ELECTRICAL SYSTEM

CONTENTS

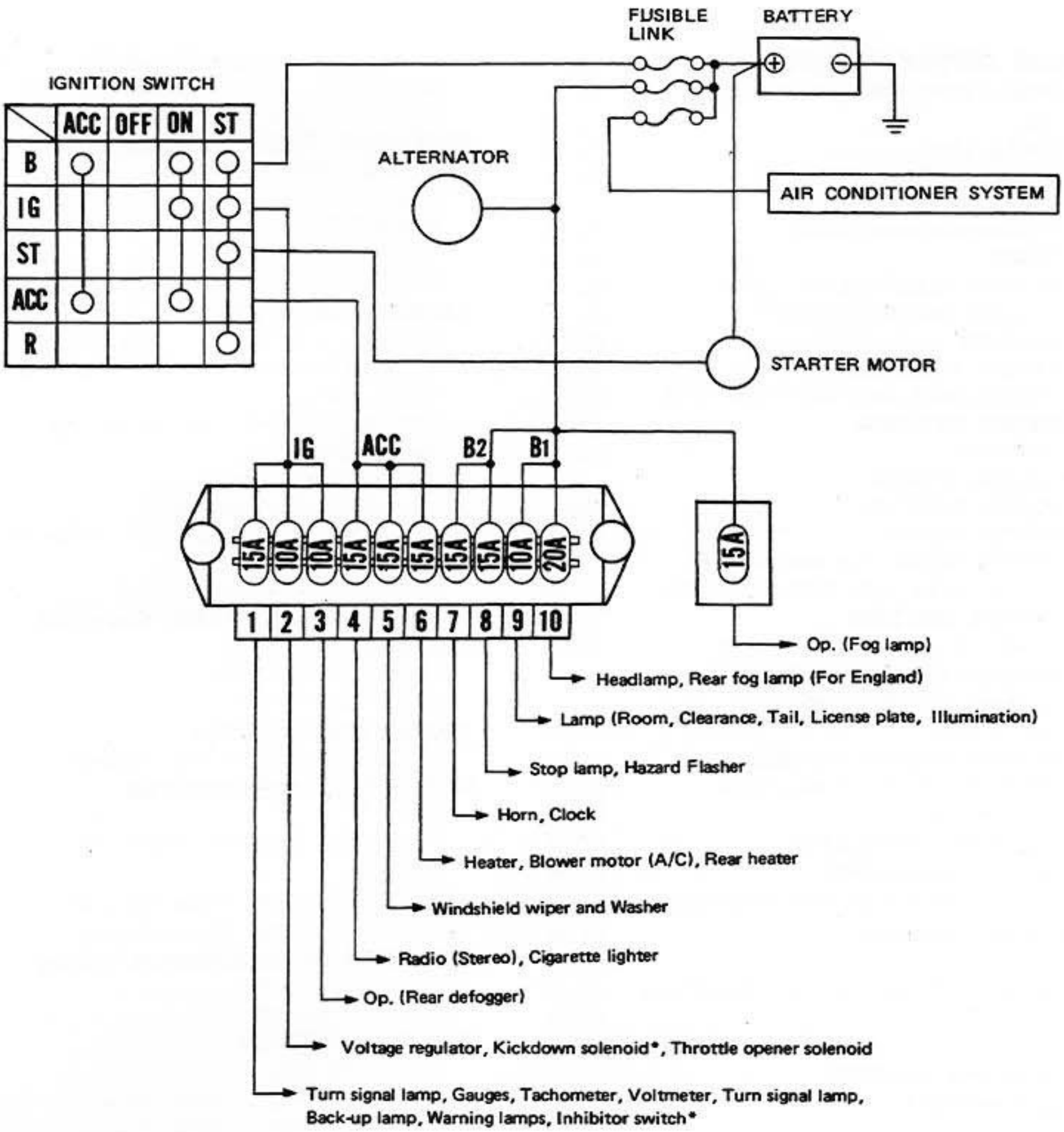
POWER SUPPLY ROUTING

CAUTION: Before starting to work, be sure to turn ignition switch "OFF" and then disconnect battery ground cable.

SCHEMATIC/POWER SUPPLY ROUTING

MODEL 160 SERIES

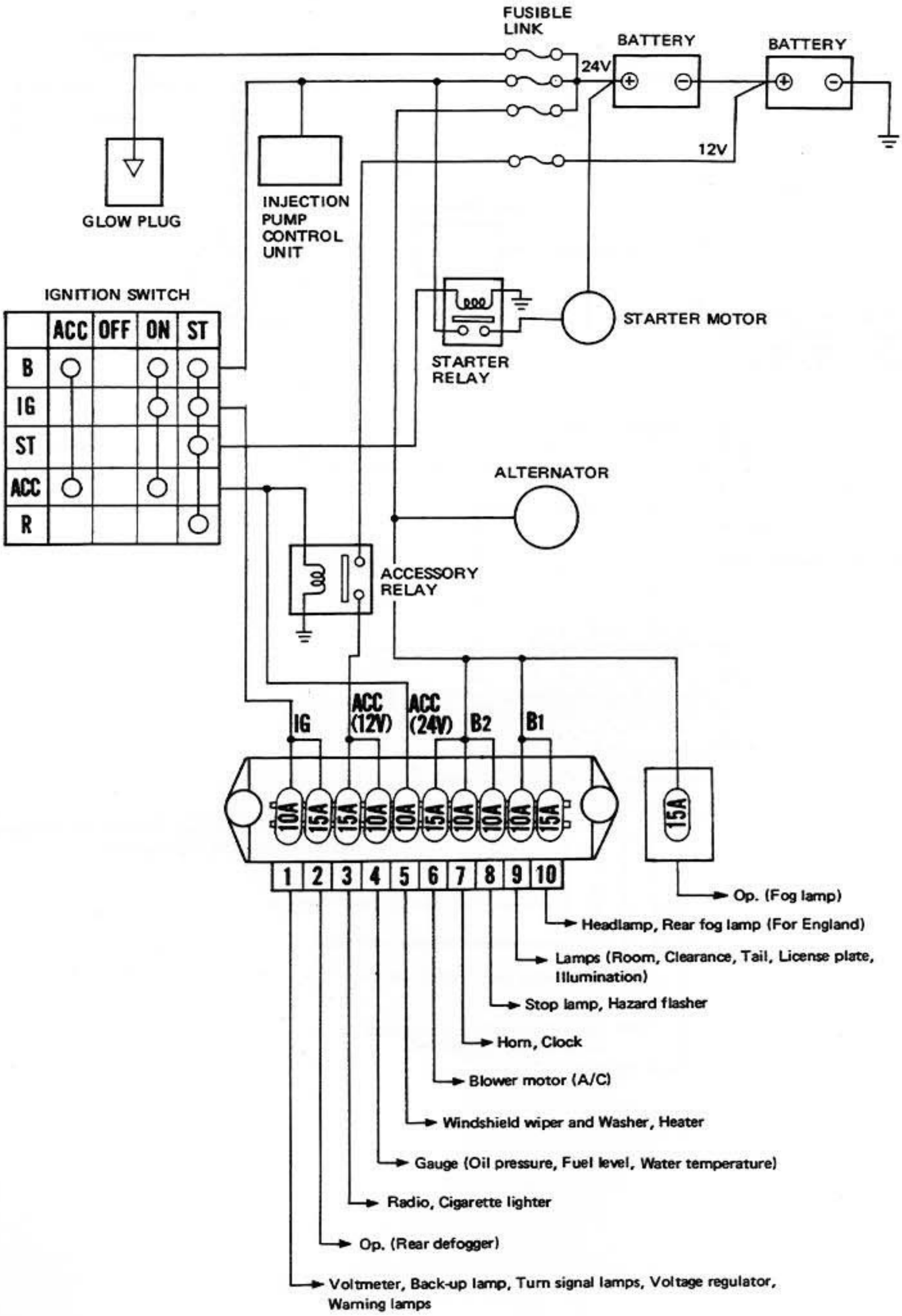
Gasoline engine equipped models



* Automatic transmission models (L28 engine, except for Europe)

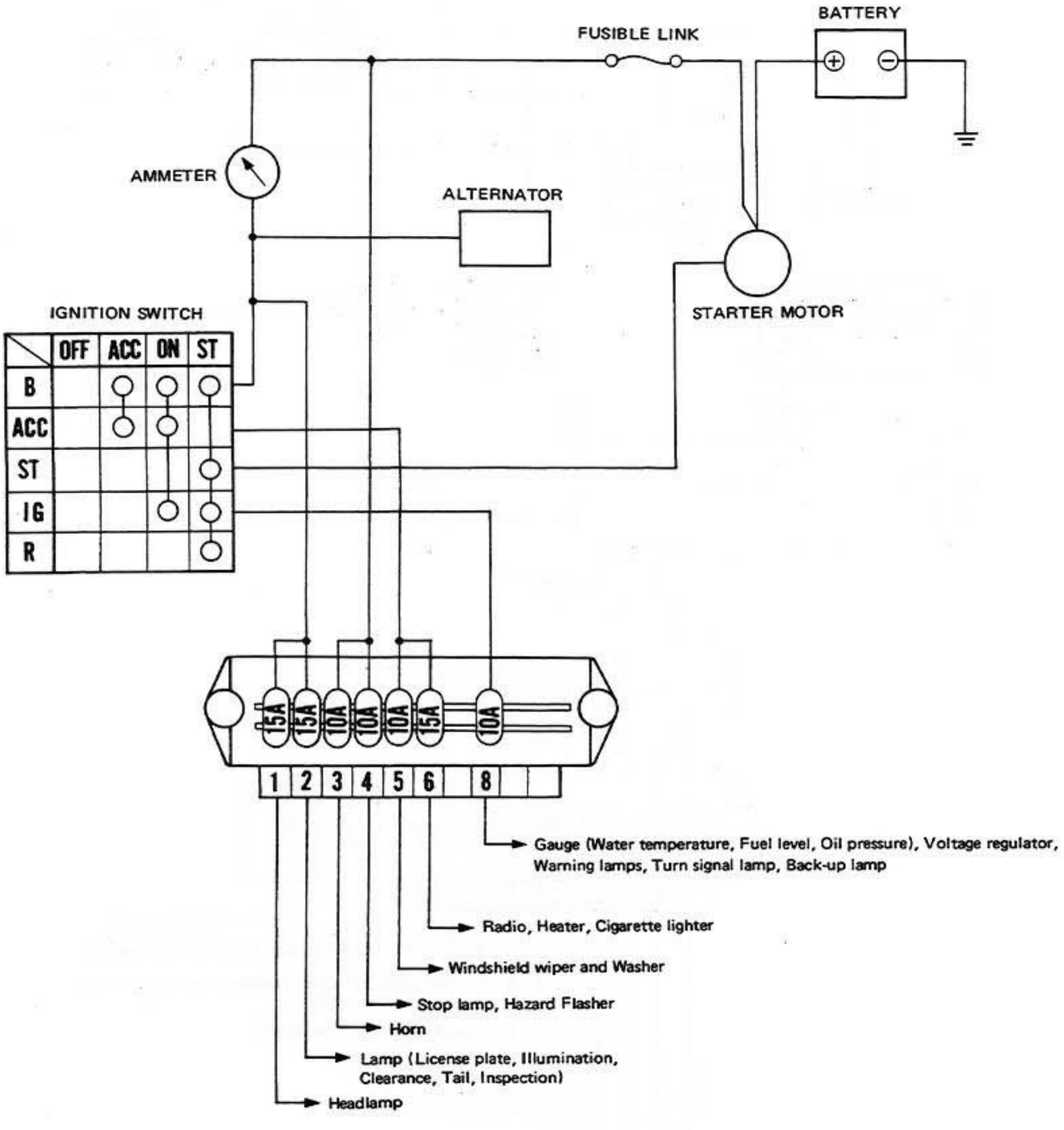
SEL991

Diesel engine equipped models



SEL992

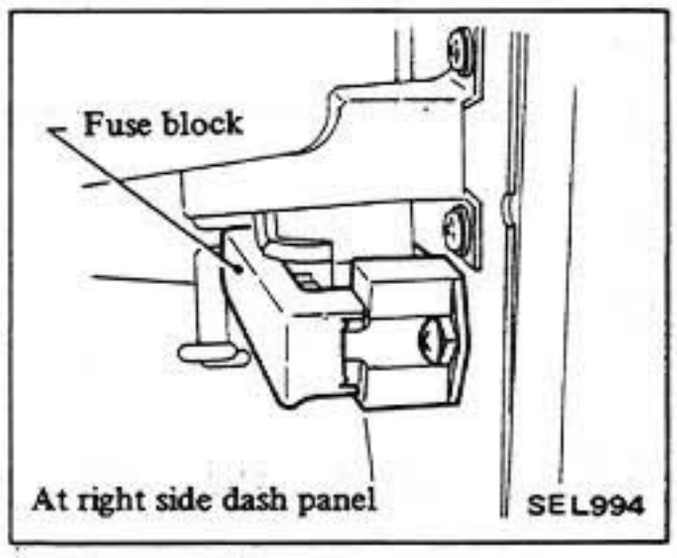
MODEL 61 SERIES



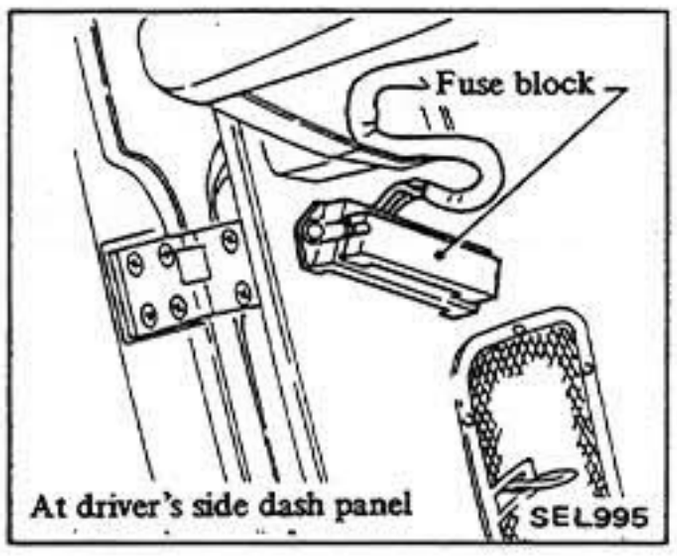
SEL993

FUSE

MODEL 160 SERIES



MODEL 61 SERIES



a. If fuse is blown, be sure to eliminate the cause of the problem before installing new fuse.

b. Never use fuse of more than specified rating.

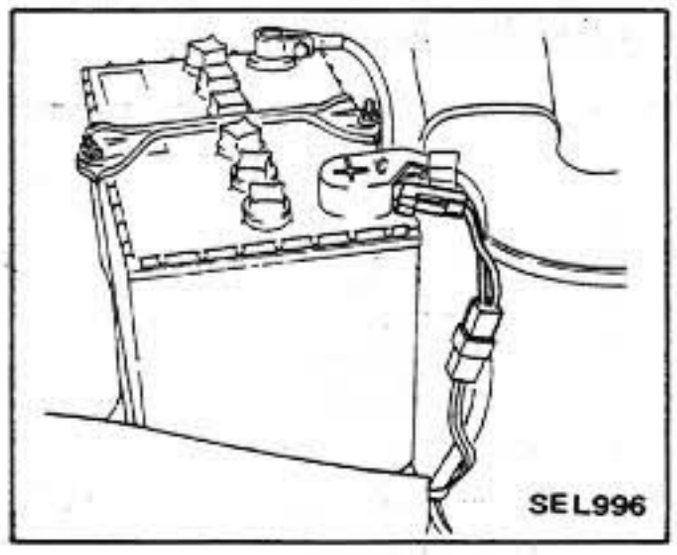
c. Check condition of fuse holders. If much rust or dirt is found, clean metal parts with fine-grained sandpaper until proper metal-to-metal contact is made.

Poor contact in any fuse holder will often lead to voltage drop or heating in the circuit and could result in improper circuit operation.

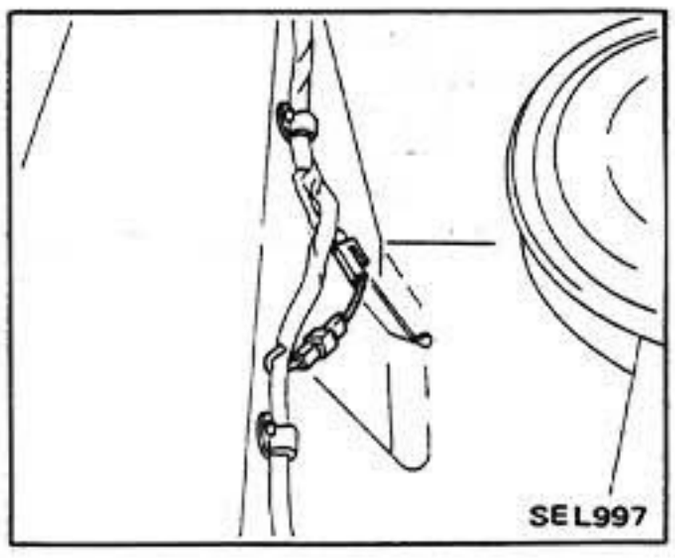
d. Do not install fuse in oblique direction, always snap it into fuse holder properly.

FUSIBLE LINK

MODEL 160 SERIES



MODEL 61 SERIES



CAUTION:

a. If fusible link should melt, it is possible that a critical circuit (power supply or large current carrying circuit) is shorted. In such a case, carefully check and eliminate the cause of the problem.

b. Never wrap periphery of fusible link with vinyl tape. Extreme care should be taken with this link to ensure that it does not come into contact with any other wiring harness or vinyl or rubber parts.

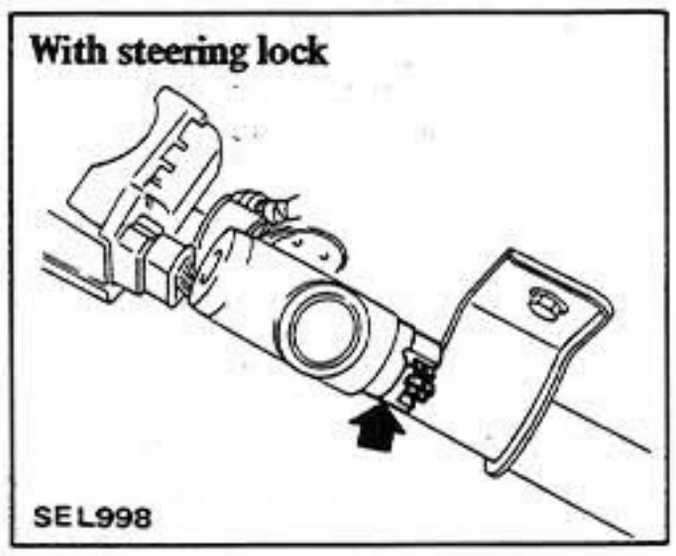
A melted fusible link can be detected either by visual inspection or by feeling with finger-tip. If its condition is questionable, use circuit tester or test lamp, as required, to conduct continuity test. This continuity test can be performed in the same manner as for any conventional fuse.

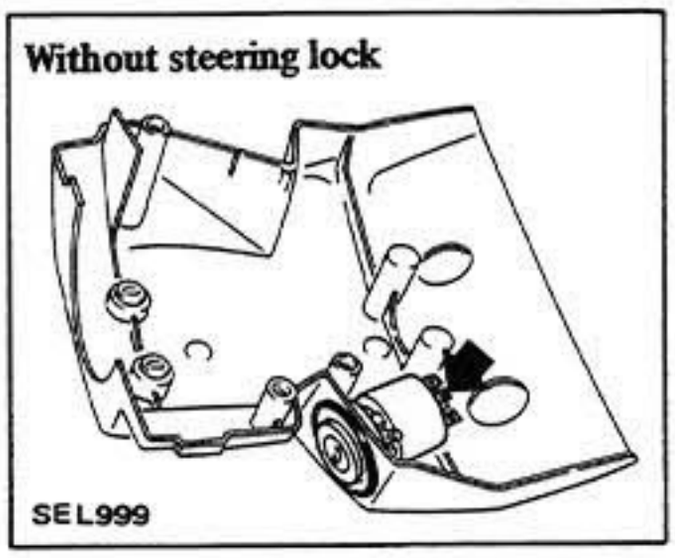
IGNITION SWITCH

REMOVAL AND INSTALLATION

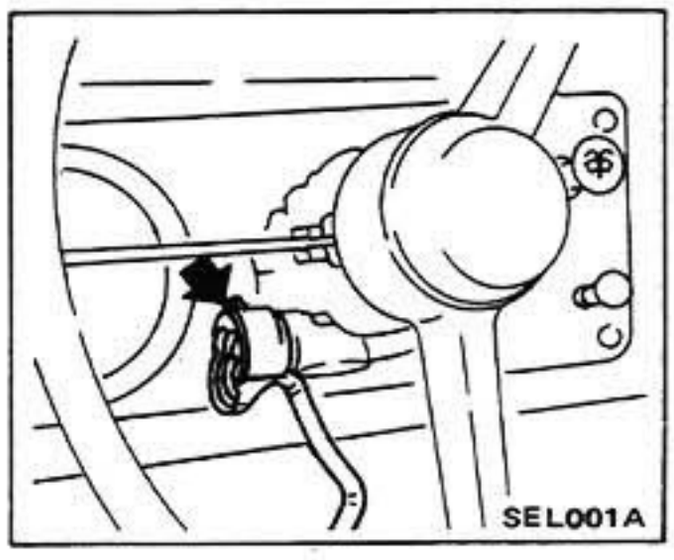
1. Disconnect battery ground cable.
2. Remove steering column cover.
3. Disconnect ignition switch harness connector.
4. Remove ignition switch.
5. Installation is in the reverse order of removal.

Model 160 series



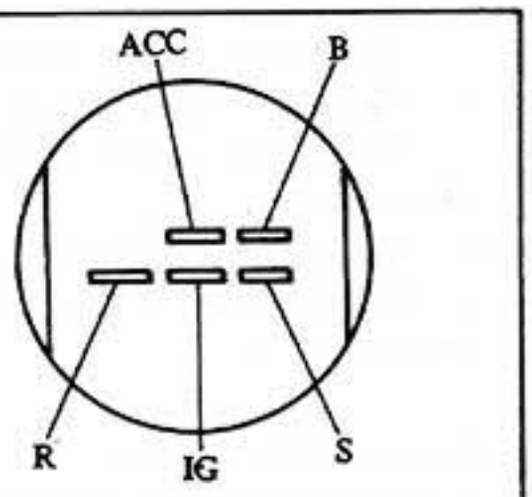


Model 61 series



INSPECTION

Test continuity through switch with an ohmmeter.



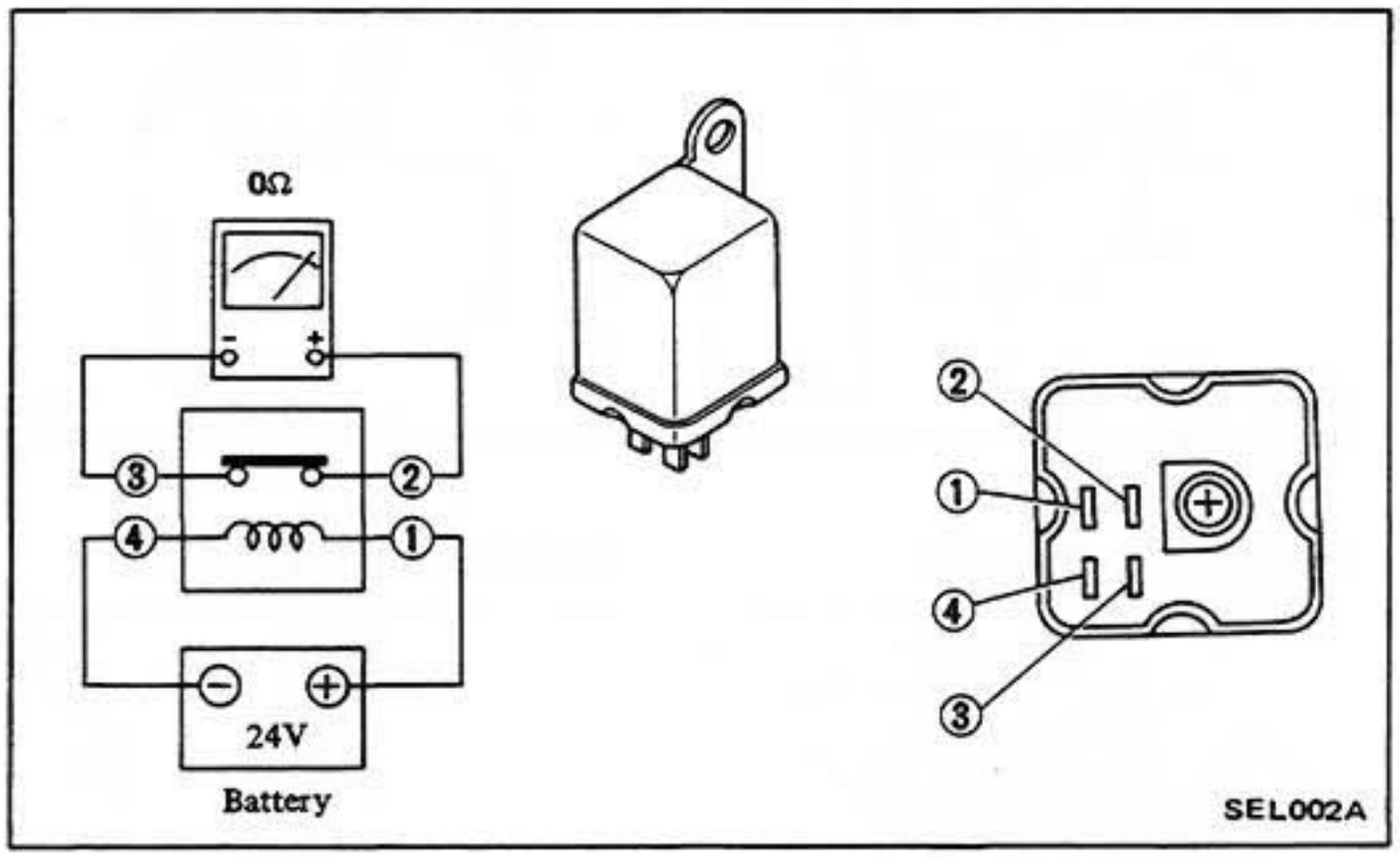
	ACC	OFF	ON	ST
B	○		○	○
IG			○	○
ST				○
ACC	○		○	
R				○

○—○ : Continuity should exist.

SEL156A

ACCESSORY RELAY (SD33 engine equipped models)

INSPECTION



SEL002A

BATTERY

CAUTION: Before starting to work, be sure to turn ignition switch "OFF" and then disconnect battery ground cable.

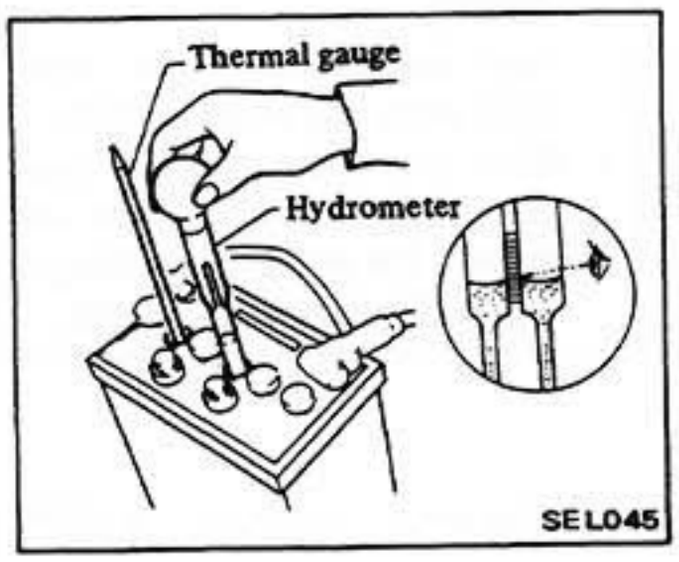
WARNING:
Never touch positive and negative terminals at the same time with bare hands. This could result in injury.

CAUTION:
- **a. If it becomes necessary to start the engine with a booster battery and jumper cables, the booster battery voltage must not exceed 12 volts, or the control unit of the fuel injection system and other electric components will be damaged.**
- **b. If the battery cables are disconnected, they should be tightly clamped to the battery terminals to secure a good contact.**

CHECKING SPECIFIC GRAVITY

1. Read hydrometer and thermal gauge indications at eye level.

Read top level with scale.



2. Correct **specific gravity at 20°C (68°F).**

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

Where,

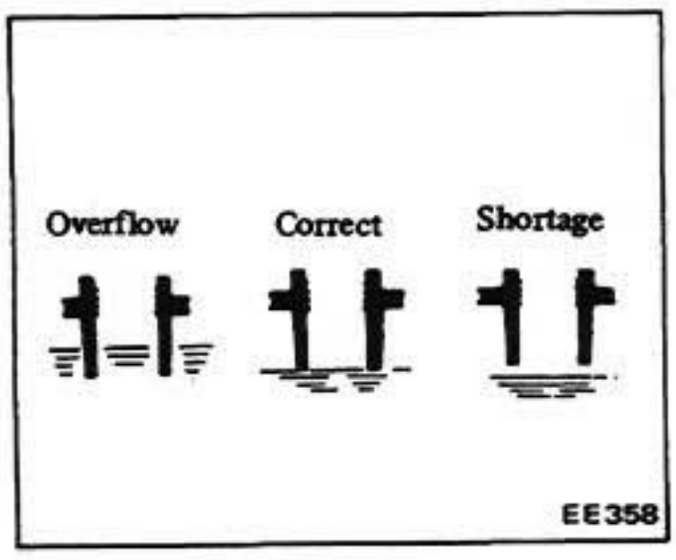
- St: Specific gravity of electrolyte at t°C
- S_{20}: Specific gravity of electrolyte corrected at 20°C (68°F)
- t: Electrolyte temperature

Examples:

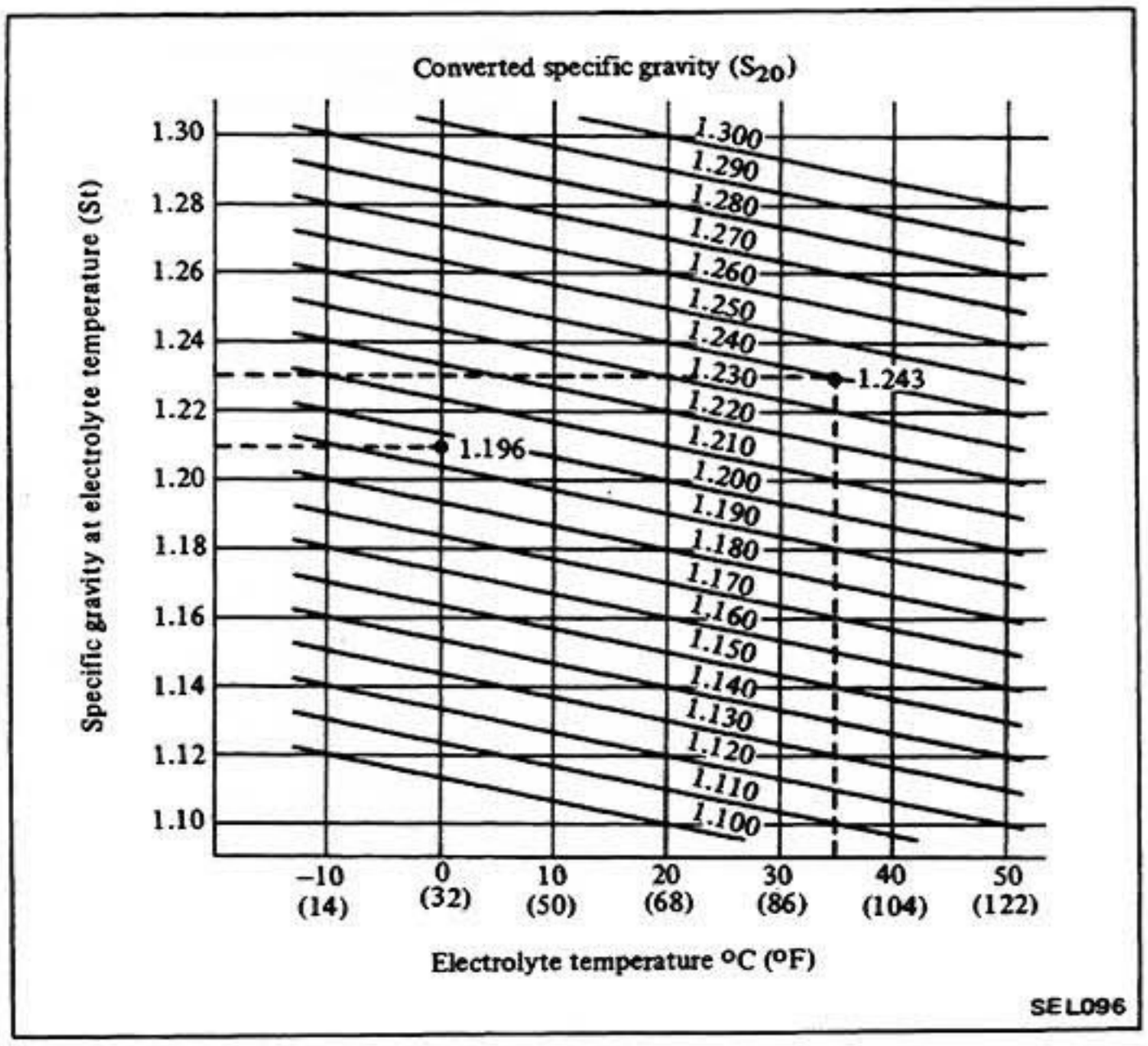
1. When electrolyte temperature is 35°C (95°F) and specific gravity of electrolyte is 1.230, specific gravity corrected at 20°C (68°F) is 1.243.
2. When electrolyte temperature is 0°C (32°F) and specific gravity of electrolyte is 1.210, specific gravity corrected at 20°C (68°F) is 1.196.

CHECKING ELECTROLYTE LEVEL

Check for electrolyte level in **each cell.**



If the level is low, fill with **distilled water.**

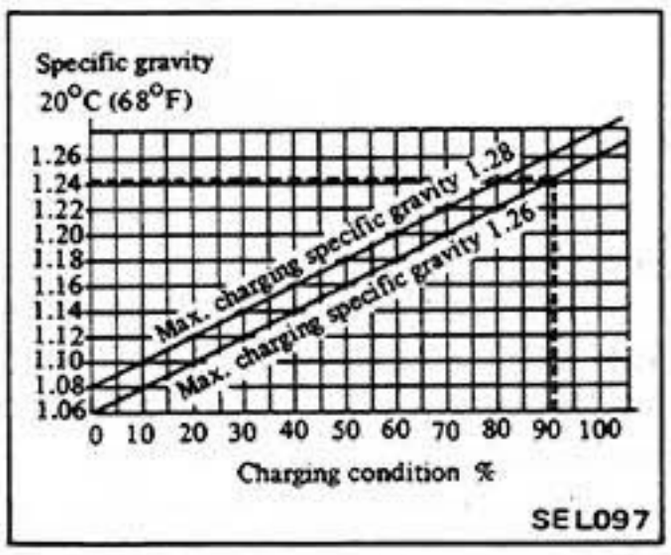


3. Determine charging state of battery.

Examples:

Charging state of battery whose max. charging specific gravity is 1.26, and whose specific gravity corrected at 20°C (68°F) is 1.243, is 92%.

For battery whose max. charging specific gravity is 1.28, charging state is 82% at a corrected specific gravity of 20°C (68°F).



4. Recharge battery if its rate drops below 70% of full charge.

CHARGING

CAUTION:

a. Carry out charging with negative cable removed.

b. Do not allow electrolyte temperature to go over 45°C (113°F).

Clean corroded terminal with a brush and common baking-soda solution.

WARNING:

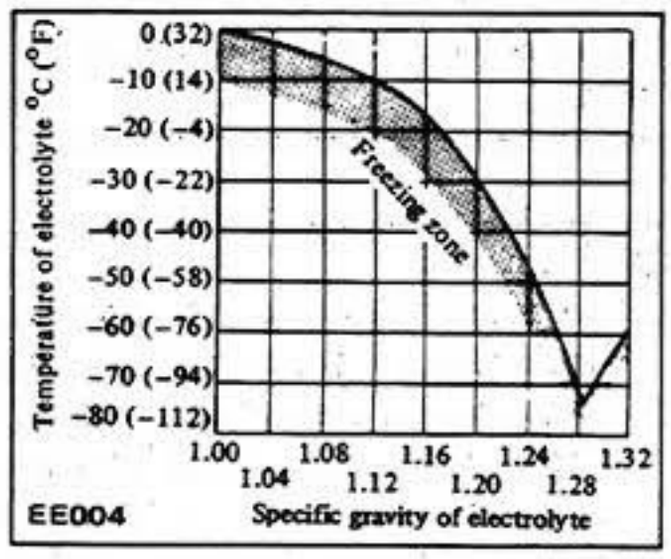
a. Keep battery away from open flame while it is being charged.

b. When connecting charger, connect leads first, then turn on charger. Do not turn on charger first, as this may cause a spark.

BATTERY FREEZING

CAUTION:

Use extreme caution to avoid freezing battery.



SERVICE DATA AND SPECIFICATIONS

BATTERY

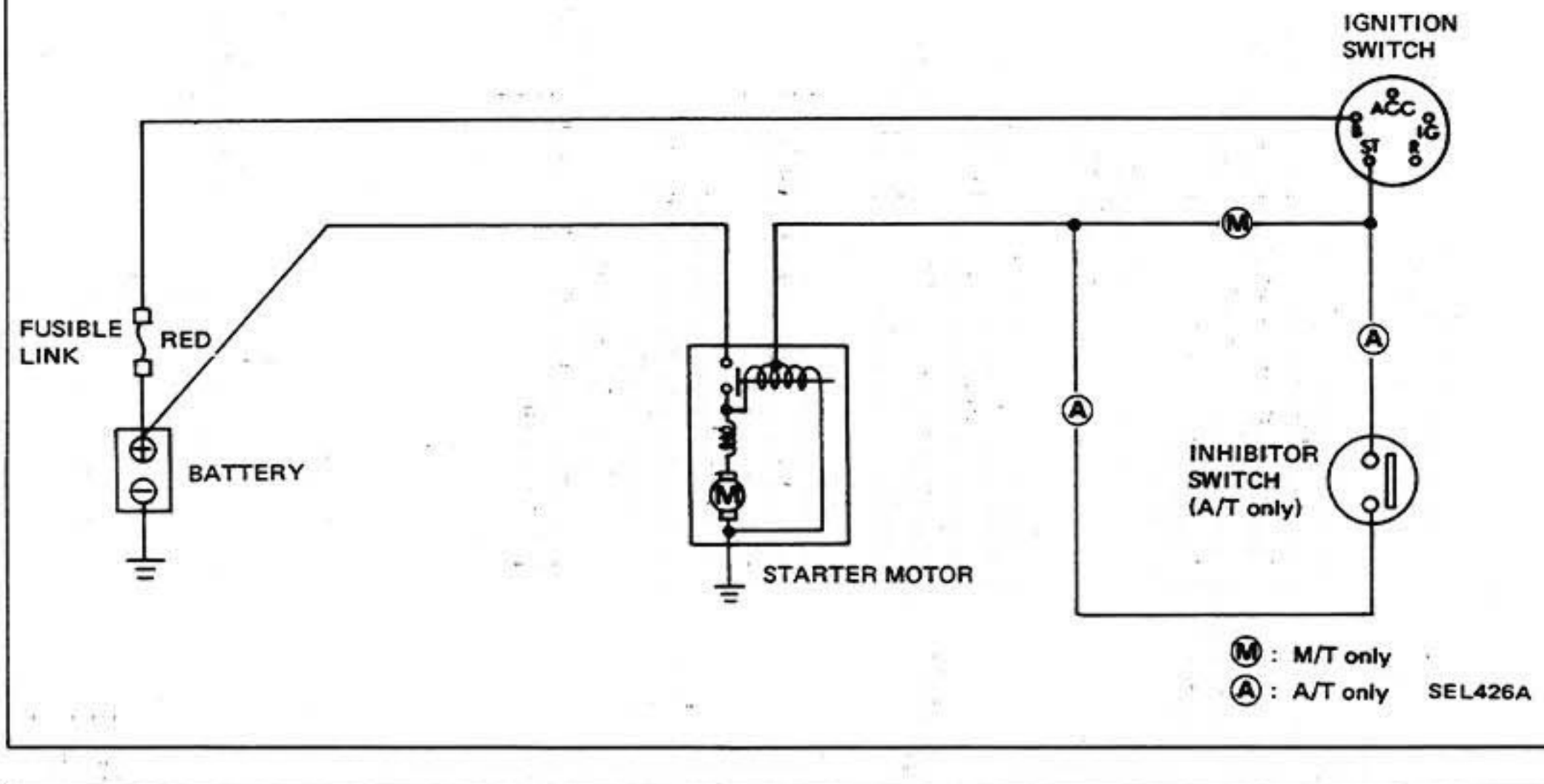
	N50Z	N70Z	NX120-7	NX110-5
Capacity V-A, H	12-60	12-70	12-80	12-65
Full charging specific gravity at 20°C (68°F)	1.26	1.28	1.28	1.26

STARTING SYSTEM

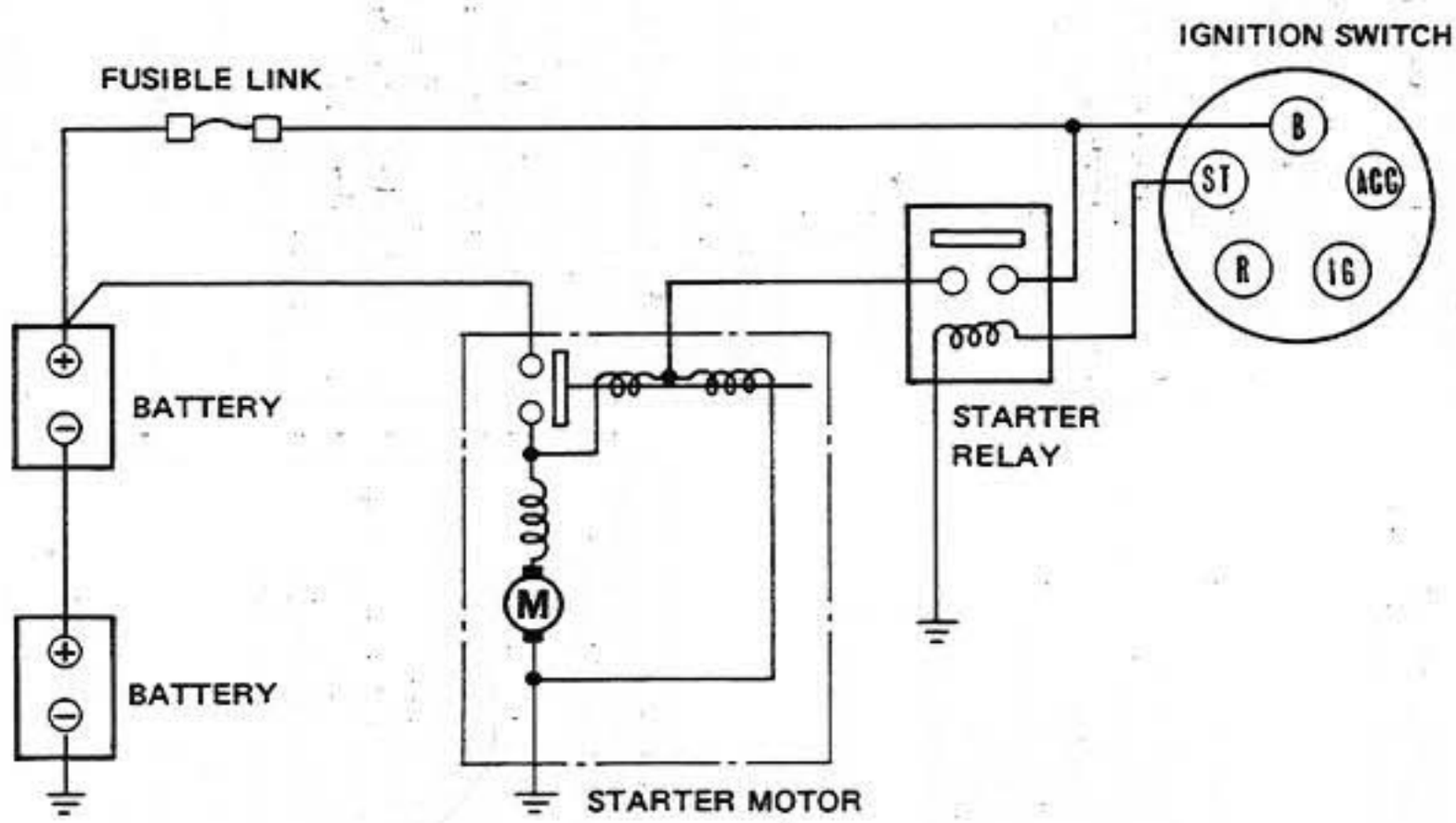
CAUTION: Before starting to work, be sure to turn ignition switch "OFF" and then disconnect battery ground cable.

SCHEMATIC

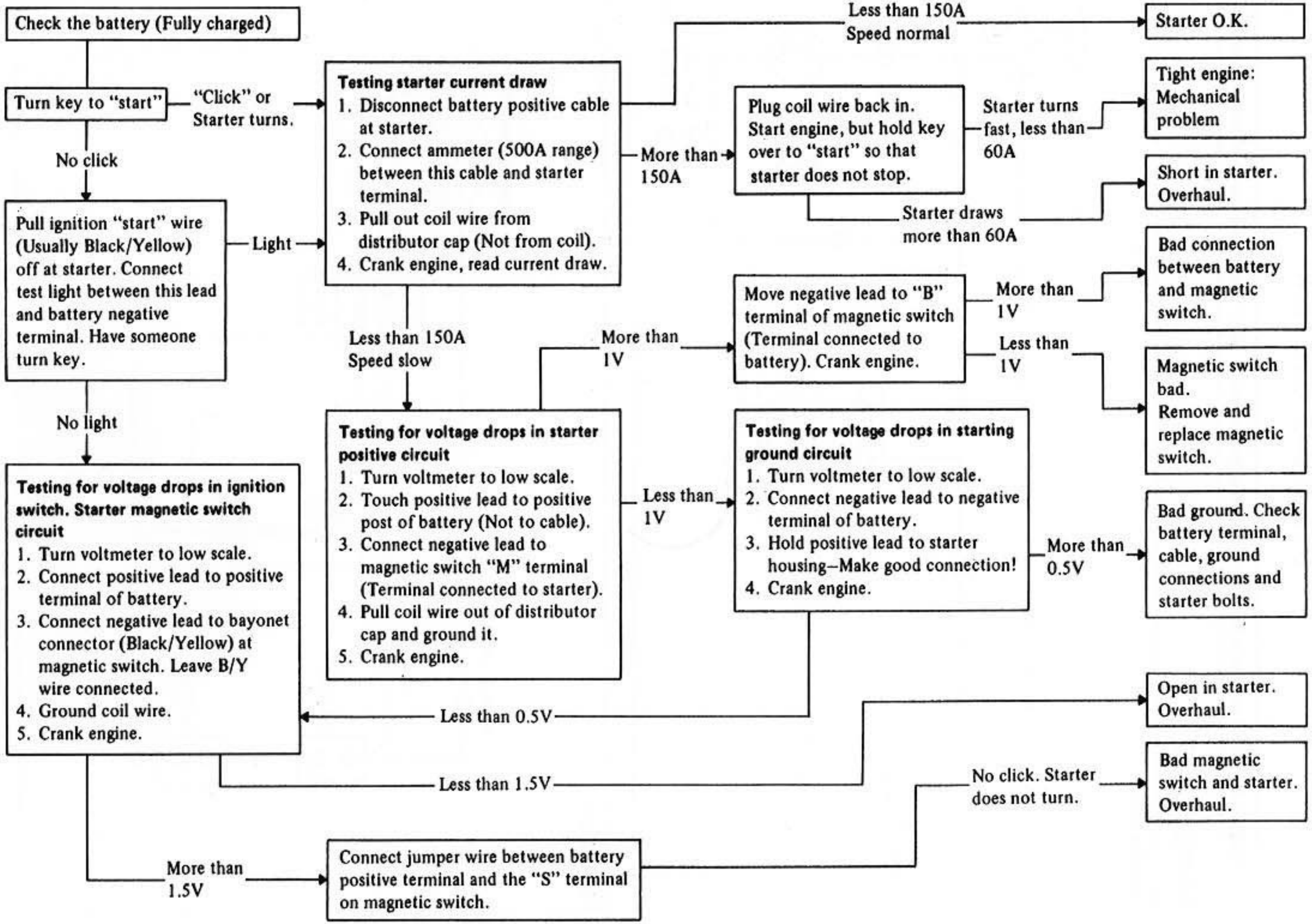
Gasoline engine



Diesel engine

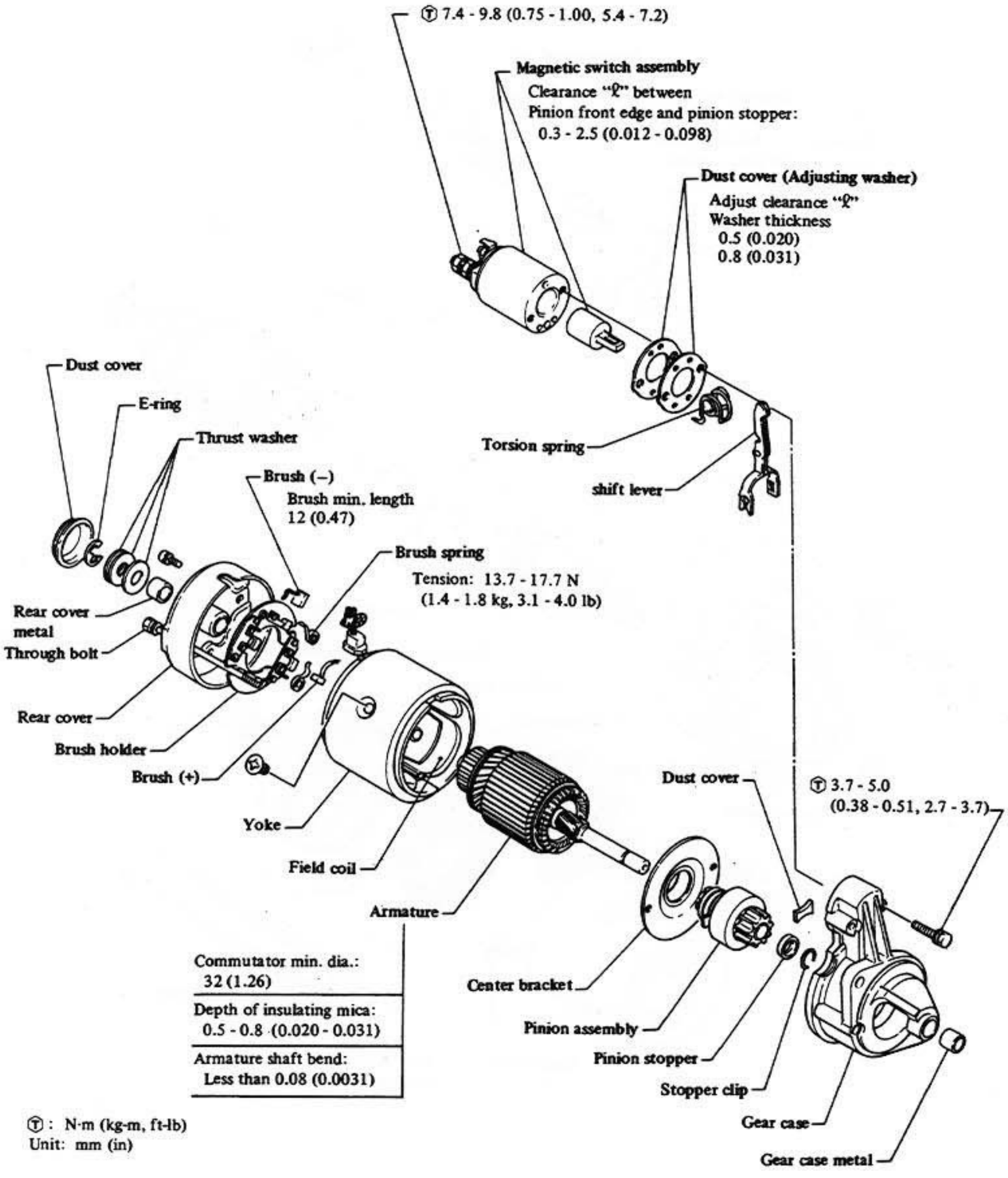


STARTING SYSTEM TROUBLE-SHOOTING



STARTER MOTOR

Non-reduction gear type (Gasoline engine)

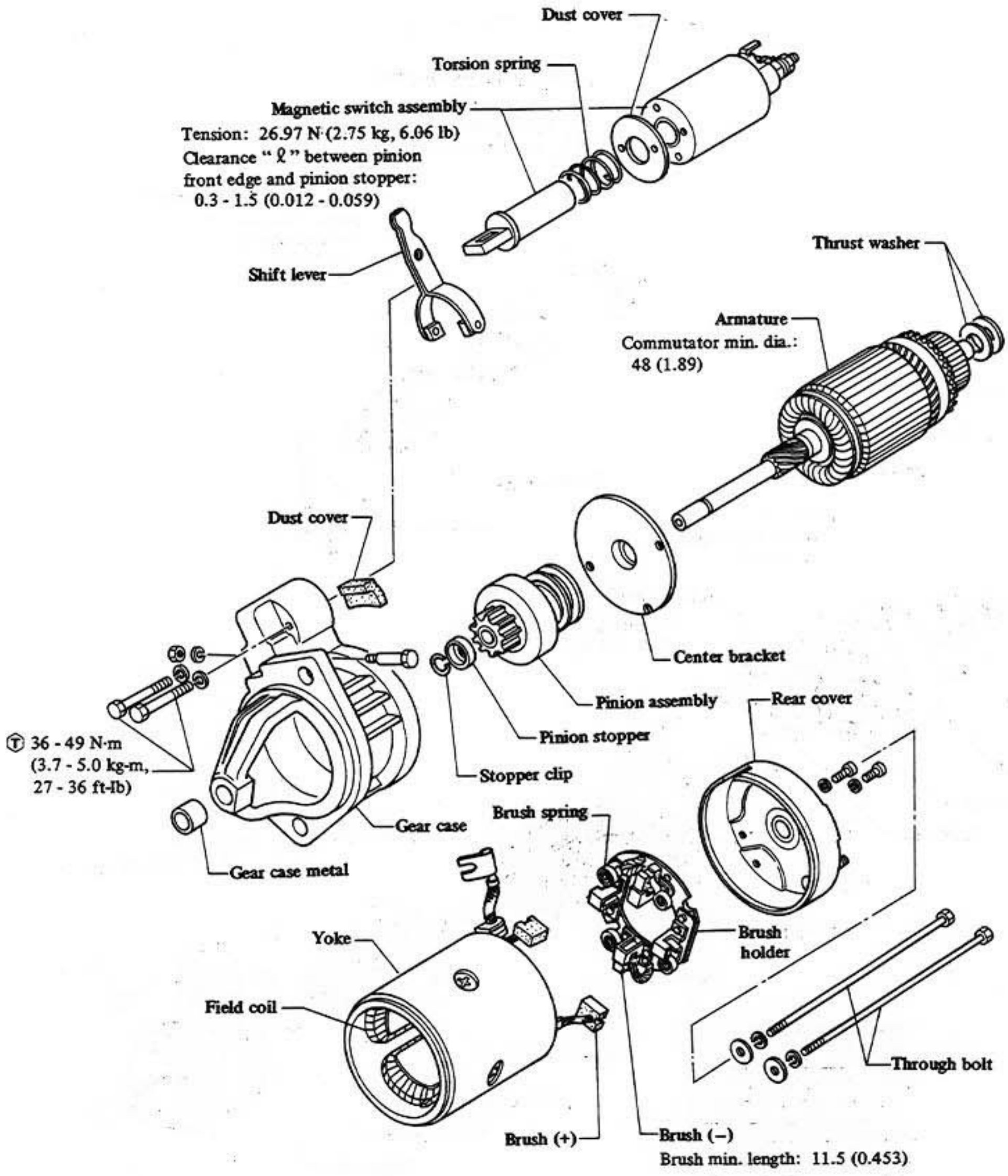


Commutator min. dia.: 32 (1.26)
Depth of insulating mica: 0.5 - 0.8 (0.020 - 0.031)
Armature shaft bend: Less than 0.08 (0.0031)

Ⓣ : N·m (kg-m, ft-lb)
Unit: mm (in)

SEL007

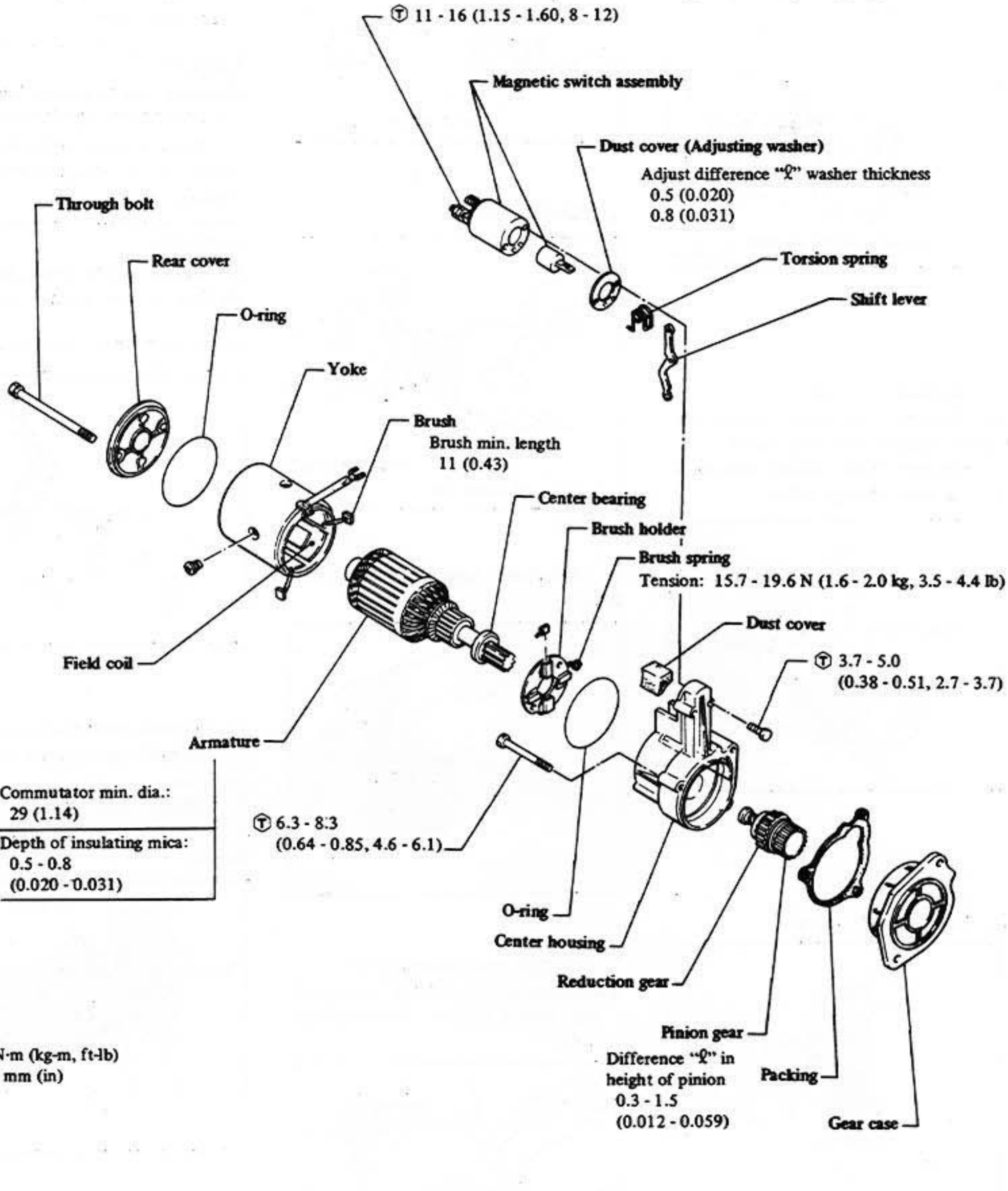
Non-reduction gear type (Diesel engine)



Unit: mm (in)

SEL065A

Reduction gear type

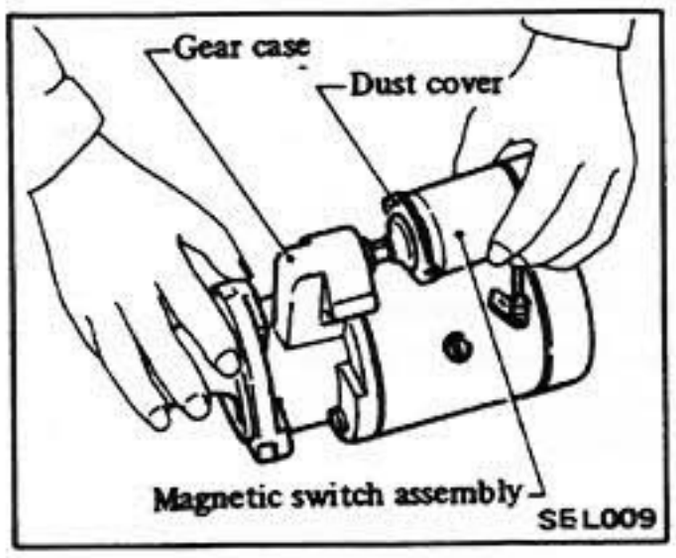


SEL008

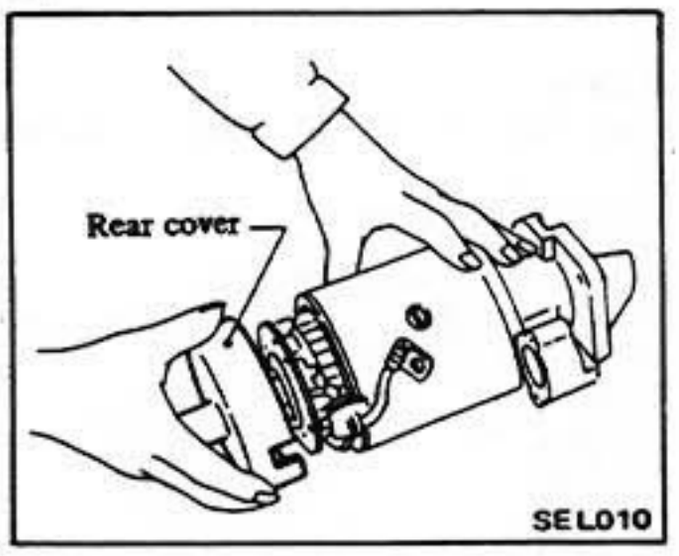
DISASSEMBLY

Non-reduction gear type

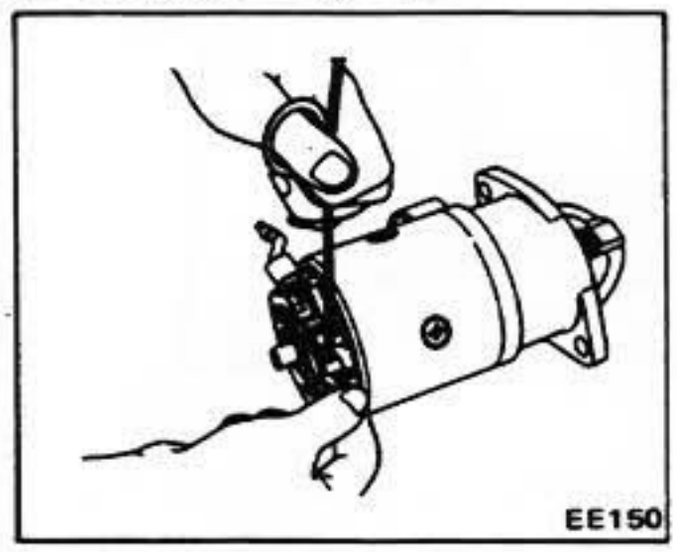
1. Remove magnetic switch.



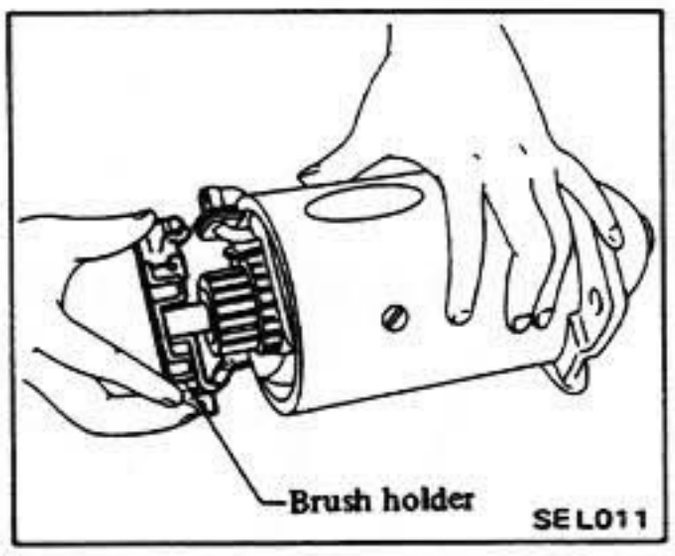
2. Remove rear cover.
(1) Remove dust cover, E-ring and thrust washers. (Gasoline engine)
(2) Remove brush holder setscrews.
(3) Remove through bolts.



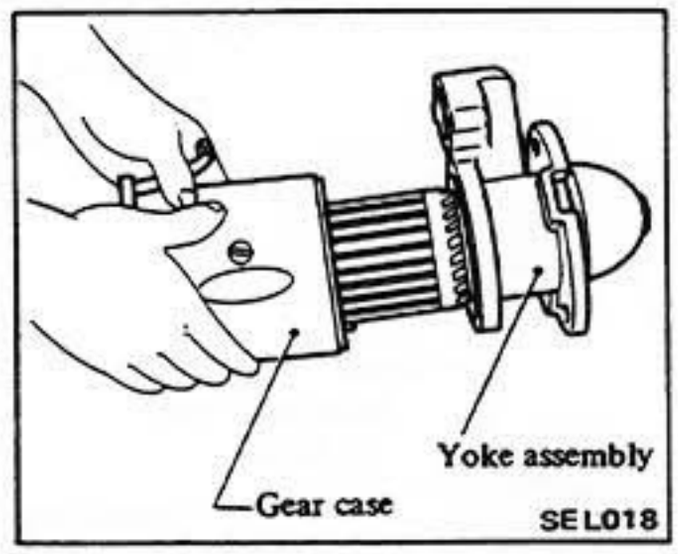
3. Lift up brush springs.



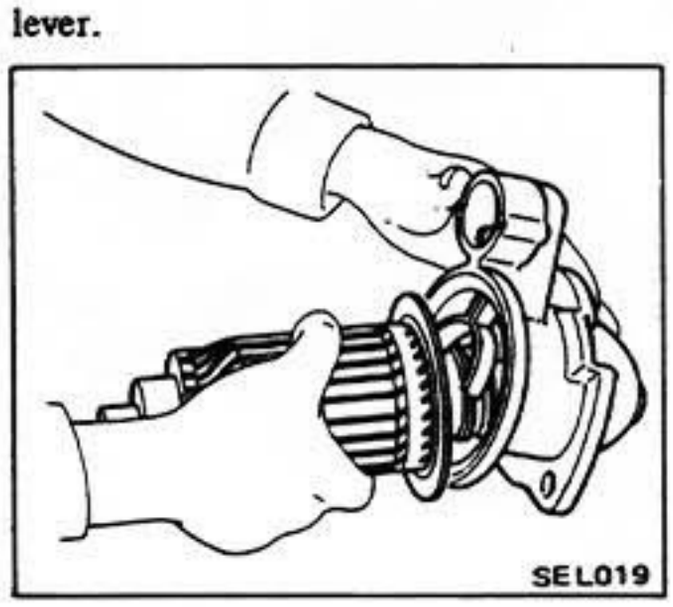
4. Remove brush holder.



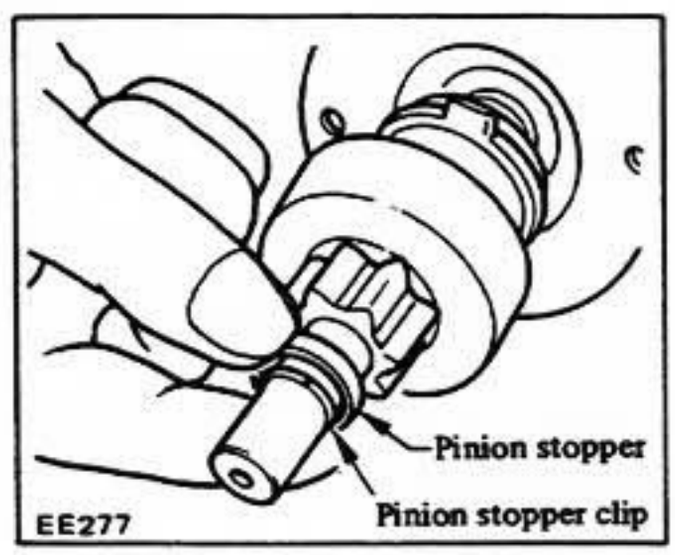
5. Remove yoke.



6. Withdraw armature and shift lever.



7. Remove overrunning clutch.
- Remove pinion stopper clip, pushing pinion stopper toward clutch side.



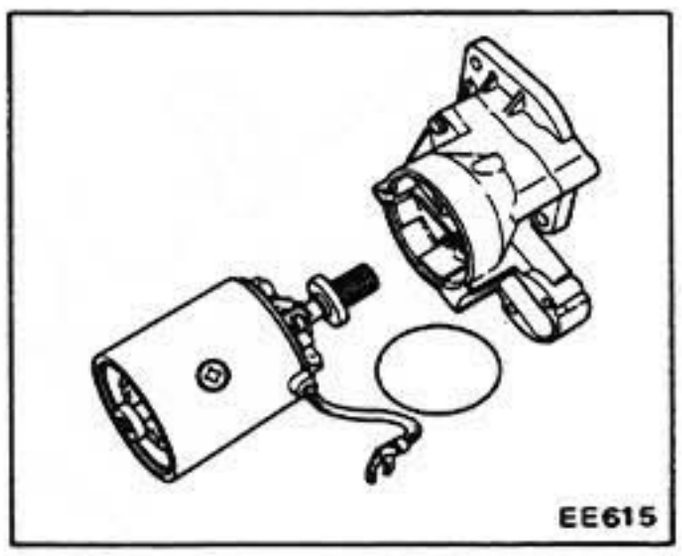
Reduction gear type

1. Remove magnetic switch assembly.
2. Remove torsion spring.
3. Remove through bolts and rear cover with O-ring.

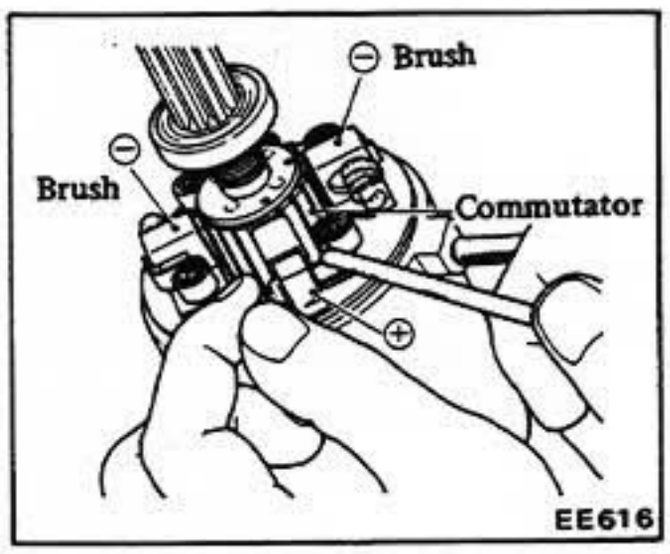
CAUTION:
Be careful not to damage O-ring.

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

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



5. Remove center housing.
6. Remove pinion gear with reduction gear.
7. Lift up brush springs.
8. Remove brushes from brush holder.

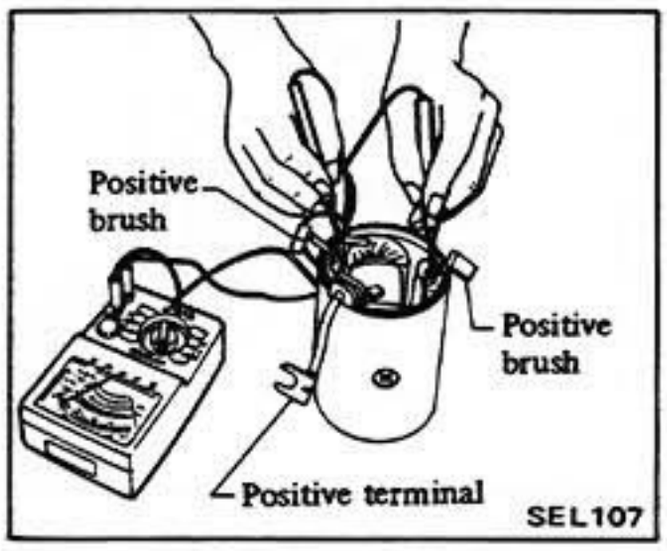


9. Remove brush holder.
10. Separate yoke and armature.

INSPECTION

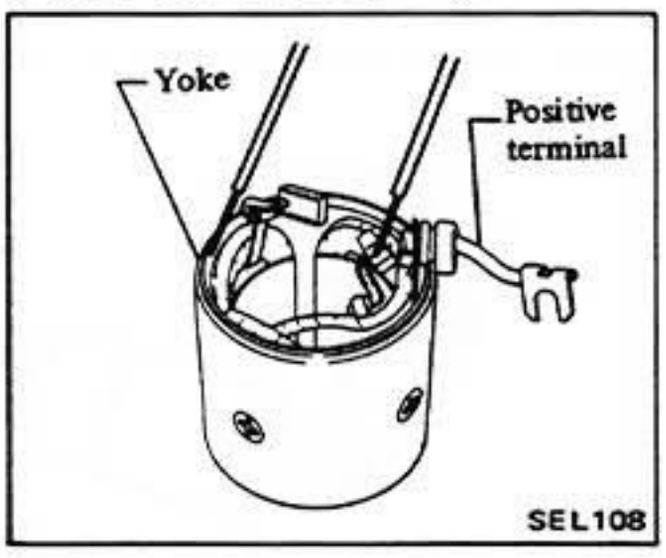
Field coil

1. Continuity test (between field coil positive terminal and positive brushes).



- No continuity ... Replace field coil.

2. Ground test. (between field coil positive terminal and yoke).



- Continuity exists ... Replace field coil.

Brush

Check the surface condition of brush contact.

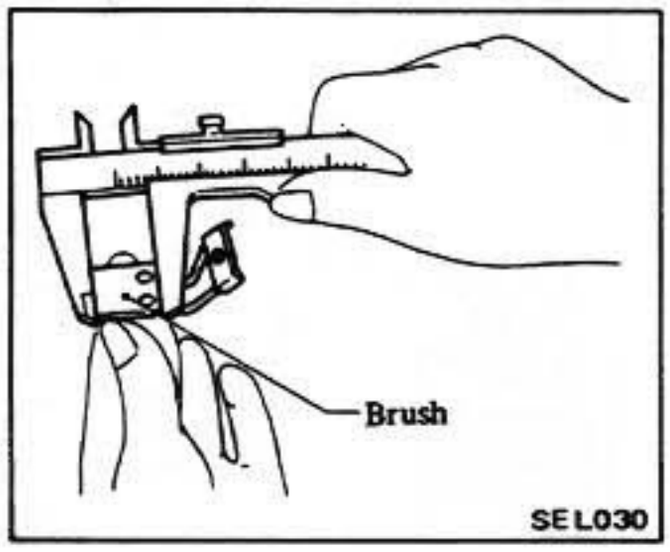
- Loose contact ... Replace.

Check wear of brush.

Minimum length of brush:

Non-reduction gear type:
Gasoline engine
More than 12 mm (0.47 in)
Diesel engine
More than 11.5 mm (0.453 in)
Reduction gear type:
More than 11 mm (0.43 in)

- Excessive wear ... Replace.

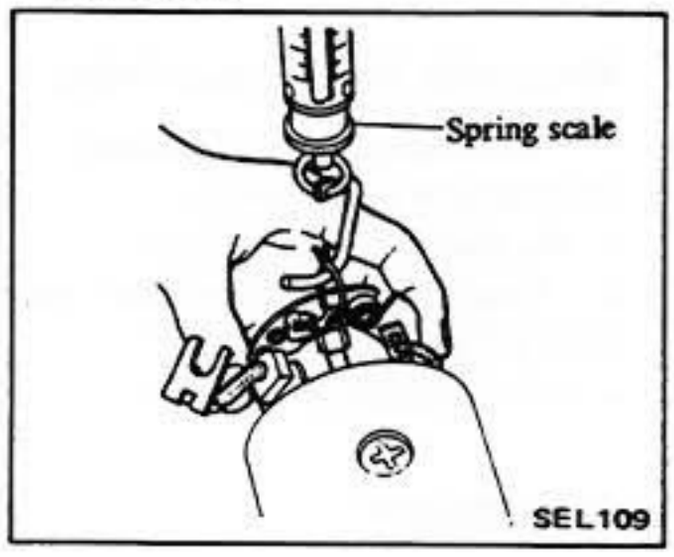


Brush spring

Check brush spring tension.

Spring tension:
Model S114-182G, S114-173F:
16.7 - 22.6 N
(1.7 - 2.3 kg,
3.7 - 5.1 lb)
Model S25-131:
24.03 - 29.91 N
(2.45 - 3.05 kg,
5.40 - 6.73 lb)
Model F114 - 254D:
17.7 - 21.6 N
(1.8 - 2.2 kg,
4.0 - 4.9 lb)

- Not in the specified value. ... Repair or replace.



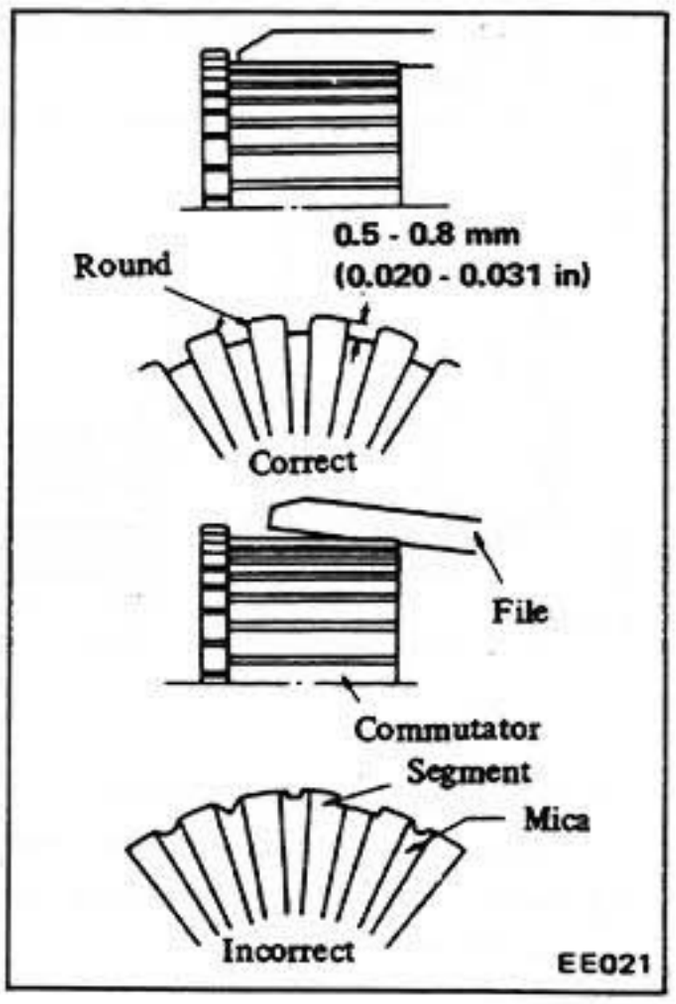
Armature assembly

1. Check commutator surface.

- Rough ... Sand lightly with No. 500 sandpaper.

2. Check depth of insulating mica from commutator surface.

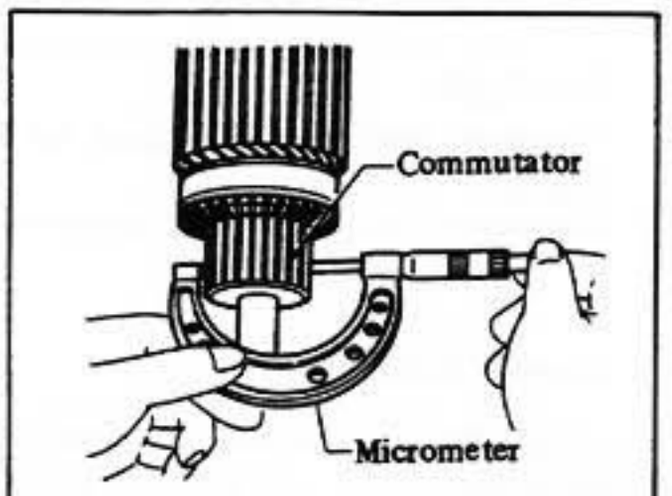
- Less than 0.2 mm (0.008 in) ... Undercut to 0.5 - 0.8 mm (0.020 - 0.031 in)



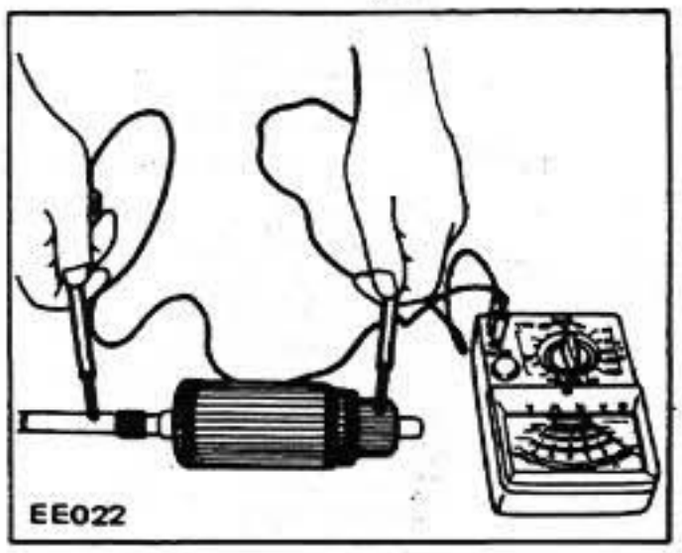
3. Check diameter of commutator.

Commutator minimum diameter:
Non-reduction gear type
Gasoline engine
Model S114-182G
More than
39 mm (1.54 in)
Model S114-173F
More than
39 mm (1.54 in)
Diesel engine
Model S25-131
More than
47 mm (1.85 in)
Reduction gear type:
Model S114-254D
More than
29 mm (1.14 in)

- Less than specified value ... Replace.

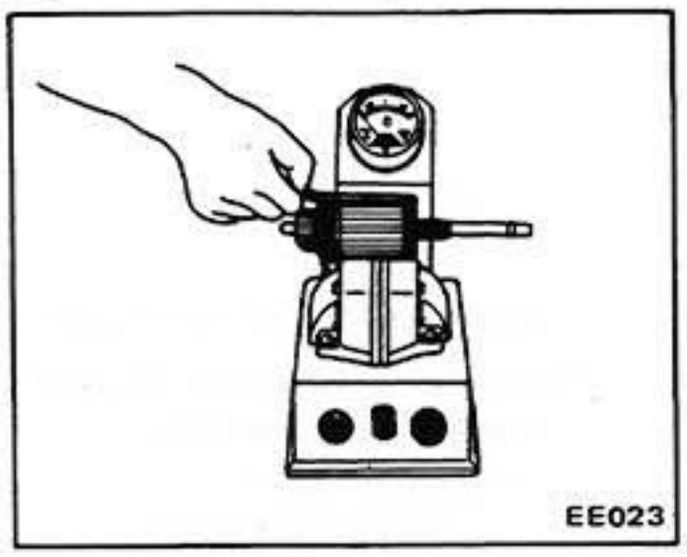


4. Ground test (between each commutator bar and shaft).


EE022

- Continuity exists ... Replace.

5. Short test with armature tester (growler) and a piece of iron over armature core.


EE023

- Plate vibrates ... Replace.

6. Continuity test (between two segments side by side).

- No continuity ... Replace.

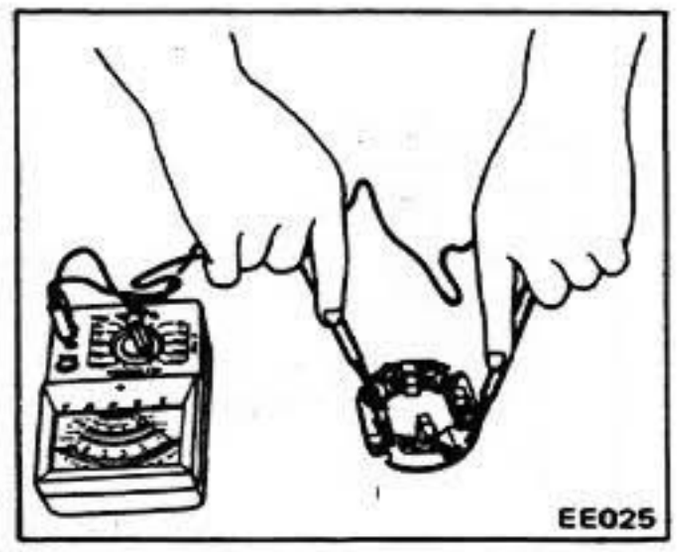
Overrunning clutch assembly

1. Inspect smooth sliding of pinion gear.
- Abnormal resistance ... Repair.
2. Inspect pinion teeth.
- Excessive rubbing ... Replace.

CAUTION:
Flywheel ring gear also must be inspected.

Brush holder

Ground test (between negative side of brush holder and another positive side).


EE025

- Continuity exists ... Replace.

Pinion case bearing metal (Non-reduction gear type)

Check clearance between bearing metal and armature shaft.

Bearing metal to armature shaft clearance:
Less than 0.2 mm (0.008 in)

- More than specified value ... Replace.

Ball bearing (Reduction gear type)

Holding outer race with finger, rotate bearing.

- Any play or bind ... Replace.

Magnetic switch assembly

1. Continuity test (between "S" terminal and switch body).
- No continuity ... Replace.
2. Continuity test (between terminals "S" and "M").
- No continuity ... Replace.

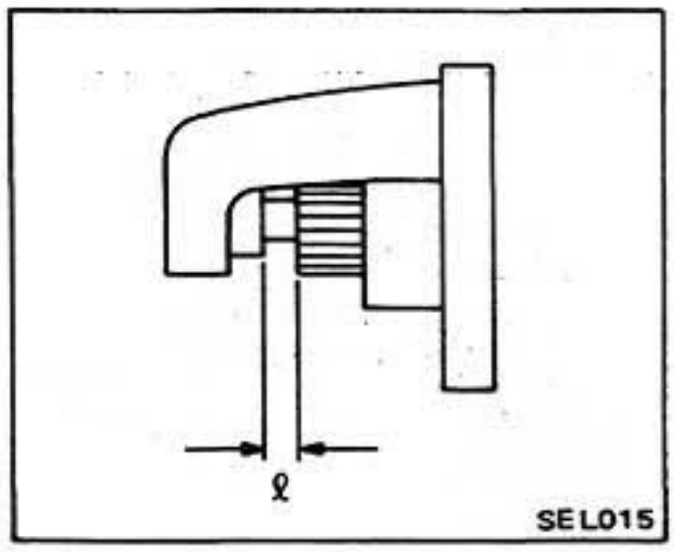
ASSEMBLY

- Apply grease to gear case and rear cover bearing metal, and apply oil to pinion slightly.

(Non-reduction gear type)

With the switch on, push pinion back to remove all slack and measure the clearance "ℓ" between pinion front edge and pinion stopper.

Clearance "ℓ":
Model S114-182G:
0.3 - 2.5 mm (0.012 - 0.098 in)
Model S25-131:
0.3 - 1.5 mm (0.012 - 0.059 in)
Model S114-173F:
0.3 - 2.5 mm (0.012 - 0.098 in)

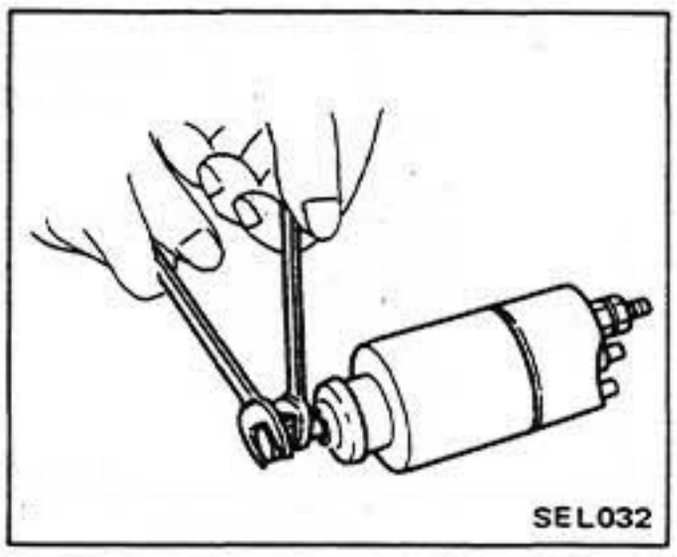


SEL015

- Not in the specified value ... Adjust by adjusting washer(s).

Adjusting washer thickness
0.5 mm (0.020 in)
0.8 mm (0.031 in)

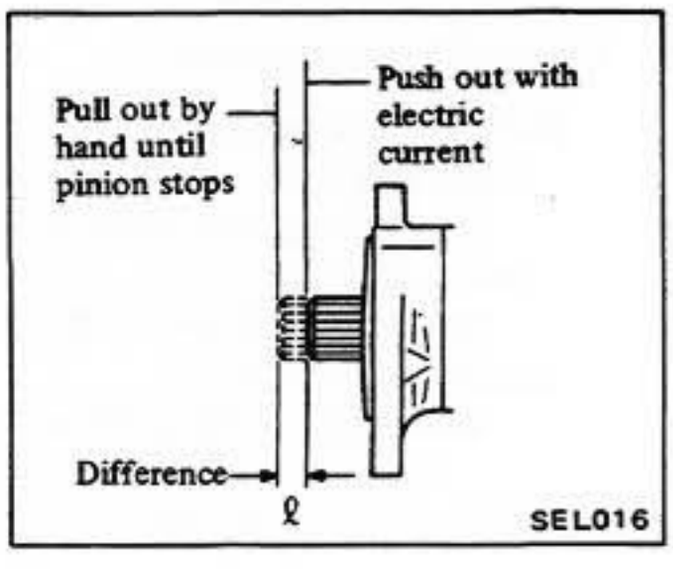
- If the gap is not within the specified value, readjust it.


SEL032

(Reduction gear type)

Compare difference "ℓ" in height of pinion when it is pushed out with magnetic switch energized and when it is pulled out by hand until it touches stopper.

Difference "ℓ":
0.3 - 1.5 mm
(0.012 - 0.059 in)



SEL016

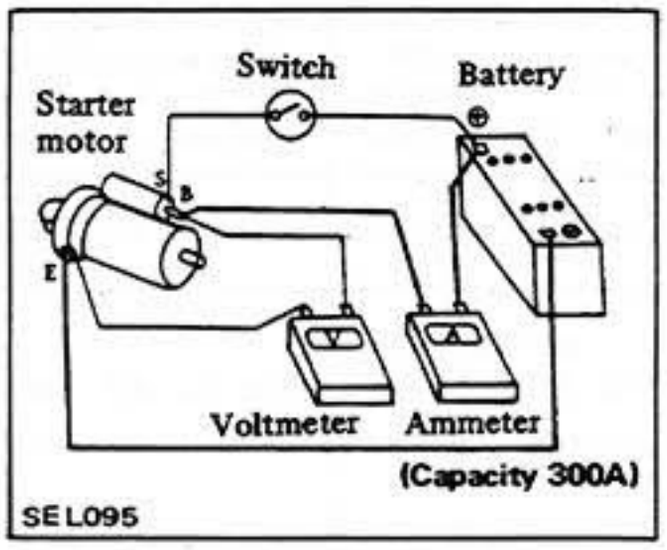
- Not in the specified value ... Adjust by adjusting washer(s).

  Adjusting washer thickness:
  0.5 mm (0.020 in)
  0.8 mm (0.031 in)

TESTING

Performance test

No-load test



Specifications

Refer to S.D.S.

Diagnosis of test

1. Low speed with no-load and high current draw.

(1) Tight, dirty or worn bearings.
(2) Bent armature shaft or loosened field probe.
(3) Shorted armature coil.
(4) A grounded armature of field coil.

2. Failure to operate with high current draw.

(1) A grounded or open field coil.
(2) Burned out commutator bar.

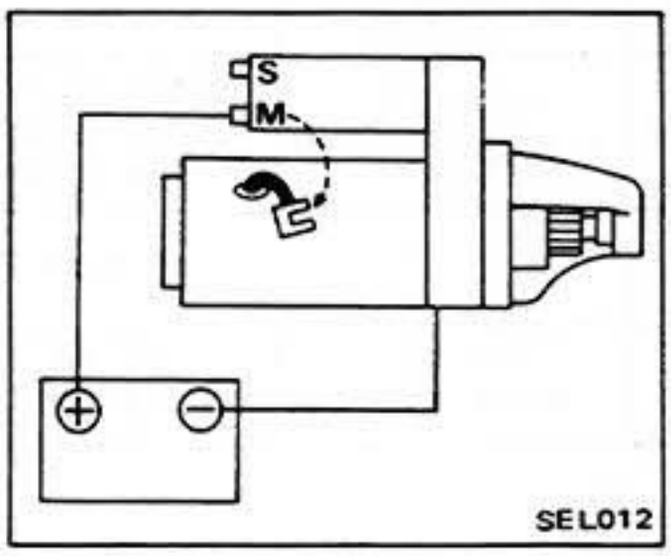
- Weak brush spring tension
- Thrust out of mica in commutator
- Loose contact between brush and commutator.

3. Low current draw and low no-load speed.

(1) Loose connections.
(2) Dirty commutator.
(3) Burned out commutator bar.

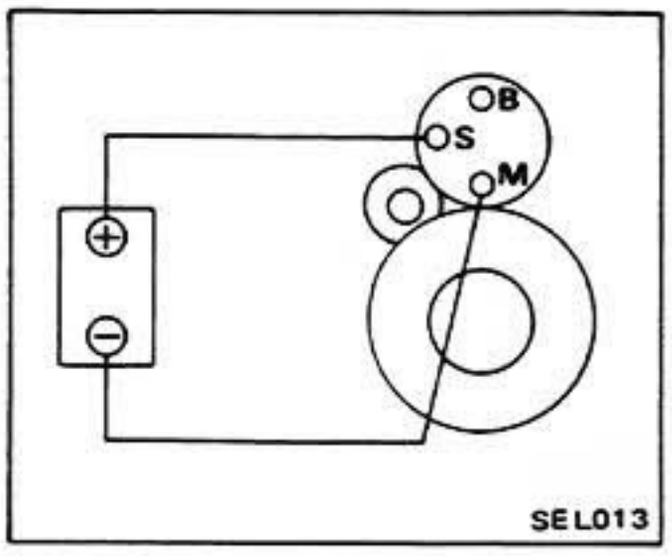
Magnetic switch returnability

1. Disconnect lead wire from terminal "M" of magnetic switch.
2. Connect terminal "M" and positive ⊕ terminal of battery with a jumper lead wire.
3. Connect starter motor body and negative ⊖ terminal of battery with a jumper lead wire.
4. Pull pinion gear all the way out with your hands.
5. Release your hands from pinion gear.
6. If pinion gear returns to its original position, magnetic switch is properly functioning.



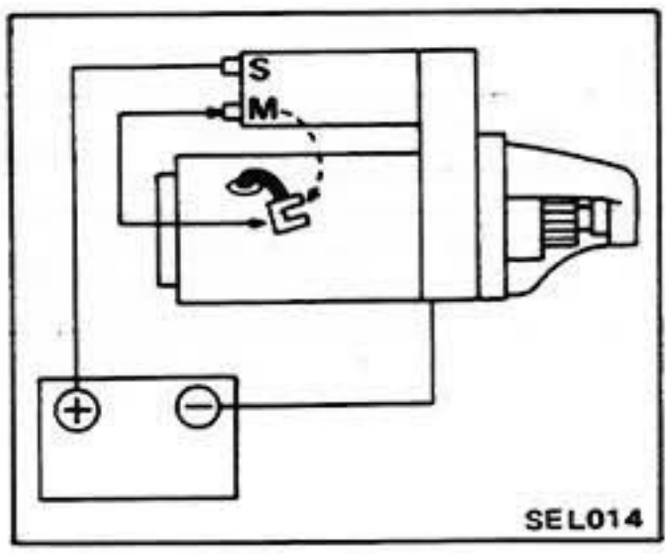
Series coil

1. Connect terminal "M" of magnetic switch and negative ⊖ terminal of battery with a jumper lead wire.
2. Connect terminal "S" of magnetic switch and positive ⊕ terminal of battery with a jumper wire.
3. With these connections having been made, if plunger is pulled in by force, series coil is properly functioning.



Shunt coil

1. Disconnect lead wire which connects terminal "M" of magnetic switch and starter motor terminal, and connect a jumper wire in its place.
2. Connect terminal "S" of magnetic switch and positive ⊕ terminal of battery with a jumper wire.
3. Connect negative ⊖ terminal of battery and starter motor body with a jumper wire. Plunger should be pulled in by force.
4. Disconnect jumper wire from terminal "M".
5. If plunger continues to be pulled in with jumper wire disconnected from terminal "M", shunt coil is properly functioning.



STARTER RELAY (For diesel engine)

This relay is the same in type and design as accessory relay. Therefore for inspection. **Refer to Accessory Relay on page EL-6.**

SERVICE DATA AND SPECIFICATIONS

STARTER MOTOR

Model			Non-reduction gear type			Reduction gear type
			S114-182G	S25-131	S114-173F	F114-254D
Applied engine model			P40	SD33	L28	P40, L28
System voltage		V	12	24	12	12
No load	Terminal voltage	V	11.5	24	11.5	11
	Current	A	Less than 60	Less than 90	Less than 60	Less than 100
	Revolution	rpm	More than 5,000	More than 6,000	More than 6,000	More than 3,900
Outer diameter of commutator		mm (in)	More than 39 (1.54)	More than 47 (1.85)	More than 39 (1.54)	More than 29 (1.14)
Minumum length of brush		mm (in)	More than 12 (0.47)	More than 11.5 (0.453)	More than 12 (0.47)	More than 11 (0.43)
Brush spring tension		N (kg, lb)	16.7 - 22.6 (1.7 - 2.3, 3.7 - 5.1)	24.03 - 29.91 (2.45 - 3.05, 5.40 - 6.73)	16.7 - 22.6 (1.7 - 2.3, 3.7 - 5.1)	17.7 - 21.6 (1.8 - 2.2, 4.0 - 4.9)
Clearance between bearing metal and armature shaft		mm (in)	0.2 (0.008)			–
Clearance "ℓ" between pinion front edge and pinion stopper		mm (in)	0.3 - 2.5 (0.012 - 0.098)	0.3 - 1.5 (0.012 - 0.059)	0.3 - 2.5 (0.012 - 0.098)	0.3 - 1.5 (0.012 - 0.059)

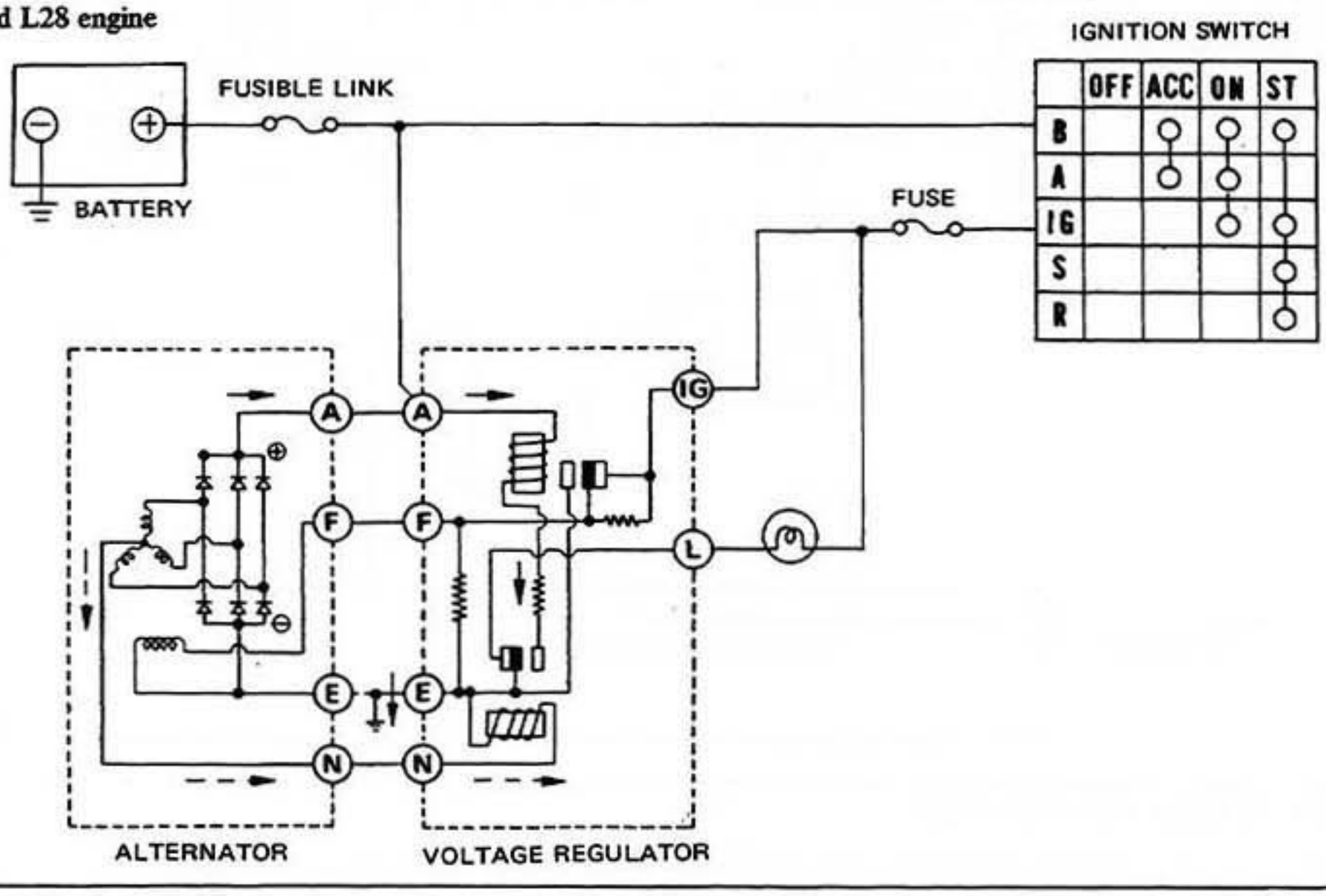
CHARGING SYSTEM

CAUTION: Before starting to work, be sure to turn ignition switch "OFF" and then disconnect battery ground cable.

SCHEMATIC

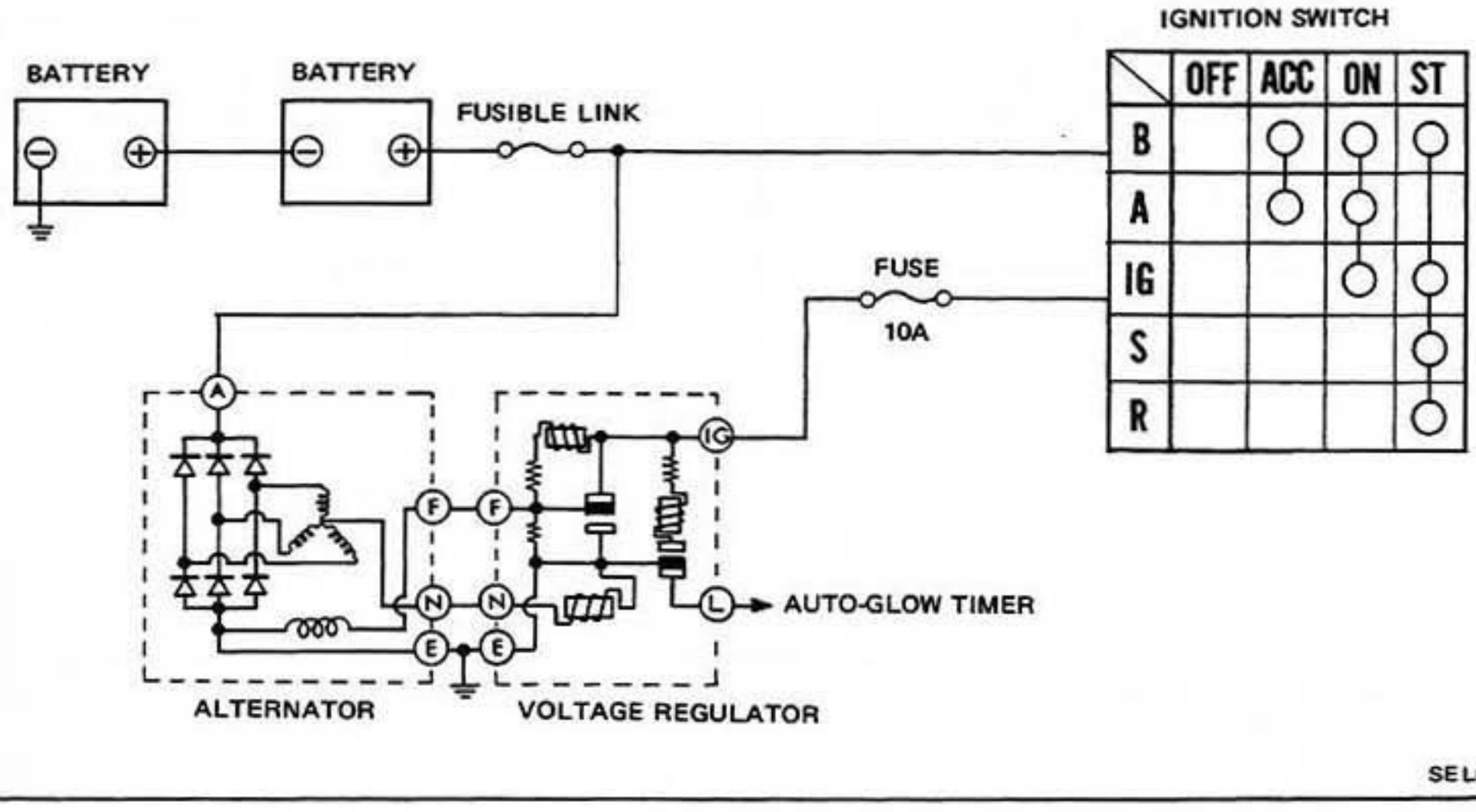
Except Europe

P40 and L28 engine



SEL066A

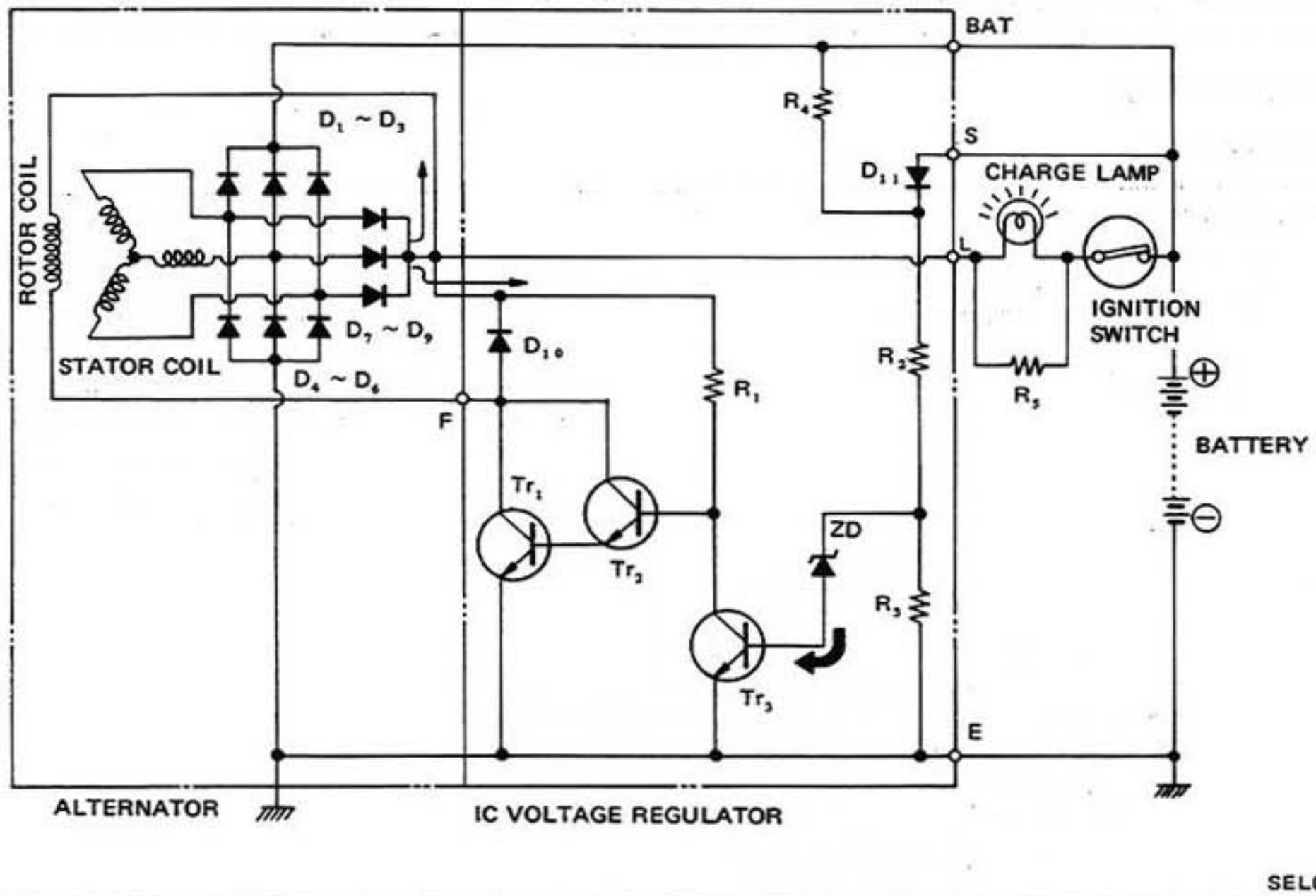
SD33 engine



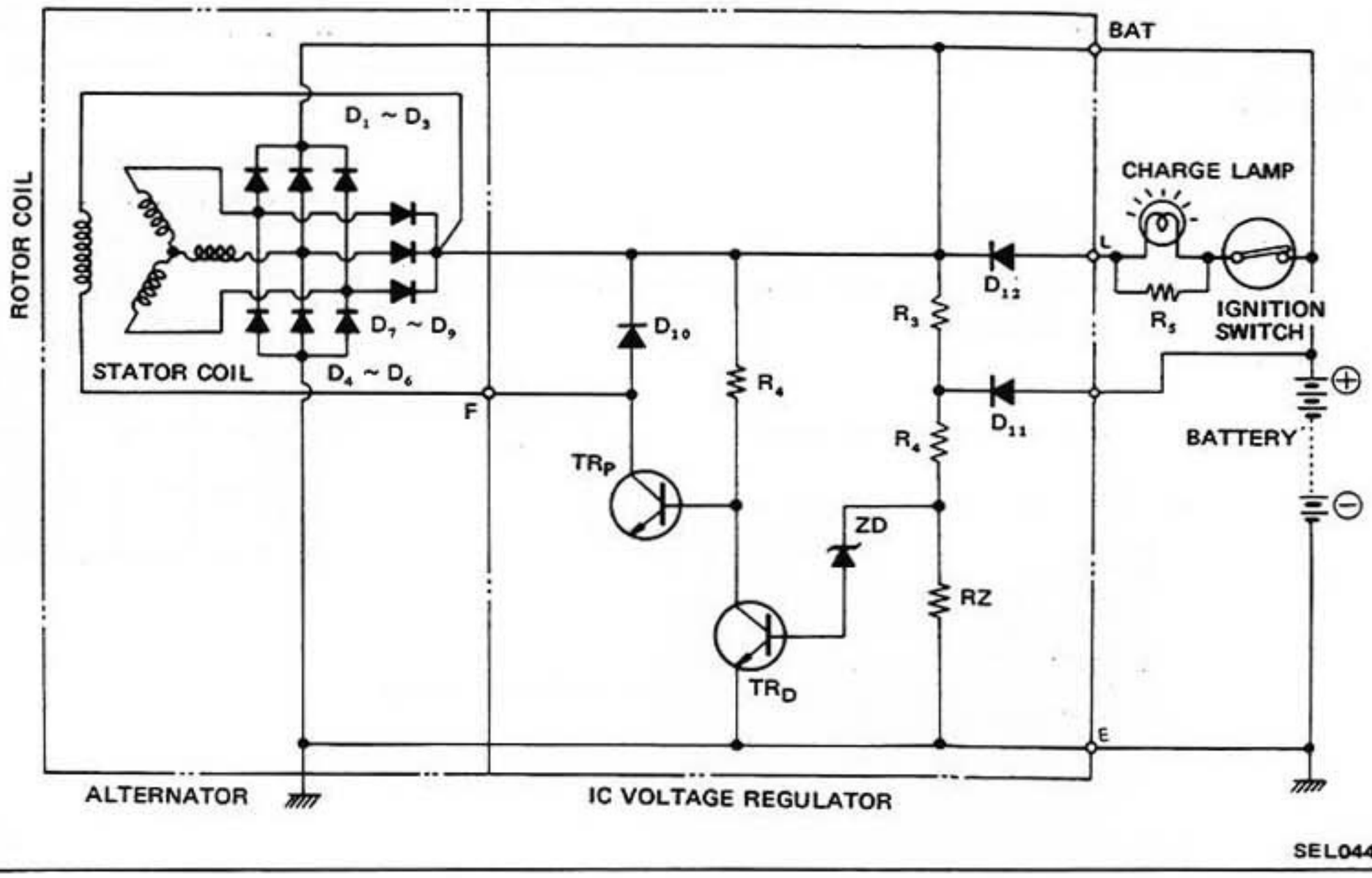
SEL067A

For Europe

P40 and L28 engine (IC voltage regulator built in)



SD33 engine (IC voltage regulator built in)



CHARGING SYSTEM TROUBLE-SHOOTING (LT135, LT150, LT160, LT225)

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

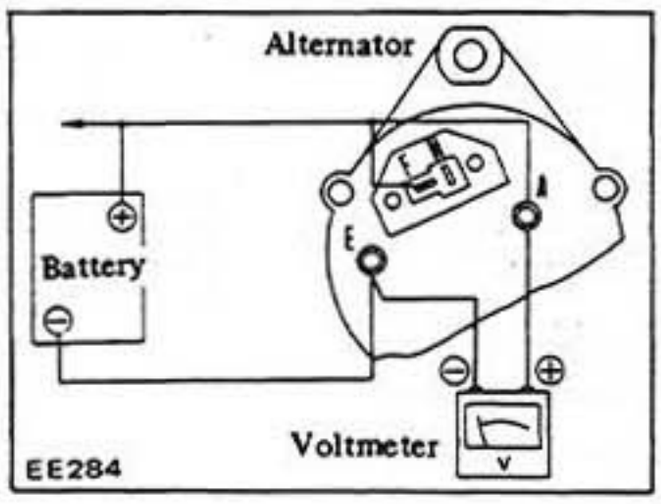
To conduct test, it is necessary to use a 30-volt voltmeter and suitable test probes.

Set up a test circuit as shown in figure and test alternator in manner indicated in 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 the voltmeter reading.

Measured value: Below 12.5 volts ... Gasoline engine
Below 24 volts ..... Diesel engine
Alternator is run-down. Remove and check it for condition.

Measured value: Over 12.5 volts ... Gasoline engine
Over 24 volts ..... Diesel engine
Alternator is in good condition.



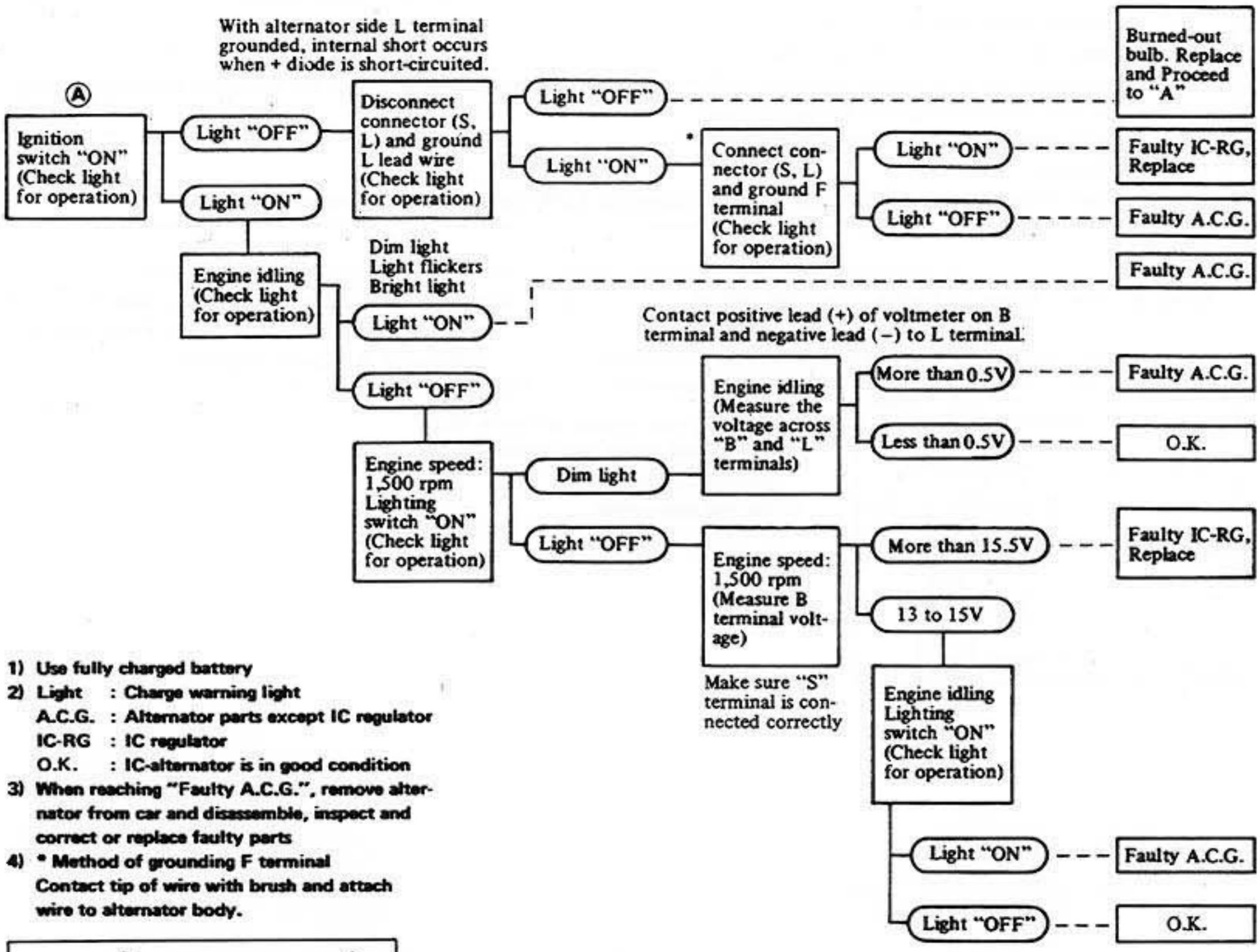
a. Do not run engine at more than 1,100 rpm while test is being conducted on alternator.
b. Do not race engine.

CHARGING SYSTEM TROUBLE-SHOOTING (LR150, LR160, LR225)

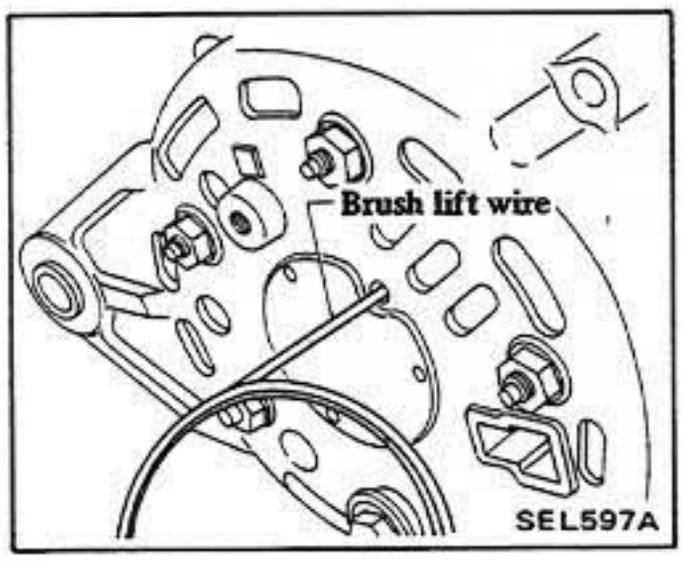
Before conducting an alternator test, make sure that the battery is fully charged.

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

The alternator can be checked easily by referring to the Inspection Table.



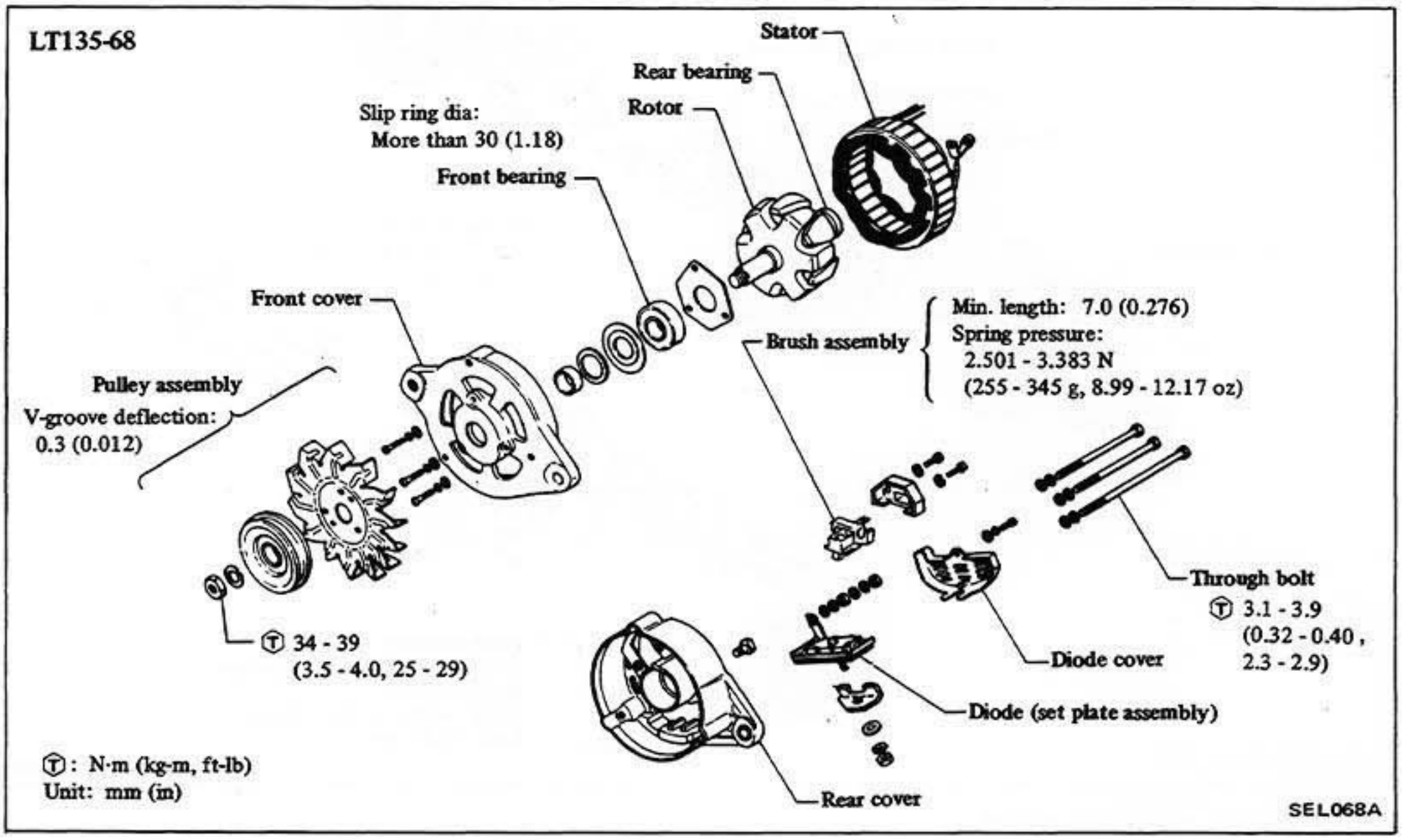
1) Use fully charged battery
2) Light : Charge warning light
   A.C.G. : Alternator parts except IC regulator
   IC-RG : IC regulator
   O.K. : IC-alternator is in good condition
3) When reaching "Faulty A.C.G.", remove alternator from car and disassemble, inspect and correct or replace faulty parts
4) * Method of grounding F terminal
   Contact tip of wire with brush and attach wire to alternator body.

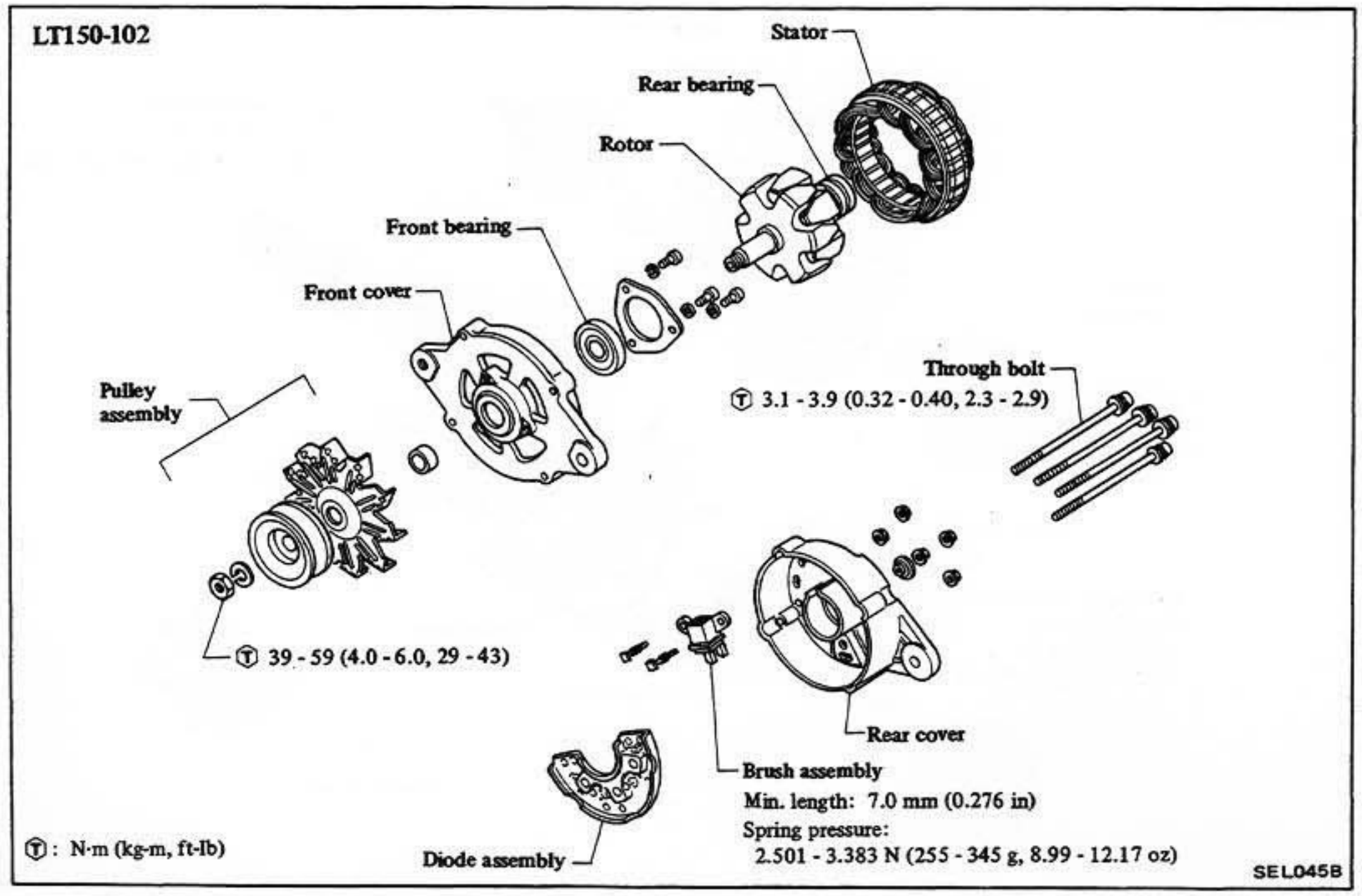


5) Terminals "S", "L", "BAT" and "E" are marked on rear cover of alternator.

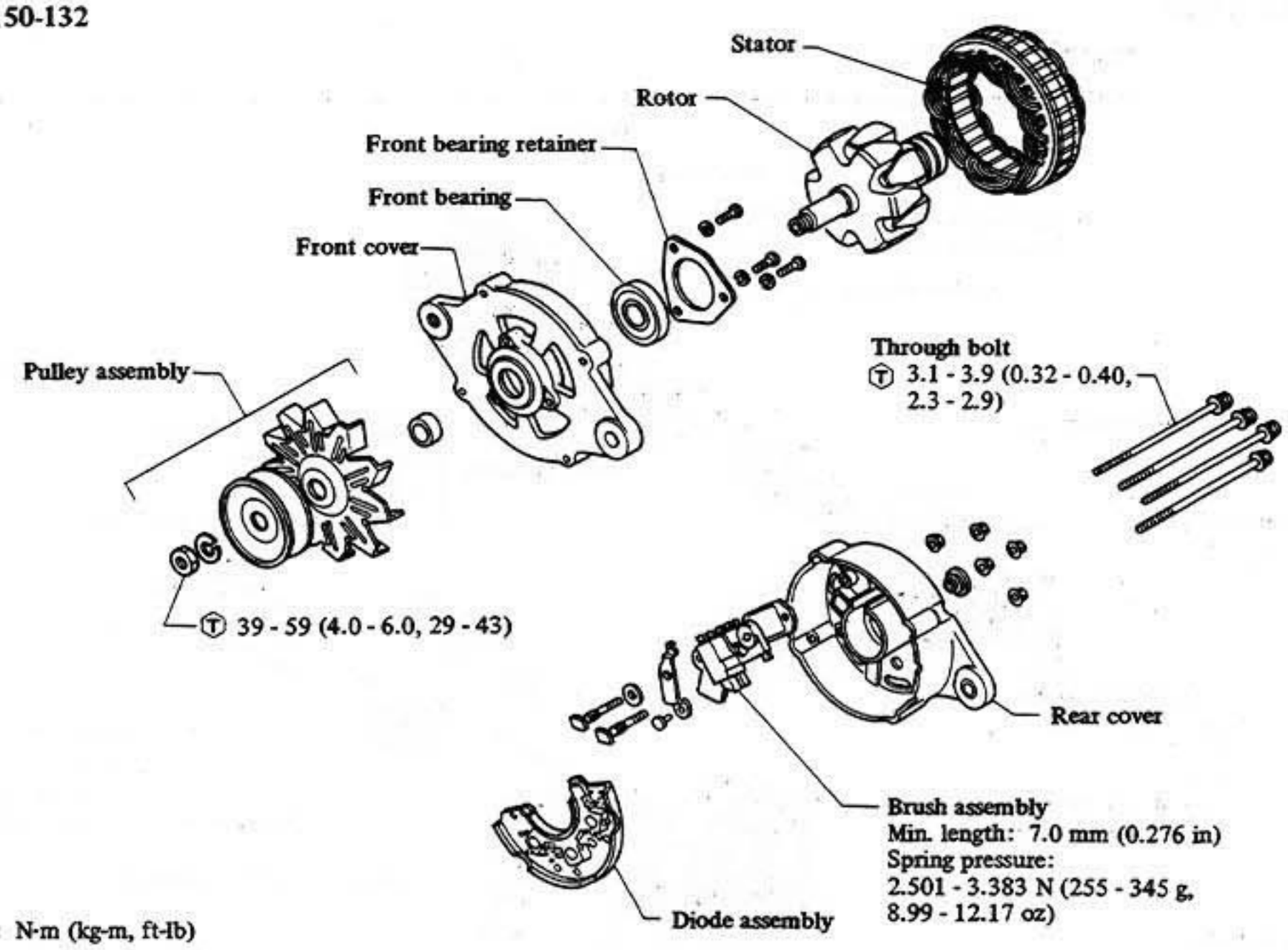
ALTERNATOR

P40 engine equipped model



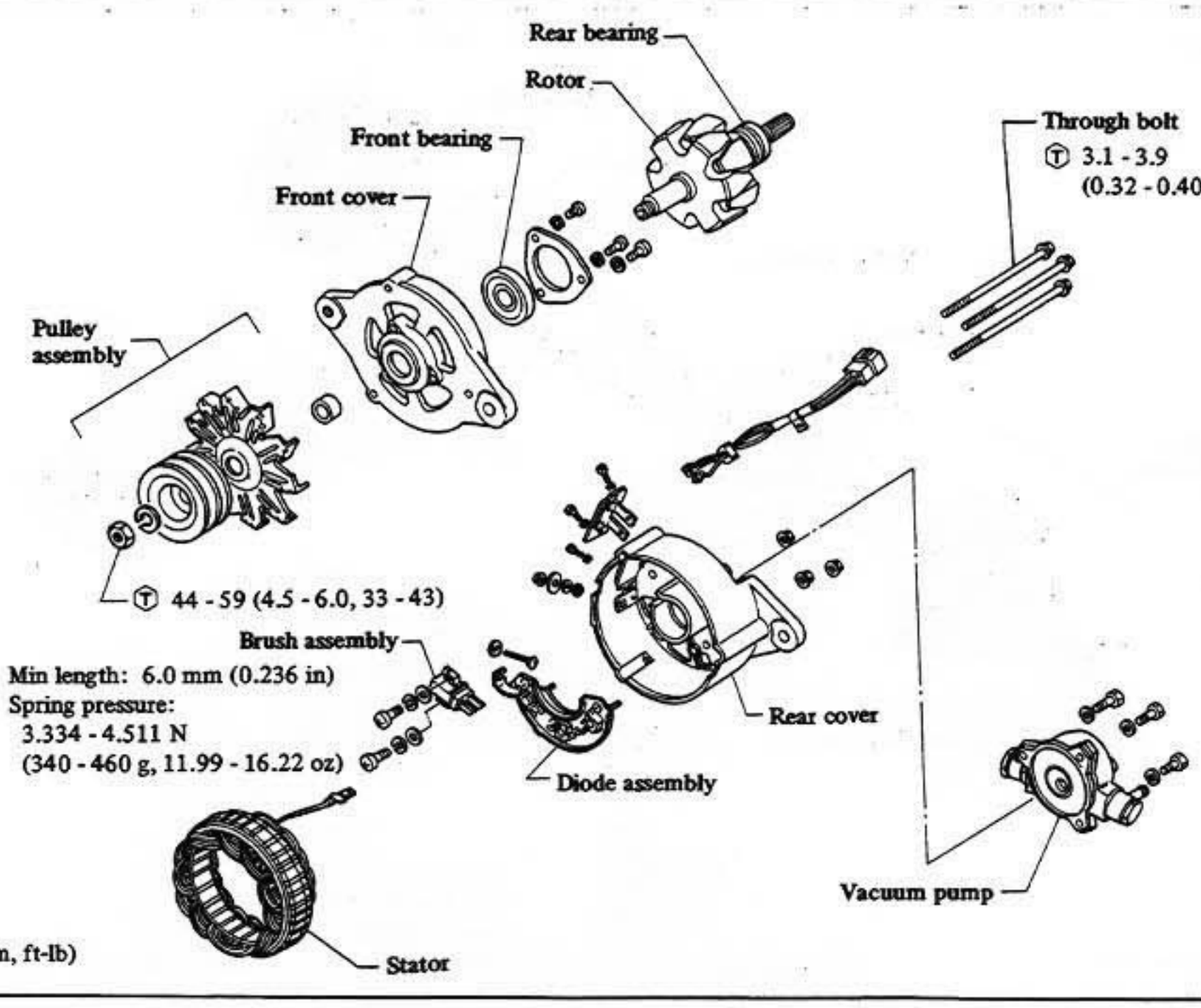


LR150-132

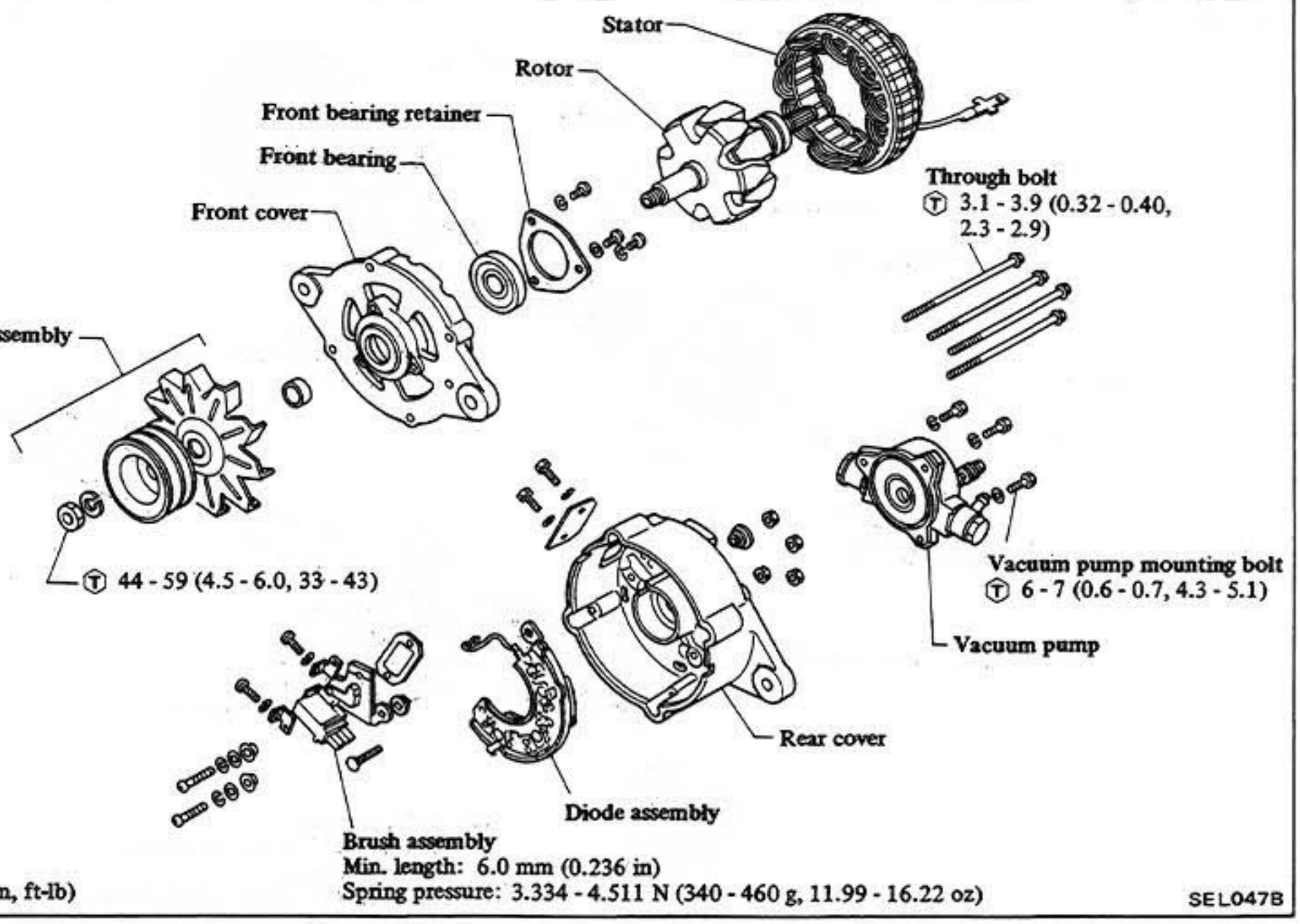


SD33 engine equipped model

LT225-60



LR225-65B

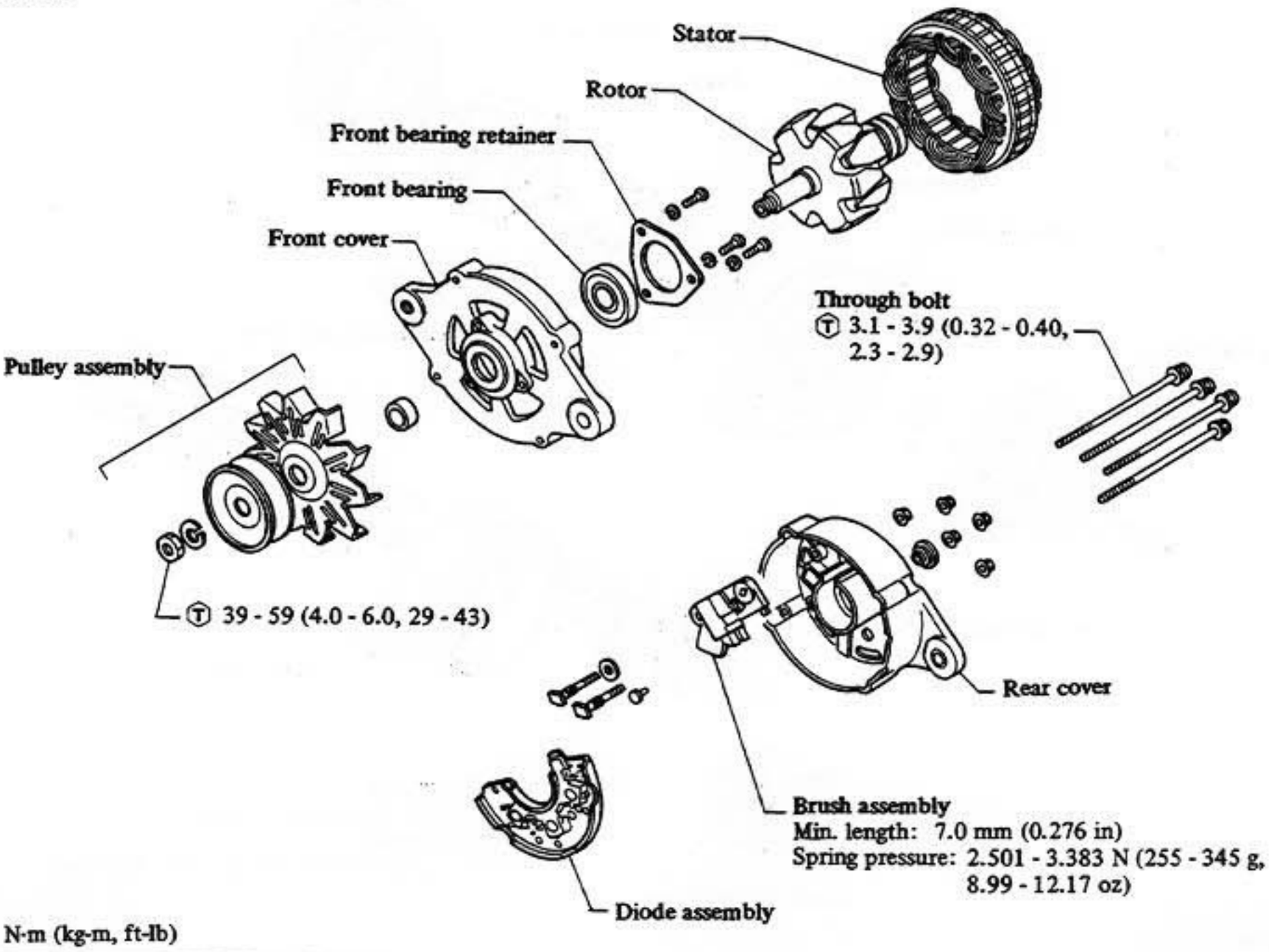


Ⓣ : N-m (kg-m, ft-lb)

SEL047B

L28 engine equipped model

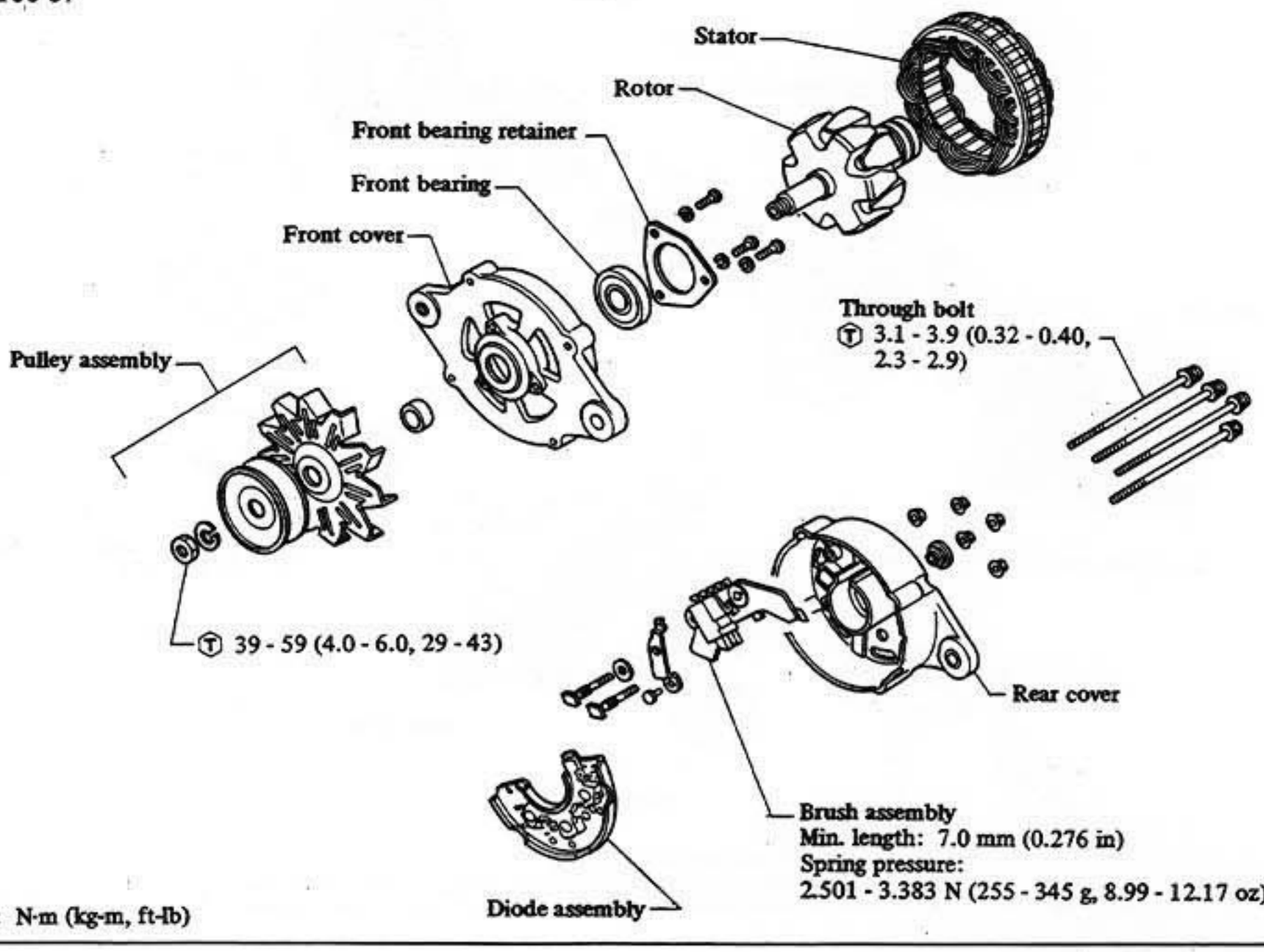
LT150-121



Ⓣ : N-m (kg-m, ft-lb)

SEL048B

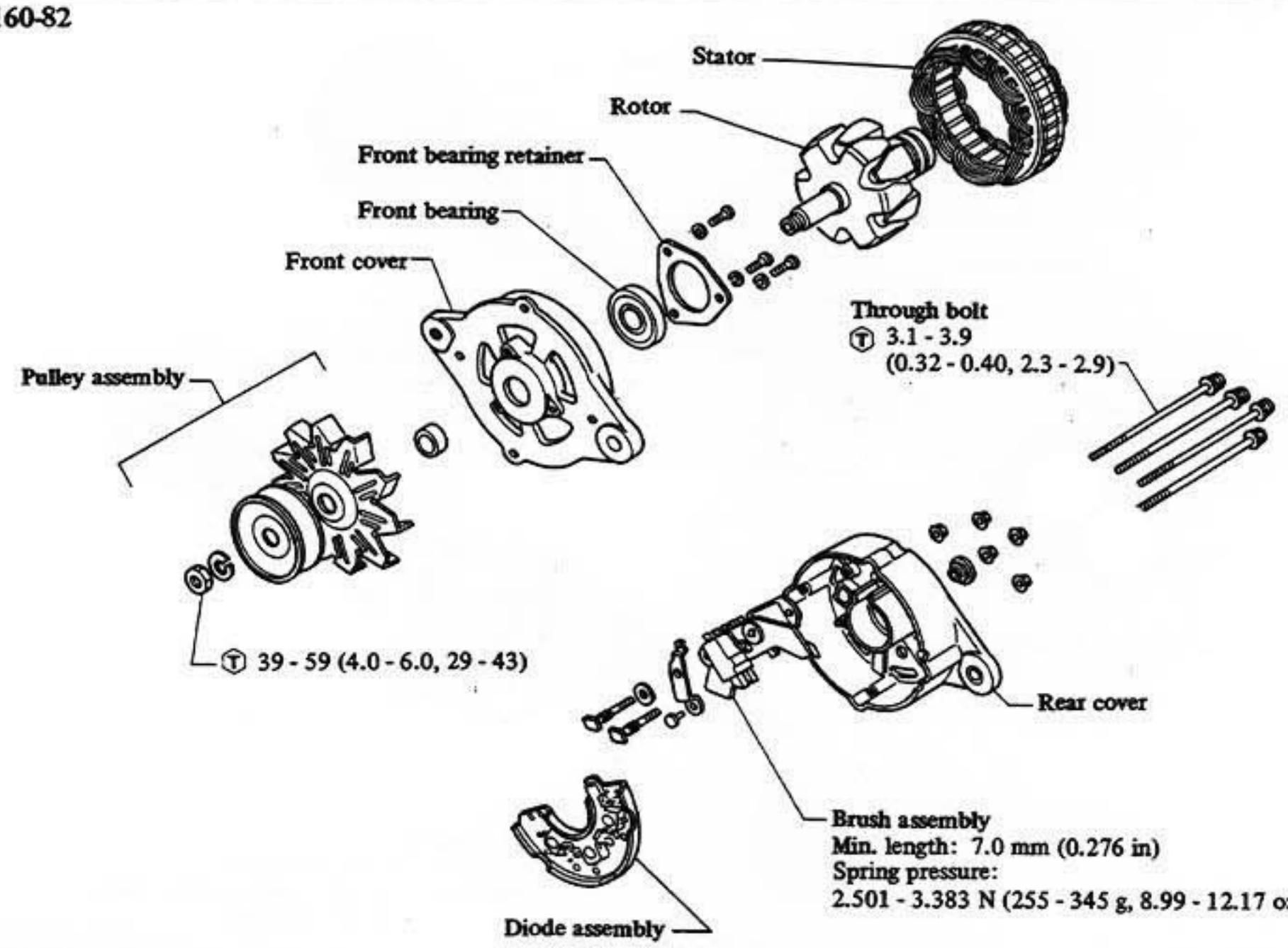
LT160-87



Ⓣ : N·m (kg-m, ft-lb)

SEL049B

LR160-82



Ⓣ : N·m (kg-m, ft-lb)

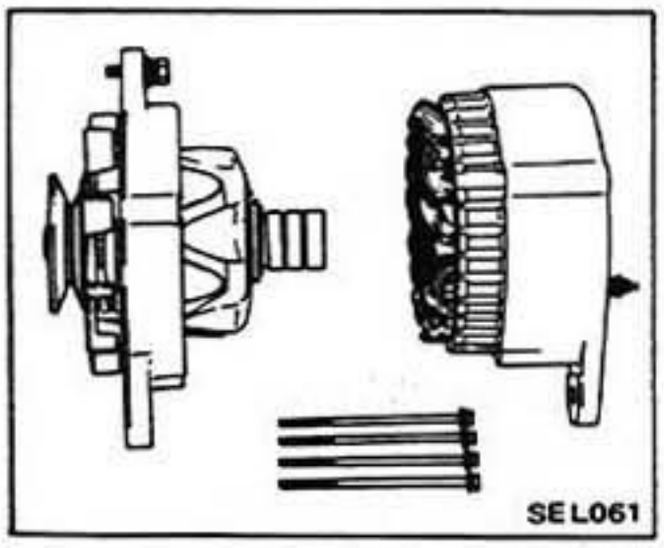
SEL050B

DISASSEMBLY

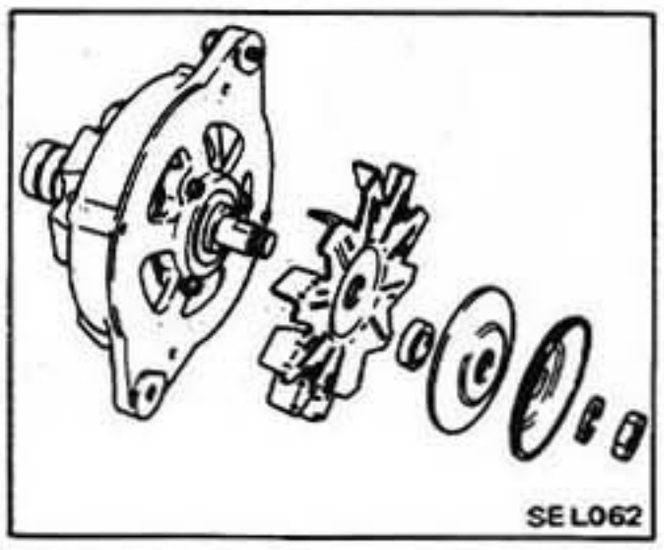
CAUTION:
Place packings and insulators in order so that they can be placed back in their original places or locations from which they were removed.

LT135-68

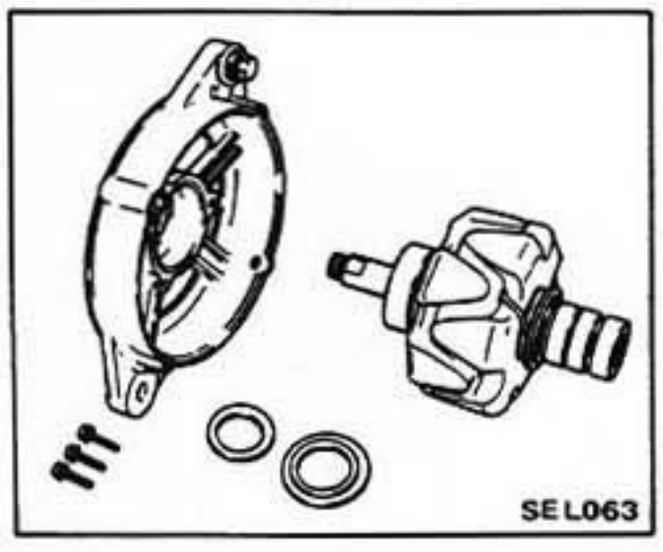
1. Remove through bolts.
2. Separate front cover from rear cover.



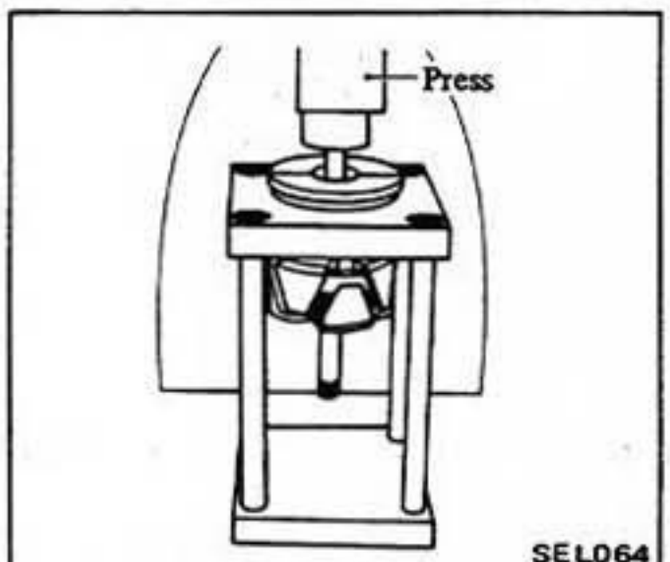
3. Remove pulley and fan.
(1) Place rear cover side of rotor in a vise.
(2) Remove pulley nut.

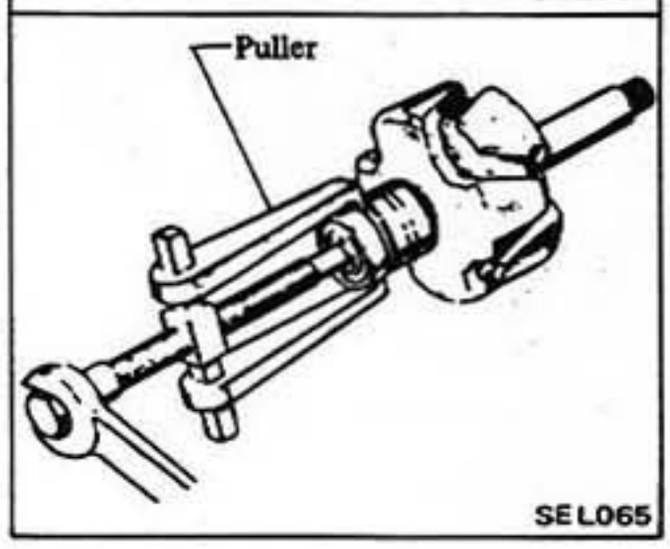


4. Separate rotor front cover.
- Remove setscrews from bearing retainer.

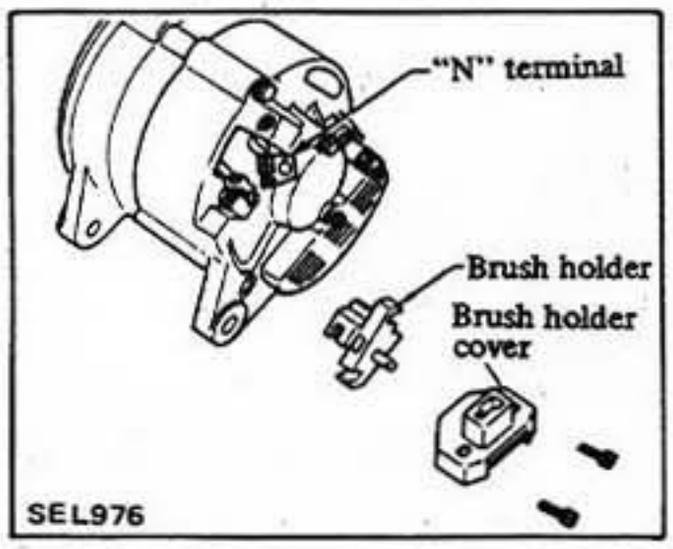


5. Pull rear bearing off rotor assembly.

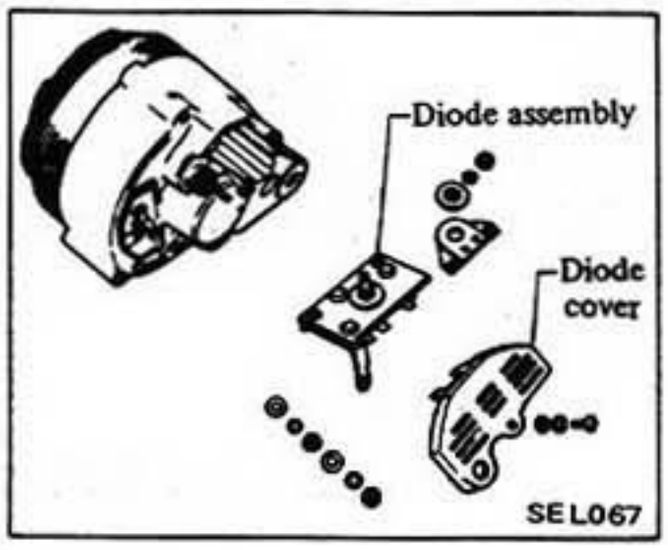




6. Remove brush holder cover.
7. Remove brushes together with brush holder.



8. Remove diode cover.
9. Disconnect stator coil lead wires from diode terminal with a soldering iron.
10. Remove "A" terminal nut and diode installation nut.
11. Remove diode assembly.

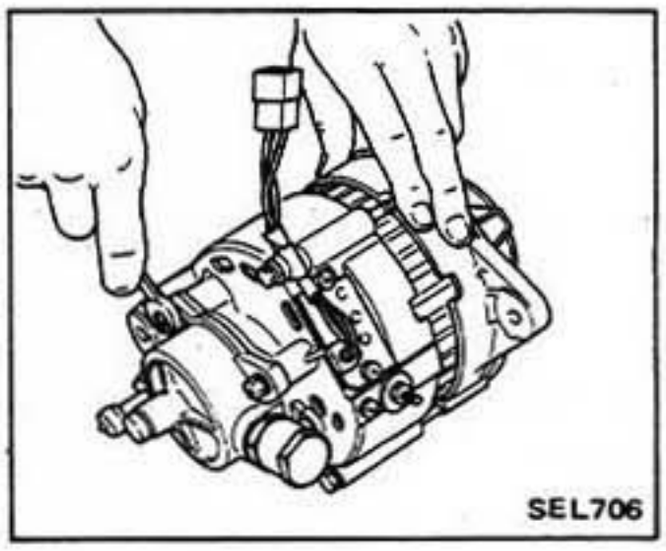


12. Pull stator coils out of rear cover.

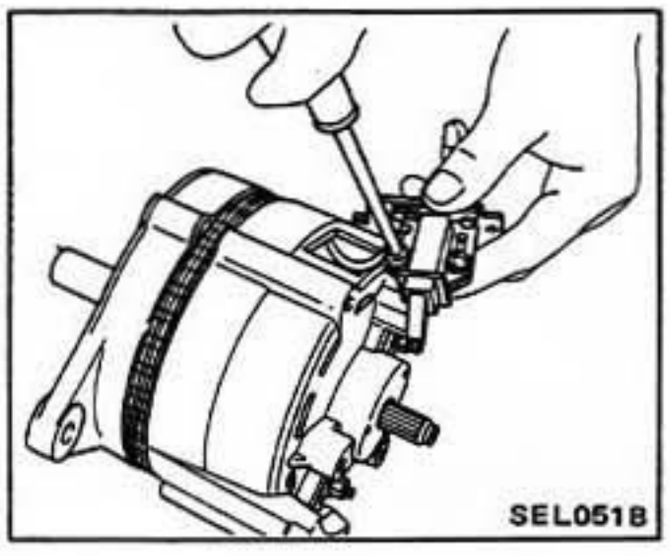
LT225-60

1. Remove vacuum pump.

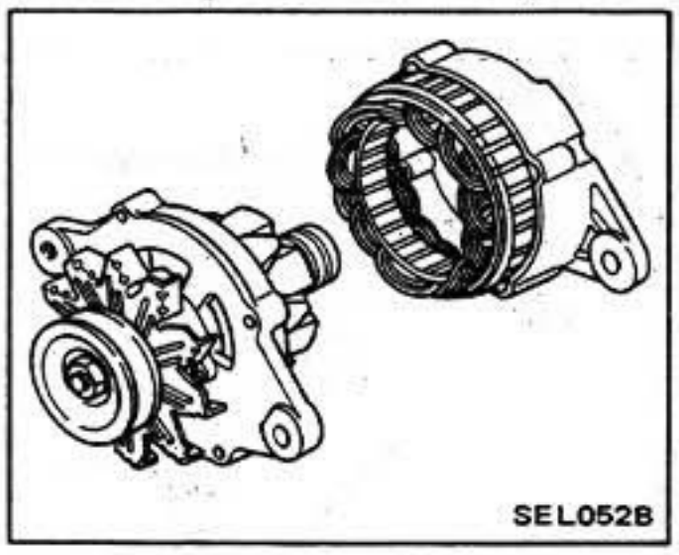
Refer to Section BR for vacuum pump.



2. Remove brush.

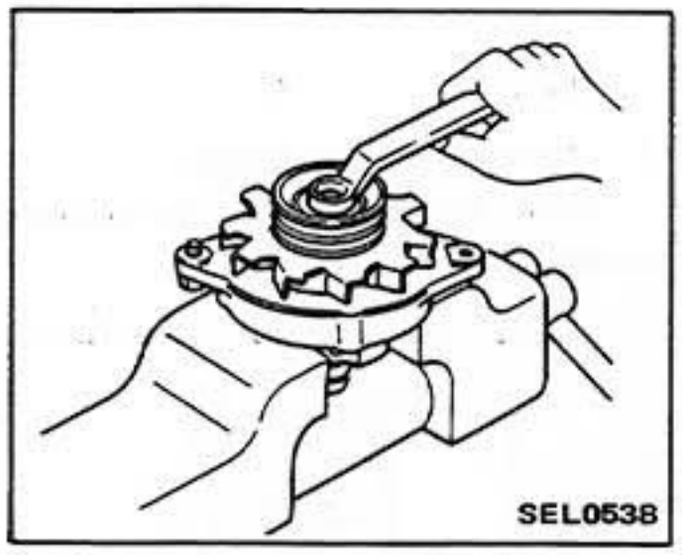


3. Separate front cover from rear cover.

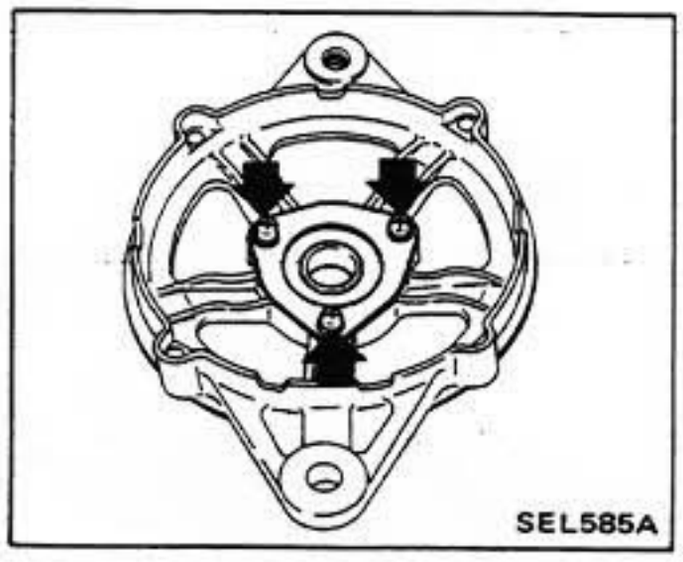

SEL052B

Use serration cap (Attach vinyl type) to prevent scratching oil seals.

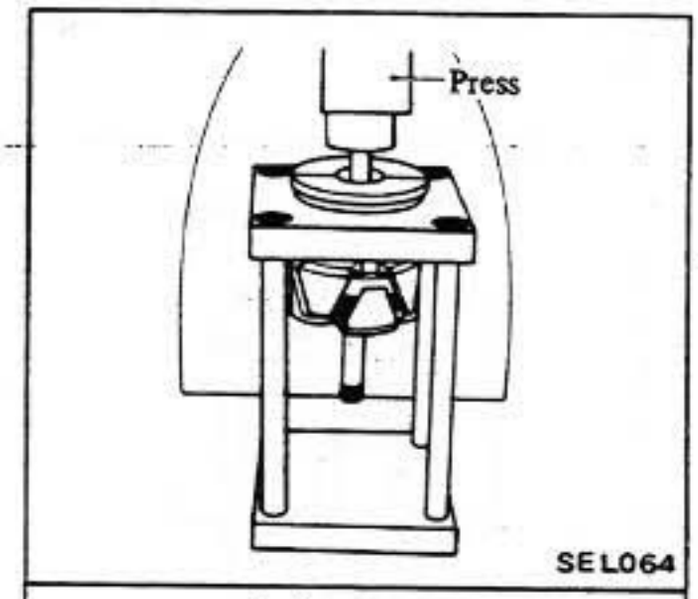
4. Remove pulley and fan.
(1) Place rear cover side of rotor in a vice.
(2) Remove pulley nut.


SEL053B

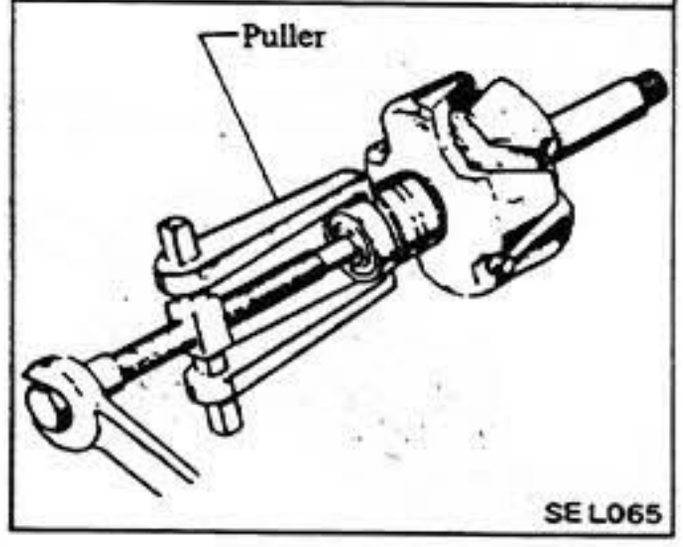
5. Remove screws from bearing retainer.


SEL585A

6. Pull rear bearing off rotor assembly.

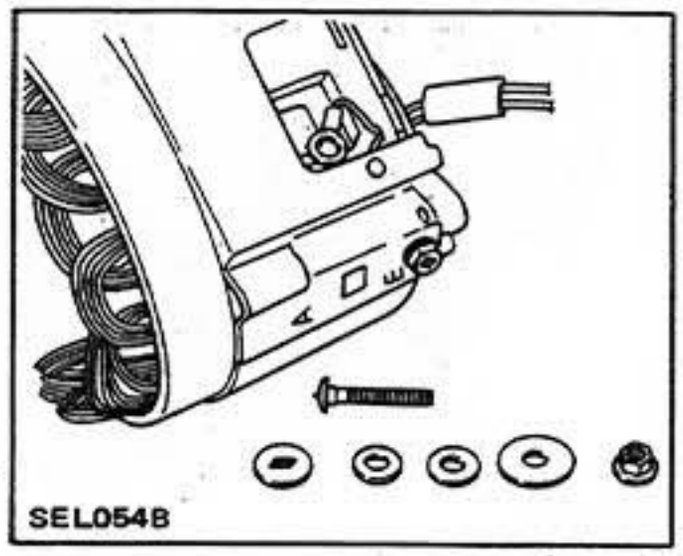


SEL064

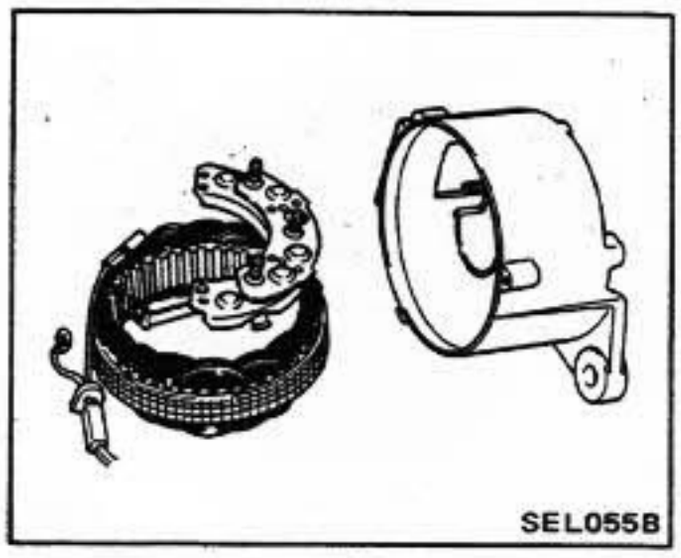


SEL065

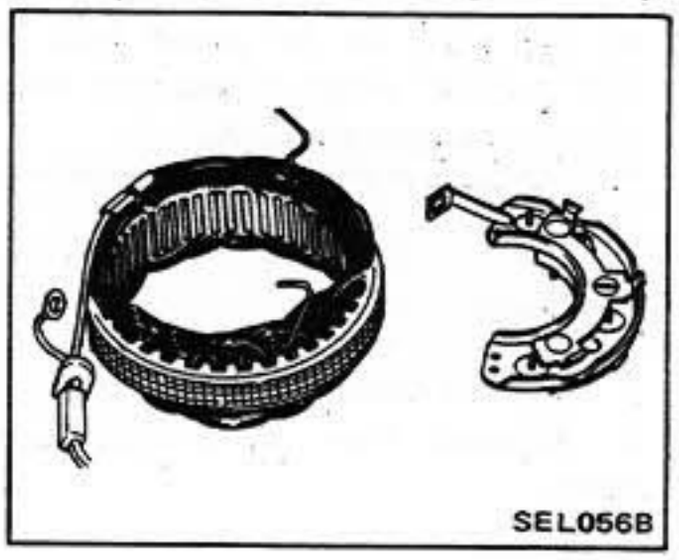
7. Separate rear cover.
(1) Remove two "A" terminal nuts, then remove "A" terminal bolts.


SEL054B

(2) Remove three M5 nuts that secure diode, then separate rear cover and stator.

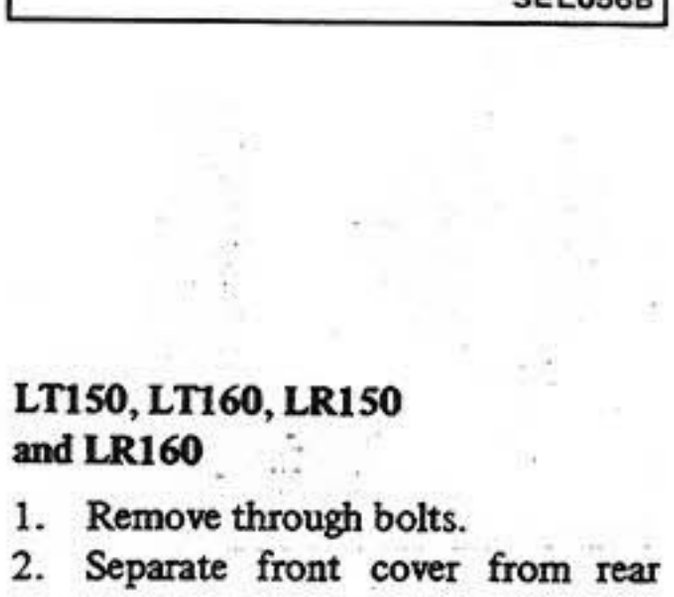

SEL055B

(3) Remove solder between stator coil and diode, the stator and diode can be separated.

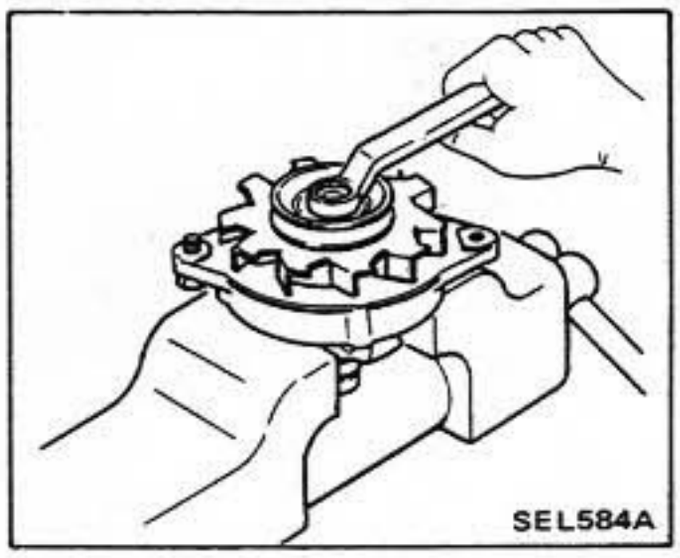

SEL056B

LT150, LT160, LR150 and LR160

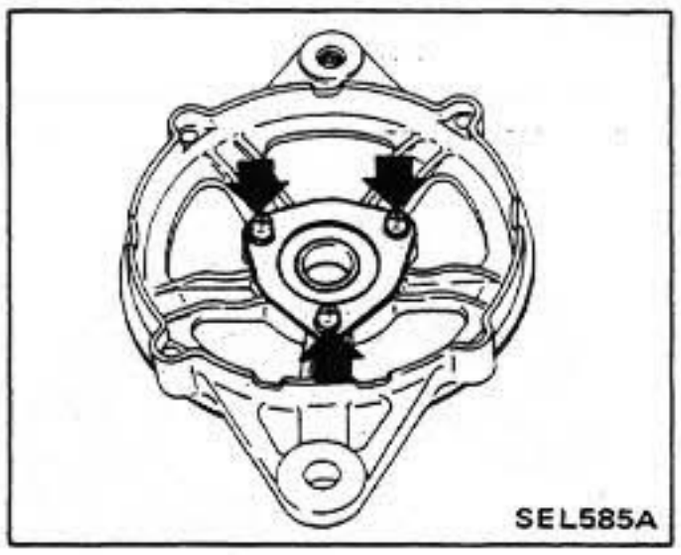
1. Remove through bolts.
2. Separate front cover from rear cover.


SEL061

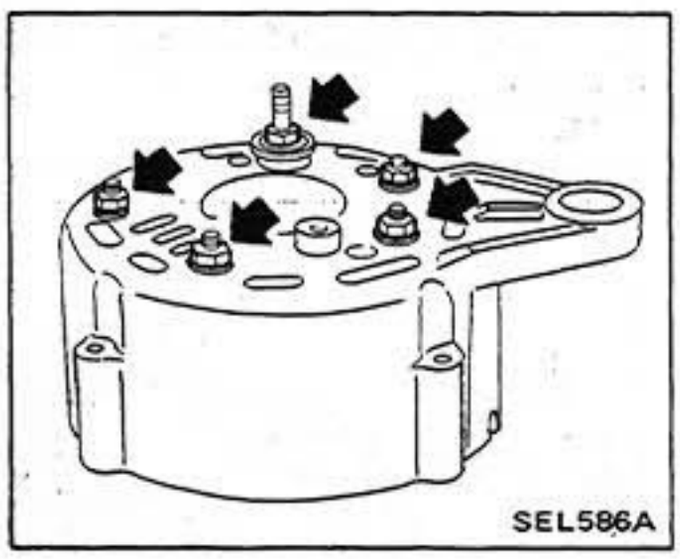
3. Remove pulley and fan.
(1) Place rear cover side of rotor in a vice.
(2) Remove pulley nut.


SEL584A

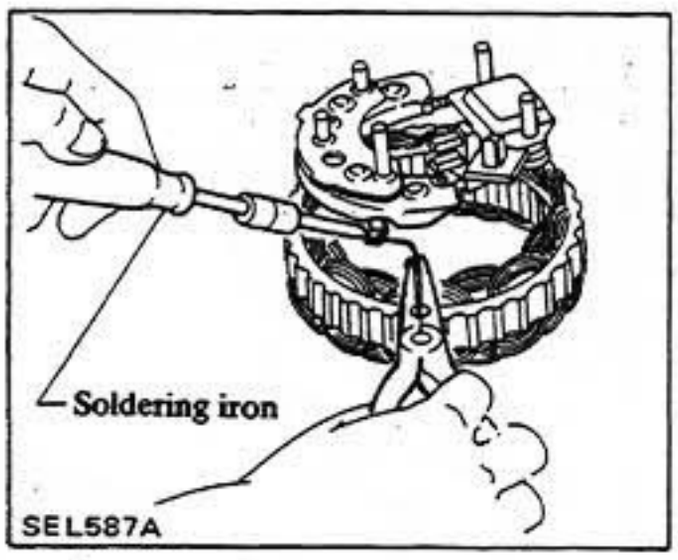
4. Remove screws from bearing retainer.


SEL585A

5. Remove attaching nuts and take out stator assembly.


SEL586A

6. Disconnect stator coil lead wires from diode terminals.



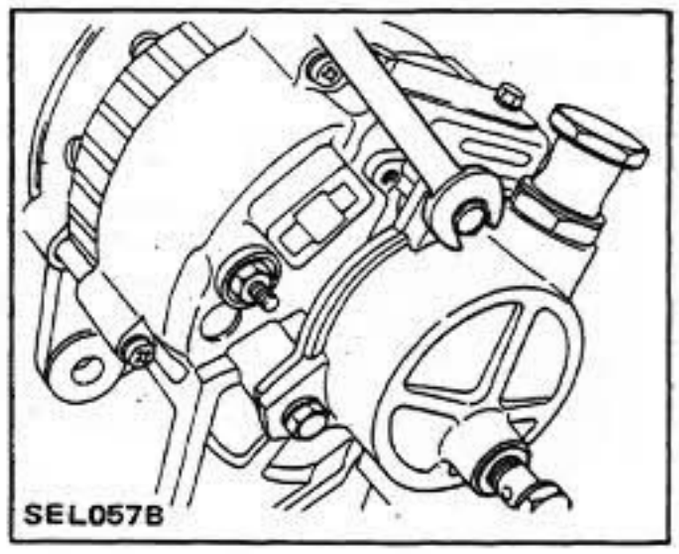
SEL587A

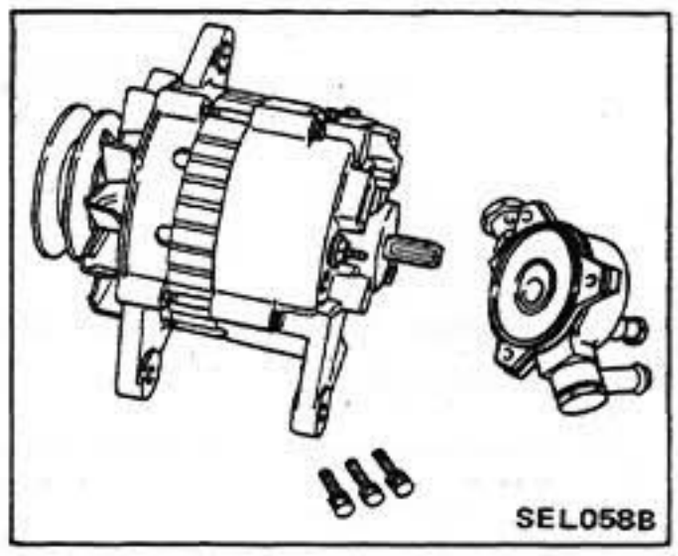
LR225-65B

1. Remove vacuum pump.

- Remove the three bolts mounting the vacuum pump.

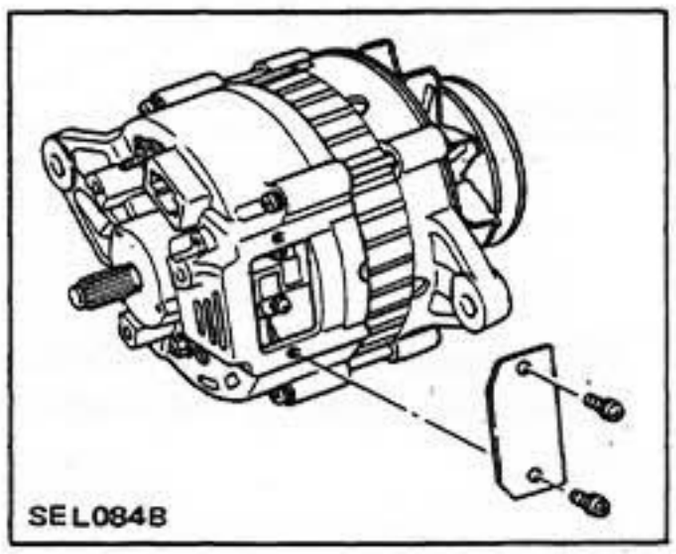
Pull the pump in the shaft direction.


SEL057B

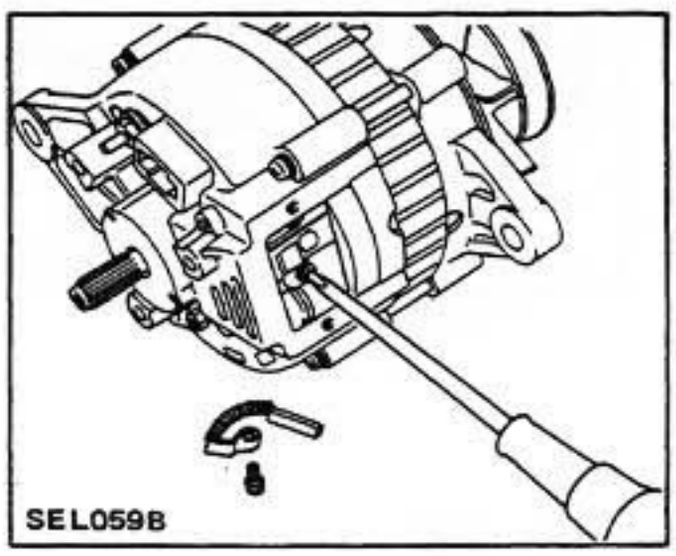

SEL058B

2. Remove brushes.

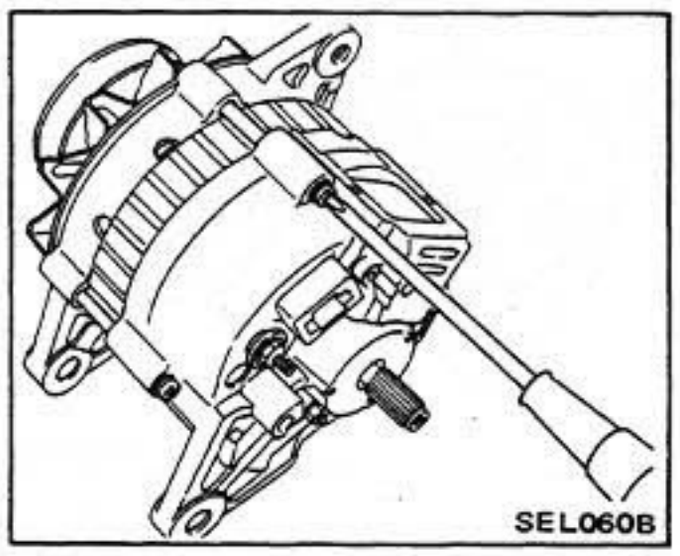
(1) Remove screw and then remove brush cover.

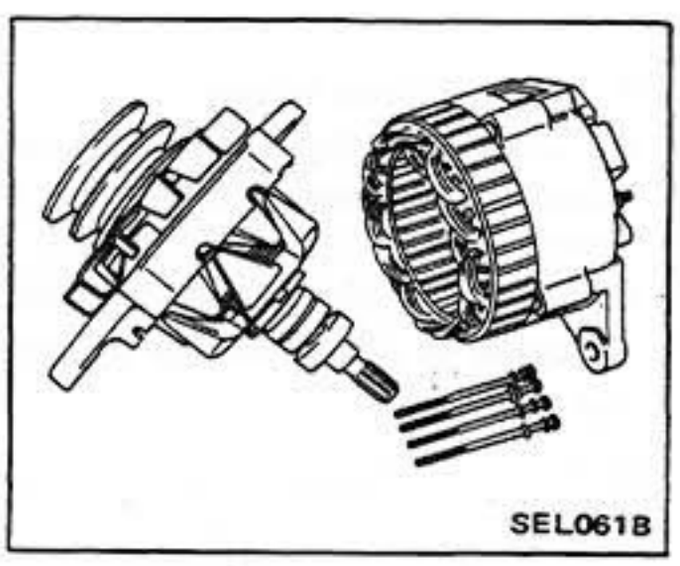

SEL084B

(2) Remove screw and then separate the brushes.


SEL059B

3. Loosen the four through bolts and then separate to the front and rear.


SEL060B

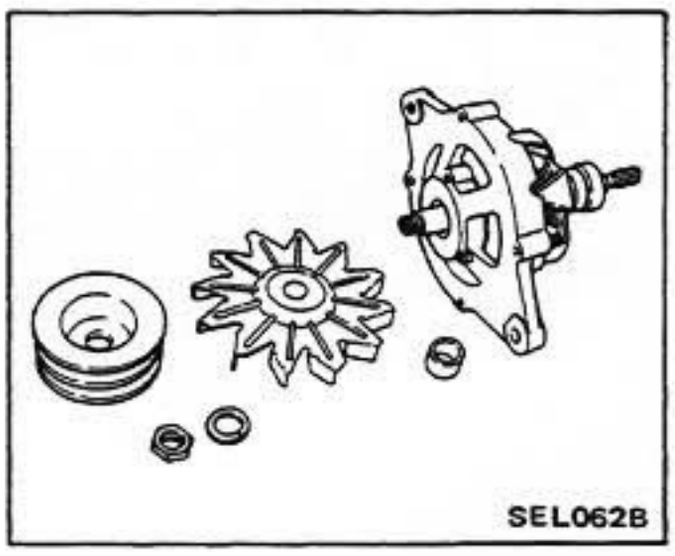

SEL061B

Use serration cap (Attach vinyl tape) to prevent scratching oil seals.

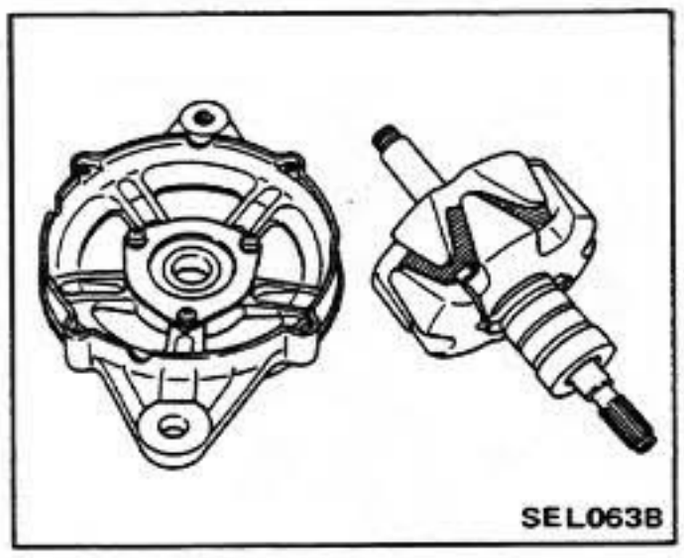
4. Remove pulley.

(1) Clamp the rotor in a vice and remove the pulley nut.

(2) After removing the nut, remove the pulley, fan and spacer.


SEL062B

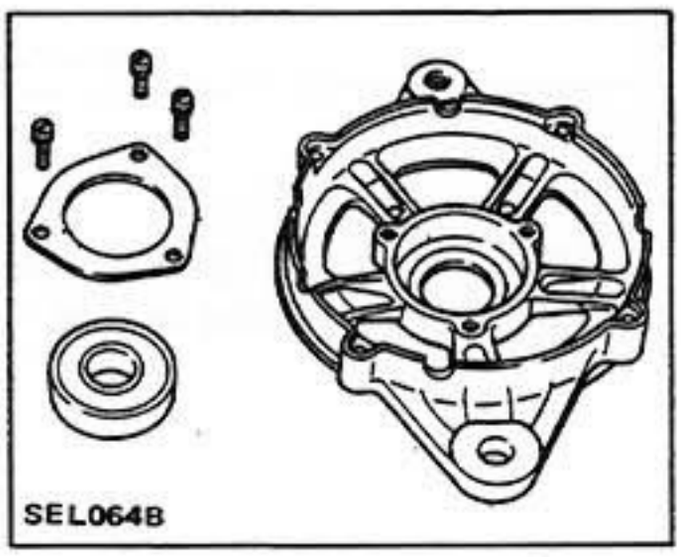
5. Pull out the rotor by hand.


SEL063B

6. Remove front bearing.

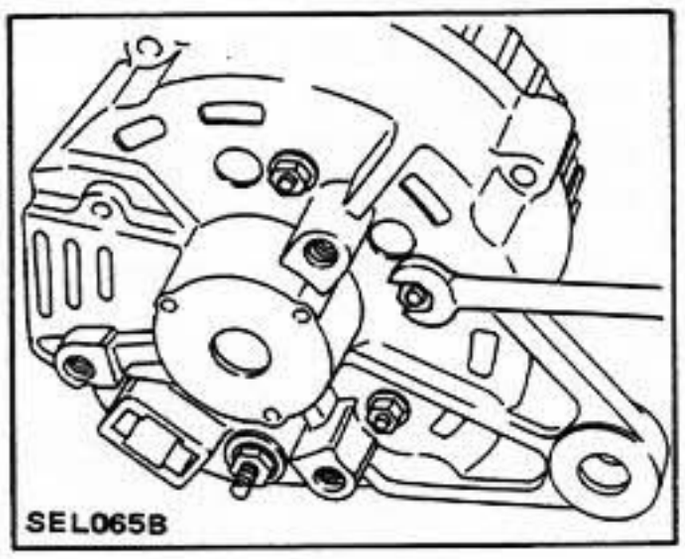
(1) Loosen the three bearing ratainer screues and remove the bearing retainer.

(2) Push out the bearing by hand slowly **so as not to damage the bearing.**

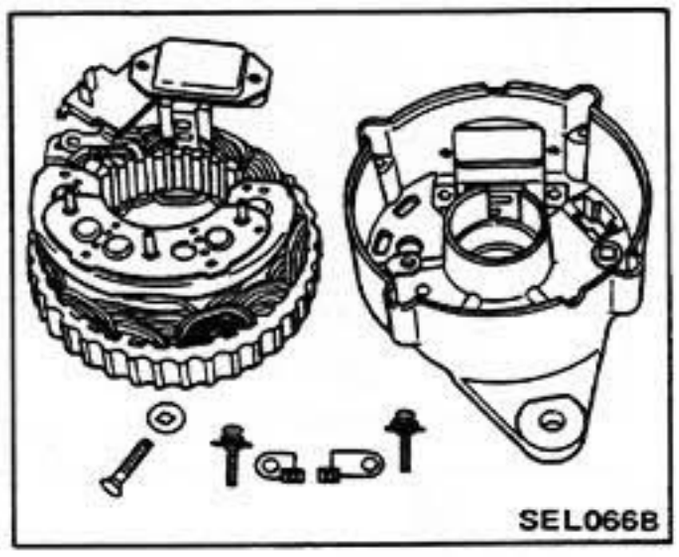

SEL064B

7. Remove stator coil.

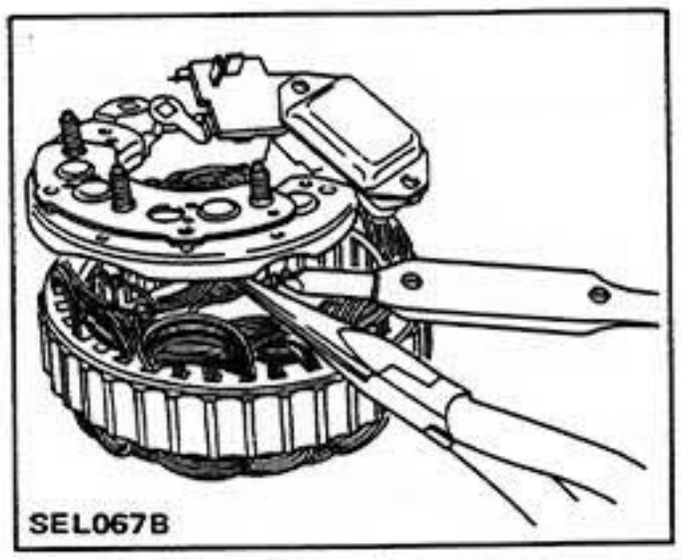
(1) Remove the BAT terminal nut and the three nuts mounting diodes.


SEL065B

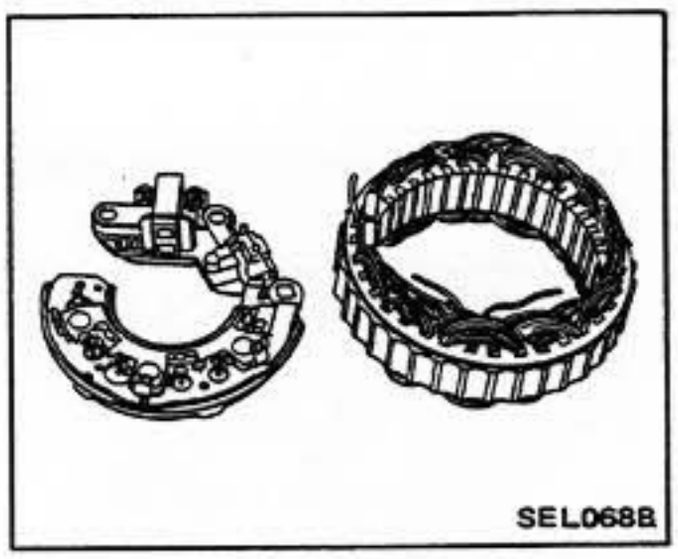
(2) Loosen the two screw mounting brush holder and regulator, and then remove the stator with diode assembly, regulator and brush holder from rear side.


SEL066B

(3) Unsolder the stator coil and diodes connection.

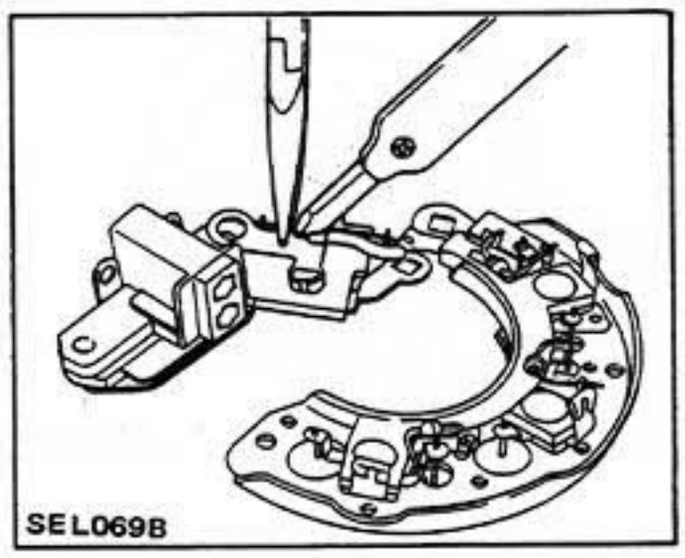

SEL067B

(4) Separate the stator and diode assembly with regulator and brush holder.

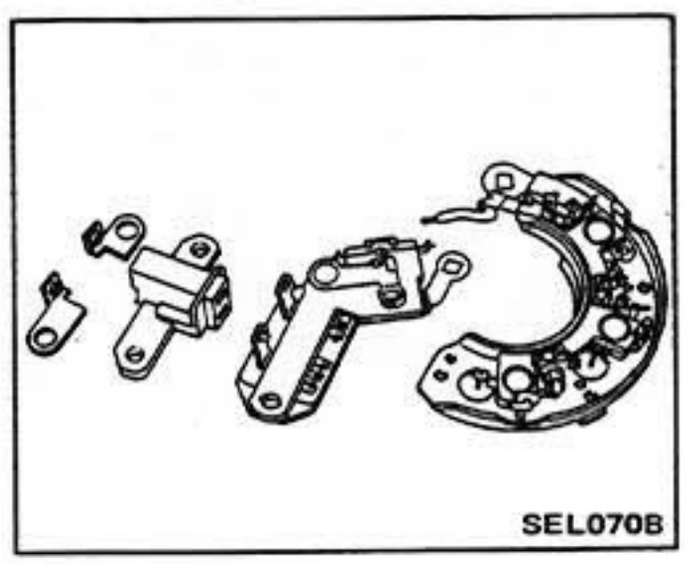

SEL068B

8. Remove the brush holder and regulator from diode assembly.

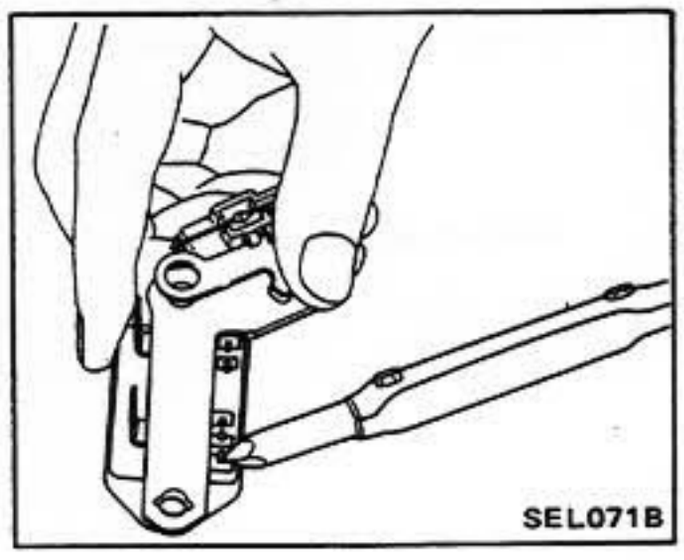
(1) Unsolder the terminal block and lead wire connection.


SEL069B

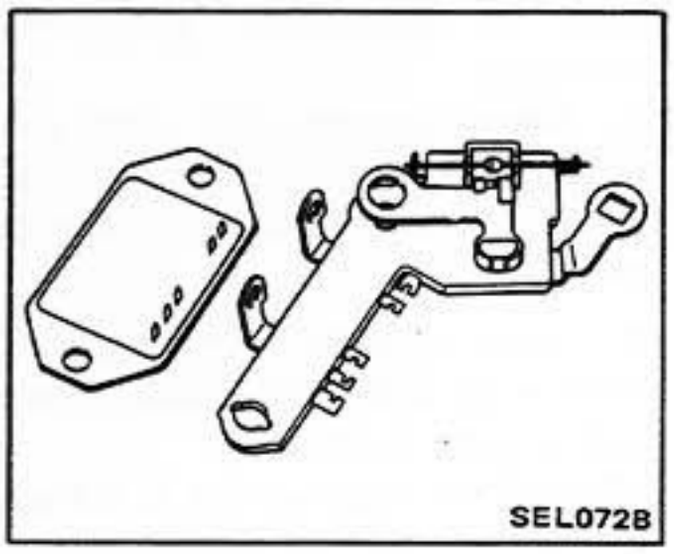
(2) Separate the brush holder, regulator with terminal block and diode assembly.


SEL070B

(3) Unsolder the terminal of regulator and terminal block connection.


SEL071B

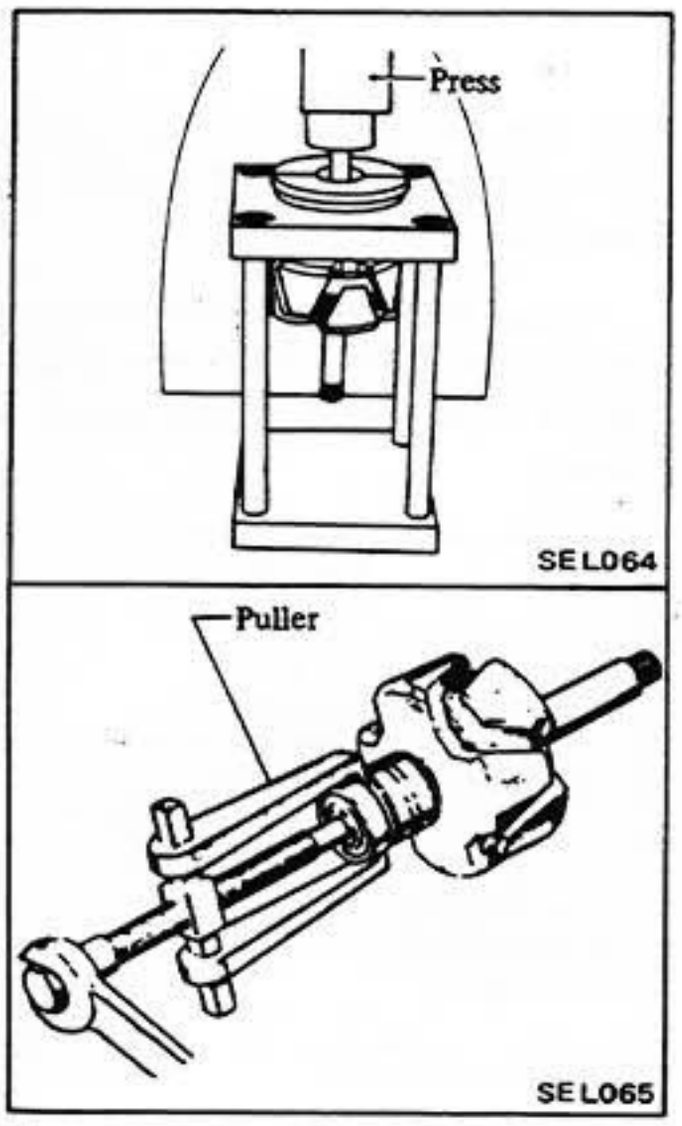
(4) Separate the regulator and terminal block.


SEL072B

Rotor (All models)

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

Once removed, bearing cannot be reused. Replace with a new one.



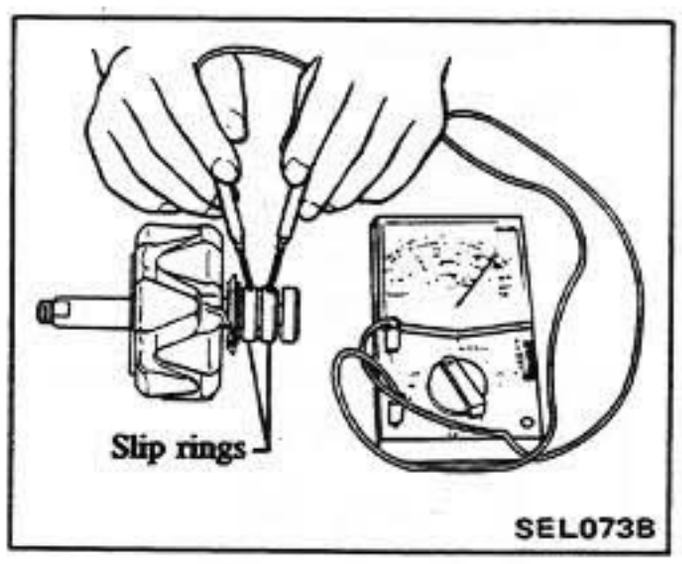
SEL064

SEL065

INSPECTION

Rotor

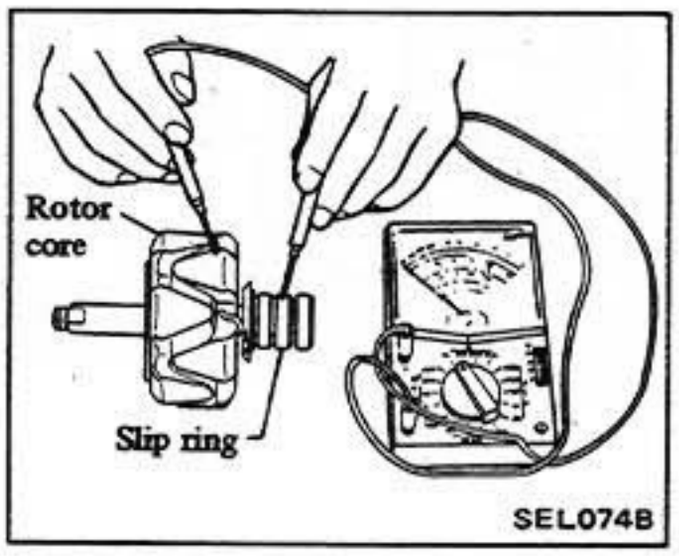
1. Continuity test.



SEL073B

- No continuity ... Replace rotor.

2. Ground test

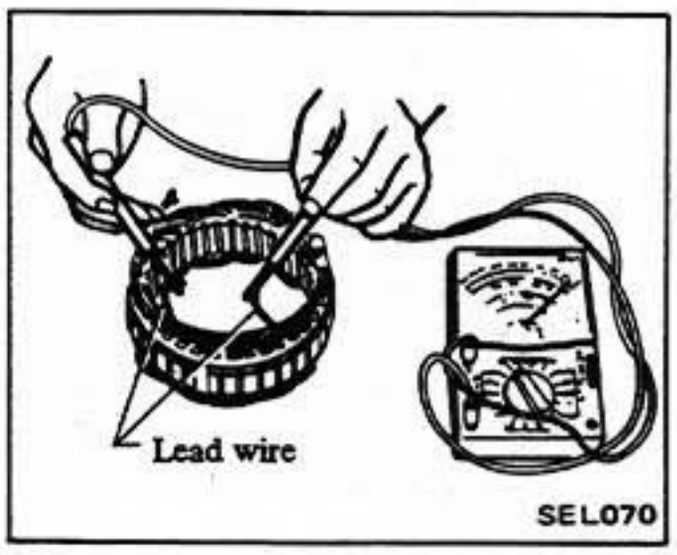


SEL074B

- Continuity exists ... Replace rotor.

Stator

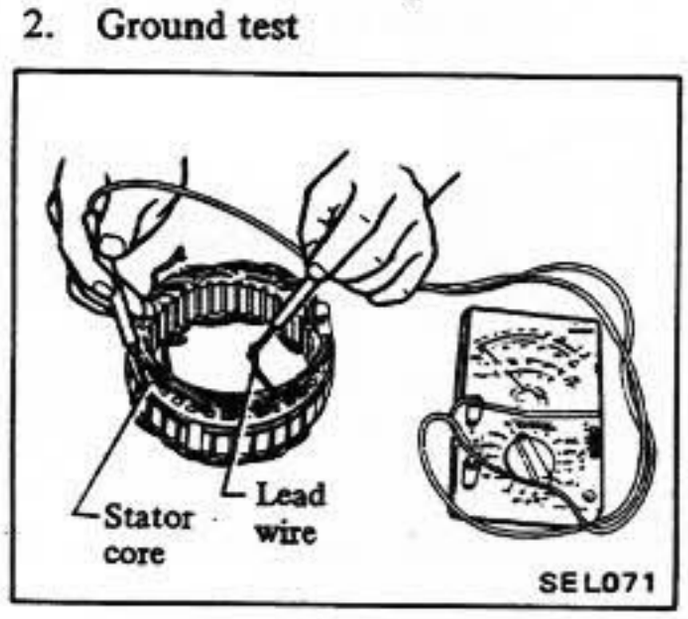
1. Continuity test



SEL070

- No continuity ... Replace stator.

2. Ground test



SEL071

- Continuity exists ... Replace stator.

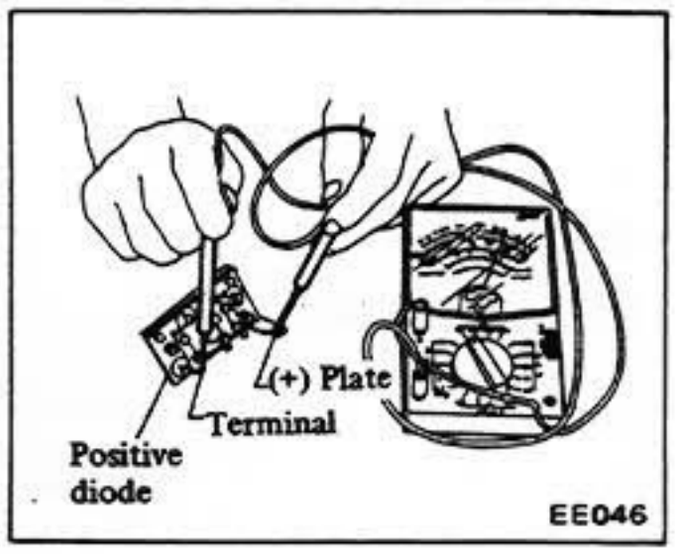
Diode

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

Circuit tester terminal		Conduction
Positive	Negative	
(+) plate Holder plate	Diode terminal	Yes
Diode terminal	(+) plate Holder plate	No
(–) plate Rear cover	Diode terminal	No
Diode terminal	(–) plate Rear cover	Yes

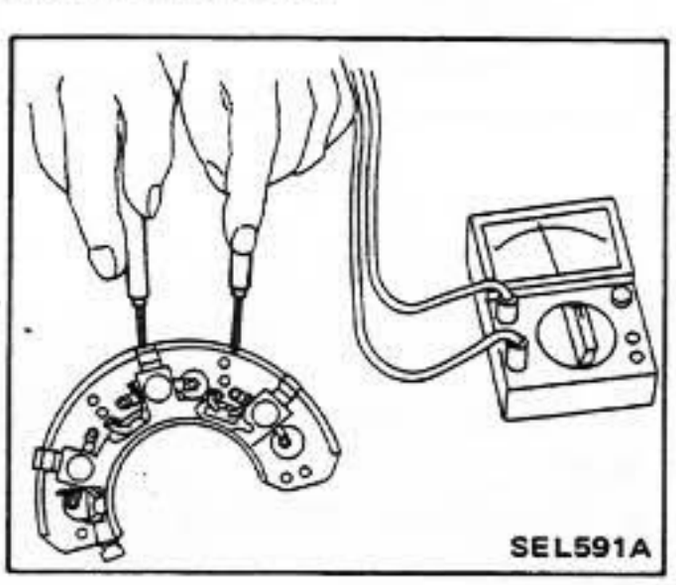
Positive diode

LT135-68



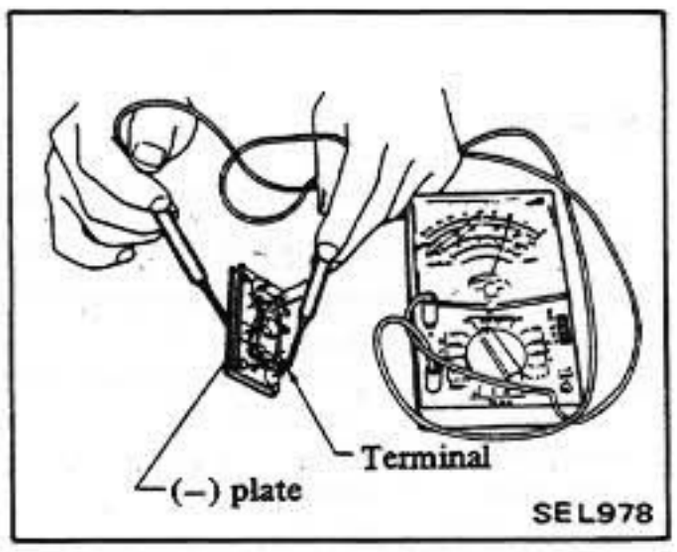
EE046

LT150, LT160, LT225, LR150, LR160 and LR225

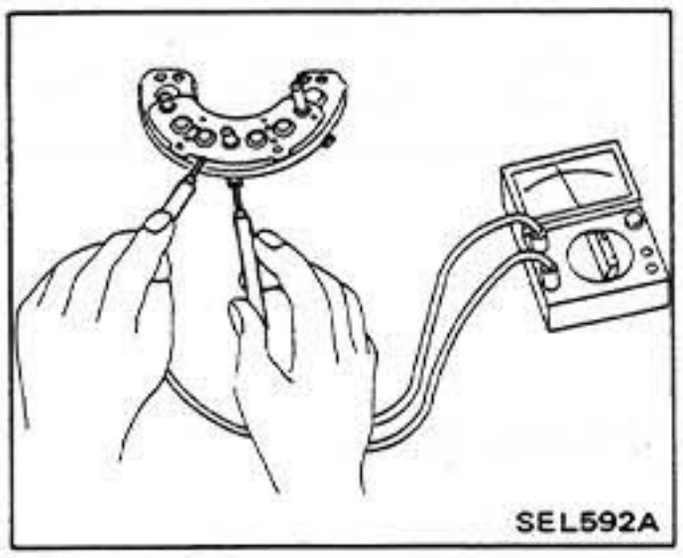

SEL591A

Negative diode

LT135-68 and LT150-121

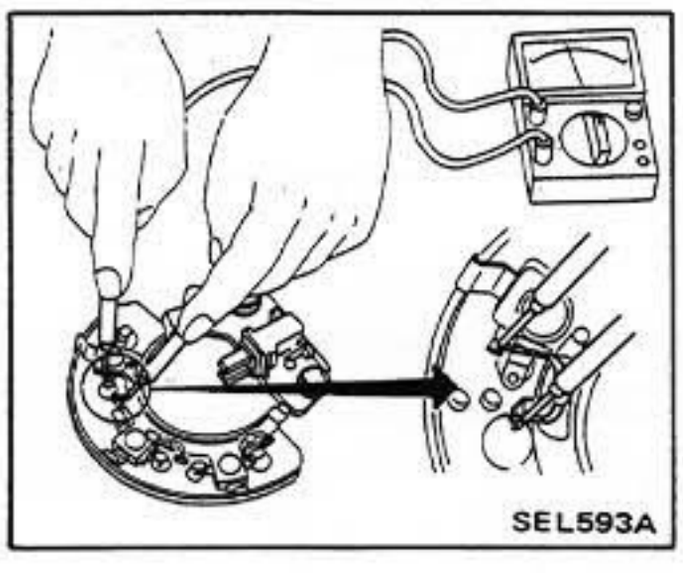


LT150-102, LT160, LT225, LR150, LR160 and LR225



Sub- diode

LR150, LR160 and LR225

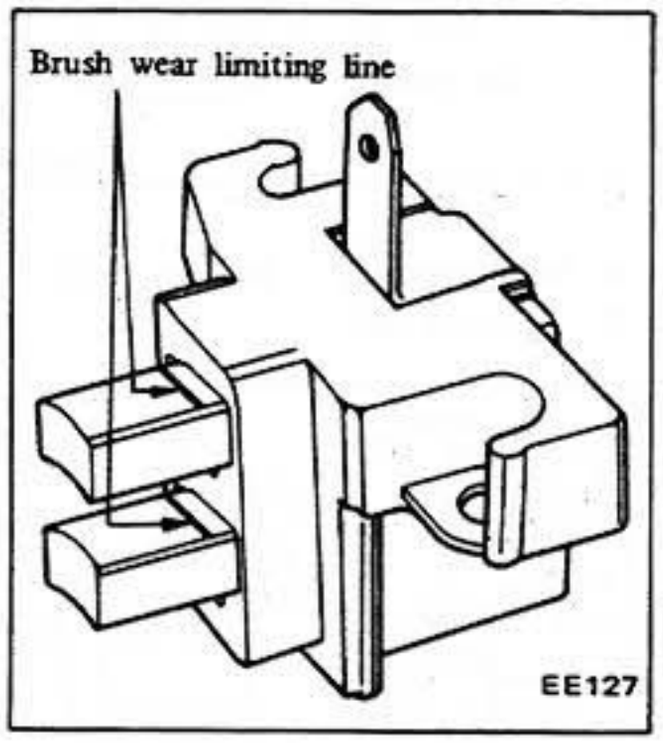


Brush

1. Check smooth movement of brush.
- Not smooth ... Check brush holder and clean.

2. Check brush for wear.

Min. brush length:
Gasoline engine
7.0 mm (0.276 in)
Diesel engine
6.0 mm (0.236 in)



- Less than the specified value ... Replace.

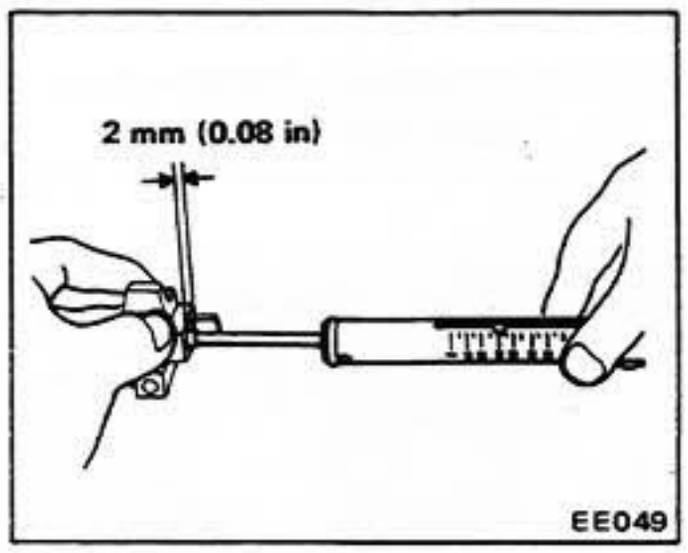
3. Check brush pig tail for damage.
- Damaged ... Replace.

4. Check brush spring pressure.

Measure brush spring pressure with brush projected approximately 2 mm (0.08 in) from brush holder.

Spring pressure:
Refer to S.D.S.

When brush is worn, pressure decreases approximately 0.196 N (20 g, 0.71 oz) per 1 mm (0.04 in) wear.



- Not in the specified value ... Replace.

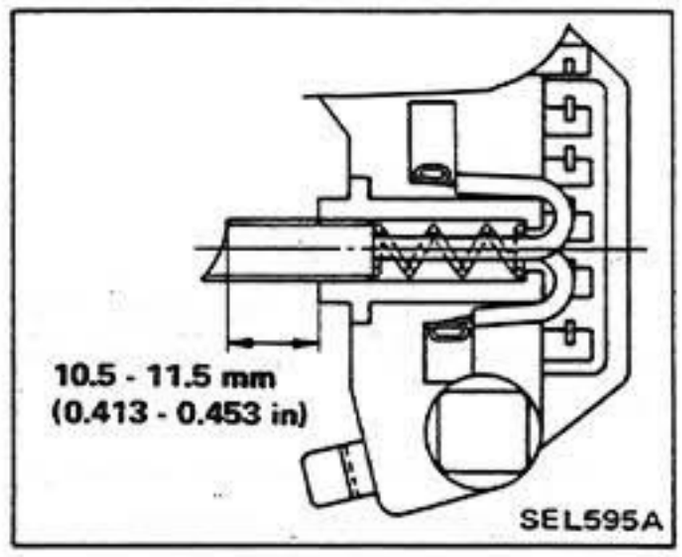
ASSEMBLY

Assemble alternator in the reverse order 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.

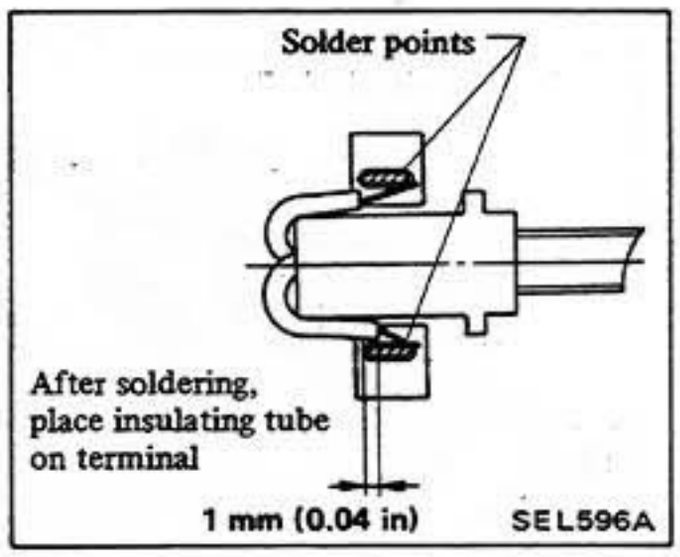
2. When soldering brush lead wire, observe the following (LT150, LT160, LR150 and LR160 type)

(1) Position brush so that it extends 11 mm (0.43 in) from brush holder.



(2) Coil lead wire 1.5 times around terminal groove. Solder outside of terminal.

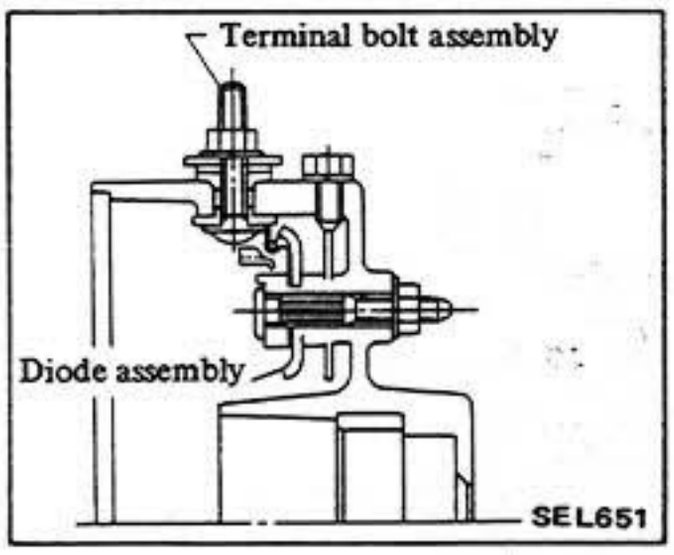
When soldering, be careful not to let solder adhere to insulating tube as it will weaken the tube and cause it to break.



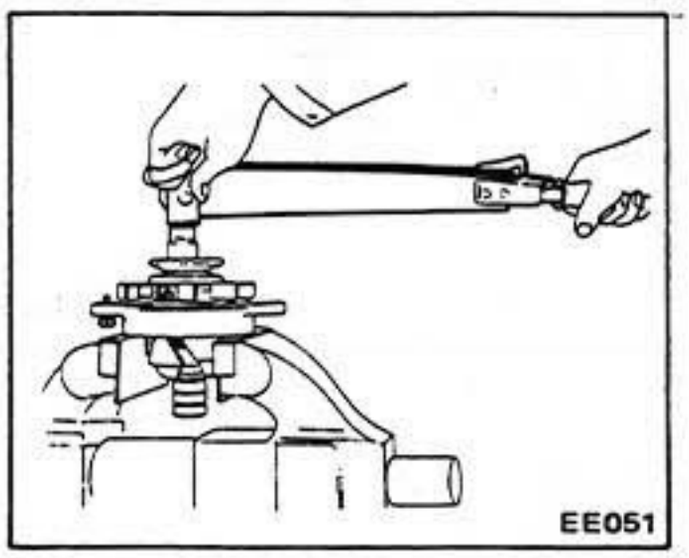
Ⓣ : **Brush holder**
3.1 - 3.9 N·m
(0.32 - 0.40 kg-m, 2.3 - 2.9 ft-lb)
Diode and IC regulator
3.1 - 3.9 N·m
(0.32 - 0.40 kg-m, 2.3 - 2.9 ft-lb)

Bearing retainer
3.1 - 3.9 N·m
(0.32 - 0.40 kg-m,
2.3 - 2.9 ft-lb)

2. When installing diode "A" terminal, install insulating bushing correctly. (LT225 type)



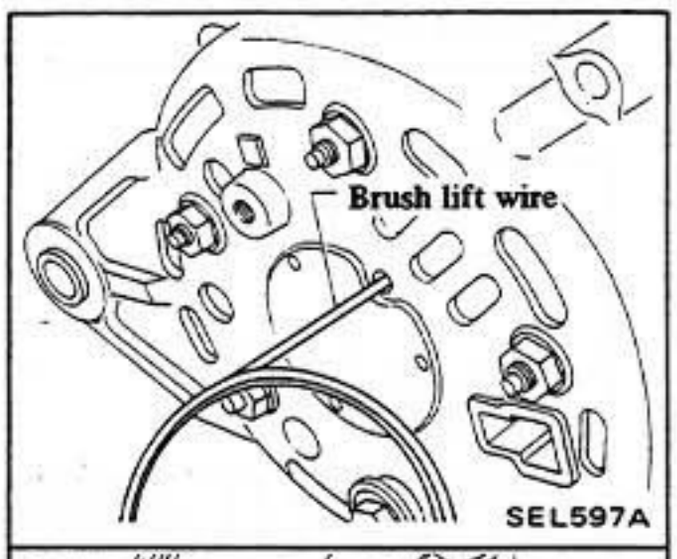
3. Tighten pulley nut and make sure that deflection of V-groove is proper.

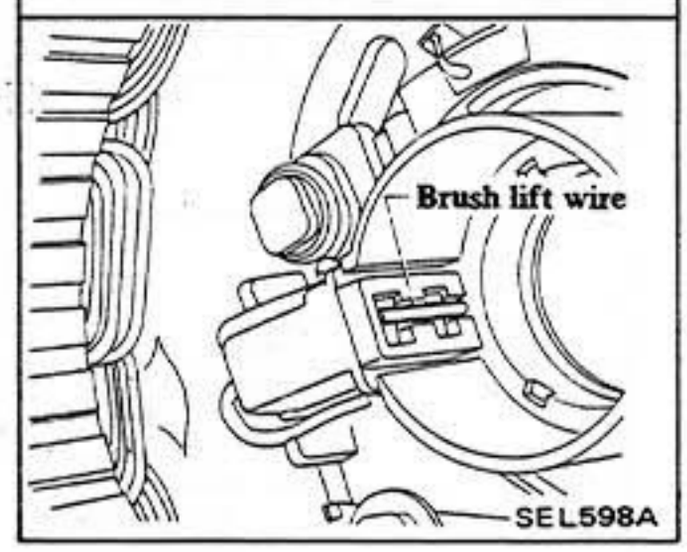


Ⓣ : Pulley nut
LT135
34 - 39 N·m
(3.5 - 4.0 kg-m,
25 - 29 ft-lb)
LT150, LT160, LR150 and LR160
39 - 59 N·m
(4.0 - 6.0 kg-m,
29 - 43 ft-lb)
LT225 and LR225
44 - 59 N·m
(4.5 - 6.0 kg-m,
33 - 43 ft-lb)

V-groove deflection:
0.3 mm (0.012 in)

4. Before installing front and rear sides of alternator, push brush up with fingers and retain brush, by inserting brush lift wire into brush lift hole from outside.





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

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

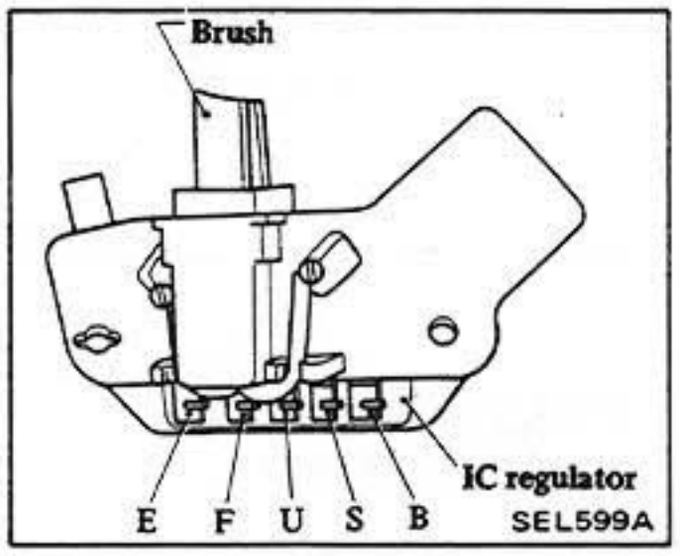
6. Tighten through bolts.

Ⓣ : Through bolts
3.1 - 3.9 N·m
(0.32 - 0.40 kg-m,
2.3 - 2.9 ft-lb)

IC VOLTAGE REGULATOR

DESCRIPTION

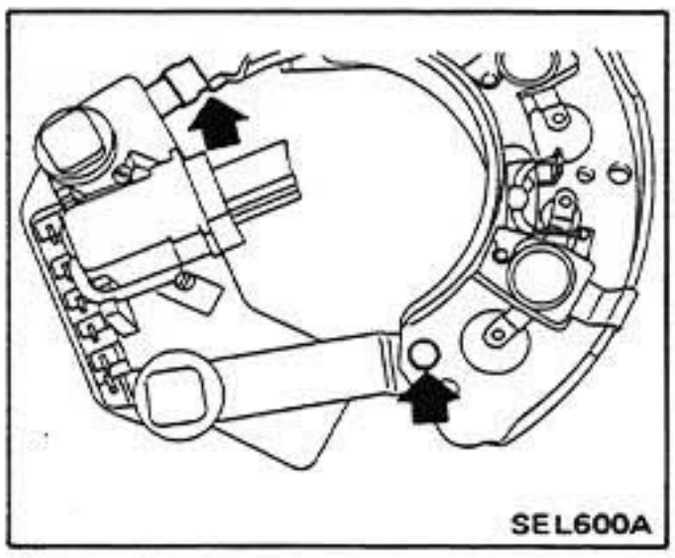
The regulator consists essentially of integrated circuits incorporating transistors. These transistors interrupt and admit current flow to the alternator rotor coil, thus maintaining its output voltage at a constant value. Unlike in a mechanical type regulator, an electronic relay employing transistors is utilized. These transistors are enclosed in a very compact, sealed case. On the charge warning lamp circuit, a diode monitors 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.



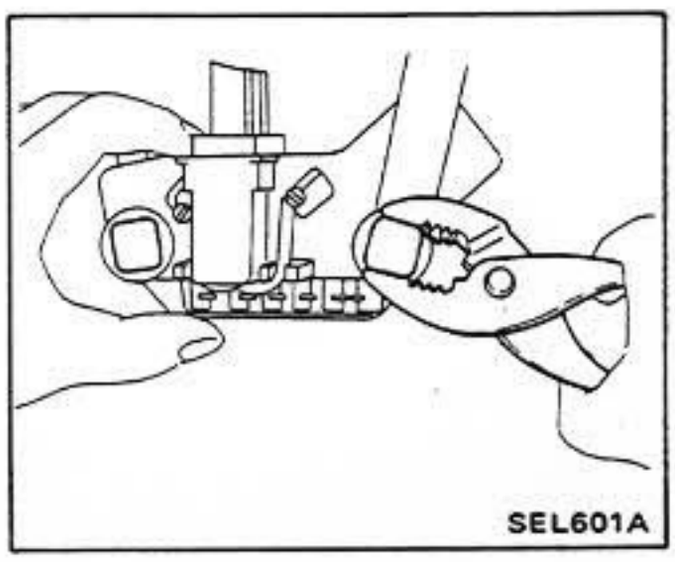
REPLACEMENT

Removal should be done only when IC regulator is being replaced.

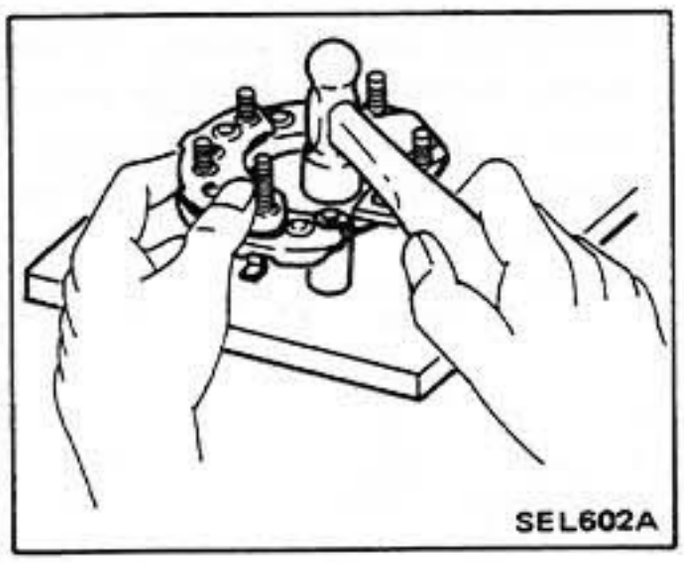
1. Remove rivet and solder.



2. Remove the terminal's solder and take out bolts.



3. When installing the regulator, reverse order of removal, noting the following.
(1) Put IC regulator on brush holder and press-fit bolts using hand press.
(2) Stake rivets using Tool.


SEL602A

VOLTAGE REGULATOR

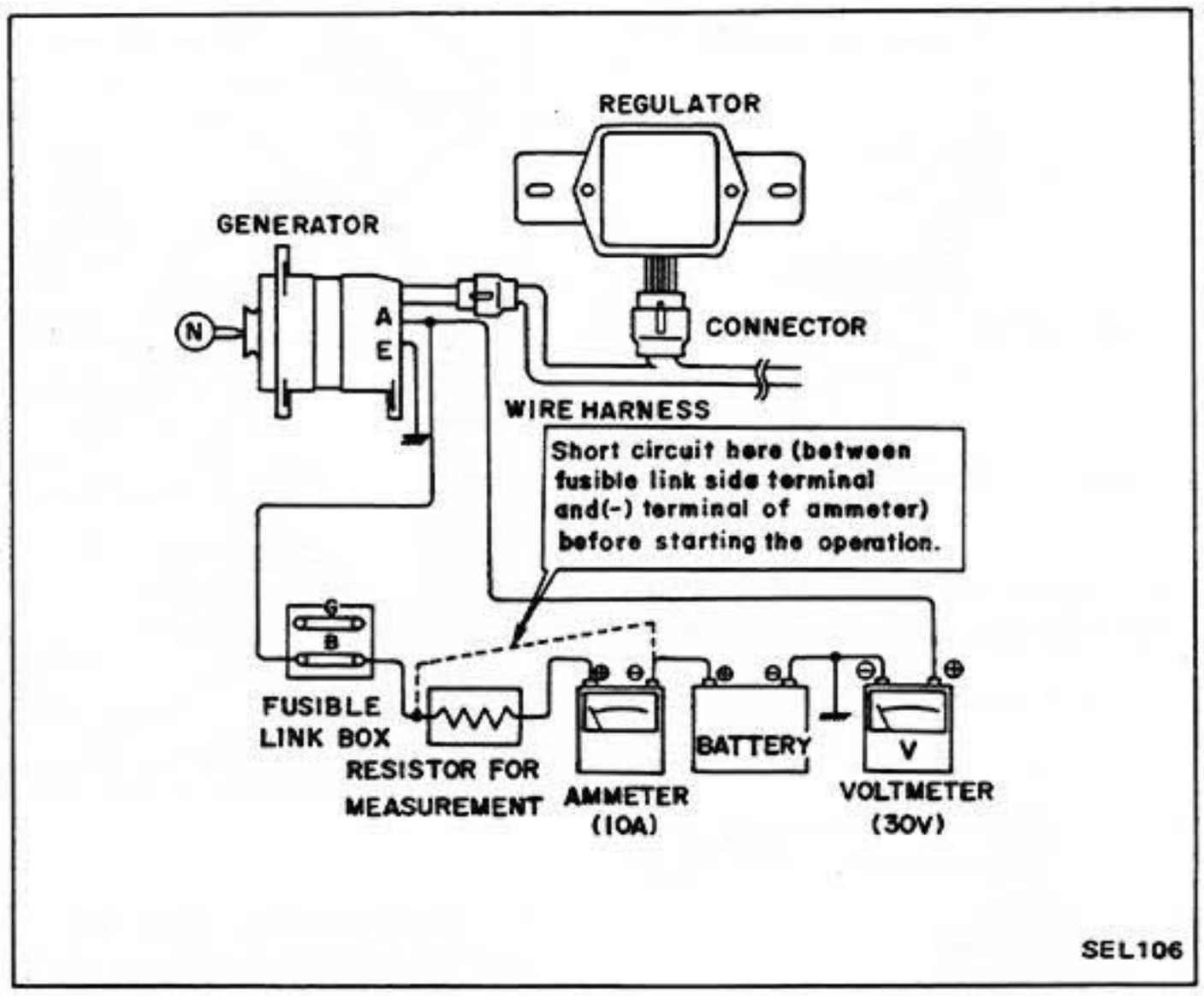
MEASUREMENT OF REGULATING VOLTAGE

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

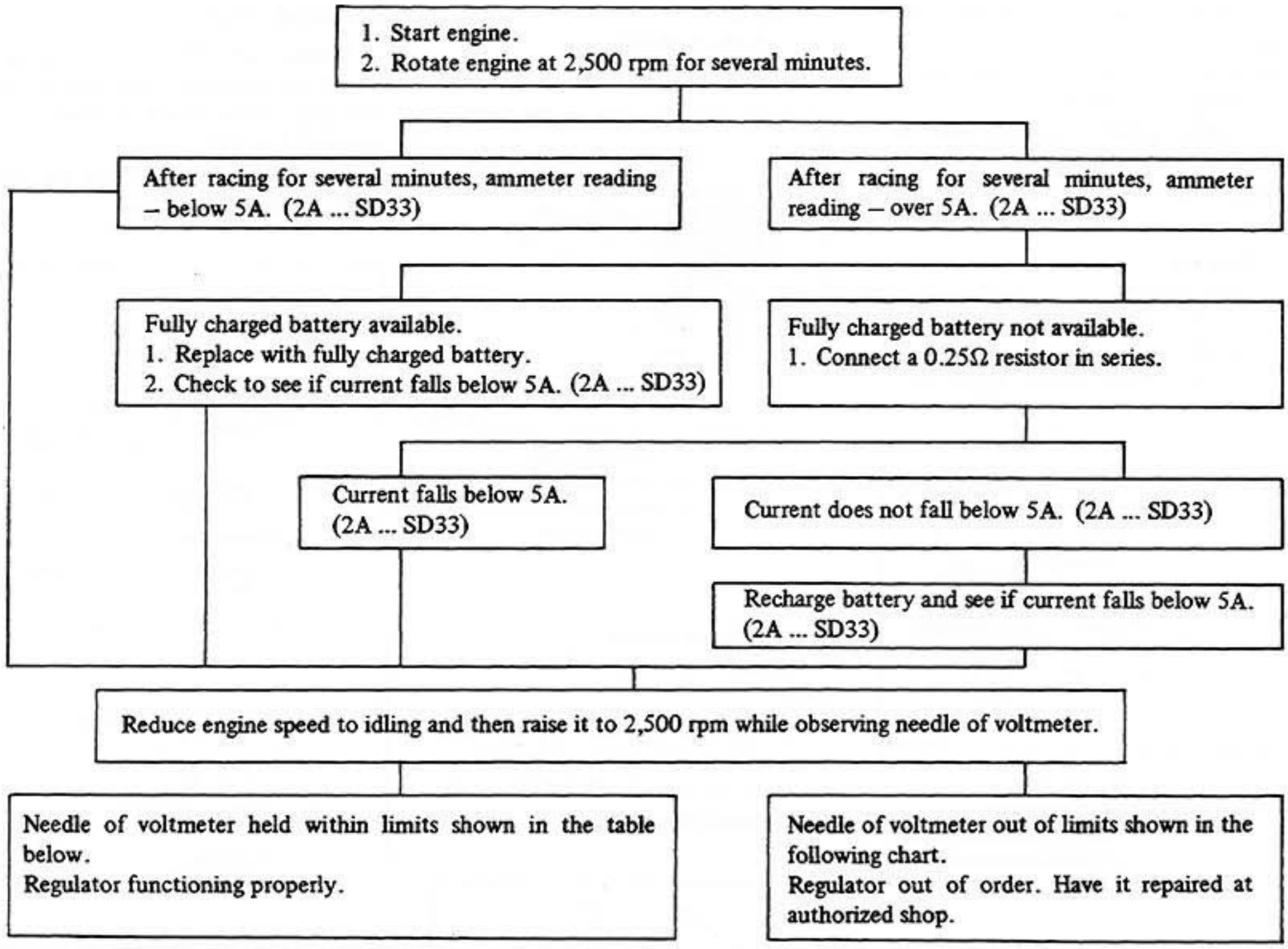
Check to be sure that all electrical loads such as lamps, air conditioner, radio, etc. are disconnected.

CAUTION:
Before starting engine, be sure to make short circuit with a cable as shown in figure.
Failure to follow this caution causes a damaged ammeter.

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



SEL106



Temperature °C (°F)	Voltage V	
	P40 and L28	SD33
–10 (14)	14.7 - 15.25	29.4 - 30.5
0 (32)	14.60 - 15.2	29.2 - 30.4
10 (50)	14.5 - 15.15	29.0 - 30.3
20 (68)	14.4 - 15.1	28.8 - 30.2
30 (86)	14.3 - 15.05	28.6 - 30.1
40 (104)	14.2 - 15.0	28.4 - 30.0

a. Do not measure voltage immediately after driving. Do this while regulator is cold.

b. To measure voltage, raise engine speed gradually from idling to rated speed.

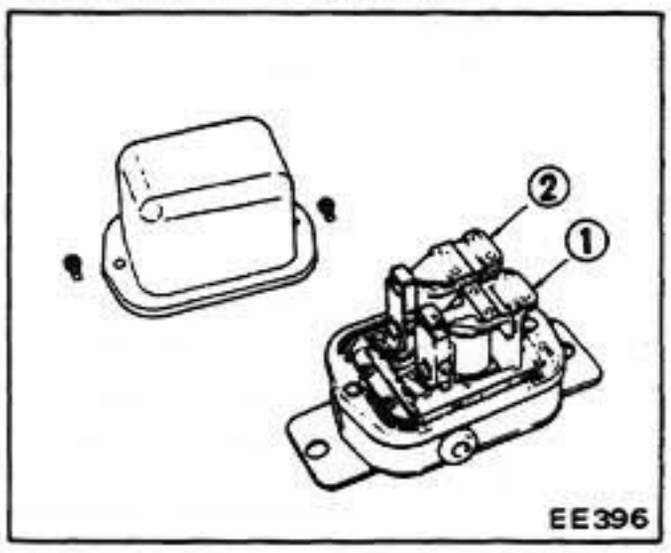
c. Voltage may be approximately 0.3V higher than the rated for two to three minutes after engine is started, or more specifically, when regulator becomes self-heated. Measurements should then be made within one minute after starting engine, or when regulator is cold.

d. The regulator is of a temperature-compensating type. Before measuring voltage, be sure to measure surrounding temperature.

ADJUSTMENT

Voltage regulator

Adjusting regulating voltage



1 Charge relay
2 Voltage regulator

1. Inspect contact surface.

Rough ... Lightly polish with sand paper (#500 or 600).

2. Measure each gap. Adjust core gap and point gap in that order. No adjustment is required for yoke gap.
3. Adjusting core gap

Loosen screw which is used to secure contact set on yoke, and move contact upward or downward properly.

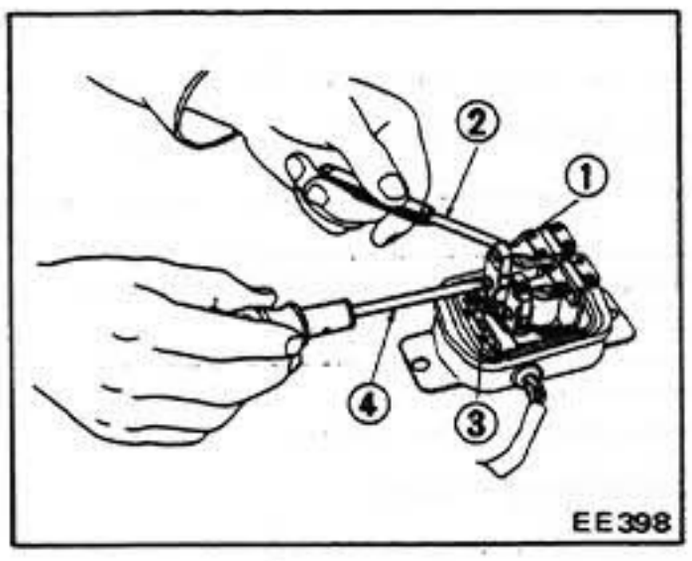
Core gap:

P40 and L28

0.6 - 1.0 mm (0.024 - 0.039 in)

SD33

0.8 - 1.2 mm (0.031 - 0.047 in)

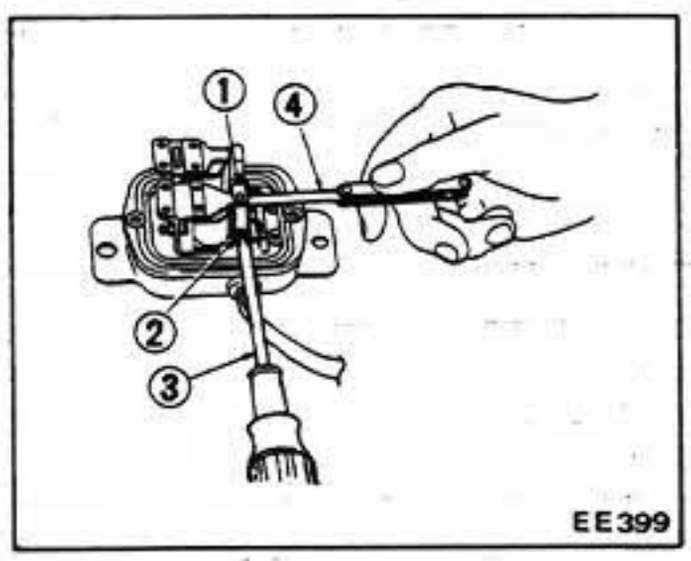


1 Contact set
2 Thickness gauge
3 4 mm (0.16 in) dia. screw
4 Crosshead screwdriver

SD33

0.45 - 0.55 mm

(0.018 - 0.022 in)

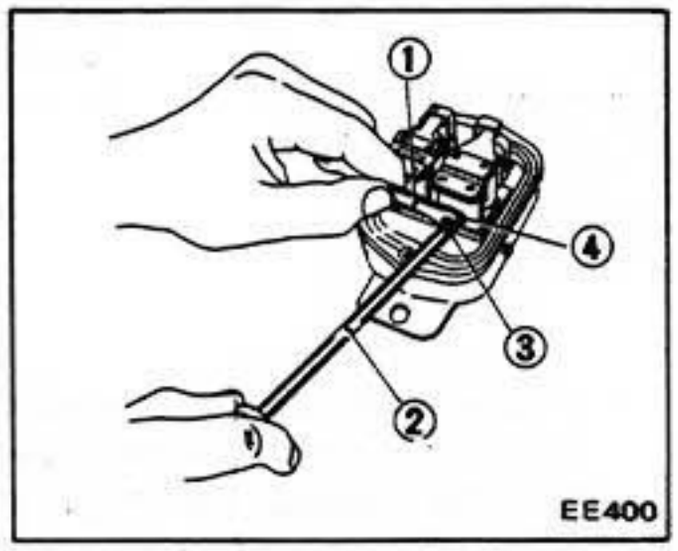


1 Thickness gauge
2 3 mm (0.12 in) dia. screw
3 Crosshead screwdriver
4 Upper contact

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.



1 Wrench
2 Crosshead screwdriver
3 Adjusting screw
4 Lock nut

4. Adjusting point gap

Loosen screw used to secure upper contact, and move upper contact upward or downward adequately.

Point gap:

P40 and L28

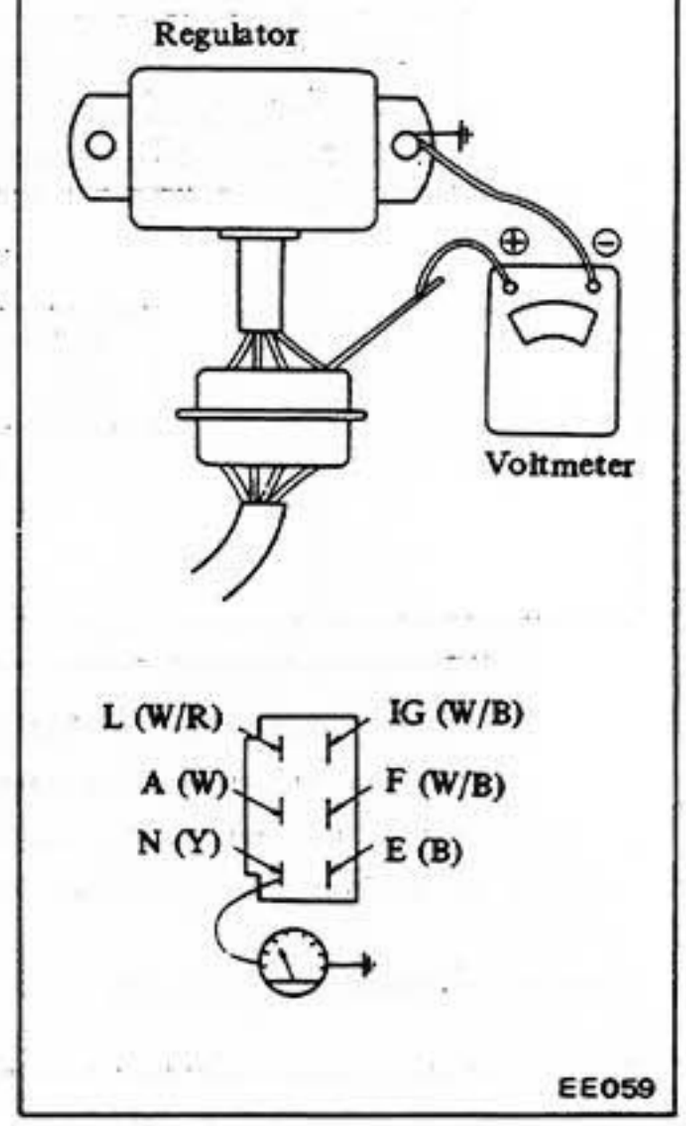
0.35 - 0.45 mm

(0.014 - 0.018 in)

Charging relay

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

Use a DC voltmeter, and set up a circuit as shown in figure.



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

0 Volt	Below 5.2 Volts (10.4 Volts ... SD33)	Over 5.2 Volts (10.4 Volts ... SD33)	Over 5.2 Volts (10.4 Volts ... SD33)
1. Check for continuity between "N" terminals of regulator and alternator. 2. Alternator circuit defective if continuity exists.	(Pilot lamp remains lit.) 1. Check fan belt tension. 2. If correct, remove regulator and adjust as necessary.	(Pilot lamp does not light.) Pilot lamp relay assembly is in good condition.	(Pilot lamp remains lit.) Pilot lamp relay coil or contact points out of order. Replace regulator.

SERVICE DATA AND SPECIFICATIONS

ALTERNATOR (Except for Australia)

Area		General areas					Europe		
Model		LT135-68	LT150-102	LT225-60	LT150-121	LT160-87	LR150-132	LR225-65B	LR160-82
Applied engine model		P40		SD33	L28		P40	SD33	L28
Nominal rating	V-A	12 - 35	12 - 50	24 - 25	12 - 50	12 - 60	12 - 50	24 - 25	12 - 60
Ground polarity		Negative							
Minimum revolution under no load	rpm	Less than 1,000	Less than 950	Less than 1,000			Less than 1,000		Less than 1,000
		When 14 volts is applied		When 28 volts is applied	When 14 volts is applied			When 26 volts is applied	When 14 volts is applied
Hot output current	A/rpm/V	More than 27.5/2,500/14 More than 35/5,000/14	More than 17/1,300/14 More than 42/2,500/14 More than 50/5,000/14	More than 25/5,000/28	More than 40/2,500/14 More than 50/5,000/14	More than 50/2,500/14 More than 60/5,000/14	More than 15/1,300/14 More than 42/2,500/14 More than 50/5,000/14	More than 25/5,000/27	More than 50/2,500/14 More than 60/5,000/14
Pulley ratio		2.17		1.86	Check on pulley ratio as necessary, as it varies with each model				2.09
Minimum length of brush	mm (in)	7.0 (0.276)		6.0 (0.236)	7.0 (0.276)		7.0 (0.276)	6.0 (0.236)	7.0 (0.276)
Brush spring pressure	N (g, oz)	2.501 - 3.383 (255 - 345, 8.99 - 12.17)		3.334 - 4.511 (340 - 460, 11.99 - 16.22)	2.501 - 3.383 (255 - 345, 8.99 - 12.17)		2.501 - 3.383 (255 - 345, 8.99 - 12.17)	3.334 - 4.511 (340 - 460, 11.99 - 16.22)	2.501 - 3.383 (255 - 345, 8.99 - 12.17)
Slip ring outer diameter	mm (in)	31.6 (1.244)			More than 31.6 (1.244)		31.6 (1.244)		More than 31.6 (1.244)

ALTERNATOR (For Australia)

Type		LT135-68	LT150-102	LT225-60	LT160-39B
Applied model		P40		SD33	L28
Nominal rating	V-A	12-35	12-50	24-25	12-60
Ground polarity		Negative			
Minimum revolution under no load (When 14 volts is applied)	rpm	Less than 1,000	Less than 950	Less than 1,000 (When 28 volts applied)	Less than 1,000
Hot output current	A/rpm/V	More than 27.5/2,500/14 More than 35/5,000/14	More than 17/1,300/14 More than 42/2,500/14 More than 50/5,000/14	More than 25/5,000/28	More than 50/2,500/14 More than 60/5,000/14
Pulley ratio		2.17		1.86	Check on pulley ratio as necessary as it varies with model
Minimum length of brush	mm (in)	7.5 (0.295)		6 (0.24)	More than 7.5 (0.295)
Brush spring pressure	N (g, oz)	2.942 (300, 10.58)		3.531 (360, 12.70)	2.501 - 3.387 (255 - 345, 8.99 - 12.17)
Slip ring outer diameter	mm (in)	31.6 (1.244)			More than 30 (1.18)

VOLTAGE REGULATOR

Model		TL1Z-61D	TL2Z-26
Applied engine model		P40 and L28	SD33
Regulator voltage [At 20°C (68°F)] (With fully charged battery)	(V)	13.8 - 14.8	27.7 - 29.7
Voltage coil resistance [At 20°C (68°F)]	(Ω)	10.3	51.5
Rotor coil inserting resistance	(Ω)	10	120
Voltage coil series resistance	(Ω)	31	107
Smoothing resistance	(Ω)	40	150
Core gap	mm (in)	0.6 - 1.0 (0.024 - 0.039)	0.8 - 1.2 (0.031 - 0.047)
Point gap	mm (in)	0.35 - 0.45 (0.014 -0.018)	0.45 - 0.55 (0.018 - 0.022)
Charge relay Release voltage at "N" terminal	(V)	4.2 - 5.2	8.4 - 10.4
Voltage coil resistance	(Ω)	31.9	104
Core gap	mm (in)	0.8 - 1.0 (0.031 - 0.039)	0.6 - 0.8 (0.024 - 0.031)
Point gap	mm (in)	0.4 - 0.6 (0.016 - 0.024)	0.4 - 0.6 (0.016 - 0.024)

IGNITION SYSTEM

CAUTION: Before starting to work, be sure to turn ignition switch "OFF" and then disconnect battery ground cable.

DESCRIPTION

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

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

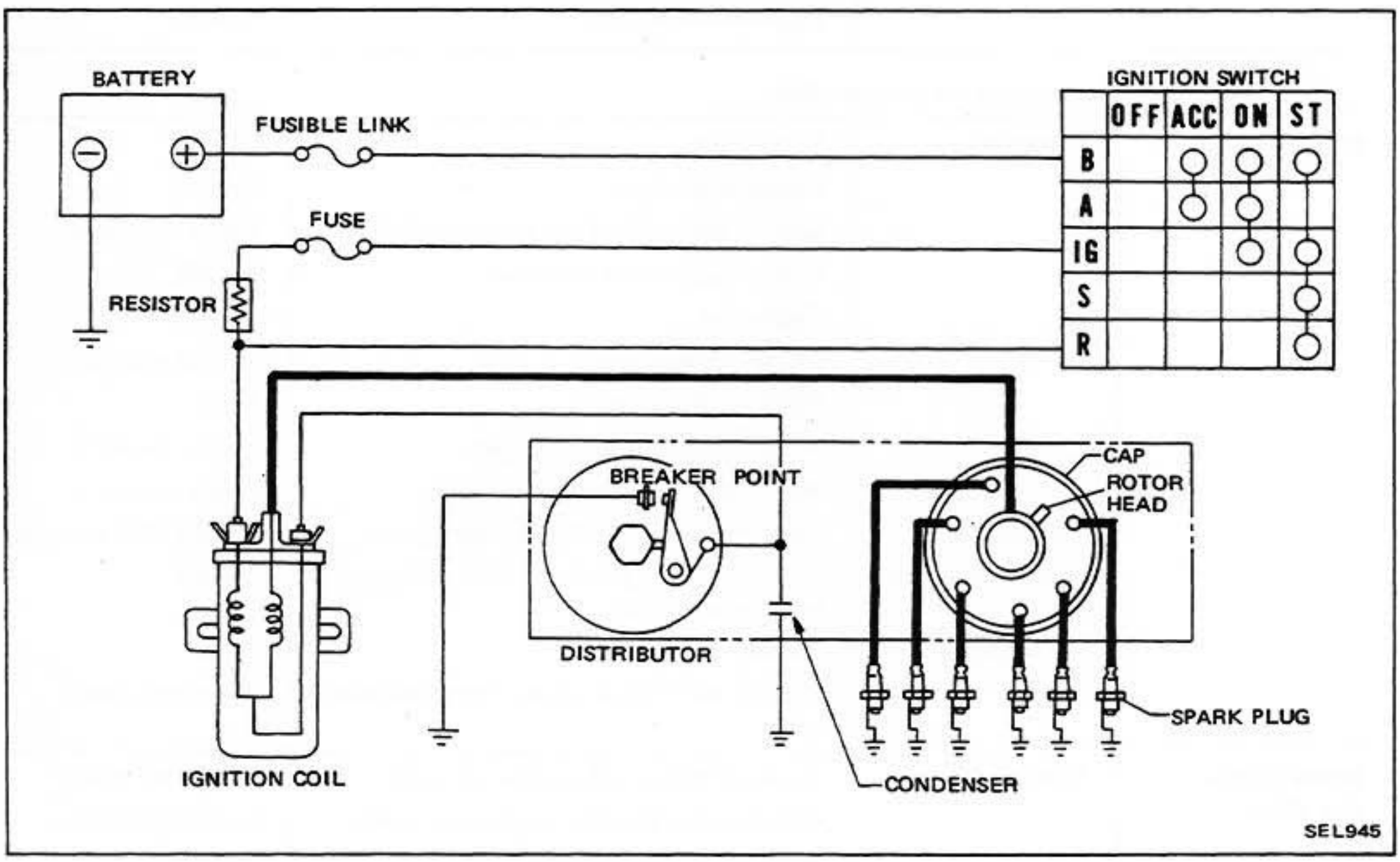
Low voltage current is supplied by the battery or alternator and flows through the primary circuit. It consists of the ignition switch, resistor, primary winding of the ignition coil, distributor contact points, condenser and all connecting low tension wiring.

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

When the ignition switch is turned on and the distributor contact points are closed, the primary current flows through the primary winding of the coil and through the contact points to ground.

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

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



IGNITION SYSTEM TROUBLE-SHOOTING

DIAGNOSTIC TABLE

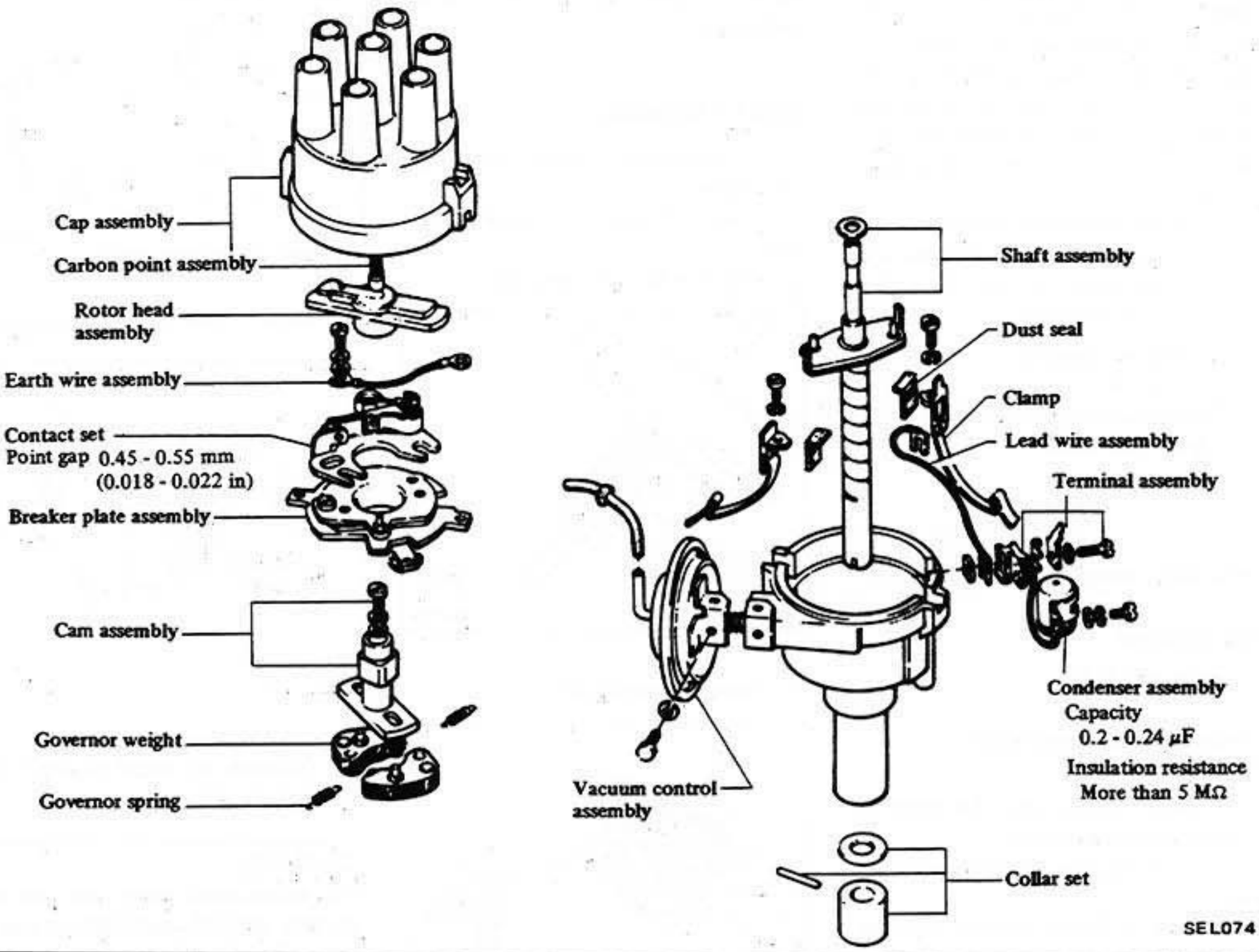
1. When engine does not start.
   If there is no trouble in fuel system, ignition system should be checked.

Condition	Trouble location	Probable cause	Corrective action
No sparks at all	Distributor	Damaged insulation of condenser.	Replace.
		Breakage of lead-wire on low tension side.	Repair.
		Door insulation of cap and rotor head.	Replace.
		Point gap wider than specification.	Adjust.
	Ignition coil	Wire breakage or short circuit of coil.	Replace with a new one.
	High tension cable	Wire coming off.	Repair.
		Faulty insulation.	Replace.
1 to 2 mm (0.04 to 0.08 in) or irregular.	Distributor	Point gap too wide.	Correct.
		Oil sticking on point.	Clean.
		Point burnt too much.	Replace.
Spark length More than 6 mm (0.24 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.

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

Engine misses.	Distributor	Dirty point.	Clean.
		Improper point gap.	Correct.
		Leak of electricity of cap and rotor head.	Repair or replace.
		Faulty insulation of condenser.	Replace.
		Faulty arm.	Oil shaft.
		Faulty spring of arm.	Replace assembly.
		Breakage of lead wire.	Replace.
		Worn out or shaky breaker plate.	Replace assembly.
		Worn out or shaky distributor shaft.	Replace assembly.
	Ignition coil	Layer short circuit or inferior quality coil.	Replace with good one.
	High tension cable	Deterioration of insulation with consequent leak of electricity.	Replace.
	Spark plugs	Fouled.	Clean.
		Leak of electricity at upper porcelain insulator.	Repair or replace.
Engine knocks very often.	Distributor	Improper ignition timing (too advance).	Correct the fitting.
		Coming off or breakage of governor spring.	Correct or replace.
		Worn pin or hole governor.	Replace.
	Spark plugs	Burnt too much.	Replace.
Engine does not give enough power.	Distributor	Improper ignition timing (too retarded).	Correct the fitting.
		Improper functioning governor.	Replace assembly.
		Foreign particles stuck in point gap.	Clean.
	Spark plugs	Fouled.	Clean.

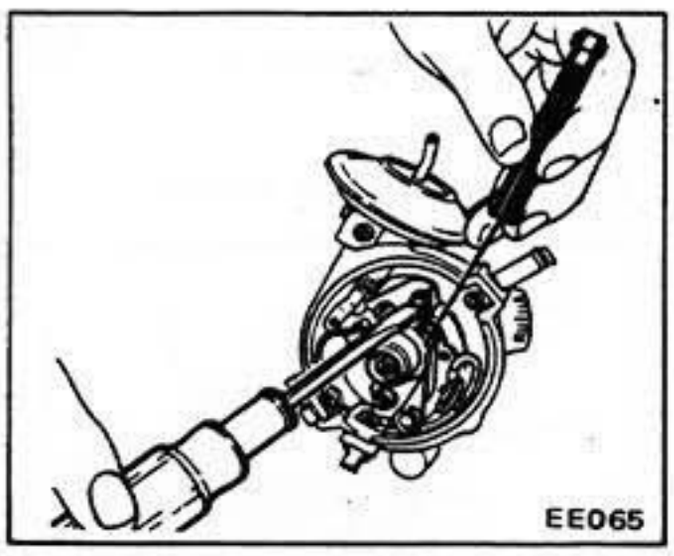
DISTRIBUTOR



CHECKING AND ADJUSTMENT

Cap and rotor head

Check cap and rotor head for dust, carbon deposits and cracks.



Contact point

1. Adjust point gap.

Loosen point screw and adjust gap with a gap gauge.

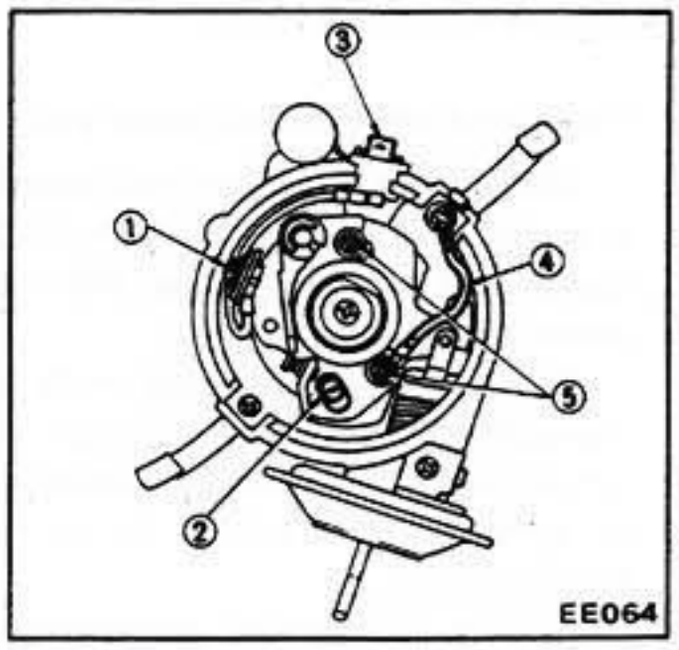
Point gap:
0.45 - 0.55 mm
(0.018 - 0.022 in)

2. Check the point surface.

Take off any irregularities with fine sandpaper (No. 500 or 600) or with oil stone.

3. Removal of contact point

(1) Disconnect primary lead wire from contact set.
(2) Remove contact set fixing screws.
(3) Remove contact set.



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

Condenser

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

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

Condenser capacity:
0.2 - 0.24 μF
Condenser insulation resistance:
More than 5MΩ

Advance mechanism

Specifications

Refer to S.D.S.

Vacuum advance mechanism mechanical parts

1. Check vacuum inlet for signs of leakage at its connection.
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 breaker plate as an assembly.

Centrifugal advance mechanical parts

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

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

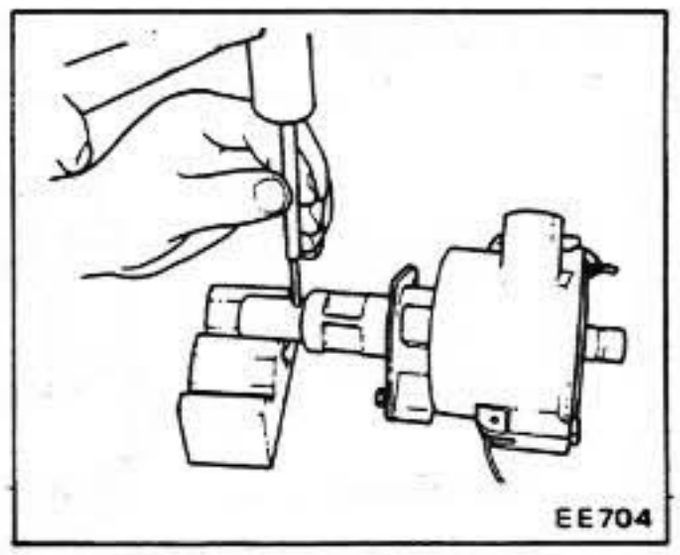
In case of improper characteristic, take off contact breaker assembly part and check closely cam assembly, governor weight, shaft and governor spring, etc.

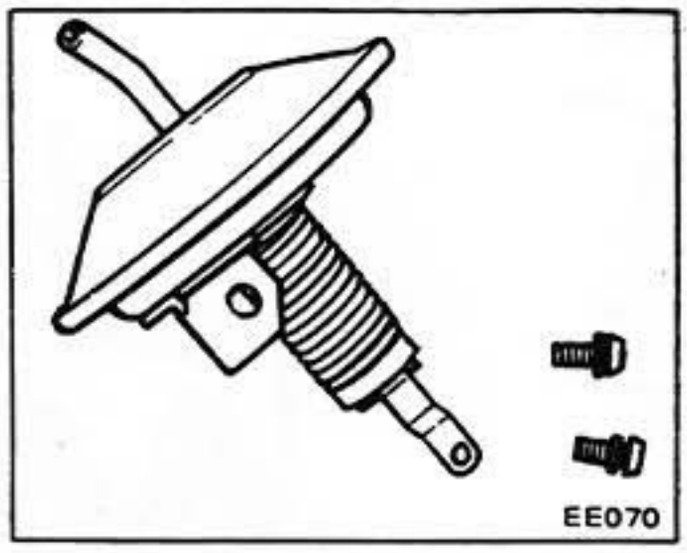
In case centrifugal advance mechanical part is reassembled, be sure to check advance characteristic with distributor tester.

DISASSEMBLY

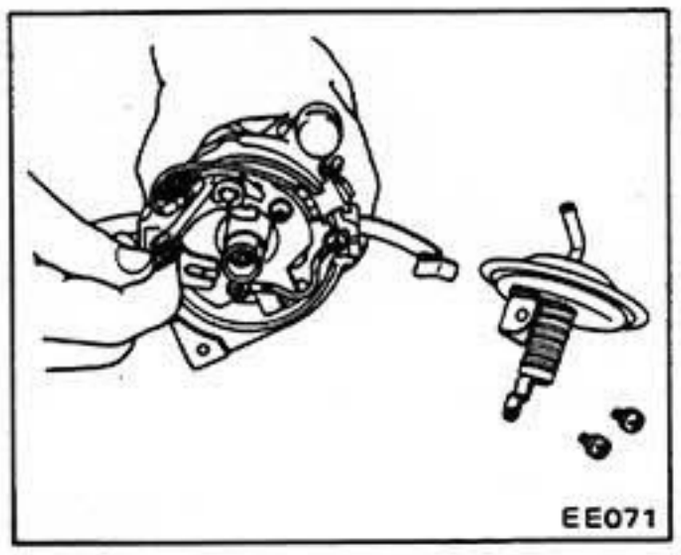
To disassemble, follow the procedure below.

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

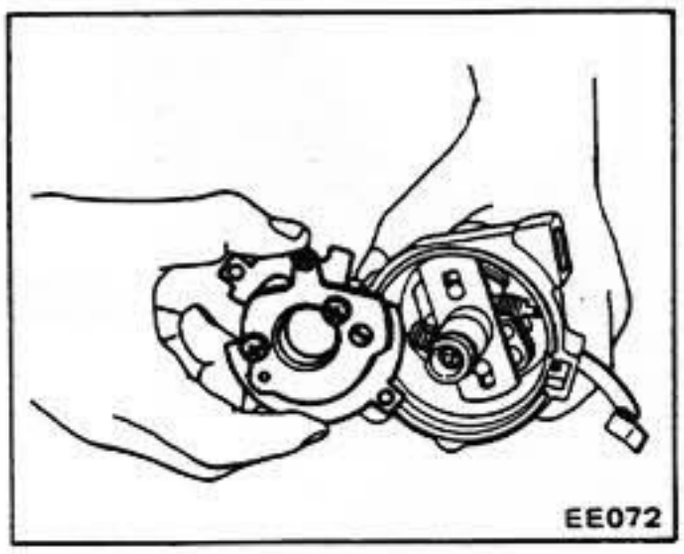

EE704


EE070

3. Remove contact set.

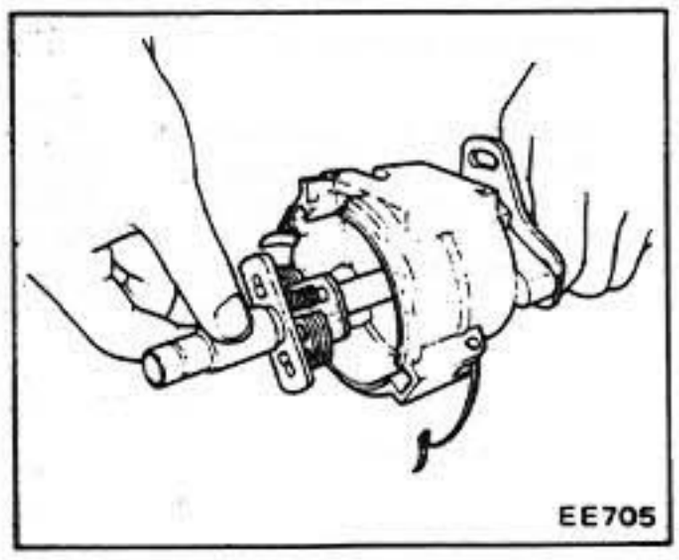

EE071

4. Remove contact breaker.


EE072

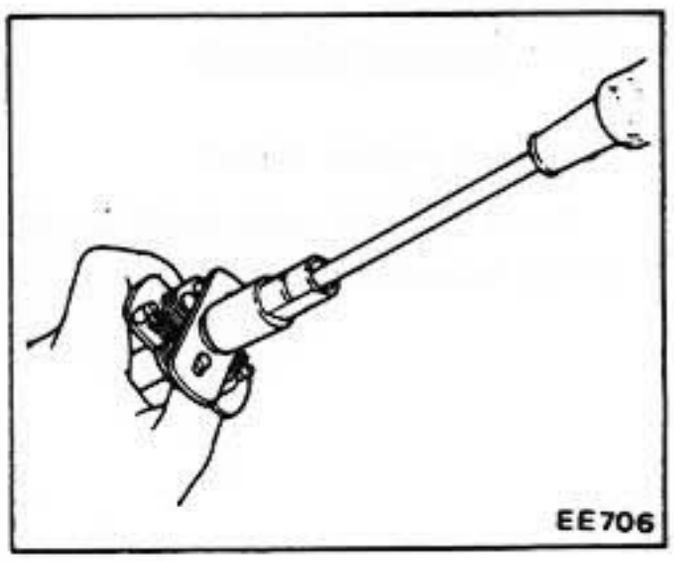
Be careful not to lose steel balls between breaker spring and breaker plate.

5. Pull knock pin out and disconnect collar.
6. Remove the entire rotating parts.


EE705

7. Remove set screw at shaft head, and remove cam.

CAUTION:
Put match mark across cam and shaft so that original combination can be restored at assembly.


EE706

8. Remove governor weight and spring.

CAUTION:
Be careful not to stretch or deform governor spring.

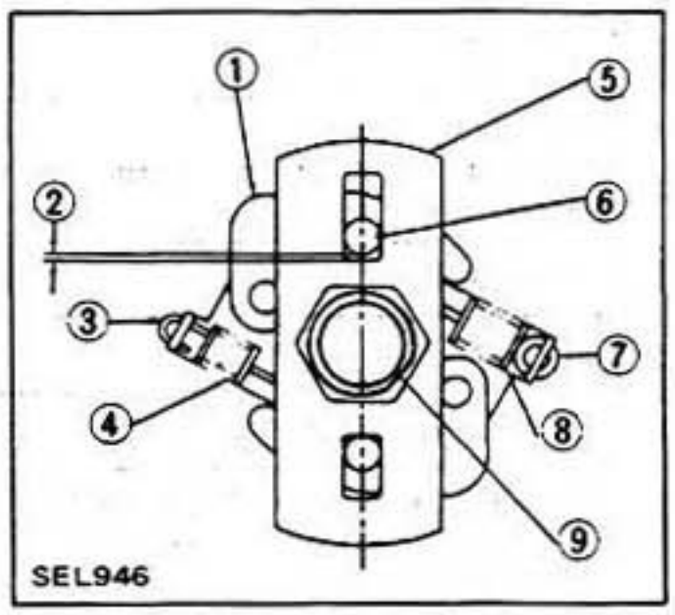
Apply grease to governor weight.

ASSEMBLY

To assemble, reverse the order of disassembly.

Carefully observe the following instructions.

1. Rotor head positioning tip at cam is set on governor spring circular hook side.
2. Weight pin for governor spring "A" with circular hook fits in long rectangular hole.
3. Check to be sure that weight pin on spring "A" is in slit in cam plate with a clearance between the two at beginning and end of governor operation. Meanwhile, weight pin on opposite side fits in short rectangular hole.
4. With unit assembled, check to be sure that driven slit and rotor positioning tip are set in the same direction.
5. Apply grease to top of cam assembly as required.
6. After assembly, check operation of governor before installing it on engine.
7. Ignition timing should be tested with unit mounted on engine.



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

SERVICE DATA AND SPECIFICATIONS

DISTRIBUTOR

Model		D610-58	D610-57	D609-62
Applied engine model		P40		L28
Firing order		1-5-3-6-2-4		
Rotation direction		Counterclockwise		
Dwell angle at point gap 0.5 mm (0.020 in)	degree	35° - 41°		
Point gap	mm (in)	0.45 - 0.55 (0.018 - 0.022)		
Cap insulation resistance	MΩ	More than 50		
Rotor head insulation resistance	MΩ	More than 50		
Cap carbon point length	mm (in)	More than 12 (0.47)		More than 10 (0.39)
Vacuum advance [Distributor degree/distributor kPa (mbar, mmHg, inHg)]		0°/13.3 (133, 100, 3.94) 4.1°/26.7 (267, 200, 7.87) 6°/35.3 (353, 265, 10.43)	0°/33.3 (333, 250, 9.84) 2.15°/36.99 (369.9, 277.5, 10.925) 3.5°/40.0 (400, 300, 11.81)	0°/20.0 (200, 150,5.91) 5°/36.0 (360, 270, 10.63) 9°/53.3 (533, 400, 15.75)
Centrifugal advance [Distributor degree/distributor rpm]		0°/450 10°/1,250	0°/490 10°/1,790	0°/550 9°/1,200

IGNITION COIL

Model		HP5-10E	CIZ-200	HP5-13E10	C6R-206
Applied model		Except Europe model		Europe model	
Primary voltage	V	12			
Spark gap	mm (in)	More than 7 (0.28)			
Primary resistance [At 20°C (68°F)]	Ω	1.25 - 1.76	3.42 - 4.18	1.28 - 1.56	1.35 - 1.65
Secondary resistance [At 20°C (68°F)]	KΩ	6.9 - 10.3	6.4 - 9.6	7.23 - 9.78	6.8 - 10.2
Ballast resistor	Ω	–		1.6	

SPARK PLUG

Applied model		Except Europe model		Europe model	
Applied engine model		P40	L28	P40	L28
Model		B-5ES, L46W	BP6ES, L45PW	BPR5ES	BPR6ES
Size (Screw dia. x reach)	mm (in)	14 x 19 (0.55 x 0.75)			
Plug gap	mm (in)	0.7 - 0.8 (0.028 - 0.031)	0.8 - 0.9 (0.031 - 0.035)	0.7 - 0.8 (0.028 - 0.031)	0.8 - 0.9 (0.031 - 0.035)

AUTO-GLOW SYSTEM (Diesel engine)

CAUTION: Before starting to work, be sure to turn ignition switch "OFF" and then disconnect battery ground cable.

DESCRIPTION

The auto-glow plug system is designed to control the preheating time of the glow plugs automatically by monitoring the engine coolant and by means of the timer.

1. Starting switch "ON"

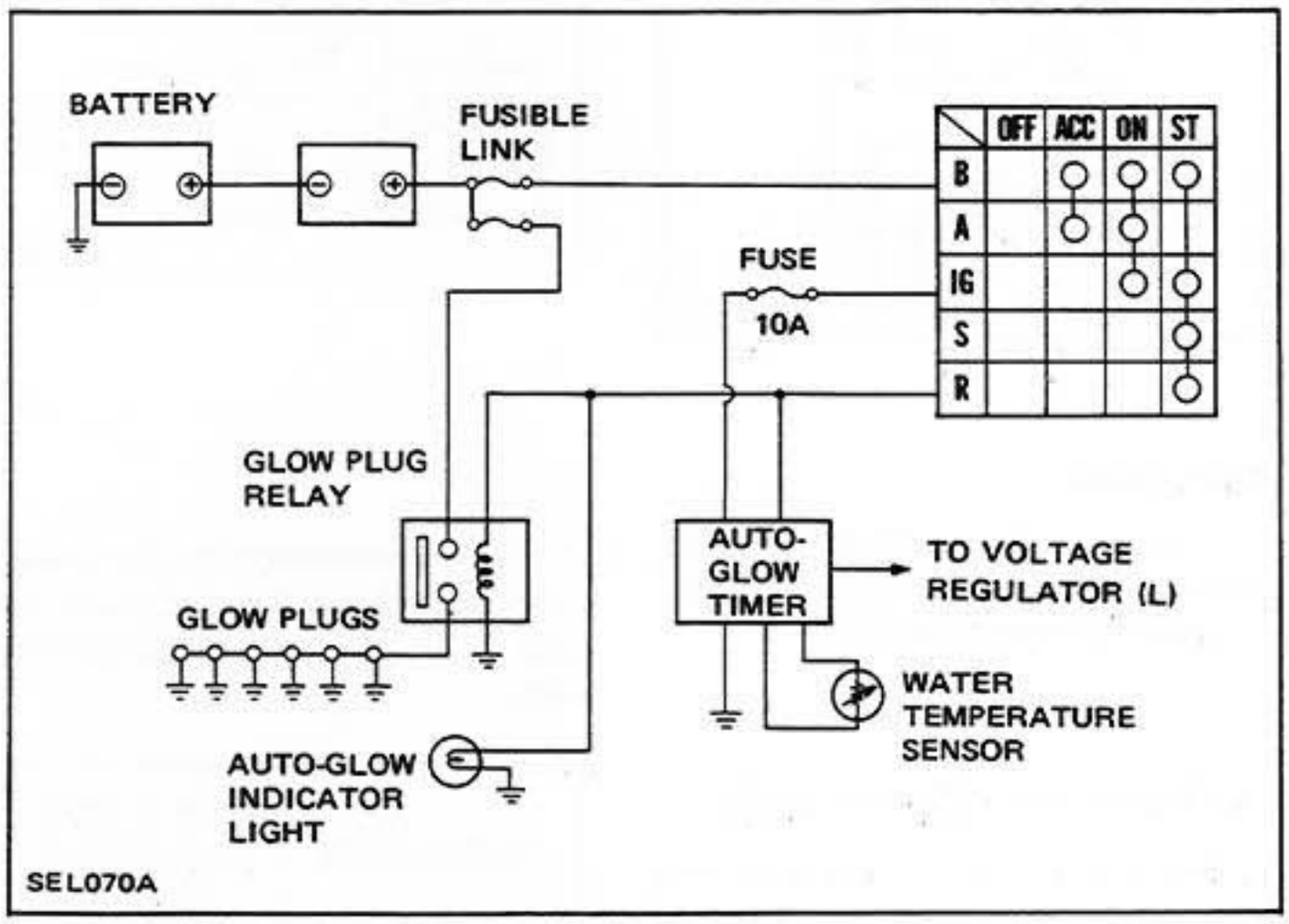
The glow plugs are automatically preheated by means of the timer and at the same time the auto-glow indicator lamp comes on. After the glow plugs are heated sufficiently, the lamp goes out.

2. Starting switch "START"

After the engine starts, the timer stops due to a signal from the charging circuit of the voltage regulator.

3. When preheating the glow plugs again.

When preheating the glow plugs again, place the starting switch to the "ACC" or "OFF" position and then place it to the "ON" position. This activates the timer again to preheat the glow plugs for a period of time specified by the coolant temperature.



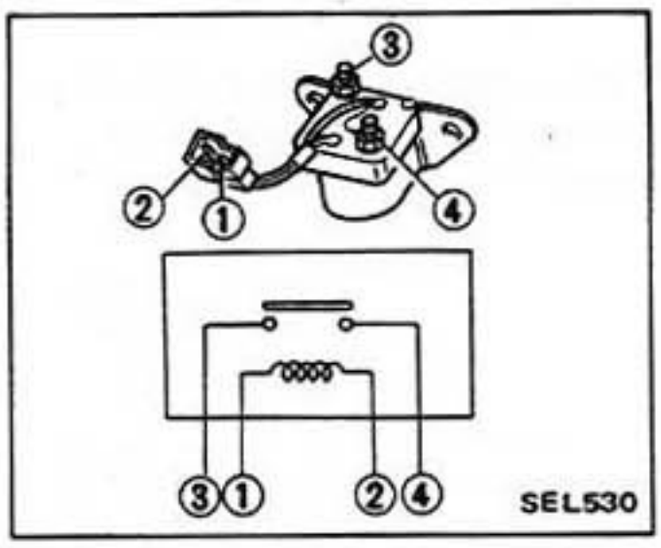
AUTO-GLOW SYSTEM TROUBLE-SHOOTING

Condition	Probable cause	Corrective action
Starting SW "ON"		
Auto-glow indicator light does not come on.	Burned bulb.	Replace.
	Faulty auto-glow timer or water temperature sensor.	Replace.
Auto-glow indicator light does not go out within specified length of time.	Faulty auto-glow timer or water temperature sensor.	Replace.
Glow plug indicator does not glow.	Faulty glow plug indicator.	Replace.
	Faulty glow relay II.	Replace.
	Faulty auto-glow timer or water temperature sensor.	Replace.
Glow plug indicator glows.		
1) Glow plug glows red prematurely (before auto-glow indicator light goes out).	Shorted glow plug/glow plug circuit.	Replace.
2) Glow plug does not glow red (before auto-glow indicator light goes out).	Open glow plug circuit or low current flow.	Replace.

Engine	Time required for light to go out after turning on.
Engine hot	about 1 sec.
Engine cold	about 30 sec.

REMOVAL AND INSPECTION

GLOW PLUG RELAY

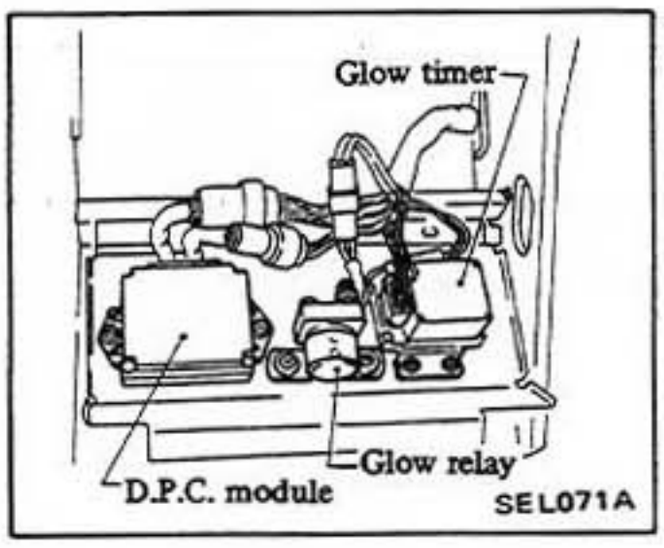


SEL530

Inspection

There must be continuity between terminals ③ and ④ when 12 volts d.c. is applied between ① and ②.

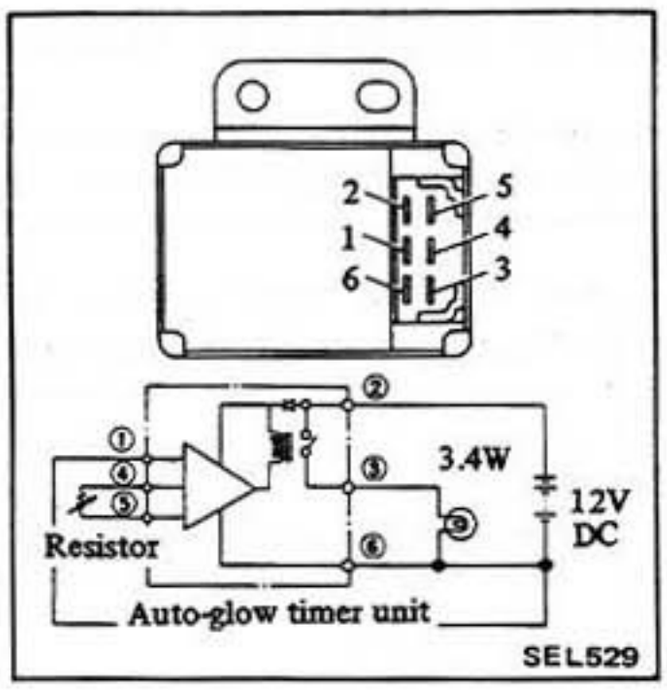
AUTO-GLOW TIMER UNIT



SEL071A

Inspection

1. Connect lead wires as shown.



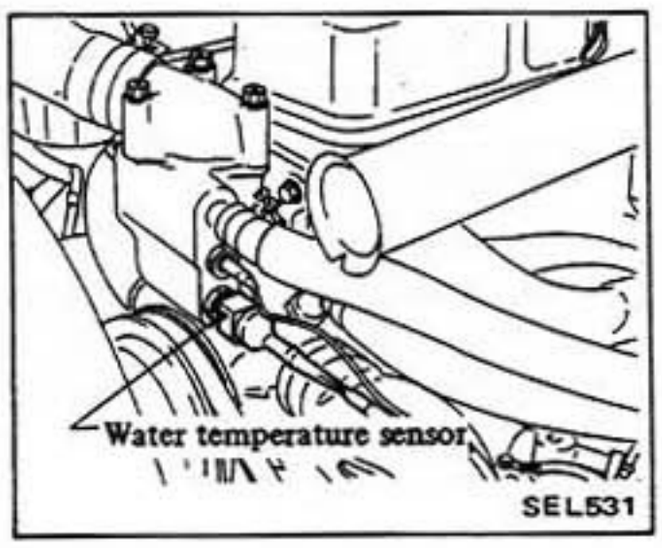
SEL529

2. Insert following resistors between terminals ④ and ⑤, and make sure that lamp goes out within specified time.

Resistor (KΩ)	Time at which lamp goes out (seconds)
More than 6.7	30 - 48
2.5	11 - 20
Less than 0.8	Less than 5

3. Insert a resistor of more than 6.7 kilo ohms between terminals ④ and ⑤, and make sure that lamp goes out immediately after disconnecting terminal ①.

WATER TEMPERATURE SENSOR

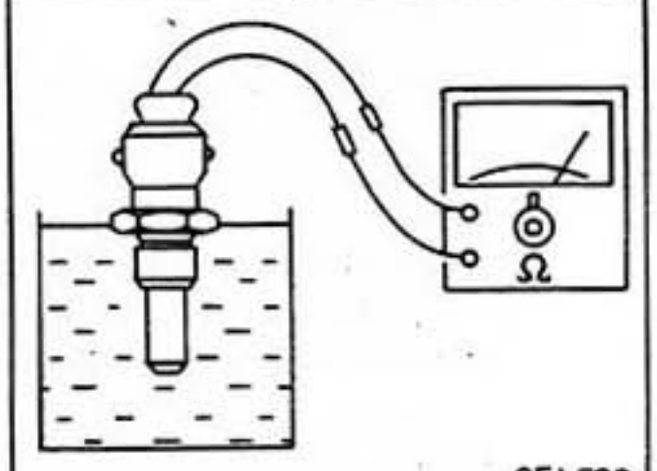


SEL531

Inspection

Measure resistance to temperature as shown.

Temperature °C (°F)	Resistance kΩ
10 (50)	32.5 - 41.5
20 (68)	22.5 - 27.5
50 (122)	7.4 - 9.4
80 (176)	2.9 - 3.6



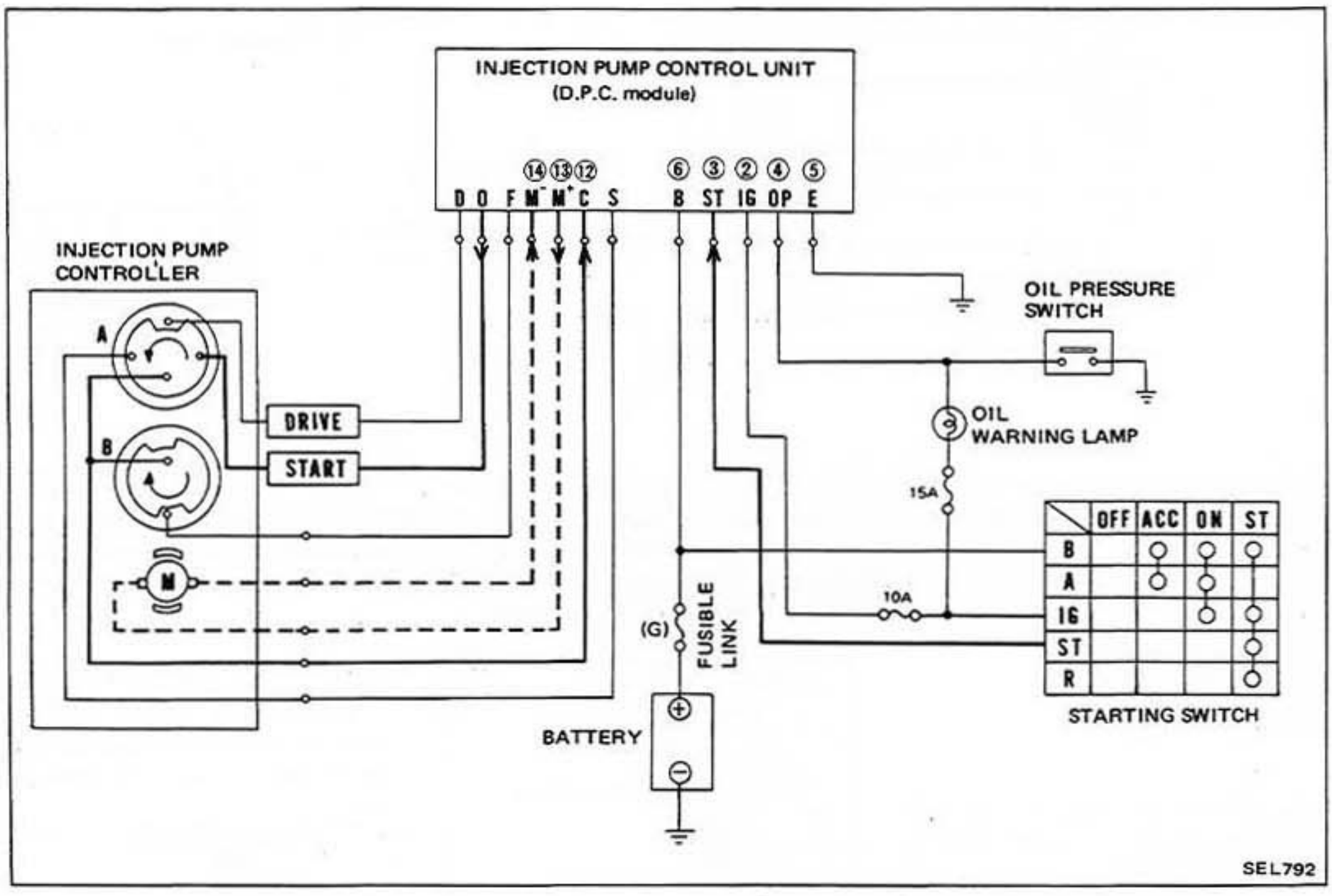
SEL532

INJECTION PUMP CONTROL SYSTEM (Diesel engine)

CAUTION: Before starting to work, be sure to turn ignition switch "OFF" and then disconnect battery ground cable.

DESCRIPTION

FUEL EXCESS OPERATION

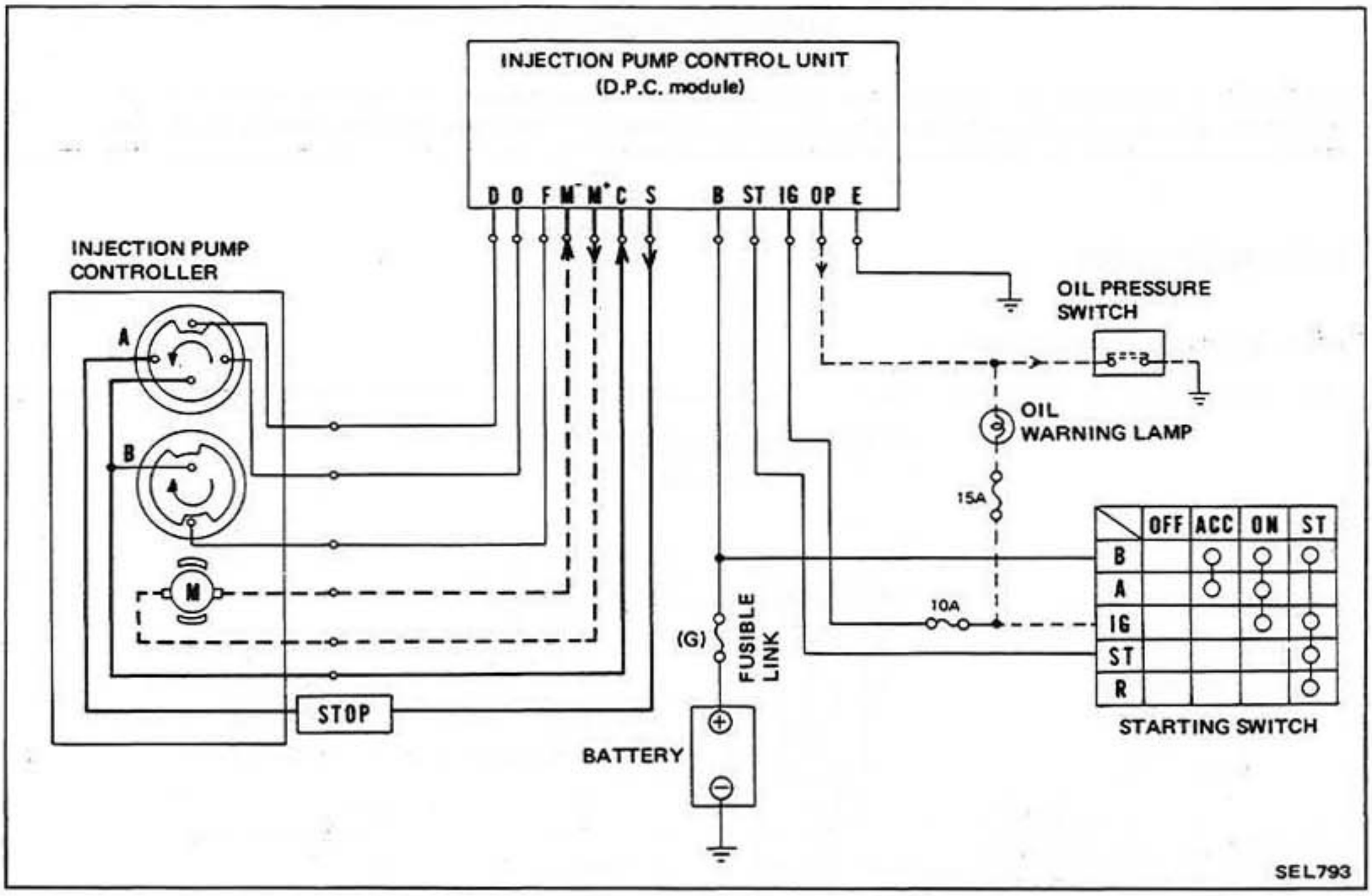


When the starting switch is turned to "START", the fuel injection control unit activates. This permits an electrical current to flow in sequence via rotor A of the fuel injection pump controller, from terminal 0 to rotor A and terminal C, causing the fuel injection controller motor to run.

As the motor runs, rotor A rotates and, when it reaches its start position, current flow between terminal 0 and C is broken, which stops the motor's operation. The controller is thus brought to its [START] position.

When the starting switch is turned to "ON" position, the fuel injection pump controller will activate and is then set at its [DRIVE] position.

ENGINE STOP OPERATION



When the starting switch is turned to "OFF" or when the oil pressure switch turns "ON", the fuel injection pump control unit will activate. When this happens, current flows in sequence through terminal S, rotor A and terminal C, causing the controller's motor to rotate as well as rotor A. As the rotor reaches the stop position, current flow between terminals S and C is broken and the motor will then stop. The controller is thus set at its STOP position.

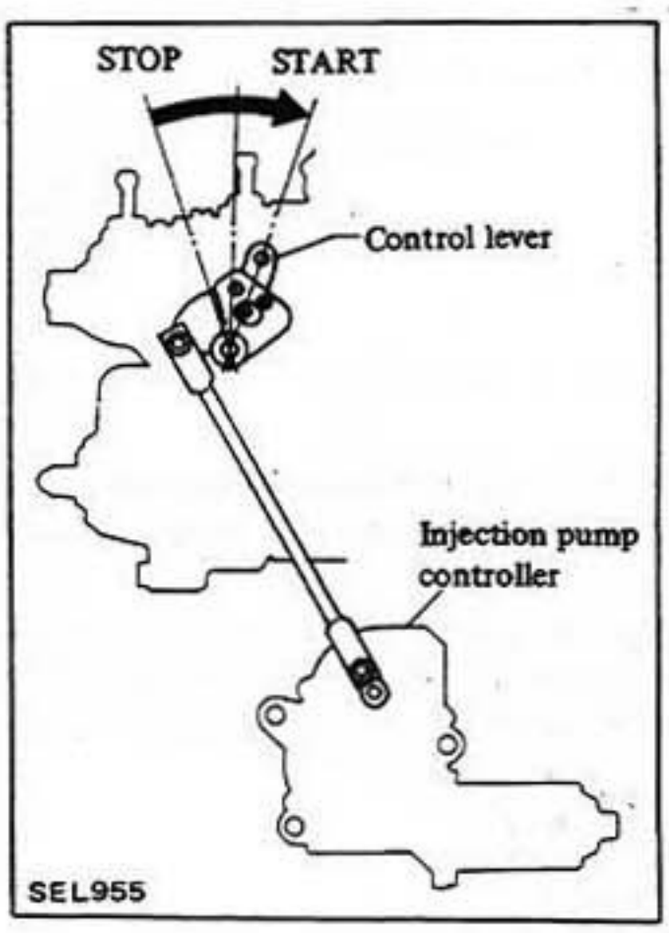
INSPECTION

ENTIRE SYSTEM

Inspect entire system for any irregularities. If any are found, refer to Trouble Diagnoses and Corrections chart in order to locate problems' cause and eliminate them as required.

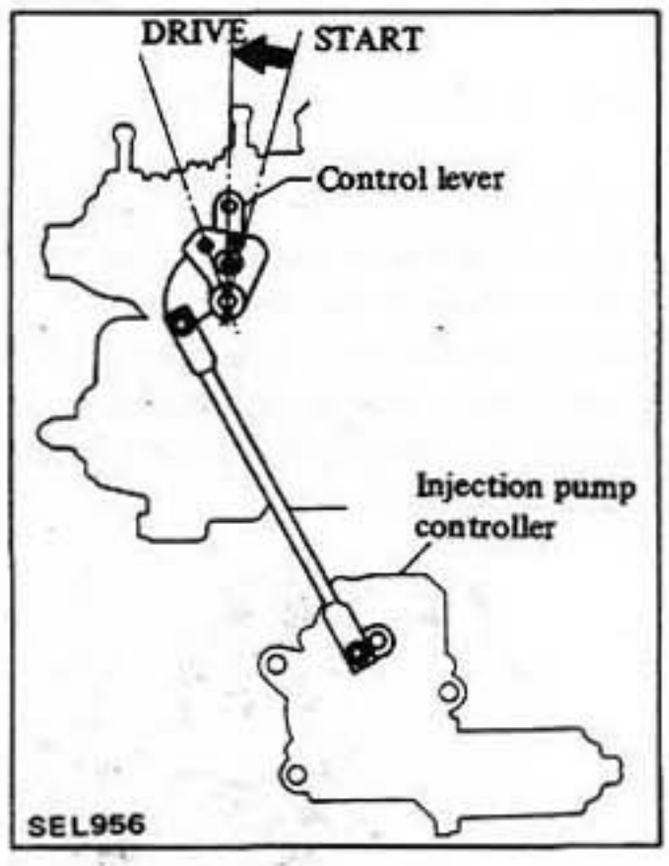
(1) "START" operation

Turn ignition key to "START" in order to ensure that injection pump control lever moves to the start position.



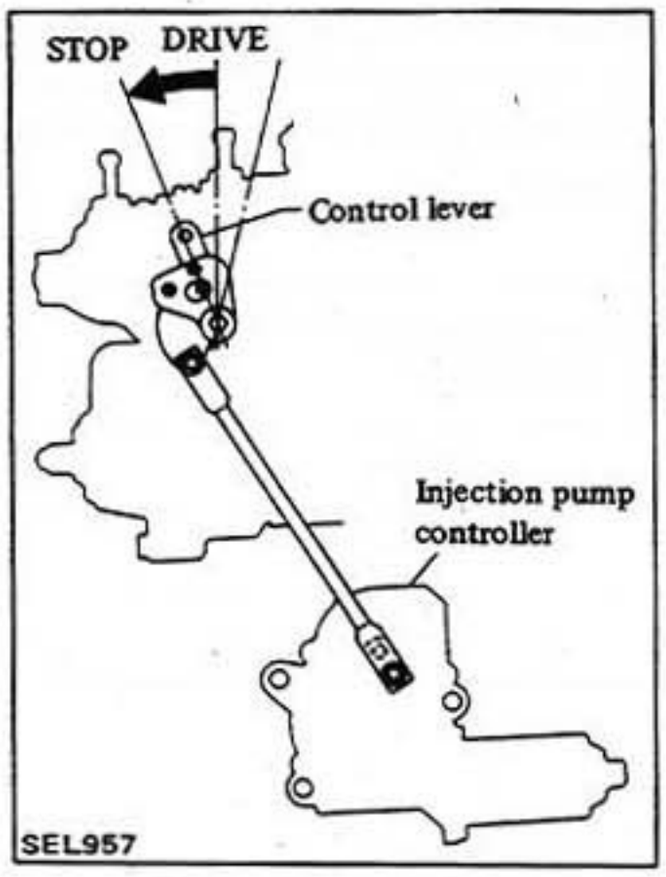
(2) "DRIVE" operation

Turn ignition key to ""ON" in order to ensure that injection pump control lever moves to the drive position.



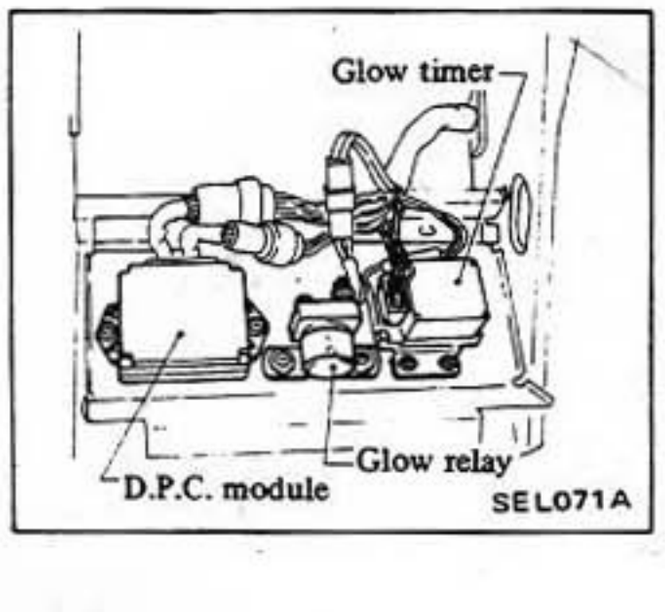
(3) "STOP" operation

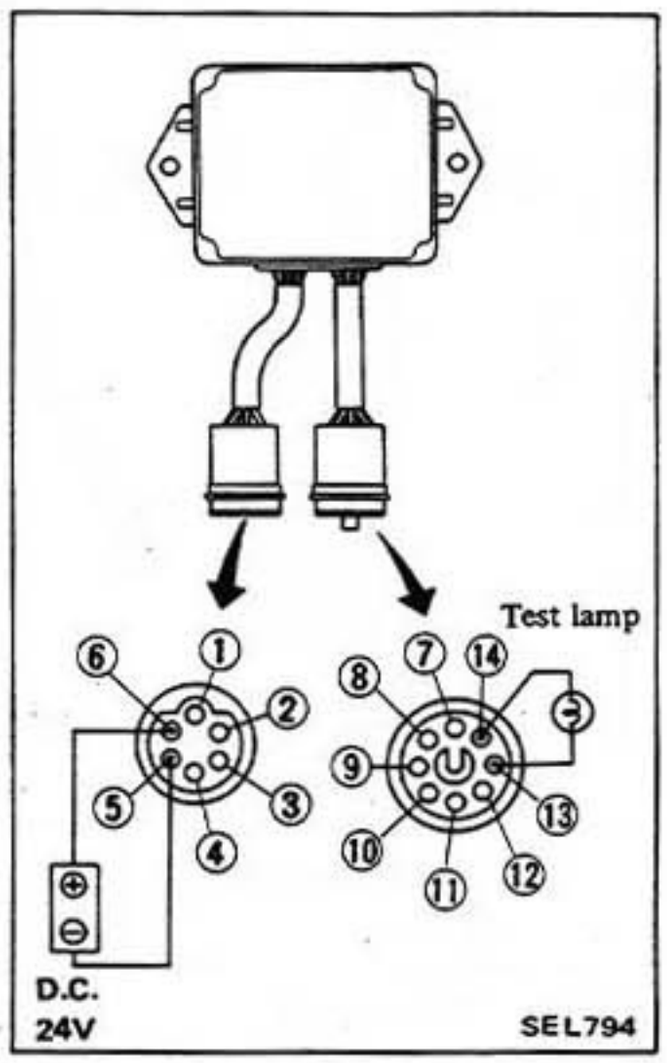
1. Turn ignition switch to "OFF" in order to ensure that injection pump control lever moves to the stop position.
2. Start engine. Disconnect and ground oil pressure switch connector with a suitable lead wire to see if injection pump control lever moves to the stop position.



INJECTION PUMP CONTROL UNIT (D.P.C. module)

Injection pump control unit (D.P.C. module) is installed on the right side of hoodledge. To check injection pump control unit (D.P.C. module), fabricate adapters as shown in the following illustration, and utilize the following procedures in the order listed.





Failure to observe the order of these test procedures may lead to incorrect test results.

If results of the following tests are satisfactory as indicated below, injection pump control unit (D.P.C. module) is functioning properly.

Be careful not to connect lead wires to the wrong terminals as this will damage injection pump control unit (D.P.C. module).

Test A

When lead wire is connected between;

Terminals ⑫ and ⑩ , or ⑫ and ⑧ :
Test lamp comes on and goes out in about 15 seconds.

Terminals ⑫ and ⑪ , or ⑫ and ⑨ :
Test lamp should not come on.

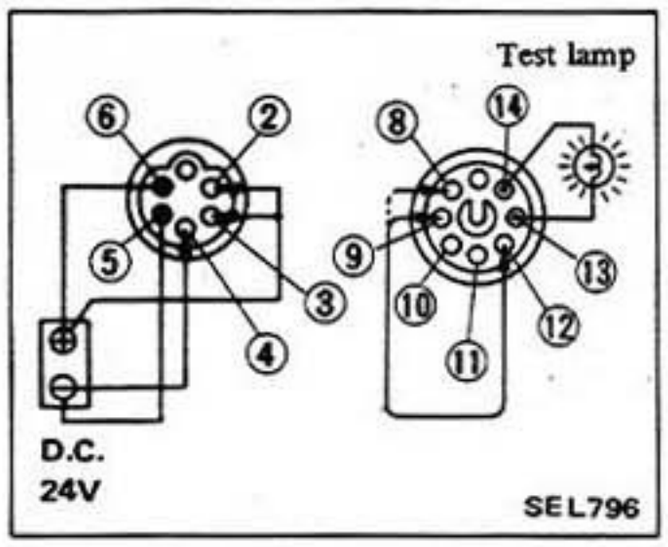
Test B

Connect positive lead wire to terminals ② and ③ , and connect negative lead wire to terminal ④ .

When lead wire is connected between;

Terminals ⑫ and ⑨ , or ⑫ and ⑧ :
Test lamp comes on and goes out in about 15 seconds.

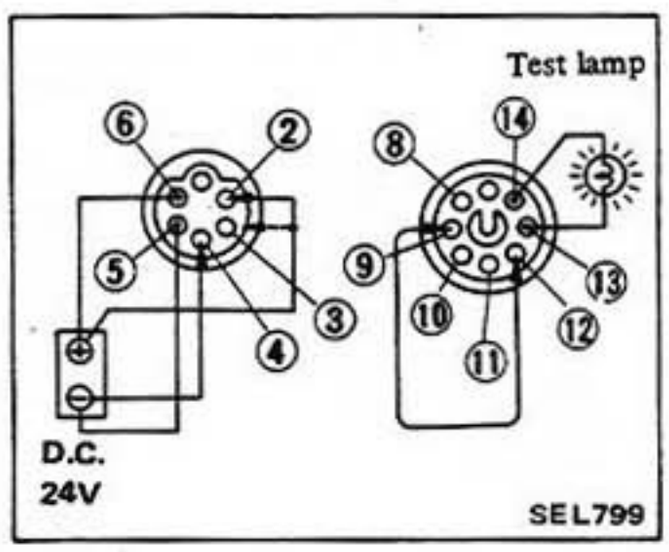
Terminals ⑫ and ⑪ , or ⑫ and ⑩ :
Test lamp should not come on.

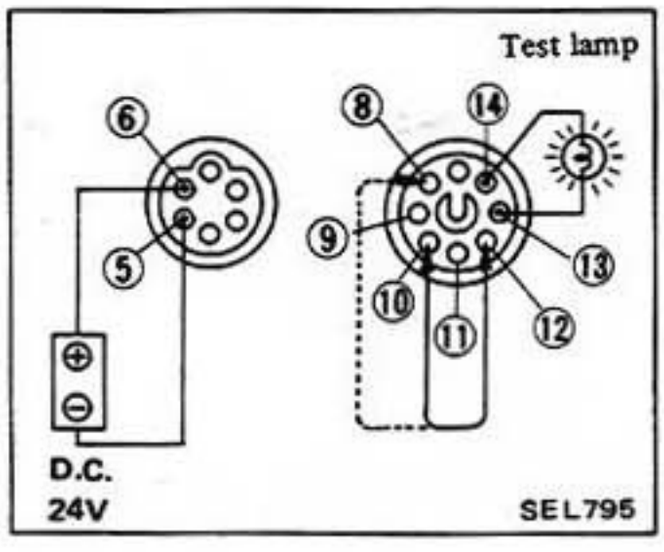


Test C

Connect lead wire between ⑫ and ⑨ , and then disconnect lead wire from terminal ③ .

Test lamp should go out in 10 seconds.



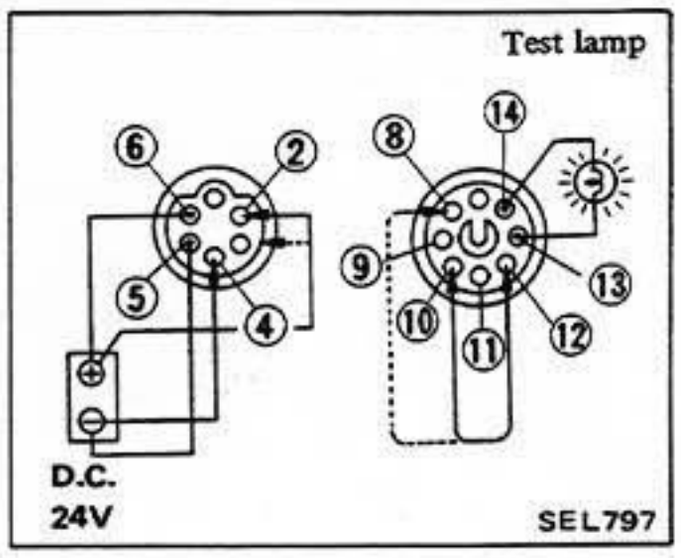


Test D

When lead wire is connected between;

Terminals ⑫ and ⑩ ; or ⑫ and ⑧ :
Test lamp comes on and goes out in about 15 seconds.

Terminals ⑫ and ⑪ , or ⑫ and ⑨ :
Test lamp should not come on.



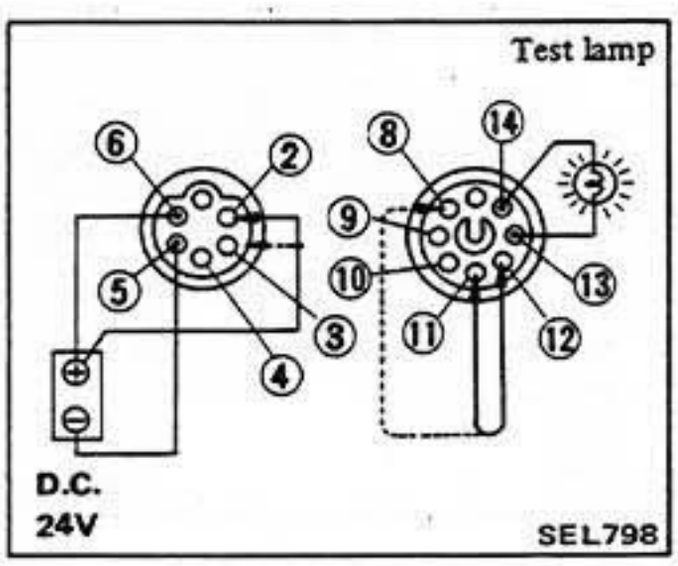
Test E

Disconnect lead wire from terminal ④ .

When lead wire is connected between;

Terminals ⑫ and ⑪ , or ⑫ and ⑧ :
Test lamp comes on and goes out in about 15 seconds.

Terminals ⑫ and ⑩ , or ⑫ and ⑨ :
Test lamp should not come on.

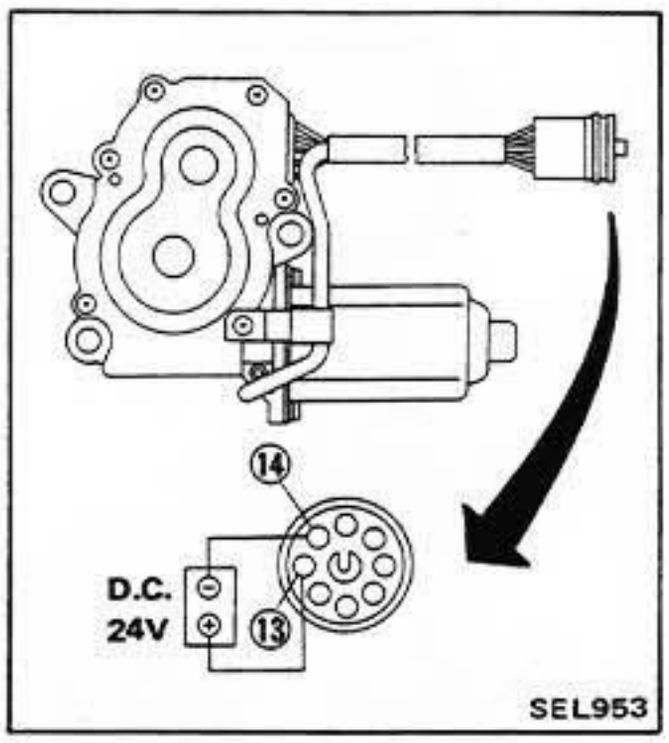


INJECTION PUMP CONTROLLER

Test A

Connect positive lead wire to terminal ⑬ , and negative lead wire to terminal ⑭ .

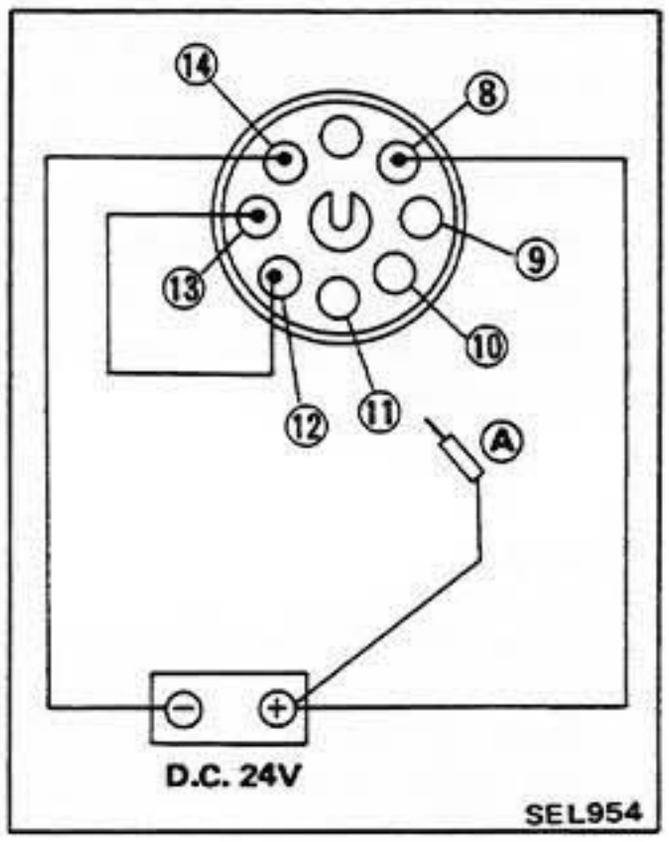
Injection pump controller motor should run.



Test B

Fabricate adapters, as shown in the following illustration, and connect terminal Ⓐ to each of terminals listed in the table below. Injection pump control lever should stop at corresponding position.

Connect terminal Ⓐ to:	Corresponding position of injection pump control lever
Terminal ⑨	START
Terminal ⑩	STOP
Terminal ⑪	DRIVE



Be careful not to connect lead wire to the wrong terminals as this will damage injection pump controller.

TROUBLE DIAGNOSES AND CORRECTIONS

CASE 1

ENGINE DOES NOT START.

↓

Turn ignition switch to START to ensure that injection pump control lever moves to START position.
- Yes → Check fuel system, glow plugs, etc.
- No ↓

Check whether connecting rod is disengaged.
- Yes → Connect.
- No ↓

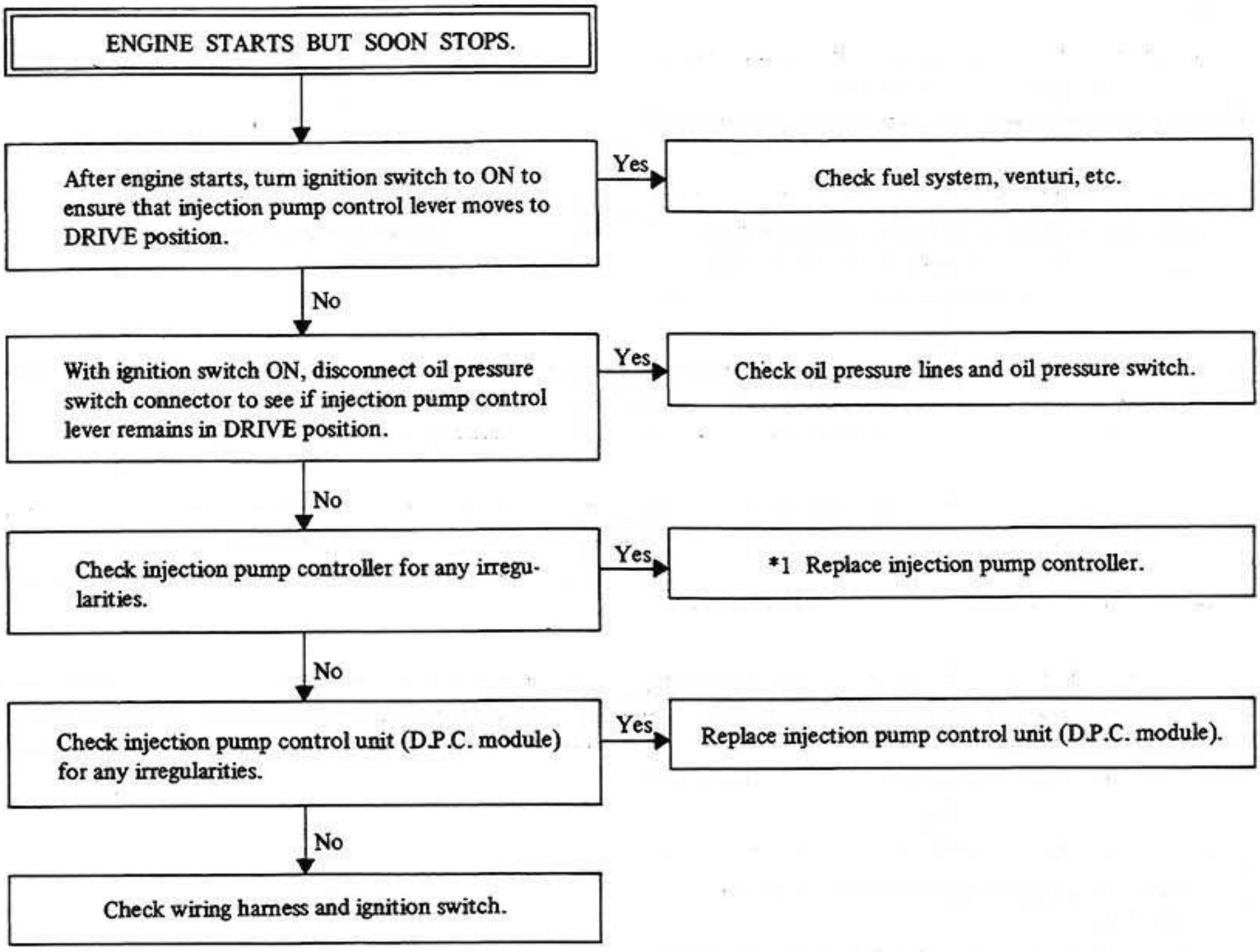
Check injection pump controller for any irregularities.
- Yes → *1 Replace.
- No ↓

Check injection pump control unit (D.P.C. module) for any irregularities.
- Yes → Replace injection pump control unit (D.P.C. module).
- No ↓

Check wiring harness, ignition switch and oil pressure switch.

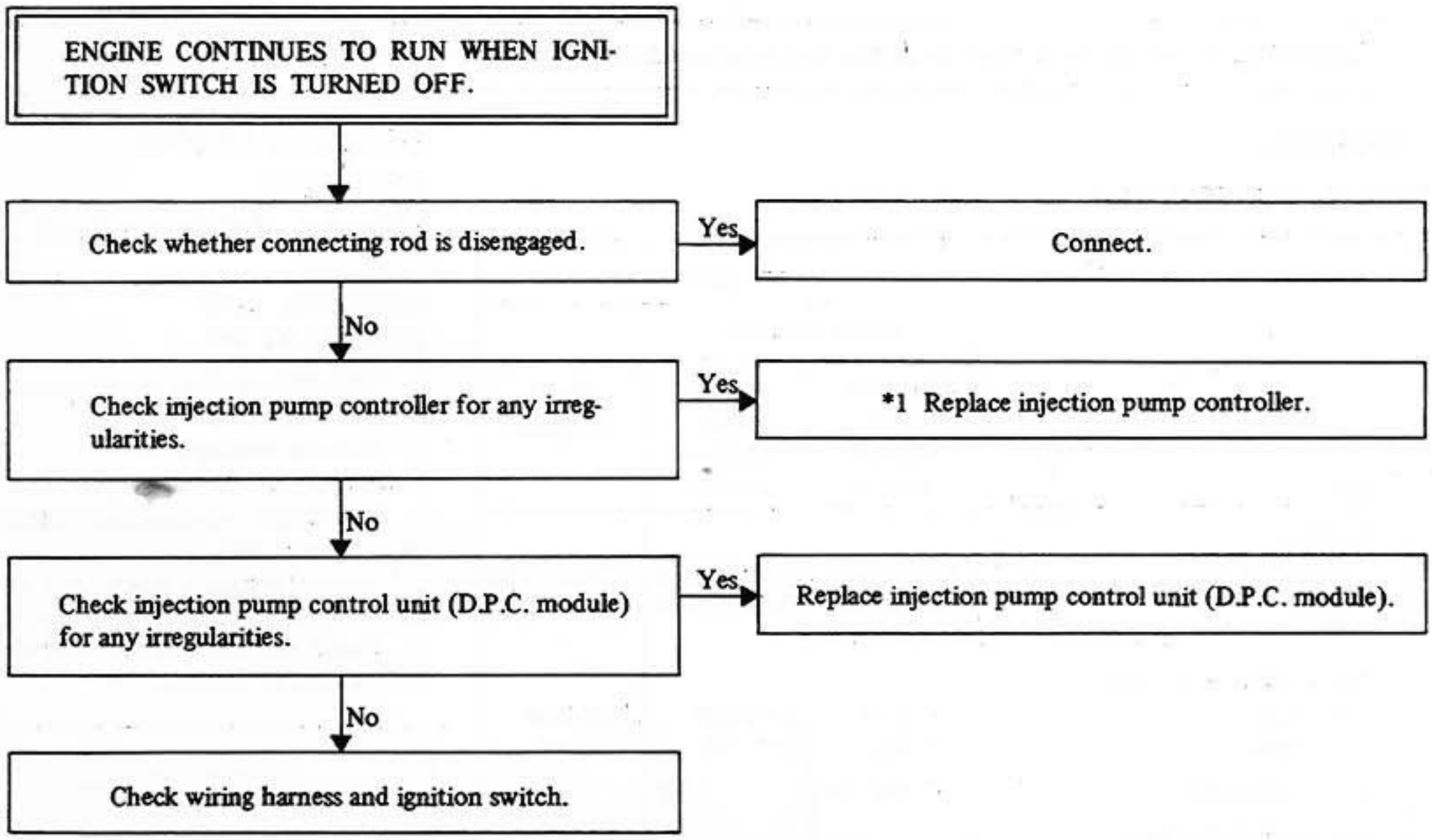
*1: Whenever injection pump controller is replaced, disconnect 6-pin connector from injection pump control unit (D.P.C. module) and connect again, then check operation of injection pump controller.

CASE 2



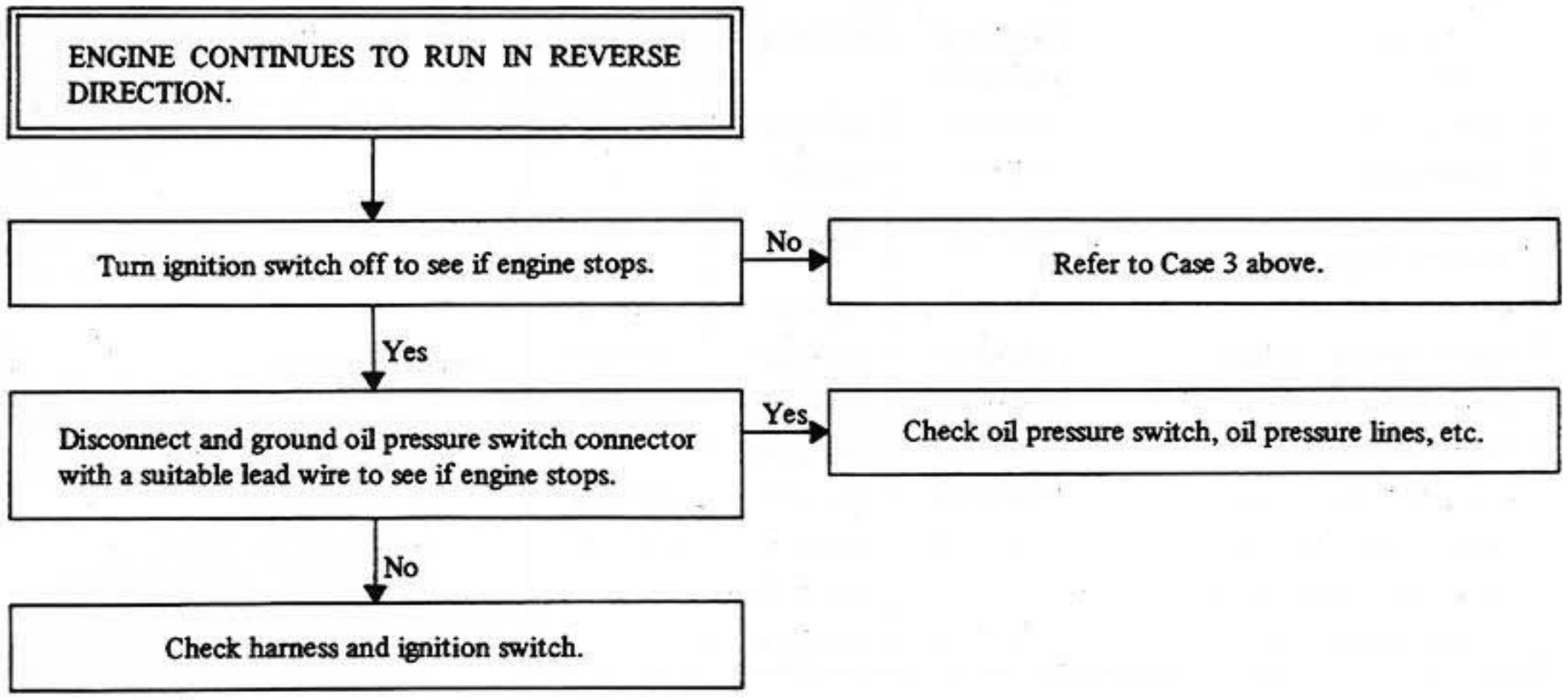
*1: Whenever injection pump controller is replaced, disconnect 6-pin connector from injection pump control unit (D.P.C. module) and connect again, then check operation of injection pump controller.

CASE 3



*1: Whenever injection pump controller is replaced, disconnect 6-pin connector from injection pump control unit (D.P.C. module) and connect again, then check operation of injection pump controller.

CASE 4



LIGHTING SYSTEM

CAUTION: Before starting to work, be sure to turn ignition switch "OFF" and then disconnect battery ground cable.

BULBS

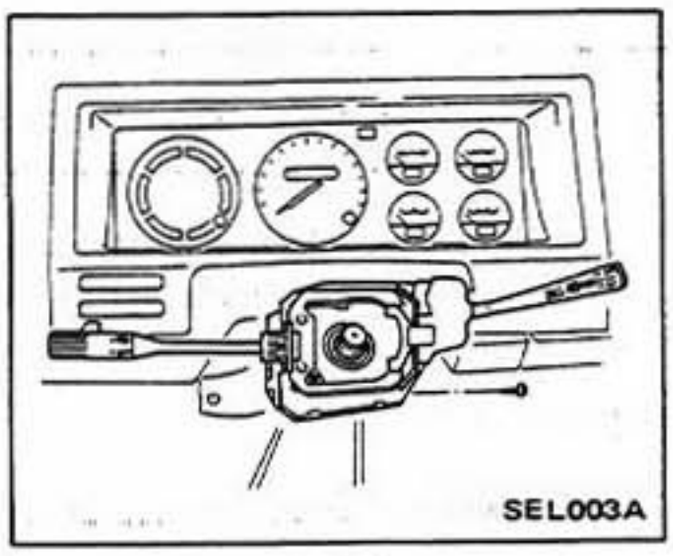
BULB SPECIFICATION

Item \ Model	Capacity		
	Model 160 series		
	Gasoline engine equipped models	Diesel engine equipped models	Model 61 series
Headlamp			
Sealed beam	12V-50/40W	24V-75/55W	12V-50/40W
Semi-sealed beam	12V-45/40W	24V-55/50W	–
Semi-sealed beam (Halogen)	12V-60/55W	–	–
Front combination lamp			
Turn signal	12V-21W	24V-21W	12V-21W
Clearance	12V-5W	24V-5W	12V-5W
Side marker lamp	12V-6W, 5W	24V-6W, 5W	–
Rear combination lamp			
Turn signal	12V-21W	24V-21W	12V-21W
Back-up	12V-21W	24V-21W	12V-21W
Stop/Tail	12V-21/5W	24V-21/5W	12V-21/5W
License plate lamp	12V-10W	24V-12W, 10W	12V-10W
Front fog lamp			
Conventional	12V-35W	24V-35W	12V-35W
Halogen	12V-35W	–	–
Rear fog lamp	12V-21W	24V-21W	–
Room lamp	12V-5W	24V-6W	–
Rear room lamp (Station Wagon only)	12V-5W	24V-6W	–
Inspection lamp	12V-10W	12V-10W	12V-10W
Meter illumination lamp	12V-3.4W	24V-3.4W	12V-1.5W
High beam pilot lamp	12V-3.4W	24V-3.4W	12V-3.4W
Brake warning lamp	12V-1.7W	24V-1.7W	–
Turn signal pilot lamp	12V-3.4W	24V-3.4W	12V-3.4W
4-wheel drive indicator lamp	12V-1.7W	24V-1.7W	12V-3.4W
Glow plug warning lamp	–	24V-1.7W	–
Charge warning lamp	12V-1.7W	24V-1.7W	–

COMBINATION SWITCH (Model 160 series)

REMOVAL AND INSTALLATION

1. Disconnect battery ground cable.
2. Remove horn pad.
3. Remove steering wheel.
4. Remove steering column cover.
5. Disconnect combination switch wires at connector.
6. Loosen retaining screw and remove combination switch assembly.
7. Install combination switch in the reverse order of removal.

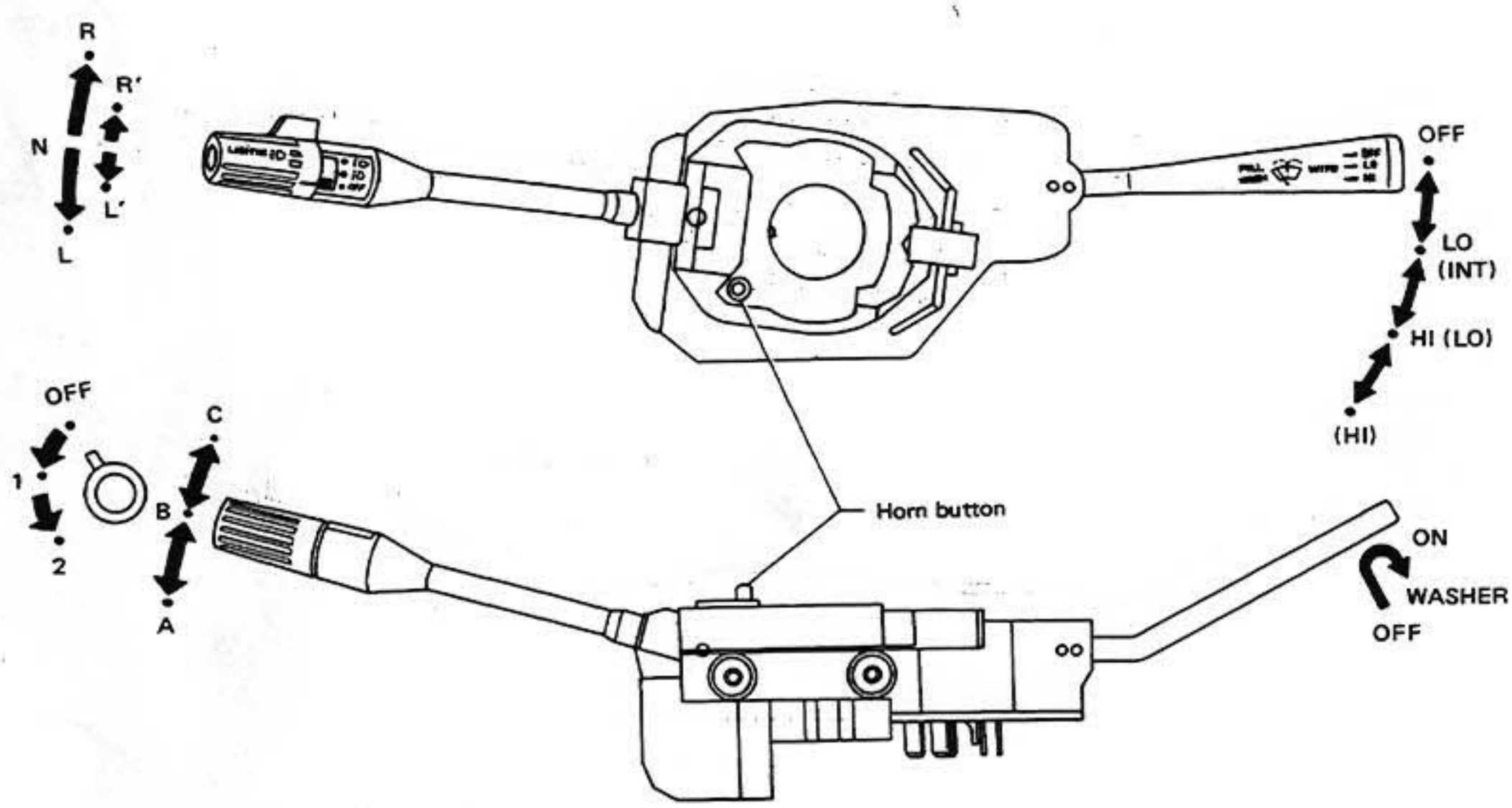


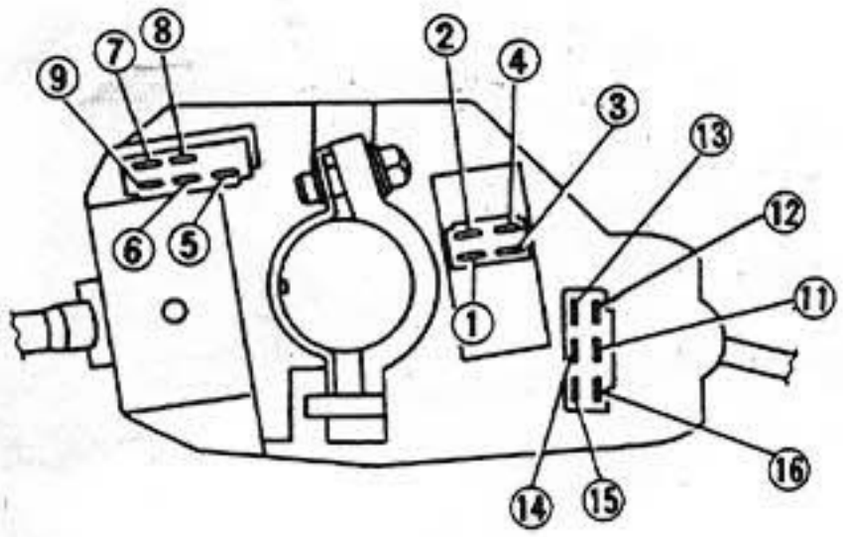
SEL003A

INSPECTION

Test continuity through switch with a test lamp or ohmmeter.

L.H. drive model





LIGHTING

	OFF			1			2		
	A	B	C	A	B	C	A	B	C
5			○			○	○	○	○
6			○			○	○		○
7								○	
8				○	○	○	○	○	○
9				○	○	○	○	○	○

TURN SIGNAL

	LEVER			HORN
	R–R'	N	L–L'	
1	○		○	
2	○			
3			○	
4				○

HORN

WIPER
(Without intermittent wiper amplifier)

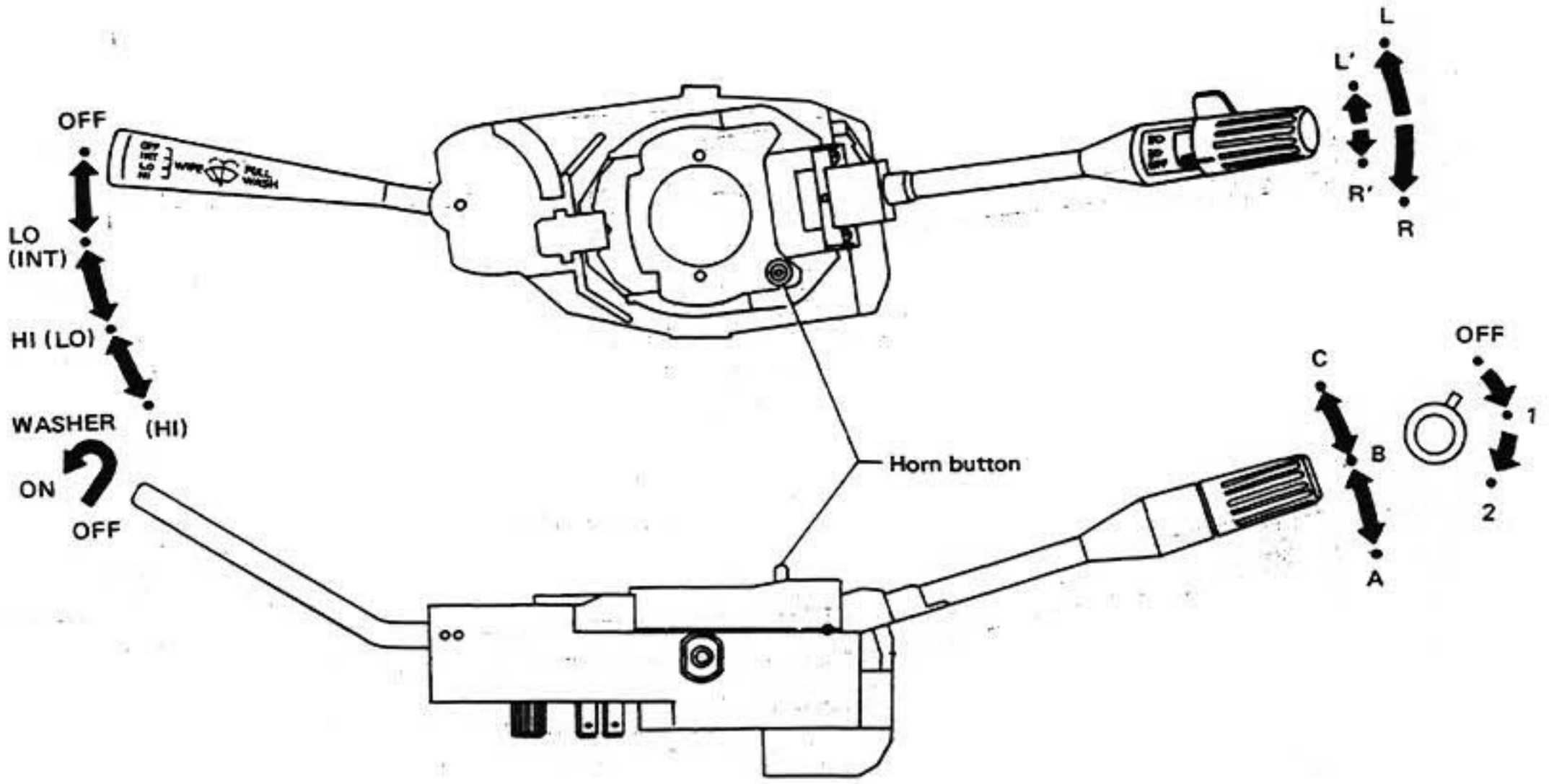
	WIPER			WASH
	OFF	LO	HI	
11				○
12	○			
13	○	○		
14				
15			○	
16		○	○	○

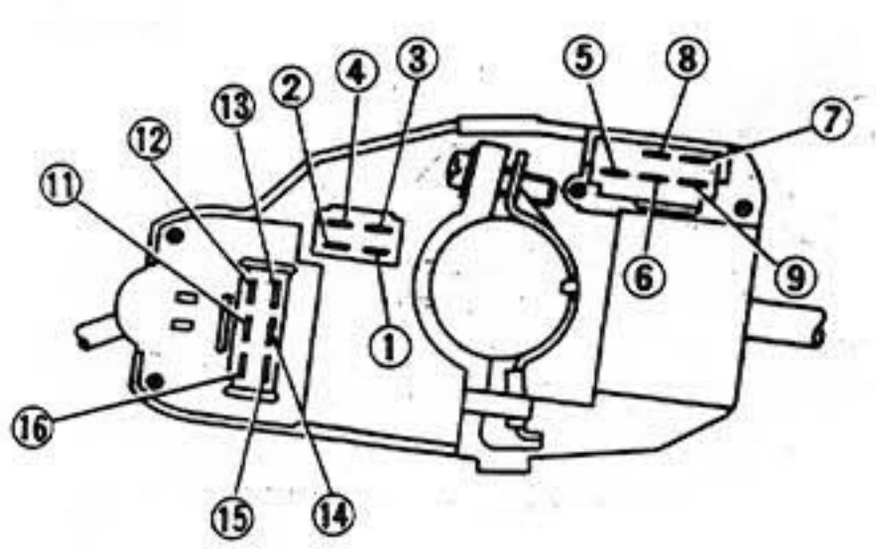
(With intermittent wiper amplifier)

	WIPER				WASH
	OFF	INT	LO	HI	
11					○
12	○	○			
13	○	○	○		
14		○			
15				○	
16		○	○	○	○

SEL004A

R.H. drive model





WIPER
(Without intermittent wiper amplifier)

	WIPER			WASH
	OFF	LO	HI	
11				○
12	○			
13	○	○		
14				
15			○	
16		○	○	○

LIGHTING

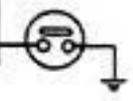
	OFF			1			2		
	A	B	C	A	B	C	A	B	C
5			○			○	○	○	○
6			○			○	○		○
7								○	
8				○	○	○	○	○	○
9				○	○	○	○	○	○

(With intermittent wiper amplifier)

	WIPER				WASH
	OFF	INT	LO	HI	
11					○
12	○	○			
13	○	○	○		
14		○			
15			○	○	
16		○	○	○	○

TURN SIGNAL

	LEVER			HORN
	R – R'	N	L – L'	
1	○		○	
2	○			
3			○	
4				○

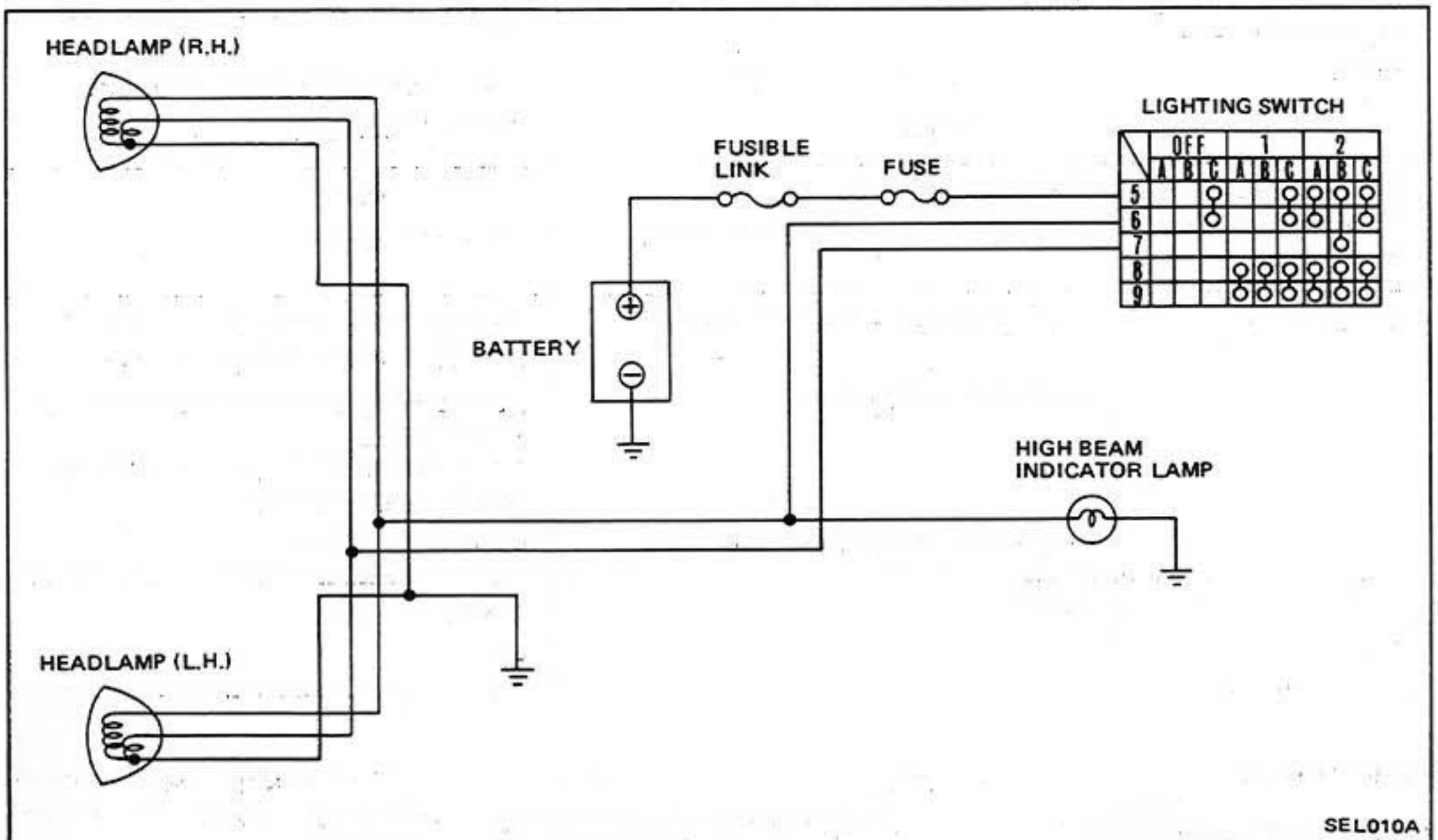


SEL005A

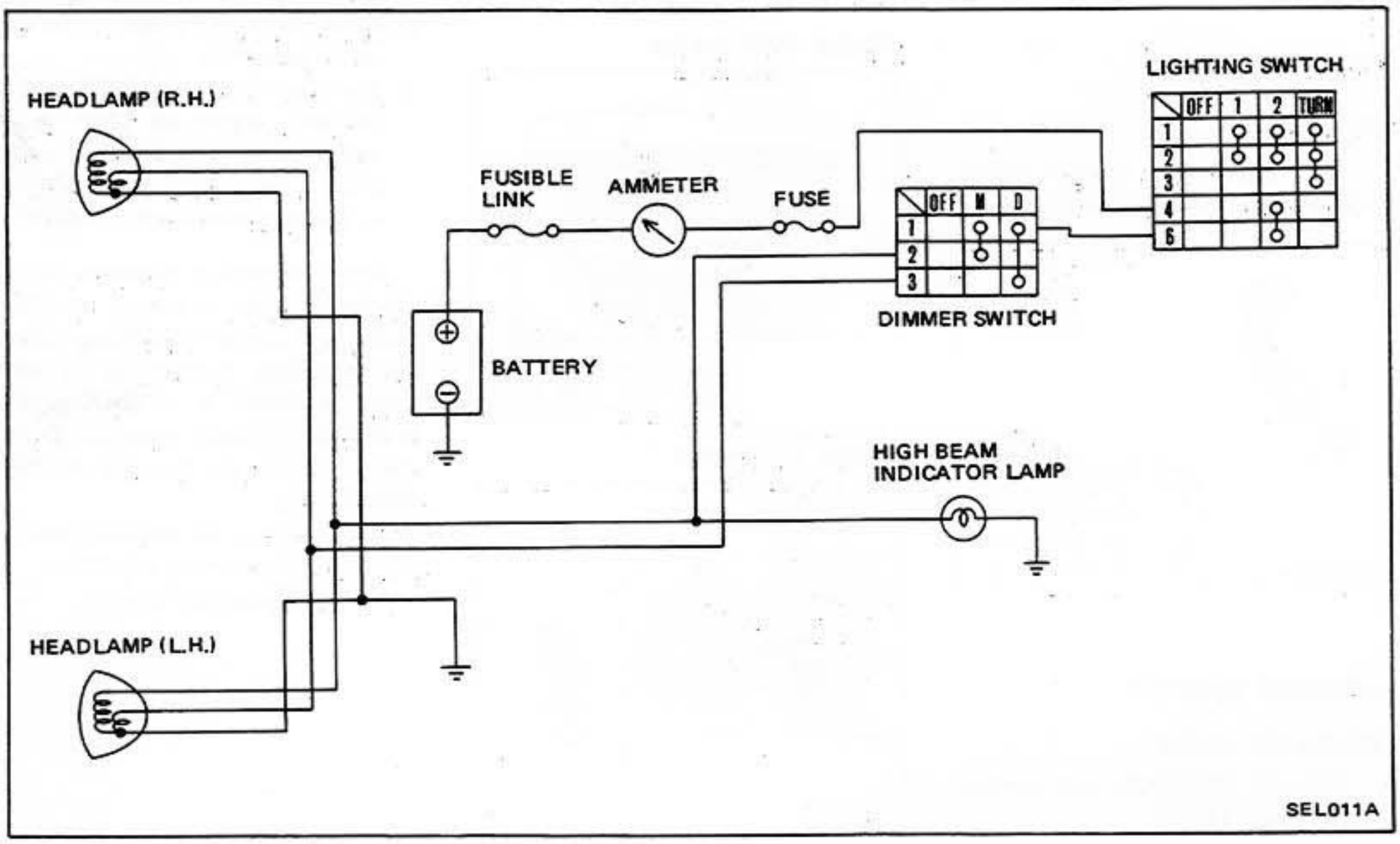
HEADLAMP

SCHEMATIC

Model 160 series



Model 61 series



TROUBLE DIAGNOSES AND CORRECTIONS

Condition	Probable cause	Corrective action
Headlamps do not come on, either high or low beams.	Blown out fusible link or fuse.	Correct cause and replace fusible link or fuse.
	Loose connection or open circuit.	Check wiring and/or repair connection.
	Faulty lighting switch.	Replace if necessary.
High beam cannot be switched to low beam or vice versa.	Faulty lighting switch.	Replace if necessary.
	Faulty dimmer switch (Model 61 series).	Replace if necessary.
Headlamps dim.	Partly discharged or run-down battery.	Measure specific gravity of electrolyte and recharge or replace battery if necessary.
	Inoperative charging system.	Measure voltage at headlamp terminals with engine running. If it is less than 12.8V, check charging system for proper operation.
	Poor ground or loose connection.	Clean and/or tighten.
Headlamp lights on only one side.	Loose headlamp connection.	Repair.
	Faulty headlamp beam.	Replace.

LIGHTING SWITCH

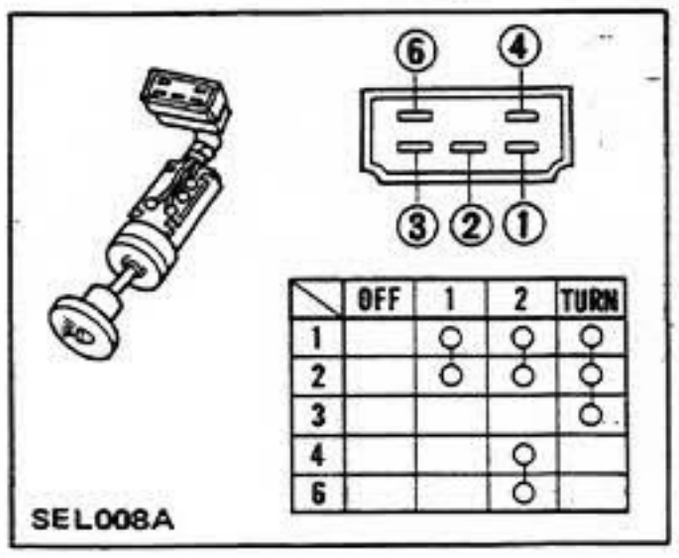
Model 160 series

Refer to Combination Switch (Page EL-54).

Model 61 series

Inspection

Test continuity through switch with a test lamp or ohmmeter.



DIMMER SWITCH

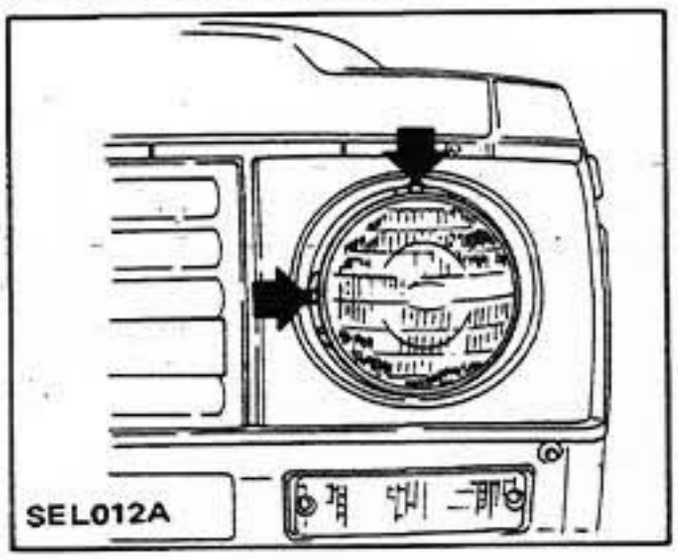
Model 61 series

Refer to Turn Signal and Dimmer Switch (Page EL-66).

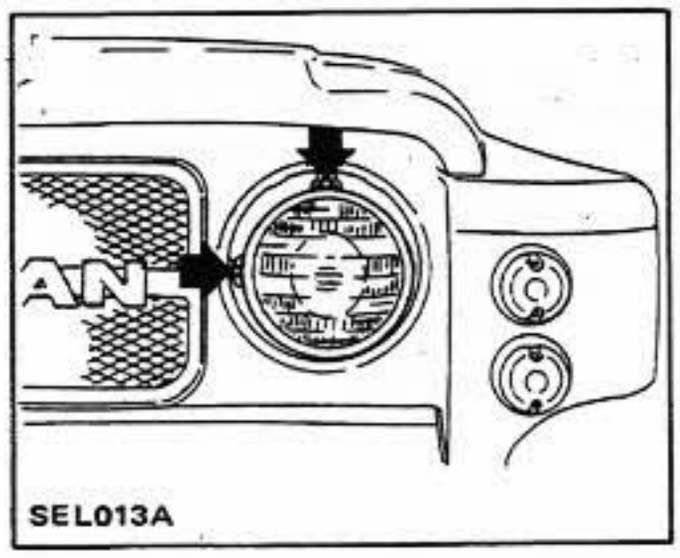
AIMING ADJUSTMENT

To adjust vertical aim, use adjusting screw on upper side of headlamp; and to adjust horizontal aim, use adjusting screw on side of headlamp.

Model 160 series



Model 61 series



Before making headlamp aiming adjustment, observe the following instructions.

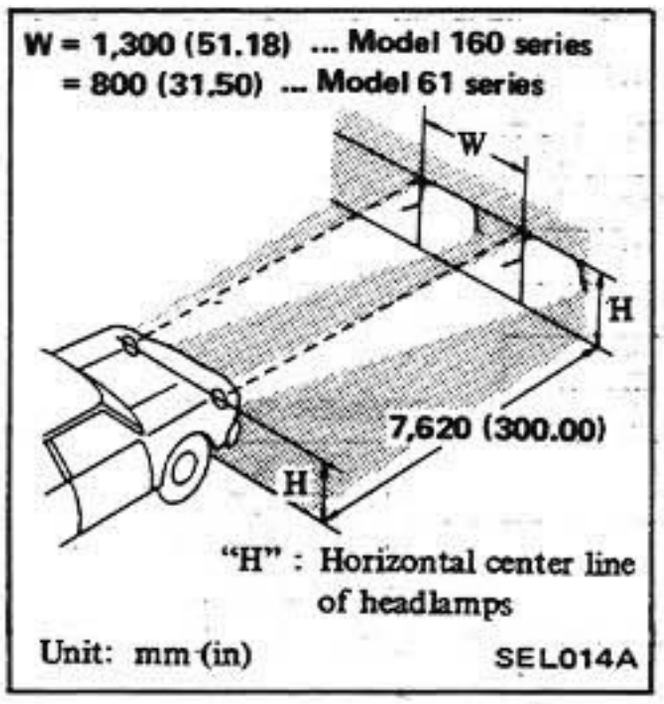
a. **Keep all tires inflated to correct pressures.**
b. **Place vehicle and tester on one and same flat surface.**
c. **See that there is no load in vehicle (coolant, engine oil filled up to correct level and full fuel tank) other than the driver (or equivalent weight placed in driver's position).**

When performing headlamp aiming adjustment, use an aiming machine, aiming wall screen or headlamp tester. For operating instructions of any aimer, it should be in good repair, calibrated and used according to respective operation manuals supplied with the unit.

If any aimer is not available, aiming adjustment can be done as follows:

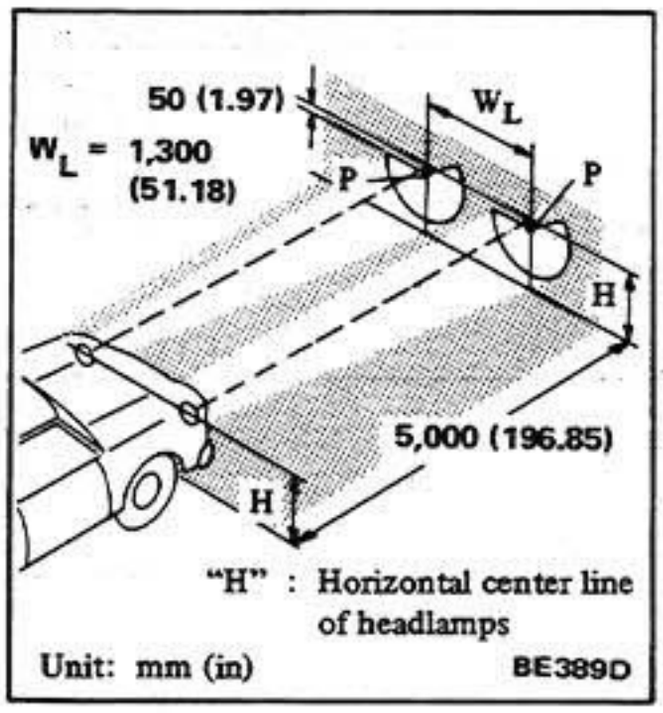
Turn headlamp low beam on.

Sealed beam type



- Adjust headlamps so that upper edge of hot spot is equal in height to headlamp height.
- The illustration shows headlamp aiming pattern for driving on right side of road; for driving on left side of road, aiming pattern is reversed.
- Dotted lines in illustration show center of headlamp.

Semi-sealed beam type

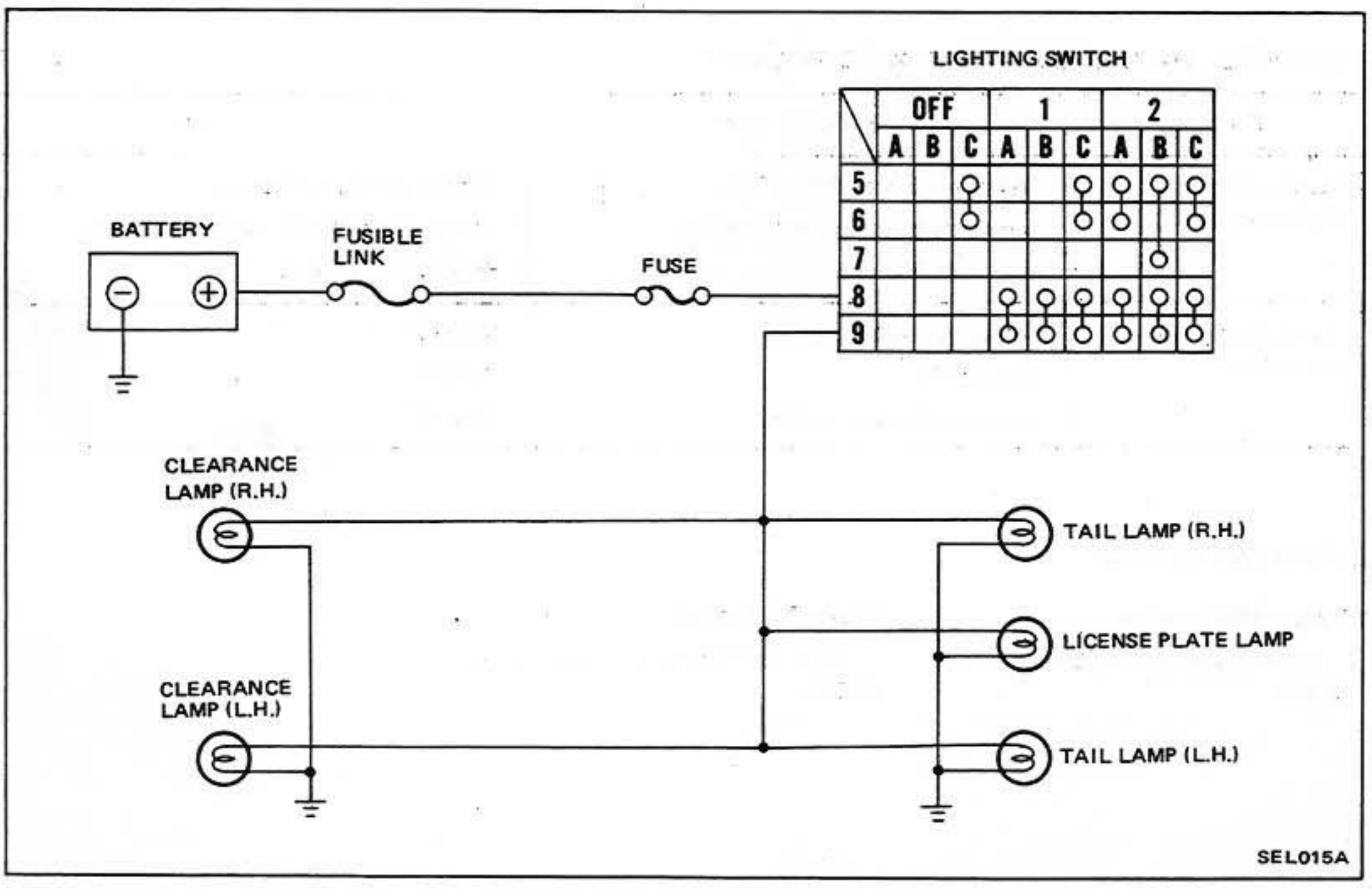


- Adjust headlamps so that main axis of light is parallel to center line of body and is aligned with point P shown in illustration.
- The illustration shows headlamp aiming pattern for driving on right side of road; for driving on left side of road, aiming pattern is reversed.
- Dotted lines in illustration show center of headlamp.

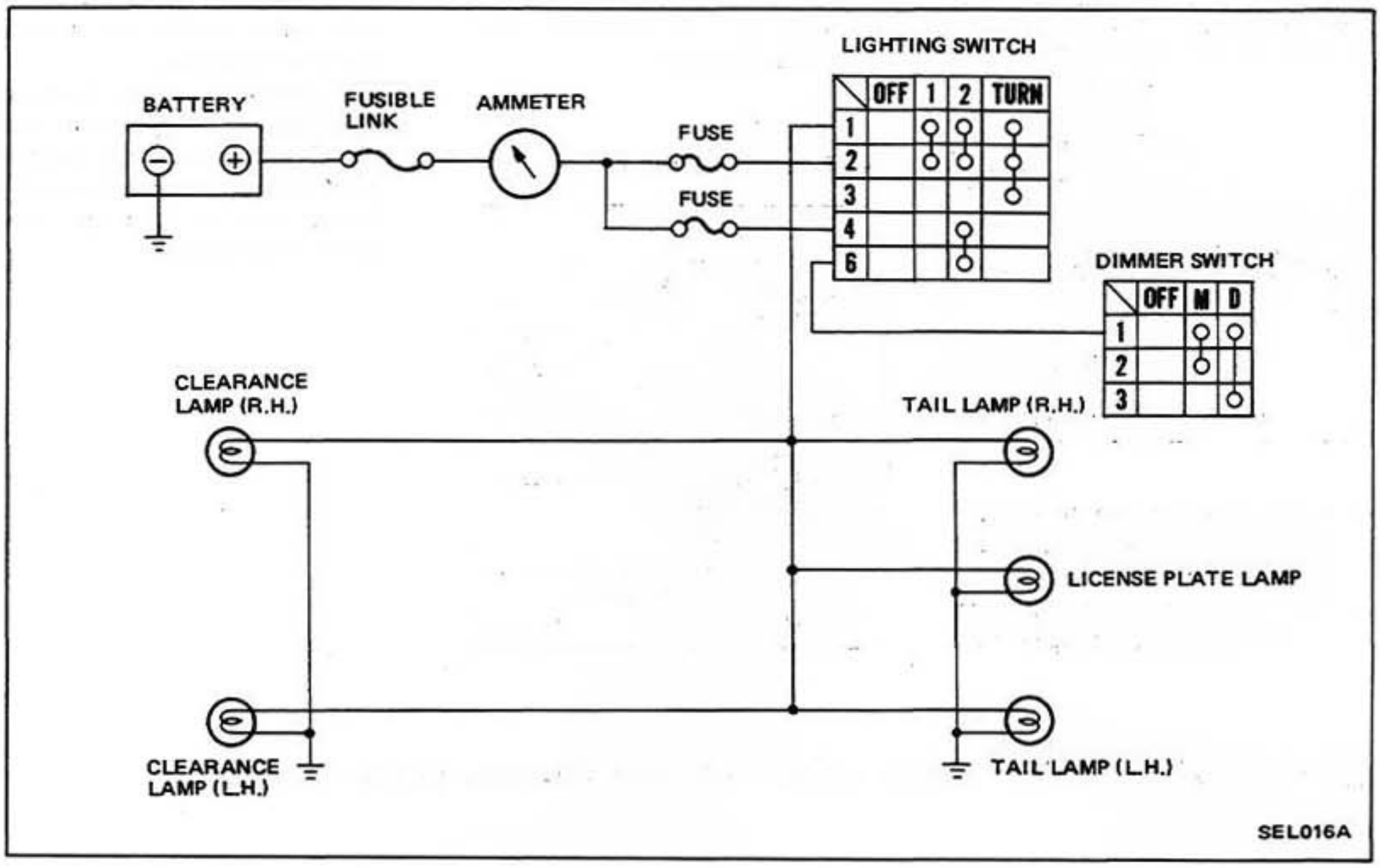
EXTERIOR LAMPS (Clearance, tail and license plate lamps)

SCHEMATIC

Model 160 series



Model 61 series



TROUBLE DIAGNOSES AND CORRECTIONS

Condition	Probable cause	Corrective action
Neither left nor right lamp lights.	Blown out fusible link or fuse. Loose connection or open circuit. Faulty lighting switch.	Correct cause and replace. Check wiring and/or repair connection. Replace if necessary.
Lamp on only one side lights.	Burned out bulb. Loose bulb. Loose connection to lamp.	Replace. Correct. Correct.

LIGHTING SWITCH

Model 160 series

Refer to Combination Switch (Page EL-54).

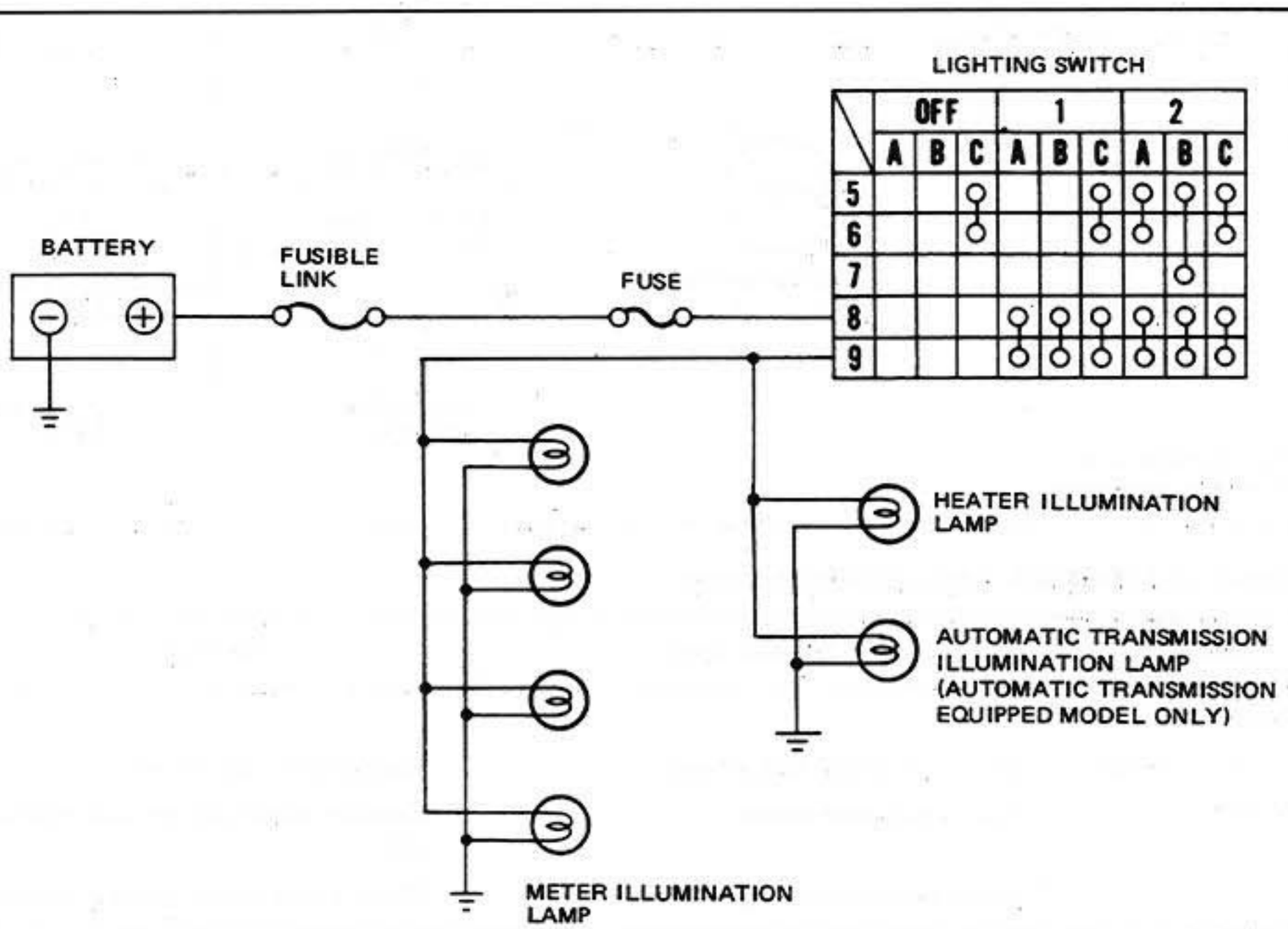
Model 61 series

Refer to Lighting Switch (Page EL-58).

ILLUMINATION LAMPS

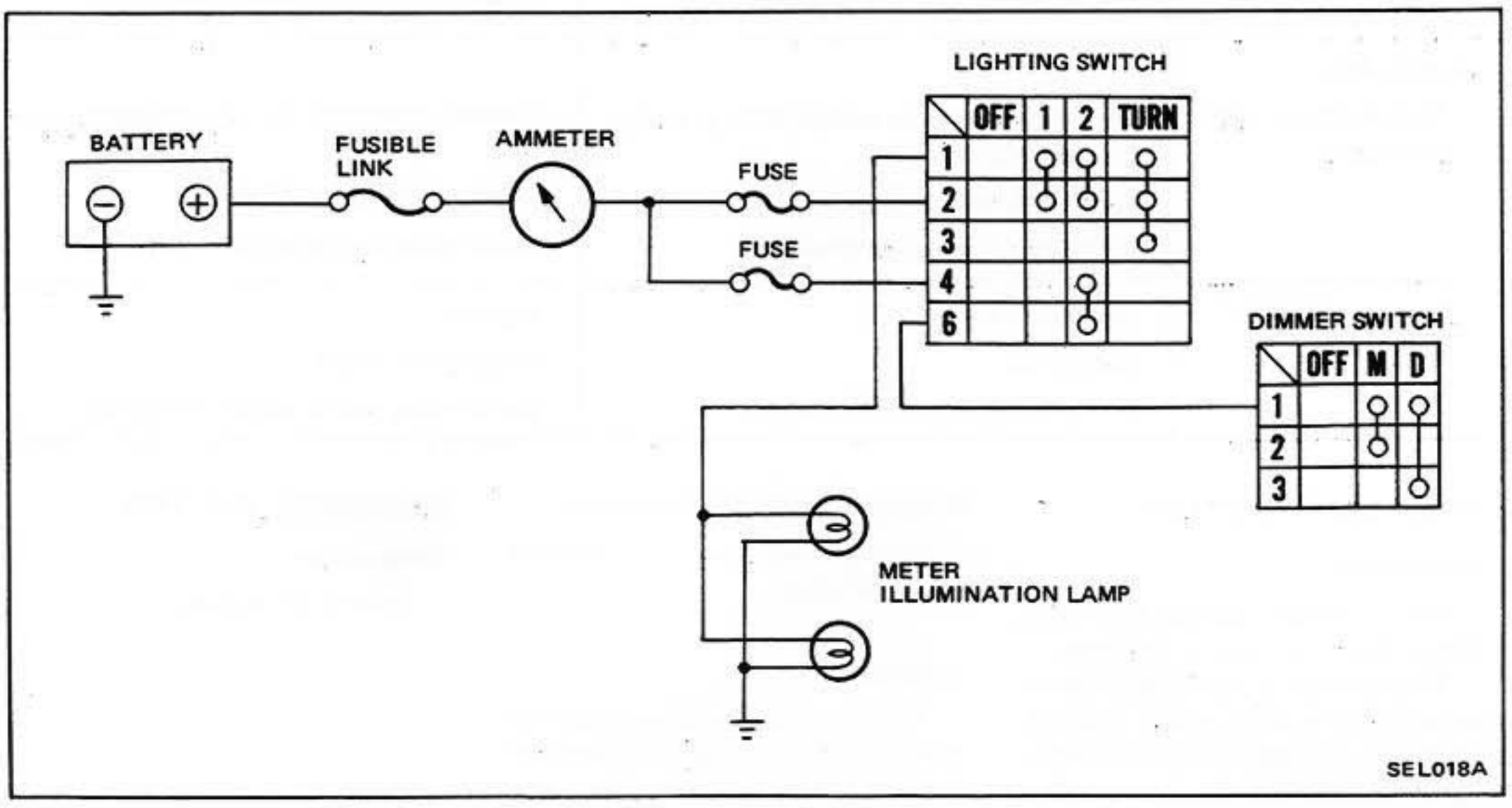
SCHEMATIC

Model 160 series



SEL382A

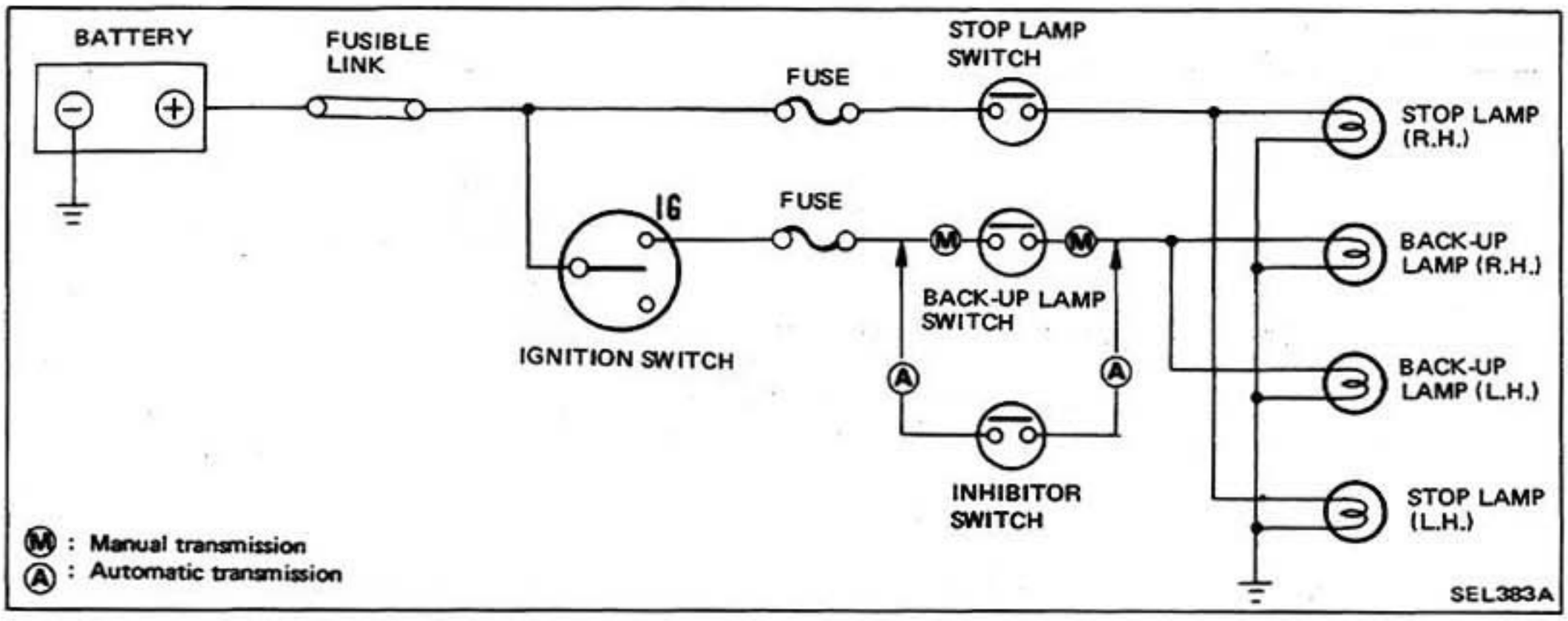
Model 61 series



SEL018A

STOP AND BACK-UP LAMPS

SCHEMATIC



TROUBLE DIAGNOSES AND CORRECTIONS

Condition	Probable cause	Corrective action
Stop lamp		
Neither left nor right lamp lights.	Blown out fusible link or fuse.	Correct cause and replace.
	Faulty stop lamp switch.	Conduct continuity test and replace if necessary.
	Loose connection or open circuit.	Check wiring and/or repair connection.
Lamp on only one side lights.	Burned out bulb.	Replace.
	Loose bulb.	Repair lamp socket.
	Loose connection or open circuit.	Check wiring and/or repair connection.
Back-up lamp		
Neither left nor right lamp lights.	Faulty back-up lamp switch (M/T) or inhibitor switch (A/T).	Conduct continuity test and replace if necessary.
	Blown out fusible link or fuse.	Correct cause and replace.
	Loose connection or open circuit.	Check wiring and/or repair connection.
Lamp on only one side lights.	Burned out bulb.	Replace.
	Loose bulb.	Repair lamp socket.
	Loose connection or open circuit.	Check wiring and/or repair connection.

STOP LAMP SWITCH

Inspection

Test continuity through stop lamp switch with a test lamp or ohmmeter.

When plunger is pressed into switch assembly, stop lamp switch contacts are open. Contacts are closed when plunger is projected.

BACK-UP LAMP SWITCH

Back-up lamp switch is installed on transmission.

Inspection

When transmission lever is in "R" position, there should be continuity between two terminals.

INHIBITOR SWITCH

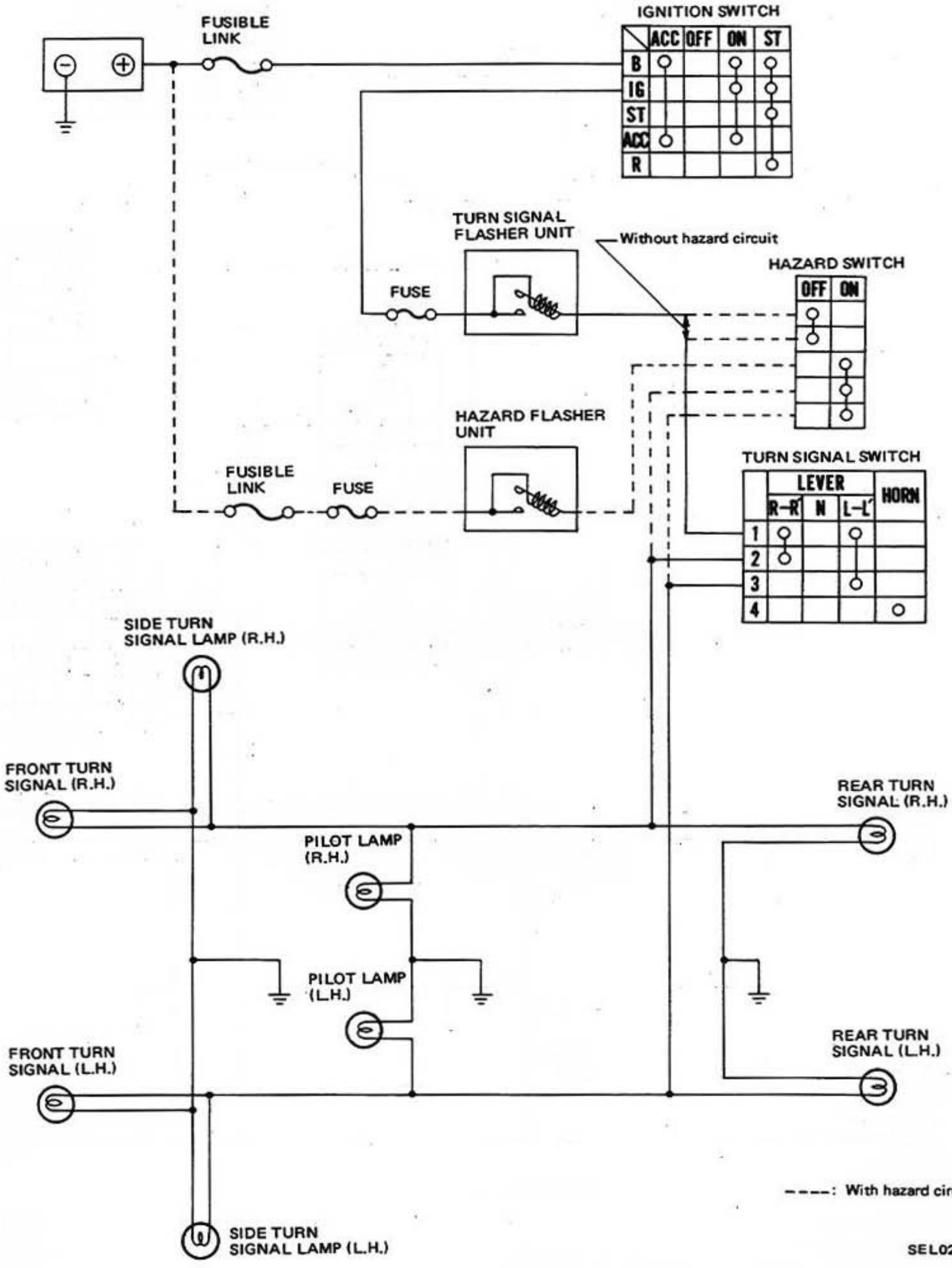
Inspection

Refer to AT section.

TURN SIGNAL AND HAZARD WARNING LAMPS

SCHEMATIC

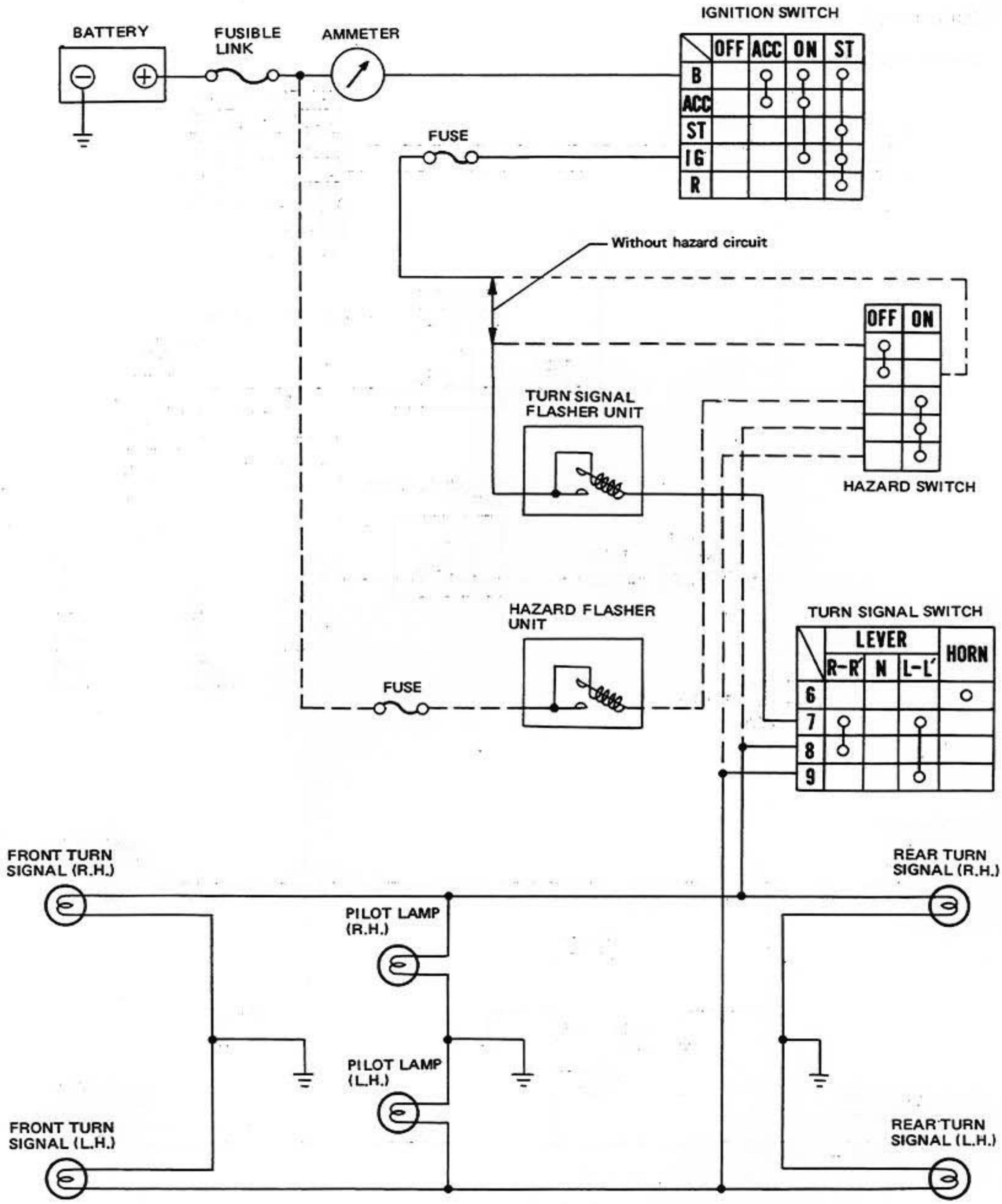
Model 160 series



----: With hazard circuit

SEL020A

Model 61 series



TROUBLE DIAGNOSES AND CORRECTIONS

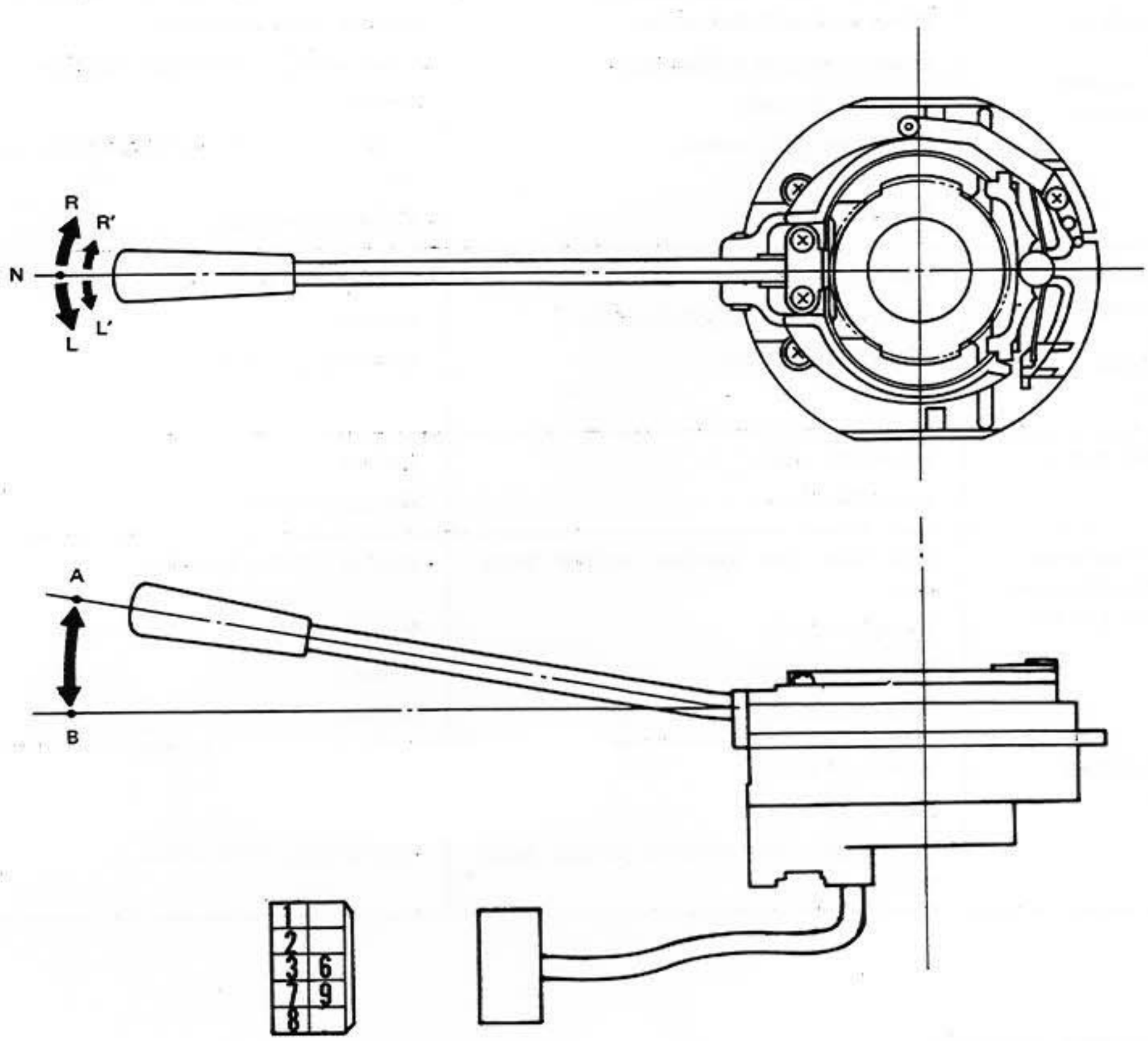
Condition	Probable cause	Corrective action
Turn signals do not operate. (Hazard warning lamps operate).	Blown out fusible link or fuse. Loose connection or open circuit. Faulty flasher unit. Faulty turn signal switch. Faulty hazard switch.	Correct cause and replace. Check wiring and/or repair connection. Replace. Conduct continuity test and replace if necessary. Replace if necessary.
Hazard warning lamps do not operate. (Turn signals operate).	Blown out fusible link or fuse. Faulty hazard warning flasher unit. Faulty hazard switch.	Correct cause and replace. Replace. Replace if necessary.
No flasher click is heard.	Burned out bulb. Loose connection.	Replace. Reconnect firmly.
Flasher cycle is too slow (Pilot lamp does not go out.), or too fast	Bulb other than specified wattage being used. Burned out bulbs. Loose connections. Faulty flasher unit.	Replace with one specified. Replace. Repair. Replace.
Flashing cycle is irregular.	Burned out bulb. Loose connection. Bulbs other than specified wattage being used.	Replace. Repair. Replace with one specified.

TURN SIGNAL SWITCH (Model 160 series)

Refer to Combination Switch (Page EL-54).

TURN SIGNAL AND DIMMER SWITCH (Model 61 series)

Inspection



TURN SIGNAL

	LEVER			HORN
	R-R'	N	L-L'	
6				○
7	○		○	
8	○			
9			○	

DIMMER

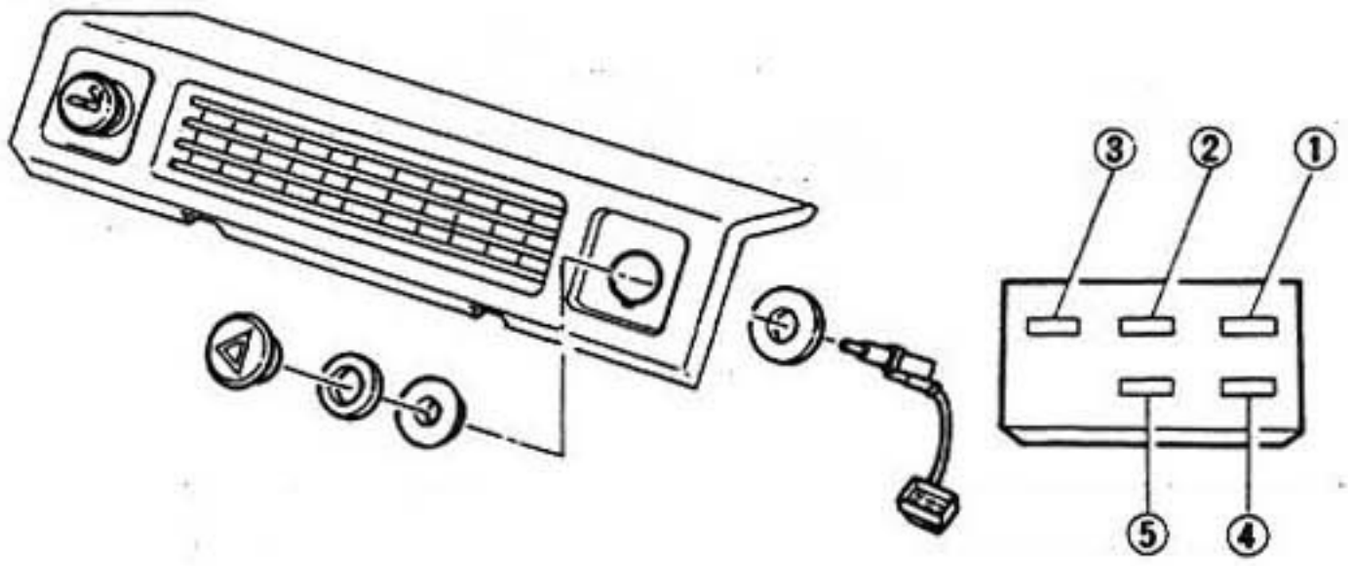
	B (M)	A (D)
1	○	○
2	○	
3		○

SEL007A

HAZARD SWITCH

Inspection

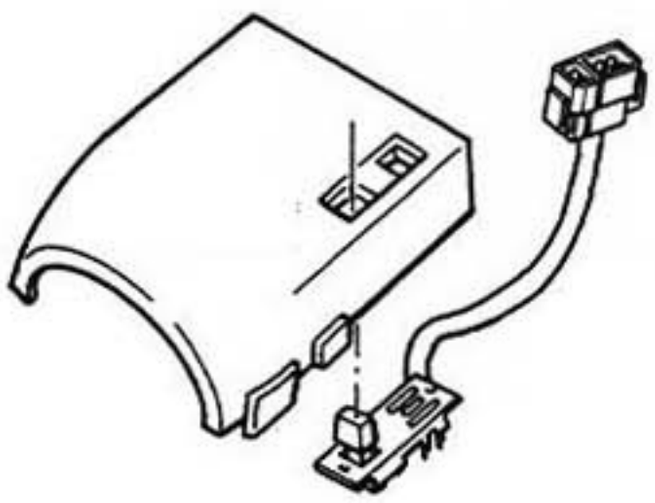
Model 160 series

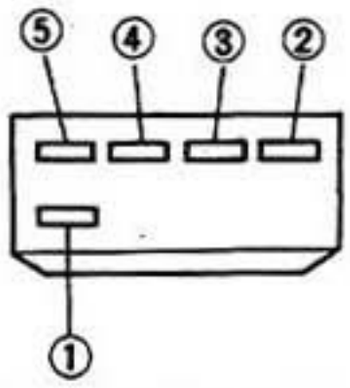


	OFF	ON
1	○	
2	○	
3		○
4		○
5		○

SEL022A

Model 61 series





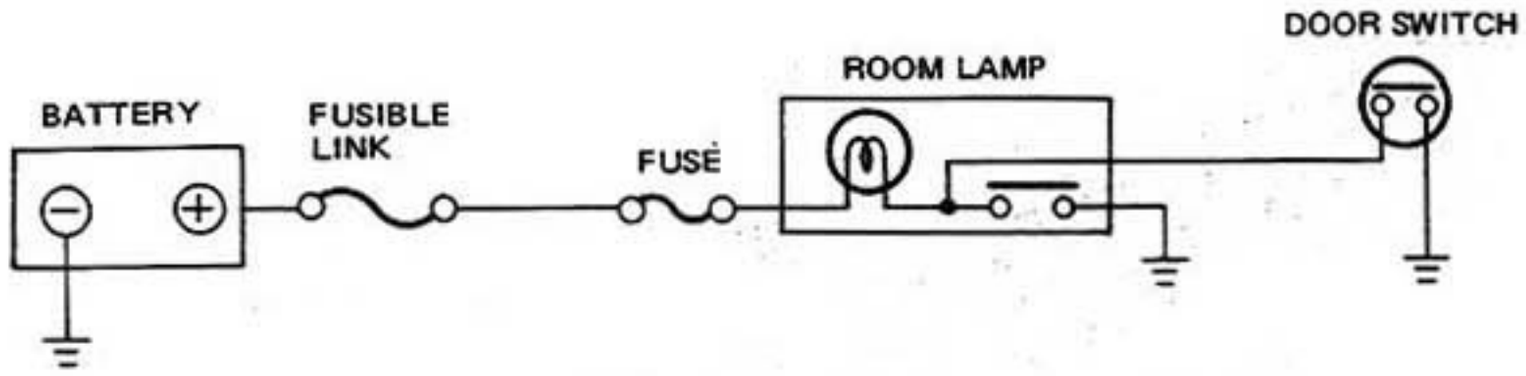
	OFF	ON
1	○	
2	○	
3		○
4		○
5		○

SEL023A

ROOM LAMP (Model 160 series)

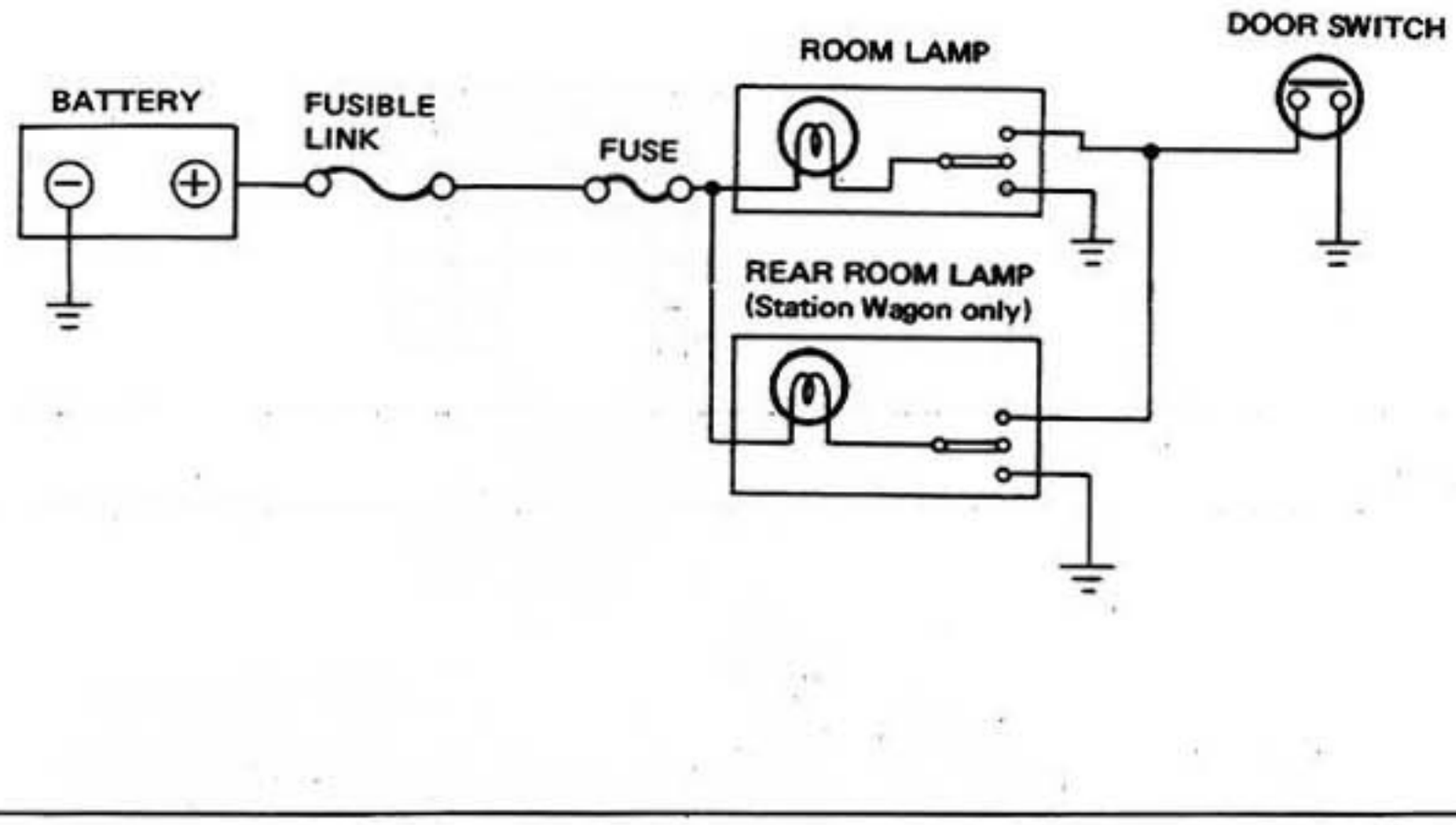
SCHEMATIC

Hardtop, High-roof Hardtop and Pick-up



SEL024A

Van and Station Wagon



SEL384A

TROUBLE DIAGNOSES AND CORRECTIONS

Condition	Probable cause	Correction action
Lamp does not light when door is opened.	Blown out fusible link or fuse.	Correct cause and replace.
	Burned out bulb.	Replace.
	Loose bulb.	Correct.
	Loose connection to lamp.	Correct.
	Faulty door switch.	Replace if necessary.
	Faulty room lamp switch.	Replace if necessary.

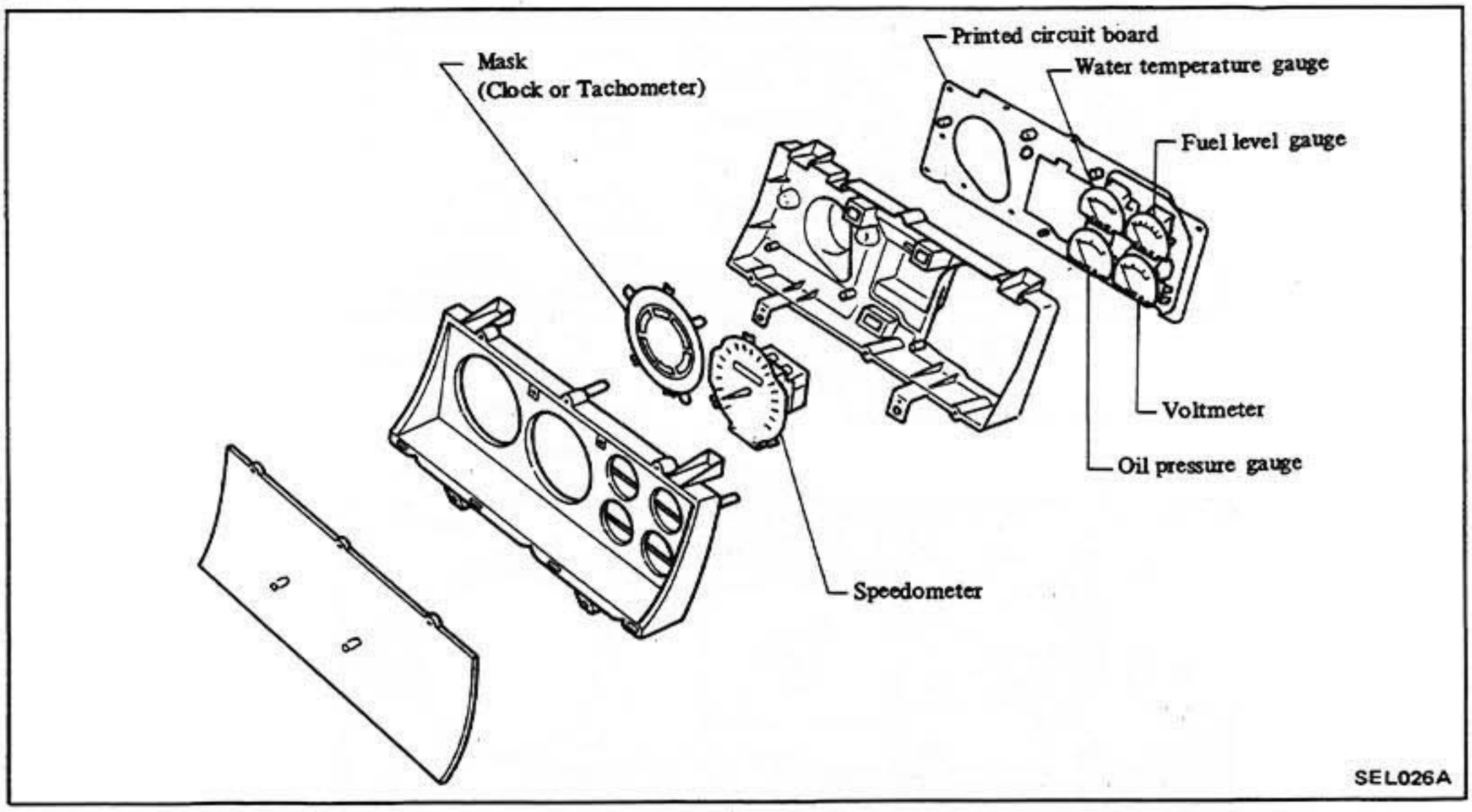
METERS, GAUGES AND WARNING SYSTEM

CAUTION: Before starting to work, be sure to turn ignition switch "OFF" and then disconnect battery ground cable.

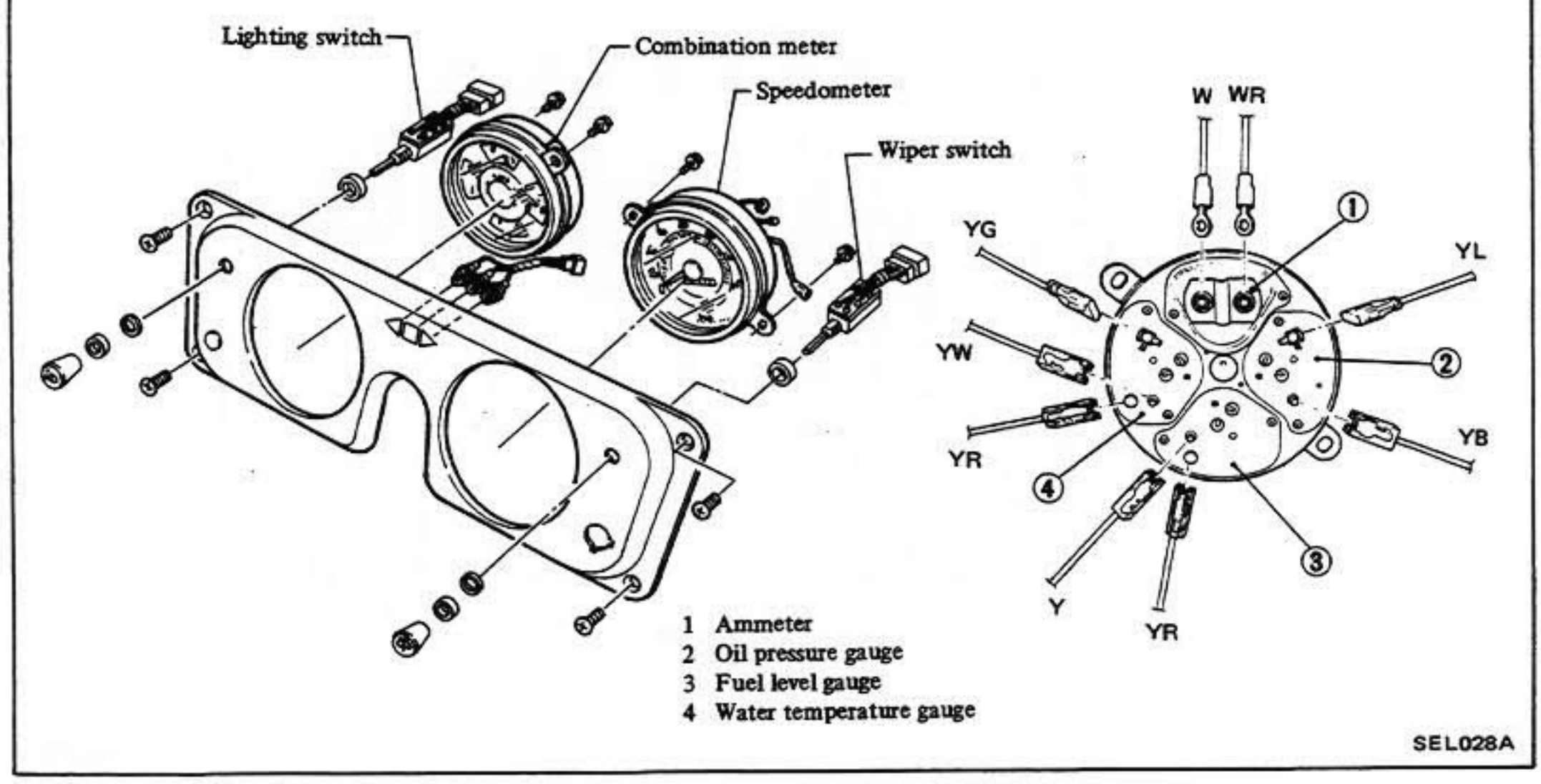
COMBINATION METER

DISASSEMBLY AND ASSEMBLY

Model 160 series

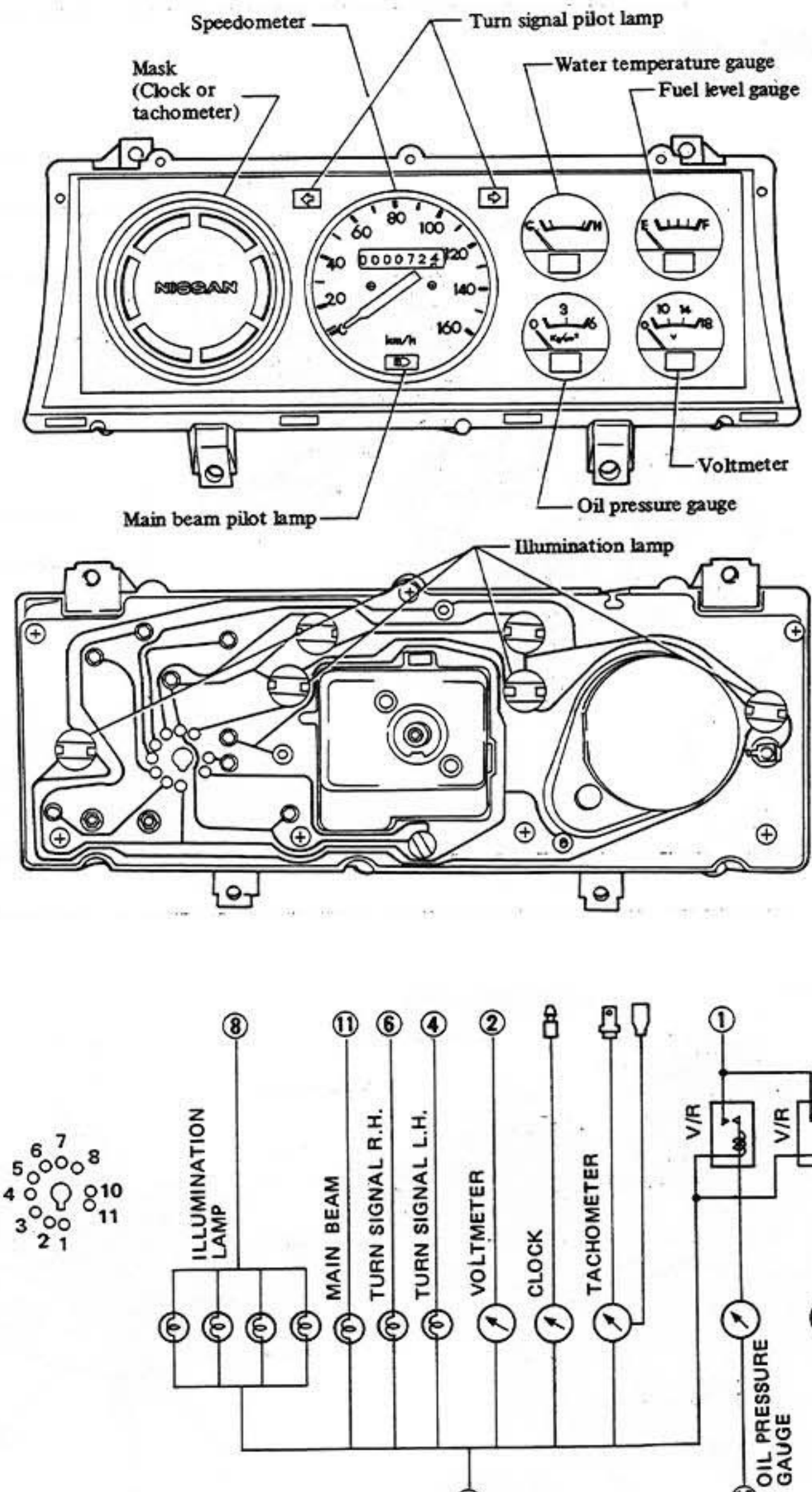


Model 61 series



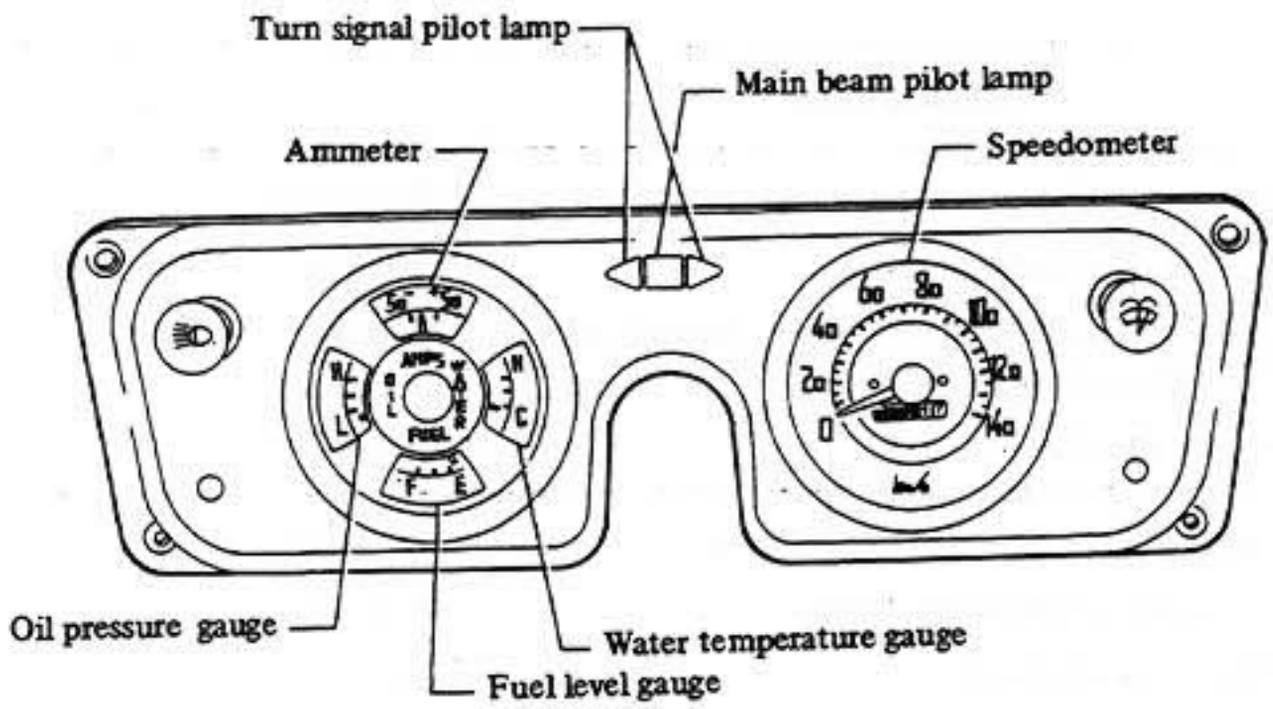
SCHEMATIC

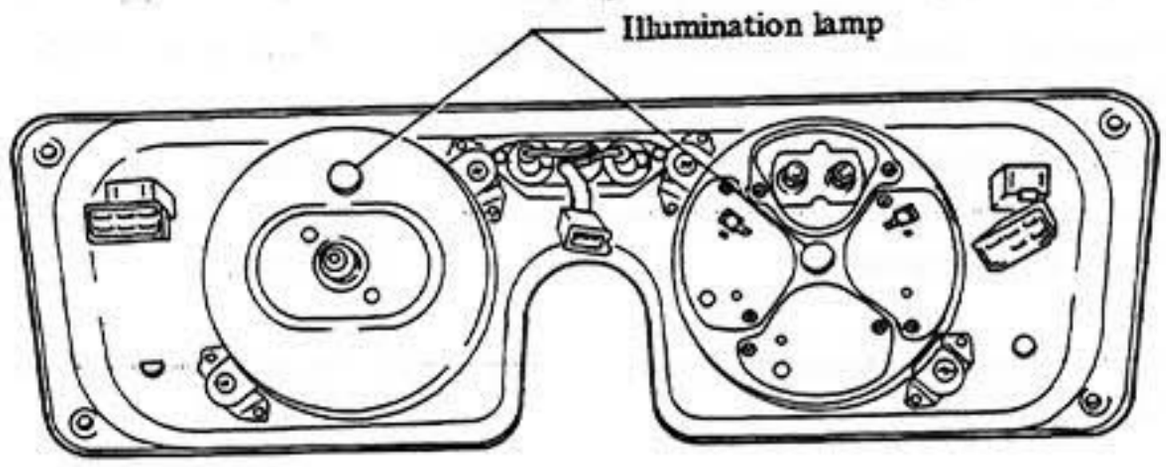
Model 160 series

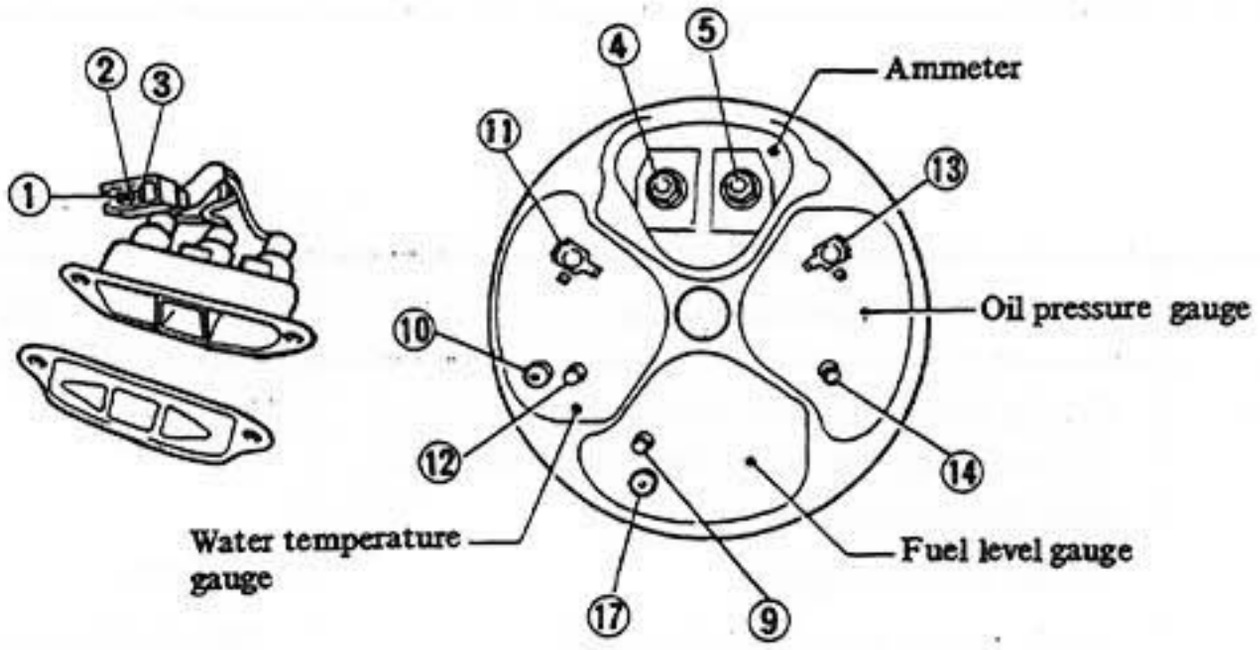


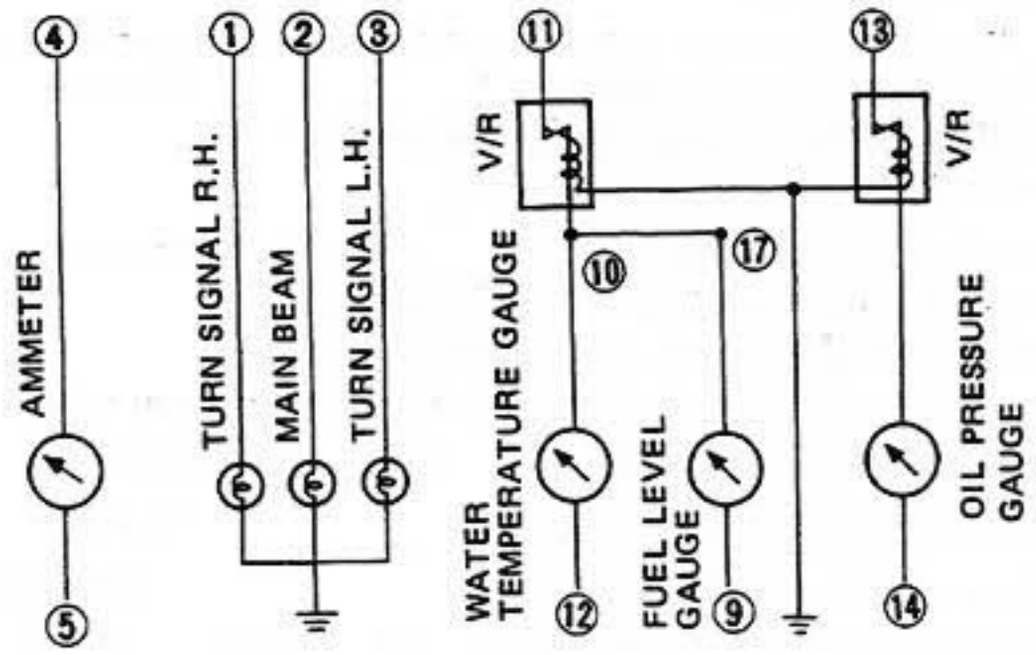
SEL027A

Model 61 series









SEL029A

TROUBLE DIAGNOSES AND CORRECTIONS

Speedometer

Condition	Probable cause	Corrective action
Neither speedometer pointer nor odometer operates.	Loose speedometer cable connector.	Retighten.
	Broken speedometer cable.	Replace.
	Damaged speedometer drive pinion gear (Transmission side).	Replace.
	Faulty speedometer.	Replace.
Unstable speedometer pointer.	Loose speedometer cable connector.	Retighten.
	Damaged speedometer cable.	Replace.
	Faulty speedometer.	Replace.
Unusual sound occurs in response to increase in driving speed	Excessively bent or twisted speedometer cable inner wire or lack of lubrication.	Replace or lubricate.
	Faulty speedometer.	Replace.
Inaccurate speedometer indication.	Faulty speedometer.	Replace.
Inaccurate odometer operation.	Faulty speedometer.	Replace.

Fuel level gauge

Condition	Probable cause	Corrective action
Fuel level gauge does not operate.	Faulty fuel tank gauge unit. (Pointer deflects when fuel tank gauge unit wire is grounded)	Replace.
	Faulty fuel level gauge.	Replace.
	Loose connection or open circuit.	Check wiring and/or repair connection.
	Faulty voltage regulator built into water temperature gauge.	Replace water temperature gauge.
Pointer indicates only "F" position.	Faulty fuel tank gauge unit. (Gauge pointer returns to original position when ignition switch is turned off.)	Replace.
	Faulty fuel level gauge. (Gauge pointer indicates "F" position even after ignition switch has been turned off.)	Replace.
Fuel level gauge does not operate accurately.	Faulty fuel tank gauge unit.	Replace.
	Faulty fuel level gauge.	Replace.
	Poor or loose connection.	Correct connector terminal contact.

Water temperature gauge

Condition	Probable cause	Corrective action
Gauge does not operate.	Faulty thermal transmitter or loose terminal connection. (When wire to thermal transmitter is grounded, gauge pointer fluctuates.)	Replace thermal transmitter or correct terminal connection.
	Faulty water temperature gauge.	Replace.
	Faulty voltage regulator built into water temperature gauge.	Replace water temperature gauge.
Gauge indicates only maximum temperature.	Faulty thermal transmitter. (Gauge pointer returns to original position when ignition switch is turned off.)	Replace.
	Faulty water temperature gauge. (Gauge pointer indicates maximum temperature even after ignition switch is turned off.)	Replace.
Gauge does not operate accurately.	Faulty water temperature gauge.	Replace.
	Loose or poor connection.	Correct connector terminal contact.

Oil pressure gauge

Condition	Probable cause	Corrective action
Oil pressure gauge does not operate.	Faulty oil pressure sending unit or loose terminal connection.	Replace oil pressure sending unit or correct terminal connection.
Gauge indicates only maximum pressure.	Faulty oil pressure gauge unit. (Gauge pointer returns to original position when ignition switch is turned off.)	Replace.
	Faulty oil pressure gauge. (Gauge pointer indicates maximum pressure even after ignition switch is turned off.)	Replace.

Voltmeter (Model 160 series)

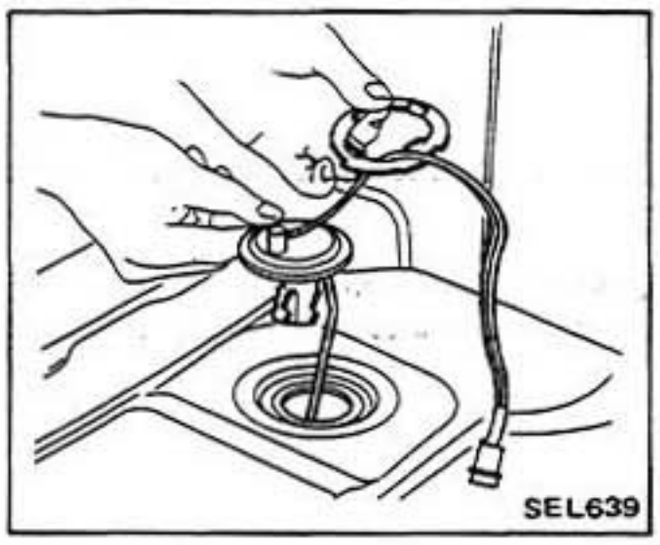
Condition	Probable cause	Corrective action
Voltmeter does not operate or indicates incorrectly.	Faulty voltmeter.	Replace.
	Loose or poor connection.	Check wiring and/or repair connection.

Tachometer

Condition	Probable cause	Corrective action
Tachometer pointer deflects.	Loose or poor connection. Faulty resistor. Faulty tachometer.	Repair. Replace resistor. Repair or replace tachometer.
Tachometer pointer will not move.	Loose or poor connection. Faulty tachometer.	Repair. Repair or replace tachometer.

FUEL TANK GAUGE UNIT

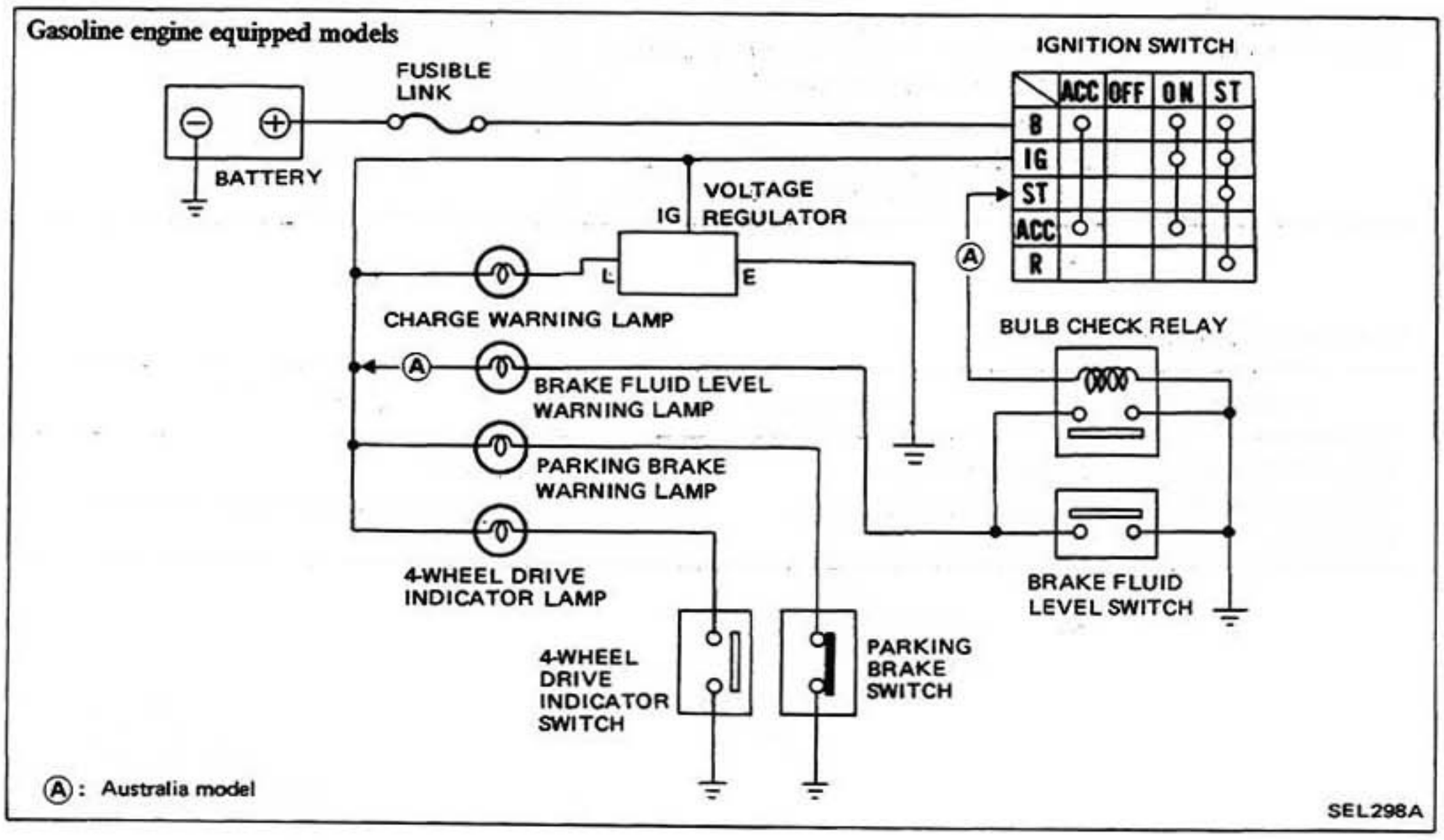
Removal and installation



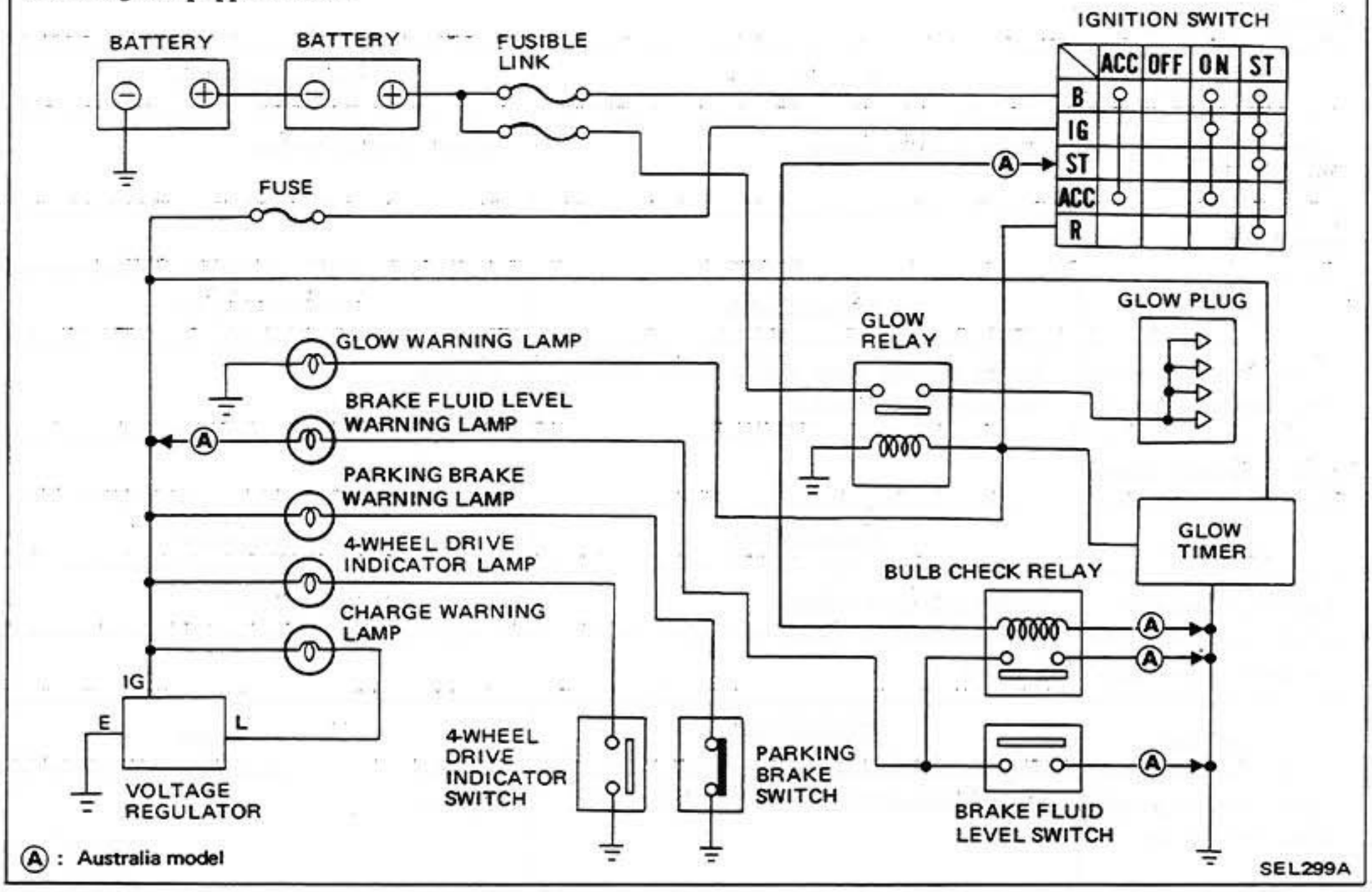
WARNING SYSTEM

SCHEMATIC

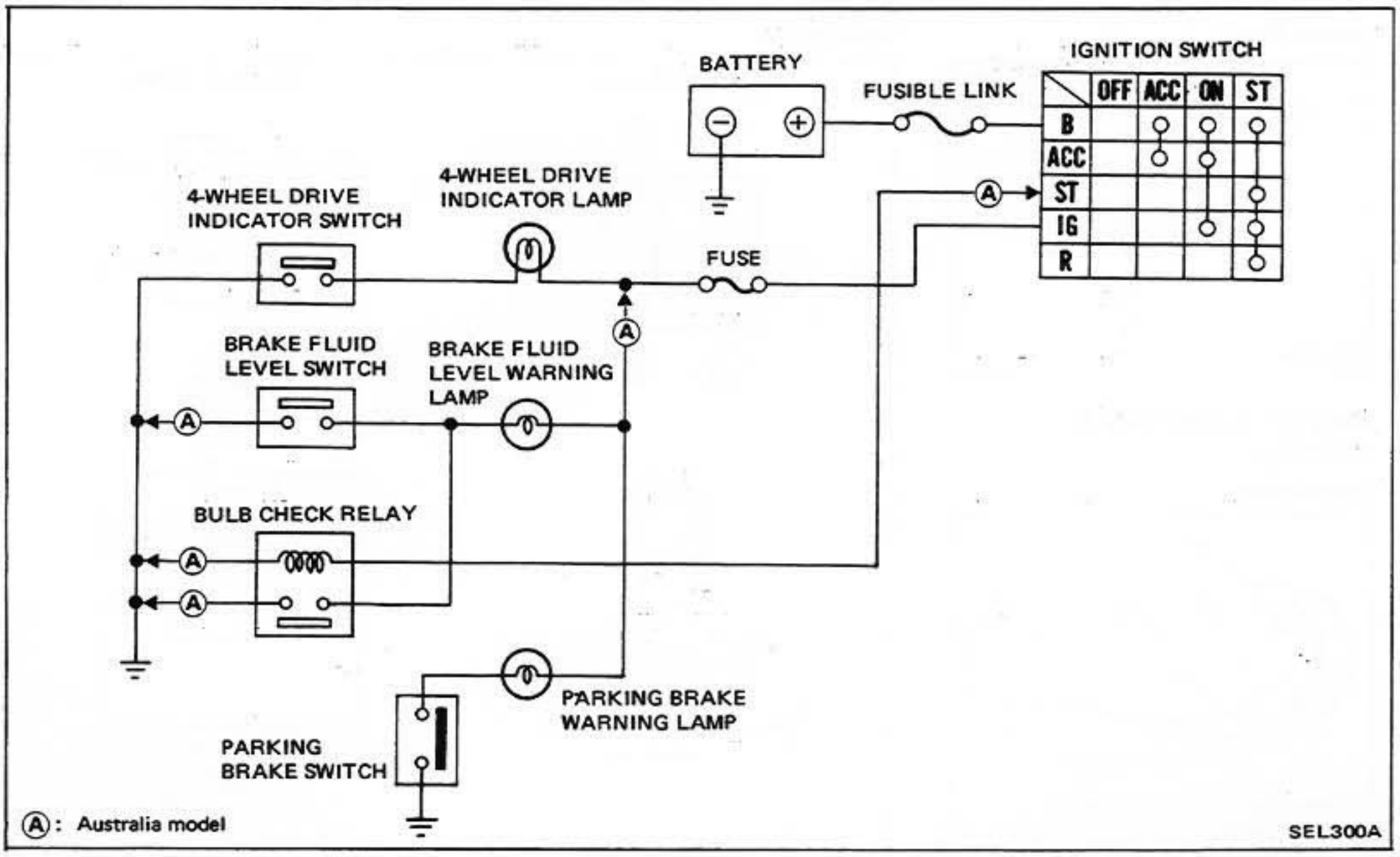
Model 160 series



Diesel engine equipped models



Model 61 series



TROUBLE DIAGNOSES AND CORRECTIONS

Charge warning lamp

Condition	Probable cause	Corrective action
Lamp does not go out when engine is started.	Faulty charging system.	Inspect charging system.

Brake warning lamp

Condition	Probable cause	Corrective action
Lamp does not go out when engine is running.	Faulty parking brake switch (When parking brake lever is released.).	Replace.

Glow warning lamp

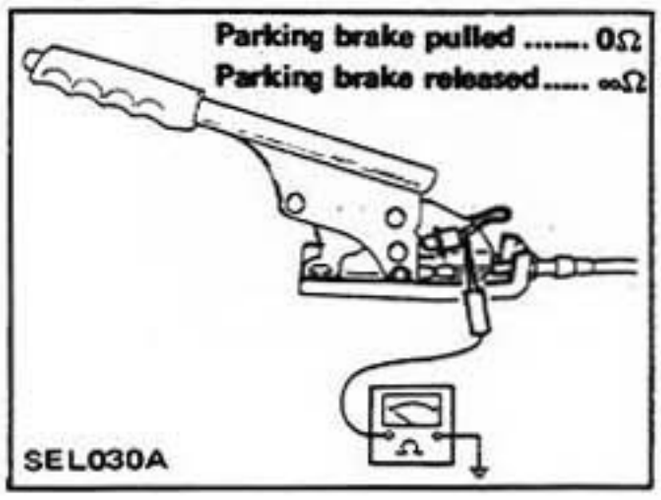
Condition	Probable cause	Corrective action
Lamp does not glow.	Faulty auto-glow system.	Inspect auto-glow system.

4-wheel drive indicator lamp

Condition	Probable cause	Corrective action
Lamp does not go out when 4-wheels are driven.	Faulty 4-wheel drive indicator switch.	Replace.

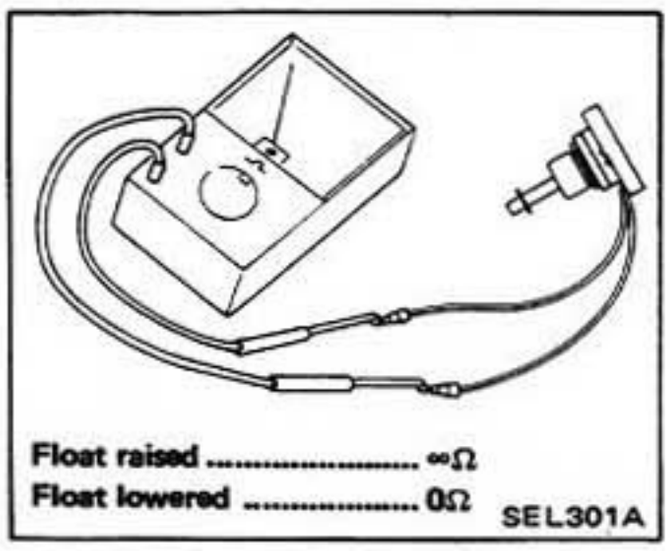
PARKING BRAKE SWITCH

Inspection



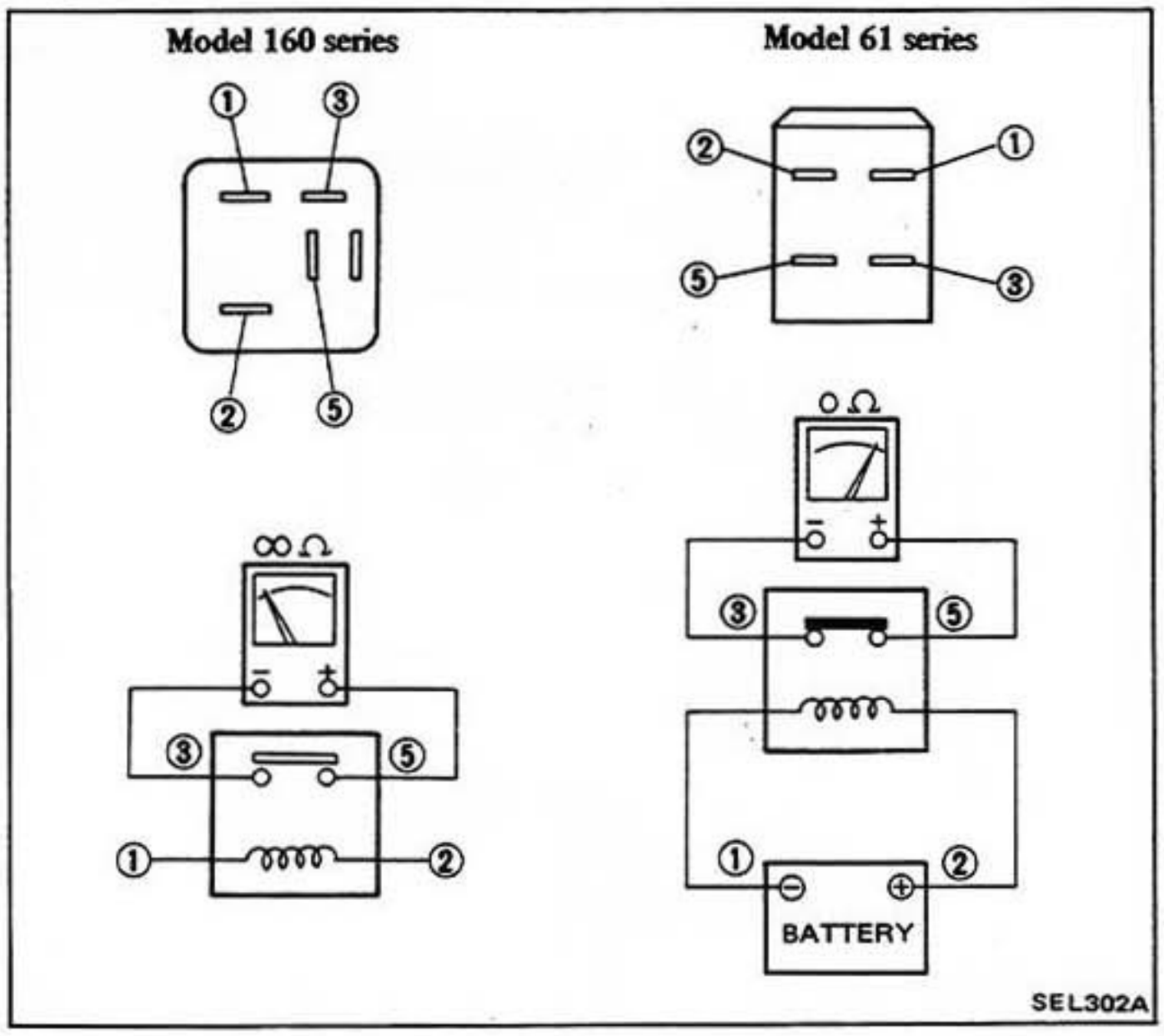
BRAKE FLUID LEVEL SWITCH

Inspection



BULB CHECK RELAY

Inspection



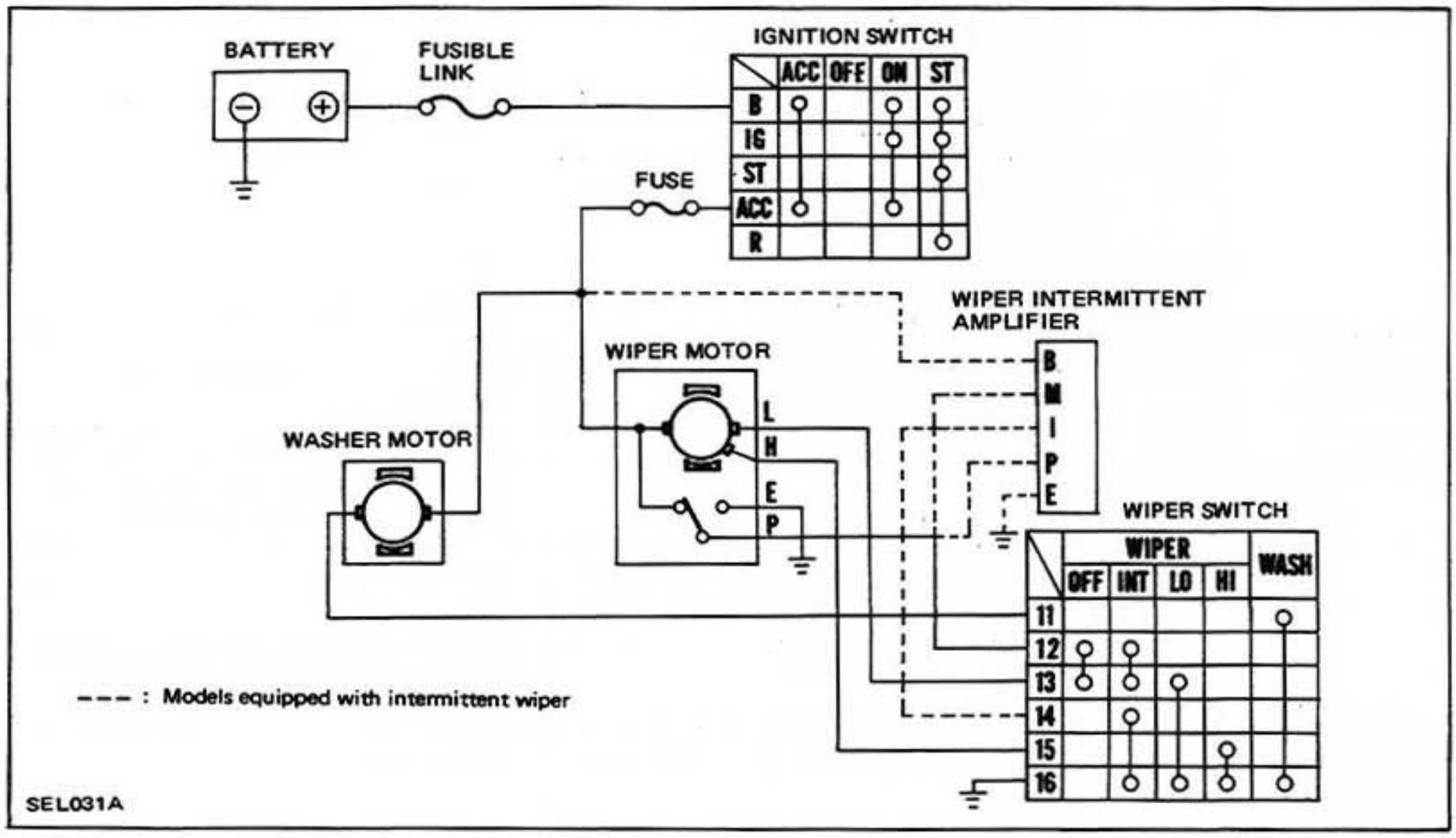
WIPER AND WASHER

CAUTION: Before starting to work, be sure to turn ignition switch "OFF" and then disconnect battery ground cable.

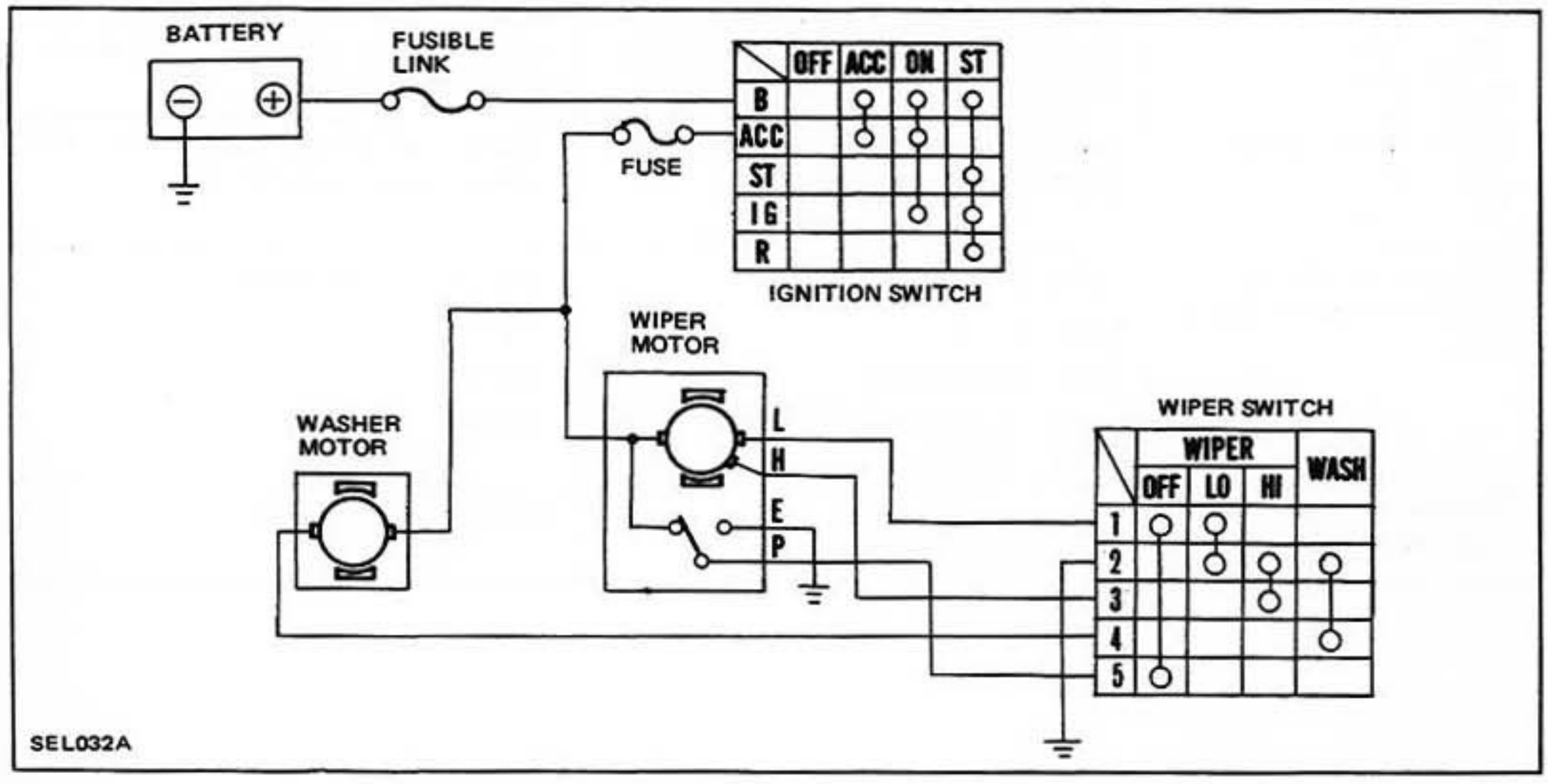
WINDSHIELD WIPER AND WASHER

SCHEMATIC

Model 160 series



Model 61 series



TROUBLE DIAGNOSES AND CORRECTIONS

Condition		Probable cause	Corrective action
Windshield wiper does not operate.	Motor	Broken armature, worn motor brush or seized motor shaft.	Replace motor.
	Power supply and cable	Blown out fusible link or fuse.	Check short-circuit, burnt component inside motor or other part for operation, and correct problem.
		Loose, open or broken wiring.	Correct.
		Improper grounding.	Correct.
	Switch	Improper switch contact.	Correct.
	Link	Foreign material interrupts movement of link mechanism.	Correct.
		Disconnect link rod.	Correct.
		Seized or rusted arm shaft.	Lubricate or replace arm shaft.
Windshield wiper operating speed is too slow.	Motor	Short-circuit of motor armature, worn motor brush or seized motor shaft.	Replace motor or lubricate bearing with engine oil.
	Power supply and cable	Low source voltage.	Measure voltage, check other electrical parts for operation, and take corrective action for power supply if necessary.
	Link	Humming occurs on motor in arm operating cycle due to seized arm shaft.	Lubricate or replace.
	Switch	Improper switch contact.	Conduct continuity test, and replace if necessary.
Windshield wiper speed can not be adjusted correctly.	Motor	Motor brush for either low or high speed is worn.	Replace motor.
Windshield wiper does not stop correctly. – Stops anywhere.	Motor	Contaminated auto-return device contacts or improper contact due to foreign matter.	Remove auto-return device cover, and clean contacts carefully so as not to deform contacts plate.
Windshield wiper does not stop correctly. – Does not stop.	Motor	Incomplete auto-return device operation (Contact is not interrupted.)	Remove auto-return device cover, and correct contacts plate bending.
Washer motor does not operate when washer switch is on.		Blown out fusible link or fuse.	Correct cause and replace.
		Faulty switch.	Replace.
		Faulty washer motor.	Replace.
		Loose or poor connection contact at motor or switch.	Replace.
Washer motor operates but washer fluid is not ejected.		Clogged washer nozzle.	Clean nozzle or replace.

INTERMITTENT WINDSHIELD WIPER

The sign for corrective action

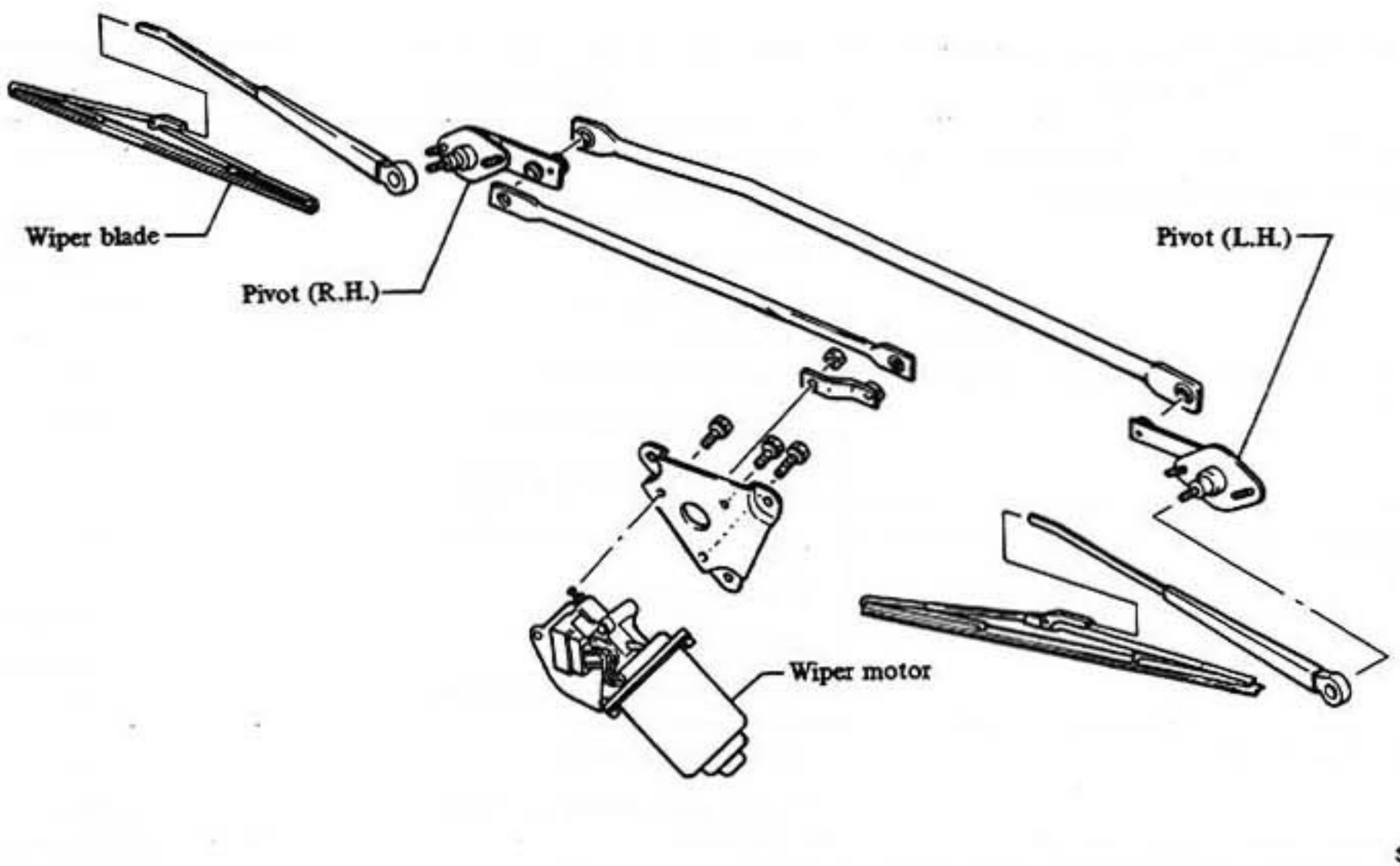
A. Measure voltage across positive (+) and negative (–) terminals of intermittent amplifier with a circuit tester.
B. Check continuity of all wiper switch positions.
C. Check continuity of terminals of wiper motor, wiper switch and intermittent amplifier.
D. Check continuity in wiper motor circuit.
E. Alternator or battery is faulty.

Condition	Probable cause	Corrective action
Wipers do not operate intermittently but operates at Low and High speeds.	Line voltage below 10 volts. Faulty wiper switch. Faulty wiring. Faulty intermittent amplifier.	A: Replace if necessary. B: Correct or replace if necessary. A,C: Repair or replace if necessary. Replace.
Intermittent period is too short for proper wiping.	Line voltage too high. Faulty wiper motor (auto-return device). Faulty intermittent amplifier.	A: Replace if necessary. D: Replace if necessary. Replace.
Intermittent period is too long for proper wiping.	Line voltage below 10 volts. Faulty wiper switch. Faulty wiring. Faulty intermittent amplifier.	A: Replace if necessary. B: Correct or replace if necessary. A,C: Repair or replace if necessary. Replace.
Wipers do not shut off.	Faulty wiper motor. Faulty intermittent amplifier.	D: Replace if necessary. Replace.
Wipers operate intermittently with wiper switch OFF.	Faulty wiper switch. Faulty wiring. Faulty intermittent amplifier.	B: Correct or replace if necessary. A,C: Repair or replace if necessary. Replace.
Intermittent period is erratic.	Line voltage fluctuation excessive. Faulty wiper switch. Faulty wiring. Faulty wiper motor. Faulty intermittent amplifier.	E: Correct or replace if necessary. B: Correct or replace if necessary. A,C: Repair or replace if necessary. D: Replace if necessary. Replace.
Wipers make a complete wiping stroke only one time with wiper switch ON but do not continue operation.	Line voltage below 10 volts. Faulty intermittent amplifier.	A: Replace if necessary. Replace.
Wiper motor is not interconnected when washer switch is on, but intermittent operation is normal.	Connections poor. Faulty intermittent amplifier.	C: Repair or replace if necessary. Replace.
Wiper motor simultaneously operates (or: does not delay) when washer switch is on.	Faulty intermittent amplifier.	Replace.
Wipers do not make a complete wiping stroke when washer switch is first turned on and is quickly turned off.	Faulty intermittent amplifier.	Replace.

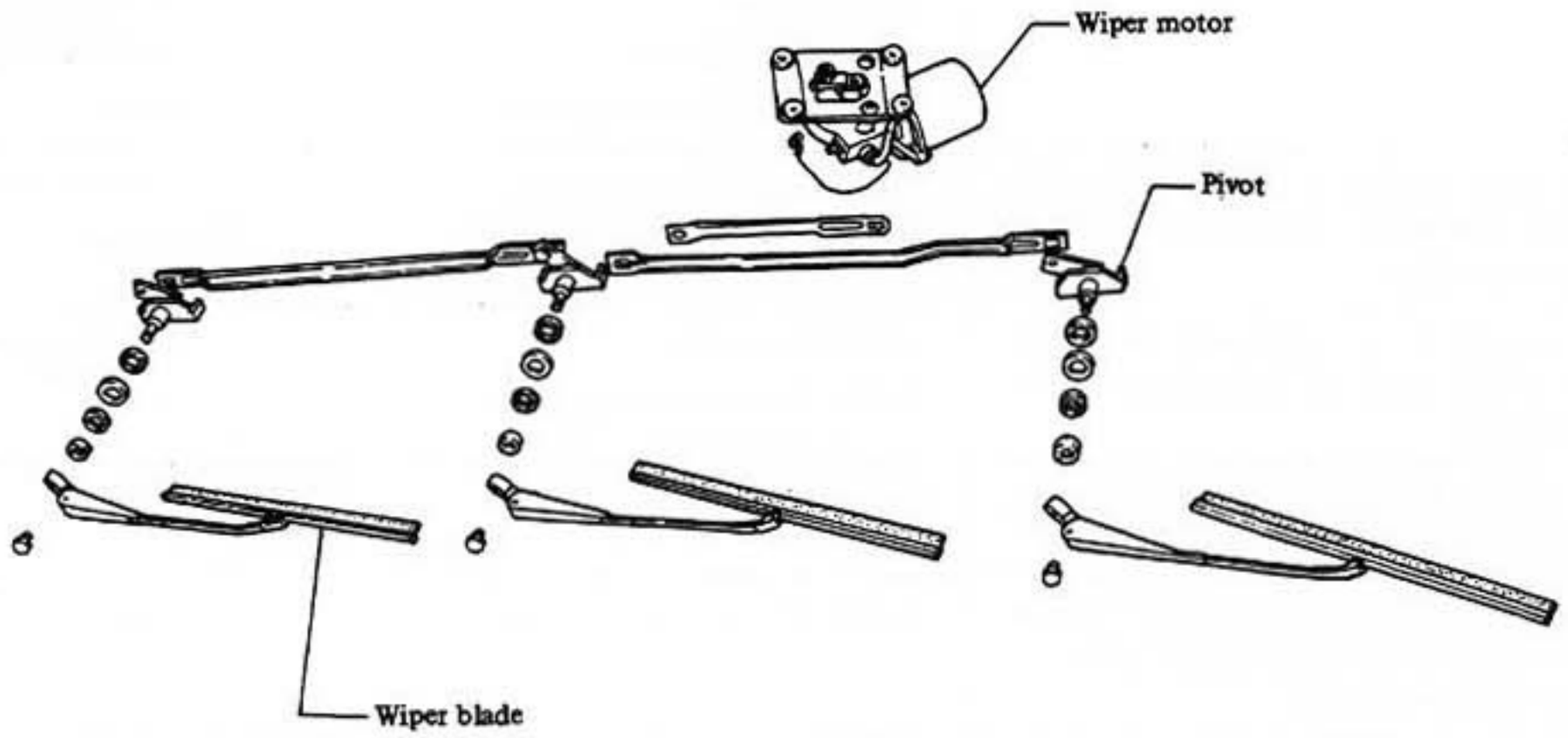
WINDSHIELD WIPER

Removal and installation

Model 160 series



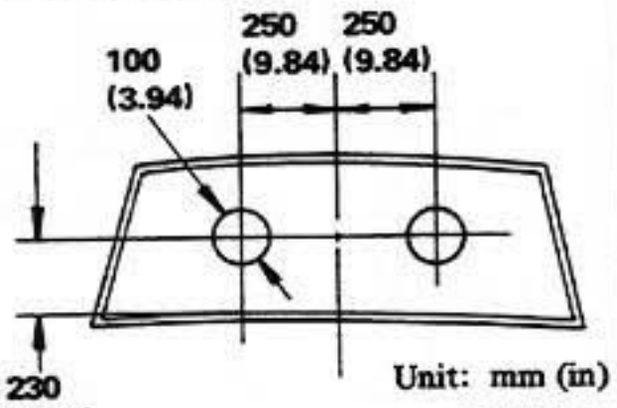
Model 61 series



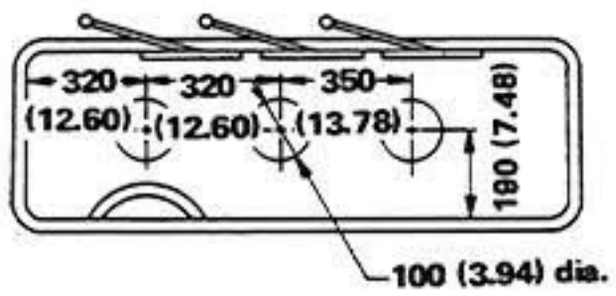
WINDSHIELD WASHER

Washer nozzle adjustment

Model 160 series



Model 61 series



CAUTION:

a. Be sure to use only windshield washing solution.
Never mix soap powder or detergent with solution.

b. To avoid improper windshield washer operation, do not operate windshield washer continuously for more than 30 seconds or without washer fluid. Normally, windshield washer should be operated for 10 seconds or less at one time.

WINDSHIELD WIPER AND WASHER SWITCH

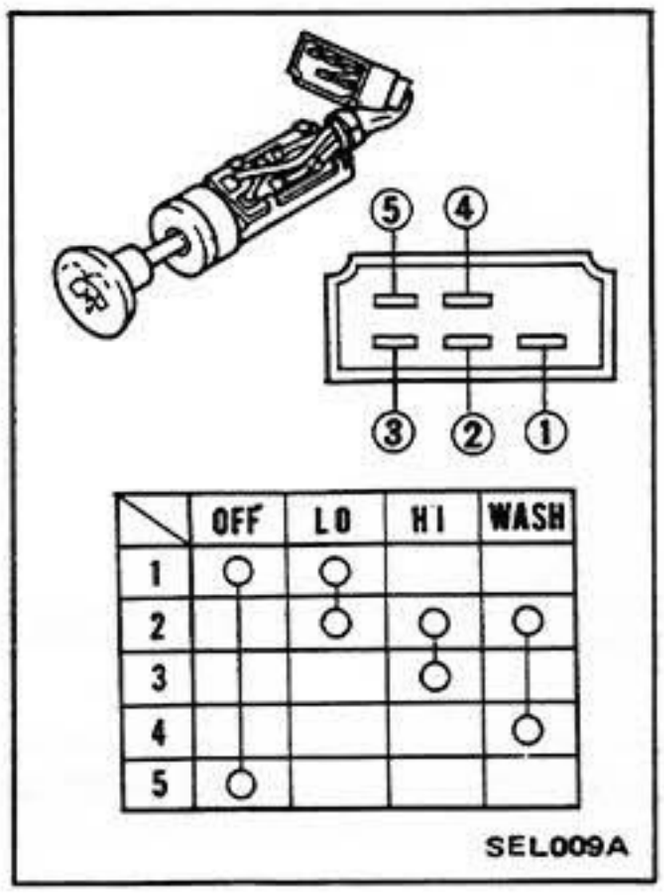
Model 160 series

Refer to Combination Switch (Page EL-54).

Model 61 series

Inspection

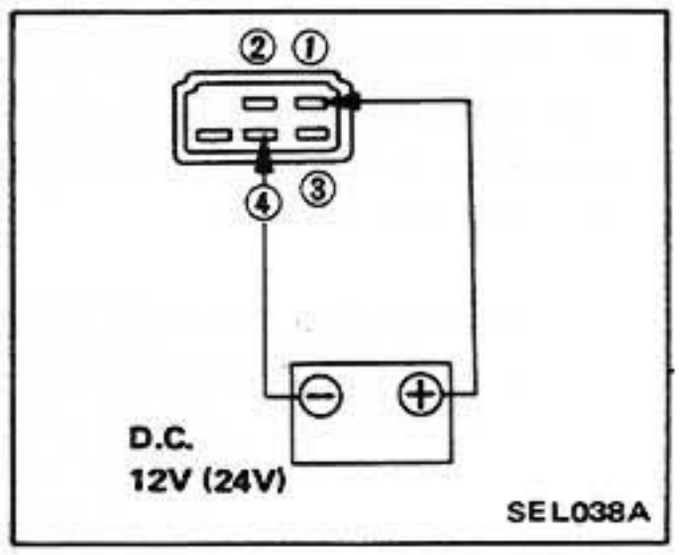
Test continuity through switch with a test lamp or ohmmter.



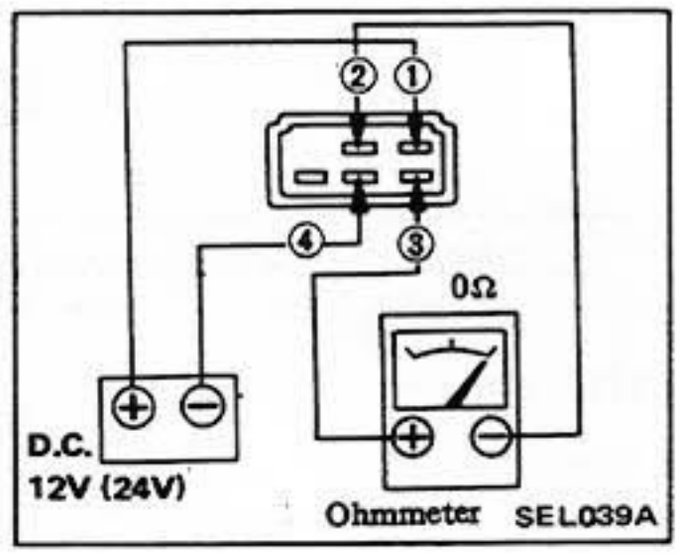
WINDSHIELD WIPER MOTOR

Inspection

1. There should be continuity between terminals ① and ④, and ① and ⑤.
2. Connect positive lead wire to terminal ①, and ground lead wire to terminal ④. The motor should be run at low speed.



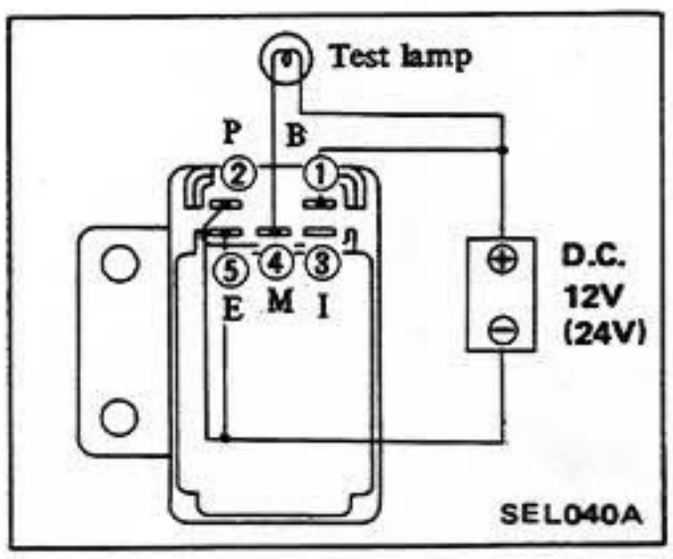
3. Keep the motor running.
Check continuity between terminals ② and ③.
Continuity should repeat "ON" and "OFF" periodically.



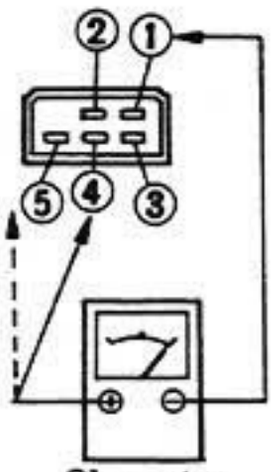
INTERMITTENT AMPLIFIER

Inspection

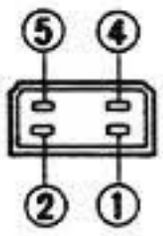
To check intermittent amplifier for proper operation, fabricate adapters shown in the following illustration, and utilize the following procedures in the order enumerated.



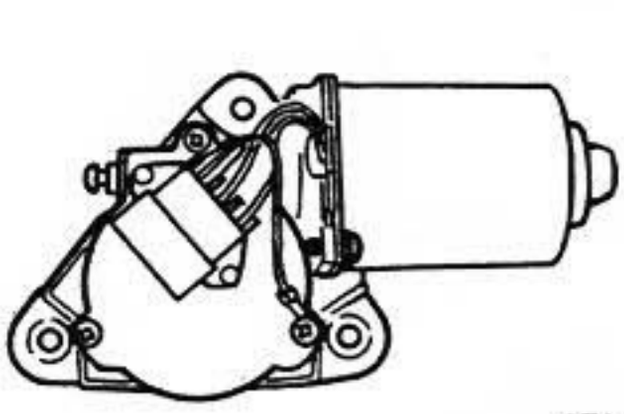
Model 160 series



Model 61 series



1	BATTERY
2	AUTO STOP
3	EARTH
4	LOW
5	HIGH

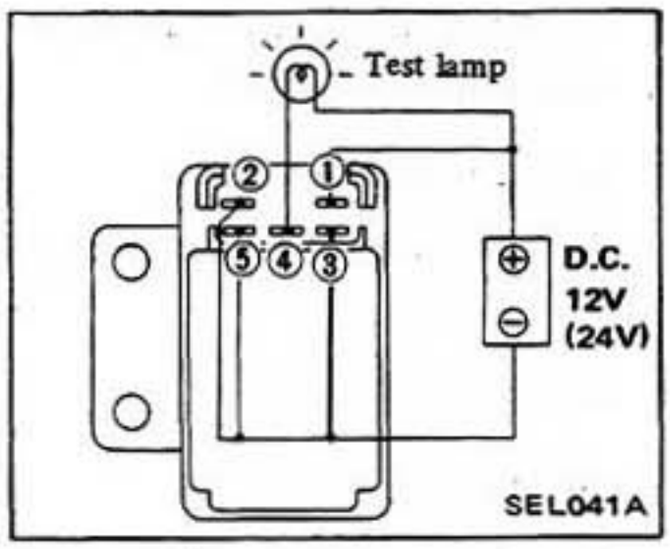


Failure to observe the order of these test procedures may lead to improper test results.

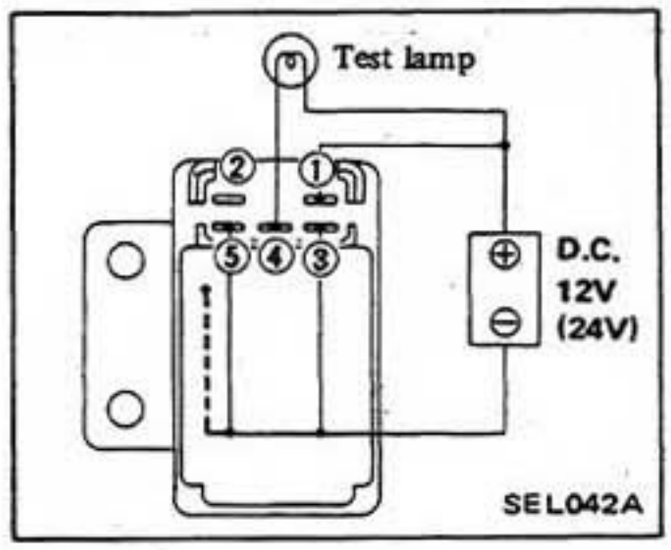
If results of following tests are satisfactory as indicated below, intermittent amplifier is functioning properly.

Be careful not to connect lead wires to incorrect terminals as this will damage intermittent amplifier.

1. Make sure that test lamp comes on when negative lead wire is connected to terminal ③.



2. Disconnect lead wire from terminal ②. Test lamp should go out and comes on in about 6 seconds.

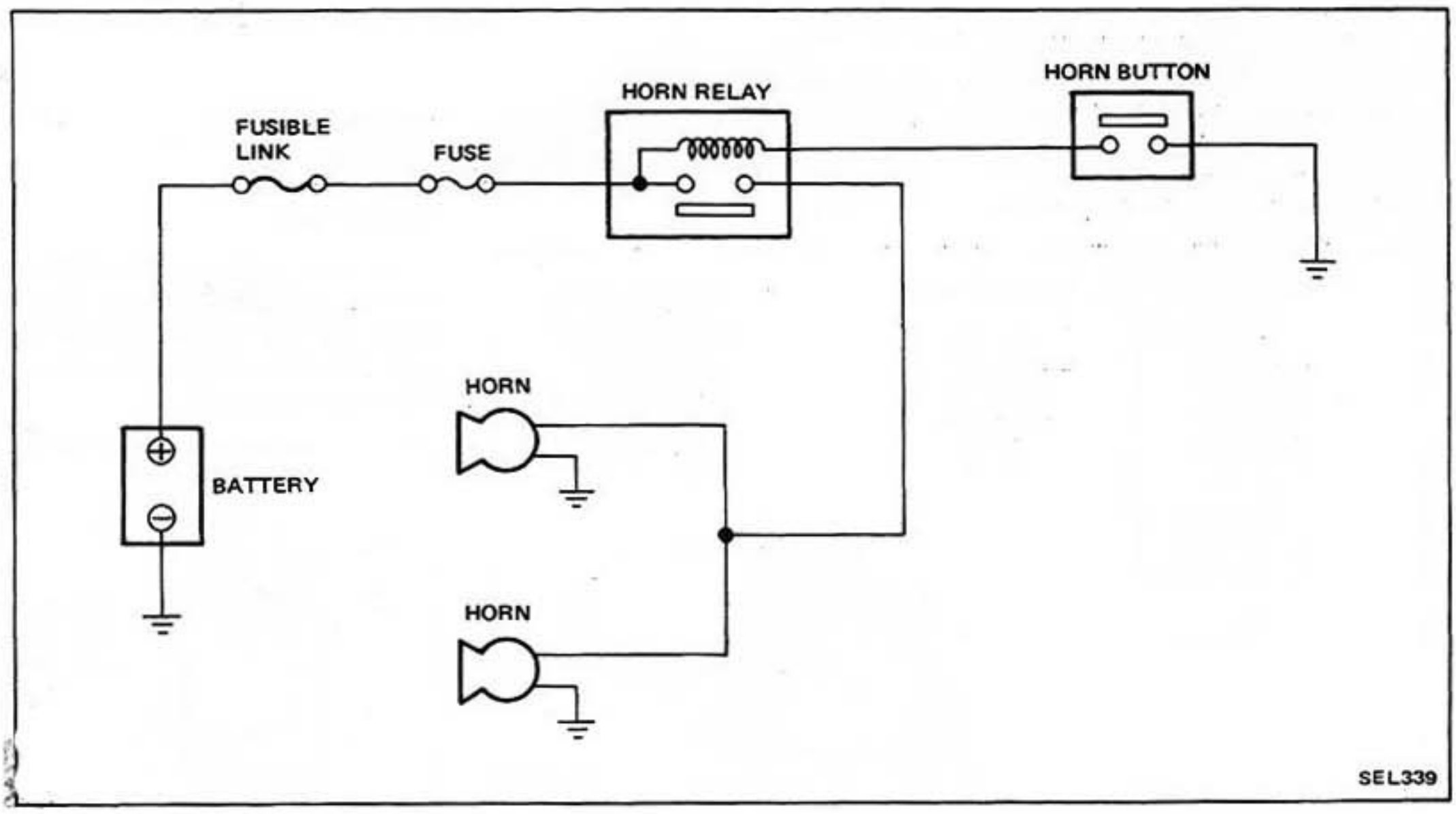


ELECTRICAL ACCESSORIES

CAUTION: Before starting to work, be sure to turn ignition switch "OFF" and then disconnect battery ground cable.

HORN

SCHEMATIC



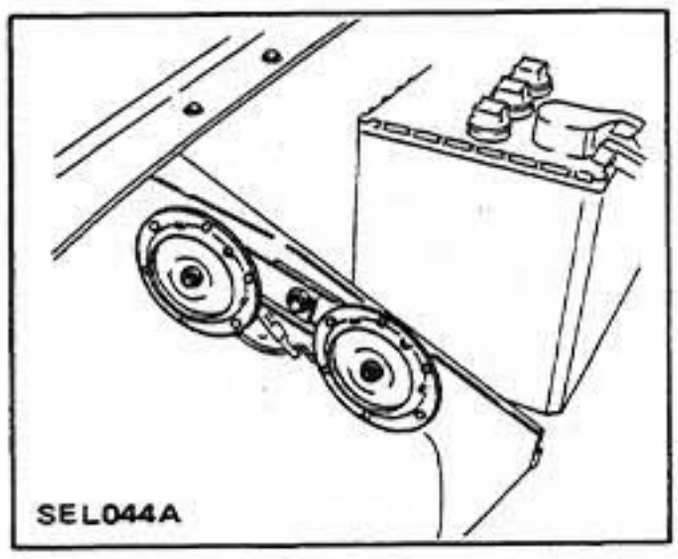
TROUBLE DIAGNOSES AND CORRECTIONS

Condition	Probable cause	Corrective action
Horn does not operate.	Discharged battery. (Measure specific gravity of electrolyte.)	Recharge.
	Burnt fuse.	Correct cause and replace fuse.
	Faulty horn button contact.	Repair horn button.
	Faulty horn relay.	Replace.
	Faulty horn or loose horn terminal connection.	Correct horn terminal connection or replace horn.
Horn sounds continuously.	Short-circuited horn button and/or horn button lead wire.	Repair horn button or its wiring.
	Faulty horn relay.	Replace.
Reduced volume and/ or tone quality.	Loose or poor connector contact. (Fuse, relay, horn and/or horn button.)	Repair.
	Faulty horn.	Adjust or replace.

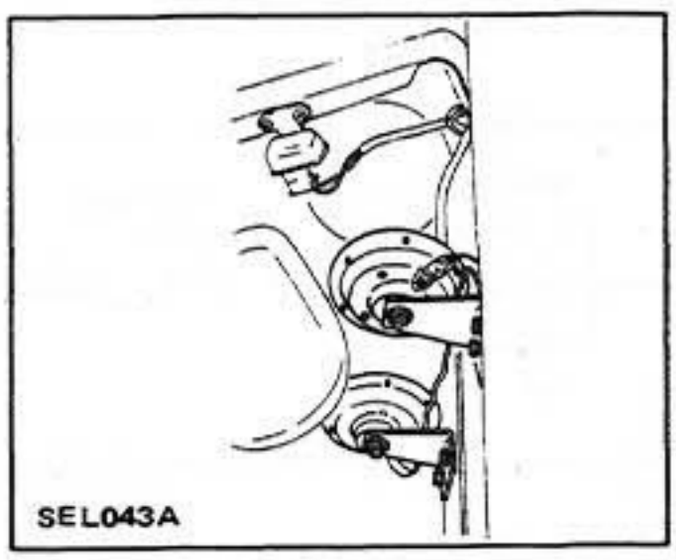
HORN

Removal and installation

Model 160 series

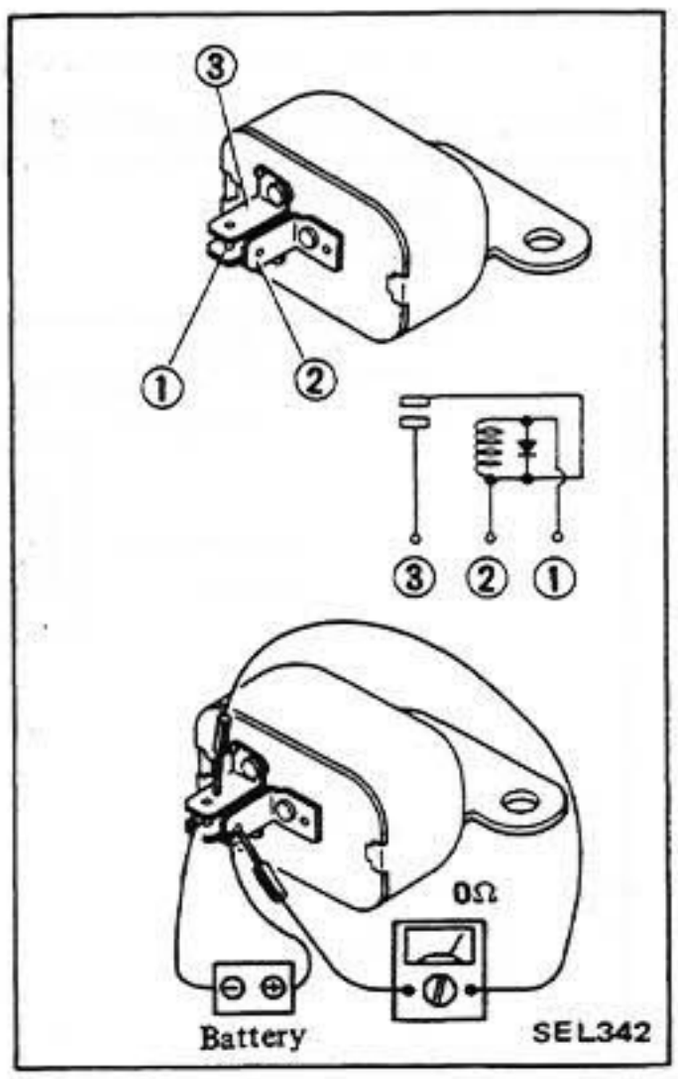


Model 61 series



HORN RELAY

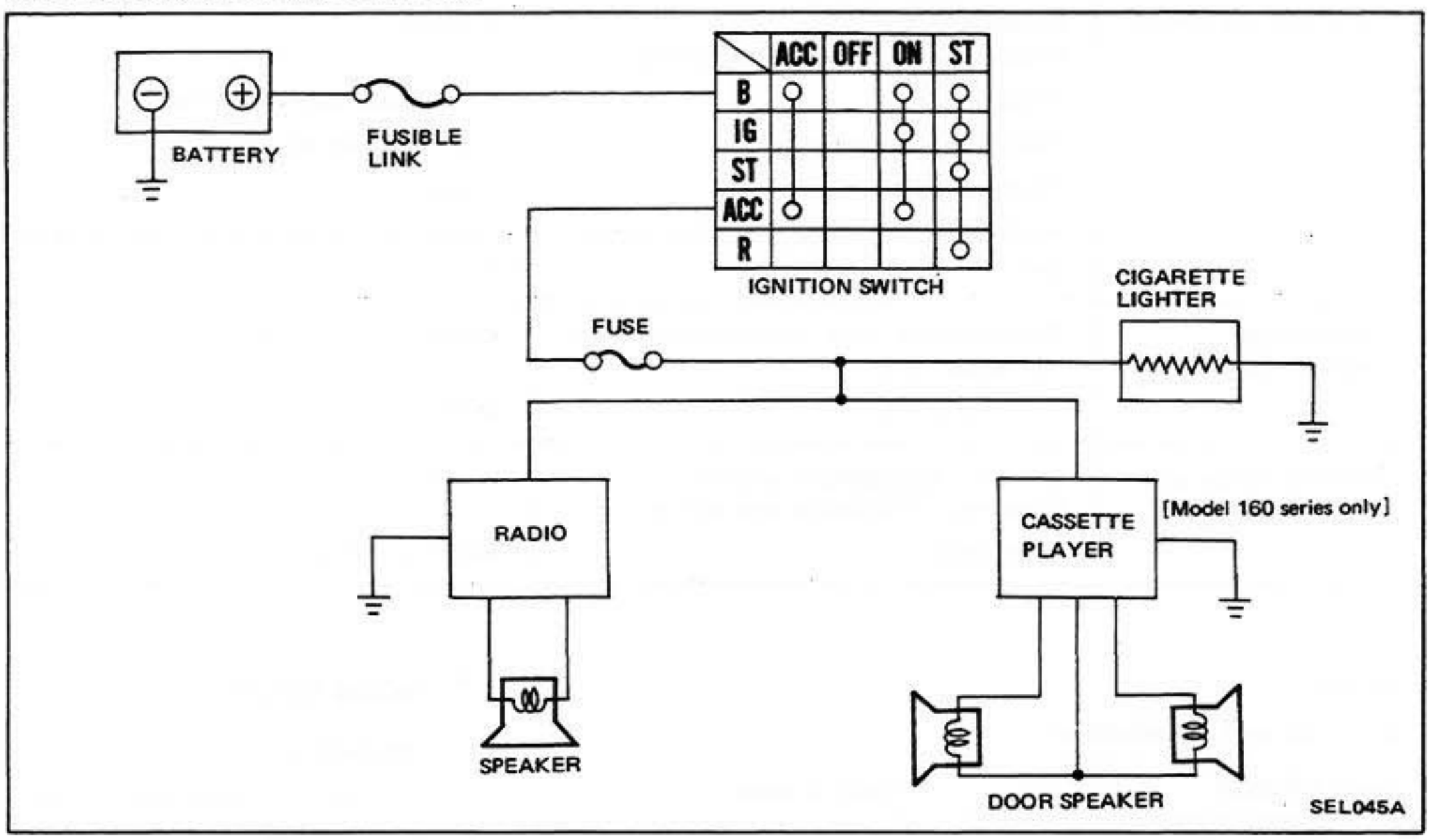
Inspection



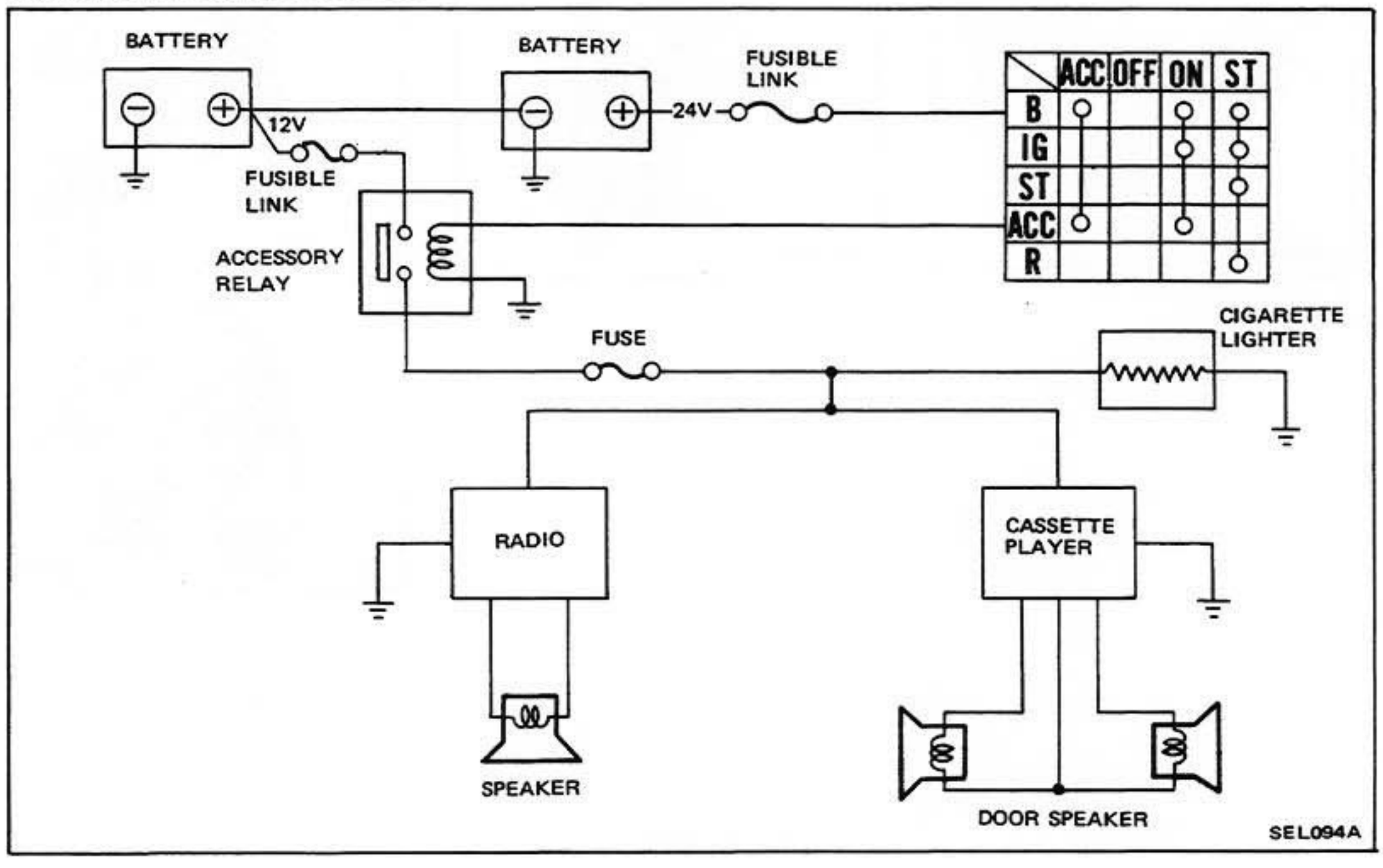
CIGARETTE LIGHTER, RADIO AND STEREO

SCHEMATIC

Gasoline engine equipped models



Diesel engine equipped models



TROUBLE DIAGNOSES AND CORRECTIONS (Radio)

Fading and weak radio reception

- Check feeder cable connections
  - N.G. → Connect or repair.
  - O.K.
- Check antenna grounding
  - N.G. → Tighten securely.
  - O.K.
- Adjust antenna trimmer
  - Unchanged
- Replace radio
  - Revised → Faulty radio
  - Unchanged → Faulty speaker.

Noisy radio reception

- Stop engine and turn off all other switches
  - Unchanged → See "Fading and weak reception"
  - Revised
- Check ignition cables
  - N.G. → Replace
  - O.K.
- Check noise prevention parts (Condenser, bending wire, etc.)
  - N.G. → Retighten or replace.
  - O.K.
- Check spark plugs
  - N.G. → Replace
  - O.K.
- Check feeder cable routing
  - N.G. → Repair
  - O.K.
- Replace radio
  - Unchanged → Faulty speaker
  - Revised → Faulty radio

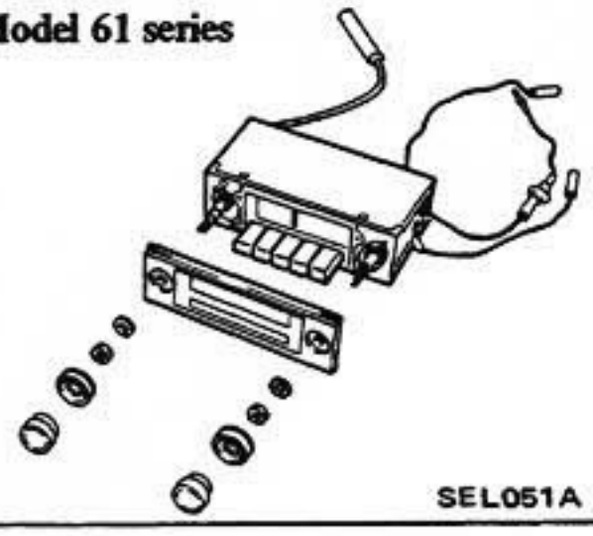
RADIO

Removal and installation

Model 160 series

Except Europe — SEL050A

Model 61 series



SEL051A

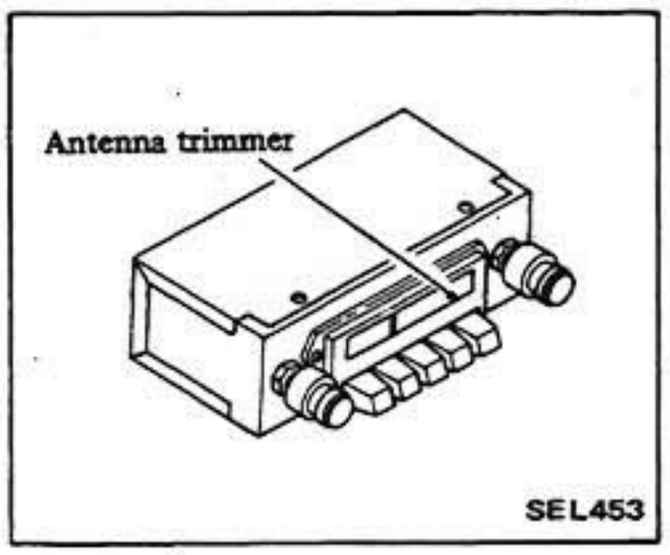
Antenna trimmer adjustment

The antenna trimmer should be adjusted in the following cases:

- Fading and weak MW (AM) reception.
- After installation of new antenna, feeder cable or radio receiver.

Before adjusting, be sure to check harness and antenna feeder cable connectors for proper connection.

1. Extend antenna completely.
2. Turn radio on, and turn volume control to increase speaker volume.
3. Push the AM selector button.
4. Tune in the weakest station (barely audible) on dial at the range around 14 (1,400 kHz).
5. Turn antenna trimmer to left or right slowly, and set it in the position where reception is strongest.

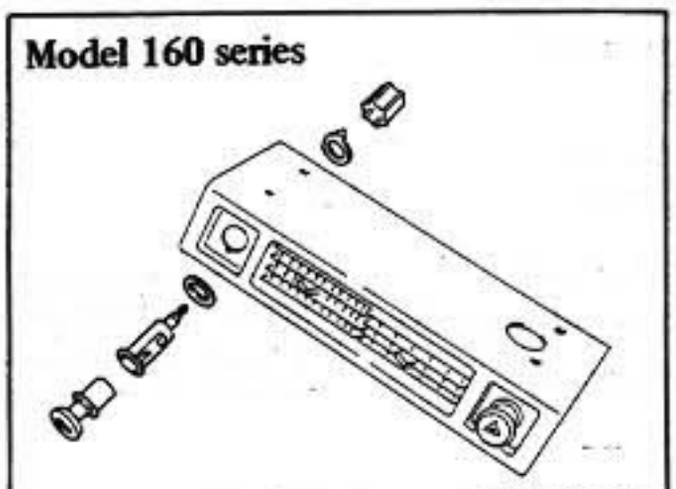


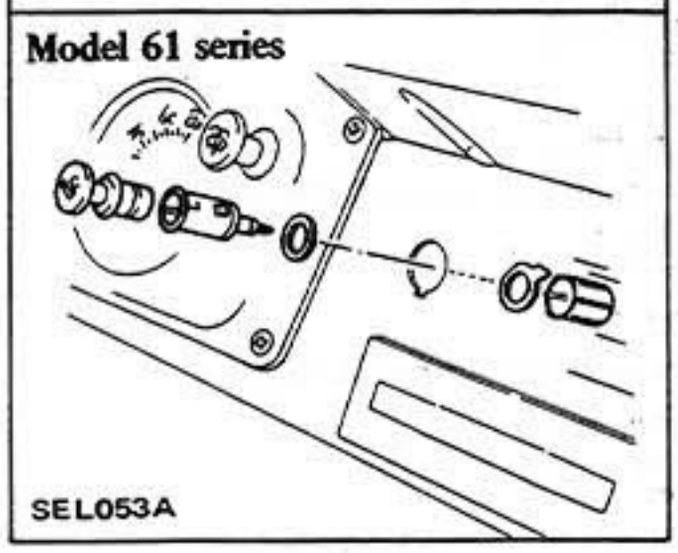
SEL453

CAUTION:
Do not turn antenna trimmer more than one-half turn.

CIGARETTE LIGHTER

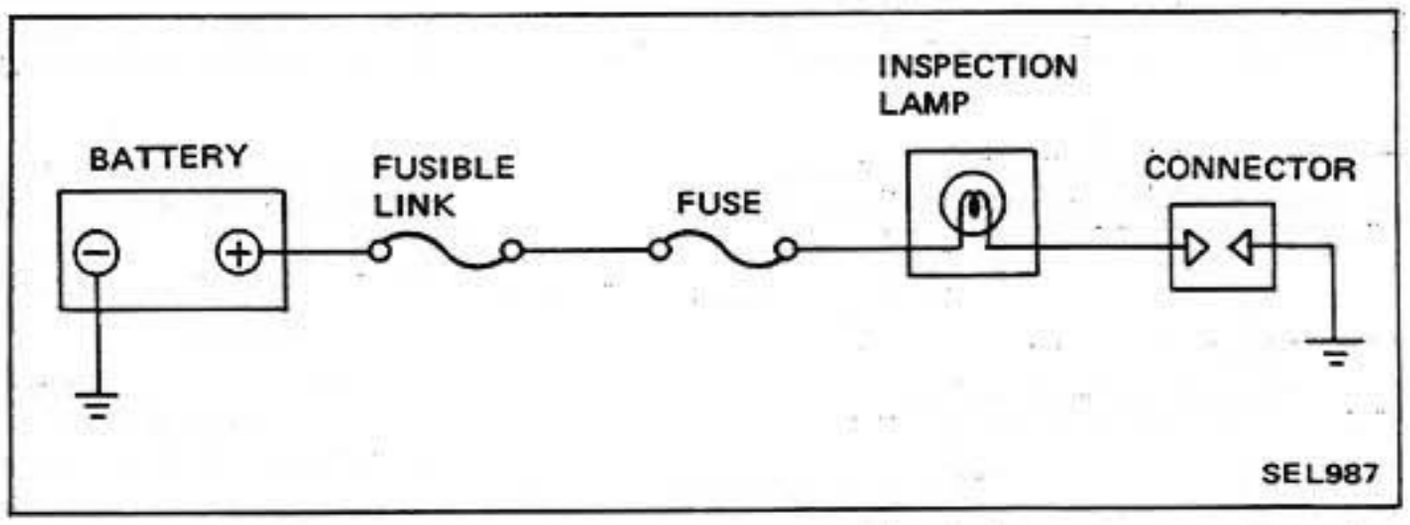
Removal and installation





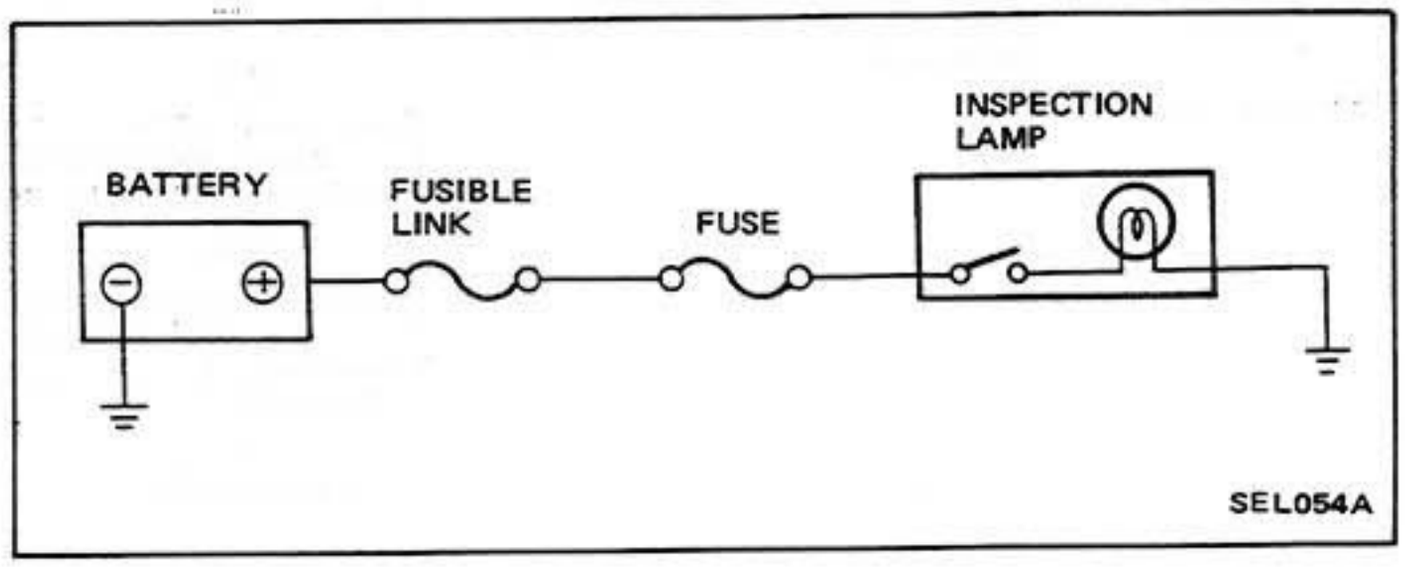
INSPECTION LAMP (Model 160 series)

SCHEMATIC

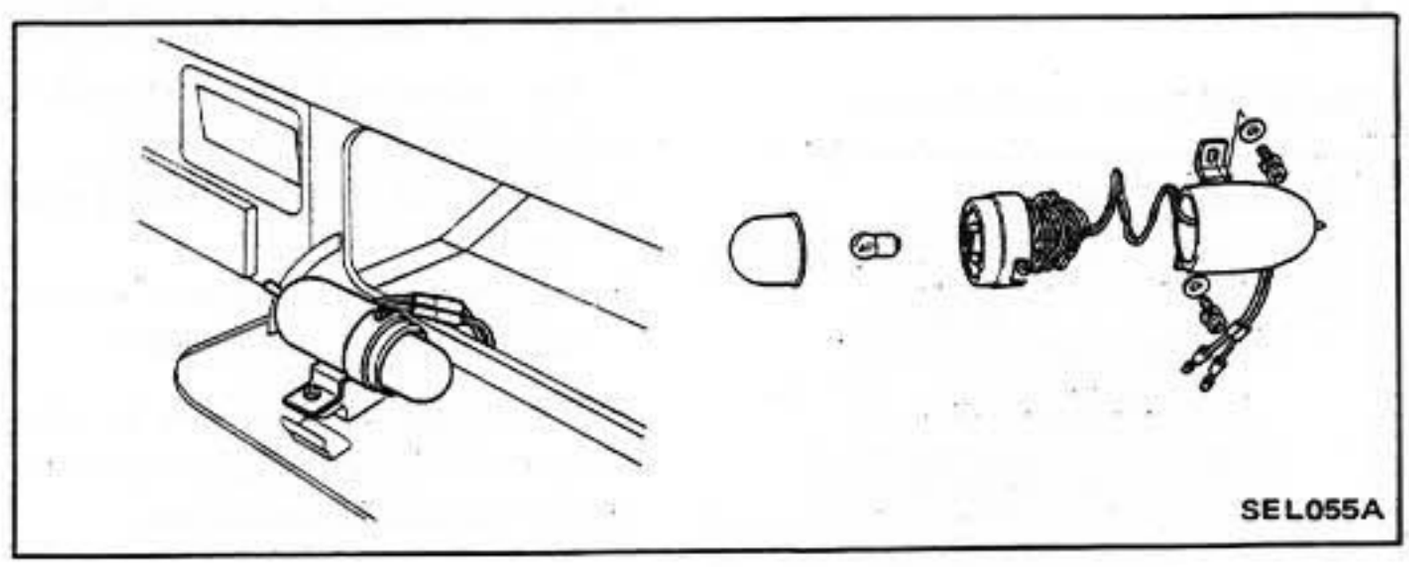


INSPECTION LAMP (Model 61 series)

SCHEMATIC



REMOVAL AND INSTALLATION

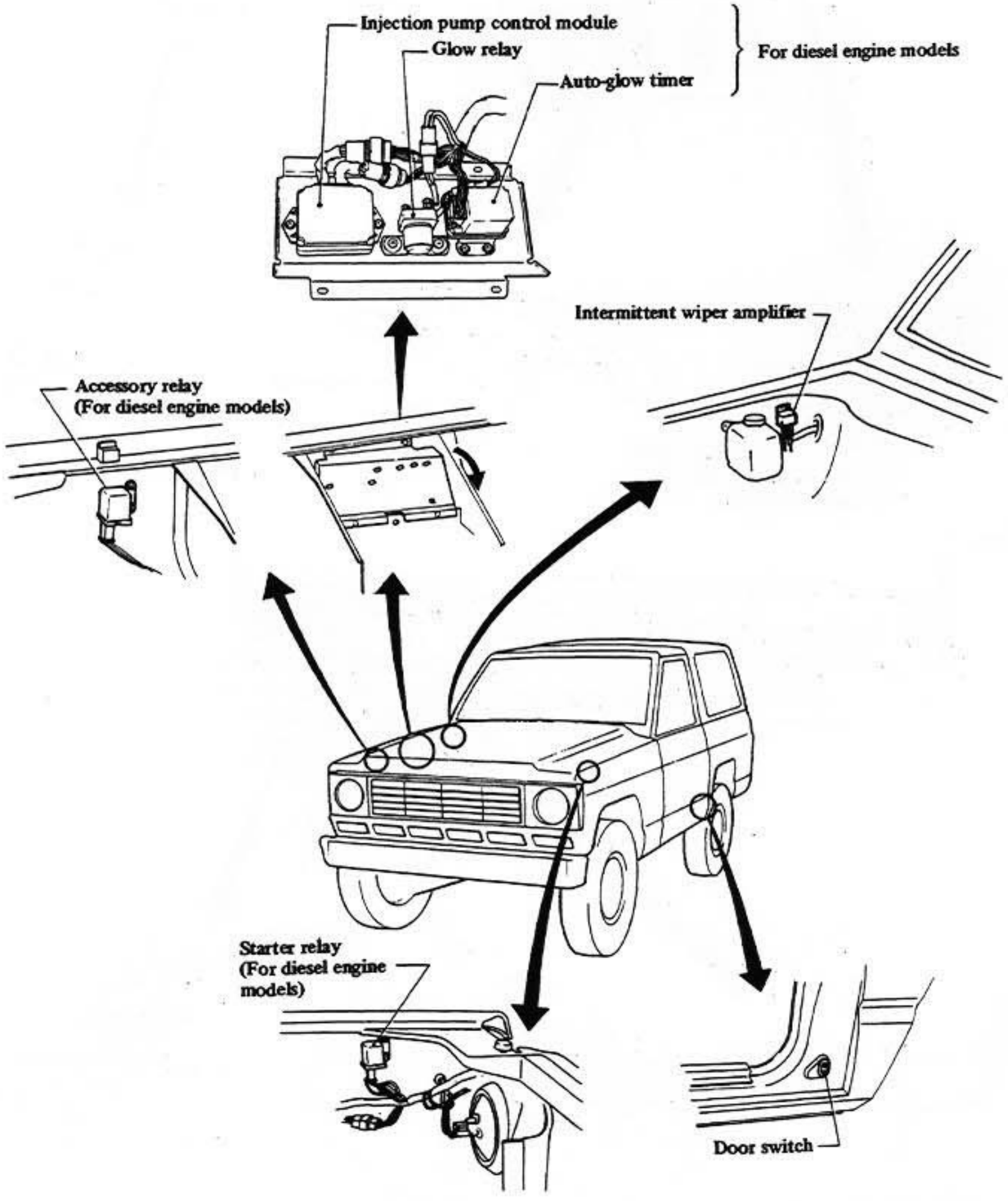


LOCATION OF ELECTRICAL UNITS

CAUTION: Before starting to work, be sure to turn ignition switch "OFF" and then disconnect battery ground cable.

MODEL 160 SERIES

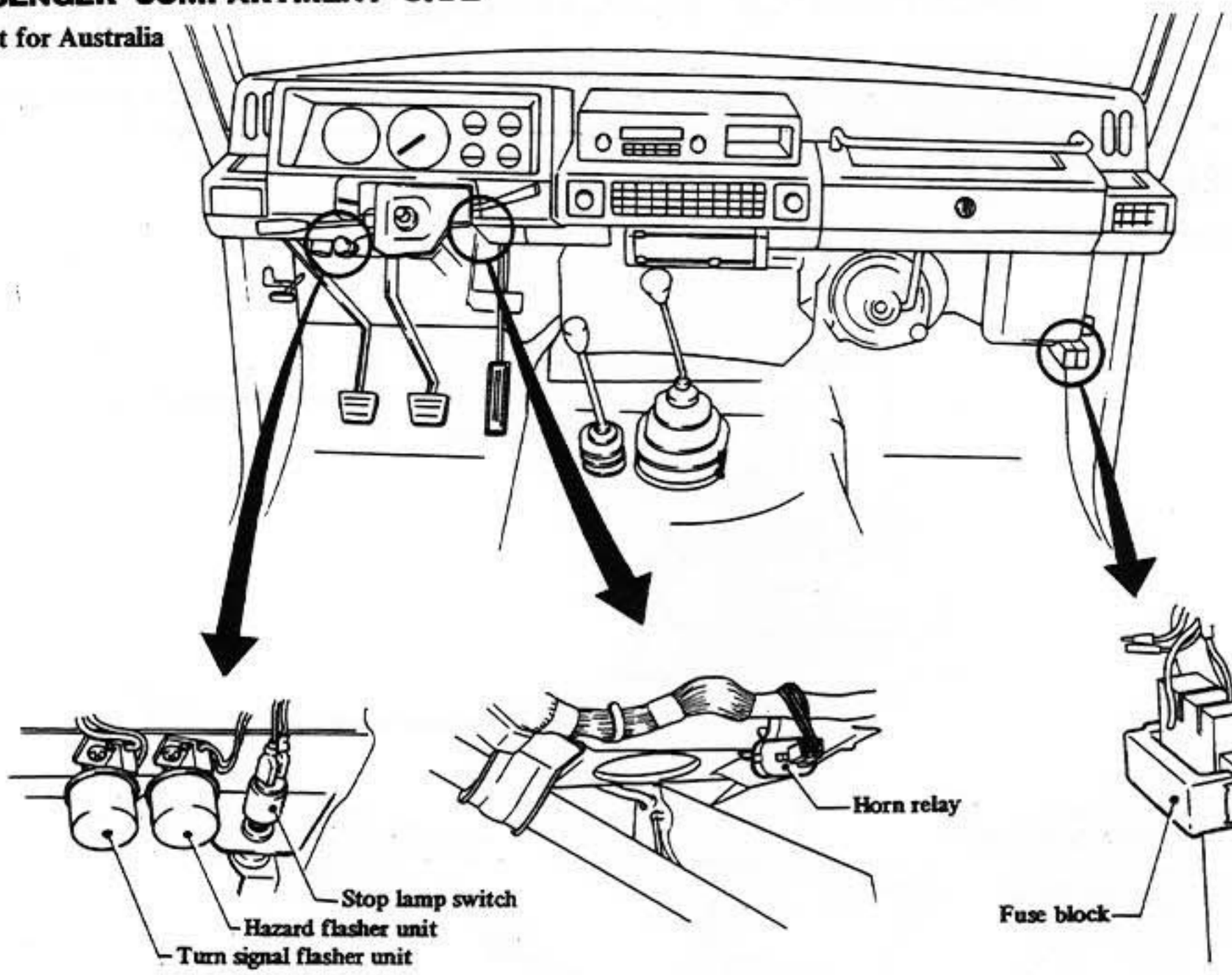
ENGINE COMPARTMENT SIDE



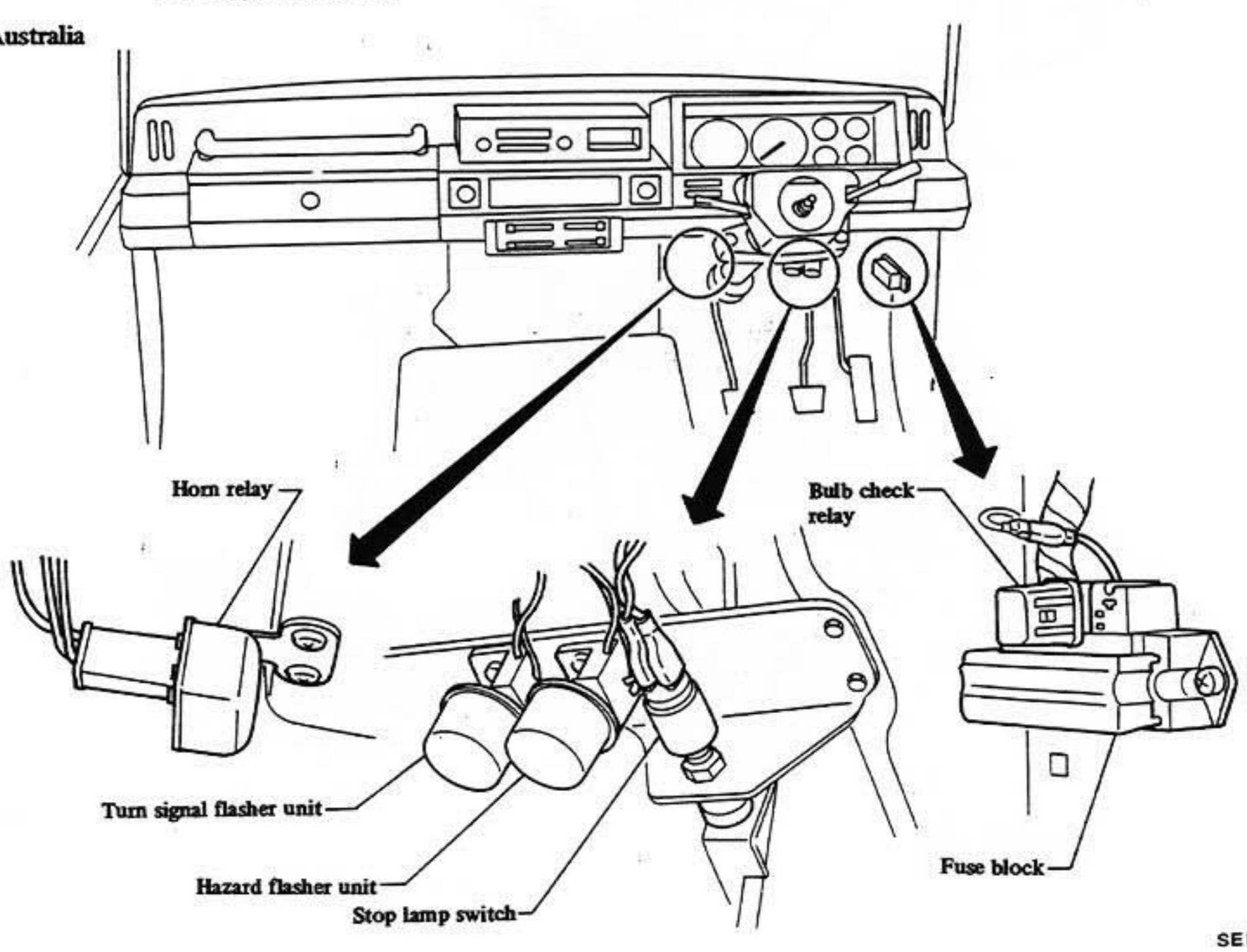
SEL056A

PASSENGER COMPARTMENT SIDE

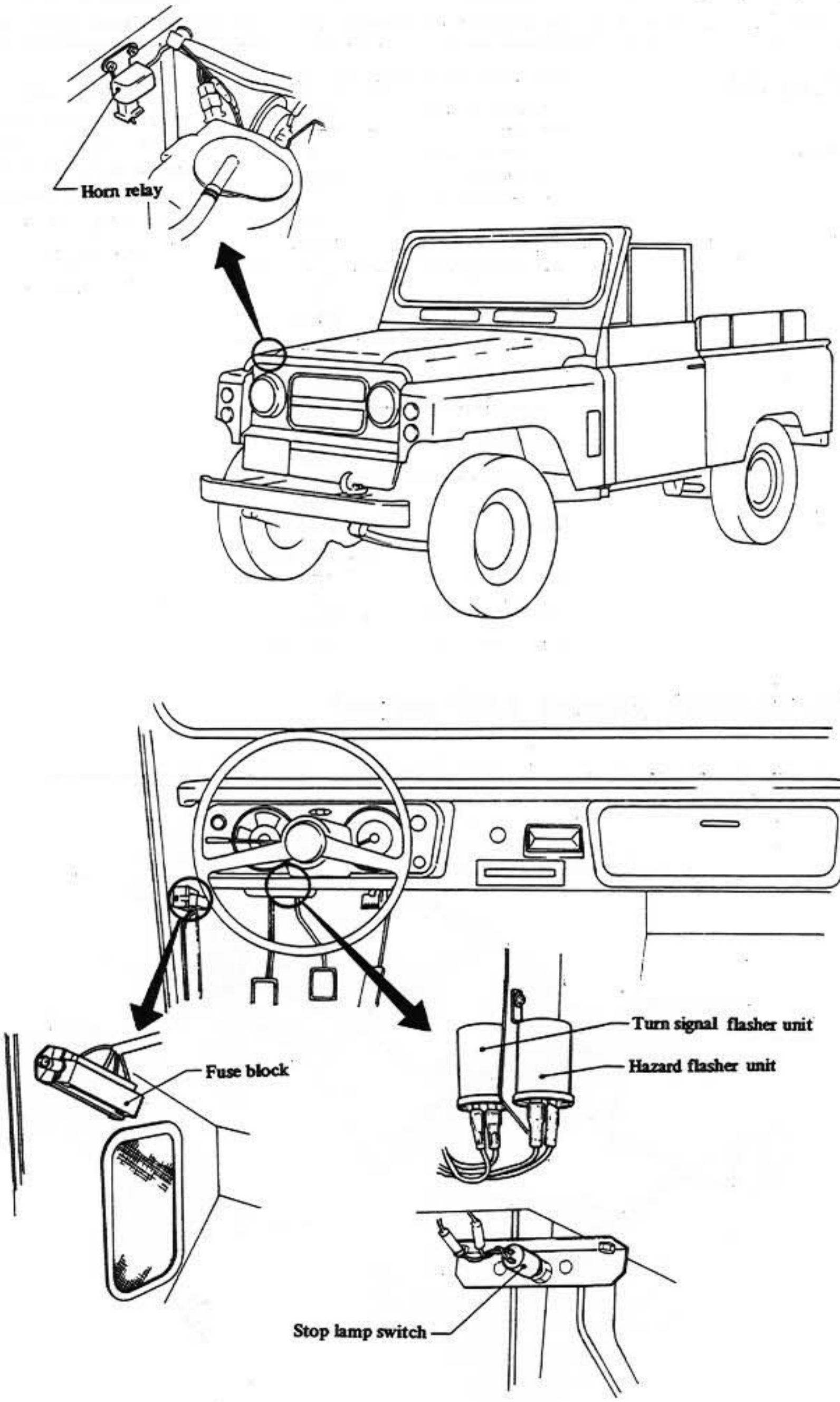
Except for Australia



For Australia



MODEL 61 SERIES



SEL058A

WIRING HARNESS

CAUTION: Before starting to work, be sure to turn ignition switch "OFF" and then disconnect battery ground cable.

CABLE COLORS

Cable colors are generally used as shown in the table at right.

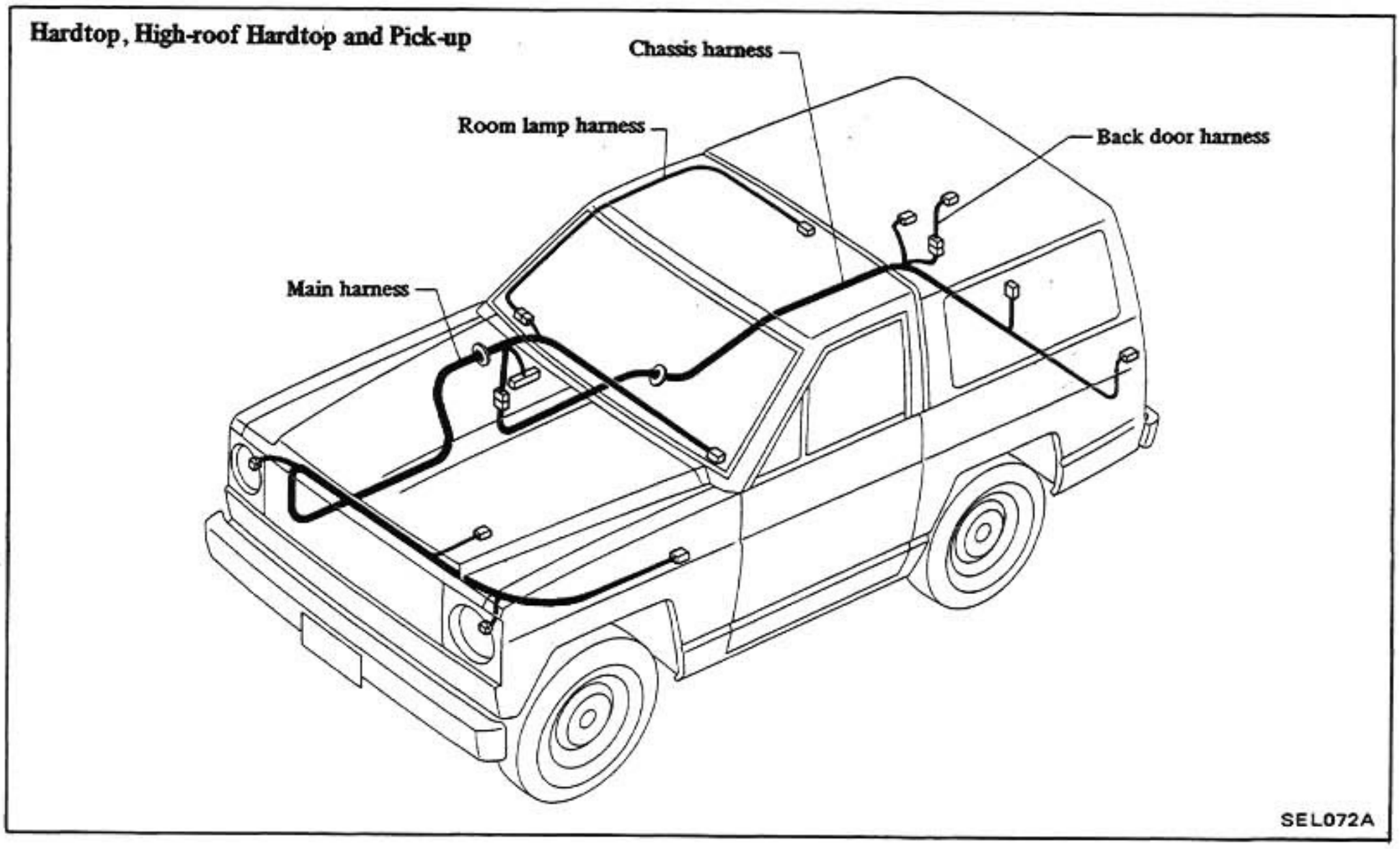
Circuit system	Color
Starting and ignition system	B (Black)
Charging system	W (White)
Lighting system	R (Red)
Signal system	G (Green)
Instrument system	Y (Yellow)
Others	L (Blue) Br (Brown) Lg (Light green)
Grounding system	B (Black)

The main cable of each system is generally coded with a single color. These colors are represented by such letters as G, W, or Br. Minor items of each circuit's terminal are coded with a two-tone color as follows:

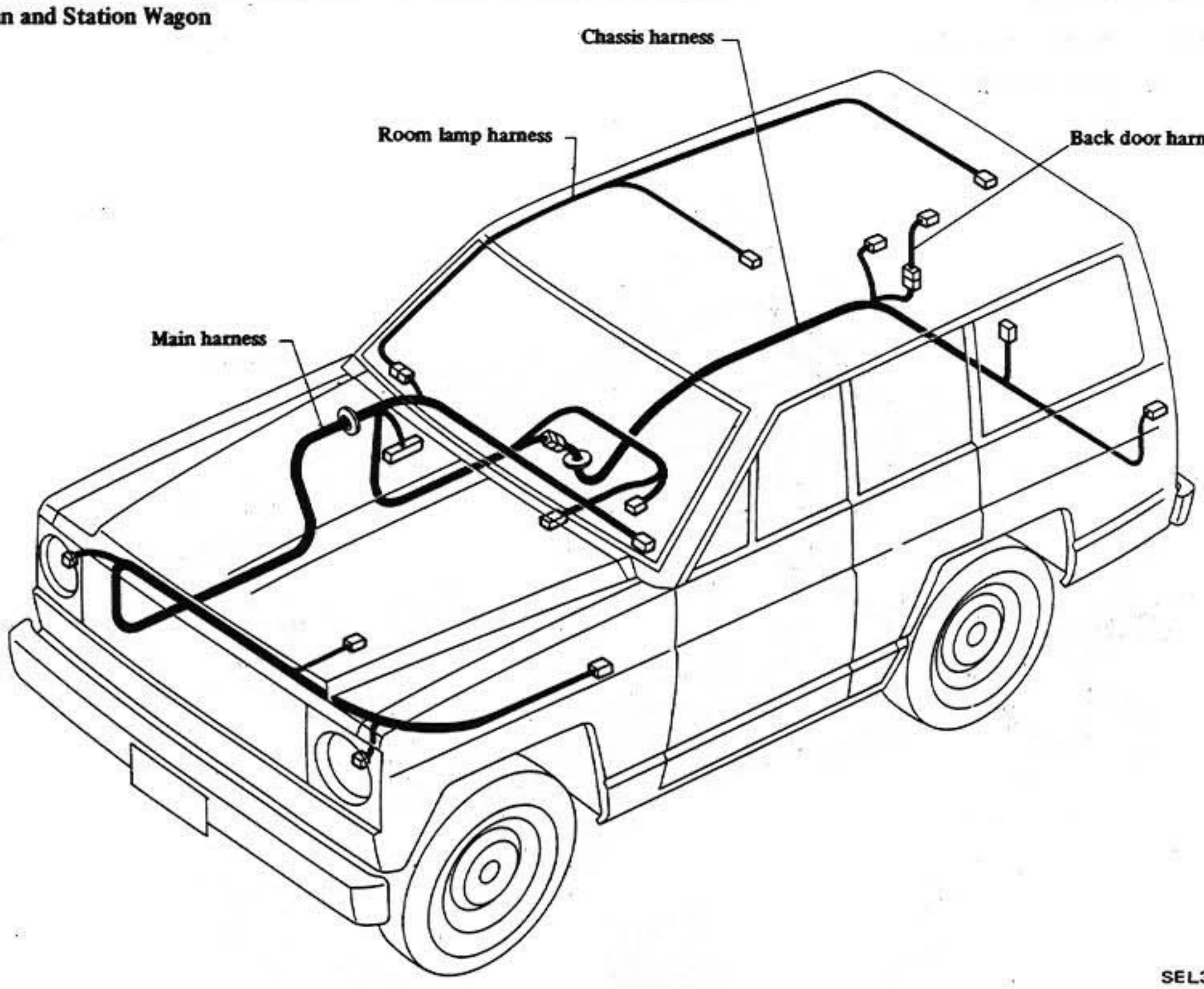
BW: Black with white stripe
LgR: Light green with red stripe

HARNESS LAYOUT (Model 160 series)

LAYOUT



Van and Station Wagon

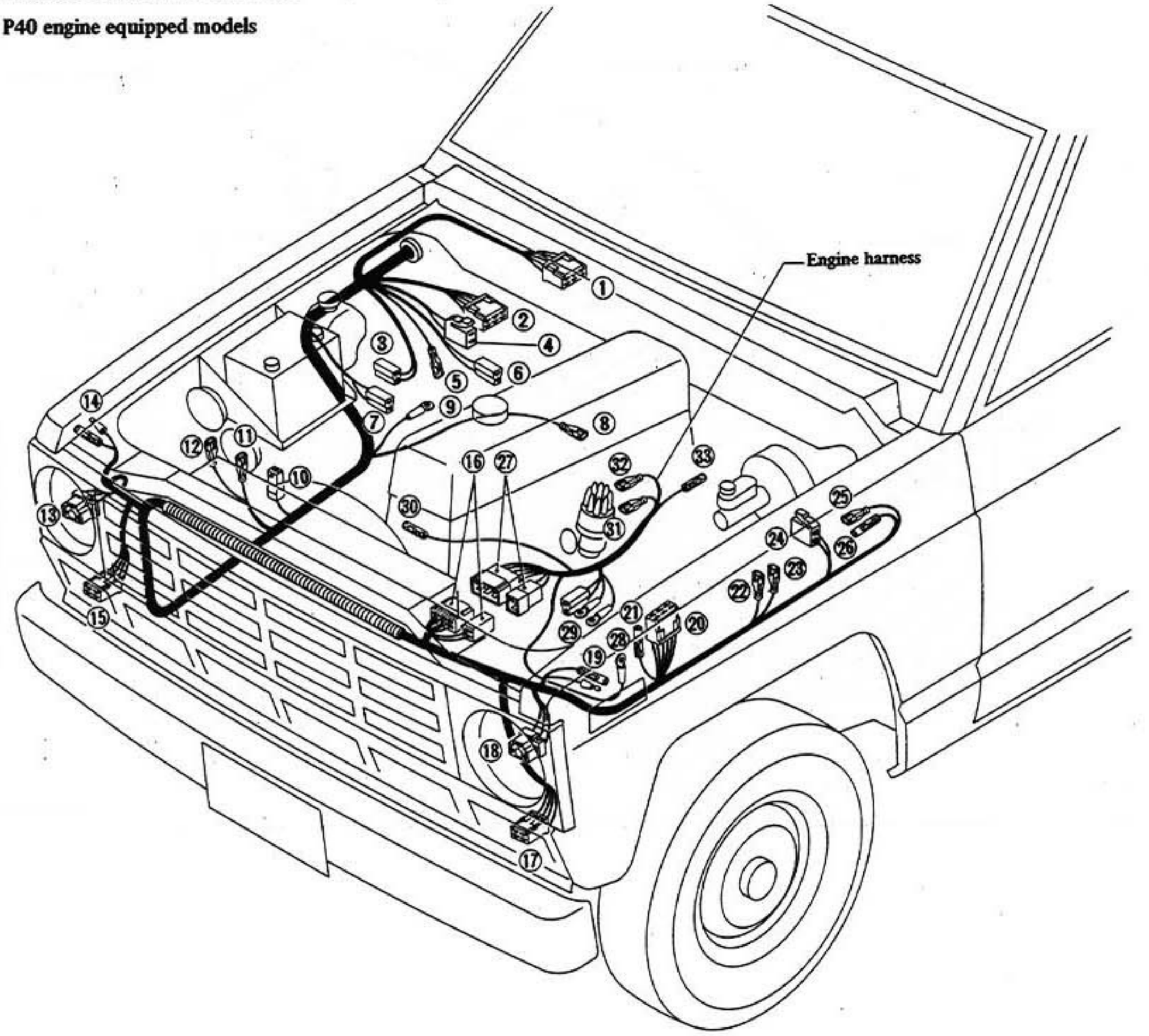


SEL386A

MAIN HARNESS

Engine compartment side

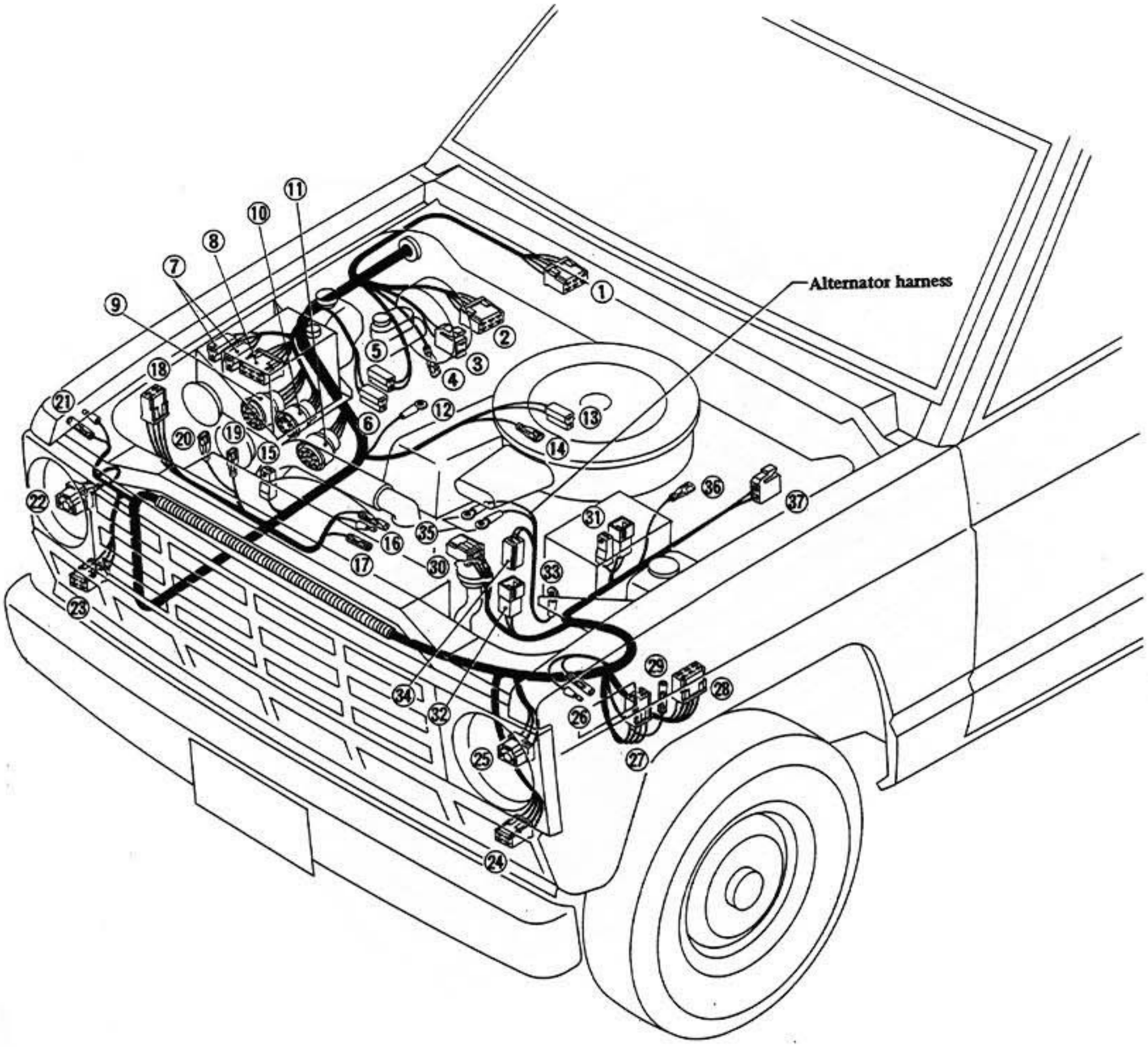
P40 engine equipped models



1 Wiper motor
2 Intermittent wiper amplifier
3 Windshield washer motor
4 Brake fluid level switch (R.H. drive model only)
5 To fog lamp calbe
6 Tachometer resistor
7 To air conditioner harness "B"
8 Starter motor
9 Ground
10 Fusible link
11 Horn "Low"
12 Horn "High"
13 Headlamp (R.H.)
14 Side flasher lamp (R.H.)
15 Front combination lamp (R.H.)
16 To engine harness
17 Front combination lamp (L.H.)
18 Headlamp (L.H.)
19 Side flasher lamp (L.H.)
20 Voltage regulator
21 Condenser
22 Resistor
23 Resistor
24 Blake fluid level switch (L.H. drive model only)
25 Ignition coil
26 Condenser
27 To main harness
28 Ground
29 Alternator
30 Thermal transmitter
31 Distributor
32 Distributor ground
33 Oil pressure unit

SEL073A

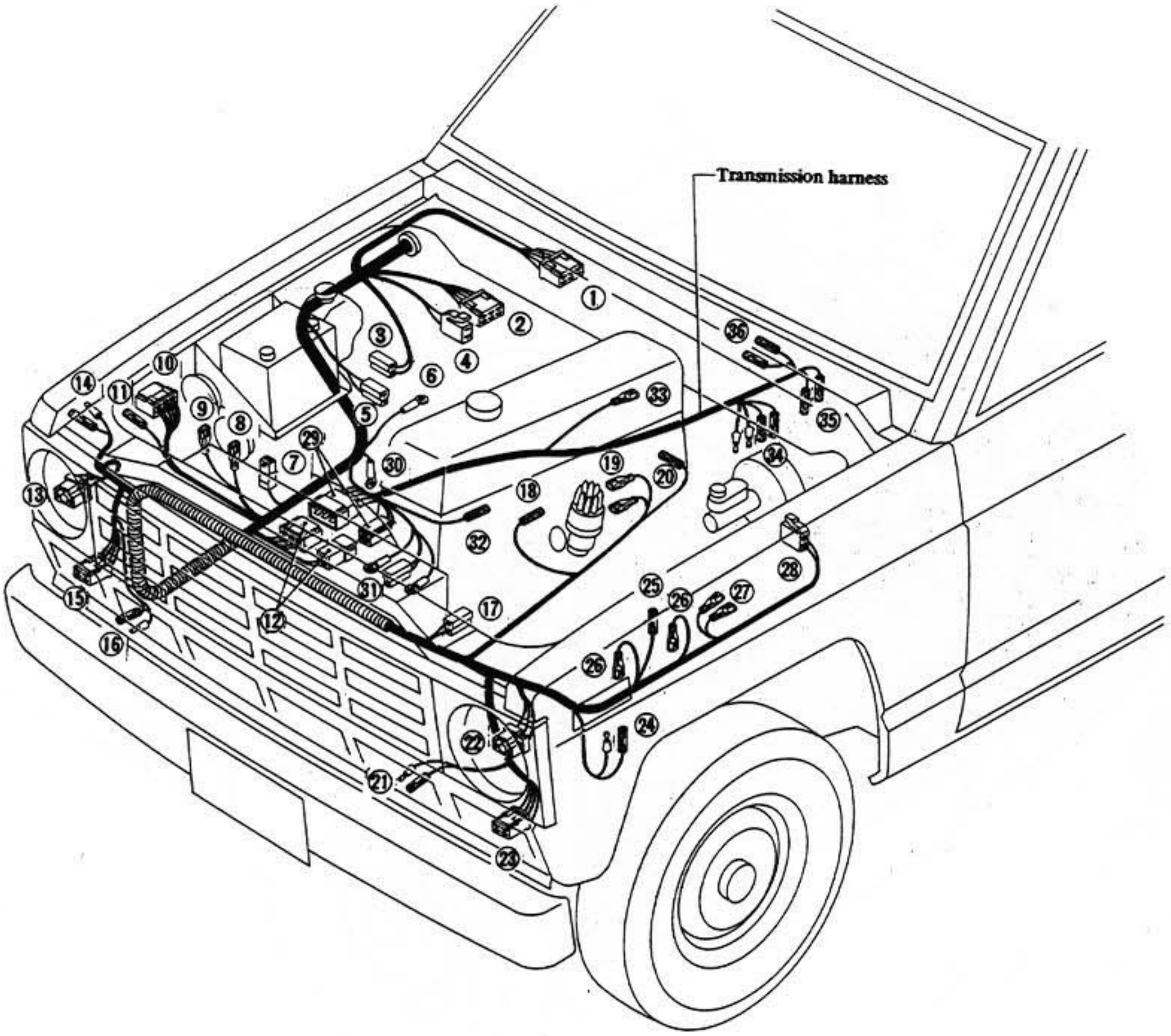
SD33 engine equipped models



1 Wiper motor
2 Intermittent wiper amplifier
3 Brake fluid level switch (R.H. drive model only)
4 To fog lamp cable
5 Windshield washer motor
6 To air conditioner harness "B"
7 Glow relay
8 Glow timer
9 Injection pump control module
10 Injection pump control module
11 Injection pump control unit
12 Ground
13 Oil pressure unit
14 Glow plug
15 Fusible link
16 Thermo sensor
17 Thermal transmitter
18 Accessory relay
19 Horn "Low"
20 Horn "High"
21 Side flasher lamp (R.H.)
22 Headlamp (R.H.)
23 Front combination lamp (R.H.)
24 Front combination lamp (L.H.)
25 Headlamp (L.H.)
26 Side flasher lamp (L.H.)
27 Starter relay
28 Voltage regulator
29 Condenser
30 Alternator
31 Fusible link
32 To alternator harness
33 Ground
34 To main harness
35 Alternator
36 Starter motor
37 Brake fluid level switch (L.H. drive model only)

SEL074A

L28 engine equipped models

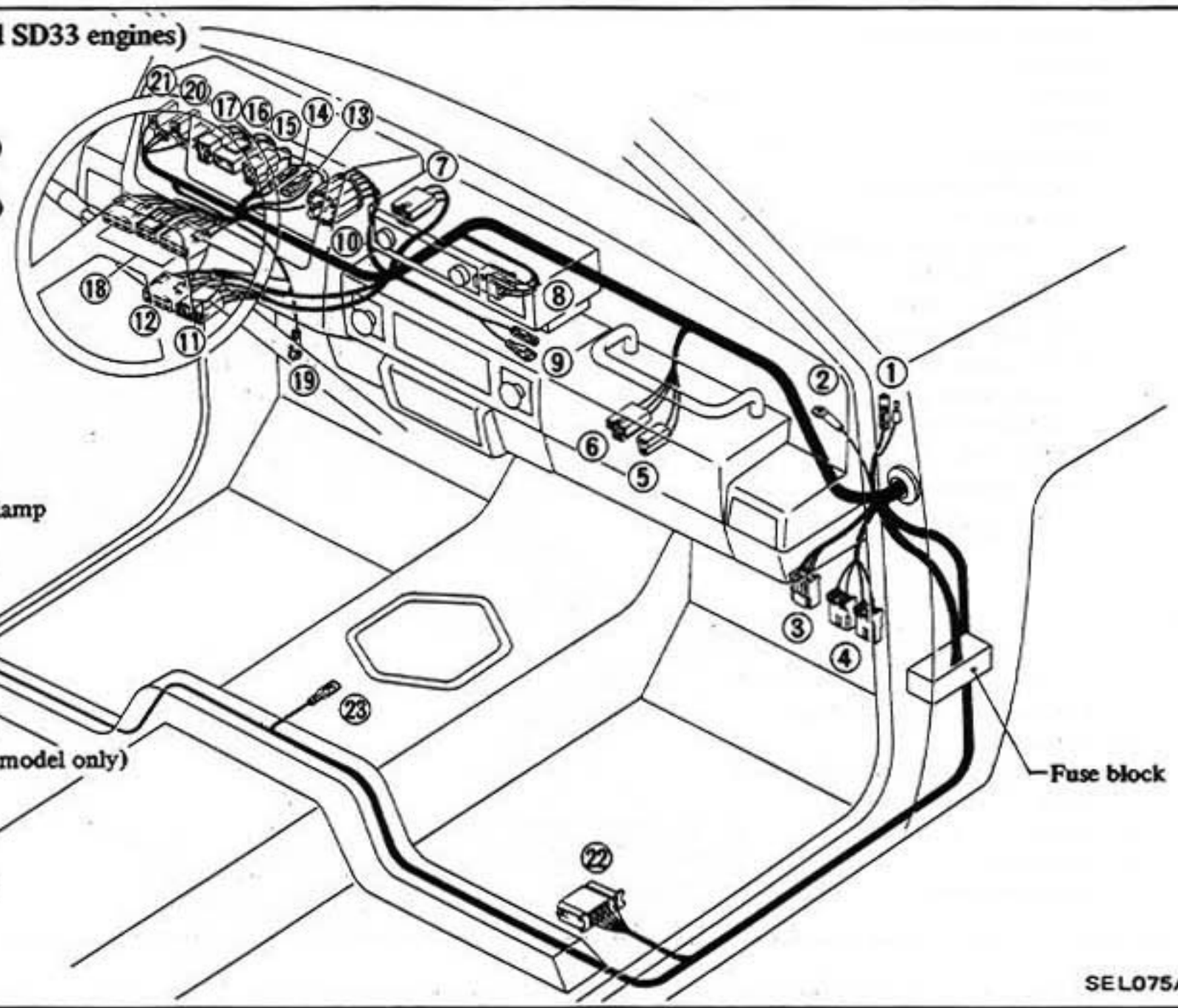


1 Wiper motor
2 Intermittent wiper amplifier
3 Windshield washer motor
4 Brake fluid level switch (R.H. drive model only)
5 To air conditioner harness "B"
6 Ground
7 Fusible link
8 Horn "Low"
9 Horn "High"
10 Voltage regulator
11 Condenser
12 To transmission harness
13 Headlamp (R.H.)
14 Side flasher lamp (R.H.)
15 Front combination lamp (R.H.)
16 Fog lamp (R.H.)
17 To tachometer harness
18 Thermal transmitter
19 Distributor
20 Throttle opener
21 Fog lamp (L.H.)
22 Headlamp (L.H.)
23 Front combination lamp (L.H.)
24 Side flasher lamp (L.H.)
25 Condenser
26 Resistor
27 Ignition coil
28 Brake fluid level switch (L.H. drive model only)
29 To main harness
30 Ground
31 Alternator
32 Oil pressure unit
33 Starter motor
34 Inhibitor switch (A/T model only)
35 Kickdown switch (A/T model only)
36 Back-up lamp switch (M/T model only)

SEL387A

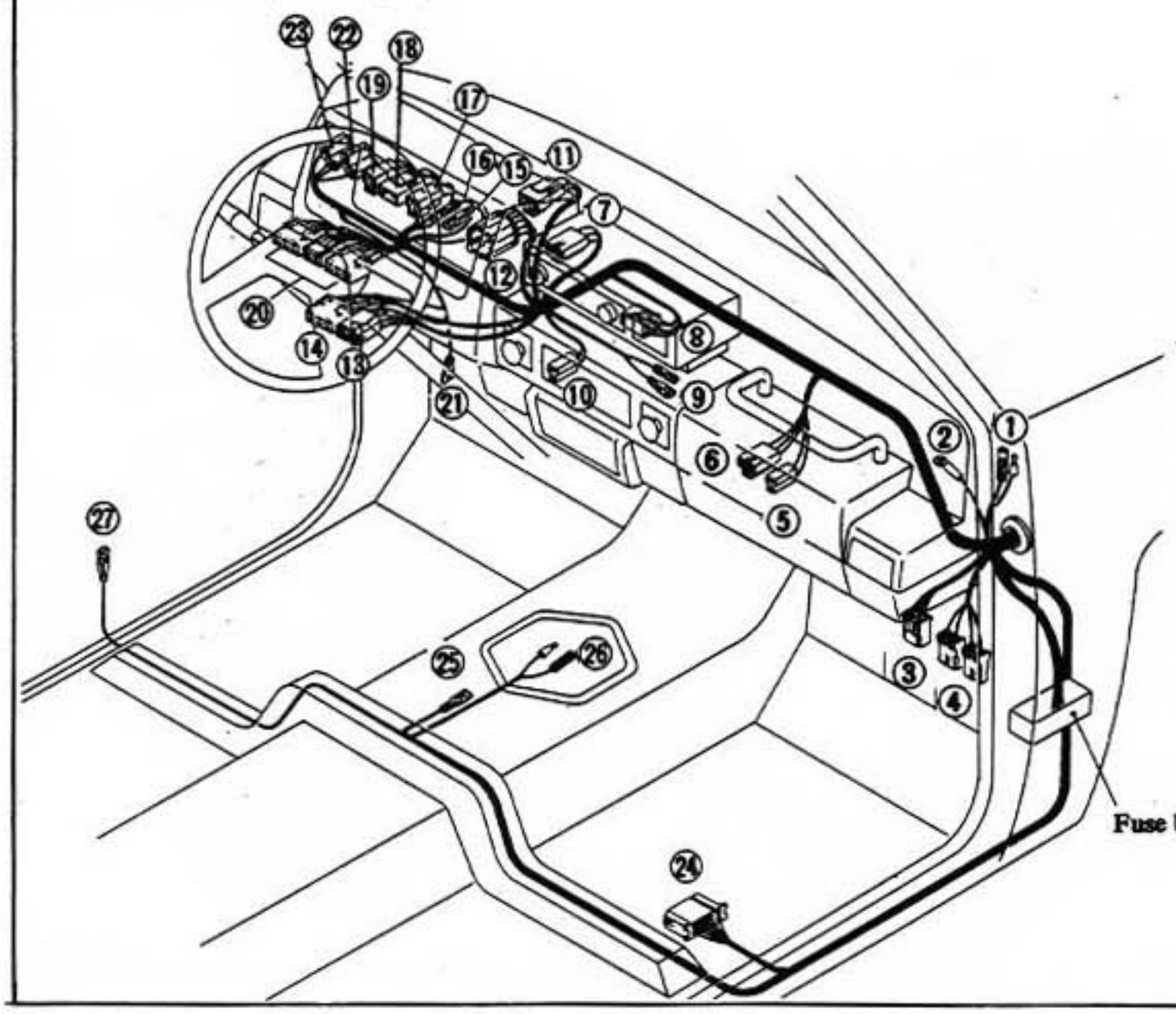
Passenger compartment side

L.H. drive models (P40 and SD33 engines)



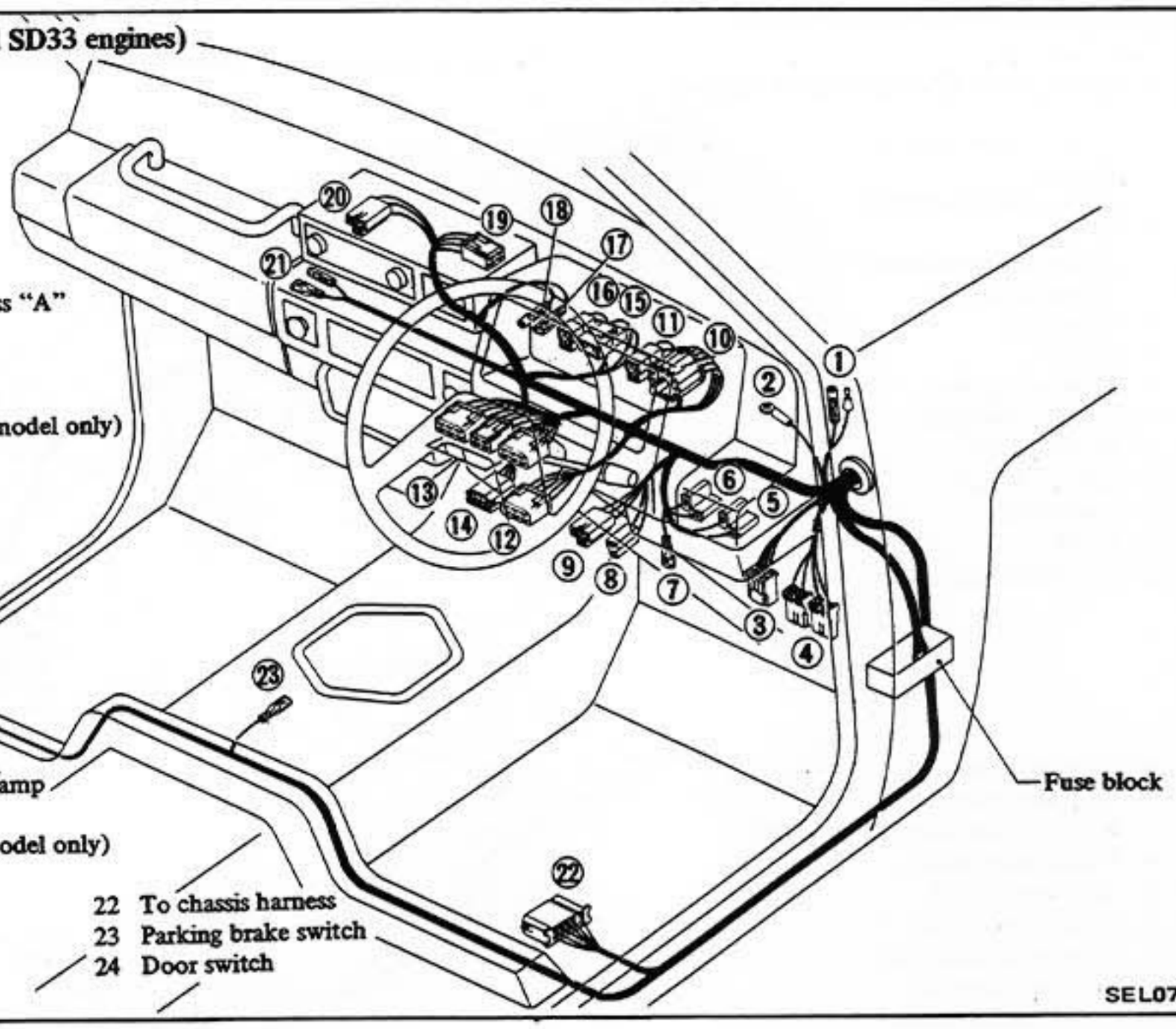
1 To room lamp harness
2 Ground
3 Option (Air conditioner)
4 Option
5 Option (Air conditioner)
6 To heater harness
7 Horn relay
8 Radio
9 Cigarette lighter
10 Combination meter
11 Hazard switch
12 Ignition switch
13 Tachometer
14 Clock
15 4-wheel drive indicator lamp
16 Brake warning lamp
17 Glow plug pilot lamp (SD33 engine equipped model only)
18 Combination switch
19 Stop lamp switch
20 Hazard flasher unit
21 Turn signal flasher unit
22 To chassis harness
23 Parking brake switch
24 Door switch

L.H. drive models (L28 engine)



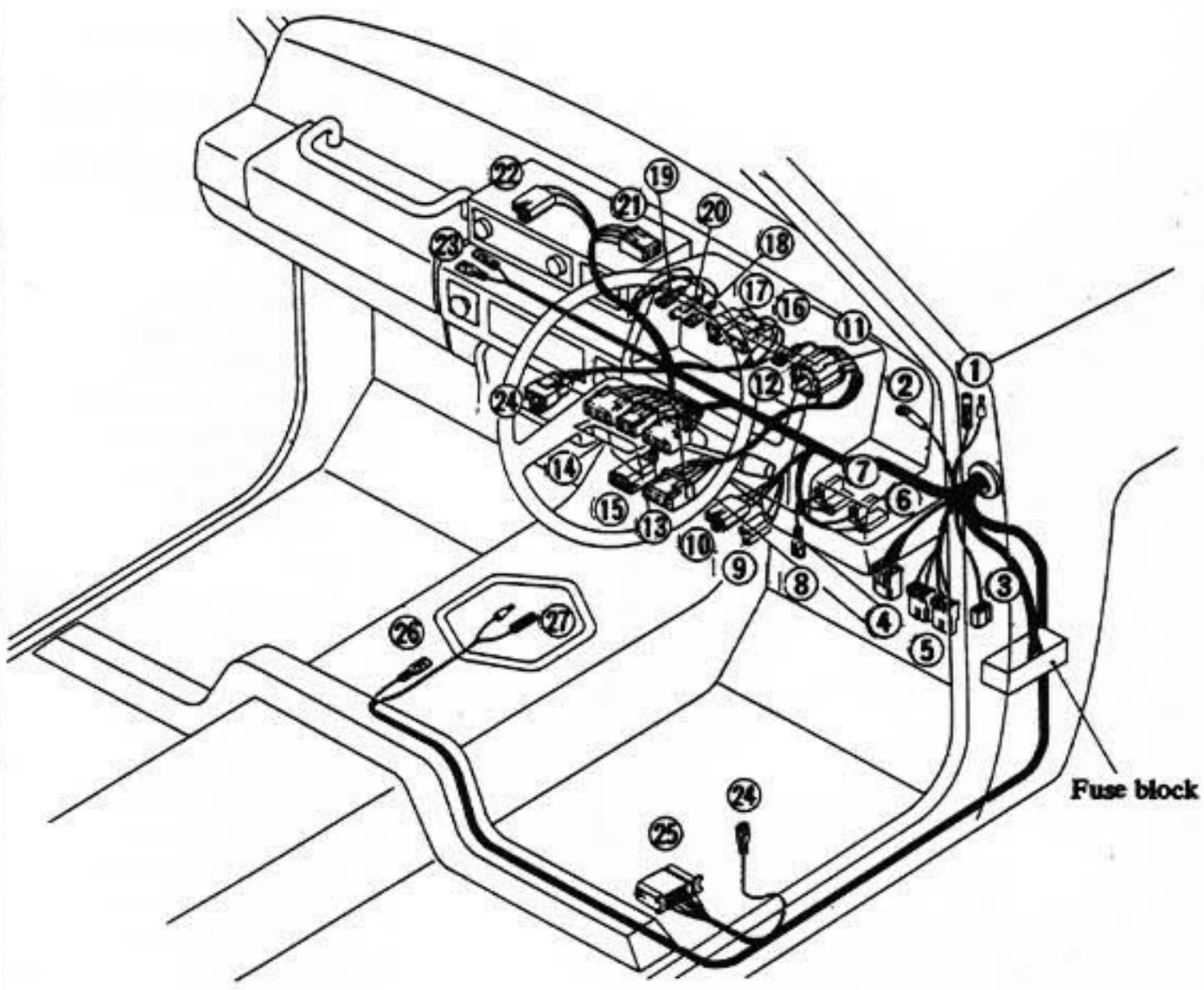
1 To room lamp harness
2 Ground
3 Option (Air conditioner)
4 Option
5 Option (Air conditioner)
6 To heater harness
7 Horn relay
8 Radio
9 Cigarette lighter
10 Kickdown switch (A/T model only)
11 Throttle opener switch
12 Combination meter
13 Hazard switch
14 Ignition switch
15 Tachometer
16 Clock
17 4-wheel drive indicator lamp
18 Brake warning lamp
19 Charge warning lamp
20 Combination switch
21 Stop lamp switch
22 Hazard flasher unit
23 Turn signal flasher unit
24 To chassis harness
25 Parking brake switch
26 A/T indicator lamp (A/T model only)
27 Door switch

R.H. drive models (P40 and SD33 engines)



1 To room lamp harness
2 Ground
3 Option
4 Option
5 Hazard flasher unit
6 Turn signal flasher unit
7 Stop lamp switch
8 To air conditioner harness "A"
9 To heater harness
10 Combination meter
11 Glow plug warning lamp (SD33 engine equipped model only)
12 Ignition switch
13 Combination switch
14 Hazard switch
15 Brake warning lamp
16 4-wheel drive indicator lamp
17 Tachometer (P40 engine equipped model only)
18 Clock
19 Radio
20 Horn relay
21 Cigarette lighter
22 To chassis harness
23 Parking brake switch
24 Door switch

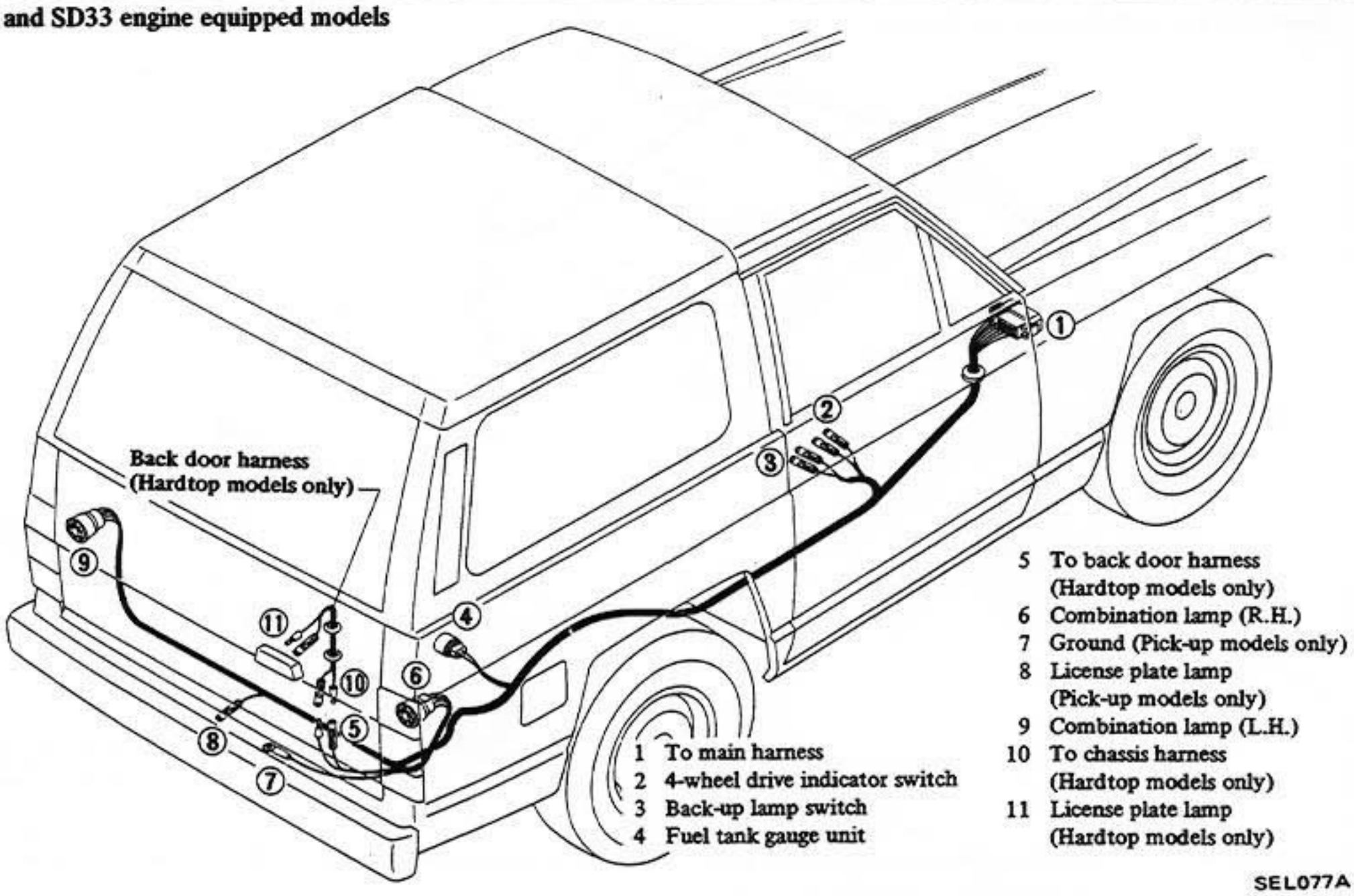
R.H. drive models (L28 engine)



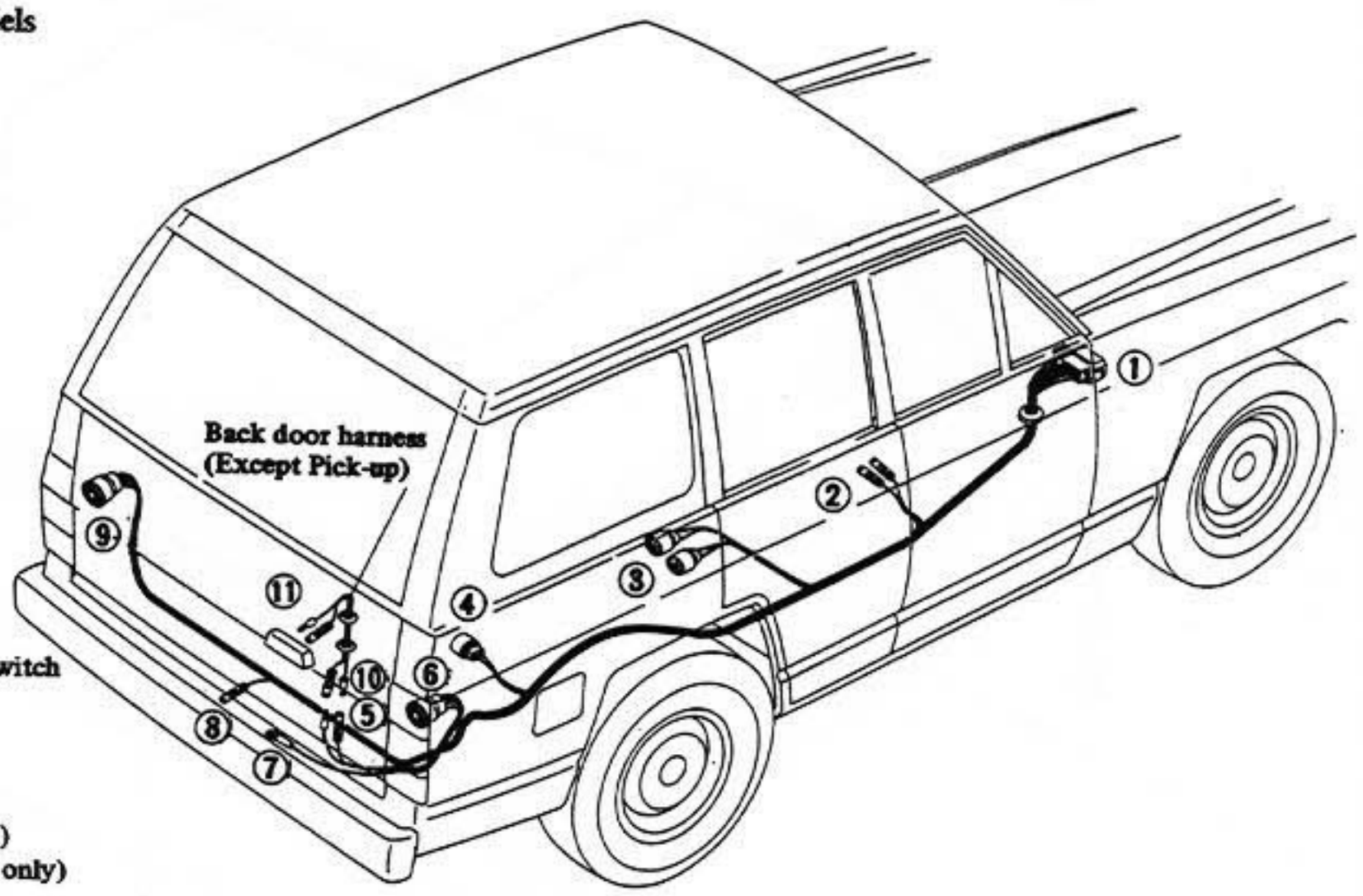
1 To room lamp harness
2 Ground
3 Kickdown switch (A/T model only)
4 Option
5 Option
6 Hazard flasher unit
7 Turn signal flasher unit
8 Stop lamp switch
9 To air conditioner harness "A"
10 To heater harness
11 Combination meter
12 Parking brake warning lamp
13 Ignition switch
14 Combination switch
15 Hazard switch
16 Brake warning lamp
17 4-wheel drive indicator lamp
18 Tachometer
19 Clock
20 Charge warning lamp
21 Radio
22 Horn relay
23 Cigarette lighter
24 Door switch
25 To chassis harness
26 Parking brake switch
27 A/T indicator lamp (A/T model only)

CHASSIS HARNESS

P40 and SD33 engine equipped models

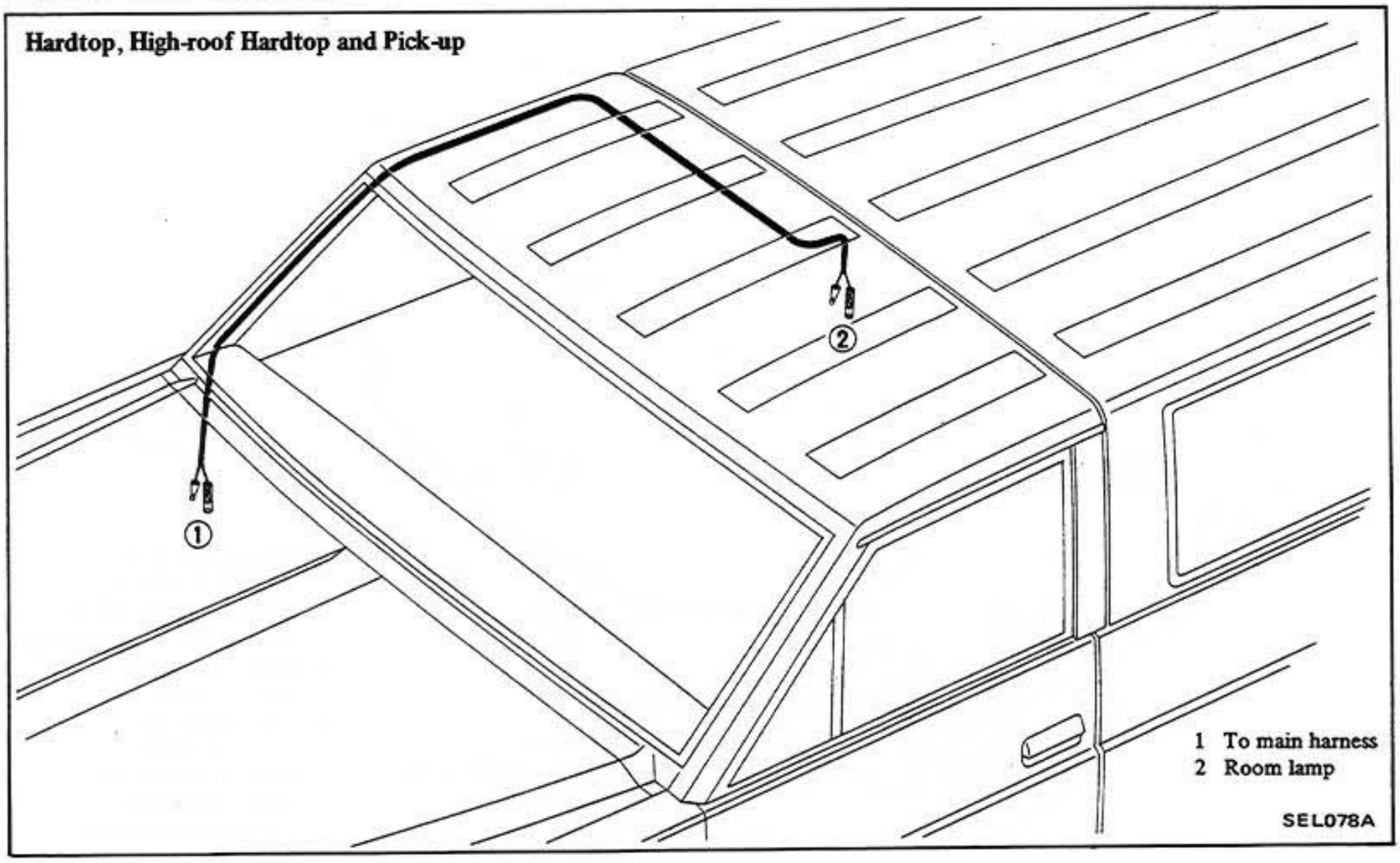


L28 engine equipped models



ROOM LAMP HARNESS

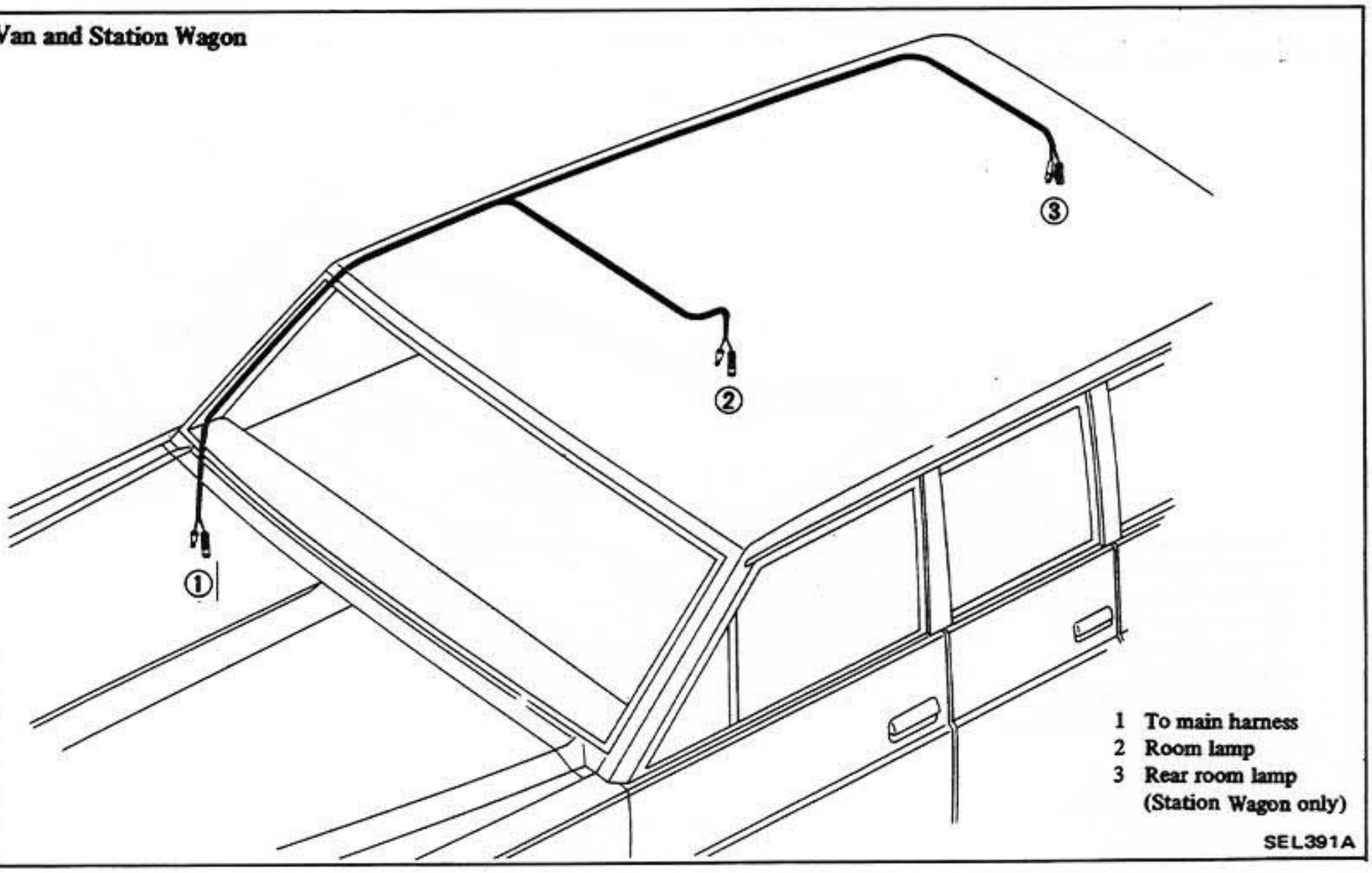
Hardtop, High-roof Hardtop and Pick-up



1 To main harness
2 Room lamp

SEL078A

Van and Station Wagon

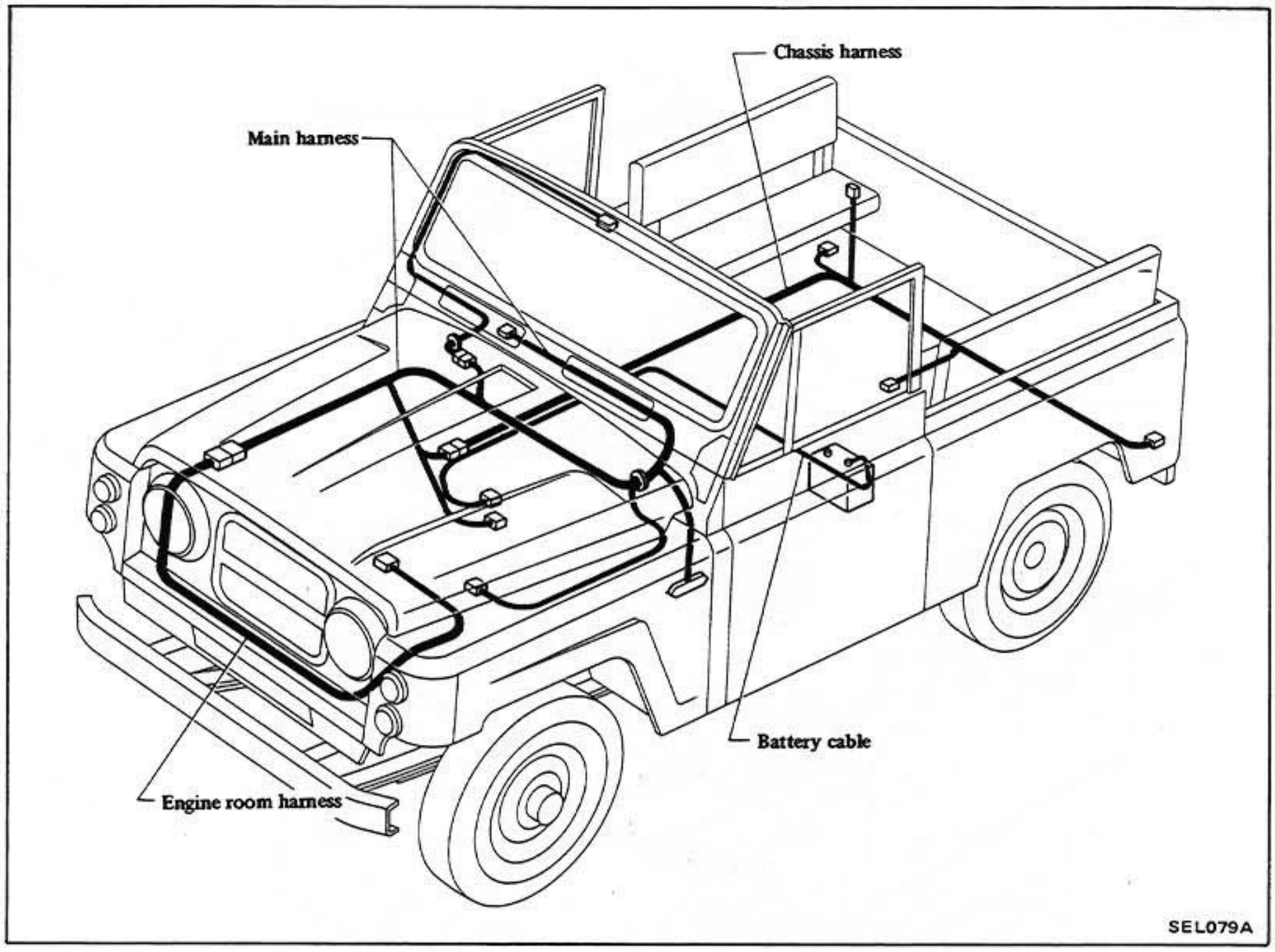


1 To main harness
2 Room lamp
3 Rear room lamp (Station Wagon only)

SEL391A

HARNESS LAYOUT (Model 61 series)

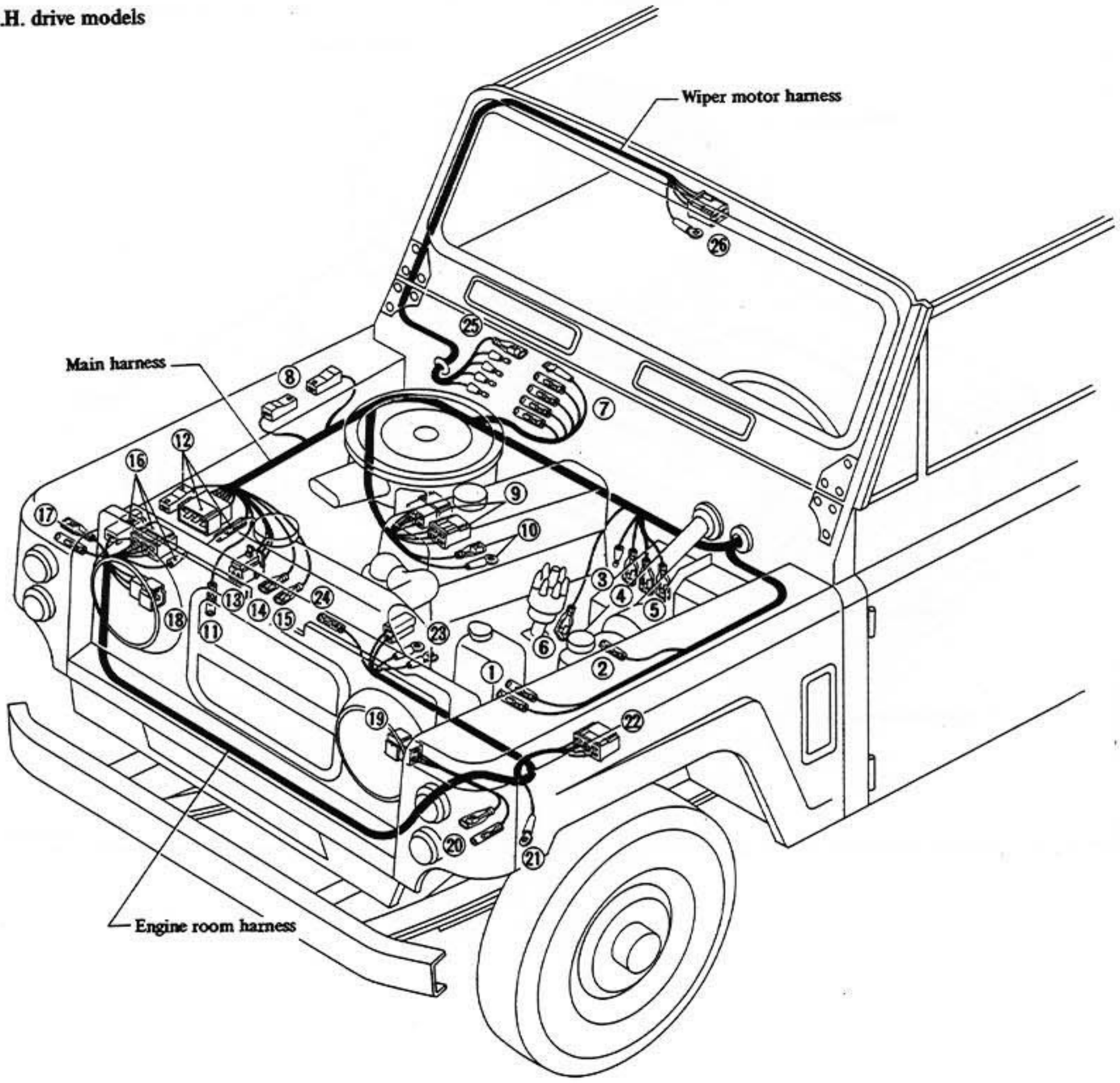
LAYOUT



MAIN HARNESS

Engine compartment side

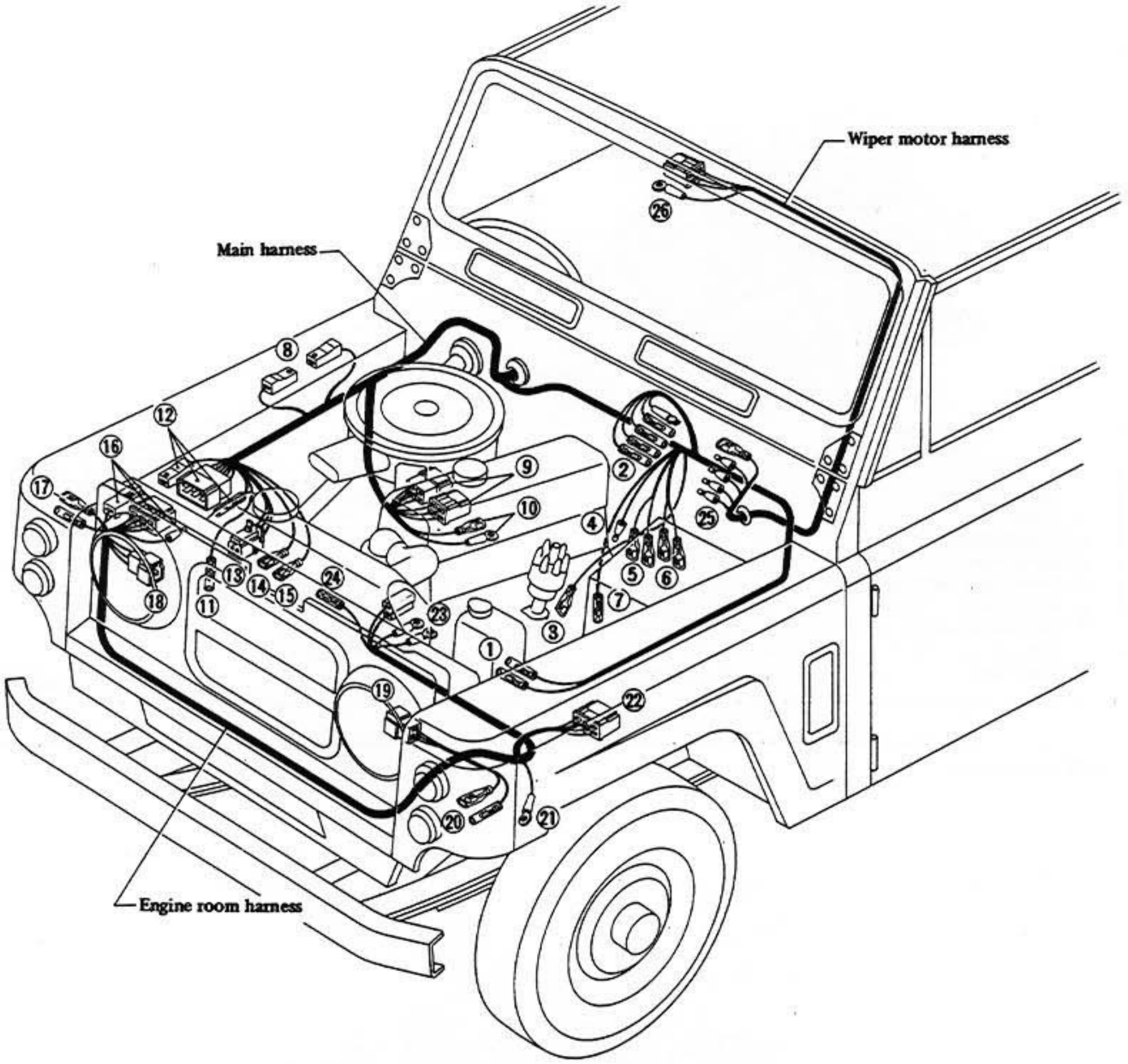
L.H. drive models



1 Windshield washer motor
2 Oil pressure unit
3 Condenser
4 Ignition coil
5 Resistor
(Models for cold area)
6 Ground (Distributor)
7 To wiper motor harness
8 Fusible link
9 To chassis harness
10 Starter motor
11 To fog lamp harness
12 To engine room harness
13 Horn relay
14 Horn (High)
15 Horn (Low)
16 To main harness
17 To front combination lamp (R.H.)
18 Headlamp (R.H.)
19 Headlamp (L.H.)
20 Front combination lamp (L.H.)
21 Ground
22 Voltage regulator
23 Alternator
24 Thermal transmitter
25 To main harness
26 Wiper motor

SEL080A

R.H. drive models

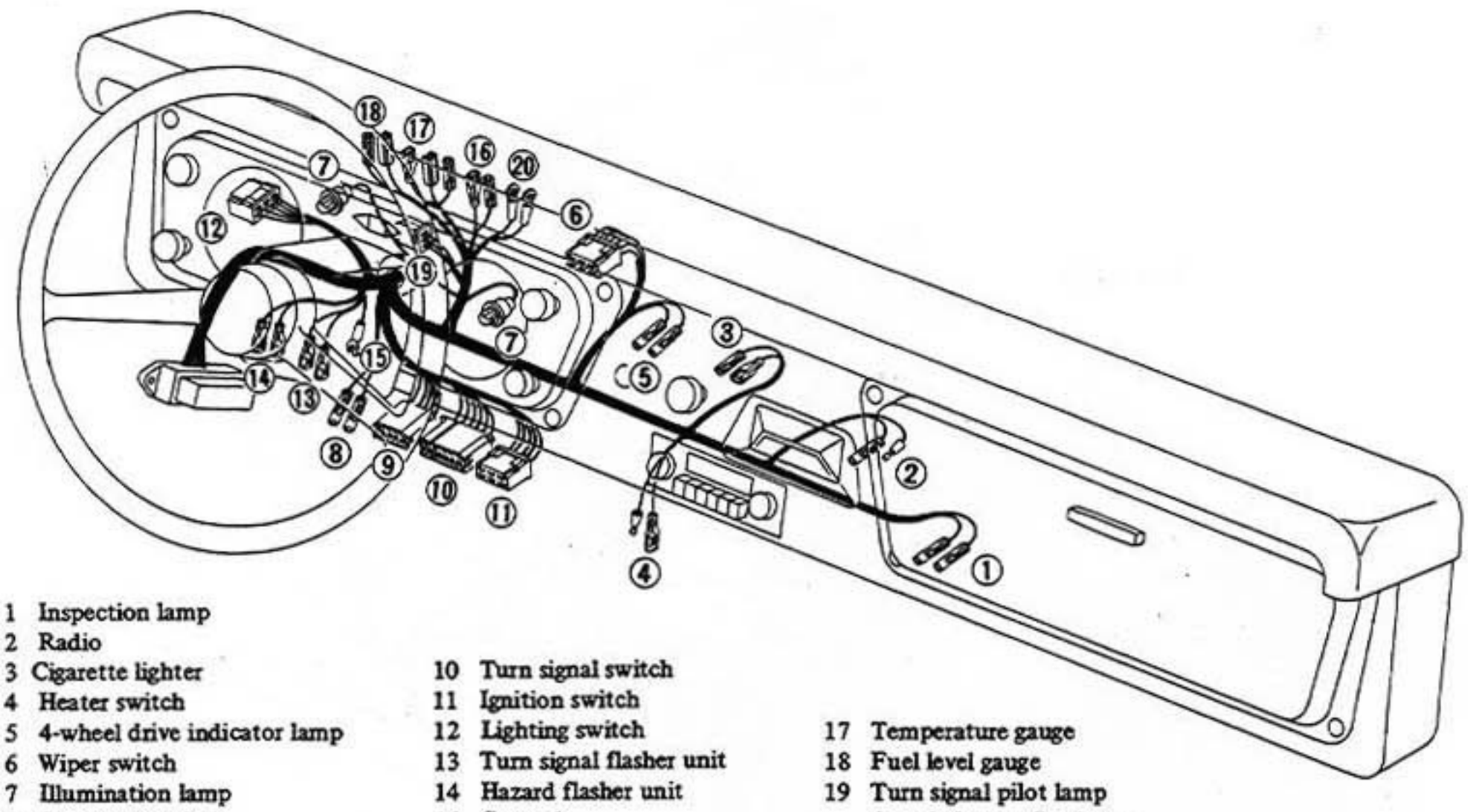


1 Windshield washer motor
2 To wiper motor harness
3 Ground (Distributor)
4 Condenser
5 Ignition coil
6 Resistor
(Models for cold area)
7 Oil pressure unit
8 Fusible link
9 To chassis harness
10 Starter motor
11 To fog lamp harness
12 To engine room harness
13 Horn relay
14 Horn (High)
15 Horn (Low)
16 To main harness
17 Front combination lamp (R.H.)
18 Headlamp (R.H.)
19 Headlamp (L.H.)
20 Front combination lamp (L.H.)
21 Ground
22 Voltage regulator
23 Alternator
24 Thermal transmitter
25 To main harness
26 Wiper motor

SEL081A

Passenger compartment side

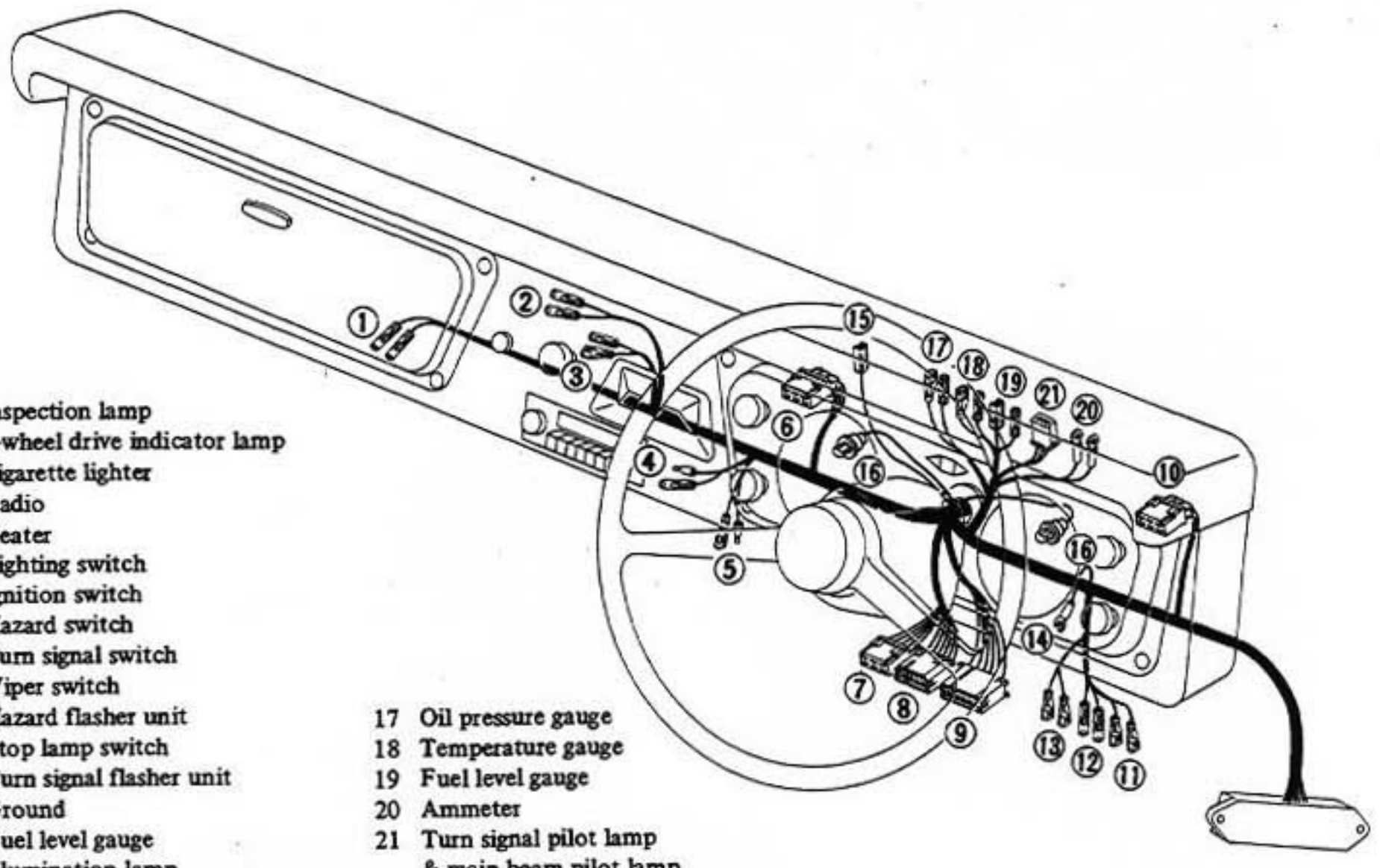
L.H. drive models



1 Inspection lamp
2 Radio
3 Cigarette lighter
4 Heater switch
5 4-wheel drive indicator lamp
6 Wiper switch
7 Illumination lamp
8 Stop lamp switch
9 Hazard switch
10 Turn signal switch
11 Ignition switch
12 Lighting switch
13 Turn signal flasher unit
14 Hazard flasher unit
15 Ground
16 Oil pressure gauge
17 Temperature gauge
18 Fuel level gauge
19 Turn signal pilot lamp & main beam pilot lamp
20 Ammeter

SEL082A

R.H. drive models



1 Inspection lamp
2 4-wheel drive indicator lamp
3 Cigarette lighter
4 Radio
5 Heater
6 Lighting switch
7 Ignition switch
8 Hazard switch
9 Turn signal switch
10 Wiper switch
11 Hazard flasher unit
12 Stop lamp switch
13 Turn signal flasher unit
14 Ground
15 Fuel level gauge
16 Illumination lamp
17 Oil pressure gauge
18 Temperature gauge
19 Fuel level gauge
20 Ammeter
21 Turn signal pilot lamp & main beam pilot lamp

SEL083A

CHASSIS HARNESS