FOREWORD

This manual describes the repair procedures for the 2F engine equipped on the TOYOTA LAND CRUISER and TRUCKS.

Under DISASSEMBLY and ASSEMBLY, you will find disassembled views which carry numbers indicating the sequence of operation procedure. The operations can be accomplished by following these numbers. To facilitate understanding, there are also some figure numbers after operation numbers showing the locations of work details. The texts have different symbol marks which supersede the figure explanation.

This manual provides complete information on the maintenance and service of this engine, and it is hoped that it will see much use.

For service of emission control devices for USA, refer to the Emission Control Repair Manual (Pub. No. 98117).

All information contained in this manual is the most up-to-date at the time of publication, and we reserve the right to make any changes without further notice.

TOYOTA MOTOR SALES CO., LTD.

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GENERAL

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GENERAL REPAIR INSTRUCTIONS

1. Use fender, seat, and floor covers to keep the car clean and prevent damage.

2. During disassembly, keep parts in order for reassembly.

3. Before performing electrical work, disconnect the cable to the positive (+) battery terminal.

4. Always replace gaskets and O-rings with new ones.

5. Always use sealer on gaskets to prevent leaks.

6. Carefully observe all specifications for bolt torques. Always use a torque wrench.

7. Use genuine Toyota parts.

8. If the vehicle is to be jacked up only at the front or rear end, be sure to block the wheels in order to ensure safety.

9. After the vehicle is jacked up, do not fail to support it on stands. It is extremely dangerous to do any work on the vehicle raised on jack alone, even for a small job that can be finished quickly.

10. Use of a special service tool (SST) may be required, depending on the nature of the repair. Be sure to use SST where specified and follow the proper work procedure. A list of the SST is found at the back of this manual.

ABBREVIATIONS USED IN THIS MANUAL

For convenience, the following codes are used in this manual.

Abbreviation	Term	Definition
SST	Special Service Tool	This term designates tools that have been manufactured specially for the servicing of this vehicle. Their part numbers are shown in the text enclosed by [ ].
STD	Standard	This term refers to the dimension of the part when originally manufactured.
O/S	Oversize	Sizes larger than STD are indicated as O/S.
U/S	Undersize	Sizes smaller than STD are indicated as U/S.
MP	Multipurpose	Use in the case of MP grease.
BTDC	Before Top Dead Center	
T/M	Transmission	

SYMBOL MARKS

The following symbols have been adapted for simplicity and for easy comprehension.


ASSEMBLY


DISASSEMBLY


INSTALLATION


REMOVAL


INSPECTION


MEASUREMENT


TIGHTENING


CLEAN


IMPORTANT

ENGINE TUNE-UP

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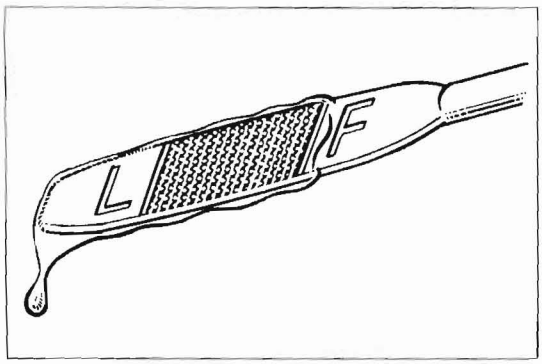
ENGINE OIL

LEVEL CHECK and REPLENISHMENT

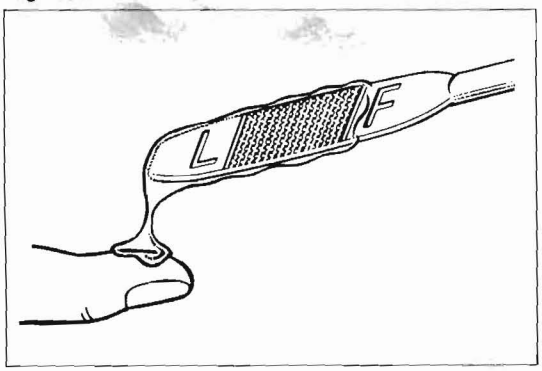
Fig. 2-1



Oil level should be up to the F line on the level gauge. If low, add oil up to the F line.
Use API service SE classification engine oil.

QUALITY CHECK

Fig. 2-2



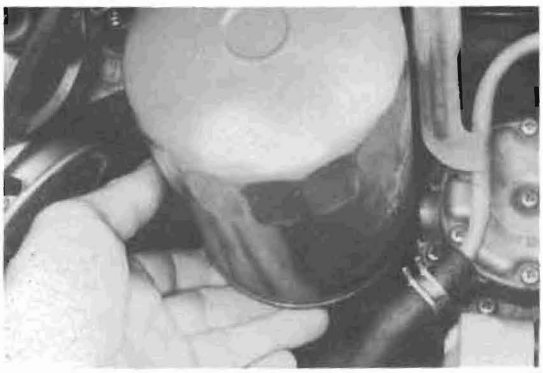
Pull out the oil level gauge and examine the oil adhering on the graduated part. The oil should not be discolored or thin.

OIL FILTER REPLACEMENT

Fig. 2-3

1. Remove the oil filter by using SST [09228-44010].
2. For installation, tighten firmly the oil filter by hand.

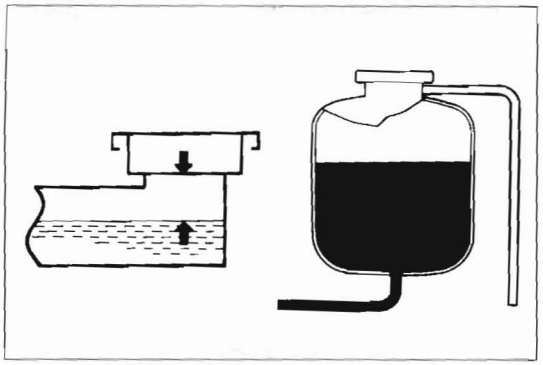
Fig. 2-4



3. After starting the engine, check for oil leak and recheck the oil level.

COOLING SYSTEM

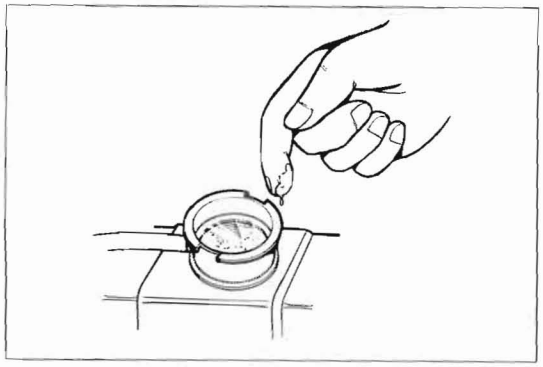
Fig. 2-5



COOLANT LEVEL CHECK and REPLENISHMENT

If coolant is low, fill resorvoir tank up to "Full" line.

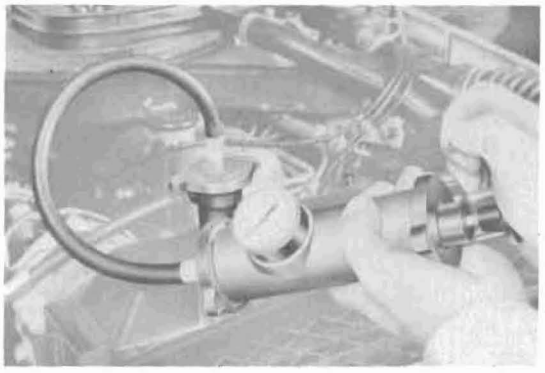
Fig. 2-6



COOLANT QUALITY CHECK

There should not be any excessive deposit of rust or scales around the radiator cap or radiator filler hole, and the coolant should also be free from oil. Replace the coolant if excessively dirty.

Fig. 2-7

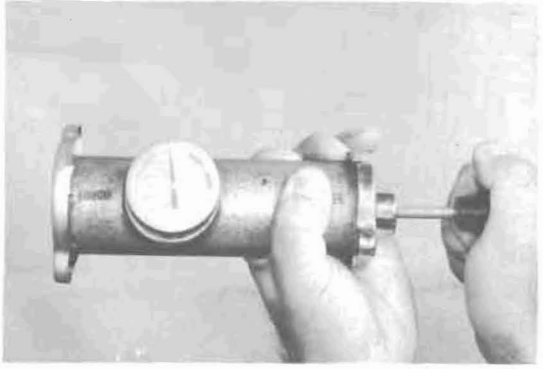


INSPECTION of COOLING SYSTEM PARTS

There should be no defects such as listed below:

1. Damage, deterioration, or loose clamps in radiator hoses, water hoses.
2. Leakage due to corrosion or damage in radiator core.
3. Leakage due to loose water drain cock.
4. Leakage from water pump.

Fig. 2-8



5. Faulty operation of radiator cap.

Inspect the radiator cap pressure regulating and vacuum valves for spring tension and seating condition. If the valve opens at a pressure level below the specified value or is otherwise defective, replace the radiator cap.

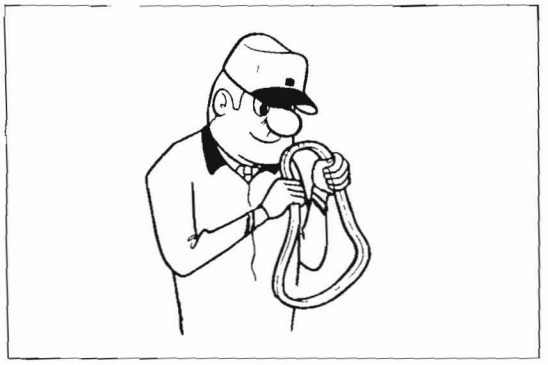
Valve opening pressure limit

	0.6 kg/cm^2 (8.5 psi)
Standard	**0.9 kg/cm^2 (12.8 psi)**

DRIVE BELT

VISUAL CHECK

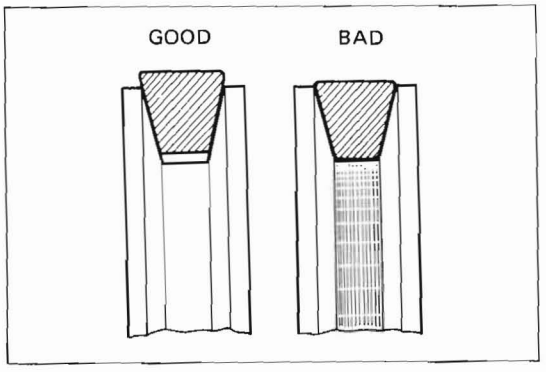
Fig. 2-9



There should be no defects such as listed below:

1. Cracked, deteriorated, stretched, or worn belt.
2. Adherence of oil or grease.

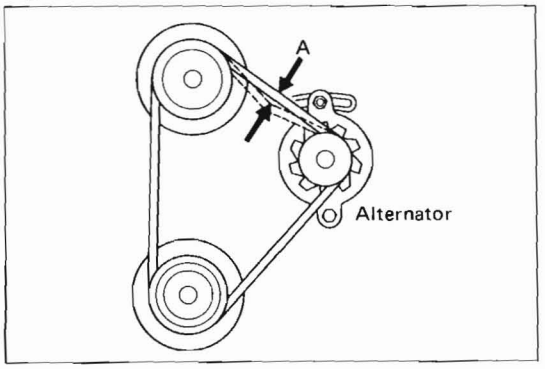
Fig. 2-10



3. Improper contacting of belt against the pulley.

TENSION CHECK and ADJUSTMENT

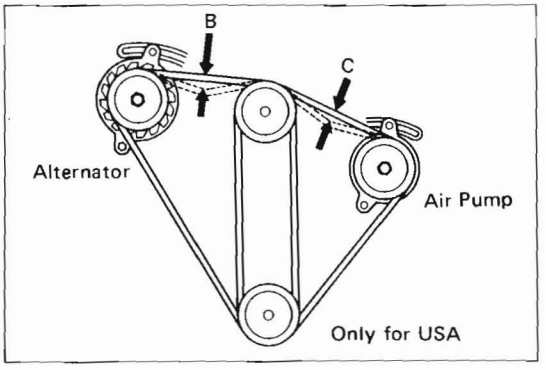
Fig. 2-11



When the belt is pressed down with 10 kg (22 lb) force, the belt should deflect the specified amount.

A : 7–10 mm (0.28–0.39 in)
B : 13–15 mm (0.51–0.59 in)
C : 7–10 mm (0.28–0.39 in)

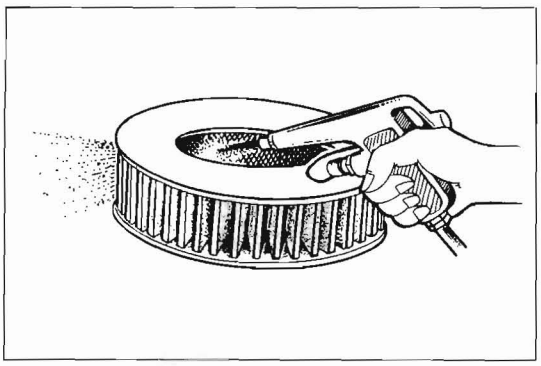
Fig. 2-12



AIR CLEANER

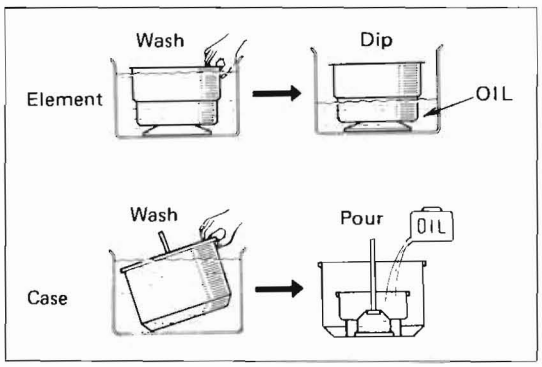
ELEMENT CLEANING

Fig. 2-13



1. In removing the air cleaner or element, and after removal, use care not to drop dirt and dust down into the carburetor.
2. In cleaning the element, blow air from the inner side.
3. In case the element is torn or excessively dirty, replace with new one.

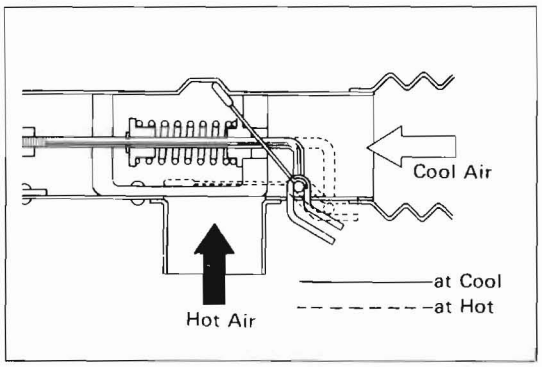
Fig. 2-14



Oil Bath Type

Wash the element and case with cleaning solvent, and dry them thoroughly before reuse.
Fill the case with engine oil to its specified level.

Fig. 2-15



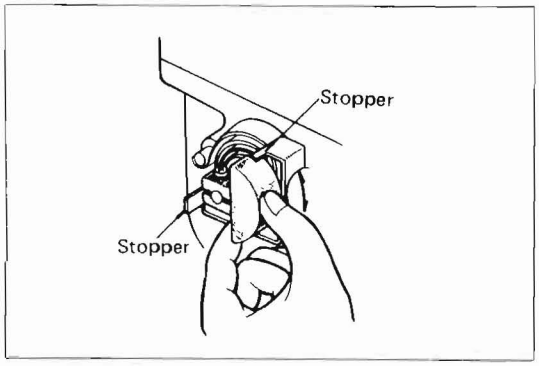
HOT AIR INTAKE

Check air control valve operation.
Valve should close cold air intake when cold, hot air intake when warm.

HEAT CONTROL VALVE

INSPECTION

Fig. 2-16

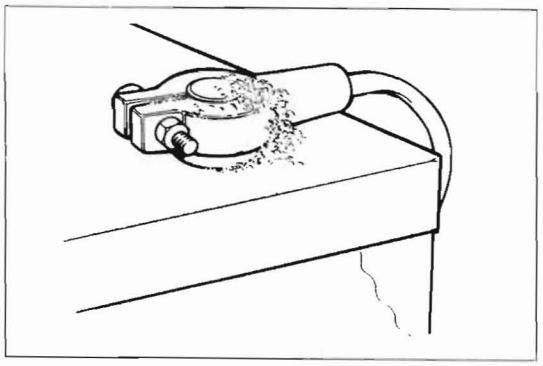


When the heat control valve shaft is turned by hand, the valve should move smoothly to the stopper, and when released, it should return to the other stopper.

BATTERY

VISUAL CHECK

Fig. 2-17

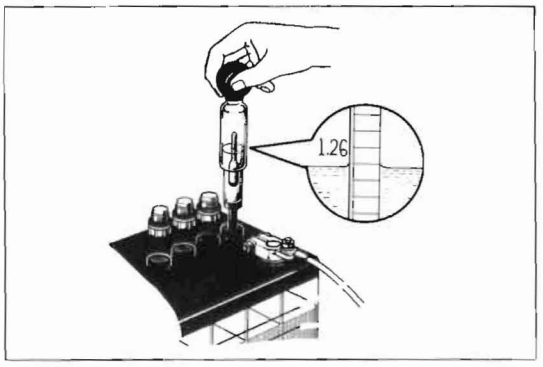


If very dirty, remove and clean before checking. There should be no defects such as listed below:

1. Rusted battery mounting hardware.
2. Damage or leakage in battery.
3. Loose connection, rusting, deterioration or corrosion of battery terminals.

SPECIFIC GRAVITY MEASUREMENT

Fig. 2-18

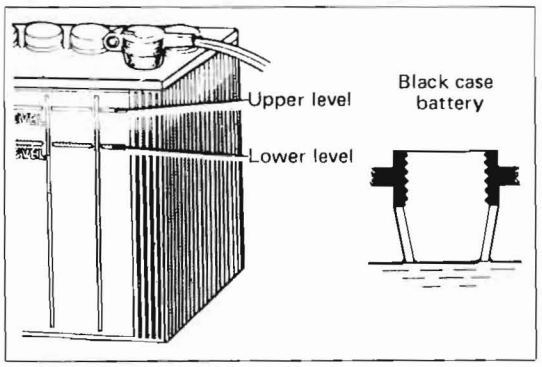


Hold the hydrometer so that the float will not contact against the cylinder wall and read the graduation.

Specific gravity **1.25–1.27**

ELECTROLYTE LEVEL CHECK and REPLENISHMENT

Fig. 2-19

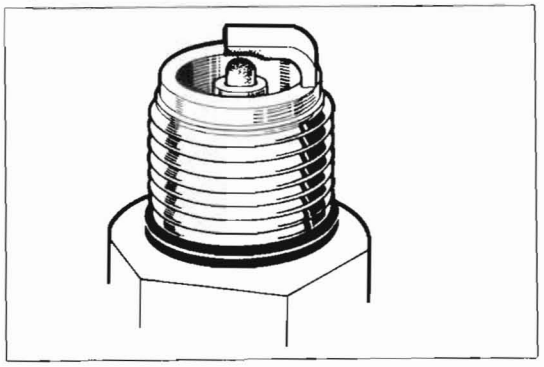


The electrolyte level should be up to the upper level. If low, add distilled water (or purified water).

SPARK PLUG

VISUAL CHECK

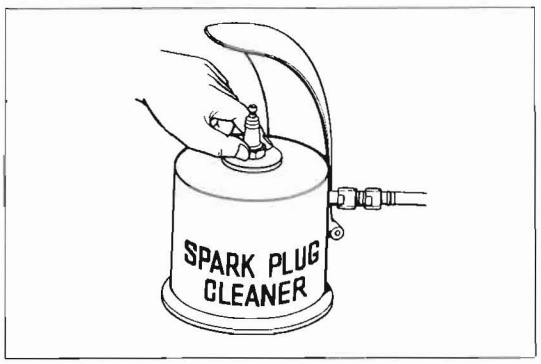
Fig. 2-20



Condition is good if none of the following defects are present:

1. Cracks or damages in the threads or insulator.
2. Wear on the electrodes.
3. Damaged or deteriorated gaskets.
4. Burnt condition of electrode and undesirable carbon deposit.

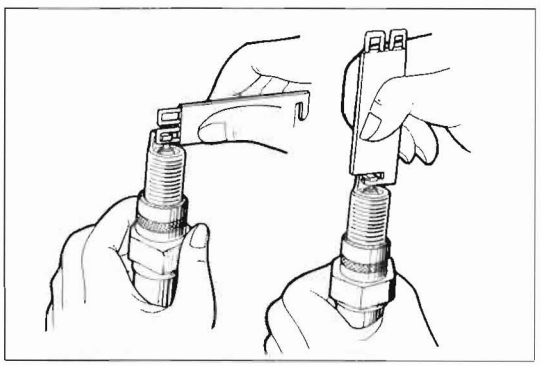
Fig. 2-21



CLEANING

1. Do not use spark plug cleaner longer than necessary.
2. Blow off cleaning compound and carbon on the threads thoroughly with air.
3. Clean off dirt from the outer surface of insulator and threads.

Fig. 2-22

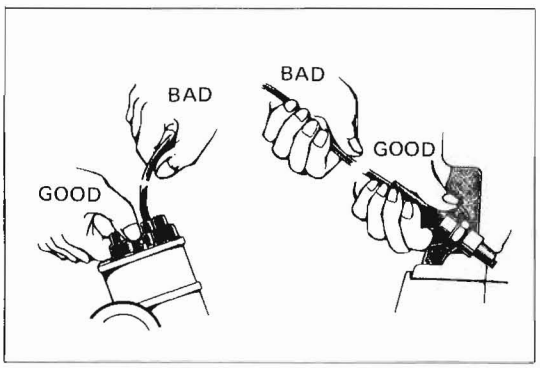


GAP ADJUSTMENT

Check the plug gap with plug gap gauge. If not to specified value, adjust by bending the ground (outer) electrode.

Plug gap **0.8 mm (0.031 in)**
1.0 mm (0.039 in) for USA

Fig. 2-23

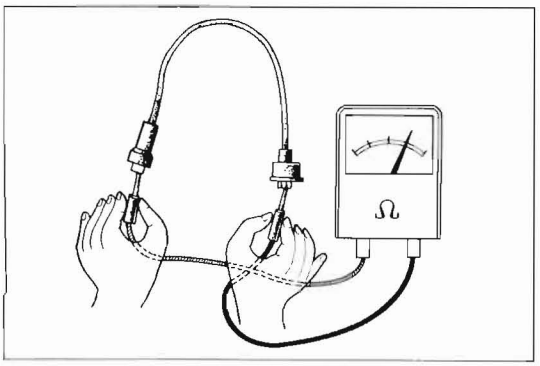


HIGH TENSION CORD

– Note –

When pulling out the spark plug cord from the plug, always grip the end of plug cord.

Fig. 2-24



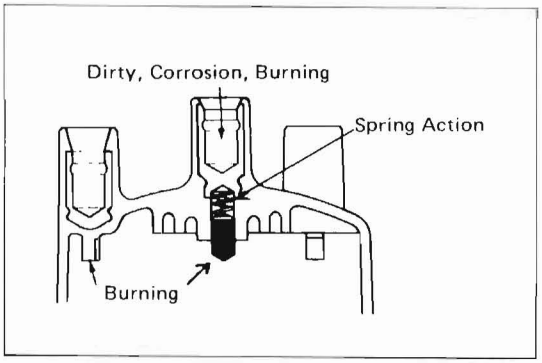
Check the resistance of resistivity cord.

Resistance **Less than 25 kΩ per cord.**

DISTRIBUTOR

CAP INSPECTION

Fig. 2-25

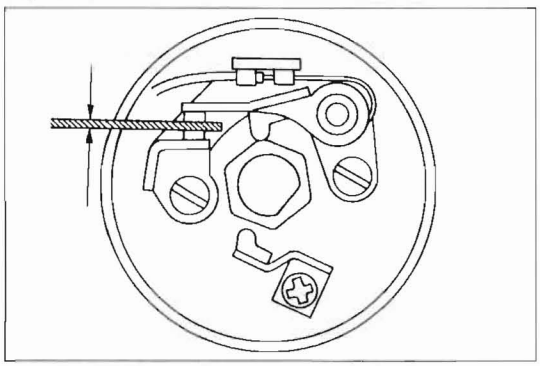


Clean the distributor cap and inspect the cap and rotor for:

1. Cracks, damage, dirty cord hole, corrosion, burning.
2. Center piece spring action.
3. Burnt electrode terminal.

POINT GAP ADJUSTMENT

Fig. 2-26

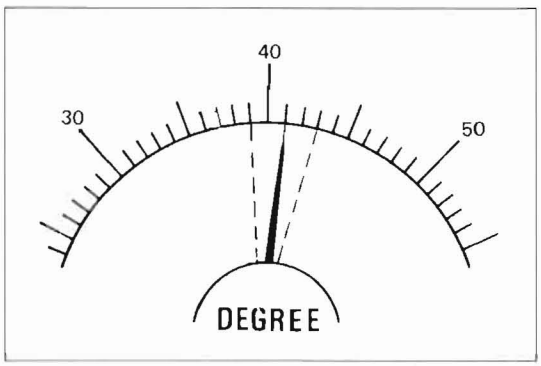


1. If the points are excessively burnt or pitted, replace the breaker points.
2. Adjust point gap.

Point gap 0.45 mm (0.018 in)

DWELL ANGLE

Fig. 2-27



Check if dwell angle is within the specified value.

Dwell angle 39–43°

Variation

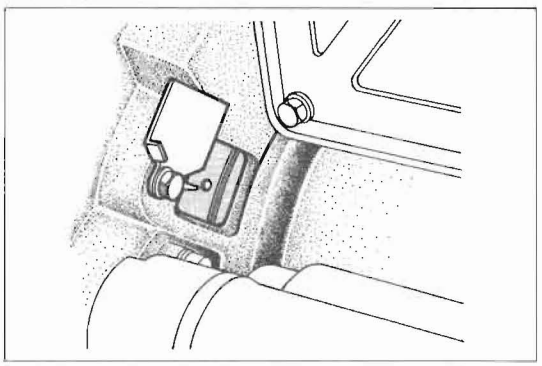
Within 3° (at idling to 2000 rpm)

– Caution –

On the vehicle equipped with transistorized ignition system, do not connect dwell tacho tester lead to distributor terminal, but to ignition coil terminal to prevent misfire.

IGNITION TIMING

Fig. 2-28



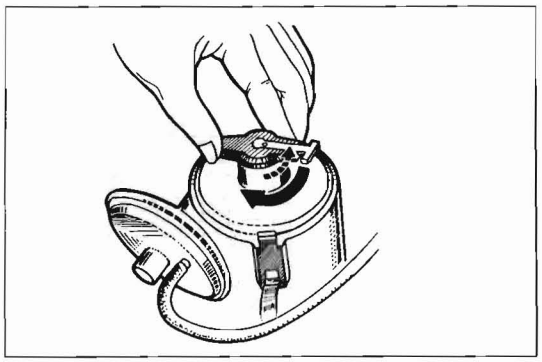
Set the engine revolution at idle speed and align the timing marks by turning distributor body.

Ignition timing

7° BTDC (at idle speed)

The octane selector must be set at standard position.

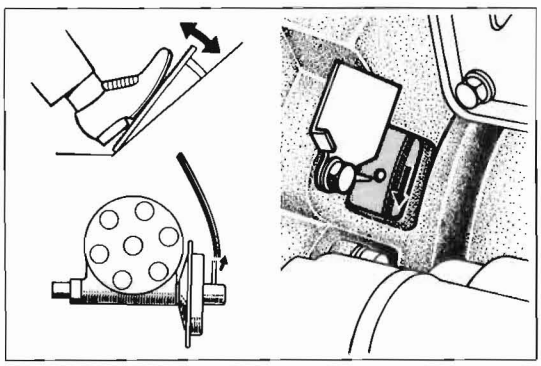
Fig. 2-29



GOVERNOR OPERATIONAL INSPECTION

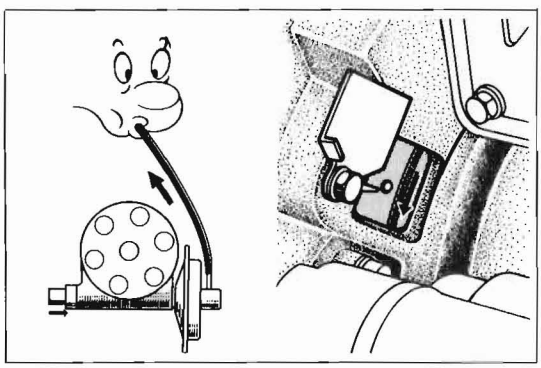
1. Rotor should return quickly when turned clockwise by hand and released.
2. Rotor should not be excessively loose.

Fig. 2-30



3. Start the engine and disconnect the vacuum hose from the distributor. The timing mark should vary in accordance with the opening and closing of throttle valve.

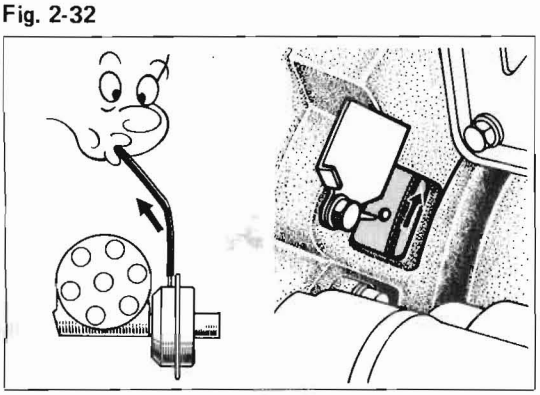
Fig. 2-31



VACUUM ADVANCE OPERATIONAL INSPECTION (Except for USA)

Disconnect the distributor vacuum hose and suck the hose with mouth while the engine is idling. Check if timing advances when sucked.

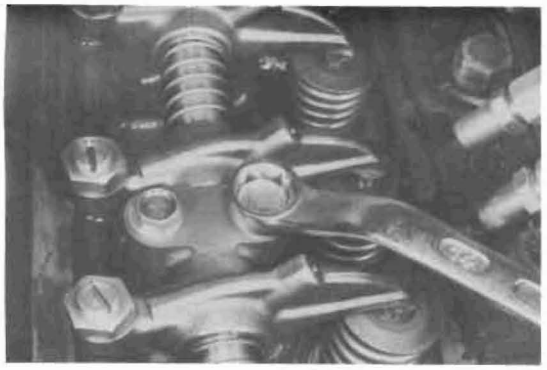
Fig. 2-32



VACUUM RETARD OPERATIONAL INSPECTION (For USA)

Disconnect the distributor vacuum hose and suck the hose with mouth while the engine is idling. Check if timing retards when sucked.

Fig. 2-33



VALVE CLEARANCE

1. Check the coolant temperature.
   80°C (180°F)
2. Tighten the rocker support bolts to specified torque.

   Torque

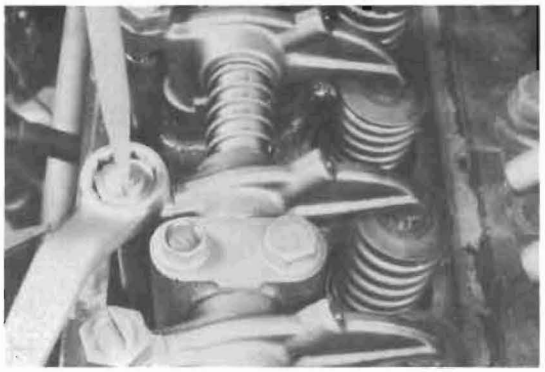
   3–4.5 kg-m (22–33 ft-lb)

Fig. 2-34

3. Make adjustment.
   (1) Set the engine at idle speed, and check the valve clearance. Adjust if necessary. Valve clearance (Hot)

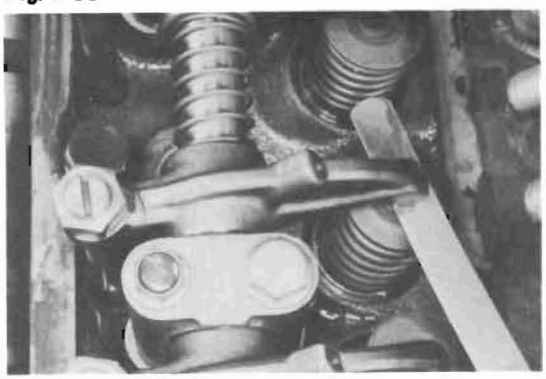
Intake	**0.20 mm (0.008 in)**
Exhaust	**0.35 mm (0.014 in)**

Fig. 2-35



   (2) Retighten the lock nuts securely after adjustment.

Fig. 2-36

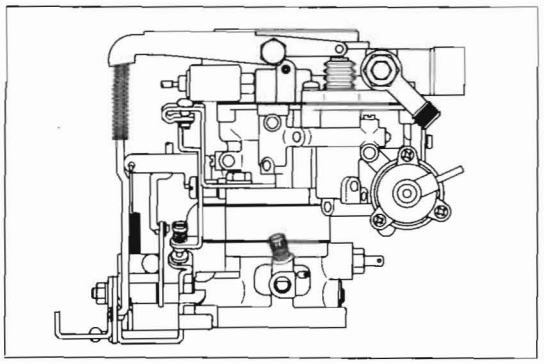


   (3) Recheck the valve clearance.

CARBURETOR

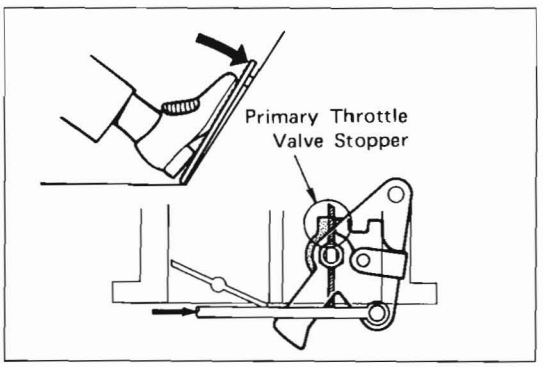
LOOSENESS and OPERATIONAL CHECK

Fig. 2-37



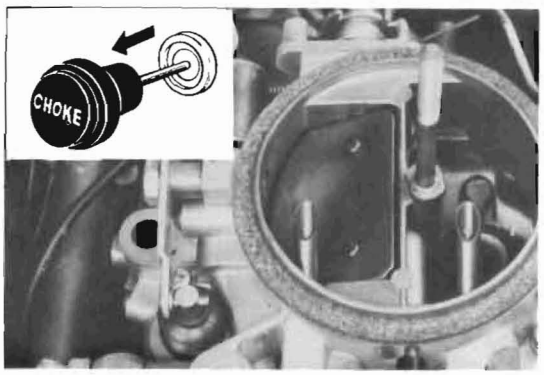
1. The various set screw, plugs and union bolts should be in properly tightened and correctly installed state.
2. The links should be free from excessive wear, the snap rings (ring pins) should all be present, and the throttle shaft should not be worn.

Fig. 2-38



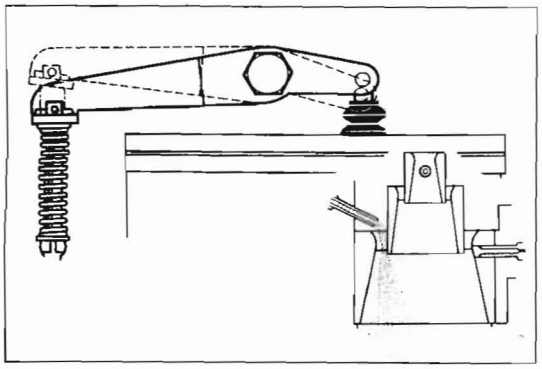
3. Check throttle valve full open.
   The throttle valve should open fully when the accelerator pedal is stepped all the way down.

Fig. 2-39



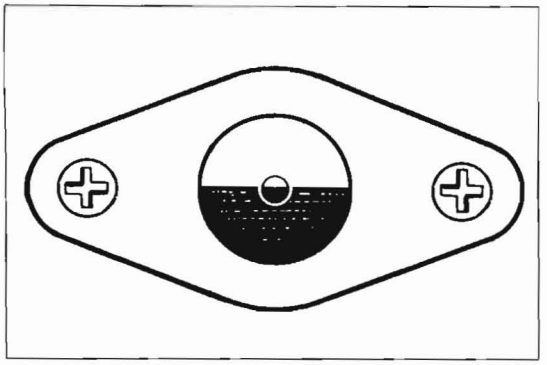
4. Check choke valve action.
   (1) Choke valve should be fully closed when the choke button is fully pulled.
   (2) At this time, open choke valve with finger and release it. It should close fully.

Fig. 2-40



5. Check the accelerating pump operation. Gasoline should shoot out with good force from the jet when the throttle valve is opened.

Fig. 2-41



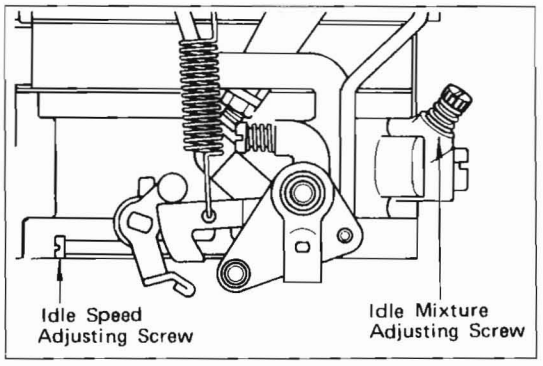
6. Check float level.
   Float level is satisfactory if the fuel level is up to the standard line when the engine is idling. For adjustment, refer to carburetor section.

INITIAL IDLE SPEED

Check the following items beforehand.

1. Coolant temperature –
   Approximately 80°C (180°F)
2. Choke valve – Full open
3. Accessory parts (wipers, heater, lights, air conditioner, etc.,)
   – All switched off.
4. Vacuum lines – All lines connected.
5. Ignition timing – Initial set position
6. Transmission – In "N"

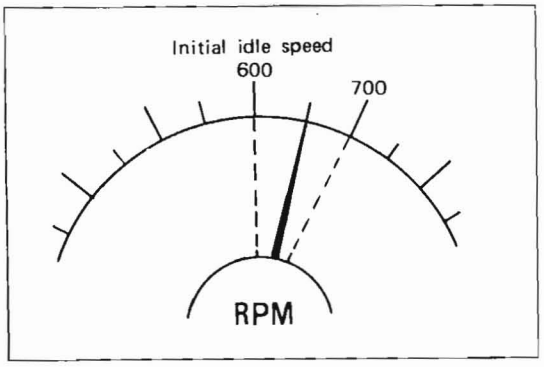
Fig. 2-42



BEST IDLE (Except for USA and ECE)

1. Set to 650 rpm by turning the idle speed adjusting screw.

Fig. 2-43



2. Set to the max. speed or max. vacuum by turning the idle mixture adjusting screw.
3. Repeat the above adjustments until the specified rpm and maximum vacuum will be obtained.

Idle speed	**650 ± 50 rpm**
Vacuum	**420 mmHg (16.5 inHg)**

Fig. 2-44

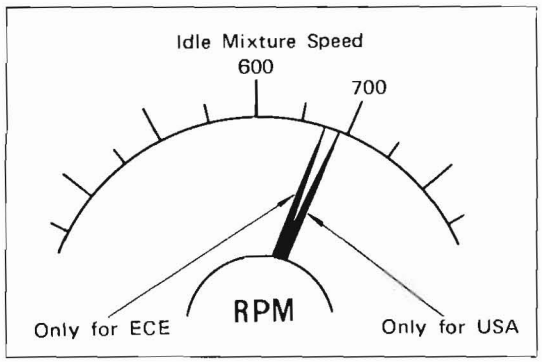


Fig. 2-45

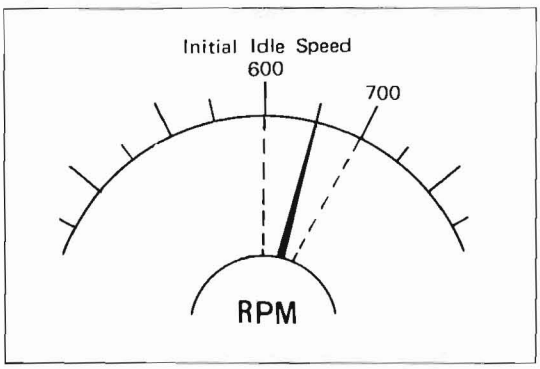


Fig. 2-46

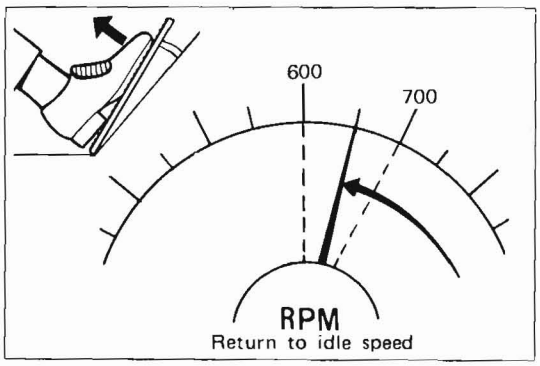
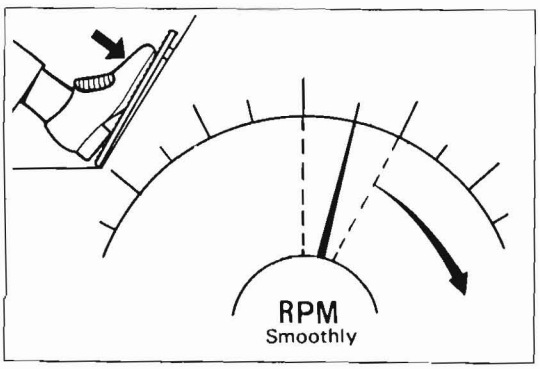


Fig. 2-47



LEAN DROP IDLE (Only for USA and ECE)

1. Set to the maximum speed by turning the idle mixture adjusting screw.
2. Set to the idle mixture speed by turning the idle speed adjusting screw.
3. Keep on repeating the adjustments (1) and (2) until the maximum speed will not rise any further no matter how much the idle mixture adjusting screw is adjusted before moving to the next step.

   Idle mixture speed

   690 rpm For USA
   675 rpm For ECE

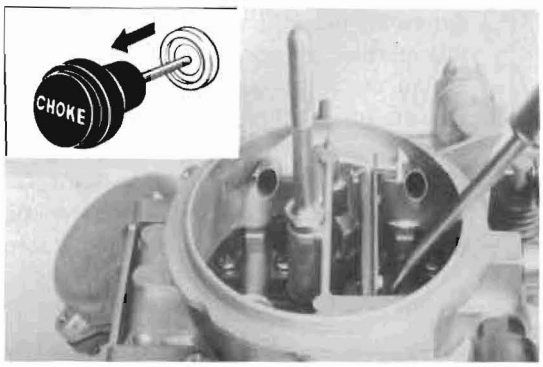
4. Set to the initial idle speed by screwing in the idle mixture adjusting screw.

   Initial idle speed **650 ± 50 rpm**

5. Check if the engine returns to idle speed when suddenly and slowly accelerated.

6. Check the engine condition.
   Opening throttle valve gradually should cause engine to speed up smoothly in relation to amount of valve opening.

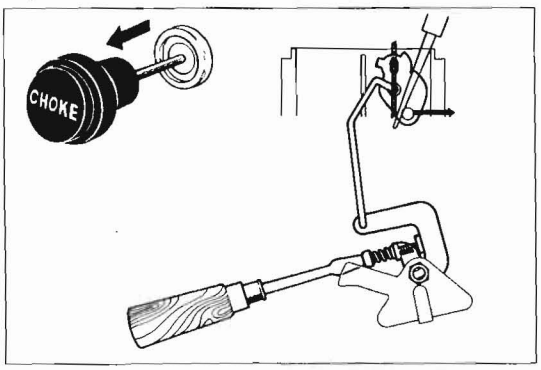
Fig. 2-48



FAST IDLE

1. Pull the choke button fully.
2. Open choke valve with a screwdriver and start the engine.

Fig. 2-49

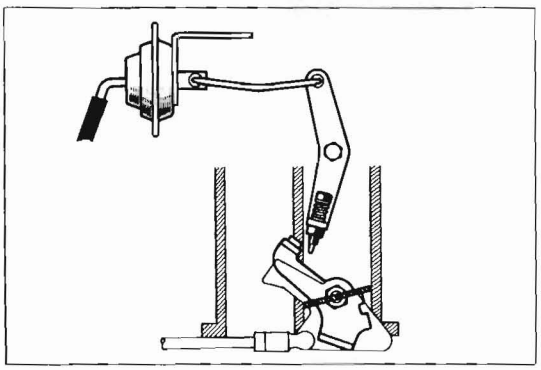


3. Set to the specified rpm by turning the fast idle adjusting screw.

Fast idle speed **1800 rpm**

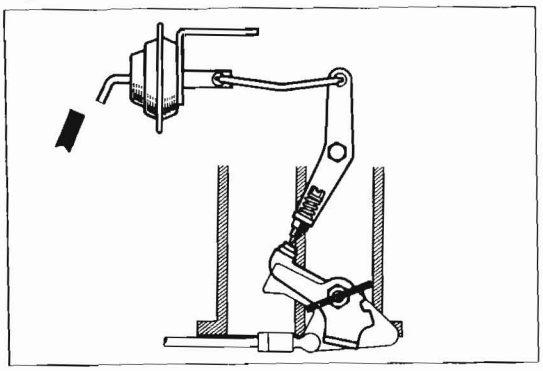
THROTTLE POSITIONER

Fig. 2-50



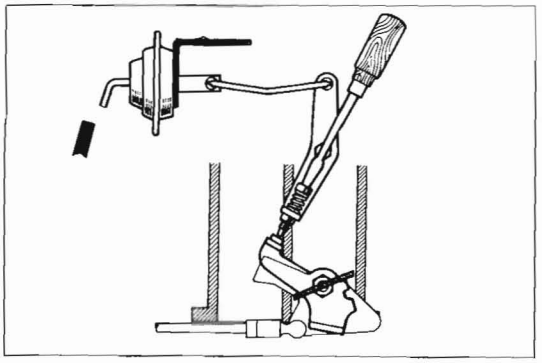
1. Warm up the engine and check the idle speed.

Fig. 2-51



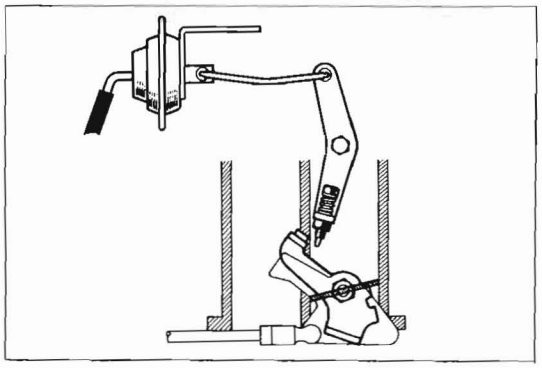
2. Disconnect the TP diaphragm hose.
3. Open throttle valve slightly and release it. TP adjusting screw should hook on to the throttle valve lever.

Fig. 2-52



4. Check the engine speed.
   If not at specified rpm, adjust by turning the TP adjusting screw.
   TP setting speed 1200 rpm

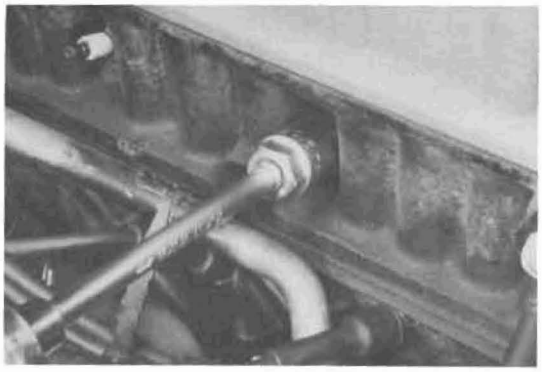
Fig. 2-53



5. Reconnect the TP diaphragm hose.
6. Open throttle valve slightly and release it. Engine should return to idle speed.

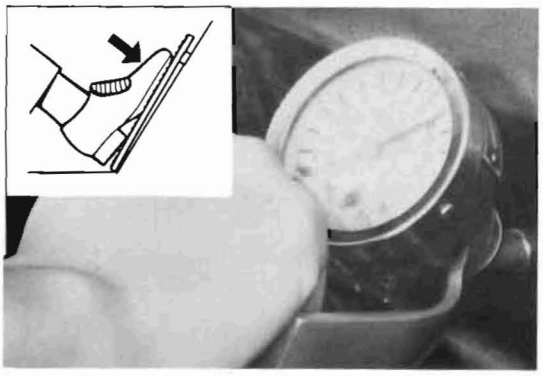
COMPRESSION PRESSURE

Fig. 2-54



1. Warm up the engine.
2. Remove all spark plugs.
3. Disconnect the high tension cord from ignition coil to cut-off the secondary circuit.

Fig. 2-55



4. Insert a compression gauge into the spark plug hole, open the throttle valve fully, and measure the compression pressure while cranking the engine with starter motor.
   Compression Pressure
   10.5 kg/cm² (149.3 psi)
   Limit
   8.0 kg/cm² (113.8 psi)
   (at 200 rpm)

MEMO

ENGINE SERVICE

Page

CYLINDER HEAD 3- 4

Includes: Cylinder Head, Valve and Spring
Rocker Arm, Manifold

DISASSEMBLY 3- 4
INSPECTION & REPAIR 3- 7
ASSEMBLY 3-15

TIMING GEAR 3-19

Includes: Valve Lifter, Camshaft
Timing Gear

DISASSEMBLY 3-19
INSPECTION & REPAIR 3-22
ASSEMBLY 3-25

CYLINDER BLOCK 3-29

Includes: Cylinder Block, Piston and Ring
Crankshaft and Bearing
Cylinder Boring, Camshaft Bearing
Input Shaft Bearing
Crankshaft Rear Oil Seal

DISASSEMBLY 3-29
INSPECTION & REPAIR 3-32
ASSEMBLY 3-40

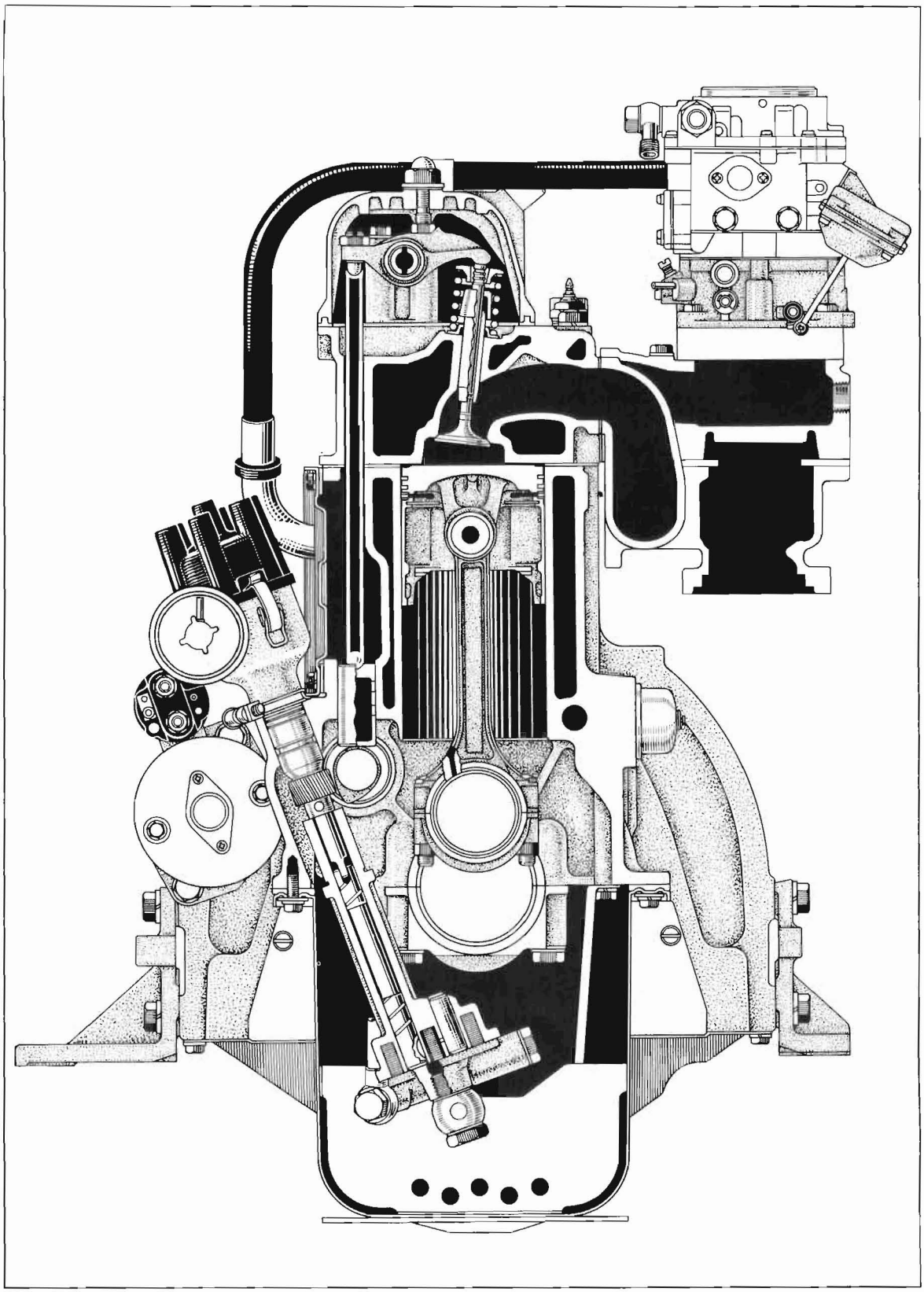


Fig. 3-1

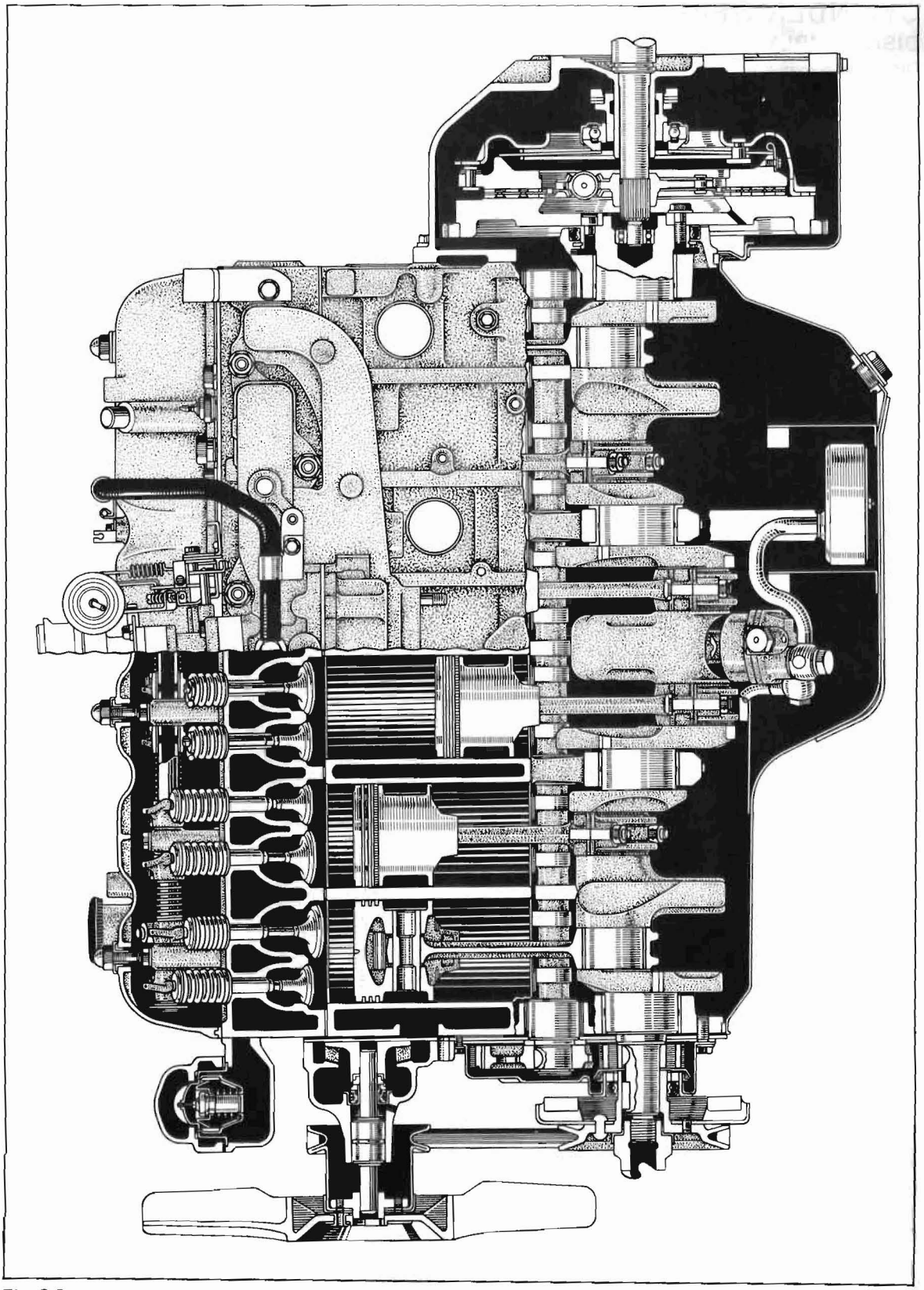
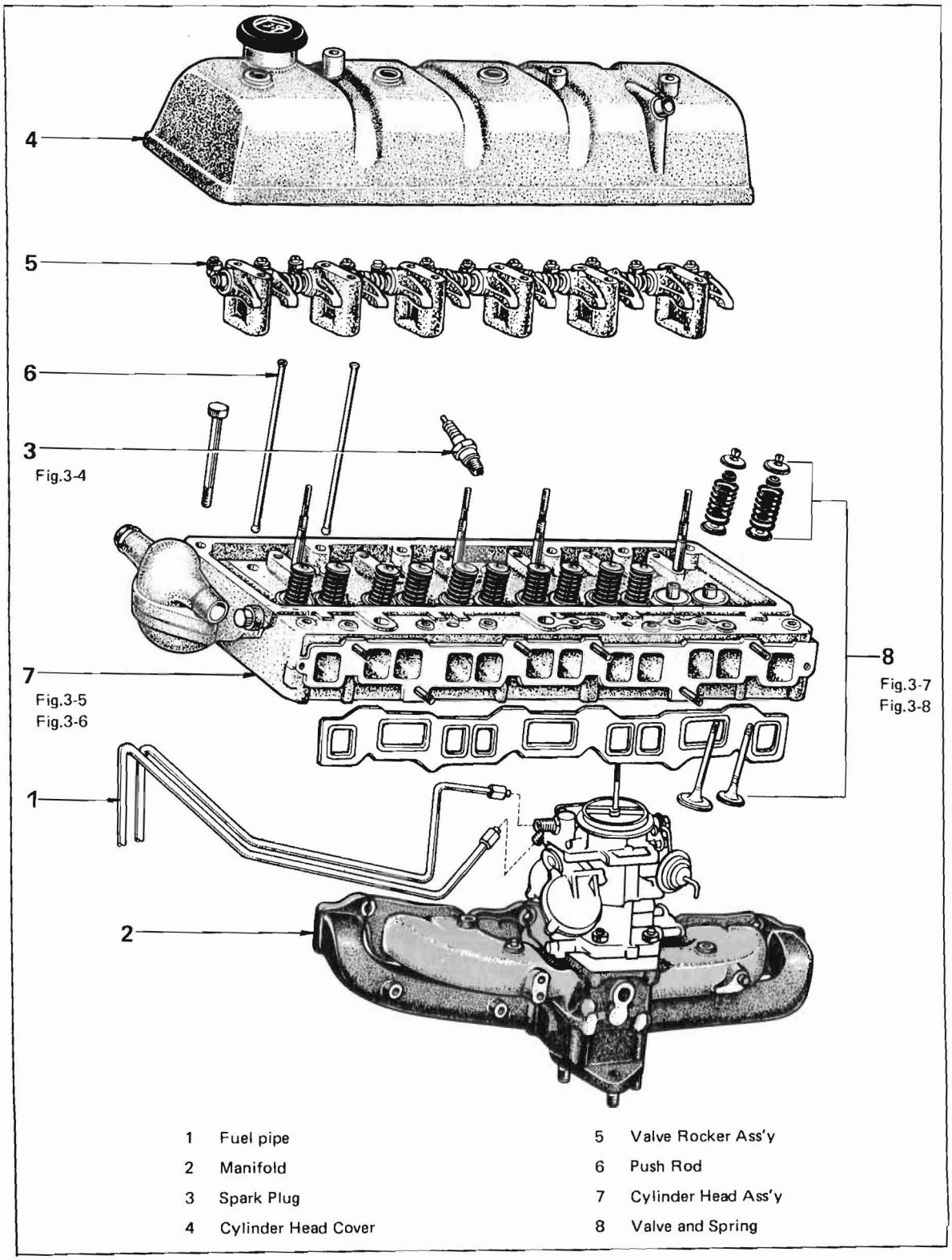


Fig. 3-2

CYLINDER HEAD

DISASSEMBLY

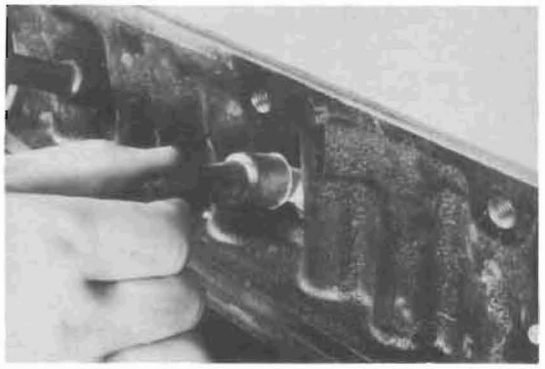
Disassemble in numerical order.



1	Fuel pipe	5	Valve Rocker Ass'y
2	Manifold	6	Push Rod
3	Spark Plug	7	Cylinder Head Ass'y
4	Cylinder Head Cover	8	Valve and Spring

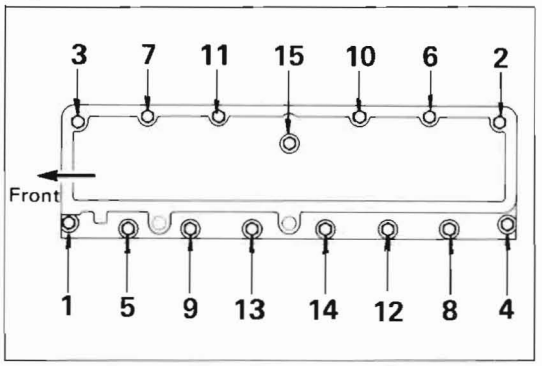
Fig. 3-3

Fig. 3-4



Remove carefully plug cords by pulling rubber boot.

Fig. 3-5

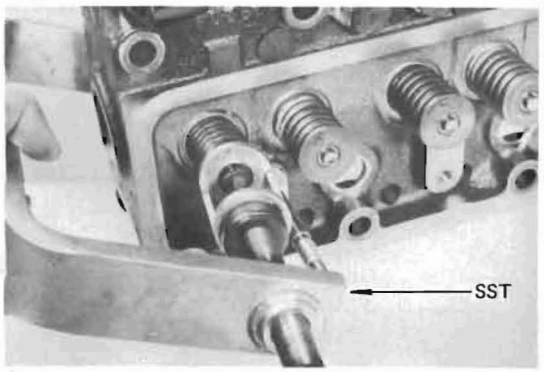


Gradually loosen cylinder head bolts in two to three stages in the sequence as shown.

Fig. 3-6

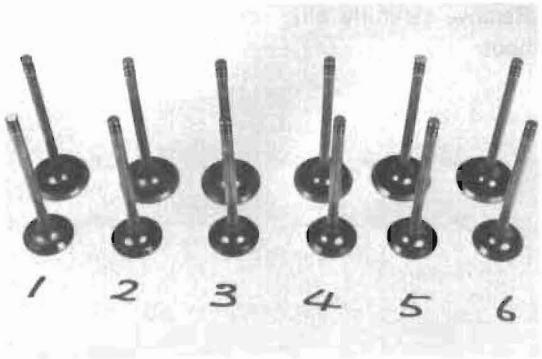
If difficult to lift up cylinder head, insert a screw driver into the notch and pry off as shown.

Fig. 3-7



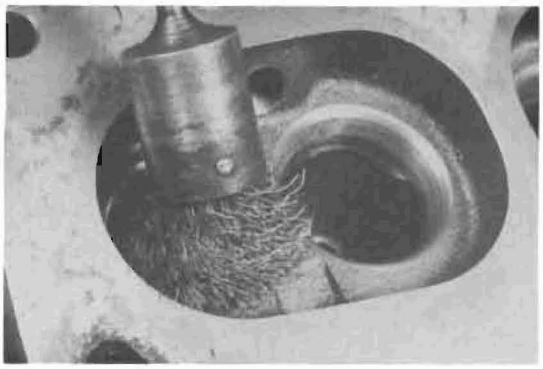
Compress the valve spring with SST [09202-43011].

Fig. 3-8



⚠ Keep valves in order.

Fig. 3-9

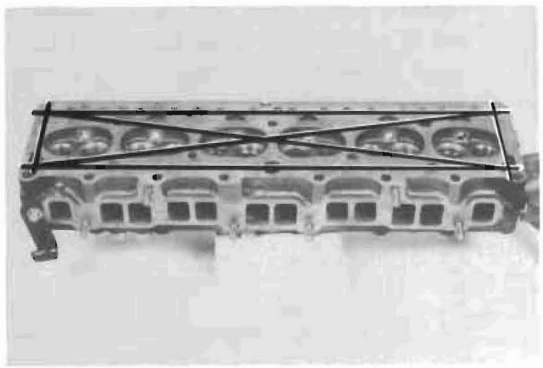


INSPECTION & REPAIR

Cylinder Head

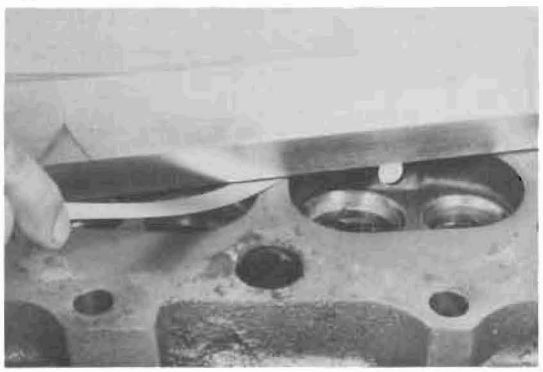
1. Clean combustion chamber and remove all gasket material from manifold and head surface.

Fig. 3-10



2. Using a precision straight edge, check head surface for flatness.

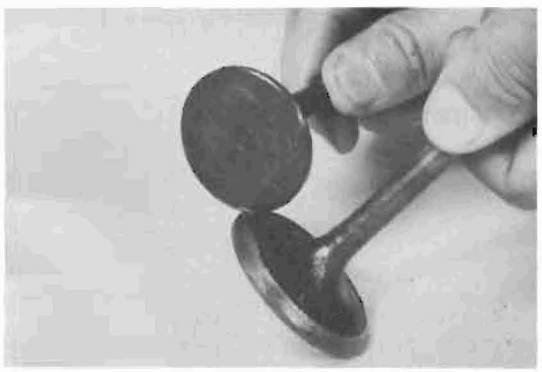
Fig. 3-11



3. If warpage exceeds limit, correct by machining or replace head.

Head surface warpage limit
0.15 mm (0.0059 in)

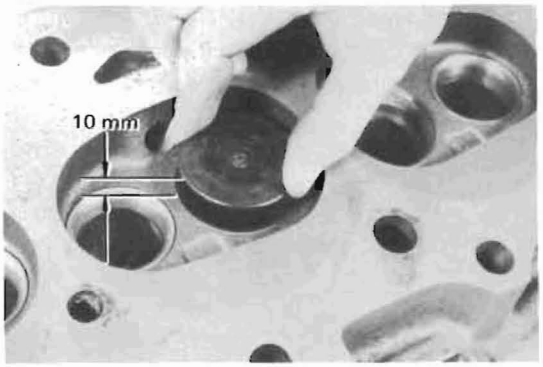
Fig. 3-12



Valve, Guide and Seat

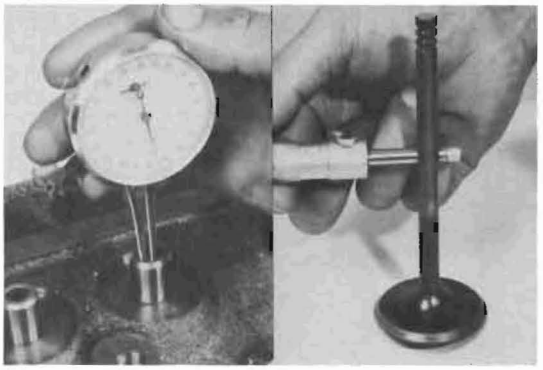
1. Clean valves.

Fig. 3-13



2. Quick-check valve stem and guide wear by inserting correct valve in guide and moving valve as shown. If movement exceeds 0.25 mm (0.01 in) for intake and exhaust, additional measurements are necessary.

Fig. 3-14

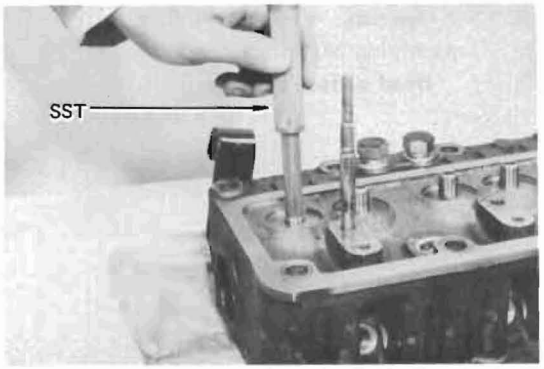


3. Measure valve stem and guide. Measure inside diameter of valve guide and valve stem diameter. Subtract stem measurement. Replace guide and valve if clearance exceeds limit.

Clearance limit

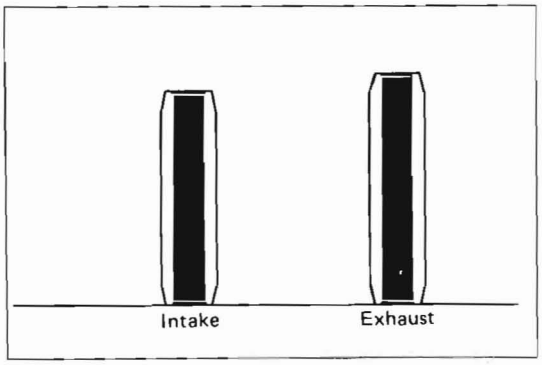
Intake	**0.10 mm (0.0039 in)**
Exhaust	**0.12 mm (0.0047 in)**

Fig. 3-15



4. Using SST [09201-60011], drive out guide from the top end toward the combustion chamber.

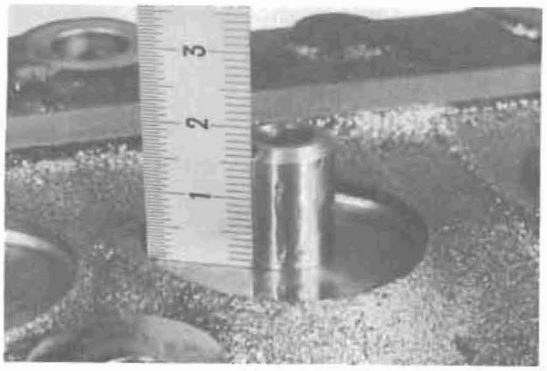
Fig. 3-16



There are two types of valve guides and lengthes are below.

Intake :	**54 mm (2.13 in)**
Exhaust :	**59 mm (2.32 in)**

Fig. 3-17



5. Using SST [09201-60011], drive in new guide until its end projects from cylinder head the distance noted below.

Projection distance

17 mm (0.67 in)

Fig. 3-18

6. Using a sharp 8 mm reamer, ream guide to obtain specified clearance.

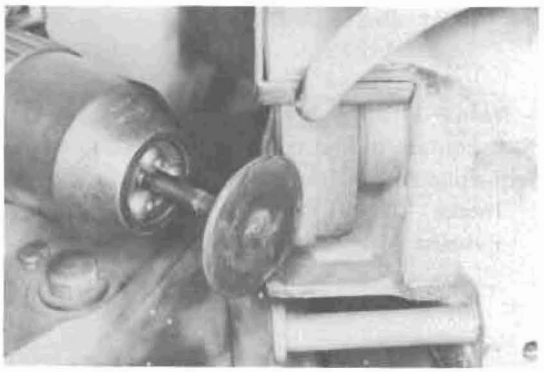
Intake

0.03-0.06 mm (0.0012-0.0024 in)

Exhaust

0.04-0.07 mm (0.0016-0.0028 in)

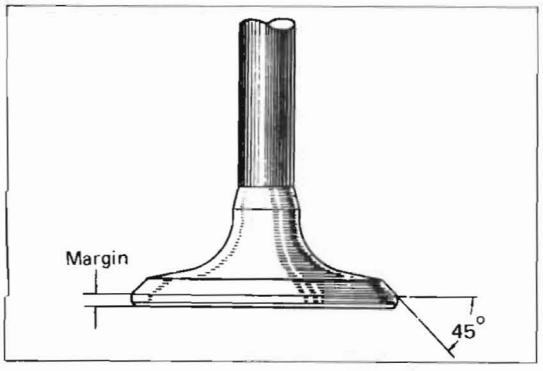
Fig. 3-19



7. Grind all valves. Remove only enough metal to remove pits and carbon.

Valve face angle : 45°

Fig. 3-20



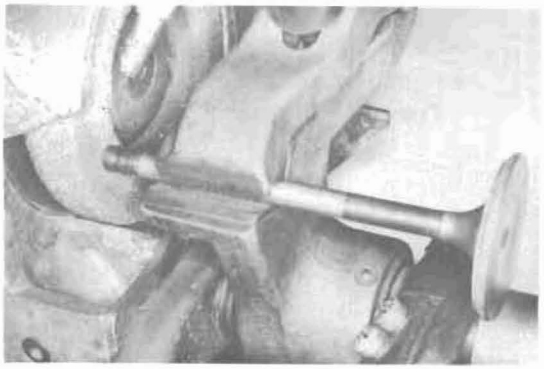
8. Check margin.
If valve head margin is less than specification, replace valve.

Margin limit

Intake 0.8 mm (0.031 in)

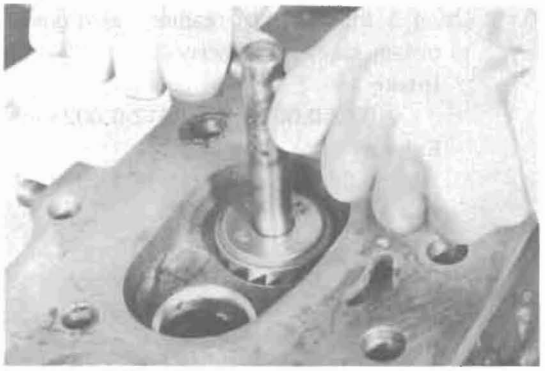
Exhaust 1.0 mm (0.039 in)

Fig. 3-21



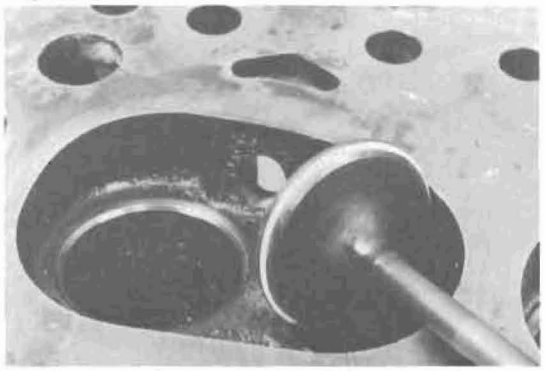
9. If valve stem tip has been worn by rocker arm, resurface with valve grinder.
   Do not grind more than 0.5 mm (0.02 in).

Fig. 3-22



10. Resurface valve seats with 45° carbide cutter.
    Remove only enough metal to clean seat.

Fig. 3-23



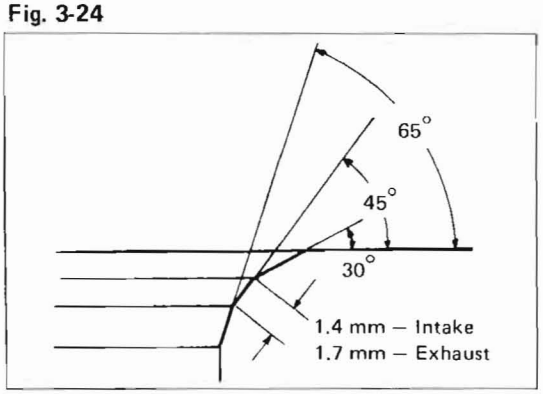
11. Coat valve face with prussion blue or white lead. Locate contact point on valve by rotating valve against seat.

– Note –

Seat contact should be in middle of valve face with following width:

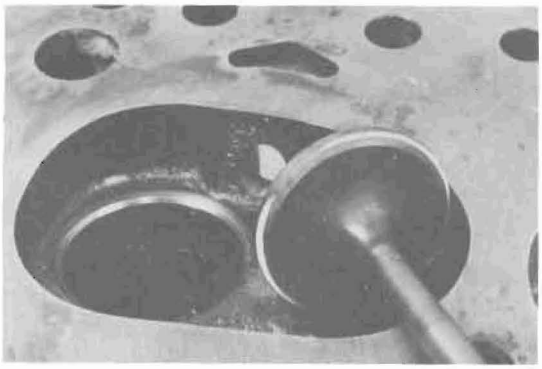
Intake	**1.4 mm (0.055 in)**
Exhaust	**1.7 mm (0.067 in)**

Fig. 3-24



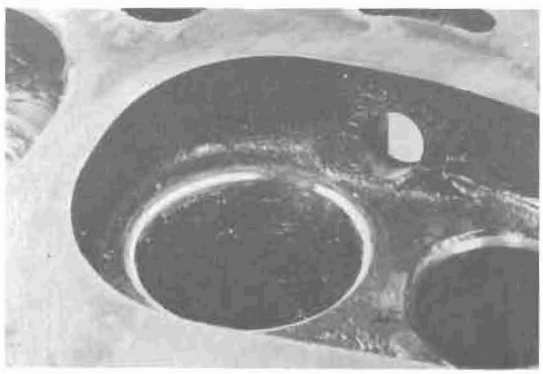
12. Correct seat position.
    To correct seating that is too high, use 30° and 45° cutters. If seating is too low, use 65° and 45° cutters.

Fig. 3-25



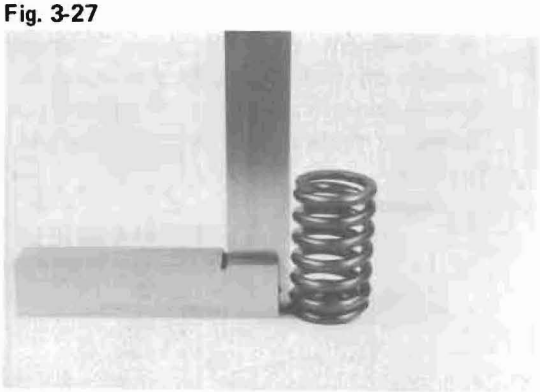
13. Check valve concentricity.
Lightly coat seat with prussian blue. Install valve and rotate. If blue appears 360° around face, valve stem and face are concentric. If not, replace valve.

Fig. 3-26



14. Check seat/guide concentricity.
Apply a light coat of prussian blue on valve face. Install and rotate valve. If blue appears 360° around valve seat, guide and seat are concentric. If not, recut seat.

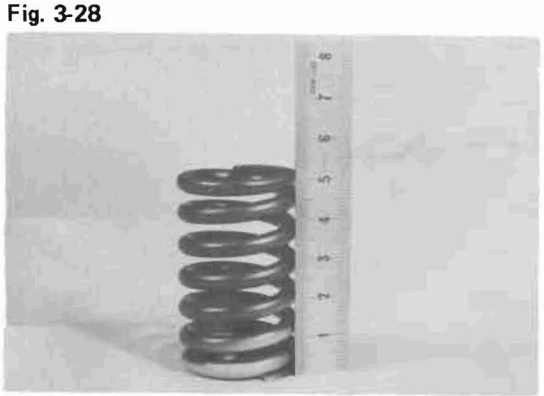
Fig. 3-27



Valve Spring

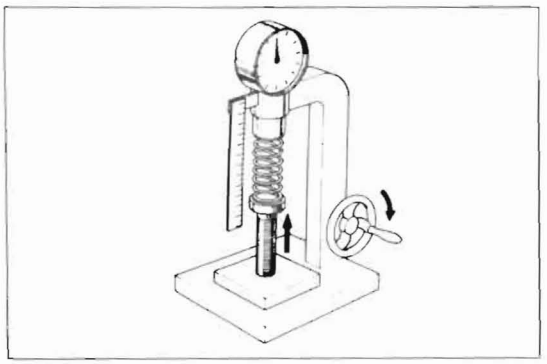
1. Check squareness of valve springs with steel square. If spring is out of square more than limit, replace.
Limit (intake and exhaust)
2 mm (0.079 in)

Fig. 3-28



2. Measure free height of all springs.
Replace any spring that is out of specification.
Free height **51.5 mm (2.028 in)**

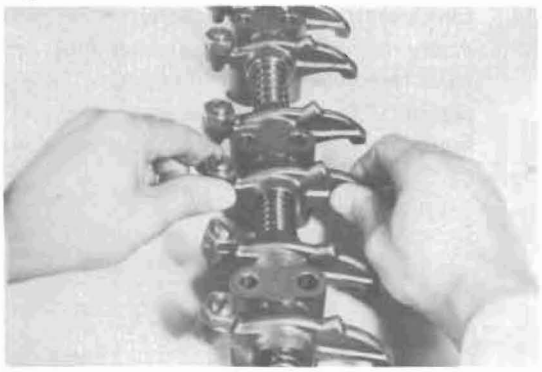
Fig. 3-29



3. Using a spring tester, measure tension of each spring at the specified installed height. Replace any spring that does not meet specification.

Limit 27 kg (59.5 lb)
Standard 32.5 kg (71.6 lb)

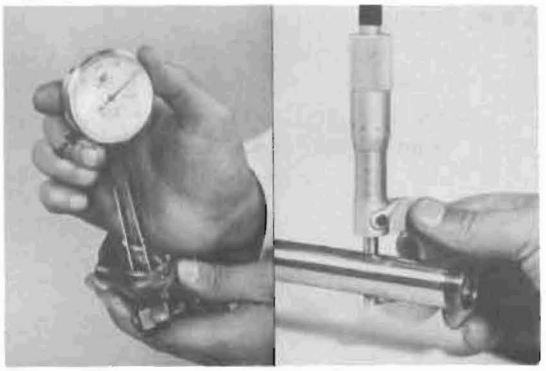
Fig. 3-30



Rocker Arm and Shaft

1. Check rocker arm to shaft clearance by moving rocker arm as shown. Little or no movement should be indicated. If movement is felt, disassemble and inspect.

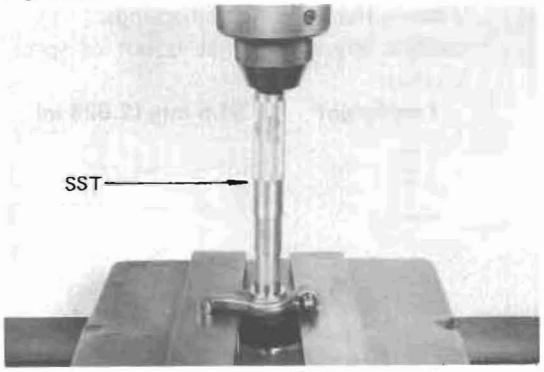
Fig. 3-31



2. If movement was felt above, measure rocker oil clearance with dial indicator and outside micrometer. If clearance is excessive, replace rocker arm bushings and/or shaft.

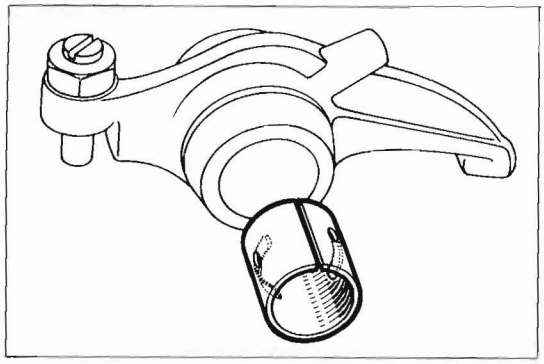
Clearance
0.01-0.04 mm (0.0004-0.0016 in)

Fig. 3-32



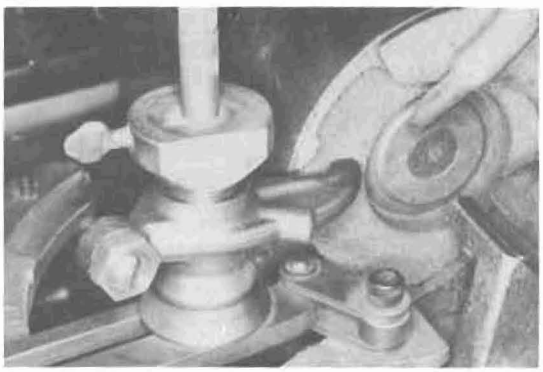
3. To remove the rocker arm bushing, use SST [09222-30010].

Fig. 3-33



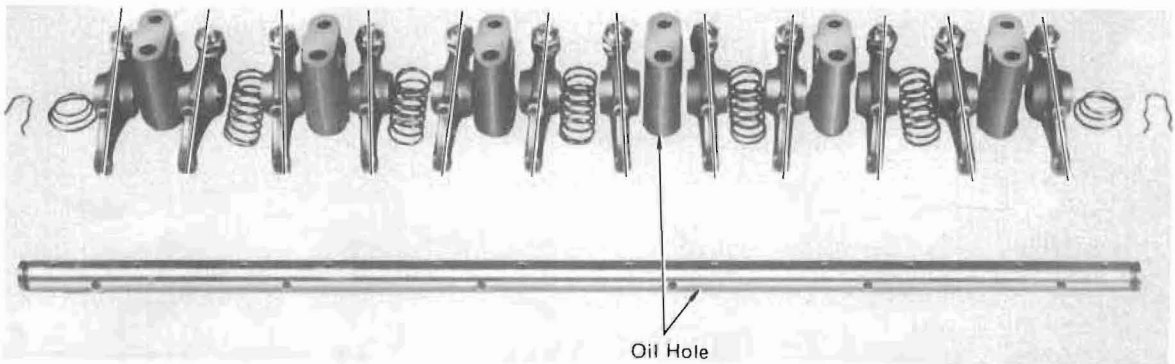
4. When assembling bushing, align oil hole with that of the rocker arm.
After assembling, ream bushing to obtain specified oil clearance.

Fig. 3-34



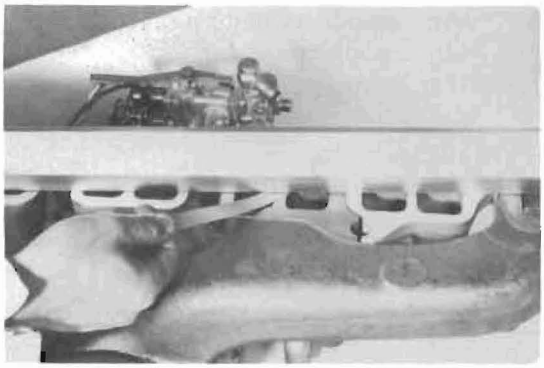
5. If the valve rocker arm surface contacting the valve stem end is worn excessively, replace the rocker arm. If only a light ridged wear, correct with valve refacer and oil stone.

Fig. 3-35



6. Assemble rockers and shaft.
There are two types of rocker arms and rocker supports. Boss of rocker supports should be pointed front. Oil hole is provided on fourth support. These should be assembled as shown.

Fig. 3-36

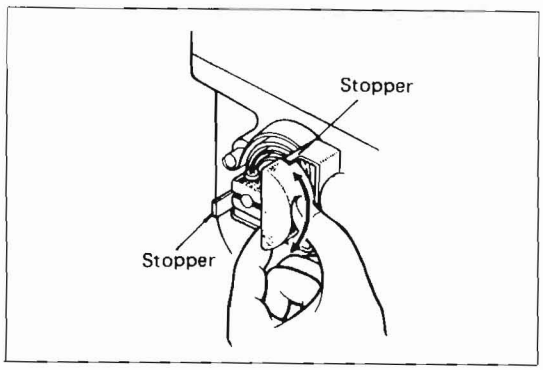


Manifolds

1. Inspect surfaces contacting cylinder head for warpage, and replace if warped over the limit.

Warpage limit **2 mm (0.08 in)**

Fig. 3-37

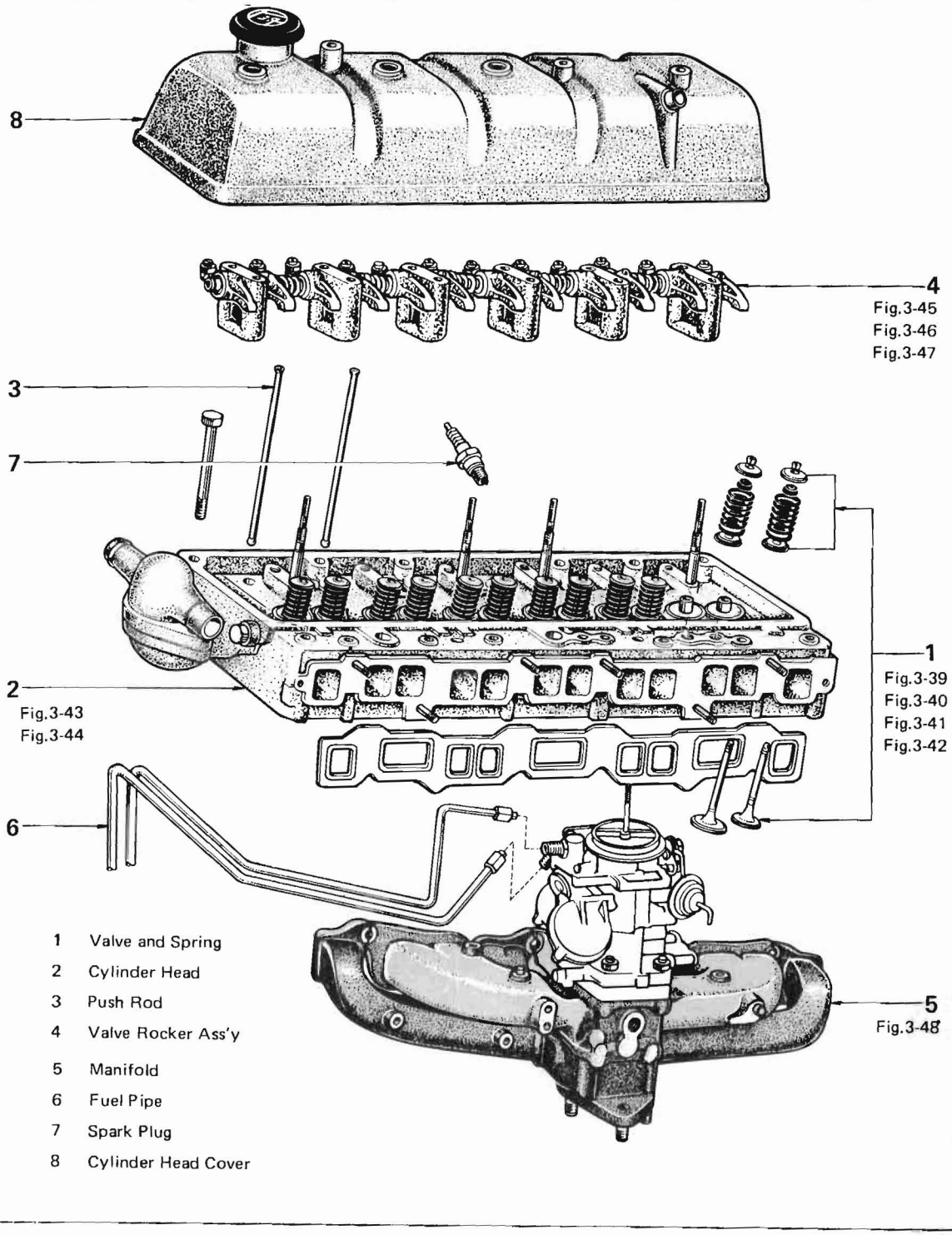


2. When the heat control valve shaft is turned by hand, the valve should move smoothly to the stopper, and when released, it should return to the other stopper.

ASSEMBLY

Assemble in numerical order.

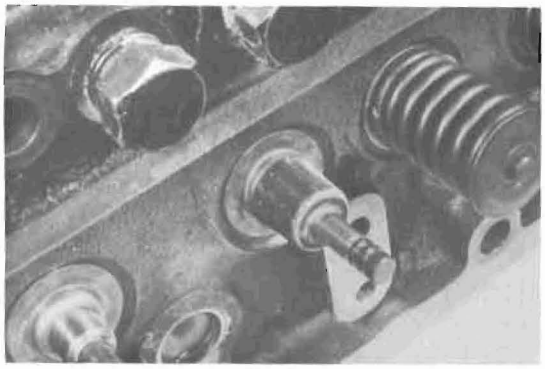
- **Thoroughly clean the parts to be assembled.**
- **Apply clean engine oil on the sliding and rotating surfaces of the parts before assembly.**



1 Valve and Spring
2 Cylinder Head
3 Push Rod
4 Valve Rocker Ass'y
5 Manifold
6 Fuel Pipe
7 Spark Plug
8 Cylinder Head Cover

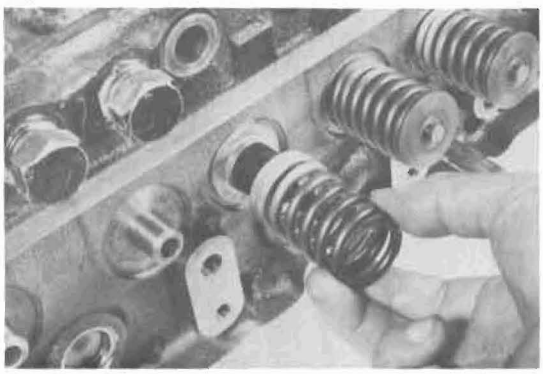
Fig. 3-38

Fig. 3-39



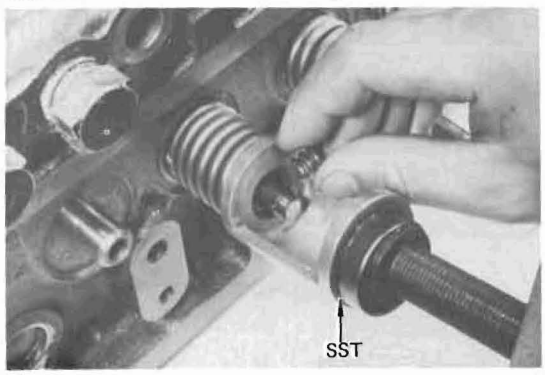
Assemble spring seat and oil seal as shown. The oil seal should be inserted until its end contacts spring seat top.

Fig. 3-40



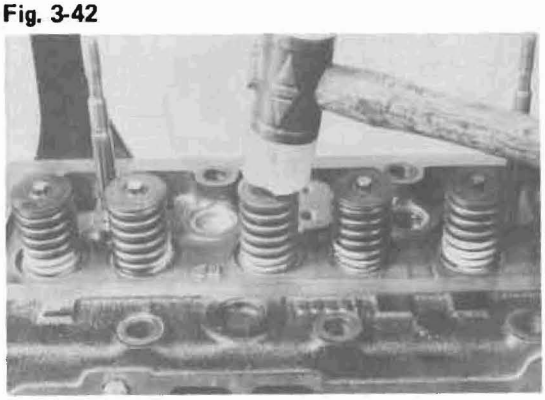
Install valve spring in direction as shown. Painted surface should be pointed toward the cylinder head.

Fig. 3-41



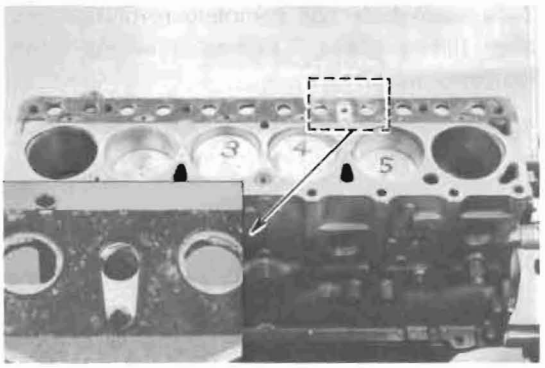
Compress the valve spring with SST [09202-43011] and install retainer locks.

Fig. 3-42



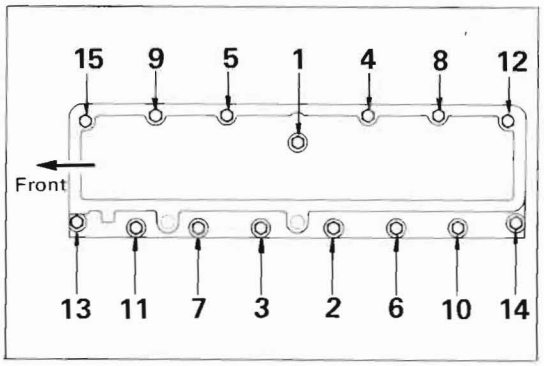
After assembling valve spring, tap stem lightly to assure proper fit.

Fig. 3-43



Put head gasket on cylinder block, mating oil hole as shown.

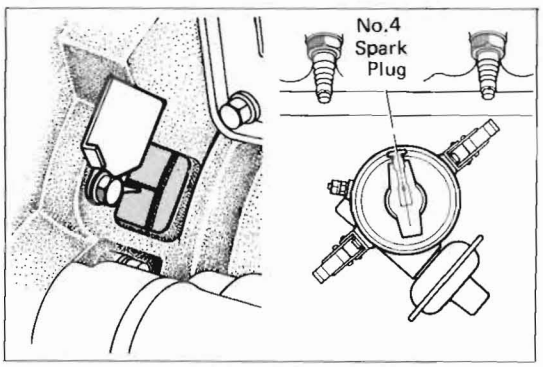
Fig. 3-44



Gradually tighten cylinder head bolts in two to three stages in the sequence as shown.

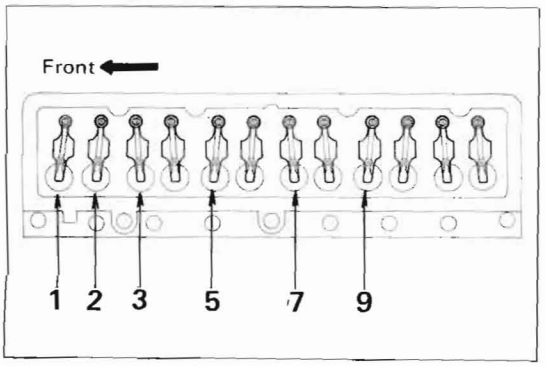
Torque **11.5-13.5 kg-m (83-98 ft-lb)**

Fig. 3-45



Set No. 1 cylinder to TDC/compression. Align Timing mark (groove) with pointer. The distributor rotor should face toward the position as shown.

Fig. 3-46

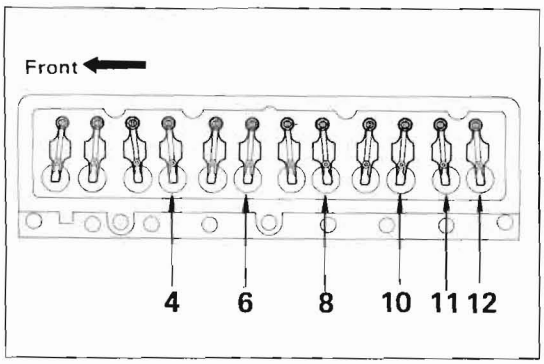


Adjust valve clearances indicated by arrows only.

Clearance (Hot)

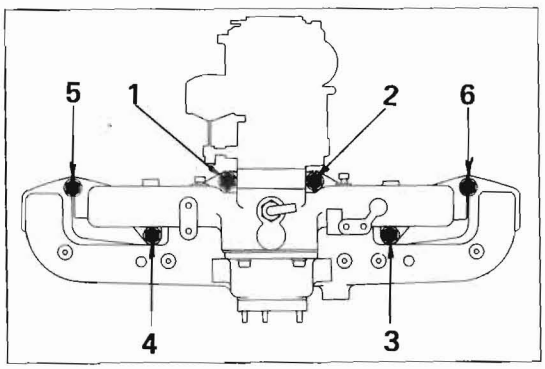
Intake	**0.20 mm (0.008 in)**
Exhaust	**0.35 mm (0.014 in)**

Fig. 3-47



Turn crankshaft one complete revolution and align timing marks. Adjust remaining valves indicated by arrows.

Fig. 3-48



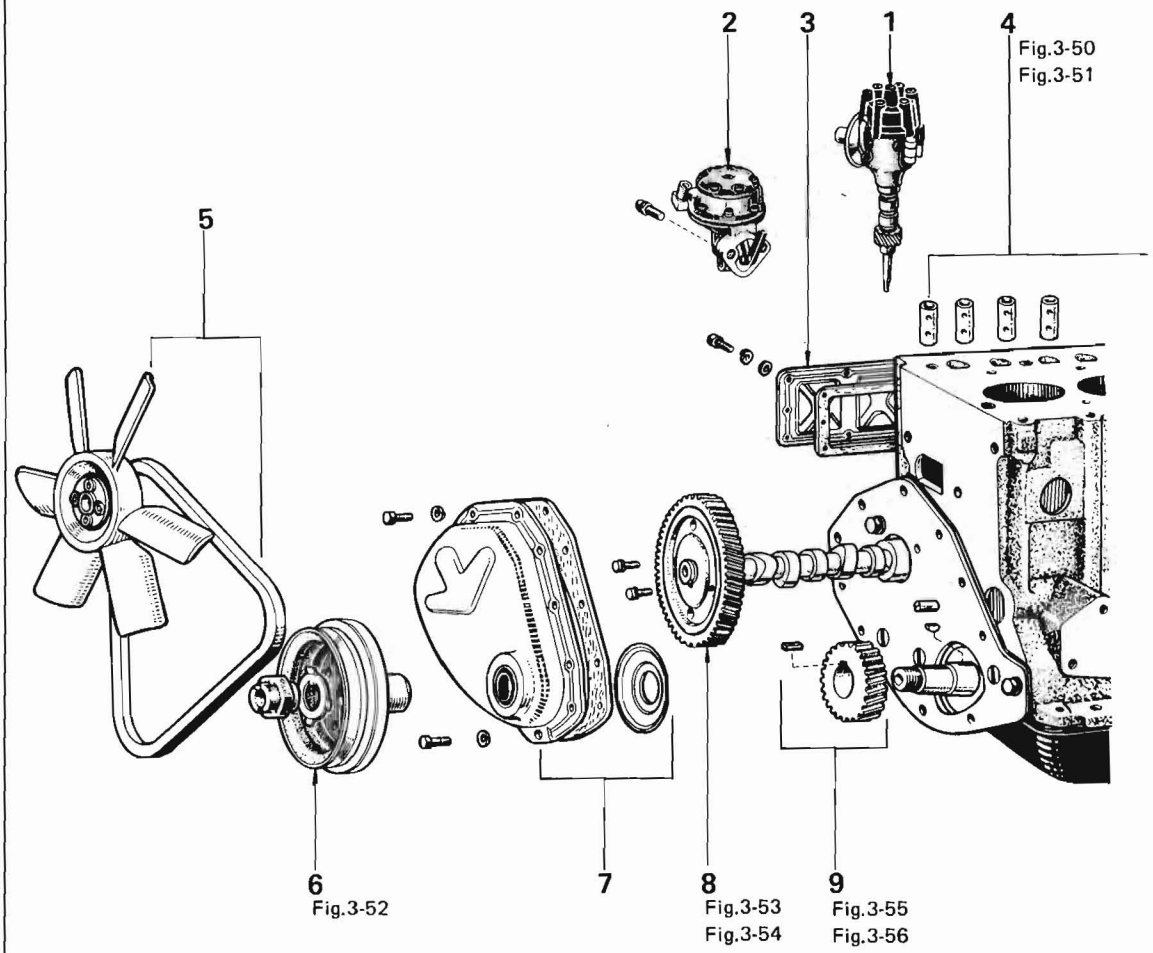
Tighten the manifold securing nuts in the sequence as shown.

Torque 3.9-5.1 kg-m (28-37 ft-lb)

TIMING GEAR

DISASSEMBLY

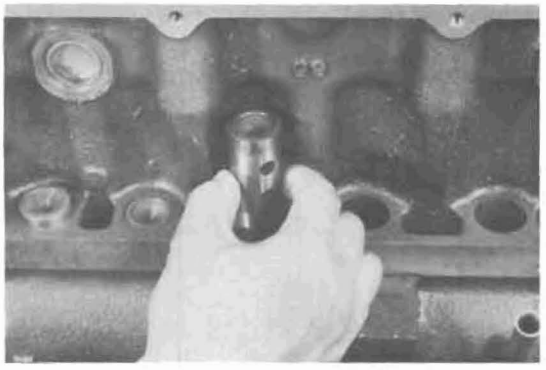
Disassemble in numerical order.



1 Distributor
2 Fuel Pump
3 Valve Lifter Cover
4 Valve Lifter
5 Fan and Belt
6 Crankshaft Pulley
7 Timing Gear Cover and Oil Slinger
8 Camshaft
9 Crankshaft Timing Gear

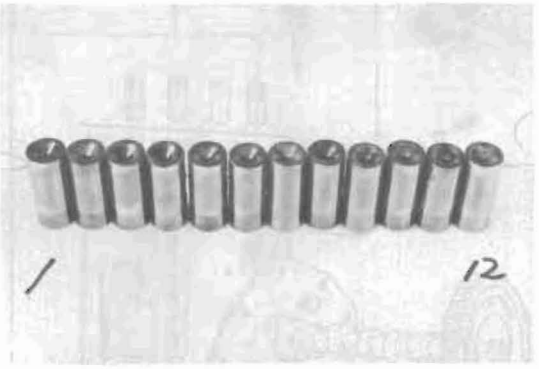
Fig. 3-49

Fig. 3-50



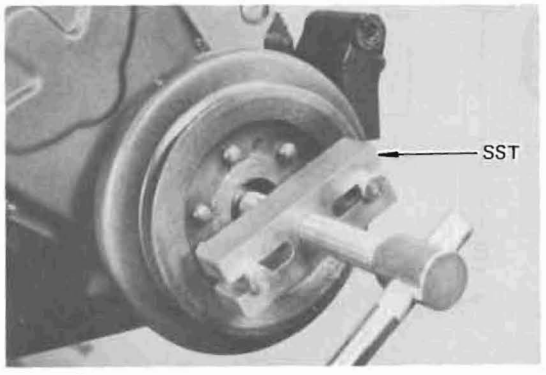
Pull out valve lifter.
Turn crankshaft to lift up lifters.

Fig. 3-51



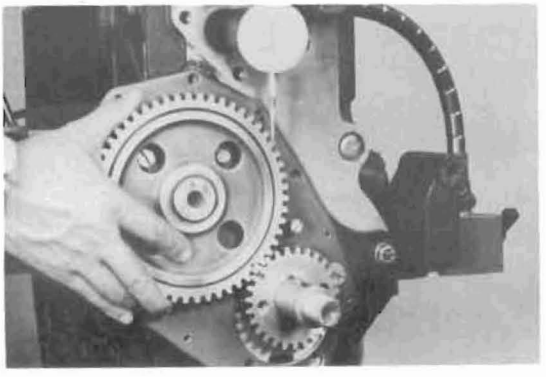
Keep lifters in order.

Fig. 3-52



Using SST [09213-60015], pull out crankshaft pulley.

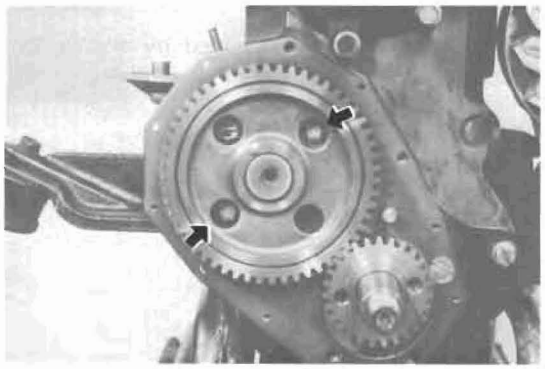
Fig. 3-53



Measure Timing gear backlash. If it exceeds limit, replace both cam and crank gears.

Backlash limit **0.2 mm (0.008 in)**
Standard
0.05-0.13 mm (0.0020-0.0051 in)

Fig. 3-54

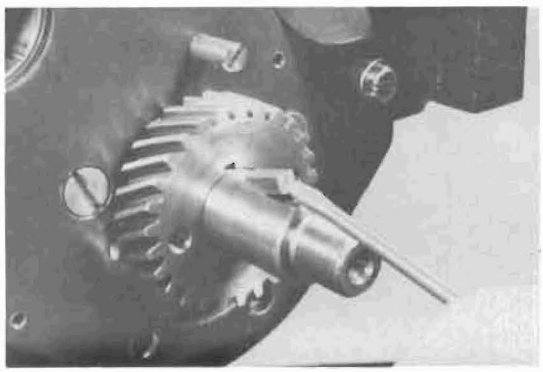


Remove two bolts indicated by arrows and slide out camshaft.

– Note –

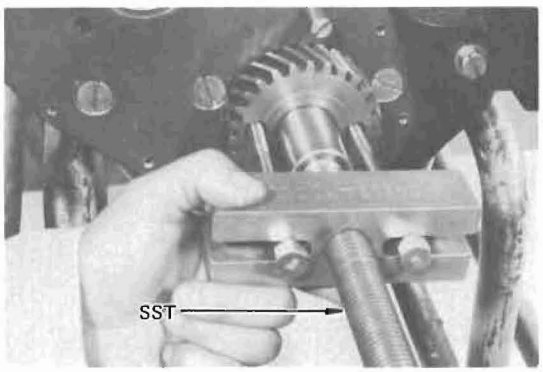
Take care not to damage camshaft bearing.

Fig. 3-55



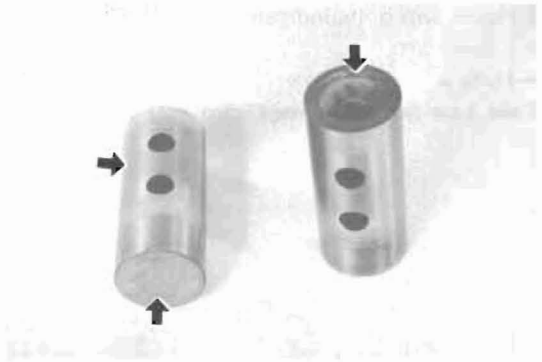
Remove pulley key from crankshaft before removing crankshaft gear.

Fig. 3-56



Using SST [09213-60015], pull out crankshaft gear.

Fig. 3-57

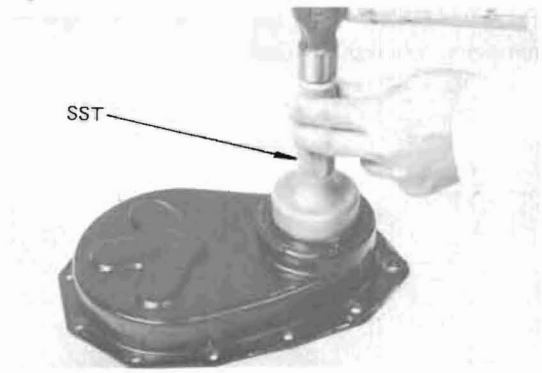


INSPECTION & REPAIR

Valve Lifter

Inspect lifter surfaces indicated by arrows for wear and pitting, and replace if necessary.

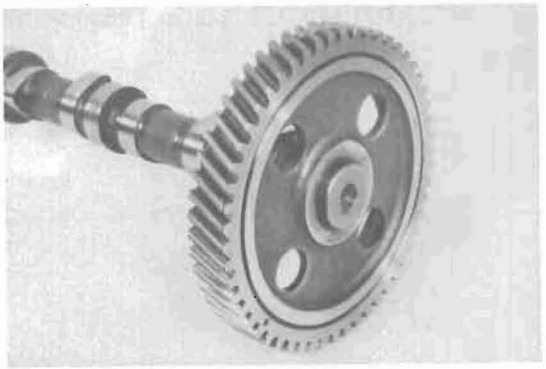
Fig. 3-58



Crankshaft Front Oil Seal

Inspect oil seal lip for wear and deformation. Replace oil seal using SST [09515-35010].

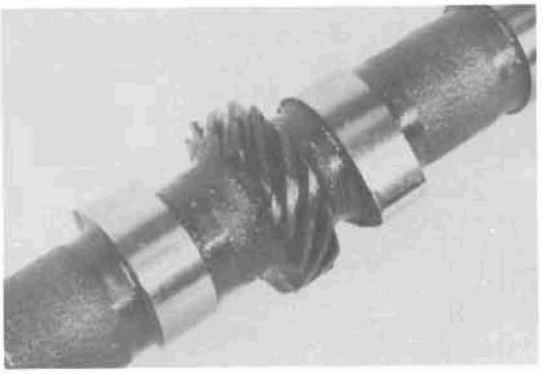
Fig. 3-59



Timing Gear

Inspect gear for cracks, wear and chipped teeth. If damaged, replace both timing gears.

Fig. 3-60



Camshaft

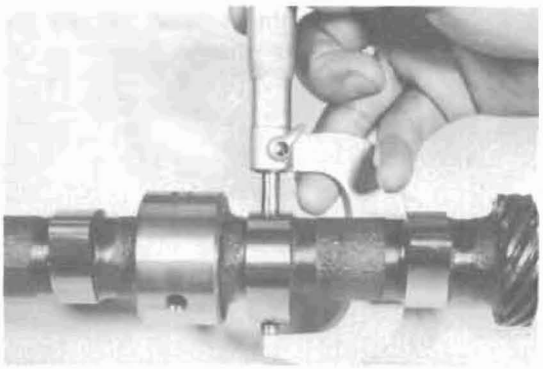
1. Inspect distributor drive gear. If damaged, replace, and also inspect distributor gear.

Fig. 3-61

2. Measure thrust clearance. If it exceeds limit, replace thrust plate.

Thrust clearance limit
0.2 mm (0.008 in)
Standard
0.09-0.15 mm (0.0035-0.0059 in)

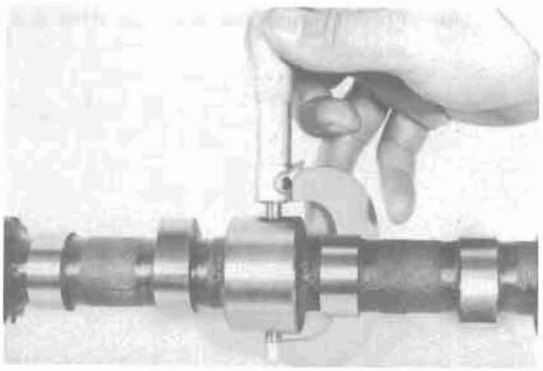
Fig. 3-62



3. Measure cam lobe height. If wear exceeds limit, replace camshaft.

Height limit Intake
38.0 mm (1.496 in)
Exhaust
37.9 mm (1.492 in)

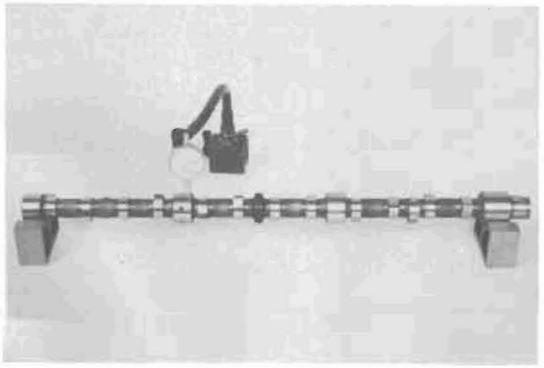
Fig. 3-63



4. Measure camshaft journal. If wear is excessive, camshaft should be reground or replaced.

Journal diameter (STD)
No.1 47.955-47.975mm(1.8880-1.8888 in)
No.2 46.455-46.475mm(1.8289-1.8297 in)
No.3 44.955-44.975mm(1.7699-1.7707 in)
No.4 43.455-43.475mm(1.7108-1.7116 in)
For u/s bearing, refer to page 3-38.

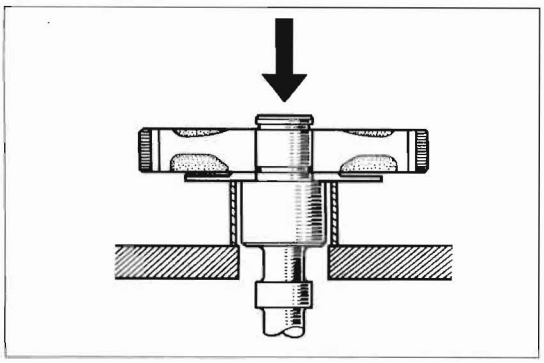
Fig. 3-64



5. Measure runout. If it exceeds limit, replace camshaft.

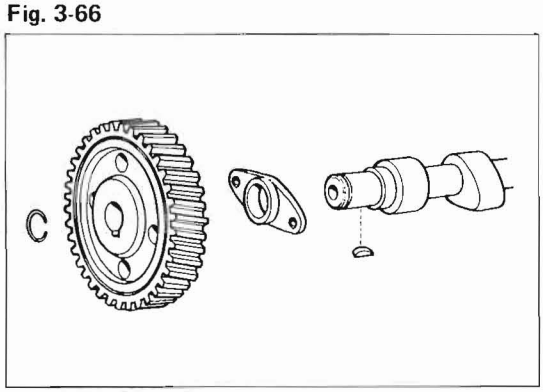
Runout limit 0.15 mm (0.0059 in)

Fig. 3-65



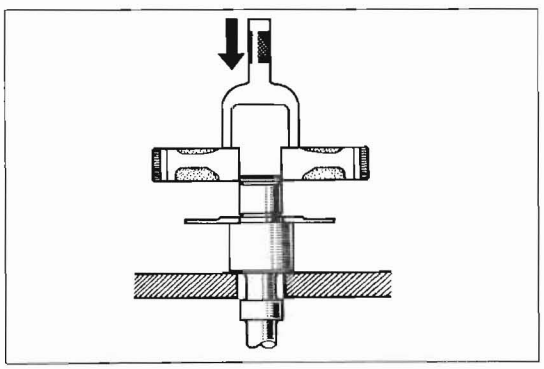
6. Camshaft gear replacement
   (1) Take out snap ring.
   (2) Press out camshaft as shown.

Fig. 3-66



(3) Assemble thrust plate and gear in direction as shown.

Fig. 3-67

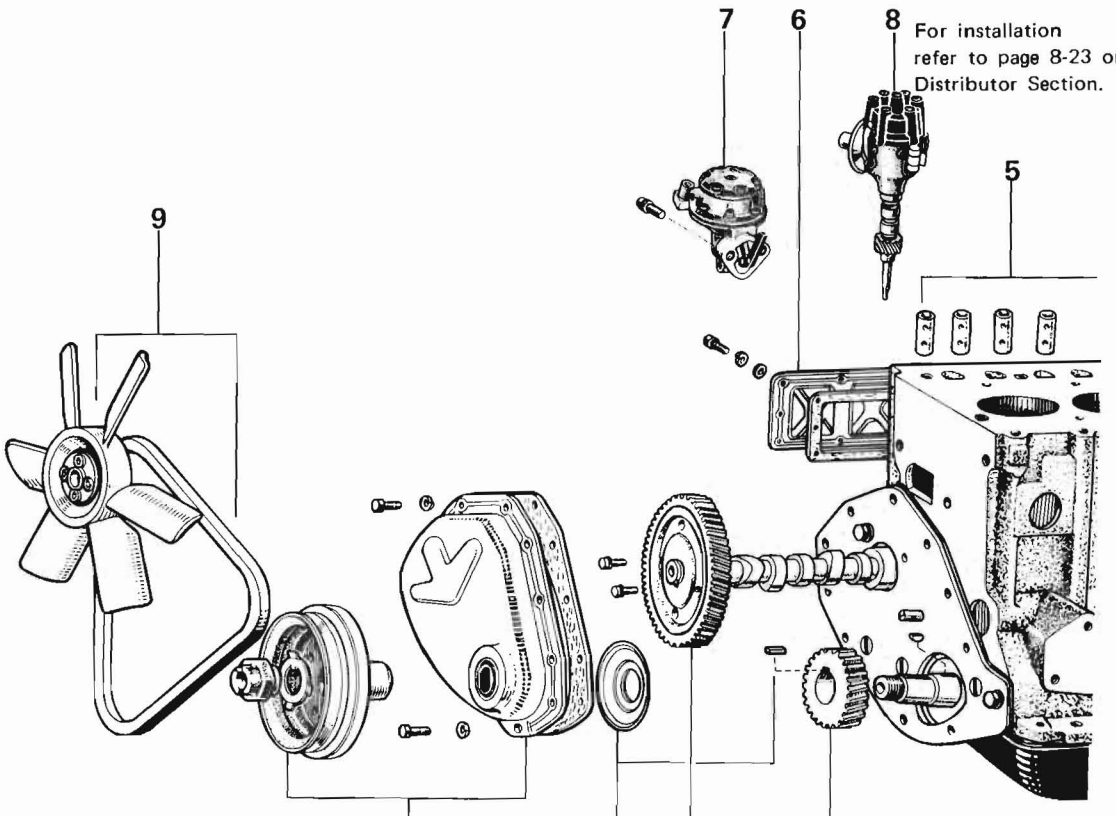


(4) Press in cam gear and lock with new snap ring.

ASSEMBLY

Assemble in numerical order.

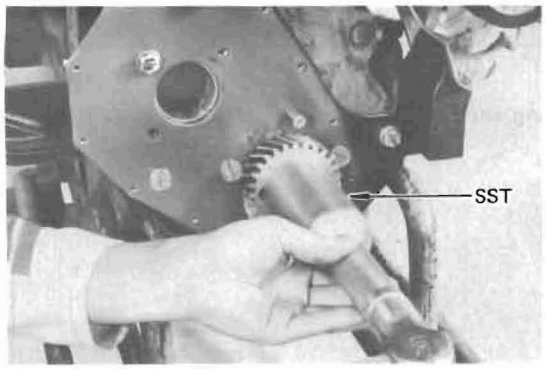
- **Thoroughly clean the parts to be assembled.**
- **Apply clean engine oil on the sliding and rotating surfaces of the parts before assembly.**



1	Crankshaft Timing Gear	6	Valve Lifter Cover
2	Camshaft	7	Fuel Pump
3	Key and Oil Slinger	8	Distributor
4	Timing Gear Cover and Pulley	9	Fan and Belt
5	Valve Lifter		

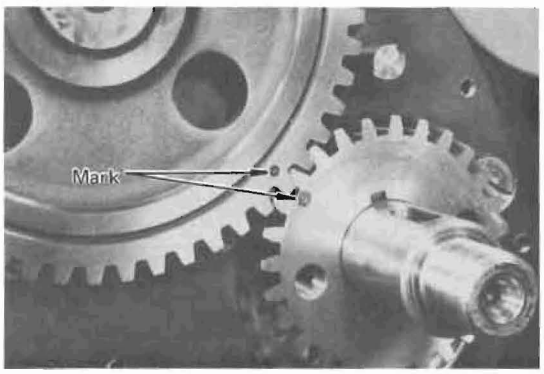
Fig. 3-68

Fig. 3-69



Use SST [09214-60010].
Timing mark stamped on gear should be faced toward front.

Fig. 3-70

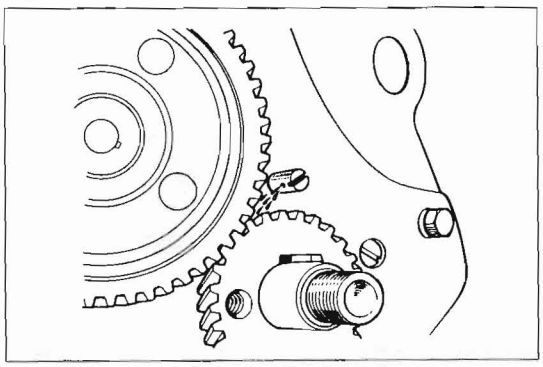


Carefully insert camshaft and mesh gears matching timing marks. Bolt on thrust plate and check gear backlash.

Torque 1-1.6 kg-m (7-12 ft-lb)
Backlash 0.05-0.13 mm (0.0020-0.0051 in)

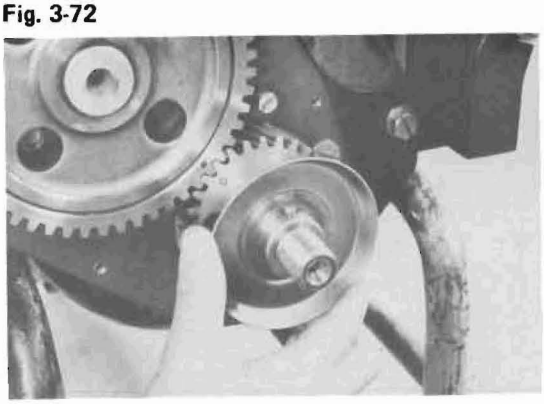
– Note –
At this time, No.6 cylinder is at TDC/compression.

Fig. 3-71



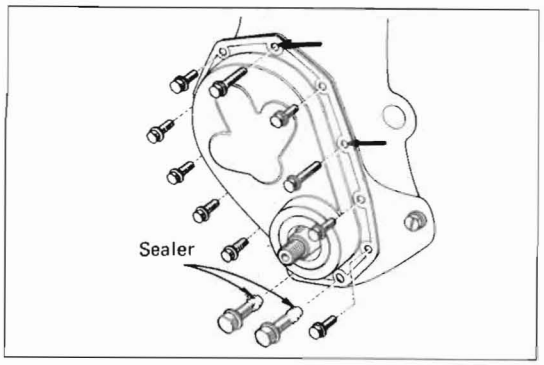
If oil nozzle was removed, screw in and stake the plate at two places.
Oil hole should be faced to position shown.

Fig. 3-72



Fit pulley key to crankshaft and install oil slinger in direction as shown.

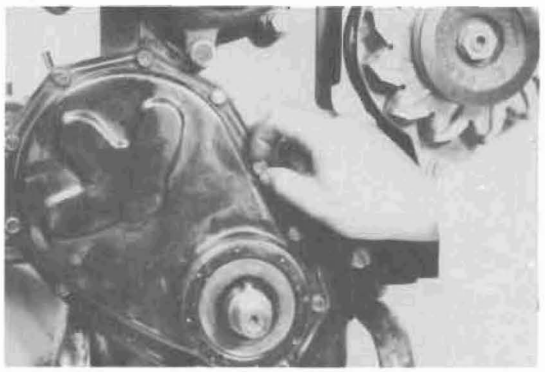
Fig. 3-73



Install timing gear cover and pulley as follows:

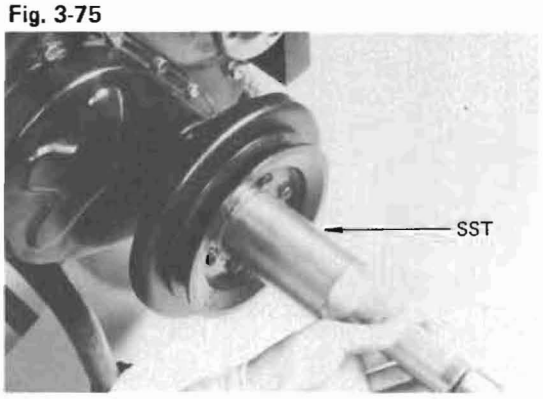
Bolts locations
Arrow – Longer bolt
Apply liquid sealer onto lower two bolts threads.

Fig. 3-74



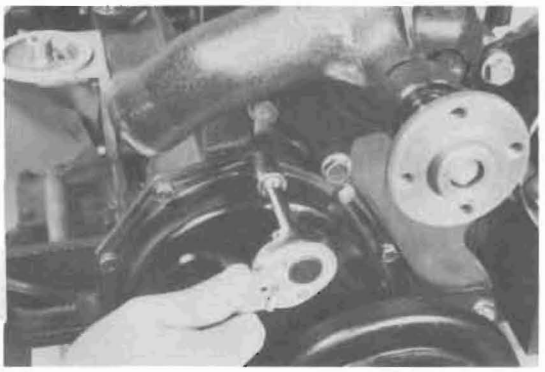
(1) Screw in all bolts to finger tightness.

Fig. 3-75



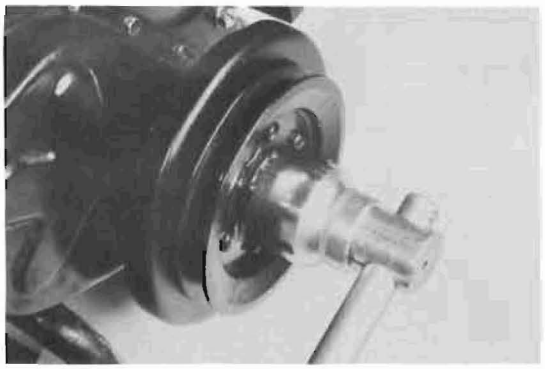
(2) Using SST [09214-60010], drive in pulley to locate the timing gear cover correctly.

Fig. 3-76



(3) After installing the pulley, tighten cover bolts.

Fig. 3-77



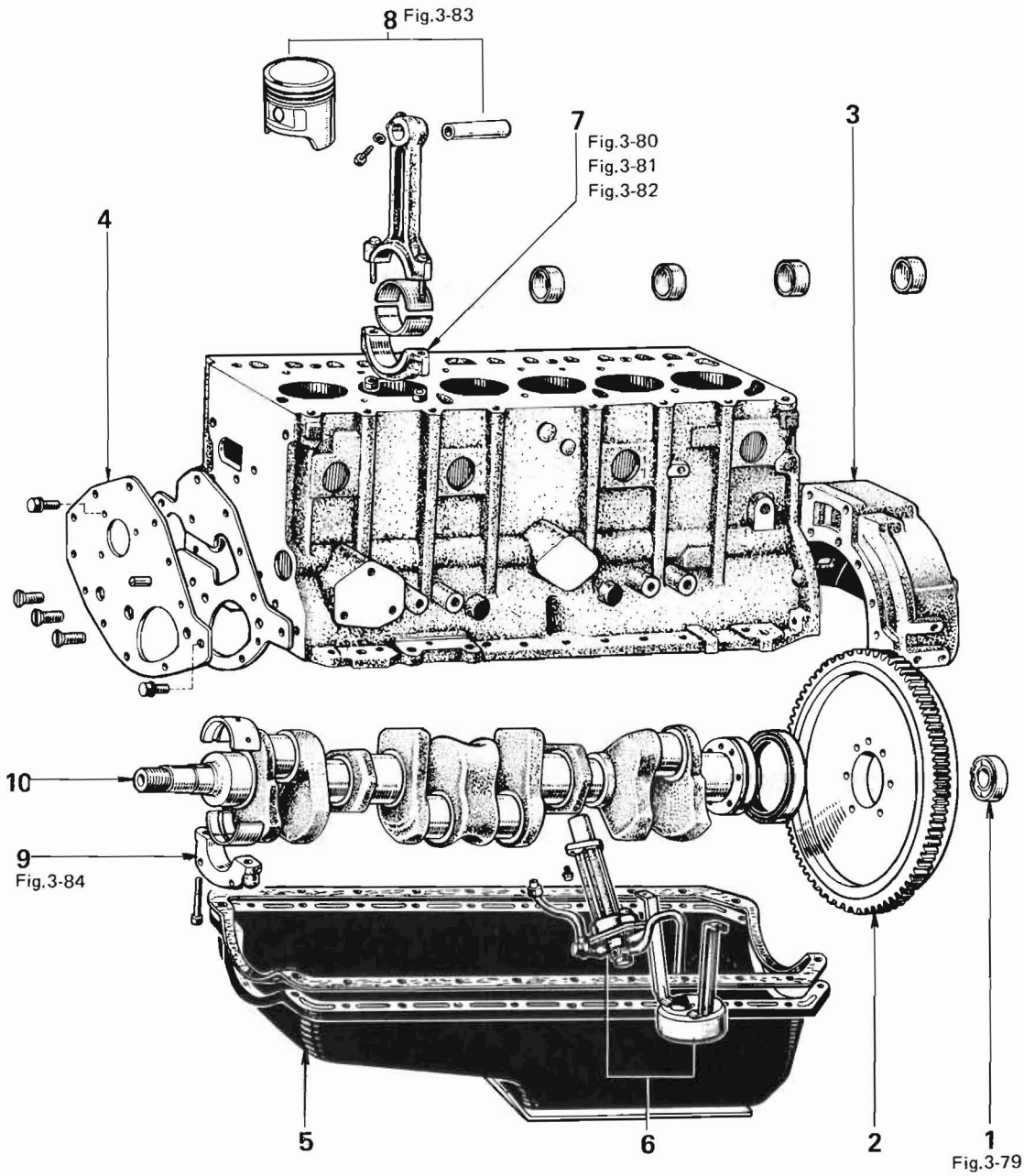
(4) Tighten claw nut and lock with lock plate.

Torque	**16-20 kg-m (116-145 ft-lb)**

CYLINDER BLOCK

DISASSEMBLY

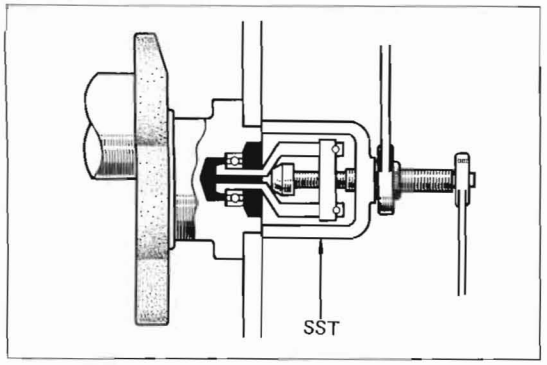
Disassemble in numerical order



1 Input Shaft Bearing
2 Flywheel
3 Flywheel Housing
4 Front End Plate
5 Oil Pan
6 Oil Pump and Strainer
7 Connecting Rod Cap
8 Piston with Connecting Rod
9 Main Bearing Cap
10 Crankshaft

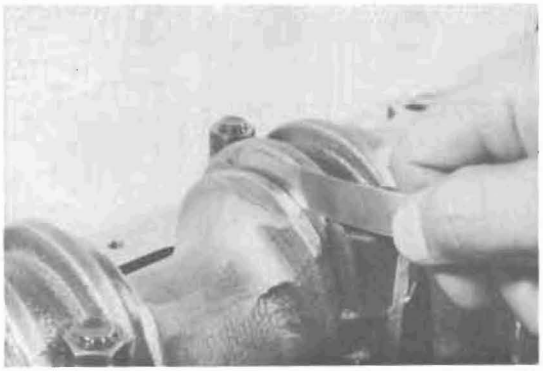
Fig. 3-78

Fig. 3-79



Using SST [09303-55010], remove input shaft bearing.

Fig. 3-80



Measure connecting rod thrust clearance. If it exceeds limit, replace connecting rod.

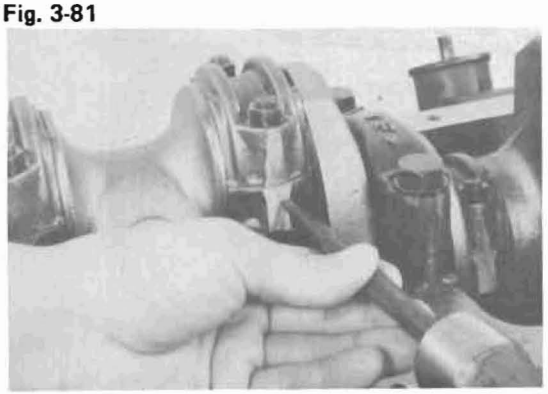
Thrust clearance limit

0.3 mm (0.012 in)

Standard

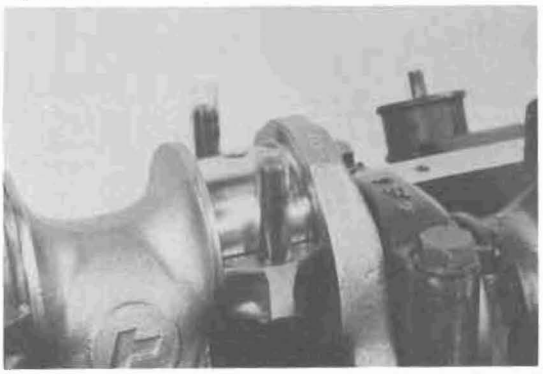
0.11-0.23 mm (0.0043-0.0091 in)

Fig. 3-81



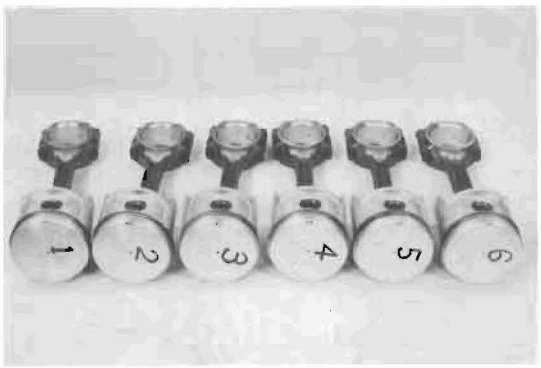
Mark connecting rod and cap for correct reassembly.

Fig. 3-82



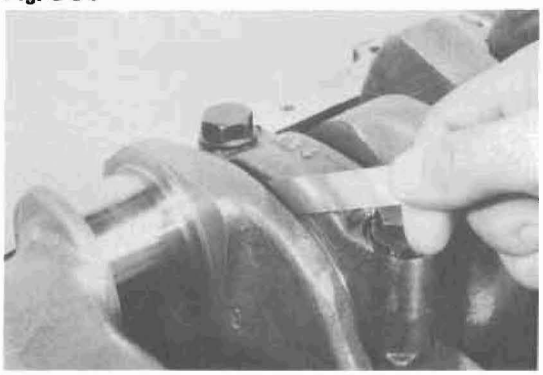
Cover rod bolts with a short length of hose to protect crankshaft from damage.

Fig. 3-83



Keep connecting rod and bearing in order.

Fig. 3-84



Measure crankshaft thrust clearance. If it exceeds limit, replace bearing as a set.

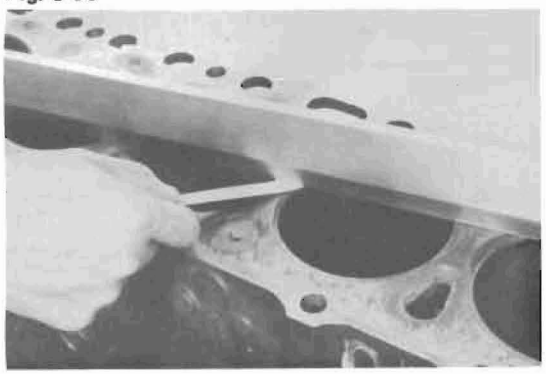
Thrust clearance limit

0.3 mm (0.012 in)

Standard

0.06-0.16 mm (0.0024-0.0063 in)

Fig. 3-85



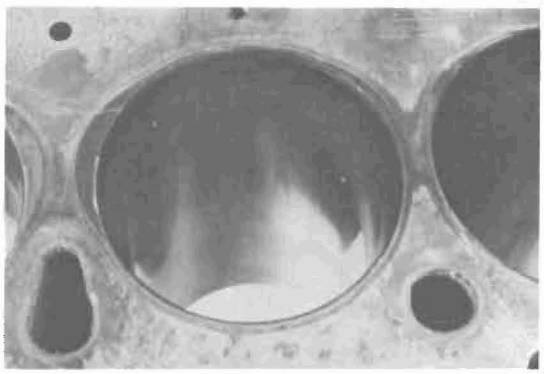
INSPECTION & REPAIR

Cylinder Block

1. Check block gasket surface for flatness. If warpage exceeds limit, correct by machining or replace block.

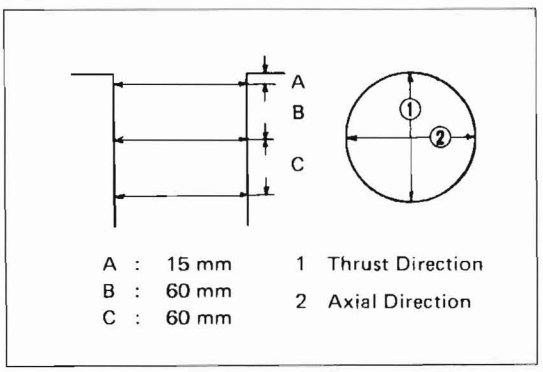
Warpage limit **0.15 mm (0.0059 in)**

Fig. 3-86



2. Visually inspect cylinders for vertical scratches. If deep scratches are present, cylinder must be rebored.

Fig. 3-87



3. Measure cylinders at the top, middle, and bottom as shown. If cylinder exceeds specification, it must be rebored.

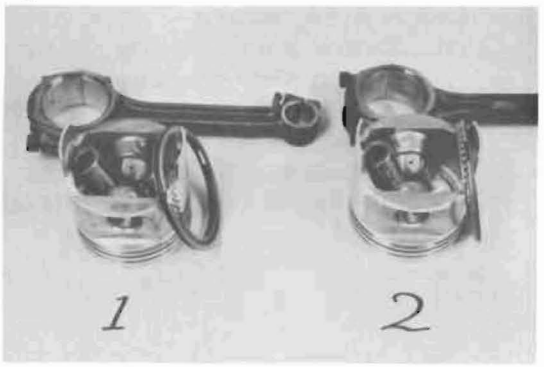
Wear limit	**0.2 mm (0.008 in)**
Standard bore	**94.00-94.05 mm (3.7008-3.7027 in)**

Fig. 3-88

Piston and Ring

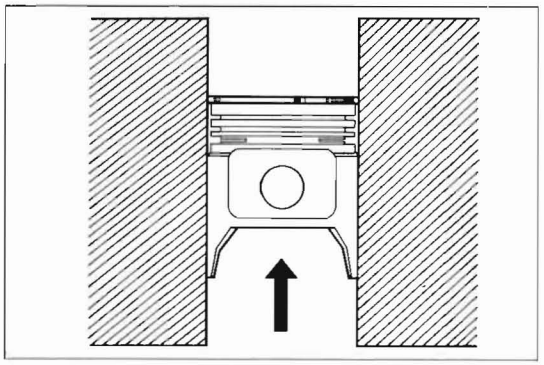
1. Check pin fit by trying to rock piston at right angle to pin. If any movement is felt, piston with pin must be replaced.

Fig. 3-89



After disassembling, keep piston, pin, ring and rod in order.

Fig. 3-90



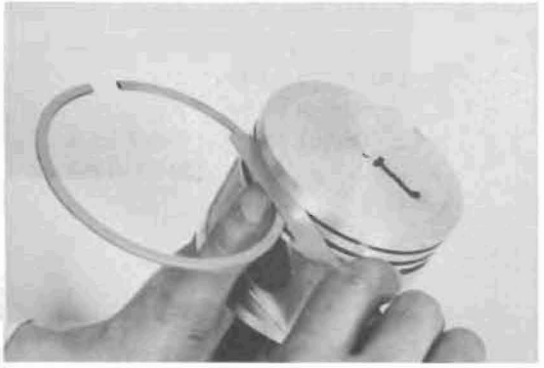
2. Measure ring end gap.
   (1) Insert ring into cylinder using a piston.

Fig. 3-91

(2) Measure end gap. If it exceeds specification, ring must be replaced.

End gap
0.20-0.38 mm (0.0079-0.0150 in)

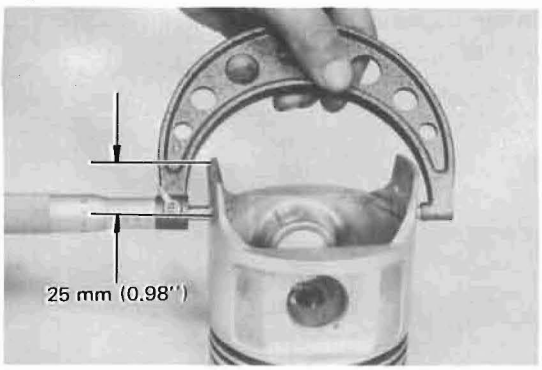
Fig. 3-92



3. Measure ring groove clearance. If it exceeds specification, replace ring and/or piston.

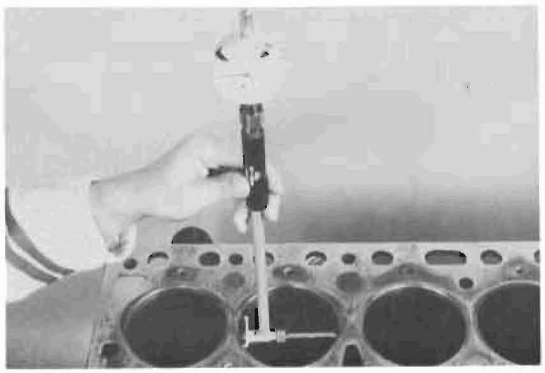
Top ring
0.03-0.06 mm (0.0012-0.0024 in)
2nd ring
0.02-0.06 mm (0.0008-0.0024 in)

Fig. 3-93



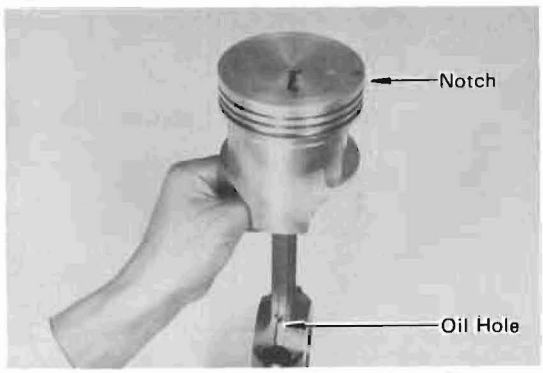
4. Measure piston clearance.
   (1) Measure piston diameter at right angle to piston pin center line.
   Measurement must be made at normal temperature (20°C or 68°F).
   Piston diameter (STD)
   93.97-94.02 mm (3.6996-3.7016 in)

Fig. 3-94



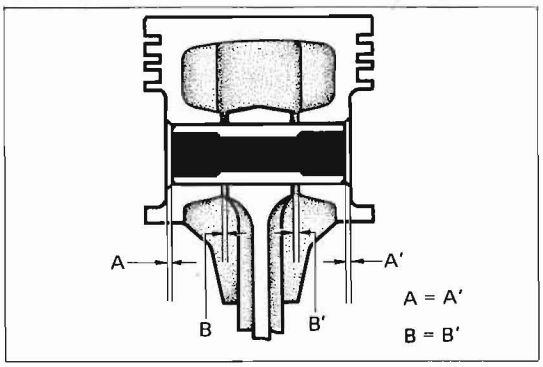
   (2) Measure cylinder bore and subtract piston measurement. If clearance exceeds specification, replace piston.
   Piston clearance
   0.03-0.05 mm (0.0012-0.0020 in)

Fig. 3-95



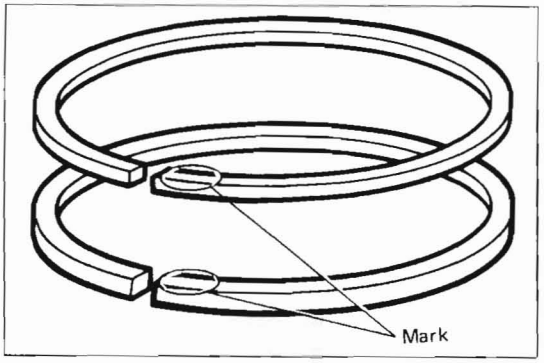
5. Assemble piston and connecting rod.
   (1) Assemble piston and rod aligning piston notch and rod hole as shown.

Fig. 3-96



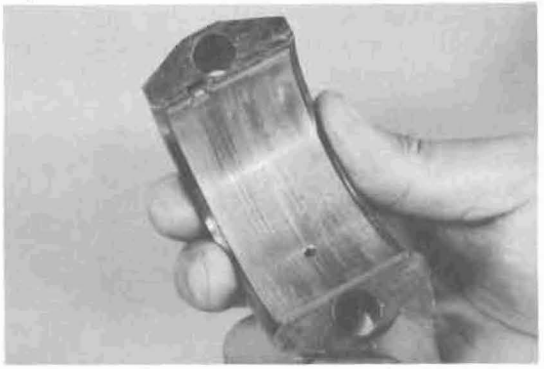
   (2) Center piston pin in the piston, and connecting rod in center of two piston pin bosses.
   Tighten pin bolt.
   Torque 5.4-7 kg-m (39-51 ft-lb)

Fig. 3-97



6. Position two compression rings with code marks facing up. Assemble rings.

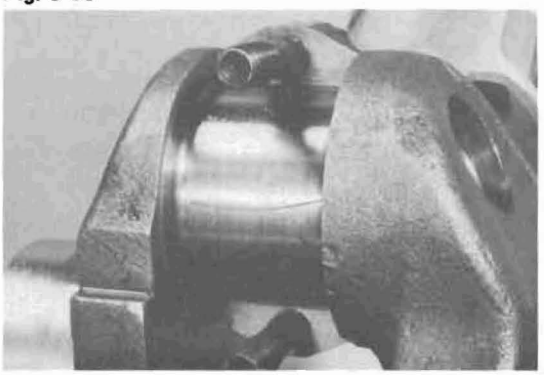
Fig. 3-98



Crankshaft and Bearing

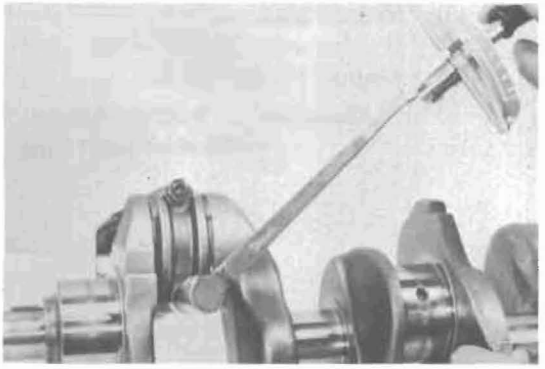
1. Inspect bearings for flaking or scoring. If bearings are damaged, replace.

Fig. 3-99



2. Measure crankpin oil clearance.
   (1) Lay strip of plastigage across pin.

Fig. 3-100

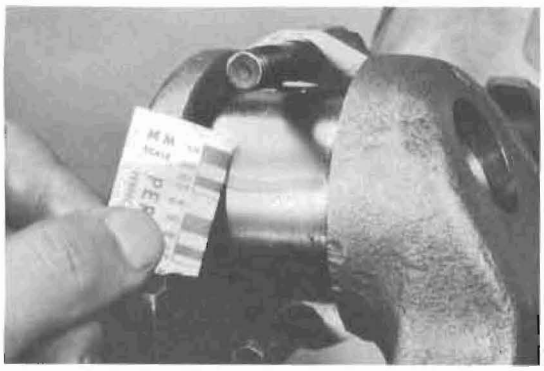


(2) Tighten cap nuts to specified torque.

Torque	**4.8-7.6 kg-m (35-55 ft-lb)**

– Note –
Do not turn connecting rod.

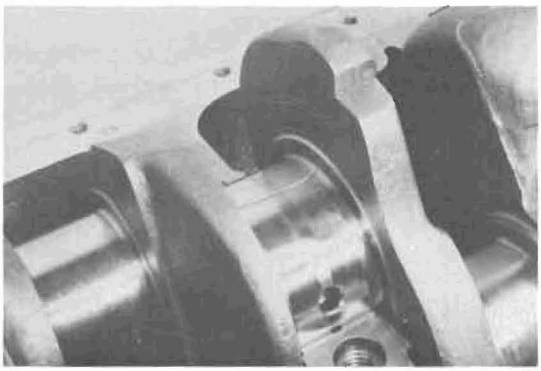
Fig. 3-101



(3) Measure plastigage at its widest point. If clearance is not within specification, replace bearings.

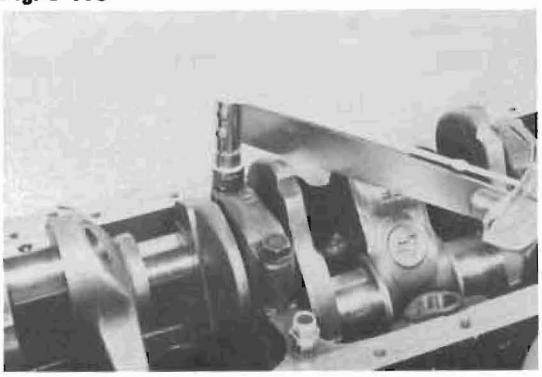
Clearance 0.02-0.06 mm (0.0008-0.0024 in)

Fig. 3-102



3. Measure main journal oil clearance.
   (1) Lay strip of plastigage across main journal.

Fig. 3-103



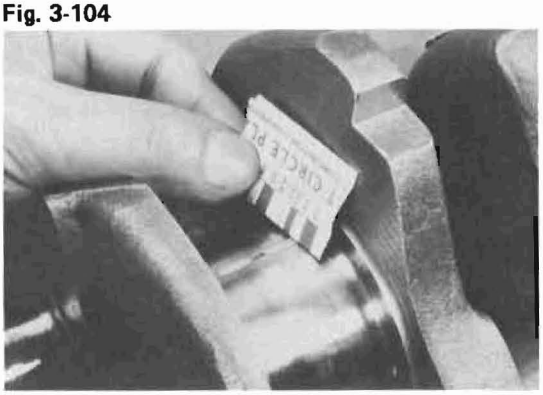
(2) Tighten cap bolts to specified torque.

Torque

No.1–No.3: 12.5-15 kg-m (90-108 ft-lb)

No.4 : 10.5-13 kg-m (76-94 ft-lb)

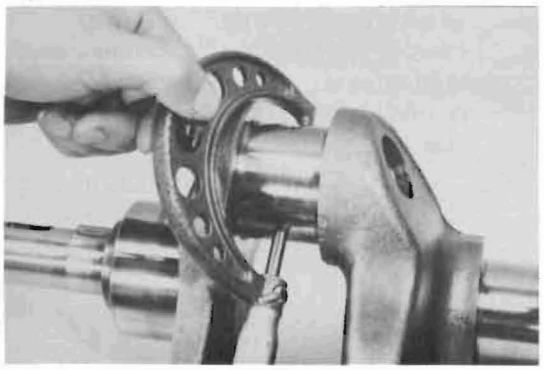
Fig. 3-104



(3) Measure plastigage at its widest point. If clearance is not within specification, replace bearings.

Clearance 0.020-0.044 mm (0.0008-0.0017 in)

Fig. 3-105



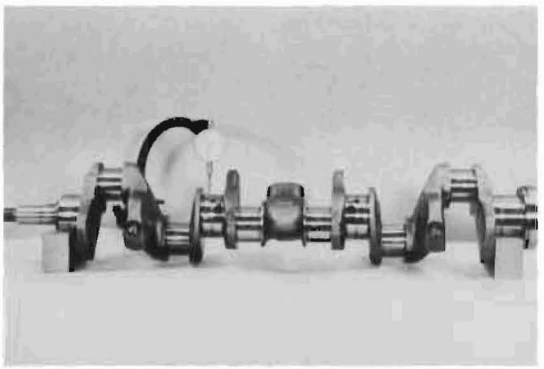
4. Measure crankpin and main journals. If wear is excessive, crankshaft must be reground or replaced.

Standard	
Front	**66.972-66.996 mm (2.6367-2.6376 in)**
Second	**68.472-68.496 mm (2.6957-2.6967 in)**
Third	**69.972-69.996 mm (2.7548-2.7557 in)**
Rear	**71.472-71.496 mm (2.8139-2.8148 in)**

Crank pin and main journal U/S bearings.

U/S bearing sizes:
U/S 0.05
U/S 0.25
U/S 0.50

Fig. 3-106



5. Check crankshaft for runout and if it exceeds limit, replace.

Runout limit **0.1 mm (0.004 in)**

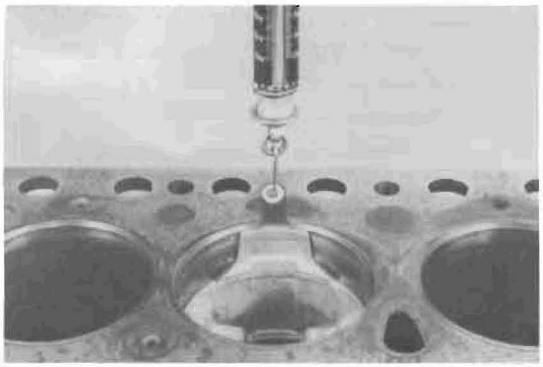
Piston sizes:

O/S 0.50	**94.46-94.51 mm (3.7189-3.7209 in)**
O/S 1.00	**94.96-95.01 mm (3.7386-3.7405 in)**
O/S 1.50	**95.46-95.51 mm (3.7583-3.7602 in)**

CYLINDER BORING

1. If cylinder bore is worn or tapered over limit or if cylinder wall is scored, rebore cylinder and install oversized pistons.
2. O/S pistons with pins are available in the sizes listed. Replace pistons in matched sets based on cylinder to be rebored.

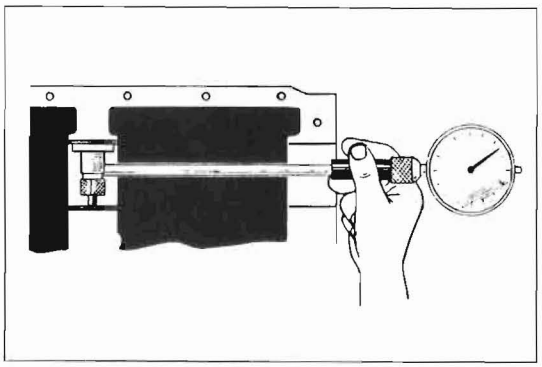
Fig. 3-107



3. Check piston clearance.
Insert into cylinder, piston and feeler gauge as illustrated. If the correct scale reading is indicated, the piston to cylinder clearance is correct.

Feeler gauge	**0.03-0.05 mm (0.0012-0.0020 in)**
Scale pull	**1.0-2.5 kg (2.2-5.5 lb)**

Fig. 3-108



CAMSHAFT BEARING

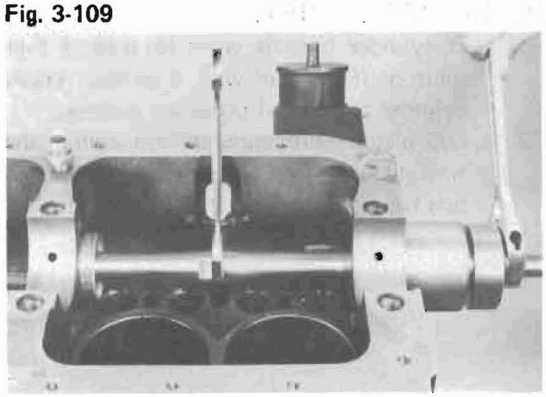
1. Inspect bearing surface for flaking, melting, and burning, and replace if damaged.
2. Inspect the oil clearance by measuring the difference between the camshaft journal diameter and the bearing inner diameter. If clearance exceeds specification, replace bearing and/or reground camshaft.

Clearance	**0.025-0.075 mm (0.0010-0.0030 in)**

U/S bearing sizes:
U/S 0.25
U/S 0.50

Camshaft U/S bearings

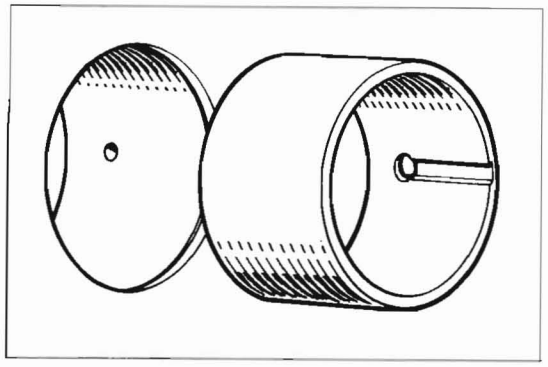
Fig. 3-109



Camshaft Bearing Replacement

1. Drive out plug from cylinder block.
2. Using SST [09215-60010], remove front and second bearings towards front, third and rear bearings towards rear.

Fig. 3-110

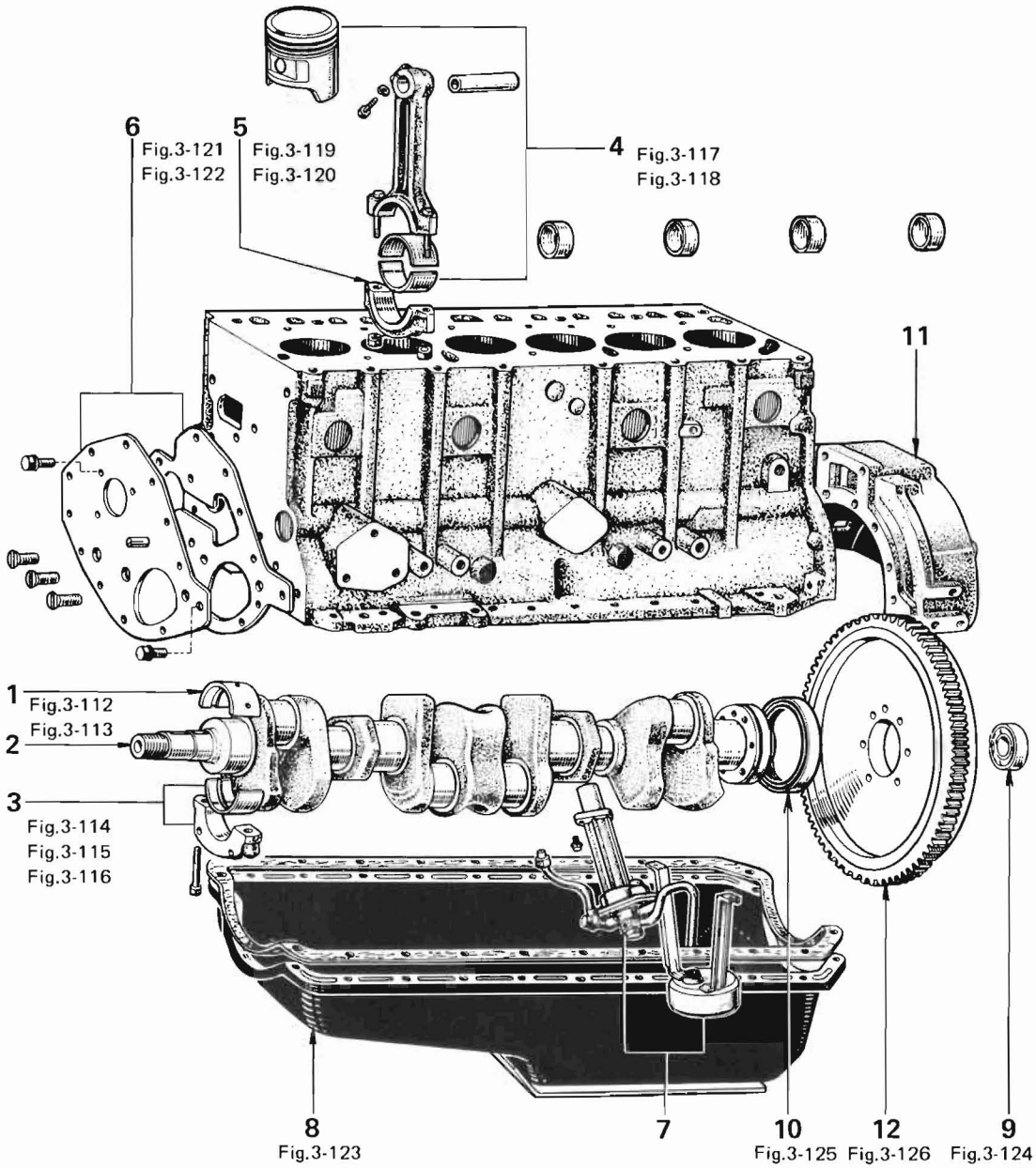


3. Align the bearing oil hole, install new selected bearings using SST [09215-60010]. If bearings are correctly installed, only a slight reaming is required.
4. Install new plug applied with liquid sealer.

ASSEMBLY

Assemble in numerical order.

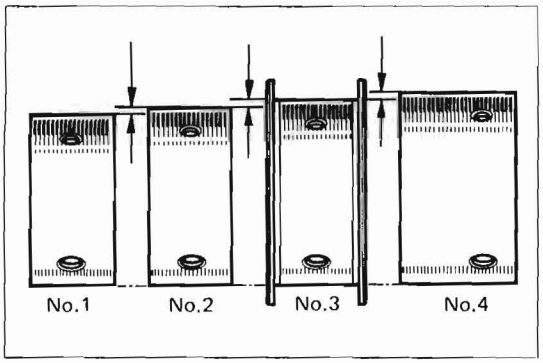
- **Thoroughly clean the parts to be assembled.**
- **Apply clean engine oil on the sliding and rotating surfaces of the parts before assembly.**



1	Main Bearing	5	Connecting Rod Cap	9	Input Shaft Bearing
2	Crankshaft	6	Front End Plate	10	Crankshaft Rear Oil Seal
3	Main Bearing Cap	7	Oil Pump and Strainer	11	Flywheel Housing
4	Piston with Connecting Rod	8	Oil Pan	12	Flywheel

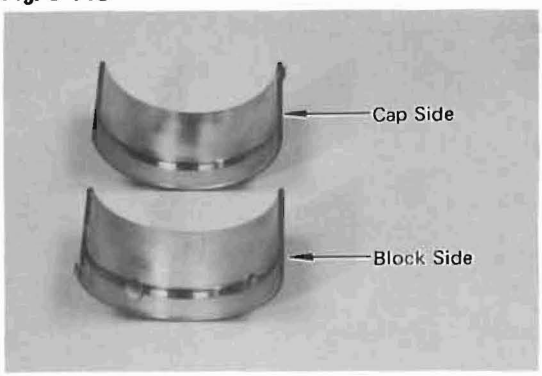
Fig. 3-111

Fig. 3-112



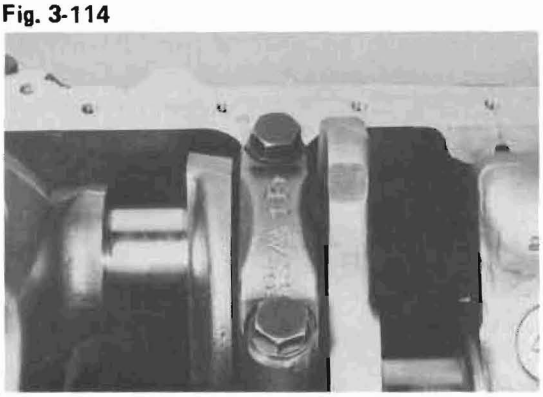
All main bearings are different. Install bearings in block and caps, lubricating face only.

Fig. 3-113



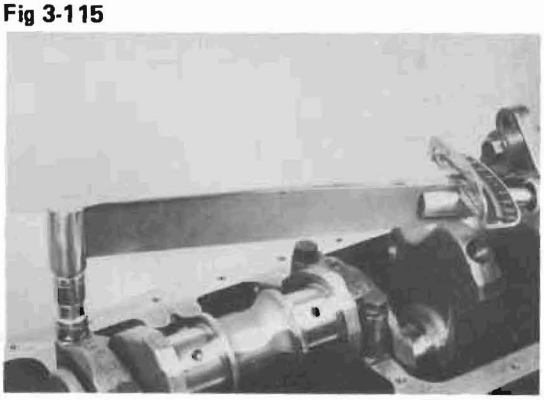
Front (No.1) and rear (No.4) bearings provided oil hole must be installed at cylinder block side.

Fig. 3-114



Face the arrow mark toward front.

Fig 3-115

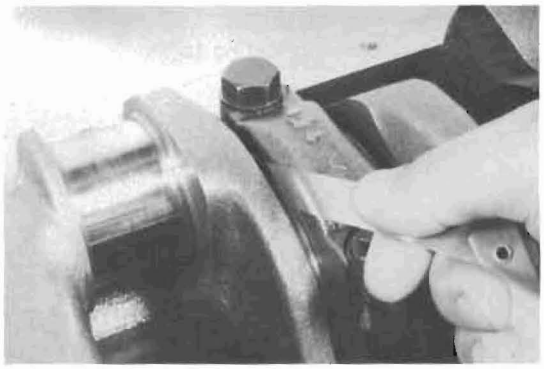


Tighten bearing cap to specified torque.

Torque No.1—No.3 : 12.5-15 kg-m (90-108 ft-lb)

No.4 : 10.5-13 kg-m (76-94 ft-lb)

Fig. 3-116

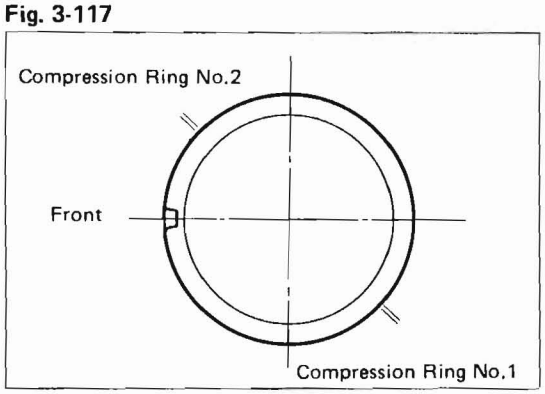


Check crankshaft thrust clearance.

Thrust clearance **0.06-0.16 mm (0.0024-0.0063 in)**

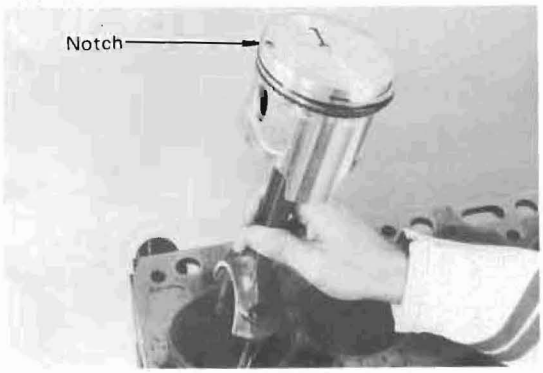
Make sure the crankshaft rotates smoothly.

Fig. 3-117



Position ring gap in direction as shown.

Fig. 3-118



Cover rod bolts with a hose to protect crankshaft from damage.

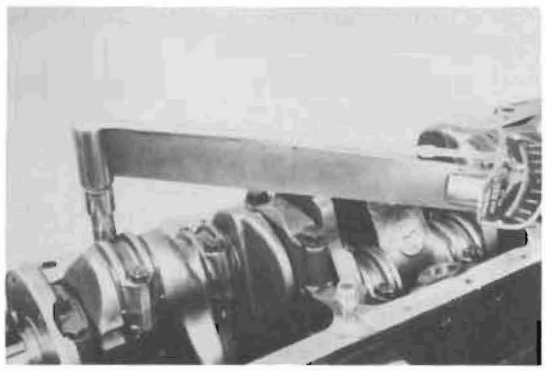
Push correctly numbered piston/rod assembly with notch forward.

Ⓟ mark on connecting rod should face rearward.

Fig. 3-119

Align rod and cap marks, fit the cap.

Fig. 3-120

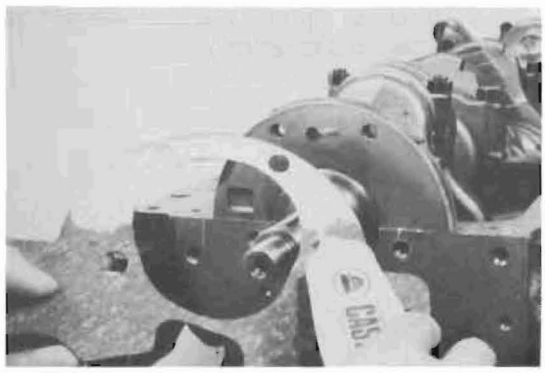


Tighten rod cap to specified torque and check rod thrust clearance.

Torque **4.8-7.6 kg-m (35-55 ft-lb)**
Thrust clearance **0.11-0.23 mm (0.0043-0.0091 in)**

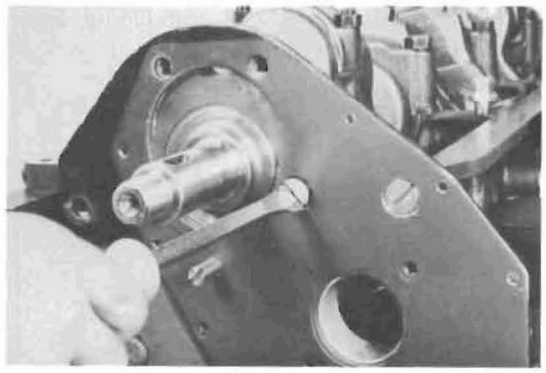
Make sure the crankshaft rotates smoothly.

Fig. 3-121



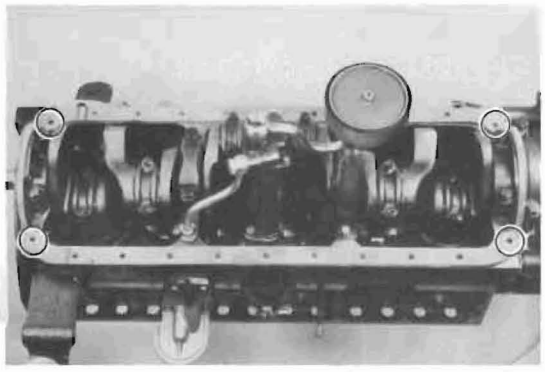
Apply liquid sealer onto end plate gasket both surfaces.

Fig. 3-122



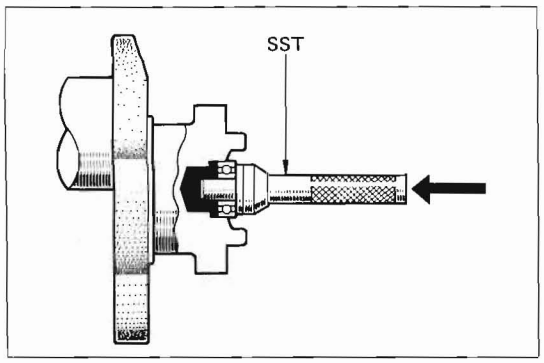
Tighten the undercut flat head screws to locate end plate correctly, then tighten the bolt.

Fig. 3-123



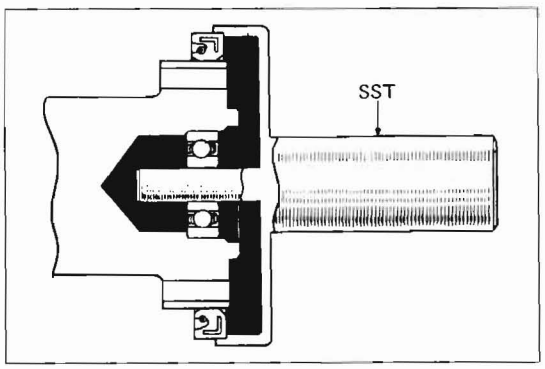
Apply liquid sealer at four places as shown.

Fig. 3-124



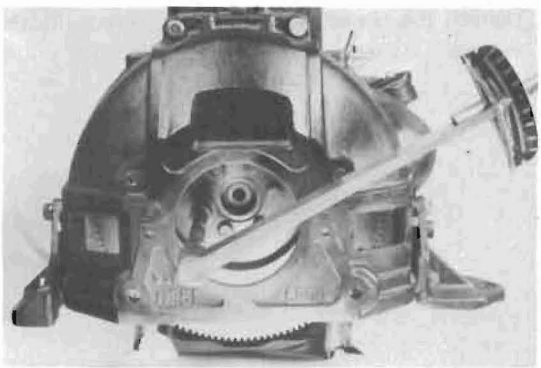
Install input shaft bearing using SST [09304-47010].

Fig. 3-125



Apply MP grease onto oil seal lip and install oil seal using SST [09223-60010].

Fig. 3-126



Coat flywheel bolt threads with liquid sealer. Tighten flywheel to specified torque.

Torque	**5.7-7.3 kg-m (41-53 ft-lb)**

LUBLICATING SYSTEM

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ASSEMBLY 4-6

4

LUBRICATING SYSTEM CIRCUIT

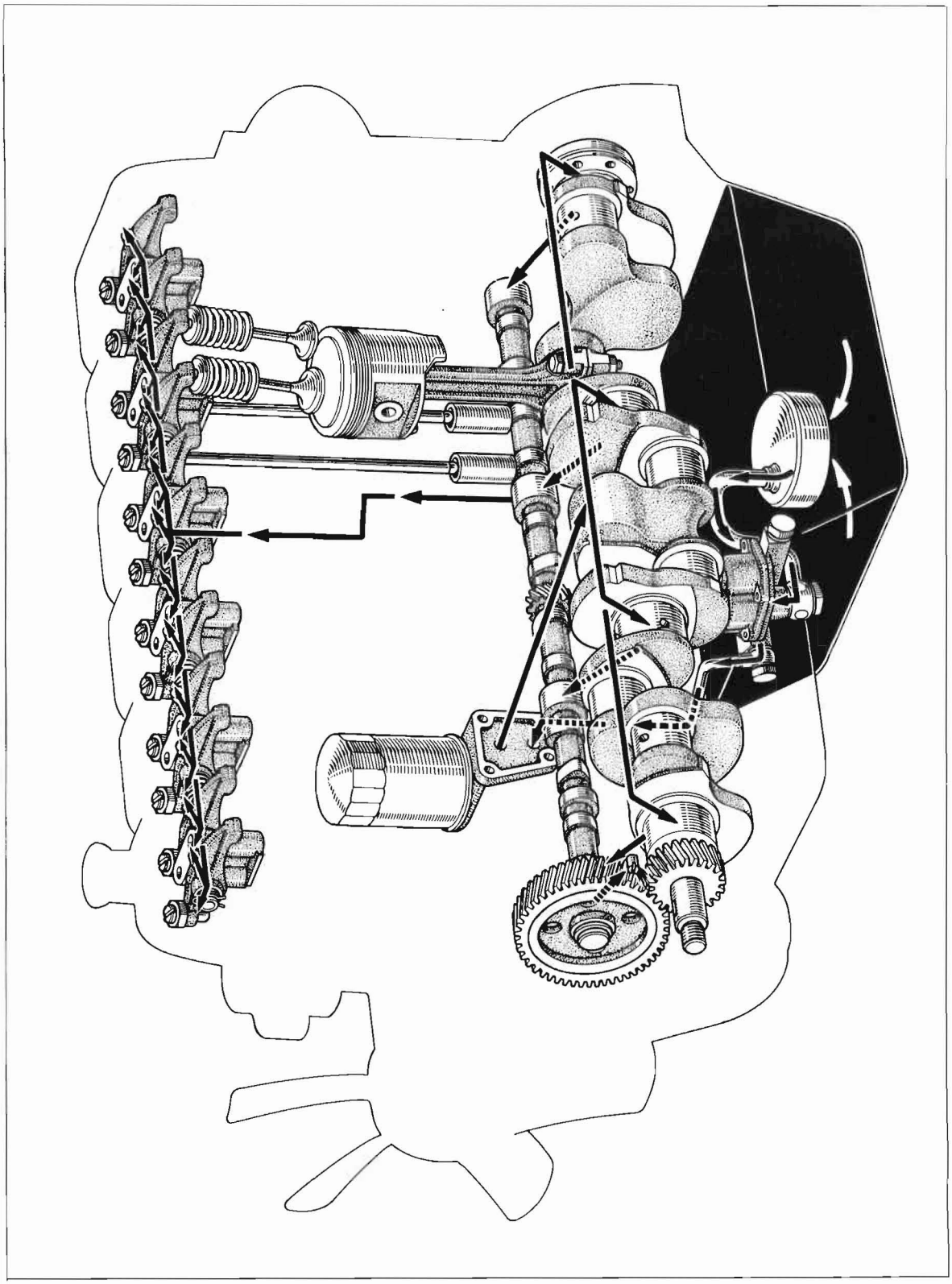
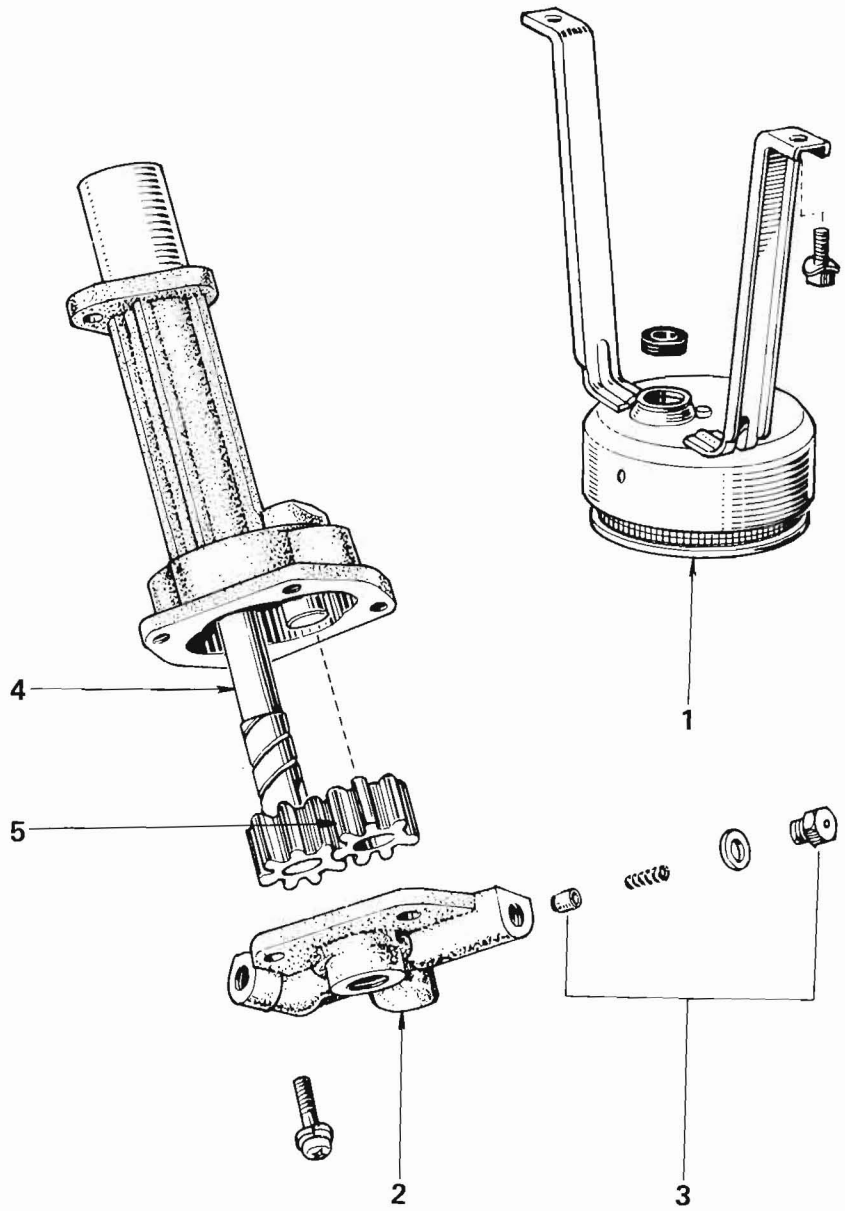


Fig. 4-1

OIL PUMP

DISASSEMBLY

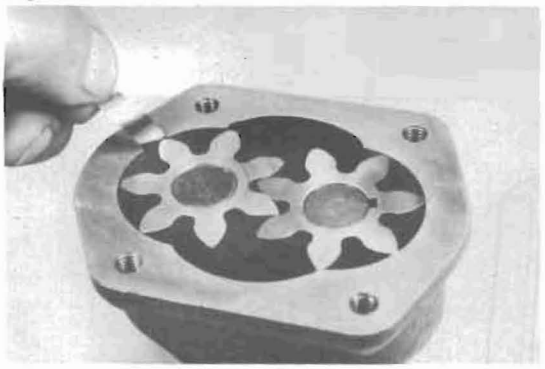
Disassemble in numerical order.



1 Oil strainer
2 Pump Cover
3 Relief Valve
4 Drive Gear
5 Driven Gear

Fig. 4-2

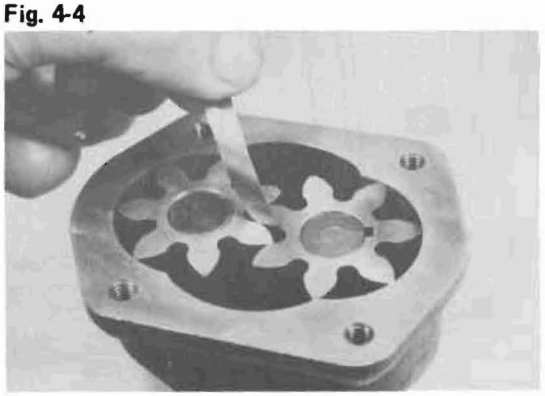
Fig. 4-3



INSPECTION

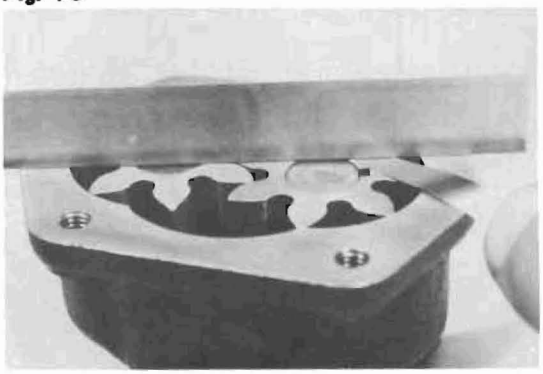
1. Measure tip clearance. If it exceeds limit, replace gear and/or pump assembly.
   Limit
   0.2 mm (0.008 in)
   Standard
   0.03–0.11 mm (0.0012–0.0043 in)

Fig. 4-4



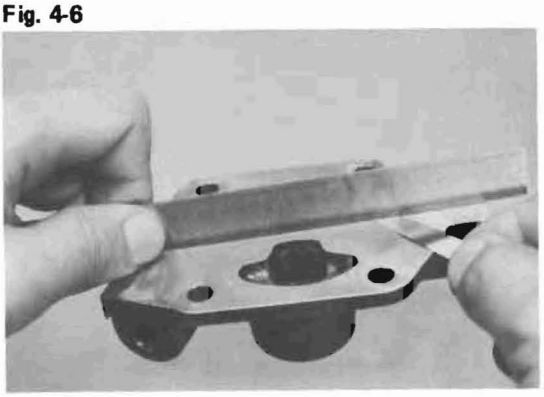
2. Measure backlash. If it exceeds limit, replace gears.
   Limit
   0.95 mm (0.0374 in)
   Standard
   0.05–0.07 mm (0.0020–0.0028 in)

Fig. 4-5



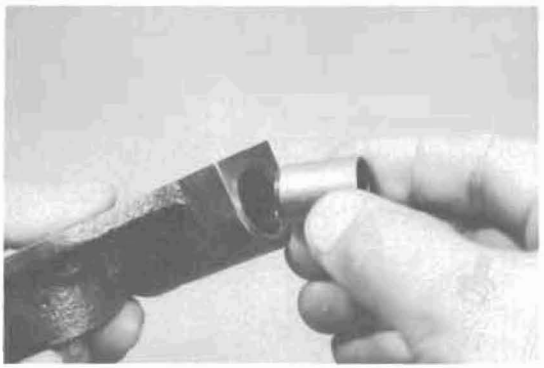
3. Measure side clearance. If it exceeds limit, replace gear and/or pump assembly.
   Limit
   0.15 mm (0.0059 in)
   Standard
   0.03–0.09 mm (0.0012–0.0035 in)

Fig. 4-6



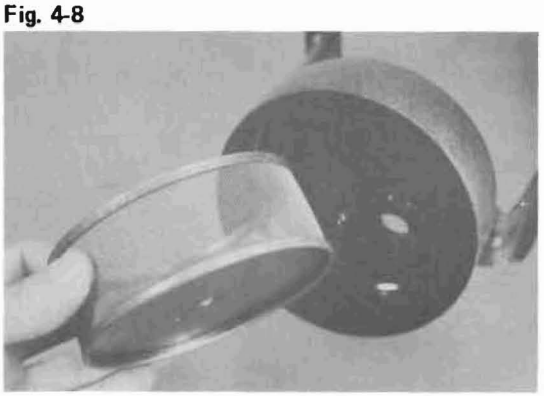
4. Measure cover wear. If the clearance exceeds limit, replace cover.
   Limit
   0.15 mm (0.0059 in)

Fig. 4-7



5. Inspect relief valve for scoring and wear. If damaged, replace valve or pump assembly.

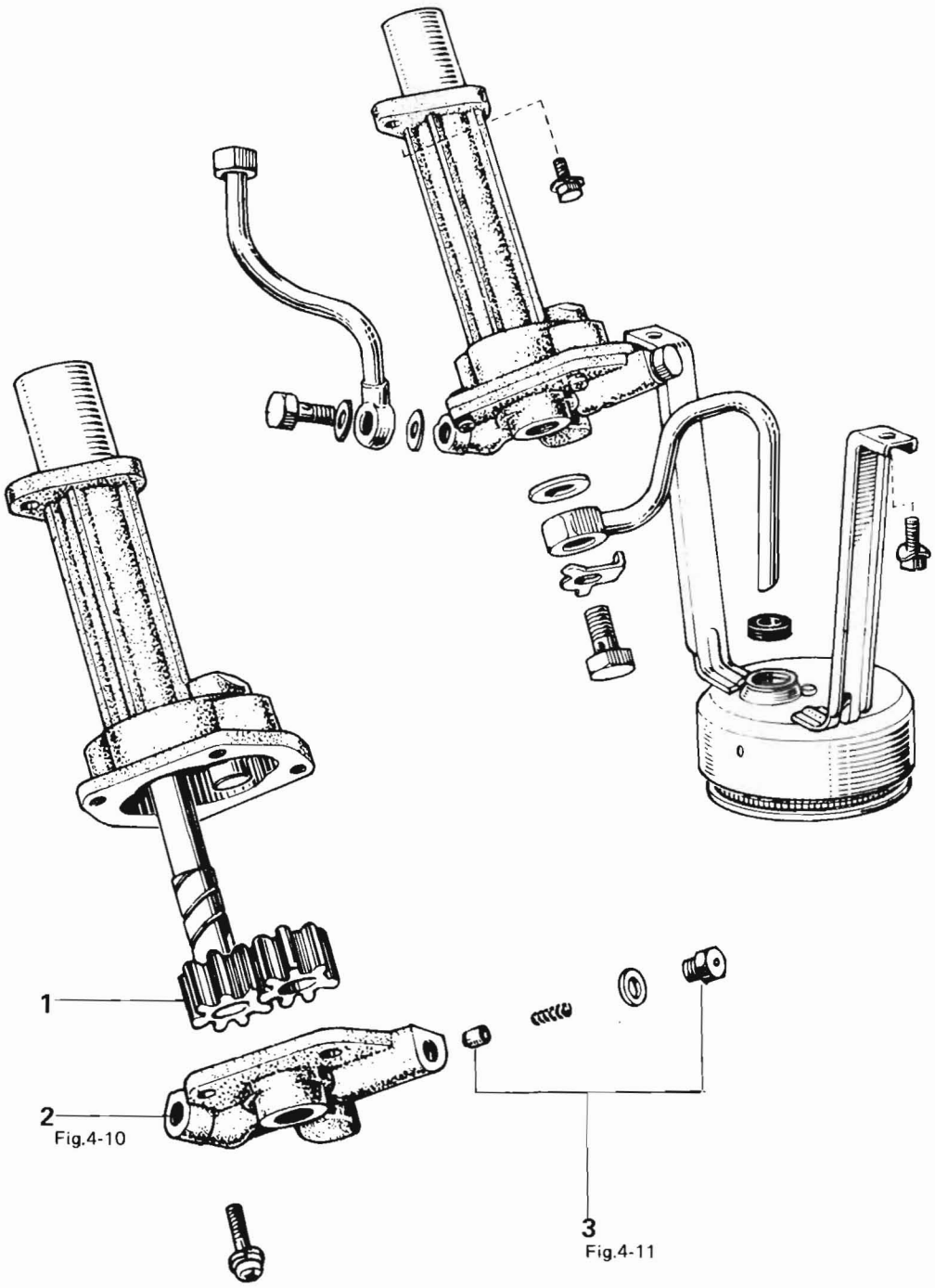
Fig. 4-8



6. Inspect oil strainer for rust, tear and clog. If damaged, replace.

ASSEMBLY

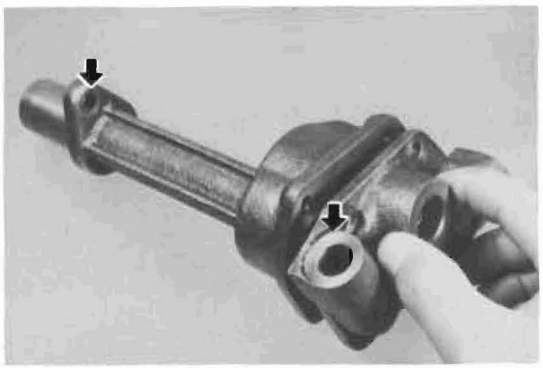
Assemble in numerical order.



1 Drive and Driven Gear
2 Pump Cover
3 Relief Valve

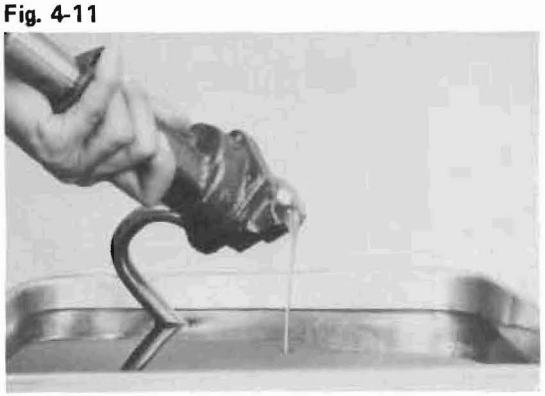
Fig. 4-9

Fig. 4-10



Install pump cover in direction as shown.
Discharge hole should be pointed toward pump body bolt hole.

Fig. 4-11



Check pump operation.
Submerge pump inlet pipe into fresh engine oil, and turn the shaft clockwise with a screwdriver. This should cause the oil to come out from discharge hole.
Close the discharge hole with thumb, and turn the shaft as before. Make sure that the shaft becomes heavy.

MEMO

COOLING SYSTEM

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COOLING SYSTEM CIRCUIT

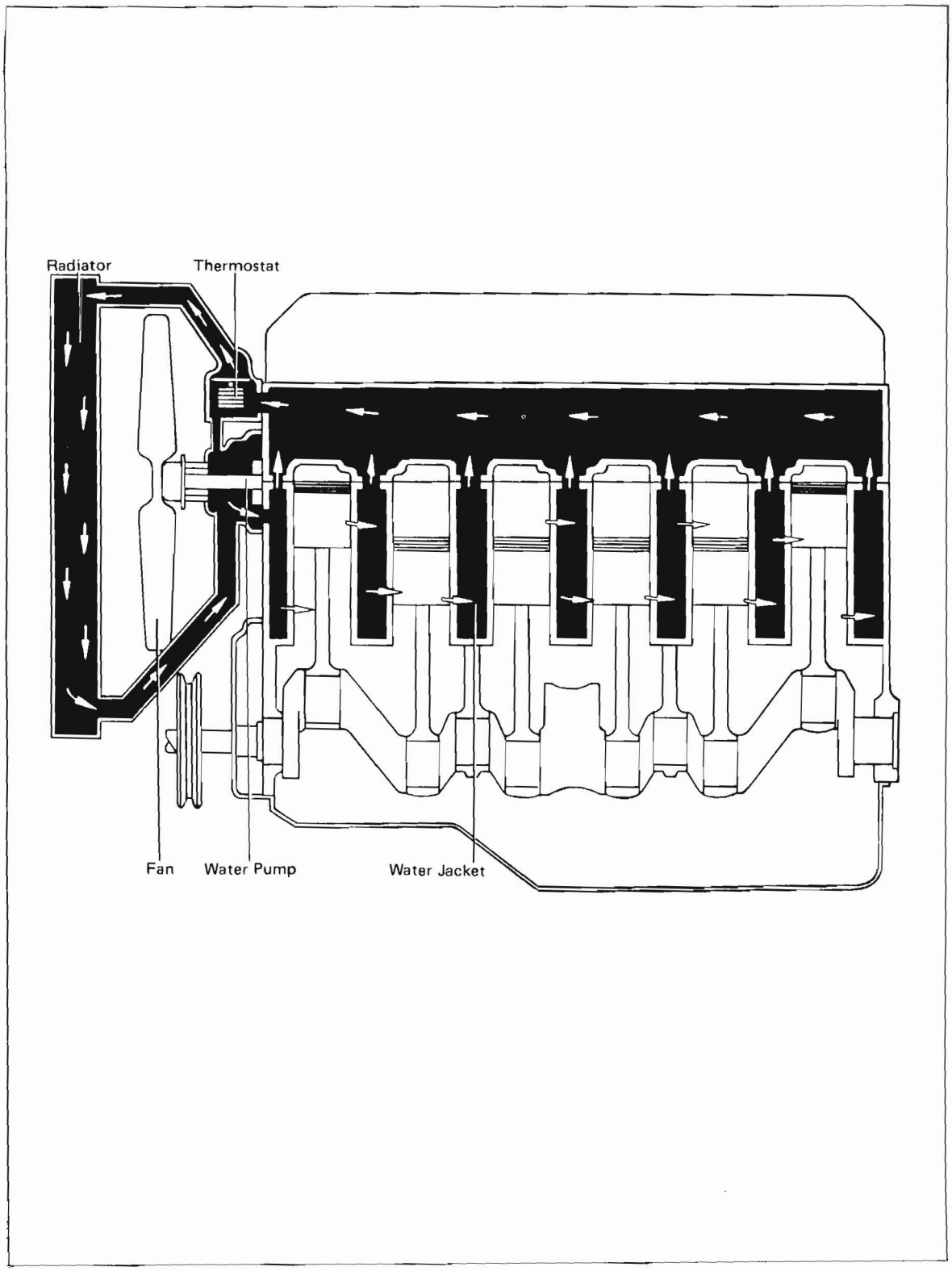


Fig. 5-1

WATER PUMP

DISASSEMBLY

Disassemble in numerical order.

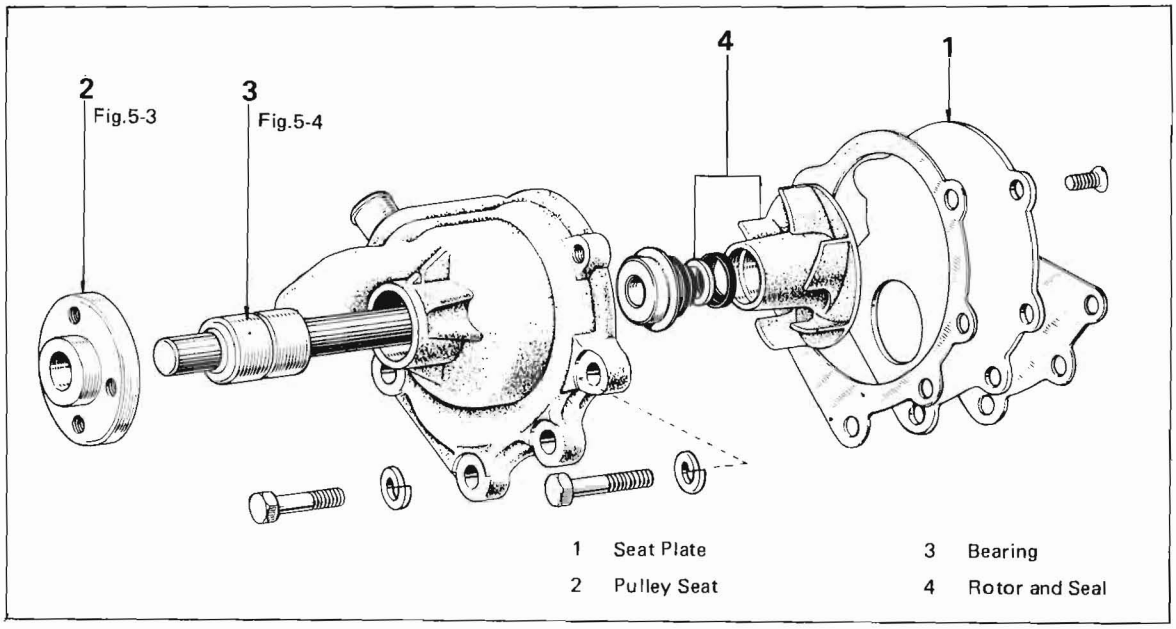
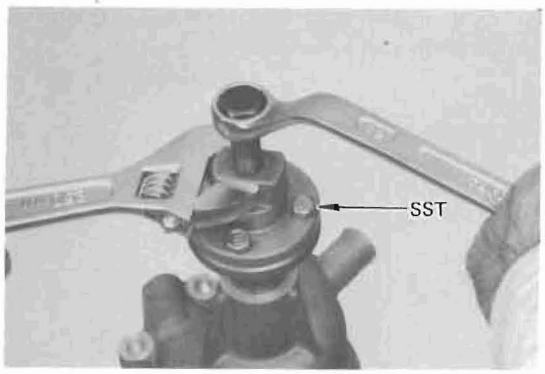


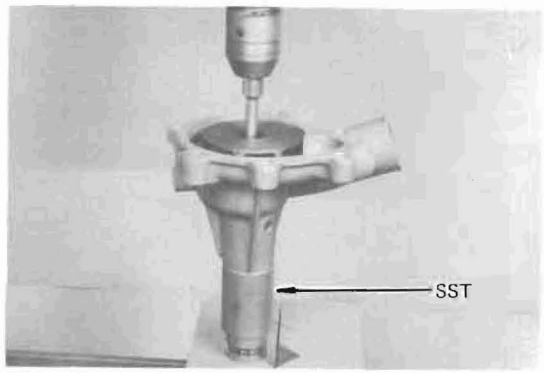
Fig. 5-2

Fig. 5-3



Using SST [09235-60010], remove pulley seat.

Fig. 5-4



Using SST [09238-40010], press bearing out of the pump body.

ASSEMBLY

Assemble in numerical order.

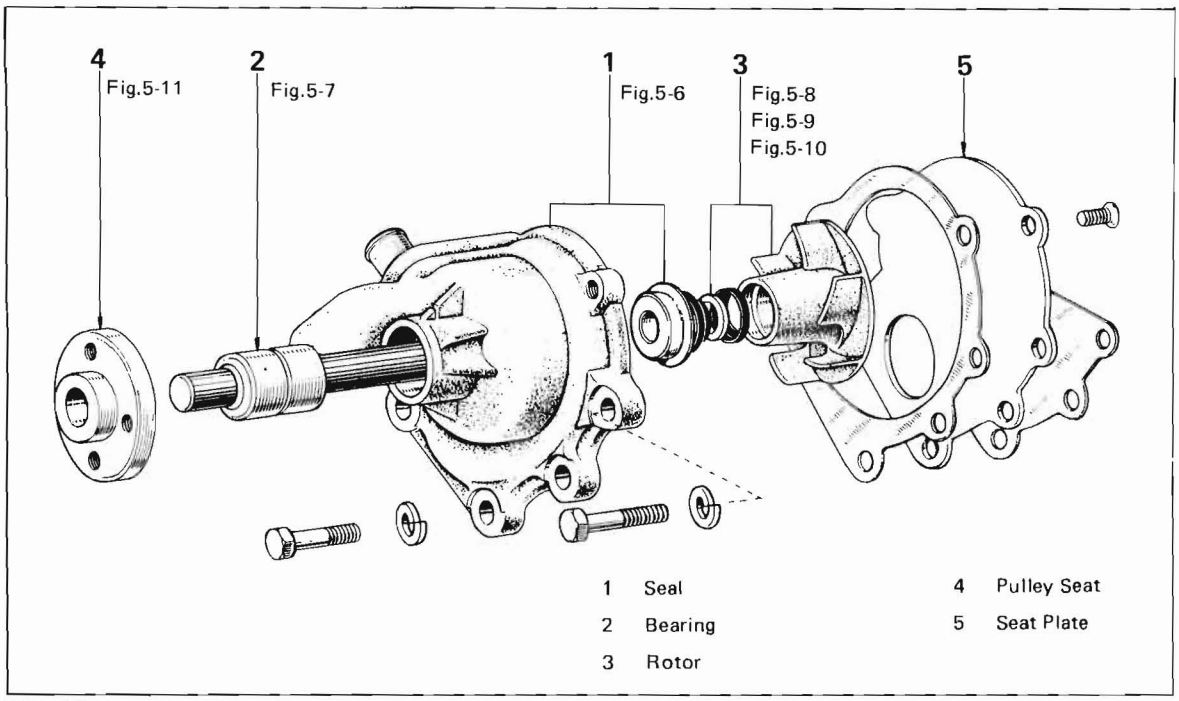
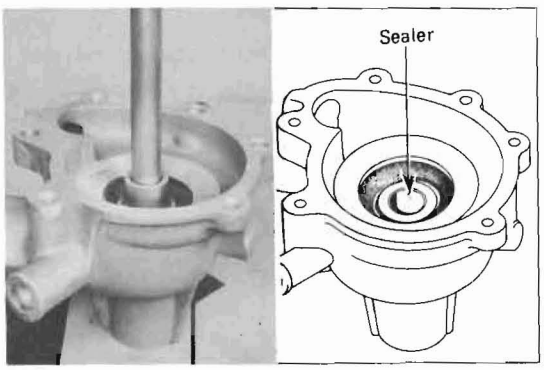


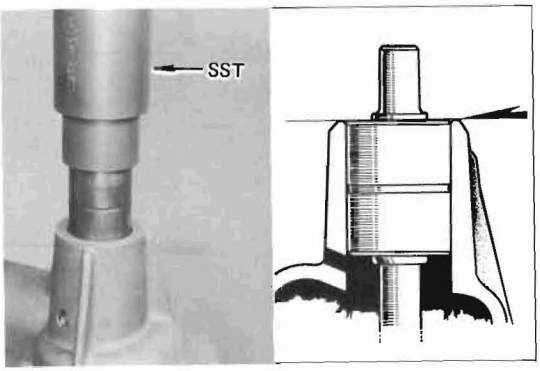
Fig. 5-5

Fig. 5-6



Apply a small amount of liquid sealer to pump body seal installing surface, press seal into body, using 26mm socket wrench.

Fig. 5-7

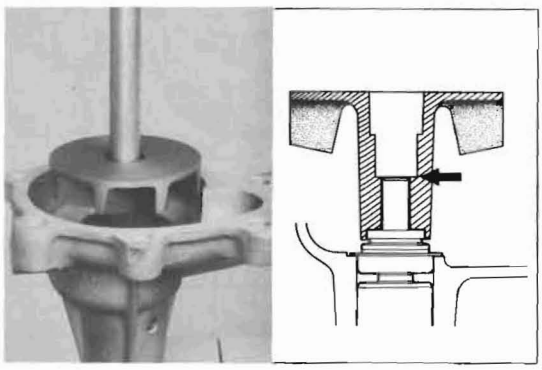


Using SST [09238-40010], press new bearing into body until its end surface is flush with body end.

Fig. 5-8

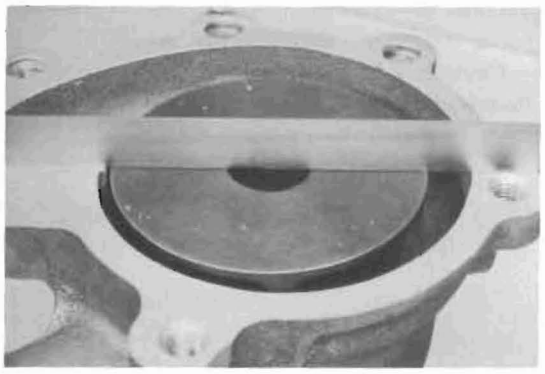
Assemble rubber seal and thrust plate into rotor.

Fig. 5-9



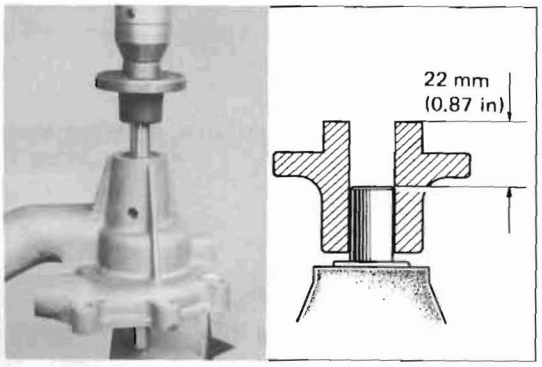
Apply a small amount of silicone oil or engine oil to the seal surfaces. Press in rotor until its surface indicated by arrow is flush with bearing shaft end.

Fig. 5-10



Make sure that the rotor end is flush with pump body end surface.

Fig. 5-11



Support the shaft from the rotor end with a suitable bar and press in pulley seat to the depth as shown.

– Note –

After assembling the rotor, check it for smooth rotation with the water pump plate in installed condition.

FLUID COUPLING

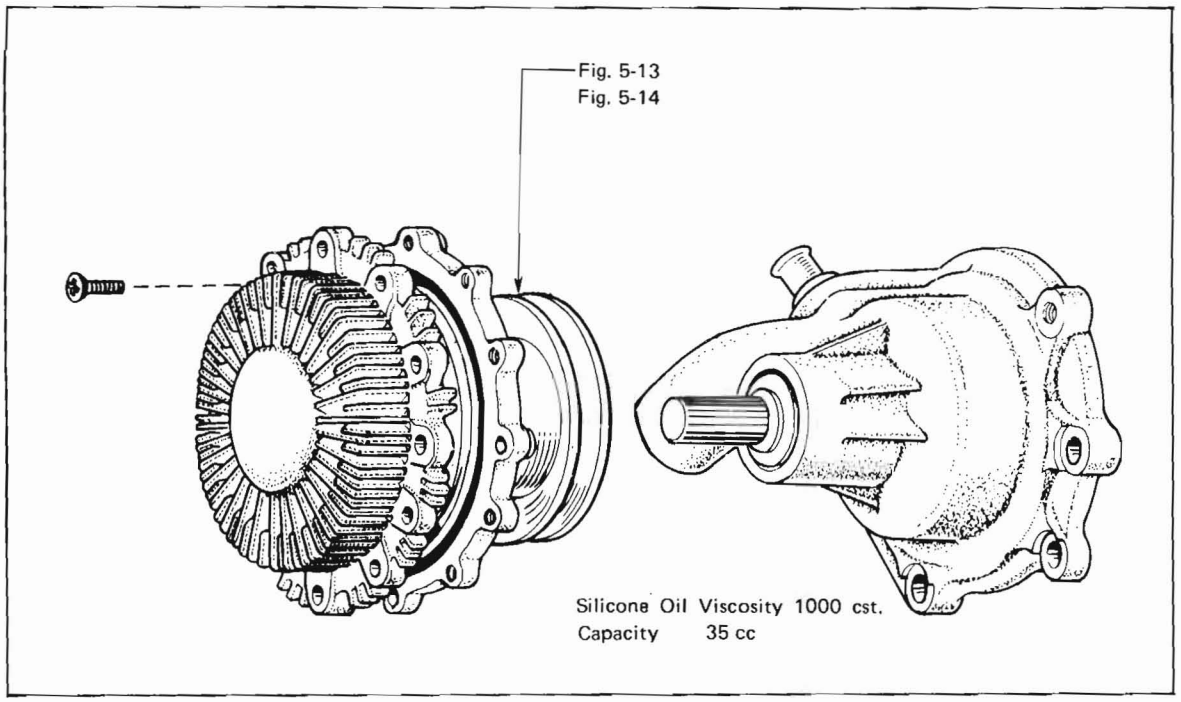
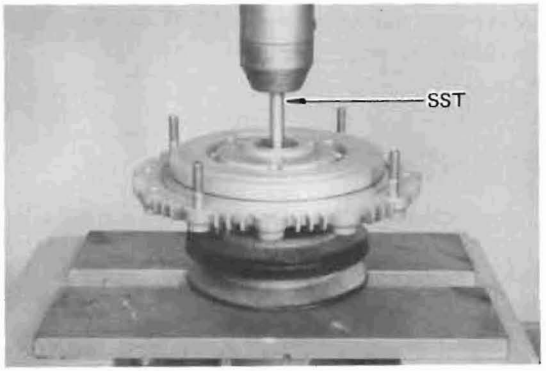


Fig. 5-12

Fig. 5-13

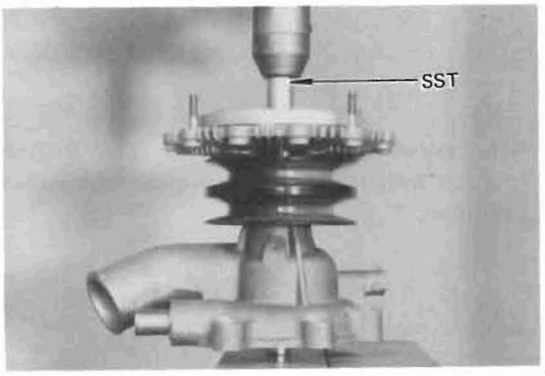


Support pulley with suitable anvils and press out pump assembly, using SST [09236-36010].

– Caution –

Removed coupling cannot be reused.

Fig. 5-14



Support pump bearing shaft end from the rotor end with a suitable bar and press in new coupling, using SST [09236-36010].

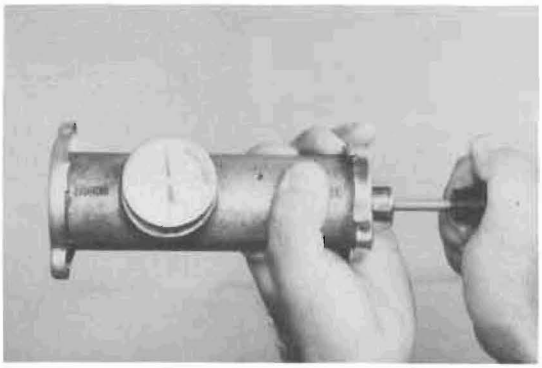
– Note –

Take care not to drop silicone oil when separating new coupling.

RADIATOR

INSPECTION

Fig. 5-15

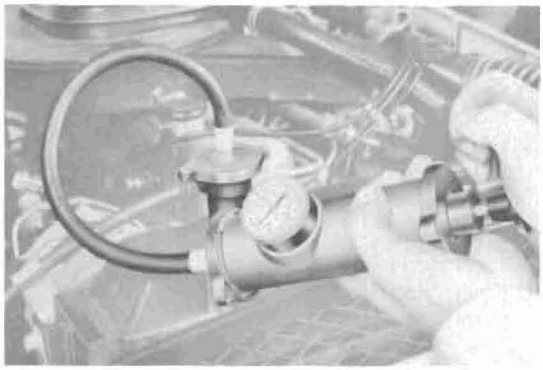


1. Inspect the radiator cap regulation pressure, and vacuum valves for spring tension and seating. If the pressure gauge drops rapidly and excessively, replace the radiator cap.

Valve opening pressure limit

	0.6 kg/cm² (8.5 psi)
Standard	**0.9 kg/cm² (12.8 psi)**

Fig. 5-16

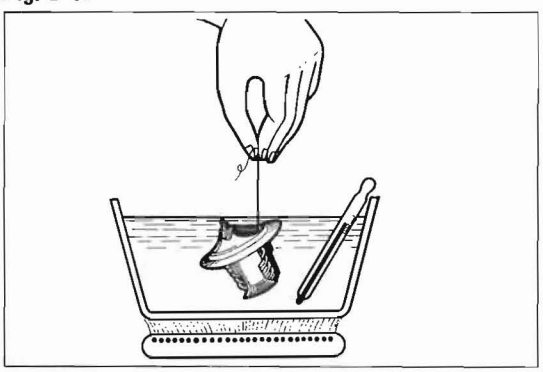


2. Inspect the cooling system for leaks. Attach the pressure tester to the radiator, pump the tester to the specified pressure. If the pressure gauge drops, inspect all hoses and fittings for an external leak. If no external leak is found an internal intake manifold, block or heater core leak should be suspected.

THERMOSTAT

INSPECTION

Fig. 5-17



1. Replace if the valve remains open at normal temperature or does not have proper tightness when fully closed.
2. Immerse the thermostat in the water, and check the valve opening temperatures by heating the water gradually.
   The valve is satisfactory if it starts to open at 80.5° to 83.5°C (177° to 182°F) and opens to more than 8mm (0.32 in.) at 95°C (203°F).
   Replace if necessary.

MEMO

FUEL SYSTEM

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FUEL PUMP

DISASSEMBLY

Disassemble in numerical order.

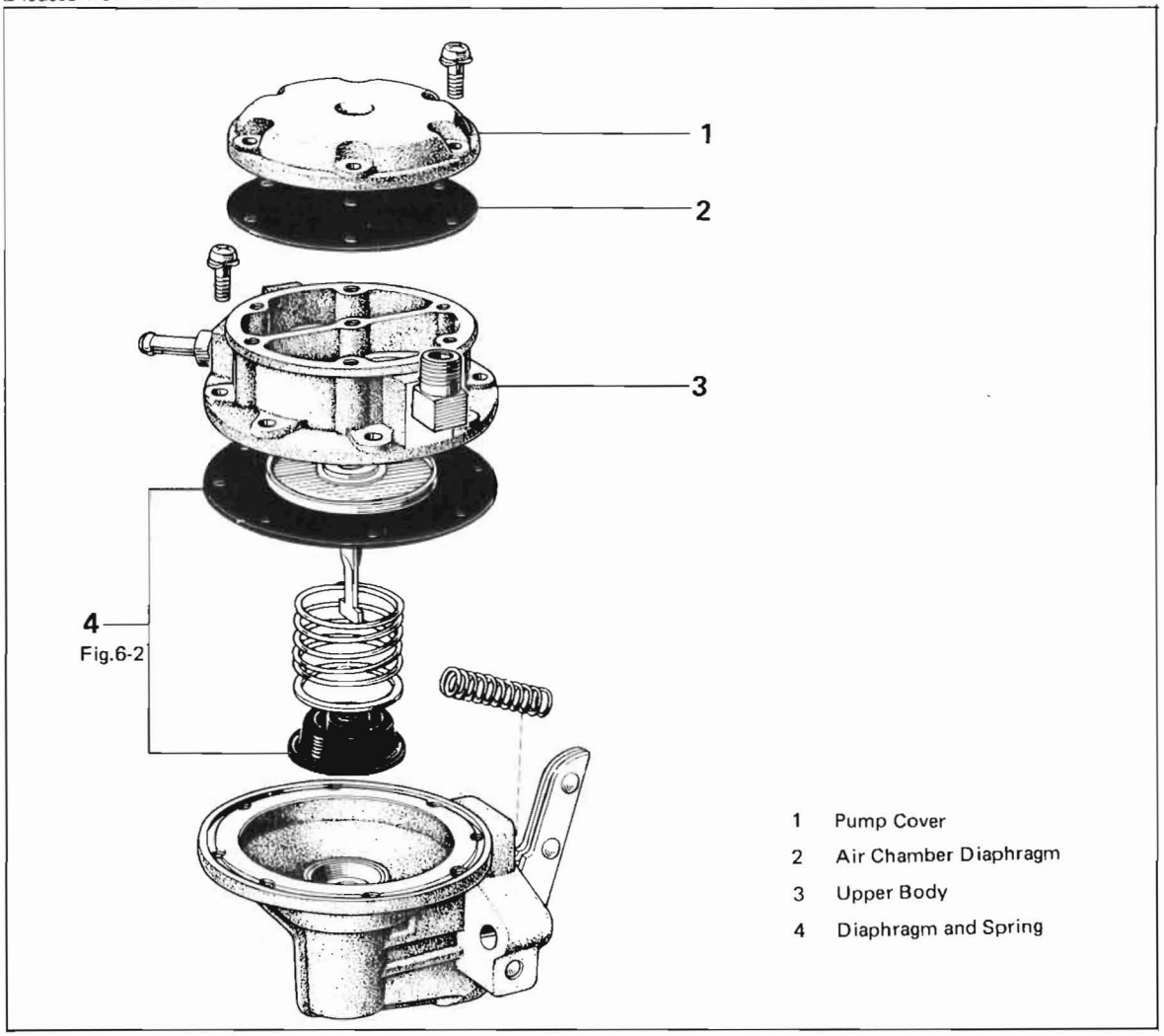
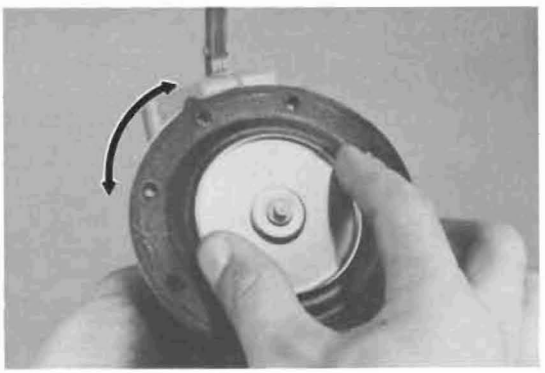


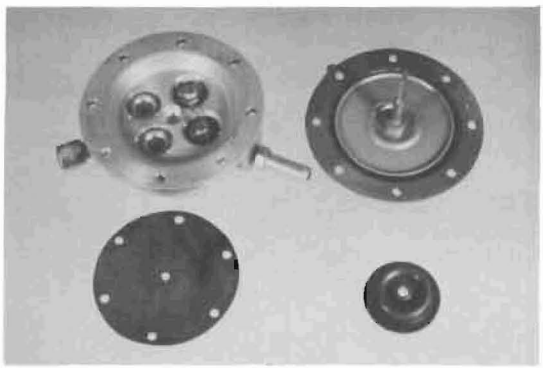
Fig. 6-1

Fig. 6-2



Remove diaphragm by turning it 90 degrees clockwise or counterclockwise while pushing.

Fig. 6-3



INSPECTION

Inspect diaphragms for tear and check valves for defective operation. Replace if damaged.

ASSEMBLY

Assemble in numerical order.

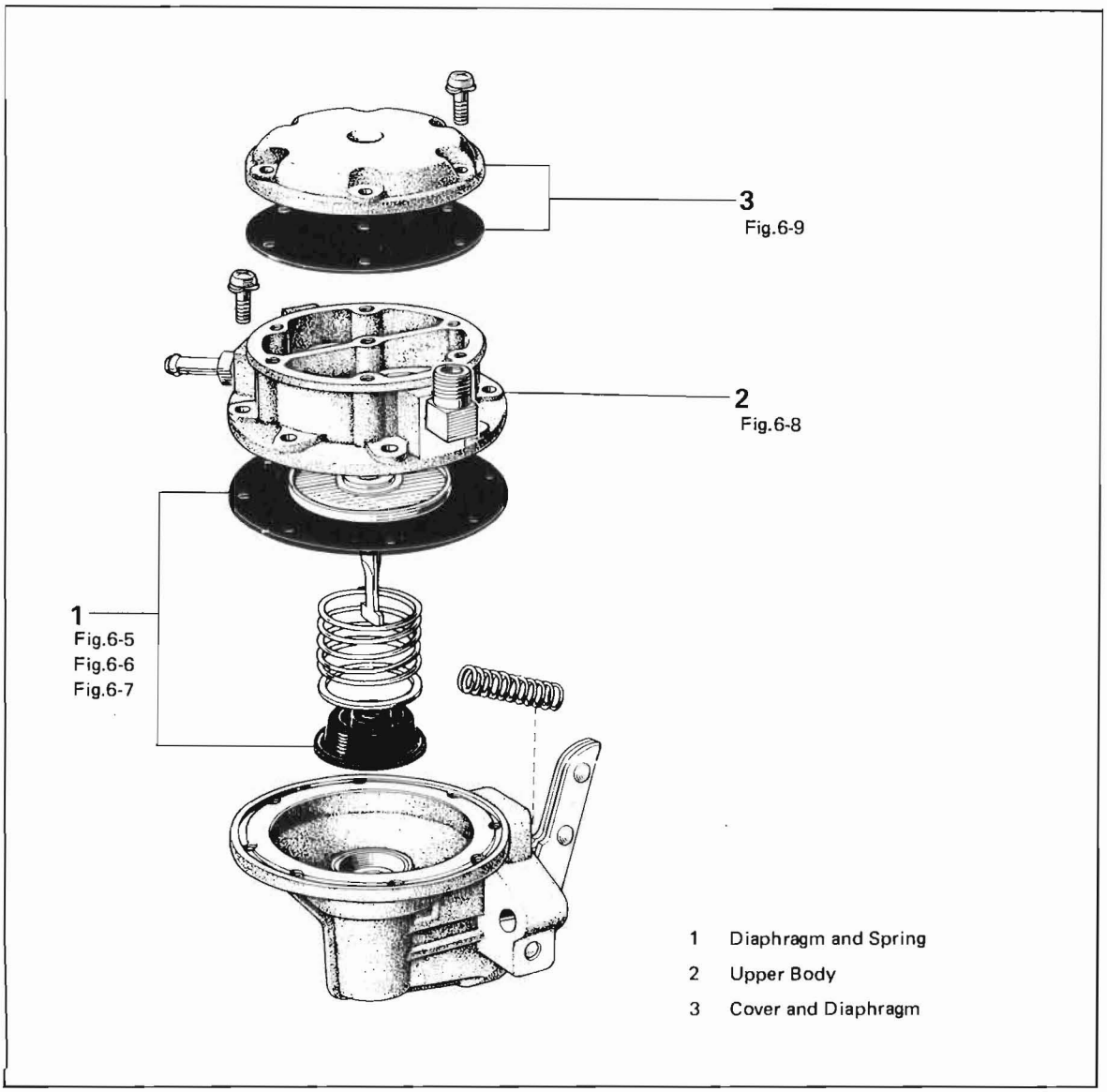
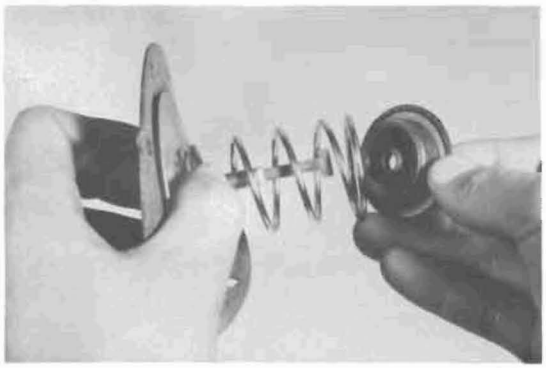


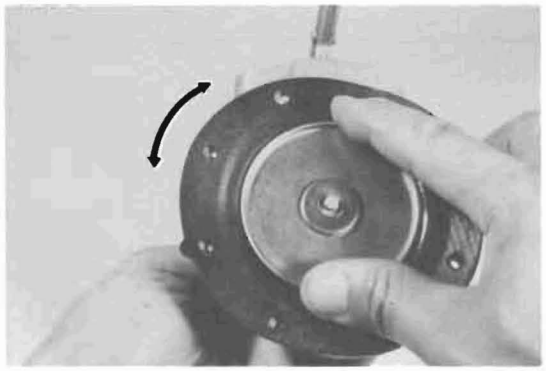
Fig. 6-4

Fig. 6-5



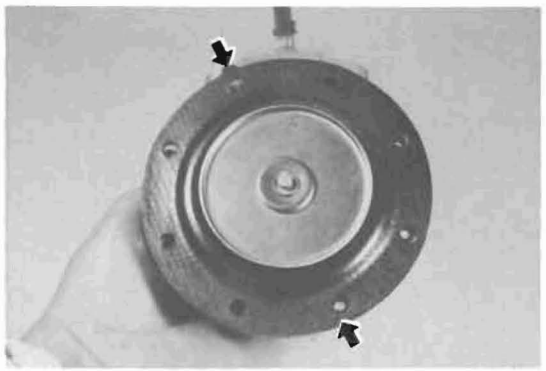
Assemble spring, retainer and oil seal onto diaphragm rod.

Fig. 6-6



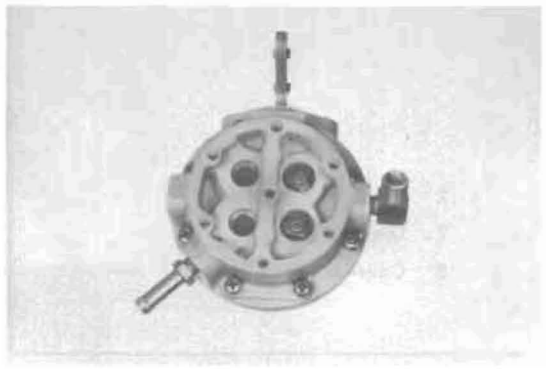
Insert diaphragm rod into lower body hole. While compressing the spring turn diaphragm 90 degrees clockwise or counterclockwise to mesh the rod and rocker arm.

Fig. 6-7



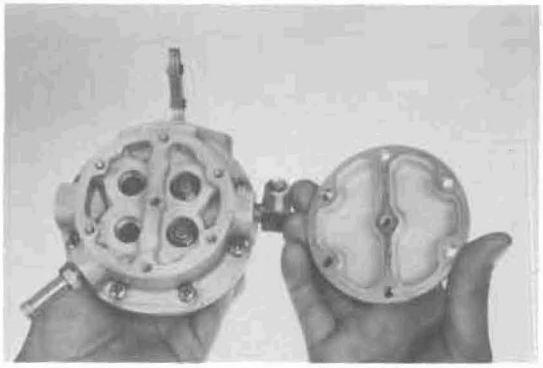
After assembling, the tab of diaphragm must face the position indicated by arrow.

Fig. 6-8



Assemble lower and upper body in direction as shown.

Fig. 6-9



⚠ Assemble upper body and cover over the diaphragm.
Inlet and outlet chamber separating walls should be aligned.

CARBURETOR

CARBURETOR CIRCUITS (Except for USA)

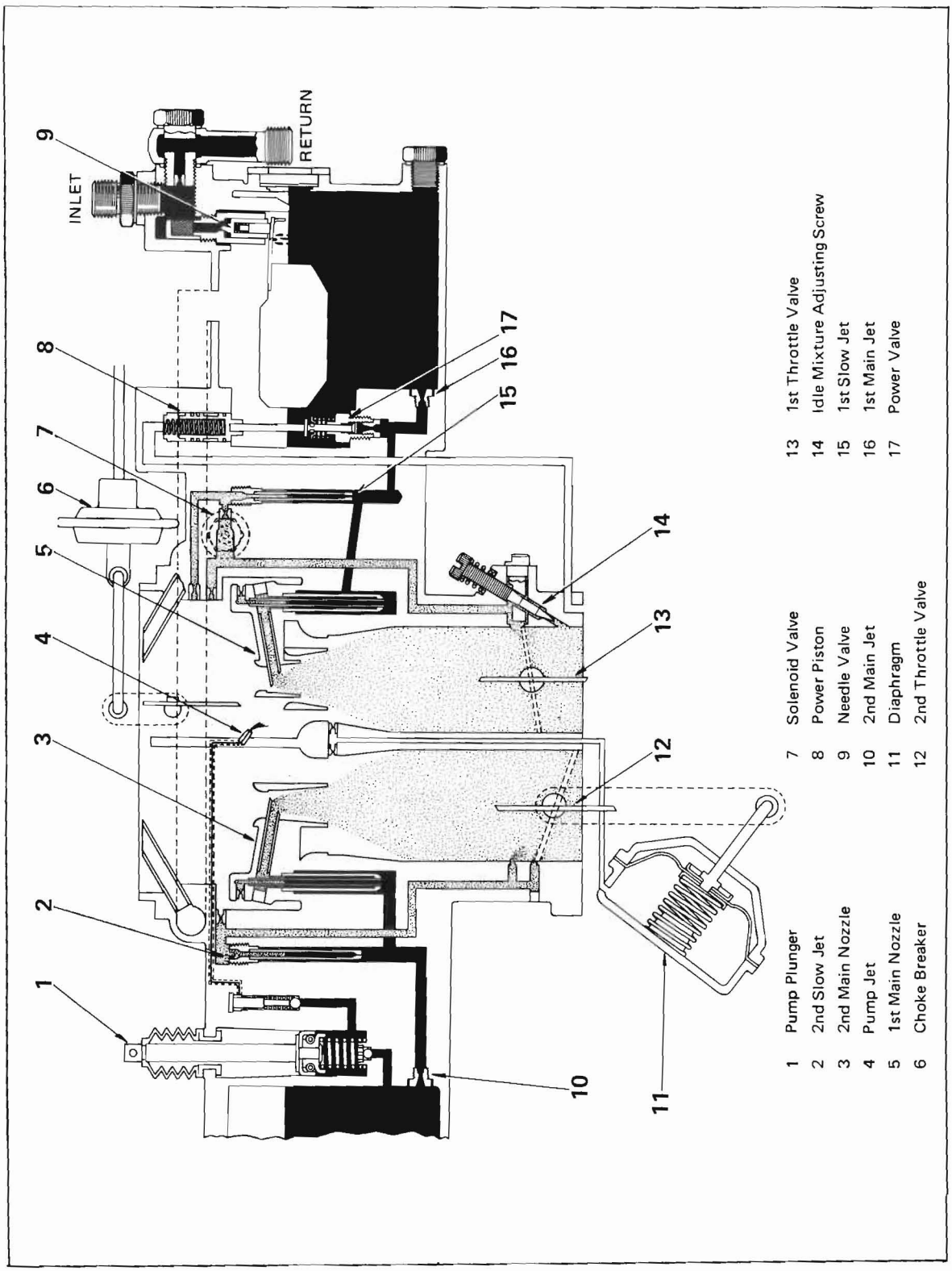


Fig. 6-10

CARBURETOR CIRCUITS (Only for USA)

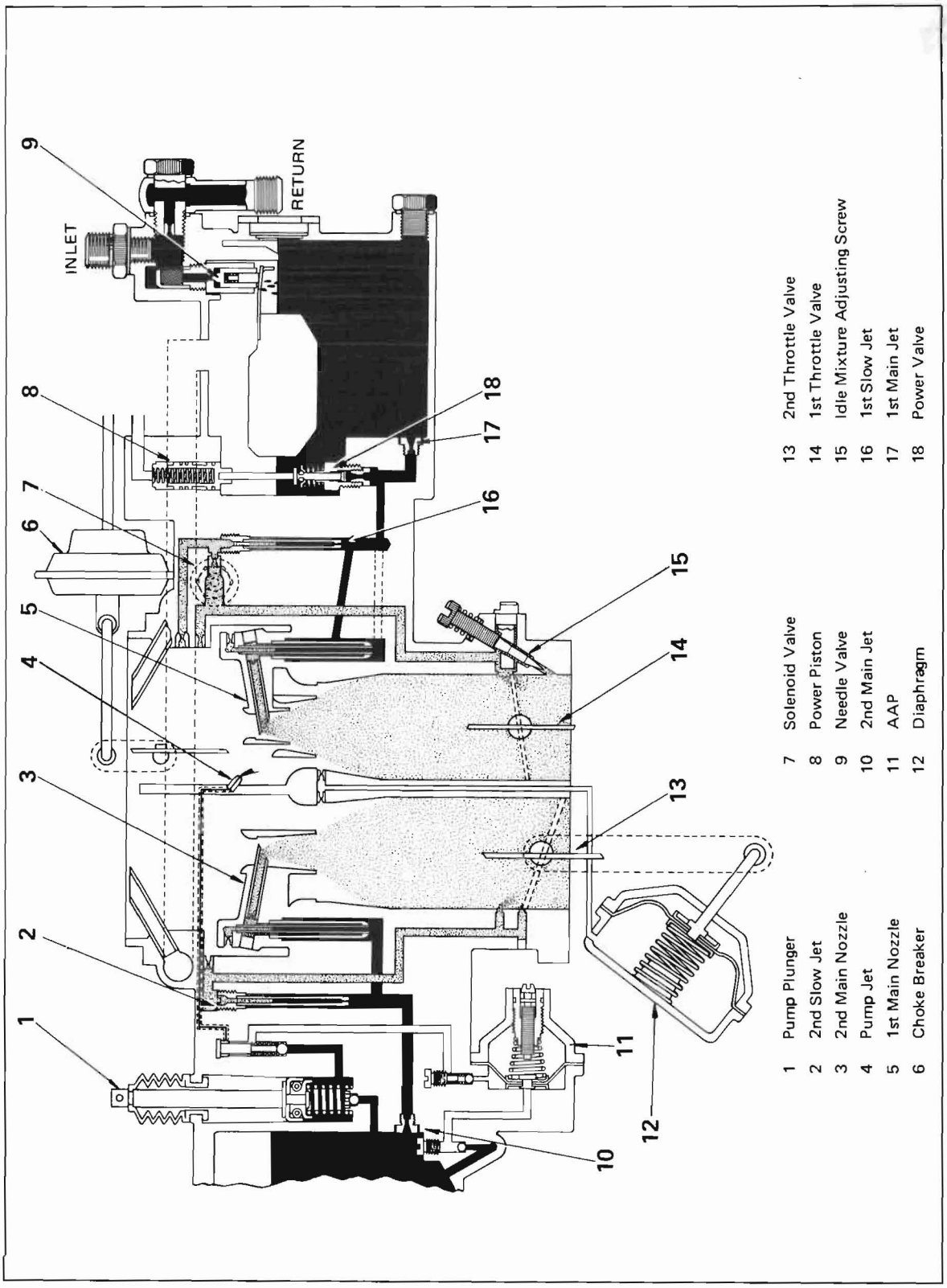
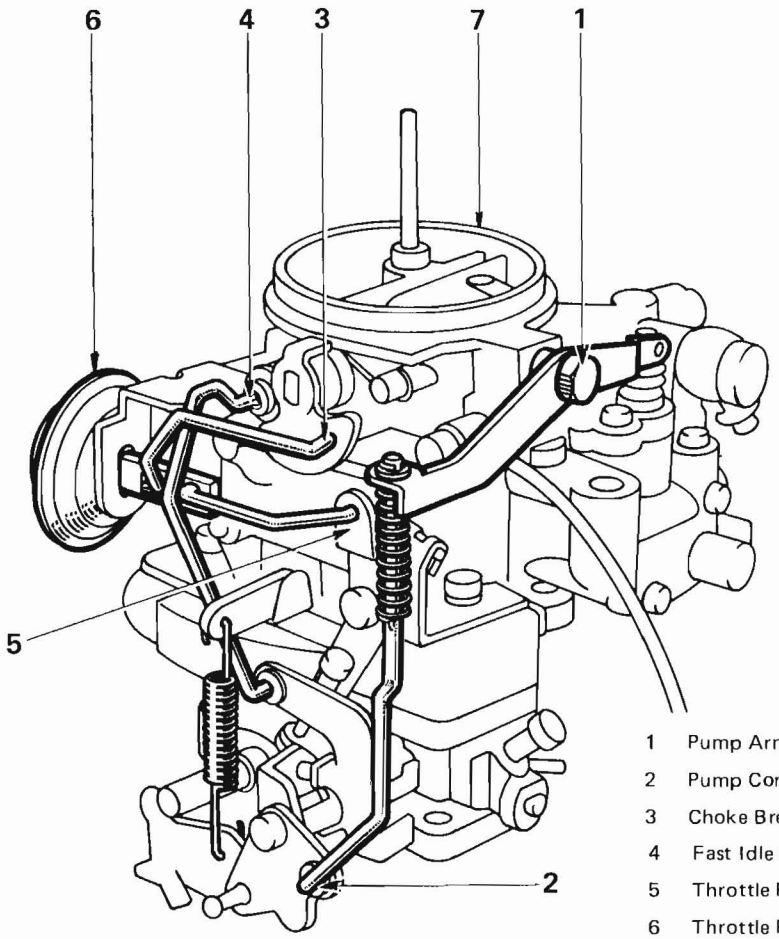


Fig. 6-11

DISASSEMBLY

Disassemble in numerical order.

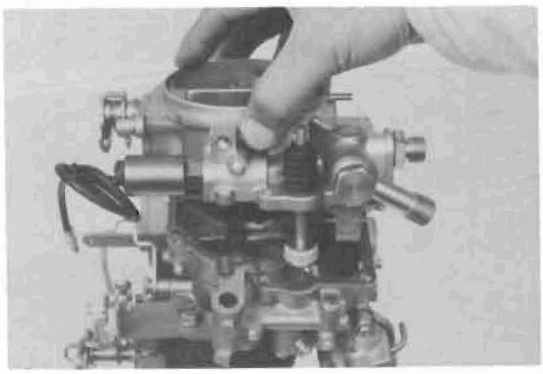
USE SST [09860-11010] FOR CARBURETOR SERVICE.



1 Pump Arm
2 Pump Connecting Link
3 Choke Breaker Connecting Link
4 Fast Idle Connecting Link
5 Throttle Positioner Connecting Link
6 Throttle Positioner (Choke Breaker)
7 Air Horn

Fig. 6-12

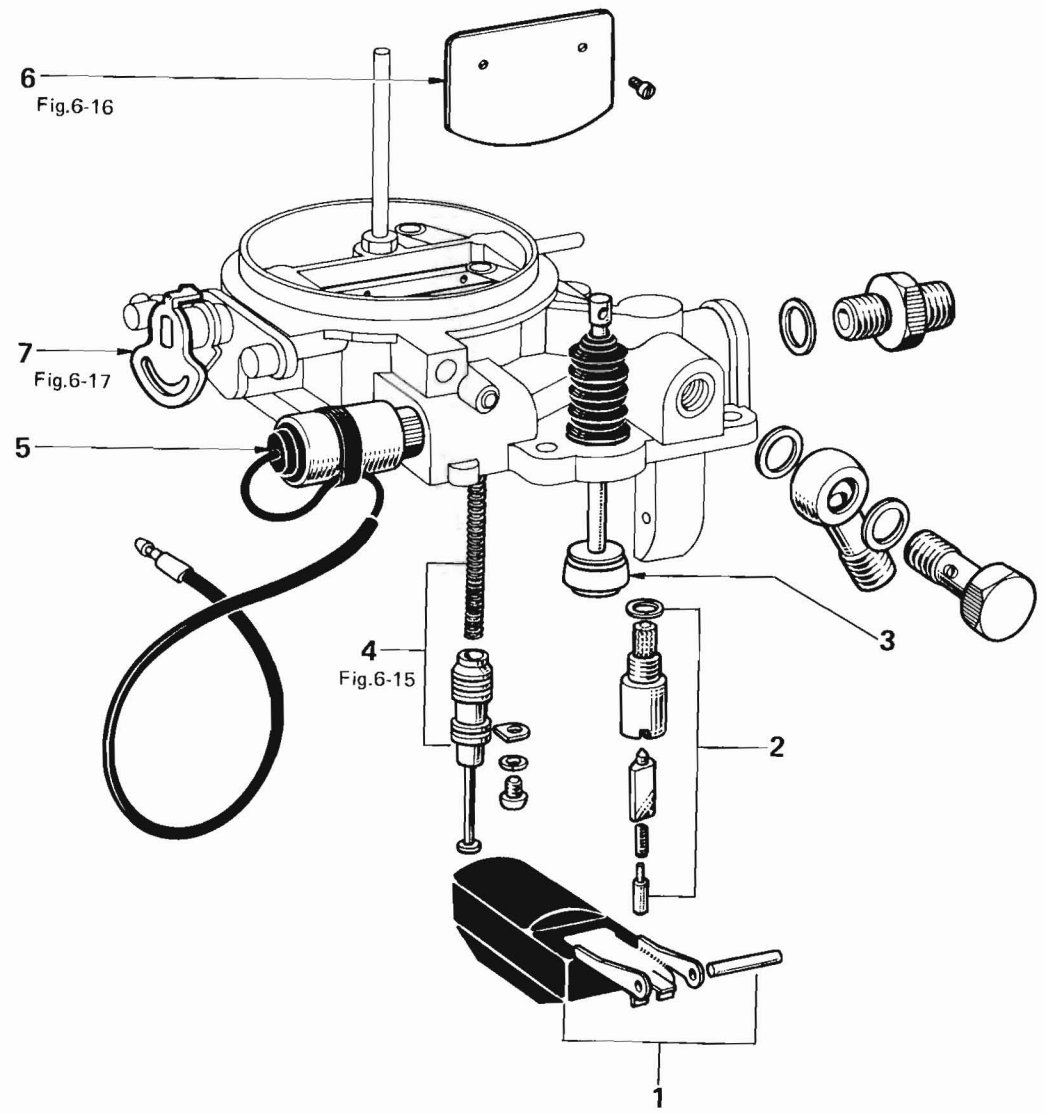
Fig. 6-13



Lift out air horn.

AIR HORN

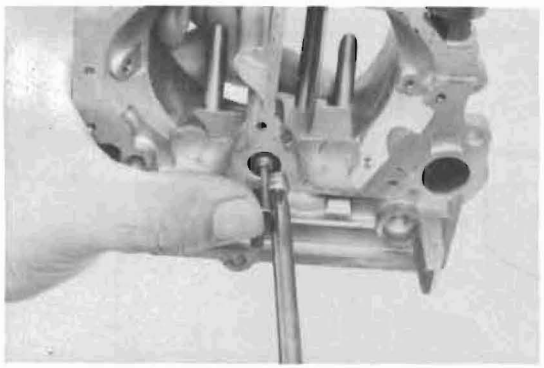
Disassemble in numerical order.



1 Float
2 Needle Valve and Seat
3 Pump Plunger
4 Power Piston
5 Solenoid Valve
6 Choke Valve
7 Choke Shaft

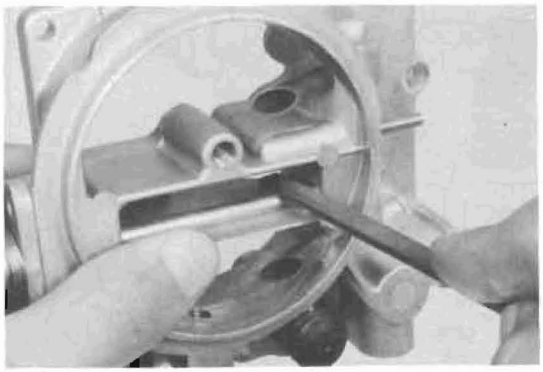
Fig. 6-14

Fig. 6-15



Remove power piston and spring. Take care not to lose the spring.

Fig. 6-16



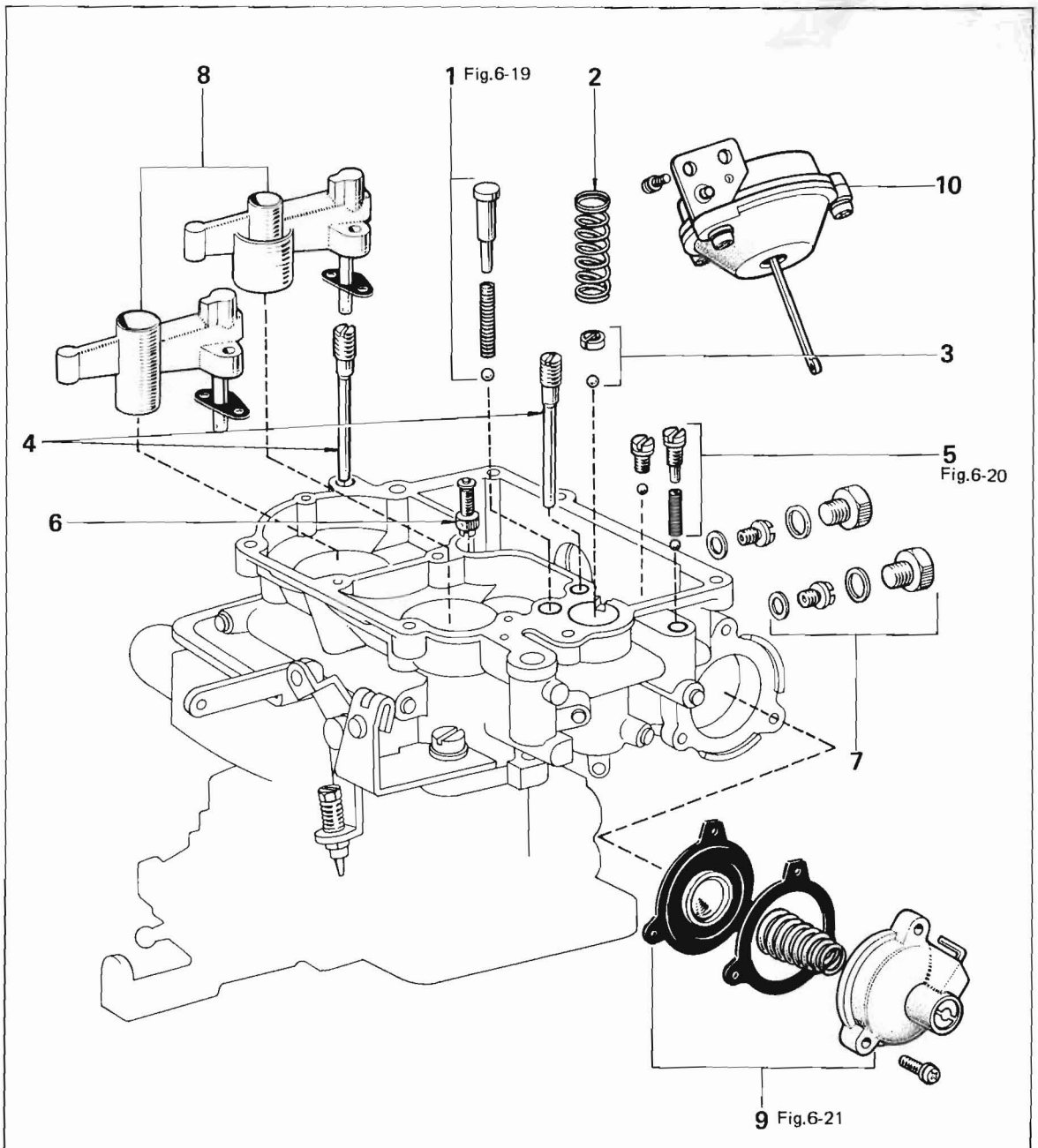
Unpeen set screws and remove choke valve.

Fig. 6-17

Unhook spring and pull out choke shaft.

BODY

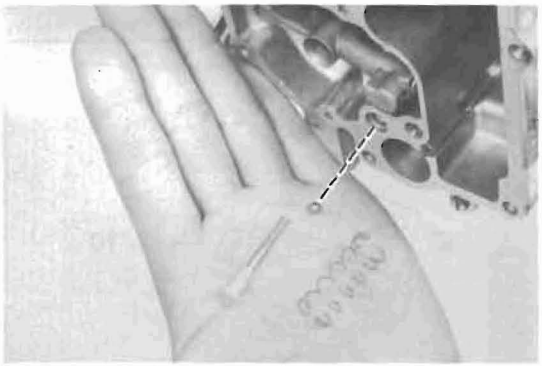
Disassemble in numerical order.



1	Pump Outlet Ball and Spring	6	Power Valve
2	Pump Damping Spring	7	Main Jet
3	Pump Inlet Ball	8	Venturi
4	Slow Jet	9	AAP Diaphragm and Housing (For USA)
5	AAP Check Ball (For USA)	10	Secondary Diaphragm

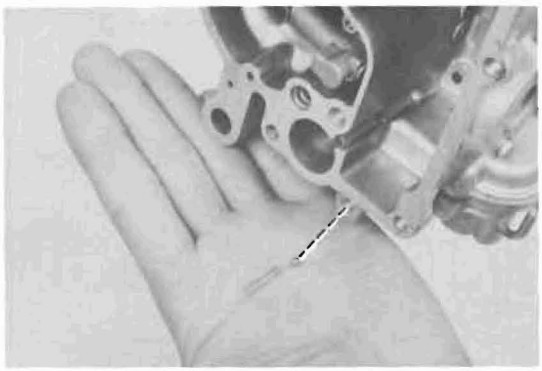
Fig. 6-18

Fig. 6-19



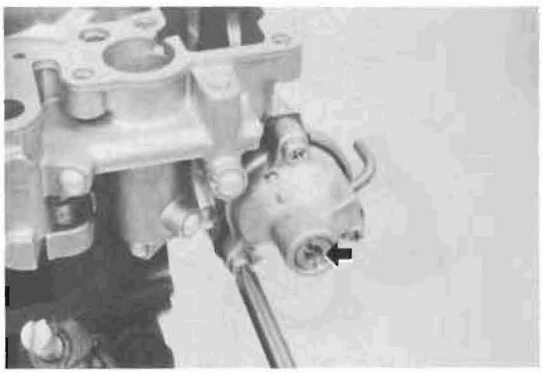
Drop out pump outlet ball and springs.

Fig. 6-20



Loosen screw plug and drop out AAP outlet ball and spring.

Fig. 6-21



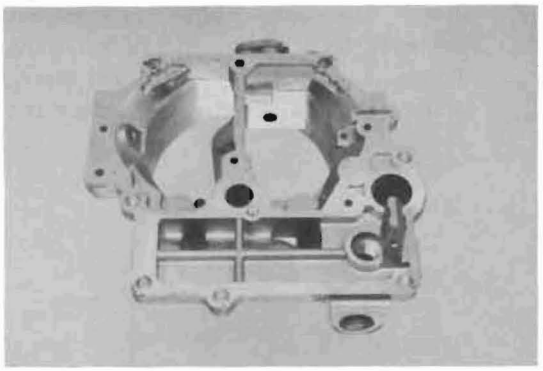
Remove AAP housing and diaphragm.
Do not turn the AAP adjusting screw (Arrow).

INSPECTION

– Precaution –

1. **Before inspecting the parts, wash them thoroughly in carburetor cleaner. Using compressed air, blow all dirt and other foreign matter from the jets and similar parts, and from the fuel passages and restrictions in the body.**
2. **Never clean the jets or orifices with wire or a drill. This could enlarge the openings and result in excessive fuel consumption.**

Fig. 6-22

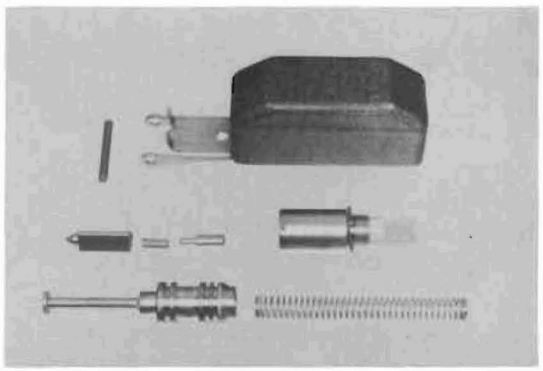


Inspect the following parts and replace any part damaged.

Air Horn Parts

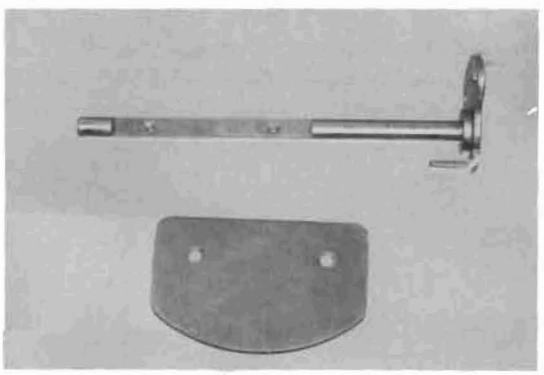
1. Air horn: Cracks, damaged threads, and wear on choke shaft bores.

Fig. 6-23



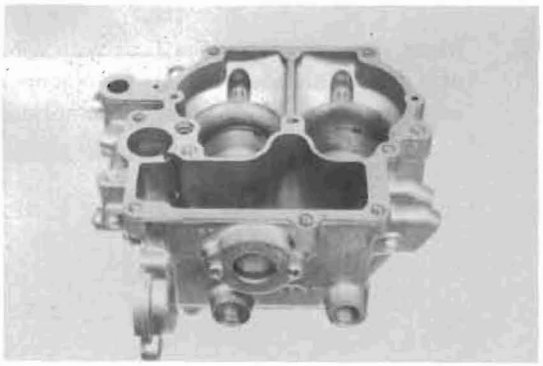
2. Float: Broken lip, wear in float pivot pin holes.
3. Needle valve surface contacting valve seat.
4. Strainer: Rust, breaks.
5. Power piston: Scratches, excessive wear. Power piston spring broken or deformed.

Fig. 6-24



6. Choke valve: Deformation. Choke shaft worn, bent, or not fitting properly into housing.

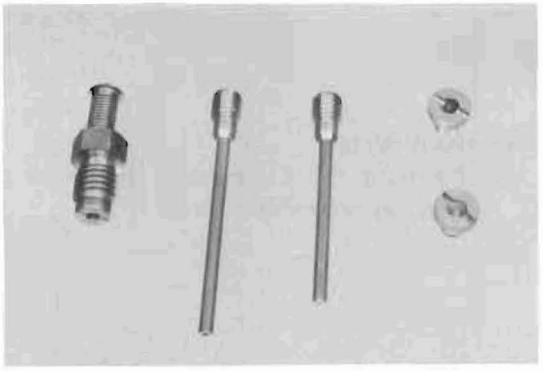
Fig. 6-25



Body Parts

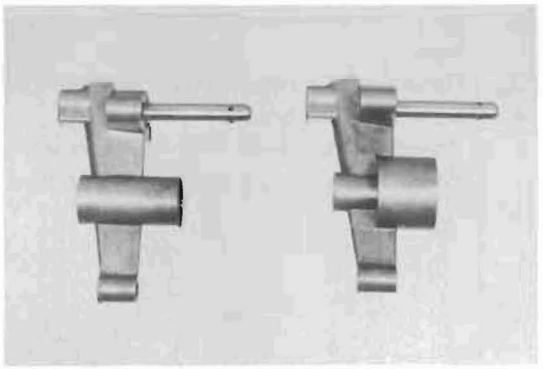
1. Body: Cracks, scored mounting surfaces, damaged threads.

Fig. 6-26



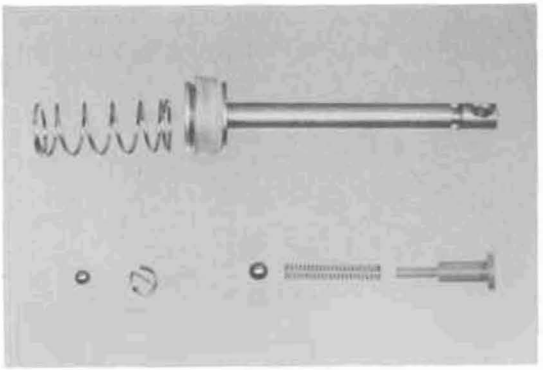
2. Jets: Damaged contacting surface, damaged threads and screwdriver slots.
3. Power valve: Faulty opening and closing action, damaged contacting surface and threads.

Fig. 6-27



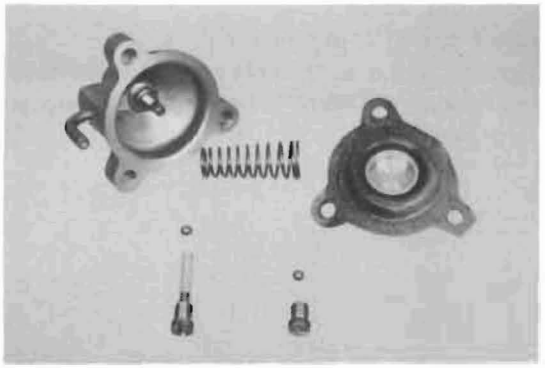
4. Venturi: Damaged.

Fig. 6-28



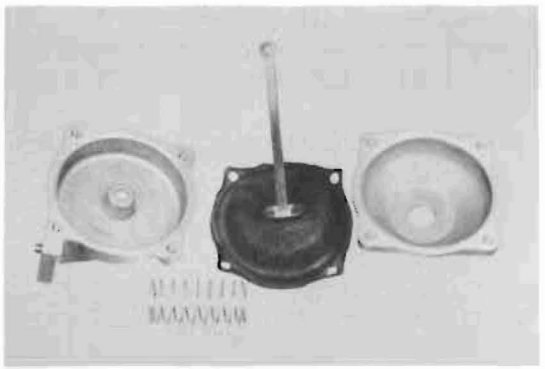
5. Pump damping spring: Deformation, rust.
6. Pump check ball: Damaged, rusted.
7. Pump plunger: Wear at sliding surface, deformed or damaged leather.

Fig. 6-29



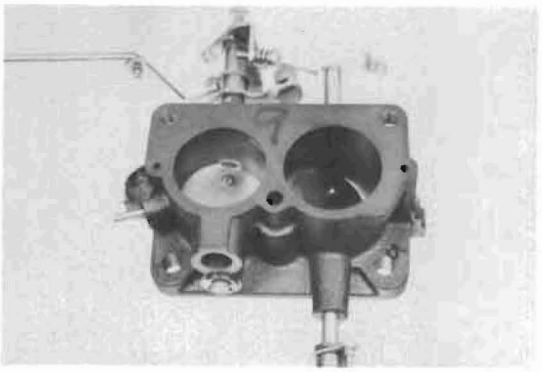
8. AAP check ball: Faulty opening and closing action or damaged diaphragm.

Fig. 6-30



9. Secondary diaphragm: Damaged.

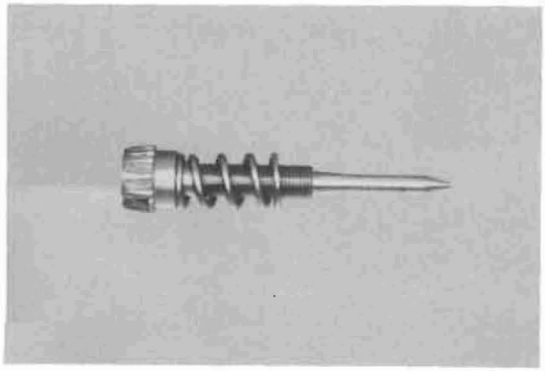
Fig. 6-31



Flange Parts

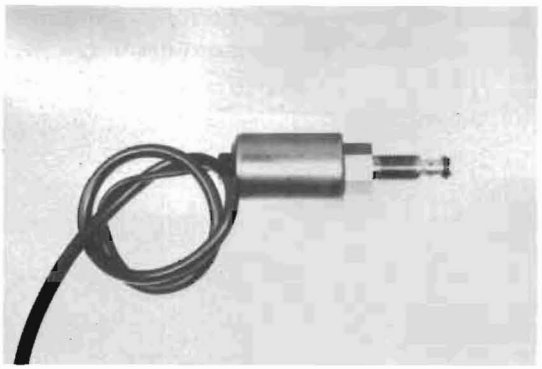
1. Flange: Cracks, injured mounting surfaces, damaged threads, wear at throttle shaft bearings.
2. Throttle valves: Wear or deformation in valves. Wear, bending, twisting, or faulty movement inside housing of shaft.

Fig. 6-32



3. Idle mixture adjusting screw: Damage at tapered tip or threads.

Fig. 6-33

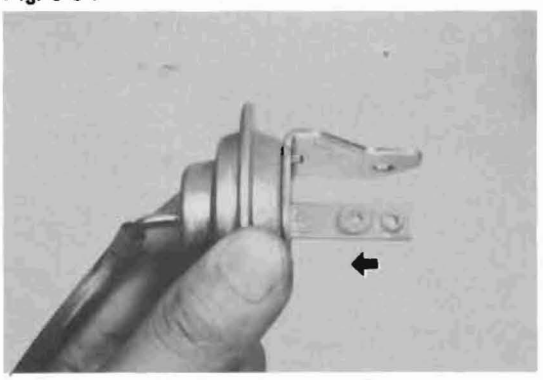


Solenoid Valve

Check operation of solenoid valve.

Connect wiring to the battery positive terminal and ground the body. The needle valve should be pulled in.

Fig. 6-34



Choke Breaker (Throttle Positioner)

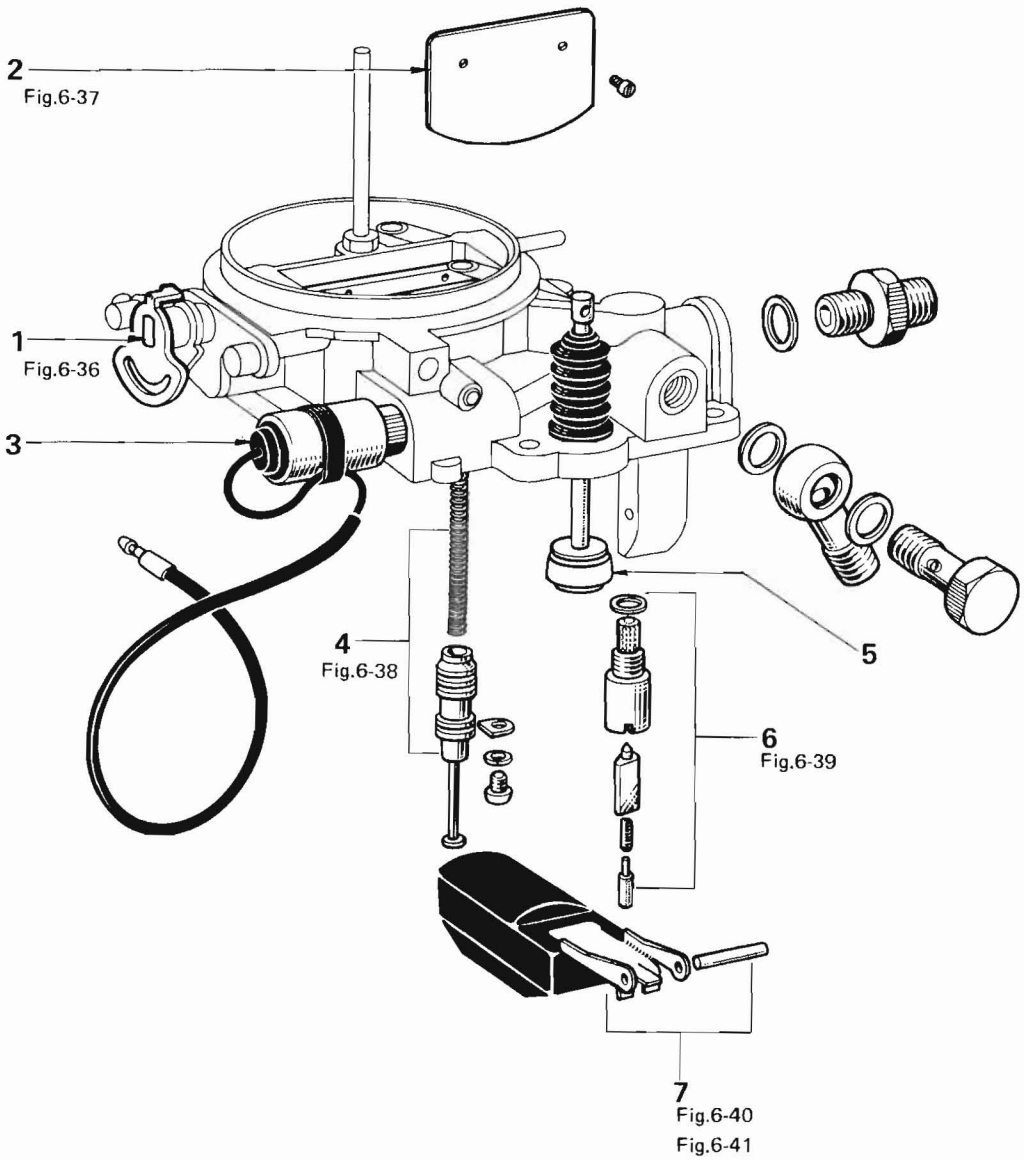
Connect hose to choke breaker diaphragm (throttle positioner) and suck the hose with mouth.

The diaphragm should move. If not, replace it.

ASSEMBLY

AIR HORN

Assemble in numerical order.



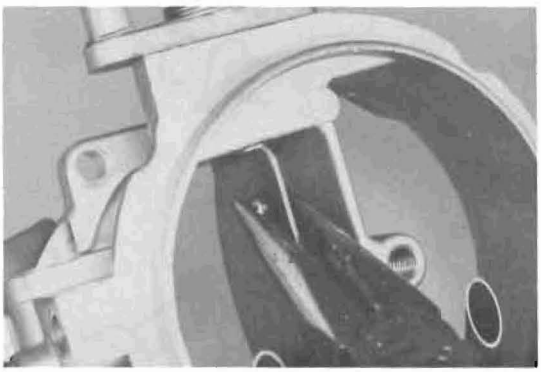
1 Choke Shaft
2 Choke Valve
3 Solenoid Valve
4 Power Piston
5 Pump Plunger
6 Needle Valve and Seat
7 Float

Fig. 6-35

Fig. 6-36

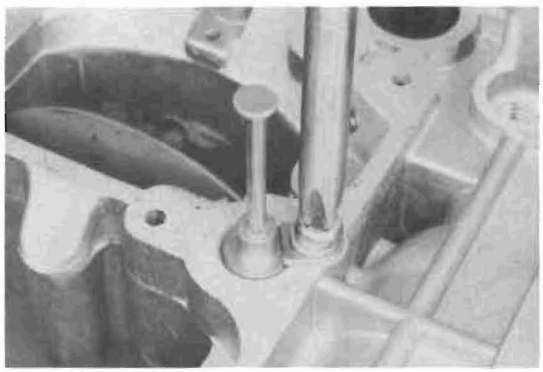
Insert choke shaft and hook the spring as shown.

Fig. 6-37



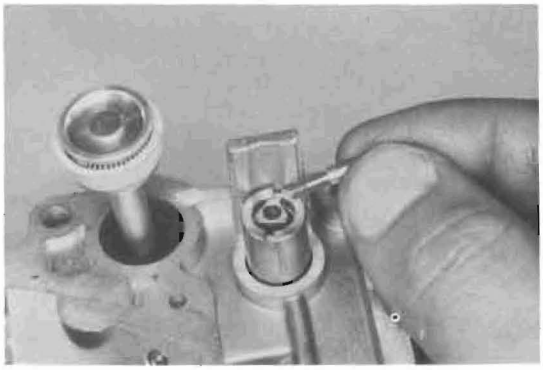
Install choke valve, then peen screws.

Fig. 6-38



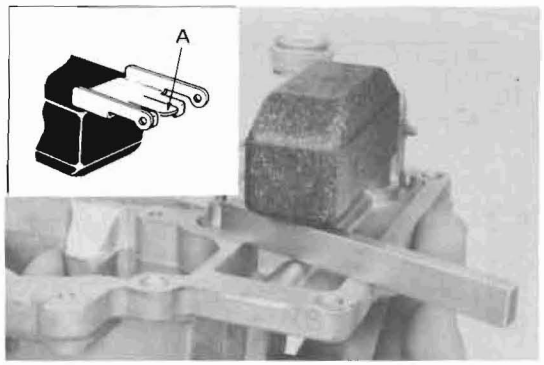
Install power piston and spring.
Make sure that the piston moves smoothly.

Fig. 6-39



Fit needle valve, spring and plunger in order.

Fig. 6-40



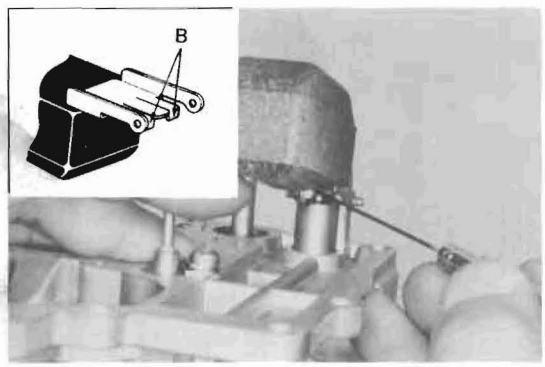
Adjust float level.
Allow the float to hang down by its own weight. Then check the clearance between the float tip and air horn with SST [09240-00011]. Adjust by bending the (A) part of float lip.

Standard **7.5 mm (0.295 in)**

– Note –

This measurement is always made without any gasket on air horn.

Fig. 6-41

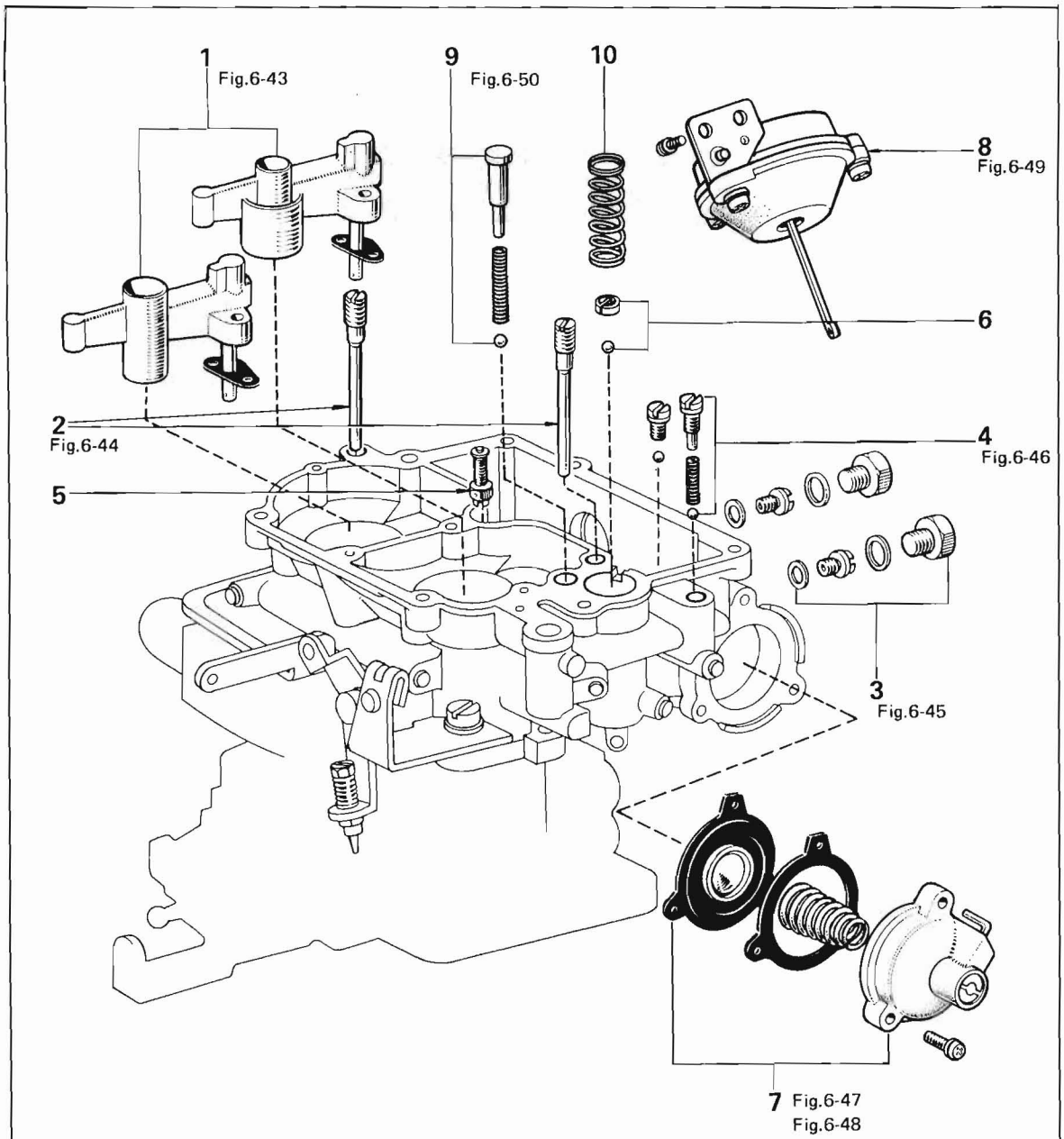


Adjust lowered position.
Lift up the float and check the clearance between the needle valve plunger and float lip with SST [09240-00011]. Adjust by bending the (B) part of float lip.

Standard **1.1 mm (0.043 in)**

BODY

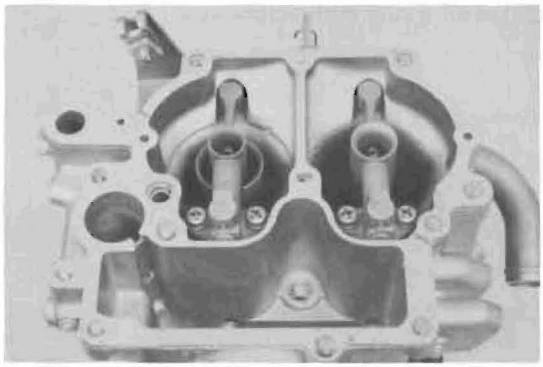
Assemble in numerical order.



1	Venturi	6	Pump Inlet Ball and Retainer
2	Slow Jet	7	AAP Diaphragm and Housing (For USA)
3	Main Jet	8	Secondary Diaphragm
4	AAP Check Ball (For USA)	9	Pump Outlet Ball and Spring
5	Power Valve	10	Pump Damping Spring

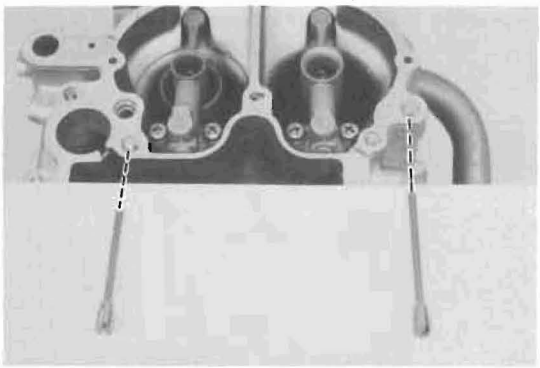
Fig. 6-42

Fig. 6-43



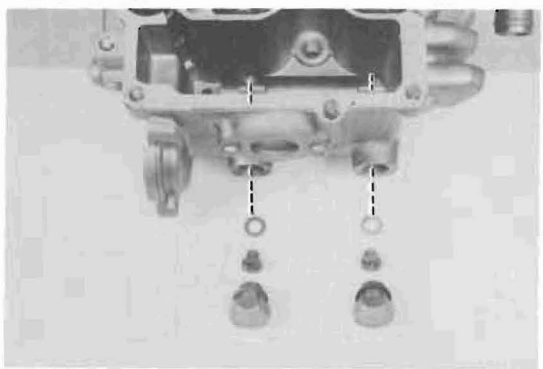
Install venturis over gasket.
Primary and secondary venturis are different.
Primary ——— Triple venturi
Secondary ——— Double venturi

Fig. 6-44



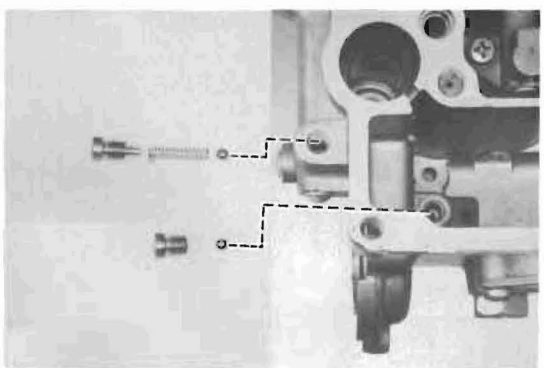
Install slow jets.
Longer or larger size jet should be installed at secondary side.

Fig. 6-45



Install main jets over gasket.
Primary jet ——— Brass colored
Secondary jet ——— Chrome colored

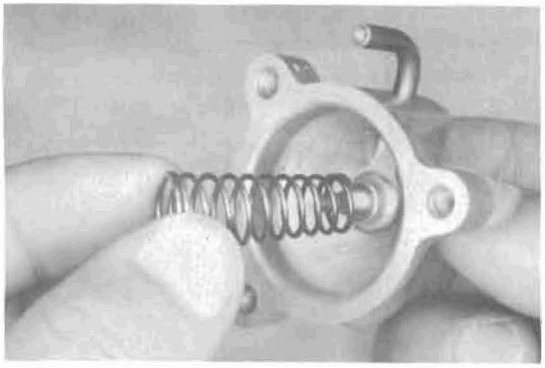
Fig. 6-46



Install AAP check balls.

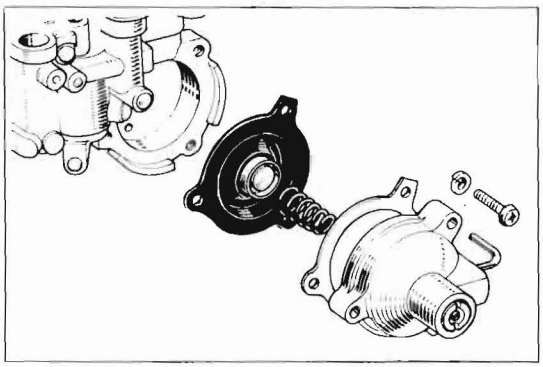
– Note –
There are two sizes of balls.
Smaller ball: For AAP and pump inlet
Larger ball: For Pump outlet

Fig. 6-47



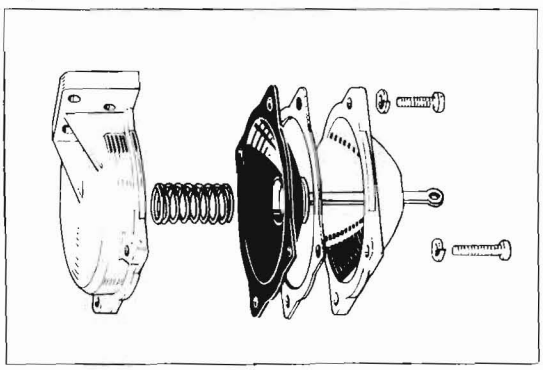
Fit AAP spring in direction as shown.

Fig. 6-48



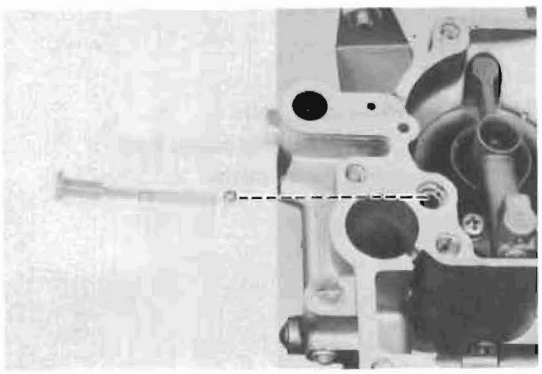
Assemble AAP diaphragm in order as shown.

Fig. 6-49



Assemble secondary diaphragm in order as shown.

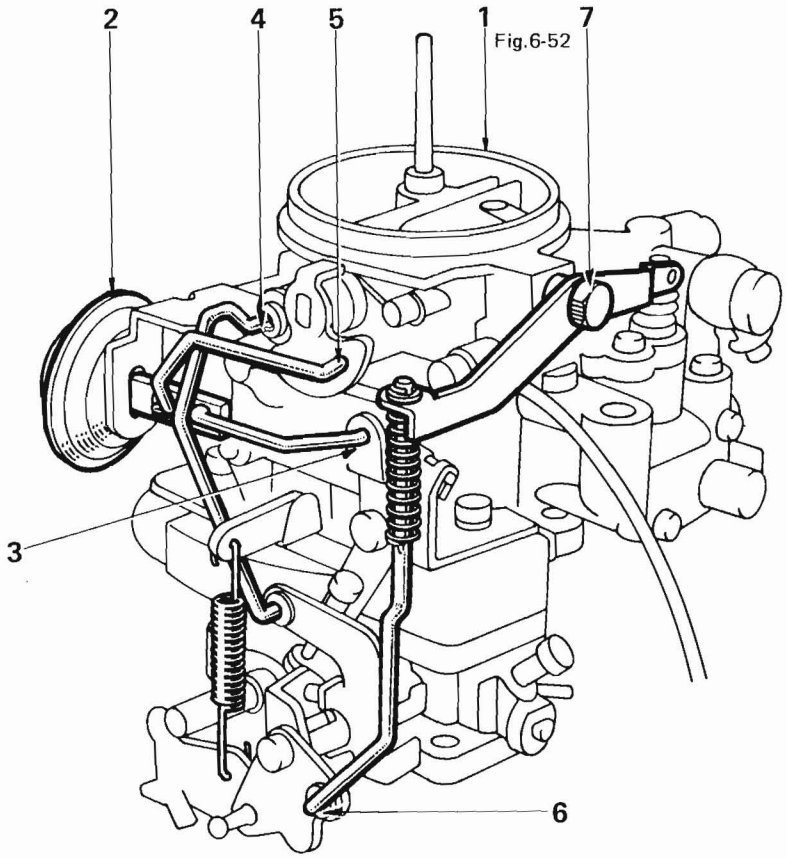
Fig. 6-50



Install pump outlet ball and spring.

BODY AND AIR HORN

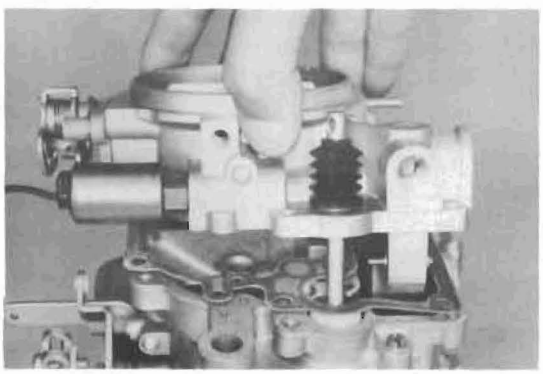
Assemble in numerical order.



1 Air Horn
2 Choke Breaker (Throttle Positioner)
3 Throttle Positioner Connecting Link
4 Fast Idle Connecting Link
5 Choke Breaker Connecting Link
6 Pump Connecting Link
7 Pump Arm

Fig. 6-51

Fig. 6-52



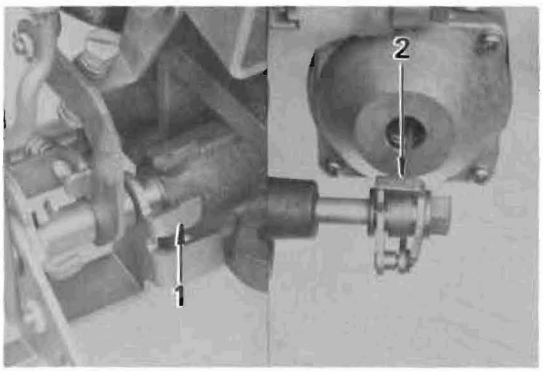
Assemble body and air horn over new gasket. Take care not to damage pump plunger leather.

Fig. 6-53

ADJUSTMENT

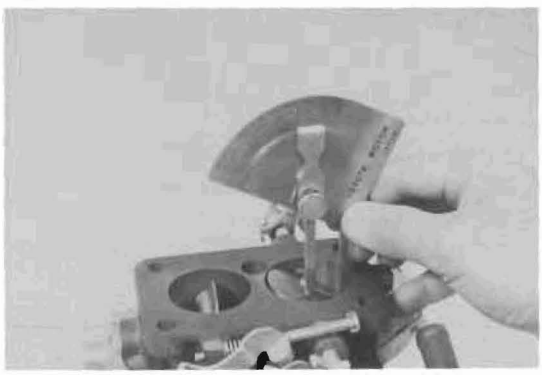
Use SST [09240-00011] to make adjustments.

Fig. 6-54



1. Throttle valve openings
Open the primary and secondary throttle valves separately and check if the throttle valves will be perpendicular to the flange surface when fully opened. Adjust by bending the respective throttle lever stoppers at the primary (1) and secondary sides (2).

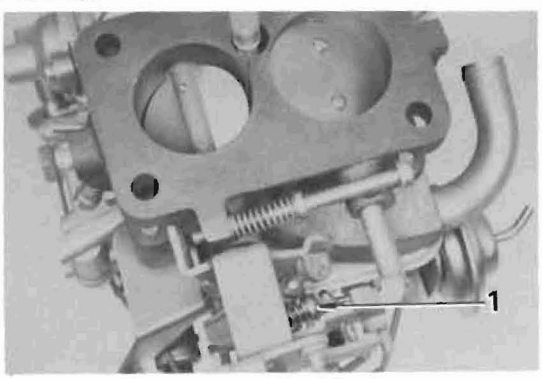
Fig. 6-55



2. Kick up
With the primary throttle valve fully opened, check the secondary throttle valve opening. Adjust by bending secondary throttle lever.

Standard **28° from bore**
25° from bore
(Only for California)

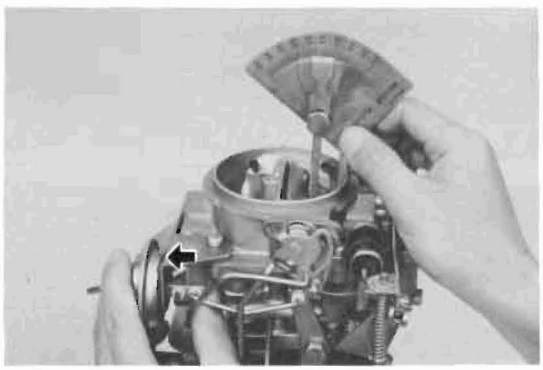
Fig. 6-56



3. Fast idle
With choke valve fully closed, check the clearance between bore and primary throttle valve. Adjust by turning fast idle adjusting screw (1).

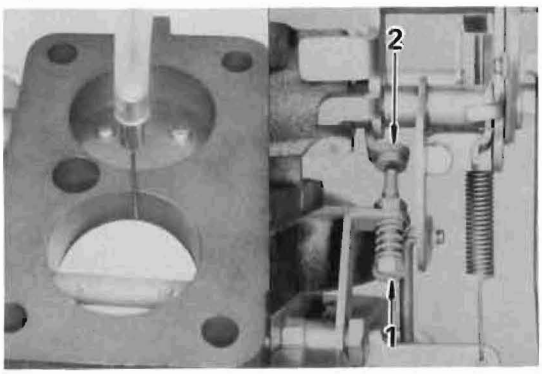
Standard clearance
1.3 mm (0.051 in)

Fig. 6-57



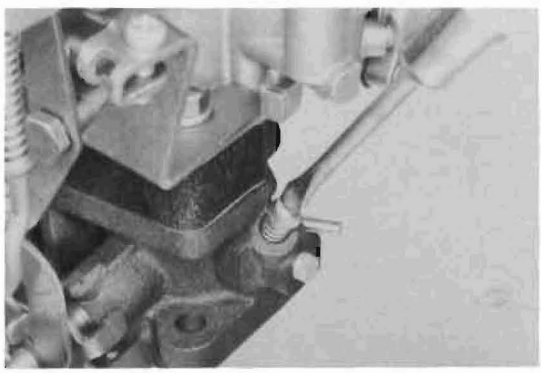
4. Choke breaker
Push in choke breaker rod to open choke valve and check the choke valve angle. Adjust by bending the choke breaker link.
Standard 38° from bore

Fig. 6-58



5. Throttle positioner
Contact throttle positioner adjusting screw (1) to throttle lever tab (2), check the clearance between bore and primary throttle valve. Adjust by turning the adjusting screw.
Standard clearance
0.8 mm (0.031 in)

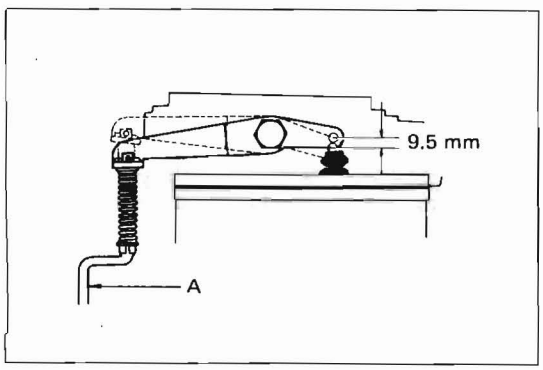
Fig. 6-59



6. Idle mixture adjusting screw
Screw in the idle mixture adjusting screw and then unscrew it by the following amount.
Standard (Reference only)
Returned about 1½ turns from full closed

– Caution –
Take care not to screw in too tightly and damage the screw tip.

Fig. 6-60



7. Accelerating pump
Adjust the pump stroke by bending part A.
Standard 9.5 mm (0.374 in)

– Note –
After adjustment is made, be sure to check the linkage to see that it operates smoothly.

MEMO

STARTING SYSTEM

Page

STARTING SYSTEM CIRCUITS 7- 2

STARTER 7- 3

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INSPECTION AND REPAIR 7- 6

ASSEMBLY 7-13

PERFORMANCE TEST 7-17

STARTING SYSTEM CIRCUITS

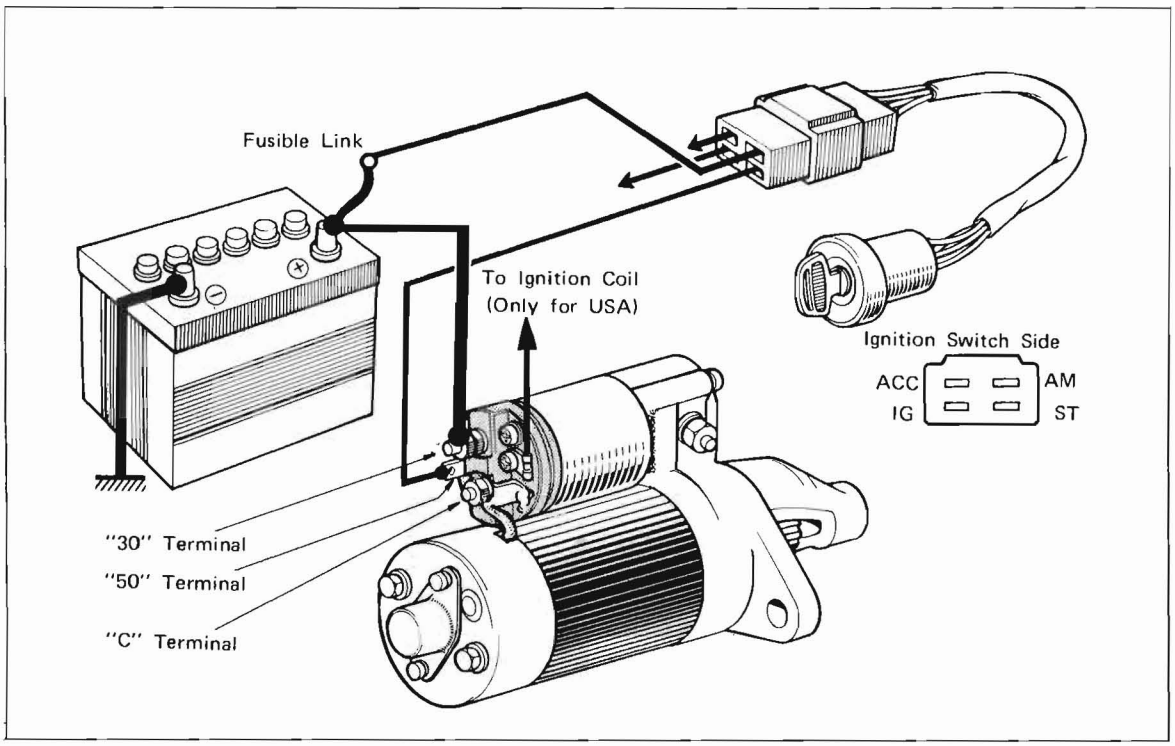


Fig. 7-1

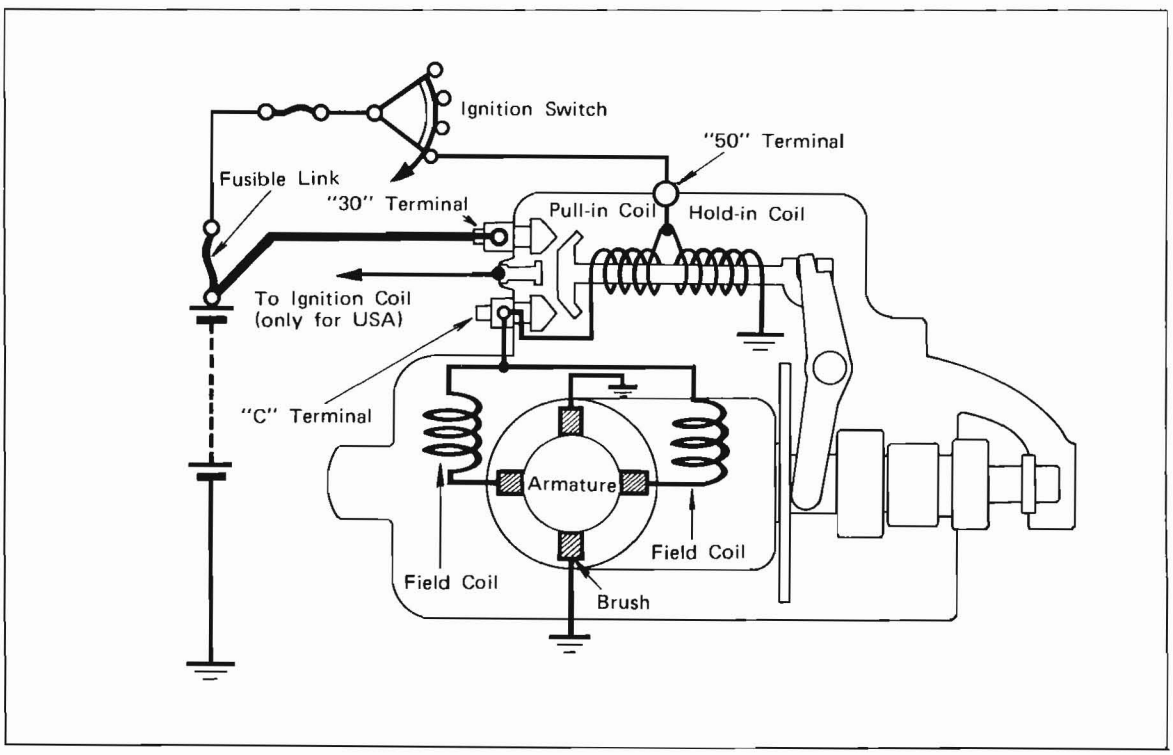
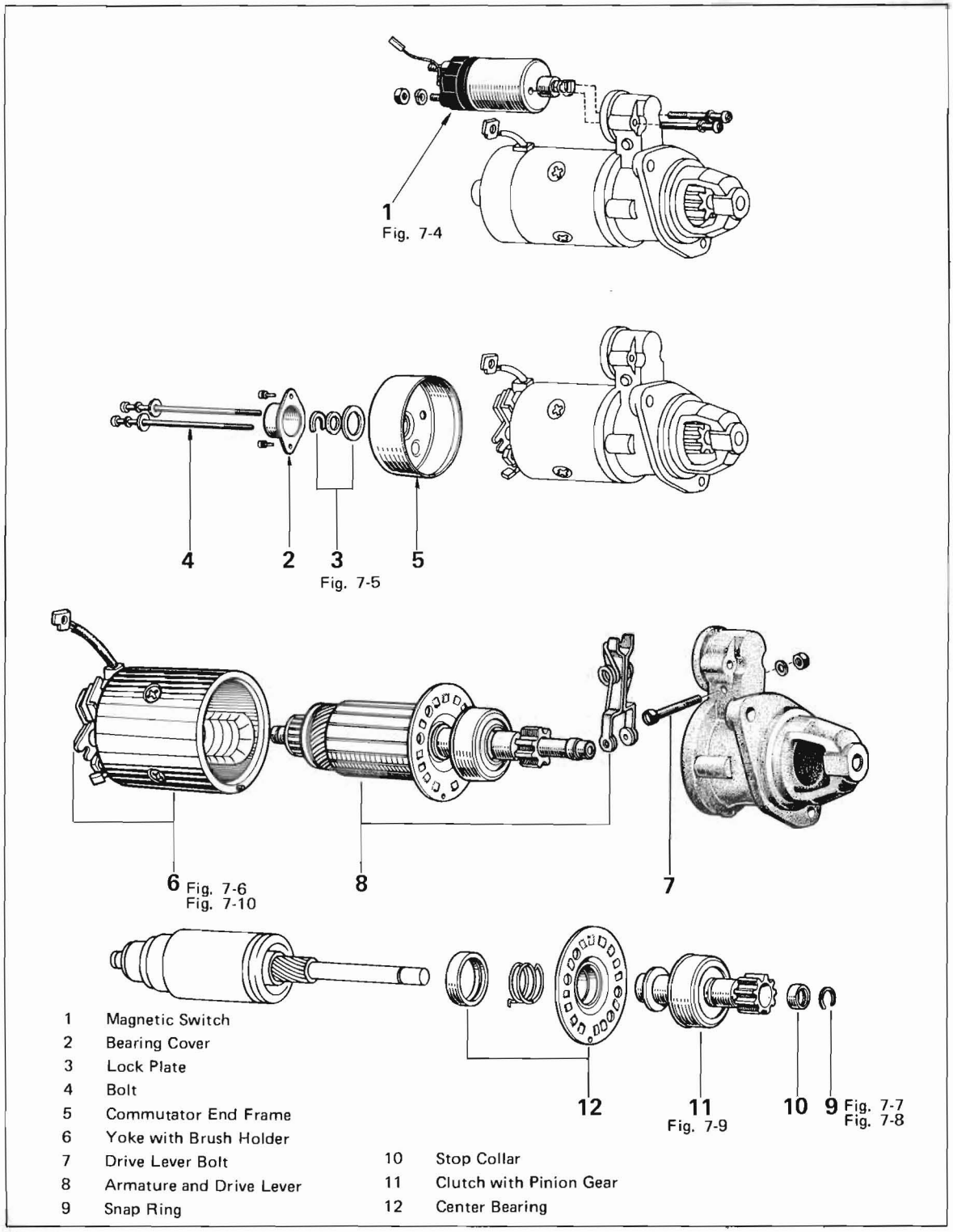


Fig. 7-2

STARTER

DISASSEMBLY

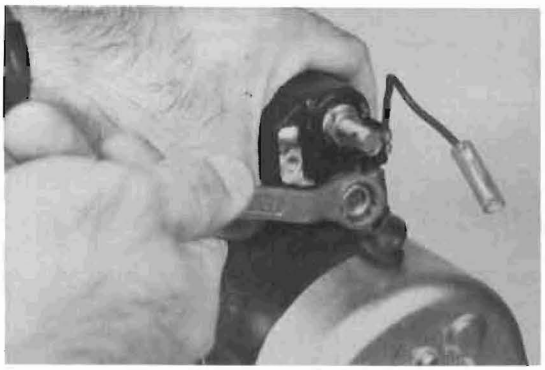
Disassemble in numerical order.



1 Magnetic Switch
2 Bearing Cover
3 Lock Plate
4 Bolt
5 Commutator End Frame
6 Yoke with Brush Holder
7 Drive Lever Bolt
8 Armature and Drive Lever
9 Snap Ring
10 Stop Collar
11 Clutch with Pinion Gear
12 Center Bearing

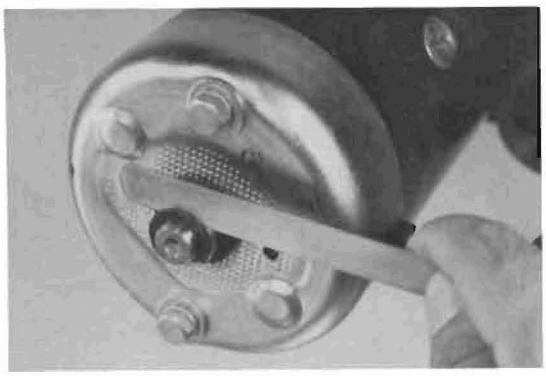
Fig. 7-3

Fig. 7-4



Disconnect lead wire before removing magnetic switch.

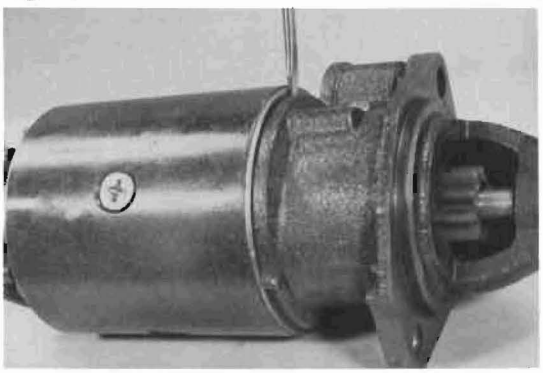
Fig. 7-5



Check the armature shaft thrust clearance.

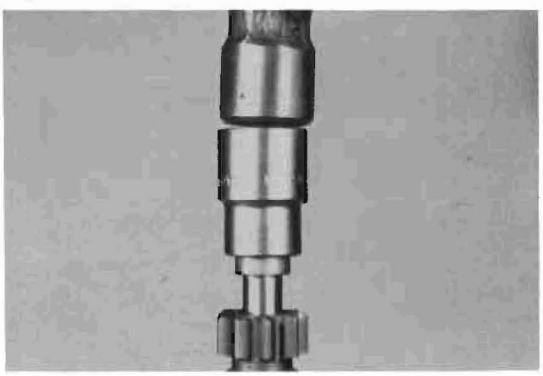
Thrust clearance **0.05-0.35 mm (0.002-0.0138 in)**

Fig. 7-6



Pry off the yoke, using a screwdriver.

Fig. 7-7

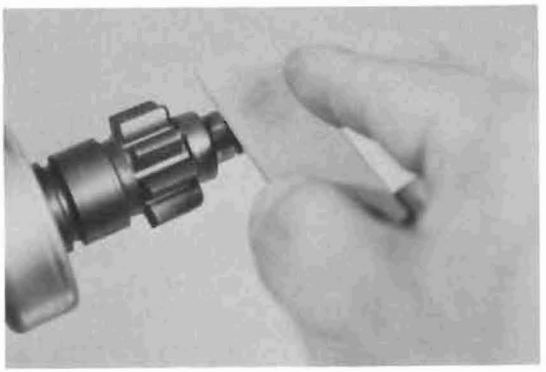


Tap in stop collar, using a socket wrench.

Fig. 7-8

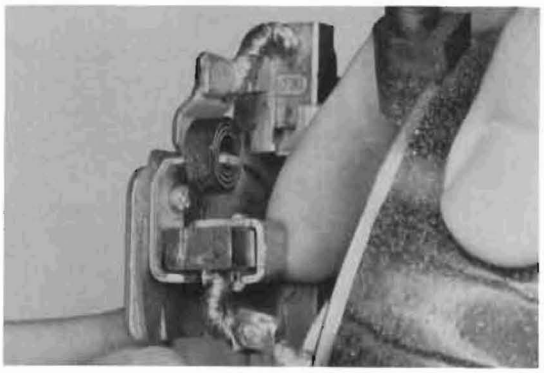
Pry the snap ring, using a screwdriver.

Fig. 7-9



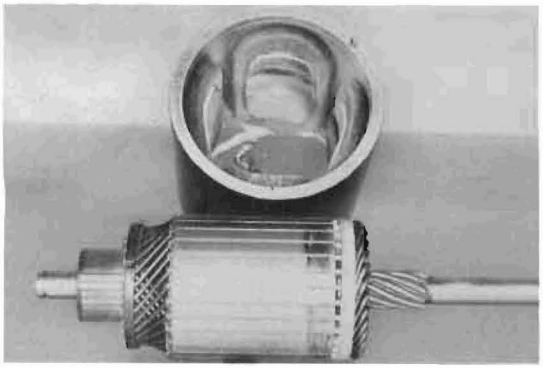
If difficult to pull out the pinion, repair the shaft with an oil stone.

Fig. 7-10



Take off brushes and remove brush holder.

Fig. 7-11

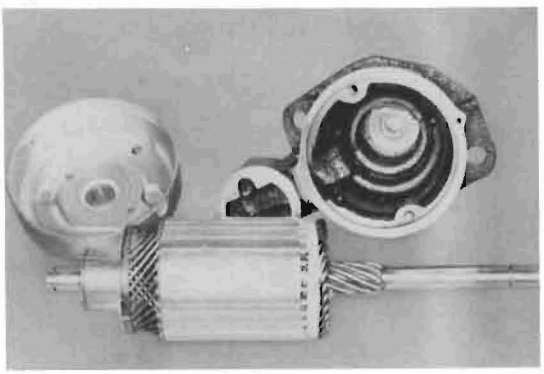


INSPECTION AND REPAIR

Armature Shaft & Bearings

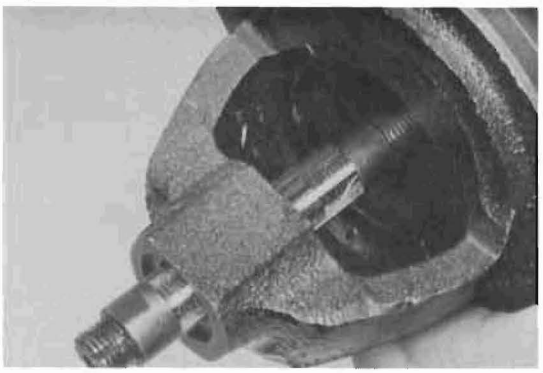
1. Inspect armature and pole shoes for signs of contact.
   Replace drive housing bushing and end frame bushing if any contact suspected.

Fig. 7-12



2. Inspect armature shaft end, drive housing bushing and end frame bushing for wear or damage.
   Oil clearance limit
   0.2 mm (0.008 in)

Fig. 7-13

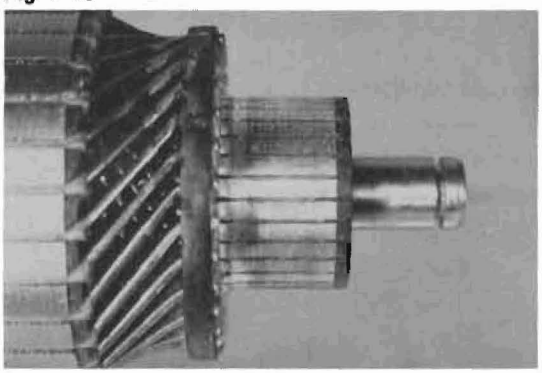


3. BUSHING REPLACEMENT
   (1) Pry out the bushing cover and press out the bushing.
   (2) Press in new bushing and ream to obtain the specified clearance.
   Oil clearance
   0.05 mm (0.0020 in)

Fig. 7-14

(3) Clean the bore, and install new bushing cover.

Fig. 7-15

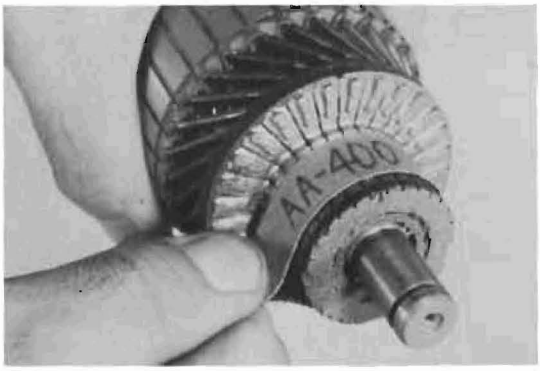


Commutator

Inspect for the following items and repair or replace.

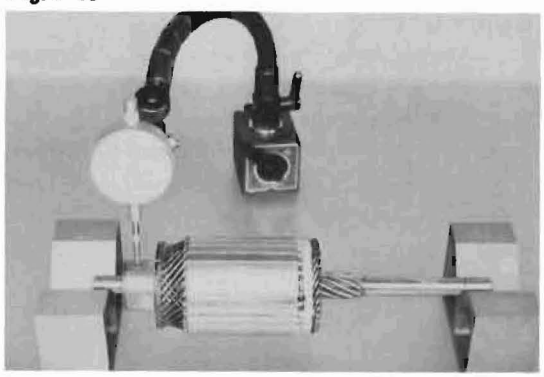
1. Dirty or burnt surface.
   Correct by sandpaper or lathe if necessary.

Fig. 7-16



Use # 400 sandpaper.

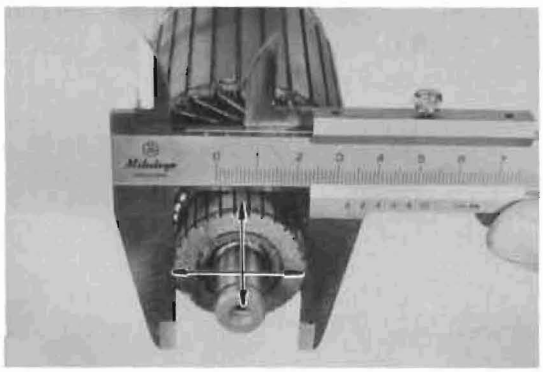
Fig. 7-17



2. Runout: Correct on a lathe if it exceeds the limit.

Runout limit	**0.4 mm (0.016 in)**
Standard	**0.05 mm (0.0020 in)**

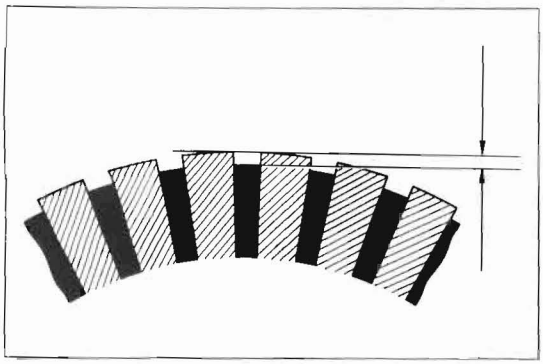
Fig. 7-18



3. Surface wear: If below the limit, replace armature.

Limit	**31 mm (1.22 in)**
Standard	**32.7 mm (1.287 in)**

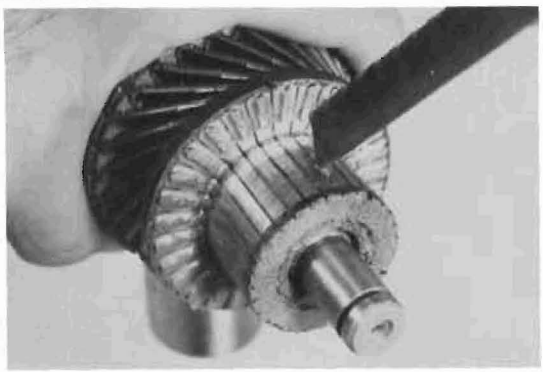
Fig. 7-19



4. Depth of segment mica.

Limit	**0.2 mm (0.008 in)**
Standard	**0.5-0.8 mm (0.020-0.031 in)**

Fig. 7-20



Correct with a hacksaw blade.
After correcting, eliminate chips using sandpaper.

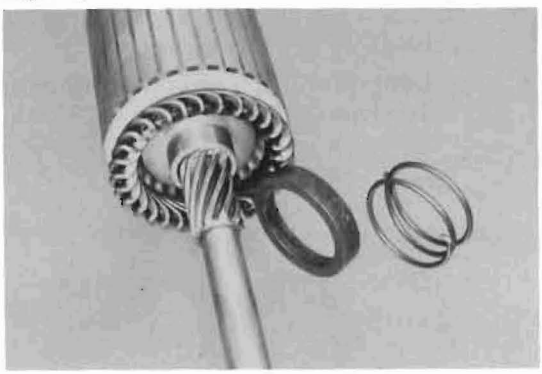
Fig. 7-21

Center Bearing

1. Inspect center bearing for wear or damage. Replace if necessary.

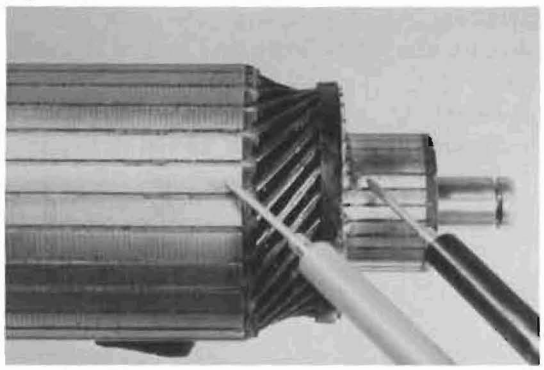
Clearance limit
0.2 mm (0.008 in)

Fig. 7-22



2. Inspect spring holder, spring and armature shaft for cracks, wear or damage. Replace if necessary.

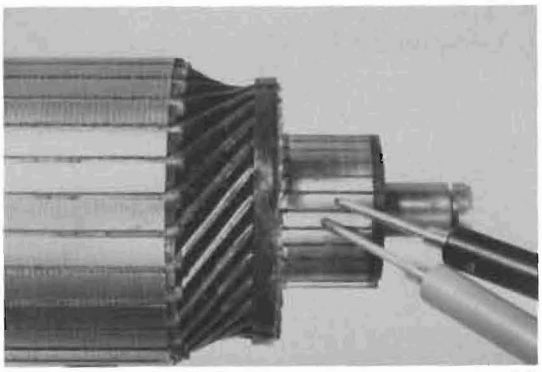
Fig. 7-23



Armature Coil

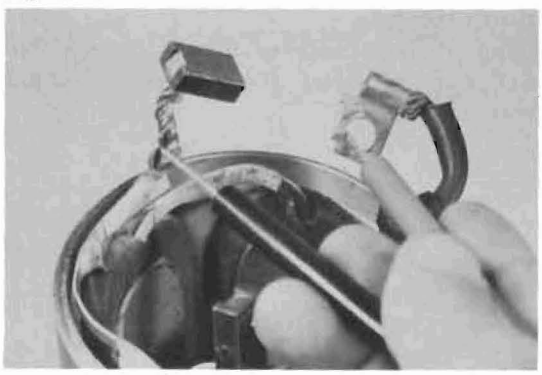
1. Ground test
   Check commutator and armature coil core. If there is continuity, the armature is grounded and must be replaced.

Fig. 7-24



2. Open-circuit test
   Check for continuity between the segments. If there is no continuity at any test point, there is an open-circuit and armature must be replaced.

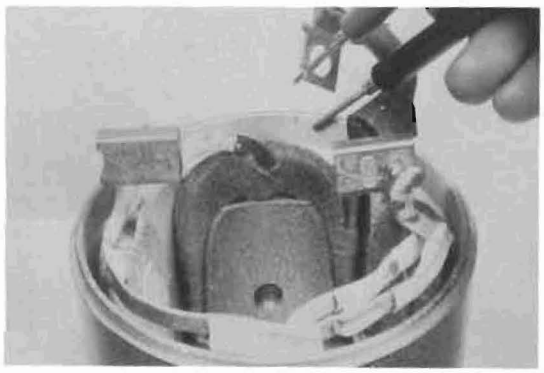
Fig. 7-25



Field Coil

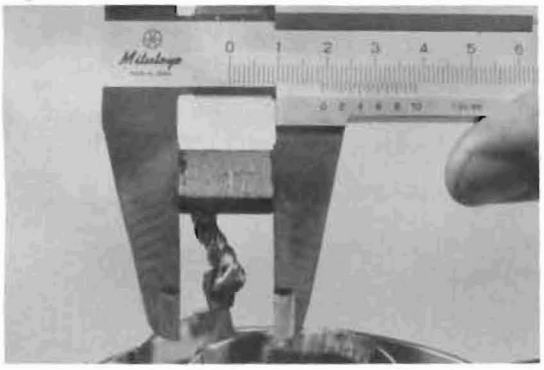
1. Open-circuit test
   Check for continuity between the lead wire and field coil brush soldered connection. If there is no continuity, there is an open-circuit in the field coil, and it should be replaced.

Fig. 7-26



2. Ground test
   Check for continuity between field coil end and field frame.
   If there is continuity, repair or replace the field coil.

Fig. 7-27

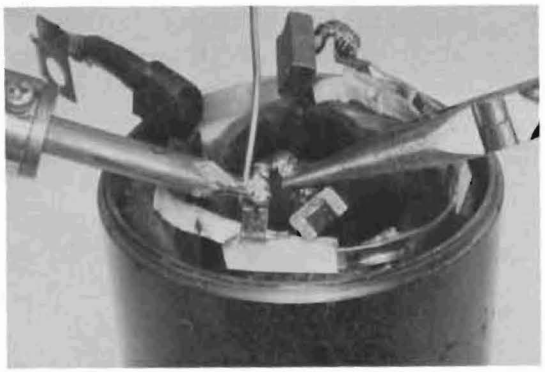


Brushes

Measure the brush length and replace if below the limit.

Limit	**13 mm (0.51 in)**
Standard	**19 mm (0.75 in)**

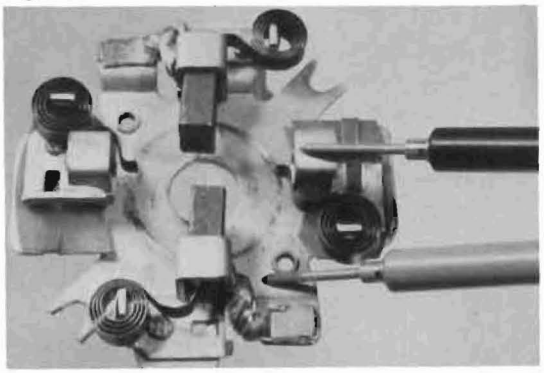
Fig. 7-28



Brush Replacement

Solder brush lead firmly.

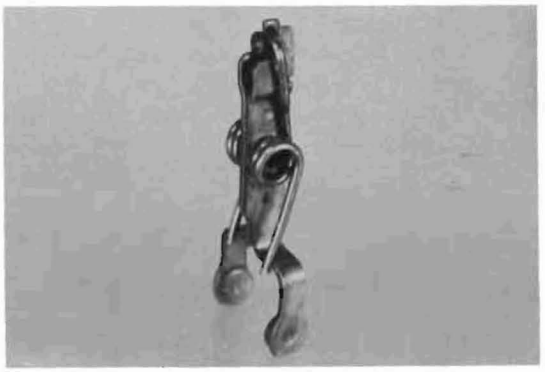
Fig. 7-29



Brush Holder

Check insulation between the (–) brush holder and (+) brush holder. Repair or replace if continuity is indicated.

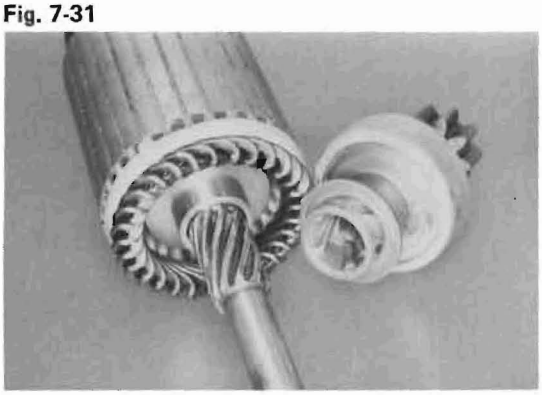
Fig. 7-30



Drive Lever

Inspect the drive lever and spring for wear. Replace if necessary.

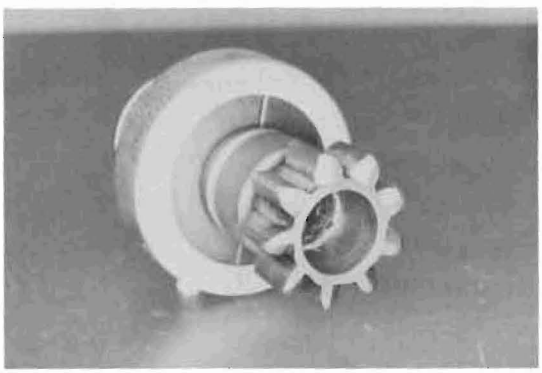
Fig. 7-31



Starter Clutch and Pinion Gear

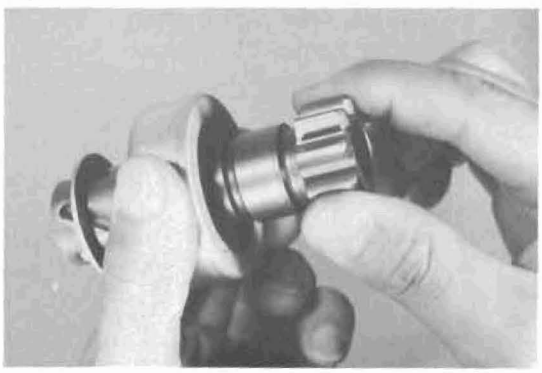
1. Inspect spline teeth for wear and damage. Replace if necessary.
2. Inspect pinion for smooth movement.

Fig. 7-32



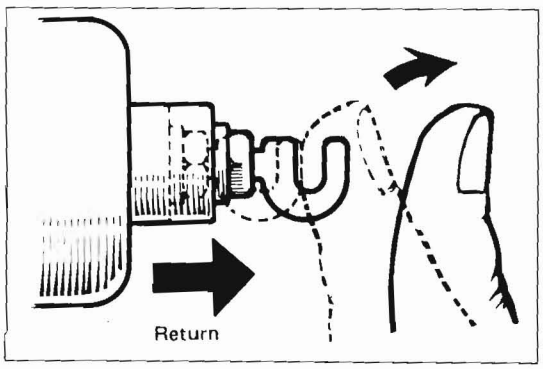
3. Inspect pinion gear teeth and chamfer if worn or damaged.

Fig. 7-33



4. Rotate pinion. It should turn free in clockwise direction and lock when turned counterclockwise.

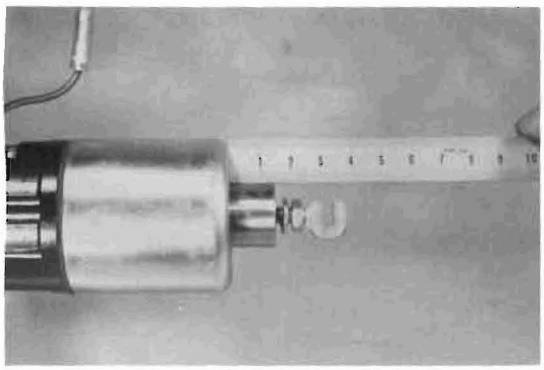
Fig. 7-34



Magnetic Switch

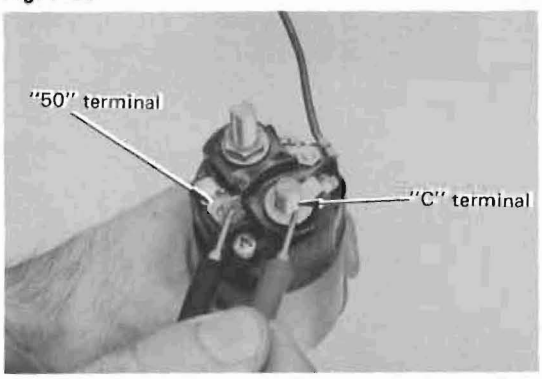
1. Push in plunger and release it.
   The plunger should return quickly to its original position.

Fig. 7-35



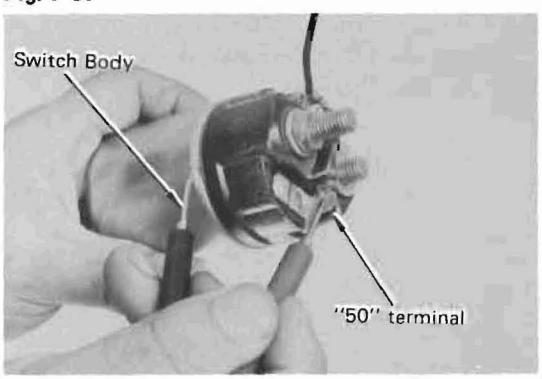
2. Measure distance from switch mounting surface to stud end.
   Standard approx. 34 mm (1.34 in)
   To adjust, loosen the lock nut and screw stud in or out.

Fig. 7-36



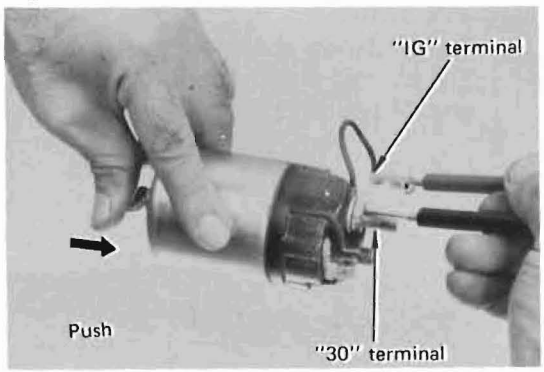
3. Pull-in coil open circuit test.
   Check for continuity between the "50" terminal and "C" terminal.

Fig. 7-37



4. Hold-in coil open circuit test.
   Check for continuity between the "50" terminal and switch body.

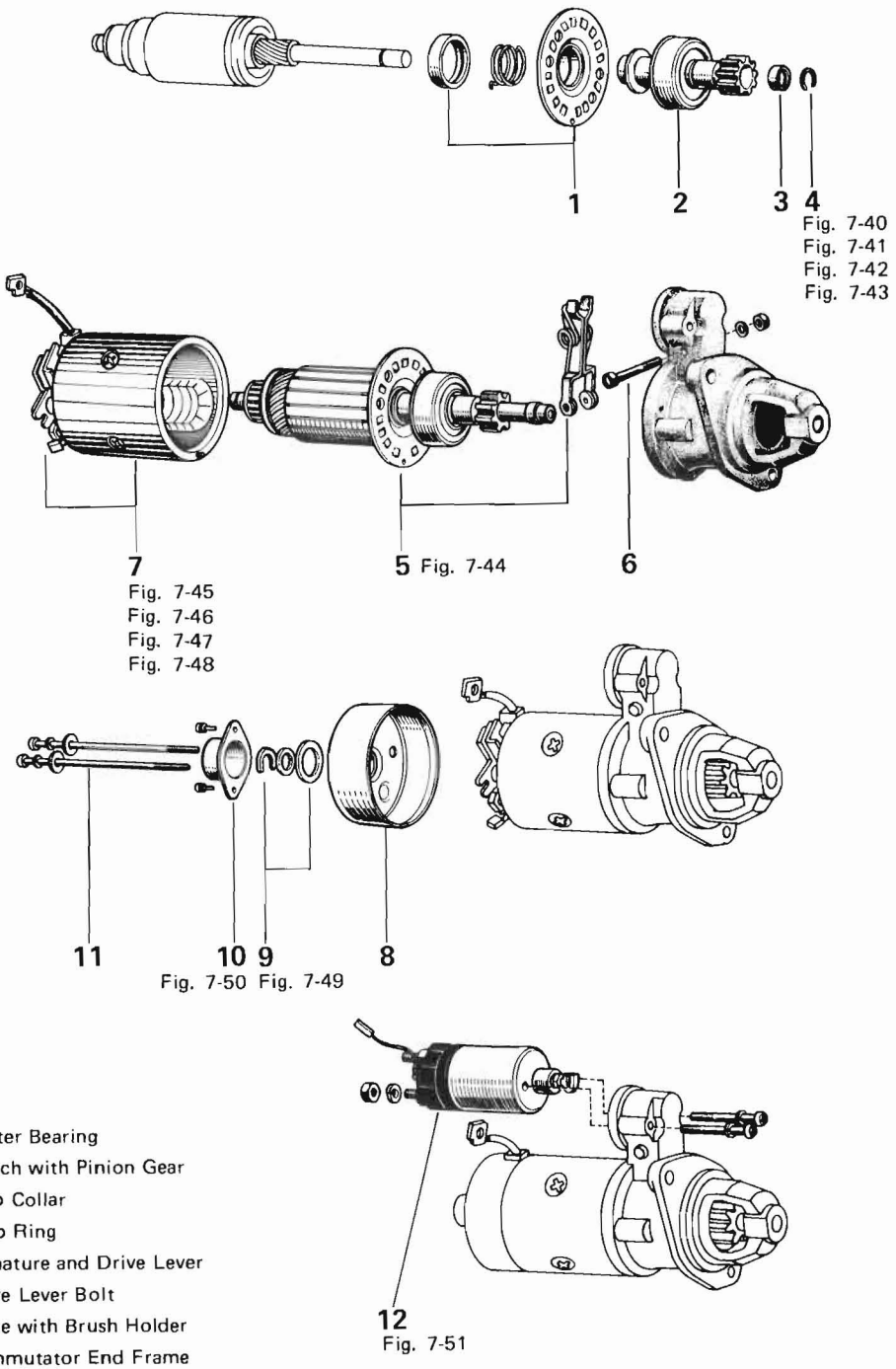
Fig. 7-38



5. I.G. terminal continuity test.
   Push in plunger until it stops. Check for continuity between "30" terminal and lead wire.
   Perform the switch operation test after assembling it to the motor.
   See page 7-17.

ASSEMBLY

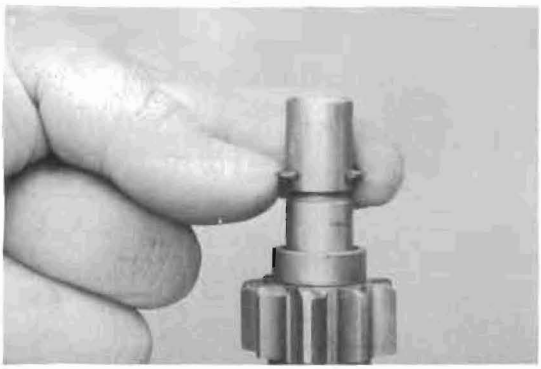
Assemble in numerical order.



1 Center Bearing
2 Clutch with Pinion Gear
3 Stop Collar
4 Snap Ring
5 Armature and Drive Lever
6 Drive Lever Bolt
7 Yoke with Brush Holder
8 Commutator End Frame
9 Lock Plate
10 Bearing Cover
11 Bolt
12 Magnetic Switch

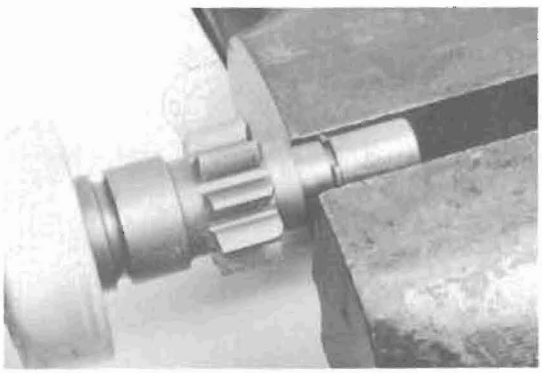
Fig. 7-39

Fig. 7-40



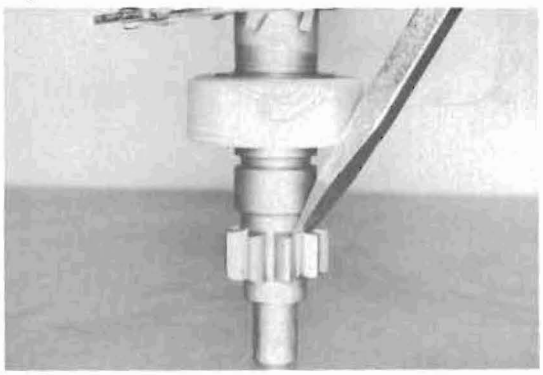
Fit snap ring into shaft groove.

Fig. 7-41



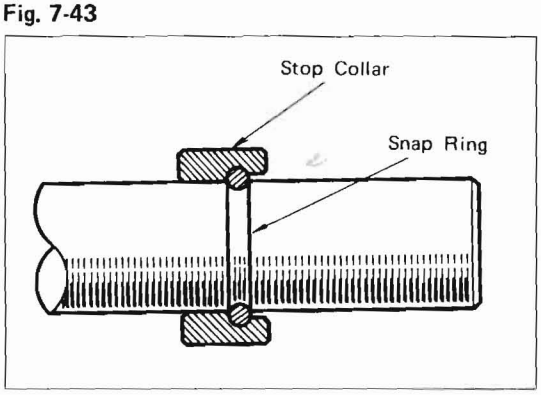
Compress the snap ring with a vise.

Fig. 7-42



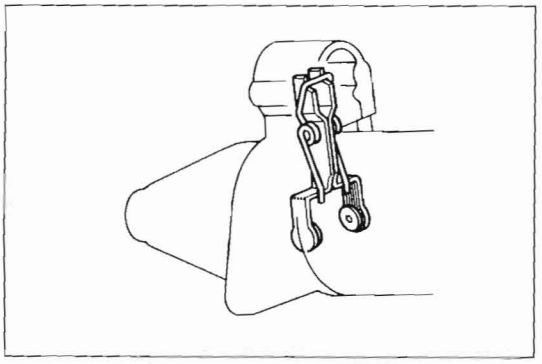
Tap pinion to slide the stop collar onto snap ring.

Fig. 7-43



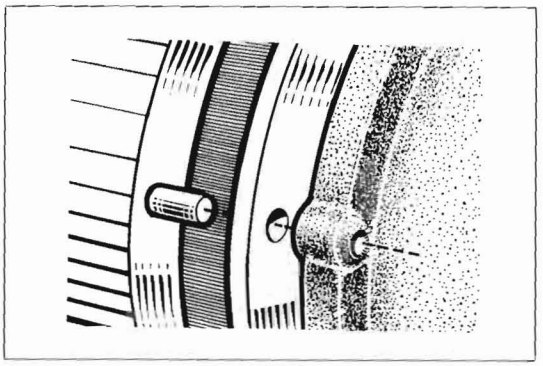
Make sure that the snap ring fits correctly.

Fig. 7-44



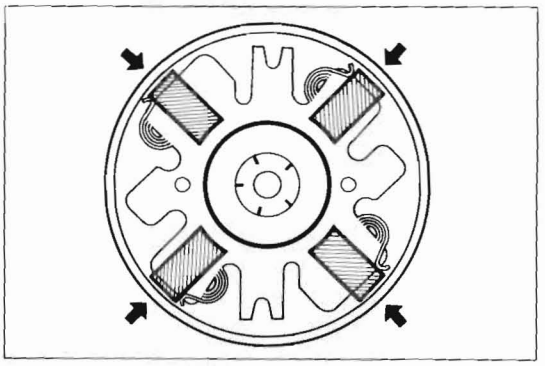
Assemble drive lever in direction as shown.

Fig. 7-45



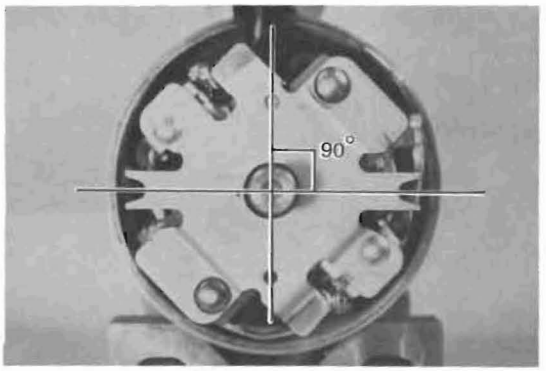
Align the dowel with holes of center bearing support and drive end housing.

Fig. 7-46



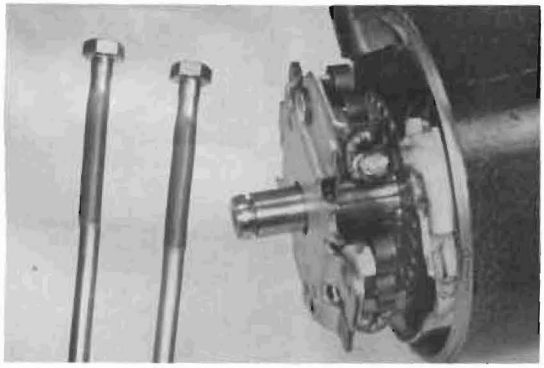
Assemble brushes, being careful not to damage them.

Fig. 7-47



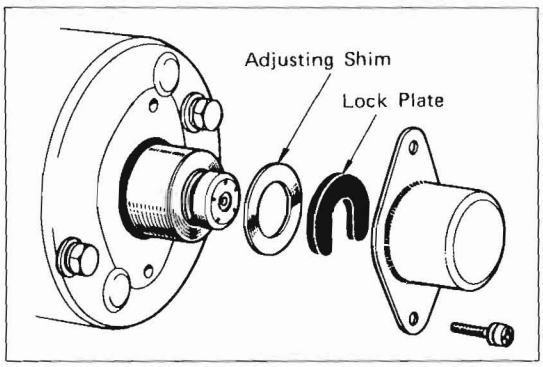
After installation, position the holder as shown.

Fig. 7-48



Check that the (+) wires are not grounded.
- Field coil
- Brush (+) leads
- Through bolts

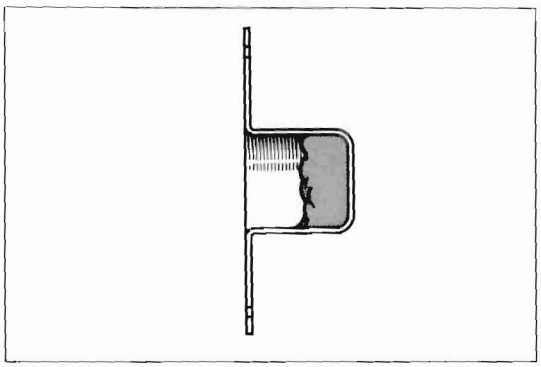
Fig. 7-49



Install the lock plate and measure the armature shaft thrust clearance. If clearance exceeds the specified value, correct by increasing the number of shims.

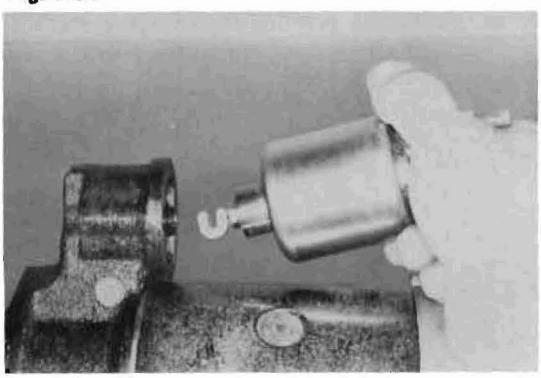
Thrust clearance	**0.05-0.35 mm (0.002-0.0138 in)**
Adjusting shim thickness	**0.5 mm (0.02 in)**

Fig. 7-50



Install end frame cap not more than half full of grease.

Fig. 7-51



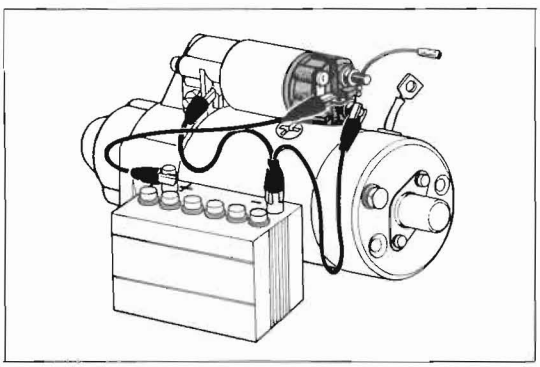
Hook the magnetic switch joint on the drive lever spring from the lower side.

– Precaution –
These tests must be performed in short time (3-5 seconds) to prevent the coil from burning. Disconnect the field coil lead from "C" terminal.

PERFORMANCE TEST

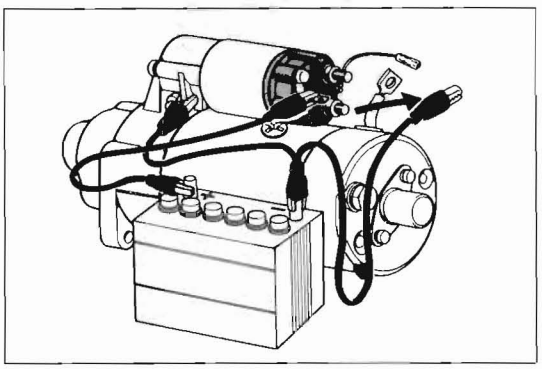
Check the magnetic switch performance and pinion gap as follows:

Fig. 7-52



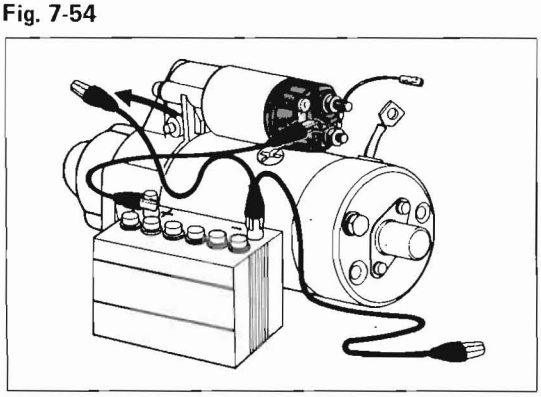
1. Pull-in test
Connect magnetic switch to battery as shown. (negative side to "C" terminal and switch body; positive side to "50" terminal). If the pinion has definitely jumped out, the pull-in coil is satisfactory.

Fig. 7-53



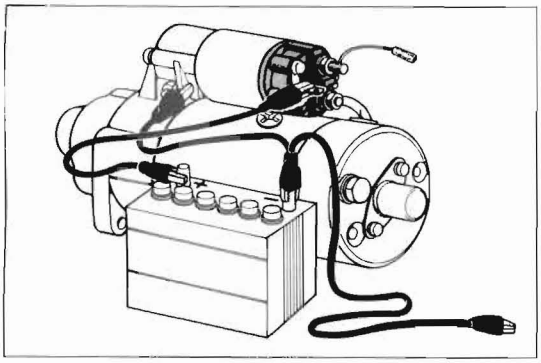
2. Hold-in test
Next disconnect the "C" terminal.
The pinion should remain in jumped-out condition.

Fig. 7-54



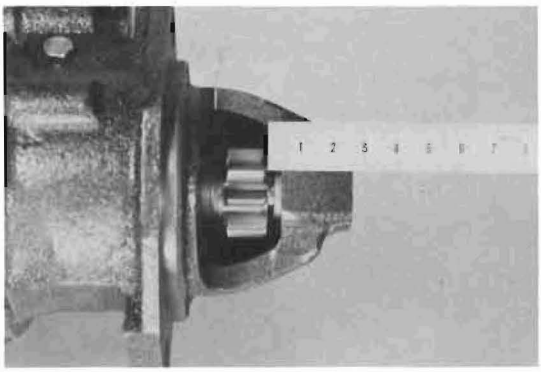
3. Check the plunger return.
When disconnecting the switch body, the pinion should return quickly.

Fig. 7-55



4. Check the pinion clearance.
   (1) Connect the magnetic switch to battery as shown.
   Field coil lead to "C" terminal
   Battery negative side to body
   Battery positive side to 50 terminal

Fig. 7-56



(2) Move the pinion to armature side to eliminate the slack, and check the clearance between the pinion end and stop collar.

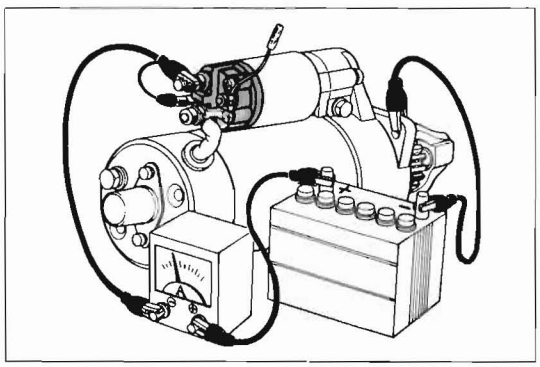
Standard clearance
0.2-4.0 mm
(0.008-0.16 in)

Fig. 7-57

(3) Adjust if necessary after loosening lock nut.

Clearance	Stud
Too large	→ Screw in
Too small	→ Screw out

Fig. 7-58



5. No-load performance test
Connect the field coil lead to the "C" terminal, making sure that the lead wire is not grounded.
Connect starter to battery. If the starter shows smooth and steady rotation with the pinion jumping out and draws less than specified current, it is satisfactory.

Specified current
Less than 50 A

IGNITION SYSTEM

Page

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DISTRIBUTOR (For USA) 8-13

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- INSTALLATION 8-23

IGNITION COIL 8-24

HIGH TENSION CORD 8-25

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IGNITION SYSTEM CIRCUITS

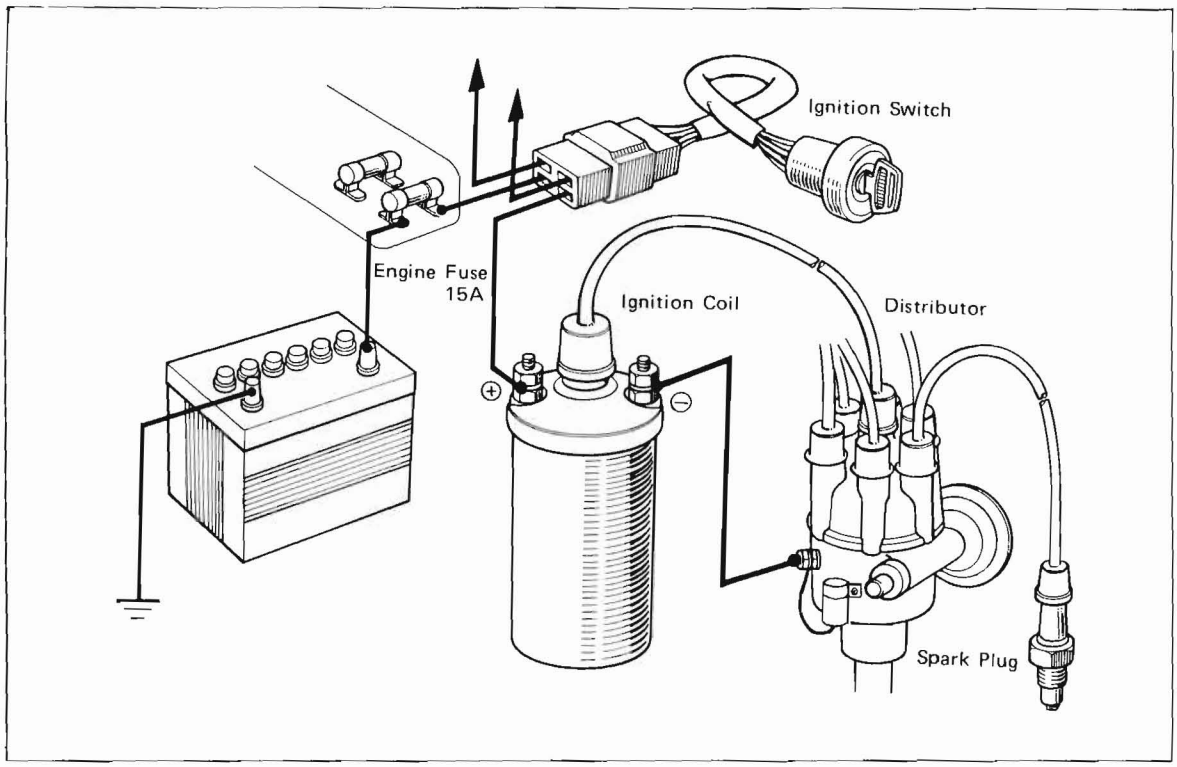


Fig. 8-1

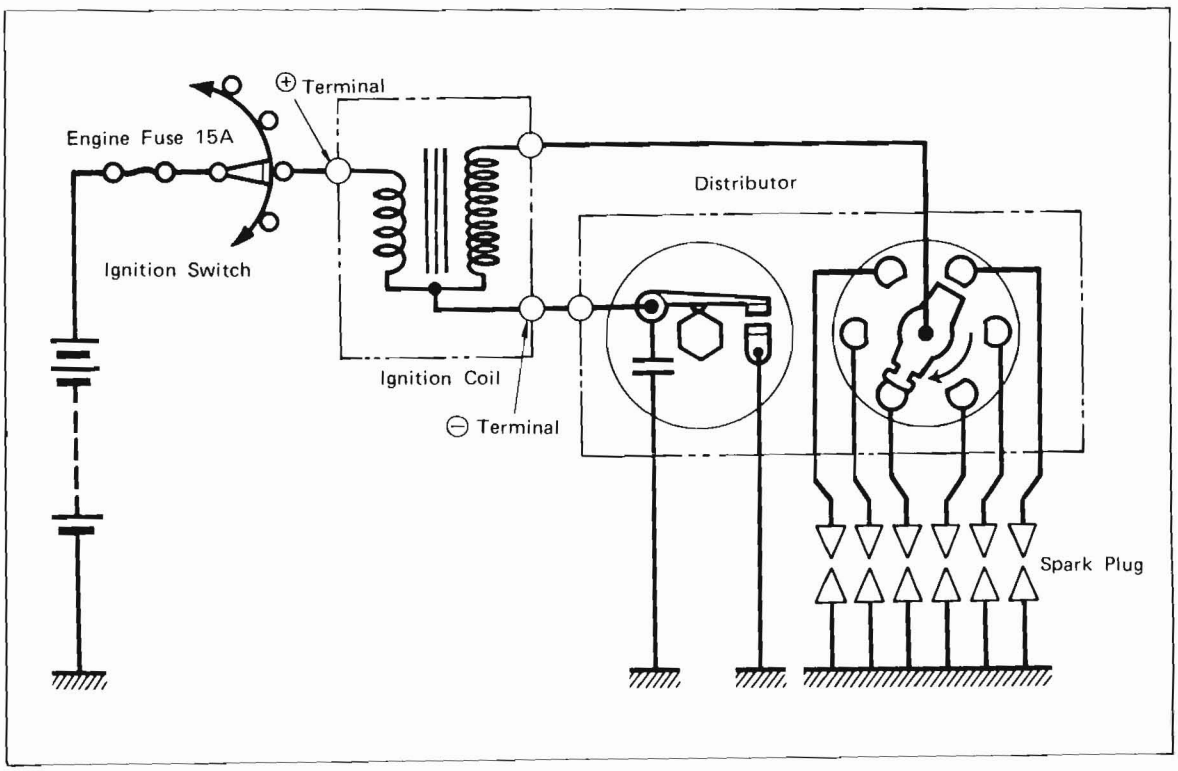


Fig. 8-2

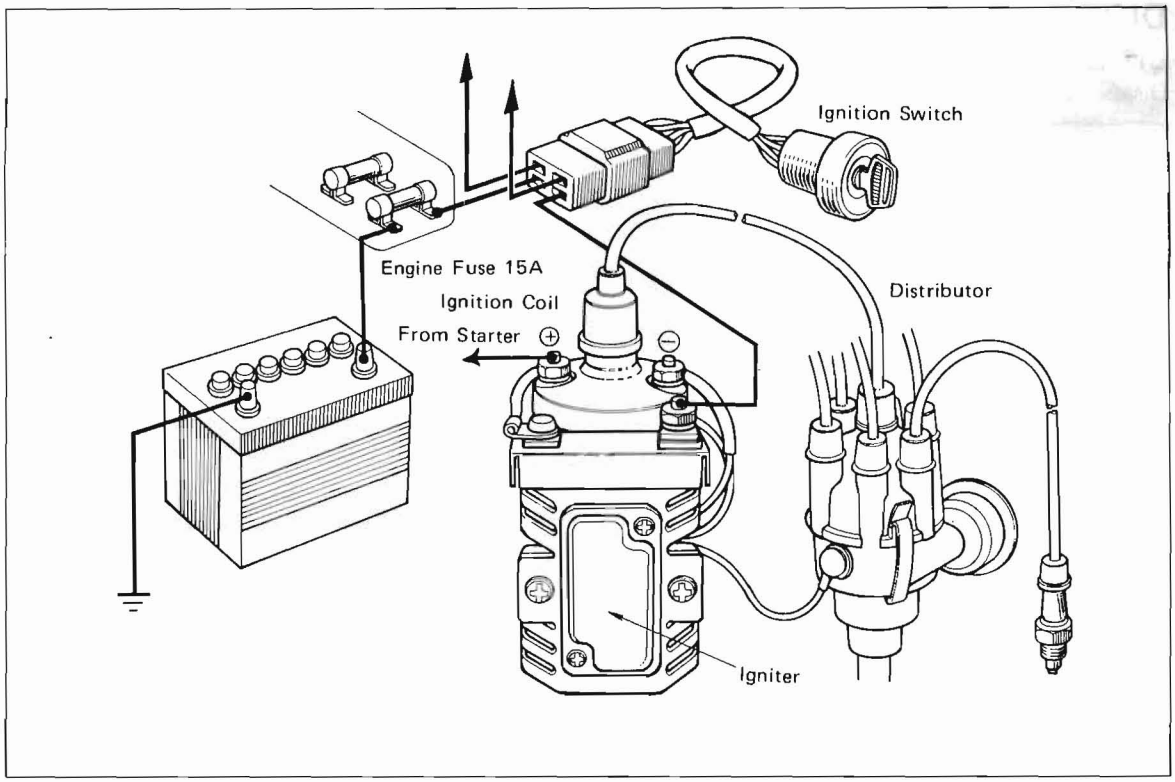

Ignition Switch
Engine Fuse 15A
Ignition Coil
From Starter ⊕
Distributor
Igniter

Fig. 8-3

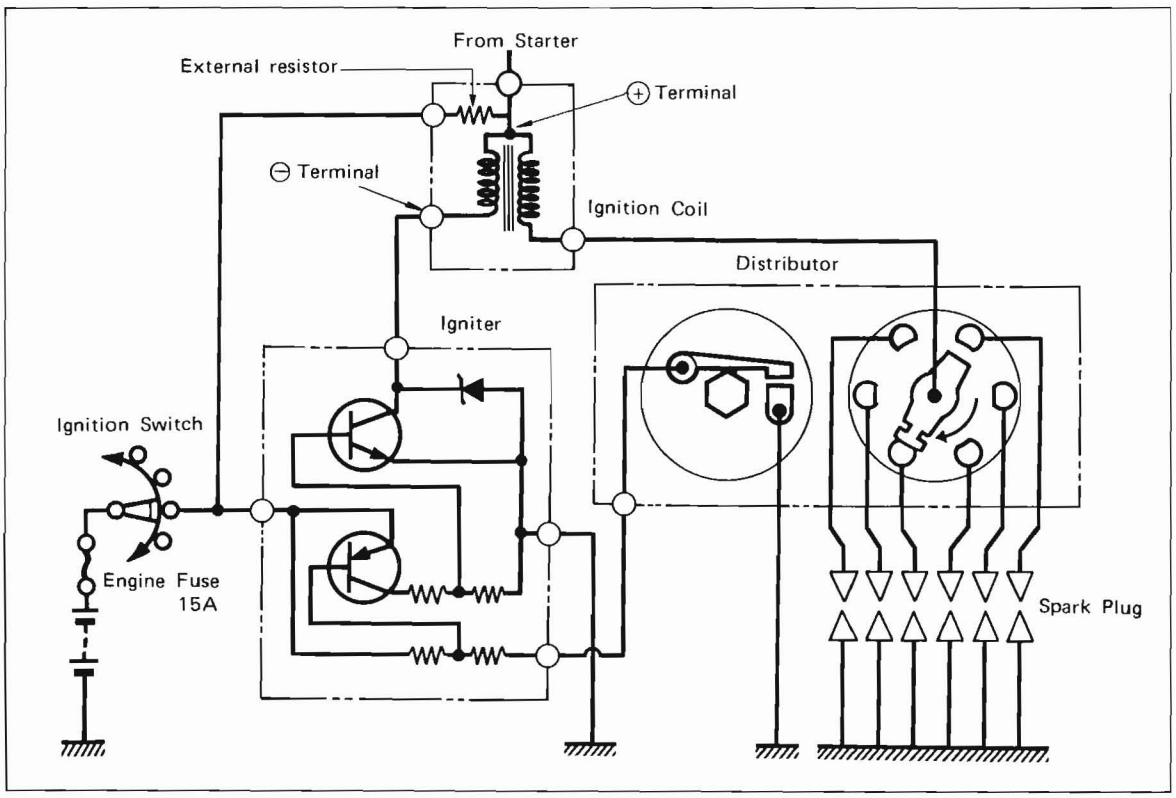

From Starter
External resistor
⊕ Terminal
⊖ Terminal
Ignition Coil
Distributor
Igniter
Ignition Switch
Engine Fuse 15A
Spark Plug

Fig. 8-4

DISTRIBUTOR (Except For USA)

DISASSEMBLY

Disassemble in numerical order.

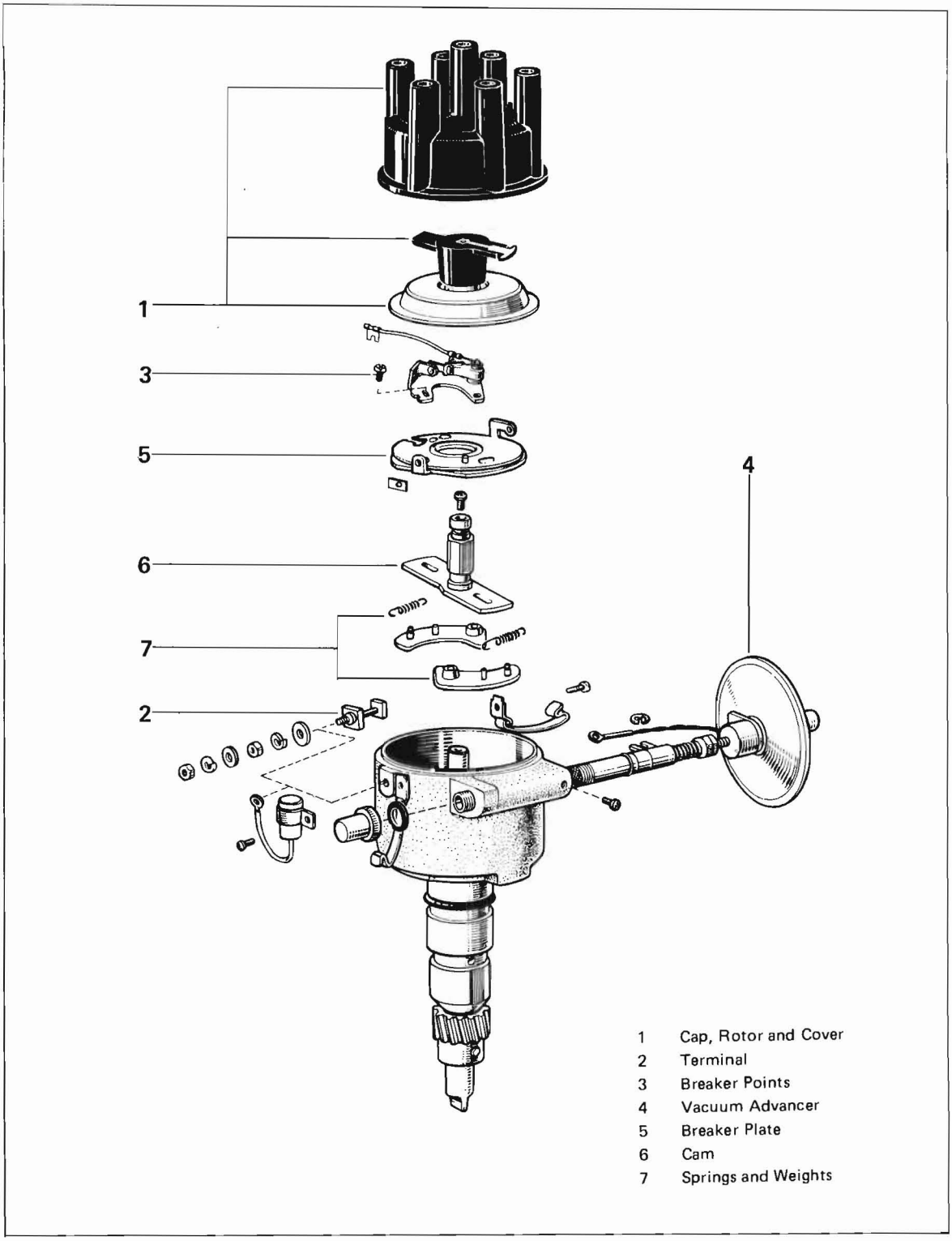


Fig. 8-5

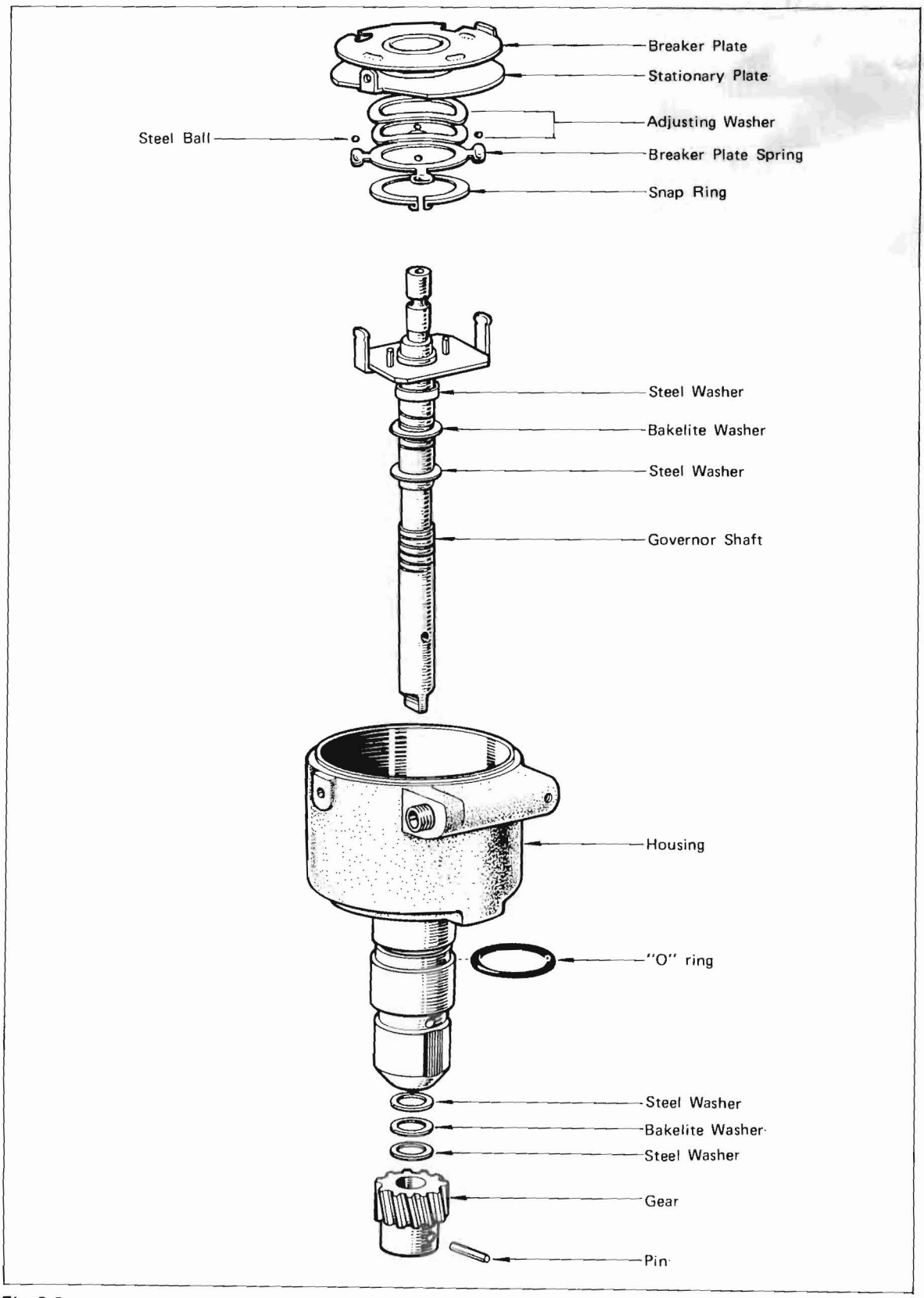
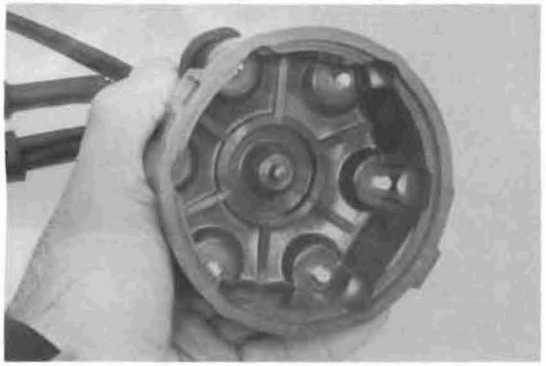

Breaker Plate
Stationary Plate
Adjusting Washer
Steel Ball
Breaker Plate Spring
Snap Ring
Steel Washer
Bakelite Washer
Steel Washer
Governor Shaft
Housing
"O" ring
Steel Washer
Bakelite Washer
Steel Washer
Gear
Pin

Fig. 8-6

INSPECTION & REPAIR

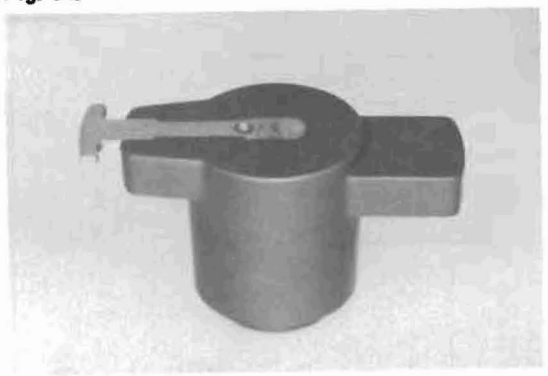
Fig. 8-7



Cap

Inspect for cracks, carbon tracks, burnt or corroded terminals, and check center contact for wear.

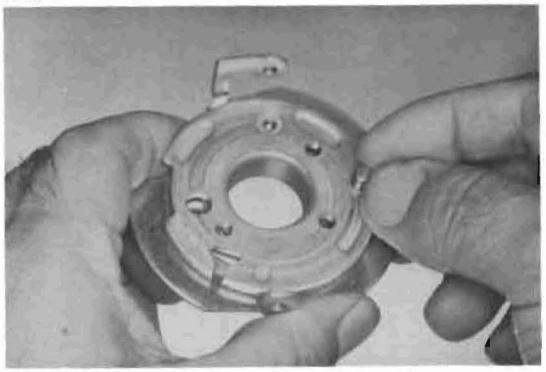
Fig. 8-8



Rotor

Inspect for cracks, carbon tracks, burnt or corroded terminals.

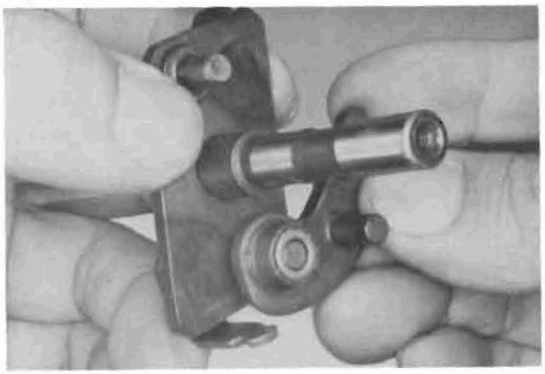
Fig. 8-9



Breaker Plate

Check breaker plate for smooth rotation.

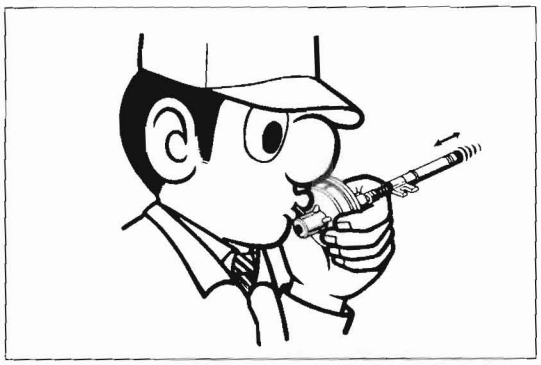
Fig. 8-10



Governor Weights and Pin

Check the fitting portions of governor weights with support pins for binding.

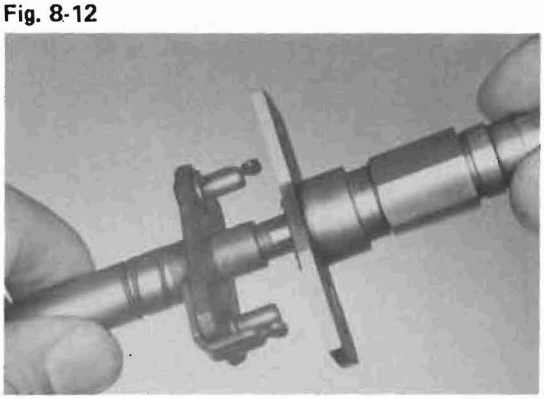
Fig. 8-11



Vacuum Advancer Diaphragm

Suck the tube with mouth. The diaphragm should move.

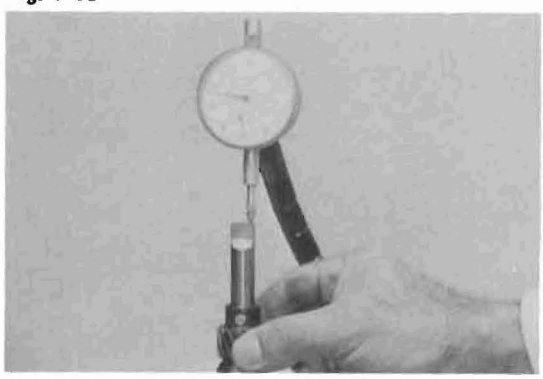
Fig. 8-12



Cam and Shaft

Inspect cam for wear, damage, and fit between cam and shaft.

Fig. 8-13



Governor Shaft and Housing

1. Check shaft thrust clearance.

Thrust clearance **0.15-0.5 mm (0.006-0.020 in)**

Fig. 8-14

2. Remove gear and pin.
Grind off the pin end, then remove the pin and gear.

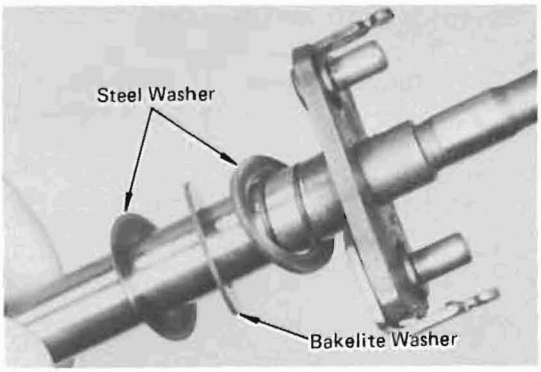
Fig. 8-15

3. Inspect governor shaft for wear and damage.

Fig. 8-16

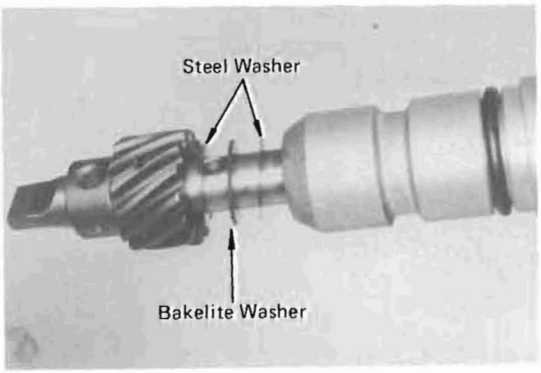
4. Inspect housing bushings, and O ring for wear, deformation, and damage.

Fig. 8-17



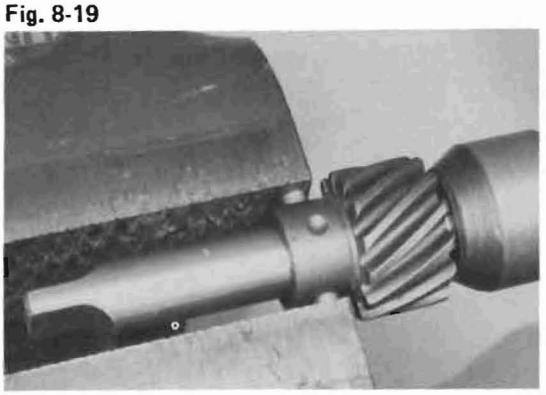
5. Assemble washers in order as shown.

Fig. 8-18



6. Assemble washers and gear in order as shown and check thrust clearance. If it exceeds specified value, adjust the clearance with steel washer.

Fig. 8-19



7. Peen both pin ends with a vise.

ASSEMBLY

Assemble in numerical order.

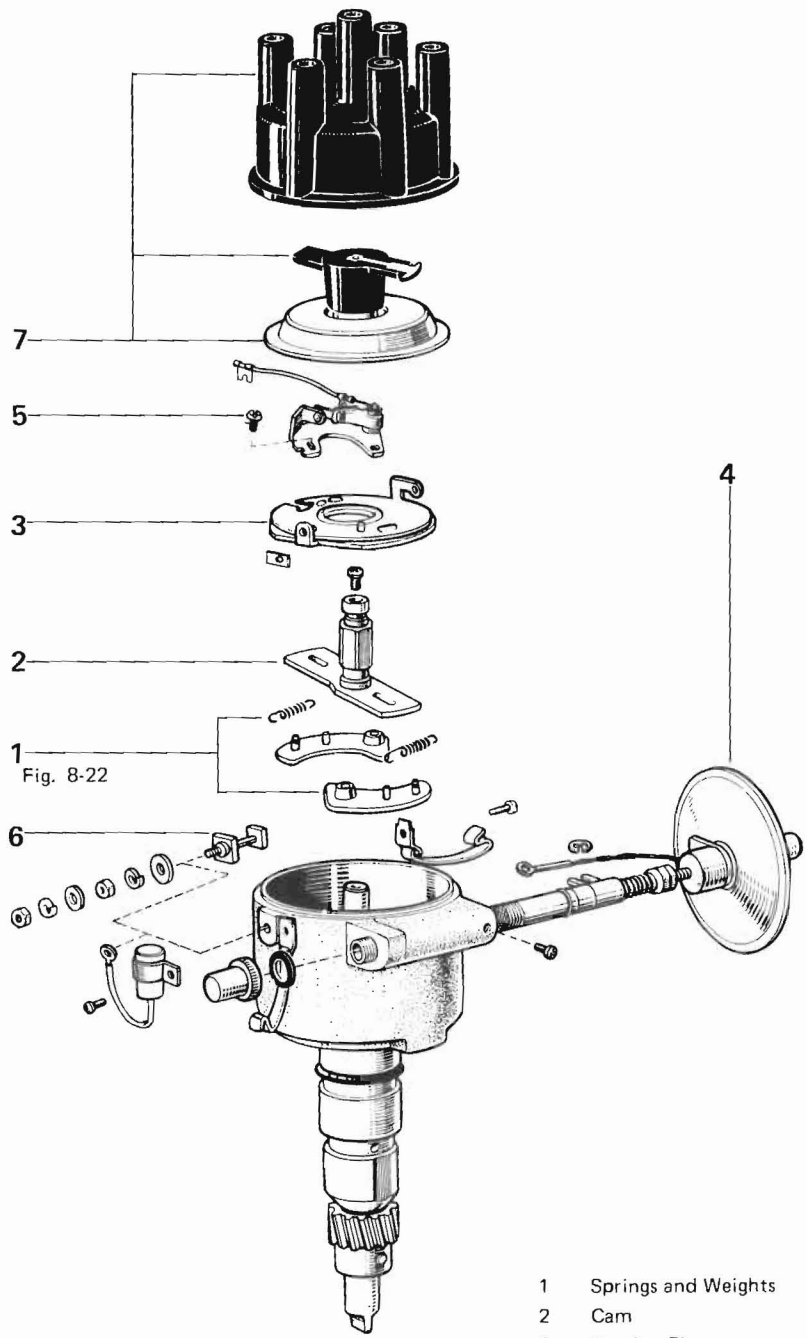


Fig. 8-22

1 Springs and Weights
2 Cam
3 Breaker Plate
4 Vacuum Advancer
5 Breaker Points
6 Terminal
7 Cover, Rotor and Cap

Fig. 8-20

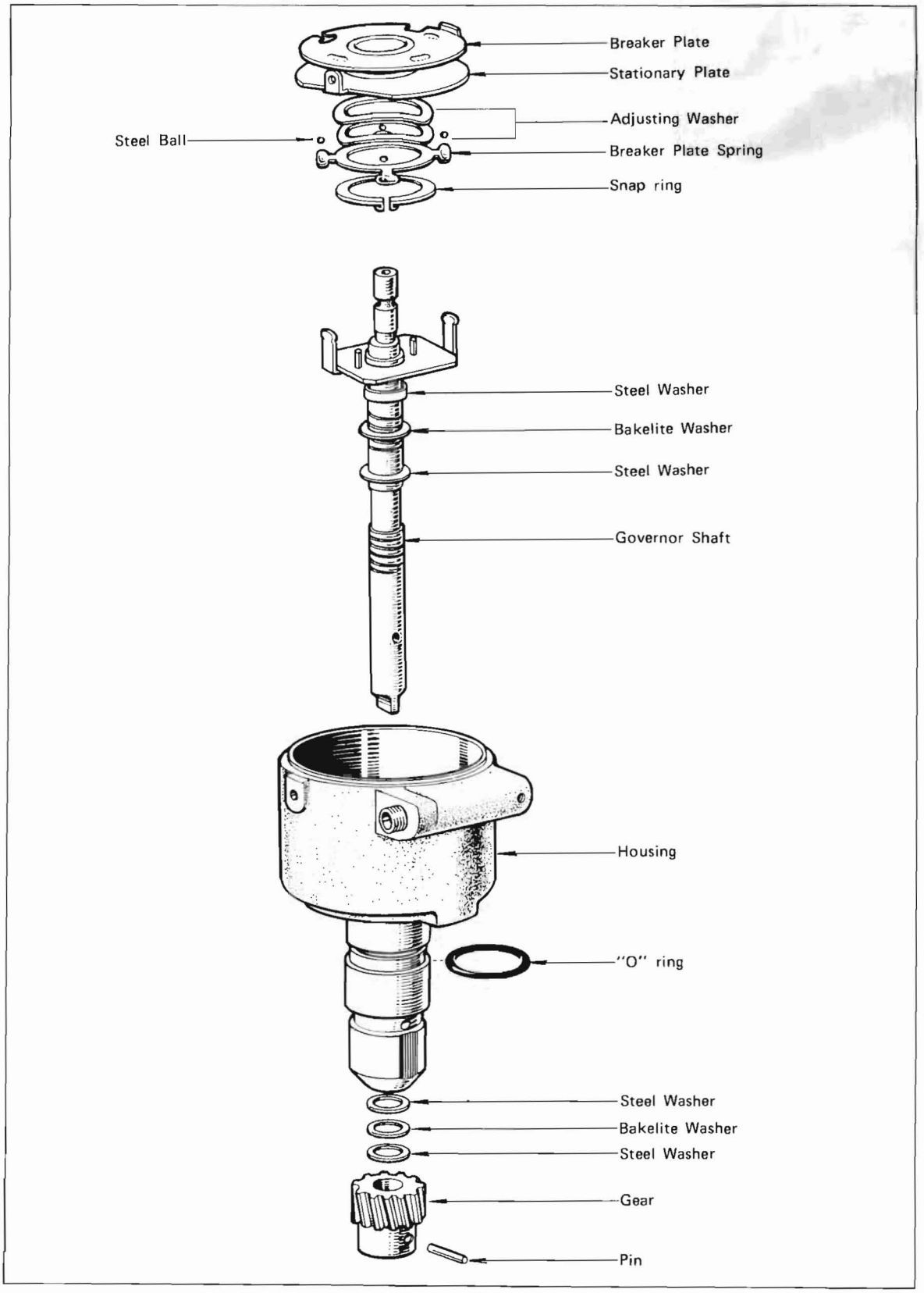
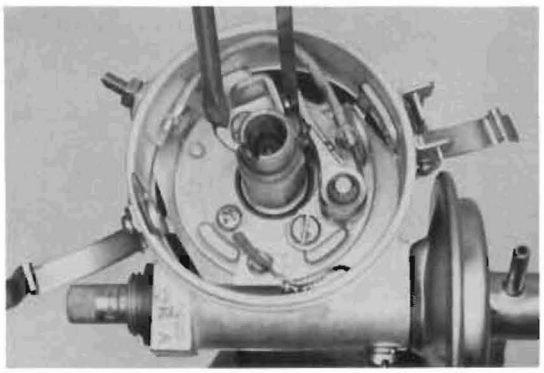

Breaker Plate
Stationary Plate
Adjusting Washer
Steel Ball
Breaker Plate Spring
Snap ring
Steel Washer
Bakelite Washer
Steel Washer
Governor Shaft
Housing
"O" ring
Steel Washer
Bakelite Washer
Steel Washer
Gear
Pin

Fig. 8-21

Fig. 8-22

Install governor springs in direction as shown.

Fig. 8-23

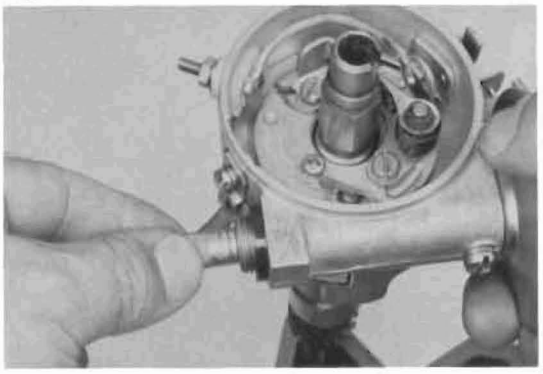


ADJUSTMENT

Install breaker points and adjust the gap.

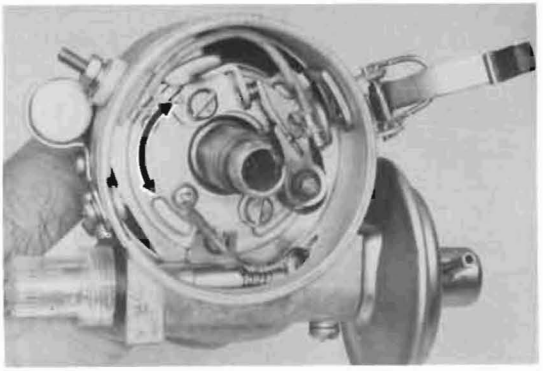
Point gap **0.45 mm (0.018 in)**

Fig. 8-24



Set the octane selector at standard line.

Fig. 8-25



Check breaker plate for smooth rotation. Suck the tube with mouth.
The breaker plate should move.

For installation, refer to page 8-23.

DISTRIBUTOR (For USA)

DISASSEMBLY

Disassemble in numerical order.

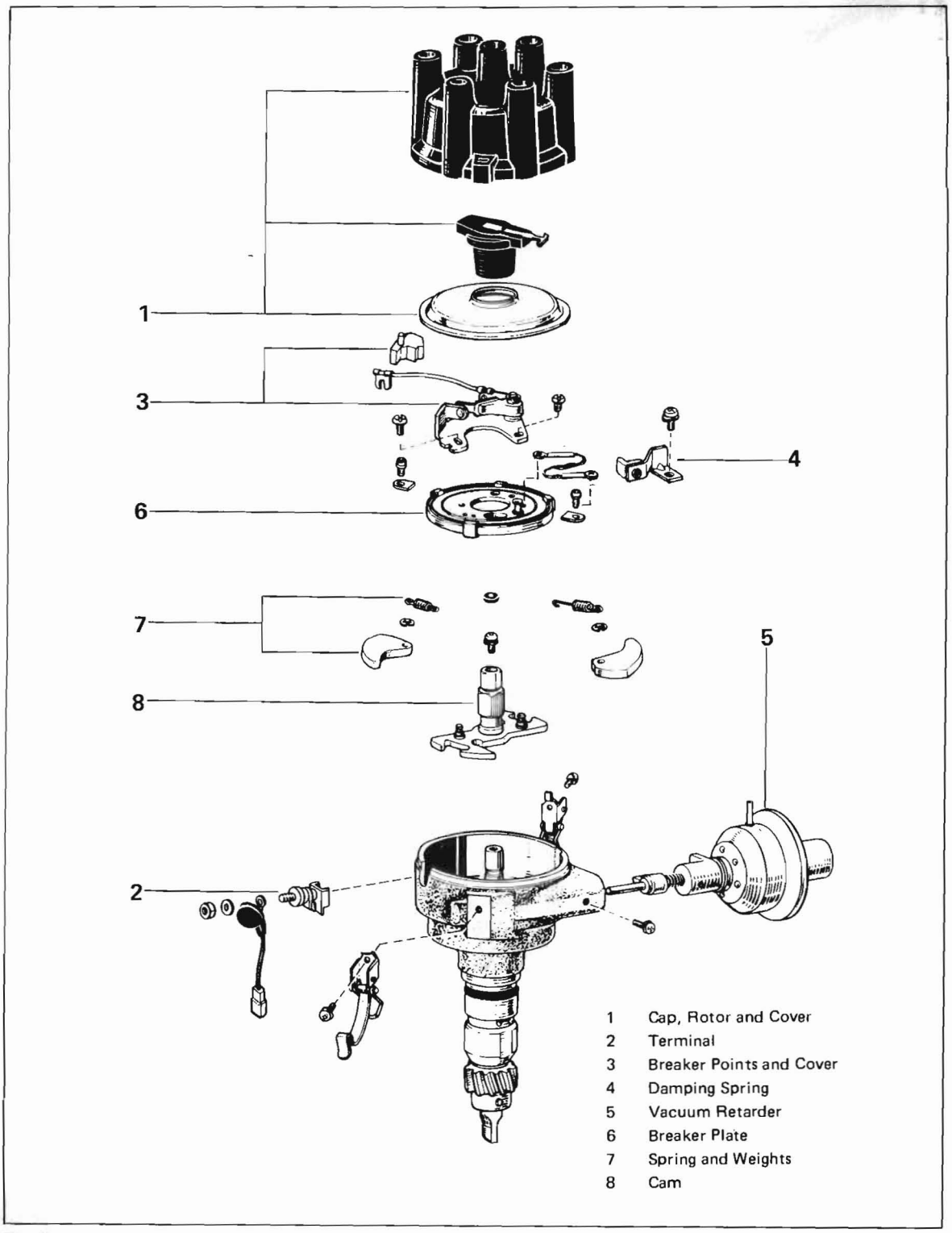


Fig. 8-26

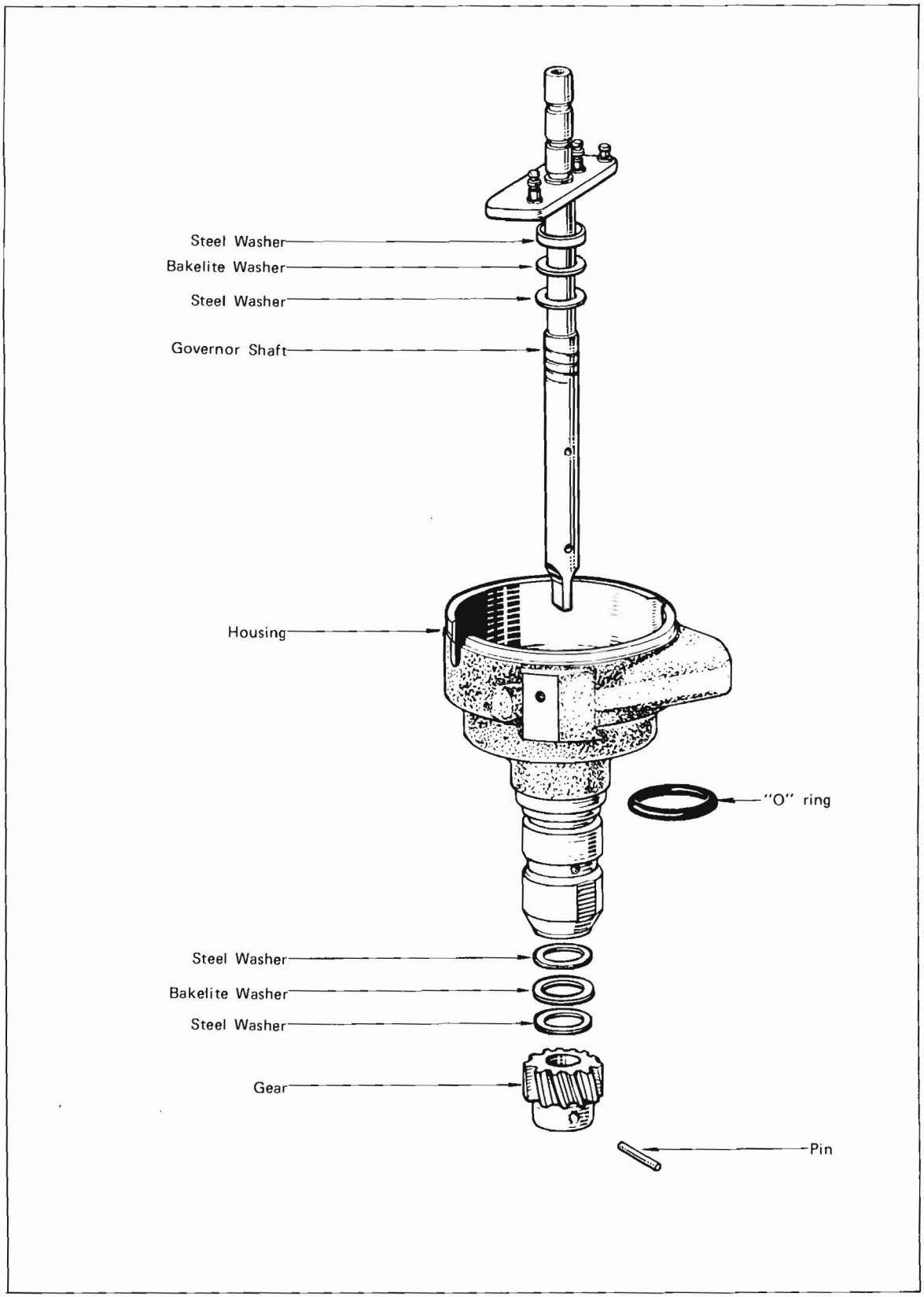
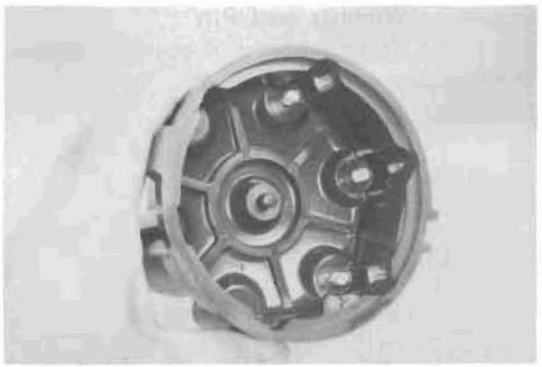

Steel Washer
Bakelite Washer
Steel Washer
Governor Shaft
Housing
"O" ring
Steel Washer
Bakelite Washer
Steel Washer
Gear
Pin

Fig. 8-27

Fig. 8-28



INSPECTION & REPAIR

Cap

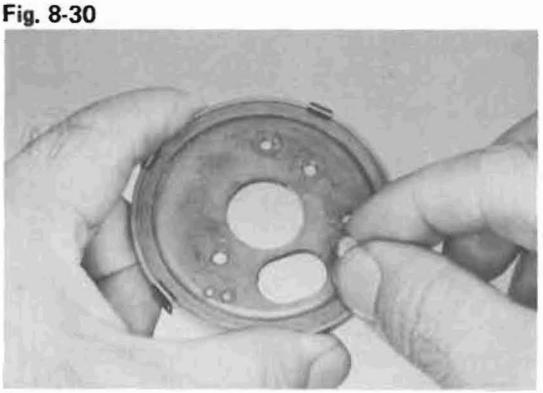
Inspect for cracks, carbon tracks, burnt or corroded terminals, and check center contact for wear.

Fig. 8-29

Rotor

Inspect for cracks, carbon tracks, burnt or corroded terminals.

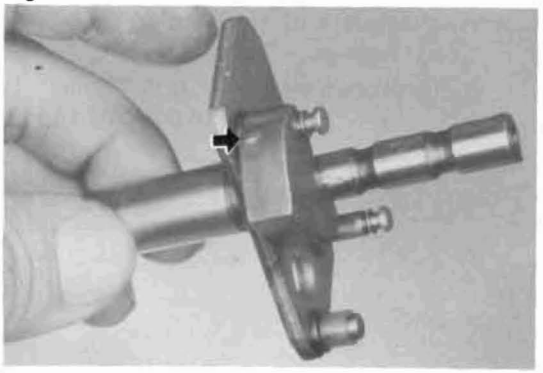
Fig. 8-30



Breaker Plate

Check breaker plate for smooth rotation.

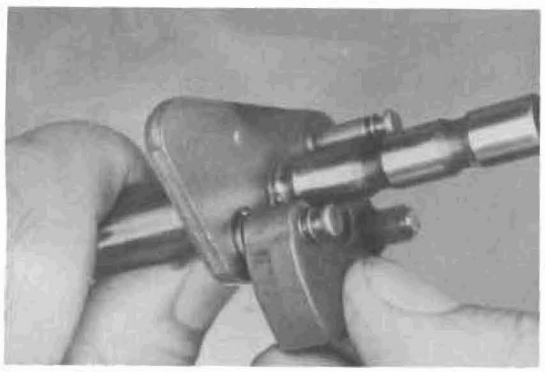
Fig. 8-31



Governor Weights

Inspect governor weights for damage.

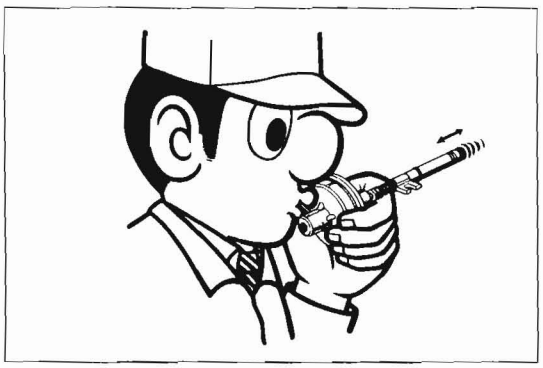
Fig. 8-32



Governor Weights and Pin

Check the fitting portions of governor weights with support pins for binding.

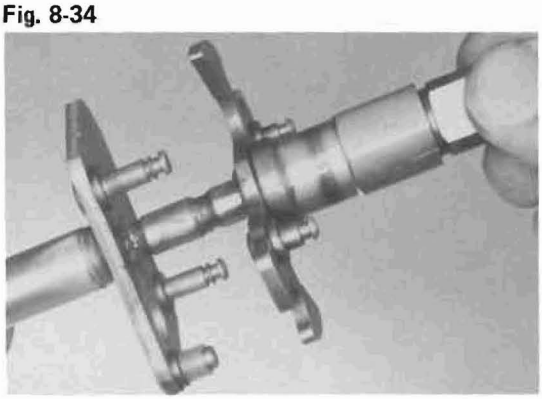
Fig. 8-33



Vacuum Retarder Diaphragm

Suck the tube with mouth. The diaphragm should move.

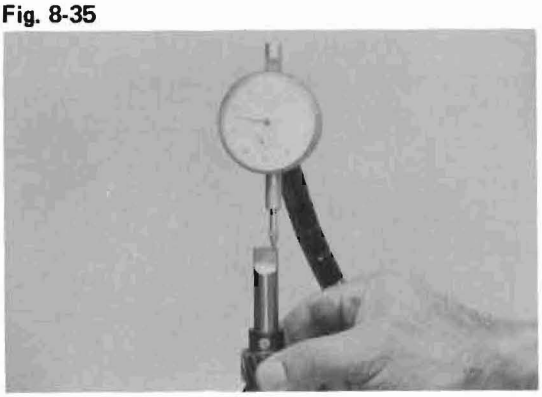
Fig. 8-34



Cam and Shaft

Inspect cam for wear, damage, and fit between cam and shaft.

Fig. 8-35



Governor Shaft and Housing

1. Check shaft thrust clearance.

Thrust clearance	**0.15-0.5 mm (0.006-0.020 in)**

Fig. 8-36

2. Remove gear and pin
Grind off the pin end, then remove the pin and gear.

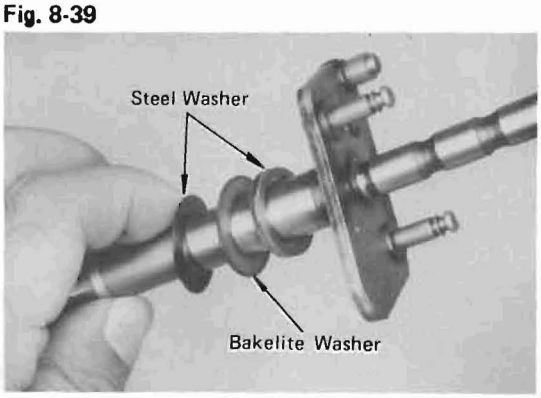
Fig. 8-37

3. Inspect governor shaft for wear and damage.

Fig. 8-38

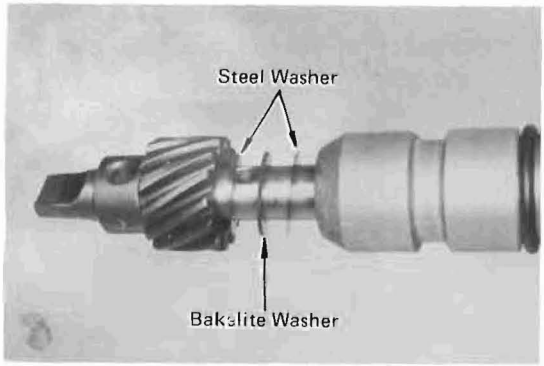
4. Inspect housing bushings, and O ring for wear, deformation, and damage.

Fig. 8-39



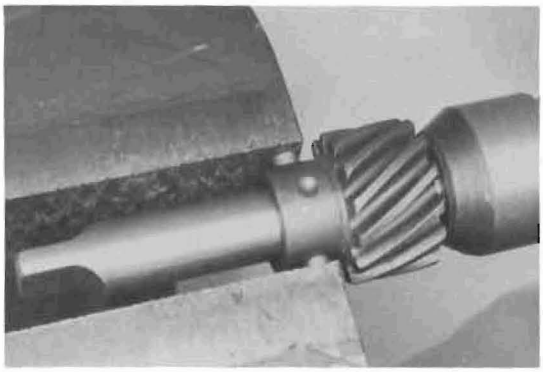
5. Assemble washers in order as shown.

Fig. 8-40



6. Assemble washers and gear in order as shown and check thrust clearance. If it exceeds specified value, adjust the clearance with steel washer.

Fig. 8-41



7. Peen both pin ends with a vise.

ASSEMBLY

Assemble in numerical order.

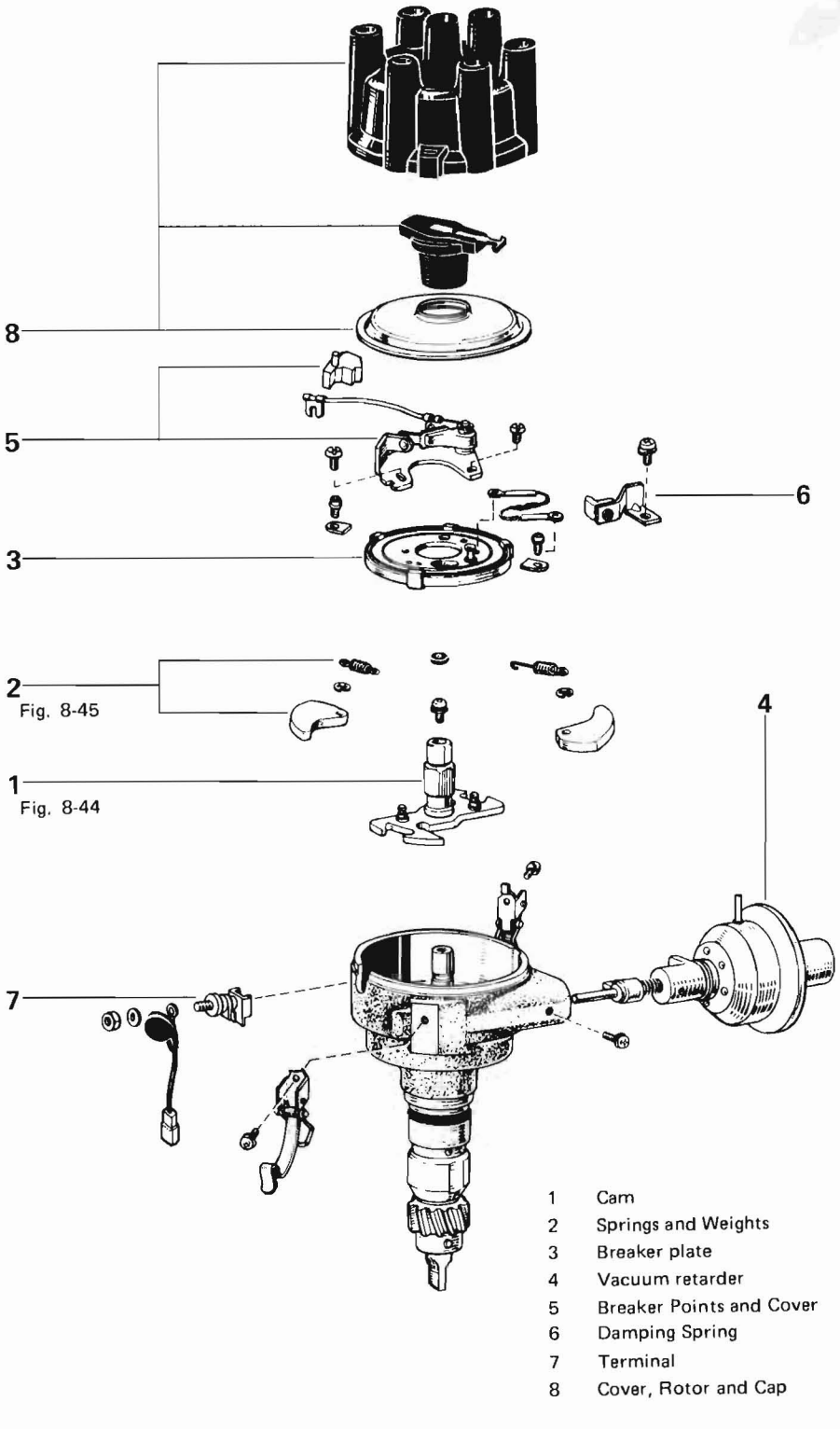


Fig. 8-42

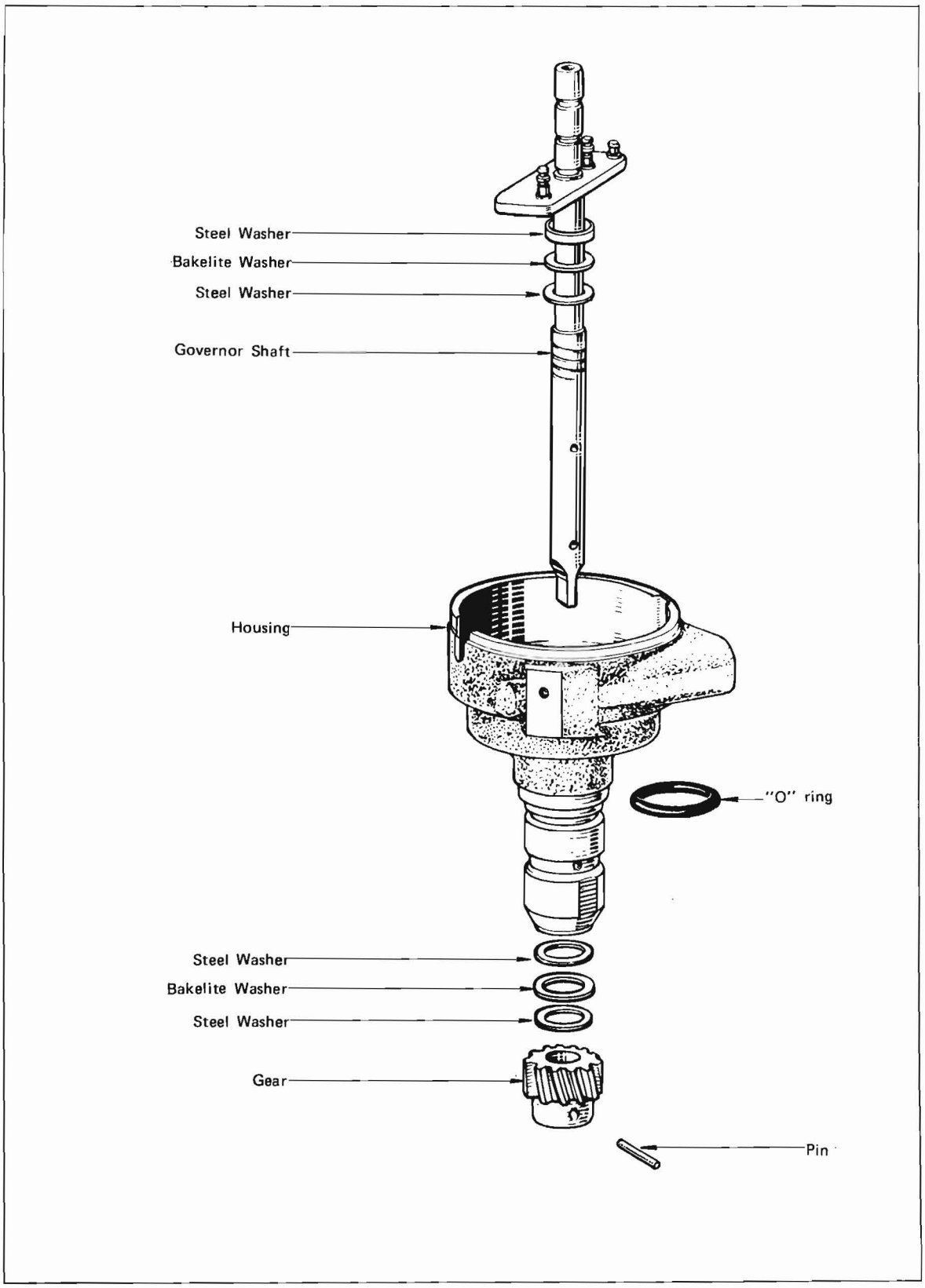
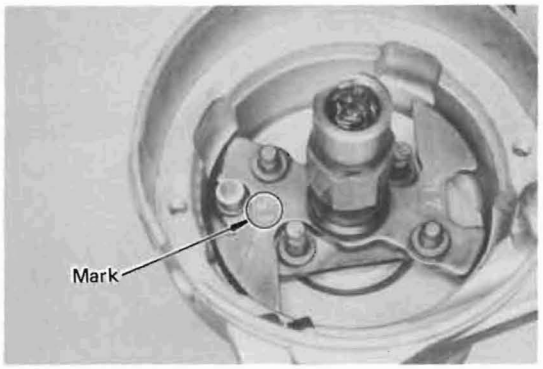

Steel Washer
Bakelite Washer
Steel Washer
Governor Shaft
Housing
"O" ring
Steel Washer
Bakelite Washer
Steel Washer
Gear
Pin

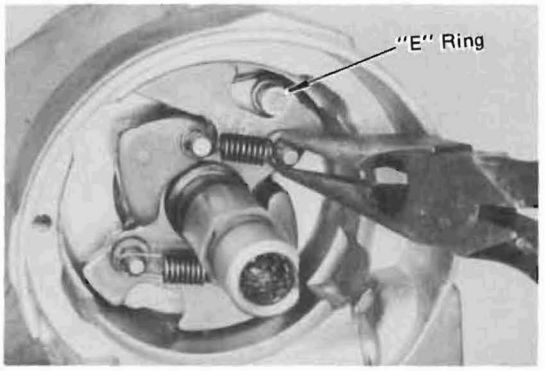
Fig. 8-43

Fig. 8-44



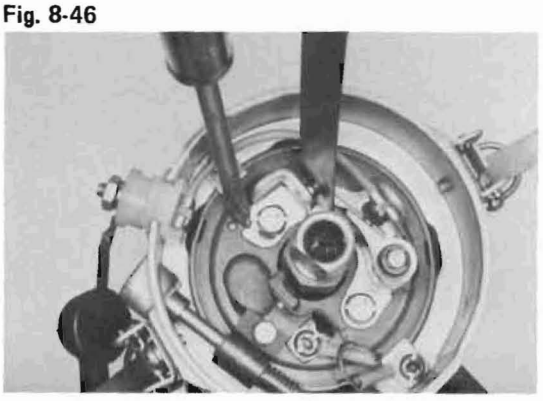
Match 15 mark with stopper, fit on the cam and tighten with screw.

Fig. 8-45



Assemble governor weights and lock with E ring. Install governor springs.

Fig. 8-46

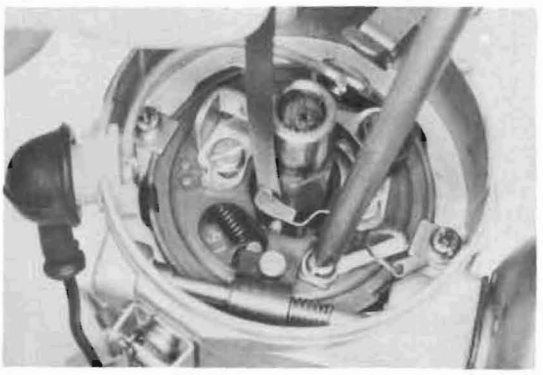


ADJUSTMENT

Install breaker points and adjust the gap.

Point gap	**0.45 mm (0.018 in)**

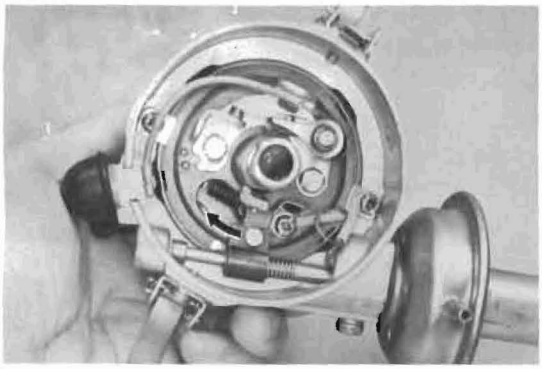
Fig. 8-47



Install damping spring and adjust it.

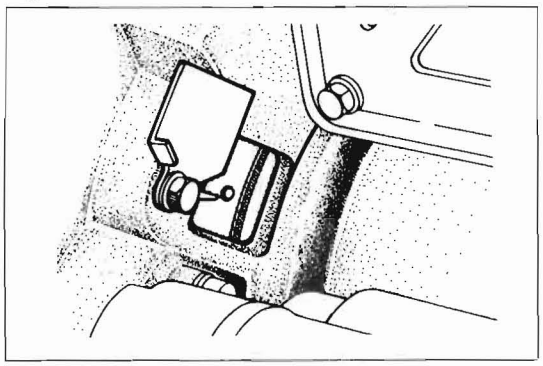
Damping spring gap	**0.1-0.4 mm (0.004-0.016 in)**

Fig. 8-48



Check breaker plate for smooth rotation.
Suck the tube with mouth. The breaker plate should move.

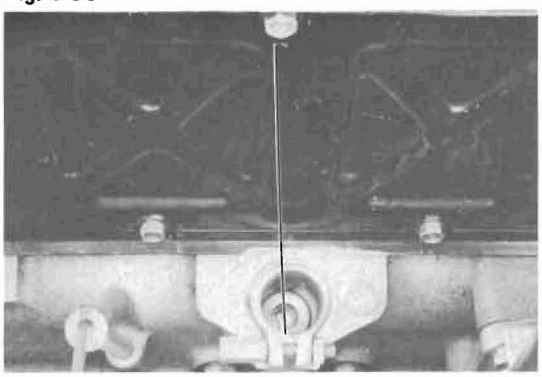
Fig. 8-49



INSTALLATION

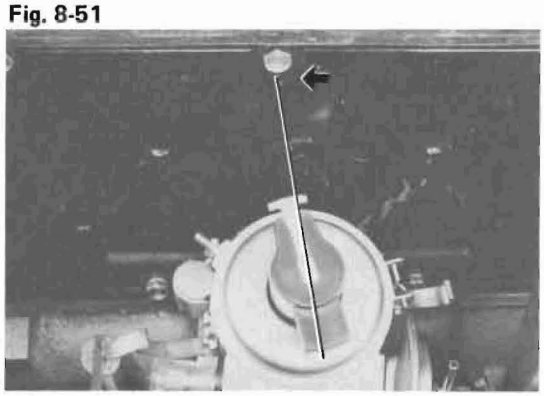
1. Set No. 1 cylinder to 7° BTDC/compression. Align the timing ball with pointer. At this time, rocker arms on No. 1 cylinder should be loose and rockers on No. 6 should be tight.

Fig. 8-50



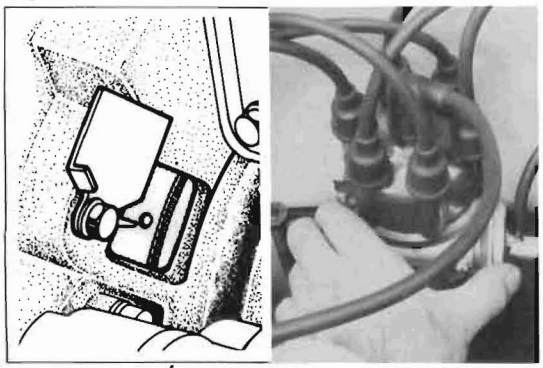
2. Set the oil pump shaft slot in direction as shown.

Fig. 8-51



3. Begin insertion of distributor with diaphragm and rotor pointing the position as shown.
   When fully installed, rotor should point toward the bolt (arrow). Rotate distributor body to the position where the points are just opening.

Fig. 8-52



4. Check ignition timing in idling condition. For adjustment, turn distributor body and align timing ball with pointer.
   Make sure that there is oil pressure at engine running.

IGNITION COIL

INSPECTION

Fig. 8-53

1. Clean the coil and inspect it for carbon paths around the terminals, and check the outside body for cracks.
2. Inspect the high tension cord insertion hole for carbon deposit or corrosion.

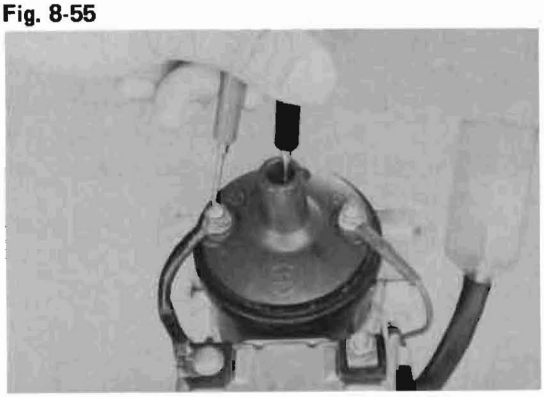
Fig. 8-54

3. Measure the following resistances.
   If the reading is not within the specified resistance, replace coil.

Primary coil resistance (Reference only)

W/O	**resistor type**	**2.6-4.0Ω**
W/	**resistor type**	**1.3-1.6Ω**

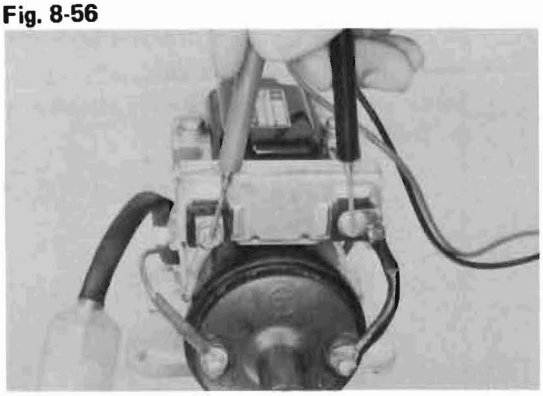
Fig. 8-55



Secondary coil resistance (Reference only)

W/O	**resistor type**	**6.0-9.0kΩ**
W/	**resistor type**	**9.5-14.5kΩ**

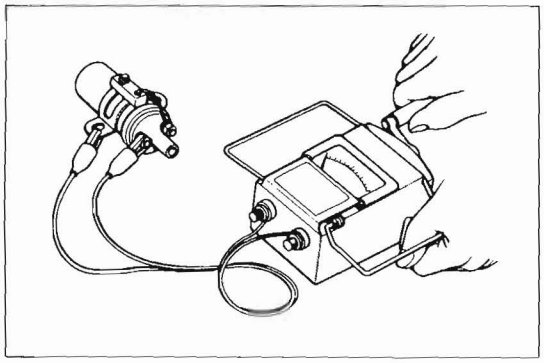
Fig. 8-56



External resistor resistance (Reference only)

1.3-1.7Ω

Fig. 8-57



Insulation resistance Over 10MΩ at 500V

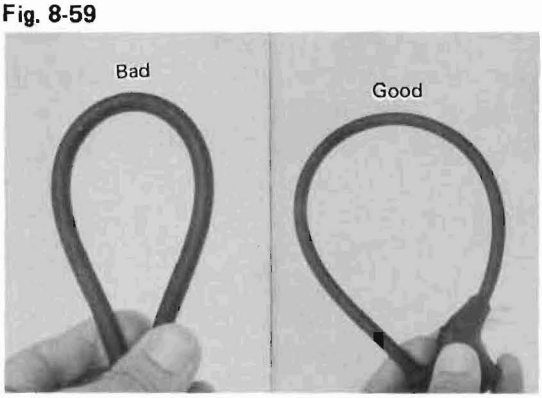
Fig. 8-58

HIGH TENSION CORD

– Caution –

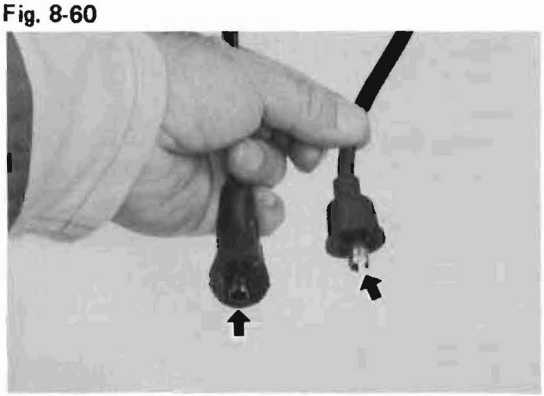
1. **Remove carefully high tension cords by pulling the rubber boot.**

Fig. 8-59



2. **Do not bend cords so as to conductor from broken.**

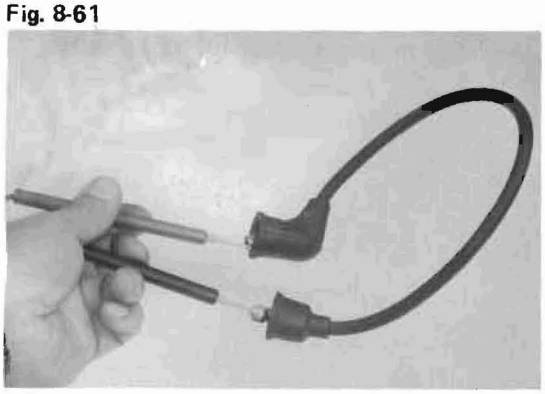
Fig. 8-60



INSPECTION

1. Check the condition of the cord terminal. If any terminal is corroded, clean it, and if it is broken or distorted, replace the cord.

Fig. 8-61



2. Check the resistance of each cord between both ends. If the reading exceeds the limit, replace the cord.

Resistance Less than 25 kΩ

Fig. 8-62

SPARK PLUG

INSPECTION

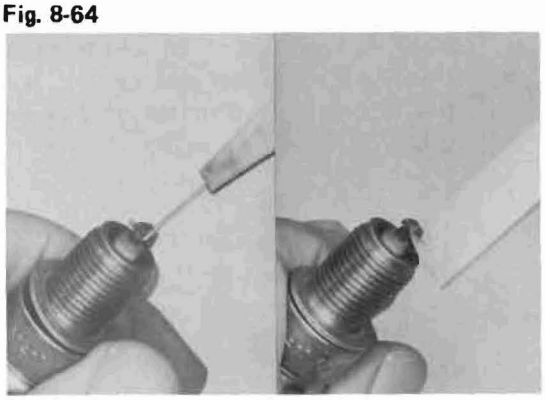
Inspect for the following items. Clean or replace plugs if necessary.

1. Cracks or damages in the threads or insulator.
2. Damaged or deteriorated gaskets.

Fig. 8-63

3. Wear on the electrodes.
4. Burnt condition of electrode and amount of carbon deposit.

Fig. 8-64



GAP ADJUSTMENT

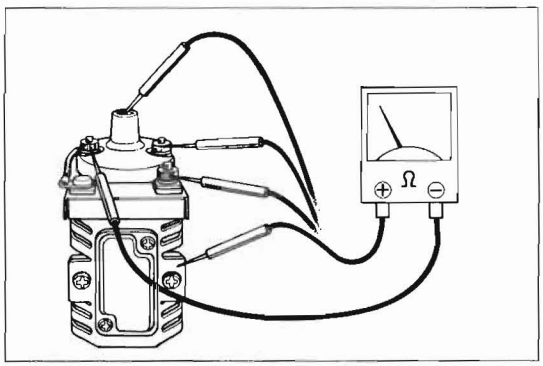
Check the plug gap with plug gap gauge.
If not to specified value, adjust by bending the ground (outer) electrode.

Spark plug gap 0.8 mm (0.031 in)
1.0 mm (0.039 in) for USA

IGNITER

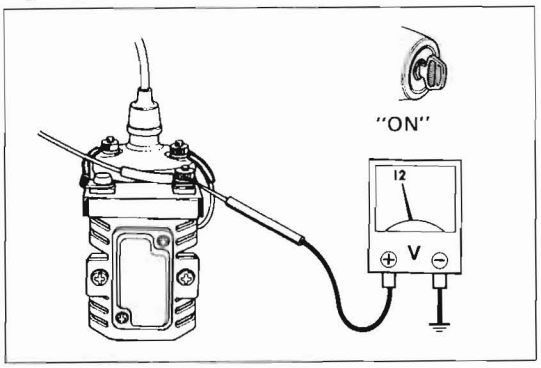
INSPECTION

Fig. 8-65



1. Inspect ignition coil resistance beforehand. Refor to Ignition Coil section.

Fig. 8-66

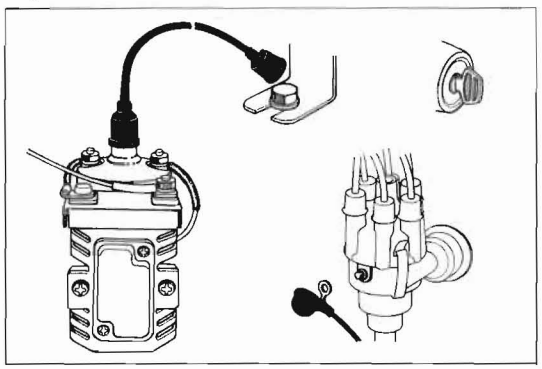


2. Turn the ignition key to ON position.
3. Check if there is battery voltage at resistor terminal as shown.

12V — GOOD

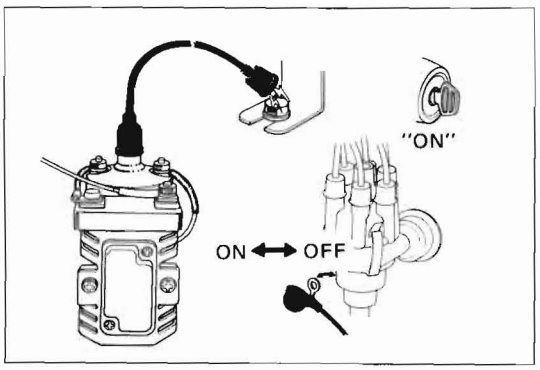
If not — Check ignition switch or wiring harness.

Fig. 8-67



4. Disconnect primary ignition wire and high tension cord from distributor.
5. Keep the cord end to ground distance about 5 mm (0.2 in).

Fig. 8-68



6. Make primary ignition wire ON–OFF contacts with ground.
7. Check if spark is produced at this time.

Spark is produced –

Igniter is satisfactory.

Spark is not produced –

Igniter is unsatisfactory.

MEMO

CHARGING SYSTEM

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CHARGING SYSTEM CIRCUITS

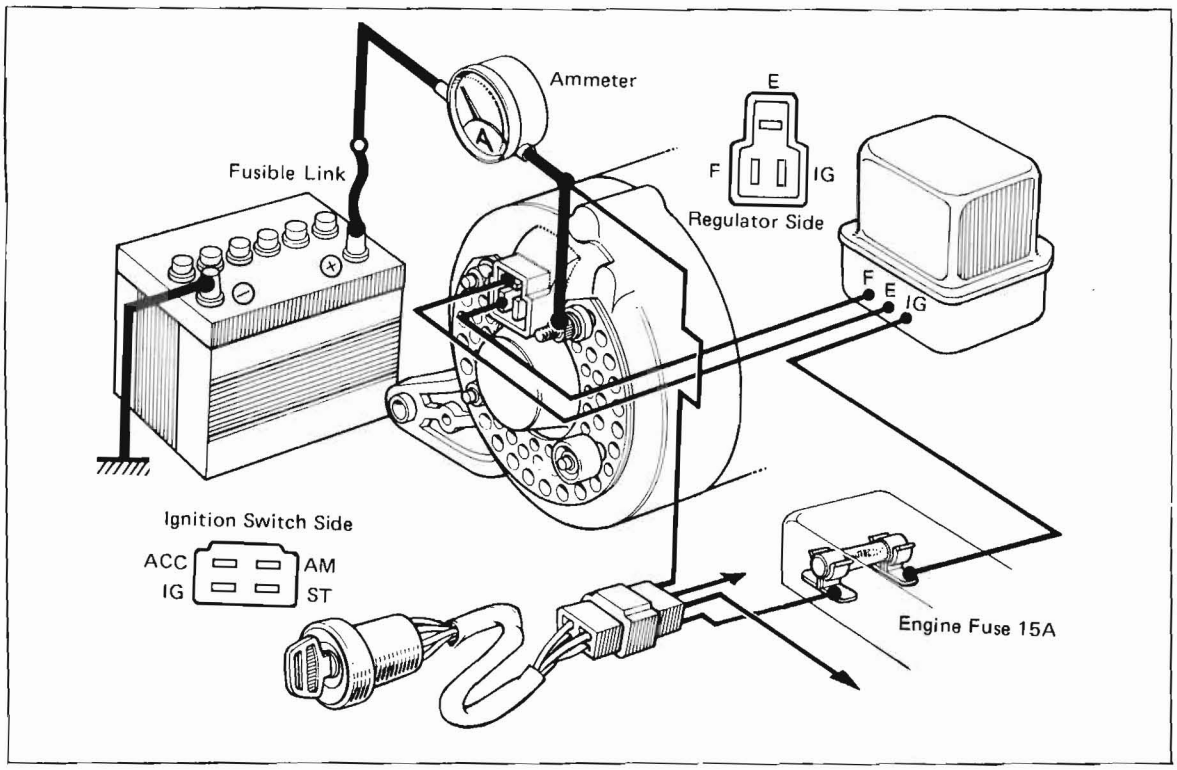


Fig. 9-1

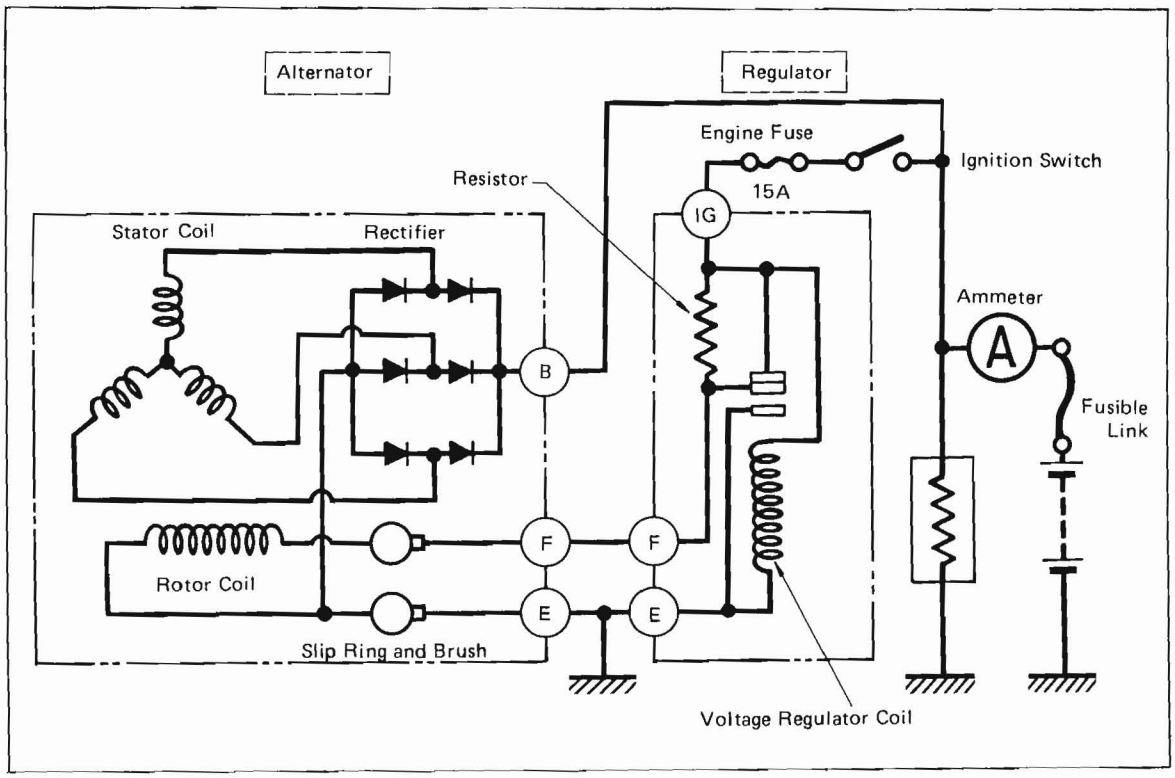


Fig. 9-2

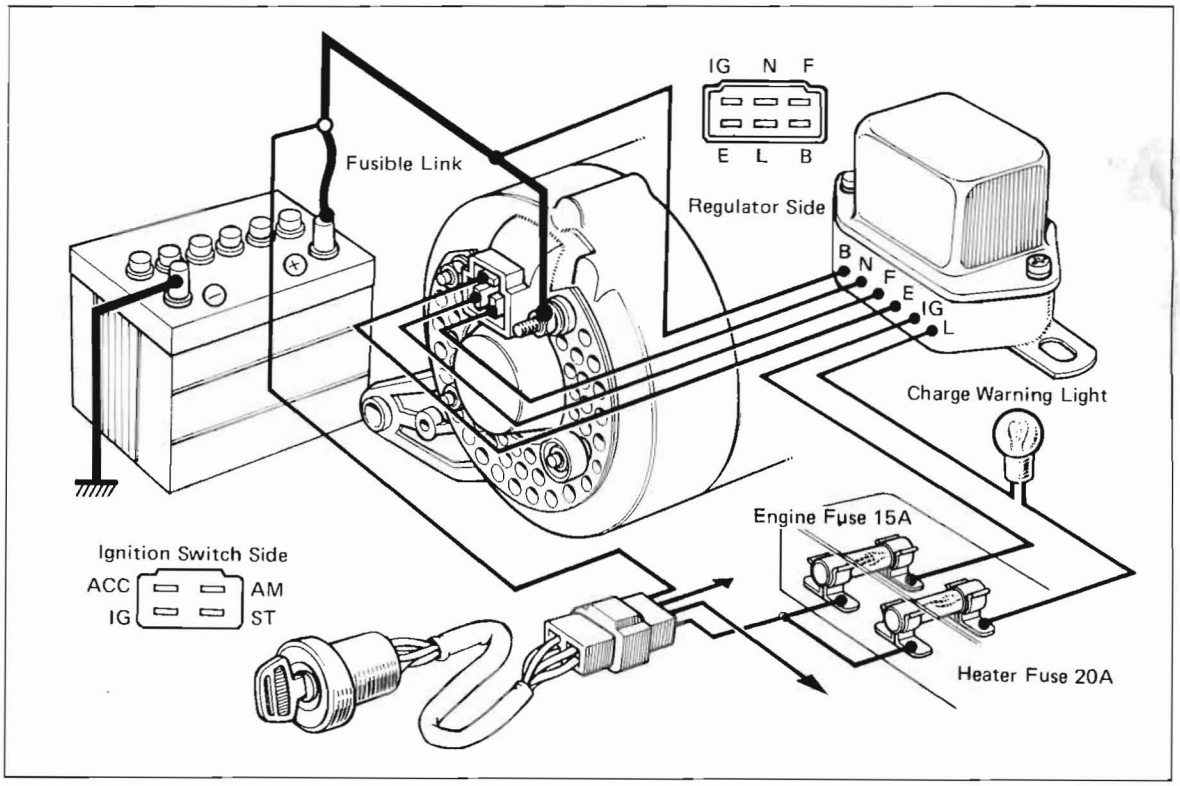

IG N F
E L B
Fusible Link
Regulator Side
B N F E IG L
Charge Warning Light
Engine Fuse 15A
Ignition Switch Side
ACC AM
IG ST
Heater Fuse 20A

Fig. 9-3

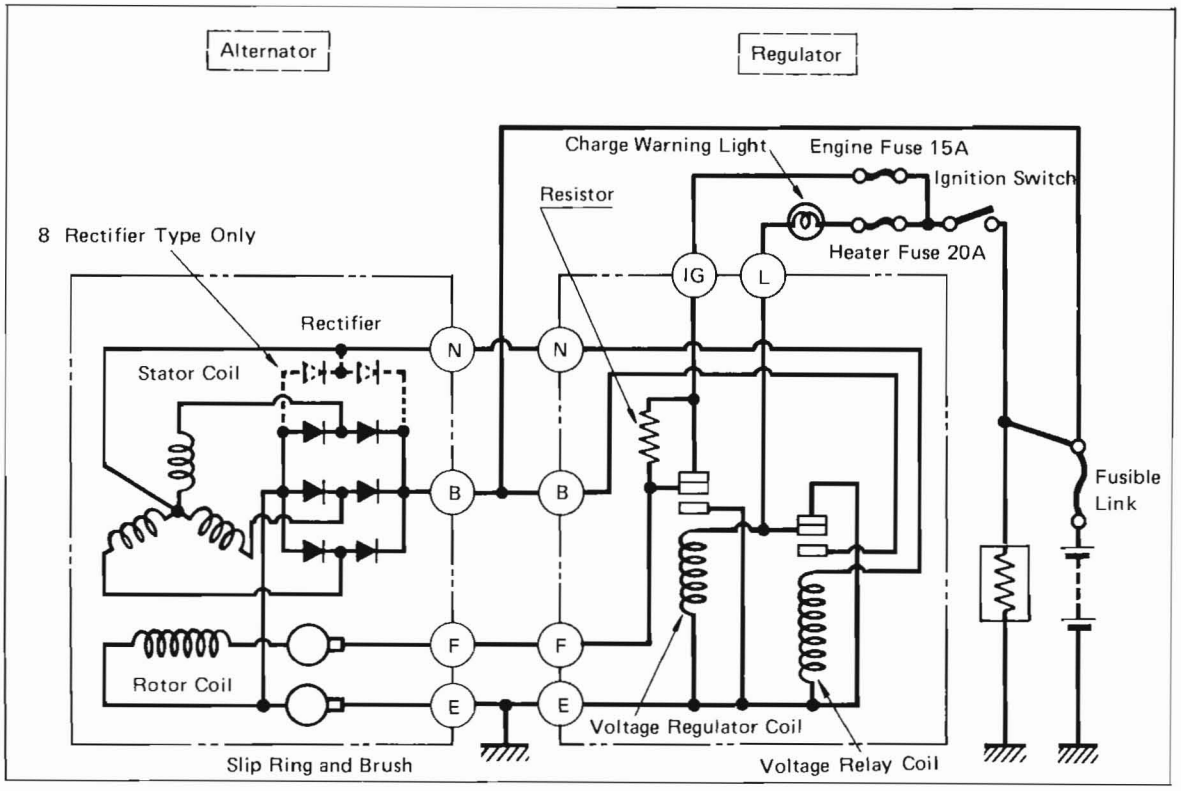
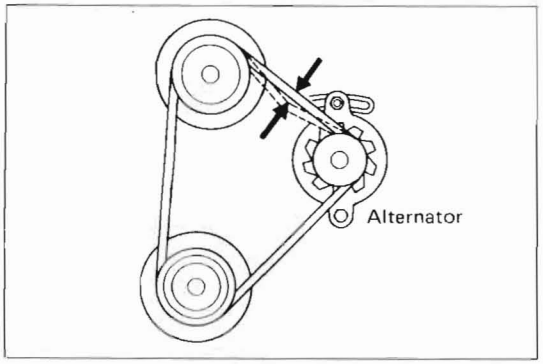

Alternator
Regulator
Charge Warning Light
Engine Fuse 15A
Ignition Switch
Resistor
8 Rectifier Type Only
Heater Fuse 20A
IG
L
Rectifier
N
N
Stator Coil
B
B
Fusible Link
F
F
Rotor Coil
E
E
Voltage Regulator Coil
Slip Ring and Brush
Voltage Relay Coil

Fig. 9-4

ON-VEHICLE INSPECTION

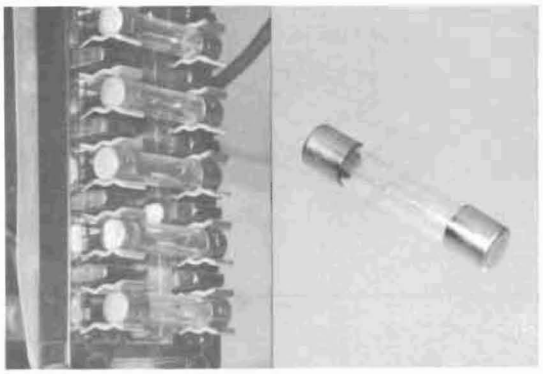
Fig. 9-5



Inspect system components as follows.

1. Drive belt tension

Fig. 9-6



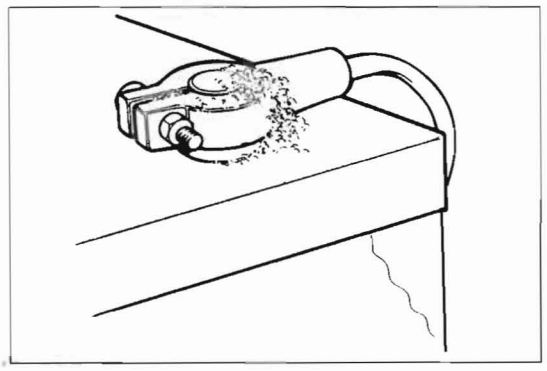
2. Fuses

Engine fuse	15A
Heater fuse	20A

Fig. 9-7

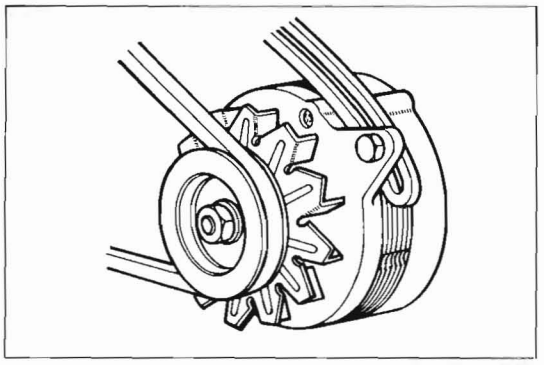
3. Installed condition of wiring for alternator and regulator.

Fig. 9-8



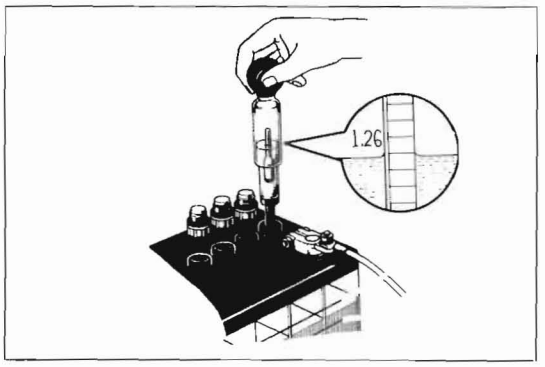
4. Battery terminal and fusible link.
   Loose
   Corroded
   Burnt

Fig. 9-9



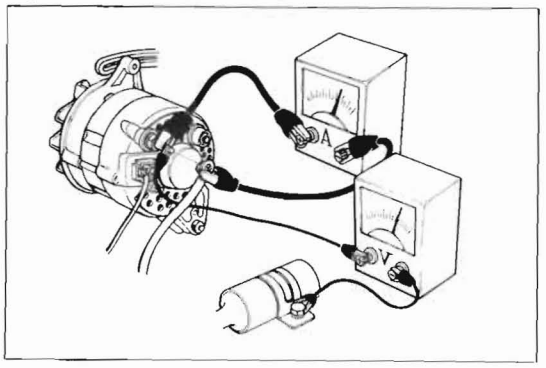
5. Alternator on-vehicle condition
Abnormal noise from alternator when engine is running.

Fig. 9-10



6. Specific gravity 1.25-1.27

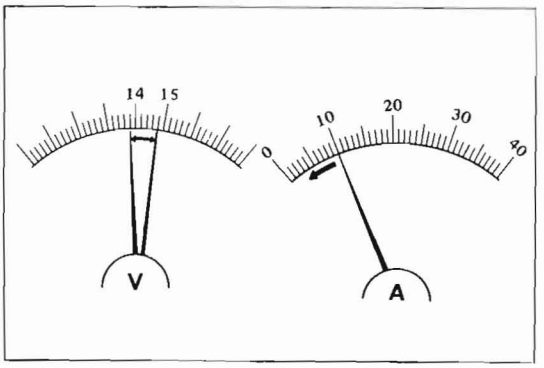
Fig. 9-11



PERFORMANCE TEST USING VOLTMETER AND AMMETER

Connect voltmeter and ammeter as illustrated, and switch off all accessory parts.

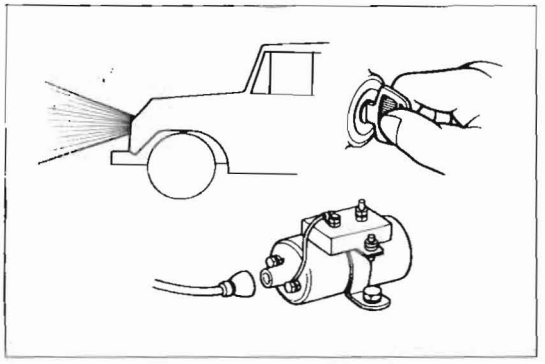
Fig. 9-12



No-load Performance test

Regulated voltage	**13.8 ~ 14.8 V**
Current	**Less than 10 A**
Engine speed	**Idling to 2000 rpm.**

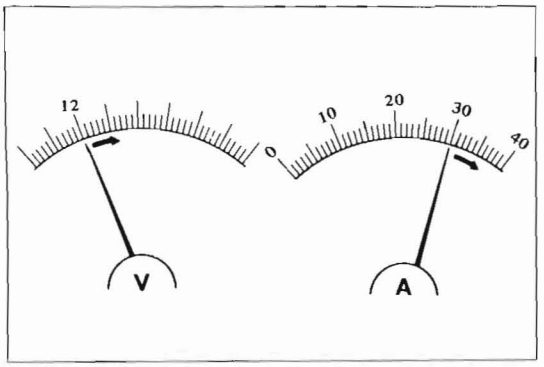
Fig. 9-13



Load Performance test

1. Crank the engine with ignition coil high tension cord disconnected for about 5 to 10 seconds.
2. Turn on headlights and accessories.

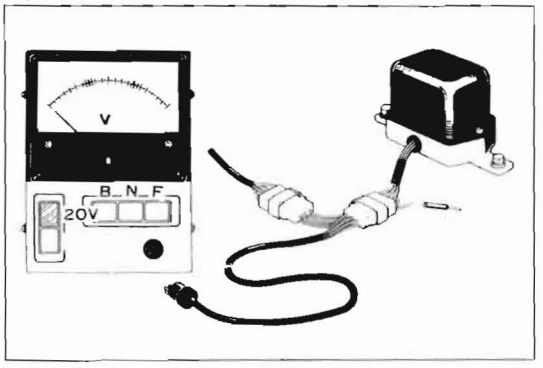
Fig. 9-14



3. Start engine, and run it at approximately 2000 rpm.

Regulated voltage	**12 V**
Current	**More than 30 A**

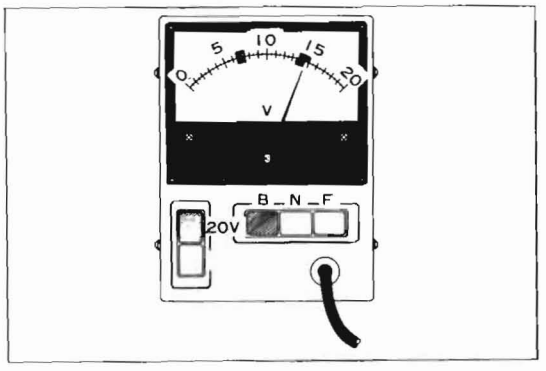
Fig. 9-15



PERFORMANCE TEST BY ALTERNATOR CHECKER

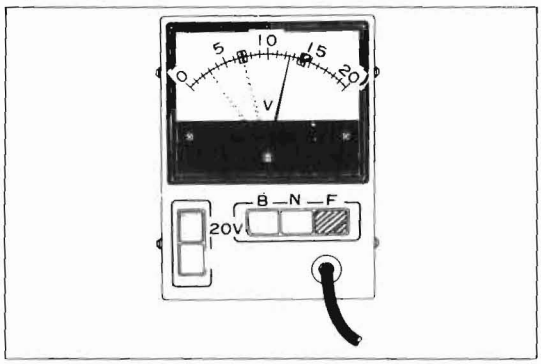
1. Unplug the alternator regulator connector and plug in the checker connector.
   Push "20V" switch.

Fig. 9-16



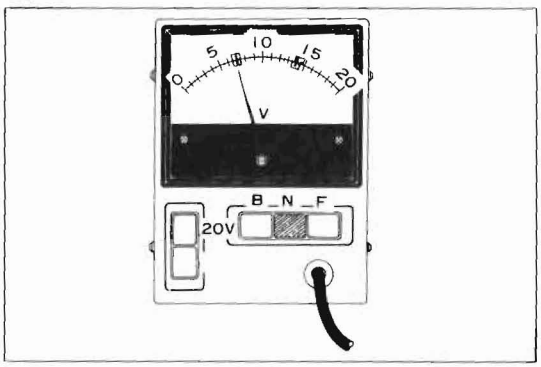
2. Check "B" terminal voltage.
   Push "B" switch.
   Raise engine speed from idling to 2000 rpm.
   Standard voltage 13.8 to 14.8 V

Fig. 9-17



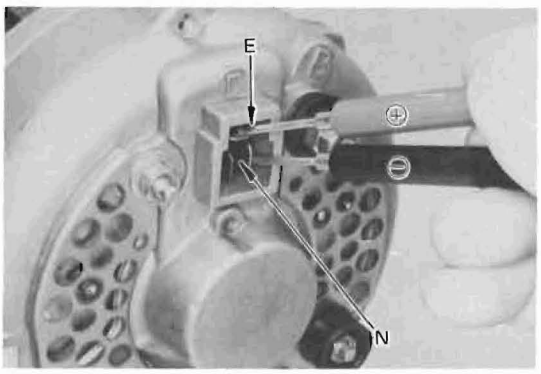
3. Check "F" terminal voltage.
Push "F" switch.
Gradually raise engine speed. The checker reading should gradually decrease from 12 volt to 3 volt.

Fig. 9-18



4. Check "N" terminal voltage.
Push "N" switch.
Maintain engine speed at approx. 1500 rpm. The pointer should be at a half of "B" terminal voltage.

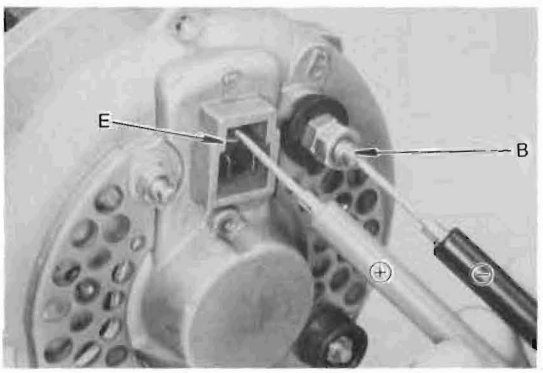
Fig. 9-19



ALTERNATOR INSPECTION

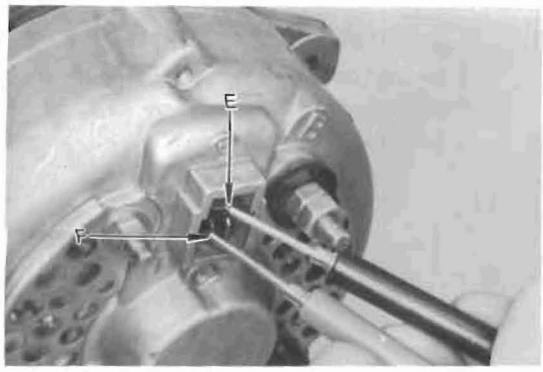
1. Negative side rectifier short test.
Connect an ohmmeter (–) lead to N terminal and (+) lead to E terminal.
Meter should indicate infinity.

Fig. 9-20



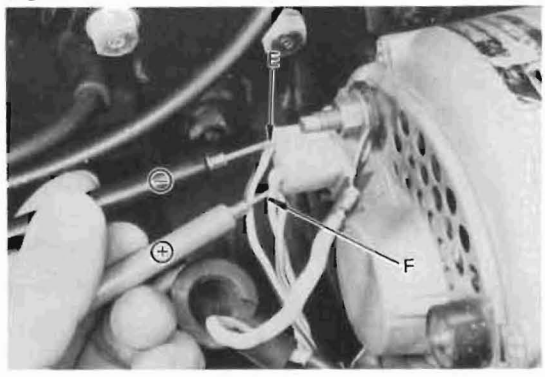
2. Positive side rectifier short test.
Connect an ohmmeter (–) lead to B terminal and (+) lead to E terminal.
Meter should indicate infinity.

Fig. 9-21



3. Check rotor coil resistance.
   Resistance 5-9 Ω

Fig. 9-22

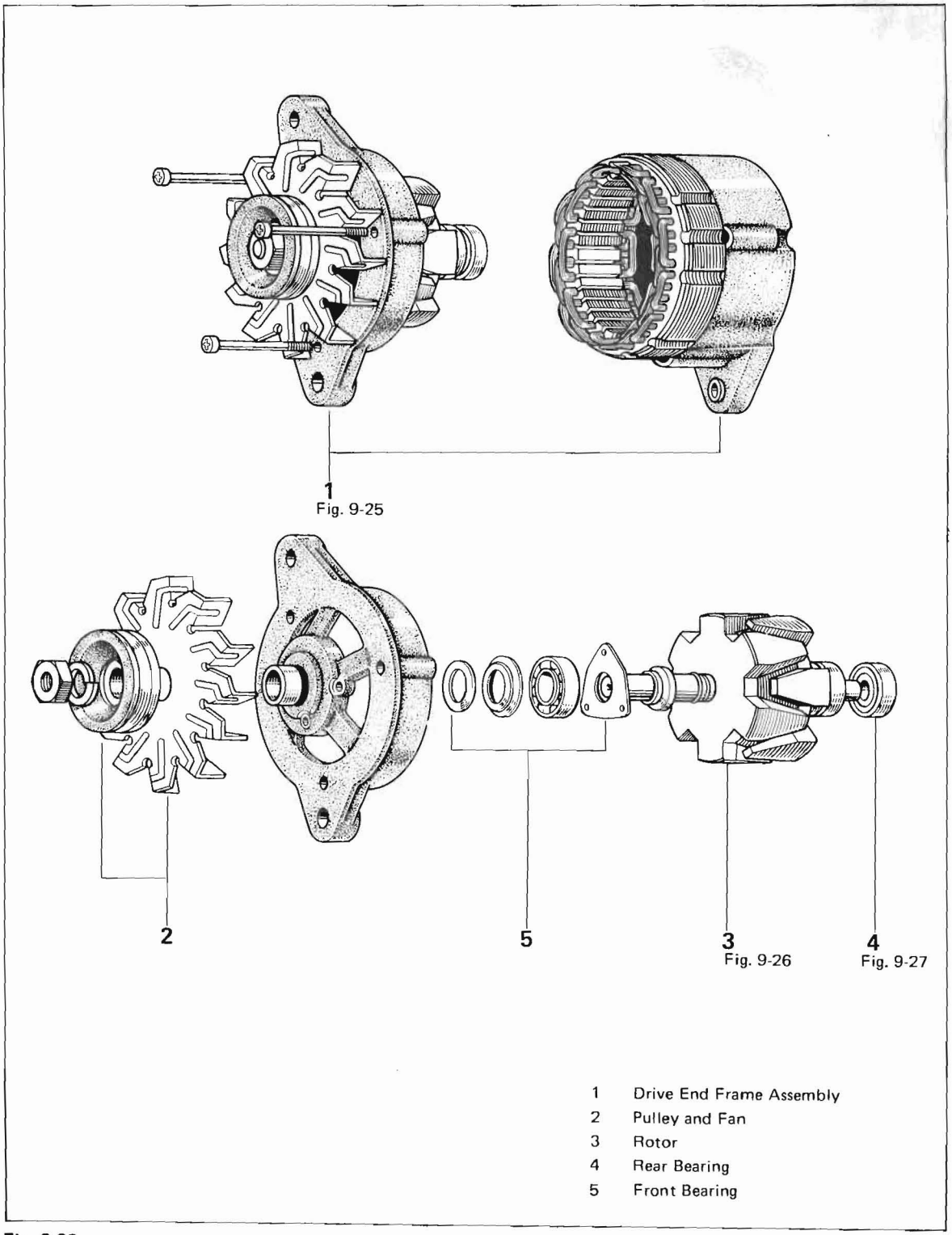


4. Turn ignition switch to ON position, and check if there is battery voltage at F terminal. If not, check ENGINE fuse.

ALTERNATOR (Conventional Type)

DISASSEMBLY

Disassemble in numerical order.



1 Drive End Frame Assembly
2 Pulley and Fan
3 Rotor
4 Rear Bearing
5 Front Bearing

Fig. 9-23

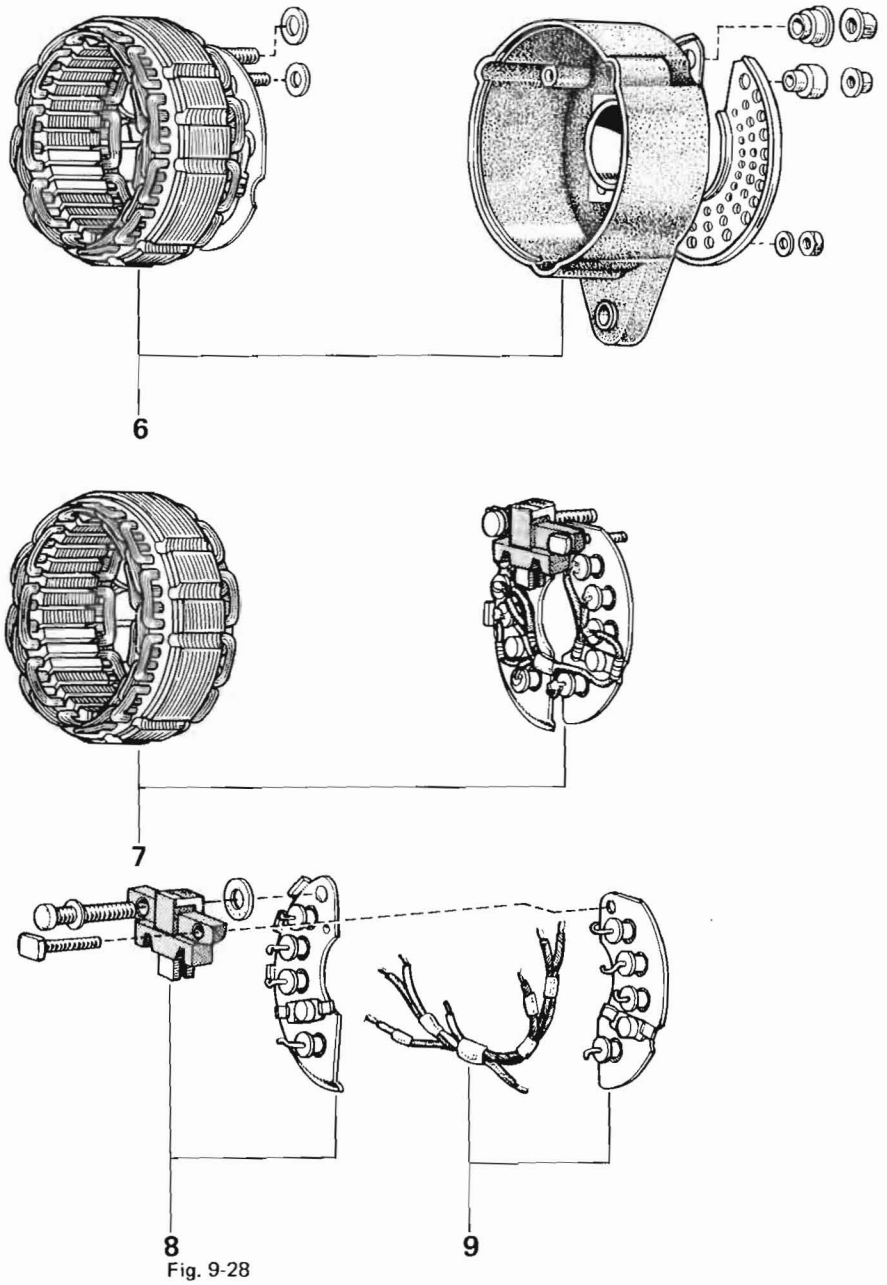
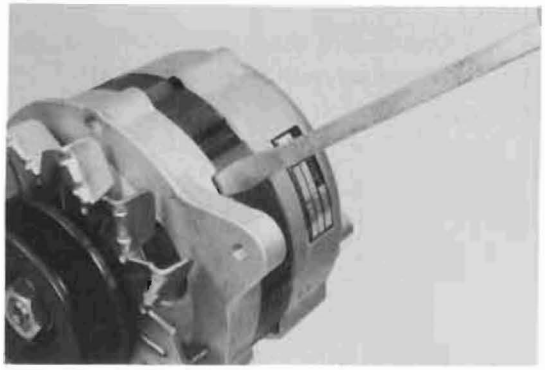


Fig. 9-28

6 Stator Coil and Rectifier Holder
7 Brush Holder and Rectifier Holder
8 Brush Holder
9 Lead Wire

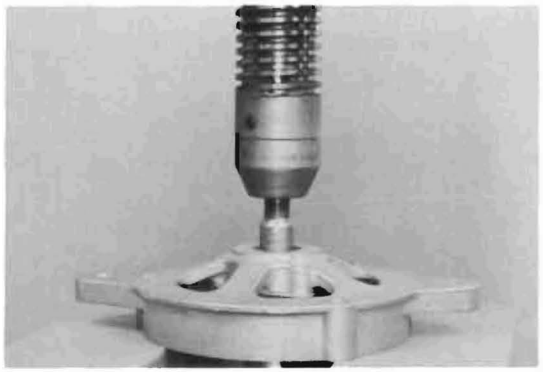
Fig. 9-24

Fig. 9-25



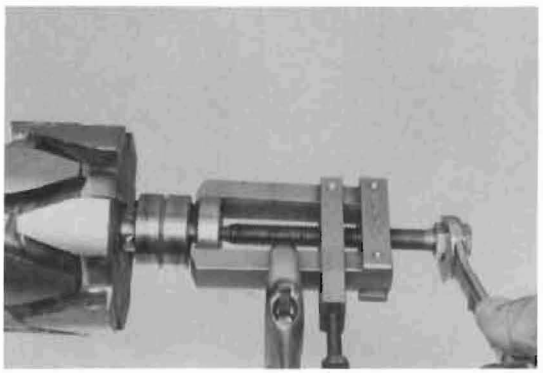
Pry drive end frame from stator.
Do not pry coil wires.

Fig. 9-26



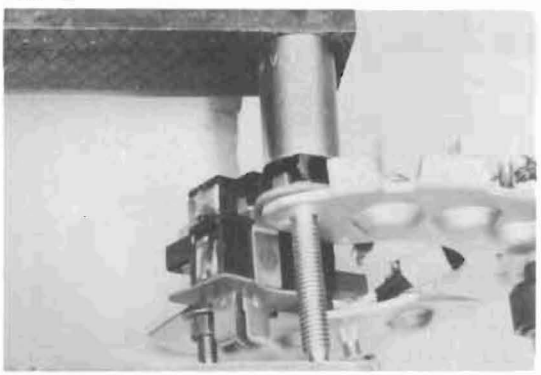
Remove rotor from drive end frame using a press.

Fig. 9-27



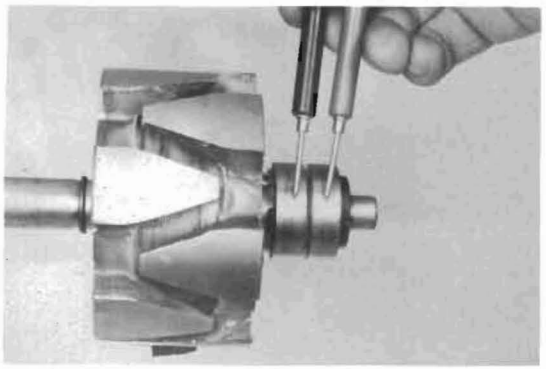
Remove rotor shaft rear bearing using SST [09286-46011].

Fig. 9-28



Remove brush holder assembly using a 10 mm socket wrench and vise.

Fig. 9-29



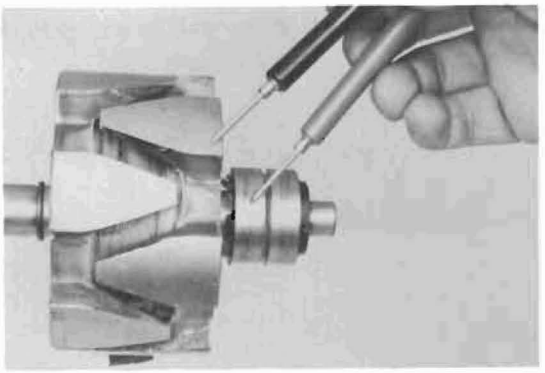
INSPECTION AND REPAIR

Rotor

1. Open circuit test

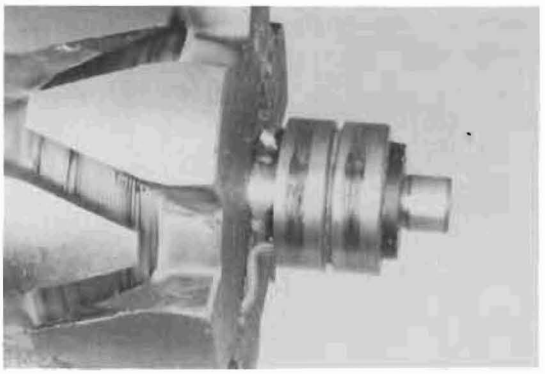
Standard resistance **4.1-4.3Ω**

Fig. 9-30



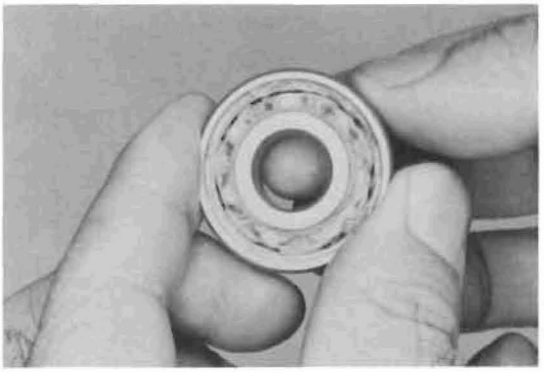
2. Ground test
Meter should indicate infinity.

Fig. 9-31



3. Check slip ring for being dirty or burnt.

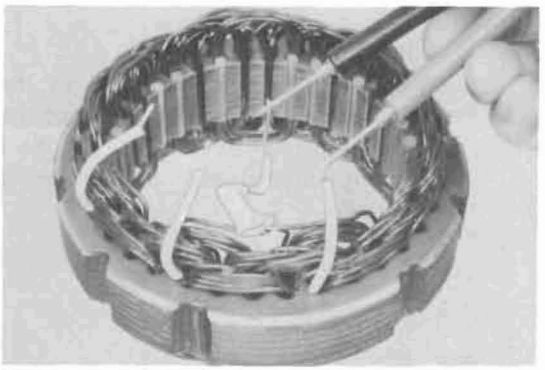
Fig. 9-32



Bearing

Check bearing for wear or roughness.

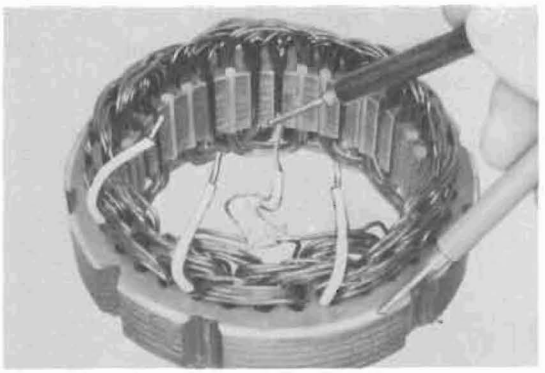
Fig. 9-33



Stator

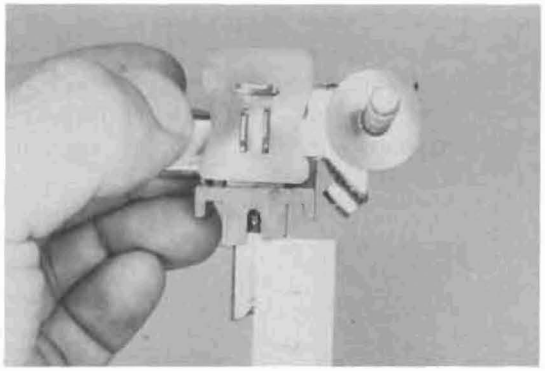
1. Open circuit test
   Test all four leads for continuity.

Fig. 9-34



2. Ground test.
   Meter should indicate infinity.

Fig. 9-35

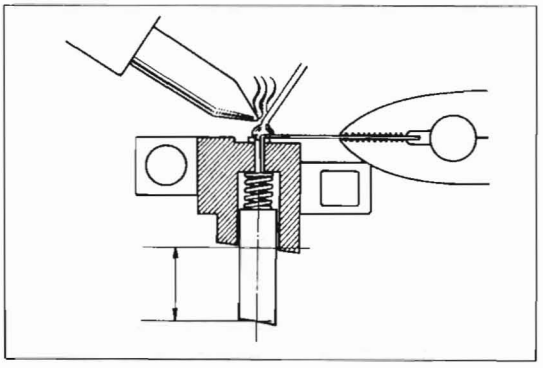


Brush and Brush Holder

Check exposed brush length.

Minimum exposed length **5.5 mm (0.22 in)**

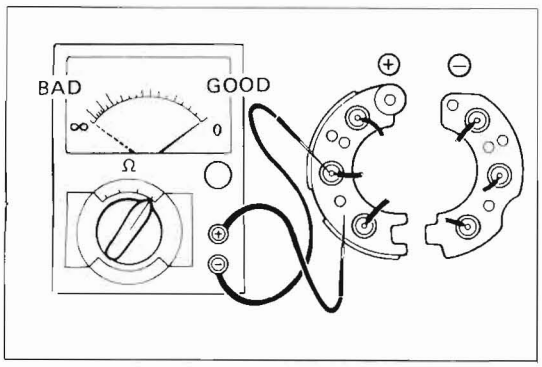
Fig. 9-36



When replacing brushes, assemble them as shown.

Exposed length **12.5 mm (0.49 in)**

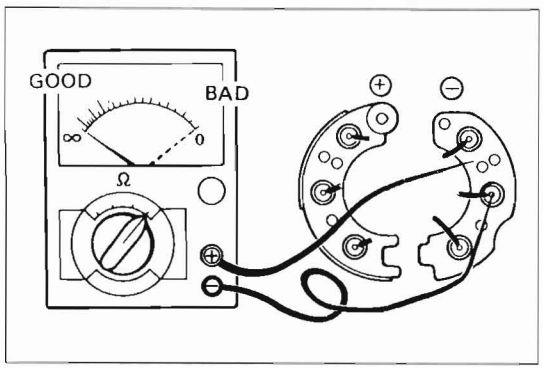
Fig. 9-37



Rectifier

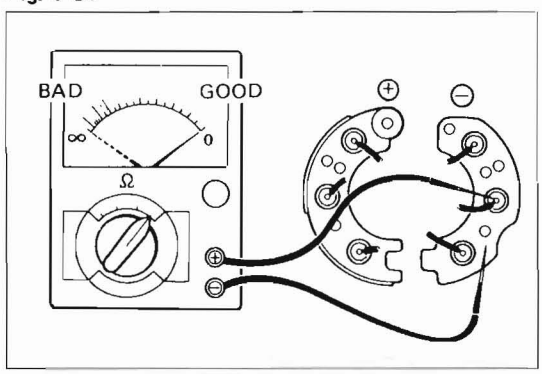
1. Rectifier holder positive side
   Connect an ohmmeter (+) lead to the rectifier holder, and the (–) lead of the meter to the rectifier terminal. If there is no continuity, rectifier assembly must be replaced.

Fig. 9-38



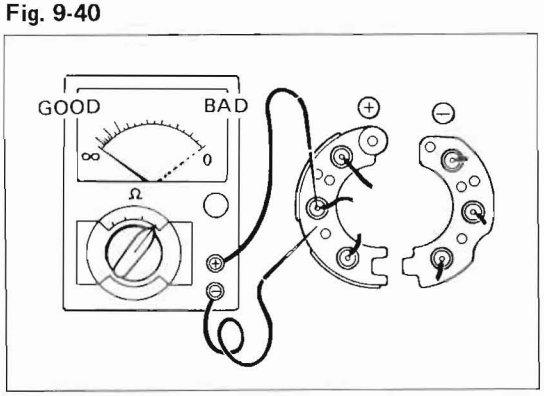
Reverse polarity of test leads and check again. If there is continuity, rectifier assembly must be replaced.

Fig. 9-39



2. Rectifier holder negative side
   Connect an ohmmeter (+) lead to the rectifier terminal, and the (–) lead of the meter to the rectifier holder. If there is no continuity, rectifier assembly must be replaced.

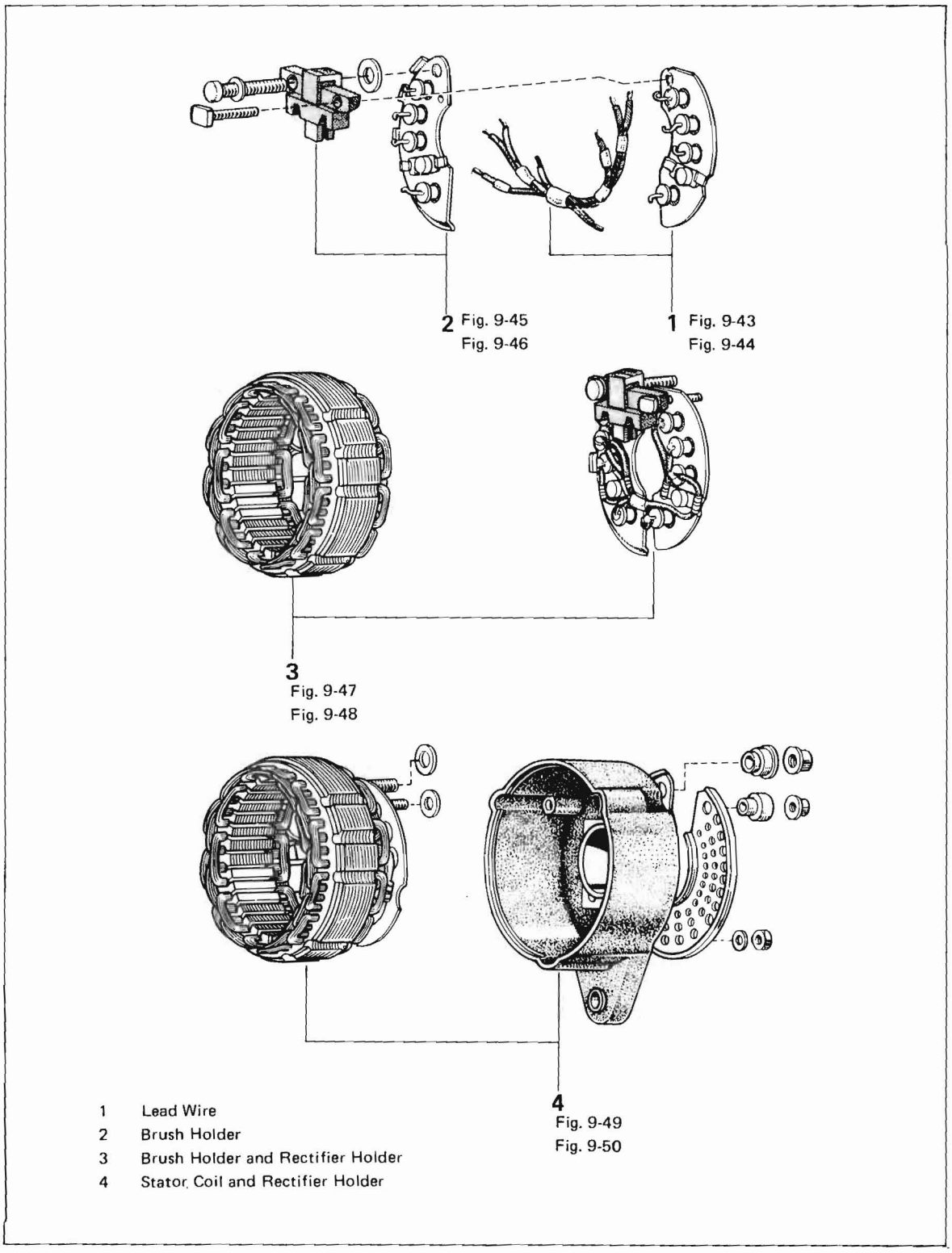
Fig. 9-40



Reverse polarity of test leads and check again. If there is continuity, rectifier assembly must be replaced.

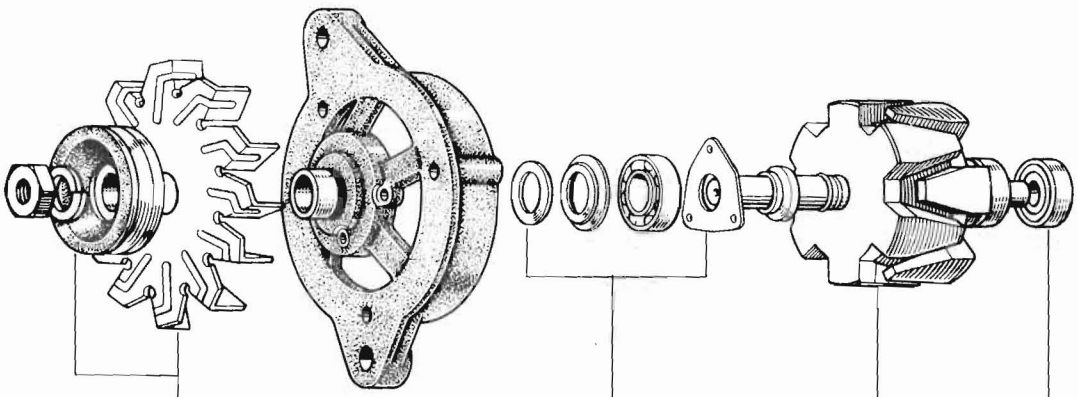
ASSEMBLY

Assemble in numerical order.



1 Lead Wire
2 Brush Holder
3 Brush Holder and Rectifier Holder
4 Stator Coil and Rectifier Holder

Fig. 9-41

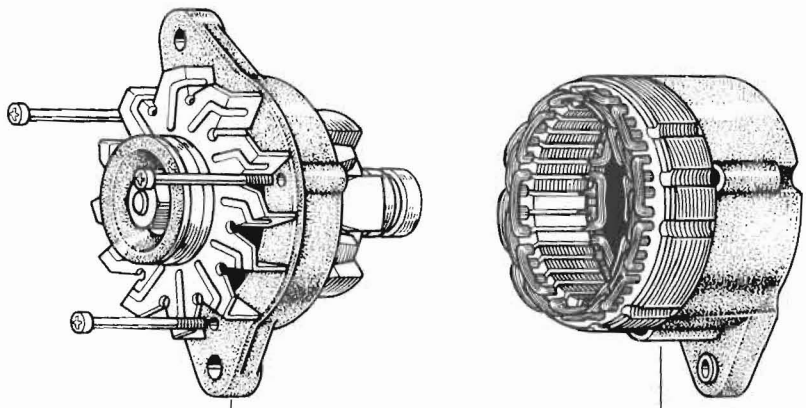


8
Fig. 9-55

6
Fig. 9-53

7
Fig. 9-54

5
Fig. 9-51
Fig. 9-52

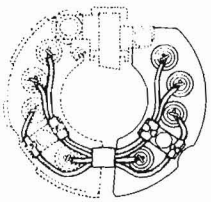


9
Fig. 9-56
Fig. 9-57

5 Rear Bearing
6 Front Bearing
7 Rotor
8 Pulley and Fan
9 Drive End Frame Assembly

Fig. 9-42

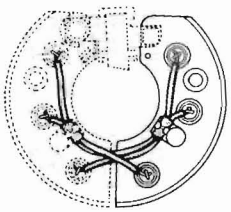
Fig. 9-43



8 Rectifier Type

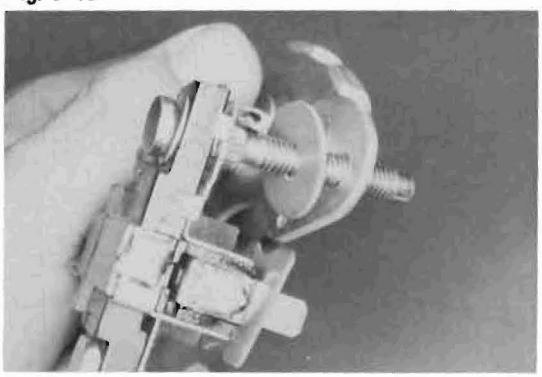
Solder negative side rectifiers.

Fig. 9-44



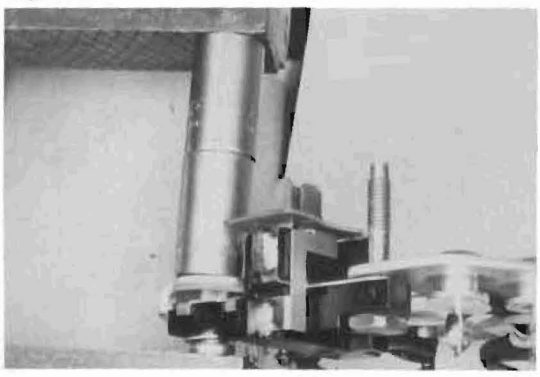
6 Rectifier Type

Fig. 9-45



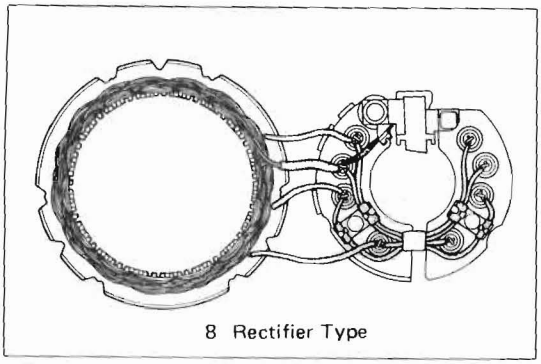
Insert insulator between positive rectifier holder and brush holder.

Fig. 9-46



Install brush holder onto rectifier holder using socket wrench and a vise.

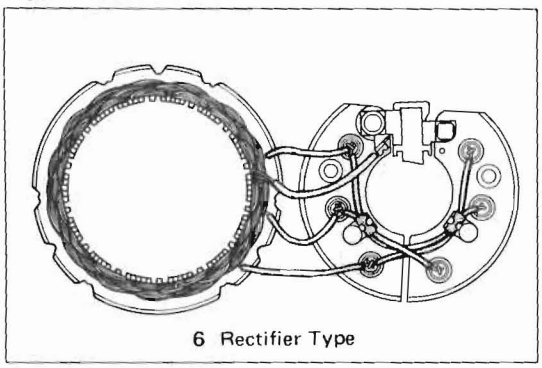
Fig. 9-47



8 Rectifier Type

Connect stator coil "N" lead onto (+) rectifier terminal and brush holder terminal.
(8 Rectifier Type)

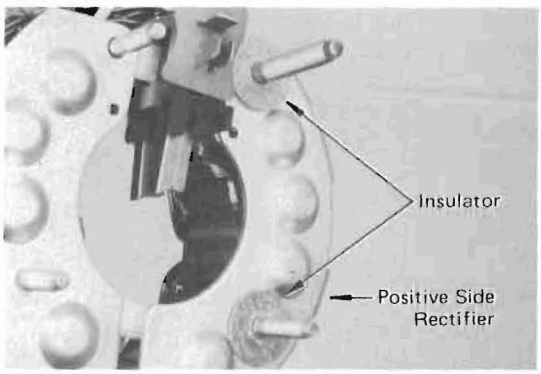
Fig. 9-48



6 Rectifier Type

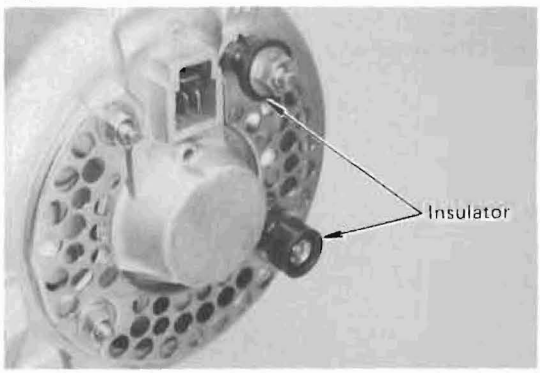
Connect stator coil "N" lead onto brush holder terminal, and solder each stator lead and rectifier lead to positive rectifier.

Fig. 9-49



Assemble rear end frame and rectifier holder with insulators.

Fig. 9-50

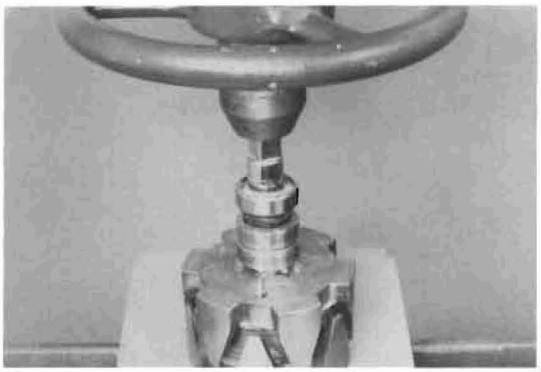


Assemble rear end cover with insulators.

Fig. 9-51

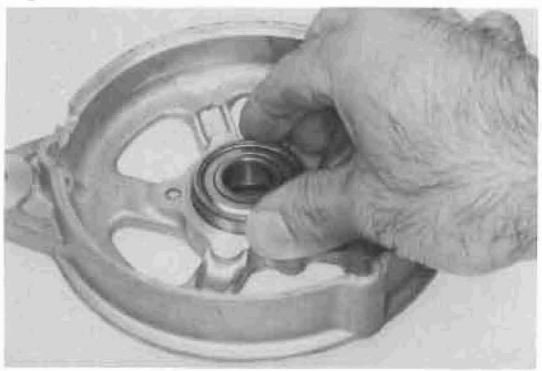
Install rear bearing facing its sealed side forward.

Fig. 9-52



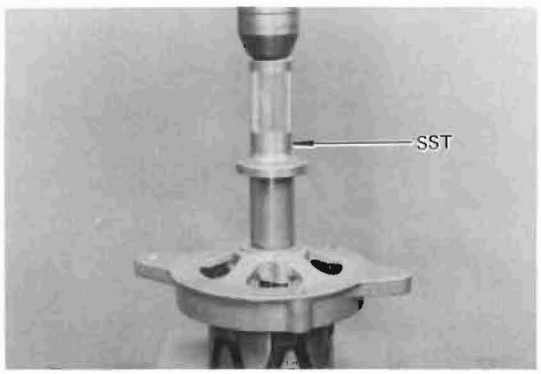
Press rear bearing onto rotor shaft, using a press.

Fig. 9-53



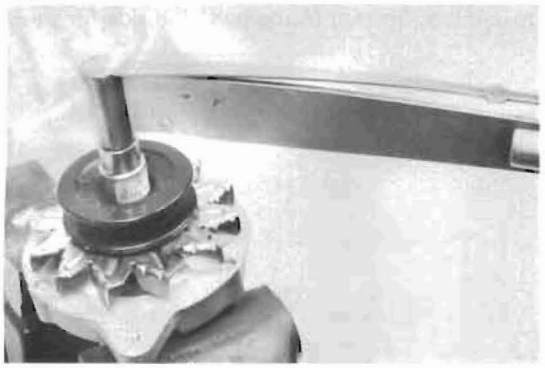
Install the front bearing facing its sealed side rearward.

Fig. 9-54



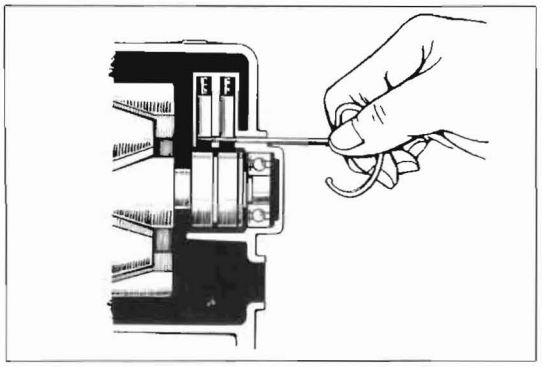
Press drive end frame assembly onto rotor shaft, using SST [09325-12010].

Fig. 9-55



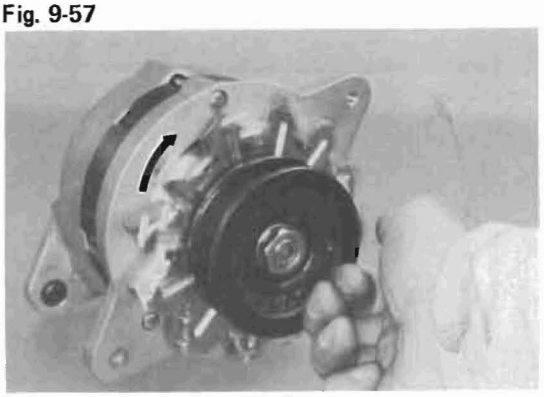
Tighten nut to specified torque.
Torque **5-6.5 kg-m (36-47 ft-lb)**

Fig. 9-56



Push in brushes and temporarily lock in place with wire inserted through access hole in end frame.
Position lead wires to clear rotor.

Fig. 9-57



Remove locking wire from the rear end frame and make sure the rotor rotates smoothly.

ALTERNATOR (Heavy Duty Type)

DISASSEMBLY

Disassemble in numerical order.

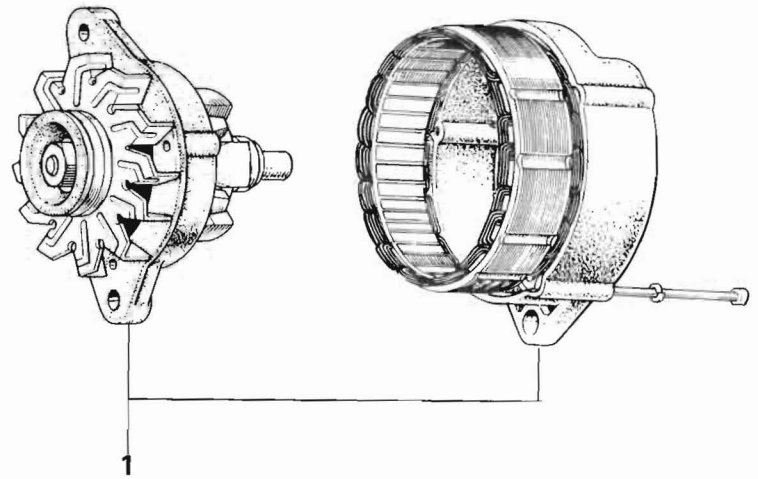


Fig. 9-60

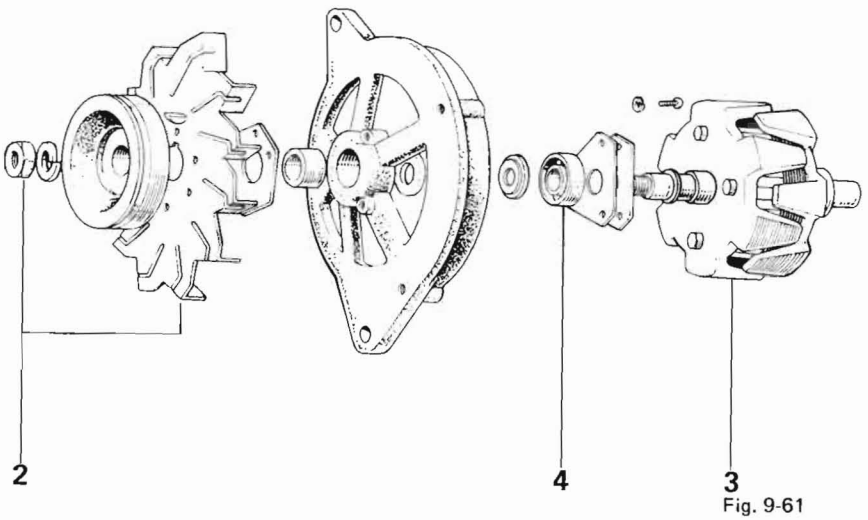


Fig. 9-61

1 Drive End Frame Assembly
2 Pulley and Fan
3 Rotor
4 Front Bearing

Fig. 9-58

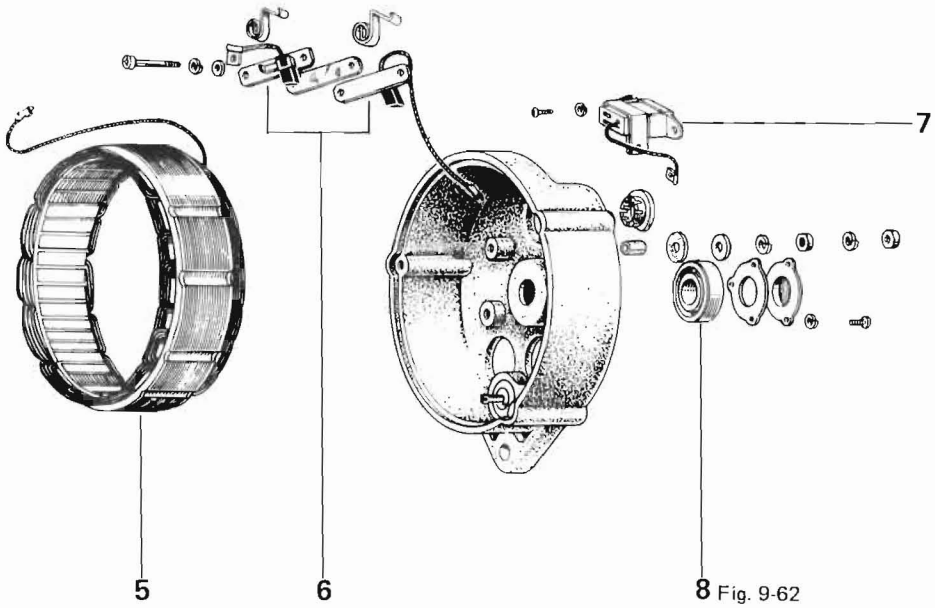
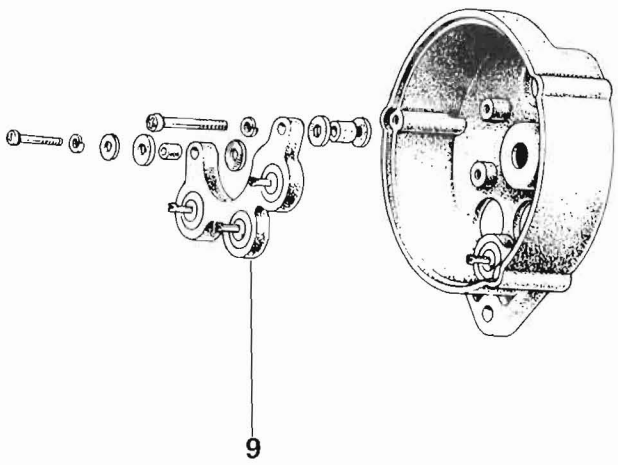


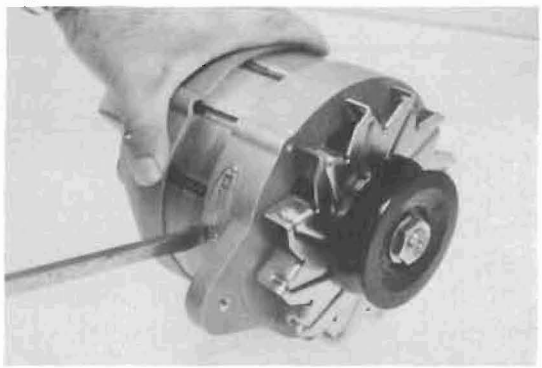
Fig. 9-62



5 Stator Coil
6 Brush Holder
7 Terminal Socket
8 Rear Bearing
9 Positive Rectifier

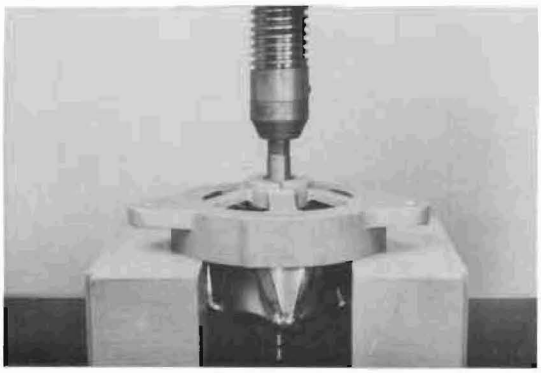
Fig. 9-59

Fig. 9-60



Pry drive end frame from stator. Do not pry coil wires.

Fig. 9-61

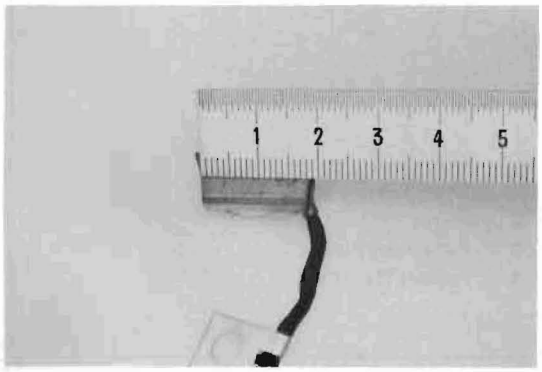


Remove rotor from drive end frame using a press.

Fig. 9-62

Tap out rear bearing, using a socket wrench.

Fig. 9-63



INSPECTION

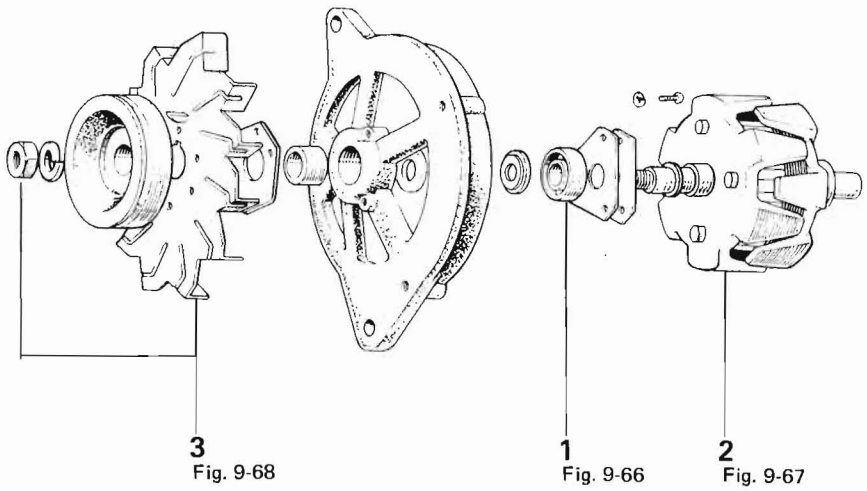
Check brush length and replace if below the limit.

Standard	**18.5 mm (0.73 in)**
Limit	**8 mm (0.31 in)**

For other items, see INSPECTION section of Conventional Type Alternator.

ASSEMBLY

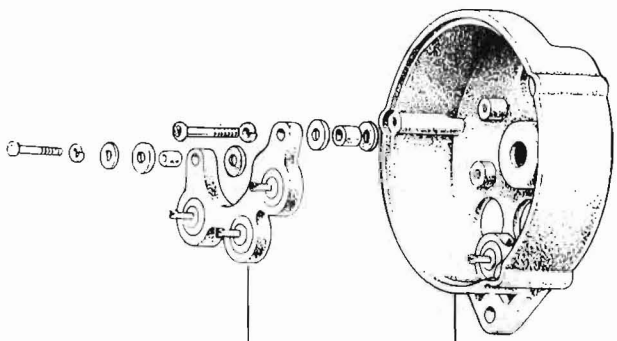
Assemble in numerical order.



3 Fig. 9-68

1 Fig. 9-66

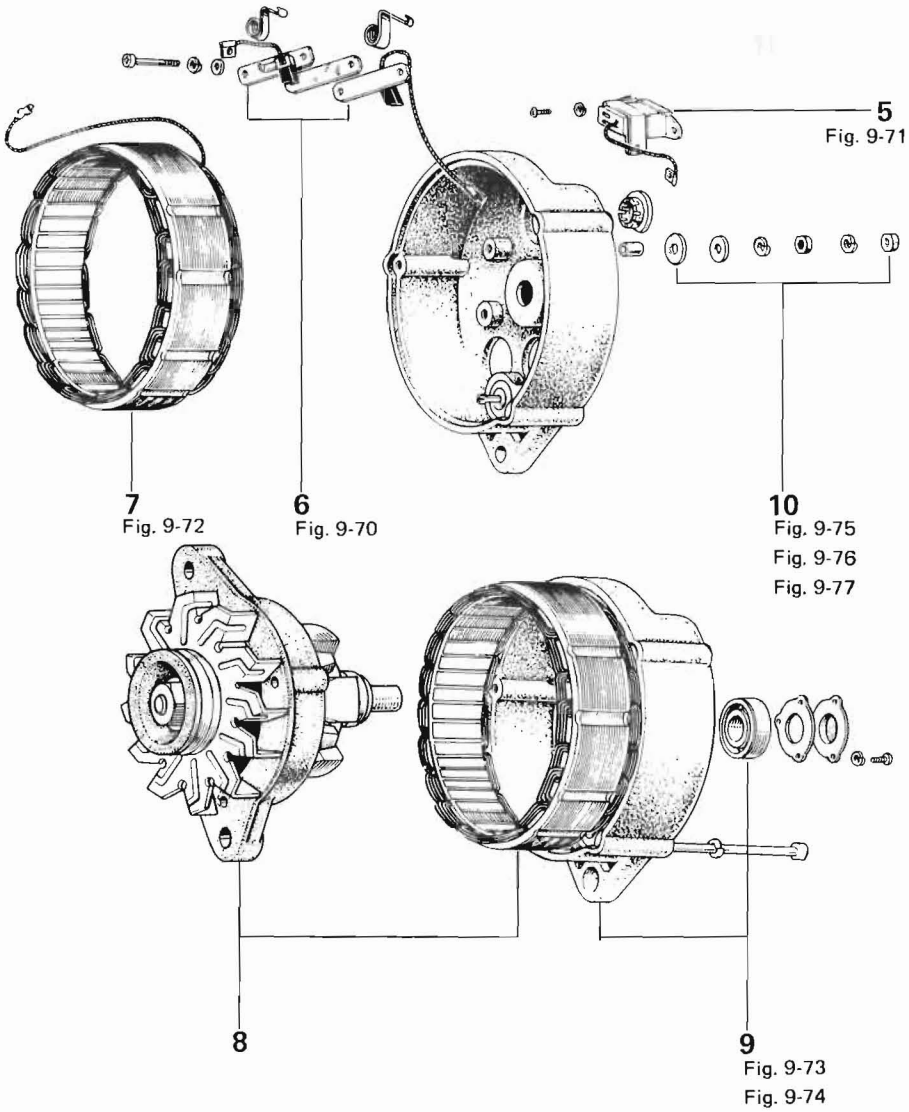
2 Fig. 9-67



4 Fig. 9-69

1 Front Bearing
2 Rotor
3 Pulley and Fan
4 Positive Rectifier

Fig. 9-64



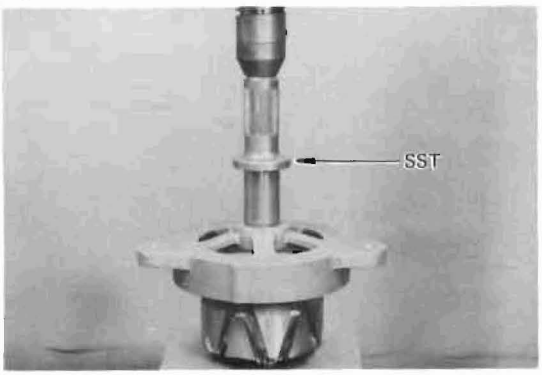
5 Terminal Socket
6 Brush Holder
7 Stator Coil
8 Drive End Frame Assembly
9 Rear Bearing
10 B Terminal Insulators

Fig. 9-65

Fig. 9-66

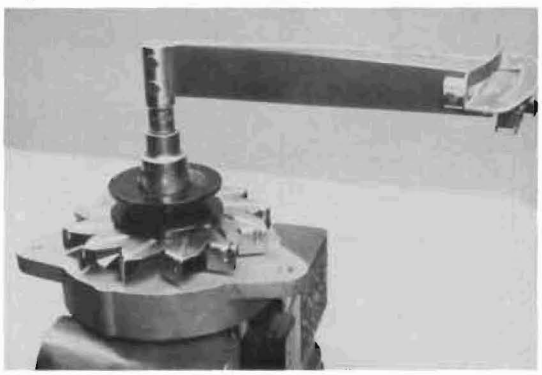
Install front bearing facing its sealed side rearward.

Fig. 9-67



Press drive end frame assembly onto shaft, using SST [09325-12010].

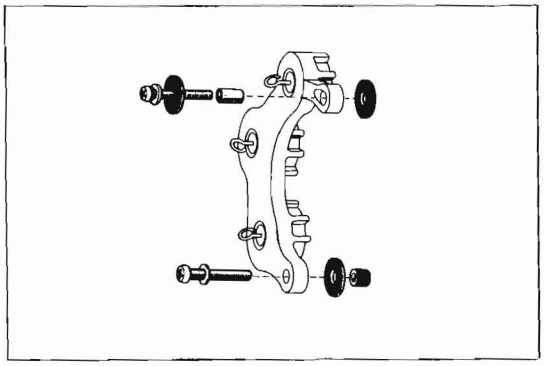
Fig. 9-68



Tighten nut to specified torque.

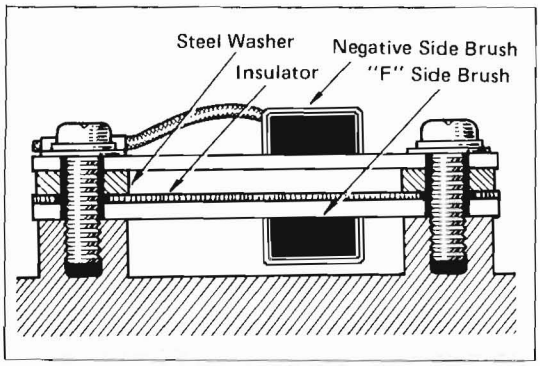
Torque **3.5-8 kg-m (25-58 ft-lb)**

Fig. 9-69



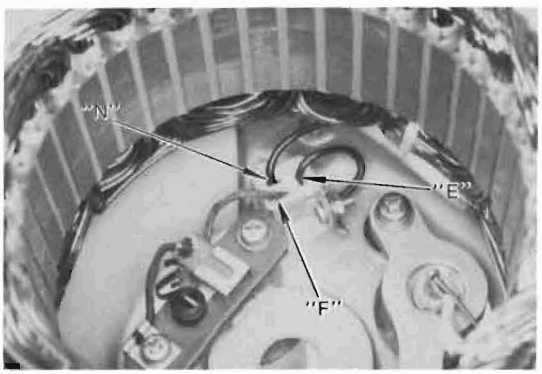
Insert insulators between positive rectifier holder and end frame.

Fig. 9-70



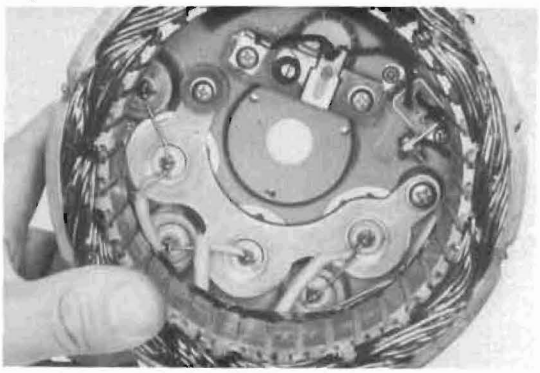
Assemble brush holder with insulators onto rear end frame as shown.
Have the brushes lifted up.

Fig. 9-71



Insert the "F", "N" and "E" lead terminals into the connecter socket as shown.

Fig. 9-72

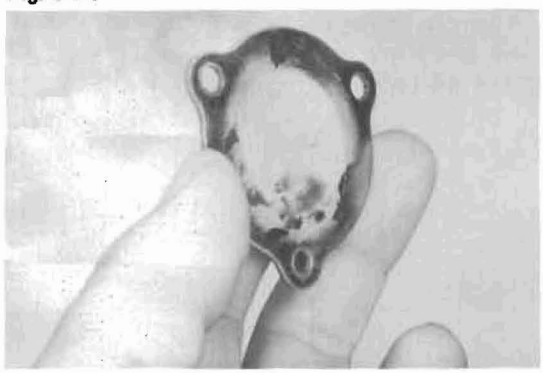


Connect stator coil leads onto positive and negative side rectifier terminals.

Fig. 9-73

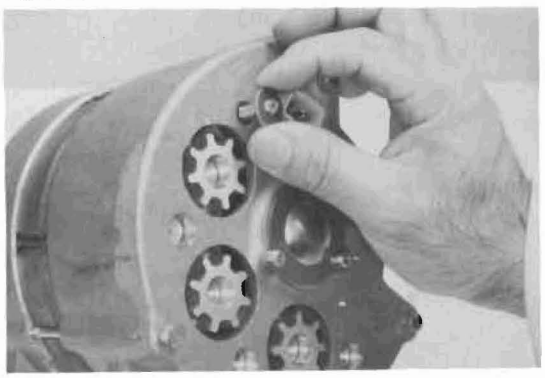
Install rear bearing, facing its sealed side front.

Fig. 9-74



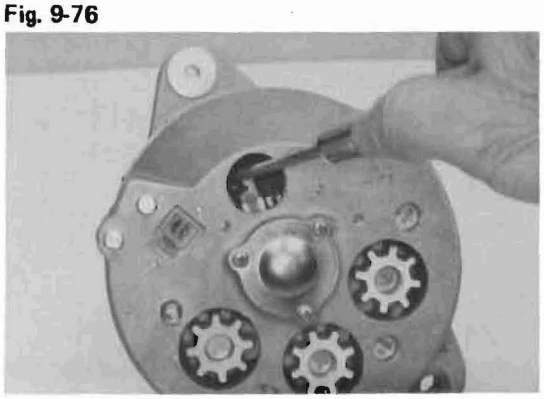
Install rear bearing cover not more than half full of grease.

Fig. 9-75



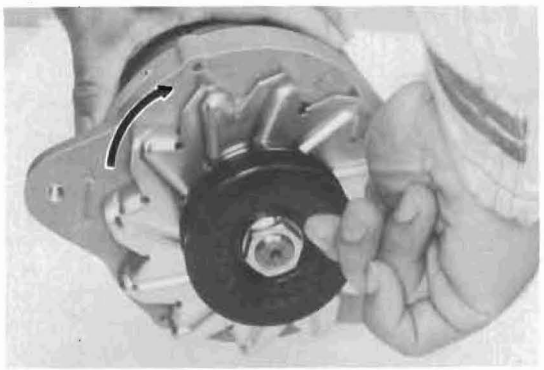
Assemble insulators onto B terminal bolt.

Fig. 9-76



Lower brushes and hold with springs.

Fig. 9-77



Make sure the rotor rotates smoothly.

ALTERNATOR (With Vacuum Pump Type)

DISASSEMBLY

Disassemble in numerical order.

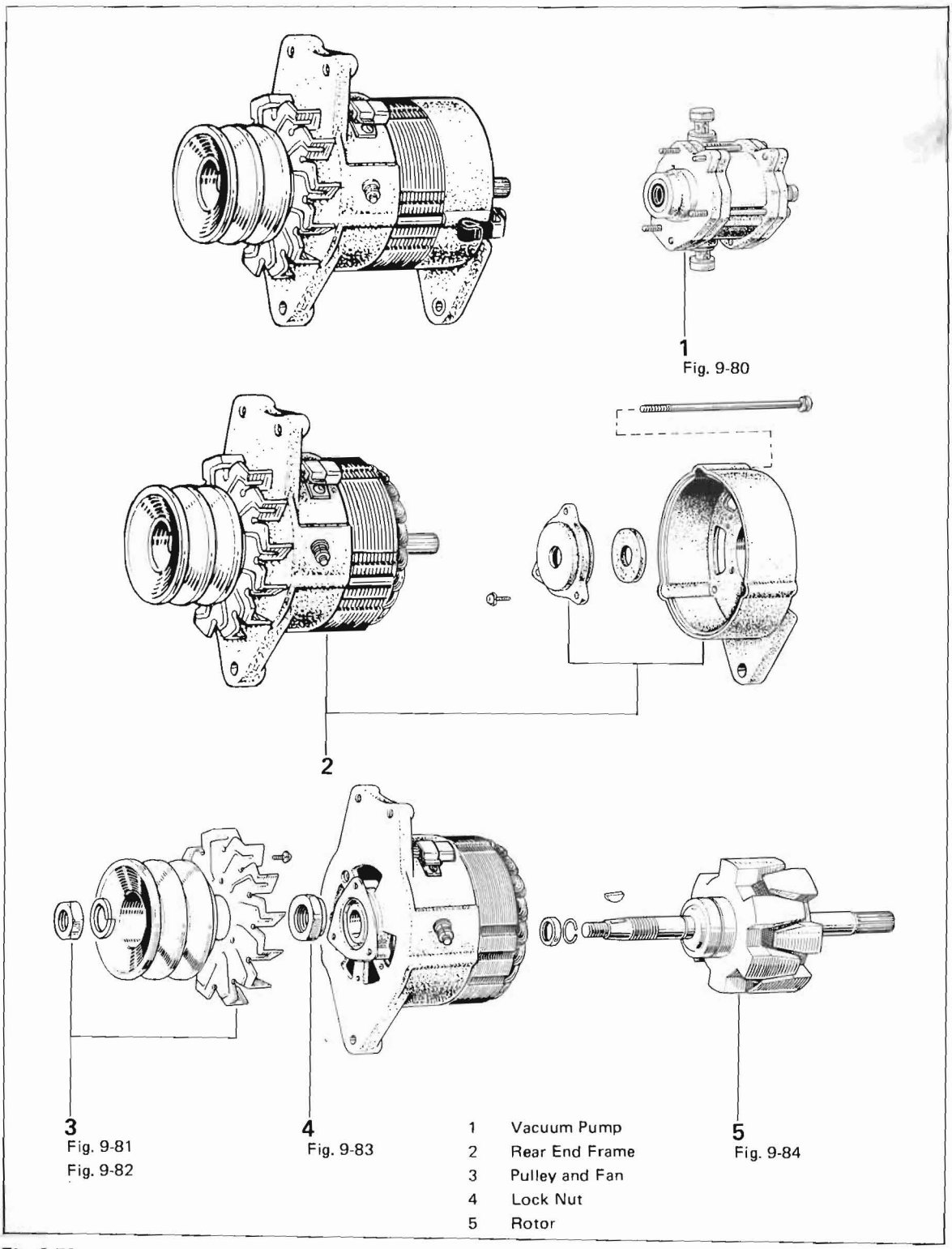


Fig. 9-78

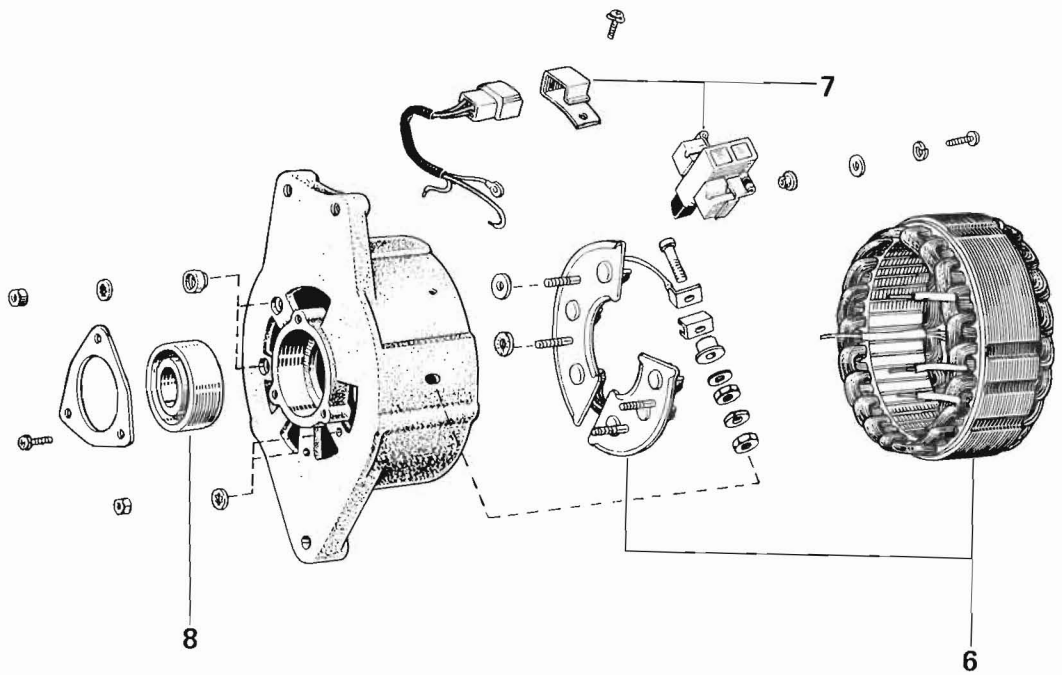
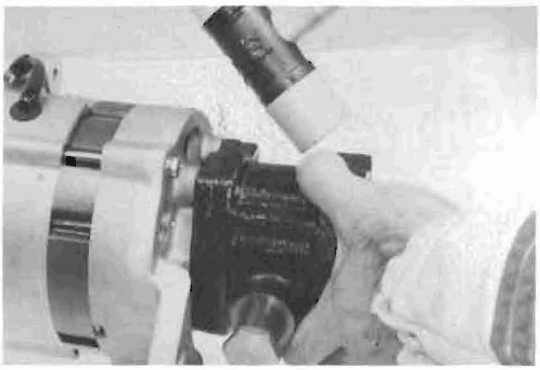


Fig. 9-85

6 Stator Coil with Rectifier Holder
7 Brush Holder and Socket
8 Front Bearing

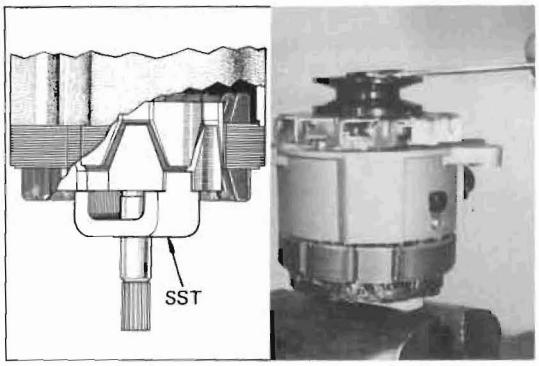
Fig. 9-79

Fig. 9-80



Lightly tap the vacuum pump with a plastic hammer to remove it.

Fig. 9-81



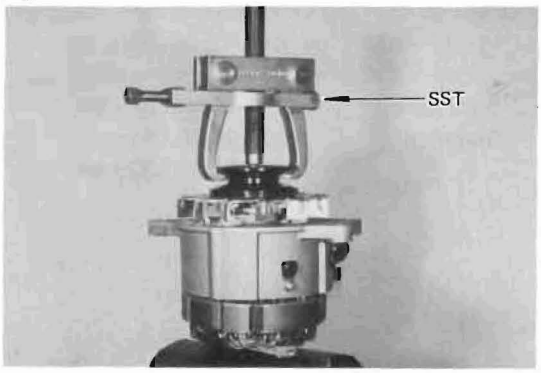
Secure SST [09841-56010] in a vise, and secure the rotor core onto the SST.

– Note –

Take care not to damage the stator coil.

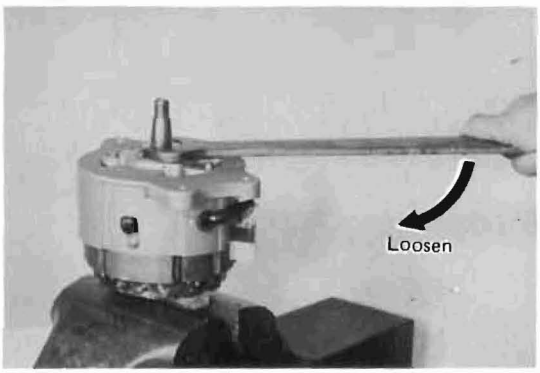
Loosen pulley nut.

Fig. 9-82



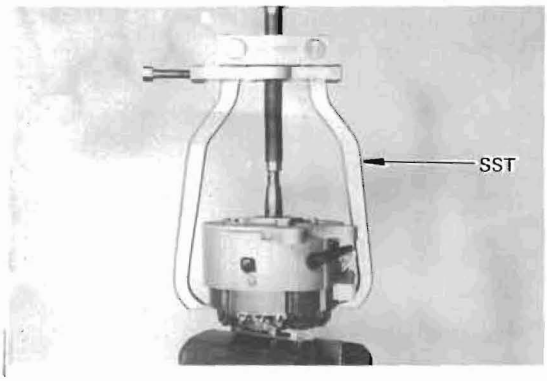
Remove pulley with fan, using SST [09950-20010].

Fig. 9-83



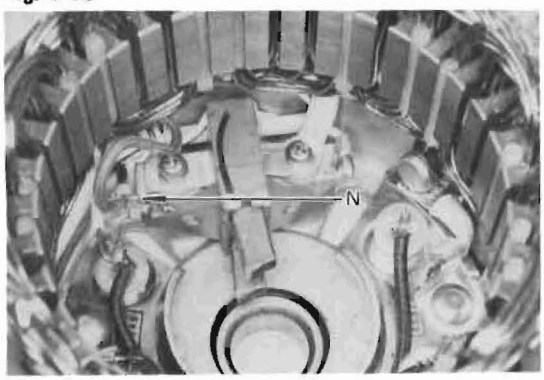
Remove bearing lock nut.
The lock nut has left-hand thread.

Fig. 9-84



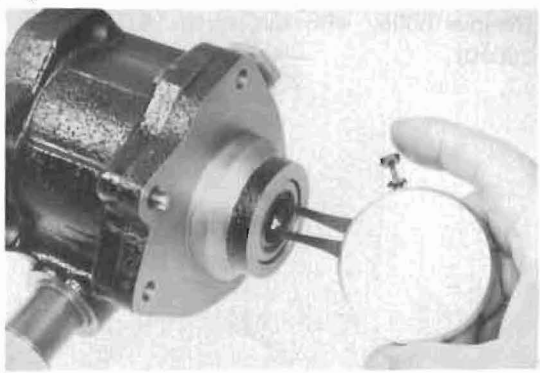
Remove rotor with SST [09950-20010].
Take care not to damage the stator coil.

Fig. 9-85



Disconnect stator coil "N" lead from brush holder, and remove stator coil with rectifier holders.

Fig. 9-86



INSPECTION

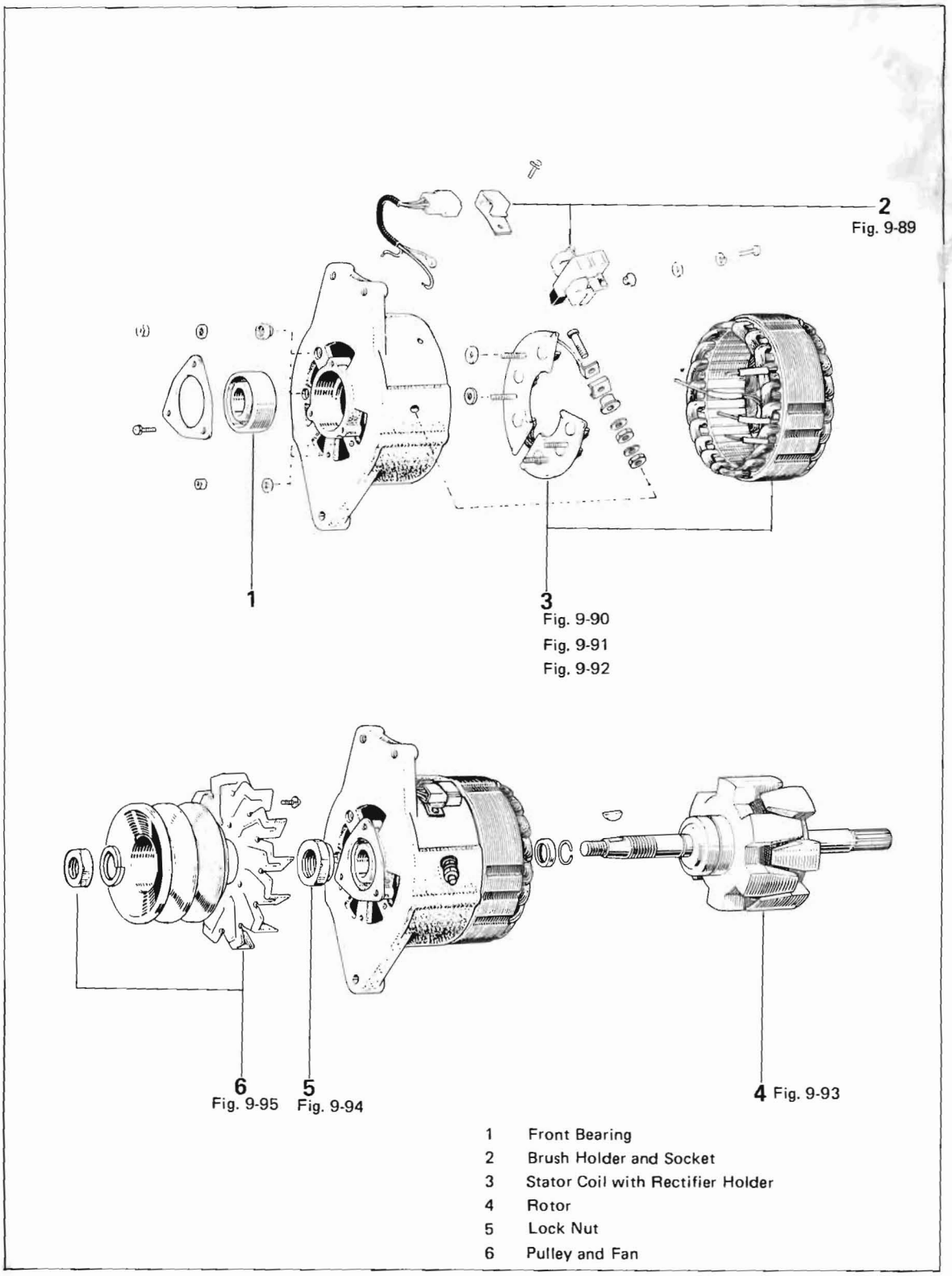
Inspect oil seal and bearing.
Measure vacuum pump bearing bore and if exceeds limit, replace vacuum pump assembly.

Bore limit	**16.14 mm (0.6354 in)**
Standard	**16.04-16.06 mm (0.6315-0.6323 in)**

FOR OTHER ITEMS, SEE INSPECTION SECTION OF CONVENTIONAL TYPE ALTERNATOR.

ASSEMBLY

Assemble in numerical order.



1 Front Bearing
2 Brush Holder and Socket
3 Stator Coil with Rectifier Holder
4 Rotor
5 Lock Nut
6 Pulley and Fan

Fig. 9-87

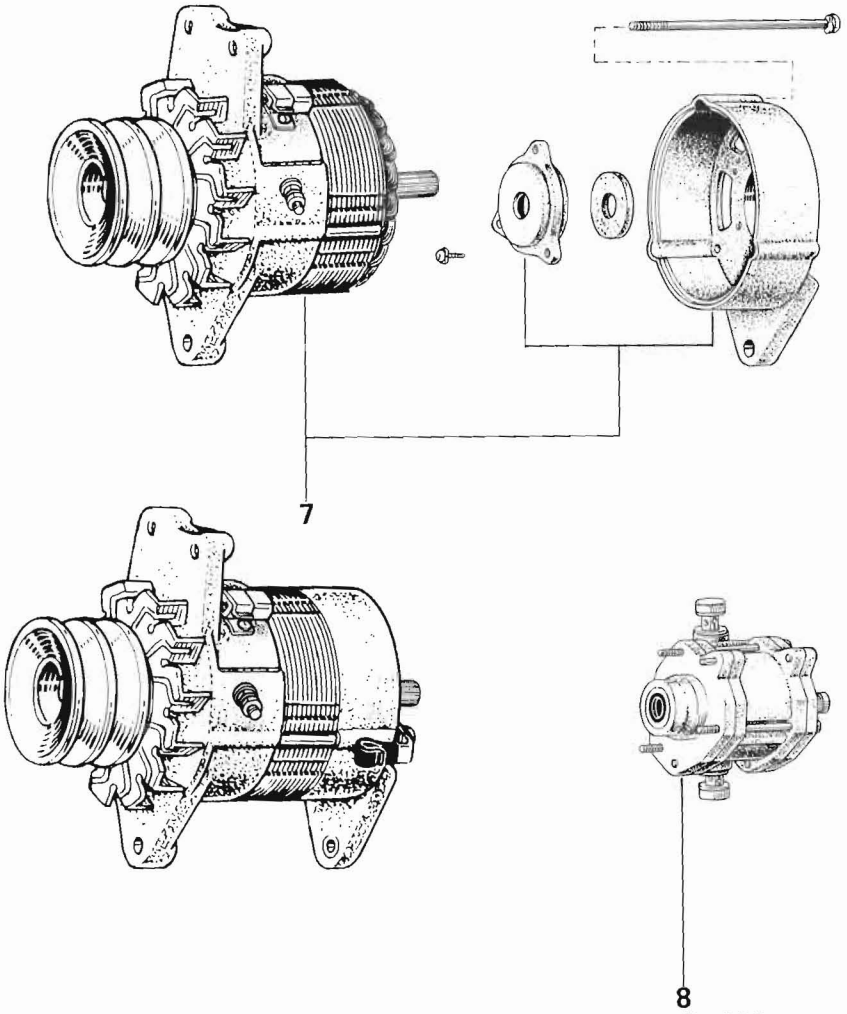
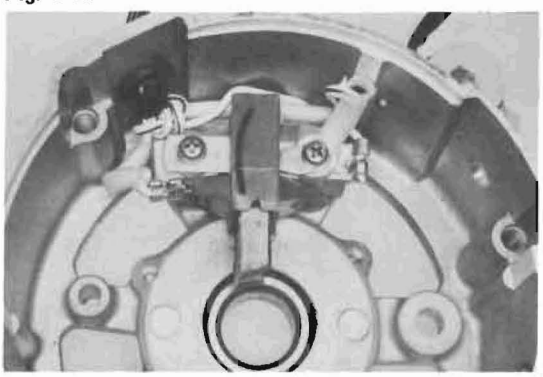


Fig. 9-96

7 Rear End Frame
8 Vacuum Pump

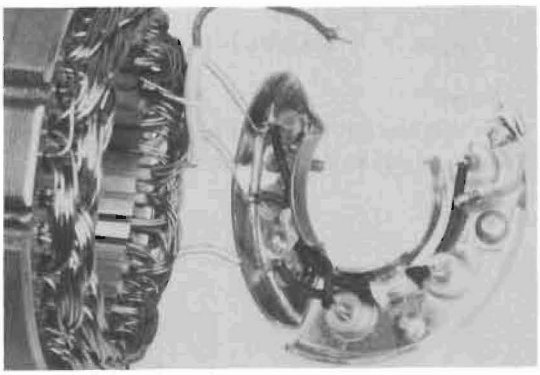
Fig. 9-88

Fig. 9-89



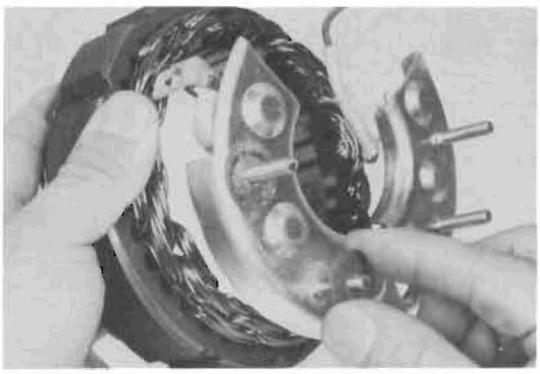
Tie the lead wires and solder the "F" terminal onto the brush holder.
Connect "E" terminal.

Fig. 9-90



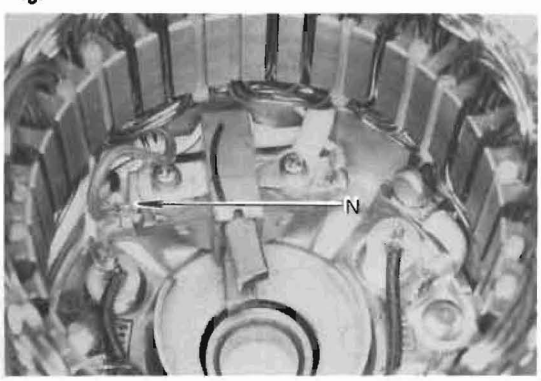
Solder rectifier leads onto stator coil.

Fig. 9-91



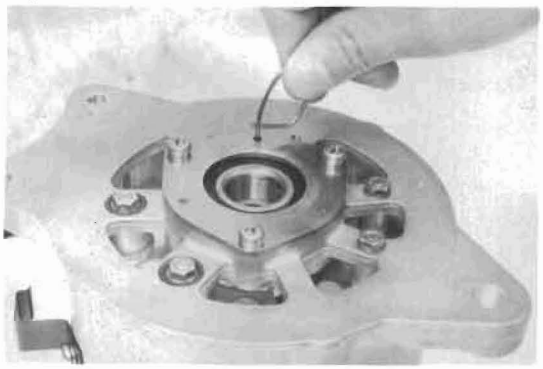
Assemble the rectifier holders and stator coil with insulators onto the drive end frame. Position insulators between B terminal and drive end frame, then install B terminal bolt.

Fig. 9-92



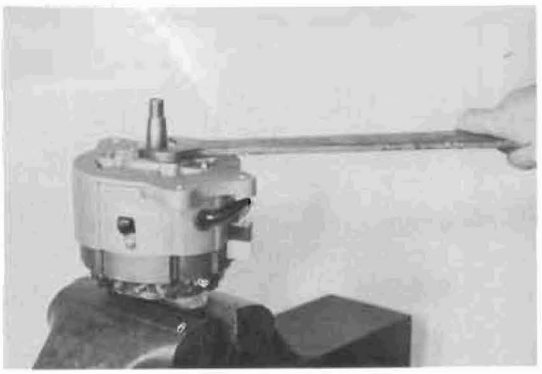
Solder the stator coil "N" lead and socket "N" lead onto brush holder.

Fig. 9-93



Lift up brushes and lock with a wire.

Fig. 9-94



Tighten bearing lock nut.

Torque **5.6-8 kg-m (41-58 ft-lb)**

– Note–

Lock nut has left-hand thread.

Take care not to damage the stator coil.

Fig. 9-95

Tighten pulley nut.

Torque **3.5-8 kg-m (25-58 ft-lb)**

Fig. 9-96

Align the vacuum pump rotor spline hole against the rear cover hole and then fit in the alternator rotor shaft spline.

ALTERNATOR REGULATOR

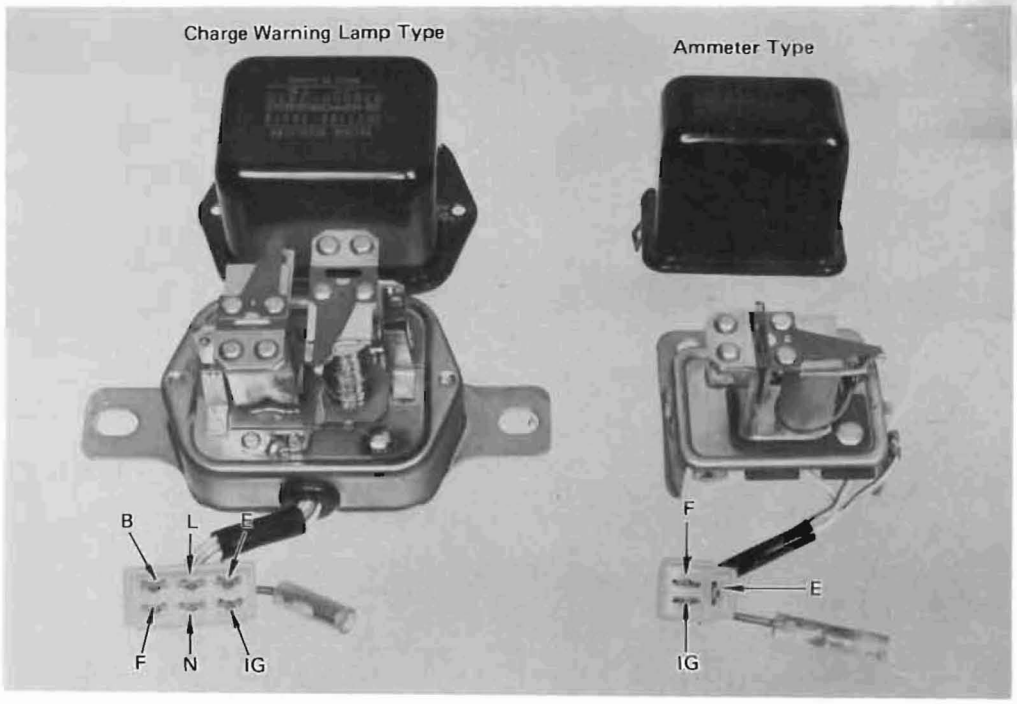


Fig. 9-97

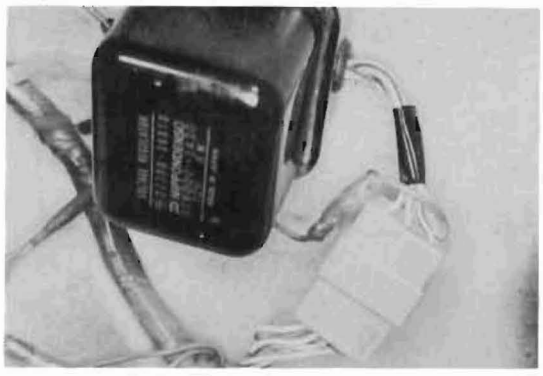
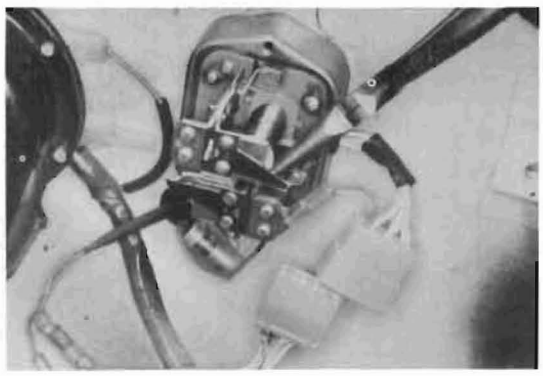


Fig. 9-98

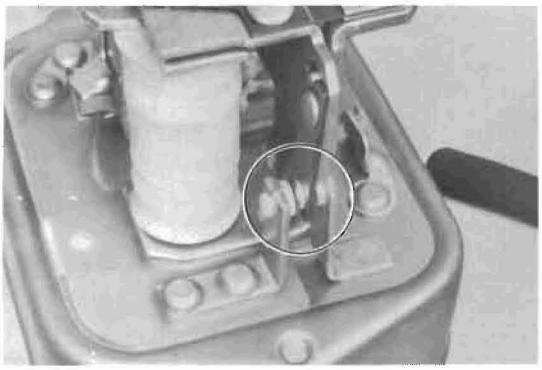


INSPECTION AND ADJUSTMENT

Check connector fitting condition before inspecting regulator.

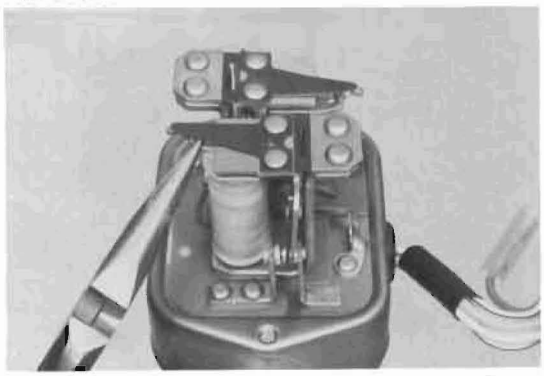
Always be sure to have the regulator connector pulled out when inspecting and adjusting.

Fig. 9-99



Inspect each point surface for burn or excessive damage. Replace if defective.

Fig. 9-100



Voltage adjustment
To adjust, bend the voltage regulator adjusting arm.

Regulated voltage **13.8-14.8V**

Fig-101

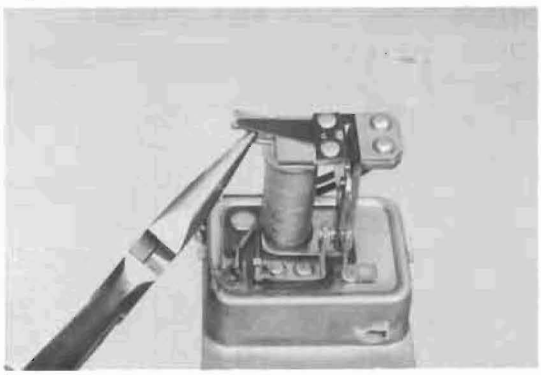
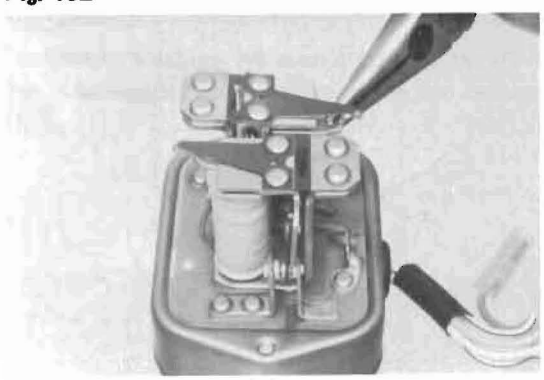


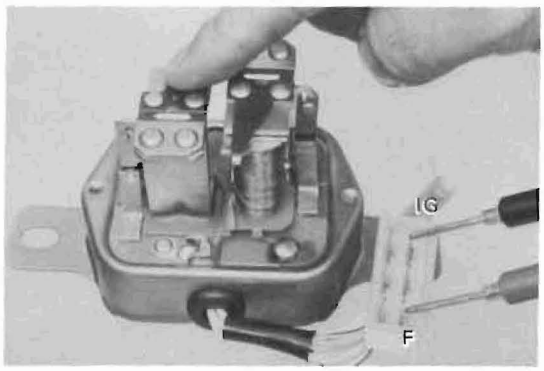
Fig. 102



Voltage relay adjustment
Check the actuating voltage of voltage relay and adjust if faulty.

Relay actuating voltage **4.5-5.8 V**
(Reference only)

Fig. 9-103

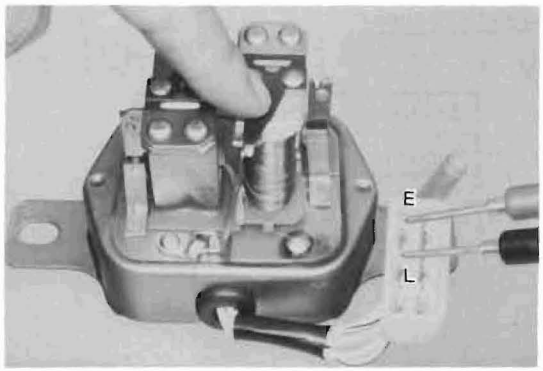


Resistance measurement between terminals.
Charge warning light type.

IG–F

Voltage Regulator	At rest	0Ω
	Pulled in approx.	11Ω

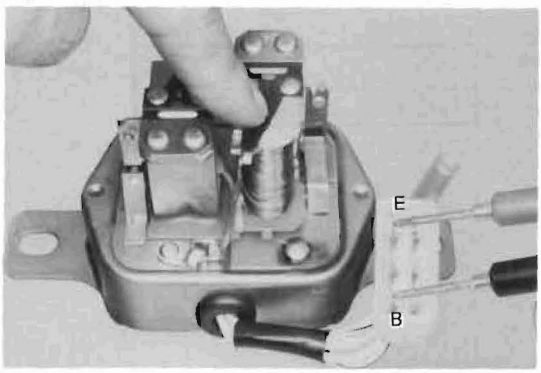
Fig. 9-104



L–E

Voltage Relay	At rest	0Ω
	Pulled in approx.	100Ω

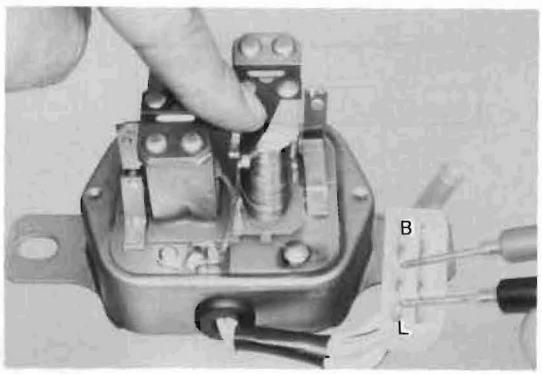
Fig. 9-105



B–E

Voltage Relay	At rest	infinity
	Pulled in approx.	100Ω

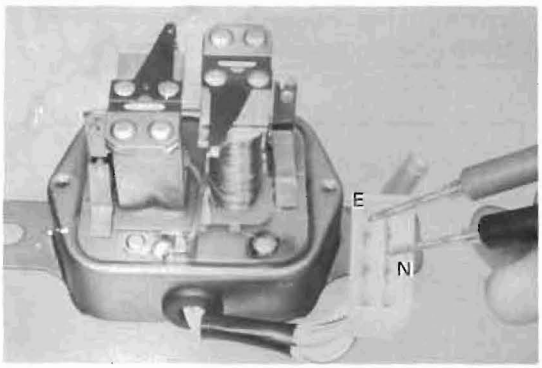
Fig. 9-106



B–L

Voltage Relay	At rest	infinity
	Pulled in	0Ω

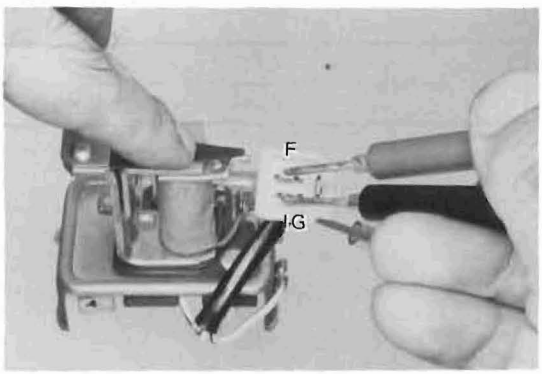
Fig. 9-107



N–E

approx. 25Ω

Fig. 9-108

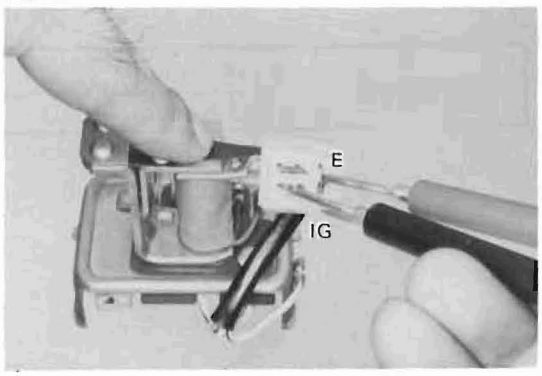


Ammeter type

IG–F

At rest	0Ω
Pulled in	approx. 11Ω

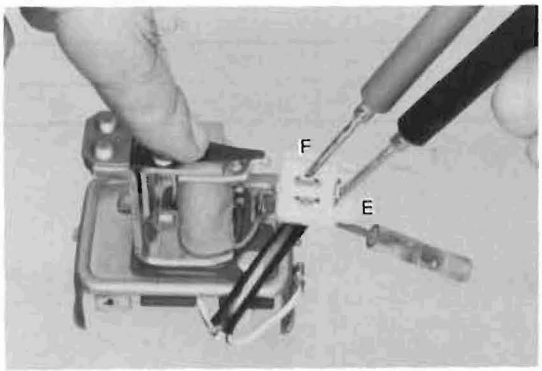
Fig. 9-109



IG–E

At rest	approx. 100Ω
Pulled in	infinity

Fig. 9-110



F–E

At rest	approx. 100Ω
Pulled in	0Ω

SST & SPECIFICATIONS

Page

SST (SPECIAL SERVICE TOOL) 10-2
STANDARD BOLT TIGHTENING TORQUE..... 10-4
MAIN PARTS TIGHTENING TORQUE..... 10-5
ENGINE SPECIFICATIONS 10-5
SERVICE SPECIFICATIONS..... 10-6

SST (SPECIAL SERVICE TOOL)

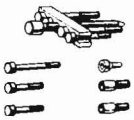
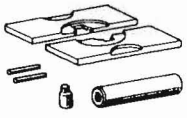
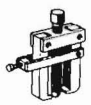
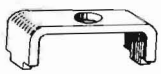
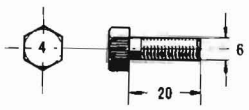
Illustration	Tool Number	Tool Name
	09081-00010	Alternator Checker
	09201-60011	Valve Stem Guide Remover & Replacer
	09202-43011	Valve Spring Compressor
	09213-60015	Crankshaft Pulley & Gear Puller
	09214-60010	Crankshaft Pulley & Gear Replacer
	09215-60010	Camshaft Bearing Remover & Replacer
	09222-30010	Connecting Rod Bushing Remover & Replacer
	09223-60010	Crankshaft Rear Oil Seal Replacer
	09228-44010	Oil Filter Wrench
	09235-60010	Water Pump Pulley Seat Puller
	09236-36010	Water Pump Overhaul Tool (For Fluid Coupling Service)

Illustration	Tool Number	Tool Name
	09238-40010	Water Pump Bearing Remover & Replacer
	09240-00011	Carburetor Adjusting Gauge Set
	09286-46011	Injection Pump Spline Shaft Puller (For Alternator Service)
	09303-55010	Input Shaft Front Bearing Puller
	09304-47010	Input Shaft Front Bearing Replacer
	09325-12010	Transmission Oil Plug (For Alternator Service)
	09515-35010	Rear Wheel Bearing Replacer (For Crankshaft Front Oil Seal Installation)
	09841-56010	Alternator Stand
	09860-11010	Carburetor Driver Set
	09950-20010	Universal Puller (For Alternator Service)

STANDARD BOLT TIGHTENING TORQUE

STANDARD BOLT CLASSIFICATION

91111-40620 – Parts Number
- Length of Bolt: 20 mm
- Basic Major Dia. of Thread: 6 mm
- Bolt Head Mark*



* Bolt Head Mark has the following indications.

STANDARD BOLT TIGHTENING TORQUE

Class	Basic Dia.	Pitch	Standard Torque kg-m	(ft-lb)	Torque Limit kg-m	(ft-lb)
4T	6	1	0.47	(3.4)	0.4 to 0.7	(2.9 to 5.0)
	8	1.25	1.11	(8.0)	1.0 to 1.6	(7.3 to 11.6)
	10	1.25	2.25	(16.3)	1.9 to 3.1	(13.7 to 22.4)
	10	1.5	2.14	(15.5)	1.8 to 3.0	(13.0 to 21.7)
	12	1.25 (ISO)	4.40	(31.8)	3.5 to 5.5	(25.3 to 39.8)
	12	1.5	3.89	(28.1)	3.5 to 5.5	(25.3 to 39.8)
	12	1.75	3.74	(27.0)	3.0 to 5.0	(21.7 to 36.2)
	13	1.5	5.08	(36.8)	4.5 to 7.0	(32.5 to 50.6)
	14	1.5	6.33	(45.8)	5.0 to 8.0	(36.2 to 57.8)
	14	2	5.93	(42.8)	4.7 to 7.7	(34.0 to 55.7)
	16	1.5	9.57	(69.2)	7.5 to 11.0	(54.2 to 79.6)
	16	2	9.10	(65.8)	7.1 to 10.6	(51.3 to 76.7)
5T	6	1	0.71	(5.1)	0.6 to 0.9	(4.4 to 6.5)
	8	1.25	1.66	(12.0)	1.5 to 2.2	(10.9 to 15.9)
	10	1.25	3.34	(24.1)	3.0 to 4.5	(21.7 to 32.5)
	10	1.5	3.22	(23.3)	2.7 to 4.2	(19.5 to 30.4)
	12	1.25 (ISO)	6.60	(47.7)	5.0 to 8.0	(36.2 to 57.8)
	12	1.5	5.84	(42.2)	5.0 to 7.0	(36.2 to 50.6)
	12	1.75	5.61	(40.6)	4.8 to 6.8	(34.7 to 49.2)
	13	1.5	7.63	(55.2)	6.5 to 9.0	(47.0 to 65.1)
	14	1.5	8.90	(65.3)	7.5 to 11.0	(54.2 to 79.6)
	14	2	9.50	(68.7)	7.0 to 10.5	(50.6 to 75.9)
	16	1.5	14.36	(103.8)	12.0 to 17.0	(86.8 to 123.0)
	16	2	13.58	(98.1)	11.5 to 16.5	(83.2 to 119.2)
7T	6	1	0.95	(6.9)	0.8 to 1.2	(5.8 to 8.6)
	8	1.25	2.21	(16.1)	2.0 to 3.0	(14.5 to 21.7)
	10	1.25	4.49	(32.5)	4.0 to 5.5	(28.9 to 39.8)
	10	1.5	4.29	(31.0)	3.7 to 5.2	(26.8 to 37.6)
	12	1.25	8.80	(63.5)	7.5 to 10.5	(54.1 to 75.8)
	12	1.5	7.78	(56.2)	7.0 to 9.0	(50.6 to 65.1)
	12	1.75	7.48	(54.1)	6.0 to 8.5	(43.3 to 61.4)
	13	1.5	10.17	(73.5)	8.0 to 12.0	(57.8 to 86.8)
	14	1.5	12.67	(91.6)	10.0 to 15.0	(72.3 to 108.5)
	14	2	11.86	(85.8)	9.5 to 14.0	(68.7 to 101.2)
	16	1.5	19.15	(138.5)	15.0 to 23.0	(108.5 to 166.2)
	16	2	18.11	(131.0)	14.0 to 22.0	(101.2 to 159.0)

– Note –

The above specified tightening torque is applicable only for female threads cut into a steel material.

If the female threads are cut in other materials than steel, and also tightening surfaces are encountered to heat or vibrations, these specified tightening torques must be reconsidered.

MAIN PARTS TIGHTENING TORQUE

Tightening Parts		Tightening Torque kg-m (ft-lb)	
Cylinder head bolt		11.5–13.5	(83– 98)
Manifold		3.9–5.1	(28– 37)
Camshaft thrust plate		1–1.6	(7– 12)
Crankshaft pulley		16–20	(116–145)
Piston pin		5.4–7	(39– 51)
Connecting rod cap		4.8–7.6	(35– 55)
Crankshaft bearing cap	No. 1–No. 3	12.5–15	(90–108)
	No. 4	10.5–13	(76– 94)
Flywheel		5.7–7.3	(41– 53)

ENGINE SPECIFICATIONS

Engine model	2F
Type	6-cylinder, in-line, 4 cycle, OHV
Bore and stroke	94 x 101.6 mm (3.70 x 4.00 in)
Displacement	4230 cc (257.9 cu.in)
Compression ratio	7.8 to 1
Firing order	1–5–3–6–2–4

SERVICE SPECIFICATIONS

ENGINE TUNE-UP

Drive belt tension at 10 kg (22 lb)	mm (in)			
Fan pulley – Alternator		7 – 10 (0.28 – 0.39)		
Fan pulley – Air pump (USA)		7 – 10 (0.28 – 0.39)		
Alternator belt (USA)		13 – 15 (0.51 – 0.59)		
Battery specific gravity		1.25 – 1.27		
Coolant capacity		Liter	US gal.	Imp. gal.
	FA	approx. 25.5	6.7	5.6
	FJ	approx. 17	4.5	3.7
Engine oil capacity		Liter	US qt.	Imp. qt.
	Total	8	8.5	7.0
	Crankcase	7	7.4	6.2
Recommended spark plug		(ND)	(NGK)	
	Conventional type	W14EP	B5ES	
	Resistive type	W14EPR	BR5ES	
	For USA	W14EX	BP5EZ	
Spark plug gap	mm (in)	0.8 (0.031)		
		1.0 (0.039) ..... For USA		
Dwell angle		39 – 43°		
Distributor point gap	mm (in)	0.45 (0.018)		
Condenser capacity	μF	0.22 (Except for USA)		
Valve clearance (Hot)	mm (in)			
	Intake	0.20 (0.008)		
	Exhaust	0.35 (0.014)		
Ignition timing at idling		7°BTDC		
Initial idle speed at T/M in N	rpm	650 ± 50		
Manifold vacuum at idling	mmHg (inHg)	420 (16.5)		
Fast idle	rpm	1800		
TP setting speed	rpm	1200		
Compression pressure at 200 rpm	kg/cm^2 (psi)			
	STD	10.5 (149.3)		
	Limit	8.0 (113.8)		

CYLINDER HEAD

Head surface warpage limit	mm (in)	0.15 (0.0059)
Valve seat contacting surface angle		45°
Valve seat contacting width	mm (in)	
	Intake	1.4 (0.055)
	Exhaust	1.7 (0.067)

VALVE GUIDE BUSHING

		mm (in)
Length	Intake	54 (2.13)
	Exhaust	59 (2.32)
Inner diameter	Both intake and exhaust	8.01–8.03 (0.3154–0.3161)
Projection distance		17 (0.67)

VALVE

		mm (in)
Valve head diameter	Intake	46 (1.81)
	Exhaust	37.5 (1.48)
Valve face angle		45°
Stem diameter	Intake	7.97–7.985 (0.3138–0.3144)
	Exhaust	7.96–7.975 (0.3134–0.3140)
Stem oil clearance	Intake	0.03–0.06 (0.0012–0.0024)
	Exhaust	0.04–0.07 (0.0016–0.0028)
Stem oil clearance limit	Intake	0.10 (0.0039)
	Exhaust	0.12 (0.0047)
Margin limit	Intake	0.8 (0.031)
	Exhaust	1.0 (0.039)
Valve tip correcting limit		0.5 (0.020)

VALVE SPRING

Free height	mm (in)	51.5 (2.028)
Installed height	mm (in)	43.0 (1.693)
Installed load	kg (lb)	32.5 (71.6)
Installed load limit	kg (lb)	27 (59.5)
Squareness limit	mm (in)	2.0 (0.079)

ROCKER ARM AND SHAFT

	mm (in)
Rocker shaft diameter	18.479–18.495 (0.7275–0.7281)
Shaft to arm clearance	0.01–0.04 (0.0004–0.0016)

MANIFOLD

	mm (in)
Manifold surface warpage limit	2.0 (0.08)

TIMING GEAR

	mm (in)
Backlash	0.05–0.13 (0.0020–0.0051)
Backlash limit	0.2 (0.008)

CAMSHAFT

		mm (in)
Thrust clearance		0.09–0.15 (0.0035–0.0059)
Thrust clearance limit		0.2 (0.008)
Journal oil clearance		0.025–0.075 (0.0010–0.0030)
Camshaft runout limit		0.15 (0.0059)
Camshaft journal diameter	(STD)	
	Front	47.955–47.975 (1.8880–1.8888)
	Second	46.455–46.475 (1.8289–1.8297)
	Third	44.955–44.975 (1.7699–1.7707)
	Rear	43.455–43.475 (1.7108–1.7116)
Camshaft U/S bearings		0.25 0.50
Cam lobe height	Intake	38.36–38.46 (1.5102–1.5142)
	Exhaust	38.25–38.35 (1.5059–1.5098)
Cam lobe height limit	Intake	38.0 (1.496)
	Exhaust	37.9 (1.492)

CYLINDER BLOCK

		mm (in)
Cylinder bore diameter	(STD)	94.00–94.05 (3.7008–3.7027)
Cylinder bore wear limit		0.2 (0.008)
Gasket surface warpage limit		0.15 (0.0059)

PISTON AND RING

mm (in)

Piston diameter	STD	93.97–94.02 (3.6996–3.7016)
	O/S 0.50	94.46–94.51 (3.7189–3.7209)
	O/S 1.00	94.96–95.01 (3.7386–3.7405)
	O/S 1.50	95.46–95.51 (3.7583–3.7602)
Piston clearance		0.03–0.05 (0.0012–0.0020)
Piston ring end gap	Top and 2nd	0.20–0.38 (0.0079–0.0150)
Piston ring to ring groove clearance		
	Top	0.03–0.06 (0.0012–0.0024)
	2nd	0.02–0.06 (0.0008–0.0024)
Piston pin to piston oil clearance		0.008–0.012 (0.0003–0.0005)

CONNECTING ROD AND BEARING

mm (in)

Connecting rod thrust clearance	0.11–0.23 (0.0043–0.0091)
Connecting rod thrust clearance limit	0.3 (0.012)
Bearing (crank pin) oil clearance	0.02–0.06 (0.0008–0.0024)
U/S bearings	0.05 0.25 0.50

CRANKSHAFT AND BEARING

mm (in)

Crankshaft thrust clearance		0.06–0.16 (0.0024–0.0063)
Crankshaft thrust clearance limit		0.3 (0.012)
Runout limit		0.1 (0.004)
Main journal oil clearance		0.020–0.044 (0.0008–0.0017)
Crank pin diameter (STD)		53.98–54.00 (2.1252–2.1260)
Main journal diameter (STD)		
	Front	66.972–66.996 (2.6367–2.6376)
	Second	68.472–68.496 (2.6957–2.6967)
	Third	69.972–69.996 (2.7548–2.7557)
	Rear	71.472–71.496 (2.8139–2.8148)
Main journal U/S bearings		0.05 0.25 0.50

OIL PUMP

		mm (in)
Gear backlash		0.05–0.07 (0.0020–0.0028)
Gear backlash limit		0.95 (0.0374)
Tip clearance		0.03–0.11 (0.0012–0.0043)
Tip clearance limit		0.2 (0.008)
Side clearance		0.03–0.09 (0.0012–0.0035)
Side clearance limit		0.15 (0.0059)
Cover wear limit		0.15 (0.0059)
Relief valve operating pressure	kg/cm^2 (psi)	3.5–4.5 (49.8–64)

RADIATOR

	kg/cm² (psi)
Cap valve opening pressure	0.9 (12.8)
Cap valve opening pressure limit	0.6 (8.5)

FLUID COUPLING

Silicone oil viscosity	cst	1000
Silicone oil capacity	cc (cu.in)	35 (2.1)

THERMOSTAT

Valve opening temperature		
Start to open at	°C (°F)	82 (180)
Fully opens at	°C (°F)	95 (203)
Valve opening travel	mm (in)	8 (0.31)

FUEL PUMP

Discharge pressure	kg/cm^2 (psi)	0.24–0.34 (3.4–4.8)
Suction vacuum	mmHg (inHg)	450 (17.7)
Discharge capacity at engine 2000 rpm		More than 2400 cc (146.5 cu. in)/min.

CARBURETOR

Carburetor part number		19100–61010 19100–61020 19100–61030 19100–61050	19100–61060 19100–61070
Float raised position	mm (in)	7.5 (0.295)	
Float lowered position	mm (in)	1.1 (0.043)	
Primary throttle valve full open angle		90°	
Secondary throttle valve full open angle		90°	
Kick up		28° from bore	25° from bore
Fast idle	mm (in)	1.3 (0.051)	
Choke breaker		38° from bore	
Throttle positioner	mm (in)	0.8 (0.031)	
Idle mixture adjusting screw initial setting (Reference only)		Screw out 1½ turns.	
Accelerating pump stroke	mm (in)	9.5 (0.374)	

STARTER

mm (in)

Starter part number		28100–60041 , 28100–60061
No load characteristics	Ampere	Less than 50
	RPM	More than 5000
	Voltage	11
Armature shaft to bushing clearance		0.05 (0.0020)
Limit		0.2 (0.008)
Armature shaft thrust clearance		0.05–0.35 (0.002–0.0138)
Brush length		19 (0.75)
Brush length limit		13 (0.51)
Commutator runout		Less than 0.05 (0.0020)
Commutator runout limit		0.4 (0.016)
Commutator diameter		32.7 (1.287)
Commutator diameter limit		31 (1.22)
Mica depth		0.5–0.8 (0.020–0.031)
Mica depth limit		0.2 (0.008)
Pinion end to stop collar clearance		0.2–4.0 (0.008–0.16)
Magnetic switch stud length (Reference only)		34 (1.34)
Armature shaft thrust adjusting shim thickness		0.5 (0.02)

DISTRIBUTOR

mm (in)

Shaft thrust clearance	0.15–0.5 (0.006–0.020)
Point gap	0.45 (0.018)
Dwell angle	39° – 43°
Damping spring gap	0.1–0.4 (0.004–0.016)

Advance characteristics

Part No. 19100–61010 19100–61030	Vacuum mmHg (inHg)	Dis. advance angle Degress
Vacuum advance angle	90–110 (3.54–4.33)	Advance begins
	200 (7.87)	4–6
	300 (11.8)	7.5–9.5
	Distributor rpm	Dis. advance angle Degree
Governor advance angle	400–500	Advance begins
	900	8–10
	1600	14–16

Part No. 19100–60090	Vacuum mmHg (inHg)	Dis. advance angle Degree
Vacuum advance angle	130–170 (5.12–6.69)	Advance begins
	220 (8.66)	3–5.6
	300 (11.8)	7.5–9.5
	Distributor rpm	Dis. advance angle Degree
Governor advance angle	370–530	Advance begins
	900	8.2–9.8
	1600	11–13

Part No. 19100–61020	Vacuum mmHg (inHg)	Dis. retard angle Degree
Vacuum retard angle	80 (3.15)	Retard begins
	120 (4.72)	4.0
	Distributor rpm	Dis. advance angle Degree
Governor advance angle	490	Advance begins
	900	7.0
	1800	15.0

IGNITION COIL (Reference only)

Primary coil resistance	W/O resistor type	2.6–4.0 Ω
	W/ resistor type	1.3–1.6 Ω
Secondary coil resistance	W/O resistor type	6.0–9.0 kΩ
	W/ resistor type	9.5–14.5 kΩ
External resistor resistance		1.3–1.7 Ω
Insulation resistance at 500 V		Over 10 MΩ

HIGH TENSION CORD

End to end resistance	Less than 25 kΩ

SPARK PLUG

Spark plug gap	mm (in)	0.8 (0.031)	
		1.0 (0.039) . . . For USA	
Recommended spark plug		(ND)	(NGK)
	Conventional type	W14EP	B5ES
	For USA	W14EX	BP5EZ
	Resistive type	W14EPR	BR5ES

ALTERNATOR

	Conventional Type			W/Vacuum pump	Heavy Duty Type	
Part number	27020-60010	60020	60071	60080	60030	60040
Maximum output Ampere	40	50	40	40	50	55
Brush exposed length	12.5 mm (0.49 in)				———	
Limit	5.5 mm (0.22 in)					
Brush length	———				18.5 mm (0.73 in)	
Limit					8.0 mm (0.31 in)	

ALTERNATOR REGULATOR (Reference only)

Part number	27700–36010	27700–60080
Regulating voltage	13.8–14.8 V	←
Relay operating voltage	4.0– 5.8 V	–
Voltage relay coil resistance	25Ω	–
Voltage regulator coil resistance	approx. 100Ω	←
Regulator resistor resistance	approx. 11Ω	←