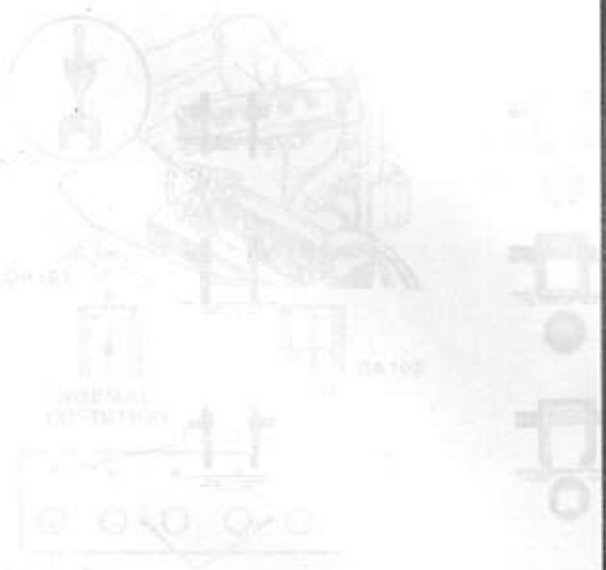
SERVICE MANUAL

MODEL

L20A, L24 & L26 SERIES

ENGINES



NISSAN

NISSAN MOTOR CO., LTD.

TOKYO, JAPAN

SECTION EE

ENGINE ELECTRICAL SYSTEM

EE

STARTING CIRCUIT

The electrical system is a 12 volt system. This section is subdivided into the following subsections for electrical parts which are required for engine operation.

- Battery
- Starting motor
- Alternator
- Regulator
- Distributor
- Ignition coil
- Spark plugs

Information on body electrical systems such as lighting, instrument, and windshield wipers is described in section BODY ELECTRICAL in CHASSIS AND BODY.

BATTERY

CONTENTS

REMOVAL AND INSTALLATION

REMOVAL

1. Disconnect negative and positive terminals.
2. Remove nuts from battery clamp; take out clamps.
3. Remove battery.

INSTALLATION

1. Install and tighten clamps securely.
2. After clamps have been tightened, clean battery cable terminals and apply grease to retard formation of corrosion.

ELECTROLYTE LEVEL CHECK

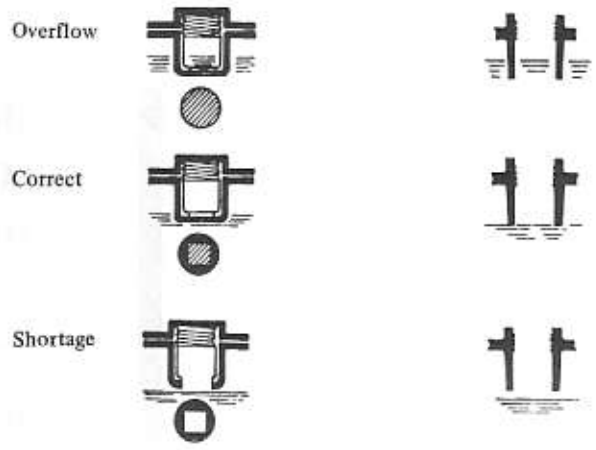
There are two types of batteries; standard and self-filling.

In case of standard type

Check the electrolyte level in each battery cell once a month.

1. Unscrew each filler cap and inspect fluid level, which can be determined by glancing into the cap openings. See Figure EE-1

Determine as shown below:



EE087

Fig. EE-1 Inspecting electrolyte level

In case of battery with fluid level lines, check to see that the level is between the upper and the lower level lines.

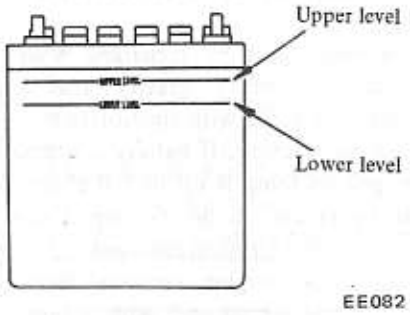


Fig. EE-2 Inspecting electrolyte level (with level lines)

If the fluid level is low, and distilled water for each cell to raise the level approximately 10 to 20 mm (0.394 to 0.787 in) above the plates. In case of battery with level lines, add distilled water to the upper level. Do not overfill.

In case of self-filling type

1. Remove filler cap and inspect the float position. If the position of float is lower than the normal level, add distilled water to case attached on battery upper face. The fluid will equally fill each cell.

After replenishing, install filler cap. Do not overfill over the projections.

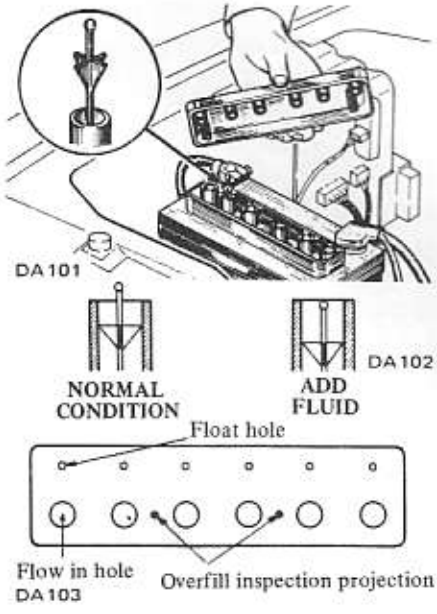


Fig. EE-3 Inspecting electrolyte level (for self-filling type)

SPECIFIC GRAVITY CHECK

Specific gravity of battery electrolyte is tested by a hydrometer.

1. When measuring specific gravity, place your eyes in line with scale to read highest level (electrolyte rises at edge due to surface tension) of electrolyte. See Figure EE-4.

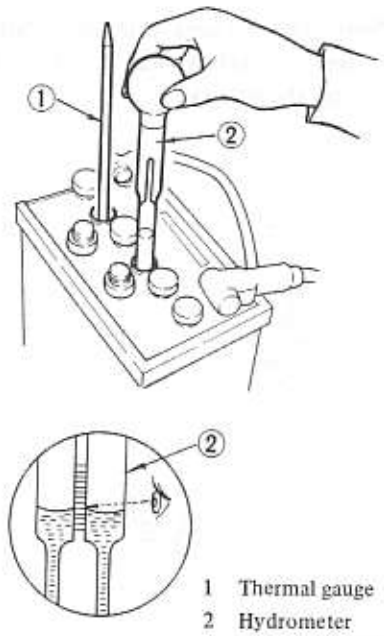


Fig. EE-4 Checking specific gravity

2. If the state of charge of battery is 60% full, or specific-gravity reading is below 1.20 [as corrected at 20°C (68°F)], battery must be recharged or battery-electrolyte concentration must be adjusted.

Add or subtract gravity points according to whether the electrolyte temperature is above or below 20°C (68°F) standard.

The gravity of electrolyte changes 0.0007 for every 1°C (33.8°F) temperature.

A correction can then be made by using the following formula:

$S_{20} = St + 0.0007\ (t - 20)$

Where

S_{20}: Specific gravity of electrolyte corrected at 20°C (68°F)

St: Specific gravity of electrolyte at t°C

t: Electrolyte temperature

For example; A hydrometer reading of 1.260 at 30°C (86°F) would be 1.267 when corrected at 20°C (68°F), indicating fully charged battery. On the other hand, a hydrometer reading of 1.220 at −10°C (14°F) would be 1.199 when corrected at 20°C (68°F), indicating a partially charged battery.

The state of charge of battery can be determined by the following tables if the specific gravity of electrolyte is known. Before checking, check to be sure that cells are filled to correct level.

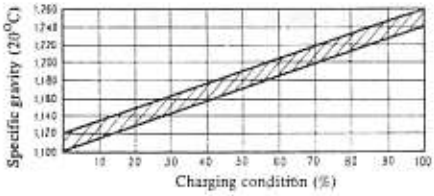


Fig. EE-5 Relation between specific gravity and charging condition

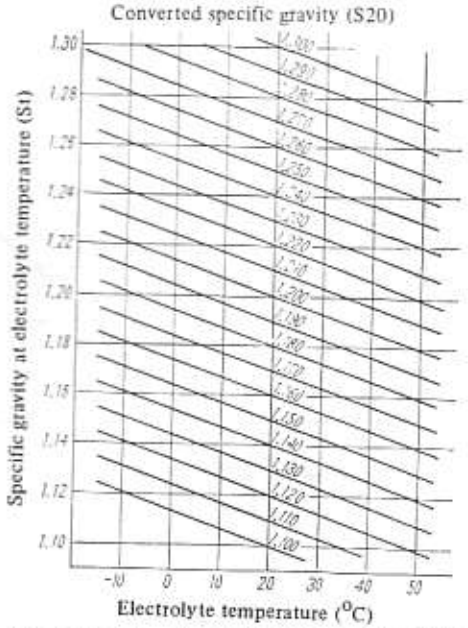


Fig. EE-6 Changes of specific gravity in response to electrolyte temperature change (°C)

BATTERY FREEZING

Temperatures at which battery electrolyte freezes vary with acid concentration or its specific gravity. A battery with an insufficient state of charge will freeze at low temperatures. If specific gravity of a battery falls below 1.100, the indication is that the battery is completely discharged and will freeze readily when temperatures fall below freezing point. See Figure EE-7.

Note: Use extreme caution to avoid freezing battery since it will usually ruin the battery.

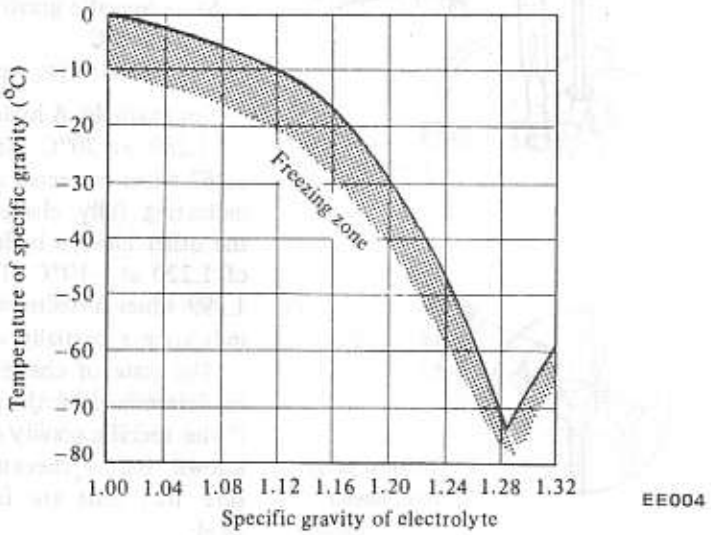


Fig. EE-7 Freezing point of electrolyte

ADJUSTING SPECIFIC GRAVITY

Be sure to check electrolyte specific gravity after fully charging battery. Standard specific gravity is 1.260 at 20°C (68°F).

When specific gravity is higher than the standard value, add distilled water. When lower, add diluted sulphuric acid [specific gravity of which is 1.400 at 20°C (68°F)].

When adjusting specific gravity, be sure to convert measured specific gravity to standard specific gravity at 20°C (68°F).

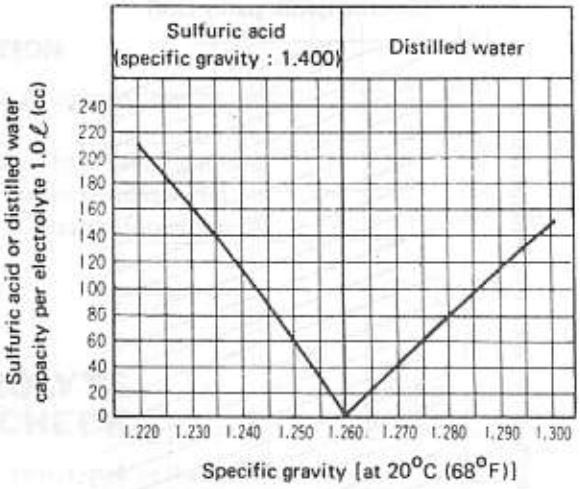


Fig. EE-8 Adjusting specific gravity

CHARGING CIRCUIT

Battery must be recharged when standard electrolyte-gravity reading falls below 1.200 with electrolyte level being satisfactory. If battery is quick-charged to bring it up to full charge, the operation should be carried out with negative terminal removed.

Prior to charging, corroded terminals should be cleaned with a brush and common baking-soda solution. In addition, the following items should be observed during recharging battery:

1. Be sure that electrolyte level is above top of each plate.
2. Keep removed plugs in a safe location.
3. Do not allow electrolyte temperature to go over 45°C (113°F).
4. After recharging, check to be certain that standard specific gravity does not exceed 1.260 [at 20°C (68°F)]. Correction can be made by adding distilled water to cells as necessary.
5. Keep battery away from open flame while it is being recharged.
6. After all vent plugs have been tightened, clean upper face of battery.

TROUBLE DIAGNOSES AND CORRECTIONS

Battery is not charged correctly.

1. Correctly adjust belt tension of alternator.
2. Complete connections in charging system.
3. Securely connect battery terminals.

Lighting load test

1. Make sure that electrolyte level is correct.
2. Crank engine for three seconds (with ignition system open).
3. Turn on headlight (low beam) for one minute, and then measure specific gravity of each cell of battery.

Specific gravity of each cell is less than 1.200.

1. When specific gravity can not be raised above 1.200 by charging, the battery is defective.

Specific gravity of some cells is above 1.200 but the others show lower specific gravity.

Specific gravity of each cell is above 1.20.

Unbalance is within 0.05

1. Discharged battery. Charge it and repeat lighting load test.

Unbalance of specific gravity between cells exceeds 0.05.

1. Battery is defective.

Unbalance is within 0.05.

1. Battery is satisfactory.

Unbalance of specific gravity between cells exceeds 0.05.

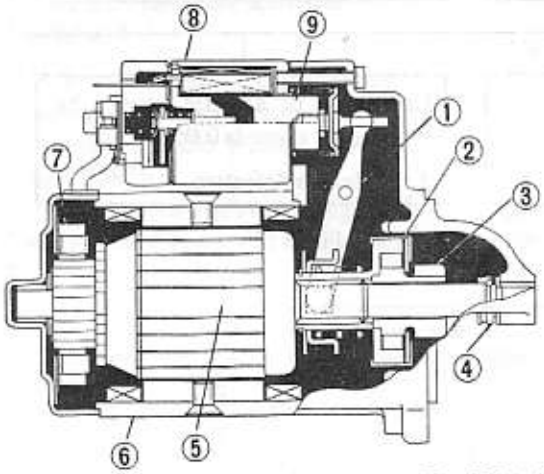
1. Battery is defective.

STARTING MOTOR

CONTENTS

DESCRIPTION

The function of the starting system, consisting of the battery, ignition switch, starting motor and solenoid, is to crank the engine. The electrical energy is supplied from the battery, the solenoid completes the circuit to operate the starting motor, and then the motor carries out the actual cranking of the engine.



1 Shift lever
2 Over-running clutch
3 Pinion
4 Pinion stopper
5 Armature
6 Yoke
7 Brush
8 Magnetic switch ass'y
9 Plunger

Fig. EE-9 Sectional view of starting motor

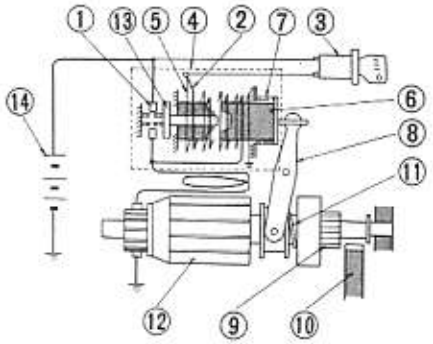
OPERATION

When the ignition switch is turned fully clockwise to the START position, battery current flows through "series" and "shunt" coils of the solenoid, magnetizing the solenoid. The plunger is pulled into the solenoid so that it operates the shift lever to move the drive pinion into the flywheel ring gear. Then the solenoid switch contacts close after the drive pinion is partially engaged with the ring gear.

Closing of the solenoid switch contacts causes the motor to crank the engine and also cut out the "series" coil of the solenoid, the magnetic pull of the "shunt" coil being sufficient to hold the pinion in mesh after the shifting has been performed.

After the engine starts running, the driver releases the ignition key and it automatically returns to the ON position.

This breaks the solenoid circuit so that reverse current flows through the series coil, and the magnetic field builds up in the direction in which the plunger moves back. As this happens, the resultant force of the magnetic fields in the shunt coil and the series coil becomes zero. The return spring then actuates the shift lever which pulls the plunger, and allows it to open the solenoid switch contacts. Consequently, the starting motor stops.



EE118

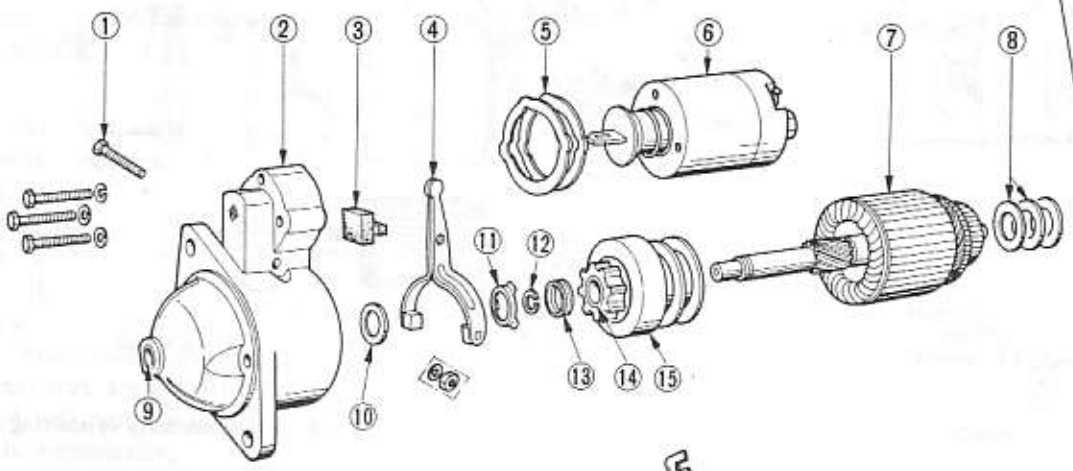
1 Stationary contact
2 Series coil
3 Ignition switch
4 Solenoid
5 Shunt coil
6 Plunger
7 Return spring
8 Shift lever
9 Drive pinion
10 Ring gear
11 Pinion sleeve spring
12 Armature
13 Movable contactor
14 Battery

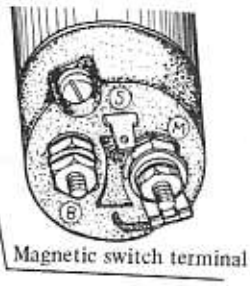
Fig. EE-10 Starting motor circuit

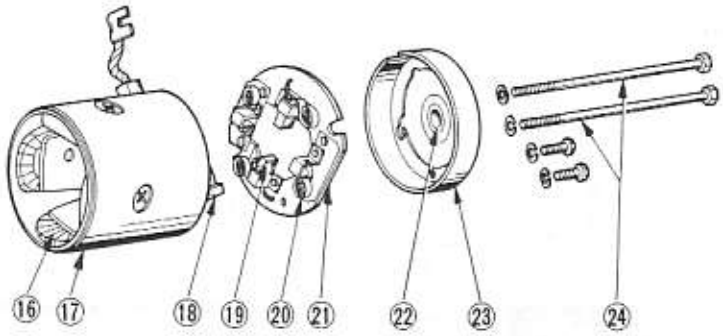
More positive meshing and demeshing of the pinion and the ring gear teeth are secured by means of the over-running clutch. The over-running

clutch employs a shift lever to slide the pinion along the armature shaft, into or out of mesh with the ring gear teeth. The over-running clutch is designed to transmit driving torque from the motor armature to the ring gear, but permit the pinion to over-run the armature after the engine has started.

CONSTRUCTION







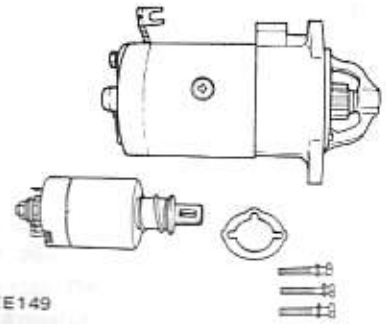
1 Shift lever pin
2 Gear case
3 Dust cover
4 Shift lever
5 Dust cover
6 Magnetic switch Ass'y
7 Armature
8 Thrust washer
9 Metal
10 Thrust washer
11 Stopper washer
12 Stopper clip
13 Pinion stopper
14 Pinion
15 Over-running clutch
16 Field coil
17 Yoke
18 Brush (+)
19 Brush (−)
20 Brush spring
21 Brush holder Ass'y
22 Metal
23 Rear cover
24 Through bolt

EE007

Fig. EE-11 Exploded view of starting motor

REMOVAL AND INSTALLATION

1. Disconnect battery ground cable.
   Disconnect black wire with yellow tracer from magnetic switch terminal, and black battery cable from battery terminal of magnetic switch.
2. Remove two bolts securing starting motor to gear case. Pull starter assembly forward and remove starting motor.
3. Install starting motor in reverse order of removal.

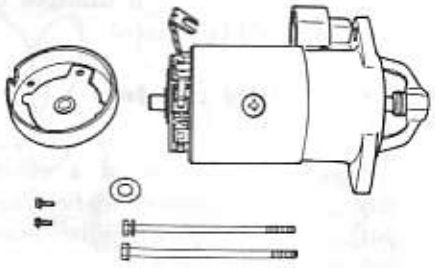


EE149

Fig. EE-12 Removing magnetic switch assembly

DISASSEMBLY

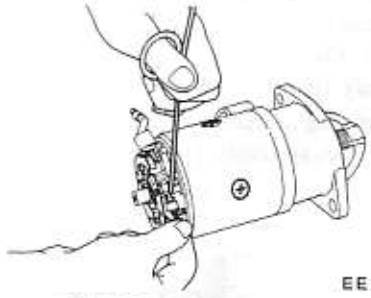
1. Loosen nut securing connecting plate to magnetic switch "M" terminal. Remove three screws securing magnetic switch and remove magnetic switch assembly.
2. Remove two through bolts and brush cover assembly.



EE009

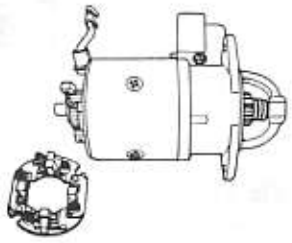
Fig. EE-13 Removing brush cover

3. Set free brushes from commutator by lifting up brush springs.



EE150

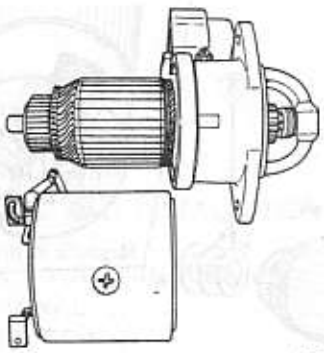
Fig. EE-14 Setting free brushes



EE151

Fig. EE-15 Removing brush holder

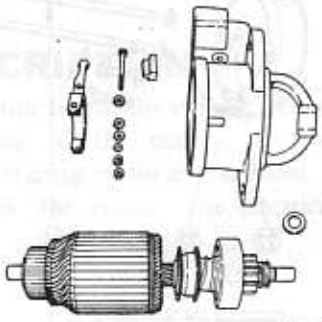
4. Remove yoke assembly by hitting lightly with a wooden hammer.



EE152

Fig. EE-16 Removing yoke assembly

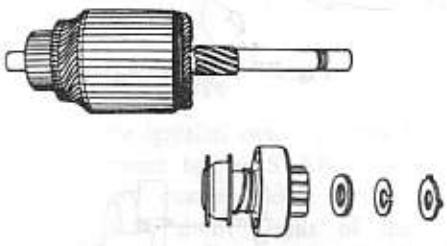
5. Withdraw armature assembly and shift lever.



EE153

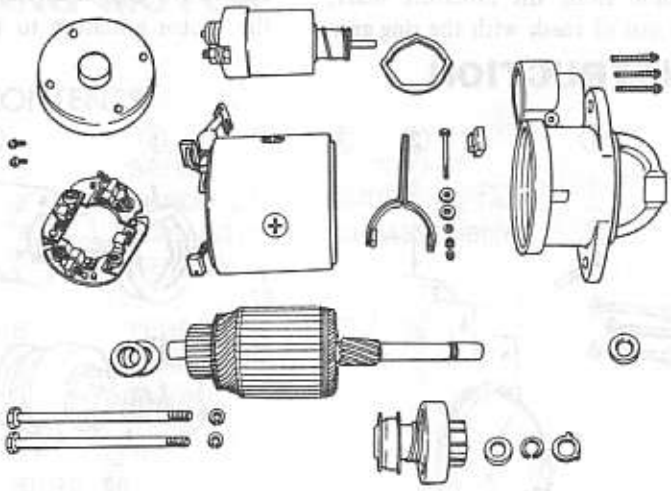
Fig. EE-17 Removing armature assembly and shift lever

6. Remove pinion stop ring located at the end of armature shaft. To remove stop ring, first push stop ring to clutch side and then, after removing snap ring, remove stop ring with over-running clutch. Withdraw over-running clutch assembly from armature shaft.



EE012

Fig. EE-18 Removing over-running clutch assembly



EE154

Fig. EE-19 Disassembly of starting motor

CLEANING AND INSPECTION

Clean all disassembled parts, but do not use grease dissolving solvents for cleaning over-running clutch, armature assembly, magnetic switch assembly and field coils since such a solvent would dissolve grease packed in clutch mechanism and would damage coils or other insulators.

Check them for excessive damage or wear, and replace if necessary.

TERMINAL

Check terminal for damage and wear, and replace if necessary.

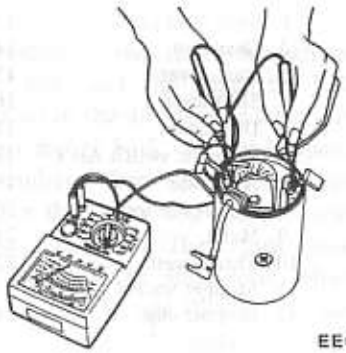
FIELD COIL

Check field coil for insulation. If the insulation of coil is damaged or worn, it should be replaced.

Testing field coil for continuity:

Connect the probe of a circuit tester or an ohmmeter to field coil positive terminal and positive brush holder.

If tester shows no conduction, field circuit or coil is open.



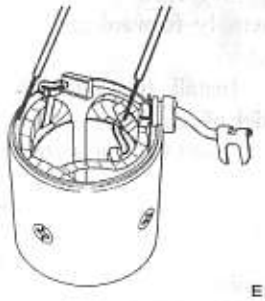
EE016

Fig. EE-20 Testing field coil for continuity

Testing field coil for ground:

Place one probe of circuit tester onto yoke and the other onto field coil lead (positive terminal).

If very little resistance is read, field coil is grounded.



EE017

Fig. EE-21 Testing field coil for ground

Field coil tester for short:

Unsolder the connected portion of each coil and proceed as mentioned above.

If a faulty coil is found, it should be replaced.

BRUSHES AND BRUSH LEAD WIRE

Check the surface condition of brush contact and wear of brush. If a loose contact is found, it should be replaced.

If brush is worn and its length is less than 12.5 mm (0.492 in), replace.

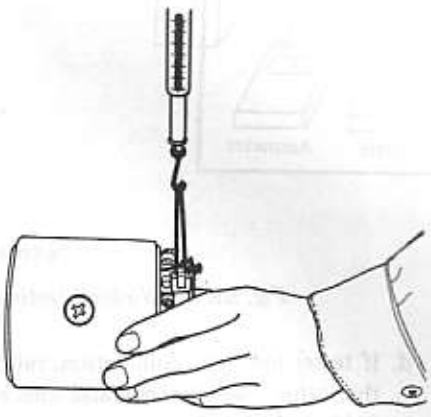
Check the connection of lead clip and lead wire.

Check brush holders and spring clip to see that they are not deformed or bent, and will properly hold brushes against the commutator.

If brushes or brush holders are dirty, they should be cleaned.

BRUSH SPRING TENSION

Check brush spring tension by a spring scale as shown in Figure EE-22. The reading should be 1.6 kg (3.53 lb). Replace spring if tension is lower than 1.4 kg (3.09 lb).



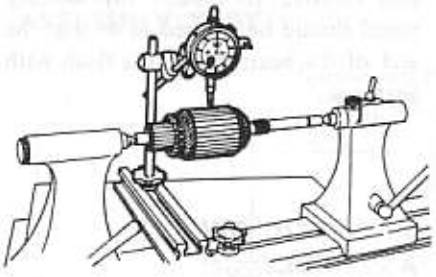
EE018

Fig. EE-22 Inspecting brush spring tension

ARMATURE ASSEMBLY

Check external appearance of armature and commutator.

1. Measure armature shaft for bend by a dial gauge. Replace armature shaft if the bend exceeds 0.08 mm (0.0031 in).



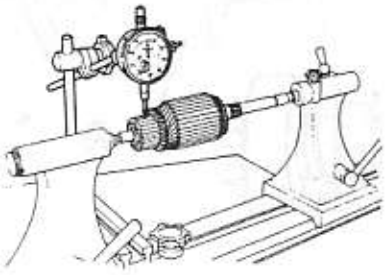
EE019

Fig. EE-23 Inspecting armature shaft for bend

2. Inspect commutator. If the surface of commutator is rough, it must be sanded lightly with a No. 500 emery cloth. Commutator must be checked also for out-of-round. If the out-of-round is more than 0.2 mm (0.0079 in), or the depth of insulating mica is less than 0.2 mm (0.0079 in) from commutator surface, commutator (armature) should be turned on a lathe, so that the out-of-round is less than 0.05 mm (0.0020 in). Insulating mica should also be undercut so that the depth of it is 0.5 to 0.8 mm (0.0197 to 0.0315 in).

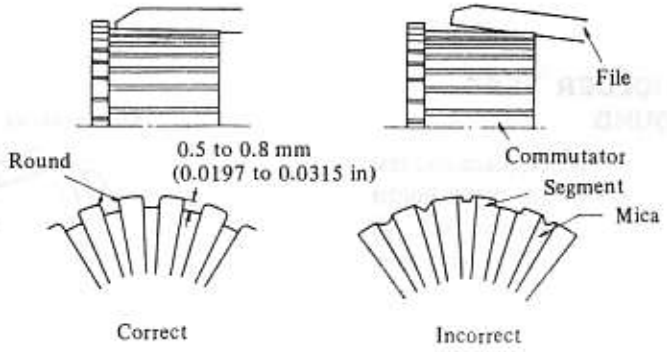
The wear limit of commutator diameter is 2 mm (0.0787 in). If commutator is beyond repair, replace.

Note: It is recommended to replace commutator as an assembly if worn or damaged.



EE020

Fig. EE-24 Inspecting commutator



EE021

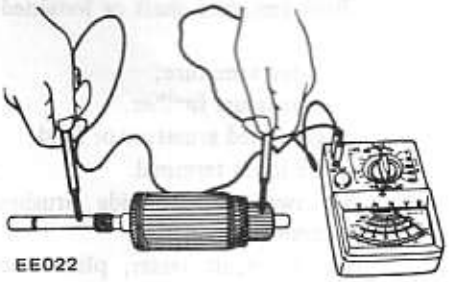
Fig. EE-25 Undercutting insulating mica

3. Inspect soldered connection of armature lead and commutator. If loose connection is found, solder it using rosin flux.

4. Armature test for ground

Using a circuit tester, place one test probe onto armature shaft and other onto each commutator bar.

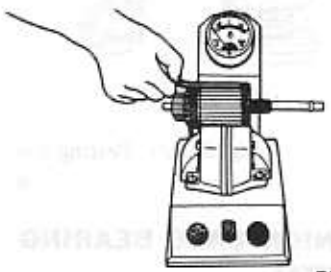
If tester shows conductive, armature is grounded and must be replaced.



EE022

Fig. EE-26 Testing armature for ground

5. Check armature for short by placing it on armature tester (growler) with a piece of iron over armature core, rotating armature. If the plate vibrates, armature is shorted.



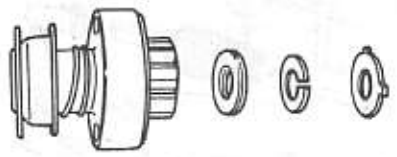
EE023

Fig. EE-27 Testing armature for short

6. Check armature for continuity by placing probes of tester on two segments side by side. If tester shows no conduction, the circuit is open.

OVER-RUNNING CLUTCH ASSEMBLY

Inspect pinion assembly and screw sleeve. Screw sleeve must slide freely along armature shaft splines. If damage is found or resistance is felt when sliding, it must be repaired. Inspect pinion teeth. If excessive rubbing is found on teeth, it should be replaced. Flywheel ring gear also must be inspected.

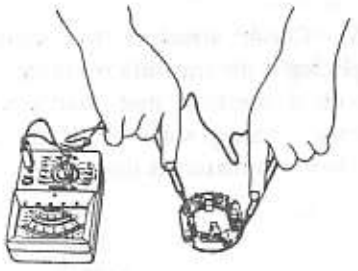


EE024

Fig. EE-28 Over-running clutch assembly

BRUSH HOLDER TEST FOR GROUND

Using a circuit tester, place one test probe onto negative side brush holder and another onto positive side. If tester shows conduction, brush holder is shorted to ground. Replace an insulator or brush holder.



EE025

Fig. EE-29 Testing brush for ground

PINION CASE BEARING METAL

Inspect bearing metal for wear or side play. If the clearance between bearing metal and armature shaft is more than 0.2 mm (0.0079 in), replace metal. Press in a new bearing and adjust the clearance to 0.03 to 0.10 mm (0.0012 to 0.0039 in). Bearing metal should be pressed in so that the end of the bearing metal is flush with gear case.

MAGNETIC SWITCH ASSEMBLY

Inspect magnetic switch contacts. If a rough welding is found on the contact, it should be repaired.

ASSEMBLY

Reassemble starting motor in reverse sequence of disassembly.

When assembling, be sure to apply grease to gear case and rear cover bearing metal, and apply oil to pinion slightly.

TEST

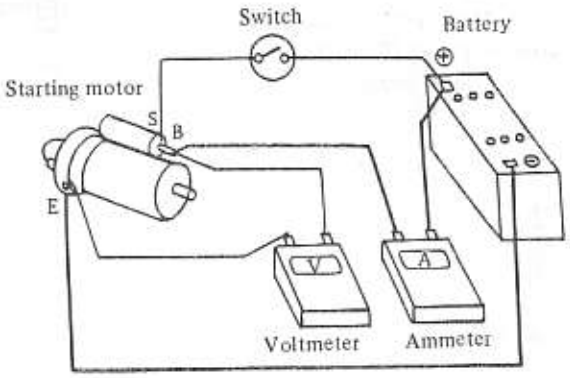
PERFORMANCE TEST

Starting motor should be subjected to a "no-load" test whenever it has been overhauled to ensure that its performance will be satisfactory when installed on engine. Starting motor should also be subjected to test when the cause of abnormal operation is to be determined. A brief outline of the test is given below.

No-load test

Connect starting motor in series with specified (12 volts) battery and an ammeter capable of indicating 1,000 amperes.

Specified current draw and revolution in this test is shown in "specification."



EE026

Fig. EE-30 No-load testing

DIAGNOSIS OF TEST

1. Low speed with no-load and high current draw may result from the following causes.
(1) Tight, dirty or worn bearings.
(2) Bent armature shaft or loosened field probe.
(3) Shorted armature;
Check armature further.
(4) A grounded armature or field;
a. Remove input terminal.
b. Raise two negative side brushes from commutator.
c. Using a circuit tester, place one probe onto input terminal and the other onto yoke.
d. If tester indicates conduction, raise the other two brushes and check field and armature separately to determine whether field or armature is grounded.

2. Failure to operate with high current draw may result from the following items.
(1) A grounded or open field coil:
Inspect the connection and trace circuit by a circuit tester.
(2) Armature coil does not operate:
Inspect commutator for excessive burning. In this case, arc may occur on defective commutator when motor is operated with no-load.

(3) Burned out commutator bar:

Weak brush spring tension, broken brush spring, rubber bush, thrust out of mica in commutator or a loose contact between brush and commutator would cause burned-out commutator bar.

3. Low current draw and low no-load speed would cause high internal resistance due to loose connections, defective leads, dirty commutator and causes listed on item 2-(3).

MAGNETIC SWITCH ASSEMBLY TEST

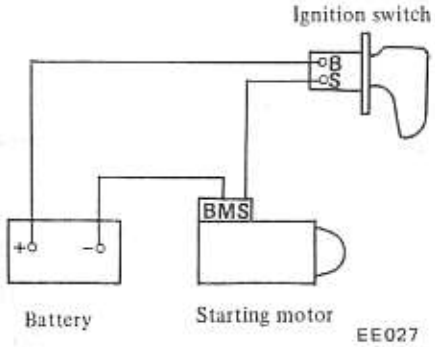


Fig. EE-31 Circuit of magnetic switch assembly test

If the starting motor check is "OK," check magnetic switch assembly. Connect cables between "negative" battery terminal and starting motor "M" terminal, "positive" battery terminal and starting motor "S" terminal connecting ignition switch in series as shown in Figure EE-31.

With ignition switch on, measure the gap "ℓ" between pinion front edge and pinion stopper.

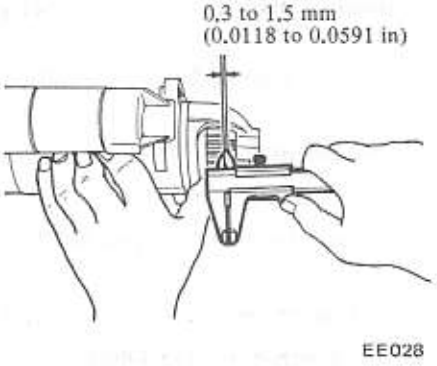


Fig. EE-32 Measuring gap "ℓ"

SERVICE DATA AND SPECIFICATIONS

SERVICE DATA

Model		S114-122N	S114-182
Armature shaft diameter (pinion side)	mm (in)	12.950 to 12.968 (0.5098 to 0.5111)	12.450 to 12.468 (0.4902 to 0.4911)
Armature shaft diameter (rear end)	mm (in)	11.450 to 11.468 (0.4511 to 0.4515)	12.450 to 12.468 (0.4902 to 0.4911)
Amendment limit of shaft diameter	mm (in)	0.10 (0.0039)	0.10 (0.0039)
Amendment limit of shaft bent	mm (in)	0.08 (0.0031)	0.08 (0.0031)
Clearance between shaft and bushing	mm (in)	0.03 to 0.10 (0.0019 to 0.0039)	0.03 to 0.10 (0.0019 to 0.0039)
Amendment limit of dittoed clearance	mm (in)	0.20 (0.0079)	0.20 (0.0079)
Outer diameter of commutator	mm (in)	35.0 (1.378)	40.0 (1.575)
Wear limit of commutator diameter	mm (in)	1.0 (0.39)	1.0 (0.39)
Brush length	mm (in)	18.5 (0.728)	16.0 (0.631)
Wear limit of dittoed length	mm (in)	6.0 (0.24)	4.0 (0.16)
(remaining brush should be more than)	mm (in)	12.5 (0.492)	12.0 (0.472)
Brush spring tension	kg (lb)	1.6 (3.5)	1.6 (3.5)
Front bracket metal inner diameter	mm (in)	13.000 to 13.018 (0.5118 to 0.5125)	12.500 to 12.527 (0.4921 to 0.4932)
Rear cover metal inner-diameter	mm (in)	11.500 to 11.521 (0.4528 to 0.4536)	12.500 to 12.521 (0.4921 to 0.4930)
Center bearing metal inner diameter	mm (in)	17.650 to 17.675 (0.6949 to 0.6959)	17.650 to 17.675 (0.6949 to 0.6959)

SPECIFICATIONS

Type		HITACHI S114-122N (For manual transmission)	HITACHI S114-182 (For automatic transmission)
Voltage	V	12	12
Output	KW	1.0	1.2
Starting current (Voltage)	A (V)	Less than 460 (6)	Less than 500 (5)
No load current (Voltage)	A (V)	Less than 60 (12)	Less than 60 (12)
No load starter revolution	rpm	More than 5,000	More than 6,000
Shift type of pinion gear		Magnetic shift	Magnetic shift
Number of teeth on pinion gear		9	9
Number of teeth on ring gear		120	120

TROUBLE DIAGNOSES AND CORRECTIONS

Condition	Probable cause	Corrective action
Starting motor will not operate.	Discharged battery.	Charge or replace battery.
	Defective solenoid switch.	Repair or replace solenoid switch.
	Loose terminal connections.	Clean and tighten terminal.
	Faulty brushes.	Replace brushes.
	Faulty starting motor.	Remove starting motor and test.
Noisy starting motor.	Loose securing bolt.	Tighten bolt.
	Worn pinion gear.	Replace pinion gear.
	Poor lubrication.	Add oil.
	Worn commutator.	Disassemble motor.
	Worn brushes.	Replace brushes.
Starting motor cranks slowly.	Discharged battery.	Charge or replace battery.
	Loose connection of terminal.	Clean and tighten terminal.
	Worn brushes.	Replace brushes.
	Locked brushes.	Inspect brush spring tension or repair brush holder.
Starting motor cranks slowly.	Dirty worn commutator.	Clean and repair.
	Armature rubs field coil.	Replace assembly.
	Faulty solenoid switch.	Repair or replace switch.
Starting motor operates but does not crank engine.	Worn pinion	Replace pinion.
	Locked pinion guide.	Repair pinion guide.
	Worn ring gear.	Replace ring gear.
Starting motor will not disengage even when ignition switch is turned off.	Faulty solenoid switch.	Repair or replace solenoid switch.
	Damaged gear teeth.	Replace damaged gear.

CHARGING CIRCUIT

The charging circuit consists of the battery, alternator, regulator and necessary wiring to connect these parts. The purpose of this system is to convert mechanical energy from the engine into electrical energy which is used to operate all electrically operated units and to keep the battery fully charged.

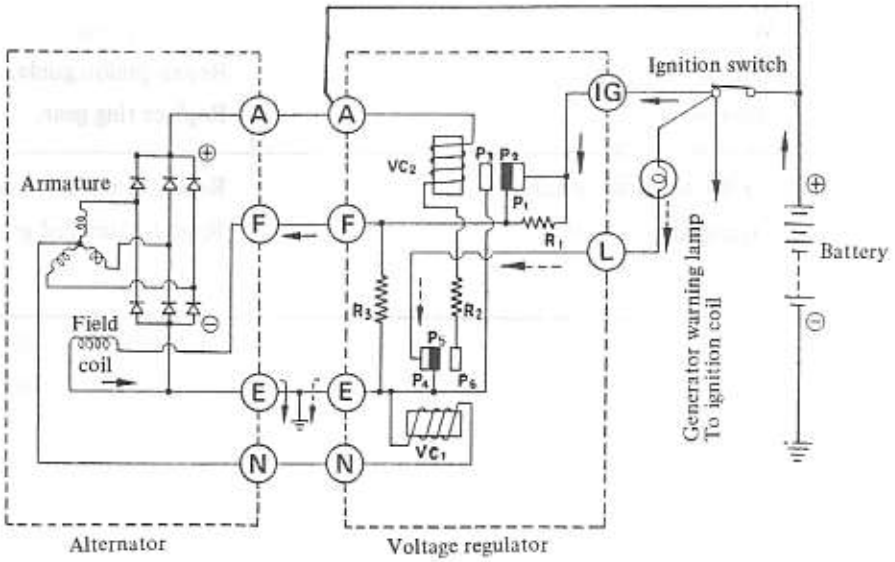
When the ignition switch is set to "ON," current flows from the battery to ground through the ignition switch, voltage regulator IG terminal, primary side contact point "P1," movable contact point "P2," voltage regulator "F" terminal, alternator "F" terminal, field coil and alternator "E" terminal, as shown in Figure EE-33 by full line arrow marks. Then the rotor in the alternator is excited. On the other hand, current flows from the battery to ground through the ignition switch, warning lamp, voltage regulator "L" terminal, lamp side contact point "P4," movable contact point "P5," and voltage regulator "E" terminal, as shown by dotted line arrow marks. Then, the warning lamp lights.

When the alternator begins to operate, three-phase alternating current is induced in the stator coil. This alternating current is rectified by the positive and negative silicon diodes. The rectified direct current output reaches the alternator "A" and "E" terminals.

On the other hand, the neutral point voltage reaches "N" and "E" terminals (nearly a half of the output voltage), and current flows from voltage regulator "N" terminal to "E" terminal or ground through the coil "VC1" as shown in Figure EE-34 by the dotted line arrow marks. Then, the coil "VC1" is excited, and the movable contact point "P5" comes into contact with voltage winding side contact point "P6." This action turns off the warning lamp and completes the voltage winding circuit, as shown by the full line arrow marks.

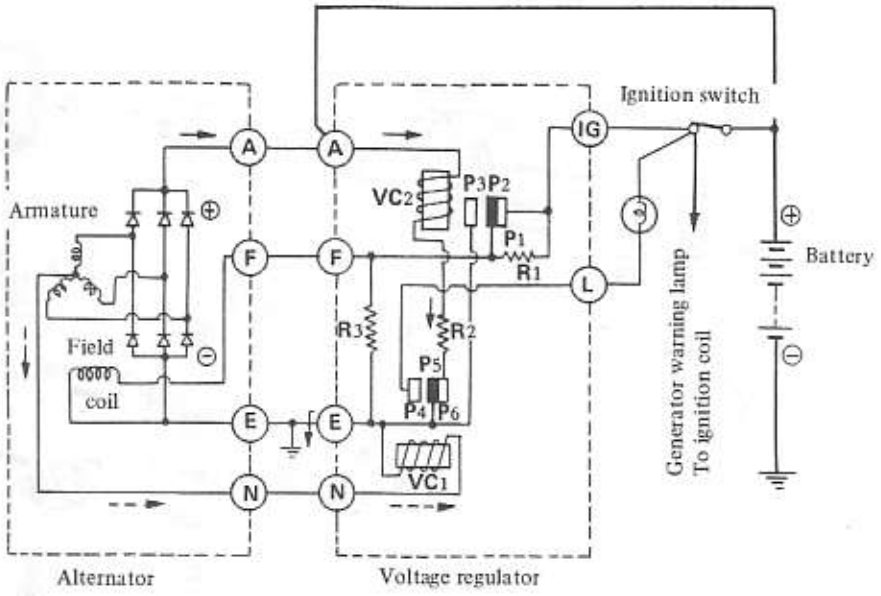
When the alternator speed is increased or the voltage starts to rise excessively, the movable contact point "P2" is separated from the primary side contact "P1" by the magnetic force of coil "VC2." Therefore, register "R1" is applied into the rotor circuit and output voltage is decreased. As the output voltage is decreased, the movable contact point "P2" and primary side contact "P1" comes into contact once again, and the alternator voltage increases. Thus, the rapid vibration of the movable contact point "P2," maintains an alternator output voltage contact.

When the alternator speed is further increased or the voltage starts to rise excessively, the movable contact point "P2" comes into contact with secondary side contact point "P3." Then, the rotor current is shut off and alternator output voltage is decreased immediately. This action separates movable contact "P2" from secondary contact "P3." Thus, the rapid vibration of the movable contact point "P2" or breaking and completing the rotor circuit maintains constant alternator output voltage.



EE029

Fig. EE-33 Charging circuit (I)



EE030

Fig. EE-34 Charging circuit (II)

ALTERNATOR

CONTENTS

DESCRIPTION

Alternator model	Applied engine
LT150-10	L20A, L24, L26
LT160-20 (Option)	

In the alternator, a magnetic field is produced by the rotor which consists of alternator shaft, field coil, pole pieces, and slip rings. The slip rings pressed in the shaft conduct only a small field current. Output current is generated in the armature coils located in the stator. The stator has three windings and generates three-phase alternating current. Silicon diodes act like a one-way valve for electricity so that charging current passes easily but reverse current is shut out.

In model LT150-10 pack type silicon diodes are used.

Six diodes (three negatives and three positives), are installed in positive and negative plates as an assembly.

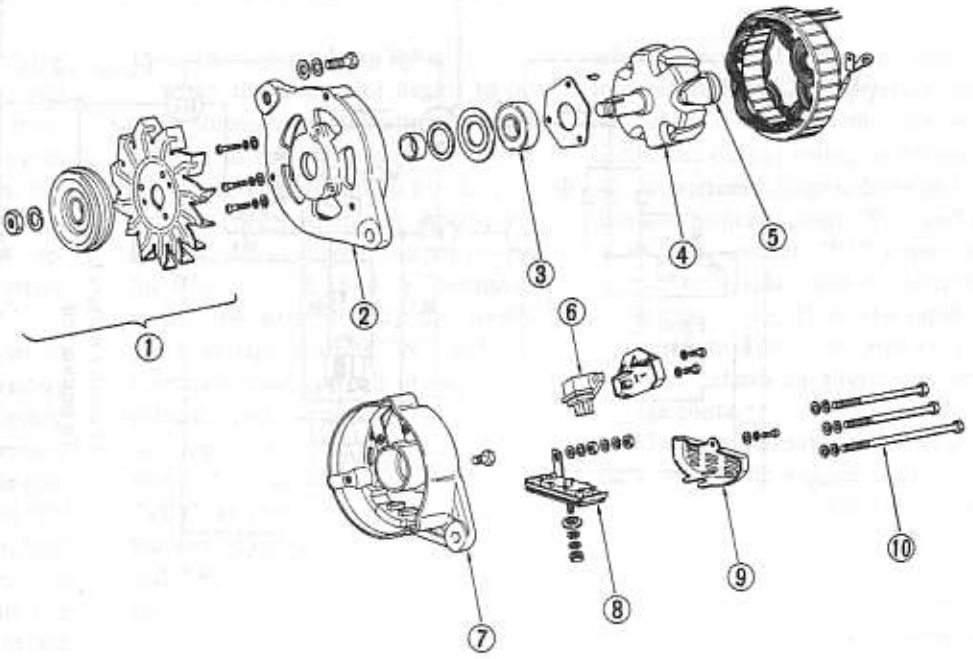
These diodes are direct-soldered at their tips, and constructed with positive and negative conjunction.

They are mounted on the two plates which combine the function of heat-dissipating plate and positive/negative terminals and are light in weight and easy to service.

In model LT160-20, conventional type diodes are used.

Three of each diodes (three negatives and three positives) are installed in positive and negative side rear cover.

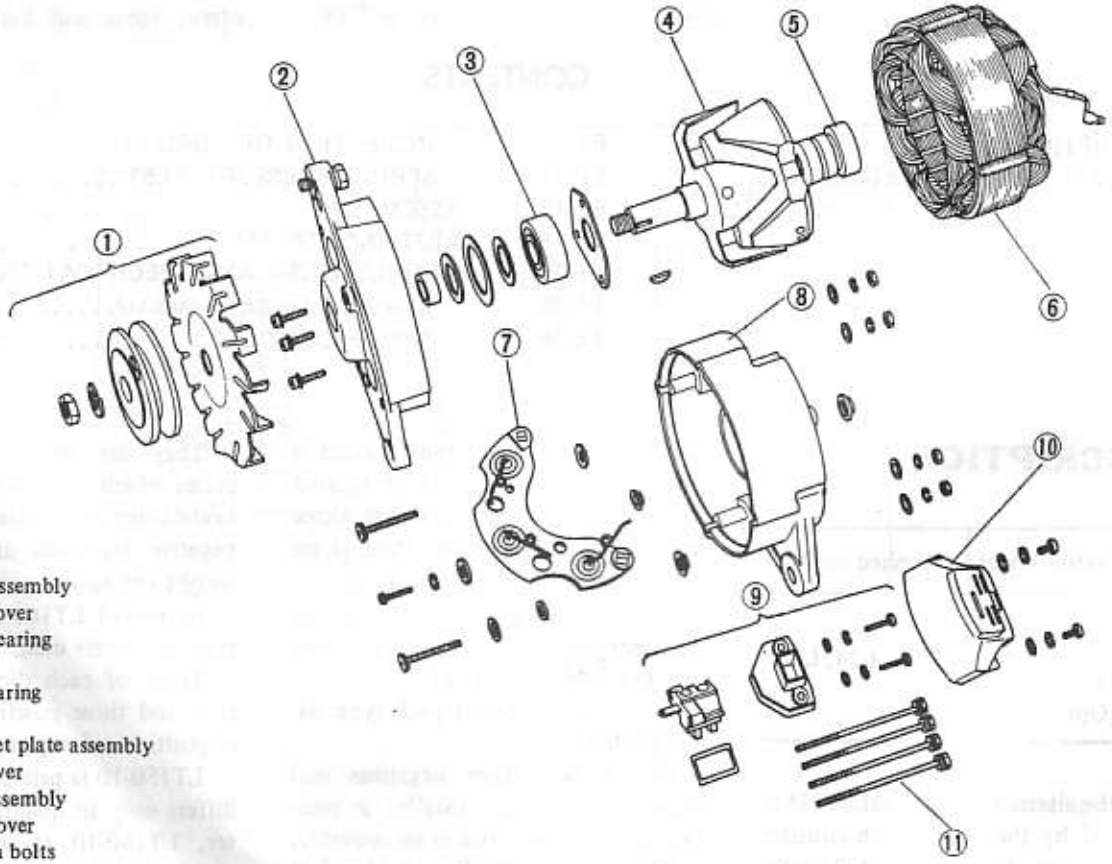
LT150-10 is primarily the same but differs only in quantity. In this chapter, LT150-10 is described as the standard and other explanations are added when the other models differ from it in instruction procedure.



1 Pulley assembly
2 Front cover
3 Front bearing
4 Rotor
5 Rear bearing
6 Brush assembly
7 Rear cover
8 Diode (set plate) assembly
9 Diode cover
10 Through bolts

EE155

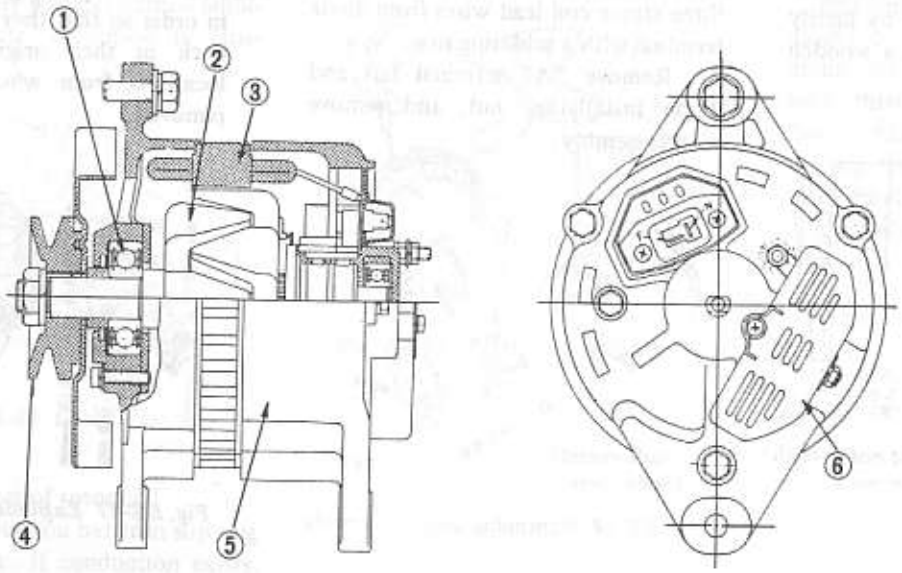
Fig. EE-35 Exploded view of LT150-10



1 Pulley assembly
2 Front cover
3 Front bearing
4 Rotor
5 Rear bearing
6 Stator
7 Diode set plate assembly
8 Rear cover
9 Brush assembly
10 Diode cover
11 Through bolts

EE120

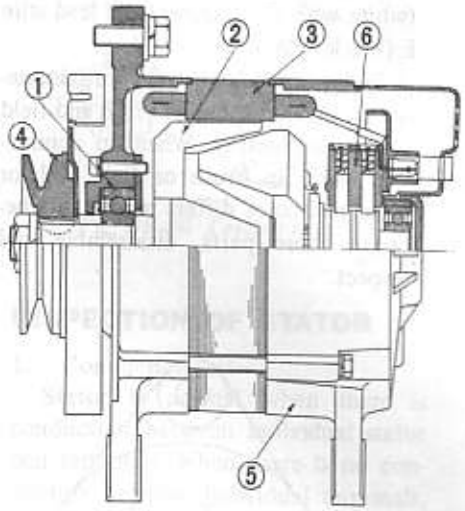
Fig. EE-36 Exploded view of LT160-20



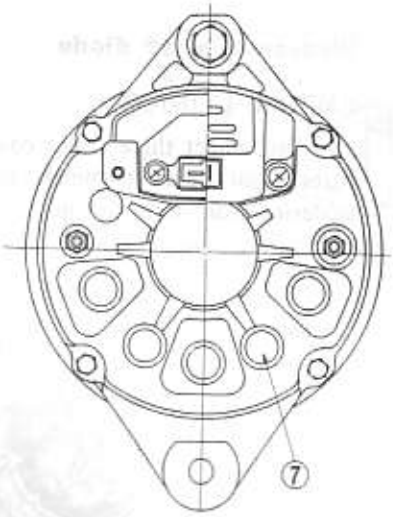
1 Front bearing
2 Rotor
3 Stator
4 Pulley
5 Rear cover
6 Encased diode

EE032

Fig. EE-37 Sectional view of LT150-10



1 Front bearing
2 Rotor
3 Stator
4 Pulley



5 Rear cover
6 Brush holder assembly
7 Diode

EE121

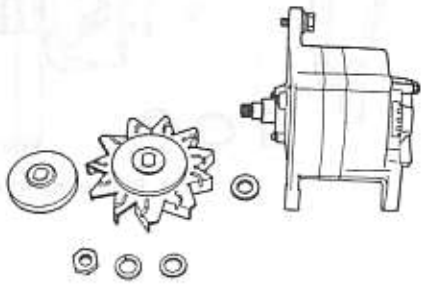
Fig. EE-38 Sectional view of LT160-20

REMOVAL AND INSTALLATION

1. Disconnect negative battery terminal.
2. Disconnect two lead wires and connector from alternator.
3. Loosen adjusting bolt.
4. Remove alternator drive belt.
5. Remove parts associated with alternator from engine.
6. Remove alternator from vehicle.
7. Install alternator in reverse order of removal.

DISASSEMBLY

1. Remove pulley nut, pulley rim, fan and spacer.

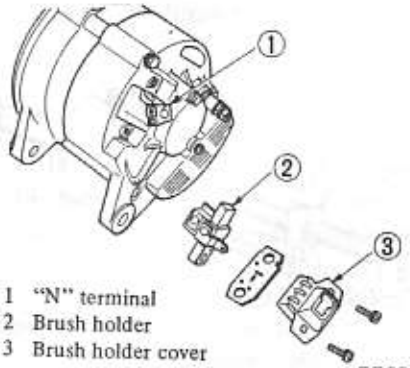


EE033

Fig. EE-39 Removing pulley and fan

2. Remove brush holder fixing screws, and remove brush holder cover. Remove brush holder forward, and remove brushes together with brush holder.

Note: Do not disconnect "N" terminal from stator coil lead wire.



1 "N" terminal
2 Brush holder
3 Brush holder cover

EE034

Fig. EE-40 Removing brush

3. Loosen and remove through bolts. Separate front cover with rotor from rear cover with stator by lightly tapping front bracket with a wooden mallet.

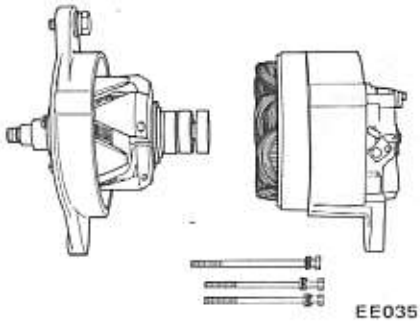


Fig. EE-41 Separating front cover with rotor from rear cover

4. Remove three set screws from bearing retainer, and separate rotor from front cover.

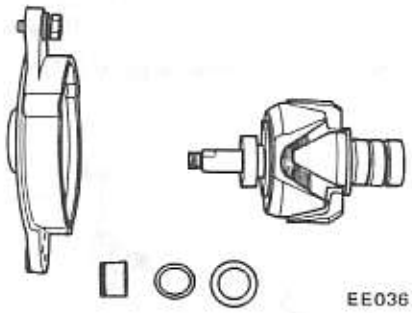
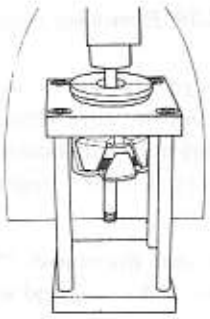


Fig. EE-42 Removing rotor

5. Pull out rear bearing from rotor assembly with a press or bearing puller.



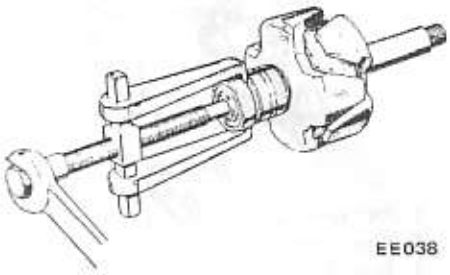
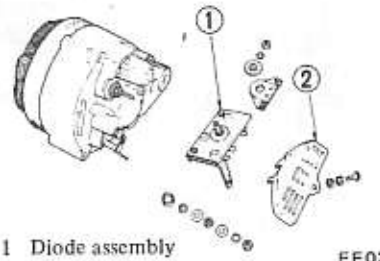


Fig. EE-43 Pulling out rear bearing

6. Remove diode cover fixing screw, and remove diode cover. Disconnect three stator coil lead wires from diode terminal with a soldering iron.

7. Remove "A" terminal nut and diode installation nut, and remove diode assembly.



1 Diode assembly
2 Diode cover

Fig. EE-44 Removing diode assembly

Note: Use care in handling diode assembly to prevent an undue stress on it.

Disassembly of diode

≪MODEL LT160-20≫

1. Disconnect three stator coil lead wires from diode terminals with a soldering iron. It is also necessary to disconnect jumper wires between diodes.

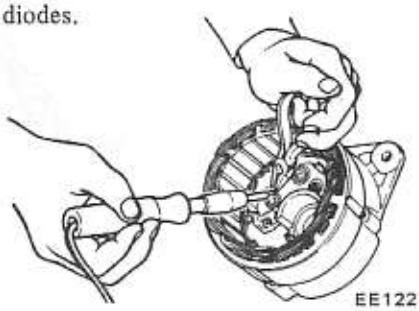


Fig. EE-45 Removing soldered connection of stator coil and diode

2. Pull stator coils out of rear cover.

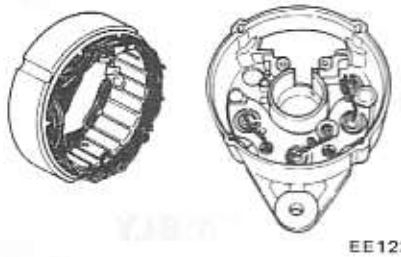


Fig. EE-46 Separating stator coil from rear cover

3. Remove diode from rear cover.

Caution: Place packings and insulators in order so that they can be placed back in their original places or locations from which they were removed.

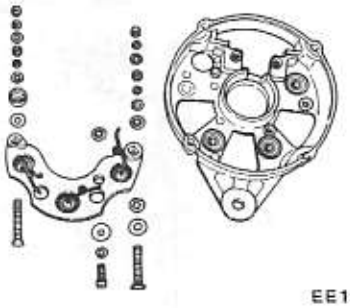


Fig. EE-47 Exploded view of diode

INSPECTION AND REPAIR

Remove alternator from vehicle and apply tester between lead wire F (white with black tracer) and lead wire E (black color).

When the resistance is approximately 5Ω, the condition of brush and field coil is satisfactory. When no conduction exists in brush or field coil, or when resistance differs remarkably between those parts, disassemble and inspect.

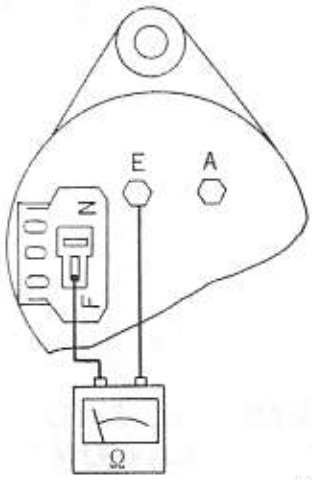


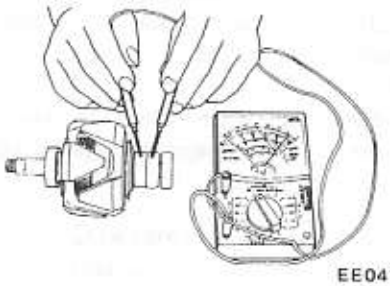
Fig. EE-48 Inspecting alternator

ROTOR INSPECTION

1. Conduction test of rotor coil

Apply tester between slip rings of rotor as shown in Figure EE-49. If

there is no conduction, discontinuity of field coil may exist. When resistance is approximately 4.4Ω at normal ambient temperature, condition is satisfactory.

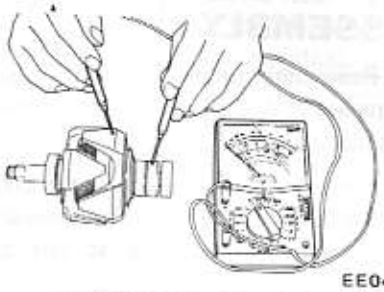


EE041

Fig. EE-49 Conduction test of rotor coil

2. Ground test of rotor coil

Check conduction between slip ring and rotor core. If conduction exists, replace rotor assembly, because field coil or slip ring may be grounded.



EE042

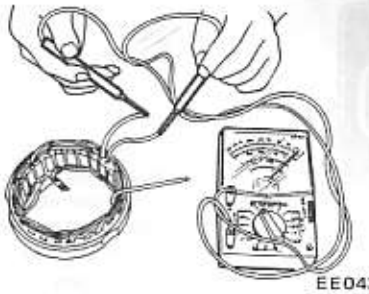
Fig. EE-50 Testing rotor coil for ground

INSPECTION OF STATOR

1. Conduction test

Stator is normal when there is conduction between individual stator coil terminals. When there is no conduction between individual terminals, cable is broken.

Replace with stator assembly.



EE043

Fig. EE-51 Testing stator for conduction

2. Ground test

If each lead wire of armature coil (including neutral wire) is not conductive with stator core, condition is satisfactory. If there is conduction, stator coil is grounded.

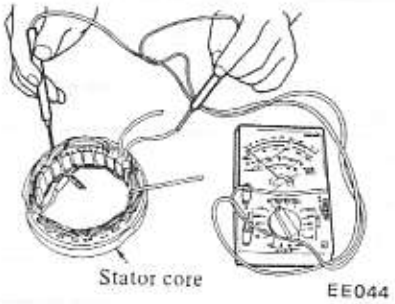


Fig. EE-52 Testing stator for ground

INSPECTION OF DIODE

Perform a conduction test on diodes in both directions, using an ohmmeter. A total of six diodes are used; three are mounted on the positive ⊕ plate, and other three are on the negative ⊖ plate. The conduction test should be performed on each diode, between the terminal and plate.

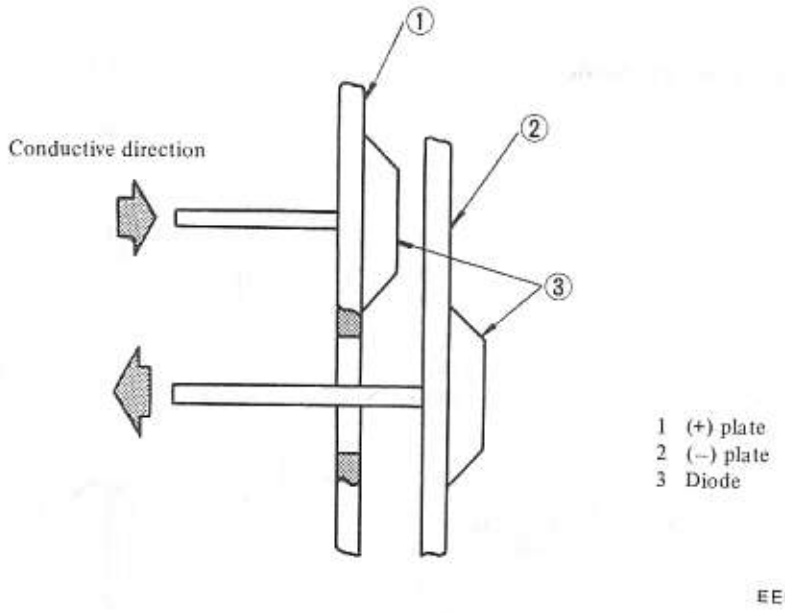


Fig. EE-53 Conduction direction of diode

Diode installed on ⊕ plate is a positive diode which allows current flowing from terminal to ⊕ plate only. In other words, current does not flow from ⊕ plate to terminal.

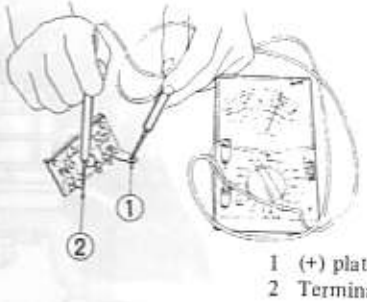


Fig. EE-54 Inspecting positive diode

Diode installed on ⊖ plate is a negative diode which allows current flowing from ⊖ plate to terminal only. In other words, current does not flow from terminal to ⊖ plate.

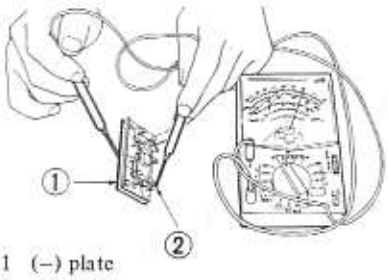


Fig. EE-55 Inspecting negative diode

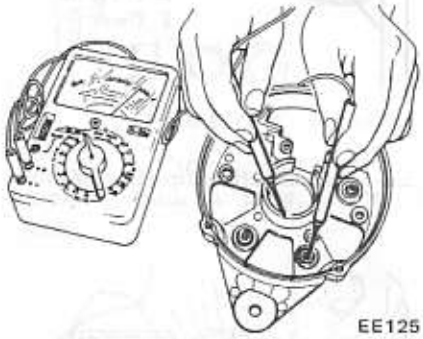
If current flows toward both positive and negative directions, diode is short-circuited. If current flows in the same direction only, diode is in good condition. If there is a defective diode, replace all diodes (six diodes) as an assembly. (See below table.) These diodes are unserviceable.

Test probe of a circuit tester		Conduction
⊖	⊕	
terminal	⊕ plate	O
⊕ plate	terminal	–
terminal	⊖ plate	–
⊖ plate	terminal	O
⊖ plate	⊕ plate	O
⊕ plate	⊖ plate	–

Inspection of diode

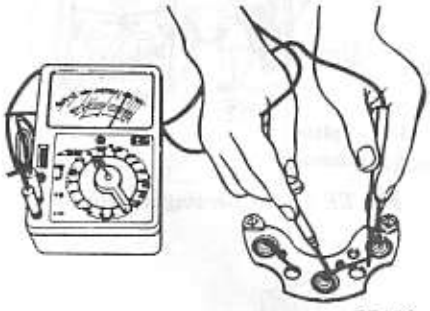
≪MODEL LT160-20≫

Use a tester to check diodes. Three diodes are placed between aluminum plate and rear cover. Testing consists of checking conduction between diode terminal and aluminum plate, and between diode terminal and rear cover. Measurements should then be evaluated as per the instructions given under LT150-10.



EE125

Fig. EE-56 Conduction test of diode (I)



EE126

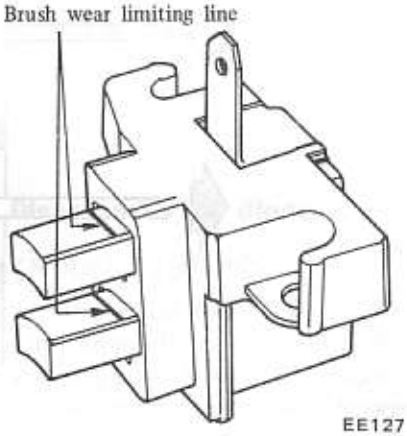
Fig. EE-57 Conduction test of diode (II)

INSPECTION OF BRUSH

Check movement of brush and if movement is unsmooth, check brush holder and clean it.

Check brush for wear. If it is worn down to less than the specified limit, replace brush assembly.

Check brush pig tail and, if found defective, replace.



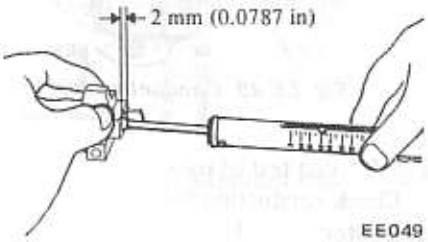
EE127

Fig. EE-58 Brush wear limit

SPRING PRESSURE TEST

With brush projected approximately 2 mm (0.0787 in) from brush holder, measure brush spring pressure by the use of a spring balance. Normally, the rated pressure of a new brush spring is 255 to 345 g (9.0 to 12.2 oz).

Moreover, when brush is worn, pressure decreases approximately 20 g (0.7 oz) per 1 mm (0.0394 in) wear.



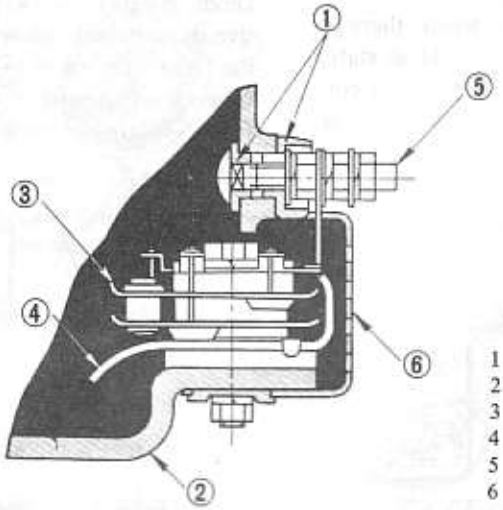
EE049

Fig. EE-59 Measuring spring pressure

ASSEMBLY

Reassemble alternator in the reverse sequence of disassembly noting following matters:

1. When soldering each stator coil lead wire to diode assembly terminal, carry out the operation as fast as possible.
2. When installing diode "A" terminal, install insulating bush and insulating tube correctly.

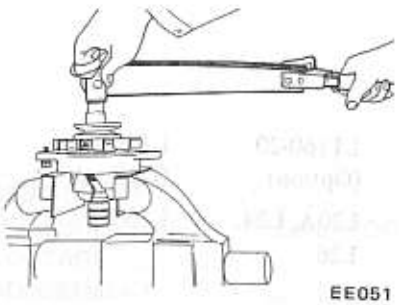


1 Insulating bush
2 Rear cover
3 Diode assembly
4 Stator coil lead wire
5 A terminal bolt
6 Diode cover

EE161

Fig. EE-60 Sectional view of diode and "A" terminal

3. Tighten pulley nut with tightening torque of 350 to 400 kg-cm (301 to 344 in-lb). When pulley is tightened, make sure that deflection of V-groove is less than 0.3 mm (0.0118 in).



EE051

Fig. EE-61 Tightening pulley nut

ALTERNATOR TEST

Before conducting an alternator test, make sure that the battery is fully charged.

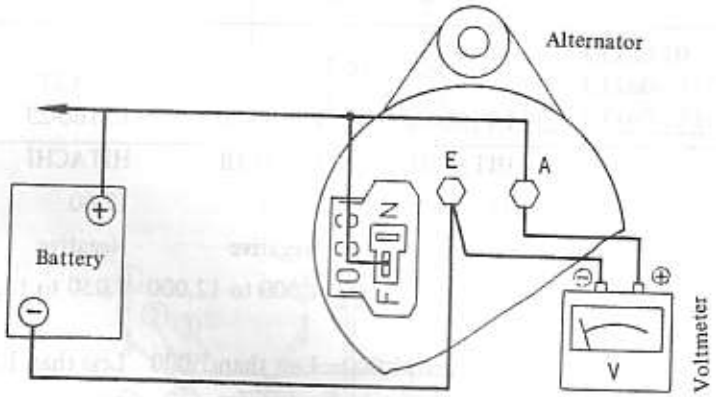
To conduct a test, it is necessary to use a 30-volt voltmeter and suitable test probes.

Set up a test circuit as shown in Figure EE-62 and test alternator in the manner indicated in the flow chart below:

1. Disconnect connectors at alternator.
2. Connect one test probe from voltmeter positive terminal to "N" terminal or "BAT" terminal. Connect the other test probe to ground. Make sure that voltmeter registers battery voltage.
3. Turn on headlights and switch to Main Beam.
4. Start engine.
5. Increase engine speed gradually until it is approximately 1,100 rpm, and take the voltmeter reading.

Measured value: Below 12.5 volts
Alternator is defective. Remove and check it for condition.

Measured value: Over 12.5 volts
Alternator is in good condition.



EE052

Fig. EE-62 Testing alternator

Notes:

a. **Do not run engine at more than 1,100 rpm while test is being conducted on alternator.**

b. **Do not race engine.**

SERVICE DATA AND SPECIFICATIONS

SERVICE DATA

Model		LT150-10	LT160-20 (Option)	LT160-23 (Option)
Applied engine		L20A, L24, L26, L26(T)	L20A, L24, L26	L26(T)
Starter coil				
Resistance per a phase [at 20°C (68°F)]	Ω	0.17	0.052	0.052
Rotor coil				
Resistance [at 20°C (68°F)]	Ω	4.4	3.96	3.97
Brush				
Brush length	mm (in)	14.5 (0.571)	14.5 (0.571)	14.5 (0.571)
Wear limit	mm (in)	7 (0.2756)	7 (0.2756)	7 (0.2756)
Spring pressure	kg (lb)	0.25 to 0.35 (0.55 to 0.77)	0.25 to 0.35 (0.55 to 0.77)	0.25 to 0.35 (0.55 to 0.77)
Slip ring				
Outer diameter	mm (in)	31 (1.220)	31 (1.220)	31 (1.220)
Reduction limit	mm (in)	1 (0.0394)	1 (0.0394)	1 (0.0394)
Repair accuracy	mm (in)	0.05 (0.0197)	0.05 (0.0197)	0.05 (0.0197)

SPECIFICATIONS

Model		LT150-10	LT160-20	LT160-23
Maker		HITACHI	HITACHI	HITACHI
Nominal rating	V-A	12-50	12-60	12-60
Grohnd porality		Negative	Negative	Negative
Revolution	rpm	1,000 to 13,500	1,000 to 12,000	1,050 to 13,500
Minimum revolution				
Under no load	rpm	Less than 1,000	Less than 1,000	Less than 1,000
Output current		37.5A (14V, 2,500 rpm)	45A (14V, 2,500 rpm)	45A (14V, 2,500 rpm)
Pulley ratio		2.09	2.09	2.09

REGULATOR

CONTENTS

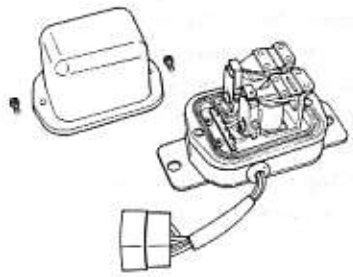
DESCRIPTION

The regulator consists basically of a voltage regulator and a charge relay. The voltage regulator has two sets of contact points, a lower set and upper set, to control alternator voltage. An armature plate placed between the two sets of contacts, moves upward or downward or vibrates. The lower contacts, when closed, complete the field circuit direct to ground; and the upper contacts, when closed, complete the field circuit to ground through a resistance (field coil), and produces alternator output.

The charge relay is similar in construction to the voltage regulator.

When the upper contacts are closed, ignition warning lamp goes on.

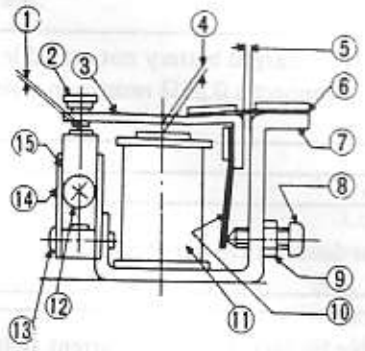
Regulator model	Applied engine	Applied alternator
TL1Z-57	L20A, L24, L26, L26(T)	LT150-10 LT160-20 (Option) LT160-23 (Option)



EE145

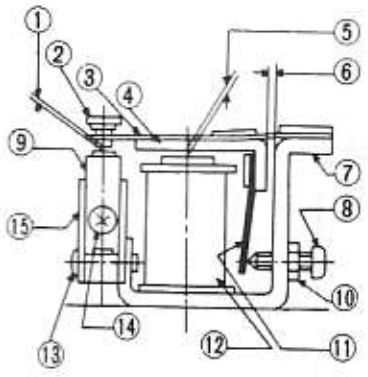
Fig. EE-63 View of removing cover

As for construction, the voltage regulator is very similar to the charge relay as shown in Figure EE-64.



1 Point gap
2 Lower contact
3 Armature
4 Core gap
5 Yoke gap
6 Connecting spring
7 Yoke
8 Adjusting screw
9 Lock nut
10 Adjust spring
11 Coil
12 3 mm (0.1181 in) dia. screw
13 4 mm (0.1575 in) dia. screw
14 Contact set
15 Upper contact

(a) Construction of voltage regulator



1 Point gap
2 Charge relay contact
3 Connecting spring
4 Armature
5 Core gap
6 Yoke gap
7 Yoke
8 Adjusting screw
9 Voltage regulator contact
10 Lock nut
11 Adjust spring
12 Coil
13 3 mm (0.1181 in) dia. screw
14 4 mm (0.1575 in) dia. screw
15 Contact set

EE054

(b) Construction of charge relay

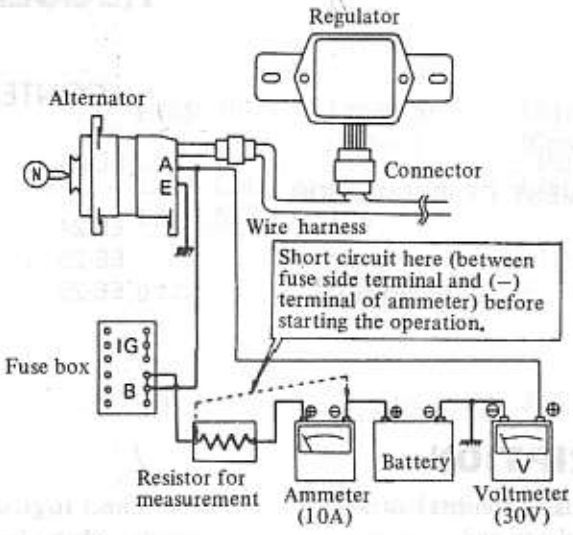
Fig. EE-64 Structural view of relay

MEASUREMENT OF REGULATOR VOLTAGE

Regulator voltage is measured with regulator assembled with alternator. When measuring voltage with regulator mounted on vehicle, it is necessary to rotate engine at high speed.

Connect DC voltmeter (15-30V), DC ammeter (15-30A), battery and resistor (0.25Ω) with cables as shown.

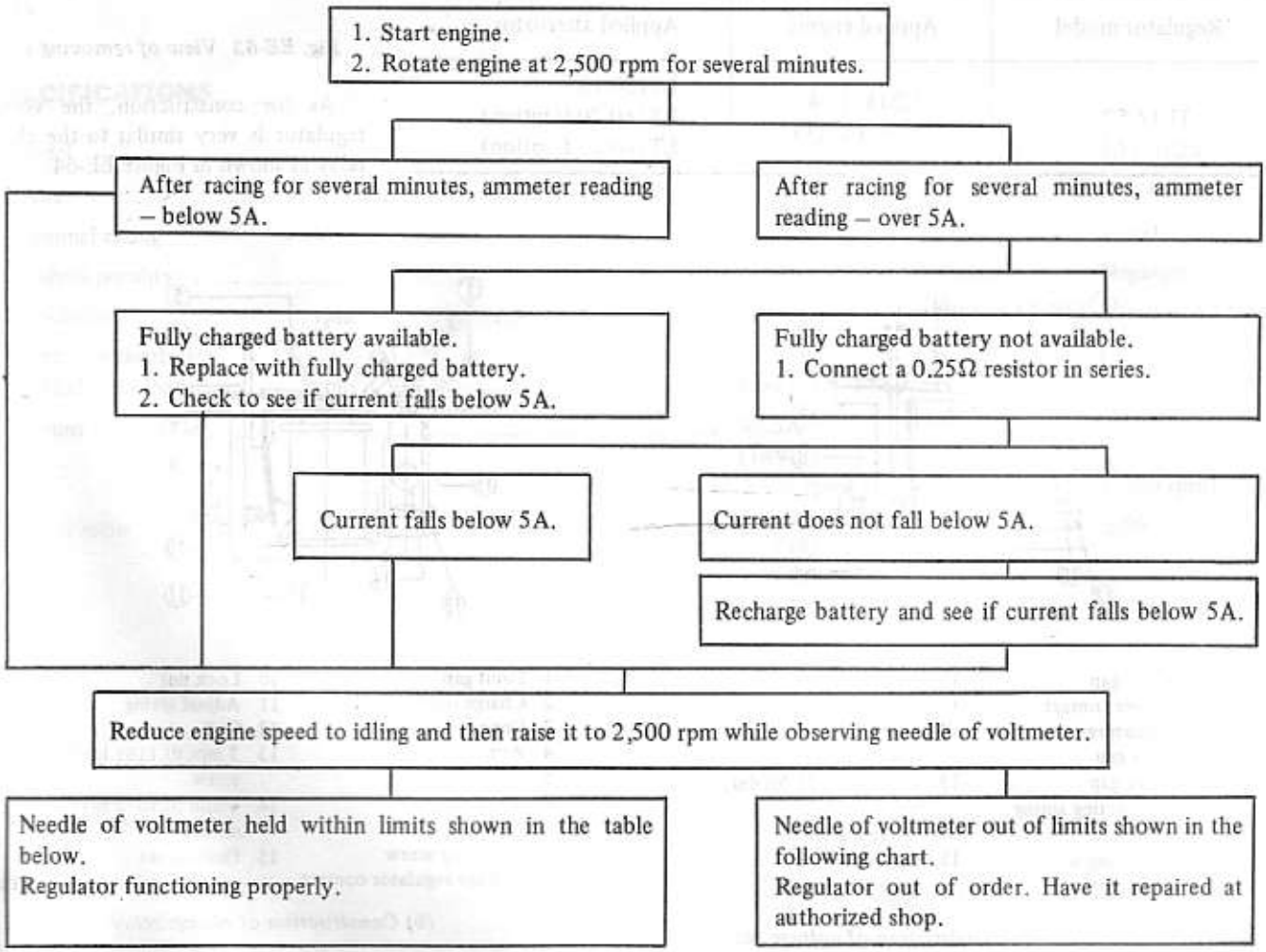
1. Check to be sure that all electrical loads such as lamps, air conditioner, radio, etc. are disconnected.
2. Before starting engine, be sure to make short circuit with a cable between fuse side terminal of resistor (0.25Ω) and negative side terminal of ammeter. Failure to follow this caution causes needle of ammeter to swing violently and reversely, resulting in a damaged ammeter.



EE055

Fig. EE-65 Measuring regulator voltage with regulator on vehicle

3. Refer to the following chart to determine if regulator and relative parts are in good condition:



Regulator model TL1Z-57 (HITACHI)

Temperature °C (°F)	Voltage V
−10 (14)	14.75 to 15.25
0 (32)	14.60 to 15.10
10 (50)	14.45 to 14.95
20 (68)	14.30 to 14.80
30 (86)	14.15 to 14.65
40 (104)	14.00 to 14.50

Notes:

a. Do not measure voltage immediately after driving. Do this while regulator is cold.
b. To measure voltage, raise engine speed gradually from idling to rated speed.
c. Voltage may be approximately 0.3V higher than the rated for two to three minutes after engine is started, or more specifically, when regulator becomes self-heated. Measurements should then be made within one minute after starting engine, or when regulator is cold.
d. The regulator is of a temperature-compensating type. Before measuring voltage, be sure to measure surrounding temperature and correct measurements according to the table on the left.

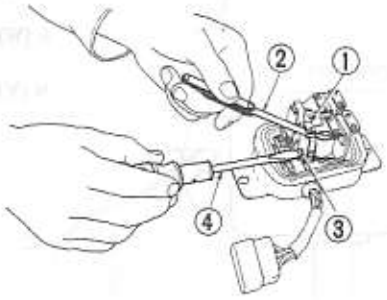
ADJUSTMENT

VOLTAGE REGULATOR

As the result of above measurement, when regulating voltage deviates from rated value, adjust regulator in accordance with the following instructions.

1. Inspect contact surface, and if rough, lightly polish surface with fine emery paper (#500 or 600).
2. Measure each gap, and adjust if necessary. Adjust core gap and point gap in that order. No adjustment is required for yoke gap.
3. Adjusting core gap

Loosen screw [4 mm (0.1575 in) diameter] which is used to secure contact set on yoke, and move contact upward or downward properly. See Figure EE-66.

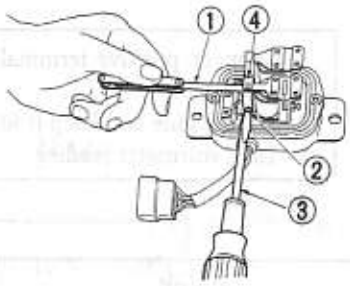


1 Contact set
2 Thickness gauge
3 4 mm (0.1575 in) dia. screw
4 Crosshead screwdriver EE056

Fig. EE-66 Adjusting core gap

4. Adjusting point gap

Loosen screw [3 mm (0.1181 in) diameter] used to secure upper contact, and move upper contact upward or downward adequately. See Figure EE-67.



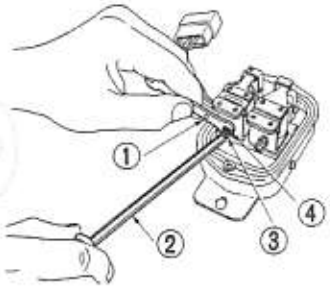
1 Thickness gauge
2 3 mm (0.1181 in) dia. screw
3 Crosshead screwdriver
4 Upper contact EE057

Fig. EE-67 Adjusting point gap

5. Adjusting voltage

Adjust regulating voltage as follows:

Loosen lock nut securing adjusting screw. Turn this screw clockwise to increase, or counterclockwise to decrease, regulating voltage. See Figure EE-68.



1 Wrench
2 Crosshead screwdriver
3 Adjusting screw
4 Lock nut EE058

Fig. EE-68 Adjusting regulating voltage

CHARGING RELAY

Normal relay operating voltage is 8 to 10V as measured at alternator "A" terminal. Relay itself, however, operates at 4 to 5V.

Use a DC voltmeter, and set up a circuit as shown in Figure EE-69.

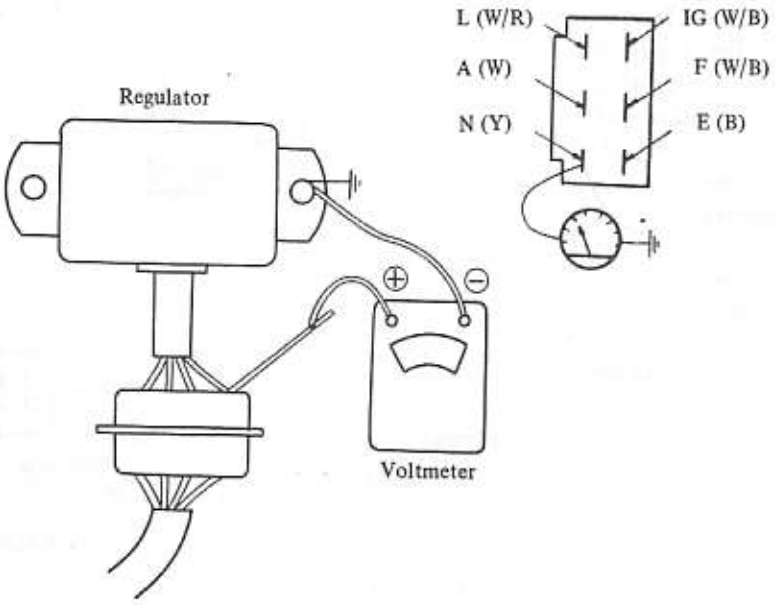
1. Connect positive terminal of voltmeter to regulator lead connector "N" terminal with negative terminal grounded.
2. Start engine and keep it idle.
3. Take voltmeter reading.

0 Volt
1. Check for continuity between "N" terminals of regulator and alternator.
2. Alternator circuit defective if continuity exists.

Below 5.2 Volts
(Pilot lamp remains lit.)
1. Check fan belt tension.
2. If correct, remove regulator and adjust as necessary.

Over 5.2 Volts
(Pilot lamp remains lit.)
Pilot lamp relay coil or contact points out of order.
Replace regulator.

Over 5.2 Volts
(Pilot lamp does not light.)
Pilot lamp relay assembly is in good condition.



EE059

Fig. EE-69 Testing charging relay

SERVICE DATA AND SPECIFICATIONS

Voltage regulator		
Model		TL1Z-57
Regulating voltage (with fully charged battery)	V	*14.3 to 15.3 [at 20°C (68°F)]
Voltage coil resistance	Ω	10.5 [at 20°C (68°F)]
Rotor coil inserting resistance	Ω	10
Voltage coil series resistance	Ω	31
Smoothing resistance	Ω	40
Core gap	mm (in)	0.6 to 1.0 (0.0236 to 0.0394)
Point gap	mm (in)	0.3 to 0.4 (0.0118 to 0.0157)
Charge relay		
Release voltage	V	4.2 to 5.2 at "N" terminal
Voltage coil resistance	Ω	37.8 [at 20°C (68°F)]
Core gap	mm (in)	0.8 to 1.0 (0.0315 to 0.0394)
Point gap	mm (in)	0.4 to 0.6 (0.0157 to 0.0236)

*Standard temperature gradient: −0.015V/°C

TROUBLE DIAGNOSES AND CORRECTIONS (Including alternator)

Condition	Probable cause	Corrective action
No output	Sticking brushes.	Correct or replace brushes and brush springs.
	Dirty brushes and slip rings.	Clean.
	Loose connections or broken leads.	Retighten or solder connections. Replace leads if necessary.
	Open stator winding.	Repair or replace stator.
	Open rotor winding.	Replace rotor.
	Open diodes.	Replace diodes.
	Shorted rotot.	Replace rotor.
	Shorted stator.	Repair or replace stator.
	Grounded "BAT" terminal.	Replace insulator.
	Broken fan belt.	Replace belt.
Excessive output	Broken neutral wire (color of wire is white.)	Replace wire.
	Faulty voltage regulator.	Check regulator operation and repair or replace as required.
	Poor grounding of alternator and voltage regulator "E" terminal.	Retighten terminal connection.
	Broken ground wire (color or wire is black.).	Replace wire.
Low output	Loose or worn fan belt.	Retighten or replace belt.
	Sticking brushes.	Correct or replace brushes and springs if necessary.
	Low brush spring tension.	Replace brush springs.
	Defective voltage regulator.	Check regulator operation and repair or replace as required.
	Dirty slip rings.	Clean.
	Partial short, ground, or open in stator winding.	Replace stator.
	Partially shorted or grounded rotor winding.	Replace rotor.
	Open or defective diode.	Replace diode.
Noisy alternator	Loose mounting.	Retighten mounting bolts.
	Loose drive pulley.	Retighten pulley correctly.
	Faulty ball bearing.	Replace bearing.
	Improperly seated brushes.	Seat brushes correctly.

IGNITION CIRCUIT

The ignition circuit consists of the ignition switch, coil, distributor, wiring, spark plugs and battery.

The circuit is equipped with a resistor. During cranking, electrical current bypasses the resistor, thereby connecting the ignition coil directly to battery. This provides full battery voltage available at coil and keeps ignition voltage as high as possible.

Low voltage current is supplied by the battery or alternator and flows through the primary circuit. It consists of the ignition switch, resistor, primary winding of the ignition coil, distributor contact points, condenser and all connecting low tension wiring.

High voltage current is produced by the ignition coil and flows through the secondary circuit, resulting in high voltage spark between the electrodes of the spark plugs in engine cylinders. This circuit contains the secondary winding of the ignition coil, coil to distributor high tension cables, distributor rotor and cap.

When the ignition switch is turned on and the distributor contact points are closed, the primary current flows through the primary winding of the coil and through the contact points to ground. This flowing produces a magnetic field around the coil winding and then electrical energy in the coil.

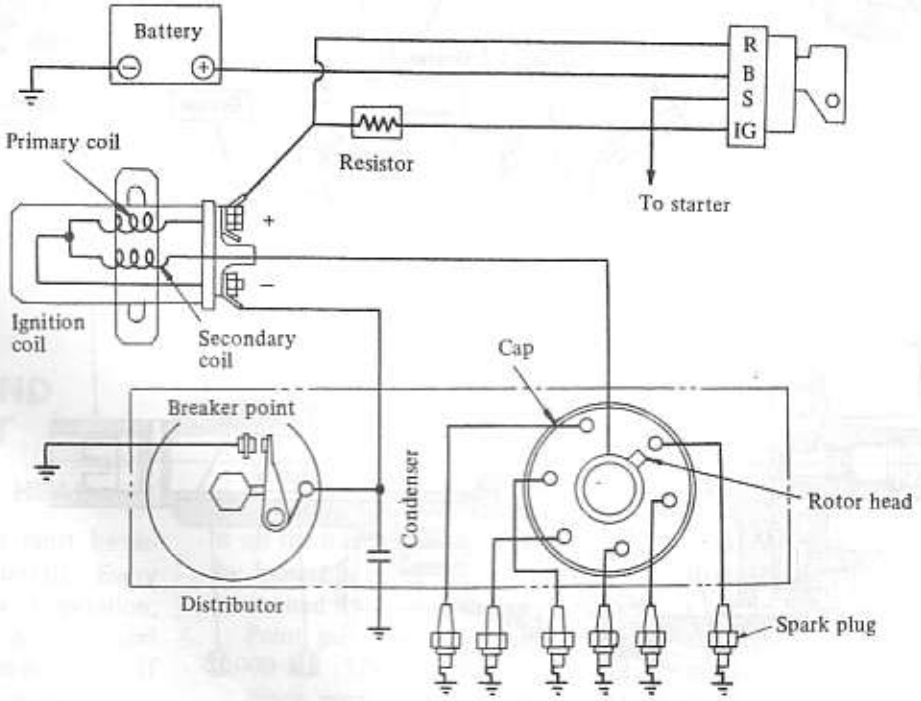
When the contact points are opened by the revolving distributor cam, the magnetic field built up in the primary winding of the coil moves through the secondary winding of the coil inducing high voltage. The high voltage is produced every time the contact points open. The high voltage current flows through the high tension cable to the distributor cap. Then the rotor distributes the current to one of the spark plug terminals in the distributor cap.

The spark is obtained when the high voltage current jumps the gap between the insulated electrode and the ground side electrode of the spark plug. This process is repeated for each power stroke of the engine.

The distributor contact points and spark plugs require periodic service. That is, the breaker points should be inspected, cleaned and regapped at tune up or replaced if necessary. In addition, lubricate distributor shaft and cam heel every 10,000 km (6,000 miles). Spark plugs should be removed, inspected and maintained to obtain good firing.

The remainder of the ignition component parts should be inspected for their operation, tightness of electrical terminals, and wiring condition.

The ignition circuit is shown below:



EE060

Fig. EE-70 Ignition system circuit diagram

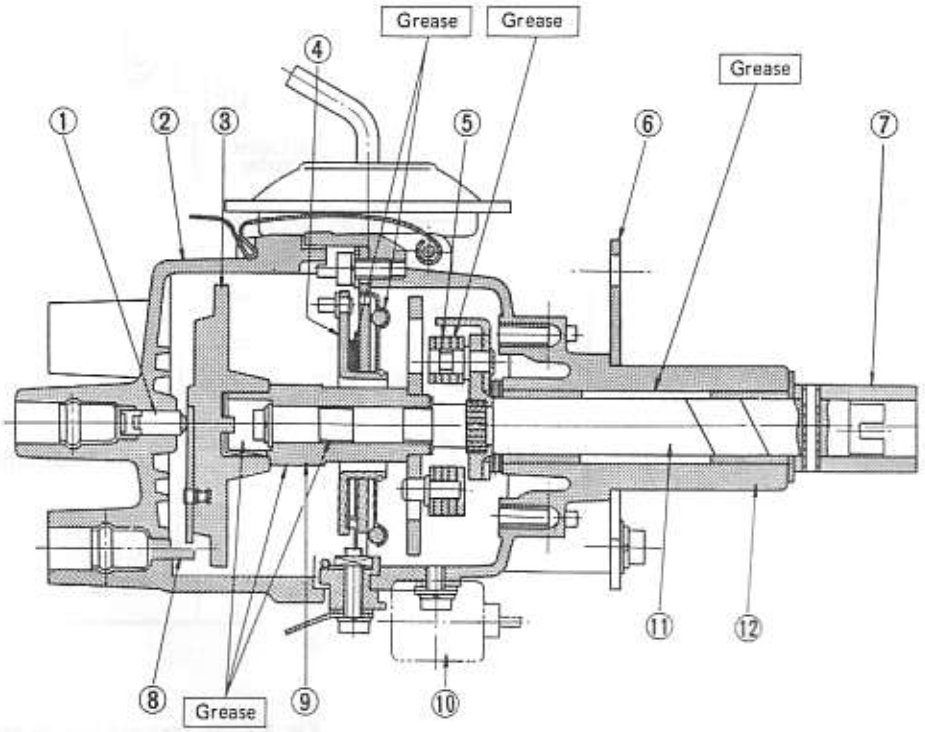
DISTRIBUTOR

CONTENTS

CONSTRUCTION

Distributor model	Applied engine
D606-52	L24
D609-56	L20A, L26
D609-56A	L24, L26 equipped with emission control system

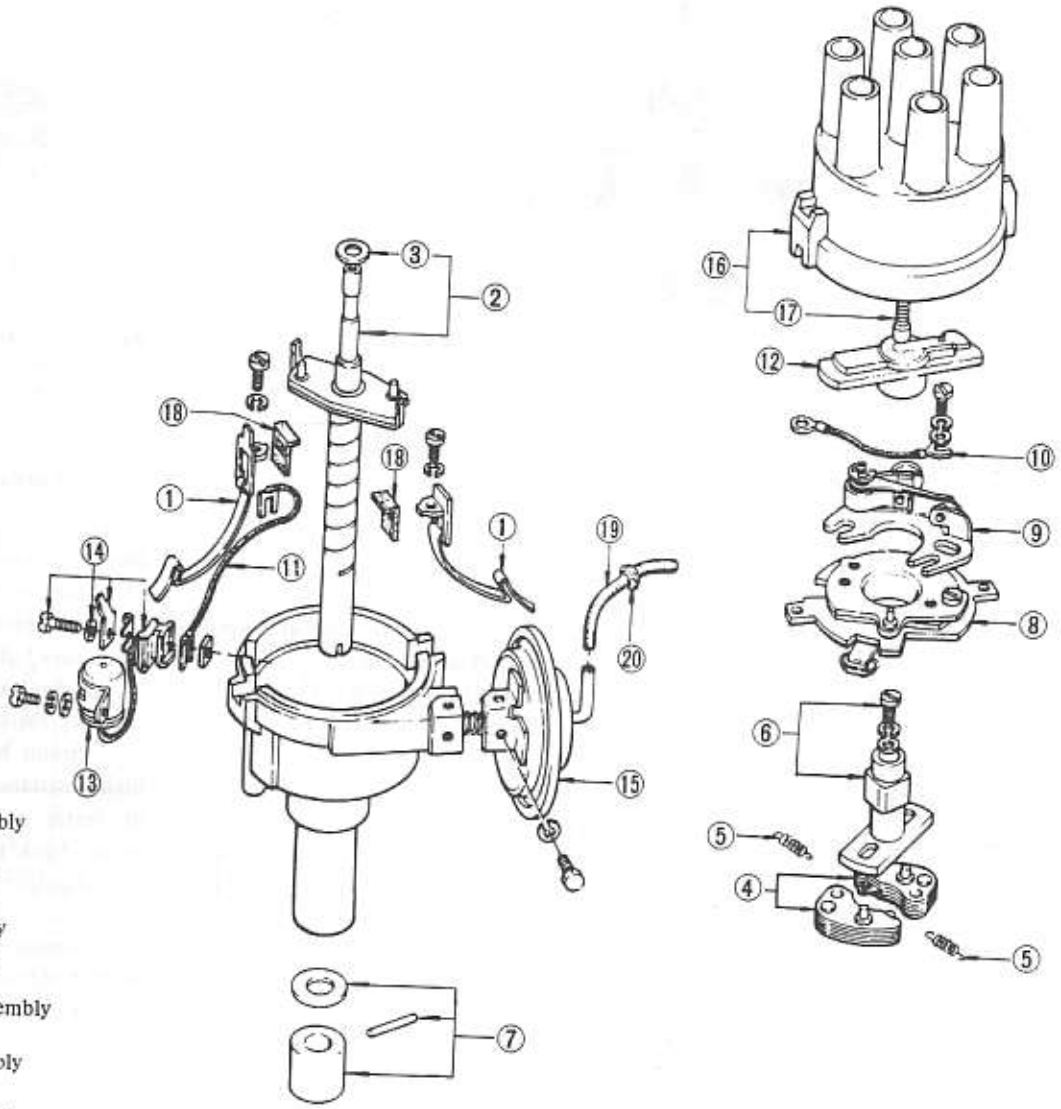
The distributor consists of breaker plate with contact points, centrifugal advance mechanism, vacuum unit, drive shaft, and rotor. Figure EE-71 and 72 show a sectional view of the unit.



1 Center carbon
2 Cap
3 Rotor head
4 Breaker point
5 Governor weight
6 Fixing plate
7 Coupling
8 Side plug
9 Cam
10 Condenser
11 Shaft
12 Housing

EE156

Fig. EE-71 Sectional view of distributor



1 Clamp
2 Shaft assembly
3 Thrust washer
4 Governor weight
5 Governor spring
6 Cam assembly
7 Collar set
8 Breaker plate assembly
9 Contact set
10 Earth wire assembly
11 Lead wire assembly
12 Rotor head assembly
13 Condenser assembly
14 Terminal assembly
15 Vacuum control assembly
16 Cap assembly
17 Carbon point assembly
18 Dust seal
19 Vacuum control tube
20 Vacuum tube grommet

EE157

Fig. EE-72 Exploded view of distributor (Model D606-52)

CHECKING AND ADJUSTMENT

CAP AND ROTOR HEAD

Cap and rotor head must be inspected at regular intervals. Every 5,000 km (3,000 miles) of operation, remove cap and clean all dust and carbon deposits from cap and rotor. If cap is cracked or is leaking, replace with a new one.

POINT

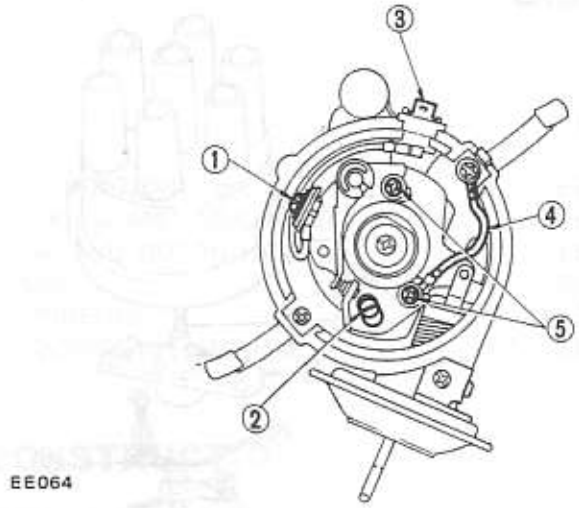
Standard point gap is 0.45 to 0.55 mm (0.0177 to 0.0217 in). In case size is off the standard, adjustment is made by loosening point screws. Gap gauge is required for adjustment.

Point gap must be checked every 5,000 km (3,000 miles) of operation.

When point surface is rough, take off any irregularities with fine sandpaper (No. 500 or 600) or with oil stone.

At this time, grease must be applied to camshaft head and cam heel.

When wear on breaker points is noticeable, replace points together with contact arm. To replace, proceed as follows:



1 Screw
2 Adjuster
3 Primary lead terminal
4 Ground lead wire
5 Set screw

Fig. EE-73 Breaker

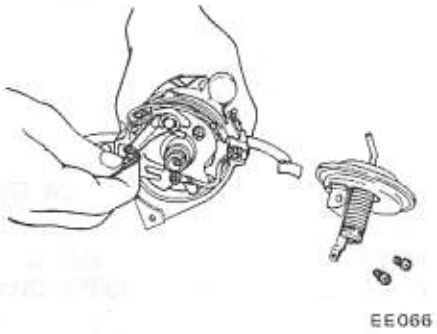


Fig. EE-75 Disassembling contact arm and contact point

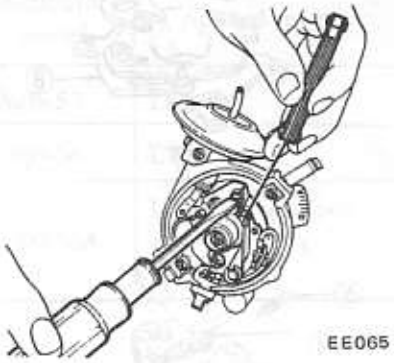


Fig. EE-74 Measuring point gap

First turn out set screws 1 to 1.5 turns at contact arm and primary lead wire connection just far enough to pull out primary lead terminal.

Referring to Figure EE-73, unscrew two contact set fixing screws and remove lead wire.

While holding contact arm by fingers, pull out contact set toward you by raising it slightly. Contact point and arm can then be removed together.

Install new contact point and arm assembly in reverse sequence of removal. Coat cam heel and cam shaft head with a light coating of grease.

CONDENSER

Satisfactory performance of condenser depends on capacity and degree of insulation, requiring attention to be sure that terminals are clean and set screws are tight.

Checking of condenser is made by a capacity tester. This can also be made by a circuit tester with its range set to high resistance reading. When needle of tester swings violently and then moves back to infinite gradually, it is an indication that condenser is in good condition.

If needle shows any steady reading or if it registers zero, the likelihood is that transformer is out of order, calling for replacement.

ADVANCE MECHANISM

≪Performances≫

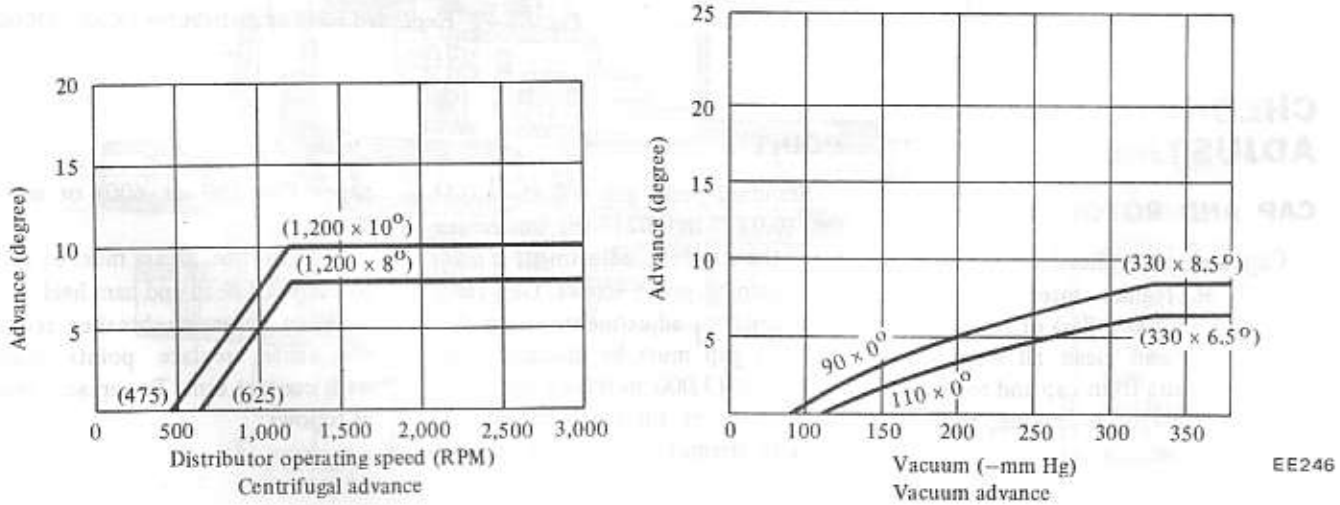
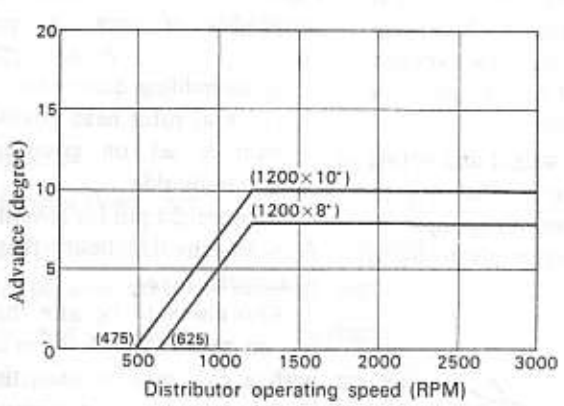
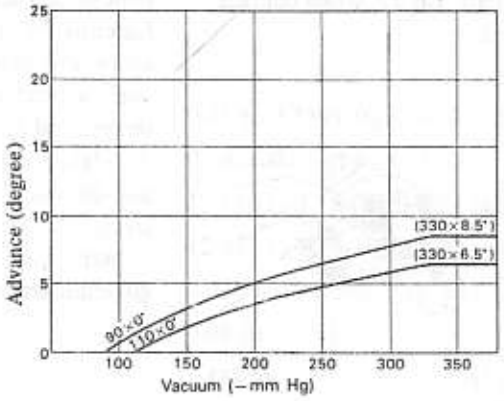


Fig. EE-76 Performance curve (Model D606-52)



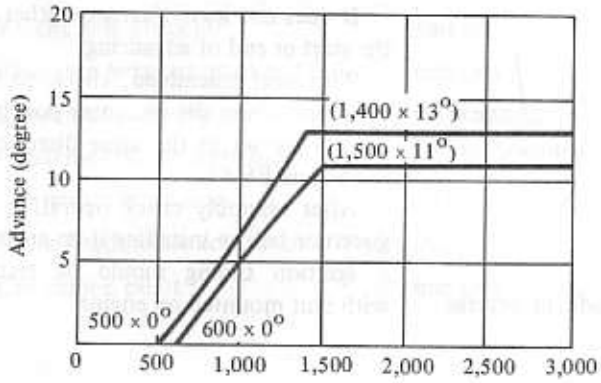
Centrifugal advance



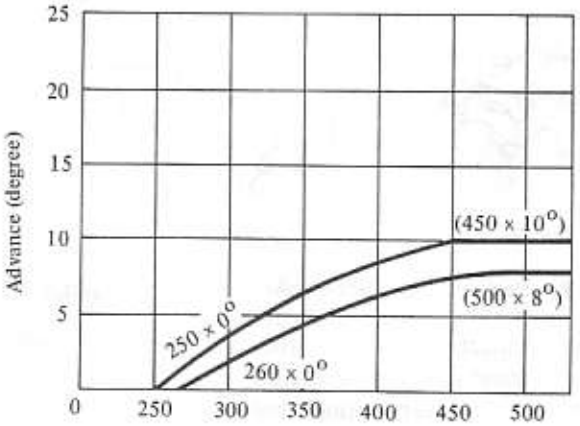
Vacuum advance

EE158

Fig. EE-77 Performance curve (Model D609-56)



Centrifugal advance



Vacuum advance

EE247

Fig. EE-78 Performance curve (Model D609-56A)

≪Vacuum advance mechanism mechanical parts≫

If vacuum advance mechanism fails to operate properly, check for the following items and correct the trouble as required.

1. Check vacuum inlet for signs of leakage at its connection. If necessary, retighten or replace with a new one.
2. Check vacuum diaphragm for air leak.

If leak is found, replace diaphragm with a new one.

3. Inspect breaker plate for smooth movement.

If plate does not move smoothly, this condition could be due to sticky steel balls or pivot. Apply grease to steel balls or, if necessary, replace breaker plate as an assembly.

≪Centrifugal advance mechanical parts≫

When cause of engine trouble is traced to centrifugal advance mechanical part, use distributor tester to check its characteristic.

When nothing is wrong with its characteristic, conceivable causes are defectiveness or abnormal wearing-out of driving part or other part.

Do not disassemble it. In case of improper characteristic, remove on-off switch part and check closely cam assembly, governor weight, shaft and governor spring, etc.

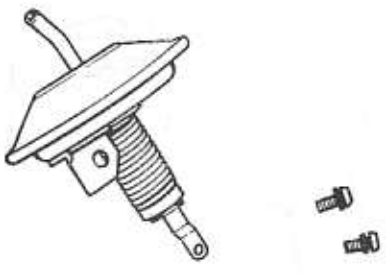
When centrifugal advance mechanical part is reassembled, be sure to check advance characteristic by distributor tester.

DISASSEMBLY AND ASSEMBLY

DISASSEMBLY

To disassemble, follow the procedure below.

1. Take off cap and disconnect rotor head.
2. Remove vacuum controller.

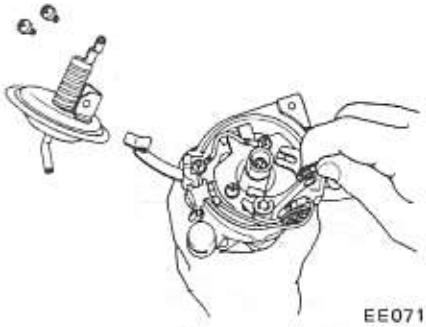


EE070

Fig. EE-79 Disassembling vacuum controller

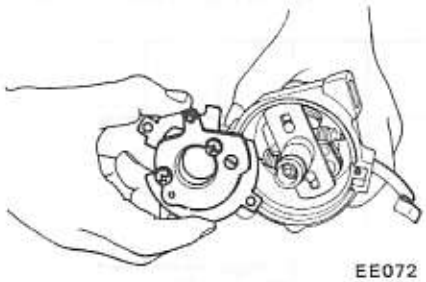
3. Remove contact breaker.

Refer to Page EE-32, when contact set is removed.



EE071

Fig. EE-80 Removing contact set

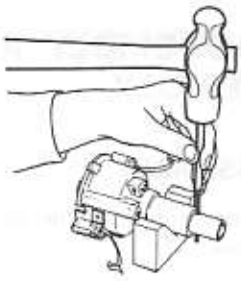


EE072

Fig. EE-81 Removing contact breaker

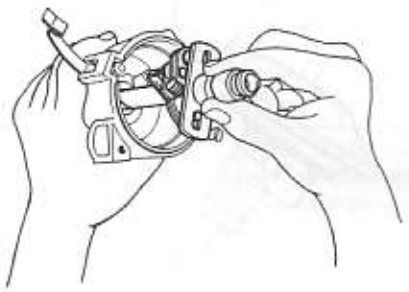
4. When contact breaker is disassembled, be careful not to lose steel balls between breaker spring and breaker plate.

5. Pull knock pin out and disconnect collar to remove the entire rotating parts.



EE073

Fig. EE-82 Removing knock pin



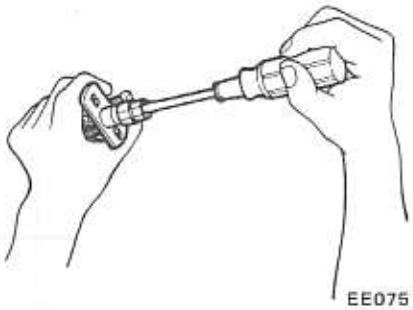
EE074

Fig. EE-83 Removing rotation parts

6. When cam is to be removed, first remove set screw since shaft head is fastened by the screw to hold cam down. Put match mark across cam and shaft so that original combination can be restored at assembly.

7. When governor weight and spring are disconnected, be careful not to stretch or deform governor spring.

After disassembling, apply grease to governor weights.



EE075

Fig. EE-84 Removing cam

ASSEMBLY

Assembly can be made in reverse sequence of disassembly. Refer to Figure EE-85 for replacement and reassembly of governor spring and cam.

In assembling distributor, use caution so that rotor head positioning tip at cam is set on governor spring circular hook side.

Then weight pin for governor spring A with circular hook fits in long rectangular hole.

Also check to be sure that weight pin on spring A is in slit in cam plate with a clearance between the two at beginning and end of governor operation.

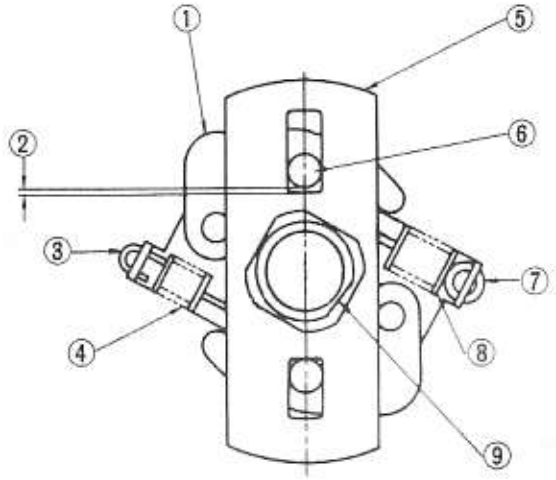
Meanwhile, weight pin on opposite side fits in short rectangular hole.

It does not leave clearance either at the start or end of advancing.

With unit assembled, check to be sure that driven slit and rotor position tip (9) are set in the same direction. See Figure EE-85.

After assembly check operation of governor before installing it on engine.

Ignition timing should be tested with unit mounted on engine.



1 Governor weight
2 Clearance for start and end of advancing angle
3 Rectangular hook
4 Governor spring (B)
5 Cam plate
6 Weight pin
7 Circular hook
8 Governor spring (A)
9 Rotor positioning tip

EE077

Fig. EE-85 Setting governor spring and cam

SERVICE DATA AND SPECIFICATIONS

SERVICE DATA

Point gap	mm (in)	0.45 to 0.55 (0.0177 to 0.0217)
Point pressure	kg (lb)	0.50 to 0.65 (1.10 to 1.43)
Shaft diameter (lower part)	mm (in)	12.430 to 12.440 (0.4894 to 0.4898)
Housing inner diameter	mm (in)	12.450 to 12.468 (0.4902 to 0.4909)
Clearance between shaft and housing	mm (in)	0.010 to 0.038 (0.0004 to 0.0015)
Repair limit of clearance	mm (in)	0.08 (0.0031)
Shaft diameter (upper part)	mm (in)	7.986 to 7.995 (0.3144 to 0.3148)
Cam inner diameter	mm (in)	8.000 to 8.015 (0.3150 to 0.3156)
Clearance between shaft and cam	mm (in)	0.005 to 0.029 (0.0002 to 0.0011)
Weight pivot diameter	mm (in)	4.972 to 4.990 (0.1959 to 0.1965)
Weight hole diameter	mm (in)	5.000 to 5.018 (0.1969 to 0.1976)
Clearance between pivot and hole	mm (in)	0.01 to 0.046 (0.0004 to 0.0018)
Condenser capacity	μF	0.20 to 0.24
Condenser isolate resistance	MΩ	5
Cap isolate resistance	MΩ	50
Rotor head isolate resistance	MΩ	50
Cap carbon point	mm (in)	12 (0.472)

SPECIFICATIONS

Distributor model	D606-52	D609-56	D609-56A
Make	Hitachi	Hitachi	Hitachi
Applied engine	L24, L26(T)	L20A, L26	L26, L26(T)
Firing order	1-5-3-6-2-4	1-5-3-6-2-4	1-5-3-6-2-4
Rotating direction	Counterclockwise	Counterclockwise	Counterclockwise
Dwell angle (degree)	35° to 41°	35° to 41°	35° to 41°

IGNITION COIL

The ignition coil is of an oil-filled type. The ignition coil case is filled with oil which has good insulating and heat-radiating characteristics.

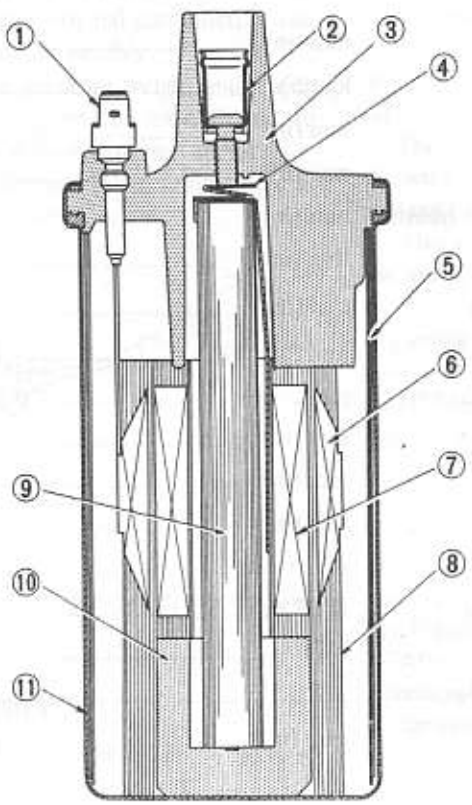
The ignition coil has a greater ratio between the primary and secondary windings to step up the battery voltage to high voltage to cause stronger sparks to jump the spark plug gap

The cap is made of alkyd resin which offers high resistance to electric arc and increased insulation.

The resistor in the ignition coil circuit helps produce strong sparks from starting to high-speed full-power operation.

The internal resistor limits to a maximum safe flow of the primary current through the coil and distributor contact points. Thus, it protects the contact points during slow speed operation when they are closed for long intervals.

The ignition coil and resistor should be handled as a matched set.



1 Primary terminal
2 Secondary terminal
3 Cap
4 Spring
5 Side core
6 Primary coil
7 Secondary coil
8 Insulator oil
9 Center core
10 Segment
11 Case

EE143

Fig. EE-86 Sectional view of ignition coil

SPECIFICATIONS

Make and type		Hitachi, C6R-200 Hanshin, HP5-13E
Primary voltage	V	12
Spark gap	mm (in)	more than 7 (0.2756)
Primary resistance at 20°C (68°F)	Ω	1.5 to 1.7
Secondary resistance at 20°C (68°F)	KΩ	9.5 to 11.6
Resistor	Ω	1.6

SPARK PLUG

CONTENTS

DESCRIPTION

The spark plugs are of the resister type, having 14 mm (0.551 in) threads and 0.8 to 0.9 mm (0.031 to 0.035 in) gap. Inspection and cleaning should be made every 10,000 km (6,000 miles), and replacement should be carried out every 20,000 km (12,000 miles).

Note: All spark plugs installed on an engine, must be of the same brand and heat range.

INSPECTION

1. Remove spark plug wire by pulling on boot, not on wire itself.
2. Remove spark plugs.
3. Check electrodes and inner and outer porcelains of plugs, noting the type of deposits and the degree of electrode erosion. Refer to Figure EE-87.

Normal: Brown to grayish-tan deposits and slight electrode wear indicate correct spark plug heat range.

Caron fouled: Dry fluffy carbon deposits on the insulator and electrode are mostly caused by slow speed driving in city, weak ignition, too rich fuel mixture, dirty air cleaner, etc.
It is advisable to replace with plugs having hotter heat range.

Oil fouled: Wet black deposits show excessive oil entrance into combustion chamber through worn rings and pistons or excessive clearance between valve guides and stems. If the same condition remains after repair, use a hotter plug.

Overheating: White or light gray insulator with black or gray brown spots and bluish burnt electrodes indicate engine overheating. Moreover, the appearance results from incorrect ignition timing, loose spark plugs, low fuel pump pressure, wrong selection of fuel, a hotter range plug, etc.
It is advisable to replace with plugs having colder heat range.

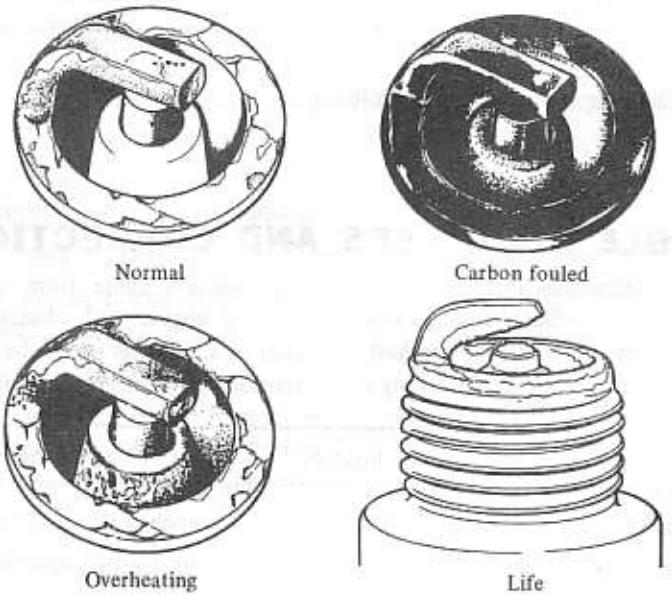


Fig. EE-87 Spark plug

4. After cleaning, dress electrodes with a small fine file to flatten the surfaces of both center and side electrodes in parallel. Set spark plug gap to specification.
5. Install spark plugs and torque each plug to 1.5 to 2.0 kg-m (11 to 15 ft-lb).
6. Connect spark plug wires.

CLEANING AND REGAPPING

Clean spark plugs in a sand blast type cleaner. Avoid excessive blasting. Clean and remove carbon or oxide deposits, but do not wear away porcelain. If deposits are too stubborn, discard plugs.

After cleaning spark plugs, renew firing surface of electrodes with file mentioned above. Then gap spark plugs to 0.8 to 0.9 mm (0.030 to 0.035 in) using a round wire feeler gauge. All spark plugs new or used should have the gap checked and reset by bending ground electrode.

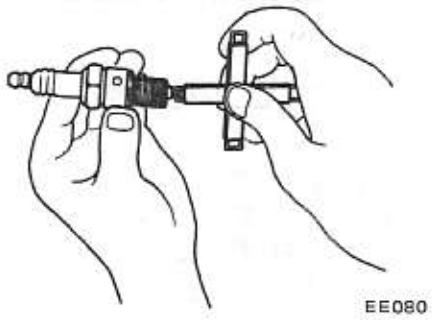


Fig. EE-88 Setting spark plug gap

SERVICE DATA AND SPECIFICATIONS

Model		BP-5ES	BP-6ES
Make		NGK	NGK
Applied engine		L20A	L24, L26
Size (screw dia. x reach)	mm (in)	14 x 19 (0.55 x 0.75)	14 x 19 (0.55 x 0.75)
Plug gap	mm (in)	0.8 to 0.9 (0.031 to 0.035)	0.8 to 0.9 (0.031 to 0.035)
Tightening torque	kg-m (ft-lb)	1.5 to 2.5 (11.0 to 15.0)	1.5 to 2.5 (11.0 to 15.0)

TROUBLE DIAGNOSES AND CORRECTIONS

1. When engine does not start.

If there is no trouble in fuel system, ignition system should be checked. This can be easily done by detaching a high tension cable from spark plug, starting engine and observing condition of spark that occurs between high tension cable and spark plug terminal. After checking this, repair as necessary.

Spark length	Trouble location	Probable cause	Corrective action
No sparks at all	Distributor	Damaged insulation of condenser.	Replace.
		Breakage of lead-wire on low tension side.	Repair.
		Damaged insulation of cap and rotor head.	Replace.
		Point does not open or close.	Repair.
	Ignition coil	Wire breakage or short circuit of coil.	Replace with a new one.
	High tension cable	Wire coming off.	Repair.
		Damaged insulation.	Replace.
1 to 2 mm (0.0394 to 0.0787 in) or irregular.	Distributor	Point gap too wide.	Correct.
		Oil sticking on point.	Clean.
		Point burnt too much.	Replace.
Less than 6 mm (0.2362 in)	Spark plugs	Electrode gap too wide.	Correct or replace.
		Too much carbon.	Clean or replace.
		Broken neck of insulator.	Replace.
		Expiration of plug life.	Replace.

2. When engine turns over but does not run smoothly.

In this case, there are many causes resulting from the ignition system and other engine conditions not related to ignition. Therefore, first complete inspection of ignition system should be carried out.

Trouble	Trouble location	Probable cause	Corrective action
Engine misses.	Distributor	Dirty point.	Clean.
		Improper point gap.	Correct.
		Leak of electricity of cap and rotor head.	Repair or replace.
		Faulty insulation of condenser.	Replace.
		Faulty arm.	Oil shaft.
		Faulty spring of arm.	Replace assembly.
		Breakage of lead wire.	Replace.
		Worn out or shaky breaker plate.	Replace assembly.
		Worn out or shaky distributor shaft.	Replace assembly.
	Ignition coil	Layer short circuit or use of inferior quality.	Replace with good one.
	High tension code	Deterioration of insulation and leak of electricity.	Replace.
	Spark plugs	Dirty.	Clean.
		Leak of electricity at upper porcelain insulator.	Repair or replace.
Engine knocks very often.	Distributor	Improper and advance timing.	Correct the fitting.
		Coming off or breakage of governor spring.	Correct or replace.
		A pin or a hole of governor portion worn out.	Replace.
	Spark plugs	Burnt too much.	Replace.
Engine does not give enough power.	Distributor	Improper and retarded timing.	Correct the fitting.
		Faulty function of governor.	Replace assembly.
		Dirty point.	Clean.
		Point gap too narrow.	Correct.
	Spark plugs	Dirty.	Clean.