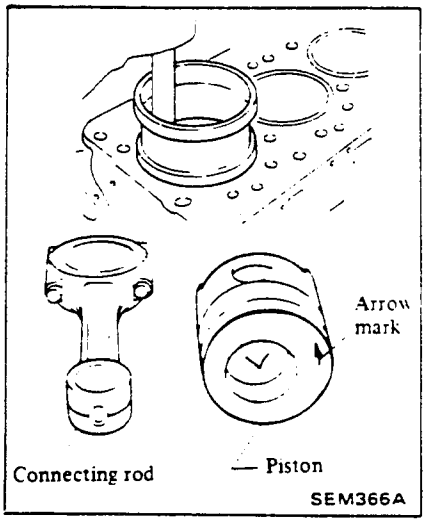
Be sure to apply a coat of engine oil to the sliding surface of the bearing shell and re-install in its original position.



SEM365A

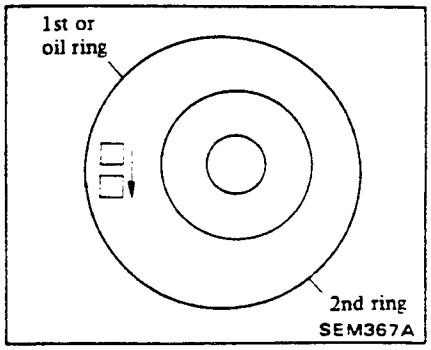
11. Using a piston insert tool, insert the piston together with the connecting rod into the cylinder liner.

a. **Make sure that the arrow mark stamped on the top of the piston faces the front of the engine and the cylinder number stamped on the large end of the connecting rod faces the side with the injection pump.**



SEM366A

b. **Do not install the piston ring in such a way that its gap faces the direction of the piston pin and is in a vertical direction.**



SEM367A

12. Attach the lower bearing shell to the connecting rod cap.

Apply a coat of engine oil to the sliding surface of the bearing shell.

ENGINE MECHANICAL

SECTION EM

CONTENTS

Muffler (Cont'd)

6. Disconnect the front tube from the exhaust manifold.

CAUTION:
Front tube is supported only by a connection between the exhaust manifold and the muffler. Be careful not to drop it when disconnecting.

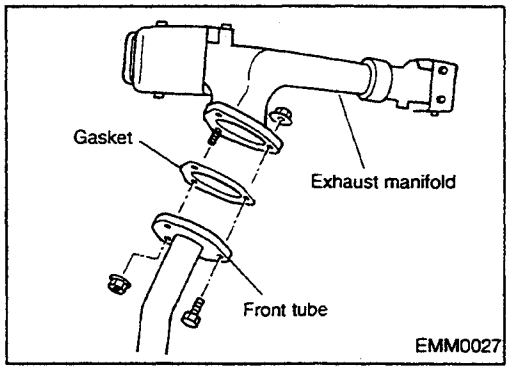
7. Disconnect the front tube from the muffler, and remove the front tube.

CAUTION:
When removing, be careful that the muffler does not interfere with other parts.

8. Remove the mounting bolts for the upper and lower muffler mounting brackets, and remove the muffler.

INSPECTION

Check the removed parts for deformation, damage, or corrosion. Repair or replace if necessary.

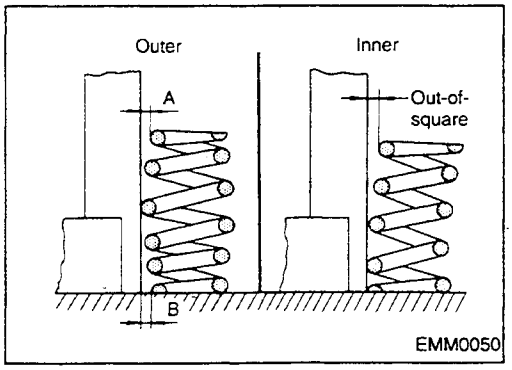


INSTALLATION

Reinstall any parts removed in the reverse order of removal, taking cake of the following points.

- When installing the front tube to the exhaust manifold, be sure the bolts and nuts are installed in the correct direction.
  Tightening torque:
  : 43 - 55 N·m (4.4 - 5.6 kg-m, 32 - 41 ft-lb)
- When installing the front and rear tubes to the muffler, apply sealant (SR seal I-20 or the equivalent) to the mating surfaces.
- After installation, start the engine and check the muffler's silencing function and exhaust leakage at the connections.

Inspection (Cont'd)



EMM0050

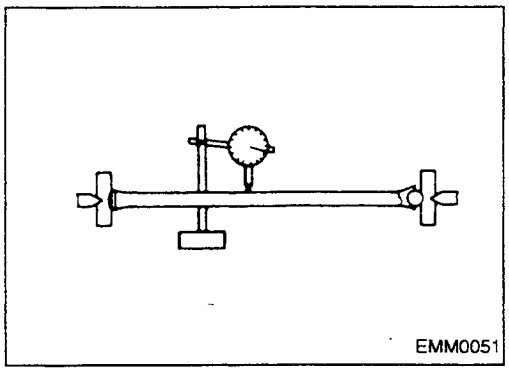
- Place a square against the spring. Turn the spring and measure the clearance between the square and the spring. If it exceeds the limit, replace the valve spring.

  Limit:

  Outer & Inner Less than 2.0 mm (0.079 in)

CAUTION:

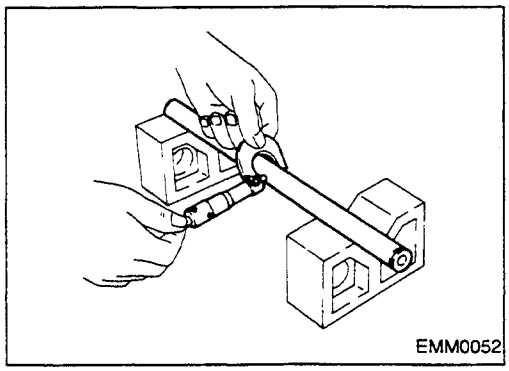
For outer spring, measure the clearance at the upper and lower ends of the spring (dimensions A and B).


EMM0051

PUSH ROD

Measure the push rod runout. If it is out of the standard, replace the push rod.

Standard: Less than 0.30 mm (0.0118 in)

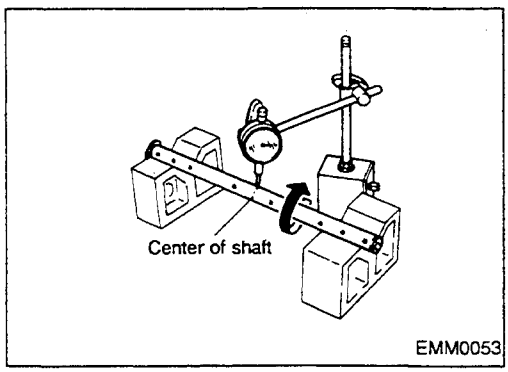

EMM0052

ROCKER SHAFT

- Measure the rocker shaft outer diameter. If it exceeds the limit, replace the rocker shaft.

  Standard: 19.98 - 20.00 mm (0.7866 - 0.7874 in)

  Limit: 19.90 mm (0.7835 in)

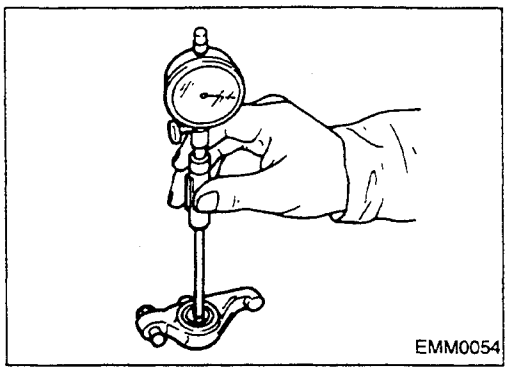


EMM0053

- Measure the rocker shaft runout. If it exceeds the limit, replace the rocker shaft.

  Standard: 0.06 mm (0.0024 in)

  Limit: 0.10 mm (0.0039 in)


EMM0054

ROCKER ARM BUSHING

Measure the rocker arm bushing inner diameter. If it exceeds the limit, replace the rocker arm bushing.

Standard: 20.02 - 20.04 mm (0.7882 - 0.7890 in)

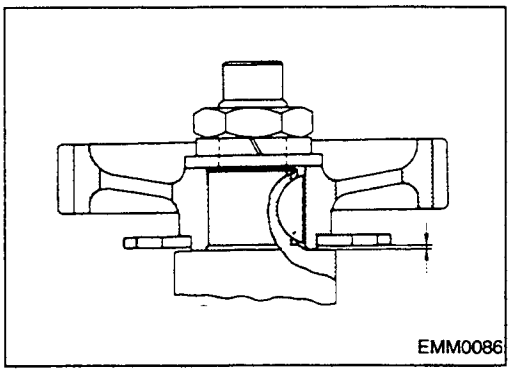
Limit: 20.10 mm (0.7913 in)

Removal (Cont'd)

- Because the water pump is tightened together with the plate gasket, it should be removed only when removing the plate gasket.

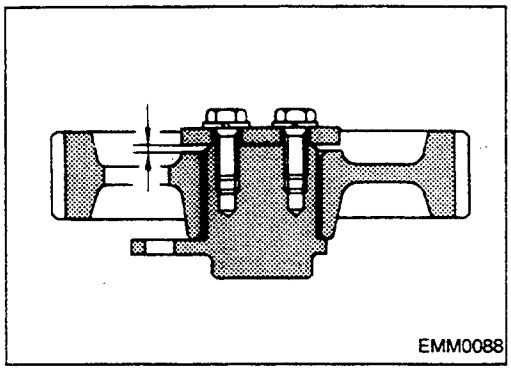
Inspection

Wash the removed parts thoroughly, and check them for damage, cracks, or wear.
If any problem is observed, correct or replace parts.


EMM0086

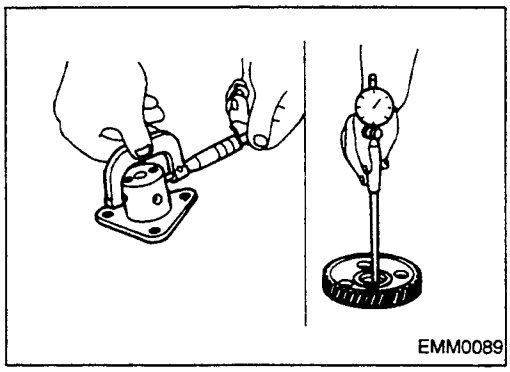
CAMSHAFT GEAR AND LOCATING PLATE

- Check the end play measured during removal. If it exceeds the limit, replace the locating plate.
  Standard:
  0.08 - 0.28 mm (0.0031 - 0.0110 in)
  Limit:
  0.30 mm (0.0118 in)
- Visually check the camshaft gear for cracked teeth, wear, or damage. Replace the camshaft gear if necessary.
- Visually check the locating plate for damage or deformation. Replace the locating plate if necessary.


EMM0088

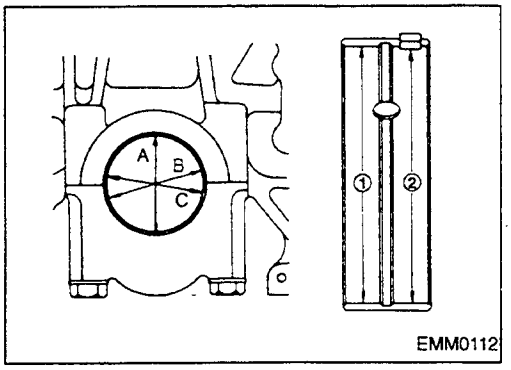
IDLER GEAR AND SHAFT

- Check the end play measured during removal. If it exceeds the limit, replace the idler gear, idler gear shaft, and idler gear plate.
  Standard:
  0.03 - 0.12 mm (0.0012 - 0.0047 in)
  Limit:
  0.3 mm (0.012 in)


EMM0089

- Measure the idler gear shaft outer diameter and the idler gear bushing inner diameter, and calculate the clearance. If it exceeds the limit, replace the idler gear bushing.
  Standard:
  0.02 - 0.06 mm (0.0008 - 0.0024 in)
  Limit:
  0.20 mm (0.0079 in)
- Visually check the idler gear for cracked teeth, wear, or damage. Replace the idler gear if necessary.
- Visually check the idler gear shaft and the idler gear plate for damage, deformation, or wear. Replace if necessary.

Inspection (Cont'd)



MAIN BEARING SHELL

- Check the main bearing shell to crankshaft journal clearance measured during removal. If it exceeds the limit, replace the main bearing shell.
  Standard:
  0.03 - 0.09 mm (0.0012 - 0.0035 in)
  Limit:
  0.15 mm (0.0059 in)
- When calculating clearance, measure dimensions at positions shown in the figure with the main bearing shell installed to the cylinder block.

THRUST BEARING

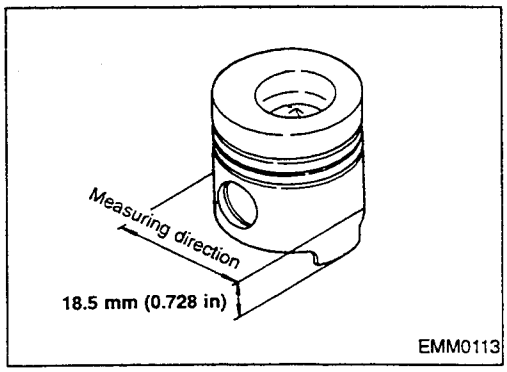
- Check the end play measured during removal. If it exceeds the limit, select the proper thrust bearing so that the standard end play is obtained.
  Standard:
  0.05 - 0.14 mm (0.0020 - 0.0055 in)
  Limit:
  0.40 mm (0.0157 in)
- Select the thrust bearing thickness from the table below.

Unit: mm (in)

Size symbols	Thickness
A	2.965 - 2.995 (0.1167 - 0.1179)
B	2.930 - 2.965 (0.1154 - 0.1167)
C	2.900 - 2.930 (0.1142 - 0.1154)
0.20 OS	3.150 - 3.200 (0.1240 - 0.1260)
0.40 OS	3.350 - 3.400 (0.1319 - 0.1339)

OS: Oversize

CAUTION:
Upper and lower thrust bearings should be replaced as a set.



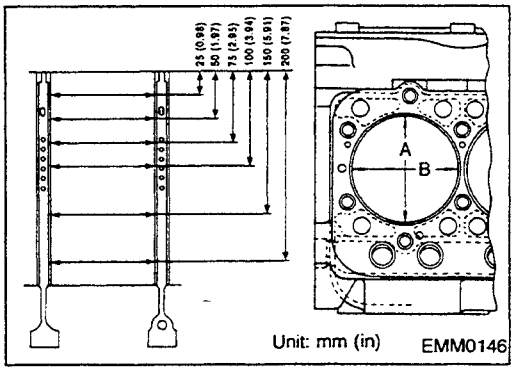
PISTON

- Measure the piston outer diameter at 18.5 mm (0.728 in) above the piston lower surface, at the right angle to the piston pin.
  If it exceeds the standard, replace the piston.
  Standard:
  107.940 - 107.970 mm (4.2496 - 4.2508 in)

- Calculate clearance by the difference between the cylinder liner inner diameter and piston outer diameter. If it exceeds the standard, replace the piston.
  Standard:
  0.050 - 0.070 mm (0.0020 - 0.0028 in)
  Cylinder liner inner diameter (Limit):
  108.23 mm (4.2610 in)

Inspection

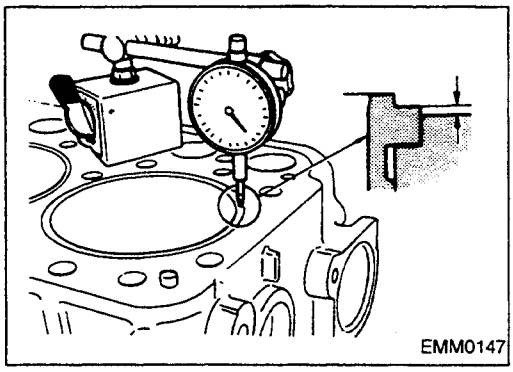
Wash removed parts thoroughly, and check them for damage or cracks.
If any problem is observed, correct or replace parts.



CYLINDER LINER

CAUTION:

- **Measure the values with the cylinder liner installed to the cylinder block.**
- **Cylinder liner wall should be measured at the point of 25, 50, 75, 100, 150, and 200 mm (0.98, 1.97, 2.95, 3.94, 5.91, and 7.87 in) from the top of the cylinder liner respectively.**
- Measure the cylinder liner inner diameter. If it exceeds the limit, replace the cylinder liner.
  Limit:
  108.23 mm (4.2610 in)
- Measure the out-of-round of cylinder liner. If it exceeds the standard, replace the cylinder liner.
  Standard:
  Less than 0.02 mm (0.0008 in)
- Measure the out-of-square of cylinder liner. If it exceeds the standard, replace the cylinder liner.
  Standard:
  Less than 0.25 mm (0.0098 in)

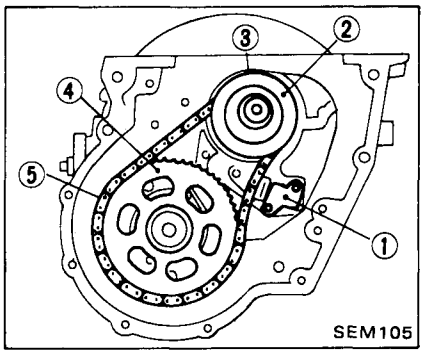


- Measure the protruding amount of cylinder liner flange from cylinder block. If it is out of standard, correct or replace the cylinder liner.
  Standard:
  0 - 0.07 mm (0 - 0.0028 in)
- When the protruding amount difference to the adjacent cylinder is out of standard, the cylinder liner should be replaced, even if the protruding amount measured in the previous step is within the standard.
  Standard:
  Less than 0.03 mm (0.0012 in)

CYLINDER BLOCK

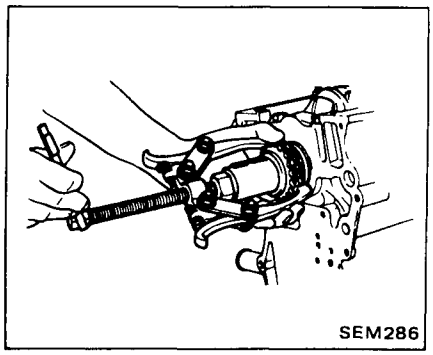
- Check the cylinder block for damage, cracks, or oil passage restriction. If any problem is observed, clean, correct, or replace the cylinder liner.

To facilitate assembling operation, scribe a mark on timing chain and camshaft sprocket with paint before removal.



1 Chain tensioner
2 Oil thrower
3 Crankshaft sprocket
4 Camshaft sprocket
5 Timing chain

If it is hard to extract crankshaft sprocket, use a suitable puller.

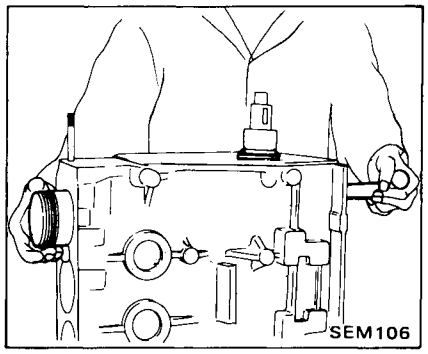


- Front plate

6. Camshaft locating plate, camshaft and valve lifters, and keep then in correct order.
7. Piston and connecting rod assembly

(1) Remove connecting rod bearing cap with bearing.

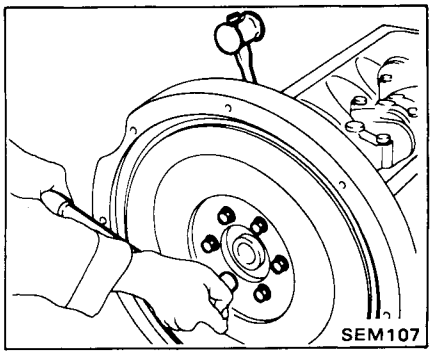
(2) Push out piston with connecting rod toward cylinder head side.



a. Piston can be easily removed by scraping carbon off top face of cylinder with a scraper.
b. Numbers are stamped on connecting rod and cap corresponding to each cylinder. Care should be taken to avoid wrong combination including bearing.

8. Flywheel while crankshaft is locked with hammer handle, and flywheel housing.

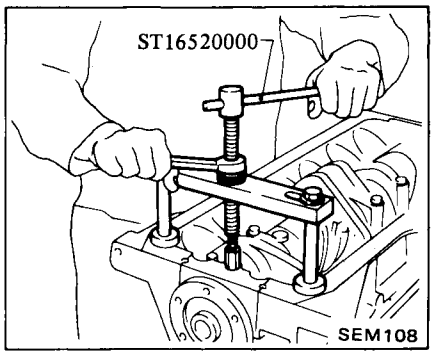
WARNING:
When removing flywheel, be careful not to drop it.



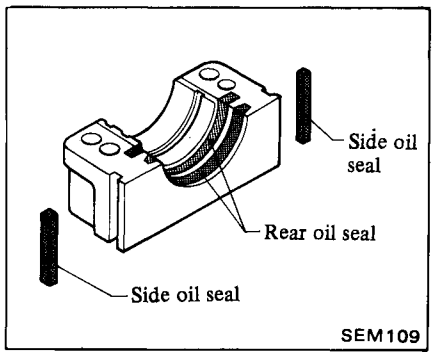
9. Crankshaft

(1) Remove main bearing cap with bearing.

a. When loosening main bearing cap bolt, loosen from outside in sequence.
Do not completely loosen bolts in one step. Instead use two or three steps for this procedure.
b. Remove rear main bearing cap using Tool.
c. Keep them in order.



(2) Remove rear and side oil seal.



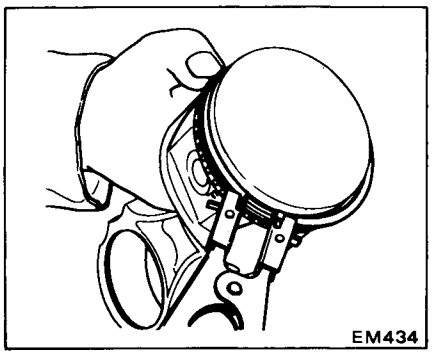
(3) Remove crankshaft.

(4) Remove main bearing and rear oil seal at block side.

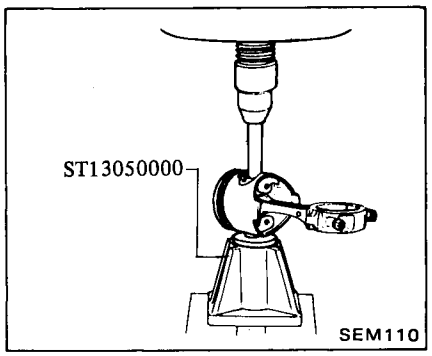
DISASSEMBLING PISTON AND CONNECTING ROD

1. Remove top & second piston rings with a ring remover and remove oil ring expander & rails by hand.

When removing piston rings, be careful not to scratch piston.



2. Press piston pin out. Using press and Tool.



TECHNICAL BULLETIN

NISSAN MOTOR CO., LTD.
Industrial Machinery Division
Overseas Sales Department
Tokyo, Japan

Engine Mechanical

FEM 88-F01

APPLIED MODEL : F05 series
APPLIED FROM : BF05-001001
WF05-001001
DF05-000639

Technical Bulletins relevant to the face-lift			
FGI88-F01	FMA88-F01	FET88-F01	FET88-F02
FEM88-F01	FEM88-F02	FEL88-F01	FEL88-F02
FCO88-F01	FCO88-F02	FEF88-F01	FEF88-F02
FEE88-F01	FEE88-F02	FBE88-F01	

ENGINE MECHANICAL

The information in this bulletin should not be interpreted as the basis for claims unless so designated.
Whenever you order spare parts, refer to the Spare Parts Bulletin, not to this Technical Bulletin.

Printed in Japan

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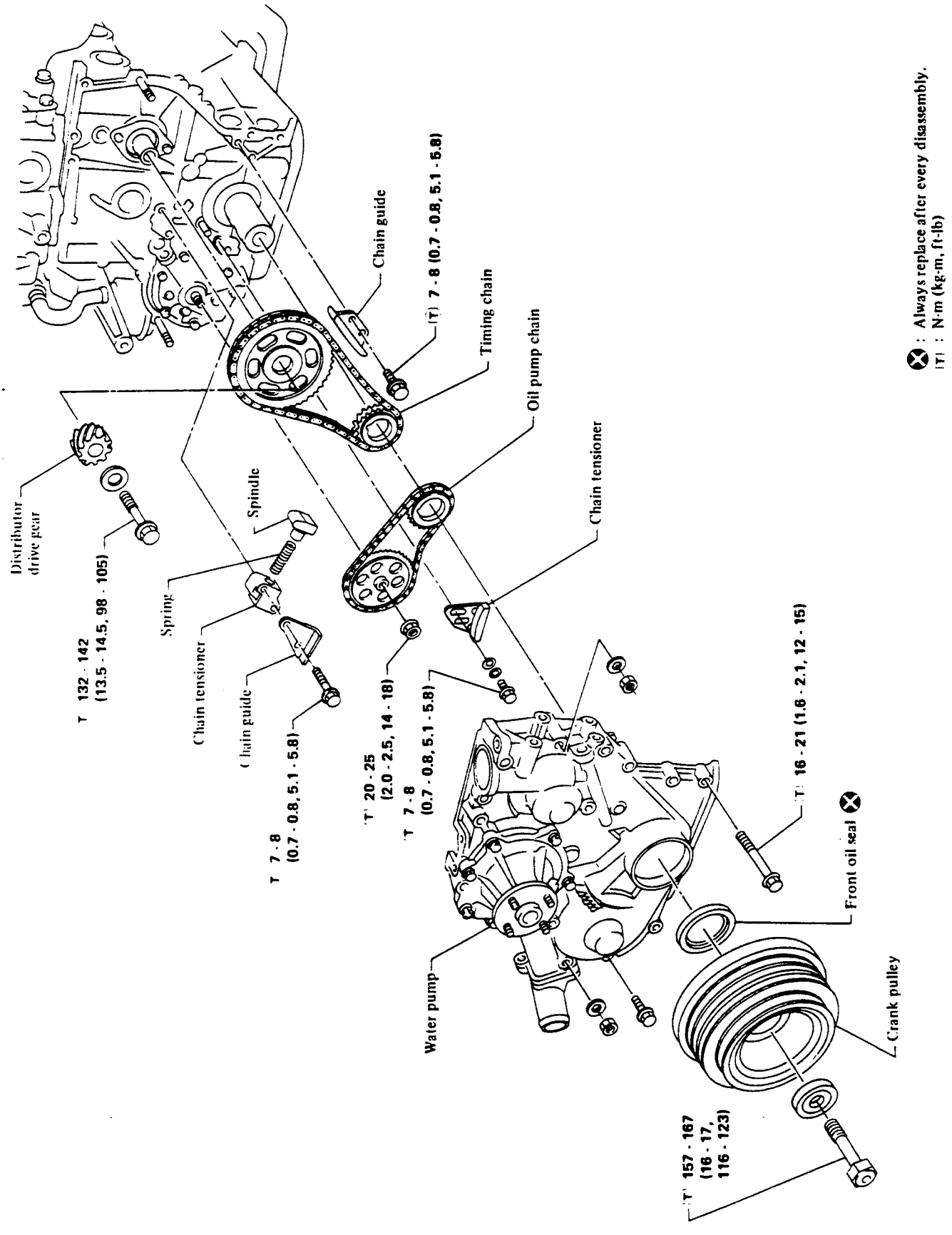
Publication No. TB8E-F06FG0

TIMING CHAIN



FEM158

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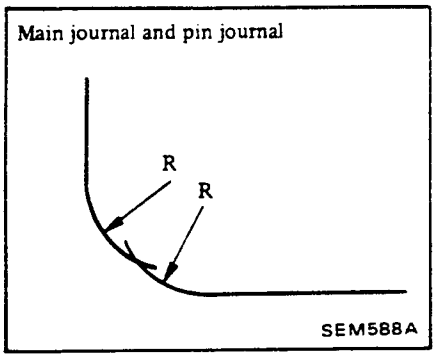
5. Calculate main bearing clearance.
Main bearing clearance = A – Dm

Standard:
0.041 - 0.087 mm
(0.0016 - 0.0034 in)
Limit:
0.09 mm (0.0035 in)

6. If it exceeds the limit, replace bearing.
7. If the clearance cannot be adjusted within the standard of any bearing, grind crankshaft journal and use undersized bearing.

a. When grinding crank pin and crank journal, fillets should be finished as shown in the figure.

R: Main journal
2.5 - 2.6 mm
(0.098 - 0.102 in)
Pin journal
3.0 - 3.1 mm
(0.118 - 0.122 in)



b. Refer to S.D.S. for grinding crankshaft and available service parts.

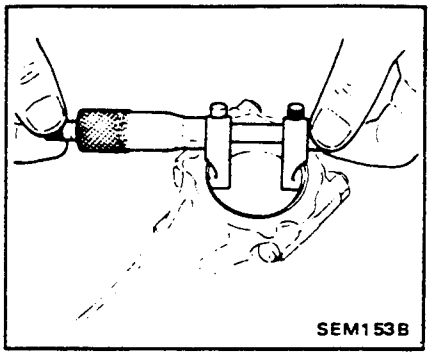
8. If crankshaft, cylinder block and main bearings are replaced with new ones, check that the clearance of main bearing is within specifications.

CONNECTING ROD BEARING CLEARANCE (Big end)

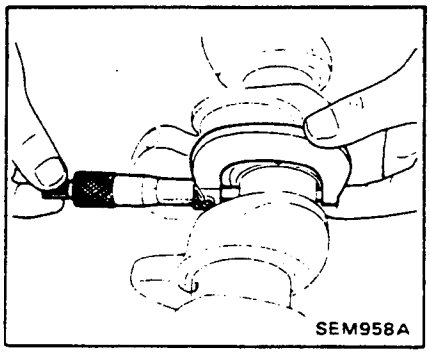
1. Install connecting rod bearing to connecting rod and cap.
2. Install connecting rod cap to connecting rod.

Tighten bolts to the specified torque.

3. Measure inner diameter "C" of bearing.



4. Measure outer diameter "Dp" of crankshaft pin journal.



5. Calculate connecting rod bearing clearance.

Connecting rod bearing clearance
= C – Dp

Standard:
0.027 - 0.061 mm
(0.0011 - 0.0024 in)
Limit:
0.09 mm (0.0035 in)

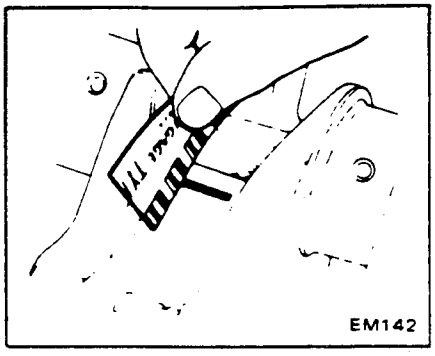
6. If it exceeds the limit, replace bearing.
7. If the clearance cannot be adjusted within the standard of any bearing, grind crankshaft journal and use undersized bearing.
Refer to step 7 of "Main bearing clearance".

Method B (Using plastigage)

CAUTION:

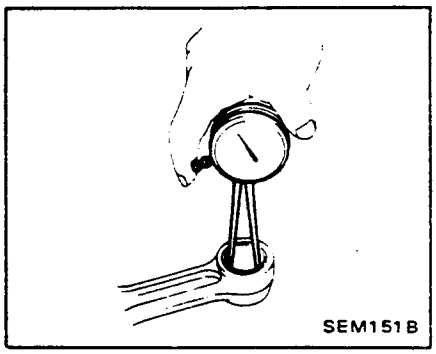
- **Do not turn crankshaft or connecting rod while the plastigage is being inserted.**
- **When bearing clearance exceeds the specified limit, ensure that the proper bearing has been installed. Then if excessive bearing clearance exists, use thicker main bearing or undersized bearing so that the specified bearing clearance is obtained.**

Main bearing clearance:
Standard
0.051 - 0.097 mm
(0.0020 - 0.0038 in)
Limit
0.1 mm (0.004 in)
Connecting rod bearing clearance:
Standard
0.040 - 0.074 mm
(0.0016 - 0.0029 in)
Limit
0.1 mm (0.004 in)

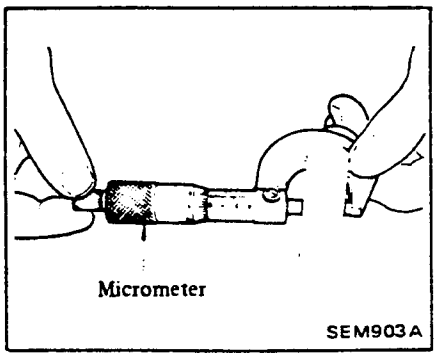


CONNECTING ROD BUSHING CLEARANCE (Small end)

1. Measure inner diameter "C" of bushing.



2. Measure outer diameter "Dp" of piston pin.



VALVE GUIDE

Unit: mm (in)

	Standard	Service
Valve guide outside diameter	12.033 - 12.044 (0.4737 - 0.4742)	–
Valve guide inner diameter (Finished size)	8.00 - 8.015 (0.3150 - 0.3156)	
Cylinder head valve guide hole diameter	12.00 - 12.011 (0.4724 - 0.4729)	–
Interference fit of valve guide	0.022 - 0.044 (0.0009 - 0.0017)	
	Standard	Max. tolerance
Stem to guide clearance		
Intake	0.023 - 0.053 (0.0009 - 0.0021)	0.15 (0.0059)
Exhaust	0.04 - 0.07 (0.0016 - 0.0028)	0.20 (0.0079)
Valve deflection limit		
Intake	0.30 (0.0118)	
Exhaust	0.40 (0.0157)	

VALVE LIFTER AND PUSH ROD

Unit: mm (in)

	Standard	Limit
Valve lifter outer diameter	24.960 - 24.970 (0.9827 - 0.9831)	–
Cylinder block valve lifter hole diameter	25.000 - 25.033 (0.9843 - 0.9855)	–
Valve lifter to lifter hole clearance	0.030 - 0.073 (0.0012 - 0.0029)	0.20 (0.0079)
Push rod bend (T.I.R.)*	Less than 0.3 (0.012)	0.5 (0.020)

*: Total indicator reading

ROCKER SHAFT AND ROCKER ARM

Unit: mm (in)

	Standard	Limit
Rocker shaft		
Outer diameter	19.979 - 20.00 (0.7866 - 0.7874)	–
Rocker shaft bend (T.I.R.)	0 - 0.10 (0 - 0.0039)	Less than 0.30 (0.0118)
Rocker arm		
Inner diameter	20.014 - 20.035 (0.7880 - 0.7888)	–
Clearance between rocker arm and rocker shaft	0.014 - 0.056 (0.0006 - 0.0022)	0.15 (0.0059)

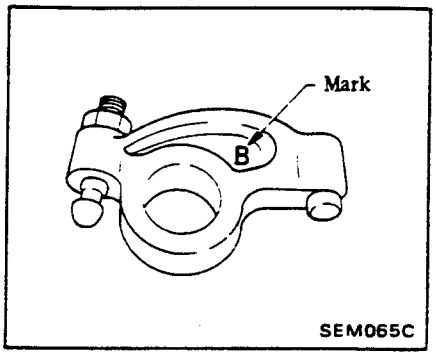
CYLINDER HEAD TO VALVE DISTANCE

Unit: mm (in)

	Standard	Limit
Intake	0.275 - 0.675 (0.0108 - 0.0266)	1.25 (0.0492)
Exhaust	0.305 - 0.695 (0.0120 - 0.0274)	1.25 (0.0492)

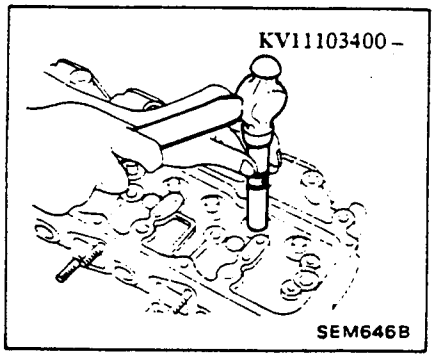
- Identification of rocker arms

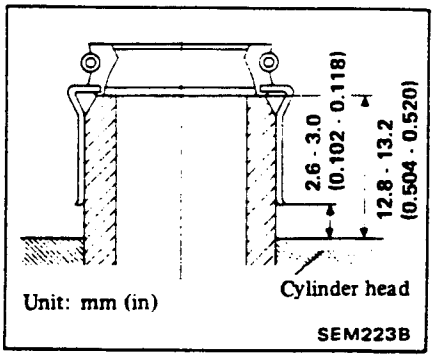
Identification mark (on rocker arm)	For use with
B	Intake
C	Exhaust



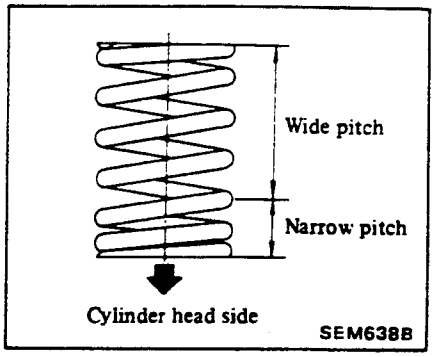
2. Install valve component parts.

- **Always use a new valve oil seal, and apply engine oil to seal when installing it in place.**





- **Install valve spring (uneven pitch type) with its narrow pitch side toward cylinder head side.**

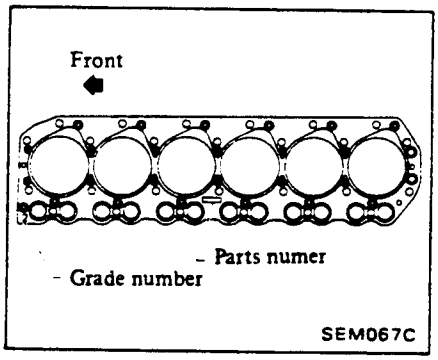


INSTALLATION

1. Install cylinder head gasket.

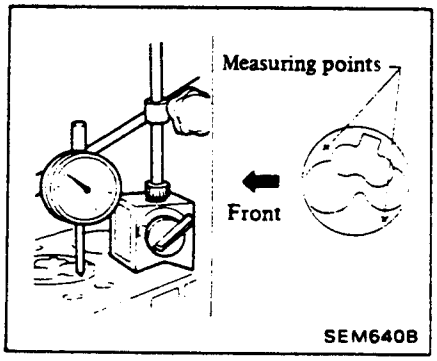
a. When replacing only cylinder head gasket, install same grade gasket as the one formerly used.

b. When replacing or repairing cylinder block, cylinder head, piston, connecting rod and crankshaft, select gasket as follows:



(1) Measure piston projection.

- Set each piston at its top dead center. With piston held in that position, measure its projections at two points.
- Calculate the average value of the two measurements.
- Determine the amount of projection of the other three pistons.



(2) Select suitable cylinder head gasket which conforms to the largest amount of projection of the four pistons.

Unit: mm (in)

Average values piston projections	Gasket thickness	Gasket grade number
Less than 0.118 (0.0046)	1.15 (0.0453)	1
0.118 - 0.168 (0.0046 - 0.0066)	1.20 (0.0472)	2
More than 0.168 (0.0066)	1.25 (0.0492)	3

Make sure that No. 1 piston is at T.D.C. on its compression stroke.

2. Install cylinder head.

3. Apply oil to the thread portion and seat surface of bolts and tighten cylinder head bolts using Tool.

CAUTION:

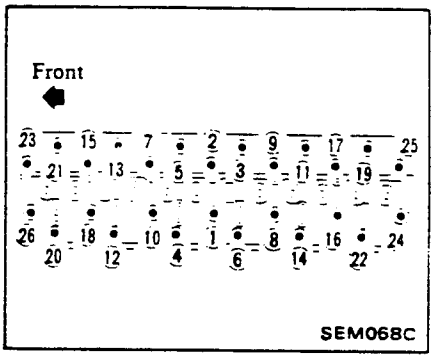
- **Tightening procedure:**

1st

Tighten bolts to 49 - 59 N·m (5.0 - 6.0 kg-m, 36 - 43 ft-lb)

2nd

Tighten bolts to 98 - 108 N·m (10.0 - 11.0 kg-m, 72 - 80 ft-lb)



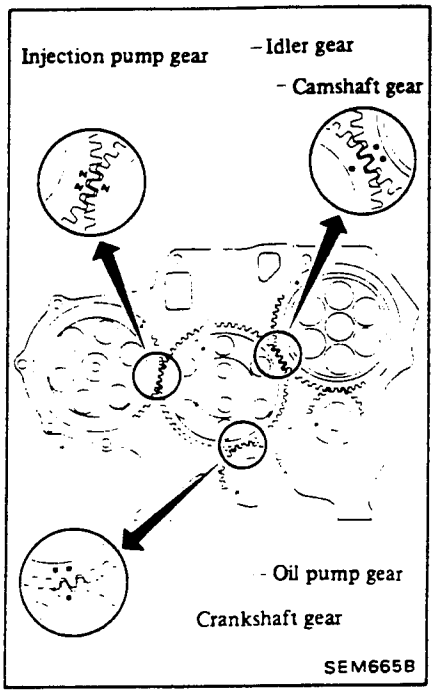
4. Apply engine oil and install push rods.

5. Install rocker shaft assembly.

Ⓣ : **Rocker shaft bracket bolt**
20 - 25 N·m (2.0 - 2.5 kg-m, 14 - 18 ft-lb)

GEAR TRAIN

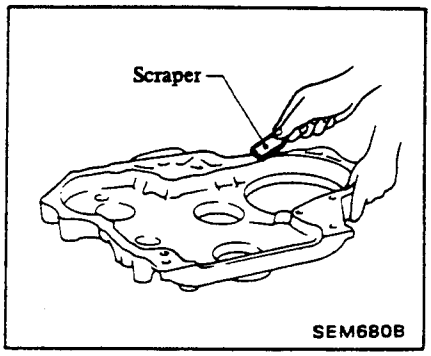
1. Set No. 1 piston at its top dead center.
2. Align each gear mark and install gears.



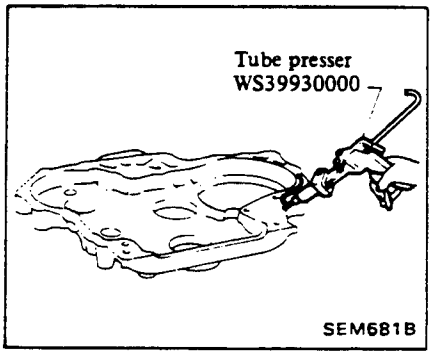
TIMING GEAR CASE

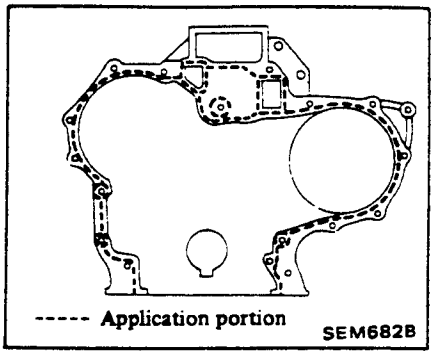
Installation

1. Before installing timing gear case, remove all traces of liquid gasket from mating surface using a scraper.
Also remove traces of liquid gasket from mating surface of front plate.

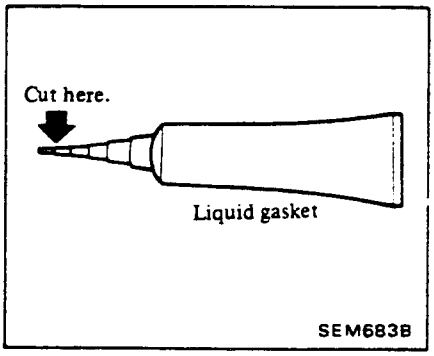


2. Apply a continuous bead of liquid gasket to mating surface of timing gear case.





- **Be sure liquid gasket is 2.5 to 3.5 mm (0.098 to 0.138 in) wide.**
- **Attach timing gear case to front plate within 10 minutes after coating.**
- **Wait at least 30 minutes before refilling engine coolant or starting engine.**
- **Use Genuine Liquid Gasket or equivalent.**



AVAILABLE MAIN BEARING

Bearing clearance

Unit: mm (in)

Main bearing clearance Standard	0.035 - 0.087 (0.0014 - 0.0034)
Limit	0.15 (0.0059)
Connecting rod bearing clearance Standard	0.035 - 0.081 (0.0014 - 0.0032)
Limit	0.15 (0.0059)

Main bearing undersize

Unit: mm (in)

	Crank journal diameter
Standard	70.907 - 70.920 (2.7916 - 2.7921)
Undersize 0.25 (0.0098)	70.657 - 70.670 (2.7818 - 2.7823)
0.50 (0.0197)	70.407 - 70.420 (2.7719 - 2.7724)
0.75 (0.0295)	70.157 - 70.170 (2.7621 - 2.7626)
1.00 (0.0394)	69.907 - 69.920 (2.7522 - 2.7528)

AVAILABLE CONNECTING ROD BEARING

Connecting rod bearing undersize

Unit: mm (in)

	Crank pin journal diameter
Standard	56.919 - 56.926 (2.2409 - 2.2412)
Undersize 0.25 (0.0098)	56.669 - 56.676 (2.2311 - 2.2313)
0.50 (0.0197)	56.419 - 56.676 (2.2212 - 2.2313)
0.75 (0.0295)	56.169 - 56.176 (2.2114 - 2.2116)
1.00 (0.0394)	55.919 - 55.926 (2.2015 - 2.2018)

AVAILABLE THRUST WASHER

Thrust washer undersize

Unit: mm (in)

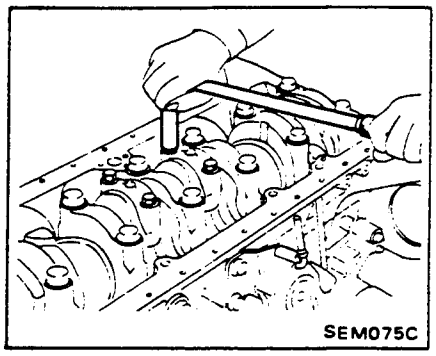
	Thrust washer thickness
Standard Standard mark A	2.275 - 2.325 (0.0896 - 0.0915)
B	2.300 - 2.350 (0.0906 - 0.0925)
C	2.325 - 2.375 (0.0915 - 0.0935)
Oversize 0.20 (0.0079)	2.475 - 2.525 (0.0974 - 0.0994)
0.40 (0.0157)	2.675 - 2.725 (0.1053 - 0.1073)

MISCELLANEOUS COMPONENTS

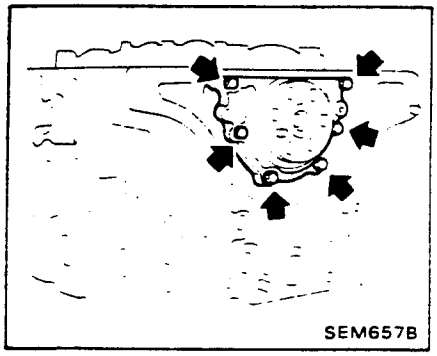
Unit: mm (in)

Gear train Backlash of each gear	0.06 - 0.12 (0.0024 - 0.0047)
Limit	0.20 (0.0079)
Flywheel Runout (Total indicator reading)	Less than 0.15 (0.0059)
Front plate Warpage limit	0.2 (0.008)

17. Remove crankshaft gear.
18. Remove flywheel and rear plate.
19. Remove oil jets.
20. Remove connecting rod caps.
21. Remove pistons.

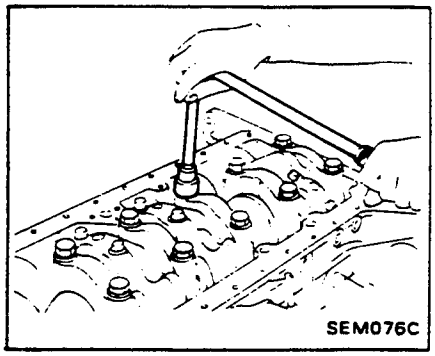


22. Remove rear oil seal retainer.



23. Remove main bearing cap and crankshaft.

Place the bearings and caps in their proper order.

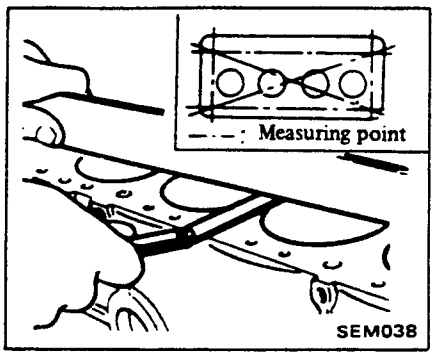


INSPECTION AND REPLACEMENT

CYLINDER BLOCK DISTORTION

If beyond the specified limit, replace it.

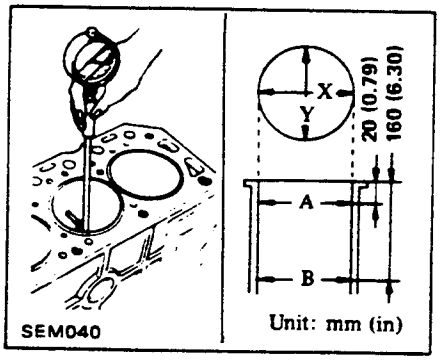
Cylinder block distortion:
Standard
Less than 0.05 mm (0.0020 in)
Limit
0.2 mm (0.008 in)



CYLINDER LINER WEAR

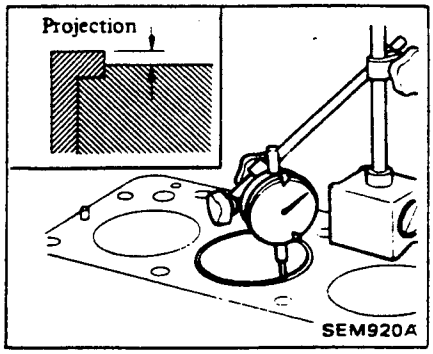
1. Measure cylinder liner bore for out-of-round and taper with a bore gauge. If beyond the limit, replace cylinder liner.

Standard inside diameter:
96.000 - 96.010 mm
(3.7795 - 3.7799 in)
Refer to S.D.S.
Wear limit:
0.20 mm (0.0079 in)
Out-of-round (X–Y) limit:
0.04 mm (0.0016 in)
Taper (A–B) limit:
0.04 mm (0.0016 in)



2. Check for scratches or seizure. If seizure is found, replace cylinder liner.
3. Check amount of projection of cylinder liner.

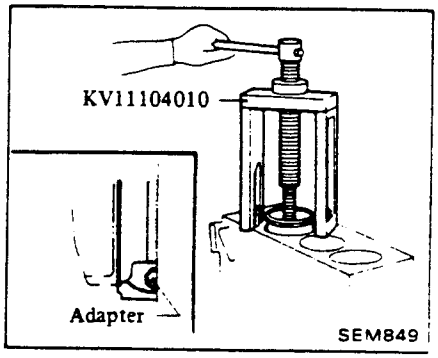
Cylinder liner projection:
Standard
0.02 - 0.09 mm
(0.0008 - 0.0035 in)
Deviation of each cylinder:
Less than 0.05 mm (0.0020 in)



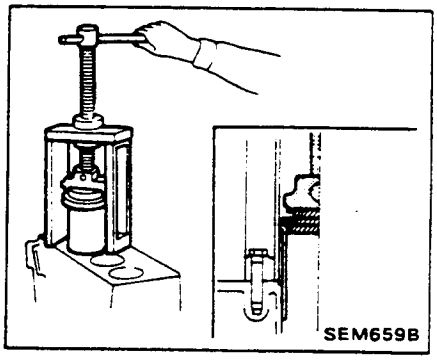
CYLINDER LINER

Replacement

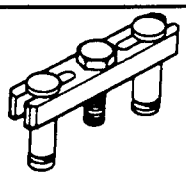
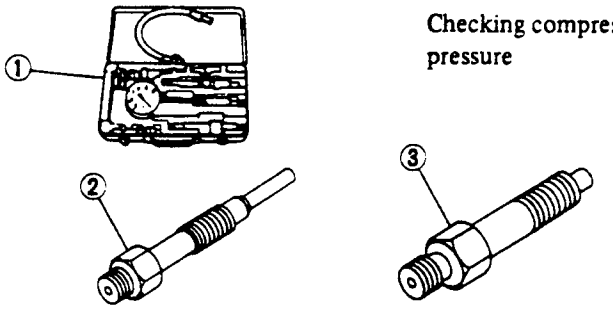
1. Remove cylinder liner with Tool.



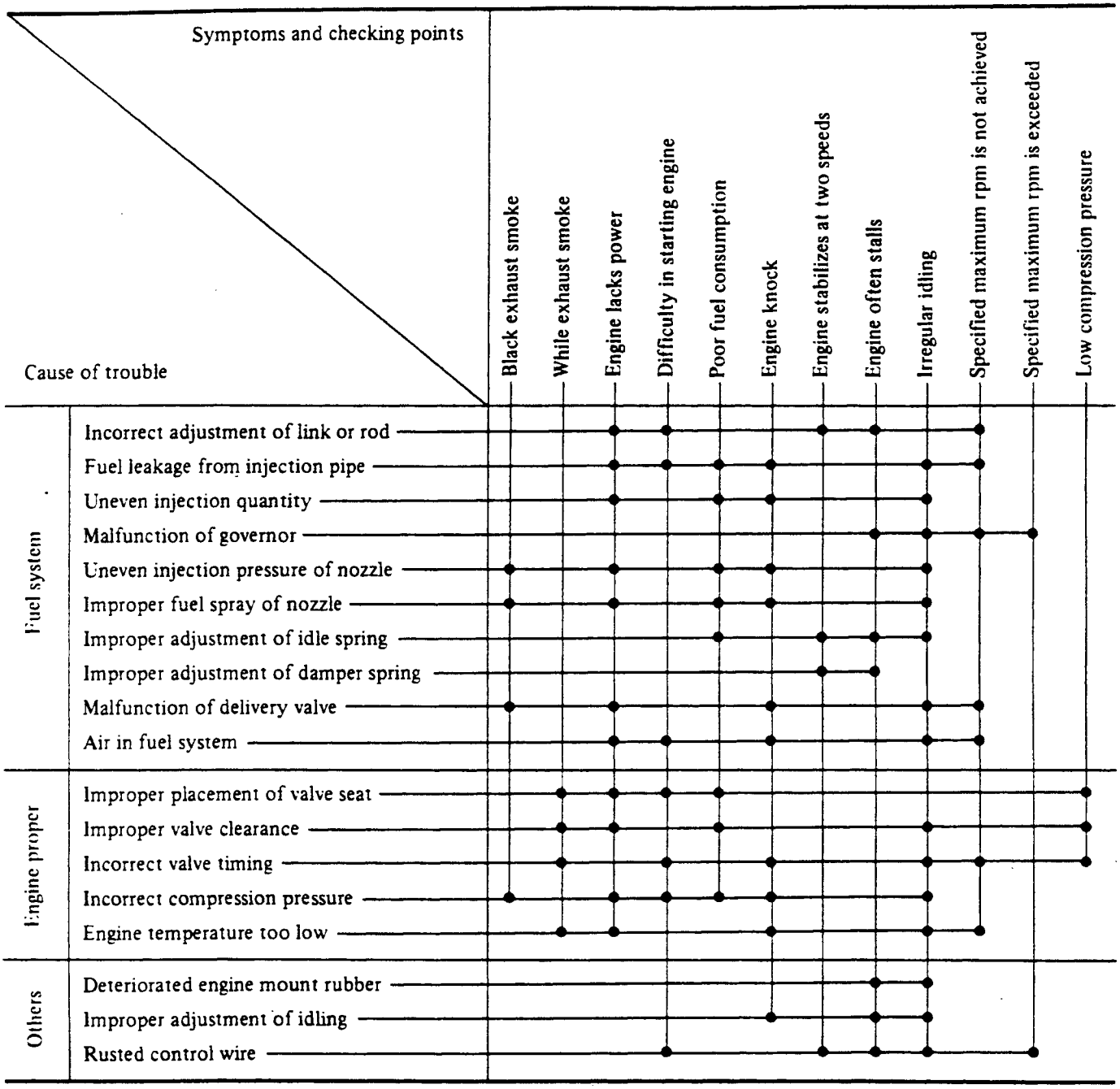
2. Install cylinder liner with Tool.



3. Check amount of projection of cylinder liner.

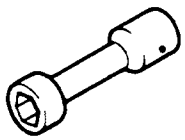
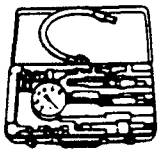
Tool number Tool name	Description	
KV10109300 Injection pump drive gear holder		Preventing drive gear from rotating (VE-type)
KV11103000 Injection pump drive gear puller		Removing drive gear (VE-type)
① ED19601000 Compression gauge ② ED19600600 Compression gauge adapter (for glow plug hole) ③ ED19600700 Compression gauge adapter (for injector hole)		Checking compression pressure

IRREGULAR ENGINE OPERATION



SPECIAL SERVICE TOOLS

*: Special tool or a commercial equivalent

Tool number	Tool name	
KV11100400*	Head bolt socket	
ED19600000*	Compression gauge set	
ED19600400	Compression gauge adapter	

SERVICE DATA AND SPECIFICATIONS

BASIC MECHANICAL SYSTEM

Valve clearance (Hot) mm (in) Intake & Exhaust	0.38 (0.015)
Drive belt deflection [Applied force 98 N (10 kg, 22 lb)] mm (in)	8 - 12 (0.31 - 0.47)
Engine oil capacity ℓ (US qt, Imp qt) With oil filter	5.5 (5-7/8, 4-7/8)
Without oil filter	4.8 (5-1/8, 4-1/4)
Water capacity ℓ (US qt, Imp qt)	13.9 (14-3/4, 12-1/4)
Radiator cap relief pressure kPa (bar, kg/cm^2, psi)	88 (0.88, 0.9, 13)
Cooling system leakage testing pressure kPa (bar, kg/cm^2, psi)	157 (1.57, 1.6, 23)
Compression pressure kPa (bar, kg/cm^2, psi)/rpm Standard	1,128 (11.28, 11.5, 164)/250
Minimum	1,030 (10.30, 10.5, 149)/250

IGNITION AND FUEL SYSTEMS

Ignition timing

Ignition timing/Idle speed (B.T.D.C.) degree/rpm	10°/500

Distributor

Point gap	mm (in)	0.45 - 0.55 (0.018 - 0.022)
Dwell angle	degree	35° - 41°

Spark plug

Type		B-4E
Plug gap	mm (in)	0.7 - 0.8 (0.028 - 0.031)

High tension cable

Resistance	ohm	Less than 30,000

Battery

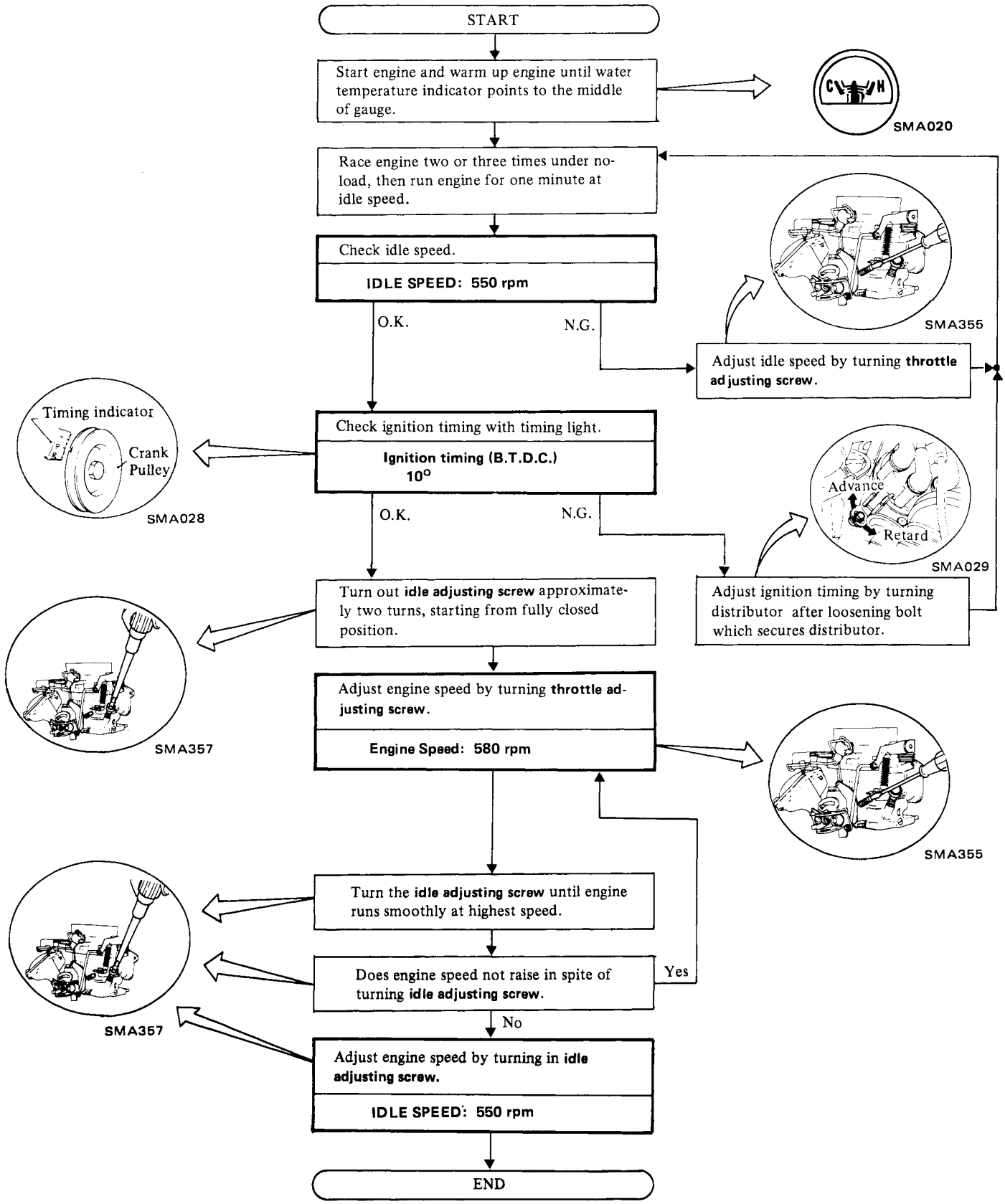
Type	N50Z		
Voltage/Capacity V/A-Hr	12/60		
Electrolyte gravity [At 20°C (68°F)]	Frigid climate	Tropical climate	Other climates
Permissible value	Over 1.22	Over 1.18	Over 1.20
Fully charged value	1.28	1.24	1.26

TIGHTENING TORQUE

	N·m	kg-m	ft-lb
Cylinder head bolt	69 - 88	7.0 - 9.0	51 - 65
Manifold bolt and nut	25 - 34	2.5 - 3.5	18 - 25
Carburetor	12 - 18	1.2 - 1.8	9 - 13
Exhaust tube	26 - 36	2.7 - 3.7	20 - 27
Spark plug	15 - 20	1.5 - 2.0	11 - 14
Oil pan drain plug	20 - 29	2.0 - 3.0	14 - 22

ADJUSTING IDLE RPM AND IGNITION TIMING

Move shift lever to Neutral. Apply hand brake securely and adjust idle rpm and ignition timing as follows:



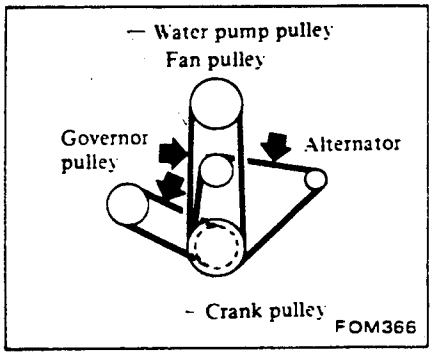
CHECKING AND ADJUSTING DRIVE BELTS

1. Check for cracks, fraying, wear or damage.
2. Check drive belt deflection by pushing midway between pulleys. Adjust if necessary.

Drive belt deflection

Unit: mm (in)

	Used	New
Fan belt	15 - 17 (0.59 - 0.67)	12 - 14 (0.47 - 0.55)
Alternator	17 - 19 (0.67 - 0.75)	14 - 16 (0.55 - 0.63)
Governor	19 - 21 (0.75 - 0.83)	15 - 17 (0.59 - 0.67)
Applied pushing force	98 N (10 kg, 22 lb)	



CHANGING ENGINE COOLANT

⚠ WARNING:

To avoid danger of being scalded, never attempt to change the coolant when the engine is hot.

When replacing engine coolant, set heater "TEMP" control lever to fully "HOT" position.

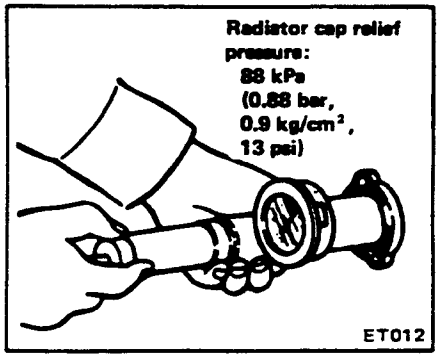
Coolant capacity:
19.5 ℓ
(5-1/8 US gal, 4-1/4 Imp gal)

- **When using anti-freeze coolant (L.L.C.), follow instructions attached to anti-freeze container for mixing ratio.**

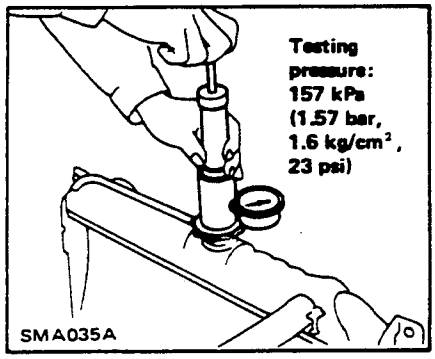
CHECKING COOLING SYSTEM, HOSES AND CONNECTIONS

Check hoses and fittings for loose connections or deterioration.

Inspection of radiator cap



Cooling system pressure test



CHANGING ENGINE OIL AND OIL FILTER

Change engine oil while engine is warm.
Refill engine with the appropriate new engine oil by referring to RECOMMENDED LUBRICANTS.

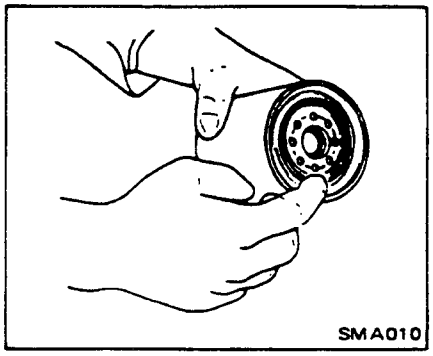
Approximate oil capacity (refill):

	liter	US qt	Imp qt
With oil filter change	7.5	7-7/8	6-5/8
Without oil filter change	7.0	7-3/8	6-1/8

Ⓣ : Oil pan drain plug
29 - 39 N·m
(3.0 - 4.0 kg-m,
22 - 29 ft-lb)

- **A milky oil indicates the presence of cooling water. Isolate the cause and take corrective measure.**
- **An oil with extremely low viscosity indicates dilution with gasoline.**

1. Smear a little engine oil on rubber seal of new filter.



2. Turn the oil filter until it touches the oil filter brackets.
Then turn it 2/3 turn further.

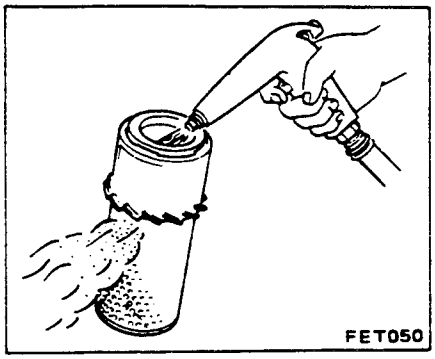
If it is turned too far, oil leakage may occur.

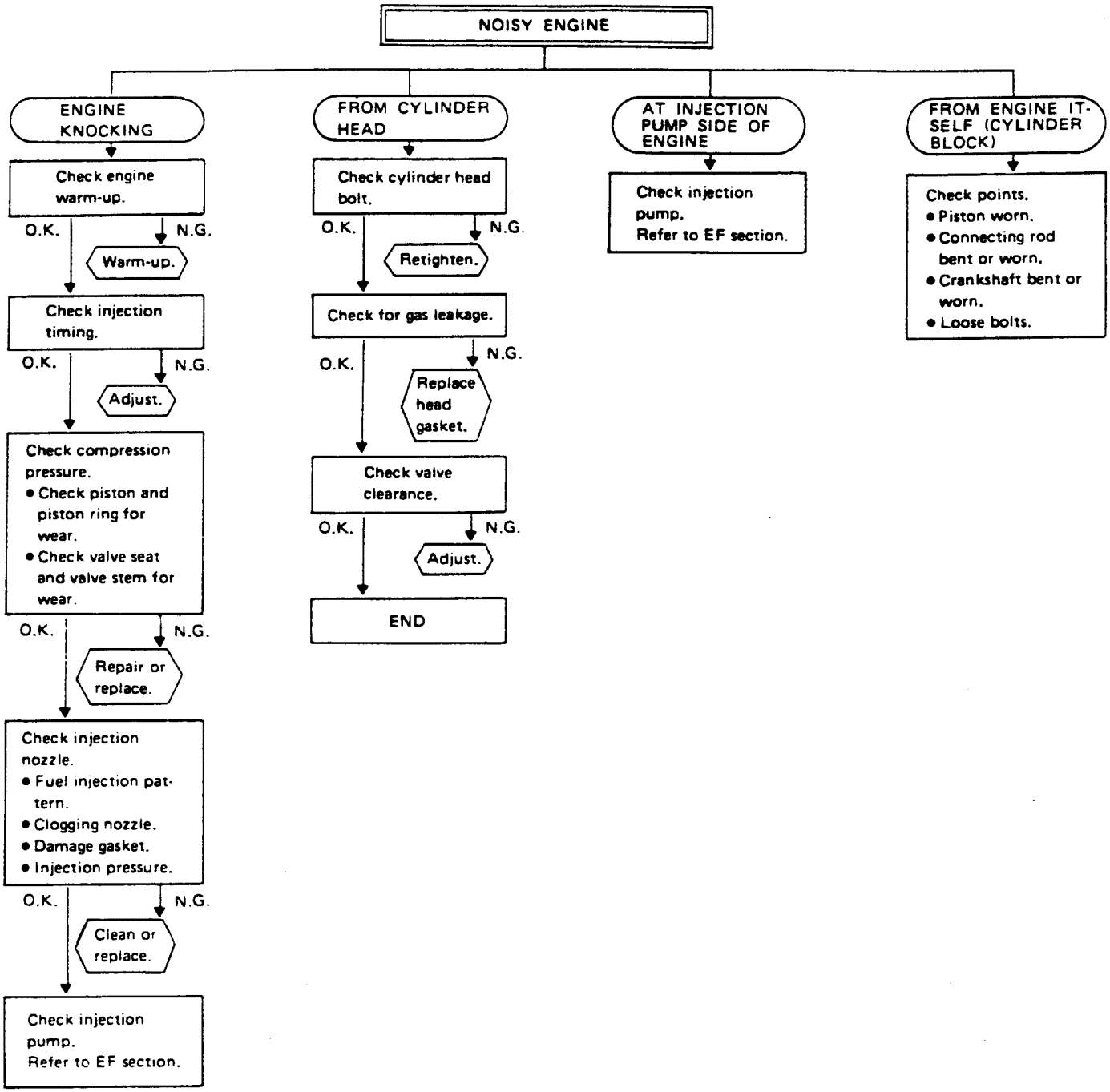
IGNITION AND FUEL SYSTEM

CLEANING OR REPLACING AIR CLEANER FILTER

Dry paper type

It is necessary to clean the element or replace it at the recommended interval, and more frequent maintenance should be carried out under dusty on other dirty operating conditions.




NOISY ENGINE
ENGINE KNOCKING
Check engine warm-up.
O.K.
N.G.
Warm-up.
Check injection timing.
O.K.
N.G.
Adjust.
Check compression pressure.
• Check piston and piston ring for wear.
• Check valve seat and valve stem for wear.
O.K.
N.G.
Repair or replace.
Check injection nozzle.
• Fuel injection pattern.
• Clogging nozzle.
• Damage gasket.
• Injection pressure.
O.K.
N.G.
Clean or replace.
Check injection pump.
Refer to EF section.
FROM CYLINDER HEAD
Check cylinder head bolt.
O.K.
N.G.
Retighten.
Check for gas leakage.
O.K.
N.G.
Replace head gasket.
Check valve clearance.
O.K.
N.G.
Adjust.
END
AT INJECTION PUMP SIDE OF ENGINE
Check injection pump.
Refer to EF section.
FROM ENGINE ITSELF (CYLINDER BLOCK)
Check points.
• Piston worn.
• Connecting rod bent or worn.
• Crankshaft bent or worn.
• Loose bolts.

NISSAN MOTOR CO., LTD.
Industrial Machinery Division
Overseas Sales Department
Tokyo, Japan

TECHNICAL BULLETIN

Front Axle &
Front Suspension

FFA 86-F01

APPLIED MODEL : F05 series

APPLIED FROM :	MODIFICATION I	MODIFICATION II
	MF05-000063	MF05-000076
	UF05-000085	UF05-000096
	DF05-000339	DF05-000365

FRONT AXLE

MODIFICATION NOTICE :

To improve the reliability of the wheel reduction units, the following modifications have been adopted.

I. The 6 mm diameter lock screws have been changed to 8 mm diameter lock bolts which have been tightened with more torque.

II. The strength of the spring pin, which fixes the pinion gear shaft and the pinion gear carrier together, has been changed.

	New	Former
Length	40 mm (1.57 in)	20 mm (0.79 in)
Diameter	6 mm (0.24 in)	4 mm (0.16 in)

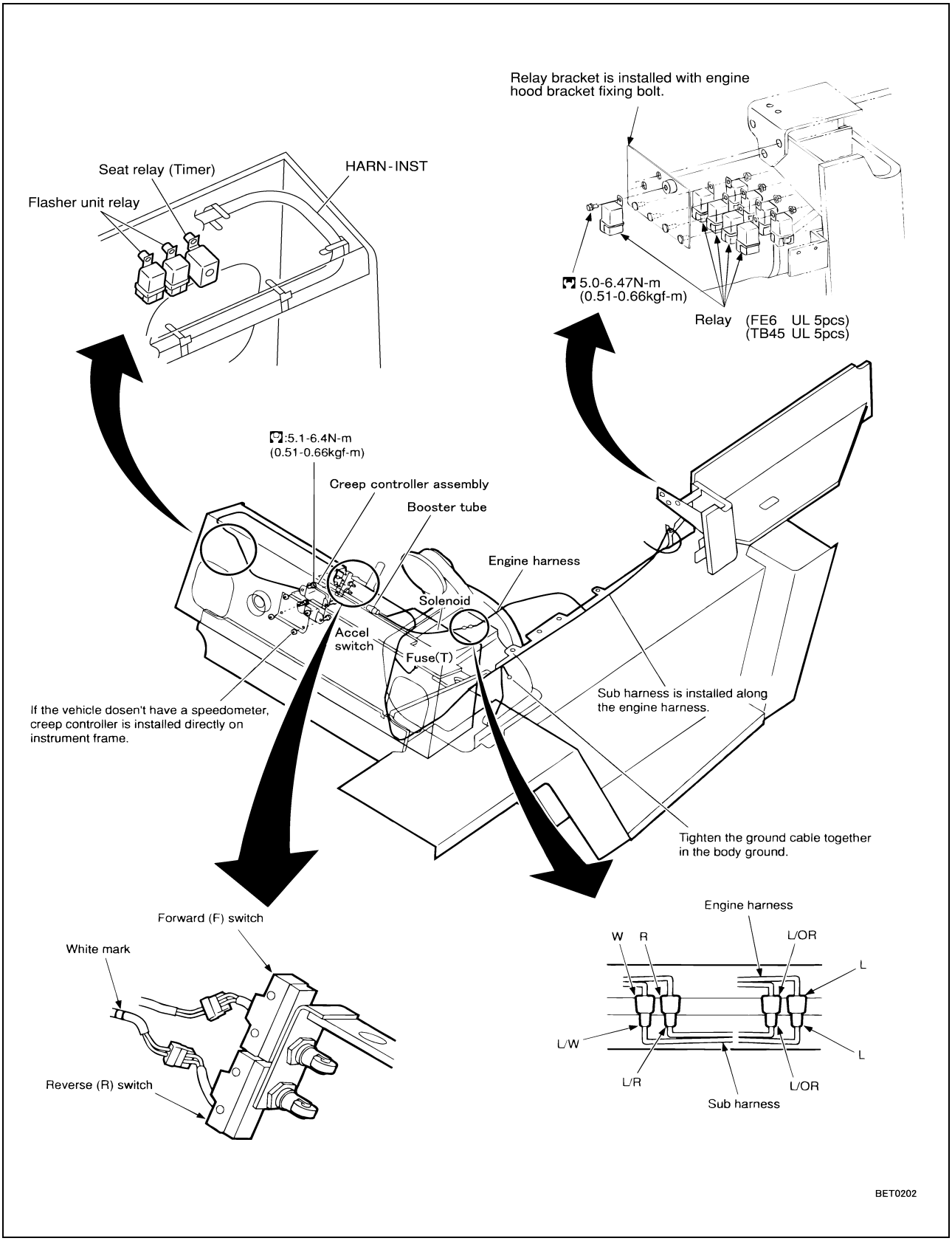
The information in this bulletin should not be interpreted as the basis for claims unless so designated.
Whenever you order spare parts, refer to the Spare Parts Bulletin, not to this Technical Bulletin.

Issue date: April 11, 1986 (01)
Publication No. TB6E-F02GG0

Printed in Japan

CONTENTS

Location of System Component Parts

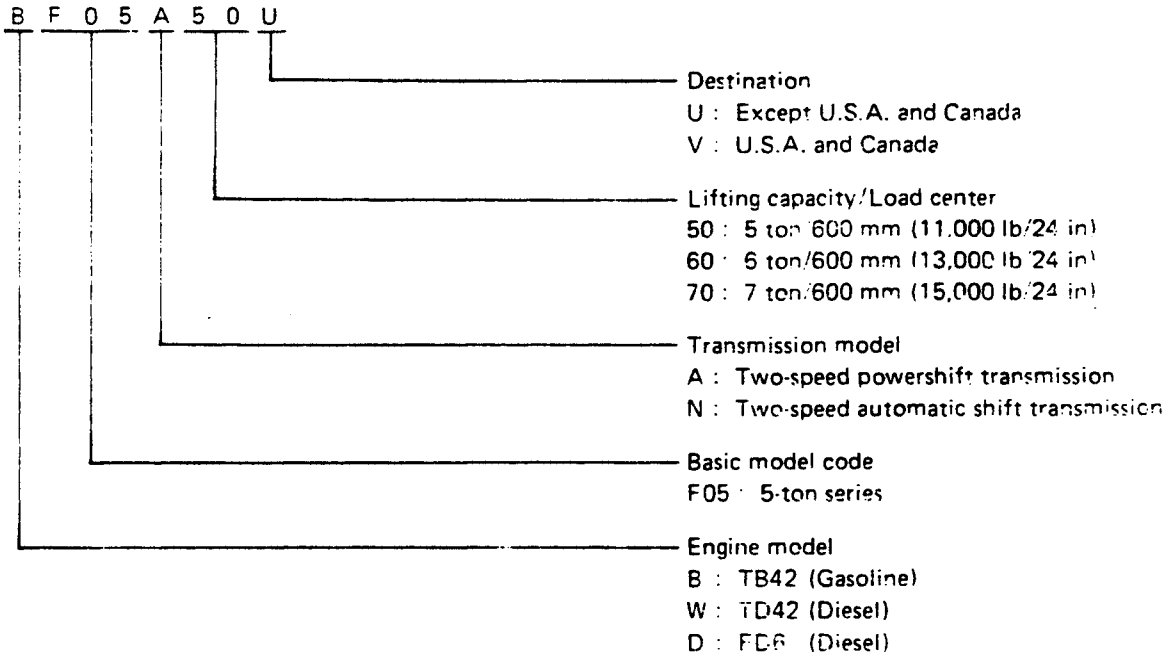


- Read and thoroughly understand the following precautions, together with "Precautions before Investigation Procedure" in the reference document.
- Hoist and/or suspend the vehicle and units only under the direct supervision of a person who has completed the required course in forklift hoisting or suspension techniques.
- The service area must be well ventilated and free of flammable objects and materials.
- If servicing the forklift in an area that has been poorly ventilated, try to ventilate the area well before the service procedure.
- Take extreme care whenever handling flammable materials and other dangerous objects to prevent fire and accidents.
- Do not smoke during service operations.
- Make sure that the engine and transmission units are cooled well enough to enable safe operation.
- If it is necessary to service with the engine running, exercise extreme care not to touch rotating or moving parts.
- Because each unit is heavy, make sure of the safe footing in servicing procedure.
- In servicing, engage the parking brake and turn the ignition switch off.
- Before disassembly and inspection, remove all rings, watches and other metallic objects from body to prevent accidental short circuits.
- Analyze carefully all symptoms at troubleshooting, to realize safe and efficient work. After servicing, make sure all the problem observed are rectified.
- Before removal and disassembly, carefully note the way in which the unit or part is installed.
- Make alignment marks on parts to be disassembled as required for easier and proper reassembly. Mark in areas that will not affect function.
- When removing wires, note the color codes and the wiring configuration before removal.
- Use proper tools for disassembly and inspection procedures. Use the designated special service tools if required.
- Tools for disassembly and inspection must be clean. Keep disassembled parts in clean areas.
- Do not mix up disassembled parts. Place them carefully in their order of removal.
- When disconnecting pressurized pipes or hoses, release the pressure from the line beforehand.
- When removing engine or counterweight, chock the wheels. Never raise the vehicle on jacks to remove them.
- Carefully clean all the disassembled parts before inspection and reassembly.
- Use only the specified bolts and nuts to install parts. Tighten the bolts and nuts to the specified torque.
- When removing oil seals, gaskets, packings materials, O-rings, lock washers, cotter pins and self-locking nuts, always replace with new ones. Refer to the Parts Catalog distributed by Nissan Motors and use the replacement parts with the correct part number. Use only genuine Nissan parts.
- When replacing taper roller bearings or needle bearings, always replace their inner and outer races as a set.
- Use only the specified lubricants and sealant.
- Be careful not to splash the brake fluid on the vehicle body or outer painted areas. If brake fluid is accidentally splashed on painted areas, immediately wipe it and wash the area with water.

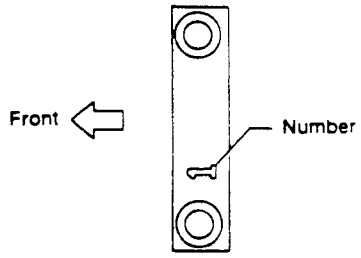
MODEL VARIATION

Lifting capacity/Load center		Engine	Transmission	Model	
ton/mm	lb/in			Except for U.S.A. and Canada	For U.S.A. and Canada
5/600	11,000/24	TB42	2FS-150S	BF05A50U	BF05A50V
		TD42		WF05A50U	–
				WF05N50U	–
		FD6		DF05A50U	DF05A50V
				DF05N50U	DF05N50V
6/600	13,000/24	TB42		BF05A60U	BF05A60V
		TD42		WF05A60U	–
				WF05N60U	–
		FD6		DF05A60U	DF05A60V
				DF05N60U	DF05N60V
7/600	15,000/24	TB42		BF05A70U	BF05A70V
		TD42		WF05A70U	–
				WF05N70U	–
		FD6		DF05A70U	DF05A70V
				DF05N70U	DF05N70V

MODEL CODING SYSTEM

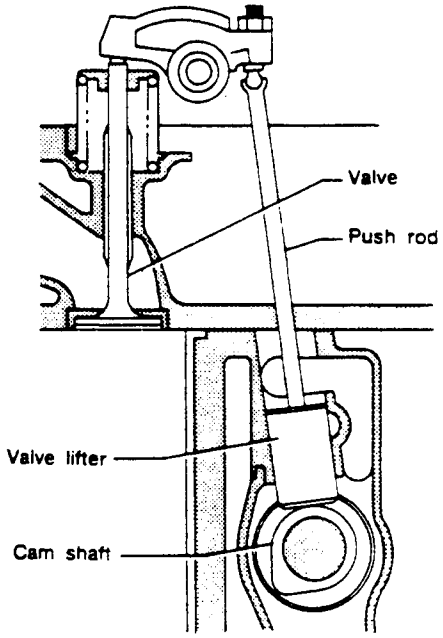


- The bearing caps are numbered (1 to 7) to identify their proper positions.
  Always install bearing caps in their designated positions, otherwise, the crankshaft may not rotate properly.



VALVE MECHANISM

- The valve mechanism is an OHV type in which the valves are arranged in line. The camshaft has been raised above that of the SD engine, which makes it possible to shorten push rod length.
  The shorter push rod is less affected by bending force during high-speed operation.

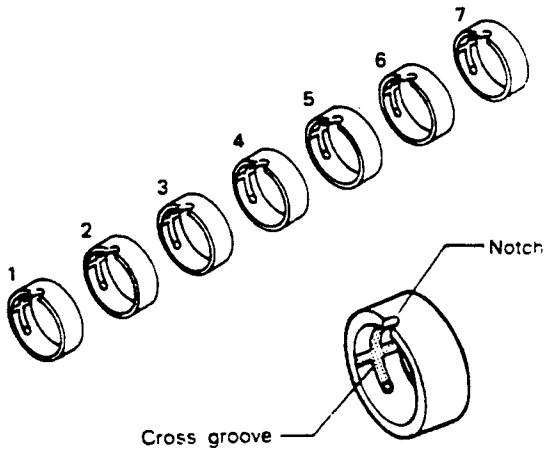


CAMSHAFT

- The camshaft is equipped with small module gears. These gears feature high-engagement rate and low noise.
- The camshaft drive gear is designed exclusively for the TD42 engine to accommodate a larger diameter of the camshaft.

CAMSHAFT BUSHING

The camshaft bushing has a cross oil groove design to lubricate both the cam journal and valve lifter.



TIGHTENING TORQUE OF STANDARD BOLT

Grade	* Nominal diameter mm	Pitch mm	Tightening torque		
			N-m	kg-m	ft-lb
4T	M6	1.0	3 - 4	0.3 - 0.4	2.2 - 2.9
	M8	1.25	8 - 11	0.8 - 1.1	5.8 - 8.0
		1.0	8 - 11	0.8 - 1.1	5.8 - 8.0
	M10	1.5	16 - 22	1.6 - 2.2	12 - 16
		1.25	16 - 22	1.6 - 2.2	12 - 16
	M12	1.75	26 - 36	2.7 - 3.7	20 - 27
		1.25	30 - 40	3.1 - 4.1	22 - 30
7T	M14	1.5	46 - 62	4.7 - 6.3	34 - 46
	M6	1.0	6 - 7	0.6 - 0.7	4.3 - 5.1
	M8	1.25	14 - 18	1.4 - 1.8	10 - 13
		1.0	14 - 18	1.4 - 1.8	10 - 13
	M10	1.5	25 - 35	2.6 - 3.6	19 - 26
		1.25	26 - 36	2.7 - 3.7	20 - 27
	M12	1.75	45 - 61	4.6 - 6.2	33 - 45
		1.25	50 - 68	5.1 - 6.9	37 - 50
	M14	1.5	76 - 103	7.7 - 10.5	56 - 76
	M16	1.5	118 - 157	12.0 - 16.0	87 - 116
	M18	1.5	177 - 235	18.0 - 24.0	130 - 174
	M20	1.5	245 - 324	25.0 - 33.0	181 - 239
	M22	1.5	324 - 441	33.0 - 45.0	239 - 325
9T	M6	1.0	8 - 11	0.8 - 1.1	5.8 - 8.0
	M8	1.25	19 - 25	1.9 - 2.5	14 - 18
		1.0	20 - 27	2.0 - 2.8	14 - 20
	M10	1.5	36 - 50	3.7 - 5.1	27 - 37
		1.25	39 - 51	4.0 - 5.2	29 - 38
	M12	1.75	65 - 88	6.6 - 9.0	48 - 65
		1.25	72 - 97	7.3 - 9.9	53 - 72
	M14	1.5	108 - 147	11.0 - 15.0	80 - 108
	M16	1.5	167 - 226	17.0 - 23.0	123 - 166
	M18	1.5	255 - 343	26.0 - 35.0	188 - 253
	M20	1.5	343 - 461	35.0 - 47.0	253 - 340
	M22	1.5	471 - 632	48.0 - 64.4	347 - 466

* Nominal diameter M 6

M: Metric screw threads

6: Nominal diameter of bolt threads (Unit: mm)

1. **Special parts are excluded.**
2. **This standard is applicable to bolts having the following mark embossed on the bolt head.**

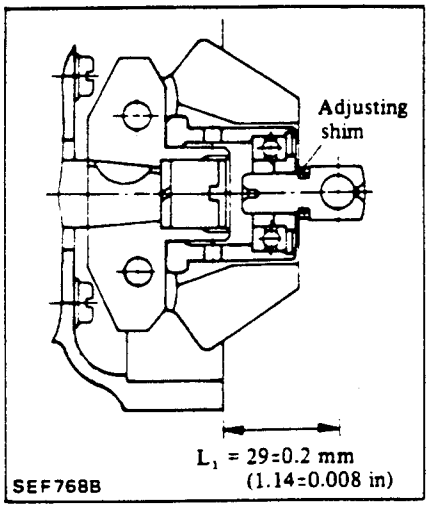
Grade	Embossed number
4T	4
7T	7
9T	9

size L_1 from the governor cover adhered surface to the center of the pin hole of the shifter may be maintenance standard by means of the adjusting shim.

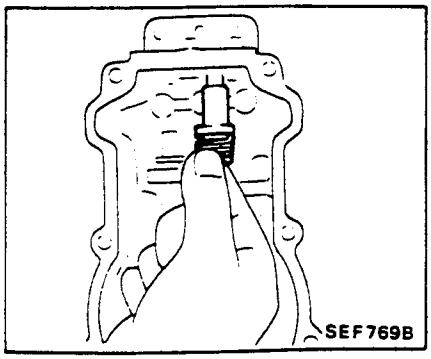
Maintenance standard:
28.8 - 29.2 mm (1.134 - 1.150 in)

A functional difficulty will occur if the dimension L_1 is set to take a value off the specification.

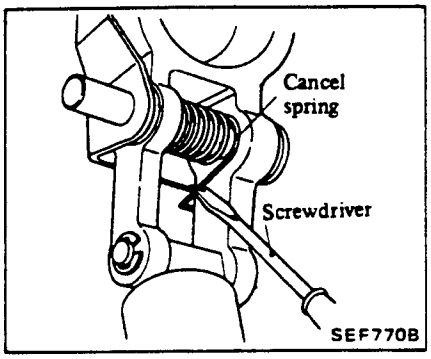
- Too large a value of L_1 causes the flyweights to open apart too wide, making the slider come off the sleeve to rub and wear the contacting surface of the sleeve. This wear is evidenced by a surface offset.
- To small a value of L_1 prevents the flyweight to move for making the maximum lift.



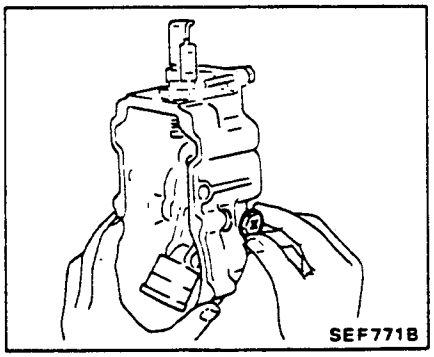
3. Install the sleeve to the tension lever.
4. Assemble the floating lever and control lever shaft.
5. Install the lever assembly to the inside of the governor cover.



6. Install the control lever.
7. Install the torque cam.
8. When the cancel spring for integrating the guide lever with the tension lever is built in, it is convenient to use a screwdriver having a ditch at its front end, as shown in the figure.



9. Install the plug to the tension lever shaft ends.
After the plug of the tension lever shaft is pressed in the governor cover, coat the periphery of the plug with sealing agent. Unless sealing agent is used, the lubricating oil may leak out.



10. Connect the torque cam to the rod of the tension lever.
11. Install the guide screw and lock nut.
12. Install the governor shaft, spring seat, springs and lock nuts.
13. Install the idling spring and lock nut.

ADJUSTMENT

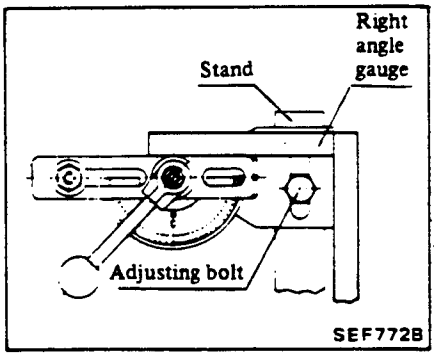
PREPARATION

Before the adjustment of the governor, the following preparations are made without fail:

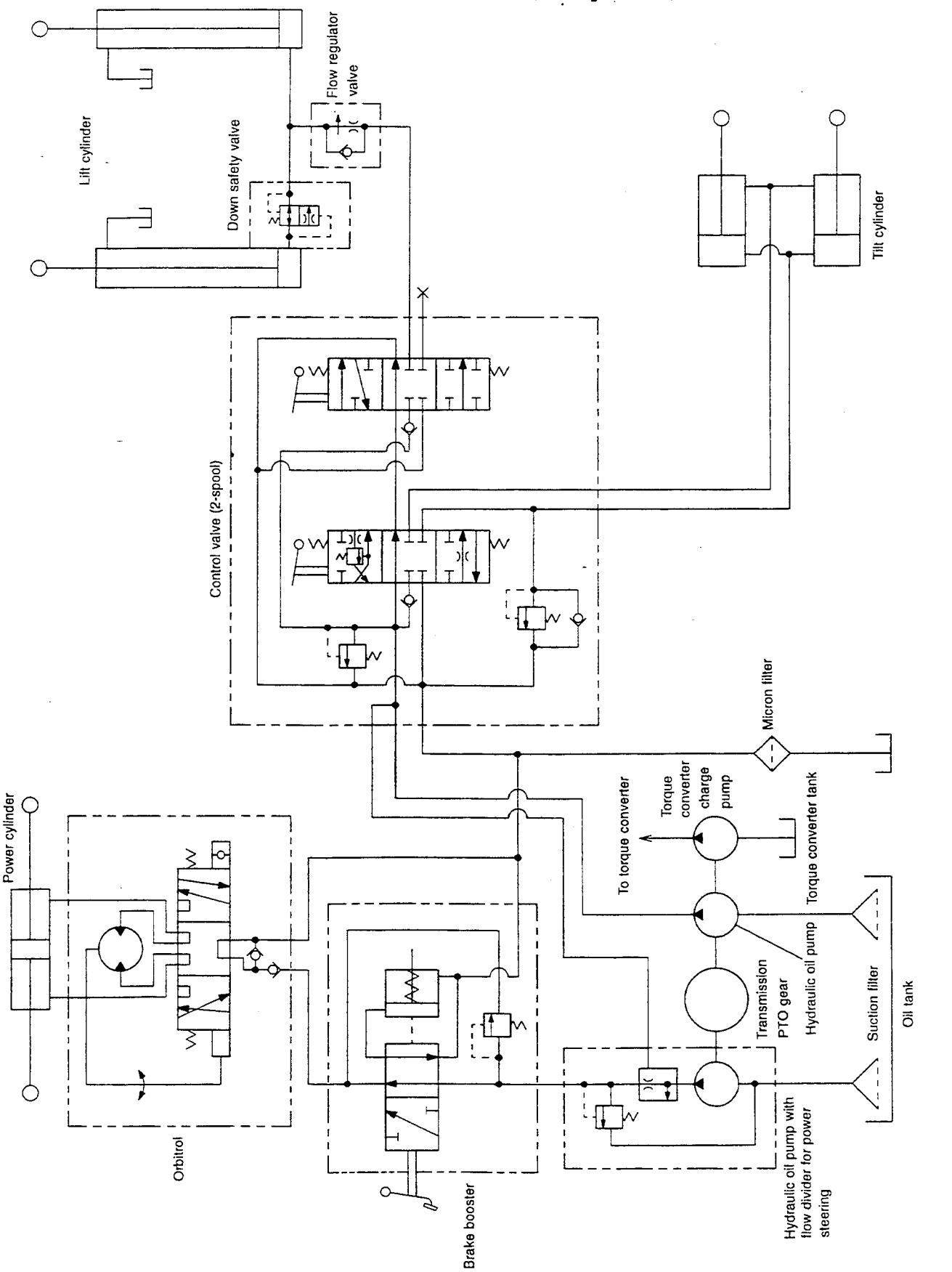
1. Supply lubricating oil [Injection Pump Oil] by a prescribed amount in the governor room and the cam room of the Injection Pump.
2. Run in the tester. After the run-in operation, check to be sure that governor operates satisfactorily.
3. Before the adjustment, the lock nuts for the idling spring and the governor shaft are removed.
4. The full speed stopped bolt, the idle stopper bolt and the full load stopper bolt are loosened beforehand.

SETTING THE ZERO DEGREE POINT OF ADJUSTING DEVICE

1. Referring to the figure showing the top view of the adjusting device, set the angular scale in the position shown, truing it with the square, and tighten the lock nut below the lever.



2. Align the center pin of the adjusting device to the axis of control lever shaft. This is accomplished by displac-


Lift cylinder
Down safety valve
Flow regulator valve
Tilt cylinder
Control valve (2-spool)
Micron filter
Torque converter charge pump
To torque converter
Torque converter tank
Power cylinder
Transmission PTO gear
Hydraulic oil pump
Suction filter
Oil tank
Orbitrol
Brake booster
Hydraulic oil pump with flow divider for power steering

HDM0037

DISASSEMBLY

Pump body

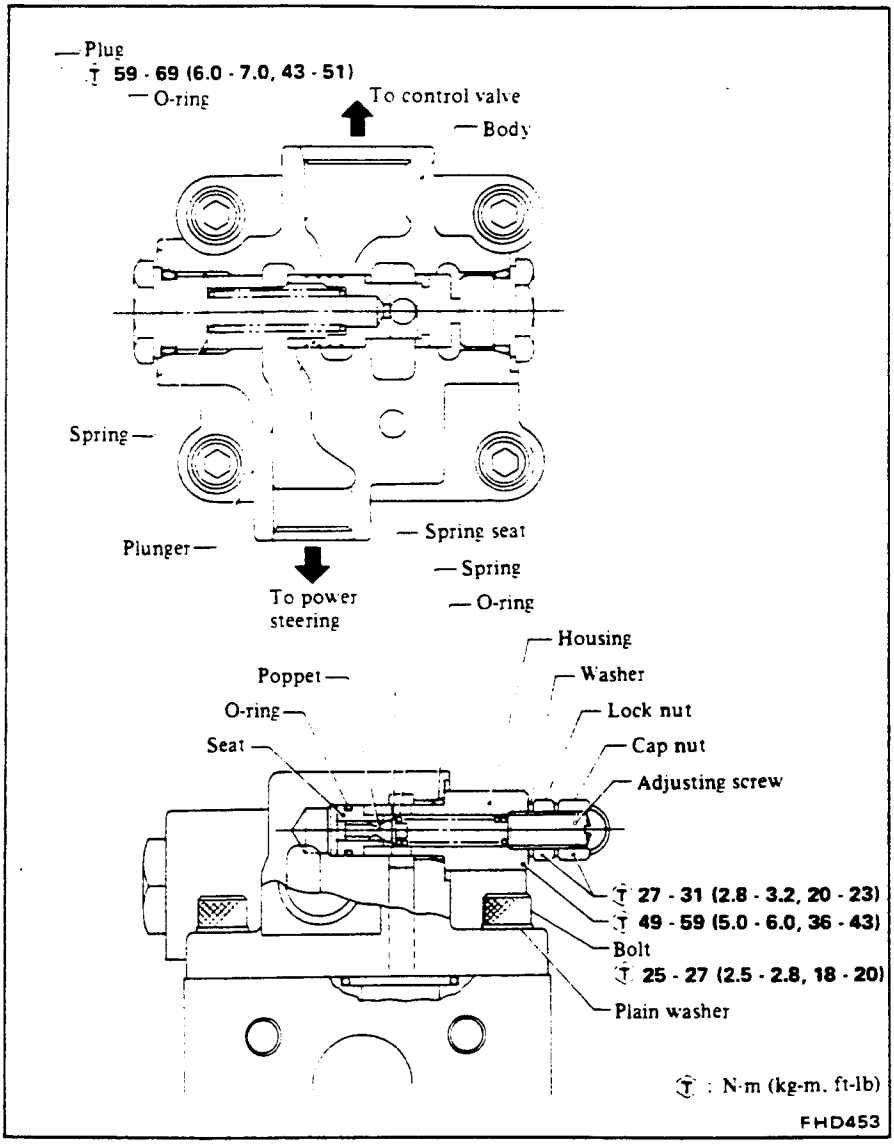
- **Up to Oct. '83**

1. Wash pump. Prepare clean paper or cloth on which disassembled parts may be placed.
2. Hold oil pump in vise and remove bolts.
3. Remove rear cover, side plate, seal block, drive gear, and driven gear.
4. Remove plate cover and back-up plate from rear cover.
5. Remove O-ring, plate cover and back-up plate from mounting flange.
6. Do not remove oil seal and snap ring in mounting flange unless absolutely necessary.

- **From Nov. '83**

1. Wash pump. Prepare clean paper or cloth on which disassembled parts may be placed.
2. Hold oil pump body in a vise and remove bolts.
3. Remove rear cover body seal, bush seal and back-up ring.
4. Remove mounting flange, body seal, bush seal and back-up ring.
5. Remove bushing, drive and driven gears from pump body.
6. Do not remove oil seal in mounting flange unless absolutely necessary.

Flow priority valve



1. Place a sheet of clean paper or cloth on the work bench to put the disassembled parts on it.
2. Clean the outer surfaces of the oil pump and flow priority valve with a solvent.
3. Place the flanged section of the oil pump in a vise with the shaft facing down, and remove the bolts and washers.
4. Remove the flow priority valve from the oil pump cover, along with the O-ring.
5. Remove the oil pump body from the vise. Next, place the oil pump body in a vise with the mating surface of the pump cover and flow priority valve facing down.
6. Remove the plug and withdraw the spring and plunger.
7. Turn the cartridge relief valve housing to remove the relief valve. Do not disassemble the relief valve unless the set pressure is outside specifications.

To disassemble it, proceed as follows:

- Place the hexagonal section of the relief valve housing in a vise, and remove the cap nut, washer, lock nut and setscrew.
- Remove the spring, spring seat and poppet from the relief valve housing. A seat is pressed into the housing and cannot be removed.

SERVICE DATA AND SPECIFICATIONS

GENERAL SPECIFICATIONS

1-SPOOL, 2-STAGE AND 3-STAGE MAST

Mast type	Roller mast
Mast tilt angle	
Forward	6°
Backward	12°
Carriage roller	Lift and side rollers

INSPECTION AND ADJUSTMENT

Clearance	mm (in)	
Mast to lift roller		0.1 - 1.0 (0.004 - 0.039)
Adjustable range with shims		1.0 - 4.0 (0.039 - 0.157)
Mast to back-up metal		0.1 - 1.0 (0.004 - 0.039)
Adjustable range with shims		0.5 - 2.5 (0.020 - 0.098)
Inner mast to carriage side roller		0.1 - 0.5 (0.004 - 0.020)
Lift chain deflection	mm (in)	25 - 30 (0.98 - 1.18)

TIGHTENING TORQUE

	N·m	kg-m	ft-lb
Lift chain lock nut	294 - 392	30 - 40	217 - 289
Mast support cap bolt	324 - 432	33 - 44	239 - 318
Back rest bolt	343 - 461	35 - 47	253 - 340
Tilt cylinder lock nut	196 - 255	20 - 26	145 - 188

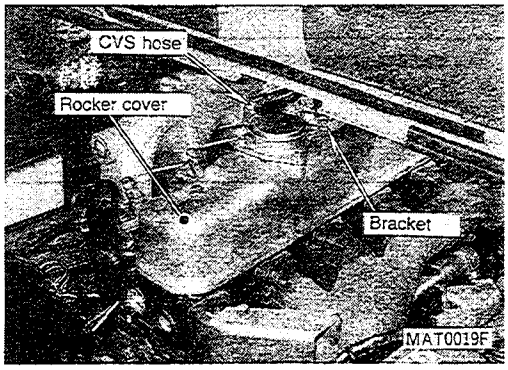
This section will cover maintenance of the FE6-series engine fitted in the VF05-series forklift.

WARNING:

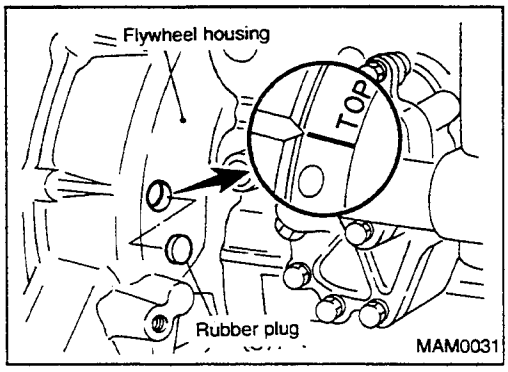
The engine will remain extremely hot for a certain amount of time after it has been stopped. In order to reduce the risk of burns or other similar injuries, wait until the engine has cooled down before commencing inspections or maintenance.

Inspecting Valve Clearance

1. With the engine stopped, open both the top panel and the radiator cover.



2. Disconnect the CVS hose and remove the bracket.
3. Remove the four bolts and then the rocker cover.



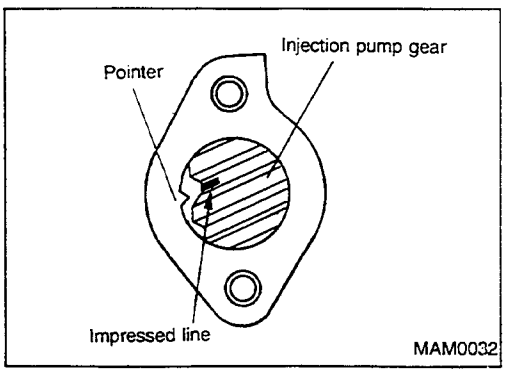
4. Remove the following plug and covers:
- Cover on the top of the torque converter housing
- Pointer rubber plug on the rear-left face of the flywheel housing
- Timing pointer cover on the injection pump gear

5. Use a lever or something similar to rotate the link gear on the outside of the flywheel in the forwards direction. Align the impressed line marked "TOP" with the timing pointer.

CAUTION:

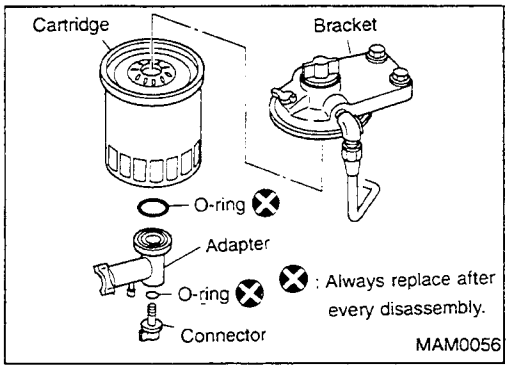
Do not rotate the link gear backwards even if it has been rotated too far. Rotate forwards and repeat the alignment procedure.

- In addition to the "TOP" mark, the edge of the flywheel also has a "1·6" mark which may also be used for this procedure. When this mark is pointing directly upwards it will indicate the same condition as when the "TOP" mark is aligned as above.



- A "15" mark will appear before the "TOP" mark comes into view. Confirm that the impressed line on the injection pump gear's tooth surface is aligned with the timing pointer when this mark is lined up with the flywheel's pointer.
- If the impressed line is aligned with the timing pointer, No. 1 cylinder (towards the rear of the vehicle) is at compression TDC. Otherwise, it will be at exhaust TDC.

Replacing Fuel Filter (Cont'd)



1. The following procedure is used for the replacement of the water separator integrated fuel filter.

(1) Remove the adapter and the connector from the bottom of the filter cartridge.

- Pay attention to the correct removal direction.

(2) Prepare a drip pan or something similar and remove the filter cartridge using the filter wrench.

(3) Attach a new filter cartridge to the bracket.

Tightening torque:

: 15 - 21 N·m (1.5 - 2.1 kg-m, 11 - 15 ft-lb)

CAUTION:

Take care not to over-tighten the cartridge.

(4) Attach the previously removed adapter and connector together with new O-rings.

Tightening torque:

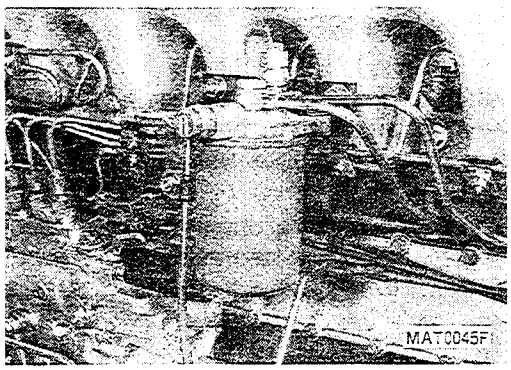
Connector

: 1.5 - 2.0 N·m (0.15 - 0.20 kg-m, 1.1 - 1.4 ft-lb)

Adapter drain cock

: 1.5 - 2.5 N·m (0.15 - 0.25 kg-m, 1.1 - 1.8 ft-lb)

(5) After the completion of this procedure, expel air from the fuel system and confirm that there are no fuel leakage.



2. The following procedure is used for the replacement of the engine-side fuel filter.

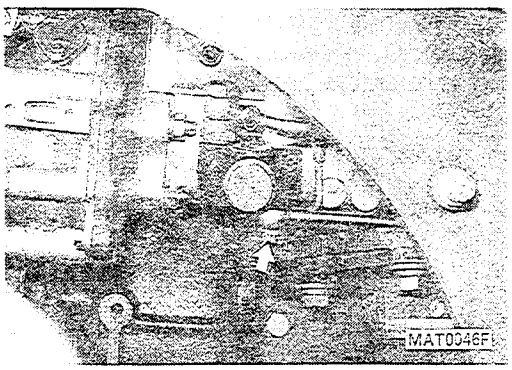
(1) Prepare a drip pan or something similar and remove the filter cartridge using the filter wrench.

(2) Attach a new filter cartridge to the bracket together with packing. Once the cartridge comes into contact with the bracket's sealing surface, rotate it by two-thirds of a turn to tighten.

CAUTION:

Always tighten by hand. Take care not to over-tighten.

(3) After the completion of this procedure, expel air from the fuel system and confirm that there are no fuel leakage.



Cleaning Gauze Filter

The following procedure is used for cleaning the gauze filter (in the lower eye bolt of the injection pump's priming or feed pump) whenever it becomes blocked.

When replacement becomes necessary, replace the whole eye bolt assembly.

1. Remove the eye bolt containing the gauze filter from the bottom of the priming pump (feed pump).

ADJUSTING INTAKE AND EXHAUST VALVE CLEARANCES

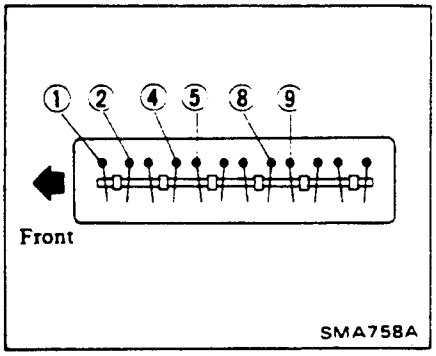
Valve clearance adjustment cannot be made while engine is in operation.

1. Start engine and warm up engine sufficiently, then stop engine.
2. Remove valve rocker cover.
3. Order of valve clearance adjustments is as follows:

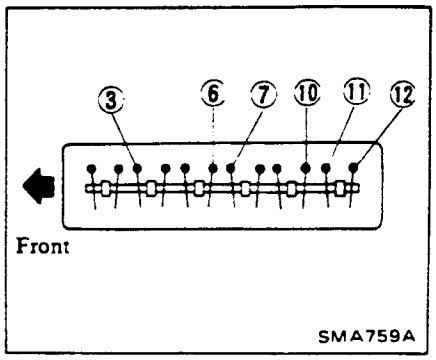
Valve clearance (Hot):
- **TD42 engine**
  - **Intake and exhaust**
    - **0.35 mm (0.014 in)**
- **FD6 engine**
  - **Intake and exhaust**
    - **0.40 mm (0.016 in)**
- **TB42 engine**
  - **Intake and exhaust**
    - **0.38 mm (0.015 in)**

TD42 AND FD6 ENGINES

1. Bring No. 1 piston to Top Dead Center on compression stroke. Adjust clearances of valves ①, ②, ④, ⑤, ⑧ and ⑨.

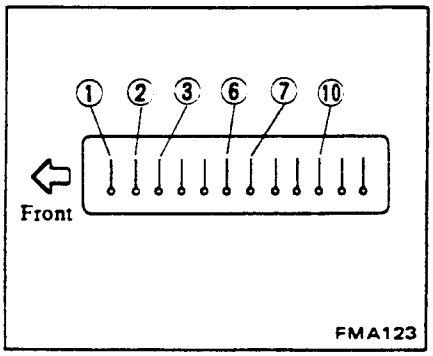


2. Bring No. 6 piston to Top Dead Center on compression stroke. Adjust clearances of valves ③, ⑥, ⑦, ⑩, ⑪ and ⑫.

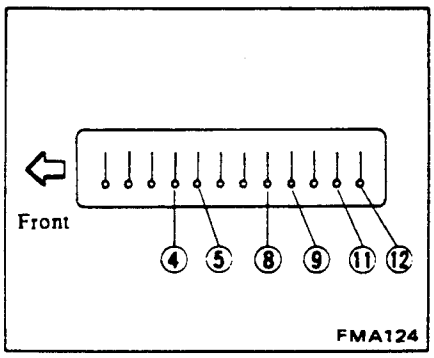


TB42 ENGINE

1. Bring No. 1 piston to Top Dead Center on compression stroke. Adjust clearances of valves ①, ②, ③, ⑥, ⑦ and ⑩.



2. Bring No. 6 piston to Top Dead Center on compression stroke. Adjust clearances of valves ④, ⑤, ⑧, ⑨, ⑪ and ⑫.



CHANGING ENGINE OIL AND OIL FILTER

1. Start engine and warm up engine until water temperature indicator points to the middle of gauge, then stop engine.
2. Remove oil filler cap, oil pan drain plug and oil filter drain plug (FD6), and allow oil to drain.

⚠ WARNING:

Be careful not to burn yourself, as the engine oil may be hot.

- **A milky oil indicates the presence of cooling water. Isolate the cause and take corrective measure.**
- **An oil with extremely low viscosity indicates dilution with gasoline.**

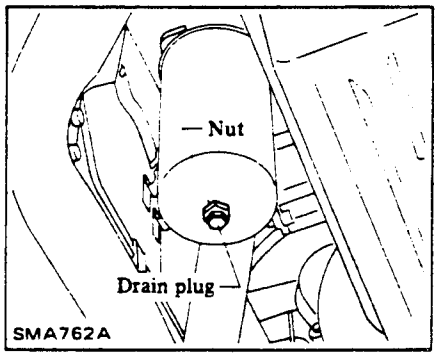
3. Clean and install oil pan drain plug with washer.

Ⓣ : Oil pan drain plug
- **TD42 engine**
  - **54 - 59 N·m**
  - **(5.5 - 6.0 kg-m, 40 - 43 ft-lb)**
- **FD6 engine**
  - **20 - 29 N·m**
  - **(2.0 - 3.0 kg-m, 14 - 22 ft-lb)**
- **TB42 engine**
  - **29 - 39 N·m**
  - **(3.0 - 4.0 kg-m, 22 - 29 ft-lb)**

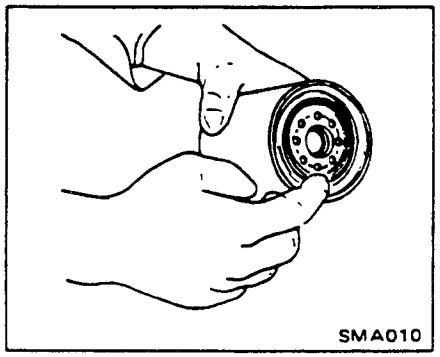
4. Remove oil filter or oil filter element.

FD6 ENGINE

1. Drain oil from oil filter by removing drain plug.
2. Remove oil filter by loosening nut which is located at bottom of oil filter.



3. Smear a little enigne oil on rubber lip of new oil filter.



4. Install oil filter by tightening nut.

Ⓣ : Nut
29 - 39 N·m
(3 - 4 kg-m, 22 - 29 ft-lb)

APPROXIMATE REFILL CAPACITIES

		Liter	US measure	Imp measure
Engine oil (with oil filter)	FD6 engine	15.0	15-7/8 qt	13-1/4 qt
	SD33 engine	9.5	10 qt	8-3/8 qt
	P engine	5.7	6 qt	5 qt
Coolant	FD6 engine	22.0	23-1/4 qt	19-3/8 qt
	SD33 engine	18.0	19 qt	15-7/8 qt
	P engine	22.0	23-1/4 qt	19-3/8 qt
Fuel tank		62	16-3/8 gal	13-5/8 gal
Hydraulic oil tank		68	18 gal	15 gal
Automatic transmission oil		21.7	23 qt	19-1/8 qt
Differential oil		6.5	13-3/4 pt	11-1/2 pt
Wheel reduction gear oil		1.5	3-1/8 pt	2-5/8 pt

CHECKING BRAKE BOOSTER OPERATION

1. Connect an oil pressure gauge to brake line, at connection on master cylinder.
2. Install a pedal force gauge on brake pedal.
3. Start engine and measure oil pressure with respect to pedal operating force.

Relationship between oil pressure and pedal operating force as follows.

	At idling speed		
Pedal operating force N (kg, lb)	98 (10, 22)	196 (20, 44)	294 (30, 66)
Brake fluid pressure kPa (bar, kg/cm^2, psi)	1,765 - 2,452 (17.7 - 24.5, 18 - 25, 256 - 356)	4,021 - 5,786 (40.2 - 57.9, 41 - 59, 583 - 839)	5,982 - 8,434 (59.8 - 84.3, 61 - 86, 867 - 1,223)

If test results are not as specified, determine cause of problem using the following chart as a guide.

Symptom	Probable cause	Remedy
Brake fails to work.	• Oil leak at/around piping or insufficient oil.	• Repair or add oil.
	• Oil pump or flow priority valve inoperative.	• Refer to HD section.
	• Foreign matter stuck in spool valve.	• Replace spool valve.
	• Foreign matter stuck in relief valve.	• Replace relief valve.
	• Oil leak due to worn oil seal.	• Replace oil seal.
Brake cannot be controlled (effects too sharply).	• Spool valve inoperative.	• Replace.
Brake drags. (Oil pressure is not zero when pedal is released).	• Foreign matter stuck in spool valve.	• Replace spool valve.
	• Foreign matter stuck in output rod.	• Replace output rod.

WHEEL AND TIRE

CHECKING TIRE CONDITION

Tire condition

1. Check tire for wear, replacing as necessary.
2. Remove pebbles, glass or other foreign materials embedded in tire treads.
3. Check tire tread and side walls for cracks, holes, separation or damage. Replace if necessary.

Tire inflation

Correct tire pressure is very important to steering ease and riding comfort. It also reduces driving sound to a minimum, resulting in longer tire life; overinflation or underinflation causes wear at center tread or shoulder of tire.

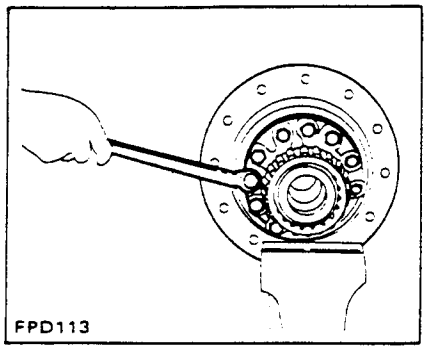
If all tires are inspected frequently and maintained at correct pressure, sharp material in the tread can easily be detected. Frequent inspection will also ensure early detection of abnormal. If tires show signs of abnormal or uneven wear, the cause of the trouble should be isolated and eliminated.

After tires are inflated, valves should be checked for leakage. If valve caps are not properly replaced, leakage will occur due to the entry of dirt and water, resulting in underinflation. Accordingly, whenever tire pressure is checked, be sure to secure valve caps and tighten firmly by hand.

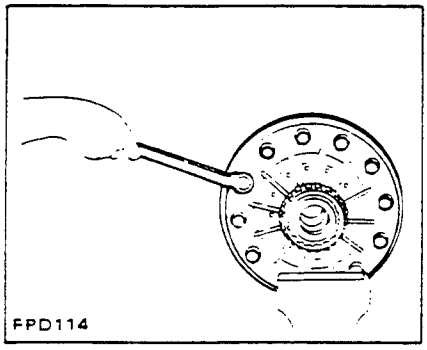
Wheel repair

Inspect wheel rim flange for bends or dents. If any are found, repair should be made to secure complete sealing. The flange should be cleaned with a wire brush if it is found to be rusted. If there is excessive pitting on the rim, eliminate it with a file.

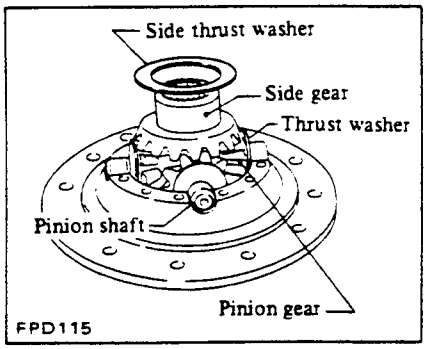
6. Loosen the bolts mounting the ring gear to the differential case and remove the ring gear. The bolts are coated with locktite.



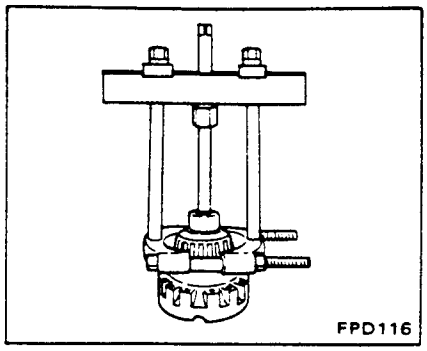
7. Loosen the differential case bolts and separate the case. The bolts are coated with locktite.



8. Remove the pinion gear, thrust washer, pinion shaft, side gear, and side thrust washer.

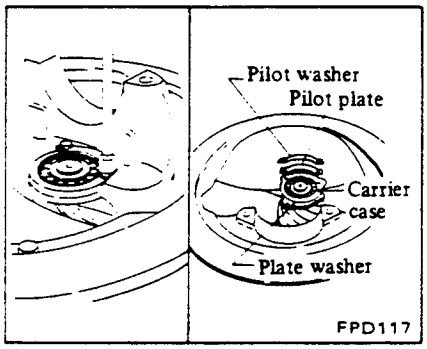


9. Remove the bearing from the differential case (right and left sides), using a bearing puller.

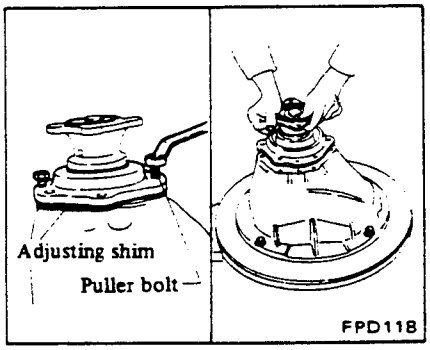


DRIVE PINION

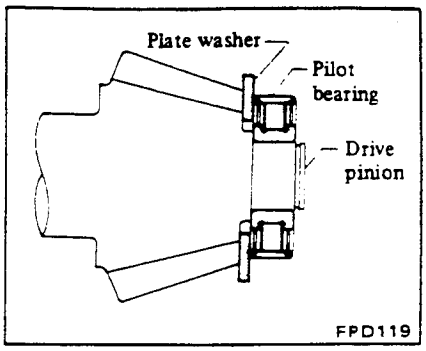
1. Unbend the pilot washer, loosen the two bolts tightening the plate washer and pilot plate.



2. Loosen the bearing sleeve mounting bolts, thread these bolts into the threaded holes as puller bolts and remove the adjusting shim, O-ring, and pilot bearing, as well as the drive pinion assembly from the carrier.

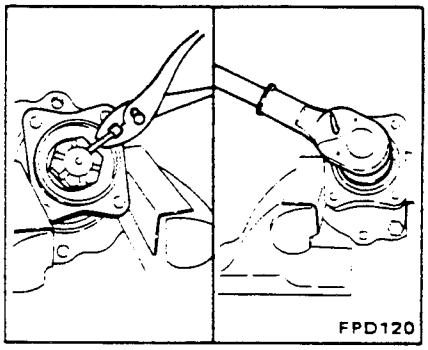


3. Remove the snap ring from the drive pinion.
4. Remove the pilot bearing and plate washer from the drive pinion, using a bearing puller.

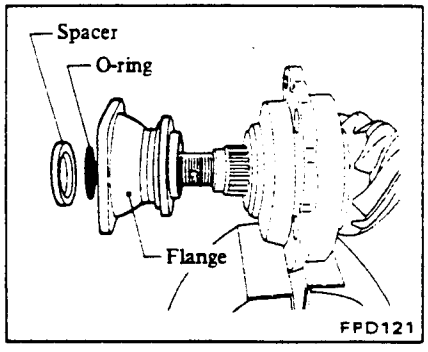


When removing the pilot bearing, always hook the bearing puller to the plate washer. If hooked to the pilot bearing, the bearing side plate may be separated.

5. Clamp the companion flange in a vice, remove the cotter pin and loosen and remove the nut.



6. Remove the spacer, O-ring, and companion flange.



SERVICE DATA AND SPECIFICATIONS

GENERAL SPECIFICATIONS

Type	Fully hydraulic power steering
Turns of steering wheel (Lock to lock)	4.2
Relief set pressure kPa (bar, kg/cm², psi)	9,807 (98.1, 100, 1,422)

Power steering pump

Make		Kayaba
Type		KP2027AV
Discharge mℓ (US fl oz, Imp fl oz)/rev.		26.5 (0.90, 0.93)
Max. revolution	rpm	2,700

Orbitrol

Make		Sumitomo Eaton
Type		UG
Discharge mℓ (US fl oz, Imp fl oz)/rev.		195 (6.6, 6.9)

Power cylinder

Inner diameter	mm (in)	90 (3.54)
Piston rod diameter	mm (in)	60 (2.36)
Stroke	mm (in)	232 (9.13)

TIGHTENING TORQUE

	N·m	kg-m	ft-lb
Steering wheel nut	26 - 32	2.7 - 3.3	20 - 24
Tilt steering clamp-to-instrument frame	16 - 22	1.6 - 2.2	12 - 16
Steering column bracket-to-orbitrol	15 - 20	1.5 - 2.0	11 - 14
Orbitrol cap screw	25 - 28	2.6 - 2.9	19 - 21
Orbitrol set screw	12	1.2	9
Power cylinder attaching bolt	490 - 588	50 - 60	362 - 434
Ball joint stud nut	343 - 392	35 - 40	253 - 289
Rear road wheel nut	441 - 588	45 - 60	325 - 434
Piping			
Orbitrol-to-power steering connector	34 - 39	3.5 - 4.0	25 - 29
Power steering connector-to-power steering hose	39 - 59	4.0 - 6.0	29 - 43
Power cylinder-to-power steering hose	39 - 59	4.0 - 6.0	29 - 43
Power steering hose-to-power steering tube	39 - 43	4.0 - 4.4	29 - 32

ENGINE GENERAL

SECTION EG

CONTENTS

ST

DESCRIPTION

- ST is a small, lightweight handheld tester. When connected to the truck-side data link connector, it communicates with control units installed on the truck and performs a variety of diagnostic tests.

FUNCTION AND APPLIED SYSTEM

Items	Function
WORK SUPPORT	Sends command to control unit to set status suitable for inspection and service.
FUNCTION SYSTEM	Checks each system as ECM basic inspection.
SELF-DIAG RESULTS	Receives self-diagnostic results from control unit and indicates DTCs and number of occurrences.
SELF-DIAG RESULTS [MEMORY]	DTCs (Diagnostic Trouble Codes) recorded in control unit's memory are displayed.
DATA MONITOR	Receives input/output signals from control unit and indicates and stores them to facilitate locating cause of malfunctions.
DATA MONITOR [SPEC]	
Active test	Sends command to control unit to change output signals and check operation of output system.
DTC RECORD DISPLAY	Indicates self-diagnostic results stored in ECM prior to the most recent "ERASE MEMORY".
Control unit part No.	Displays control unit part number.
Control unit identification No.	Displays control unit identification number.

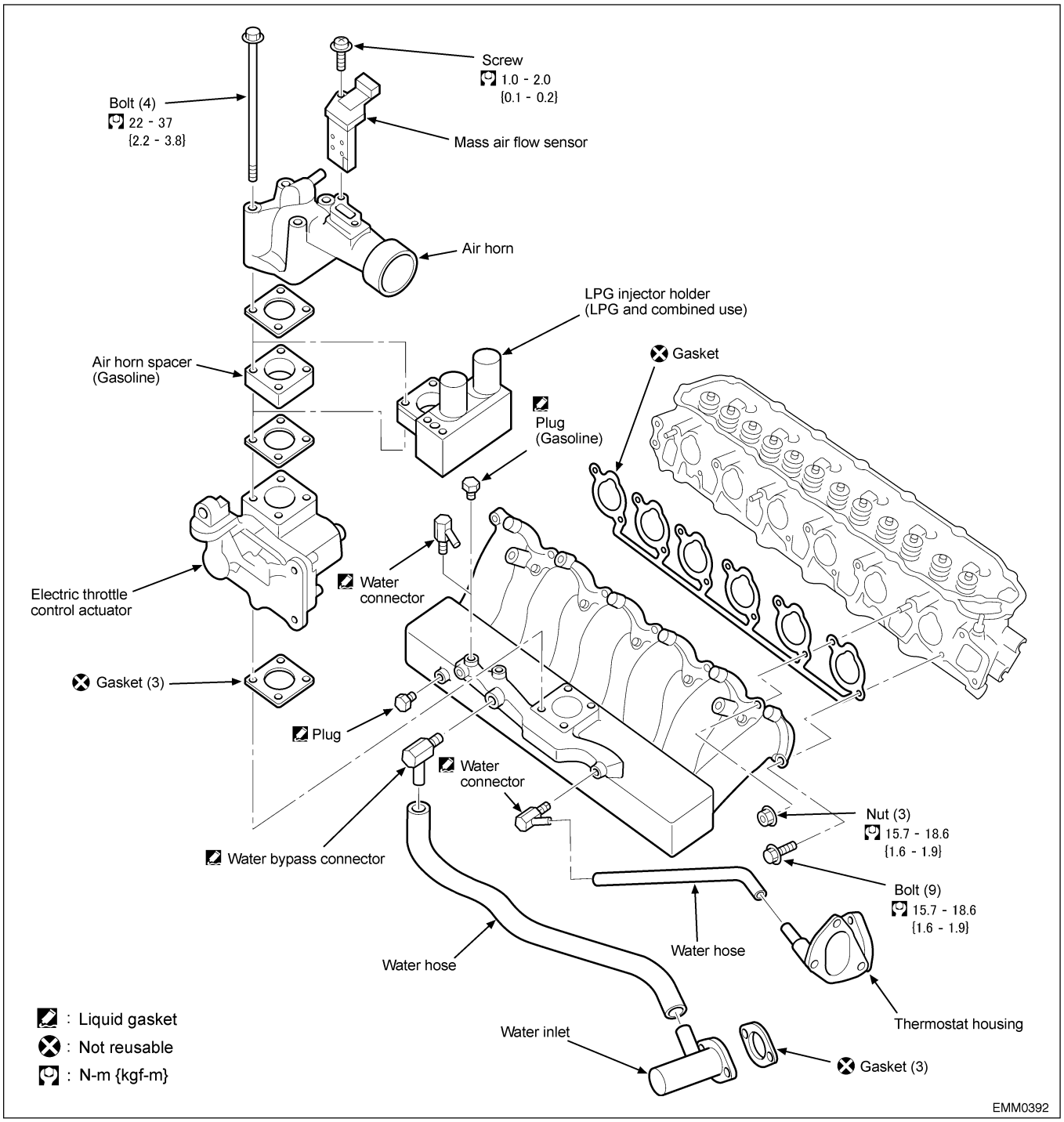
Diagnostic systems	Engine
WORK SUPPORT	○
SELF-DIAG RESULTS	○
SELF-DIAG RESULTS [MEMORY]	
DATA MONITOR	○
DATA MONITOR [SPEC]	○
Active test	○
DTC RECORD DISPLAY	
Control unit part No.	○
Control unit identification No.	

ENGINE TUNE-UP

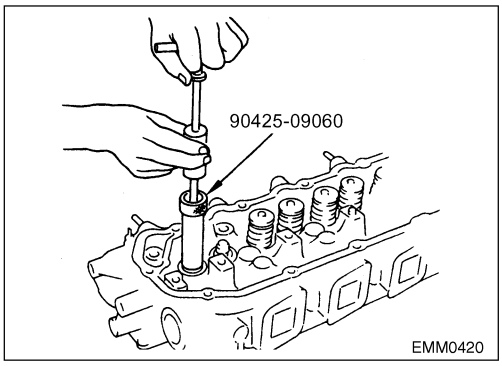
SECTION ET

CONTENTS

Component Parts Location

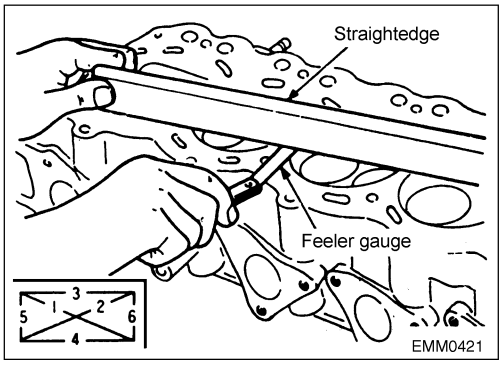


Cylinder Head Assembly (Cont'd)



5. Remove valve oil seal using a valve oil seal puller (ST) when removing.
6. Remove valve spring seats.
7. Refer to (EM section), "Valve seat contact inspection" when removing valve seat.
8. Blow compressed air around spark plug and use a spark plug wrench (commercial service tool) when removing spark plug.

INSPECTION

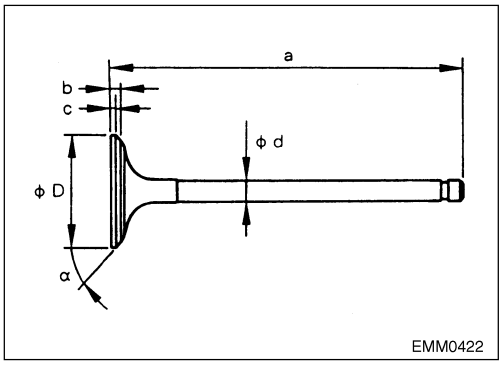


1. Cylinder head distortion

- Remove oil, scale, gasket, sealant, and carbon deposits from surface of cylinder head using a scraper.

⚠ **CAUTION:**

- **Do not allow gasket fragments to enter oil or engine coolant passages.**
- **Check flatness of cylinder head lower surface. Measure distortion in 6 directions shown in the figure, at several points in each direction.**
  Limit: 0.2 mm (0.008 in)

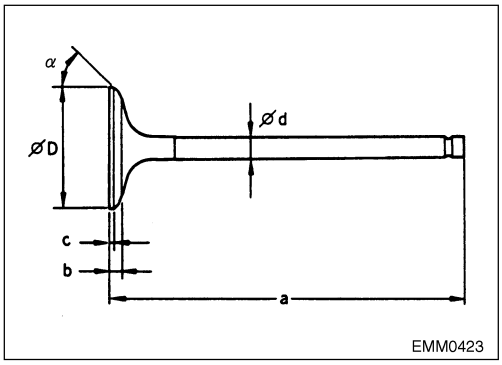


2. Bulb Dimensions

- Measure dimensions at the points shown in the figure using a micrometer.

Standard Unit: mm (in)

	Intake	Exhaust
a	:118.15 (4.65)	1118.8 (4.677)
b	:3.1 - 3.5 (0.122 - 0.138)	31 - 3.5 (0.122 - 0.138)
c	:1.15 - 1.45 (0.0453 - 0.0571)	1.35 - 1.65 (0.0531 - 0.0650)
D (diameter)	:47.0 - 47.2 (1.850 - 1.8583)	38.0 - 38.2 (1.496 - 1.504)
d (diameter)	:7.965 - 7.980 (0.3136 - 0.3142)	7.945 - 7.960 (0.3128 - 0.3134)
α (degree)	:45°15' - 45°45'	45°15' - 45°45'



- Valve face is corrected using valve surface grinder.

Installation

Install in the reverse order of removal and note the following.

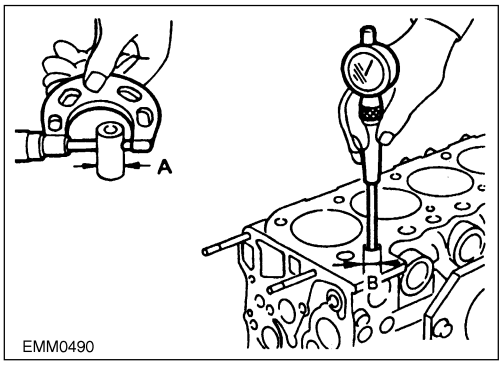
- Do not allow oil to get on the engine mount insulator. Be careful not to damage the engine mount insulator.
- Securely insert positioning stopper pin into mating side hole.
- Make sure all mount insulators are seated properly, then tighten mount bolts and nuts.

Inspection

- Check amount of engine coolant, oil and grease before starting engine. Refill as necessary.
- Start engine and check for any unusual noise and vibration.
- Warm up engine, and then check engine coolant, oil and grease, fuel, and exhaust gas for leakage.

Inspection After Disassembly (Cont'd)

VALVE LIFTER OIL CLEARANCE



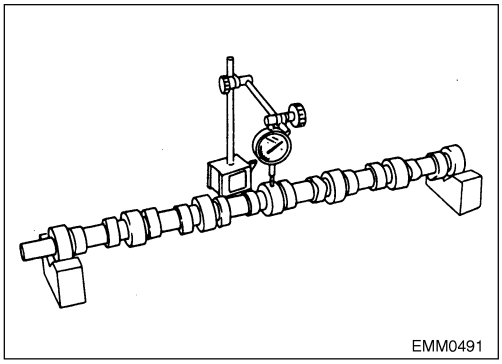
- Check sliding surfaces with camshaft and lifter bore for uneven wear and damage.
- Replace valve lifter if necessary.

1. Valve lifter outer diameter
- Measure the valve lifter outer diameter using a micrometer. (A in the figure)
  Standard:
  24.960 - 24.970 mm (0.9827 - 0.9831 in) dia.
2. Valve lifter bore inner diameter
- Measure valve lifter bore inner diameter using a bore gauge. (B in the figure)
  Standard:
  25.000 - 25.003 mm (0.9843 - 0.9855 in) dia.
3. How to calculate valve lifter oil clearance
- (Clearance) = (Valve lifter bore inner diameter) - (Valve lifter outer diameter)
  Standard:
  0.030 - 0.073 mm (0.0012 - 0.0029 in)
  Repair limit:
  0.1 mm (0.004 in)
- Refer to standards for each part and replace valve lifter and/or cylinder block if clearance exceeds the repair limit.

VISUAL INSPECTION OF CAMSHAFT

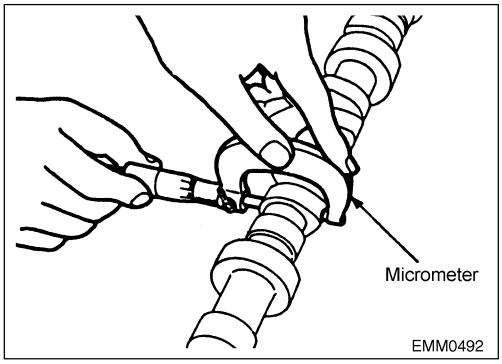
- Check camshaft nose or journal for damage and uneven wear.
- Replace camshaft as necessary.

CHECKING FOR CAMSHAFT BEND

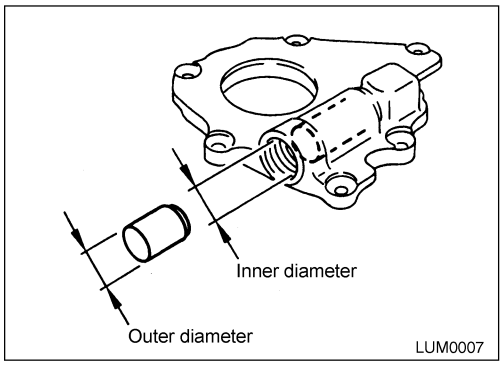


- Set a pair of V-blocks on a level surface and support journals (1 and 7) of camshaft.
- Set a dial indicator vertically onto center of journal 4.
- Rotate the camshaft in one direction by hand and read indication on the dial indicator. (Half of the reading is the bend.)
  Repair limit:
  0.03 mm (0.0012 in)

CAM NOSE HEIGHT



- Measure with a micrometer.
  Standard (intake side):
  42.126 - 42.376 mm (1.6585 - 1.6683 in)
  Standard (exhaust side):
  42.126 - 42.376 mm (1.6585 - 1.6683 in)



Inspection (Cont'd)

REGULATOR VALVE CLEARANCE

- Measure inner diameter of regulator valve cylinder using an inside micrometer.
- Measure regulator valve outer diameter using a micrometer.
  (Clearance) = (Cylinder bore inner diameter) – (Valve outer diameter)

  Standard:

  0.040 - 0.097 mm (0.0016 - 0.0965 in)

⚠ **CAUTION:**

- **Apply engine oil to regulator valve. Make sure that the valve moves smoothly.**

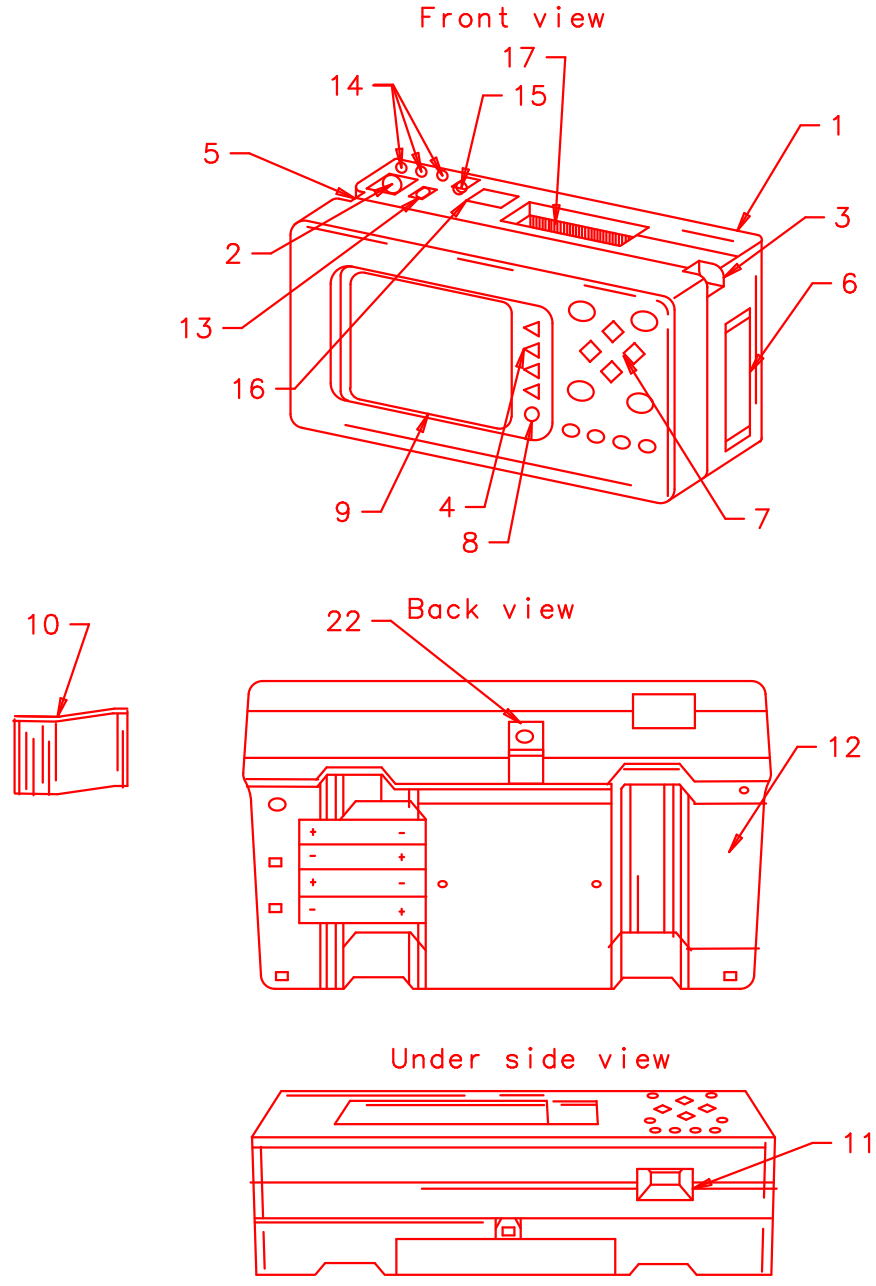
REGULATOR VALVE SPRING

- Check spring for sagging.

  Free length:

  Approx. 63 mm (2.48 in)

Diagnostic Monitor



1. Rubber Jacket
2. Power Switch
3. Wrist strap attaching point
4. LED Display
5. Wrist strap attaching point
6. Cartridge
7. Key Pad-(see next Page)
8. Power Lamp
9. Display screen
10. Battery Cover
11. Contrast adjustment
12. Cartridge Ejector
13. Power Supply Connection-(Not needed if connected To vehicle)
14. MultiMeter Probe Connection
15. RS-232 Connector
16. IrDA Port
17. Diagnostic Cable Connection
18. Threaded Hole for tripod

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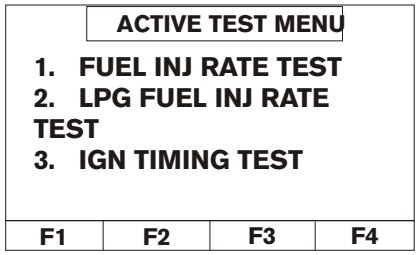
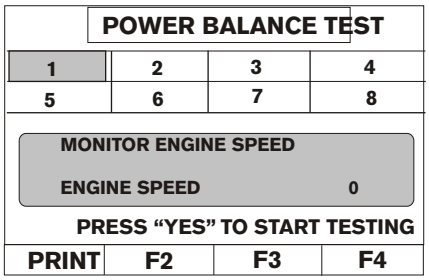


SELECT POWER BALANCE TEST
NOTE: BALANCE TEST WILL ONLY OPERATE WHEN ENGINE IS RUNNING ON GASOLINE

76



SELECT CYLINDER TO DEACTIVATE AND PRESS "YES" TO START TEST
NOTE: ONLY ONE CYLINDER CAN BE DEACTIVATED AT A TIME

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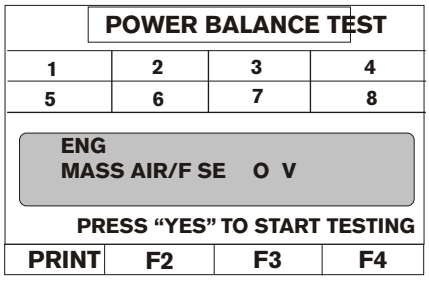
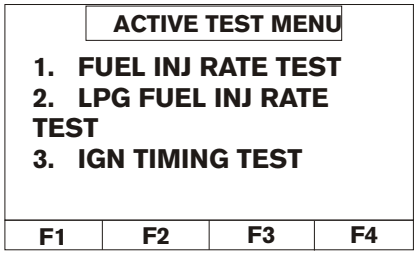


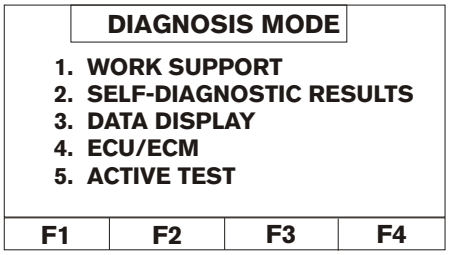
TEST RUNNING, PRESS "YES" TO TERMINATE TESTING

78



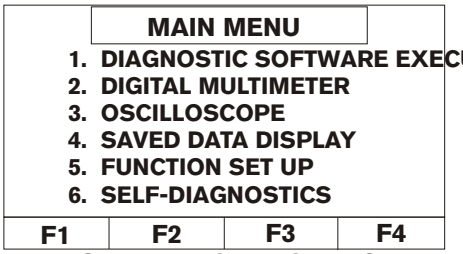
TO END TESTING WITH HITACHI HAND SET PRESS"C" UNTIL MAIN MENU APPEARS

79



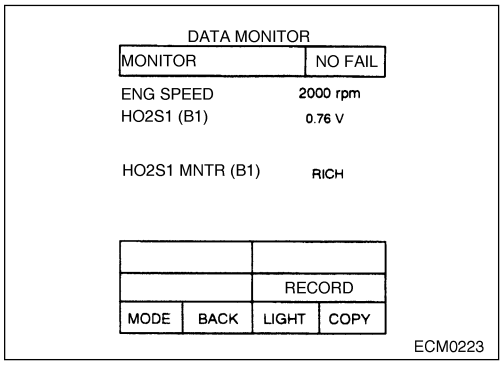
PRESS "C"

80



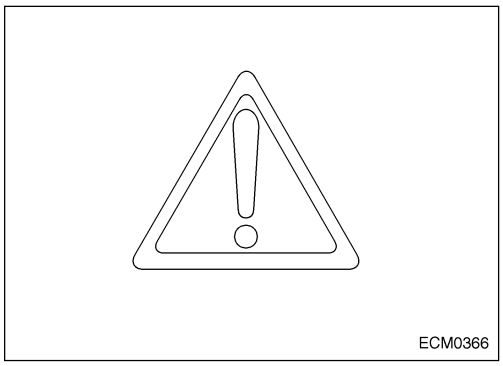
TURN OFF HAND SET & SHUT OFF IGN SWITCH

Inspection of Idle Speed, Ignition Timing, and Air-Fuel Ratio (Cont'd)



WITH SST

1. Select "HO2S1 MNTR (B1)" in "DATA MONITOR" mode.
2. Keep engine speed at approximately 2,000 rpm, and make sure that "RICH" and "LEAN" are alternately displayed.



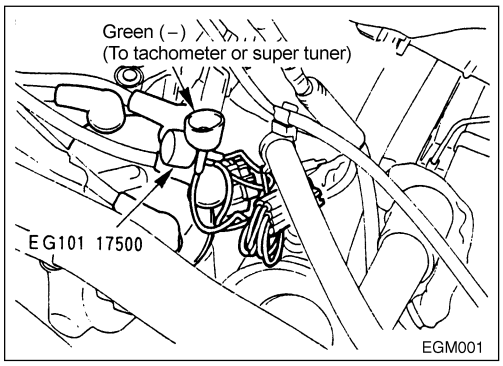
WITHOUT SST

1. Inspect using heated oxygen sensor monitor mode. (Refer to EC section, "DIAGNOSTIC TEST MODE II ? HEATED OXYGEN SENSOR MONITOR" for operation procedure.)
2. Keep engine speed at approximately 2,000 rpm, and make sure that MIL blinks at least 5 times within 10 seconds.

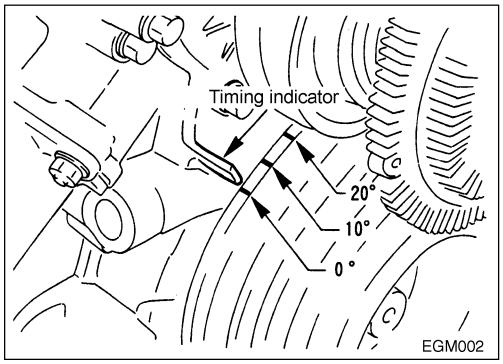
NOTE:

- Increase engine speed when inspecting while air-fuel ratio feedback control is activated during idle.

INSPECTION AND ADJUSTMENT OF IGNITION TIMING



- Connect a timing light (super tuner, etc.) to receive a signal from the ignition primary system using an adapter harness for molded coils (SST).
  (Attach pickup to the 1 high-tension cable for general timing lights.)



•Perform "AAC Valve Adjustment" in WORK SUPPORT mode.

•Remove harness connector from throttle position sensor.

(The operation above stops idle speed and ignition timing feedback control.)

- Make sure that ignition timing and base idle speed is BTDC 10° ±2°/675 rpm.

Diagnosis Chart by Symptom (Cont'd)

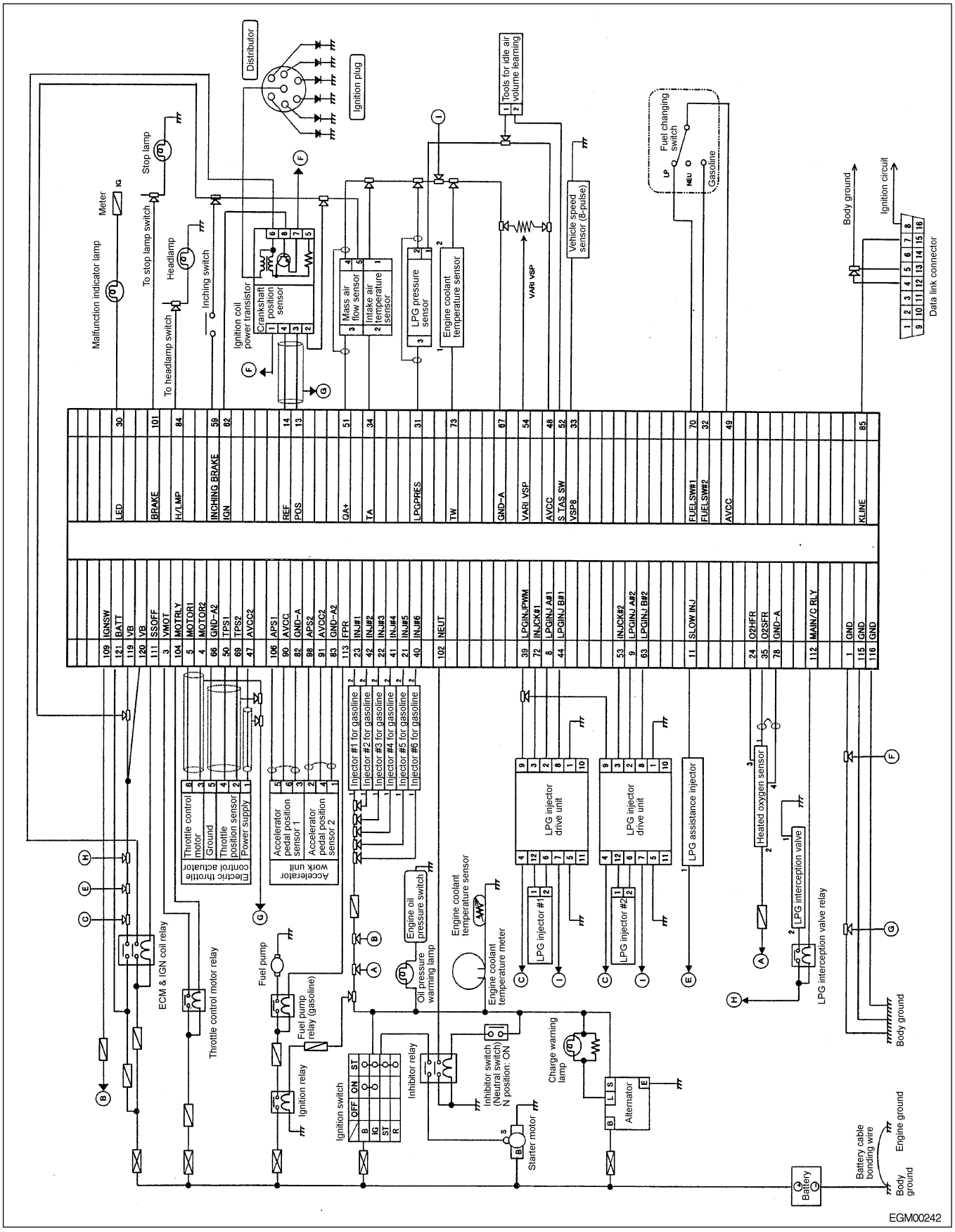
TB45 ENGINE RELATIONSHIP BETWEEN MALFUNCTIONING SYMPTOM AND THE ENGINE MAIN BODY/AUXILIARY COMPONENT

When the three elements of combustion, compression pressure, fuel mixture, and sparking are all normal, no malfunctions are caused in the gasoline-type engine.
The ECM controls the fuel mixture and sparking (ignition timing). But with malfunctions on the part of engine main body, malfunctioning symptoms result.
The table below shows the possible symptoms caused by the malfunction of engine main body system. It will be helpful in malfunction trouble diagnosis. (The table lists general symptoms and some may not be applicable.)

Symptoms		Impossible to start		Impossible to start		Poor idle					Poor driving control								Engine stall				Other		Description/notable characteristics of the symptom
		No initial combustion	Initial combustion	When engine is cold	When engine is warming up	Fast idle is not effective	High idle rpm	Low idle rpm	Inconsistent idle when engine is cold.	Inconsistent idle when warming up	Poor power output	Poor acceleration	Engine rpm does not increase smoothly.	During surge and acceleration	During surge and constant speed drive	Knocking	Backfire	After-burn	At idle	Driving	During deceleration	During a heavy load	Overheat	Poor fuel		
Main unit symptom ⊕ : Highly possible ♦ : Possible ∇ : Not very possible																									
Fuel mixture	Air sucked from oil level gauge										♦	∇		♦	♦						∇			∇		∇	Air-fuel ratio becomes LEAN. High air-fuel correction factor. Low suction power (vacuum pressure) of intake manifold. Use a pressure gauge to check the suction. Generally applicable to air suction in air intake system
	Air sucked from oil filler cap										♦	∇		♦	♦						∇			∇		∇	
	Air sucked from PCV hose (downstream of PCV)				♦	∇					♦	♦	♦	♦	♦	♦	♦	∇	∇		♦	♦		♦		∇	
	Air sucked from intake manifold and gasket				♦	∇					♦	∇	♦	♦	♦	♦	♦	∇	∇		♦	♦		♦		∇	
	PCV kept open							♦			♦	∇		♦	♦	♦	♦									♦	• Noise (high hissing tone)
	Clogged fuel strainer				♦	∇					♦	∇	♦	♦	♦	♦	♦	♦	♦		∇	♦		♦			• Symptom depends on clogging status. This tends to happen during high-speed or high load operation.
	Clogged air cleaner element												♦	♦	♦	♦	♦									♦	
	Malfunctioning gasoline pressure regulator	∇	♦	♦	♦						♦	♦	♦	♦	♦	♦	♦				♦	♦	♦	♦			• Symptom varies depending on combustion pressure.
	Poor quality gasoline	∇	♦	♦	♦						♦	♦	♦	♦	♦	♦	♦	∇			♦	♦	♦	♦		∇	• Symptom varies depending on oil quality.
	Improper LPG fuel (cold area and propane ratio)	⊕	♦	♦							♦	♦	♦	♦	♦	♦	♦	∇			♦	♦	♦	♦			• Starting ability at cold area is changed depending on propane ratio. • Use LPG with proper propane ratio.
	Malfunctioning LPG vaporizer pressure adjusting valve	∇	♦	♦	♦						♦	♦	♦	♦	♦	♦	♦				♦	♦	♦	♦			• If the pressure is low, it is caused by poor output during high-speed or high load operation. • If the pressure is excessively high, relief valve operates and engine stalls at rich.
	Clogged LPG vaporizer hot water circuit							♦			♦	♦	♦	♦	♦	♦	♦				♦	♦	♦	♦			• Symptom depends on fuel temperature. This tends to happen during engine stall and is impossible to restart during engine warming up.
	Clogged LPG interception valve filter				♦	∇					♦	♦	♦	♦	♦	♦	♦	♦	♦		∇	♦		♦			• Symptom depends on clogging status. This tends to happen during high-speed or high load operation.
	Valve deposit				♦	♦					∇	∇	♦	♦	♦	♦	♦	♦	♦		♦	♦	♦	♦		∇	• The malfunction tends to happen during high-speed or high load operation (low vacuum).

Circuit Diagram (Cont'd)

3.



Diagnosis item	Malfunction Return Condition	Display	MIL	Trip
LPG injector 1 malfunction	•LPG injector signal circuit is open.	LPG F/INJ 1 MALFUNCTION (INJECTION) [**P1240**]	-	-
LPG injector 1 malfunction	•LPG injector signal circuit is open.	LPG F/INJ 1 malfunction (No injection) [**P1241**]	-	-
LPG injector 2 malfunction	•LPG injector signal circuit is open.	LPG F/INJ 2 MALFUNCTION (INJECTION) [**P1242**]	-	-
LPG injector 2 malfunction	•LPG injector signal circuit is open.	LPG F/INJ 2 MALFUNCTION (NO INJECTION) [**P1243**]	-	-
LPG fuel pressure sensor malfunction	•LPG fuel pressure sensor output voltage is higher than normal (?V or more).	LPG FUEL PRESSURE SENSOR HIGH INPUT MALFUNCTION [**P1245**]	-	-
LPG vaporizer malfunction	•LPG fuel pressure is excessively high.	LPG FUEL PRESSURE EXCESSIVELY HIGH MALFUNCTION [**P1249**]	-	-
Throttle/Accelerator position sensor power supply	•Power supply of accelerator position sensor and throttle position sensor is shorted.	AVCC SHORT [**P1229**]	-	-
Crankshaft position sensor 1° (POS) signal circuit	•The crankshaft position sensor (POS) signal is not detected for a predetermined time at the engine start or during engine running (during camshaft position sensor (REF) signal input). •The crankshaft position sensor (POS) signal irregular waveform is detected for a predetermined time during engine running (during camshaft position sensor (REF) signal input).	CKP SEN/CIRCUIT [**P0335**] HALL POS SENSOR PPEN DIAGNOSIS AT START [**P0335**] Hall POS SENSOR INSTANTANEOUS/NOISE/ DAMAGED TEETH DIAGNOSIS [**P0335**]	ON	2
Crankshaft position sensor 120° (REF) signal circuit	•At start-up, no camshaft position sensor (REF) signal has been detected for more than a predetermined period. •The camshaft position sensor (REF) signal is not detected for a predetermined time during engine running (during crankshaft position sensor (POS) signal input). •A camshaft position sensor (REF) signal irregular waveform is detected for a predetermined time during engine running (during crankshaft position sensor (POS) signal input).	CMP SEN/CIRCUIT [**P0340**] Hall PHASE SENSOR OPEN DIAGNOSIS AT START [**P0340**] Hall PHASE SENSOR INSTANTANEOUS/NOISE/ DAMAGED TEETH DIAGNOSIS [**P0335**]	ON	2
Vehicle speed sensor	•Vehicle sensor signal has not been input under some condition for a predetermined time during driving after warming up.	VEH SPEED SEN/CIRC [**P0500**] ECM VEH SPEED SEN/ CIRC [**P0500**]	ON	2

SST Reference Value in Data Monitor (Cont'd)

Monitor item	Measuring condition		Reference value
ENG SPEED			Almost in accordance
MAS A/F SE	• After engine warming up • Selector lever: N • No load	At Idle	Approx. 1.3V
		At approx. 2,000 rpm	Approx. 1.6V
B/FUEL SCHDL	• After engine warming up • Selector lever: N • No load	At Idle	Approx. 2.5 - 4 msec
		At approx. 2,000 rpm	
A/F ALPHA	• After engine warming up	At Idle	Approx. 90 - 110%
COOLANT TEMP/S	• After engine warming up		Approx. 80°C or more
HO2S1	• After engine warming up	At Idle	Changes between approx. 0.1 - 0.4V⇔0.6 - 0.9V
		Maintain at approx. 2,000 rpm	Changes between approx. 0.1 - 0.4V⇔0.6 - 0.9V
HO2S1 MNTR	• After engine warming up	At Idle	Switches slowly between LEAN⇔RICH.
		Maintain at approx. 2,000 rpm	Switches between LEAN⇔RICH at least 5 times for 10 seconds.
VHCL SPEED SE	• Drive, and compare with the value displayed on speedometer.		Almost in accordance
BATTERY VOLT	• Ignition switch: ON (with engine stopped)		Approx. 11 - 14V
ACCEL SEN 1 ACCEL SEN 2	• After engine warming up	At Idle	Approx. 0.6 - 0.65V
		Approx. 2,000 rpm	Approx. 0.75 - 0.8V
		Ignition switch ON with accelerator pedal depressed (With engine stopped)	Approx. 4.1 - 4.3V
THRTL SEN 1 THRTL SEN 2	• After engine warming up	At Idle	Approx. 0.5 - 0.55V
		Approx. 2,000 rpm	Approx. 0.65 - 0.7V
		Ignition switch ON with accelerator pedal depressed (With engine stopped)	Approx. 0.7 - 0.75V
P/N POSI SW	• Ignition switch: ON	N position	ON
		Other than above	OFF
LOAD SIGNAL	• Ignition switch: ON	Headlamp switch: ON	ON
		Above switch: OFF	OFF
IGNITION SW	• Ignition switch: ON→OFF		ON→OFF
BRAKE SW	• Ignition switch: ON	Brake pedal depressed	ON
		Brake pedal released	OFF
INJ PULSE	• After engine warming up • Selector lever: N • No load	At Idle	Approx. 2 - 4 msec
		At approx. 2,000 rpm	
IGN TIMING	• After engine warming up • Selector lever: N • No load	At Idle	Approx. 15°BTDC
		At approx. 2,000 rpm	Approx. 30 - 40°BTDC
Incalculable	• After engine warming up • Selector lever: N • No load	At Idle	Approx. 0 - 20%
		At approx. 2,000 rpm	Approx. 14 - 28%
FUEL PUMP RLY	• For 1 second after ignition switch is ON • While engine is running and cranking		ON
	• Other than above		OFF
THRTL RELAY	• Ignition switch: ON→OFF		ON→OFF
HO2S1 HTR	• After engine warmed up (at idle)	Approx. ? rpm or more	OFF
		Other than above	ON

SST Data Monitor Display

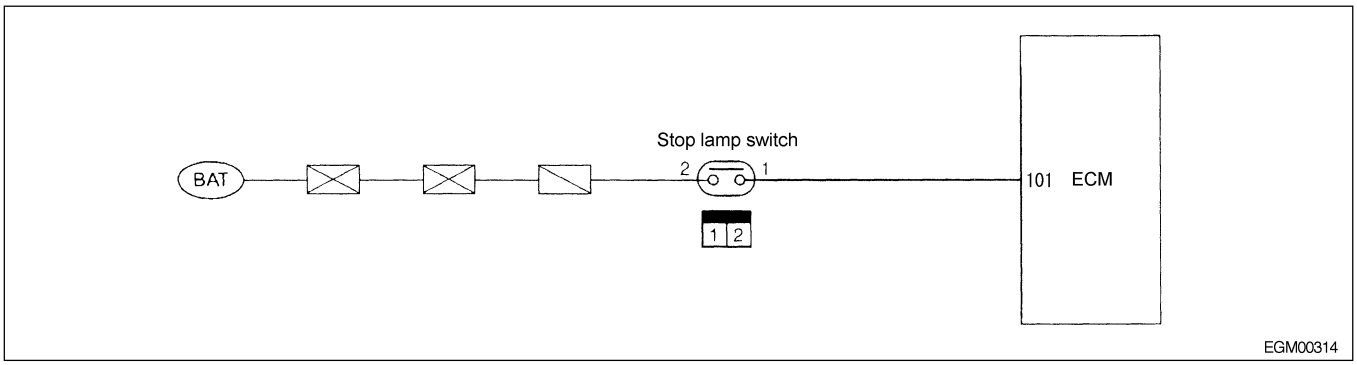
Monitor item	Brake pedal released	Brake pedal depressed
BRAKE SW	OFF	ON

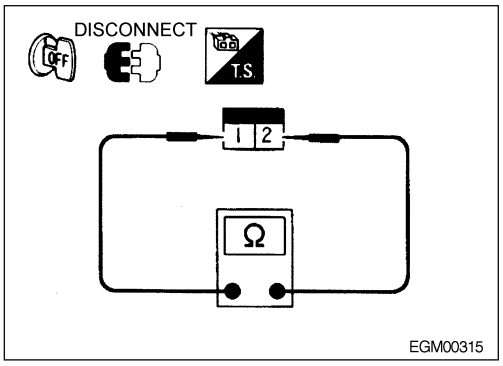
ECM Input/Output Signal Specifications

Measure voltage between terminals shown below and ground using a circuit tester.

Terminal	Signal name	Brake pedal released	Brake pedal depressed
101	Stop lamp switch	Approx. 0V	Battery voltage

Circuit Diagram





Component Parts Inspection

STOP LAMP SWITCH

Check continuity between stop lamp switch terminals 1 and 2.

Brake pedal released:

Continuity should not exist.

Brake pedal depressed:

Continuity should exist.

Removal and Installation of Heated Oxygen Sensor (With Heated Oxygen Sensor Heater)

1. Remove harness connector from hearted oxygen sensor.
2. Remove heated oxygen sensor using a socket designed for heated oxygen sensor removal and installation (SST).

⚠ **CAUTION:**

- **Handle it carefully and avoid impacts.**

Removal and Installation of Throttle Position Sensor (Electric Throttle Control Actuator Assembly)

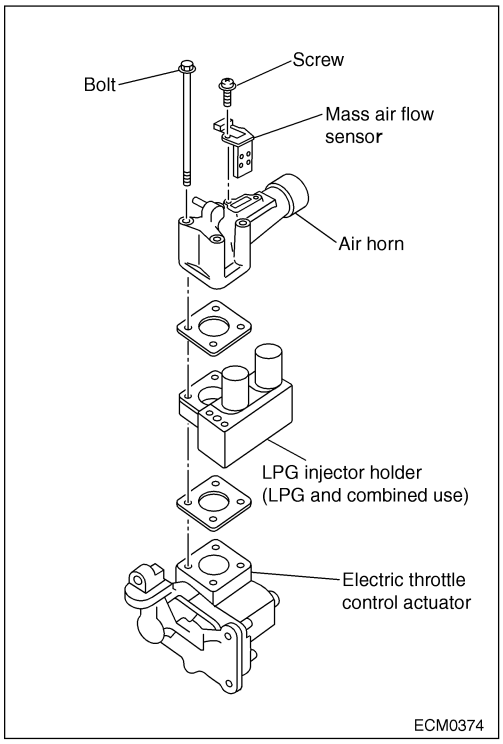
REMOVAL

1. Remove air duct from air horn.
2. Remove harness connector.

⚠ **CAUTION:**

- **Also, remove harness connectors of mass air flow sensor, LPG injector, and LPG fuel pressure sensor so that when removing and installing air horn, LPG injection holder (LPG and Combined) is performed at the same time.**

3. Loosen bolts diagonally, remove air horn, LPG injection holder (LPG or Combined) or air horn spacer (Gasoline), and then remove electric throttle control actuator.



INSTALLATION

CAUTION FOR INSTALLATION

- Uniformly tighten bolts diagonally in several steps.

⚠ **CAUTION:**

- **Make sure that there is no moisture around connector when removing and installing throttle position sensor connector. If there are any water drops, completely wipe them off.**
- **Do not apply voltage to throttle position sensor terminal.**
- **Perform "Throttle Valve Closed Position Learning" if disconnecting connector. Perform if replacing electric throttle control actuator. (Refer to EC section, "Throttle Valve Closed Position Learning and Idle Air Volume Learning".)**
- **Do not disassemble electric throttle control actuator.**

Removal and Installation of Fuel Tube and Fuel Injector (Cont'd)

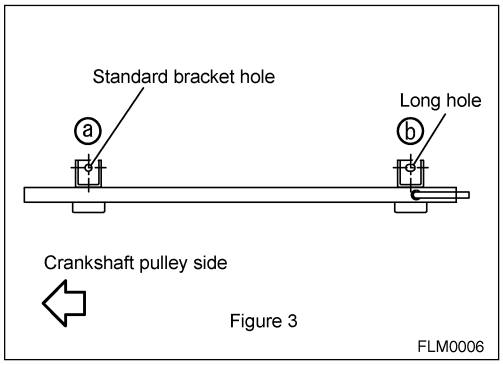


Figure 3

5. First tighten fuel tube bolt in position "a" in figure 3, and then tighten it in position "b" in the same figure.
   Repeat above tightening procedure 2 times.
   Tightening torque
   First tightening:
   : 9 - 20 N•m (0.9 - 2.1 kgf-m, 7 - 15 ft-lb)
   Second tightening:
   : 21 - 26 N•m (2.1 - 2.7 kgf-m, 16 - 19 ft-lb)

Check for Fuel Leakage After Installation

Check for fuel leakage by racing several times after idling for 5 to 10 minutes.

FEEDBACK

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Dealer name: _____ Submitted by: _____

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City: _____ State: _____

Zip code: _____ Country: _____

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