SERVICE MANUAL

DATSUN 280Z
MODEL S30 SERIES

NISSAN

NISSAN MOTOR CO., LTD.
TOKYO, JAPAN

SECTION EE

ENGINE ELECTRICAL SYSTEM

EE

BATTERY

CONTENTS

WARNING:
Never touch positive and negative terminals at the same time with bare hands. This could result in injury.

REMOVAL

1. Disconnect negative and positive cables.
2. Remove nuts from battery clamps; take off clamps.
3. Remove battery.

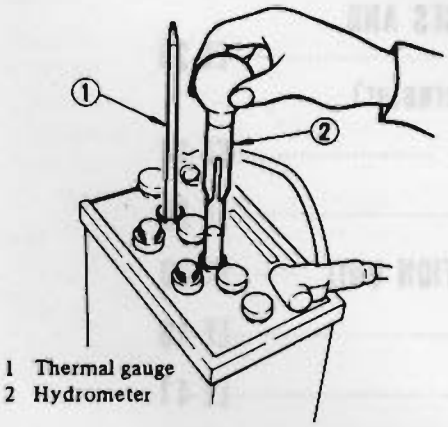
CHECKING ELECTROLYTE LEVEL

Remove six vent plugs and check for electrolyte level in each cell.

If necessary, pour distilled water.

CHECKING SPECIFIC GRAVITY

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



1 Thermal gauge
2 Hydrometer

Fig. EE-1 Checking specific gravity

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

The gravity of electrolyte changes 0.0007 for every 1°C (1.8°F) temperature. A correction can then be made by using the following formula:

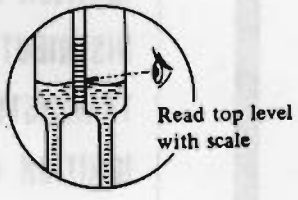
$$S_{20} = St + 0.0007\ (t - 20)$$

Where,

- St: Specific gravity of electrolyte at t°C
- S_{20}: Specific gravity of electrolyte corrected at 20°C (68°F)
- t: Electrolyte temperature

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

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



EE001

Fig. EE-2 Checking specific gravity

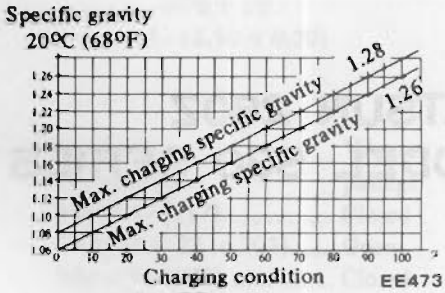


Fig. EE-3 Charging condition

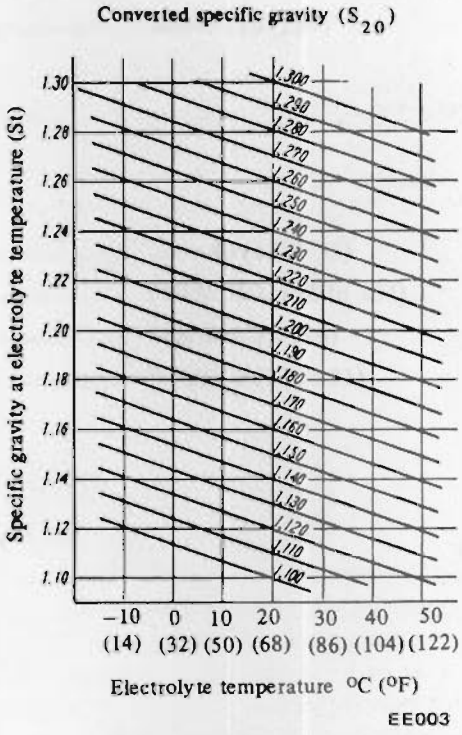


Fig. EE-4 Specific gravity at electrolyte temperature

BATTERY FREEZING

Battery electrolyte freezing point varies with acid concentration or its specific gravity. A battery with an insufficient charge will freeze at lower temperatures. If specific gravity of a battery falls below 1.1, this is an

indication that battery is completely discharged and will freeze readily when temperatures fall below freezing.

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

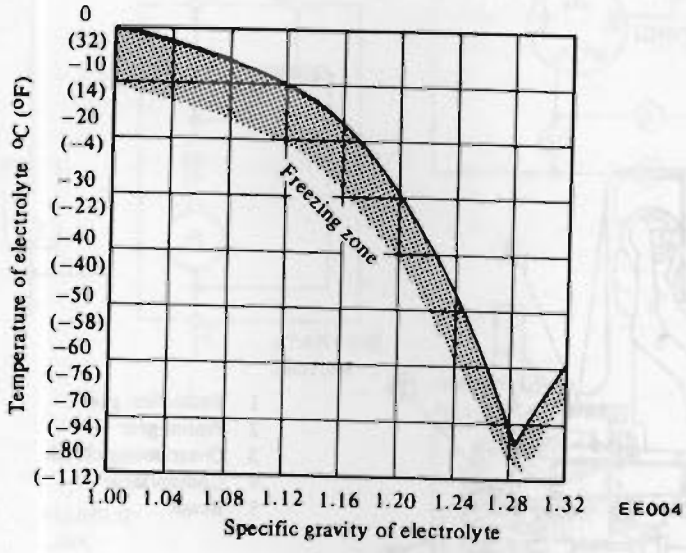


Fig. EE-5 Freezing point of electrolyte

CHARGING

If electrolyte level is satisfactory, battery must be recharged when electrolyte-gravity reading falls below 1.20. If battery 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 terminals should be cleaned with a brush and common baking-soda solution. In addition, the following items 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 recharging, check to be certain that specific gravity does not exceed 1.260 or 1.280 (N70Z) [at 20°C (68°F)]. Correction can be made by adding distilled water into cells as necessary.
5. Keep battery away from open flame while it is being recharged.
6. After all vent plugs have been tightened, clean all sprayed electrolyte off upper face of battery.

INSTALLATION

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

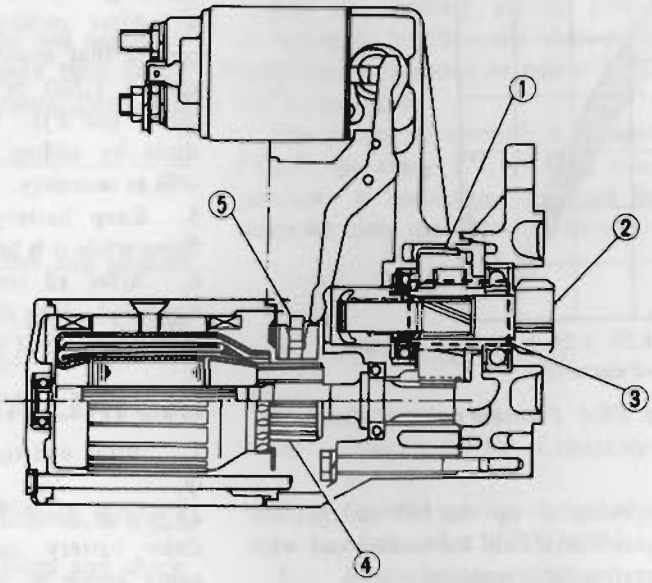
STARTING MOTOR

CONTENTS

DESCRIPTION

Reduction gear type

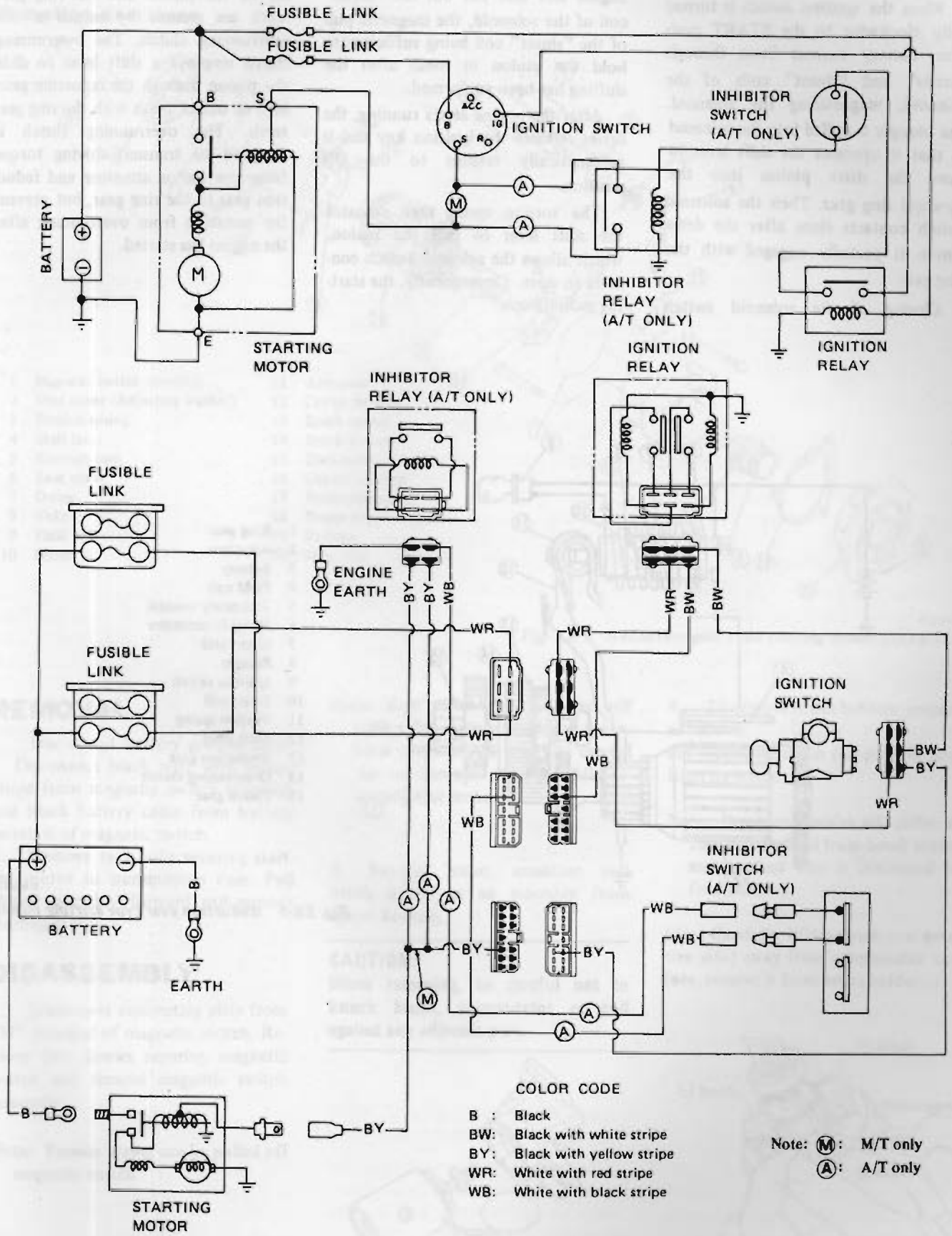
The reduction gear, located between the armature and pinion gear, transmits the rotation of the armature to the pinion gear, thereby reducing the speed from the armature and increasing the rotating torque. In construction, the pinion gear is located independently of the armature. The brush and commutator are positioned on the pinion and reduction gear side.



1 Reduction gear
2 Pinion gear
3 Overrunning clutch
4 Commutator
5 Brush

EE610

Fig. EE-6 Reduction gear starting motor [S114-254]



EE611

Fig. EE-7 Circuit diagram of starting system

OPERATION

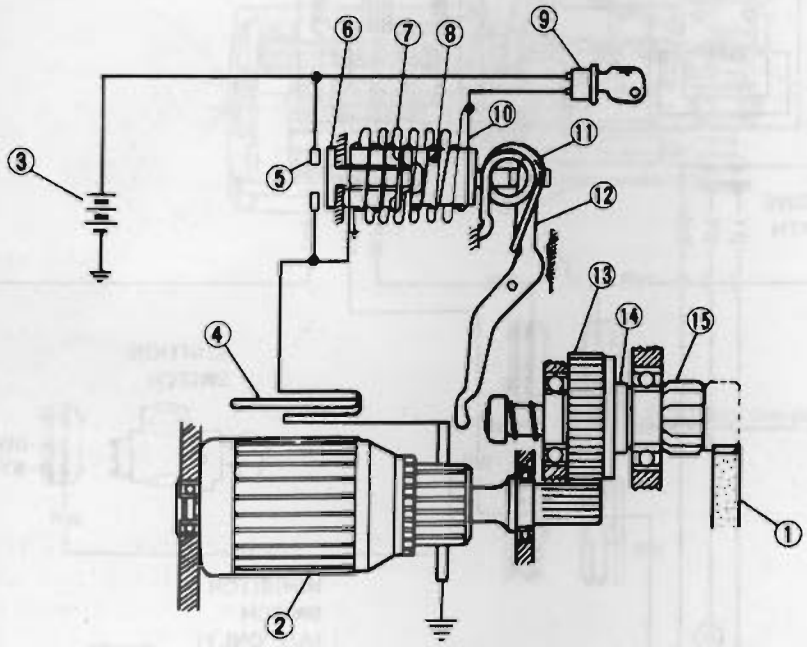
When the ignition switch is turned fully clockwise to the START position, battery current flows through "series" and "shunt" coils of the solenoid, magnetizing the solenoid. The plunger is pulled into the solenoid so that it operates the shift lever to move the drive pinion into the flywheel ring gear.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

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

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

The torsion spring then actuates the shift lever to pull the pinion, which allows the solenoid switch contacts to open. Consequently, the starting motor stops.

More positive meshing and demeshing of the pinion and the ring gear teeth are secured by means of the overrunning clutch. The overrunning clutch employs a shift lever to slide the pinion through the reduction gear, into or out of mesh with the ring gear teeth. The overrunning clutch is designed to transmit driving torque from the motor armature and reduction gear to the ring gear, but prevent the armature from overrunning after the engine has started.



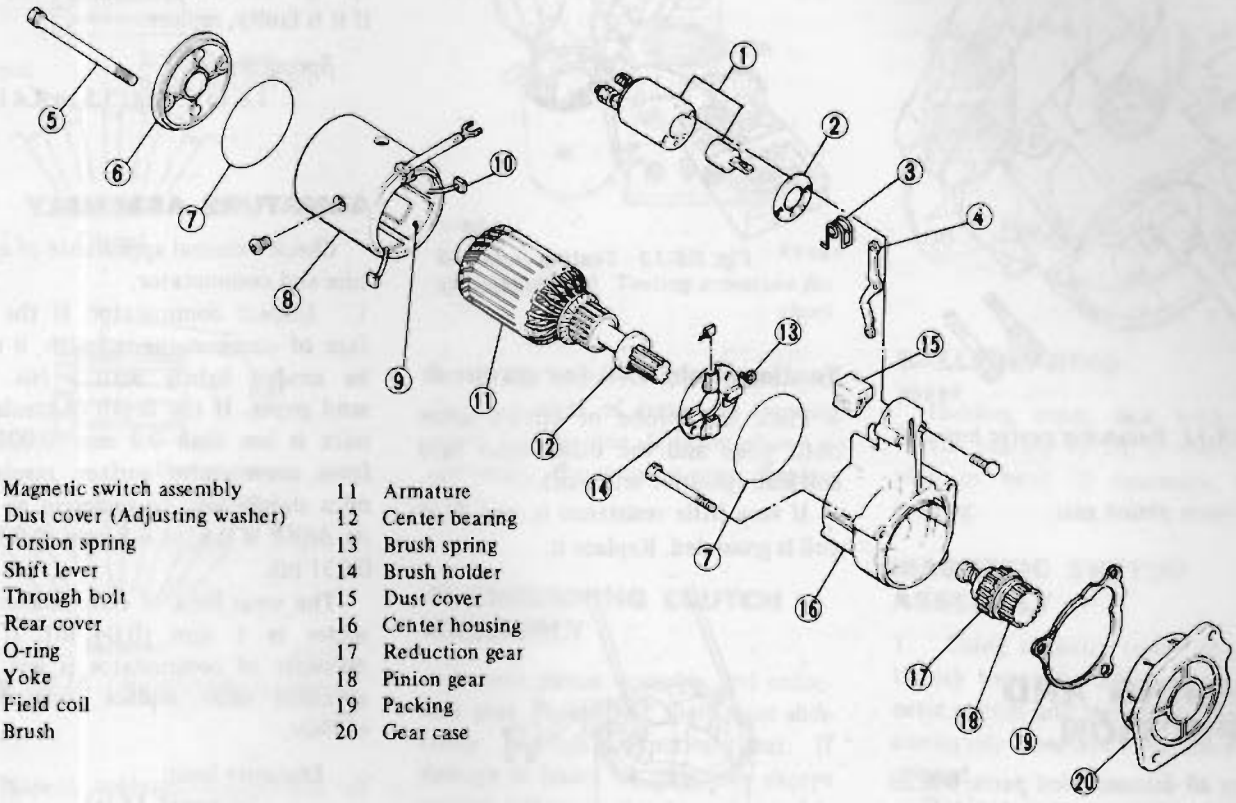
1 Ring gear
2 Armature
3 Battery
4 Field coil
5 Stationary contact
6 Movable contactor
7 Shunt coil
8 Plunger
9 Ignition switch
10 Series coil
11 Torsion spring
12 Shift lever
13 Reduction gear
14 Overrunning clutch
15 Pinion gear

EE613

Fig. EE-8 Reduction gear type starting motor

CONSTRUCTION

Reduction gear type



1	Magnetic switch assembly	11	Armature
2	Dust cover (Adjusting washer)	12	Center bearing
3	Torsion spring	13	Brush spring
4	Shift lever	14	Brush holder
5	Through bolt	15	Dust cover
6	Rear cover	16	Center housing
7	O-ring	17	Reduction gear
8	Yoke	18	Pinion gear
9	Field coil	19	Packing
10	Brush	20	Gear case

EE614

Fig. EE-9 Reduction gear type starting motor (S114-254)

REMOVAL

1. Disconnect battery ground cable.
Disconnect black wire with yellow stripe from magnetic switch terminal, and black battery cable from battery terminal of magnetic switch.
2. Remove two bolts securing starting motor to transmission case. Pull starter assembly forward and remove starting motor.

DISASSEMBLY

1. Disconnect connecting plate from "M" terminal of magnetic switch. Remove two screws securing magnetic switch and remove magnetic switch assembly.

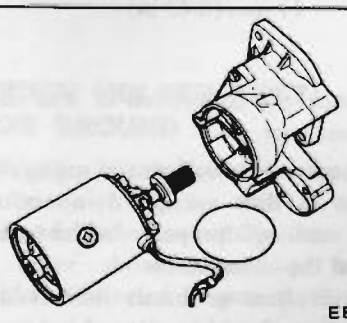
Note: Torsion spring can be pulled off magnetic switch.

2. Remove through bolts and rear cover.

Note: Rear cover can be pried off with a flat-blade screwdriver inserted between it and yoke. Be careful not to damage packing while removing rear cover.

3. Remove yoke, armature and brush holder as an assembly from center housing.

CAUTION:
When removing, be careful not to knock brush, commutator or coil against any adjacent part.



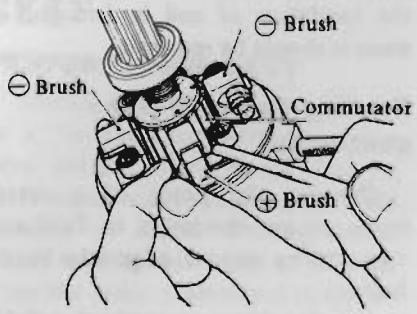
EE615

Fig. EE-10

4. To remove brush holders, proceed as follows:
(1) Remove brush (on positive side) from its holder.

Note: Brush on positive side differs in that it is isolated from brush holder and its lead wire is connected to field coil.

(2) Carefully lifting brush (on netative side) away from commutator surface, remove it from brush holder.



EE616

Fig. EE-11 Removing brush holder

5. Remove bolts securing center housing to gear case, and detach center housing.

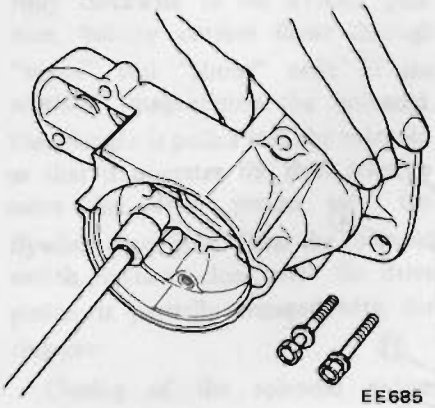


Fig. EE-12 Removing center housing

6. Remove pinion gear.

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 the insulation of coil is damaged or worn it should be replaced.

Testing field coil for continuity:

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

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

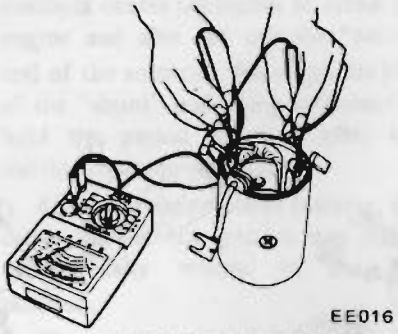


Fig. EE-13 Testing field coil for continuity

Testing field coil for ground:

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

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

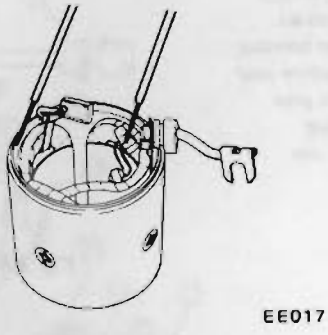


Fig. EE-14 Testing field coil for ground

BRUSHES AND BRUSH LEAD WIRE

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

If brush is worn so that its length is less than specified value, replace.

Serviceable length limit:
11 mm (0.43 in)

Check the 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 the commutator.

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

BRUSH SPRING TENSION

Check brush spring tension by a spring scale as shown in Figure EE-15. If it is faulty, replace.

Spring tension:
1.6 to 2.0 kg (3.5 to 4.4 lb)

ARMATURE ASSEMBLY

Check external appearance of armature and commutator.

1. Inspect commutator. If the surface of commutator is rough, it must be sanded lightly with a No. 500 sand paper. If the depth of insulating mica is less than 0.2 mm (0.008 in) from commutator surface, insulating mica should also be undercut so that its depth is 0.5 to 0.8 mm (0.020 to 0.031 in).

The wear limit of commutator diameter is 1 mm (0.04 in). If the diameter of commutator is less than specified value, replace armature assembly.

Diameter limit:
29 mm (1.14 in)

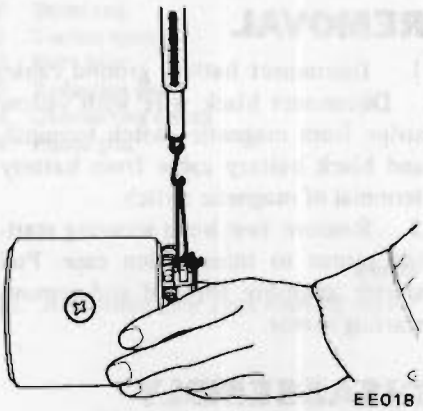


Fig. EE-15 Inspecting brush spring tension

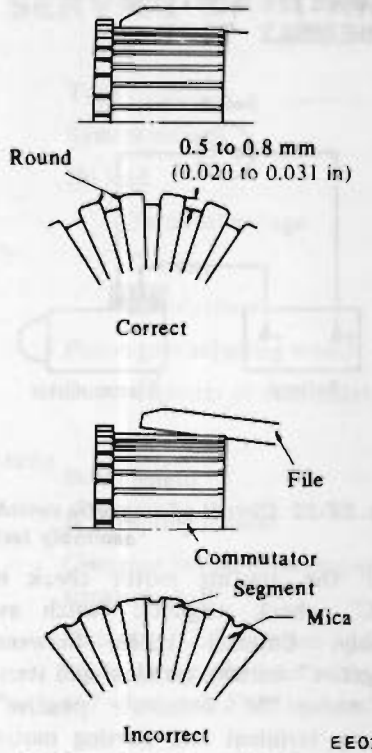


Fig. EE-16 Undercutting insulating mica

2. Inspect soldered connection of armature lead and commutator. If loose connection is found, solder it using resin flux.
3. Armature test for ground

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

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

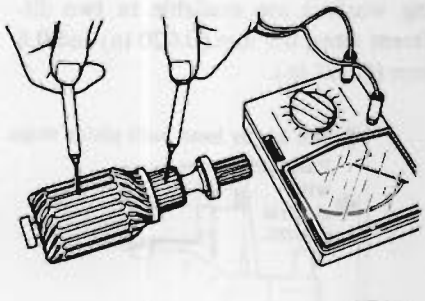


Fig. EE-17 Testing armature for ground

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

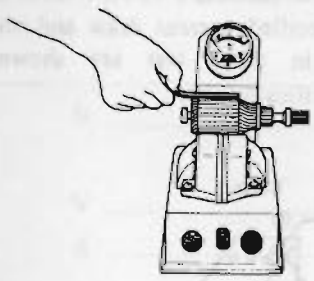


Fig. EE-18 Testing armature for short

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

OVERRUNNING CLUTCH ASSEMBLY

Inspect pinion assembly and reduction gear. Pinion gear shaft must slide freely through reduction gear. If damage is found or resistance except normal resistance due to spring 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.

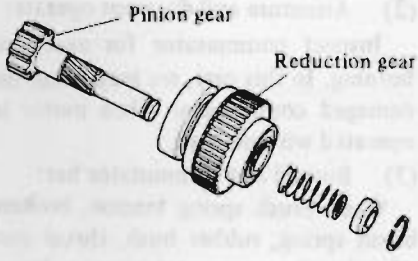


Fig. EE-19 Pinion and reduction gear overrunning clutch

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.

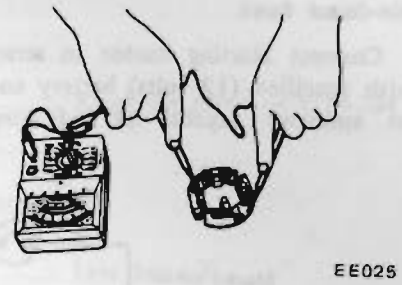


Fig. EE-20 Testing brush for ground

BALL BEARING

Holding outer race with finger, rotate bearing to see if there is any play or bind. If necessary, replace bearing.

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 opened.

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 opened.

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

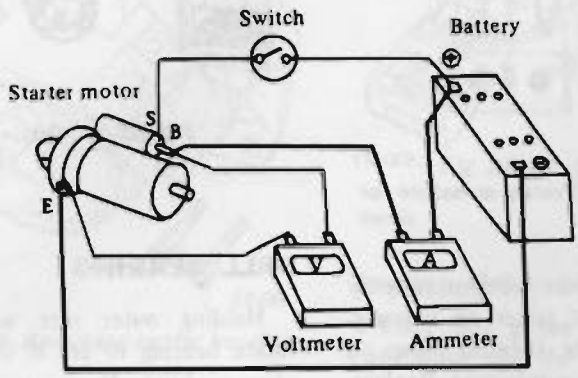
PERFORMANCE TEST

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 the test when the cause of abnormal operation is to be determined. A brief outline of the test is given below.

No-load test

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

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



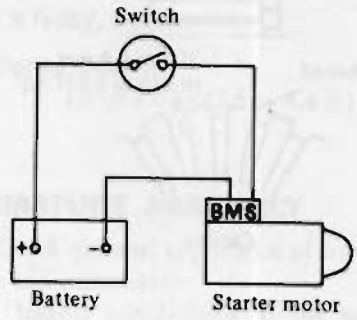
EE026

Fig. EE-21 No-load testing

DIAGNOSES OF TEST

1. Low speed with no-load and high current draw may result from the following:
(1) Tight, dirty or worn bearings.
(2) Bent armature shaft or loosened field probe.
(3) Shorted armature;
Check armature further.
(4) A grounded armature or field;
a. Remove input terminal.
b. Raise two negative side brushes from commutator.
c. Using a circuit tester, place one probe onto input terminal and the other onto yoke.
d. If tester indicates continuity, 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 be caused by the following:
(1) A grounded or open field coil:
Inspect the connection and trace circuit by a circuit tester.
(2) Armature coil does not operate:
Inspect commutator for excessive burning. In this case, arc may occur on damaged commutator when motor is operated with no-load.
(3) Burned out commutator bar:
Weak brush spring tension, broken brush spring, rubber bush, thrust out of mica in commutator or a loose contact between brush and commutator would cause commutator bar to burn.
3. Low current draw and low no-load speed would cause high internal resistance due to loose connections, damaged leads, dirty commutator and causes listed on item 2-(3).

MAGNETIC SWITCH ASSEMBLY TEST



EE351

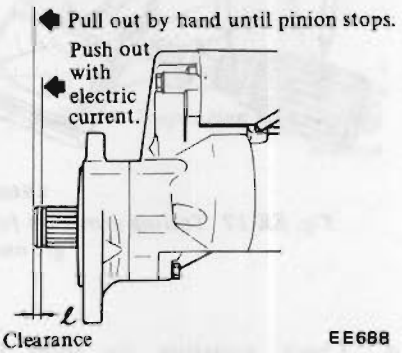
Fig. EE-22 Circuit of magnetic switch assembly test

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

With the switch on compare difference in height of pinion when it is pushed out with magnetic switch energized and when it is pulled out by hand until its stopper touches reduction gear.

Clearance ℓ:
0.3 to 1.5 mm
(0.012 to 0.059 in)

If necessary, adjust it by changing or adding adjusting washer(s). Adjusting washers are available in two different sizes, 0.5 mm (0.020 in) and 0.8 mm (0.031 in).



EE688

Fig. EE-23 Measuring clearance "ℓ"

SERVICE DATA AND SPECIFICATIONS

Type		Reduction gear type S114-254
System voltage	V	12
No load		
Terminal voltage	V	12
Current	A	Less than 100
Revolution	rpm	More than 4,300
Pinion gear adjusting washer	mm (in)	0.5 (0.020), 0.8 (0.031)
Outer diameter of commutator	mm (in)	More than 29 (1.14)
Brush length	mm (in)	More than 11 (0.43)
Brush spring tension	kg (lb)	1.6 to 2.0 (3.5 to 4.4)
Clearance between bearing metal and armature shaft	mm (in)	Ball bearing type
Clearance "ℓ" between pinion front edges when pushed out with magnetic switch and when pulled out by hand	mm (in)	0.3 to 1.5 (0.012 to 0.059)

Tightening torque

Terminal nuts	kg-cm (in-lb)	115 to 160 (100 to 139)
Magnetic switch attaching bolts	kg-cm (in-lb)	38 to 51 (33 to 44)
Gear case attaching bolts	kg-cm (in-lb)	64 to 85 (56 to 74)

TROUBLE DIAGNOSES AND CORRECTIONS

Condition	Probable cause	Corrective action
Starting motor will not operate.	Discharged battery.	Charge or replace battery.
	Damaged solenoid switch.	Repair or replace solenoid switch.
	Loose connections of terminal.	Clean and tighten terminal.
	Damaged field coil.	Replace yoke.
	Damaged brushes.	Replace brushes.
	Damaged bearing.	Replace bearing.
	Starting motor inoperative.	Remove starting motor and make test.
	Damaged armature.	Replace armature.
Noisy starting motor.	Loose securing bolt.	Tighten.
	Worn pinion gear.	Replace.
	Poor lubrication.	Add oil.
	Worn commutator.	Replace.
	Worn brushes.	Replace.
Starting motor cranks slowly.	Discharged battery.	Charge.
	Loose connection of terminal.	Clean and tighten.
	Worn brushes.	Replace.
	Locked brushes.	Inspect brush spring tension or repair brush holder.
	Loose connections of terminal.	Clean and tighten terminal.
	Damaged field coil.	Replace yoke.
	Damaged brushes.	Replace brushes.
	Damaged bearing.	Replace bearing.
	Starting motor inoperative.	Remove starting motor and make test.
	Damaged armature.	Replace armature.

CHARGING CIRCUIT

The charging circuit consists of a battery, an alternator incorporating an IC voltage regulator and wiring that connects 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.

With the ignition switch in ON, the circuit between transistor Tr1 of the IC voltage regulator and ground is closed. Current from the battery then flows along the route shown by the arrow in Figure EE-24, turning on the charge warning lamp and flowing on through terminal L to excite the rotor.

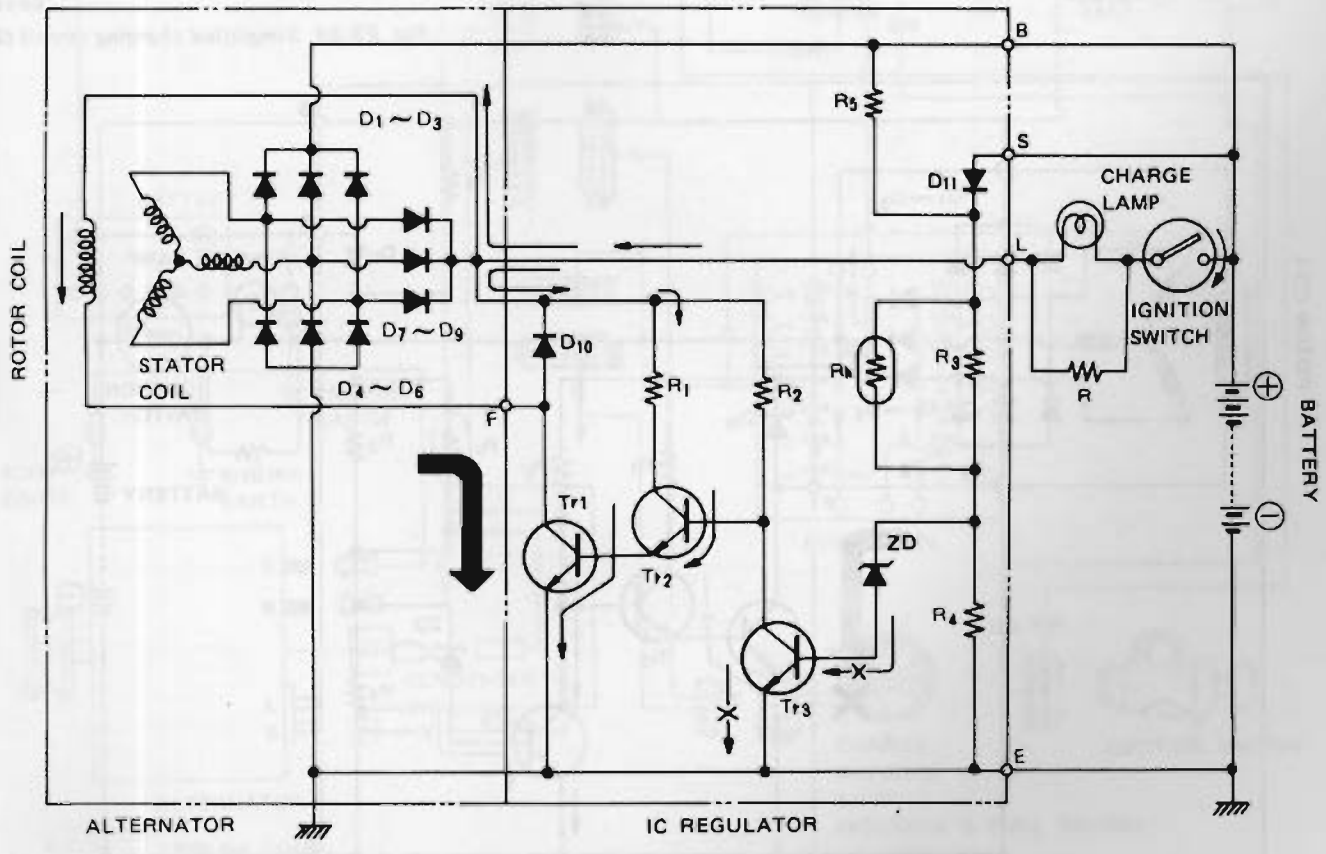
When the alternator begins to operate, three-phase alternating current is induced in the stator coil. This alternating current is rectified by the positive and negative silicon diodes.

When the voltage at terminal B is higher than battery voltage, current produced at the stator flows to re-charge the battery. While the battery is being re-charged, the voltage at terminal L is equal to that of terminal B. At this point, there is no voltage differential on either side of the charge warning lamp, which causes the charge warning lamp to turn off. In other words, current does not flow from the battery to terminal L. Accordingly, current flow through the rotor as shown in Figure EE-25, is taken over by current produced at the stator. The circuit between terminal F and Tr1 is then closed. See Figure EE-25.

The IC voltage regulator monitors generating voltage to be applied to the battery at terminal S. When current exceeds the specified value, it then flows through the zener diode (ZD), closing the circuit consisting of transistor Tr3 and resistor R_2. At this point, current neither flows through transistor Tr1 to ground nor to the rotor, thereby reducing the voltage generated at the stator. See Figure EE-26.

When voltage generated at terminal S is reduced to the specified value, transistor allows current to flow through the rotor, increasing the generating voltage.

In this manner, output voltage from the alternator does not rise above the specified value by the ON-OFF operation of the rotor coil through the IC voltage regulator.



EE618

Fig. EE-24 Simplified charging circuit (1)

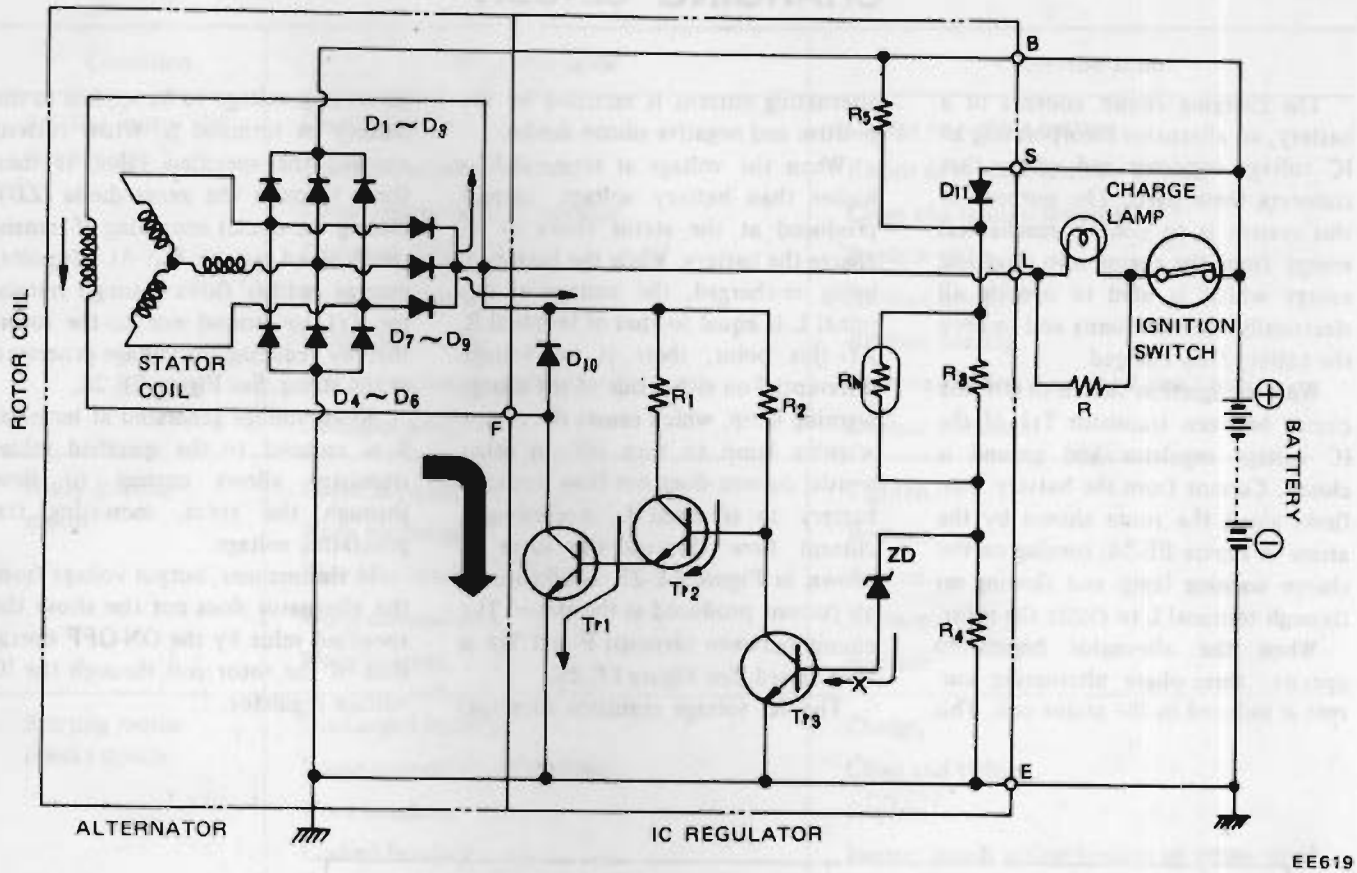


Fig. EE-25 Simplified charging circuit (2)

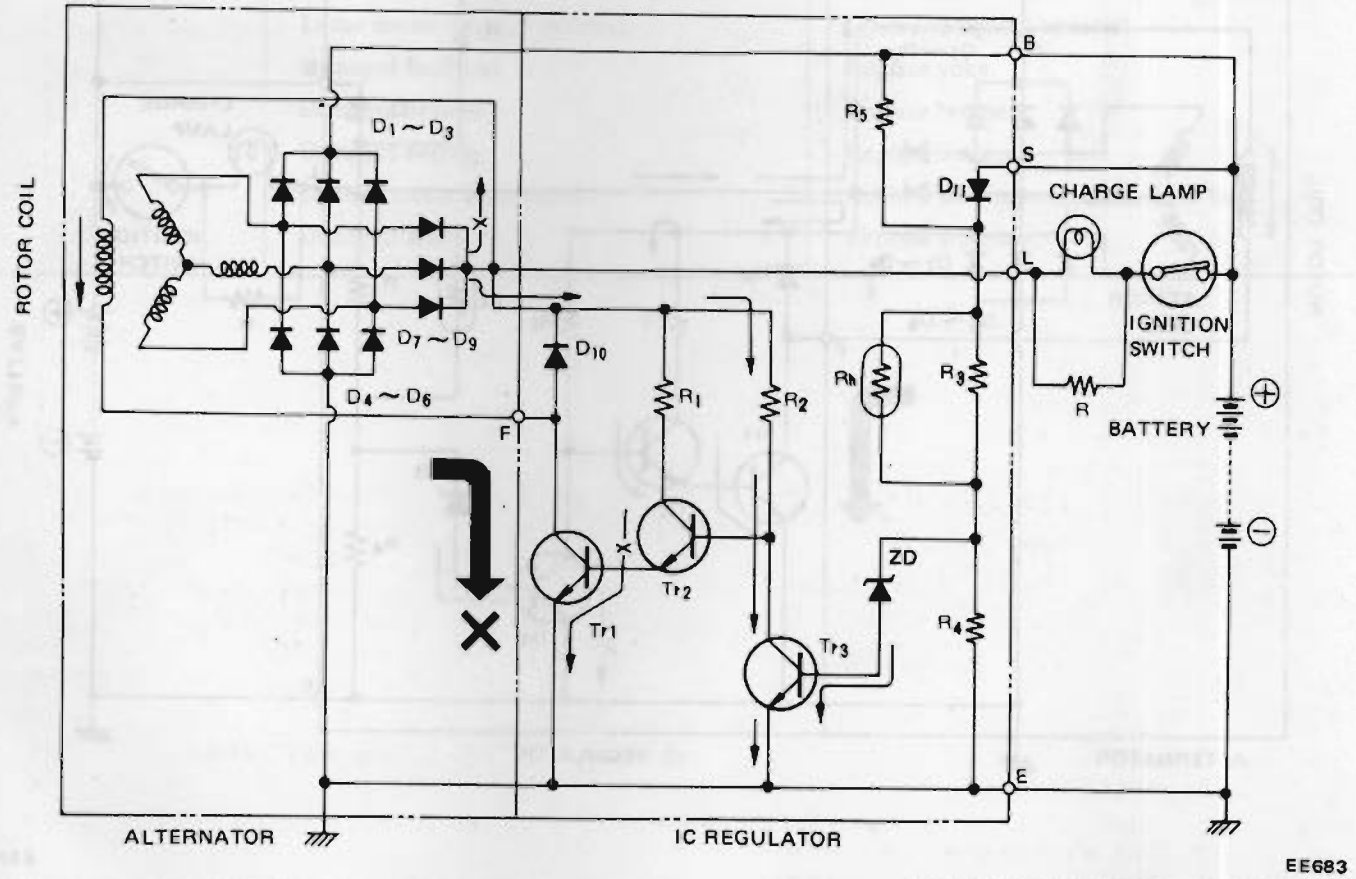
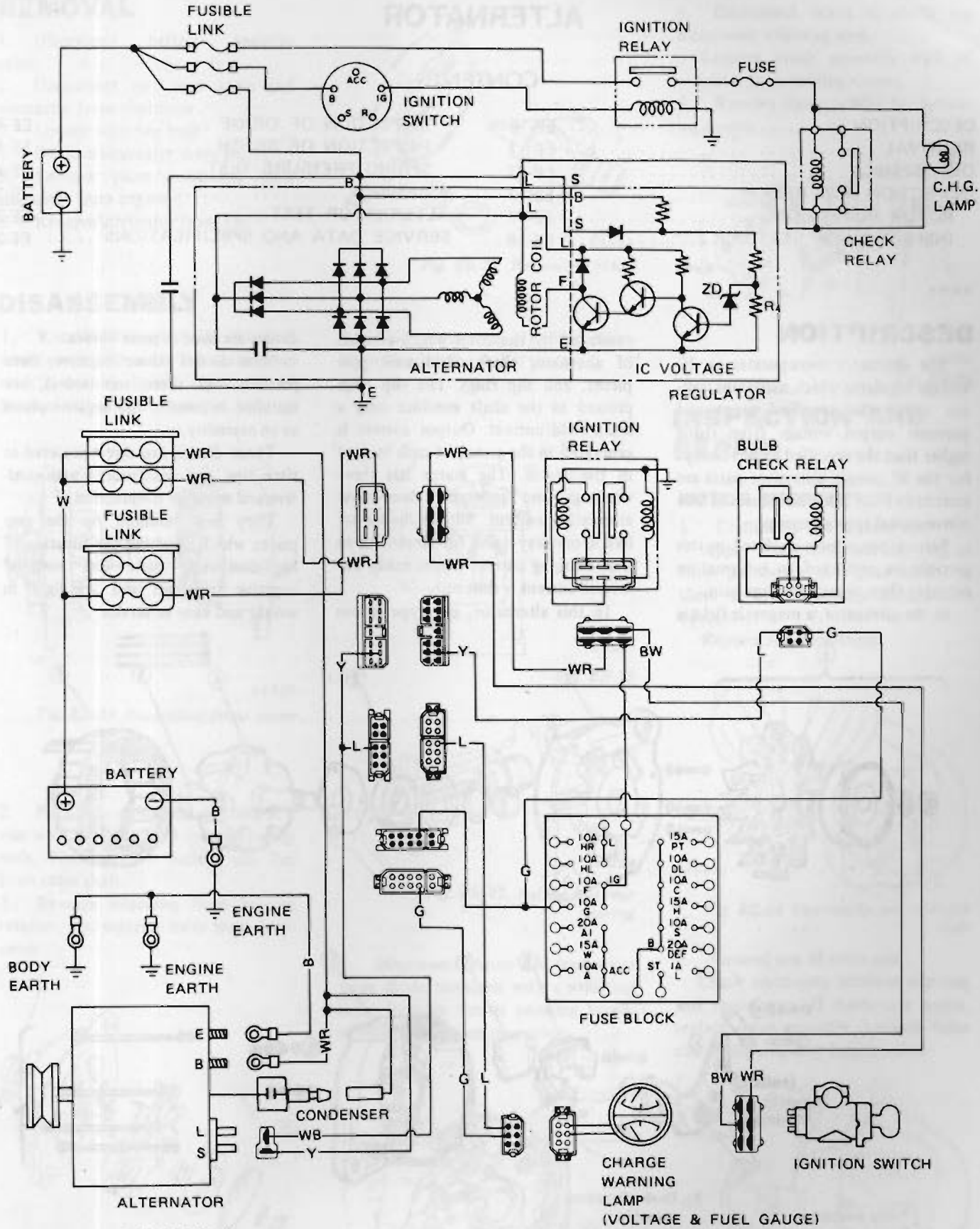


Fig. EE-26 Simplified charging circuit (3)



COLOR CODE

B :	Black	WB:	White with black stripe
BW:	Black with white stripe	G :	Green
W :	White	Y :	Yellow
WR:	White with red stripe	L :	Blue

EE621

Fig. EE-27 Circuit diagram of charging system

ALTERNATOR

CONTENTS

DESCRIPTION

The alternator incorporates an IC voltage regulator which maintains voltage within the specified range and prevents output voltage from rising higher than the specified value. Except for the IC circuit, alternator parts are essentially the same as those of the conventional type alternator.

Service procedures outlined in this section are restricted to information on other than the voltage regulator.

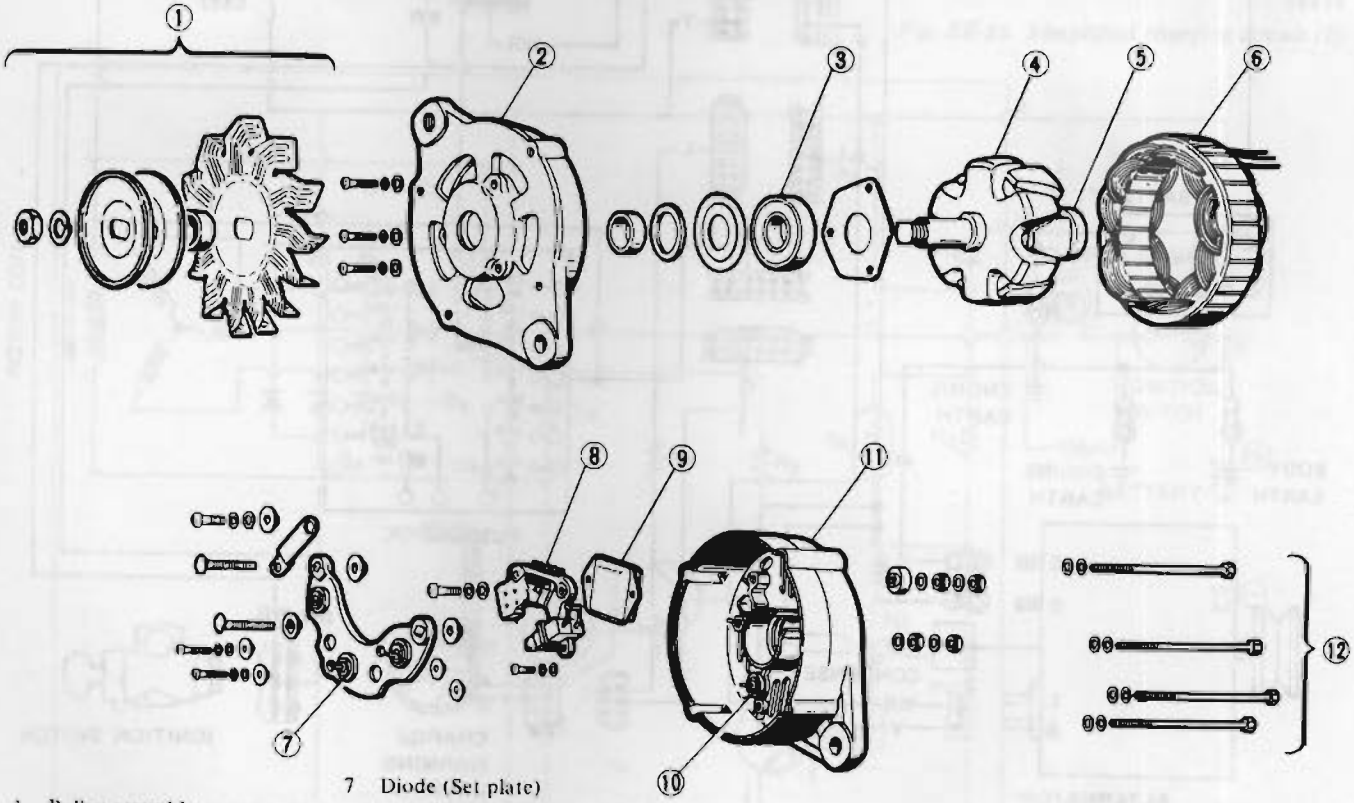
In the alternator, a magnetic field is produced by the rotor which consists of alternator shaft, field coil, pole pieces, and slip rings. The slip rings pressed in the shaft conduct only a small field current. Output current is generated in the armature coils located in the stator. The stator has three 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, can type silicon diodes are used as main diodes.

Nine diodes (three negative, three positive and three sub-diodes), are installed in positive and negative plates as an assembly.

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

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



1 Pulley assembly
2 Front cover
3 Front bearing
4 Rotor
5 Rear bearing
6 Stator
7 Diode (Set plate) assembly
8 Brush assembly
9 IC voltage regulator
10 Diode
11 Rear cover
12 Through bolt

EE623

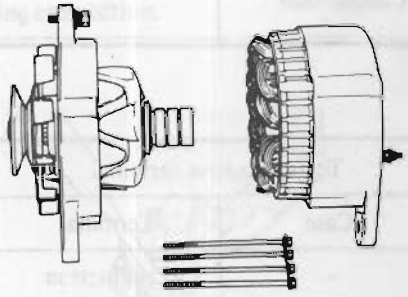
Fig. EE-28 Alternator

REMOVAL

1. Disconnect battery negative cable.
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 car.

DISASSEMBLY

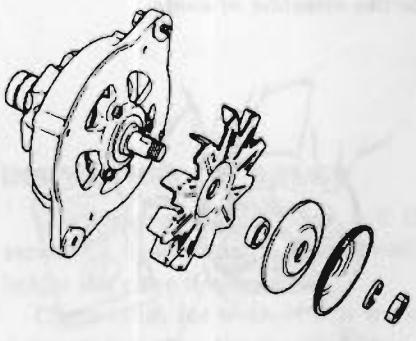
1. Remove through bolts. Separate front cover with rotor from rear cover with stator by lightly tapping front bracket with a wooden mallet.



EE525

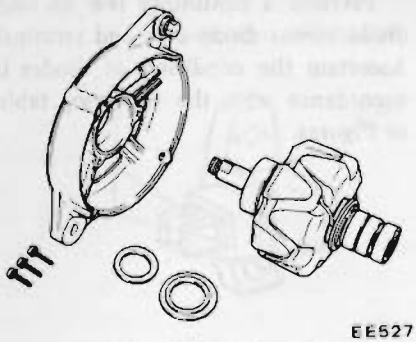
Fig. EE-29 Separating front cover

2. Place rear cover side of rotor in a vise with soft jaw, and remove pulley nuts. Then remove pulley and fan from rotor shaft.
3. Remove setscrews from bearing retainer, and separate rotor from front cover.



EE526

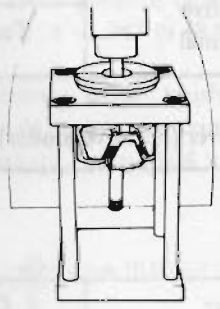
Fig. EE-30 Removing pulley and fan



EE527

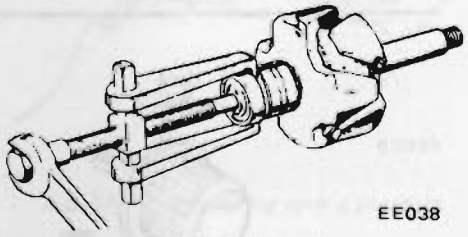
Fig. EE-31 Removing rotor

4. Pull rear bearing off rotor assembly with a bearing puller press.



EE037

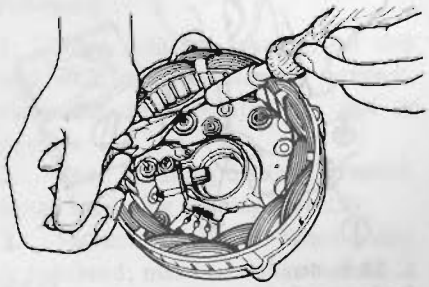
Fig. EE-32



EE038

Fig. EE-33 Pulling out rear bearing

5. Disconnect stator coil lead wires from diode terminals with a soldering iron. Remove screws securing brush; remove stator from rear cover.



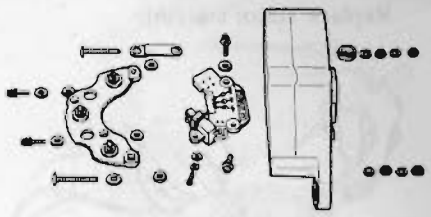
EE623

Fig. EE-34

6. Disconnect wires at diode terminal with soldering iron.

Remove brush assembly with IC regulator by loosening screws.

7. Remove diode holder by loosening screws.



EE624

Fig. EE-35

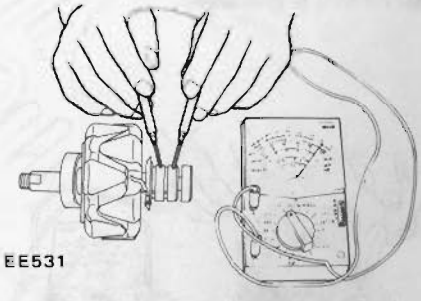
INSPECTION AND REPAIR

ROTOR INSPECTION

1. Continuity test of rotor coil

Apply tester between slip ring of rotor as shown in Figure EE-36. If there is no continuity field coil is open.

Replace rotor assembly.

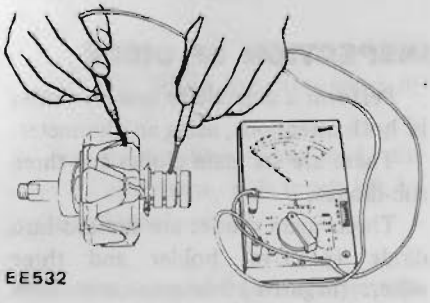


EE531

Fig. EE-36 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.



EE532

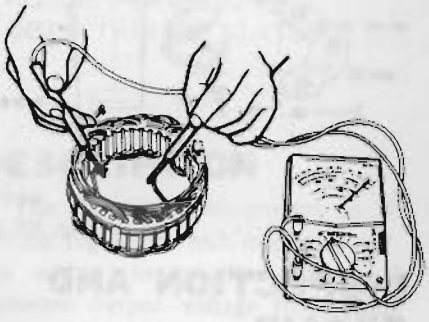
Fig. EE-37 Testing rotor coil for ground

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 stator assembly.

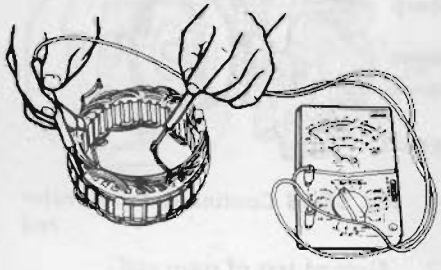


EE533

Fig. EE-38 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.



EE534

Fig. EE-39 Testing stator for ground

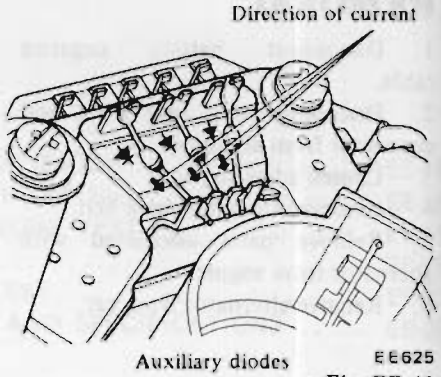
INSPECTION OF DIODE

Perform a continuity test on diodes in both directions, using an ohmmeter.

There are six main diodes and three sub-diodes.

Three main diodes are pressed into diode (positive) holder and three others (negative) into rear cover. Sub-diodes are soldered onto brush assembly.

Perform a continuity test on each diode across diode case and terminal. Ascertain the condition of diodes in accordance with the following tables or Figures.



EE625

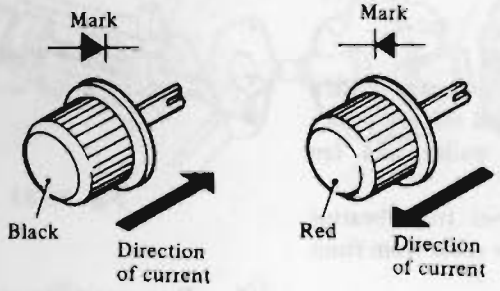
Fig. EE-40

- **Diode holder (positive diodes)**

		Tester positive terminal	
		Case	Terminal
Tester negative terminal	Case	–	Nonconduction
	Terminal	Conduction	–

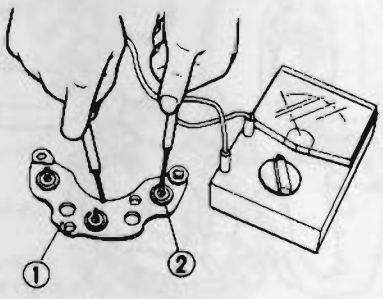
- **Rear cover (negative diodes)**

		Tester positive terminal	
		Case	Terminal
Tester negative terminal	Case	–	Conduction
	Terminal	Nonconduction	–



EE535

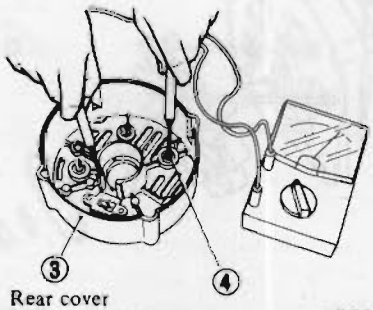
Fig. EE-41 Conductive direction of diode



1 SR holder
2 Positive diode

EE536

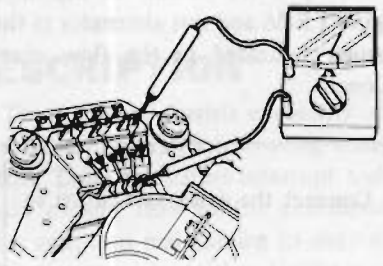
Fig. EE-42



3 Rear cover
4 Negative diode

EE537

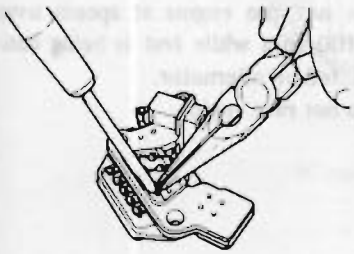
Fig. EE-43 Checking diode



EE626

Fig. EE-44 Checking diode

CAUTION:
If it is necessary to remove sub-diode, pinch diode lead wire with a pair of pliers to prevent heat transfer from soldering iron to diode when unsoldering connection.



EE627

Fig. EE-45 Removing sub-diode

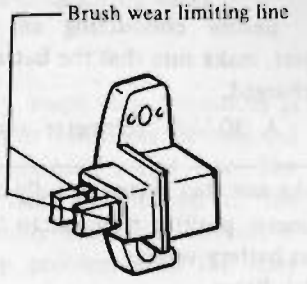
If current flows in both positive and negative directions, diode is short-circuited. If current flows in one direction only as shown in Figures EE-40 and EE-41, diode is in good condition. Replace diodes if faulty.

INSPECTION OF BRUSH

Check movement of brush and if movement is not smooth, check brush holder and clean if necessary.

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

Check brush pig tail and, if damaged, replace.



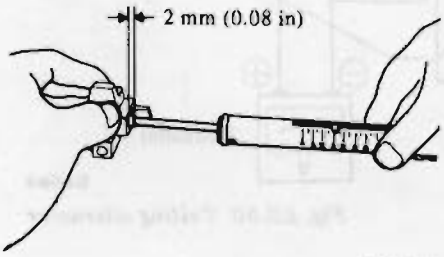
EE538

Fig. EE-46 Brush wear limit

SPRING PRESSURE TEST

With brush projected approximately 2 mm (0.08 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 (8.99 to 12.17 oz).

Moreover, when brush is worn, pressure decreases approximately 20 gr (0.71 oz) per 1 mm (0.04 in) wear.



EE049

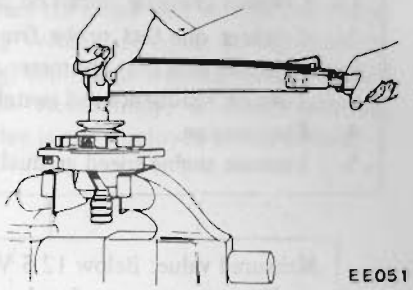
Fig. EE-47 Measuring spring pressure

ASSEMBLY

Assemble alternator in the reverse sequence of disassembly, noting the following:

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 bushing correctly.
3. Tighten pulley nut. When pulley is tightened, make sure that deflection of V-groove is less than 0.3 mm (0.012 in).

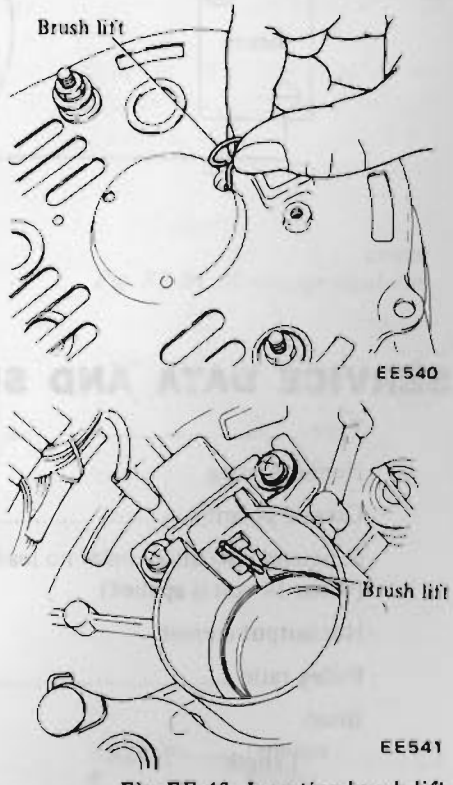
Tightening torque:
Pulley nut:
4.5 to 6.0 kg-m
(33 to 43 ft-lb)



EE051

Fig. EE-48 Tightening pulley nut

4. Before installing front and rear sides of alternator, push rear cover brush up with fingers and retain brush, as shown in Figure EE-49, by inserting brush lift into brush lift hole from outside.



EE540

EE541

Fig. EE-49 Inserting brush lift

5. After installing front and rear sides of alternator, pull brush lift by pushing toward center.

Note: Do not pull brush lift by pushing toward outside of cover as it will damage slip ring sliding surface.

Tightening torque:
Through bolts:
0.35 to 0.40 kg-m
(2.5 to 2.9 ft-lb)

ALTERNATOR TEST

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

A 30-Volt voltmeter and suitable test probes are necessary for the test.

Set up a test circuit as shown in Figure EE-56 and test alternator in the manner indicated in the flow chart below:

1. Connect charging circuit on car. Make sure that battery is fully charged.
2. Connect one test probe from voltmeter positive terminal to "BAT" terminal. Connect the other test probe to ground. Make sure that voltmeter registers battery voltage.
3. Turn on headlights and switch to High Beam.
4. Start engine.
5. Increase engine speed gradually.

Measured value: Below 12.5 Volts
Alternator is out of order; remove and check it for condition.

Measured value: Over 12.5 Volts at idling 20°C (68°F)
Over 14 Volts at 2,400 rpm 20°C (68°F)
Alternator is in good condition.

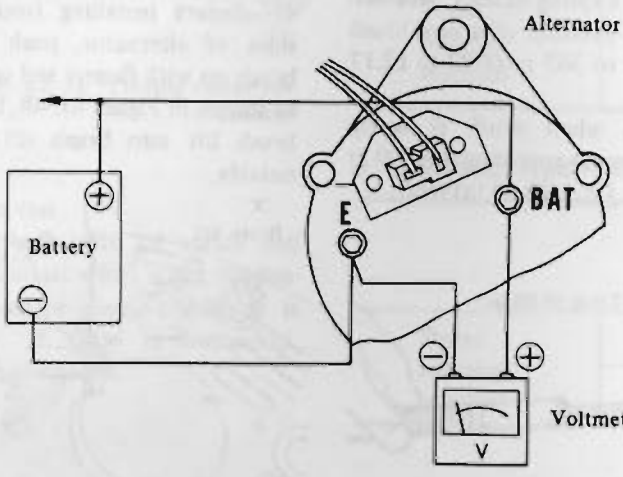


Fig. EE-50 Testing alternator

Note:

a. Do not run engine at speeds over 1,100 rpm while test is being conducted on alternator.

b. Do not race engine.

SERVICE DATA AND SPECIFICATIONS

Type		LR160-42
Nominal rating	V-A	12-60
Ground polarity		Negative
Minimum revolution under no load (When 14 volt is applied)	rpm	Less than 1,000
Hot output current	A/rpm	60/500
Pulley ratio		2.09
Brush		
Length	mm (in)	More than 7 (0.28)
Spring pressure	gr (oz)	255 to 345 (8.99 to 12.17)
Slip ring outer diameter	mm (in)	More than 30 (1.18)
Regulating voltage	V	14.4 to 15

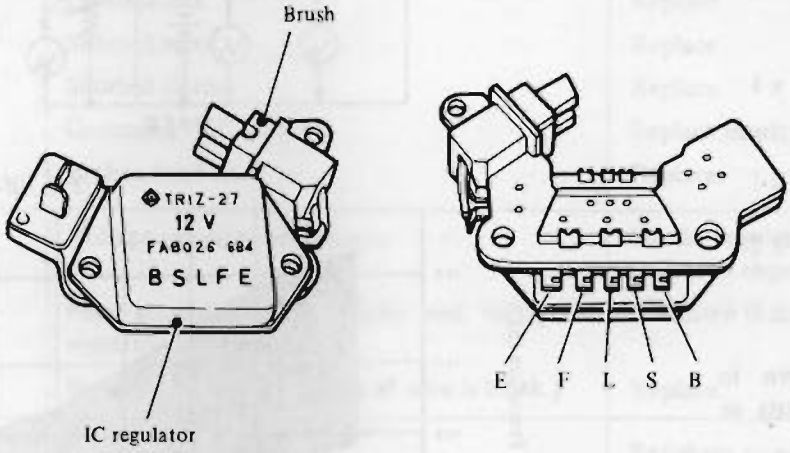
Tightening torque

Through bolts	kg-m (ft-lb)	0.35 to 0.40 (2.5 to 2.9)
Pulley nut	kg-m (ft-lb)	4.5 to 6.0 (33 to 43)

REGULATOR

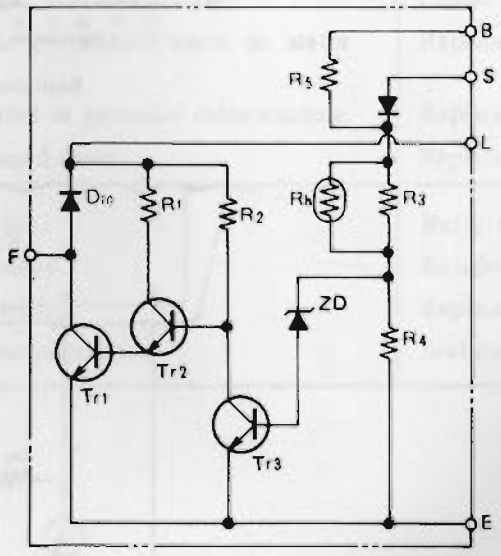
DESCRIPTION

The regulator consists essentially of integrated circuits incorporating transistors. These transistors interrupt and admit current flow to the alternator rotor coil, thus maintaining its output voltage at a constant value. Unlike in a mechanical type regulator, an electronic relay employing transistors is utilized. These transistors are enclosed in a very compact, sealed case. The electronic relay is soldered to the brush assembly inside the alternator. Should any problem with the relay arise, it should be replaced together with the brush assembly. On the charge warning lamp circuit, a diode is attached to the stator coil to monitor generating voltage at the stator so that when the monitored voltage and charging voltage are equal during re-charging, the charge warning lamp is turned off. Accordingly, a charge warning relay is not employed in this circuit.



EE629

Fig. EE-51 IC voltage regulator



B.S.L.E.F. ..... Terminal
R ..... Resistor
Rh ..... Thermistor
Tr ..... Transistor
ZD ..... Zener diode
D ..... Diode

EE630

Fig. EE-52 Circuit of regulator

INSPECTION

Remove IC regulator and brushes at the same time, as outlined in "Disassembly and Assembly" section under the heading "Alternator".

CAUTION:
When performing test continuously, resistor may generate heat. If it becomes high temperature, stop testing for a while to avoid burning.

1. The following test equipment and accessories are required.

(1)	Resistor (R_1), 10 ohms, 20 watts	x 1
(2)	Variable resistor (R_v), 0 to 300 ohms, 20 watts	x 1
(3)	Batteries (1 and 2), 12 volts	x 2
(4)	DC voltmeter, 0 to 30 volts	x 1

2. Connect wiring as shown in Figure EE-49, and perform tests as follows:

(1) Measure voltage V_1 at battery. If it is not within 10 to 13 volts, re-charge or replace battery as necessary.

(2) Disconnect lead wire at terminal S; measure voltage V_2 between terminals F and E. If it is below 2.0 volts, regulator is functioning properly. Connect lead wire to terminal S.

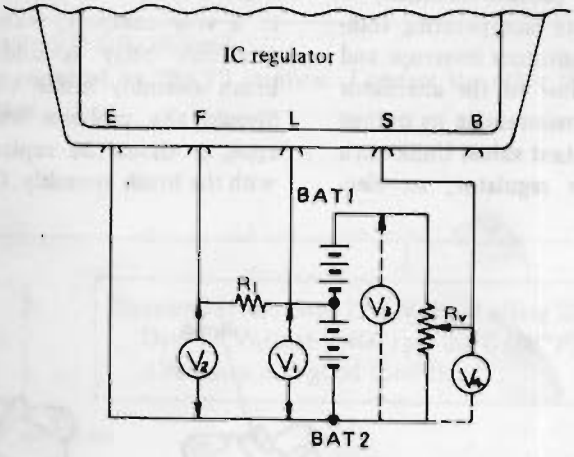
(3) Measure voltage V_3 (total voltage of batteries 1 and 2). If it is not within 20 to 26 volts, re-charge or replace either or both batteries.

(4) Gradually decrease resistance of variable resistor Rv from 300 ohms, and measure voltage V_2 between terminals E and F. As resistance varies, voltage V_2 should at a certain point increase to as high as voltage V_1. (Refer to step 1.) If there is such a variation, regulator is functioning properly. Hold variable resistor Rv at the same voltage as V_1. If there is no voltage variation, regulator is out of order and must be replaced.

(5) Measure voltage V_4 between center tap of variable resistor Rv and terminal E.

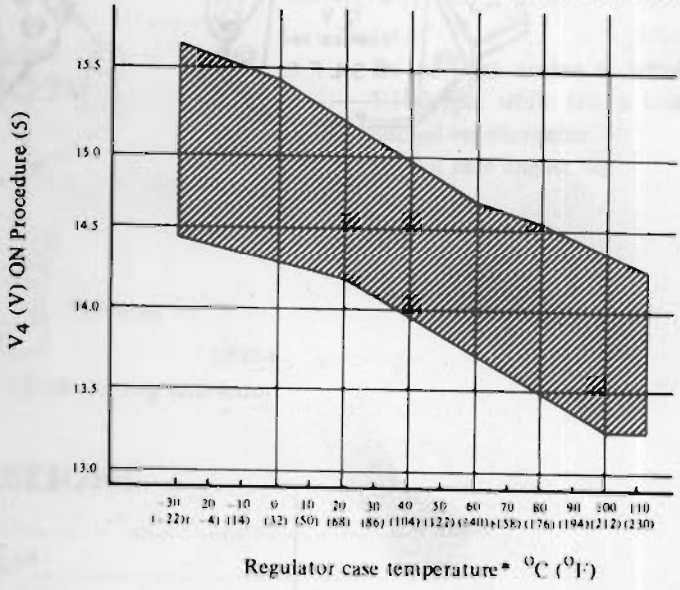
With Rv resistance set at a value obtained in step (4) above, measure voltage V_4 to see if it is within specified range indicated in Figure EE-50. If it is not, regulator is not functioning properly. Replace.

(6) Reconnect wiring as shown in Figure EE-51, and repeat steps (4) and (5). If voltage V_4 is 0.5 to 2.0 volts higher than that in step (5), regulator is functioning properly. If it is not, replace.



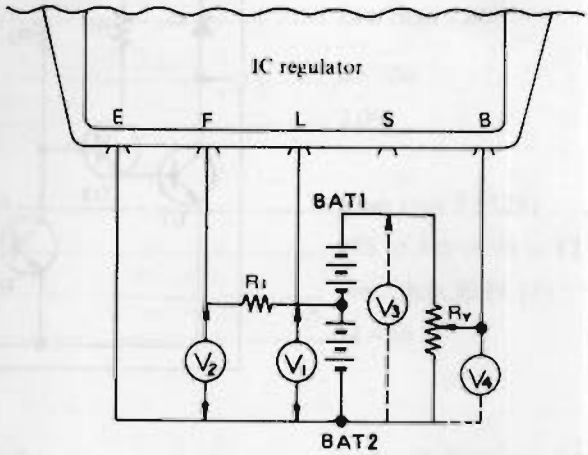
EE631

Fig. EE-53 Testing regulator



EE632

Fig. EE-54 Testing regulator



EE633

Fig. EE-55 Testing regulator

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.	Replace.
	Open rotor winding.	Replace.
	Open diodes.	Replace.
	Shorted rotor.	Replace.
	Shorted stator.	Replace.
	Grounded "A" terminal.	Replace insulator.
	Broken fan belt.	Replace.
Excessive output	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 CIRCUIT

DESCRIPTION

The ignition circuit consists of ignition switch, transistor ignition unit, distributor, wiring, spark plugs and battery.

The distributor is of the contactless type and is equipped with a pick-up coil which electrically detects the ignition timing signal in place of the circuit breaker of the conventional distributor. The transistor ignition unit is a new addition, which generates the signal required for the make and break of the primary electric current for the ignition coil.

The low voltage current is supplied by the battery or alternator and flows through the primary circuit.

It consists of the ignition switch, primary winding of the ignition coil, transistor ignition unit and all connecting low tension wiring.

The high voltage current is produced by the ignition coil and flows through the secondary circuit, resulting in high voltage spark between the electrodes of the spark plugs in engine cylinders.

This circuit contains the secondary winding of the ignition coil, distributor high tension wires to coil and spark plugs, distributor rotor and cap.

When the ignition switch is turned on and the distributor reluctor rotates, the primary current flows through the primary winding of the coil and through transistors ignition unit to ground.

When the primary circuit is opened by circuit of transistor ignition unit, the magnetic field built up in the primary winding of the coil moves through the secondary winding of the coil, inducing high voltage. This high voltage is produced every time the primary circuit opens.

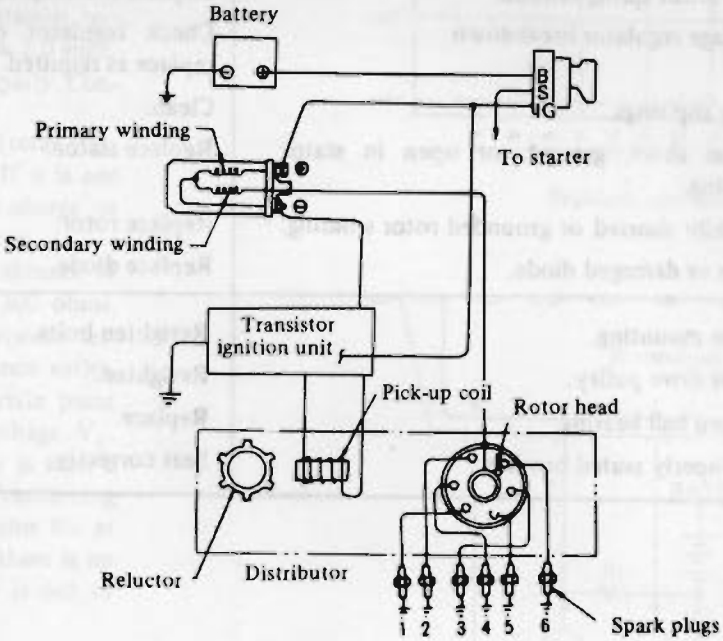
The high voltage current flows through the high tension wire to the distributor cap, then the rotor distributes the current to one of the spark plug terminals in the distributor cap.

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

The spark plug should be inspected, cleaned and regapped at tune up. Spark plugs should also be replaced periodically as specified in the "Maintenance Schedule".

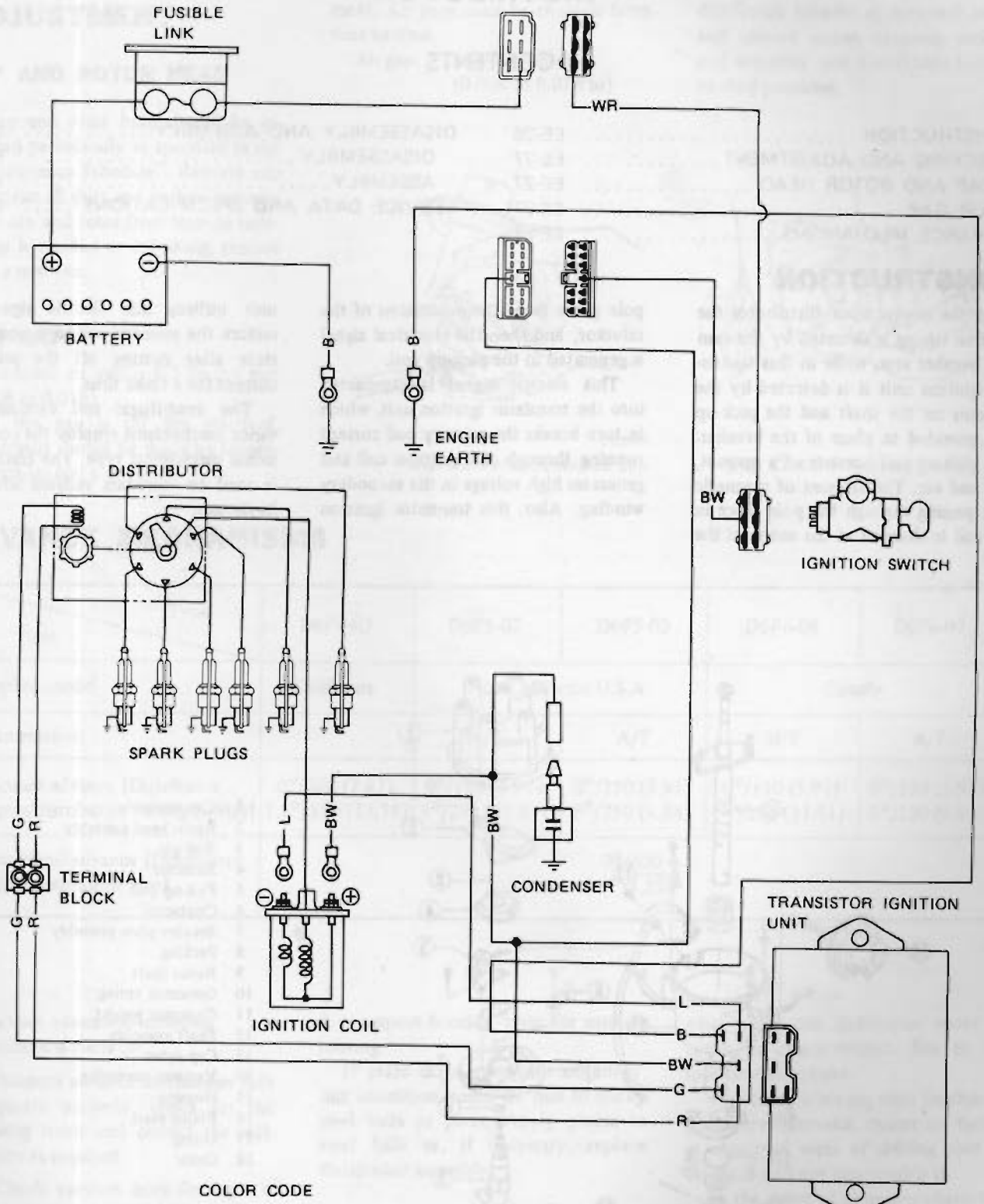
The remainder of the ignition component parts should be inspected for only their operation, air gap of distributor, tightness of electrical terminals, and wiring condition.

Apply grease (NLGI consistency No. 1 containing MoS_2 or equivalent) to distributor rotor shaft as required.



EE634

Fig. EE-56 Ignition system circuit diagram



COLOR CODE

B	:	Black
BW	:	Black with white stripe
WR	:	White with red stripe
R	:	Red
G	:	Green
L	:	Blue

EE635

Fig. EE-57 Ignition system circuit diagram

DISTRIBUTOR

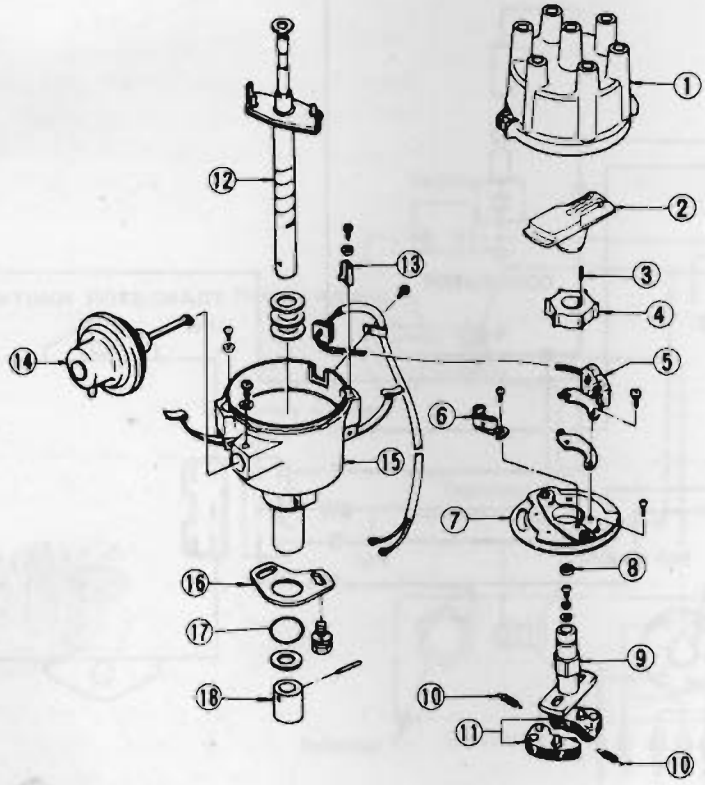
CONTENTS

CONSTRUCTION

In the conventional distributor the ignition timing is detected by the cam and breaker arm, while in this transistor ignition unit it is detected by the reluctor on the shaft and the pick-up coil provided in place of the breaker. The pick-up coil consists of a magnet, coil and etc. The amount of magnetic flux passing through the pole piece in the coil is changed at the moment the pole piece faces the protrusion of the reluctor, and then the electrical signal is generated in the pick-up coil.

This electric signal is conducted into the transistor ignition unit, which in turn breaks the primary coil current running through the ignition coil and generates high voltage in the secondary winding. Also, this transistor ignition unit utilizes this electric signal to restore the primary coil to the original state after cutting off the primary current for a fixed time.

The centrifugal and vacuum advance mechanisms employ the conventional mechanical type. The contactor is used to eliminate vacuum advance hysteresis.



1 Cap assembly
2 Rotor head assembly
3 Roll pin
4 Reluctor
5 Pick-up coil
6 Contactor
7 Breaker plate assembly
8 Packing
9 Rotor shaft
10 Governor spring
11 Governor weight
12 Shaft assembly
13 Cap setter
14 Vacuum controller
15 Housing
16 Fixing plate
17 O-ring
18 Collar

EE635

Fig. EE-58 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 from time to time. If cap is cracked or is leaking, replace with a new one.

AIR GAP

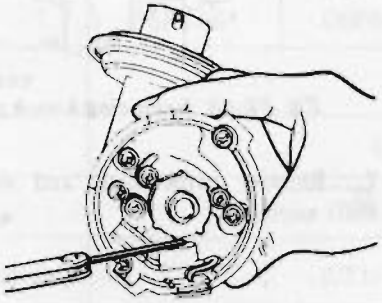
Standard air gap is 0.2 to 0.4 mm (0.008 to 0.016).

If the gap is off the standard, adjustment should be made by loosening pick-up coil screws.

Gap gauge is required for adjustment. Air gaps must be checked from time to time.

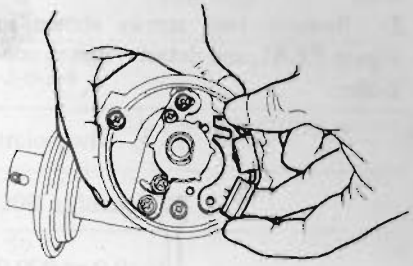
Air gap: 0.2 to 0.4 mm (0.008 to 0.016 in)

To remove pick-up coil, disconnect distributor harness at terminal block and remove screws securing pick-up coil assembly and distributor harness to their positions.



EE638

Fig. EE-59 Checking air gap



EE636

Fig. EE-60 Removing pick-up coil

ADVANCE MECHANISMS

Item \ Type	D6F4-03	D6F5-02	D6F5-03	D6F6-06	D6F6-07
Applied model	California	Non-California U.S.A.		Canada	
Transmission		M/T	A/T	M/T	A/T
Vacuum advance [Distributor degree/distributor mmHg (inHg)]	0°/200 (7.87) 7.5°/350 (13.78)	0°/150 (5.91) 9°/295 (11.61)	0°/150 (5.91) 5°/250 (9.84)	0°/150 (5.91) 9°/295 (11.61)	0°/150 (5.91) 5°/250 (9.84)
Centrifugal advance [Distributor degree/distributor rpm]	0°/600 8.5°/1,250				

≪ Vacuum advance mechanism mechanical parts ≫

If vacuum advance mechanism fails to operate properly, check for the following items and correct the malfunction 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 vacuum controller assembly.

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 distributor assembly.

≪ Centrifugal advance mechanical parts ≫

When cause of engine malfunction is traced to centrifugal advance mechanical parts, use distributor tester to check its characteristics. See to the specifications above.

If nothing is wrong with its characteristics, conceivable causes are faulty or abnormal wear of driving part or others. So do not disassemble it.

In the event of improper characteristics, check closely rotor shaft assembly, governor weight and shaft.

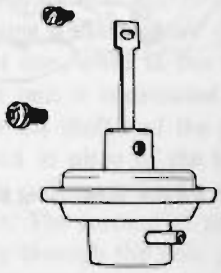
If any of above parts are malfunctioning, replace distributor assembly.

DISASSEMBLY AND ASSEMBLY

DISASSEMBLY

To disassemble, follow the below procedure.

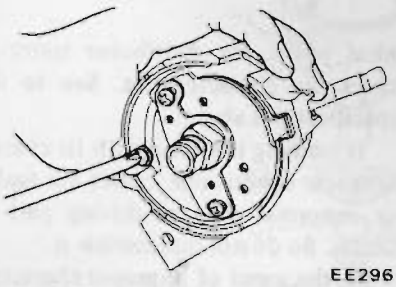
1. Take off cap and remove rotor head.
2. Remove two screws shown in Figure EE-61, and detach vacuum controller.



EE637

Fig. EE-61 Removing vacuum controller

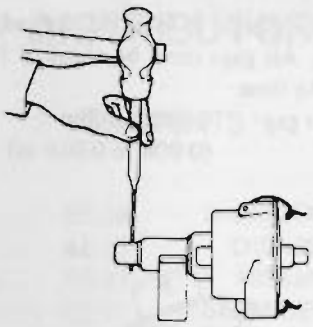
3. Remove pick-up coil assembly.
4. Using two pry bars, pry reluctor from shaft. Be careful not to distort or damage the teeth of reluctor. Remove roll pin.
5. Remove breaker plate setscrews and remove breaker plate assembly.



EE296

Fig. EE-62 Removing breaker plate setscrews

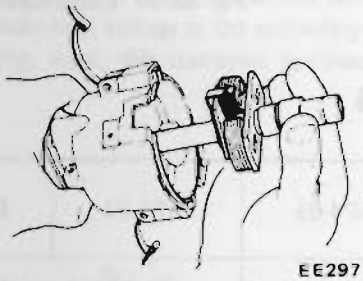
6. Punch knock pin out and remove pinion.



EE639

Fig. EE-63 Removing knock pin

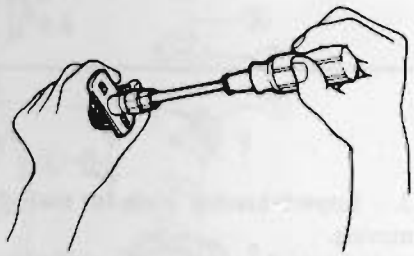
7. Remove rotor shaft and drive shaft assembly.



EE297

Fig. EE-64 Removing rotor shaft and drive shaft assembly

8. Mark rotor shaft and drive shaft. Remove packing from the top of rotor shaft and unscrew rotor shaft setscrew. Remove rotor shaft.



EE075

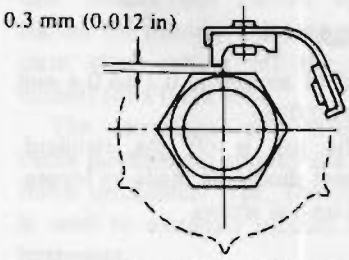
Fig. EE-65 Removing rotor shaft

9. Mark one of the governor springs and its bracket. Also mark one of the governor weights and its pivot pins.
10. Carefully unhook and remove governor springs.
11. Remove governor weights. Apply grease to governor weights, after disassembling.

ASSEMBLY

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

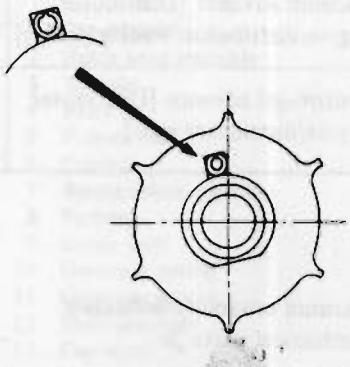
1. Align match marks so that parts are assembled to their original positions.
2. If, for any reason, contactor is removed from breaker plate, adjust cam-to-contactor clearance to 0.3 mm (0.012 in) as shown in Figure EE-66, after installation.



EE368

Fig. EE-66 Cam-to-contactor clearance

3. Ensure that reluctor is properly oriented when installing on shaft. Always drive in roll pin with its slit toward the outer end of shaft. See Figure EE-67. Be sure to use a new roll pin.



EE373

Fig. EE-67 Driving in roll pin

4. When installing pinion on shaft, be sure to install pinion gear correctly to position where it was installed.
5. Apply grease to the top of rotor shaft as required.
6. Check the operation of governor before installing distributor on engine.
7. Adjust ignition timing after distributor is installed on engine.

SERVICE DATA AND SPECIFICATIONS

Applied model		Non-California		California	
Transmission		M/T	A/T	M/T	A/T
Type		D6F5-02, D6F6-06*	D6F5-03, D6F6-07*	D6F4-03	
Firing order		1-5-3-6-2-4			
Rotating direction		Counterclockwise			
Duty		70% (8 to 20% at idling)			
Air gap	mm (in)	0.2 to 0.4 (0.008 to 0.016)			
Cap insulation resistance	MΩ	More than 50			
Rotor head insulation resistance	MΩ	More than 50			
Cap carbon point length	mm (in)	10 (0.39)			

*For Canada

TRANSISTOR IGNITION UNIT

CONTENTS

DESCRIPTION

TRANSISTOR IGNITION UNIT

The transistor ignition unit provides the following functions:

1. It makes and breaks the electric current in the primary circuit of the ignition coil.
2. The duty control circuit sets the rate of make and break within one cycle, i.e., this maintains good ignition characteristics of engine from low speed to high speed and is equal to the dwell angle in the conventional breaker type distributor.
3. A preventive circuit against locking is provided. This cuts off the primary electric current in the ignition coil even when the ignition switch is turned on with the engine not running.
4. In addition, a current limiting circuit is provided. This controls the electric current that flows in the power switching circuit so as not to exceed a certain level.

Each component part of this unit is highly reliable, however, should any part be found faulty, the entire assembly must be replaced.

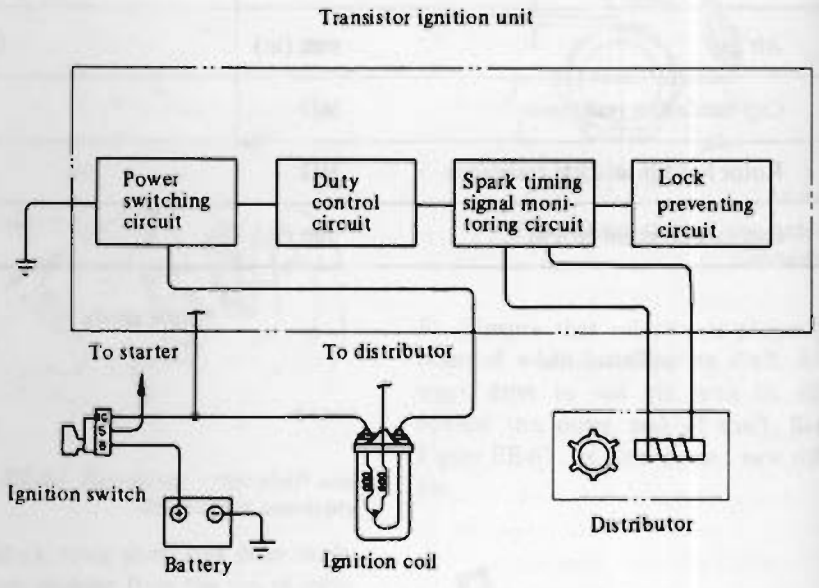


Fig. EE-68 Transistor ignition unit circuit diagram

REMOVAL AND INSTALLATION

Transistor ignition unit is located on the right-hand dash side panel in passenger compartment.

1. Disconnect battery terminals.
2. Disconnect ignition unit connector from unit.
3. Remove two setscrews and remove unit.

Note: To remove ignition unit connector, push latch of connector and pull the connector out.

4. To install, reverse the order of removal.

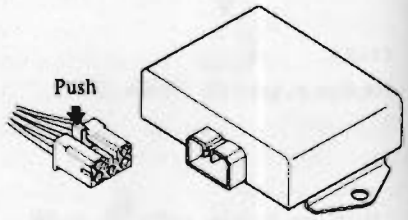


Fig. EE-69 External view of ignition unit

INSPECTION

If the engine does not run due to faulty ignition system, check the ignition system as follows:

Check for a cracked distributor rotor or cap and corroded terminals. Visually inspect high tension wire for condition and, if necessary, use an ignition oscilloscope or a circuit tester to make performance checks. Check spark plugs and adjust gaps as necessary.

Replace a spark plug which is not suitable for further use. If the above checks cannot correct the problem, check the entire ignition system with an oscilloscope or a circuit tester.

CHECKING WITH AN OSCILLOSCOPE

An oscilloscope can be used for checking almost all the items in a transistor ignition system.

CHECKING WITH A CIRCUIT TESTER

A circuit tester can not be used for the duty control circuit and power transistor performance tests. Both methods (use of an oscilloscope and a circuit tester) are described in this section.

The items are classified by numerals in accordance with the objective of checks to be performed. Several wiring diagrams are found on pages EE-36 to EE-40. The thick lines indicate the objective of each individual item check.

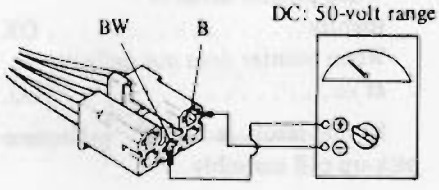
When checking a circuit with an oscilloscope or a circuit tester, be careful not to confuse the polarity of the lead wires if a potential difference exists between the check points at which the lead wires are to be contacted. Also, do not attempt to connect the lead wires to any points in the circuit other than those designated. Careless handling of the lead wires will result in damage to the transistor ignition unit as well as to the oscilloscope or circuit tester.

The connection of a tachometer or a timing light in parallel with an oscilloscope or a circuit tester is allowable, provided that such a connection is made with due consideration to wiring connections.

1. POWER SUPPLY WIRING AND BATTERY CHECK (See wiring diagram in Figure EE-82)

Procedure:

1. Disconnect ignition unit connector from unit.
2. Turn on ignition switch.
3. Connect a circuit tester or an oscilloscope as shown in the figure below.



EE565

Fig. EE-70 Checking power supply wiring and battery

Criterion:

When power source (battery) voltage is indicated . . . . . OK
Lower or no indication. . . . . N.G.

If the result is "N.G." – Take the following measures:

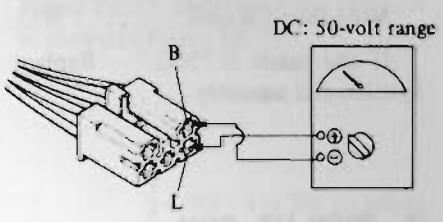
1. Check "BW" and "B" color wire harnesses respectively, for proper conductance.
2. Check battery terminals for proper connection.
3. Check charge condition of battery if an excessively low voltage is indicated.

2. CONTINUITY CHECK OF PRIMARY CIRCUIT

2-1. Checking primary circuit (See wiring diagram in Figure EE-83)

Procedure:

1. Disconnect ignition unit connector from unit.
2. Turn on ignition switch.
3. Connect a circuit tester.



EE566

Fig. EE-71 Checking primary circuit

Criterion:

When normal power source (battery) voltage is indicated . . OK
Lower or no indication. . . . . N.G.

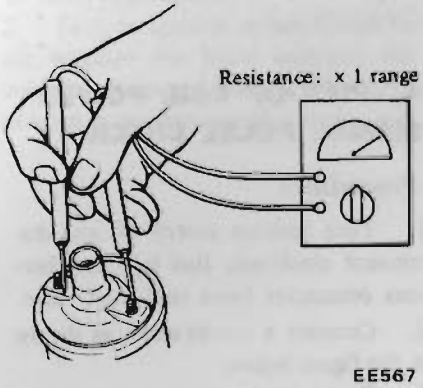
If the result is "N.G." – Take the following measures:

1. Check "L" color wire harness for proper conductance.
2. Check ignition coil terminals for loose contact.
3. Check ignition coil for discontinuity.

2-2. Checking ignition coil assembly (See wiring diagram in Figure EE-84)

Procedure:

1. Disconnect engine room harness from ignition coil.
2. Connect a circuit tester as shown in the figure below.



EE567

Fig. EE-72 Checking ignition coil assembly

Criterion:

When approximately 0 ohm is indicated . . . . . OK
More than 1.8 ohm . . . . . N.G.

If the result is "N.G." – Replace ignition coil assembly.

3. PICK-UP COIL CONTINUITY CHECK (See wiring diagram in Figure EE-85)

Procedure:

1. Disconnect ignition unit connector from unit.
2. Connect a circuit tester as shown in the figure below:

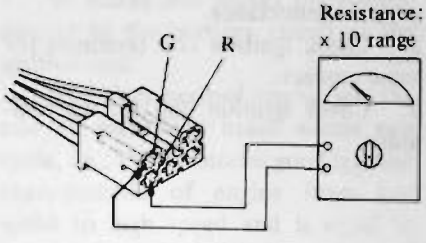


Fig. EE-73 Checking pick-up coil

Criterion:

When approximately 720 ohm is indicated . . . . . OK
Far less than, or more than, 720 ohm . . . . . N.G.

If the result is "N.G." – Replace pick-up coil assembly.

4. PICK-UP COIL POWER SIGNAL PULSE CHECK

Procedure:

1. Turn ignition switch off and disconnect electronic fuel injection harness connector from cold start valve.
2. Connect a circuit tester as shown in the figure below.
3. Rotate starter motor.
4. Read the tester indication.

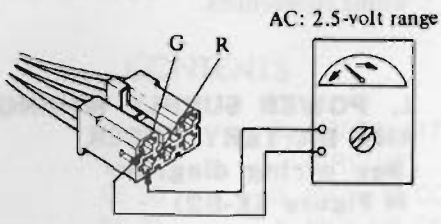


Fig. EE-74 Checking pick-up coil power signal pulse

Criterion:

When pointer deflects slightly . . . . . OK
When pointer does not deflect at all . . . . . N.G.

If the result is "N.G." – Replace pick-up coil assembly.

Procedure: (with an oscilloscope)

1. Turn ignition switch off and disconnect electronic fuel injection harness connector from cold start valve.
2. Connect the positive lead of an oscilloscope to "R", and the negative lead of the oscilloscope to "G" as shown in the figure below.

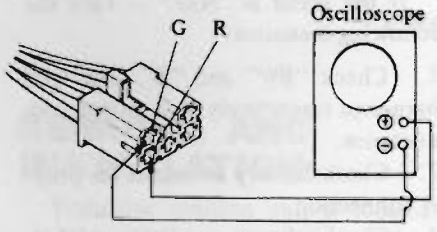


Fig. EE-75 Checking pick-up coil power signal pulse

3. Set "SLOPE" select switch of oscilloscope to positive side. (If so equipped.)
4. Rotate starter motor.
5. Check the wave form as shown in the figure below.

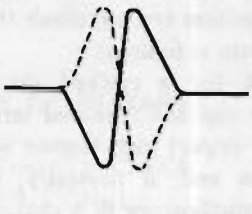


Fig. EE-76 Wave form of pick-up coil

Criterion:

When the wave form takes the shape of a full line . . . . . OK
When the wave form takes the shape of a dashed line or when there is no wave form. . . . . N.G.

If the result is "N.G." – Replace pick-up coil assembly.

5. TRANSISTOR IGNITION UNIT CHECK (See wiring diagram in Figure EE-86)

Check items 5-1 and 5-2 with an oscilloscope.

Where an oscilloscope is not available, check to make sure that all previous tests are satisfactory and that no spark is issuing from the secondary high-tension wire.

If everything else is satisfactory, then the transistor ignition unit is faulty or there is discontinuity in the secondary high-tension wire. Replace the faulty part. After replacement check the sparks from the secondary cord.

5-1. Checking operation of transistor ignition unit

Procedure:

1. Connect engine room harness to ignition coil.
2. Connect ignition unit connector to ignition unit.
3. Turn ignition switch off and disconnect electronic fuel injection harness connectors from injectors and cold start valve.
4. Connect oscilloscope as shown in Figure EE-76, rotate the starter motor and observe the wave form on the oscilloscope.

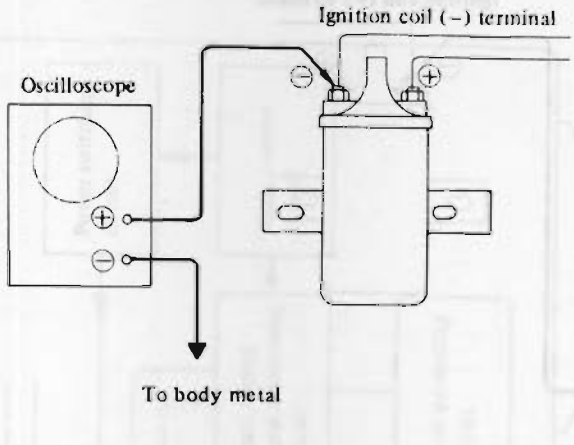


Fig. EE-77 Checking operation of transistor ignition unit

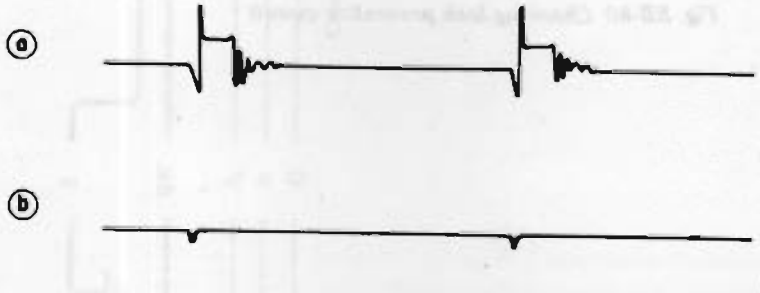


Fig. EE-78 Wave form of pulse

Criterion:

See Figure EE-78.

When a wave form similar to (a) is observed. . . . . OK
When a wave form similar to (b) is observed or when no wave form is observed . . . . . N.G.

If the result is "N.G.", the fault lies either in the transistor unit or in the secondary high-tension wire.

Replace these parts.

– If an oscilloscope is not available –

Procedure:

1. Connect engine room harness to ignition coil.
2. Connect ignition unit connector to ignition unit.
3. Turn ignition switch off and disconnect electronic fuel injection harness connectors from injector and cold start valve.
4. Keep the secondary high-tension wire end 4 to 5 mm (0.16 to 0.20 in) away from engine block, rotate the starter motor, and check whether sparks fly across the clearance.

Criterion:

Where sparks issue . . . . . OK
Where no spark issues. . . . . N.G.

If the result is "N.G.", the fault lies either in the transistor unit or in the secondary high-tension wire.

Replace these parts.

5-2. Checking operation of duty

Procedure:

1. Turn ignition switch off and connect electronic fuel injection harness connectors to injectors and cold start valve.
2. While the engine is idling, observe the wave form on the oscilloscope in the same way as stated in item 5-1, Figure EE-77. Determine the ratio t/T as shown in Figure EE-79.

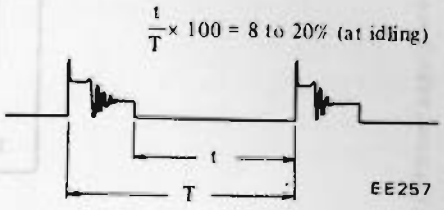


Fig. EE-79 Wave form of duty pulse

Criterion:

When a standard ratio of about 8 to 20% is obtained . . . . . OK
When the ratio obtained is less than 8%, or more than 20% . . . . . N.G.

If the result is "N.G." – Replace transistor ignition unit.

5-3. Checking lock preventive circuit

– If a circuit tester is used –

Procedure:

1. Connect a circuit tester as shown in Figure EE-80; positive terminal of tester is connected to – terminal of the ignition coil and negative terminal of tester is grounded.
2. Turn on ignition switch. Check to see whether the tester indicates the voltage of power source (battery) as soon as ignition switch is turned on.

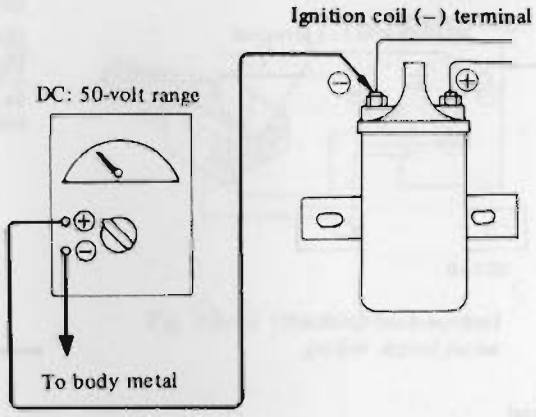


Fig. EE-80 Checking lock preventive circuit

Criterion:

When power source voltage is indicated ..... OK
When approximately zero-voltage is indicated ..... N.G.

If the result is "N.G." – Take the following measures:

Replace transistor ignition unit.

– If an oscilloscope is used –

Procedure:

When using an oscilloscope instead of a tester, arrange the connection in the same way as shown in Figure EE-77. Turn on ignition switch.

Check to see whether the wave form on the oscilloscope rises up to the power source voltage as soon as ignition switch is turned on.

Criterion:

The same as described before for use of a tester.

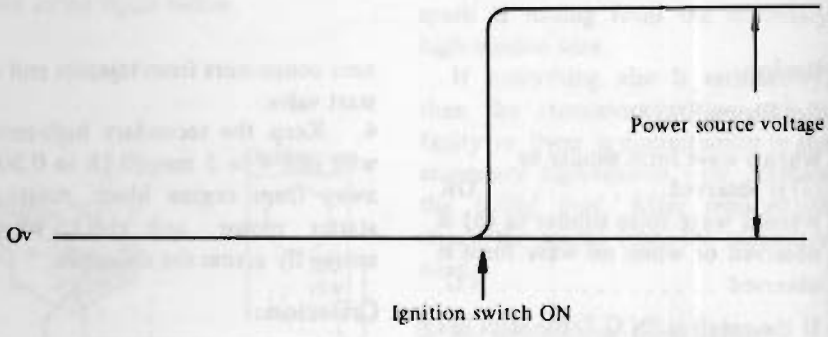
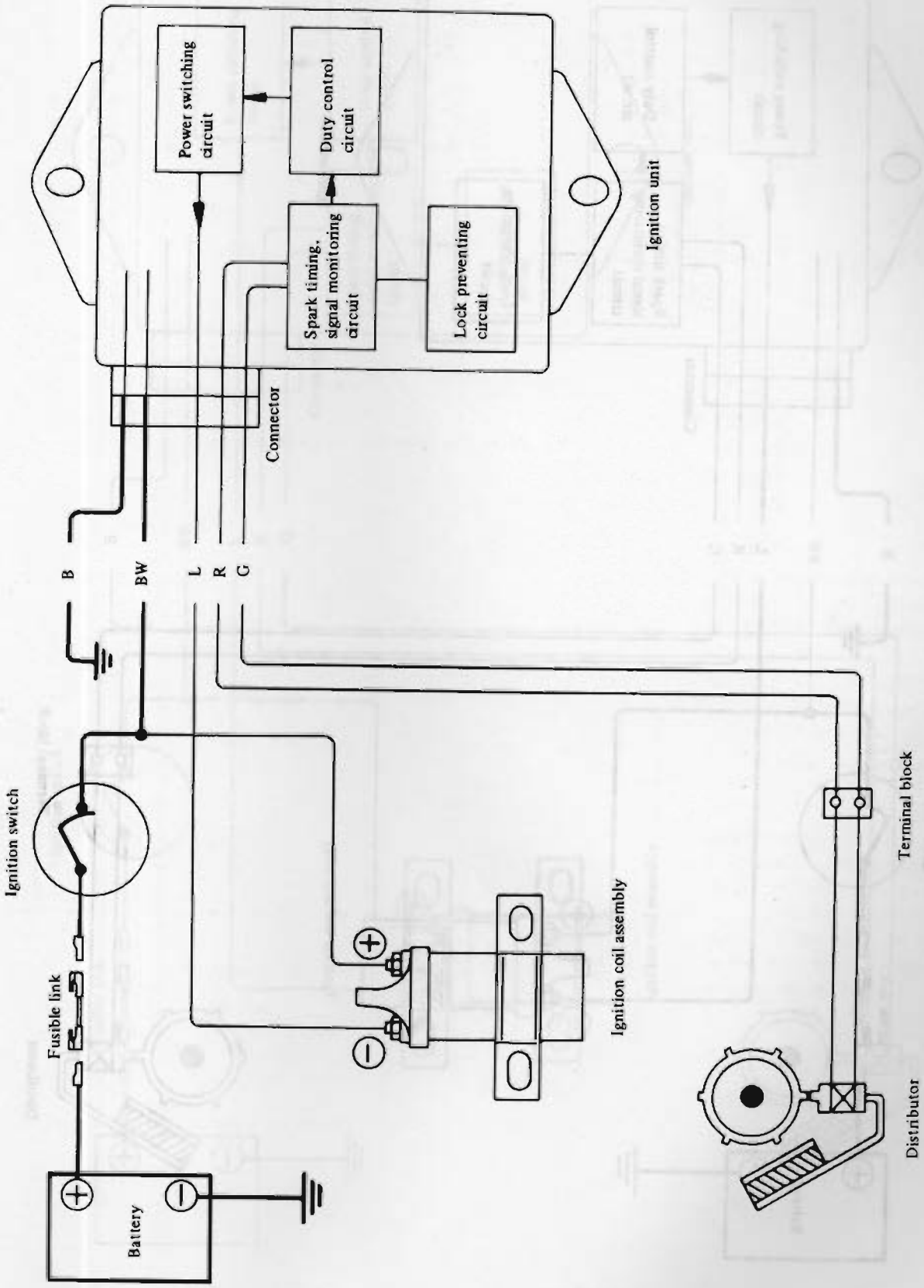


Fig. EE-81 Wave form of lock preventive circuit



EE690

Fig. EE-82 Wiring diagram for item (1) (Power supply wiring and battery check)

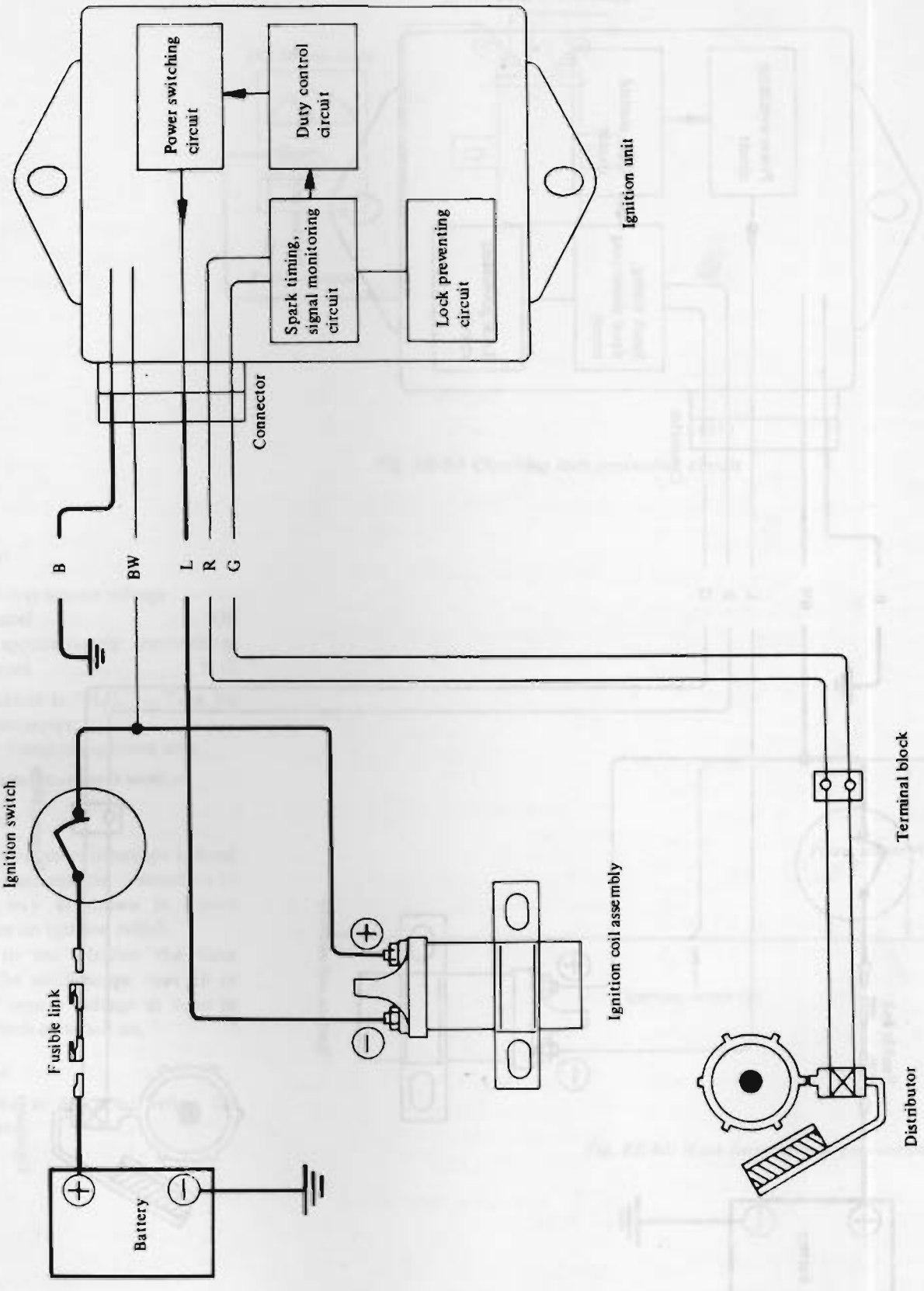


Fig. EE-83 Wiring diagram for item (2)-1 (Checking primary circuit)

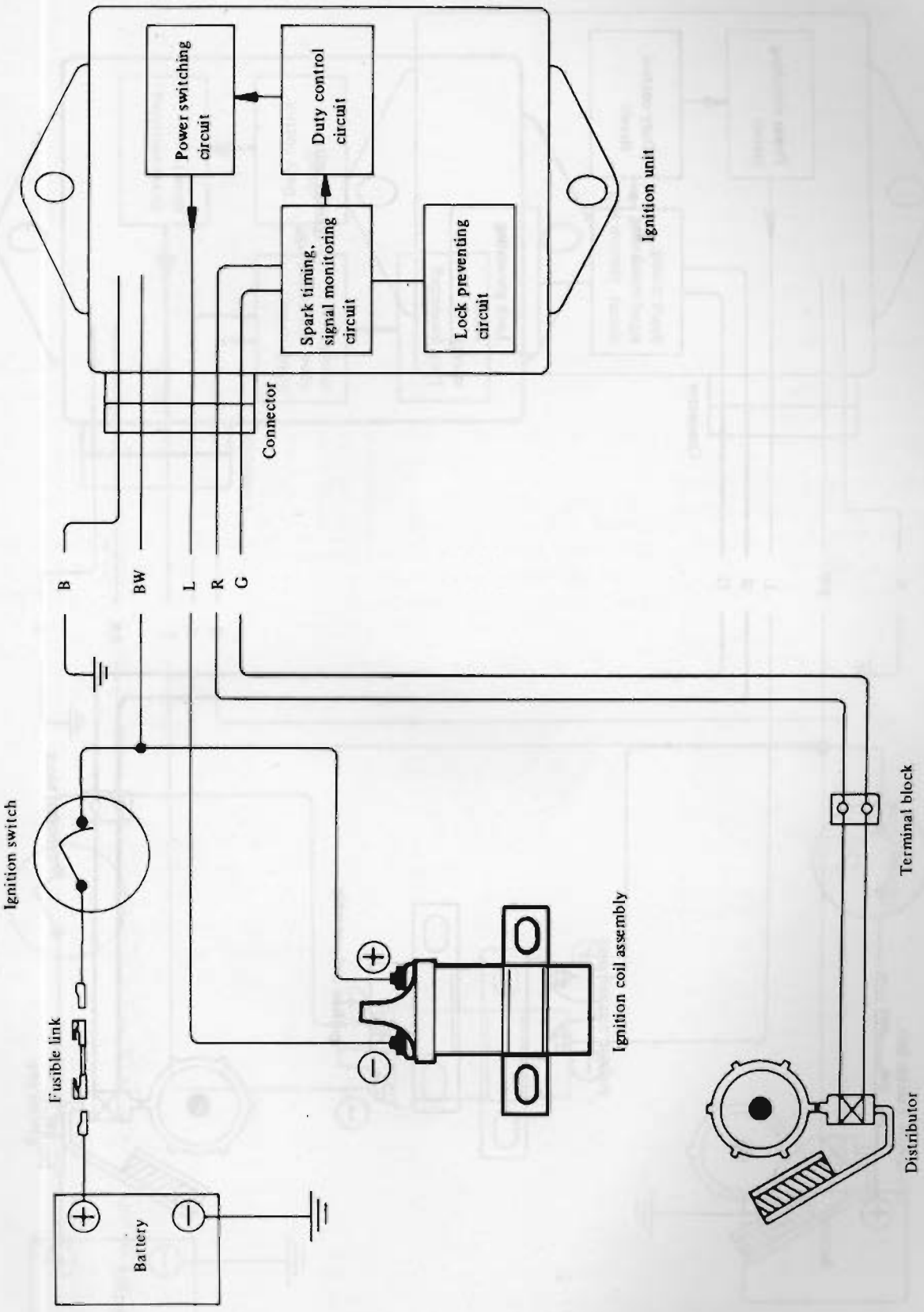


Fig. EE-84 Wiring diagram for item (2)-2 (Checking ignition coil assembly)

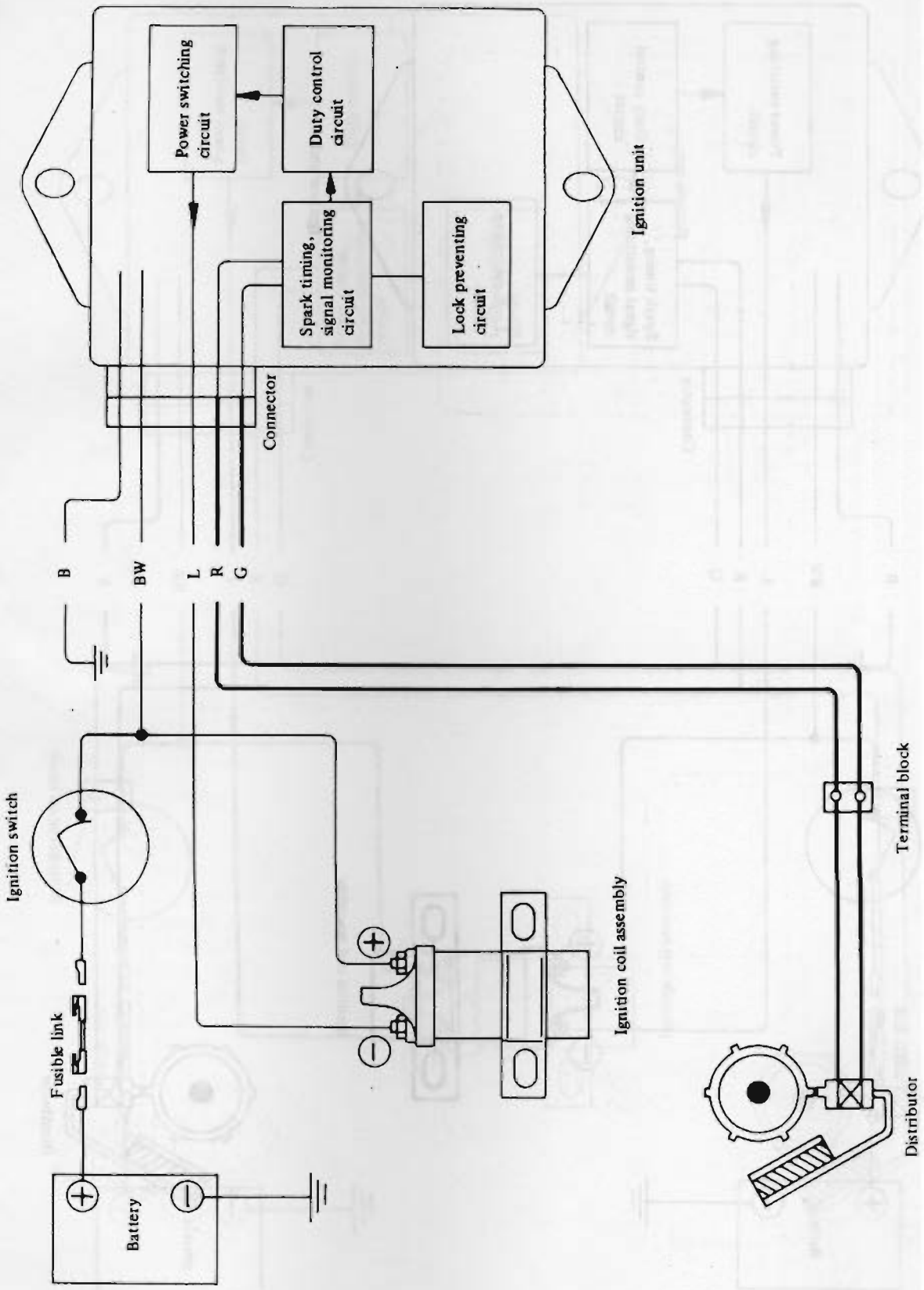
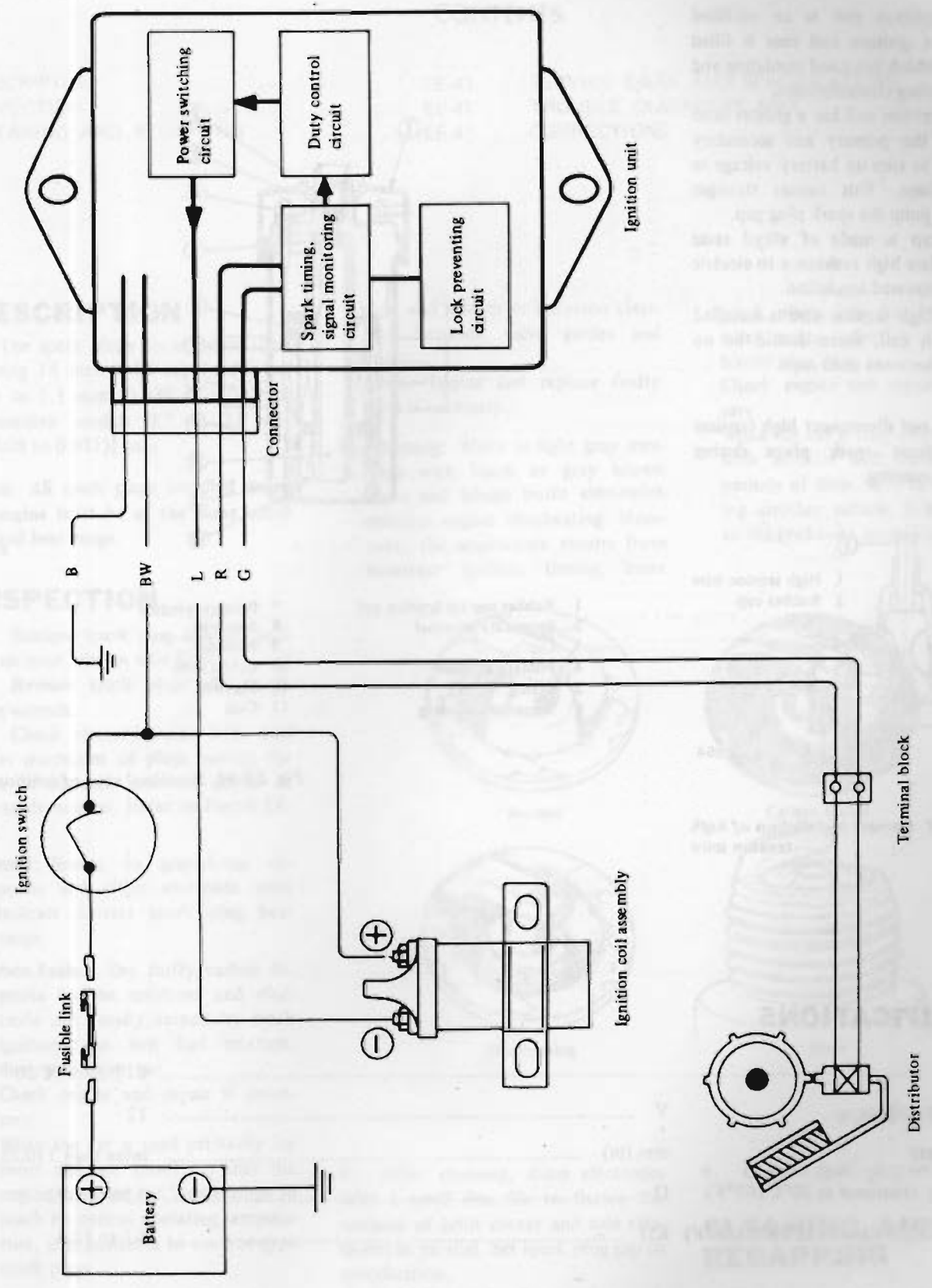


Fig. EE-85 Wiring diagram for item (3) (Pick-up coil continuity check)



EE694

Fig. EE-86 Wiring diagram for item (5) (Transistor ignition unit check)

IGNITION COIL

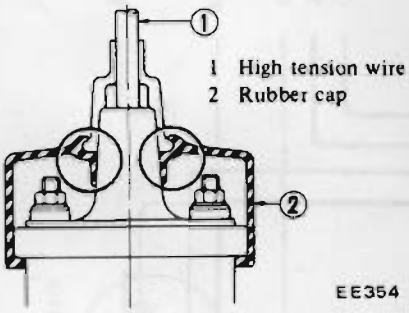
The ignition coil is an oil-filled type. The ignition coil case is filled with oil which has good insulating and heat-radiating characteristics.

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

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

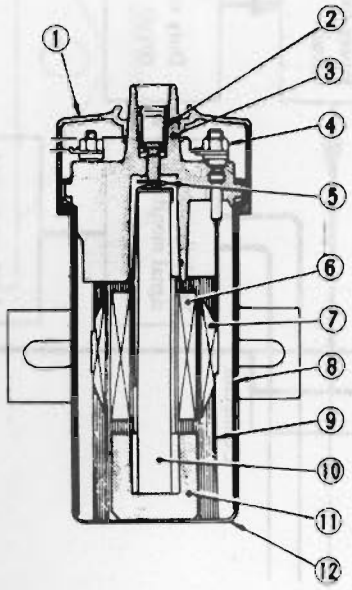
When high tension wire is installed to ignition coil, there should be no clearance between their caps.

Note: Do not disconnect high tension wires from spark plugs during engine running.



1 High tension wire
2 Rubber cap

Fig. EE-87 Correct installation of high tension wire



1 Rubber cap for ignition coil
2 Secondary terminal
3 Cap
4 Primary terminal
5 Spring
6 Secondary winding
7 Primary winding
8 Side core
9 Insulator
10 Center core
11 Segment
12 Case

Fig. EE-88 Sectional view of ignition coil

SPECIFICATIONS

Type		C1T-30, STC-30
Primary voltage	V	12
Spark gap	mm (in)	more than 7 (0.28)
Primary resistance at 20°C (68°F)	Ω	0.84 to 1.02
Secondary resistance at 20°C (68°F)	KΩ	8.2 to 12.4

SPARK PLUG

CONTENTS

DESCRIPTION

The spark plugs are standard type, having 14 mm (0.55 in) threads and 1.0 to 1.1 mm (0.039 to 0.043 in) [Canadian models 0.7 to 0.8 mm (0.028 to 0.031)] gap.

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

INSPECTION

1. Remove spark plug wire by pulling on boot, not on wire itself.
2. Remove spark plugs with spark plug wrench.
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-89.

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 weak ignition, too rich fuel mixture, dirty air cleaner, etc.
Check engine and repair if necessary.
When the car is used primarily for short distance travel, so that the engine does not run long enough to reach its normal operating temperature, it is advisable to use hot-type spark plugs.

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.
Repair engine and replace faulty parts if necessary.

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.
Check engine and repair if necessary.
When the car is frequently operated with throttle wide open for long periods of time, such as when towing another vehicle, it is advisable to use cold-type spark plugs.

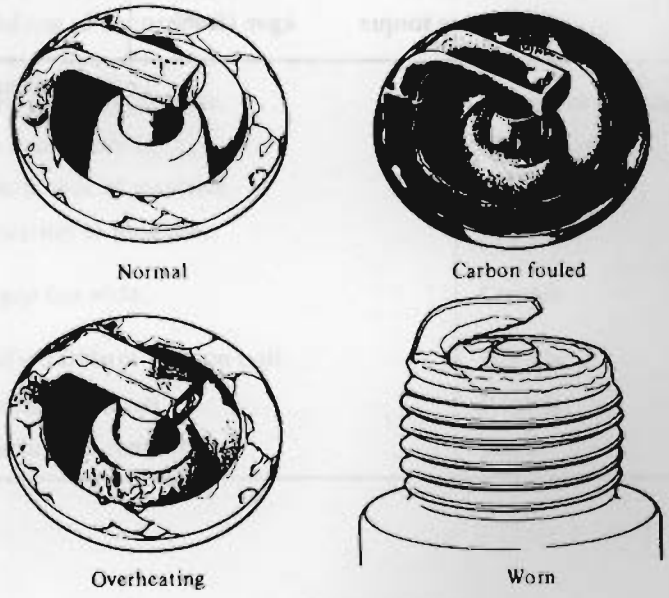


Fig. EE-89 Spark plug

4. After cleaning, dress electrodes with a small fine file to flatten the surfaces of both center and side electrodes in parallel. Set spark plug gap to specification.
5. Install spark plugs and torque each plug to 1.5 to 2.0 kg-m (11 to 14 ft-lb).
6. Connect spark plug wires.

CLEANING AND REGAPPING

Clean spark plugs in a sand blast type cleaner. Avoid excessive blasting. Clean and remove carbon or oxide

deposits, but do not wear away porcelain. If deposits are too stubborn, discard plugs.

After cleaning spark plugs, renew firing surface of electrodes with file mentioned above. Then gap spark plugs to 1.0 to 1.1 mm (0.039 to 0.043 in) [Canada models 0.7 to 0.8 mm (0.028 to 0.031 in)] using a round wire feeler gauge. All spark plugs new or used should have gap checked and reset by bending ground electrode.

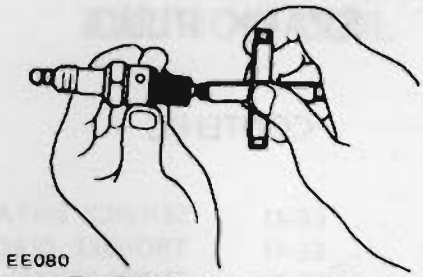


Fig. EE-90 Setting spark plug gap

SERVICE DATA AND SPECIFICATIONS

Type	Standard	B6ES-11, L45W-11 BR6ES*
	Hot type	B5ES-11, L46W-11 BR5ES*
	Cold type	B7ES-11, L44W-11 BR7ES*
Plug gap	mm (in)	1.0 to 1.1 (0.039 to 0.043) 0.7 to 0.8 (0.028 to 0.031)*
Tightening torque	kg-m (ft-lb)	1.5 to 2.0 (11 to 14)

*For Canada

TROUBLE DIAGNOSES AND CORRECTIONS

1. When engine does not start

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

Note: Turn ignition switch off and disconnect ground cable from battery and electronic fuel injection harness connector from injectors and cold start valve, to cut off supply of fuel to engine. Then, observe the condition of sparks while starter motor is in operation.

Condition	Location	Probable cause	Corrective action
No spark at all	Distributor	Breakage of lead-wire on low tension side.	Repair.
		Poor insulation of cap and rotor head.	Replace.
		Open pick-up coil.	Replace.
		Air gap wider than specification.	Adjust.
	Ignition coil	Wire breakage or short circuit of coil.	Replace with new one.
	High tension wire	Wire coming off.	Repair.
		Faulty insulation.	Replace.
	Transistor ignition unit	Faulty transistor ignition unit.	Replace.
		Breakage of circuit.	Replace.
		Detaching of connection.	Repair.
Spark length More than 6 mm (0.236 in)	Spark plugs	Spark plug gap too wide.	Correct or replace.
		Too much carbon.	Clean or replace.
		Broken neck of insulator.	Replace.
		Expiration of plug life.	Replace.
	Distributor	Air gap too wide.	Correct.
	Transistor ignition unit	Faulty transistor ignition unit.	Replace.
		Breakage of circuit.	Replace.
		Detaching of connection.	Repair.

2. Engine rotates but does not run smoothly.

This may be caused by the ignition system or other engine conditions not related to ignition. Therefore, first a complete inspection of ignition system should be carried out.

Condition	Location	Probable cause	Corrective action
Engine misses.	Distributor	Foreign matter on pick-up coil.	Clean.
		Improper air gap.	Correct.
		Leak of electricity at cap and rotor head.	Repair or replace.
		Breakage of pick-up coil lead wire.	Replace.
		Worn or shaky breaker plate.	Replace assembly.
		Worn or shaky distributor driving shaft.	Replace assembly.
	Ignition coil	Layer short circuit or inferior quality coil.	Replace with good one.
	High tension wire	Deterioration of insulation with consequent leak of electricity.	Replace.
	Spark plugs	Fouled.	Clean.
		Leak of electricity at upper porcelain insulator.	Repair or replace.
		Spark plug gap too narrow.	Correct or replace.
	Transistor ignition unit	Faulty transistor ignition unit.	Replace.
		Breakage of circuit.	Replace.
		Detaching of connection.	Repair.
Engine causes knocking very often.	Distributor	Improper ignition timing (too advanced).	Correct.
		Coming off or breakage of governor spring.	Correct or replace.
		Worn pin or hole of governor.	Replace.
	Spark plugs	Burnt too much.	Replace.
Engine does not deliver enough power.	Distributor	Improper ignition timing (too retarded).	Correct.
		Improper functioning governor.	Replace assembly.
		Foreign particles stuck in air gap.	Clean.
	Spark plugs	Fouled.	Clean.