SERVICE MANUAL

MODEL
L20A, L24 SERIES
ENGINES

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NISSAN

NISSAN MOTOR CO., LTD.
TOKYO, JAPAN

SECTION EE

ENGINE ELECTRICAL SYSTEM

STARTING CIRCUIT ..... EE- 1
STARTING MOTOR ..... EE- 1
CHARGING CIRCUIT EE-11
ALTERNATOR EE-13
REGULATOR EE-20
IGNITION CIRCUIT EE-27
DISTRIBUTOR EE-28
IGNITION COIL EE-35
SPARK PLUGS EE-37

STARTING CIRCUIT

The electrical system is a 12-Volt system. This section is divided into the following subsections:

1. Starting motor 2. Alternator 3. Regulator 4. Ignition coil 5. Spark plugs

Information for body electrical system, such as the lighting circuit, instrument, windshield wipers, etc. are described in section BE.

STARTING MOTOR

CONTENTS

DESCRIPTION EE-1
OPERATION EE-2
CONSTRUCTION EE-2
REMOVAL EE-3
DISASSEMBLY EE-3
CLEANING AND INSPECTION EE-4
- Terminal EE-4
- Field coil EE-4
- Brushes and brush lead wire EE-5
- Brush spring tension EE-5
- Armature assembly EE-5
- Over-running clutch assembly EE-6
- Testing brush holder for ground EE-6
- Pinion case bearing metal ..... EE- 7
- Magnetic switch assembly ..... EE- 7

REASSEMBLY ..... EE- 7
TEST ..... EE- 7
- Performance test ..... EE- 7
- Diagnosis of test ..... EE- 8
- Magnetic switch assembly test ..... EE- 8

SPECIFICATIONS AND SERVICE DATA .... EE- 9
- Specifications ..... EE- 9
- Service data ..... EE- 9

TROUBLE DIAGNOSES AND CORRECTIONS EE-10

DESCRIPTION

The starting system permits the engine being cranked by setting the ignition switch to "start." While the ignition switch is set to "start," the starting motor continues operation. Current to the starting motor is interrupted and the motor is disengaged by setting the ignition switch to "ON." This starting motor is a compound motor, and is equipped with an enclosed over-running clutch. The solenoid switch is built in the yoke.

Note: Make sure to set ignition switch to "ON" position as soon as engine starts lest starter pinion should be damaged.

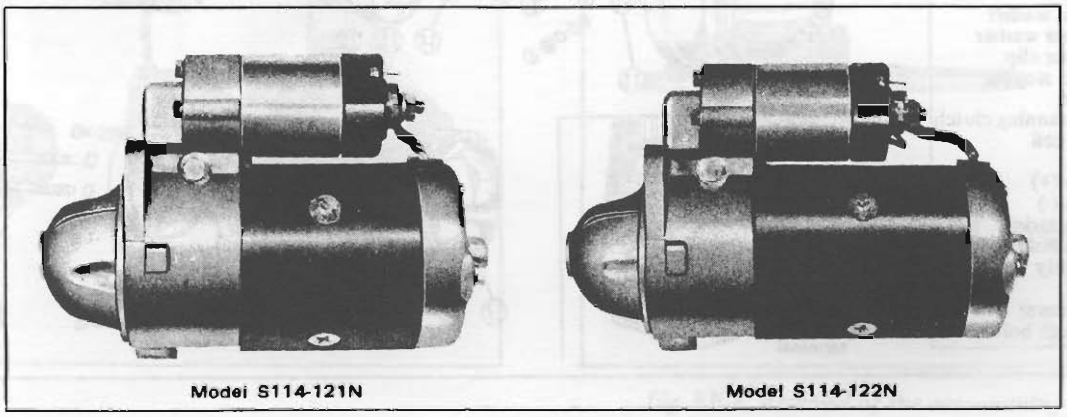
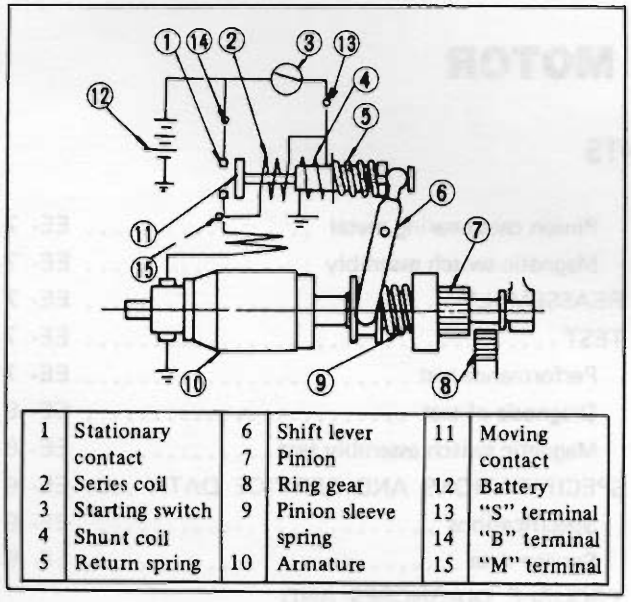


Fig. EE-1 External view

OPERATION

When the ignition switch is set to "start," current flows through the "series" and "shunt" coils of the solenoid and the solenoid is excited. The plunger is pulled into the solenoid so that it operates the shift lever to engage the drive pinion with flywheel ring gear, and the solenoid switch is closed.



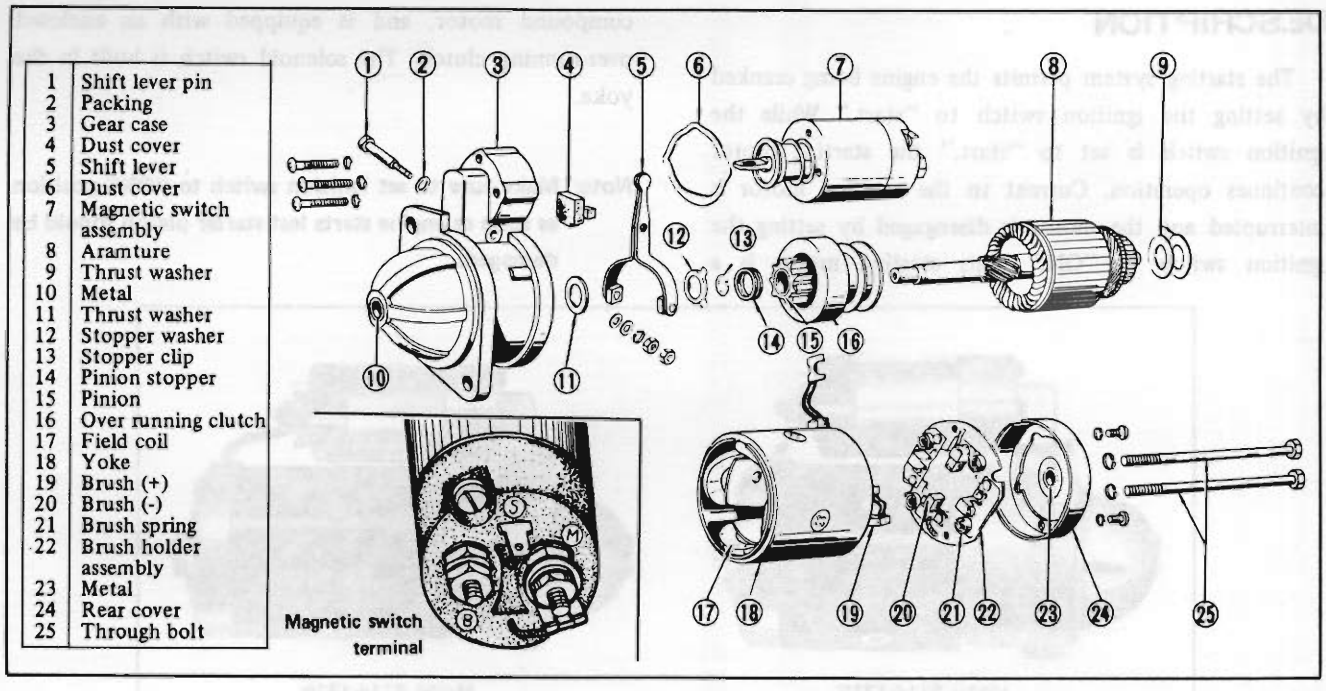
1	Stationary contact	6	Shift lever	11	Moving contact
2	Series coil	7	Pinion	12	Battery
3	Starting switch	8	Ring gear	13	"S" terminal
4	Shunt coil	9	Pinion sleeve spring	14	"B" terminal
5	Return spring	10	Armature	15	"M" terminal

Fig. EE-2 Starting motor circuit

When the contacts (stationary and movable) are closed, the motor operates to crank the engine, and the "series" coil of the solenoid is cut out. The magnetic force of the "shunt" coil is sufficient to hold the pinion in mesh after shifting the system.

When the engine is operated, and the ignition switch is set to "ON," the "series" coil demagnetizes the "shunt" coil, and the return spring actuates the plunger to return to the original position. Consequently, the motor stops. 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 so as to engage or disengage with the ring gear teeth. The over-running clutch is designed to transmit driving torque from the motor armature to the ring gear, and to permit the pinion over-running the armature when the engine is started.

CONSTRUCTION



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

Fig. EE-3 Components of starting motor

REMOVAL

1. Disconnect battery ground cable.

Disconnect black wire with yellow tracer from magnetic switch terminal, and black battery cable from battery terminal.

2. Remove two bolts used to secure starting motor on gear case. Pull starter assembly forward and remove starting motor.

DISASSEMBLY

1. Loosen nut used to secure connecting plate to magnetic switch "M" terminal. Remove three screws used to secure magnetic switch, and remove the magnetic switch assembly.

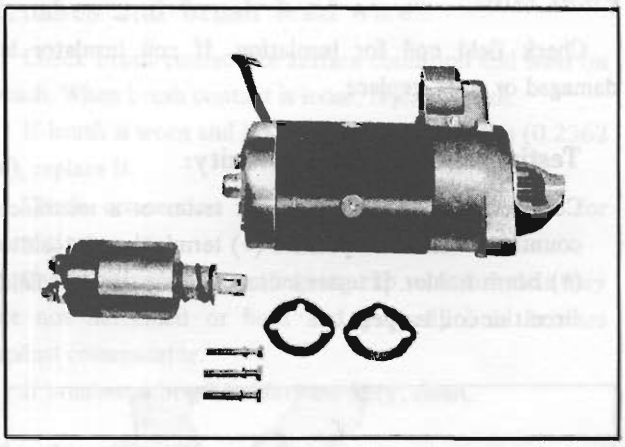


Fig. EE-4 Removing magnetic switch assembly

2. Remove two through bolts and brush cover assembly.

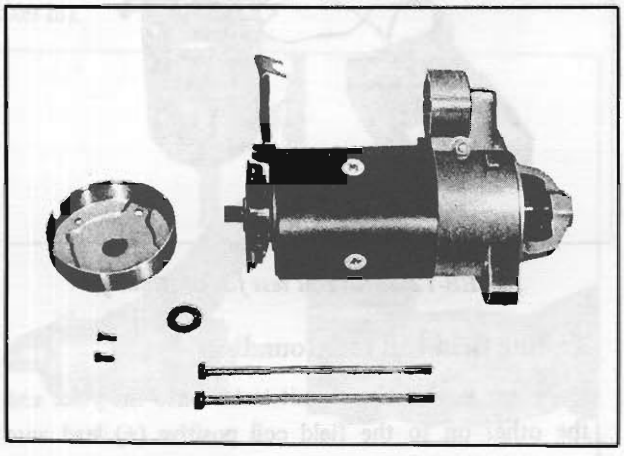


Fig. EE-5 Removing the rear cover

3. Remove yoke assembly by lightly tapping with a wooden mallet.

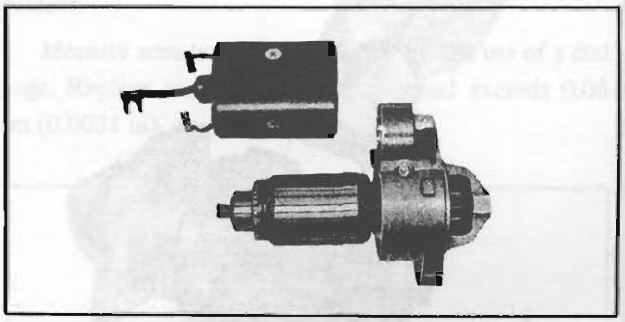


Fig. EE-6 Removing the yoke assembly

4. Withdraw the armature assembly and shift lever.

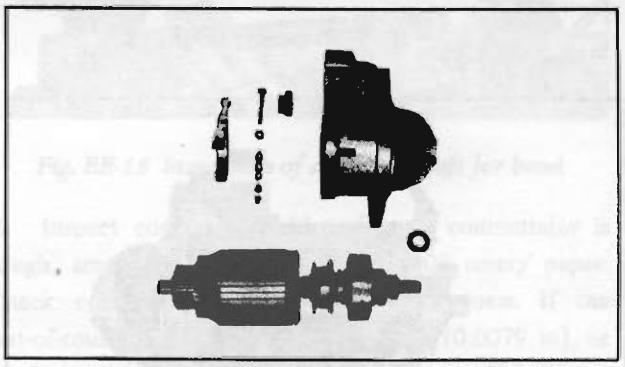


Fig. EE-7 Removing the armature assembly and shift lever

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

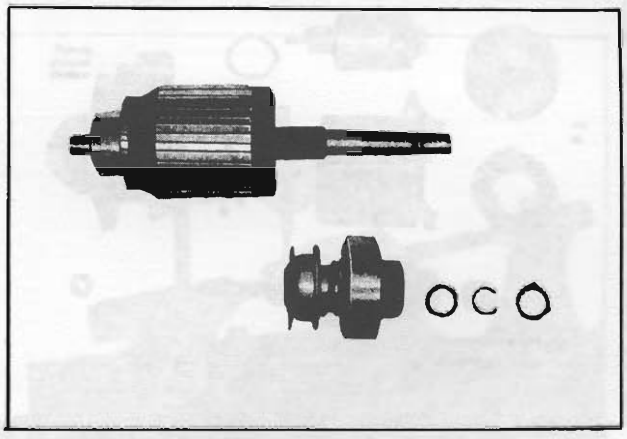


Fig. EE-8 Removal of the over-running clutch assembly

6. Remove brush springs and then brushes.

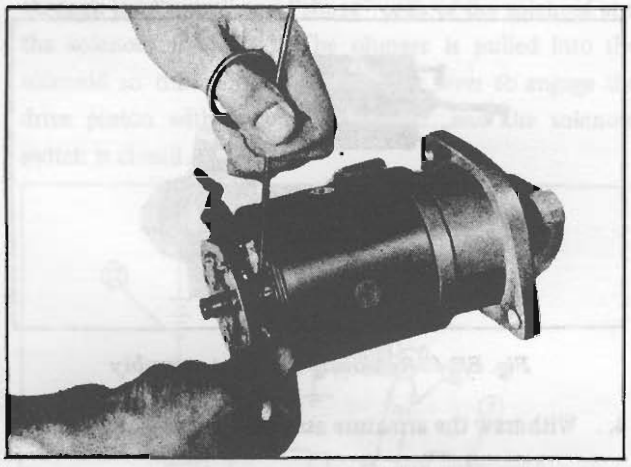


Fig. EE-9 Removing brush

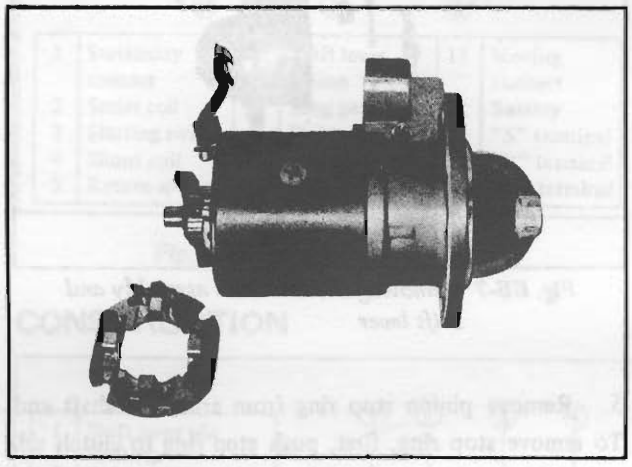


Fig. EE-10 Removing brush holder

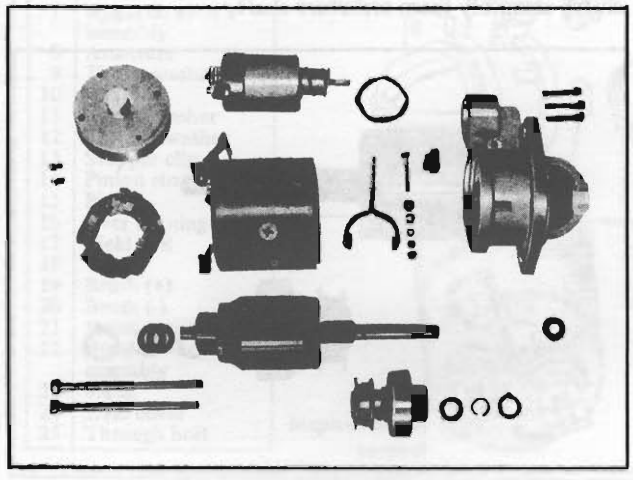


Fig. EE-11 Disassembly

CLEANING AND INSPECTION

Clean all disassembled parts. Be careful not to use grease dissolving solvent for cleaning of over-running clutch, armature assembly, magnetic switch assembly and field coils since solvent dissolves grease packed in clutch mechanism and damages coils or other insulators.

Check them for damage or excessive wear. Replace them as required.

Terminal

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

Field coil

Check field coil for insulation. If coil insulator is damaged or worn, replace.

Testing field coil for continuity:

Connect test probe of a circuit tester or a resistance counter to field coil positive (+) terminal and positive (+) brush holder. If tester indicates no continuity, field circuit or coil is open.

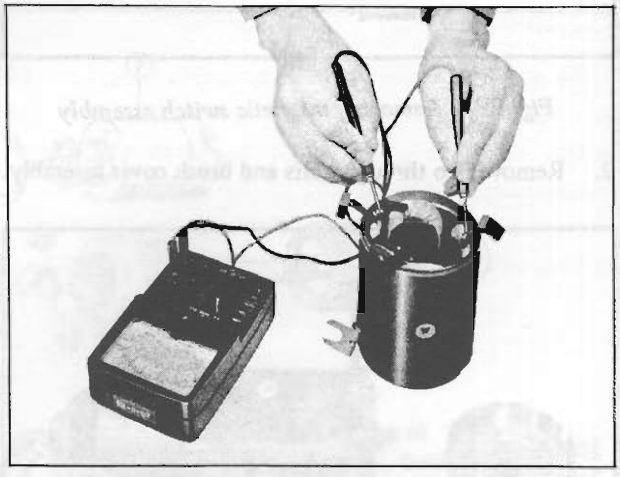


Fig. EE-12 Field coil test for continuity

Testing field coil for grounding:

Place one probe of a circuit tester onto the yoke and the other on to the field coil positive (+) lead wire terminal. If resistance is read, the field coils are grounded.

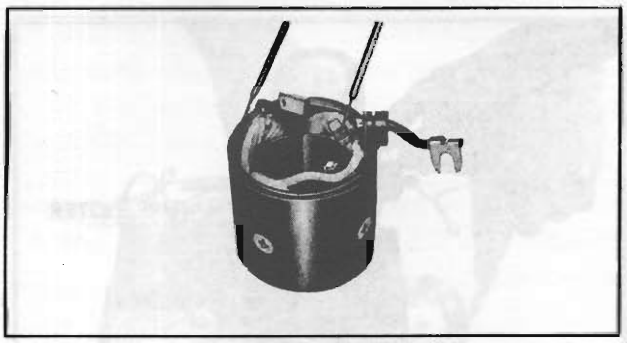


Fig. EE-13 Field coil test for grounding

Field coil test for short-circuit

Unsolder connected section of each coil and check circuit with a tester in the same manner as described above.

When coil is defective, replace coil.

Brushes and brush lead wire

Check brush contact for surface condition and wear on brush. When brush contact is loose, replace brush.

If brush is worn and height is less than 6.0 mm (0.2362 in), replace it.

Check connection of lead clip and lead wire for conditions:

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

If brushes or brush holders are dirty, clean.

Brush spring tension

Measure brush spring tension by the use of a spring scale as shown in Figure EE-14. The reading should be 1.6 kg (3.52 lb). Replace spring if tension is lower than 1.4 kg (3.09 lb).

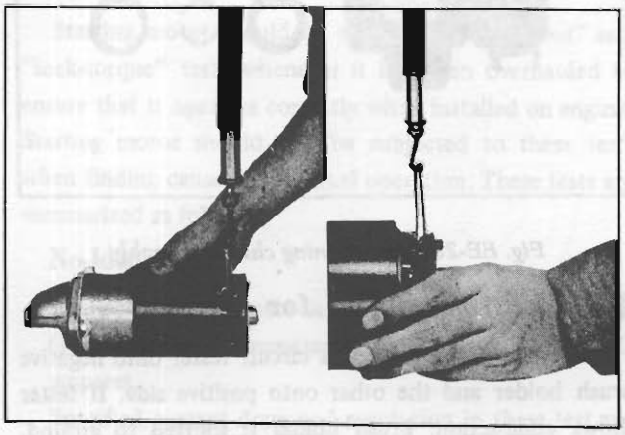


Fig. EE-14 Inspection of brush spring tension

Armature assembly

Check external appearance of armature and commutator.

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

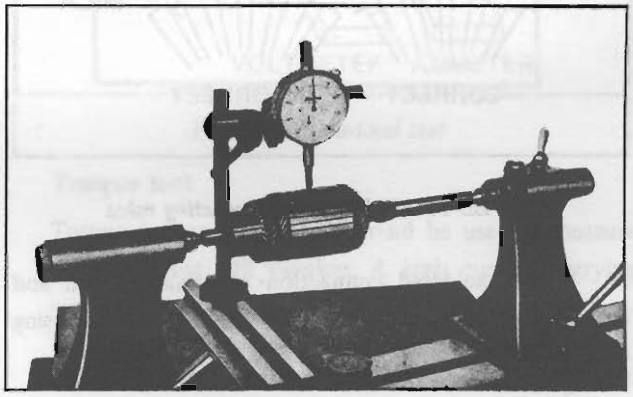


Fig. EE-15 Inspection of armature shaft for bend

2. Inspect commutator. If surface of commutator is rough, smooth it lightly with a No. 500 emery paper. Check commutator also for out-of-roundness. If the out-of-roundness is more than 0.2 mm (0.0079 in), or insulating mica depth is less than 0.2 mm (0.0079 in) from commutator surface, turn commutator (armature) in a lathe, so that out-of-roundness is less than 0.05 mm (0.0020 in). Insulating mica should also be under-cut so that depth is from 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 worn excessively, repair or replace it.

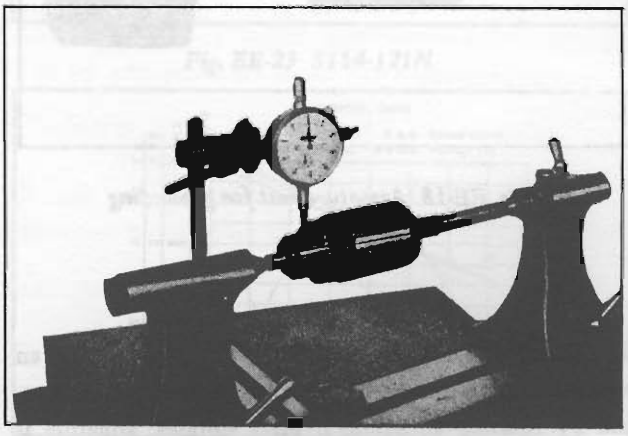


Fig. EE-16 Inspection of commutator

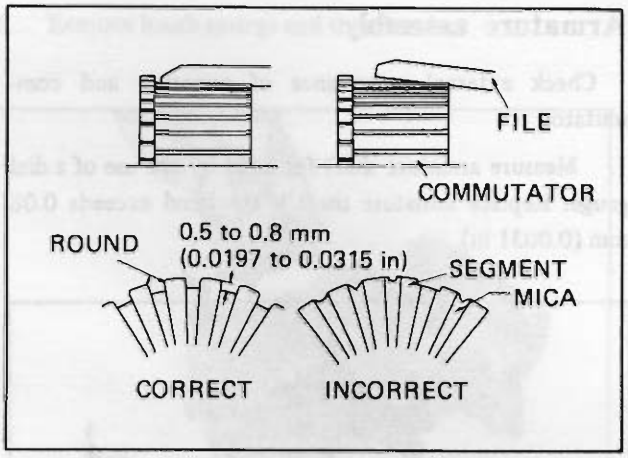


Fig. EE-17 Undercutting insulating mica

3. Inspect soldered connection of armature lead and commutator. If loose connection is found, resolder (using rosin flux).

4. Testing armature for grounding

Place one test probe of a circuit tester, on to armature shaft and the other on to each commutator bar.

If tester shows continuity, armature is grounded. Replace armature with a new one.

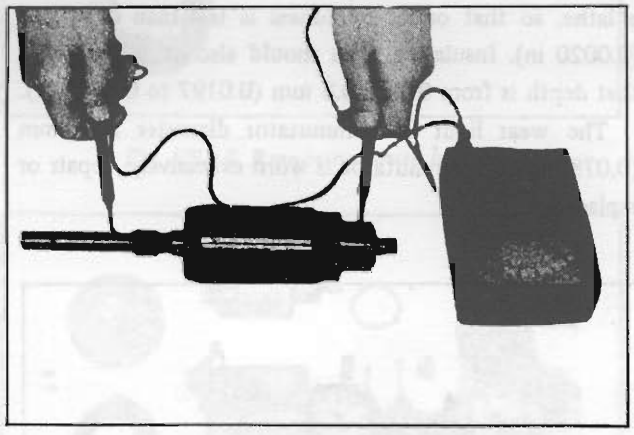


Fig. EE-18 Armature test for grounding

5. Check armature for short-circuit by placing it on an armature tester placing an iron plate over armature core, and by rotating armature. If plate vibrates, armature is short-circuited.

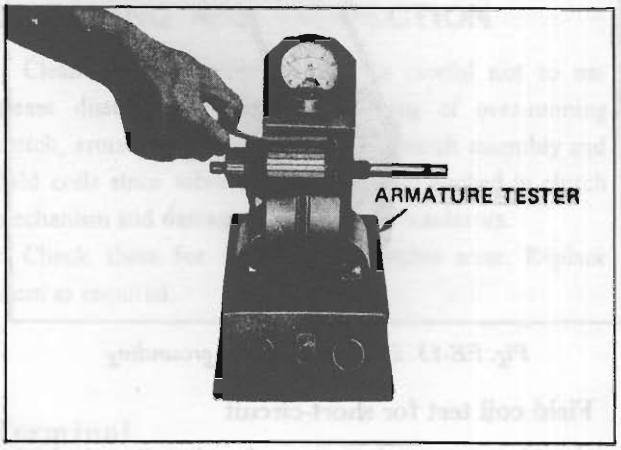


Fig. EE-19 Armature test for shaft

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

Over-running clutch assembly

Inspect pinion assembly and sleeve. Sleeve must slide freely along armature shaft spline. If damages are found or there is a resistance while sliding, replace. Inspect pinion teeth for excessive wear, and replace as required. Check flywheel ring gear also for damage and wear.

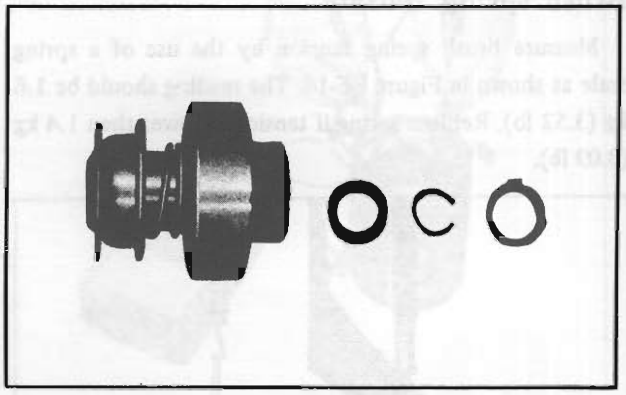


Fig. EE-20 Over-running clutch assembly

Testing brush holder for ground

Place one test probe of a circuit tester onto negative brush holder and the other onto positive side. If tester shows conduction, brush holder is shorted to ground. Replace insulator or brush holder.

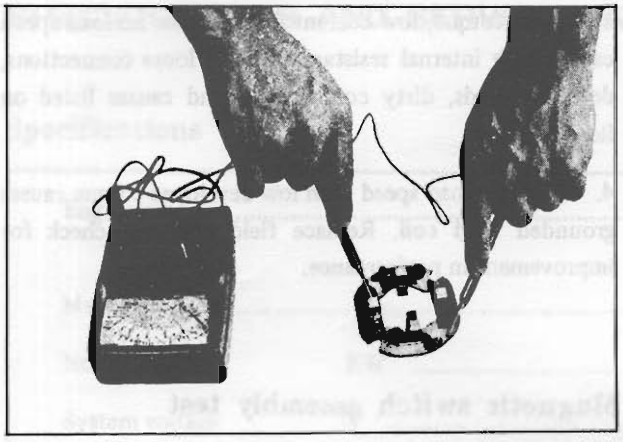


Fig. EE-21 Brush holder test for grounding

Pinion case bearing metal

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

Magnetic switch assembly

Inspect magnetic switch contacts. If contact surface is rough, replace.

REASSEMBLY

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 sparingly.

TEST

Performance test

Starting motor should be subjected to "no-load" and "lock-torque" tests whenever it has been overhauled to ensure that it operates correctly when installed on engine. Starting motor should also be subjected to these tests when finding cause of abnormal operation. These tests are summarized as follows.

No-load test

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

Specified current draw and revolution in these test are shown in "specifications."

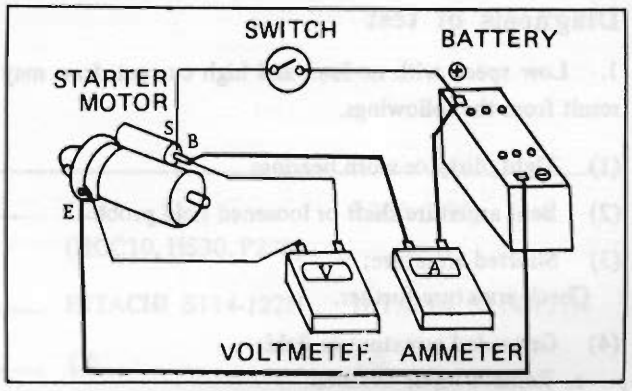


Fig. EE-22 No-load test

Torque test

Torque testing equipment should be used to measure torque motor will develop. A high current carrying variable resistance should be connected to circuit so that specified voltage at starting motor may be obtained, since a small variation in the voltage will produce a marked difference in the torque development.

Specified power, voltage and torque are shown in Figure EE-23 and EE-24.

≪ Characteristic curves ≫

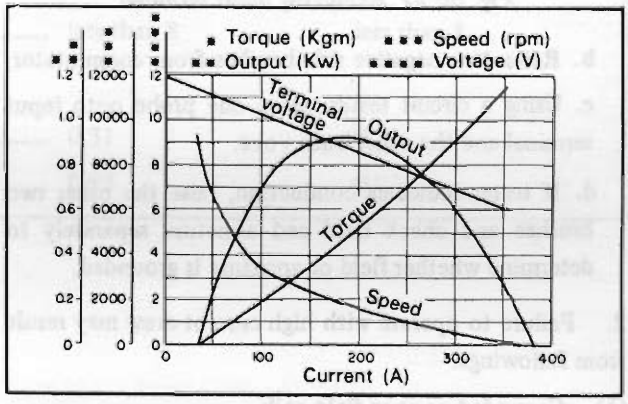


Fig. EE-23 S114-121N

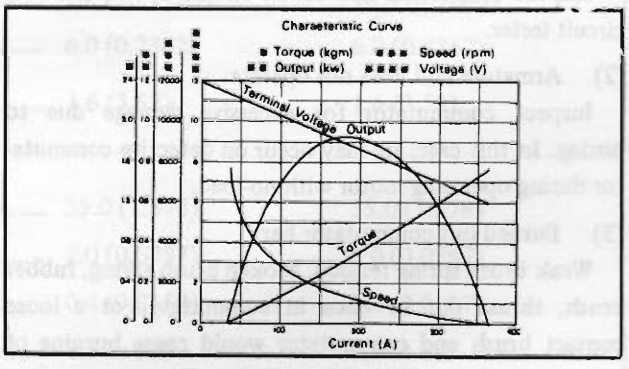


Fig. EE-24 S114-122N

Diagnosis of test

1. Low speed with no-load and high current draw may result from the followings.

(1) Tight, dirty or worn bearings

(2) Bent armature shaft or loosened field probe

(3) Shorted armature;
Check armature further.

(4) Grounded armature or field;
a. Remove input terminal.

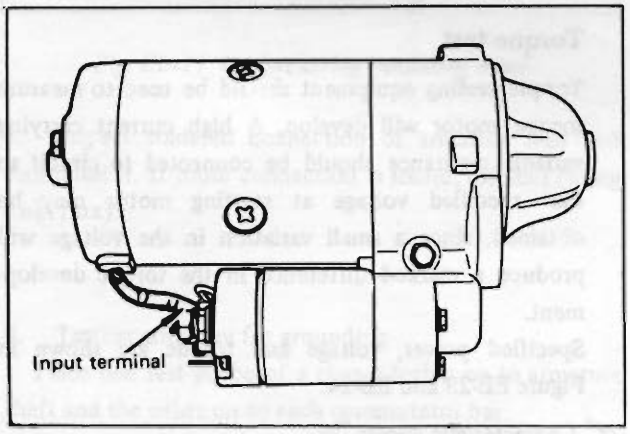


Fig. EE-25 Removing input terminal

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 followings.

(1) Grounded or open field coil:
Inspect connection and check circuit by the use of a circuit tester.

(2) Armature coil does not operate:
Inspect commutator for excessive damage due to buring. In this case, arc may occur on defective commutator during operating motor with no-load.

(3) Burned out commutator bar:
Weak brush spring tension, broken brush spring, rubber brush, thrust out of mica in commutator or a loose contact brush and commutator would cause burning of commutator bar.

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

4. High no-load speed with low developed torque causes grounded field coil. Replace field coil and check for improvement in performance.

Magnetic switch assembly test

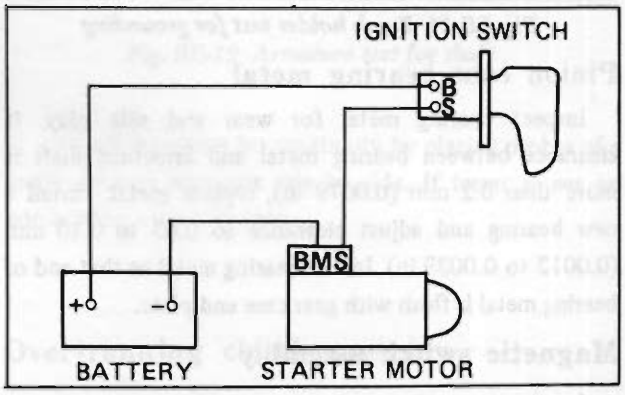


Fig. EE-26 Circuit of magnetic switch assembly test

When starting motor is checked completely, check magnetic switch assembly. Connect jumper 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-26.

With ignition switch on, measure gap "ℓ" between pinion front edge and pinion stopper, and adjust by changing length of magnetic switch shaft if necessary.

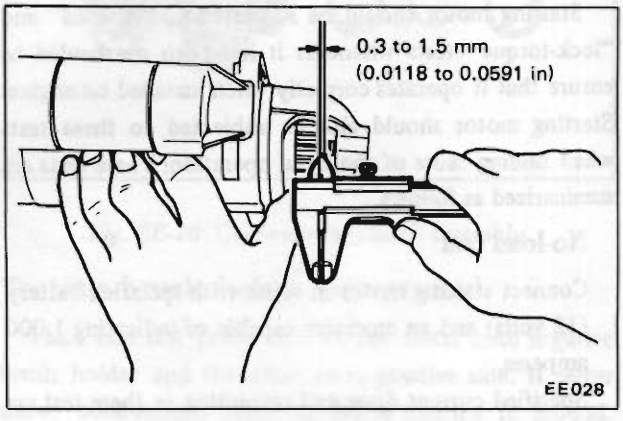


Fig. EE-27 Measurement of gap "ℓ"

SPECIFICATIONS AND SERVICE DATA

Specifications

Engine model			L24 (HGC10, HS30, P230)	L20A (230)
Make and type			HITACHI S114-122N	HITACHI S114-121N
Nominal output	KW		1.0	1.0
System voltage	V		12	12
Weight	kg (lb)		6.0 (13.2)	5.3 (11.7)
No load				
Terminal voltage	V		12	12
Current	A		less than 60	less than 60
Revolution	rpm		more than 5,000	more than 7,000
Load				
Terminal voltage	V		6	6
Current	A		less than 460	less than 460
Torque	kg-m (ft-lb)		more than 1.4 (10.1)	more than 1.15 (8.3)
Pinion drive out voltage	V		less than 8	less than 8
Magnetic switch				
Series coil resistance	Ω		0.31	0.31
Shunt coil resistance	Ω		0.93	0.93

Service data

Brush length	mm (in)		18.5 (0.7283)	18.5 (0.7283)
Wear limit	mm (in)		6.0 (0.2362)	6.0 (0.2362)
Brush spring tension	kg (lb)		1.6 (3.52)	1.6 (3.52)
Commutator				
Outer diameter	mm (in)		35.0 (1.378)	35.0 (1.378)
Wear limit	mm (in)		2.0 (0.0787)	2.0 (0.0787)
Taper limit	mm (in)		0.4 (0.0157)	0.4 (0.0157)
Depth of mica	mm (in)		0.5 to 0.8 (0.0197 to 0.0315)	0.5 to 0.8 (0.0197 to 0.0315)

Wear limit	mm (in)	0.2 (0.0079)	0.2 (0.0079)
Clearance between armature shaft and bushing	mm (in)	0.03 to 0.1 (0.0012 to 0.0040)	0.03 to 0.1 (0.0012 to 0.0040)
Wear limit	mm (in)	0.2 (0.0079)	0.2 (0.0079)
Armature shaft diameter			
Pinion side	mm (in)	11.0 (0.433)	11.0 (0.433)
Rear end	mm (in)	11.5 (0.453)	11.5 (0.453)
Wear limit	mm (in)	0.1 (0.0039)	0.1 (0.0039)
Bend limit	mm (in)	0.08 (0.0031)	0.08 (0.0031)

TROUBLE DIAGNOSES AND CORRECTIONS

Troubles	Possible causes	Corrective action
Starting motor does not operate.	Discharged battery	Charge or replace the battery.
	Defective solenoid switch	Repair or replace the solenoid switch.
	Loose terminal connection	Clean and retighten terminal.
	Defective brush	Replace brush.
	Defective starting motor	Dismount starting motor and conduct testing.
Noisy starting motor.	Loose securing bolt	Retighten bolt.
	Worn pinion gear	Replace pinion gear.
	Poor lubrication	Lubricate.
	Worn commutator	Overhaul.
	Worn brush	Replace brush.
Starting motor cranks slowly.	Discharged battery	Charge or replace battery.
	Loose terminal connection	Clean and retighten terminal.
	Worn brush	Replace brush.
	Locked brush	Check brush spring for tension or brush holder, and repair or replace as required.
	Dirty or worn commutator	Clean and repair.
	The armature rubs the field coil.	Overhaul.

	Defective solenoid switch	Repair or replace the 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 does not disengage when ignition switch is turned off.	Defective solenoid switch	Repair or replace solenoid switch.
	Defective gear teeth	Replace defective 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-28 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 armature. 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-29 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 causes to turn off the warning lamp and complete 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 field 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 constant.

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 field current is shut off and alternator output voltage is decreased immediately. This action causes to separate movable contact "P2" from secondary contact "P3." Thus, the rapid vibration of the movable contact point "P2" or breaking and completing the field circuit maintains an alternator output voltage constant.

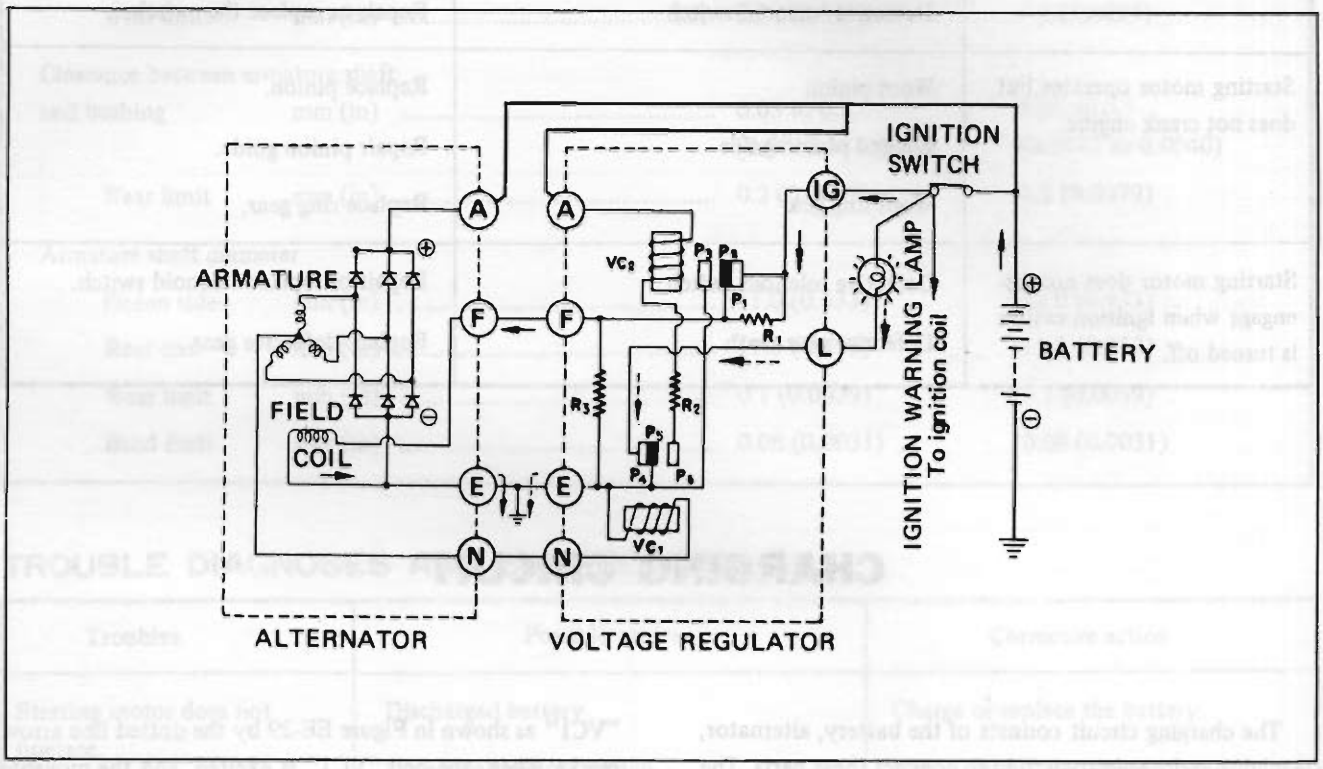


Fig. EE-28 Charging circuit (I)

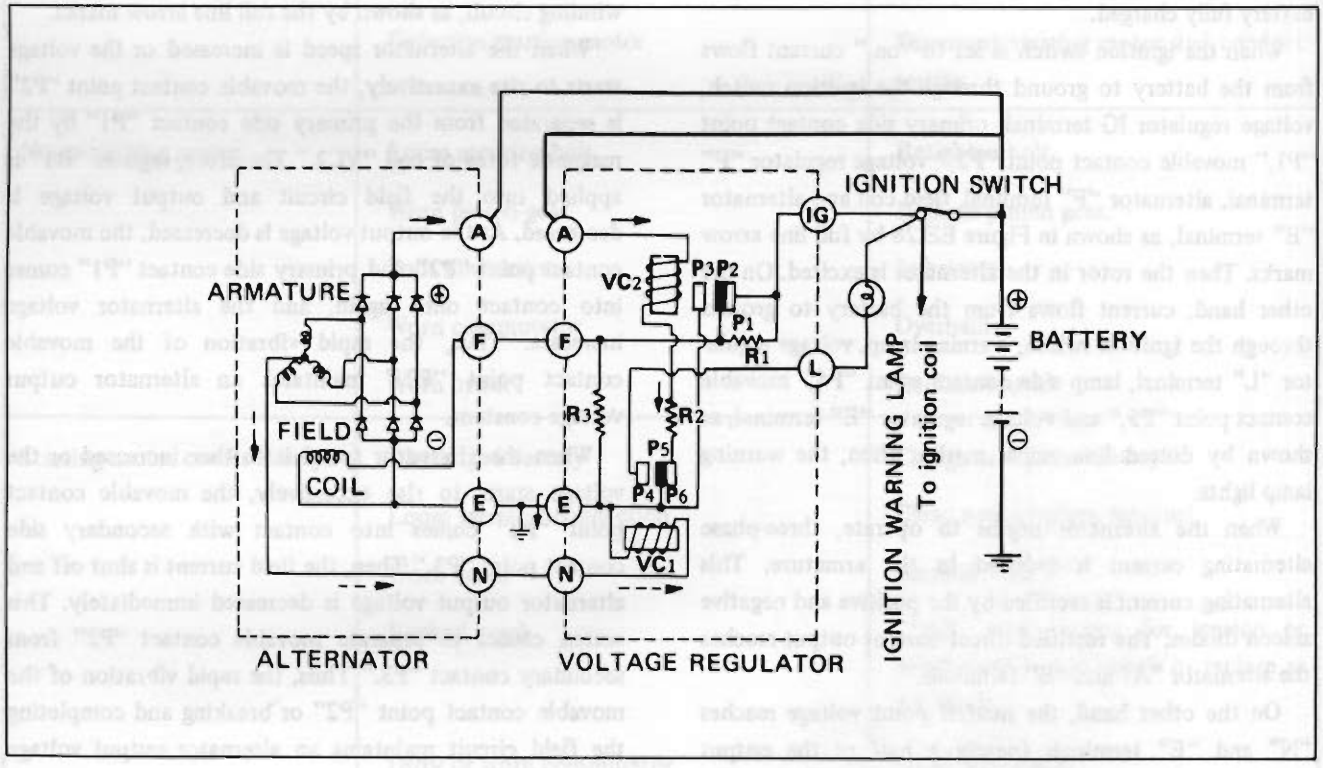


Fig. EE-29 Charging circuit (II)

ALTERNATOR

CONTENTS

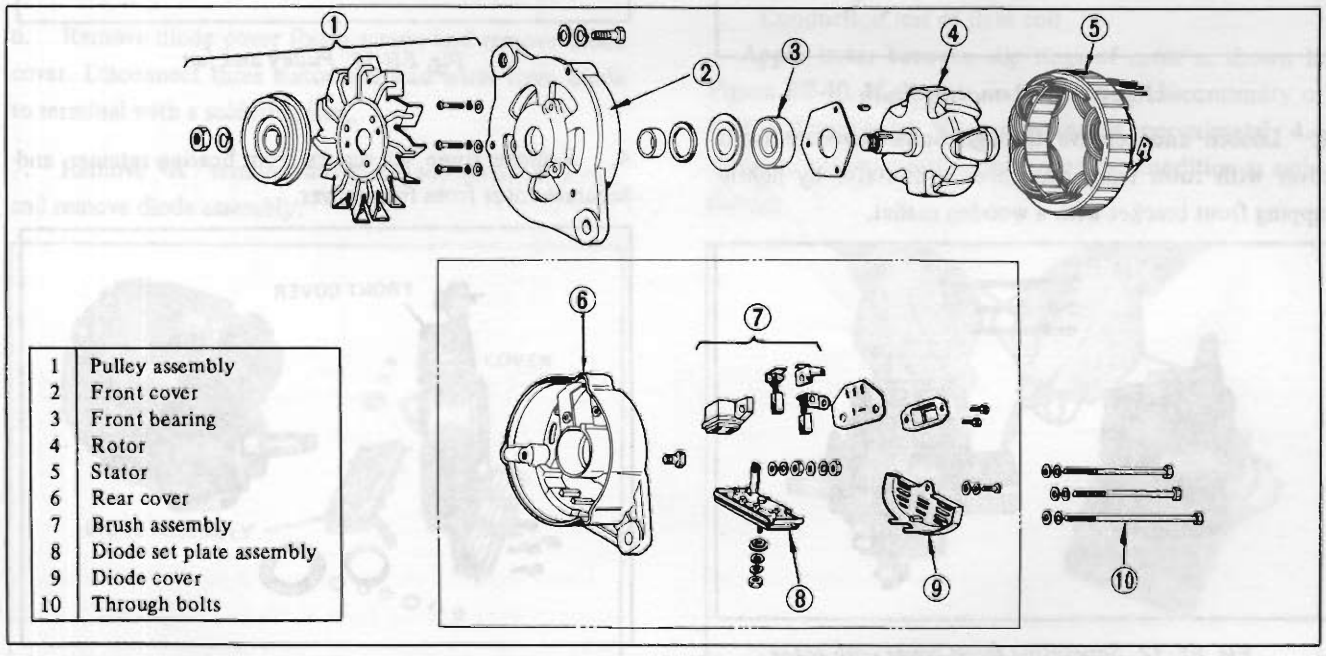
DESCRIPTION EE-13
REMOVAL EE-14
DISASSEMBLY EE-14
INSPECTION AND REPAIR EE-15
Rotor inspection EE-15
Inspection of stator EE-16
Inspection of diode EE-16
Inspection of brush EE-17
Spring pressure test EE-18
REASSEMBLY EE-18
ALTERNATOR TEST EE-18
SPECIFICATIONS AND SERVICE DATA EE-19
Specifications EE-19
Service data EE-20

DESCRIPTION

Alternator model	Engine model
LT150-05	L20A, L24 engine

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 this alternator, six diodes (three negative and three positive), are installed in positive and negative plates as an assembly.

Pack-type silicon diodes are used in this alternator. 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.



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

Fig. EE-30 Exploded view of alternator

REMOVAL

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.

DISASSEMBLY

1. 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.

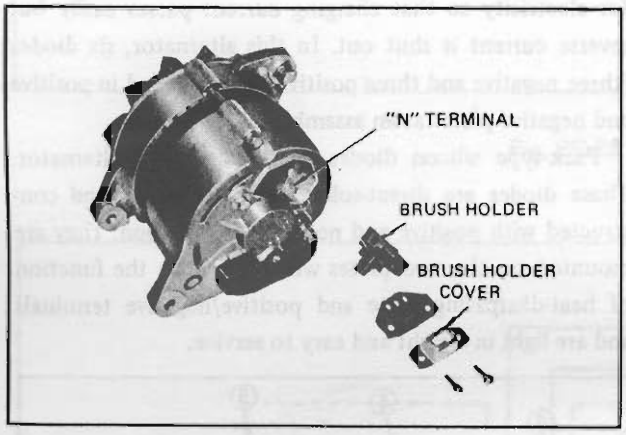


Fig. EE-31 Removing brush

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

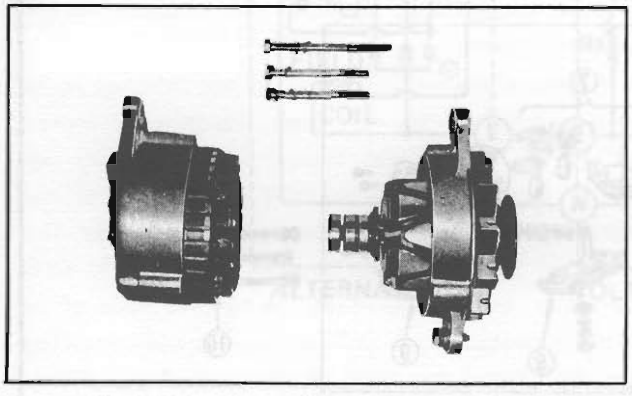


Fig. EE-32 Separating front cover with rotor from rear cover

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

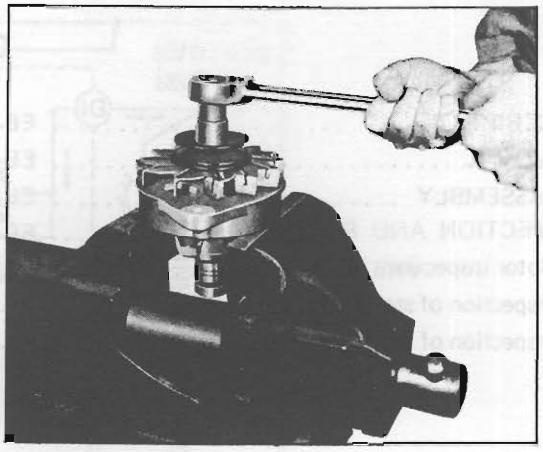


Fig. EE-33 Removing pulley and fan

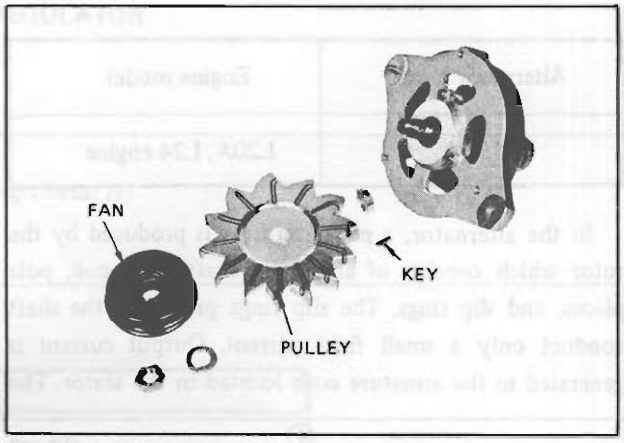


Fig. EE-34 Pulley and fan

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

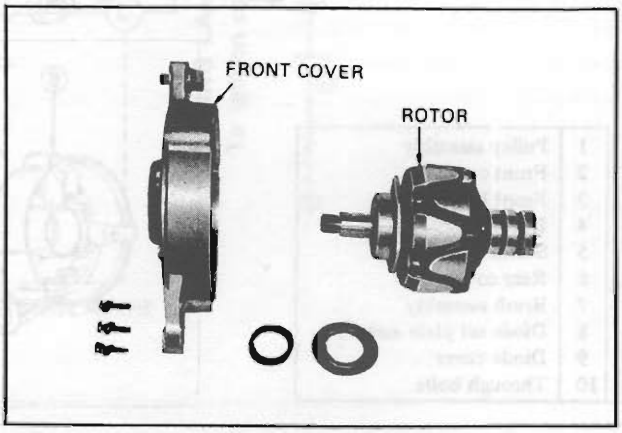


Fig. EE-35 Removing rotor

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

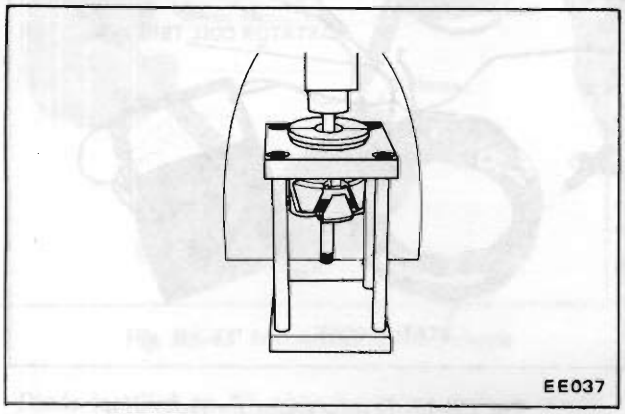


Fig. EE-36 Pulling out of rear bearing (I)

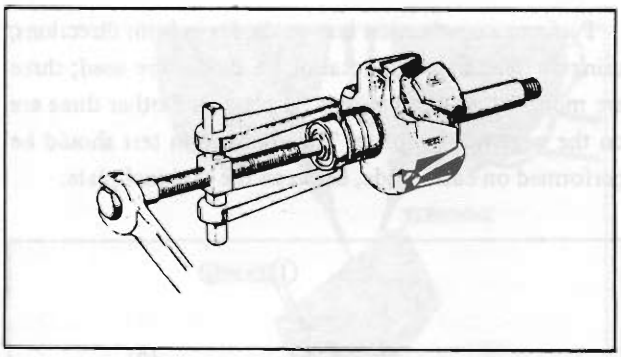


Fig. EE-37 Pulling out of rear bearing (II)

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

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

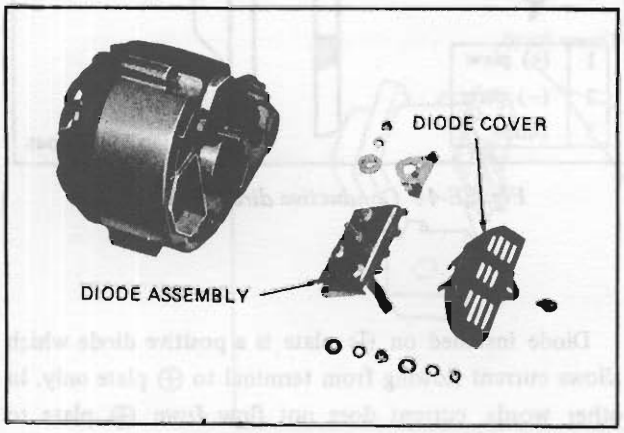


Fig. EE-38 Removing diode assembly

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

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

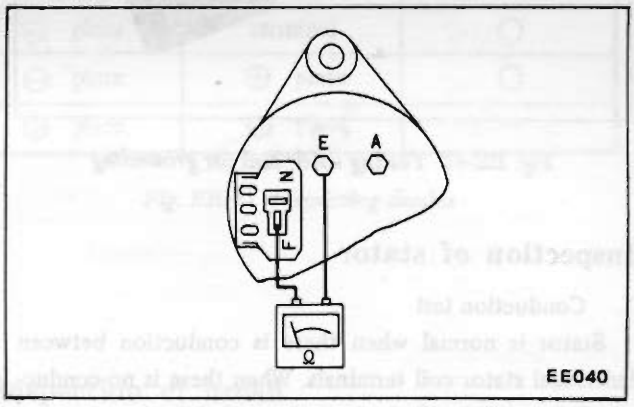


Fig. EE-39 Inspecting alternator

Rotor inspection

1. Conduction test of field coil

Apply tester between slip rings of rotor as shown in Figure EE-40. If there is no conduction, discontinuity of field coil may exist. When resistance is approximately 4.4 ohms at normal ambient temperature, condition is satisfactory.

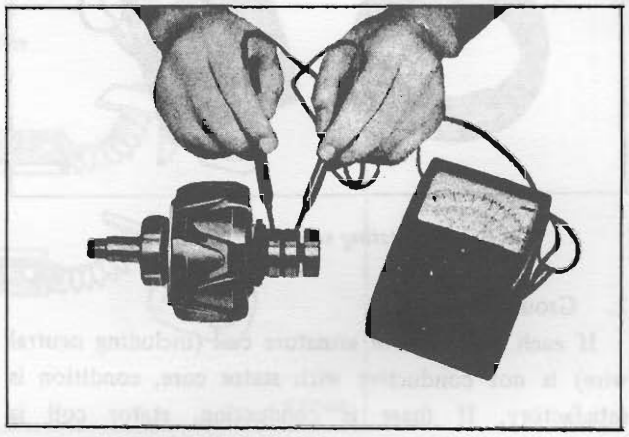


Fig. EE-40 Conduction test of rotor coil

2. Ground test of field coil

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

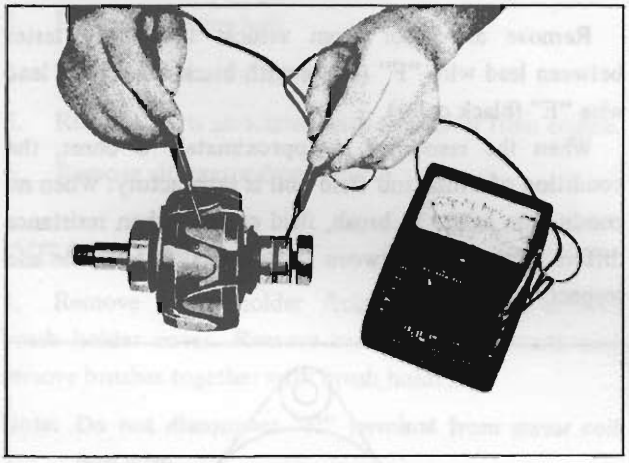


Fig. EE-41 Testing rotor coil for grounding

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.

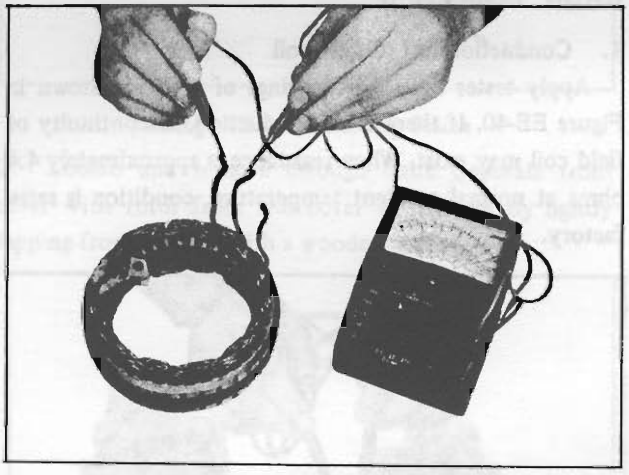


Fig. EE-42 Testing stator for conduction

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.

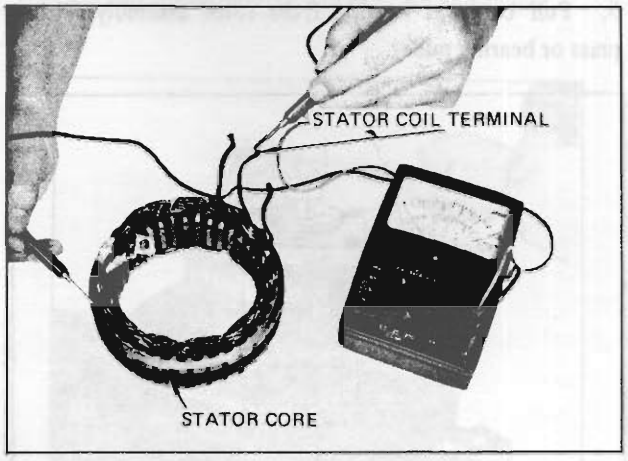


Fig. EE-43 Testing stator for grounding

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 plate.

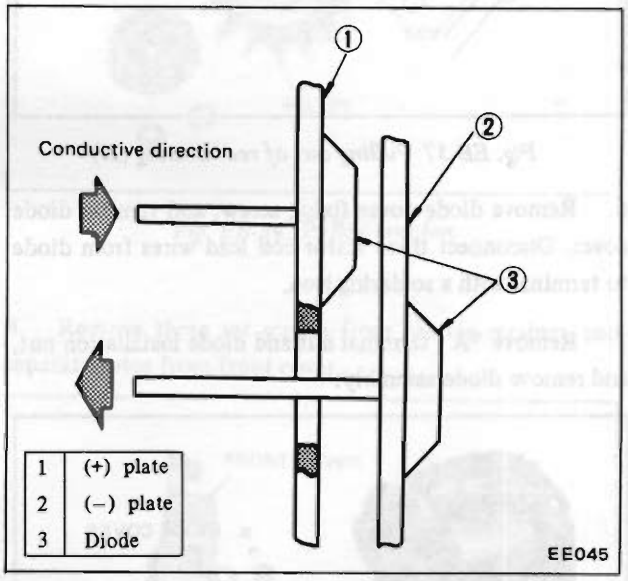


Fig. EE-44 Conductive direction of diode

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.

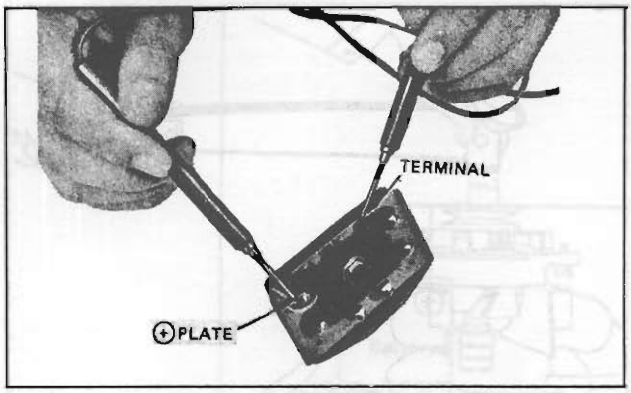


Fig. EE-45 Inspecting positive diode

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.

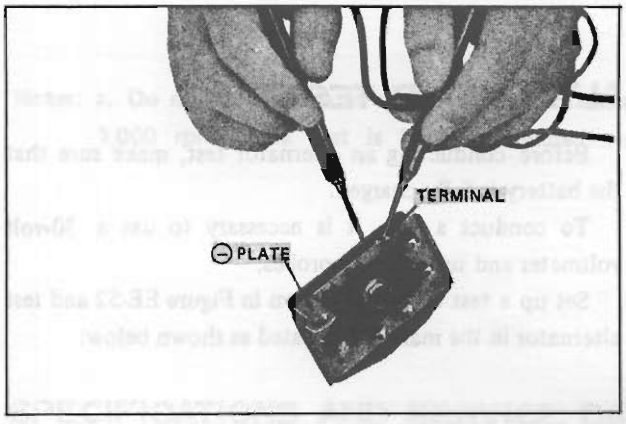


Fig. EE-46 Inspecting negative diode

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. These diodes are unserviceable. If there is a defective diode, replace all diodes (six diodes) as an assembly. (See Fig. EE-47.)

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

Fig. EE-47 Inspecting diodes

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.

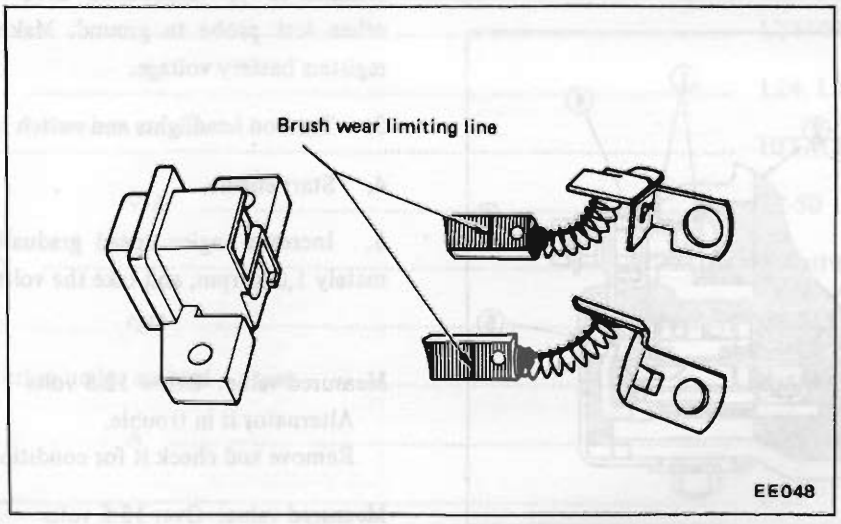


Fig. EE-48 Brush wear limit

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 gr (9.0 to 12.2 oz).

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

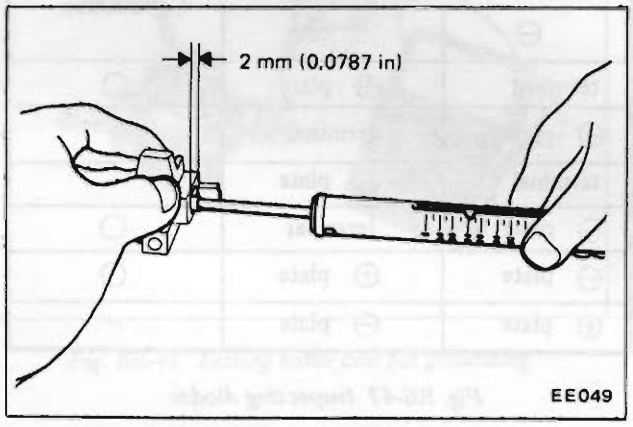


Fig. EE-49 Measuring spring pressure

REASSEMBLY

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.

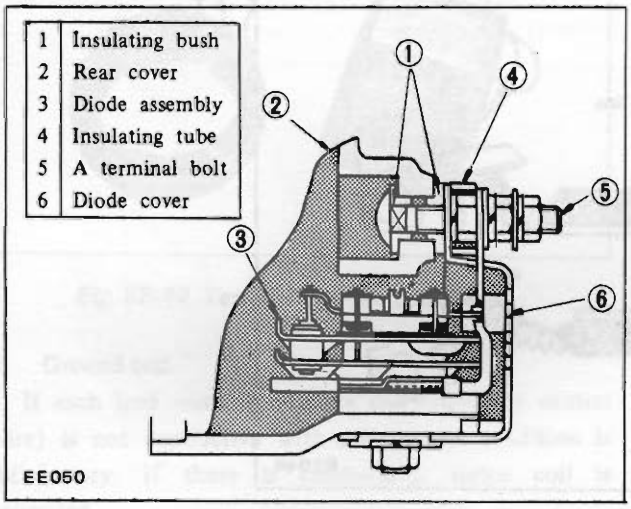


Fig. EE-50 Sectional view of diode and "A" terminal

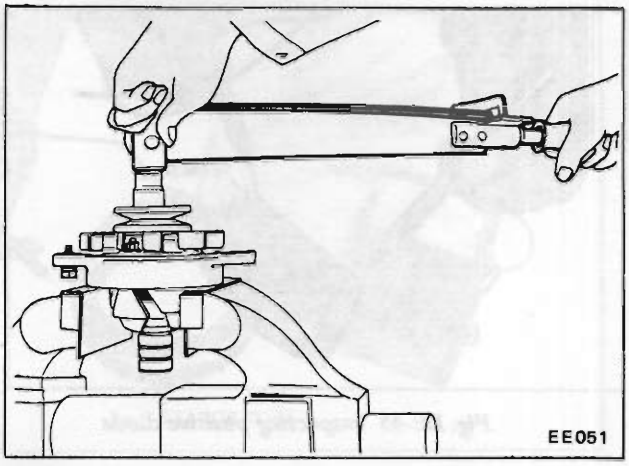


Fig. EE-51 Tightening pulley nut

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-52 and test alternator in the manner indicated as shown 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 1,000 rpm, and take the voltmeter reading.

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

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

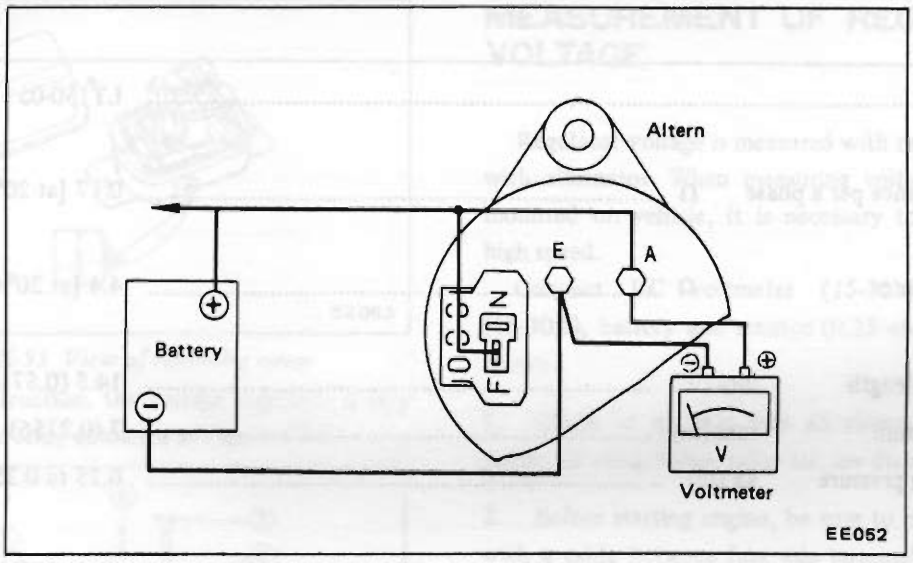


Fig. EE-52 Testing alternator

Notes: a. Do not run engine at the speed of more than 1,000 rpm while test is being conducted on alternator.
b. Do not race engine.

SPECIFICATIONS AND SERVICE DATA

Specifications

Model		LT150-05
Applicable to		L24, L20 engine
Maker		HITACHI
Nominal rating	V-A	12-50
Ground polarity		Negative
Revolution	rpm	1,000 to 13,500
Minimum revolution under no load	rpm	less than 1,000
Output current	A	37.5 (14V, 2,500 rpm)
Pulley ratio		2.25

Service data

Model		LT150-05
Stator coil		
Resistance per a phase	Ω	0.17 [at 20°C (68°F)]
Rotor coil		
Resistance	Ω	4.4 [at 20°C (68°F)]
Brush		
Brush length	mm (in)	14.5 (0.571)
Wear limit	mm (in)	7 (0.2756)
Spring pressure	kg (lb)	0.25 to 0.35 (0.55 to 0.77)
Slip ring		
Outer diameter	mm (in)	31 (1.220)
Reduction limit	mm (in)	1 (0.0394)
Repair accuracy	mm (in)	0.05 (0.0197)

REGULATOR

CONTENTS

DESCRIPTION EE-20
MEASUREMENT OF REGULATOR VOLTAGE EE-21
ADJUSTMENT EE-23
Voltage regulator EE-23
Charging relay EE-24
SPECIFICATIONS AND SERVICE DATA EE-25
TROUBLE DIAGNOSES AND CORRECTIONS (Including alternator) EE-26

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 losed, ignition warning lamp goes on.

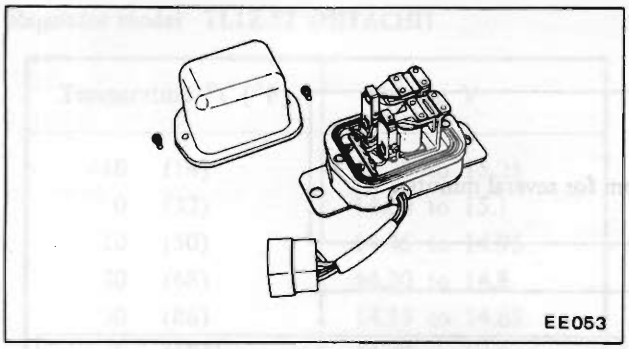
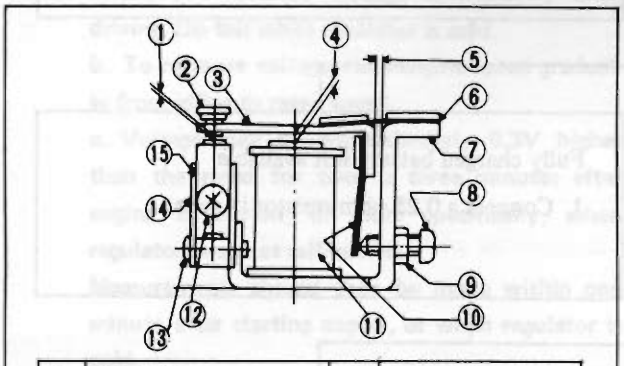


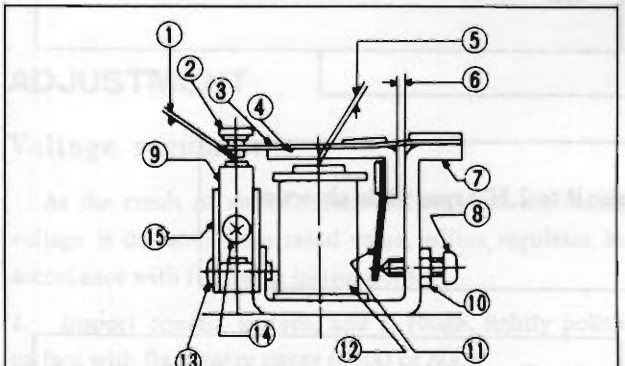
Fig. EE-53 View of removing cover

As for the construction, the voltage regulator is very similar to the charge relay as shown in Figure EE-54.



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

(a) Construction of voltage regulator



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

(b) Construction of charge relay

Fig. EE-54 Structural view

MEASUREMENT OF REGULATING 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 (0.25 ohm) 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 (0.25 ohm) 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.

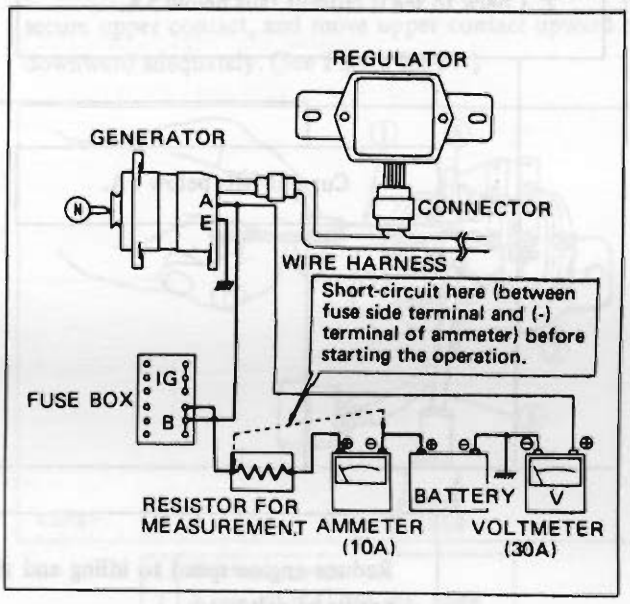


Fig. EE-55 Measuring regulator voltage with regulator on vehicle

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

1. Start engine.
2. Rotate engine at 2,500 rpm for several minutes.

After racing for several minutes, ammeter reading below 5A

After racing for several minutes, ammeter reading over 5A

Fully charged battery available

1. Replace with fully charged battery.
2. Check to see if current falls below 5A.

Fully charged battery not available

1. Connect a 0.25 ohm resistor in series.

Current falls below 5A.

Current does not fall below 5A.

Recharge battery and see if current falls below 5A.

Reduce engine speed to idling and then raise it to 2,500 rpm while observing needle of voltmeter.

Needle of voltmeter held within limits shown in following chart.
Regulator functioning properly.

Needle of voltmeter out of limits shown in following chart.
Regulator out of order. Have it repaired at authorized shop.

Regulator model TL1Z-57 (HITACHI)

Temperature °C (°F)	Voltage V
−10 (14)	14.75 to 15.25
0 (32)	14.60 to 15.1
10 (50)	14.45 to 14.95
20 (68)	14.30 to 14.8
30 (86)	14.15 to 14.65
40 (104)	14.00 to 14.5

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.

ADJUSTMENT

Voltage regulator

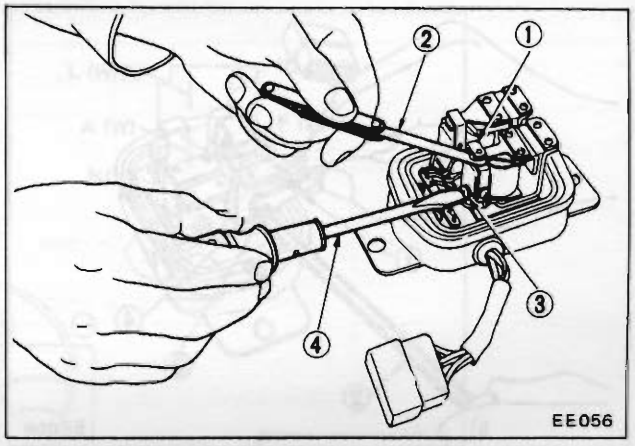
As the result of above measurement, when regulating voltage is deviated from rated value, adjust regulator in accordance with following instructions.

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 the 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-56.)

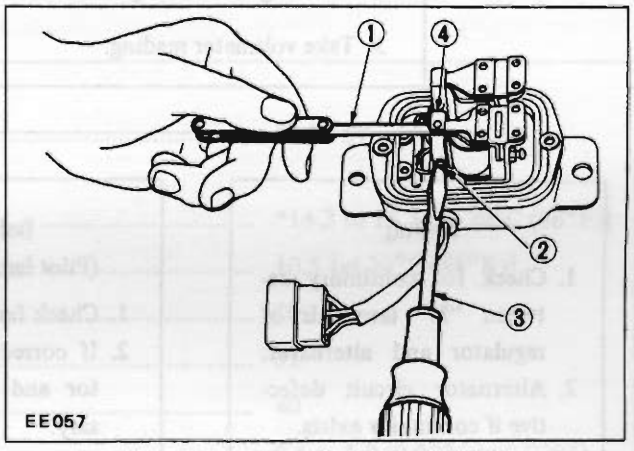


1	Contact set
2	Thickness gauge
3	4mm (0.1575 in) dia. screw
4	Crosshead screwdriver

Fig. EE-56 Adjusting core gap

4. Ajusting 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-57.)

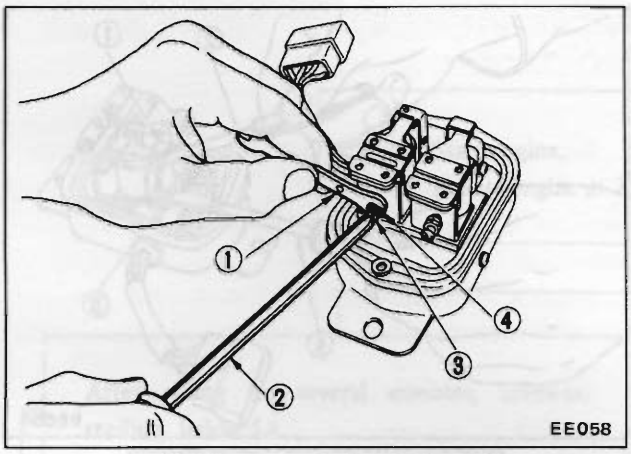


1	Thickness gauge
2	3 mm (0.1181 in) dia. screw
3	Crosshead screwdriver
4	Upper contact

Fig. EE-57 Adjsuting point gap

5. Adjusting regulating voltage

Loosen lock nut securing adjusting screw. Turn this screw clockwise to increase, or counterclockwise to decrease, regulating voltage. (See Figure EE-58.)



1	Wrench
2	Crosshead screwdriver
3	Adjusting screw
4	Lock nut

Fig. EE-58 Adjusting regulating voltage

Charge relay

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

Use DC voltmeter, and set up a circuit as shown in Figure EE-59.

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 5.2V
(Pilot lamp remains lit.)

1. Check fan belt tension.
2. If correct, remove regulator and adjust as necessary.

Over 5.2V
(Pilot lamp remains lit.)

Pilot lamp relay coil or contact points out of order.
Replace regulator.

Over 5.2V
(Pilot lamp does not lit.)

Pilot lamp relay assembly is in good condition.

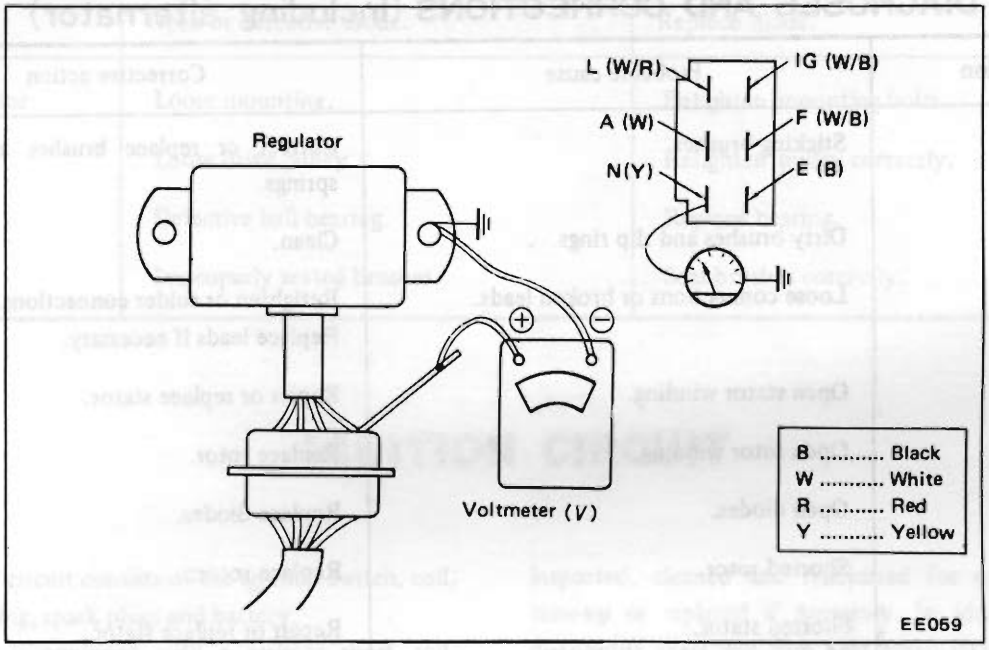


Fig. EE-59 Testing charging relay

SPECIFICATIONS AND SERVICE DATA

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 rotor.	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.
	Defective 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 of 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 the 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.
	Defective 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 short coil. During cranking engine, electric 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.

The distributor contact points and spark plugs require periodic service. That is, the breaker points should be inspected, cleaned and readjusted for specified gap 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 other ignition component parts should be inspected for their operation, tightness of electrical terminals and wiring condition.

The ignition circuit is as shown below:

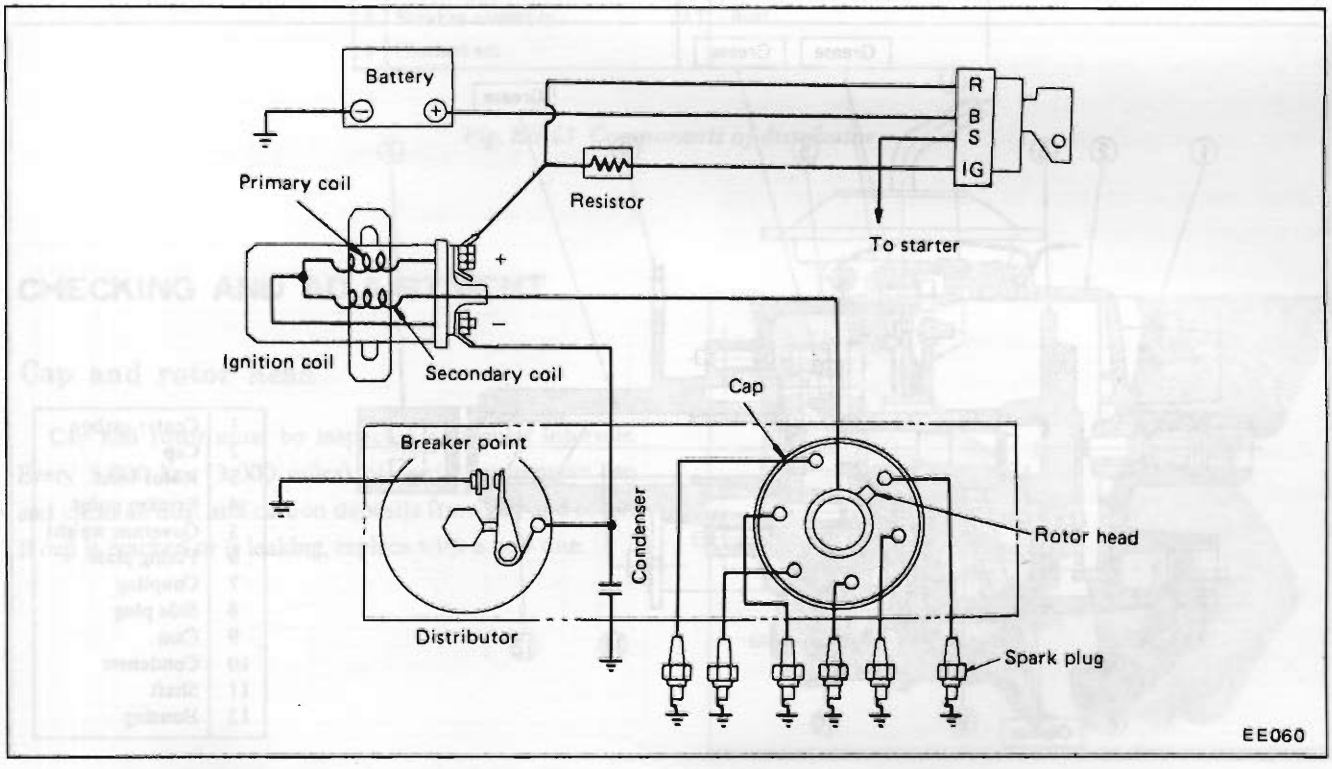


Fig. EE-60 Ignition system circuit diagram

DISTRIBUTOR

CONTENTS

CONSTRUCTION AND OPERATION EE-27
CHECKING AND ADJUSTMENT EE-29
Cap and rotor head EE-29
Point EE-30
Condenser EE-30
Vacuum and centrifugal advance part EE-30
DISASSEMBLY AND ASSEMBLY EE-31
Disassembly EE-31
Assembly EE-33
SPECIFICATIONS AND SERVICE DATA EE-34
Specifications EE-34
Service data EE-34

Distributor model	Applied engine
D606-52	L24 (with single and twin carb.)
D609-56	L20 engine

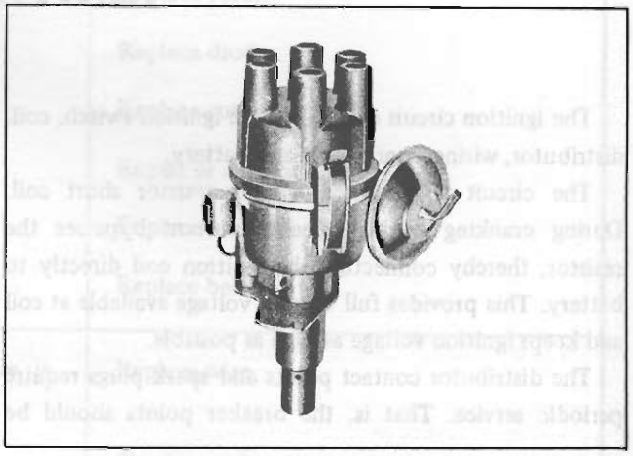
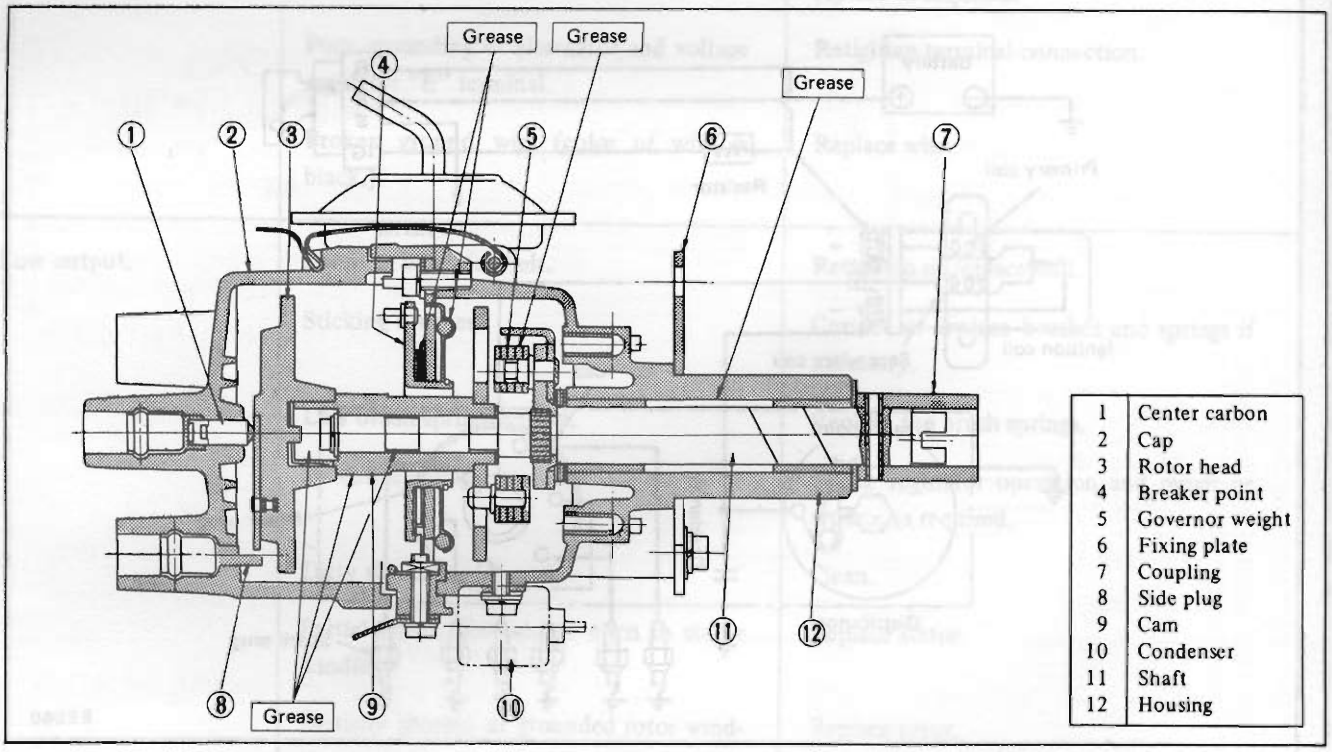


Fig. EE-61 D612-53

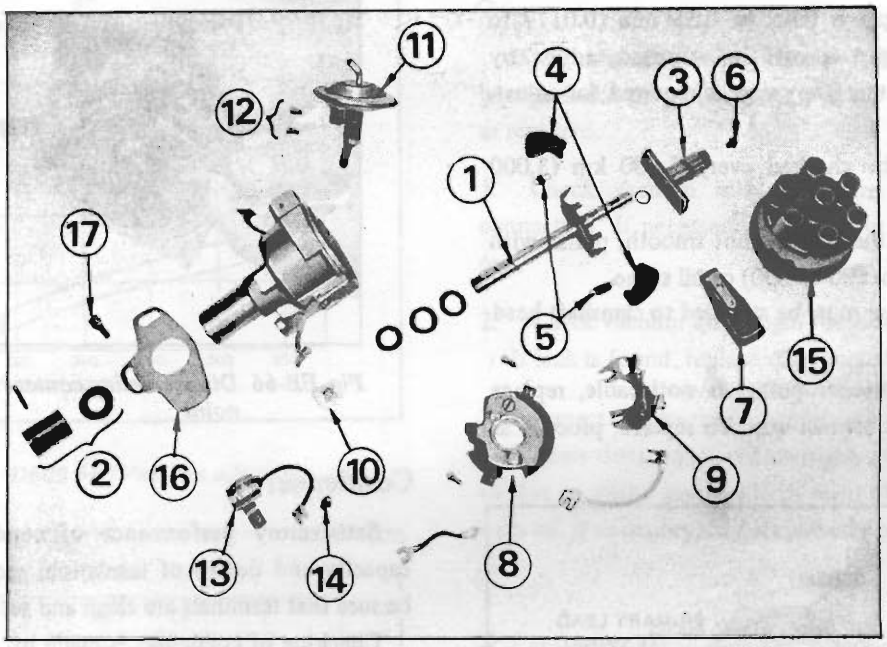
CONSTRUCTION AND OPERATION

Figure EE-62 shows a distributor removed off the engine. It consists of breaker plate with contact points, centrifugal advance mechanism, vacuum unit, drive shaft and rotor.



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

Fig. EE-62 Structure



1	Shaft assembly	10	Terminal assembly
2	Collar set assembly	11	Vacuum control assembly
3	Cam assembly	12	Screw
4	Governor weight assembly	13	Condenser
5	Governor spring	14	Screw
6	Screw	15	Distributor cap assembly
7	Rotor head assembly	16	Fixing plate
8	Breaker assembly	17	Bolt
9	Contact set		

Fig. EE-63 Components of distributor

CHECKING AND ADJUSTMENT

Cap and rotor head

Cap and rotor 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.



Fig. EE-64 Removing rotor head

Point

Standard point gap is 0.45 to 0.55 mm (0.0177 to 0.0217 in). When gap is off the standard, adjust 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 surface of the point is not smooth, polish with fine emery paper (No. 500 or 600) or oil stone.

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

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

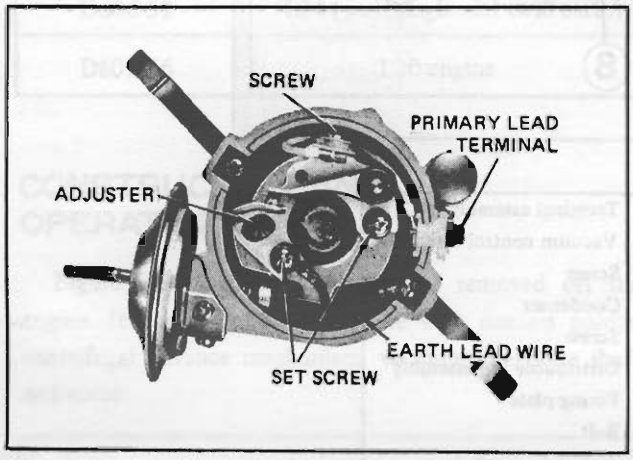


Fig. EE-65 Breaker

First loosen set screws 1 to 1.5 turns at contact arm and primary lead wire connection just far enough to permit removal of primary lead terminal, Figure EE-66.

Referring to Figure EE-66 in the right hand side, unscrew two contact arm set screws to remove lead wire.

While holding contact arm assembly by fingers, pull out contact arm by raising it slightly.

Contact set can then be removed together. Install new contact set in reverse sequence of removal. Coat cam heel and camshaft head with a light coating of grease.

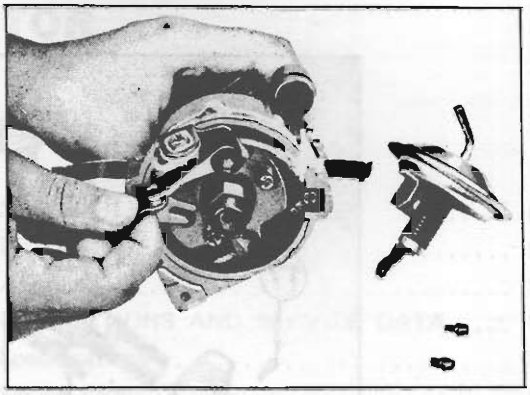


Fig. EE-66 Disassembling contact arm and contact point

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 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.

Vacuum and centrifugal advance part

≪Advance characteristics≫

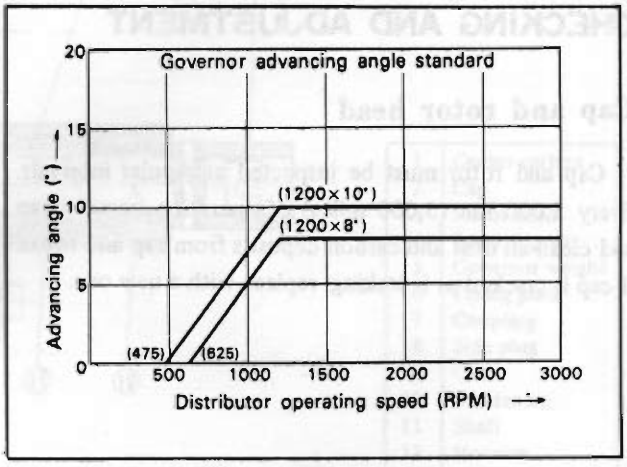


Fig. EE-67 D609-56 (Centrifugal advance)

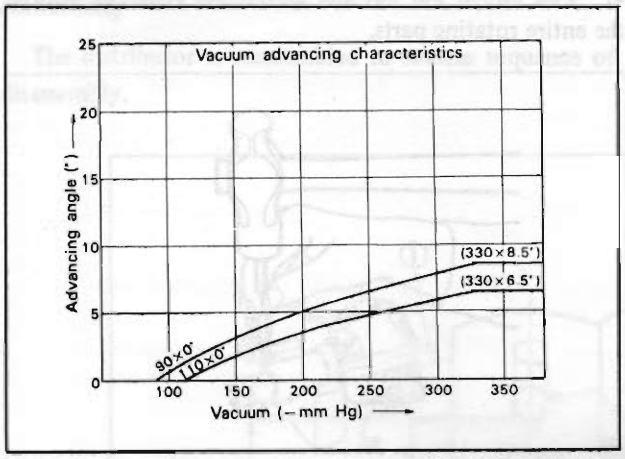


Fig. EE-68 D609-56 (Vacuum advance)

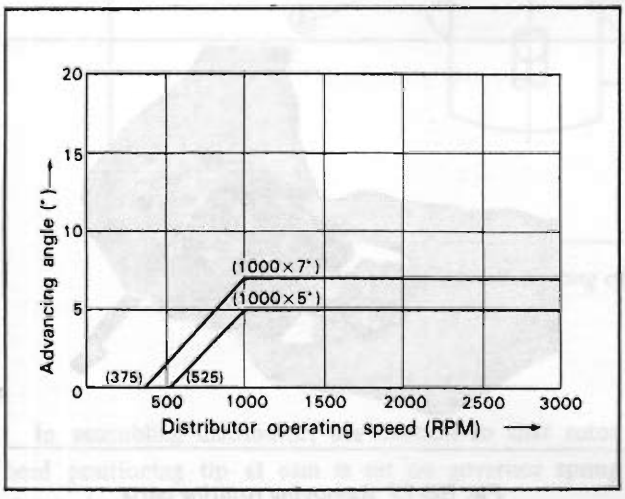


Fig. EE-69 D606-52 (Centrifugal advance)

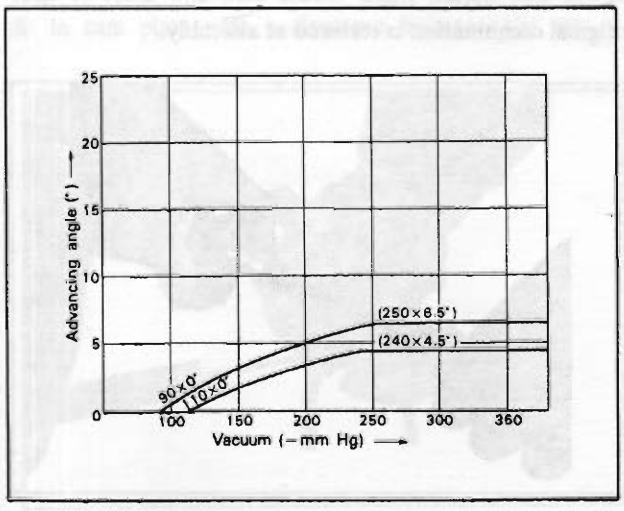


Fig. EE-70 D606-52 (Vacuum advance)

≪ Vacuum advance part ≫

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 moving.
   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 mechanism ≫

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 of abnormal wearing-out of driving part or others.

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

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

DISASSEMBLY AND ASSEMBLY

Disassembly

Disassembly can be made in the following order.

1. Take off cap and disconnect rotor head.

2. Remove vacuum controller.

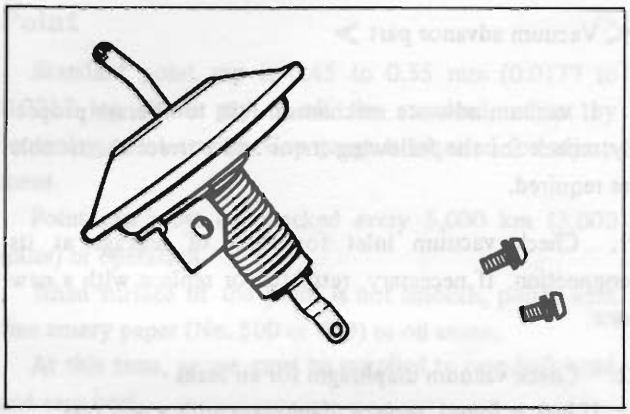


Fig. EE-71 Disassembling vacuum controller

3. Remove contact breaker.
Refer to page EE-72 when contact set is removed.

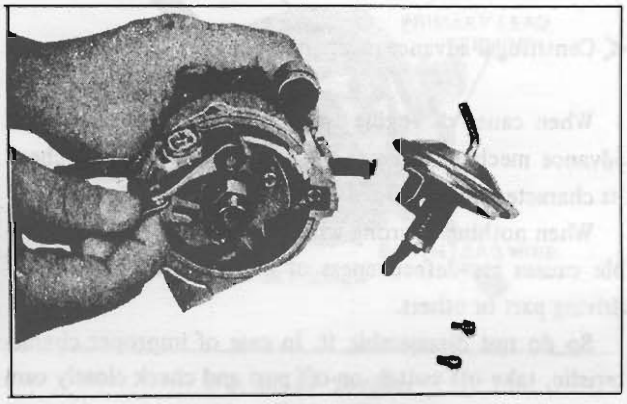


Fig. EE-72 Removing contact set

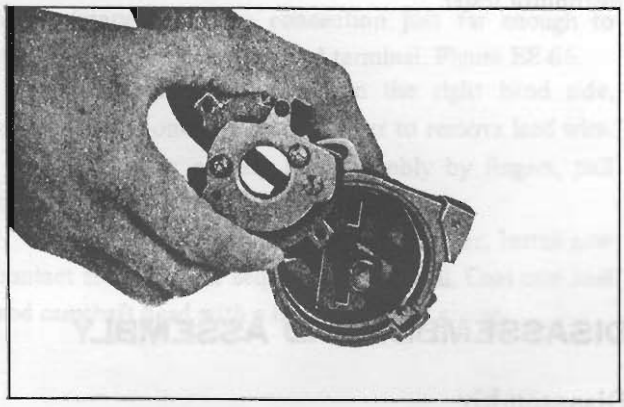


Fig. EE-73 Removing contact breaker

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.

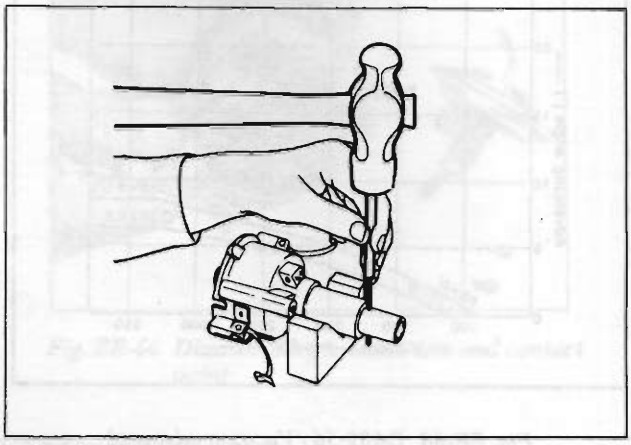


Fig. EE-74 Removing knock pin

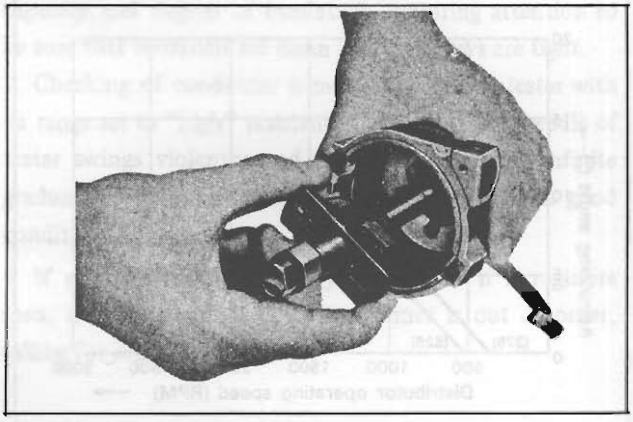


Fig. EE-75 Removing rotating parts

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

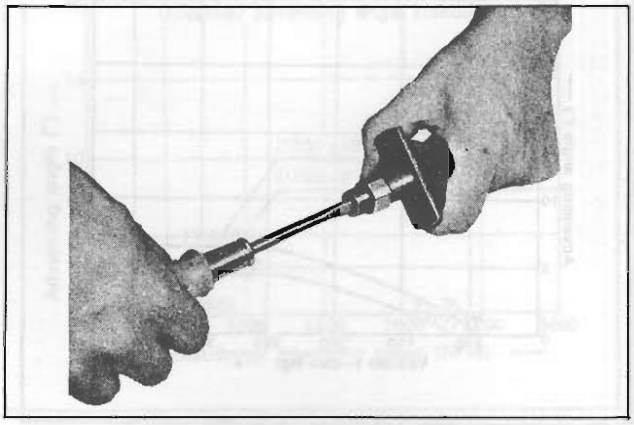


Fig. EE-76 Removing cam

Assembly

The distributor is reassembled in reverse sequence of disassembly.

Refer to Figure EE-79 for replacement and reassembly of governor spring and cam.

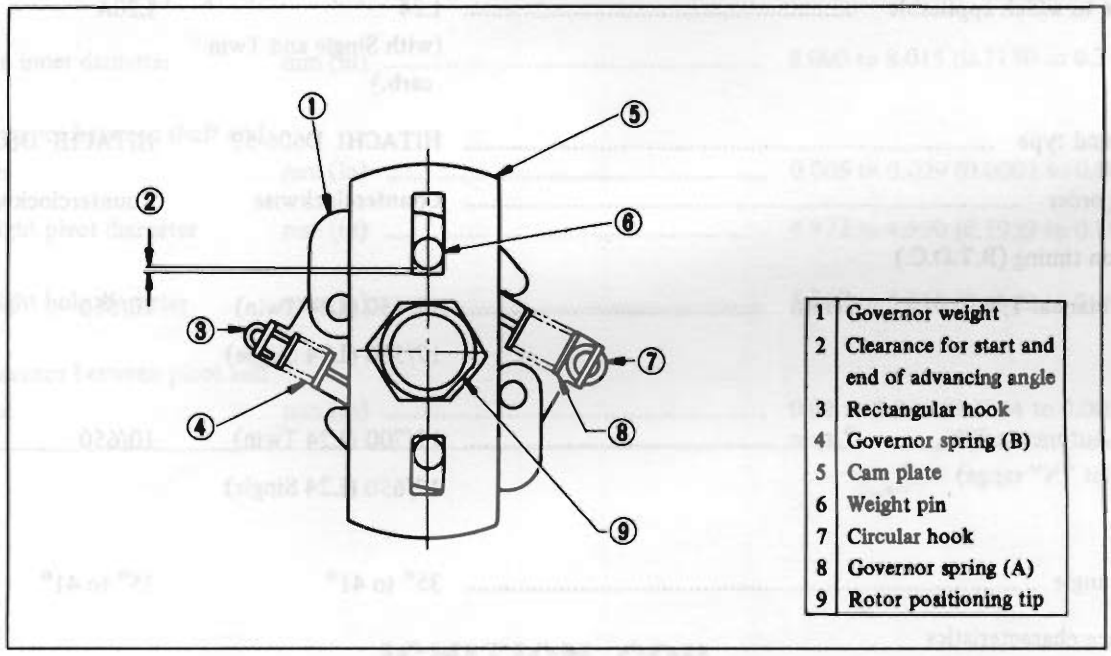


Fig. EE-77 Setting of governor spring and cam

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 comes 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 comes in short rectangular hole. It does not leave clearance either at the start and end of advancing.

After assembly, check operation of governor before installing it on engine. Ignition timing should be tested with unit mounted on engine.

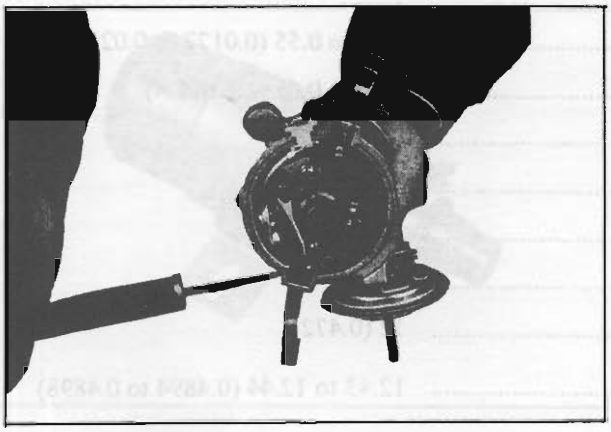


Fig. EE-78 Testing point pressure

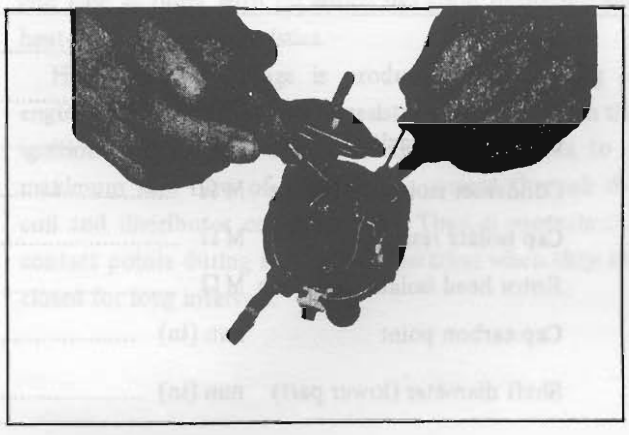


Fig. EE-79 Measuring point gap

SPECIFICATIONS AND SERVICE DATA

Specifications

Engine to which applicable		L24 (with Single and Twin carb.)	L20A
Make and type		HITACHI D606-52	HITACHI D609-56
Firing order		Counterclockwise	Counterclockwise
Ignition timing (B.T.D.C.)			
Manual T/M	°/rpm	17/650 (L24 Twin) 17/550 (L24 Single)	10/550
Automatic T/M (at "N" range)	°/rpm	17/700 (L24 Twin) 17/650 (L24 Single)	10/650
Dwell angle		35° to 41°	35° to 41°
Advance characteristics			
Centrifugal			
Start	rpm	450	550
Maximum	°/rpm	6/1,000	9/1,200
Vacuum			
Start	mmHg (inHg)	100 (3.94)	100 (3.94)
Maximum	°/mmHg (inHg)	5.5/245 (9.6)	7.5/330 (13.0)
Weight	kg (lb)	1.0 (2.2)	1.0 (2.2)

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 (1.1 to 1.4)
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)
Shaft diameter (lower part)	mm (in)	12.43 to 12.44 (0.4894 to 0.4898)
Housing inner diameter	mm (in)	12.45 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)
Amendment 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 (0.1962 to 0.1969)
Clearance between pivot and hole	mm (in)	0.01 to 0.046 (0.0004 to 0.0018)

IGNITION COIL

CONTENTS

DESCRIPTION EE-35
SPECIFICATION EE-36

DESCRIPTION

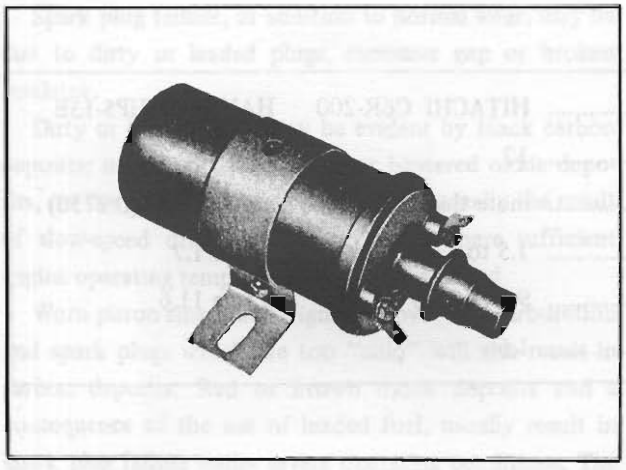
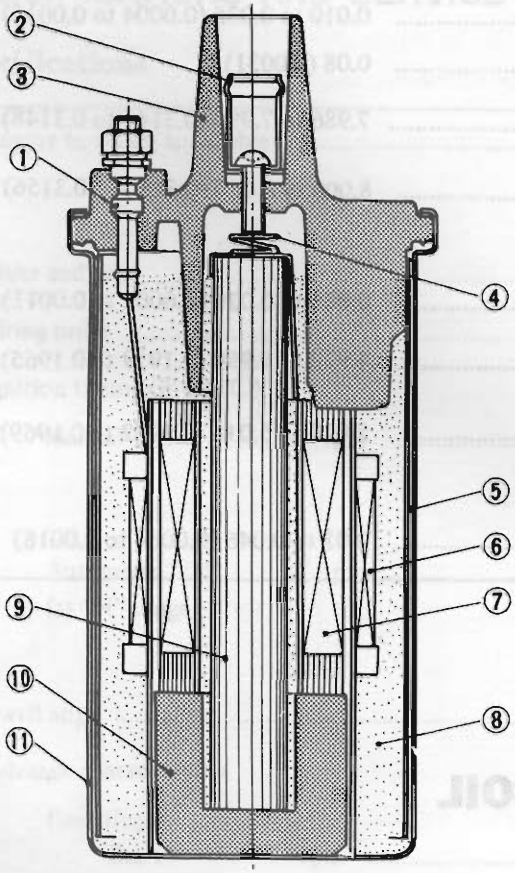


Fig. EE-80 HP5-13E

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.

High sparking voltage is produced from starting to engine high revolution by the resistor which is used in the ignition coil circuit. 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.



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

Fig. EE-81 Construction

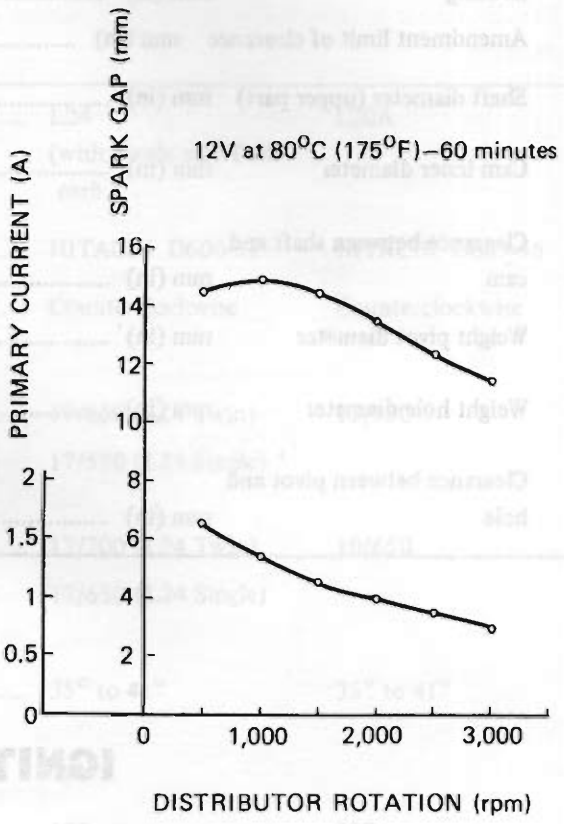


Fig. EE-82 C6R-200, HP5-13E characteristic curve

SPECIFICATION

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

SPARK PLUGS

CONTENTS

PERIODICAL SERVICES EE-38
INSPECTION EE-38
CLEANING AND REGAP EE-40
SPECIFICATION AND SERVICE DATA EE-40
TROUBLE DIAGNOSES AND CORRECTIONS EE-40

PERIODICAL SERVICES

Plugs should be removed for cleaning, inspection and regapping periodically (actual time depending on operating conditions).

INSPECTION

Spark plug life is affected to a large extent by operating conditions and plug life varies consequently. In order to secure peak performance, spark plugs should be checked, cleaned and regapped every 12 months or 20,000 km (12,000 miles).

Worn or dirty plugs will give satisfactory operation at idling speed, but under high speed operation, they frequently fail. The fault of plugs are evident in a number of ways such as increased fuel consumption, power loss, loss of speed, hard starting and general poor engine performance.

Spark plug failure, in addition to normal wear, may be due to dirty or leaded plugs, excessive gap or broken insulator.

Dirty or leaded plugs may be evident by black carbon deposits, or red, brown, yellow or blistered oxide deposits, on the plugs. The black deposits are usually the result of slow-speed driving and short runs where sufficient engine operating temperature is seldom reached.

Worn piston rings, faulty ignition, over-rich carburetion and spark plugs which are too "cold" will also result in carbon deposits. Red or brown oxide deposits and a consequence of the use of leaded fuel, usually result in spark plug failure under severe operating conditions. The oxides have no adverse effect on plug operation as long as they remain in a powdery state. But, under high speed or heavy load, the powder oxide deposits melt and form a heavy glaze coating on the insulator which, when hot, acts as a good electrical conductor, allowing current to follow the deposits and short out the plug.

Excessive gap wear on plugs of low mileage, usually indicates the engine is operating at high speeds or loads that are consistently greater than normal or that a plug which is too "hot" is being used. In addition, electrode wear may be the result of plug overheating, caused by combustion gases leaking through the threads and gasket, due to insufficient compression of the spark plug gasket, dirt under the gasket seat. Too "lean" carburetion will also result in excessive electrode wear.

Broken insulators are usually the result of improper installation or carelessness when regapping the plug. Broken upper insulators usually result from a poor fitting wrench or an outside blow. The cracked insulator may not make itself evident immediately, but soon oil or moisture will penetrate the fracture. The fracture is usually just below the crimped part of shell and may not be visible.

Broken lower insulators usually result from carelessness when regapping and generally are visible. In fairly rare instances, this type of break may result from the plug operating too "hot" such as encountered in sustained periods of high-speed operation or under extremely heavy loads. When regapping a spark plug, to avoid lower insulator breakage, always make the gap adjustment by bending the ground side electrode. Spark plugs with broken insulators should always be replaced.

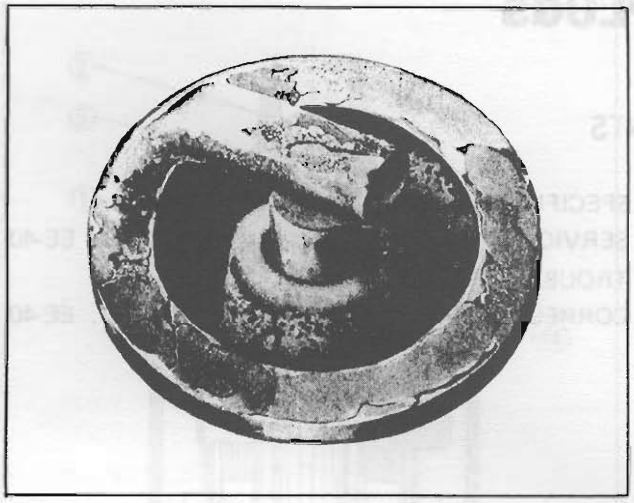


Fig. EE-83 Normal

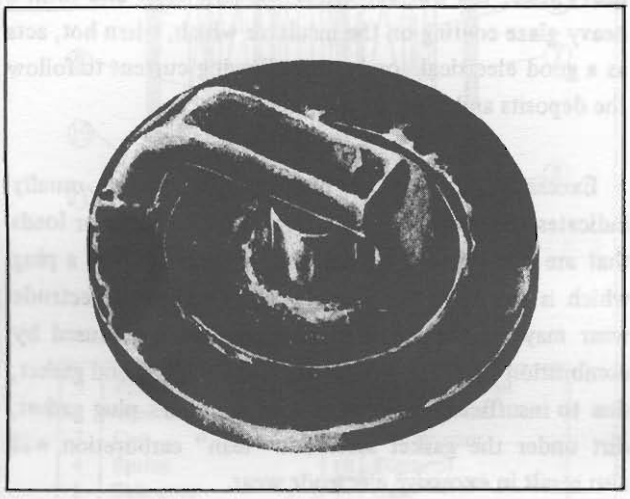


Fig. EE-84 Wet

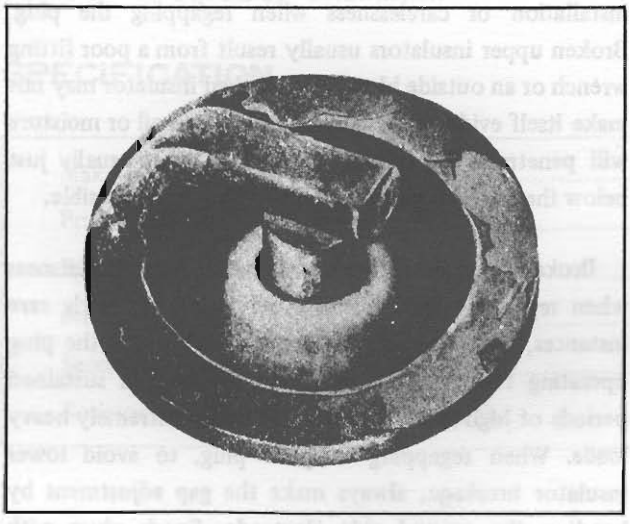


Fig. EE-85 Overheating (I)

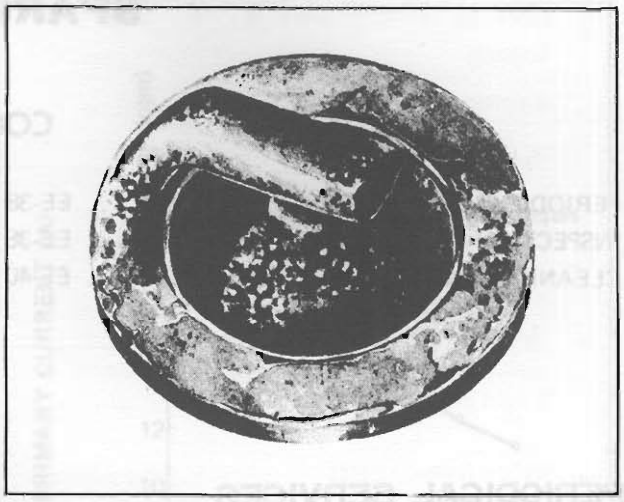


Fig. EE-86 Overheating (II)

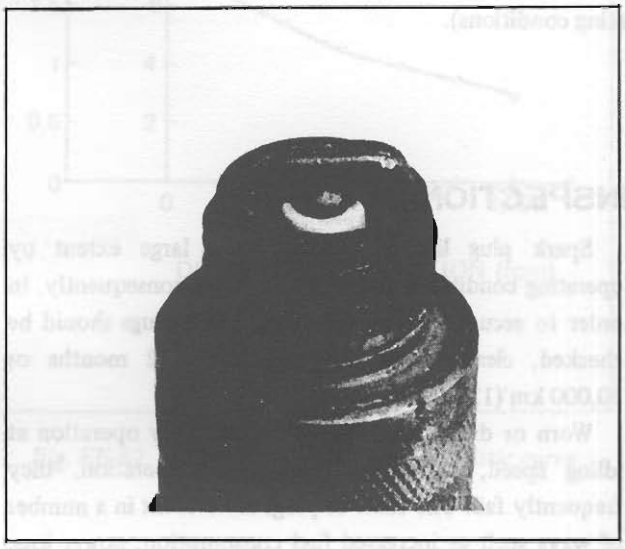


Fig. EE-87 Overheating (III)

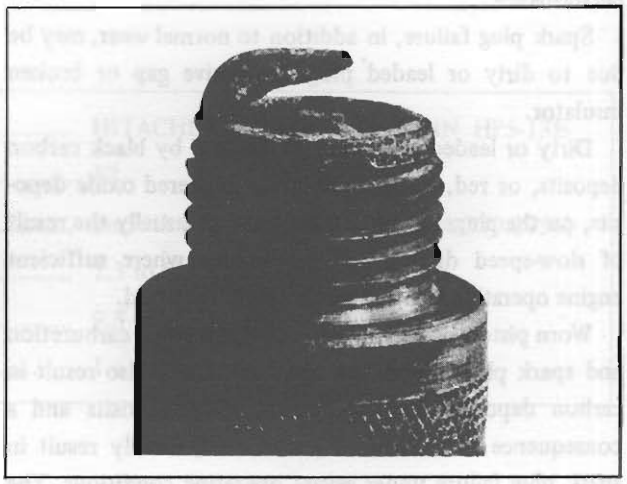


Fig. EE-88 Life

CLEANING AND REGAP

Clean spark plugs thoroughly using an abrasive-type cleaner. All spark plugs must be of the same make and number or heat range. Use a round feeler gauge to adjust the spark plug gaps.

Note: Before adjusting gap, file center electrode falt. In adjusting spark plug gap, never bend center electrode which extends through porcelain center. Always make adjustments by bending ground side electrode.

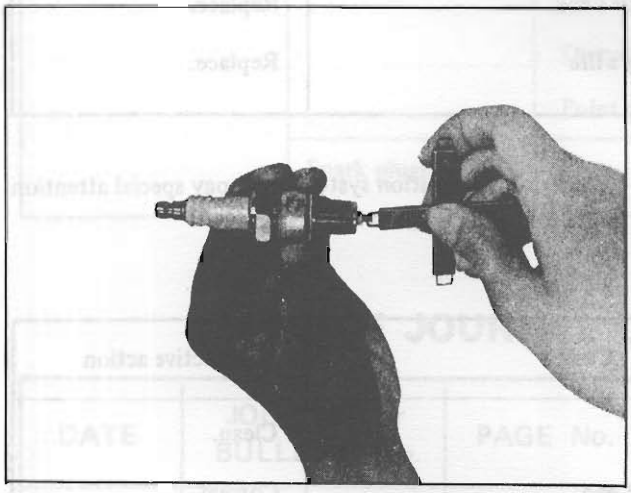
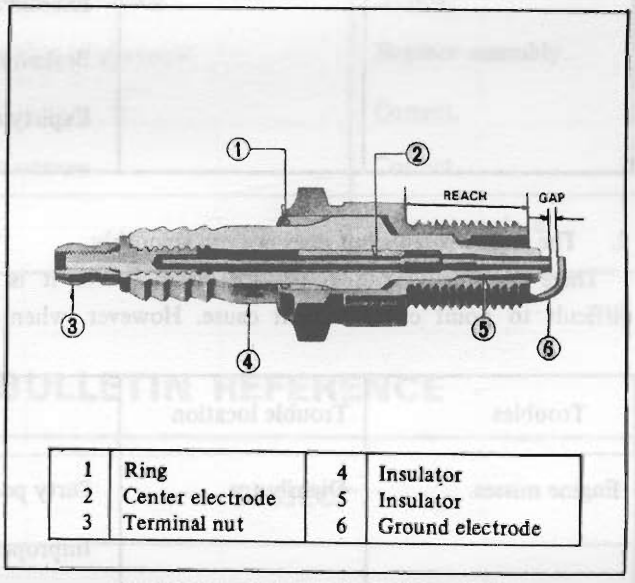


Fig. EE-89 Measuring spark plug gap

SPECIFICATION AND SERVICE DATA

Item \ Make	NGK
Model	BP-5ES (230 only) BP-6ES
Applied engine	L20A, L24
Size (screw diameter x reach) mm (in)	14 x 19 (0.55 x 0.75)
Plug gap mm (in)	0.8 to 0.9 (0.031 to 0.035)
Torque kg-m (ft-lb)	1.5 to 2.0 (11.0 to 15.0)



1	Ring	4	Insulator
2	Center electrode	5	Insulator
3	Terminal nut	6	Ground electrode

Fig. EE-90 Cross section of spark plug

TROUBLE DIAGNOSES AND CORRECTIONS

1. The engine does not start.

If there is no trouble in the fuel system, the ignition system should be checked. This can be easily done by detaching the high tension cord from spark plugs, start the engine by the starting motor and observe the condition of the sparks that occur between the high tension cord and spark plug terminal. After checking this, use the proper countermeasures.

Spark gap	Trouble location	Causes	Corrective action
No sparks at all	Distributor	Defective insulation of condenser	Replace.
		Breakage of lead-wire on low tension side	Repair.
		Defective 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 new one.

	High tension code	Wire coming off	Repair.
		Defective 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.
		Excessively burnt point	Replace.
		Layer short-circuit	Replace assembly.
Less than 6 mm (0.2362 in)	Spark plugs	Electrode gap too wide	Correct or replace.
		Excessively accumulated carbon	Clean or replace.
		Broken insulator neck	Replace.
		Expirty of plug's life	Replace.

2. The engine rotates but does not run smoothly.

There are many causes for this trouble, and it is difficult to point out the right cause. However, when considering the ignition system only, pay special attention to the following points.

Troubles	Trouble location	Causes	Corrective action
Engine misses.	Distributor	Dirty point	Clean.
		Improper point gap	Correct.
		Leak of electricity of cap and rotor head	Replace.
		Defective insulation of condenser	Replace.
		Defective insulation of lead wire of condenser	Replace.
		Defective arm	Oil the shaft.
		Defective spring of arm spring.	Replace assembly.
		Near-breakage of lead wire	Replace.
		Worn or shaky breaker plate	Replace assembly.
		Worn or shaky distributor shaft.	Replace assembly.
	Ignition coil	Layer short-circuit or use of inferior quality	Replace assembly.
	High tension code	Deterioration of insulation and leak of electricity	Replace.

	Spark plugs	Dirty	Clean or replace.
		Electricity leaks at the upper porcelain insulator	Replace assembly.
Engine causes knocking very often.	Distributor	Improper advance timing	Adjust.
		Come off or breakage of governor spring	Correct or replace.
		Worn out pin or hole of governor portion	Replace.
	Spark plugs	Excessively burnt spark plug	Clean or replace.
Engine does not provide enough power	Distributor	Improper or retarded timing	Adjust.
		Defective function of governor	Replace assembly.
		Dirty point	Correct.
		Point gap too narrow	Correct.
	Spark plugs	Dirty	Clean or replace.

SERVICE JOURNAL OR BULLETIN REFERENCE

DATE	JOURNAL or BULLETIN No.	PAGE No.	SUBJECT

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