SERVICE MANUAL

MODEL
A10 & A12
ENGINE

NISSAN
NISSAN MOTOR CO., LTD.
TOKYO, JAPAN

SECTION EE

ENGINE ELECTRICAL SYSTEM

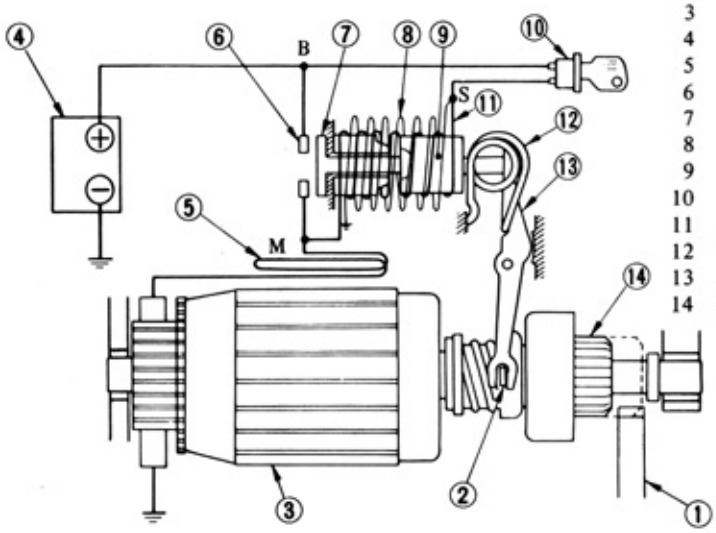
EE

STARTING SYSTEM

CONTENTS

STARTING CIRCUIT

The starting circuit consists essentially of a battery, ignition switch, starting motor and solenoid, as shown in Figure EE-1.



1 Ring gear
2 Shift lever guide
3 Armature
4 Battery
5 Field coil
6 Stationary contact
7 Movable contact
8 Shunt coil
9 Plunger
10 Ignition switch
11 Series coil
12 Torsion spring
13 Shift lever
14 Pinion

Fig. EE-1 Starting circuit

BATTERY

VISUAL INSPECTION

1. Check for corroded terminals or broken cables. Clean or replace, as necessary.
2. Check case for cracks or leaks. If necessary, replace.
3. Check cell connectors for cracks, and check for missing cell connectors. Check vents for clogging or leaks. Clean or replace, as necessary.
4. Check for corroded, broken, or loose fittings. Clean, replace or retighten, as necessary.

Notes:

a. Always keep battery top and sides clean and dry to prevent current leak.

b. Keep battery terminals clean. After connecting cables to terminals, apply a thin coating of vaseline to battery terminals and top surfaces of cable terminals to prevent formation of corrosion.

INSPECTION OF BATTERY ELECTROLYTE

Electrolyte level

Check electrolyte level in each battery cell at least once a month.

1. Remove six vent plugs and inspect electrolyte level in each cell. Level can be quickly determined by glancing into cell opening.
2. If electrolyte level is found to be low, add distilled water to each cell until level rises to approximately 10 to 20 mm (0.394 to 0.787 in) above top of plates.

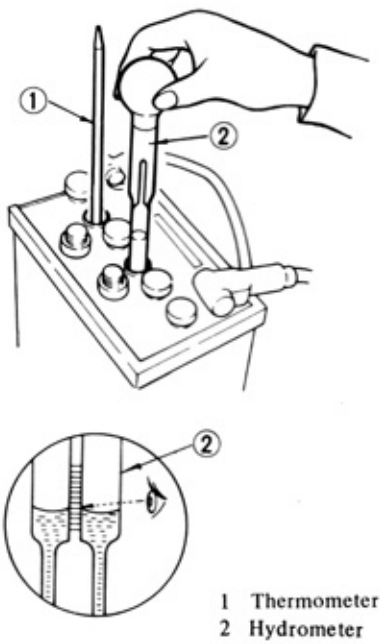
For a battery with electrolyte guide lines on its wall, check that electrolyte level is between upper and lower lines.

Note: Do not overfill. Overfilling will cause loss of electrolyte, resulting in poor performance and short life.

Specific gravity of electrolyte

Specific gravity of battery electrolyte is tested with a hydrometer. Observe the following:

1. When measuring specific gravity, place your eyes in line with scale to read the highest level of electrolyte (electrolyte rises at edge due to surface tension). See Figure EE-2.



1 Thermometer
2 Hydrometer

Fig. EE-2 Checking specific gravity

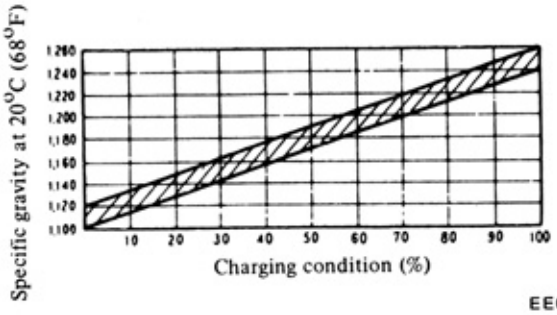


Fig. EE-3 Relation between specific gravity and charging condition

2. A fully charged battery will have a specific gravity reading of approximately 1.260 at an electrolyte temperature of 20°C (68°F).

Battery must be recharged or battery acid concentration must be adjusted if:

a. Battery charging condition is below 60% of its normal capacity, or
b. Specific gravity reading is below 1.200 as corrected to 20°C (68°F).

3. If electrolyte temperature is above or below 20°C (68°F), additions or subtractions of gravity points must be made in order to obtain a hydrometer reading corrected to the 20°C (68°F) standard.

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

To obtain specific gravity reading corrected to 20°C (68°F), add or substract the value determined by chart (along vertical axis) in Figure EE-4, for measured specific gravity.

Examples:

1) When electrolyte temperature is 30°C (86°F) and measured specific gravity is 1.240, specific gravity corrected to 20°C (68°F) is determined by:
   1.240 + 0.007 = 1.247
2) When electrolyte temperature is 10°C (50°F) and measured specific gravity is 1.240, specific gravity corrected to 20°C (68°F) is determined by:
   1.240 – 0.007 = 1.233

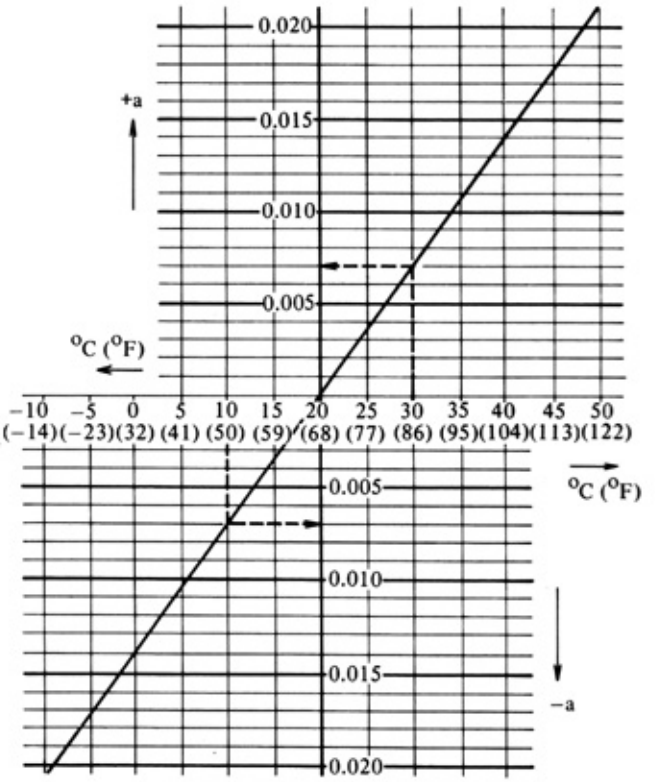


Fig. EE-4 Changes of specific gravity in response to electrolyte temperature change

Electrolyte freezing

The electrolyte freezing point depends on the acid concentration and its specific gravity. If specific gravity of electrolyte falls below 1.200 as corrected to 20°C (68°F), battery must be recharged.

Note: Since freezing may ruin battery, always be extremely careful to protect battery against freezing by keeping it in a charged condition.

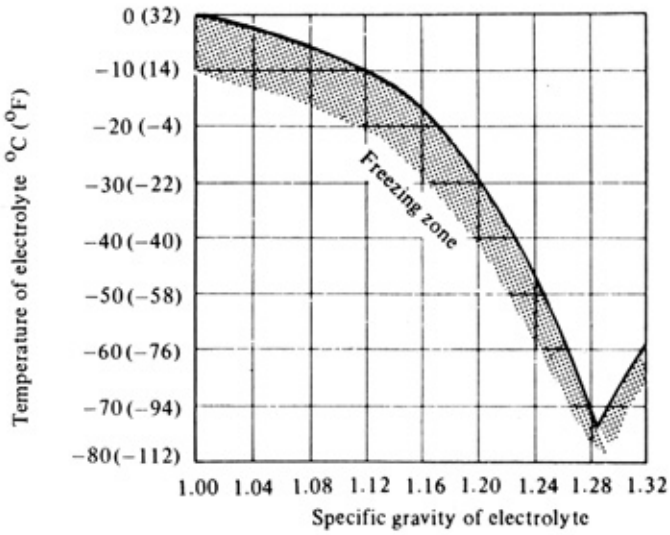


Fig. EE-5 Freezing point of electrolyte

CHARGING

If electrolyte level is satisfactory, battery must be charged when electrolyte gravity reading falls below 1.200 corrected to 20°C (68°F). If battery still mounted on car is quick-charged to bring it up to full charge, the operation should be carried out with negative cable removed.

Prior to charging, corroded battery terminals should be cleaned with a brush and common baking-soda solution. In addition, the following should be observed while battery is being charged:

1. Be sure that electrolyte level is above top of each plate.
2. Keep removed plugs in a safe place.
3. Do not allow electrolyte temperature to go over 45°C (113°F).
4. After charging, check to be certain that specific gravity does not exceed 1.260 corrected to 20°C (68°F). Correction can be made by adding distilled water into cells as necessary.
5. After all vent plugs have been tightened, clean all sprayed electrolyte off upper face of battery.

Caution: Keep battery away from open flame while it is being charged.

STARTING MOTOR

CONSTRUCTION

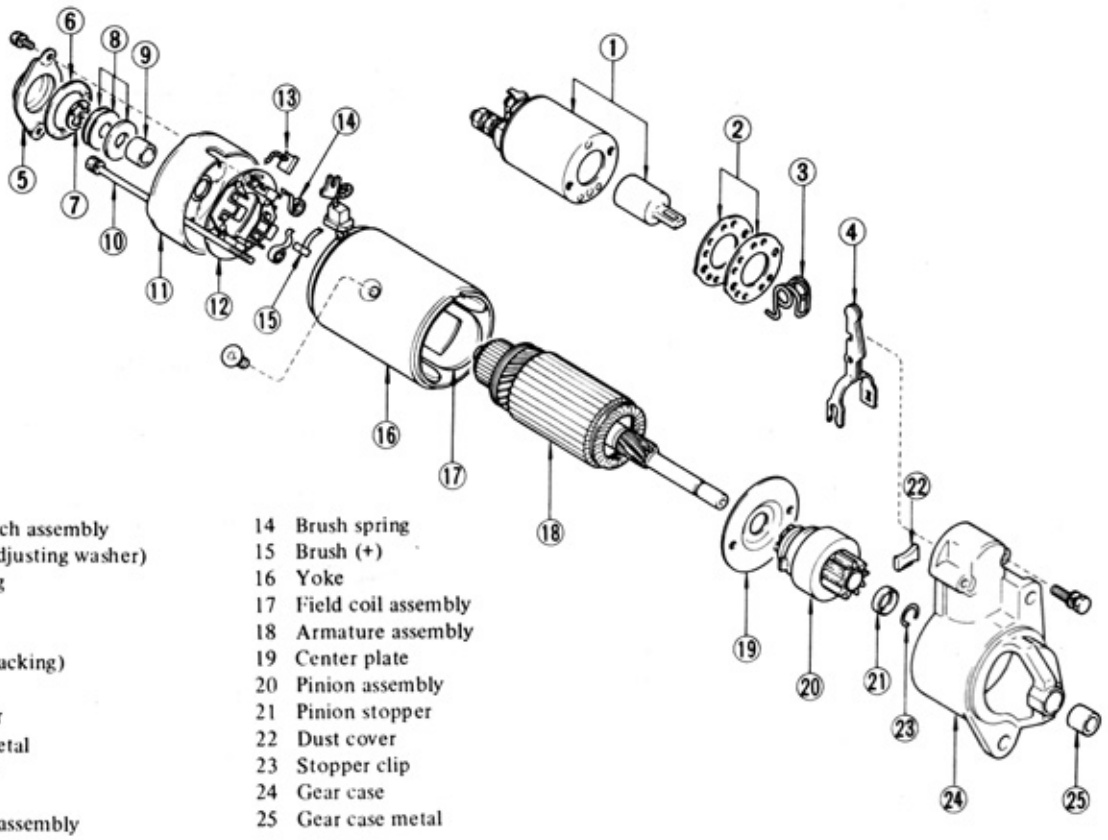
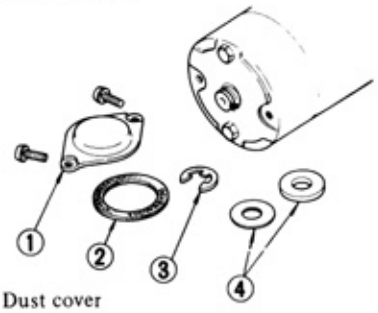


Fig. EE-6 Exploded view of starting motor

DISASSEMBLY

1. Disconnect connecting plate from "M" terminal of magnetic switch. Remove two screws securing magnetic switch and remove magnetic switch assembly.
2. Remove dust cover, E-ring and thrust washer(s).

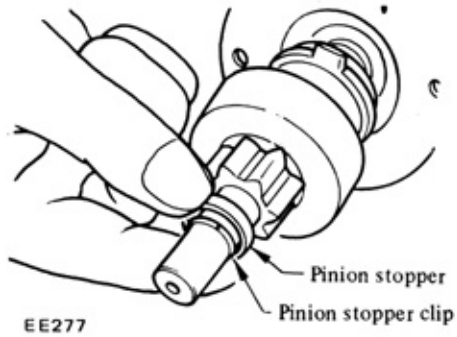


1 Dust cover
2 Packing
3 E-ring
4 Thrust washer

EE402

Fig. EE-7 Removing dust cover, E-ring and thrust washer(s)

3. Remove two through bolts and rear cover.
4. Remove brushes from their holders by moving each brush spring away from brush with a hook. Remove brush holder.
5. Remove yoke assembly and withdraw armature assembly and shift lever.
6. Remove pinion stopper located at end of armature shaft. To remove stopper, first move stopper toward pinion and after removing stopper clip, remove stopper with overrunning clutch assembly from armature shaft.



EE277

Fig. EE-8 Removing pinion stopper

CLEANING AND INSPECTION

Clean all disassembled parts, but do not use grease dissolving solvents for cleaning overrunning 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.

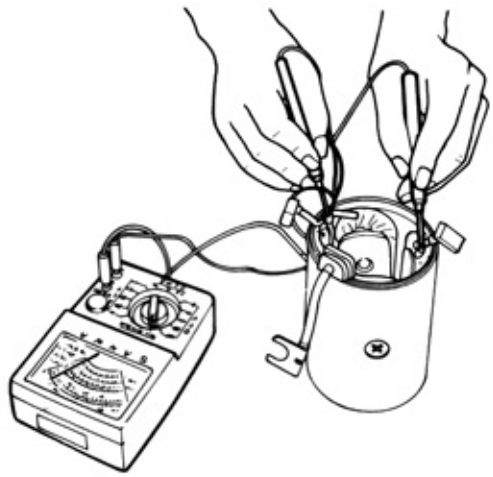
Check them for excessive damage or wear, and replace if necessary.

Terminal

Check terminal for damage and wear, and replace magnetic switch assembly if necessary.

Field coil

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



EE016

Fig. EE-9 Testing field coil for continuity

Testing field coil for continuity:

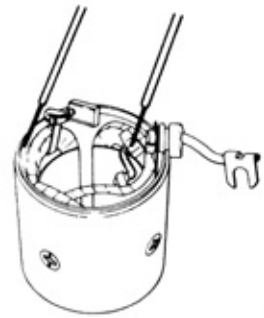
Connect probe of a circuit tester or an ohmmeter to field coil positive terminal and positive brush holder.

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

Testing field coil for ground:

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

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



EE017

Fig. EE-10 Testing field coil for ground

Brushes and brush lead wire

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

If brush is worn so that its length is less than 12 mm (0.472 in), replace.

Check connection of lead clip and lead wire.

Check brush holders and spring clip to see if they are not deformed or bent, and will properly hold brushes against 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-11. Reading should be 1.4 to 1.8 kg (3.1 to 4.0 lb). Replace spring if tension is lower than the specification.

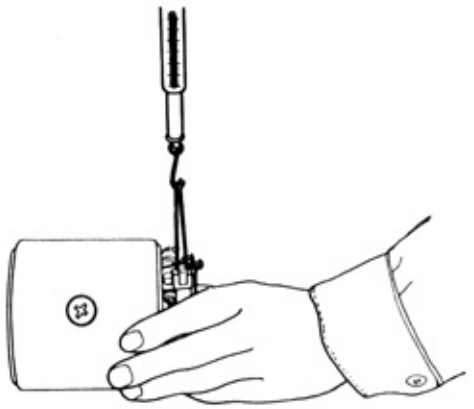


Fig. EE-11 Inspecting brush spring tension

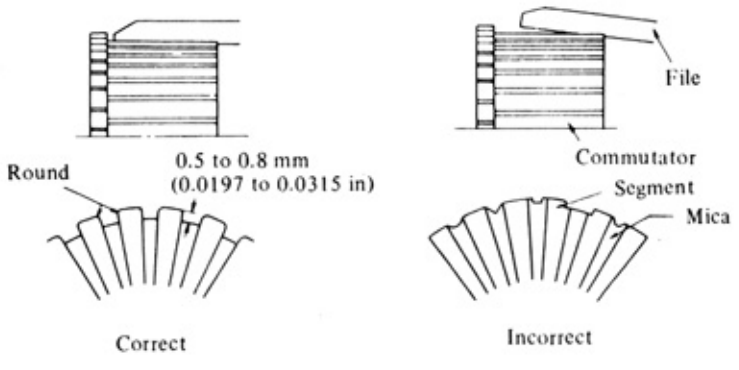


Fig. EE-12 Undercutting insulating mica

Armature assembly

Check external appearance of armature and commutator.

1. Inspect commutator. If commutator surface is rough, it must be sanded lightly with a No. 500 emery cloth. If depth of insulating mica is less than 0.2 mm (0.0079 in) from commutator surface, insulating mica should also be undercut so that its depth is 0.5 to 0.8 mm (0.0197 to 0.0315 in).

Wear limit of commutator diameter is 2 mm (0.0787 in). If diameter of commutator is less than 31 mm (1.22 in), replace armature assembly.

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

3. Armature test for ground

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

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

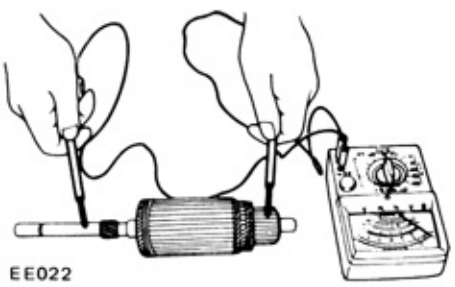


Fig. EE-13 Testing armature for ground

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

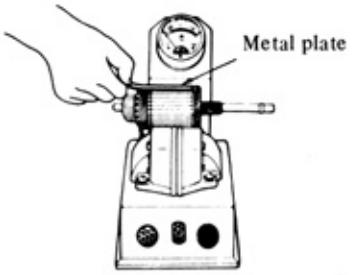
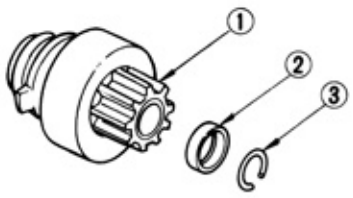


Fig. EE-14 Testing armature for short

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

Overrunning 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, replace. Flywheel ring gear also must be inspected.

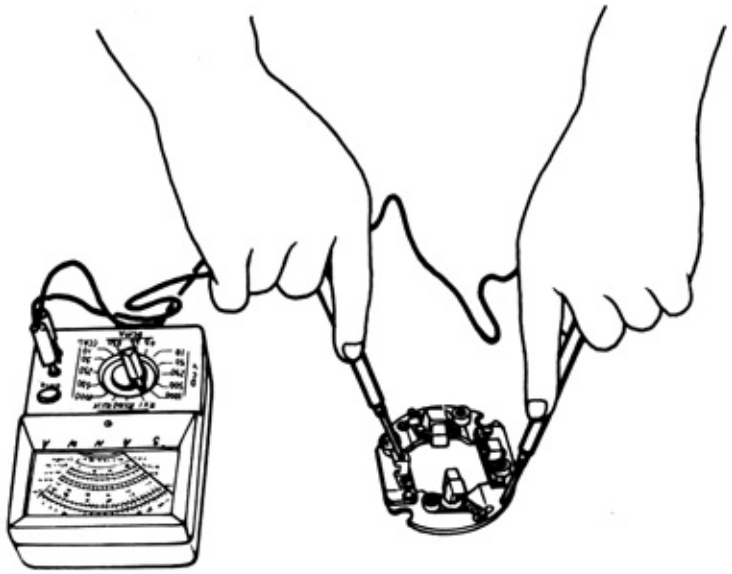


1 Pinion assembly
2 Pinion stopper
3 Clip

Fig. EE-15 Overrunning clutch assembly

Brush holder test for ground

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



EE025

Fig. EE-16 Testing brush for ground

Bearing metal

Inspect bearing metal for wear or side play. Replace metal if required.

Magnetic switch assembly

1. Using a circuit tester, check continuity between "S" terminal of magnetic switch and switch body metal. If continuity does not exist, shunt coil is open. Replace switch assembly.
2. In the same manner as above, check continuity between terminals "S" and "M". If continuity does not exist, series coil is open. Replace switch assembly.

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 lightly to pinion.

TEST

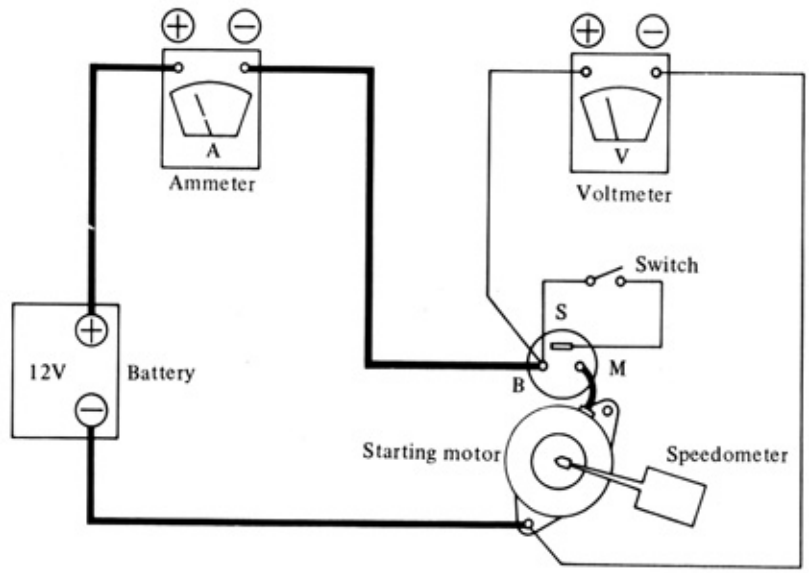
Performance test

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 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 battery (12 volts) and an ammeter capable of indicating 1,000 amperes.

Specified current draw and revolution in these tests, are shown in Service Data and Specifications.



EE405

Fig. EE-17 Circuit of no-load test

Test diagnosis

Condition	Probable cause
Low speed with no-load and high current draw.	• Tight, dirty or worn bearings. • Bent armature shaft or loose field probe. • Shorted armature. • A grounded armature or field coil.
Failure to operate with high current draw.	• A grounded or open field coil. • Armature coil does not operate. • Burned out commutator bar.
Low current draw and low no-load speed.	• Loose connections, damaged lead or dirty commutator.
High speed with no-load and high current draw.	• Shorted field coil.
Starting motor does not operate and current does not draw.	• Shorted armature and field coil. • Shorted brush leads. • Dirty commutator. • Failure of brush-to-commutator contact.

Magnetic switch assembly test

Test magnetic switch assembly after performance test.

1. Connect starting motor in series with battery and switch as shown in Figure EE-18.
2. Make sure that pinion assembly is quickly pushed out by means of magnetic switch when switch (described in step 1 above) is turned "ON".
3. With switch on, push pinion back to remove all slack and measure the clearance "ℓ" between pinion front edge and pinion stopper. The clearance should be held within 0.3 to 1.5 mm (0.012 to 0.059 in). See Figure EE-18. If necessary, adjust it by changing or adding adjusting washer(s). Adjusting washers are available into two different sizes, 0.5 mm (0.020 in) and 0.8 mm (0.032 in).

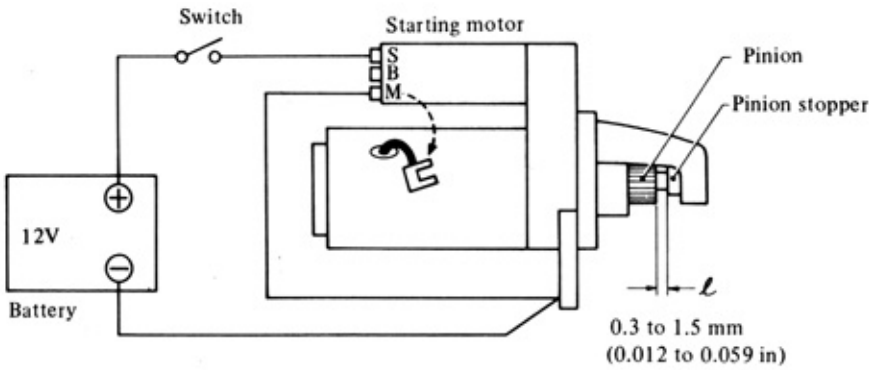


Fig. EE-18 Circuit of magnetic switch assembly test

SERVICE DATA AND SPECIFICATIONS

Starting motor

Type		S114-160	S114-161	S114-163
Applied engine model		A12 for B210 and B120	A10 and A12 for F10	A12 for B210 (Option)
System voltage	V		12	
No-load				
Current	A		Less than 60	
Revolution	rpm		More than 7,000	
Terminal voltage	V		12	
Magnetic switch				
Series coil resistance	Ω		0.324	
Shunt coil resistance	Ω		0.694	
Gap between pinion and pinion stopper	mm (in)		0.3 to 1.5 (0.012 to 0.059)	
Outer diameter of commutator	mm (in)		More than 31 (1.22)	
Brush length	mm (in)		More than 12 (0.47)	
Brush spring tension	kg (lb)		1.4 to 1.8 (3.1 to 4.0)	

TROUBLE DIAGNOSES AND CORRECTIONS

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

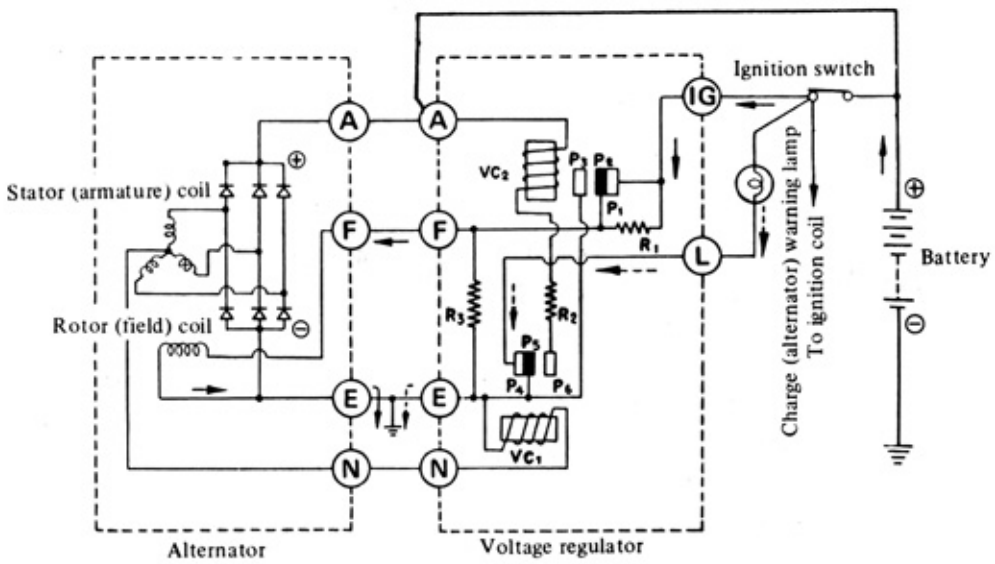
CHARGING SYSTEM

CONTENTS

CHARGING CIRCUIT

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

Figure EE-19 shows a charging circuit when ignition switch is turned to "ON". Figure EE-20 shows what happens when alternator speed is increased or voltage starts to rise excessively.



EE029

Fig. EE-19 Charging circuit (I)

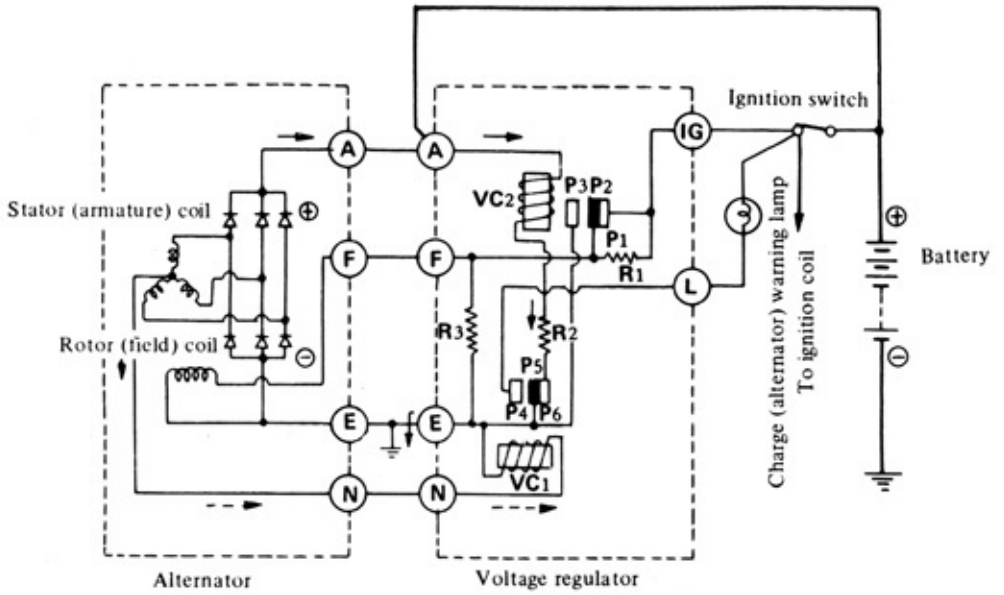


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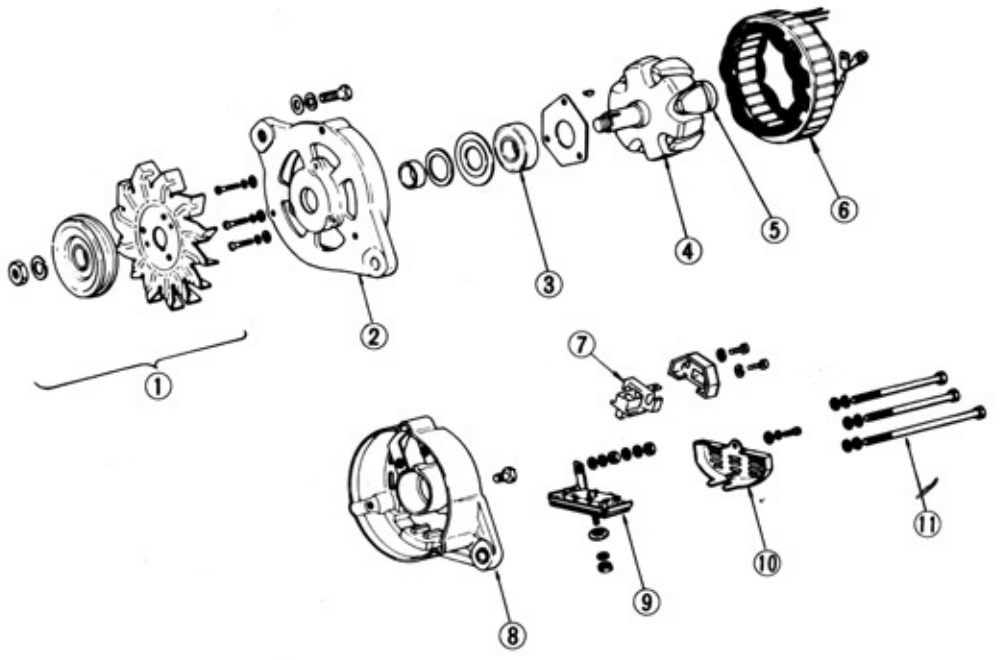
Fig. EE-20 Charging circuit (II)

ALTERNATOR

CONSTRUCTION



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

EE345

Fig. EE-21 Exploded view of alternator

DISASSEMBLY

1. Remove pulley nut and pulley assembly.

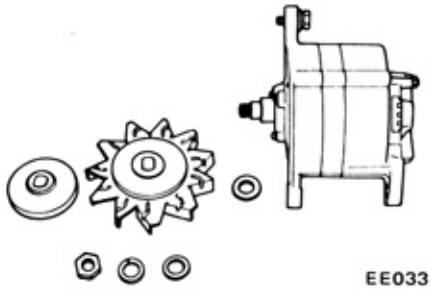
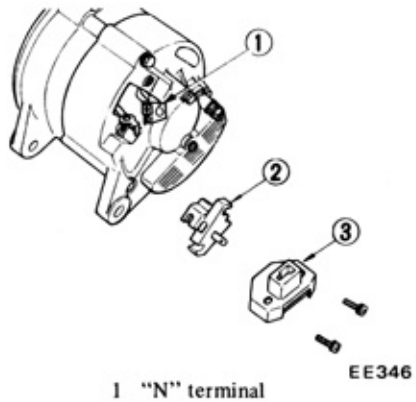


Fig. EE-22 Removing pulley and fan

2. Remove brush holder fixing screws, and remove brush holder cover. Pull 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

Fig. EE-23 Removing brush

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

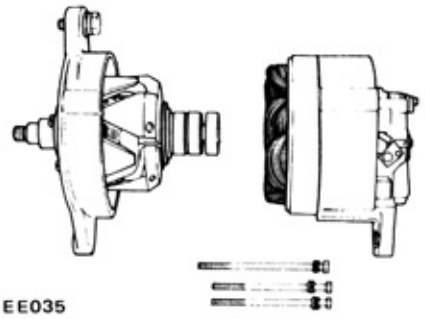


Fig. EE-24 Separating front cover with rotor from rear cover

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

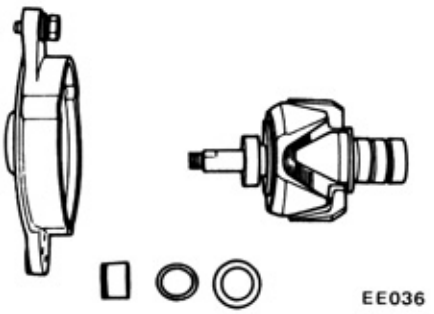
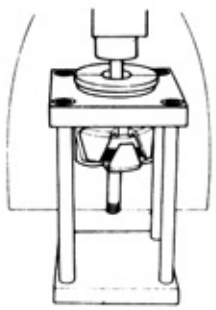


Fig. EE-25 Removing rotor

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



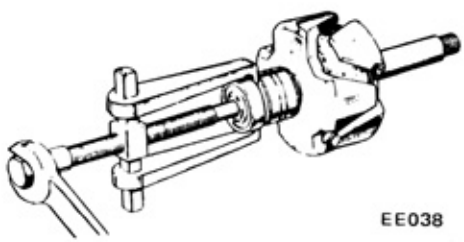
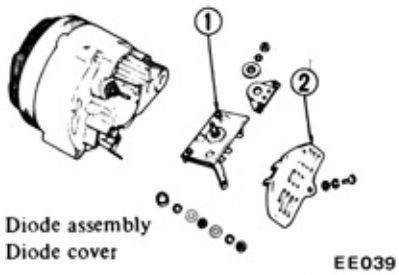


Fig. EE-26 Pulling out of rear bearing

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-27 Removing diode assembly

Note: Do not apply undue stress to diode assembly when handling.

INSPECTION AND REPAIR

Remove alternator from car and connect a circuit tester between F terminal and E terminal.

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

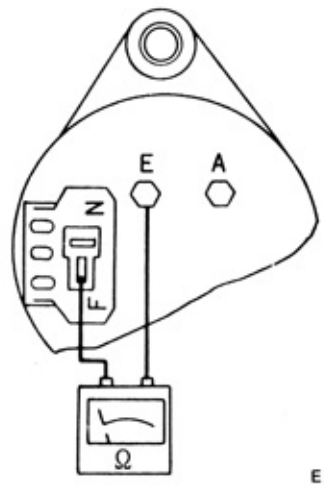


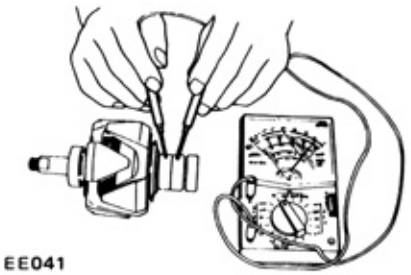
Fig. EE-28 Inspecting alternator

Rotor inspection

1. Continuity test of rotor coil.

Apply tester between slip rings of rotor as shown in Figure EE-29. If there is no continuity, rotor coil (field coil) is open.

Replace rotor assembly.

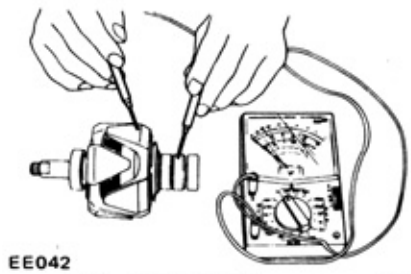


EE041

Fig. EE-29 Continuity test of rotor coil

2. Ground test of rotor coil

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



EE042

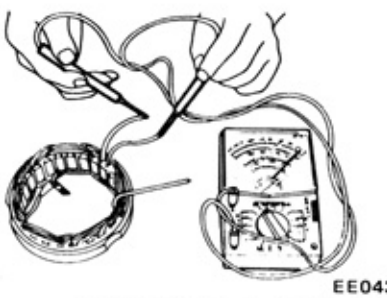
Fig. EE-30 Testing rotor coil for ground

Inspection of stator

1. Continuity test

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

Replace with stator assembly.

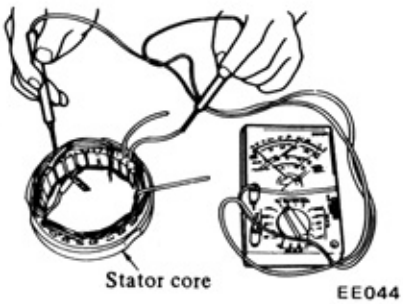


EE043

Fig. EE-31 Testing stator for continuity

2. Ground test

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

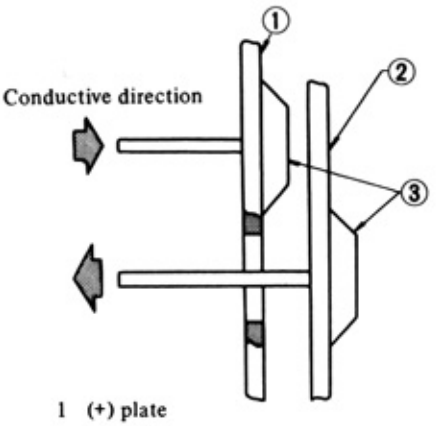


EE044

Fig. EE-32 Testing stator for ground

Inspection of diode

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

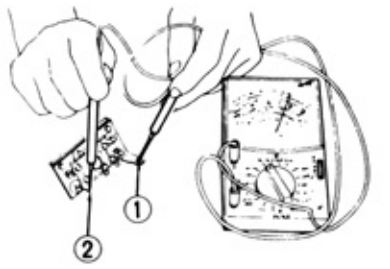


1 (+) plate
2 (−) plate
3 Diode

EE045

Fig. EE-33 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.

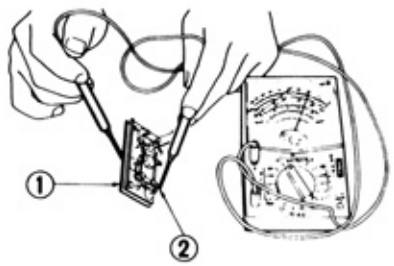


1 (+) plate
2 Terminal

EE046

Fig. EE-34 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.



1 (−) plate
2 Terminal

EE047

Fig. EE-35 Inspecting negative diode

If current flows in both positive and negative directions, diode is short-circuited. If current flows in one direction only, diode is in good condition.

If any diode is faulty, replace all diodes (six diodes) as an assembly. (See table below.) These diodes are unserviceable.

Test probe of a circuit tester		Conduction (X)
⊖	⊕	
terminal	⊕ plate	X
⊕ plate	terminal	–
terminal	⊖ plate	–
⊖ plate	terminal	X
⊖ plate	⊕ plate	X
⊕ plate	⊖ plate	–

Inspection of brush

Check movement of brush. If brush does not slide smoothly, check brush holder and clean if necessary.

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

Check brush pig tail and, if damaged, replace.

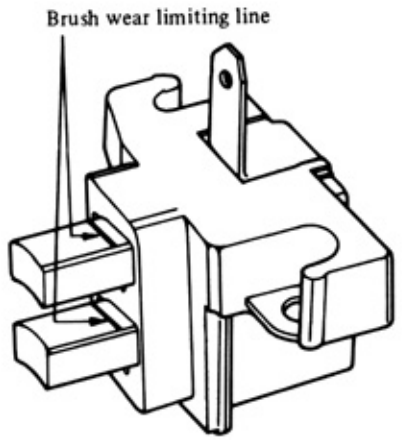


Fig. EE-36 Brush wear limit

Spring pressure test

With brush projected approximately 2 mm (0.079 in) from brush holder, measure brush spring pressure by a spring balance. Normally, rated pressure of a new brush spring is 255 to 345 gr (9.0 to 12.2 oz).

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

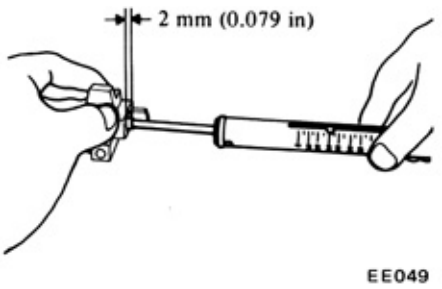


Fig. EE-37 Measuring spring pressure

ASSEMBLY

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

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

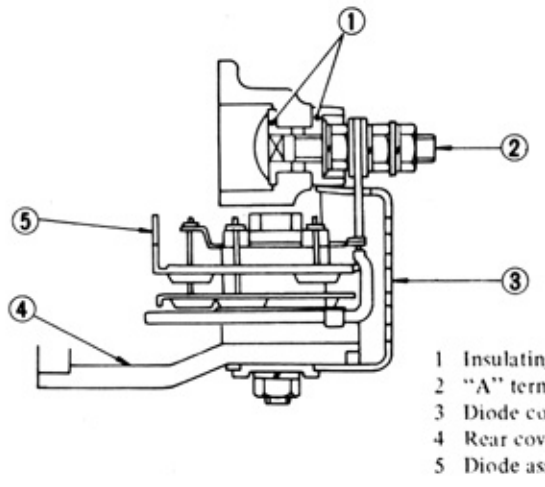


Fig. EE-38 Sectional view of diode and A terminal

3. Tighten pulley nut with tightening torque of 3.5 to 4.0 kg-m (25.3 to 29.0 ft-lb). When pulley is tightened, make sure that deflection of V-groove is less than 0.3 mm (0.0118 in).

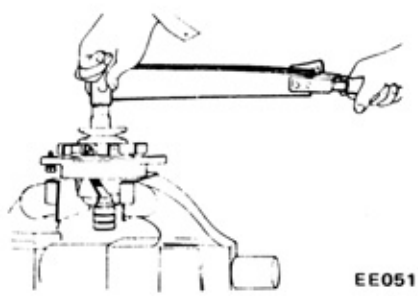


Fig. EE-39 Tightening pulley nut

ALTERNATOR TEST

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

A 30-volt voltmeter and suitable test probes are necessary for this test.

Set up a test circuit as shown in Figure EE-40 and test alternator in the manner indicated in the flow chart below:

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

Measured value: Below 12.5 Volts
Alternator is in trouble. Remove and check.

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

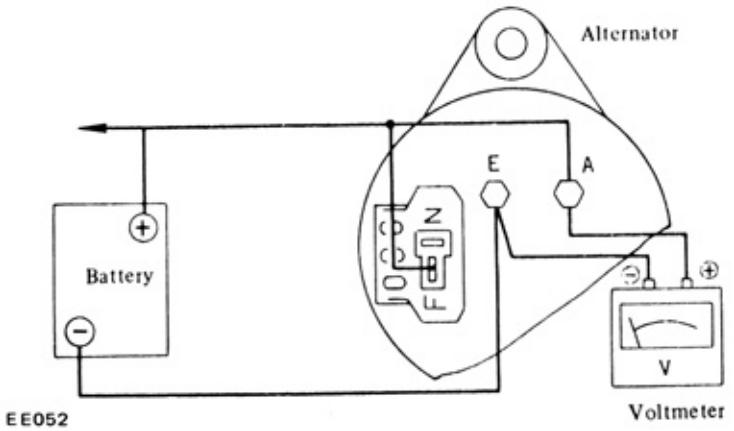


Fig. EE-40 Testing alternator

Notes:

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

b. Do not race engine.

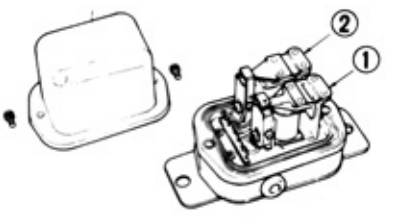
REGULATOR

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 an 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 produce alternator output.

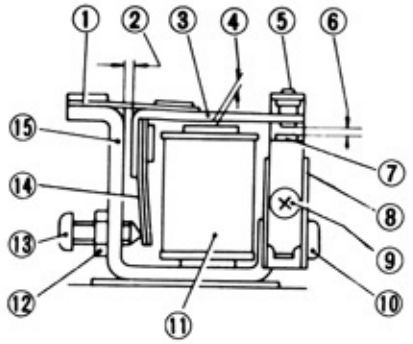
When the upper contacts are closed, charge warning lamp goes on.

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



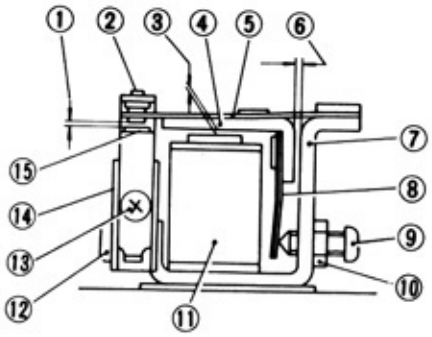
1 Charge relay
2 Voltage regulator

Fig. EE-41 External view of regulator



1 Connecting spring
2 Yoke gap
3 Armature
4 Core gap
5 Low speed contact
6 Point gap
7 High speed contact
8 Contact set
9 3mm (0.118 in) dia. screw
10 4mm (0.157 in) dia. screw
11 Coil
12 Lock nut
13 Adjusting screw
14 Adjusting spring
15 Yoke

Voltage regulator



EE397

1 Point gap
2 Charge relay contact
3 Core gap
4 Armature
5 Connecting spring
6 Yoke gap
7 Yoke
8 Adjusting spring
9 Adjusting screw
10 Lock nut
11 Coil
12 4mm (0.157 in) dia. screw
13 3mm (0.118 in) dia. screw
14 Contact set
15 Voltage regulator contact

Charge relay

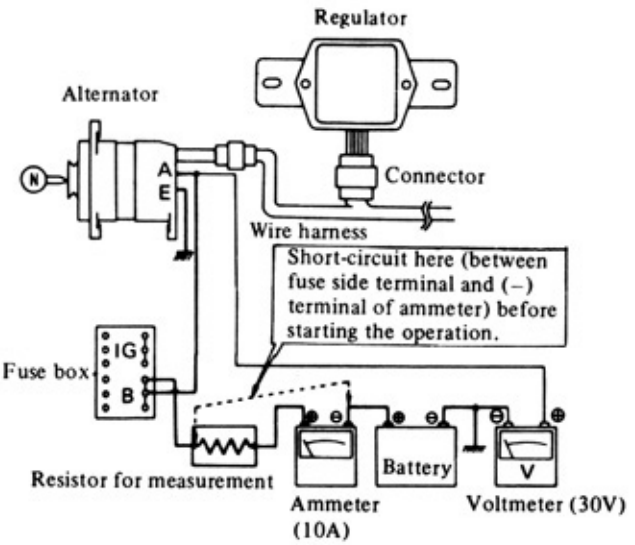
Fig. EE-42 Structural view

MEASUREMENT OF REGULATOR VOLTAGE

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

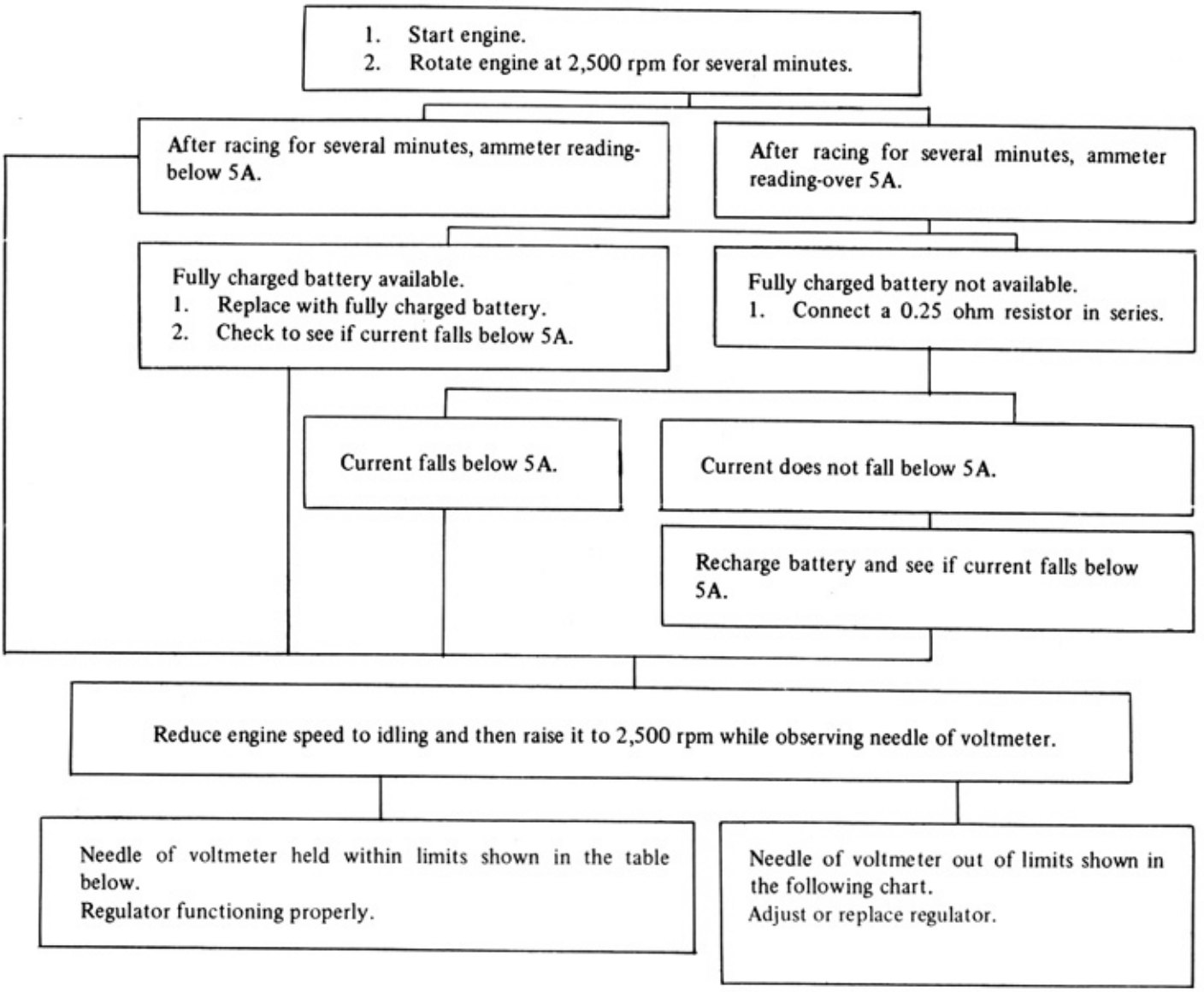
Connect a DC voltmeter (15-30V), DC ammeter (15-30A), battery and 0.25Ω resistor (rated at 25W) with cables as shown.

1. Check to be sure that all electrical loads such as lamps, air conditioner, radio etc. are turned off.
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 precaution will cause needle of ammeter to swing violently, resulting in a damaged ammeter.
3. Refer to the following chart to determine if regulator and relative parts are in good condition:



EE055

Fig. EE-43 Measuring regulator voltage with regulator on car



Temperature °C (°F)	Voltage V	
	Type TL1Z-57 (Hitachi)	Type RQB2220B (Mitsubishi)
−10 (14)	14.75 to 15.75	14.75 to 15.25
0 (32)	14.60 to 15.60	14.60 to 15.10
10 (50)	14.45 to 15.45	14.45 to 14.95
20 (68)	14.30 to 15.30	14.30 to 14.80
30 (86)	14.15 to 15.15	14.15 to 14.65
40 (104)	14.00 to 15.00	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 0.3 V higher than 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 at left.

ADJUSTMENT

Voltage regulator

When regulating voltage, as measured above, deviates from rated value, adjust regulator in accordance with the following instructions.

1. Inspect contact surface, and if rough, lightly polish 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 (0.157 in) diameter] which is used to secure contact set on yoke, and move contact upward or downward properly. See Figure EE-44.

Type	Core gap
TL1Z-57	0.6 to 1.0 mm (0.0236 to 0.0394 in)
RQB2220B	0.7 to 1.3 mm (0.0276 to 0.0512 in)

4. Adjusting point gap

Loosen screw [3 mm (0.118 in) diameter] used to secure upper contact, and move upper contact upward or downward as necessary. See Figure EE-45.

Type	Point gap
TL1Z-57	0.3 to 0.4 mm (0.0118 to 0.0157 in)
RQB2220B	0.3 to 0.45 mm (0.0118 to 0.0177 in)

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-46.

Charge relay

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

Use a DC voltmeter, and set up a circuit as shown in Figure EE-47.

Adjust charge relay in the same manner as that for voltage regulator.

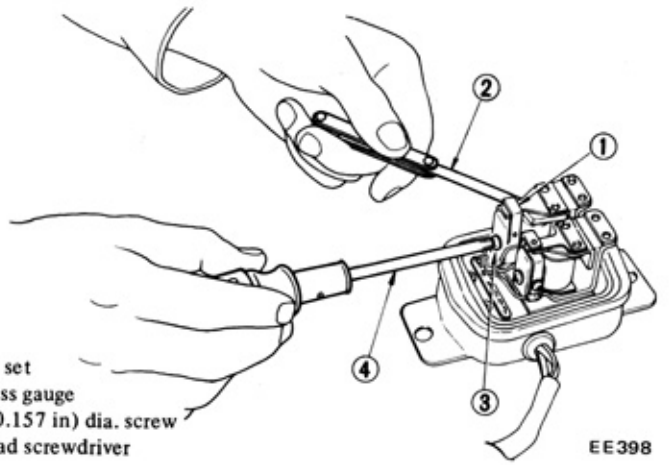


Fig. EE-44 Adjusting core gap

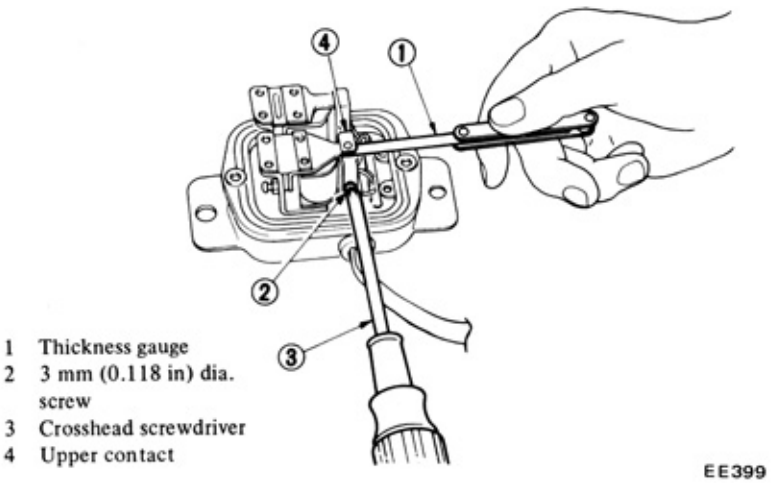


Fig. EE-45 Adjusting point gap

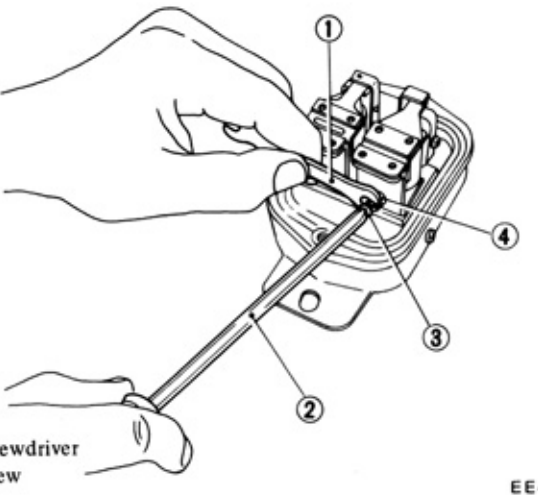


Fig. EE-46 Adjusting regulating voltage

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 inoperative if continuity exists.

Below 5.2 Volts

(Charge warning lamp on.)
1. Check fan belt tension.
2. If correct, remove regulator and adjust as necessary.

Over 5.2 Volts

(Charge warning lamp on.)
Charge relay coil or contact points out of order.
Replace regulator.

Over 5.2 Volts

(Charge warning lamp off.)
Charge relay assembly is in good condition.

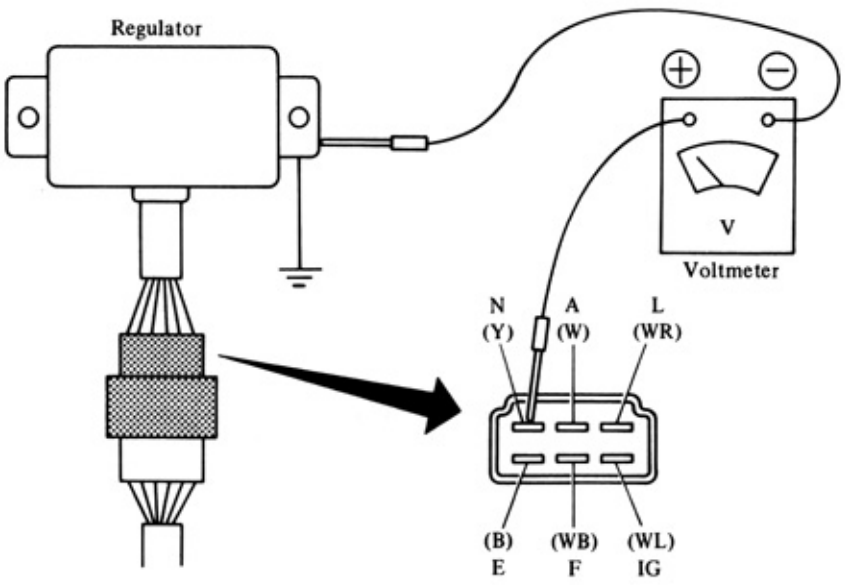


Fig. EE-47 Testing charge relay

SERVICE DATA AND SPECIFICATIONS

Alternator

		LT135-13B	LT150-12
Model		LT135-13B	LT150-12
Applied engine model		A10 and A12	A12 for B210 (Option)
Nominal rating	V-A	12-35	12-50
Ground polarity		Negative	Negative
Minimum revolution under no load (When 14 volts are applied)	rpm	Less than 1,000	Less than 1,000
Output current	A/rpm	28/2,500 35/5,000	37.5/2,500 50/5,000
Pulley ratio		2.25	2.25
Brush			
Length	mm (in)	More than 7.5 (0.30)	More than 7.5 (0.30)
Spring pressure	gr (oz)	255 to 345 (9.0 to 12.2)	255 to 345 (9.0 to 12.2)
Outer diameter of slip ring	mm (in)	More than 30 (1.18)	More than 30 (1.18)

Regulator

Voltage regulator			
Type		TL1Z-57	RQB2220B
Regulating voltage	V	* 14.3 to 15.3 at 20°C (68°F)	* 14.3 to 15.3 at 20°C (68°F)
Voltage coil resistance	Ω	10.5 at 20°C (68°F)	23.6 at 20°C (68°F)
Rotor coil inserting resistance	Ω	10	10
Voltage coil series resistance	Ω	31	38
Core gap	mm (in)	0.6 to 1.0 (0.0236 to 0.0394)	0.7 to 1.3 (0.0276 to 0.0512)
Point gap	mm (in)	0.3 to 0.4 (0.0118 to 0.0157)	0.3 to 0.45 (0.0118 to 0.0177)
Charge relay			
Release voltage	V	4.2 to 5.2 at "N" terminal	4.2 to 5.2 at "N" terminal
Voltage coil resistance	Ω	37.8 at 20°C (68°F)	23.6 at 20°C (68°F)
Core gap	mm (in)	0.8 to 1.0 (0.0315 to 0.0394)	0.9 to 1.4 (0.0354 to 0.0551)
Point gap	mm (in)	0.4 to 0.6 (0.0157 to 0.0236)	0.7 to 1.1 (0.0275 to 0.0433)

* Standard temperature gradient – 0.015 V/°C

TROUBLE DIAGNOSES AND CORRECTIONS

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.
	Shorted rotor.	Replace rotor.
	Shorted stator.	Repair or replace.
	Grounded "A" terminal.	Replace insulator.
	Broken fan belt.	Replace.
Excessive output	Broken neutral wire (color of wire is yellow.)	Replace.
	Voltage regulator breakdown.	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.
Low output	Loose or worn fan belt.	Retighten or replace.
	Sticking brushes.	Correct or replace brushes and springs if necessary.
	Low brush spring tension.	Replace brush springs.
	Voltage regulator breakdown.	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 damaged diode.	Replace diode.
Noisy alternator	Loose mounting.	Retighten bolts.
	Loose drive pulley.	Retighten.
	Broken ball bearing.	Replace.
	Improperly seated brushes.	Seat correctly.

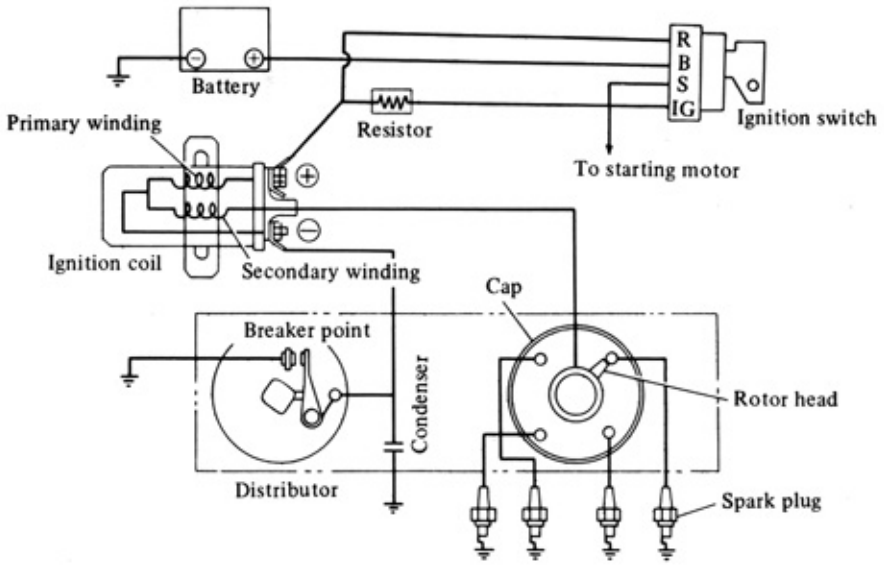
IGNITION SYSTEM

CONTENTS

IGNITION CIRCUIT

The ignition circuit consists essentially of a battery, ignition switch, ignition coil, distributor, spark plugs and connecting wires, as shown in Figure EE-48.

Model B210 and B120



Model F10

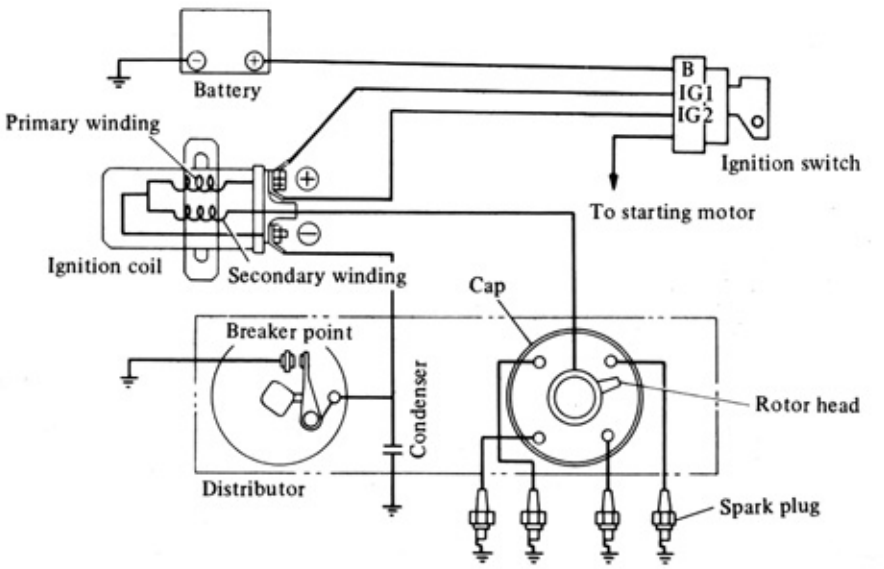


Fig. EE-48 Ignition system circuit

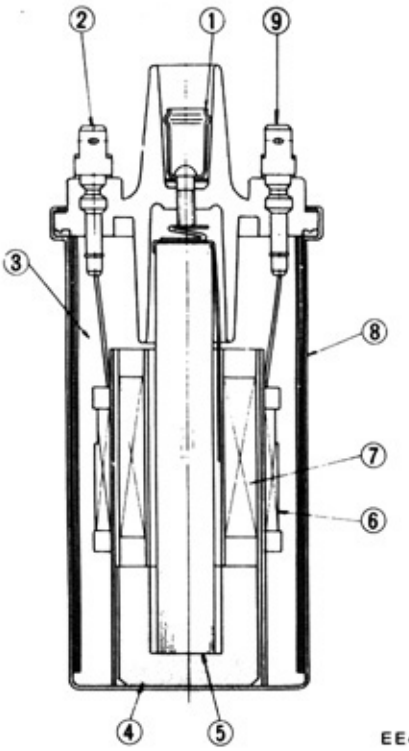
IGNITION COIL

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

In the ignition coil, there is a greater ratio between the primary and secondary windings to step up the battery voltage to a higher voltage so as to cause stronger sparks to jump the spark plug gap.

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

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



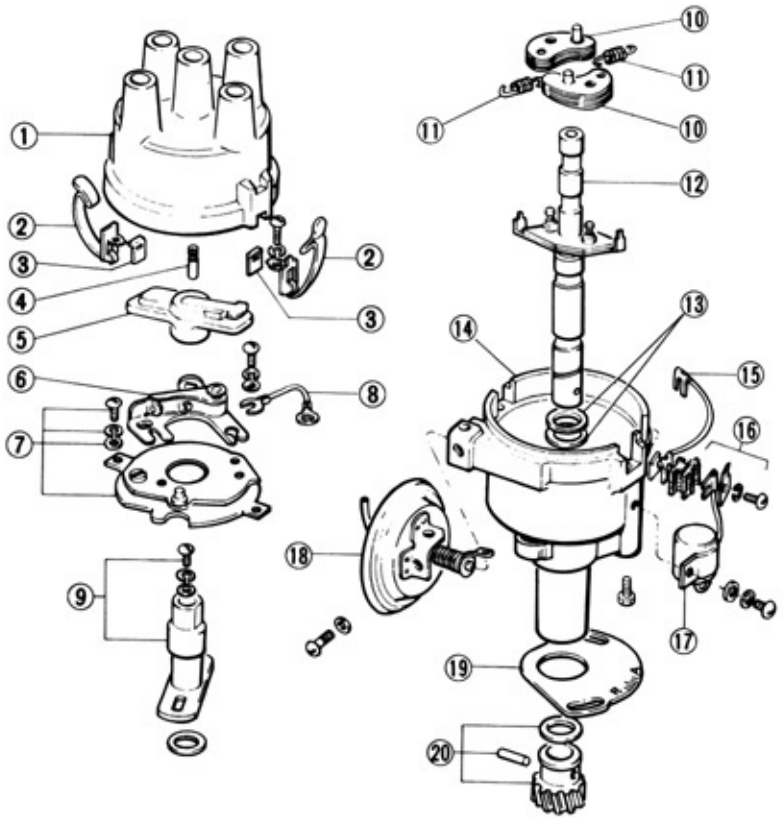
1 High voltage terminal
2 Primary terminal
3 Insulation oil
4 Core insulating material
5 Core
6 Primary coil
7 Secondary coil
8 Case
9 Secondary terminal

Fig. EE-49 Cross-sectional view of ignition coil

DISTRIBUTOR

CONSTRUCTION

The distributor consists of a breaker plate with contact points, centrifugal advance mechanism, vacuum controller, distributor shaft and rotor.



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

Fig. EE-50 Exploded view of distributor

CHECKING AND ADJUSTMENT

Cap and rotor head

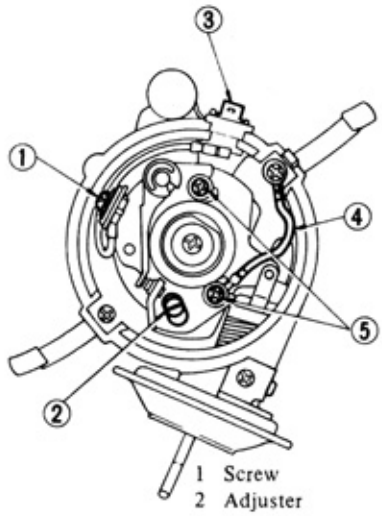
Cap and rotor head should be inspected periodically as specified in the "Maintenance Schedule". Remove cap and clean all dust and carbon deposits from cap and rotor. If cap is cracked or is leaking, replace.

Contact 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.

When point surface is rough, take off any irregularities with fine sand paper of No. 500 or 600 or with oil stone.

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



EE064

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

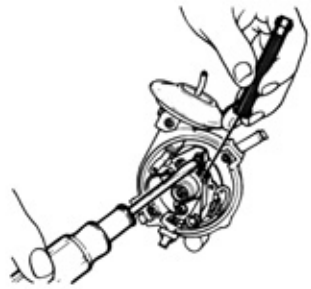
Fig. EE-51 Breaker

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

Referring to Figure EE-51, unscrew two contact set fixing screws and remove lead wire.

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

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



EE411

Fig. EE-52 Adjusting point gap

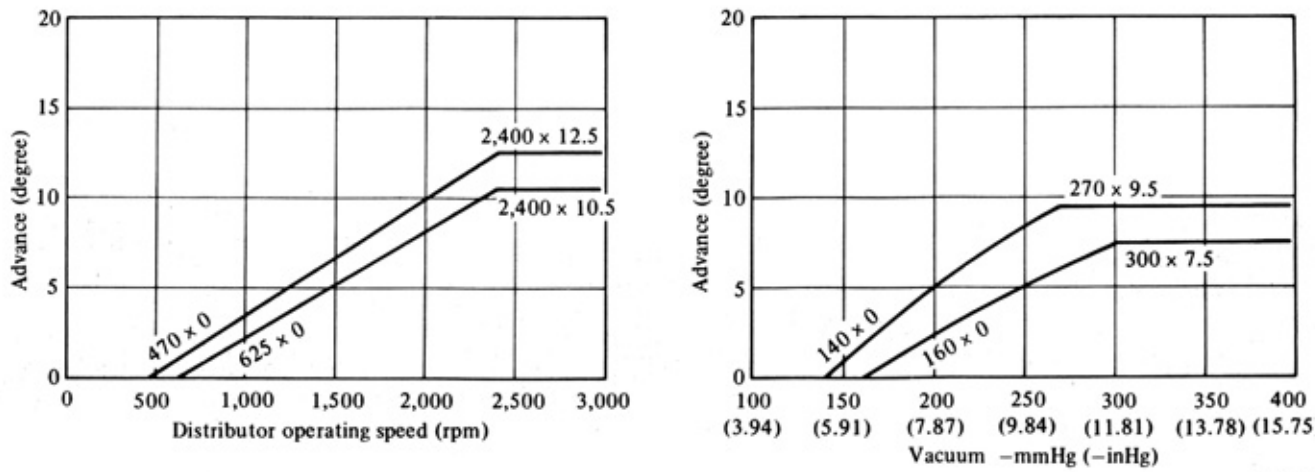
Condenser

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 condenser tester.

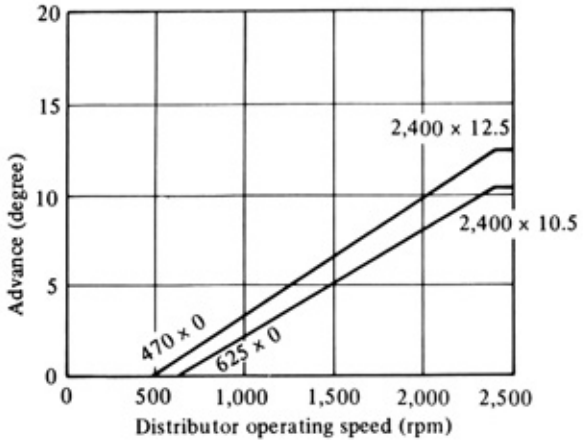
Advance mechanisms

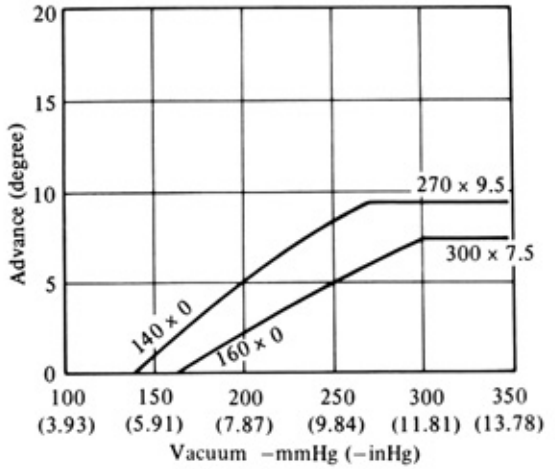
Advance characteristics



EE412

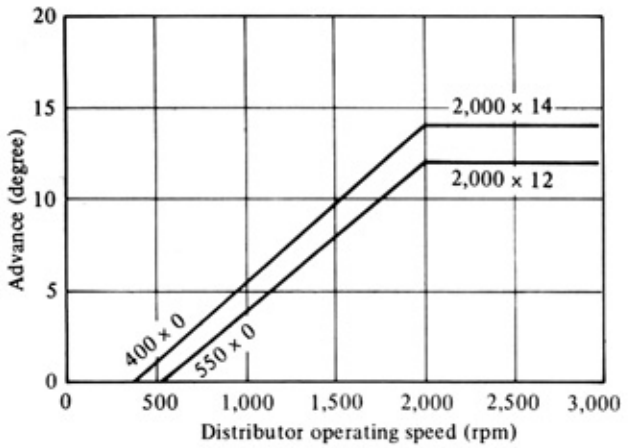
Fig. EE-53 Advance characteristics (Type D411-89)

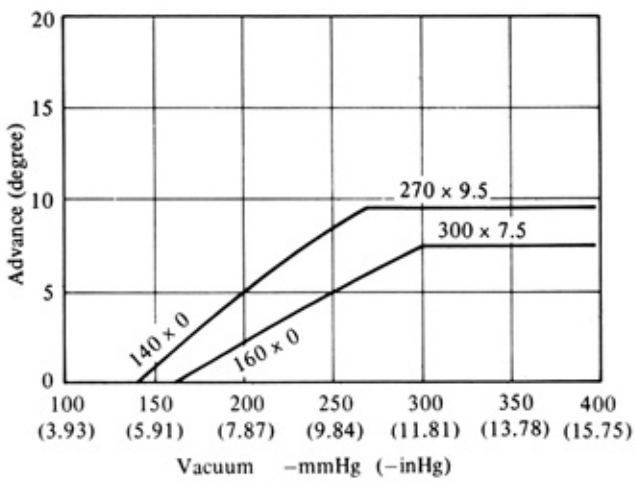




EE413

Fig. EE-54 Advance characteristics (Type D411-97)





EE414

Fig. EE-55 Advance characteristics (Type D413-67)

Vacuum advance mechanical parts

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

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

If leak is found, replace vacuum control assembly.

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 assembly.

Centrifugal advance mechanical parts

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

See the specifications above.

When nothing is wrong with its characteristic, conceivable causes are break-down, abnormal wear of driving part, or others. So do not disassemble it.

In case of improper characteristic, remove contact breaker assembly 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 with a distributor tester.

Disassembly

To disassemble, follow the below procedure.

1. Remove cap and disconnect rotor head.
2. Remove vacuum control assembly.
3. Remove contact set.

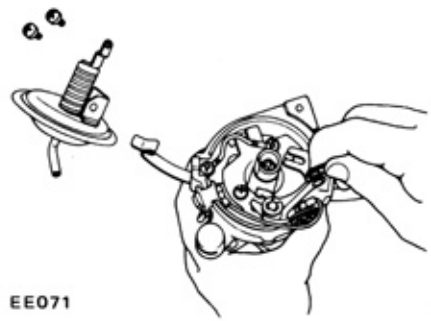


Fig. EE-56 Removing vacuum control assembly and contact set

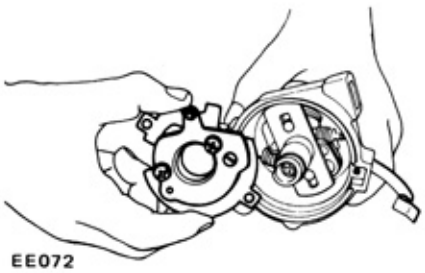


Fig. EE-57 Removing breaker plate

4. When breaker plate is removed, be careful not to lose steel balls between breaker spring and breaker plate.
5. Pull knock pin out and disconnect pinion to remove the entire rotating parts.

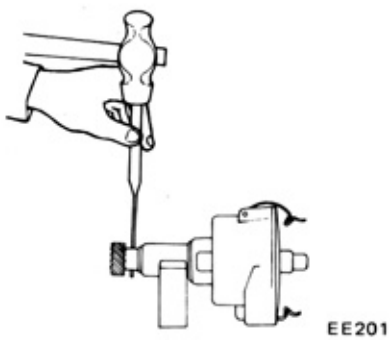


Fig. EE-58 Removing knock pin

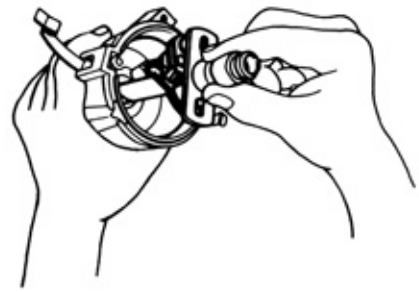


Fig. EE-59 Removing rotation parts

6. Remove packing from top of cam assembly and unscrew rotor shaft setscrew. Put match mark across cam and shaft so that original combination can be restored at assembly.

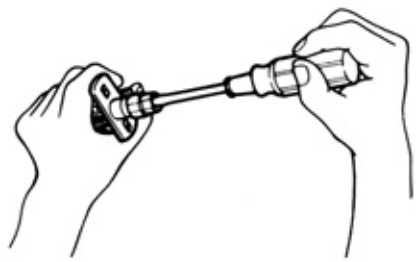


Fig. EE-60 Removing cam

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

After disassembling, apply grease to governor weights.

ASSEMBLY

To assemble, reverse order of disassembly. Carefully observe the following instructions.

1. Align match marks so that parts are assembled to their original positions.
2. Apply grease to top of cam assembly as required.
3. Check operation of governor before installing distributor on engine.
4. Adjust ignition timing after distributor is installed on engine.

SPARK PLUG

INSPECTION

The inspection and cleaning should be made every suitable maintenance period. If necessary, replace.

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-61.

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

Carbon fouled: Dry fluffy carbon deposits on the insulator and electrode are usually 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 indicate 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 plug, etc.
It is advisable to replace with plugs having colder heat range.

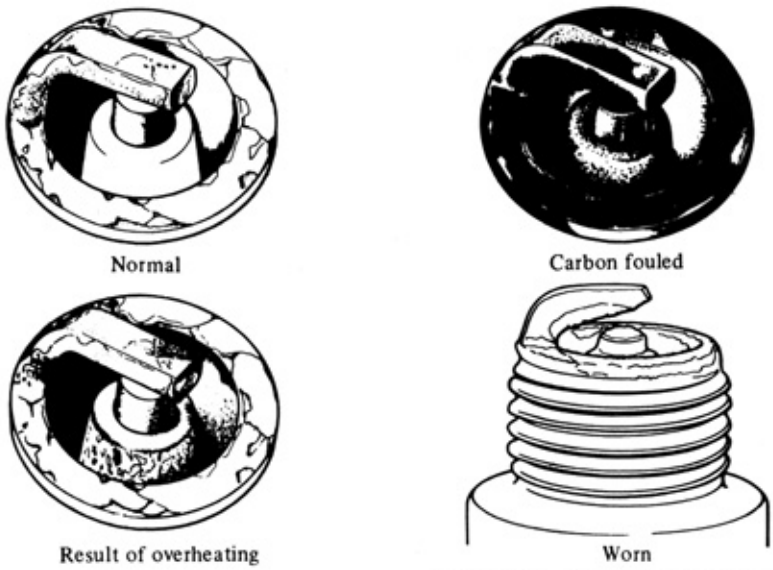


Fig. EE-61 Appearance of firing end

4. After cleaning, dress electrodes with a small fine file to flatten 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.

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

CLEANING AND REGAP

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 the specification using a round wire feeler gauge. All spark plugs, new or used, should have the gap checked and reset by bending electrode.

Spark plug gap

Model	mm (in)
L46W B5ES BR5ES	0.7 to 0.8 (0.028 to 0.031)
L46PW BP5ES BPR5ES	0.8 to 0.9 (0.031 to 0.035)

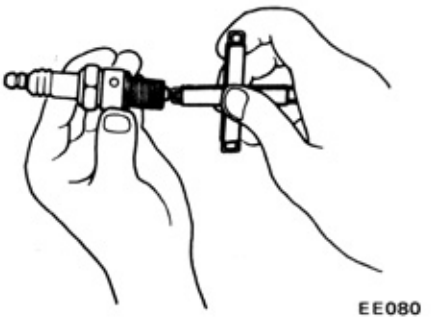


Fig. EE-62 Measuring spark plug gap

SERVICE DATA AND SPECIFICATIONS

Ignition coil

Type		C6R-205	HP5-13E11
Primary voltage	V	12	12
Spark gap	mm (in)	More than 7 (0.2756)	More than 7 (0.2756)
External resistance	Ω	1.6	1.6

Distributor

Type		D411-89	D411-97	D413-67
Applied engine model		A12 for F10 and B210	A12 for B120	A10 for F10
Firing order		1-3-4-2	1-3-4-2	1-3-4-2
Rotating direction		Counterclockwise	Counterclockwise	Counterclockwise
Dwell angle	degree	49 to 55	49 to 55	49 to 55
Point gap	mm (in)	0.45 to 0.55 (0.0177 to 0.0217)	0.45 to 0.55 (0.0177 to 0.0217)	0.45 to 0.55 (0.0177 to 0.0217)
Point pressure	kg (lb)	0.50 to 0.65 (1.1 to 1.4)	0.50 to 0.65 (1.1 to 1.4)	0.50 to 0.65 (1.1 to 1.4)
Condenser capacity	μF	0.20 to 0.24	0.20 to 0.24	0.20 to 0.24
Condenser insulation resistance	MΩ	5	5	5
Cap insulation resistance	MΩ	50	50	50
Rotor head insulation resistance	MΩ	50	50	50
Cap carbon point	mm (in)	12 (0.472)	12 (0.472)	12 (0.472)

Spark plug

Model		L46W, B5ES, BR5ES	L46PW, BP5ES, BPR5ES
Applied engine model		A10	A12
Gap	mm (in)	0.7 to 0.8 (0.028 to 0.031)	0.8 to 0.9 (0.031 to 0.035)
Tightening torque	kg-m (ft-lb)	1.5 to 2.0 (11 to 14)	1.5 to 2.0 (11 to 14)

TROUBLE DIAGNOSES AND CORRECTIONS

1. Engine does not start.

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

Condition	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.
	High tension cable	Wire coming off.	Repair.
		Damaged insulation.	Replace.
Spark length 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.
More than 6 mm (0.2362 in)	Spark plugs	Spark plug gap too wide.	Correct or replace.
		Too much carbon.	Clean or replace.
		Broken neck of insulator.	Replace.
		Expiry of plug life.	Replace.

2. When engine rotates 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, a complete inspection of the ignition system should first be carried out.

Condition	Location	Probable cause	Corrective action
Engine misses	Distributor	Dirty points.	Clean.
		Improper point gap.	Correct.
		Leak of electricity from cap and rotor head.	Repair or replace.
		Damaged condenser insulation.	Replace.
		Malfunctioning arm.	Oil shaft.
		Damaged arm spring.	Replace assembly.
		Broken 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 inferior quality coil.	Replace.
	High tension cord	Deterioration of insulation and consequent leak of electricity.	Replace.
	Spark plugs	Fouled.	Clean.
		Leak of electricity at upper porcelain insulator .	Repair or replace.
Engine knocks very often	Distributor	Improperly advanced timing.	Correct fitting.
		Displaced or broken governor spring.	Correct or replace.
		Worn pin or hole in governor portion.	Replace.
	Spark plugs	Excessively burnt.	Replace.
Engine does not deliver enough power	Distributor	Improperly retarded timing.	Correct fitting.
		Malfunctioning governor.	Replace assembly.
		Dirty points.	Clean.
		Point gap too narrow.	Correct.
	Spark plugs	Fouled.	Clean.

ENGINE COOLING SYSTEM (F10 SERIES ONLY)

FAN MOTOR

Fan motor specifications are as follows:

SPECIFICATIONS

Voltage	V	12
Wattage	W	95
Revolution	rpm	2,350 to 2,650

THERMOMETER SWITCH

INSPECTION

Carry out conduction test as follows:

1. Submerge temperature sensing unit of thermometer switch into water as shown in Figure EE-63. Gradually heat water to 90°C (194°F). Never boil water.
2. Make sure that thermometer switch comes on in the temperature range specified in the chart.
3. Stop heating water and make sure that switch goes out outside specified temperature range.
4. Replace thermometer switch if it does not function properly.

		Water temperature
Thermometer switch	On	83 to 87°C (181 to 189°F)
	Off	79.5 to 80.5°C (175 to 177°F)

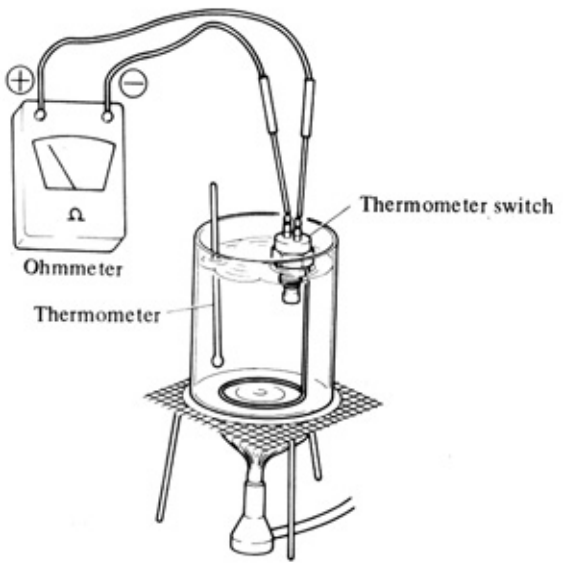


Fig. EE-63 Inspecting thermometer switch

SPECIFICATIONS

Voltage	V	12
Amperage	A	7
Thermometer switch tightening torque	kg-m (ft-lb)	2.0 to 2.5 (14 to 18)

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