8–1. Description

The car heater is of a hot water type and operates quietly. The air is heated by the engine coolant and the warm air is blown into the car interior by the blower motor.
The blower motor is driven electrically, independent of engine speed, and operates effectively even when the engine speed is low.

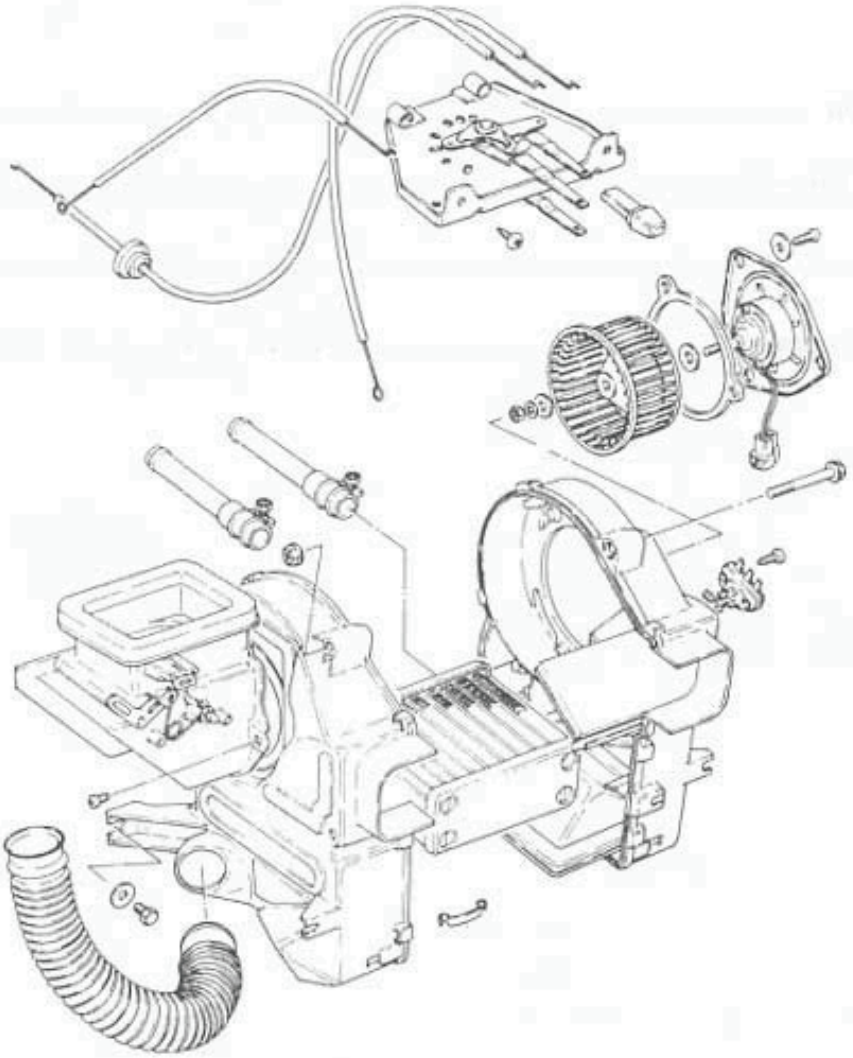
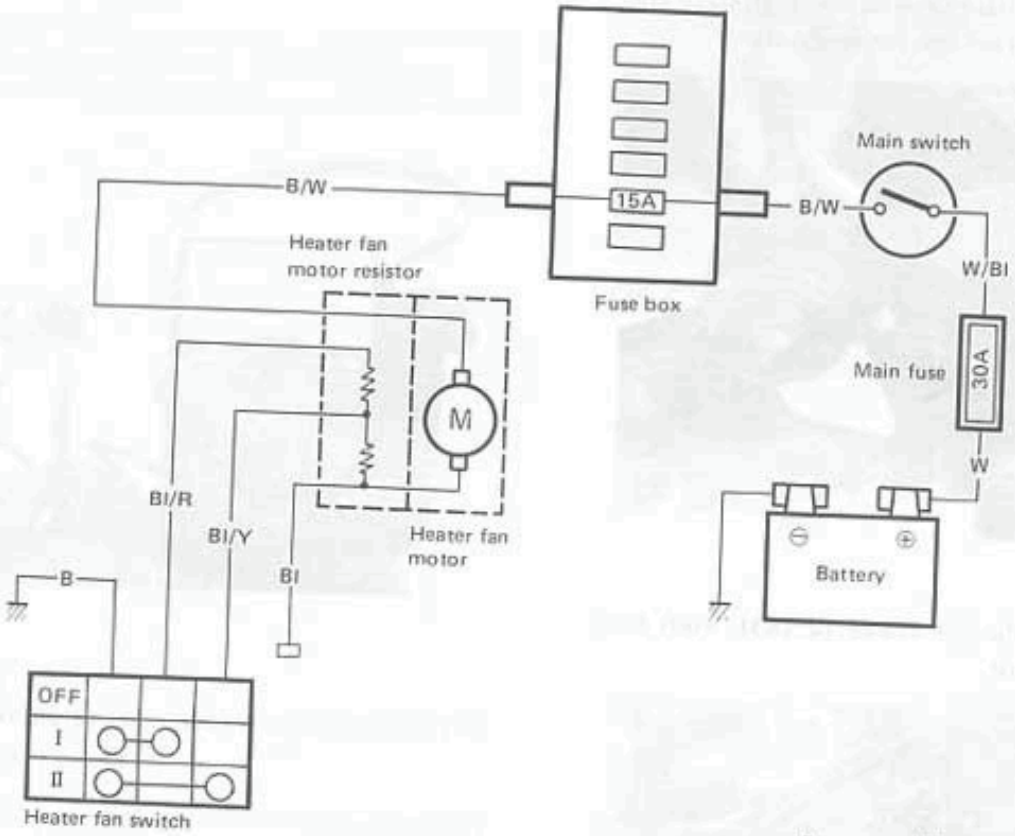


Fig. 8-1

8–2. Electrical Circuit

The circuit diagram (Fig. 8-2) shows how the blower motor is controlled. Turn the main switch to "ON", pull the fan switch knob out one step, and voltage is applied across the blower motor. The current is small because of the resistor provided in the circuit (indicated as "fan resistance" in the diagram). Under this condition, the blower runs slowly. By pulling the fan switch knob fully out, the battery voltage is applied across the blower motor, a large current flows and the blower motor runs at full speed.



Bl . . . . Blue
B . . . . Black
W . . . . White
B/W . . . Black with white tracer
Bl/R . . Blue with red tracer
Bl/Y . . Blue with yellow tracer
W/Bl . . . White with blue tracer

Fig. 8-2

Fan resistor

The fan resistor has been installed on the right side of the heater box. Disconnect the lead wire at the coupler and remove the resistor from the box.

Heater radiator

1) Unscrew the drain plug at the bottom of the radiator and drain the cooling water.

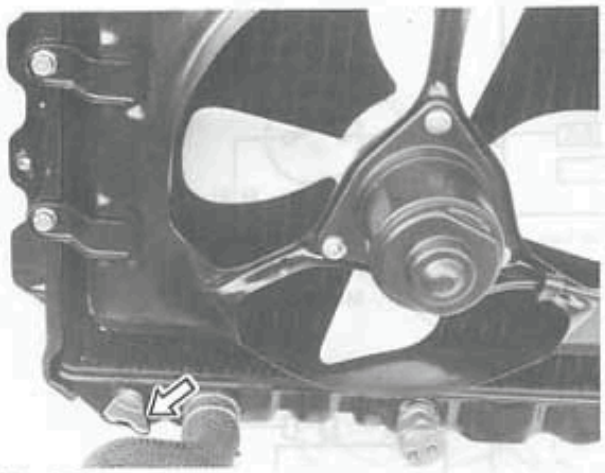


Fig. 8-3

2) Detach the heater hoses (2 pcs) from the heater radiator.

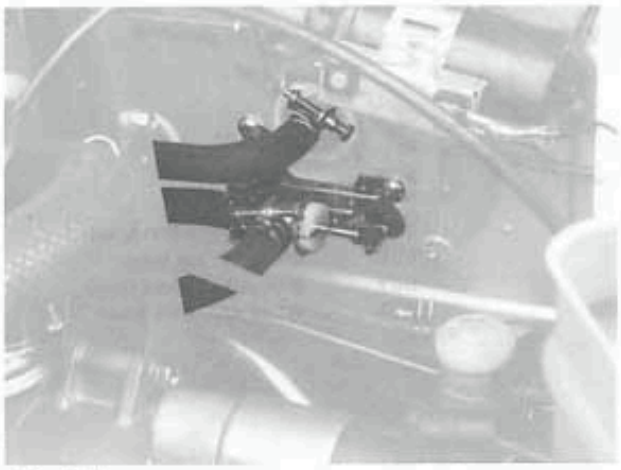


Fig. 8-4

3) Remove the heater box.

8–4. Heater Services

Fan resistor

This resistor is on the heater case right side. Inspect it for signs of cracking or breakage and replace it as necessary. If the blower motor will not run or when you replace the existing resistor, check to be sure the total resistor has an ohmic resistance of about several ohms. Use a circuit tester for this purpose.

Fan resistor specification	Several ohms

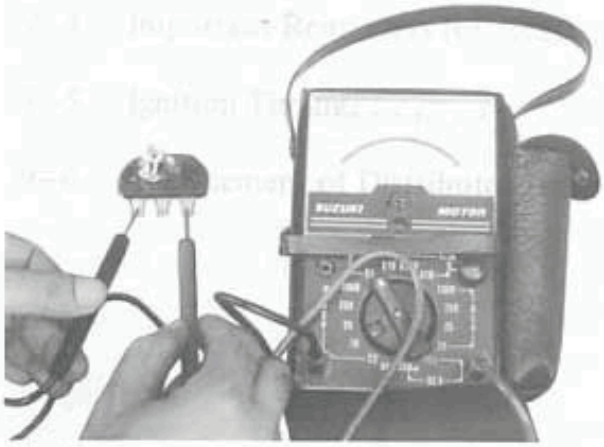


Fig. 8-5

Fan switch

Using a circuit tester, check this switch for circuit continuity:

II	○	———	○
I	○	——— ○	
OFF			
	Yellow	Blue/red	Blue

Heater hoses

Check the heater hoses for the connection condition, breakage, cracks and other damage and replace if necessary.

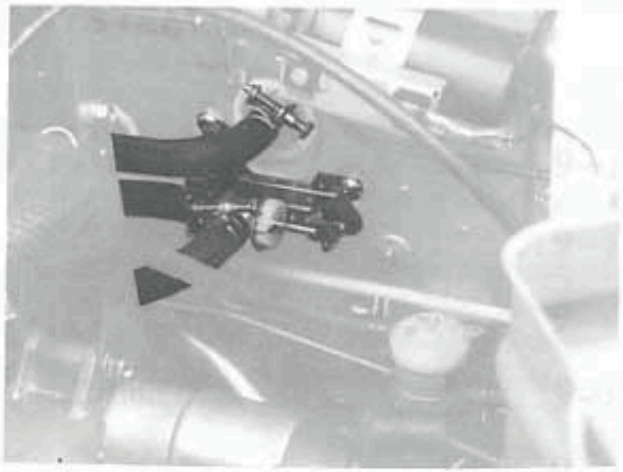


Fig. 8-6

9–1. Description

The principal components of the ignition system are, as shown in the circuit diagram of Fig. 9-1, the spark plugs, distributor, contact-breaker, ignition coil and, as the source of igniting energy, the battery. Note that the ignition coil has two windings, primary and secondary.

Current from the battery flows through the primary winding and then the contact-breaker; the contact point in the breaker opens and closes to interrupt this current intermittently.
Each time the primary current is interrupted, a very high voltage develops in secondary winding. It is this intermittent high voltage that the distributor passes sequentially to the three spark plugs to fly a spark across the gap in each, one plug a time.

The distributor is sort of rotary switch, whose rotor connects the three plugs, one at a time, to secondary winding of the ignition coil through the wires called "high-tension" cords. Note that there are one high-tension cord, from secondary winding to the center of the distributor cap, and three more high-tension cords between the spark plugs and the three terminals on the cap.

The resistor, connected in series to primary winding, serves to reduce the inductance of primary winding so that the high voltage generation in secondary winding will be stabilized.

NOTE:
Whereabouts of terminal connections are clearly indicated in the diagram below. When inspecting the electrical wiring, refer to this diagram and check to be sure that each connection is tight. Examine the cords for torn insulation and for evidence of grounding.

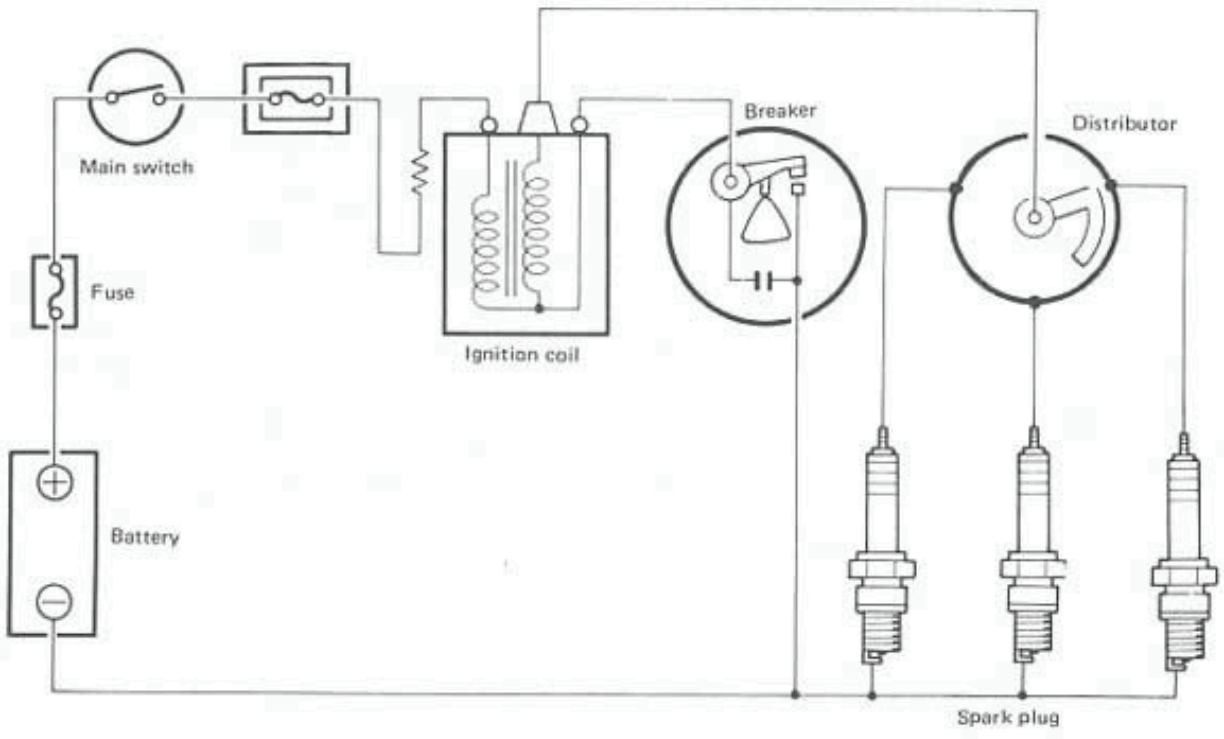


Fig. 9-1

9–2. Description of Components

Distributor

Fig. 9-2 shows the distributor unit in section to expose its internal mechanisms to easy viewing. The shaft is driven from engine camshaft through worm gearing, and rotates once for every two revolutions of the crankshaft.

Inside the cap are three side electrodes (for spark plugs) and one center electrode (to which the secondary side of the ignition coil is connected). The arm of the rotor, mounted on the shaft, touches the side electrodes one by one "distribute" the high voltage to the spark plugs.

Immediately below the distributing mechanism is the contact-breaker, whose cam, mounted on the shaft, actuates the breaker arm to make and break the primary current circuit for the purpose already mentioned. The condenser (capacitor) secured to the distributor body is for absorbing the current surge, which would otherwise result in a sparking across the contact point gap. The surge occurs every time the contact point is opened, and is due to, so to say, the inertia of electric current. The object served by the condenser is obvious; it is to prevent the point faces from getting burnt by sparking.

The ignition is advanced automatically by centrifugal action and by the difference between carburetor vacuum and atmospheric pressure. How the advancer operates will be described in reference to Figs. 9-4, 9-5, 9-6 and 9-7.

Distributor data	
Cam dwell angle	62° ± 2°
Condenser capacitance	0.25 microfarad
Ignition timing	10° B.T.D.C. below 950 r/min
Number of gear teeth	13
Direction of rotation	Clockwise, as viewed from top

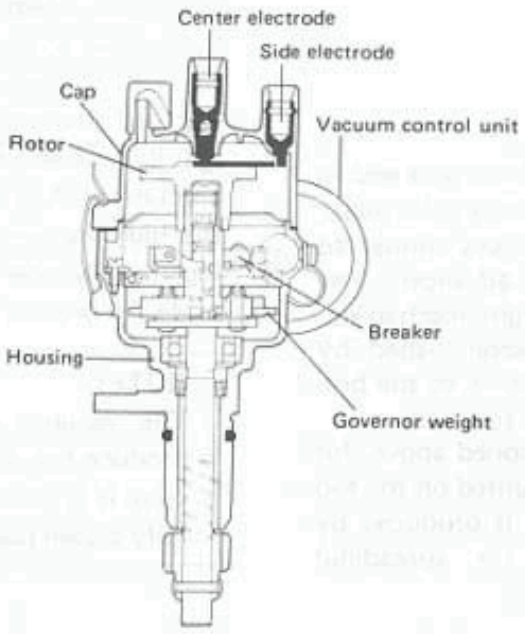


Fig. 9-2

Ignition coil

The ignition coil is a sort of miniature tarnsformer and, as such, has an iron core around which two coils are wound — primary and secondary windings mentioned above. The two are so close to each other that a sudden change in the magnetic flux produced by "primary current" flowing in primary winding (in a less number of coil turns) induces a very large electromotive force (voltage) in secondary winding (in a greater number of coil turns). These live parts are housed in a tight, insulator case topped by the cap mentioned above. Note that the cap has three terminals: one high-tension terminal and two low-tension terminals.

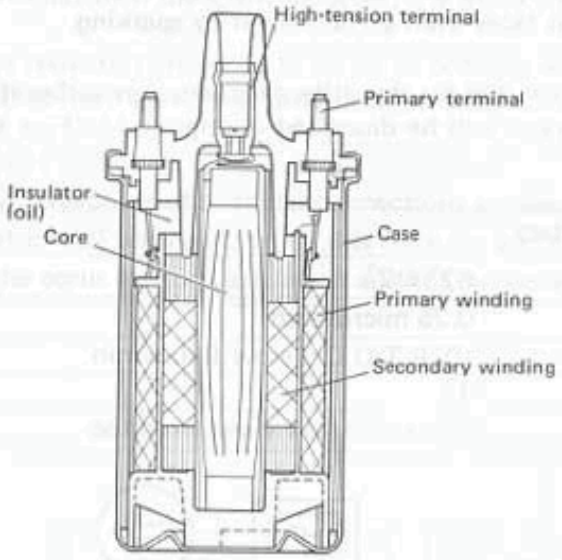


Fig. 9-3

Timing advancer

The distributor shaft, from its driven-gear end to the rotor-carrying end, is not a single solid piece; actually this shaft is in two pieces connected together through the timing advancer. The advancer is essentially a flyweight mechanism. Timing advancing action is accomplished by twisting the top shaft piece relative to the bottom one in the direction of shaft rotation.

The contact-breaker cam, mentioned above, for actuating the breaker arm is mounted on the top piece. The twisting movement is produced by the speed-dependent radial (or spreading) movements of the two flyweights.

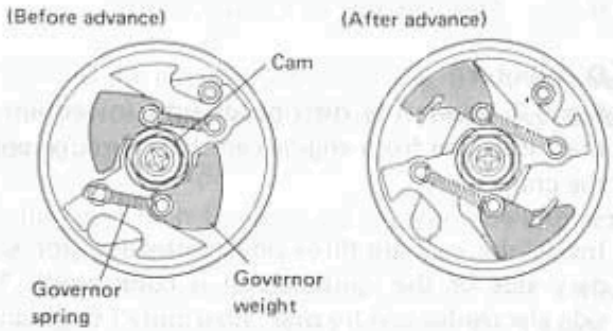


Fig. 9-4

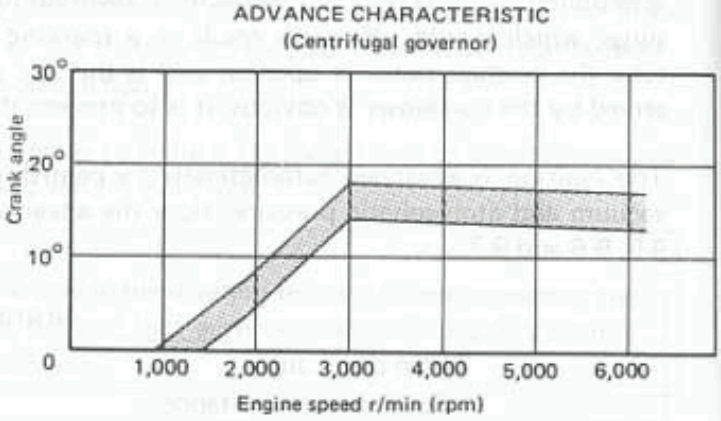


Fig. 9-5

Vacuum advancer

When the engine is in lightly loaded condition, the amount of fuel being supplied to it is not much and, needless to say, throttle valve is open but a little, so that the vacuum in the inlet manifold side of the carburetor is high.

For fuel economy, it is desirable to advance the ignition when the engine is burning a small amount of fuel. The vacuum advancer utilizes the high vacuum to produce a force for actuating the advancer rod in order to angularly displace the breaker plate.

> **NOTE:**
> The vacuum advancer starts working to produce the advancing force when throttle valve is 5° to 6° open as measured from its fully closed position.

The diaphragm is spring-loaded. With a high vacuum, the differential pressure acting on the diaphragm causes to overcome the spring force and move in the direction for pulling the advancer rod. The rod so pulled turns the breaker plate counterclockwise (counter to the direction of distributor shaft rotation) to advance the ignition.

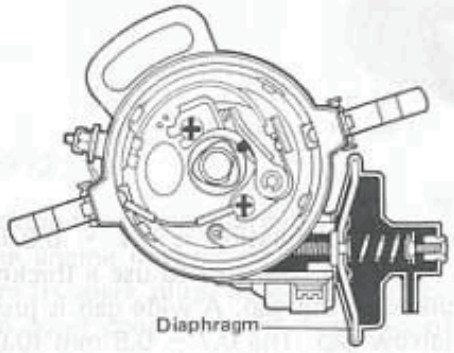


Fig. 9-6

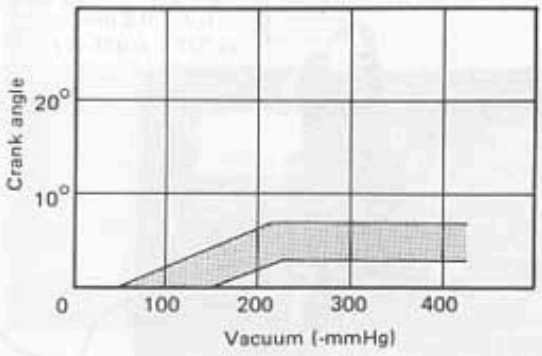


Fig. 9-7

Spark plugs

Each new machine shipped from the factory is fitted with standard plugs.

	Hot type	Standard
NGK	BP 5EA	BP 5ES
Nippon Denso	W14EX-U	W16EX-U

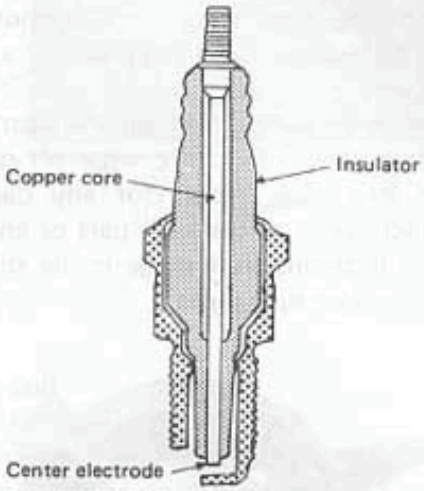


Fig. 9-8

Distributor cap

Leadage of high-tension energy for ignition shows up as misfiring in the engine. It occurs at any part of the high-tension line where insulation has failed or in a dirty distributor cap, that is, an internally dirty cap.

A wider spark gap in the plug, a conditin often found in poorly cared spark plugs, promotes the tendency of high-tension energy to find a short-cut to ground.

Cleanliness is very important for the distributor cap. With a clean dry cloth, wipe off dust or grime, if any, and inspect for any damaged (scarred, scratched or cracked) part or any part evidencing high-tension leakage inside the cap. Be sure to replace such parts.

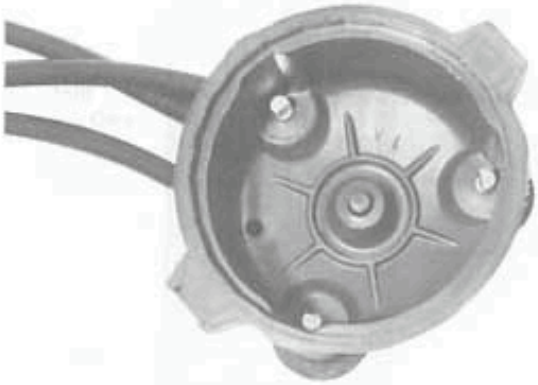


Fig. 9-9

Distriburtor driven gear

Inspect the gear teeth for wear, and see if the backlash is normal or not. Excessive backlash can be told by turning the shaft back and forth, with its driven gear in mesh with driving gear. Maladjusted ignition timing is often due to excessive tooth wear in this gearing and, in such a case, can be corrected by replacing the driven gear.

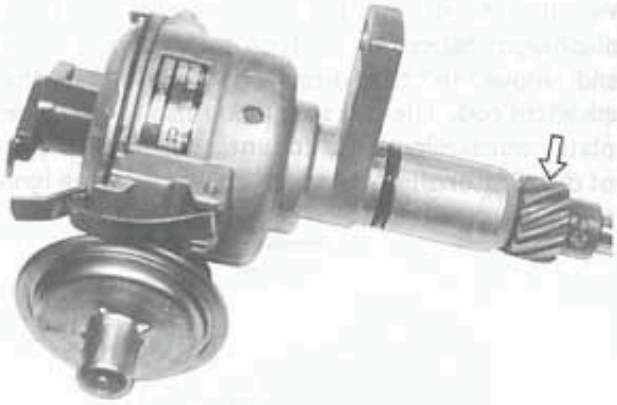


Fig. 9-10

Spark plugs

The spark gap specification is 0.7 ~ 0.8 mm (0.027 ~ 0.031 in). Be sure to use a thickness gauge in checking the gap. A wide gap is just as bad as a narrow gap. The 0.7 ~ 0.8 mm (0.027 ~ 0.031 in) gap will produce the right kind of sparks needed by the air-fuel mixture in this engine.

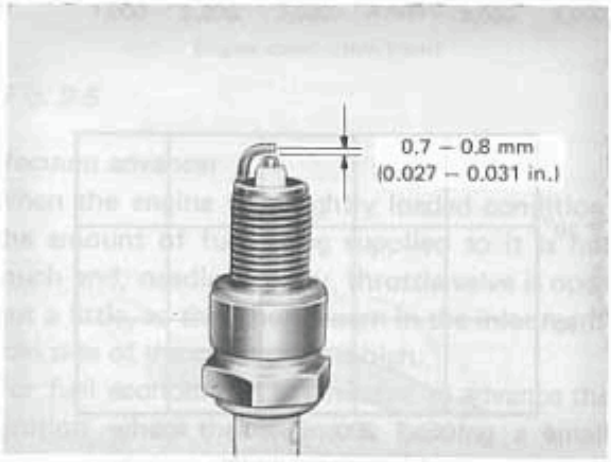


Fig. 9-11

Contact point faces

In the contact breaker, push the breaker arm with your fingertip just a little so that you can see the point faces. If the faces are oily, clean; if roughened, smoothen by grinding. In most cases, the point faces can be reconditioned by grinding with a file or oil stone. Points worn beyond repair must be replaced.

The illustration, below, tells what must be done in each case but the last one showing a pair of properly aligned, smooth faces. Wear or burning is hard to occur in the contact point whose point faces are in the condition labeled "good."

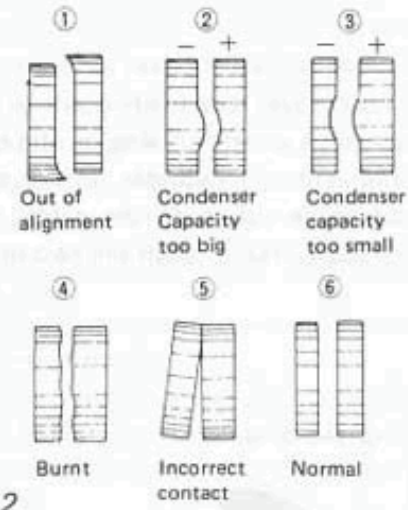


Fig. 9-12

Checking the primary circuit for fault

If the engine misfires or does not fire up at all where its spark plugs have just been checked to be in good condition, the first step of locating the cause is to check the primary circuit (between distributor and ground) for continuity by using a circuit tester as shown. Since the contact point is open, the tester should indicate discontinuity (infinitely large resistance); if contituity is noted, it means that there is a fault somewhere along the primary circuit, which could be in condenser or elsewhere.

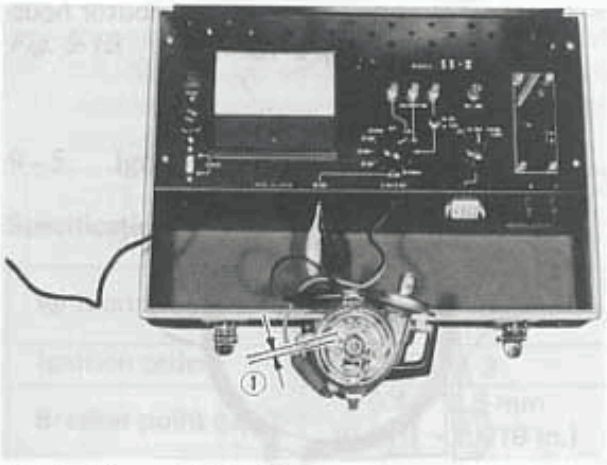


Fig. 9-13 ① *Open*

Condenser

Check the condenser for capacitance by using the electro-tester. You may do so with the condenser in place or removed. When checking it in place, that is, as mounted on the distributor, be sure to have the contact point opened. A condenser not meeting the following capacitance specification must be replaced:

Condenser capacitance specification	0.25 microfarad

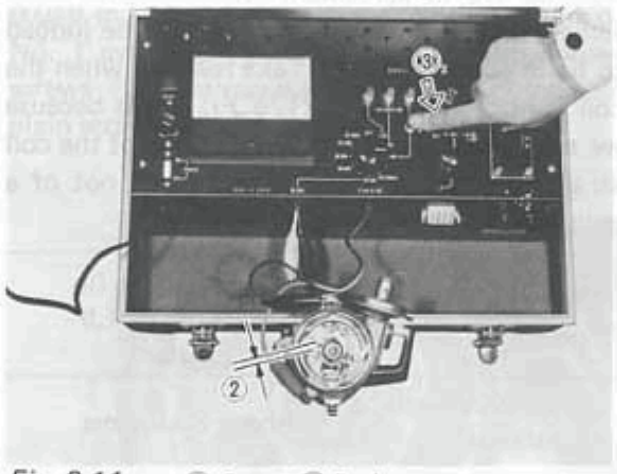


Fig. 9-14 ② *Open* ③ *Push*

Ignition coil

(1) Sparking performance test

The purpose of this test is to see if the ignition coil is capable of producing high voltage surges forceful enough to fly good sparks at the ignition coils at all times, particularly when its temperature has risen to the normal operating level. Use of the electro tester is assumed for this test. With the ignition coil connected to the tester, as shown, let the spark fly across the three-needle gap. Continue this testing for about three minutes so that the coil will get warm to simulate the normal operating condition. The coil may be deemed to be in good condition if the sparking is stable, without any misses. In the use of the electro tester for this purpose, do not enlarge the three-needle gap wider than 7 mm (0.27 in.)

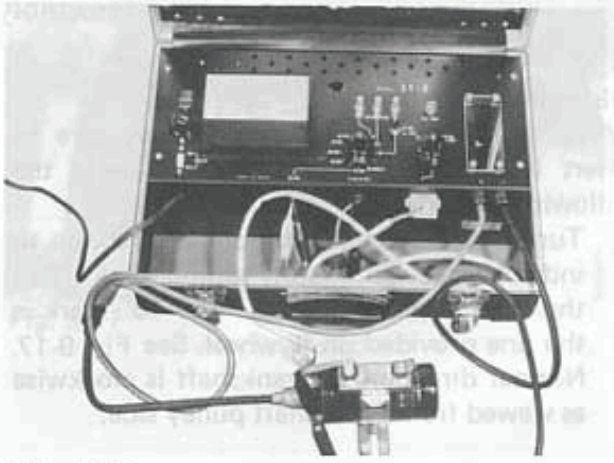


Fig. 9-15

(2) Resistance measurement

Measure the ohmic resistances of primary and secondary windings in the ignition coil. If the readings are in agreement with the prescribed values, indicated below, the coil may be judged to be in good condition. Take readings when the coil is hot, about 80°C (176°F); this is because we are interested in the performance of the coil at the normal operating temperature, not of a cold coil.

Primary winding resistance	About 3 ohms (inclusive of the 1.5-ohm resistor)
Secondary winding resistance	About 8 kilohms

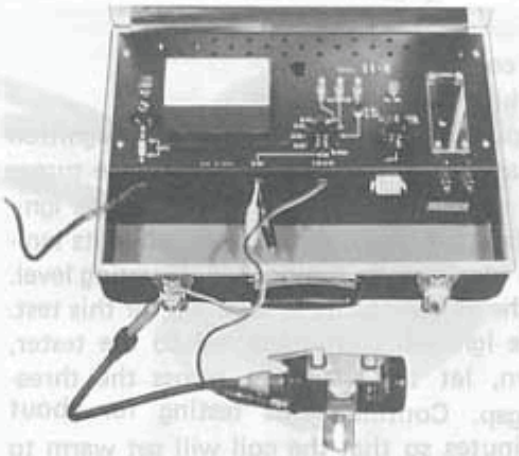


Fig. 9-16

9–4. Important Reminders for Reassembly and Installation

Distributor

When re-installing the distributor, be sure to insert it into the distributor gear case in the following sequence:

1) Turn over crankshaft in normal direction to index the 10° (B.T.D.C.) timing mark ① to the timing match bolt ②. The 10° mark is the one provided on flywheel. See Fig. 9-17. Normal direction of crankshaft is clockwise as viewed from crankshaft pulley side.

CAUTION:

After aligning marks ① and ② , remove cylinder head cover to visually confirm that the rocker arms are not riding on the camshaft cams at No. 1 cylinder. If the arms are found to be riding on the cams, turn over crankshaft 360° to align the two marks anew.

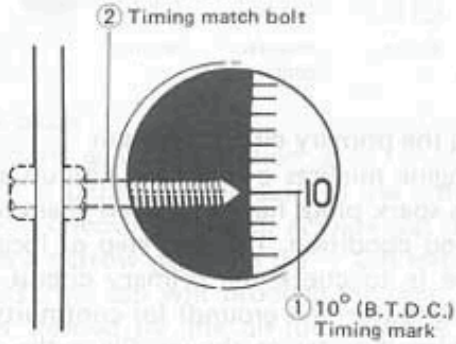


Fig. 9-17

2) Remove the distributor cap. Turn the rotor to make the center ③ of rotor flush with mark ④ embossed on the distributor housing, as shown in Fig. 9-18.

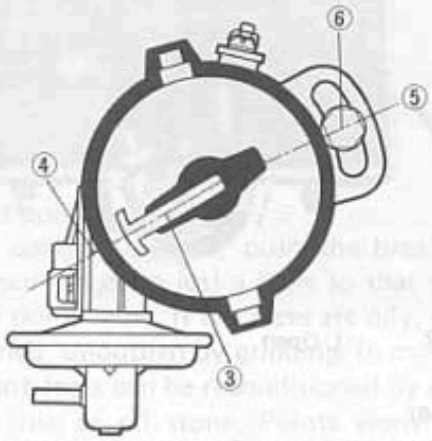


Fig. 9-18

3) Feed the distributor into the gear case in such a way that the center ⑤ of distributor flange will coincide with the distributor mounting screw hole ⑥ provided in the distributor gear case. Secure the distributor in place tentatively by making the mounting screw finger-tight, and adjust the ignition timing.

High-tension cords

Install the three high-tension cords by referring to Fig. 9-19, making sure to identify the three cap terminals of the distributor for the three cylinders.

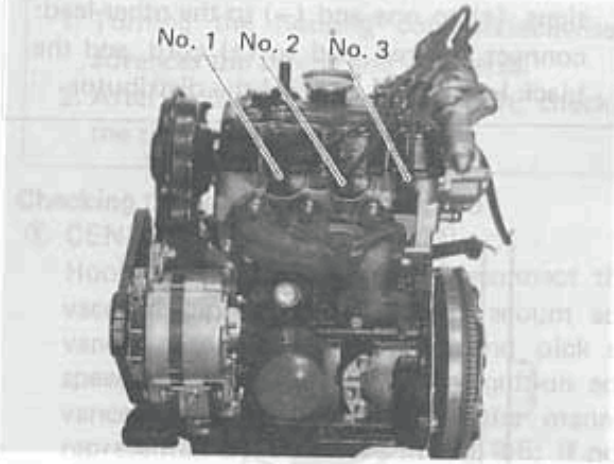


Fig. 9-19

9–5. Ignition Timing

Specifications

Ignition timing	10° B.T.D.C. below 950 r/min
Ignition order	1→3→2
Breaker point gap③	0.4 ~ 0.5 mm (0.016 ~ 0.019 in.)

Checking methods

Check to be sure that the point gap is within the specified range, from 0.40 to 0.50 mm (0.016 ~ 0.019 in.) and then check the ignition timing on No. 1 cylinder. To adjust the point gap, loosen screws ① and move the stationary point with plain screwdriver inserted into slit ② .

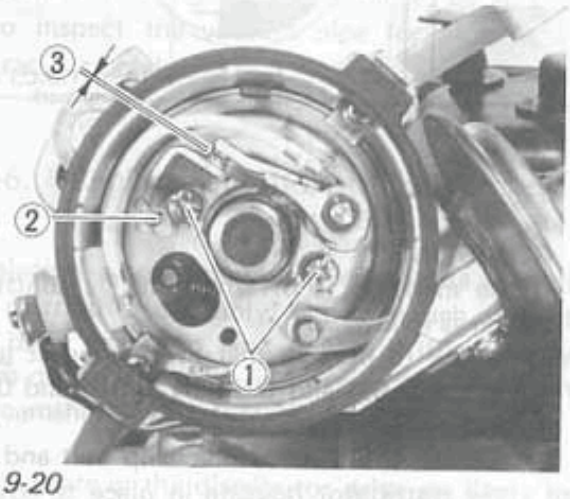


Fig. 9-20

(1) Checking and adjusting with timing light

CHECKING:

Tie the light to No. 1 high-tension cord. Start up the engine and run it at a speed not higher than 950 r/min. Under this condition, direct the light to the flywheel. If the 10° timing mark ④ appears aligned to the timing match bolt ⑤ , the ignition is properly timed. See Fig. 9-22.

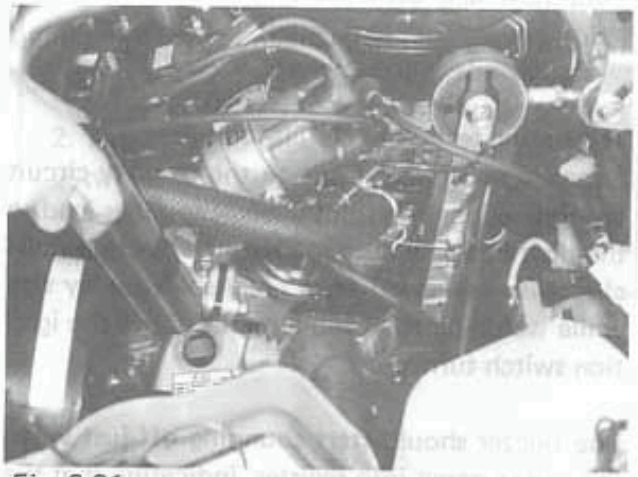


Fig. 9-21

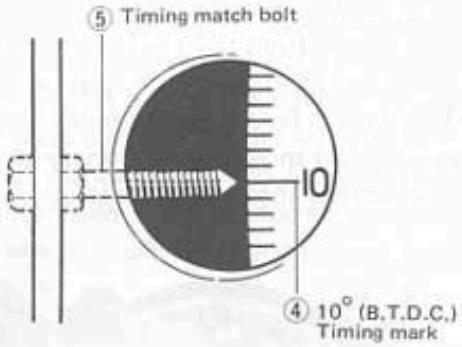


Fig. 9-22

ADJUSTING:
If the mark ④ is off the bolt ⑤, adjust the timing as follows:

1) Check to be sure that breaker point gap is between 0.4 and 0.5 mm (0.016 and 0.019 in.).
2) Loosen the distributor clamp bolt and turn the distributor housing in place to advance or retard the timing.

NOTE:
- Turning the housing counterclockwise advances the timing, and vice versa.
- After repositioning the housing, check the timing with the timing light and, as necessary, repeat step 2).

(2) Checking and adjustment with the timing tester

The timing tester has a built-in buzzer.
Connect one of its leads to the primary-circuit terminal of the distributor and the other lead to the distributor body. Slowly turn the crankshaft clockwise as viewed from crankshaft pulley side while watching the timing marks. (have the ignition switch turned off.)

The buzzer should start sounding off just when the marks come into register, indicating that the engine is set for the specified timing.

CAUTION:
With timing marks ④ ⑤ lined up as shown in Fig. 9-23, remove the cylinder head cover and check to be sure that No.1 cylinder rocker arms are not riding on cam lobes. If the arms are up, turn over crankshaft by one rotation (360°) clockwise (as viewed from crankshaft pulley side). This turning should cause the buzzer to sound off just when the marks come into alignment.

NOTE:
The two tester leads are given polarity signs, (+) to one and (–) to the other lead: connect the red lead to (+) cord, and the black lead to (–) cord, of the distributor.

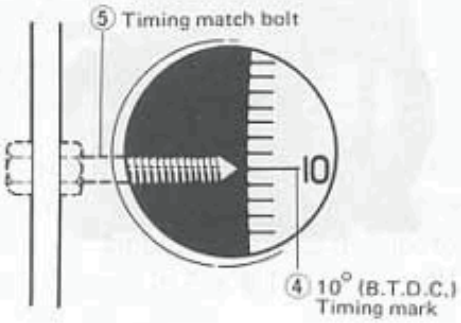


Fig. 9-23

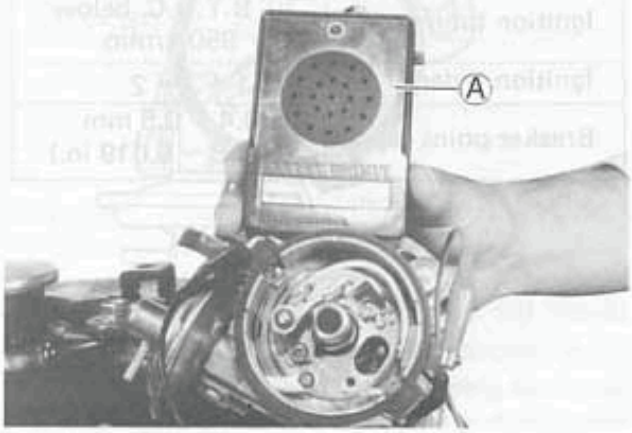


Fig. 9-24 Ⓐ Timing tester (09900-27003)

ADJUSTING:

Upon noting that the ignition is not timed to the specification, proceed as follows:

1) Make sure that the breaker point gap is set right, that is, between 0.4 and 0.5 mm (0.016 - 0.019 in.).
2) Bring timing mark ④ into alignment with mark ⑤, as shown in Fig. 9-23. Mark ④ represents the 10° crank angle.
3) Loosen the distributor clamp bolt, and slowly rotate the distributor housing until the buzzer starts sounding off. Hold the distributor right there and tighten the clamp bolt.

NOTES:

1. Turning the housing counterclockwise advances the timing and vice versa.
2. After tightening the clamp bolt, check the timing once again.

Checking the timing advancer action

① CENTRIFUGAL ADVANCE:

Hook up the timing light. Disconnect the vacuum pipe to cut out the vacuum advancer. Start up the engine and pick up speed gradually to see if the ignition advances with rising speed in the manner represented by the curve in Fig. 9-5; if not, the cause is most likely a malcondition in the centrifugal advancer, due to broken or weakened governor-weight return springs or bound or sticky weights.

NOTE:

When reading the ignition timing by referring to the Fig. 9-5, add 10 degrees (Static ignition timing) to the value represented by the graph.

② VACUUM ADVANCE:

Reconnect the vacuum pipe, and, as in ①, observe the flywheel timing mark under the timing light, with the engine running in no-load condition.

a. Read the timing in terms of crank angle when the engine is running at 3,500 rpm.
b. With the engine running at that speed, pull the vacuum pipe off the carburetor body and read the timing again. The difference between the first reading and the second reading is the angle of advance due to vacuum advancing.

NOTE:

If the first reading is nearly equal to the second reading, vacuum advance is malfunctional.

CAUTION:

Before checking vacuum advance, be sure to inspect the vacuum pipe for pinhole, crack or break.

9–6. Replacement of Distributor Drive Gear

Replacing a worn-down driven gear (a part of the distributor assembly) is not enough. Inspect the drive gear, too, and replace it if it is badly worn down. The drive gear can be removed from the camshaft.

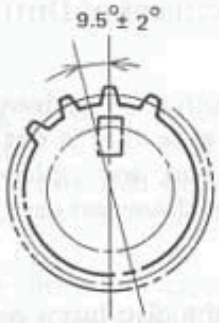
Worn gears in the distributor drive are likely to disturb the ignition timing and must be replaced.

When pressing the replacement drive gear onto camshaft, be sure to position the gear angularly as shown in Fig. 9-25. Note that the tooth root is radially centered on the center line through the keyway provided in camshaft.

NOTES:

1. Before removing the drive gear from the camshaft, scribe a match mark on this shaft and, when mounting the replacement drive gear, refer to this mark.
2. There is no need to discriminate between the two end faces of the drive gear: the gear may be fitted with either end held foremost.

CAUTION:
Distributor gear case
Where the distributor gear case has been removed in engine disassembly or at any other occasion, be sure to fill up the case with 60 cc (2.03/2.11 US/Imp oz) of engine oil after re-installing the case. Never start up the engine with the gear case empty of oil.



Camshaft pulley side view

Fig. 9-25

10–1. Description

A shift-lever type starter motor is used for cranking the engine. The motor is mounted on the cylinder block, with its drive pinion meshed with the ring gear of the flywheel. In the following illustration, note that the whole motor assembly inclusive of the magnetic switch and lever mechanism is enclosed.

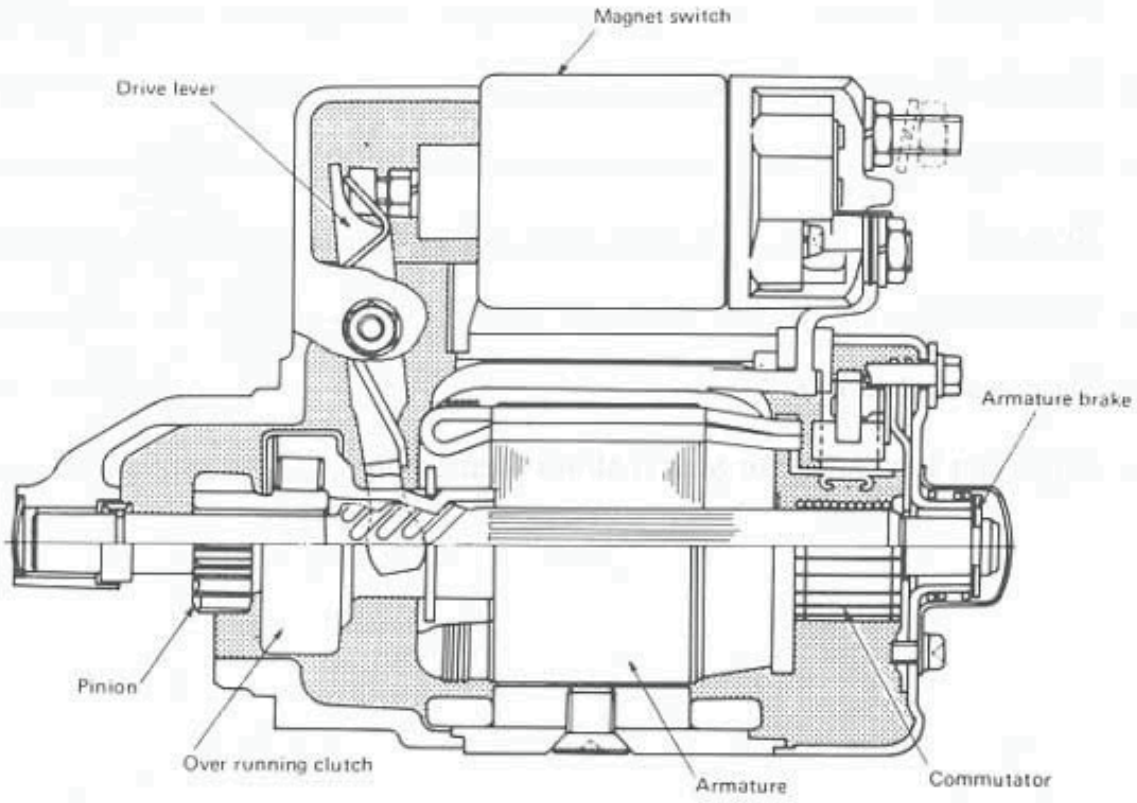


Fig. 10-1

10–2. Specifications

Voltage	12 volts
Output	0.6 kW
Rating	30 seconds
Direction of rotation	Counterclockwise as viewed from pinion side
Brush length	19 mm (0.75 in.)
Number of pinion teeth	9
No-load characteristic	55 A maximum at 11 volts, 3,500 rpm minimum
Load characteristic	230 A maximum at 9.5 volts and 0.5 kg-m torque, 2,000 rpm minimum
Locked rotor current	450A maximum at 8.5 volts, 1.1 kg-m minimum
Magnetic switch operating voltage	8 volts maximum

10–3. Cranking Action

Starting up the motor

Turning on the starting switch results in a small current flowing throught the holding coil and another through the pull-in coil, both in the magnetic switch. The former current flows direct into ground, but the latter flows through motor armature and field. In other words, motor begins to run. In the magnetic switch, the two coils energized—pull-in coil and holding coil—develop a combined magnetic pull, by which the moving core is pulled against the force of the spring and moves toward the right (in the illustration). At this time, the motor armature is running but slowly because of the small initial current. As the moving core is forced toward the right, its left end turns the shift lever around its pivot, so that the bottom end of the lever pushes the clutch toward the left. Since the clutch is splined to the motor shaft and because the motor shaft is rotating, the clutch advances toward the left as assisted by the helical splines.

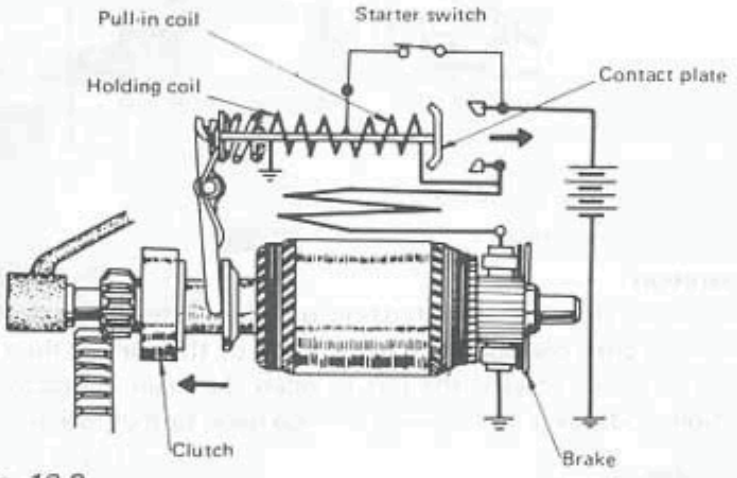


Fig. 10-2

Pinion meshing with the ring gear

The pinion may mesh into the ring gear smoothly or may bounce on the ring gear, depending on the relative positions of their teeth. In the latter event, the springs mounted on the clutch absorb the shock and, since the pinion is rotating and being pushed, its teeth will eventually mesh into those of the ring gear. In either case, the shift lever is allowed to turn fully and permit the moving core to be kept pulled all the way toward the right. When this happens, the main contactor of the magnetic switch closes to connect the starter motor direct to the battery. Consequently, a very large current—load current—flows through the motor to develop a high cranking torque for driving the engine crankshaft through the drive pinion and ring gear.

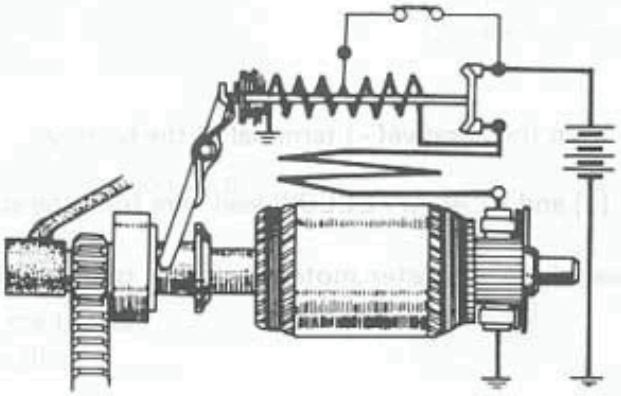


Fig. 10-3