

STARTING SYSTEM

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8-2 **STARTING SYSTEM** – Starting System Circuit**STARTING SYSTEM CIRCUIT**

Fig. 8-1

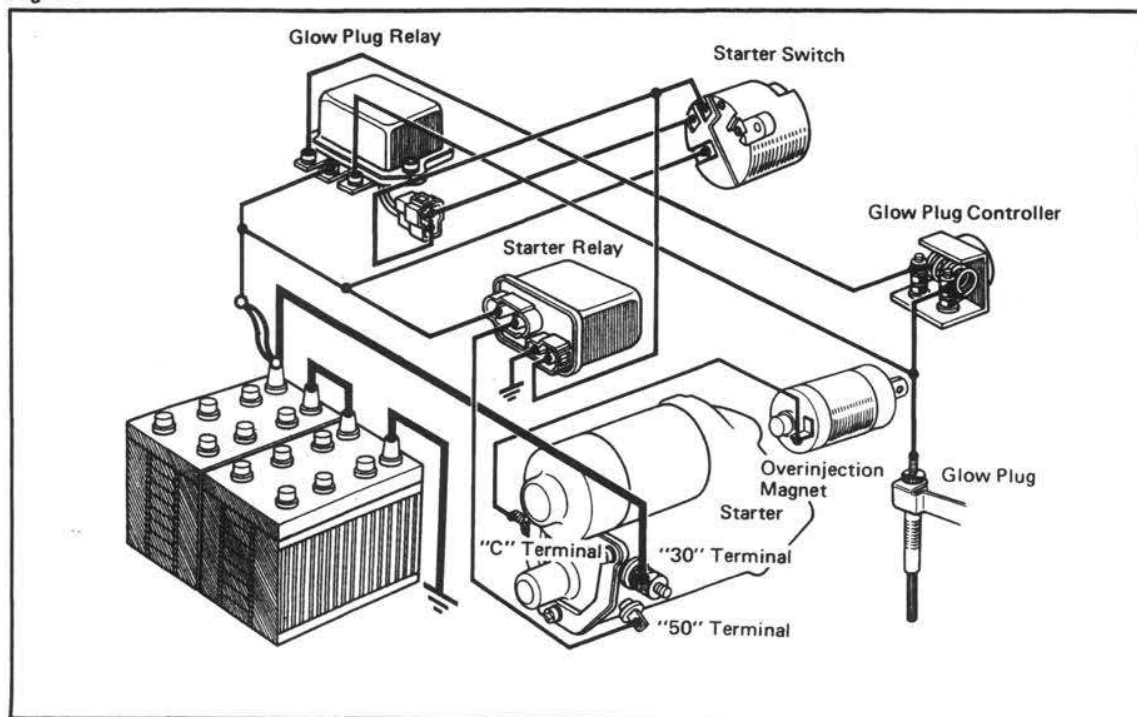
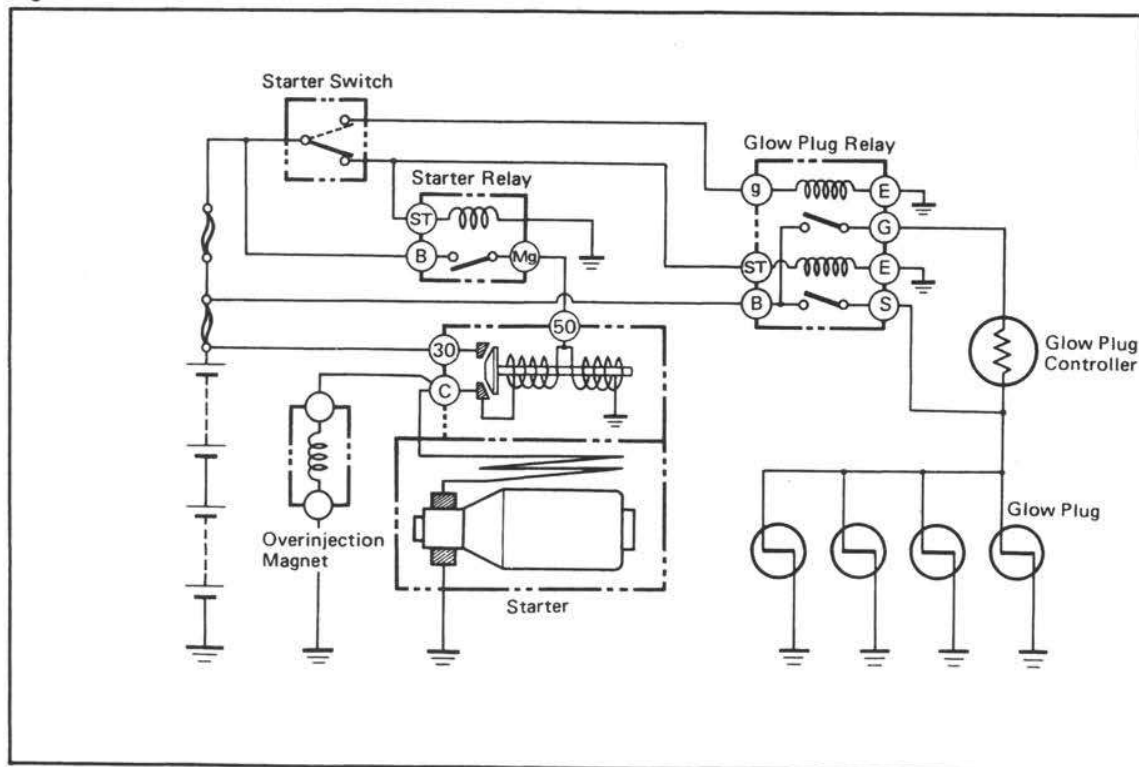


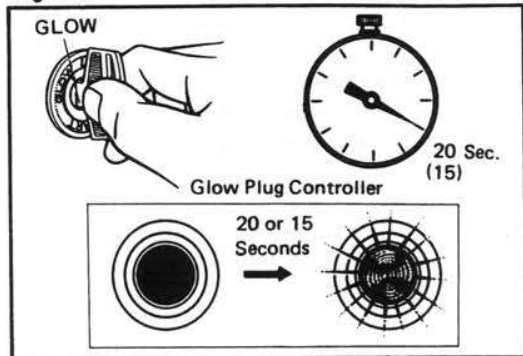
Fig. 8-2



STARTING SYSTEM – Preheating System

8-3

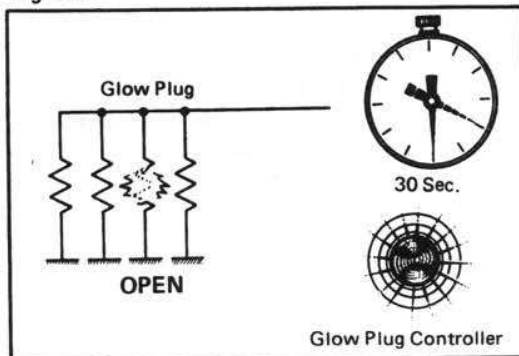
Fig. 8-3

**PREHEATING SYSTEM****INSPECTION**

1. To check the heating time of the glow controller, turn the starter switch to "GLOW" position.

Glow time at 0°C (32°F)**12V type About 20 seconds****24V type About 15 seconds**

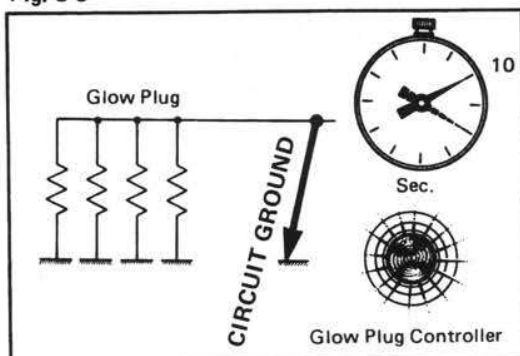
Fig. 8-4



2. If glow time more than 30 seconds, check following conditions:

- (1) Open circuit in wiring
- (2) Loose terminal connection
- (3) Burnt switch or relay points
- (4) Open glow plug or controller

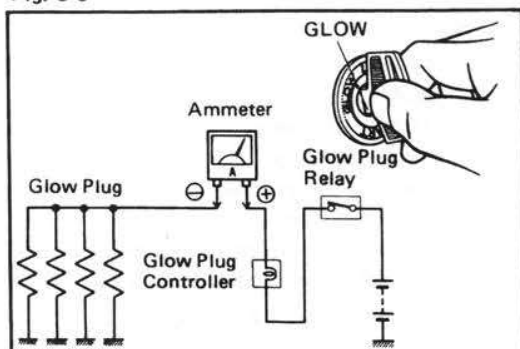
Fig. 8-5



3. If glow time less than 15 seconds, check following conditions:

- (1) Short circuit in wiring
- (2) Shorted glow plug or controller

Fig. 8-6



4. Measure load current.

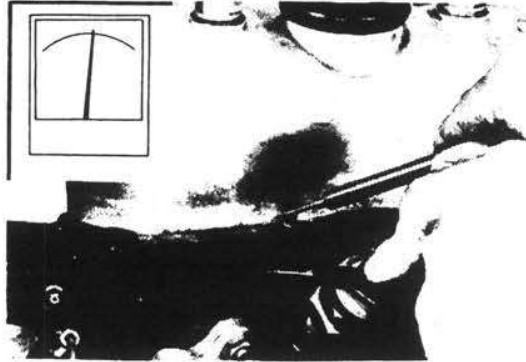
- (1) Connect the ammeter to the No.4 glow plug lead wire.

- (2) Turn the starter switch to "GLOW" position.

Load current**12V type 7.7 – 10.3 A****24V type 4.1 – 5.5 A**

8-4 **STARTING SYSTEM** — Preheating System

Fig. 8-7



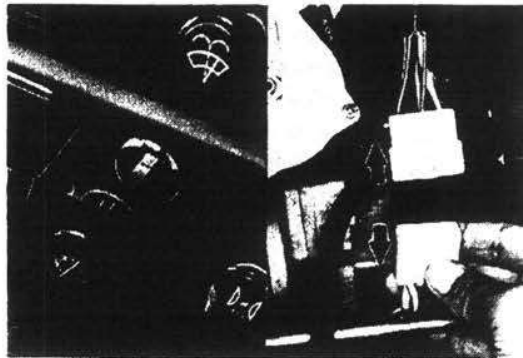
5. Check glow plug resistance.

Resistance

12V type 0.2 Ω

24V type 0.9 Ω

Fig. 8-8



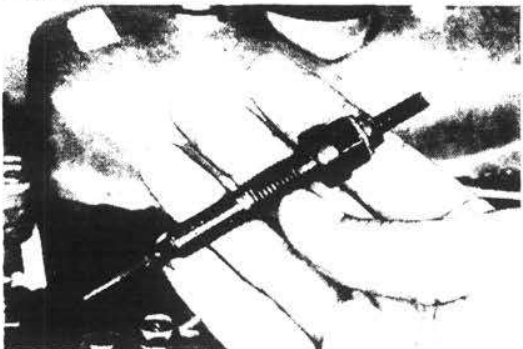
6. Check glow plug relay.
- (1) Pull the stop button all the way out, or disconnect the connector of EDIC motor wires to prevent accidental starting of the engine.

Fig. 8-9



- (2) When the starter switch is turned to the "START" position, a voltage should register at "S" terminal.

Fig. 8-10



— Note —

1. Be careful not to damage the glow plug pipes.
This might cause open circuit or shorten life of the plugs.
2. Avoid getting oil and gasoline on glow plug when cleaning.
3. At the time of inspection, be sure to wipe oil off glow plug terminals and bakelite washer with a dry cloth.

STARTING SYSTEM — Starter Relay & Overinjection Magnet

8-5

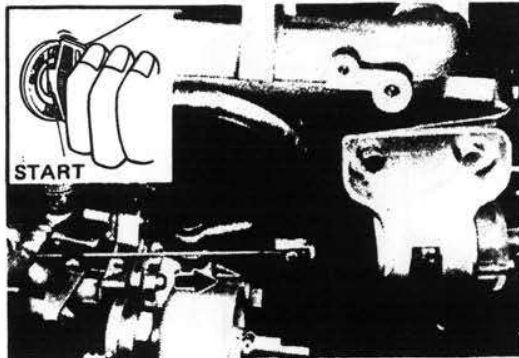
STARTER RELAY & OVERINJECTION MAGNET

Fig. 8-11

**INSPECTION****Starter Relay**

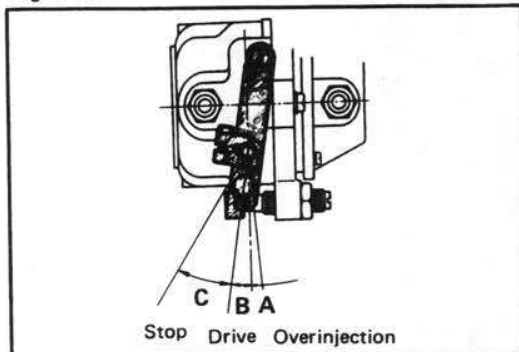
Check the contact "click" noise when starter switch is turned to the "START" position.

Fig. 8-12

**Overinjection Magnet**

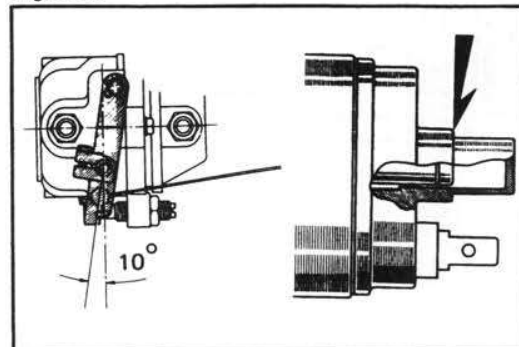
Check to see if the injection pump lever moves to the overinjection position when starter switch is turned to "START" position.

Fig. 8-13



- A: 5°
B: 10°
C: 25°

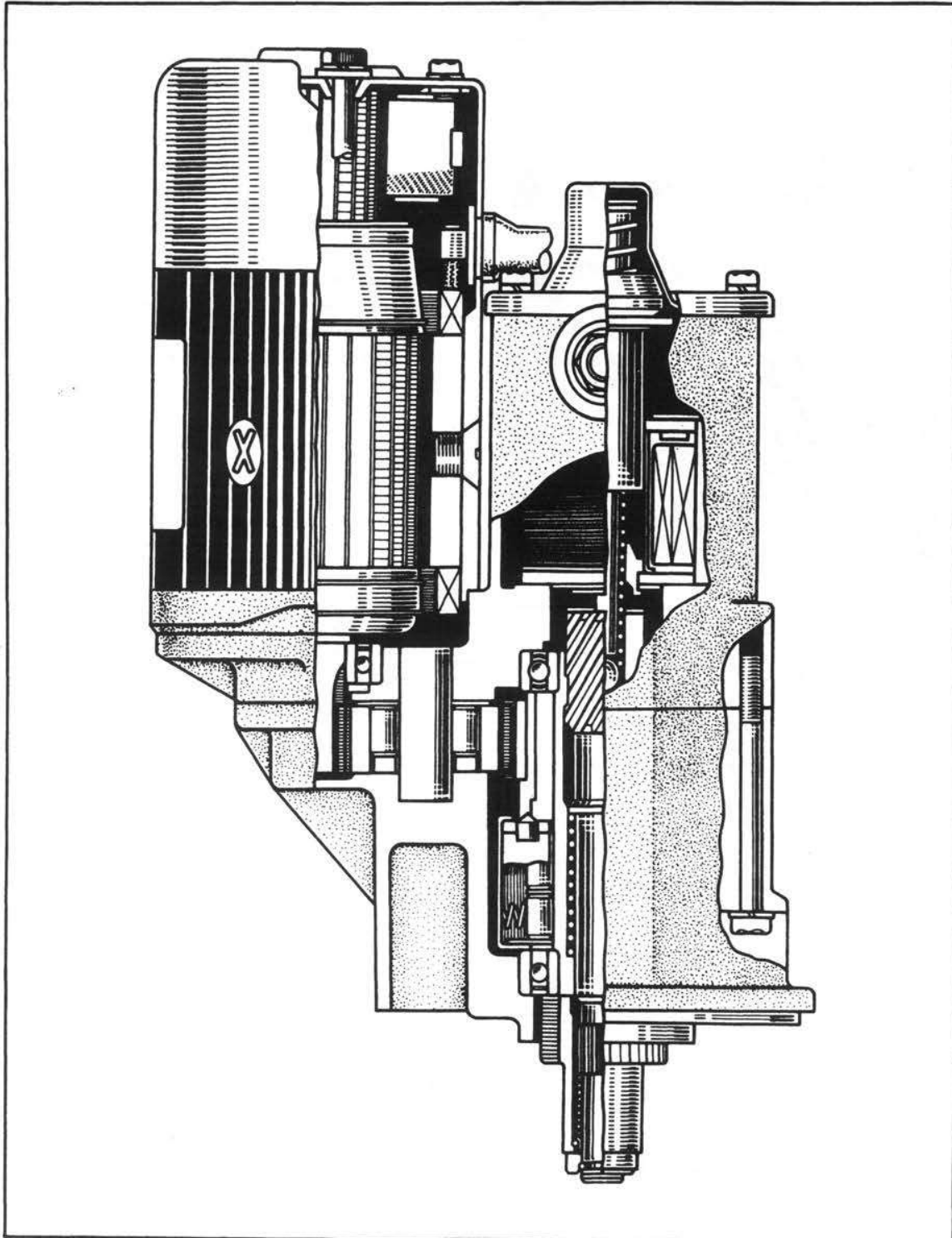
Fig. 8-14



When connecting the overinjection magnet connecting wire, position the magnet core end surface as shown.

8-6 **STARTING SYSTEM** – Starter**STARTER**
CROSS SECTIONAL VIEW

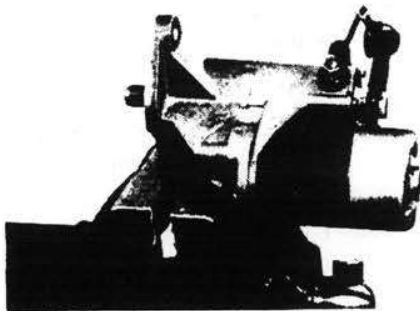
Fig. 8-15



STARTING SYSTEM – Starter

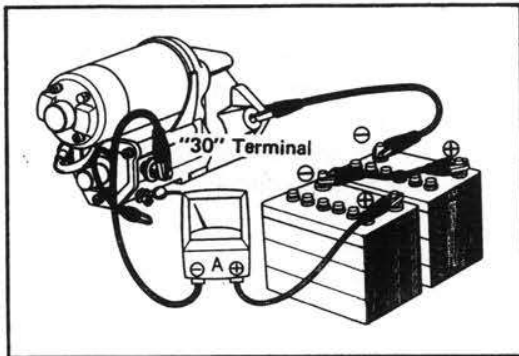
8-7

Fig. 8-16

**PERFORMANCE TEST****No-Load Performance Test**

1. Secure the starter in a vise to prevent accident.

Fig. 8-17



2. Connect starter to battery as shown.

Positive side

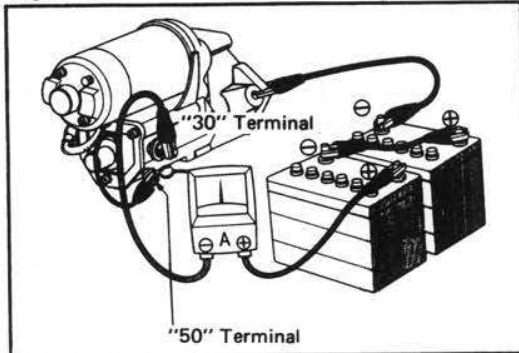
Battery (+) → Ammeter (+)

Ammeter (-) → "30" Terminal

Negative side

Battery (-) → Starter housing

Fig. 8-18

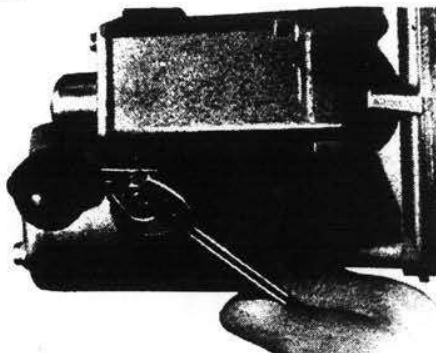


3. Connect the positive wire to "50" terminal.

If the starter shows smooth and steady rotation with the pinion jumping out and draws less than specified current, it is satisfactory.

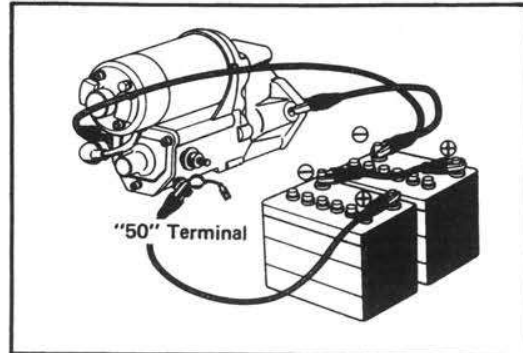
Specified current**12V type Less than 180A****24V type Less than 90A**

Fig. 8-19

**Test Magnetic Switch****— Caution —**

Each test must be performed within a short time (3 – 5 seconds) to prevent the coil from burning out.

1. Disconnect "C" terminal.

8-8 **STARTING SYSTEM – Starter****Fig. 8-20**

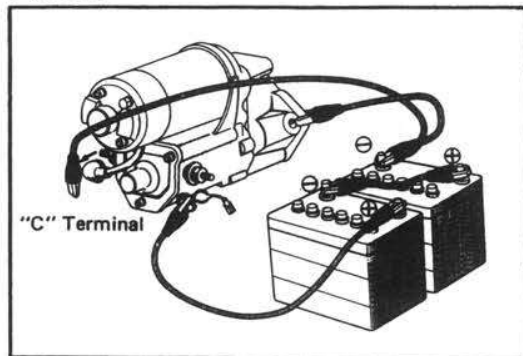
2. Test pull-in coil.
Connect magnetic switch to battery as shown. The pinion should jump out.

Negative side

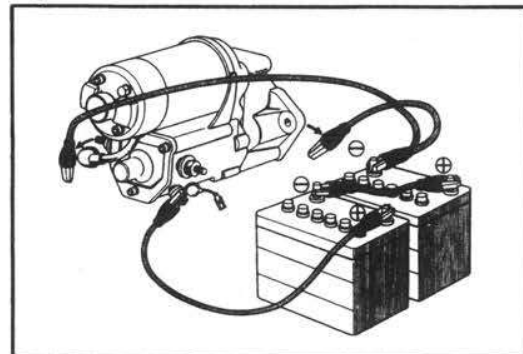
Battery (–) → Starter housing and
"C" terminal

Positive side

Battery (+) → "50" terminal

Fig. 8-21

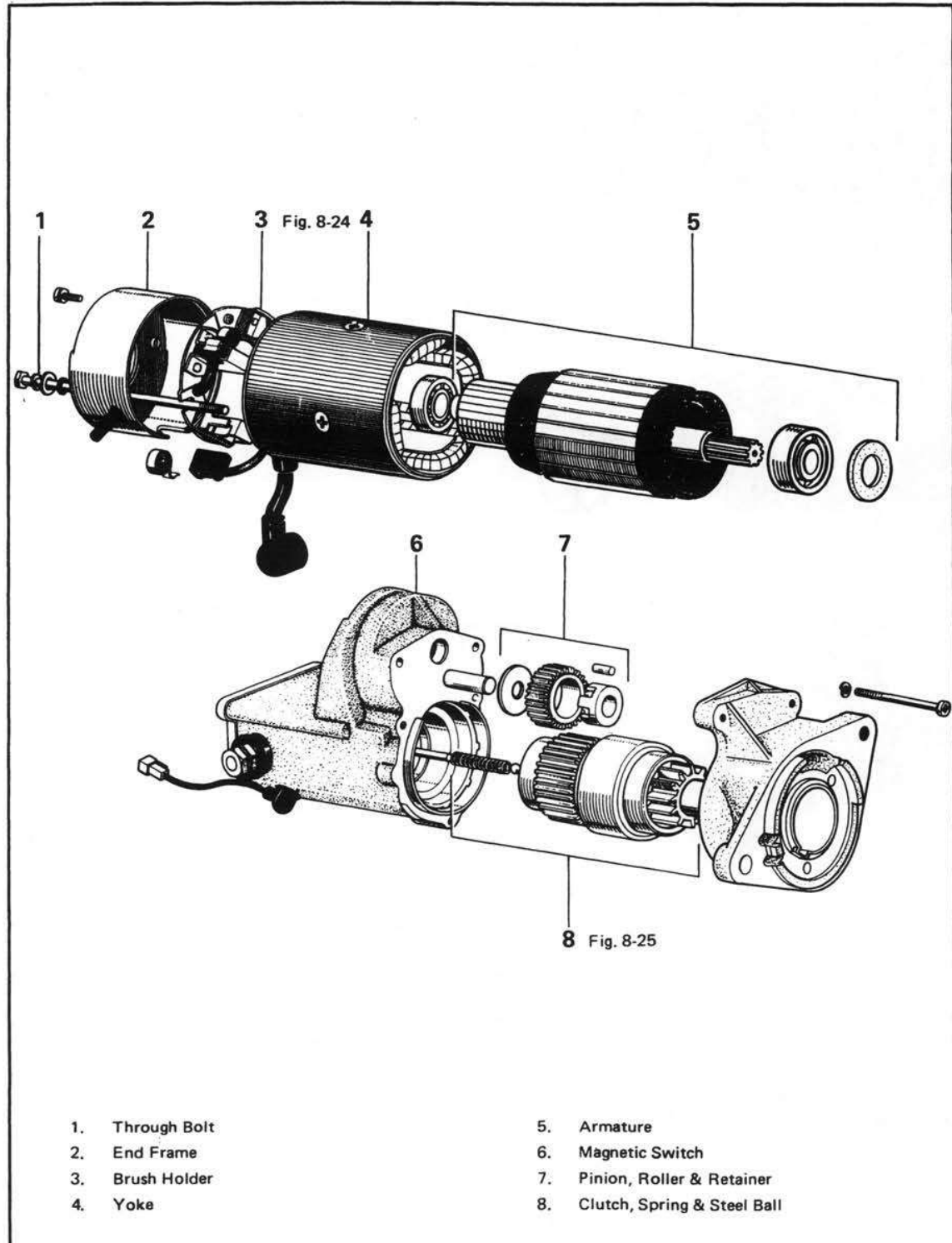
3. Test hold-in coil.
With the same connections as in the "Pull-in coil test", disconnect "C" terminal.
At this time, the pinion should remain in jumped out condition.

Fig. 8-22

4. Check pinion return.
When disconnecting the cable from starter housing, the jumped out pinion should return quickly.

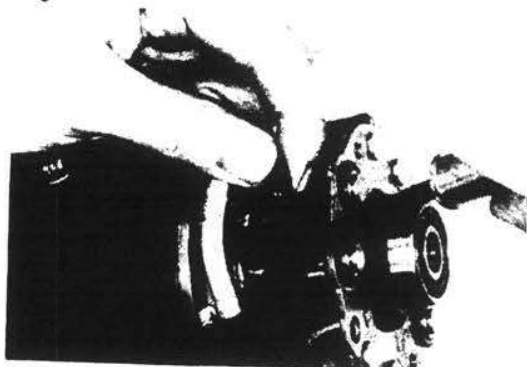
STARTING SYSTEM – Starter 8-9**DISASSEMBLY**

Disassemble in numerical order.

Fig. 8-23

8-10 STARTING SYSTEM – Starter

Fig. 8-24

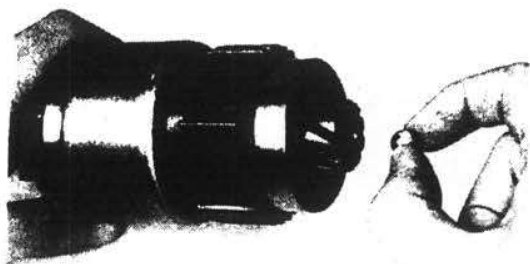


Lift up the brush spring and pull out the brush from the brush holder.

– Caution –

Use care not to damage the brush and commutator. Also avoid oil or grease to get on.

Fig. 8-25



Take the steel ball out from the clutch shaft hole.

Fig. 8-26



INSPECTION & REPAIR



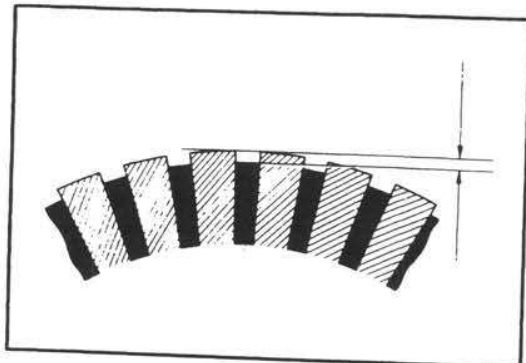
Wipe off dirt and gease from the disassembled parts.

Commutator

Inspect for the following items and repair or replace as necessary.

1. Dirty or burnt surface:
Correct with sandpaper or a lathe if necessary.

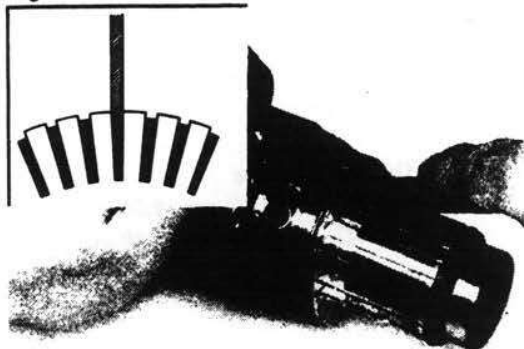
Fig. 8-27



2. Depth of segment (Mica depth):

Mica depth

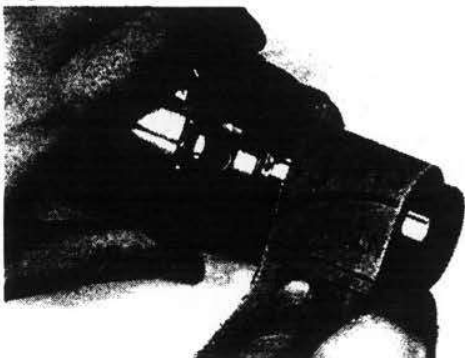
Limit	0.2 mm (0.008 in.)
STD	0.5 – 0.8 mm (0.020 – 0.031 in.)

STARTING SYSTEM – Starter**8-11****Fig. 8-28**

3. If the mica depth is below the limit, correct with a hacksaw blade.

Fig. 8-29

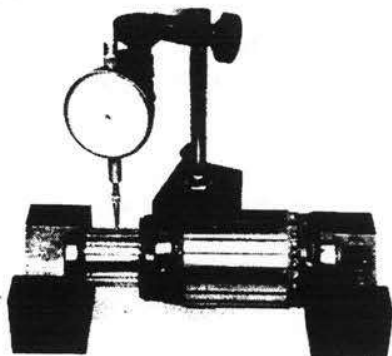
4. Smooth out the edge with a hacksaw blade.

Fig. 8-30

5. After correcting, eliminate chips with sandpaper.

— Note —

Use # 400 sandpaper.

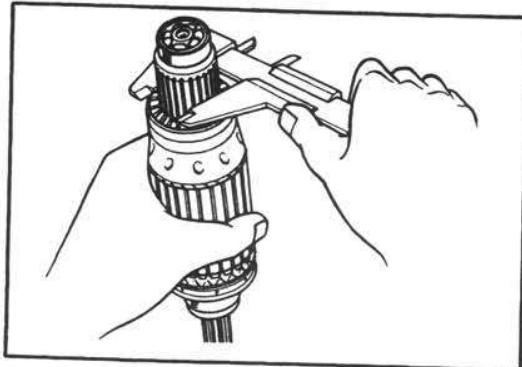
Fig. 8-31

6. Run out:
Correct on a lathe if it exceeds the limit.

Run out	
Limit	0.05 mm (0.002 in.)
STD	Less than 0.02 mm
	(0.001 in.)

8-12 STARTING SYSTEM — Starter

Fig. 8-32

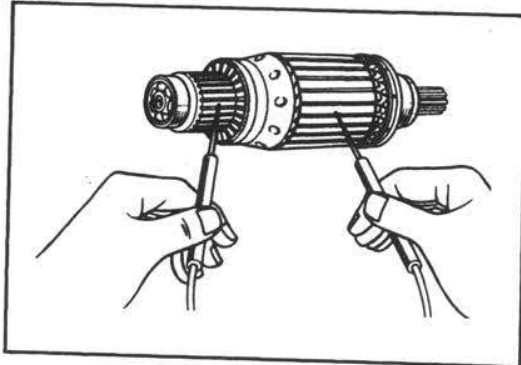


7. Diameter wear:
If the diameter is less than the limit,
replace armature.

Outside diameter

Limit	34 mm (1.34 in.)
STD	35 mm (1.38 in.)

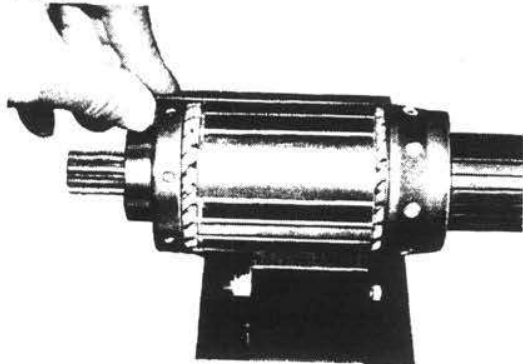
Fig. 8-33



Armature Coil

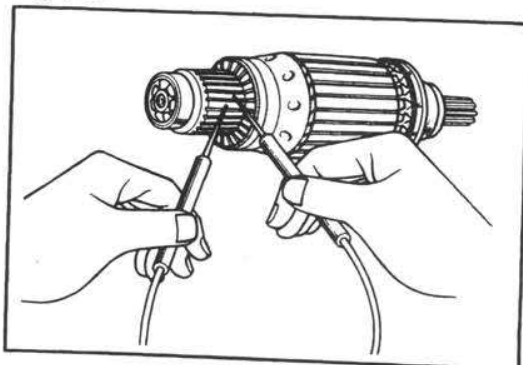
1. Ground test:
Using an armature tester or a circuit tester,
check for continuity between commutator
and armature coil core.
If there is continuity, the armature is
grounded and must be replaced.

Fig. 8-34

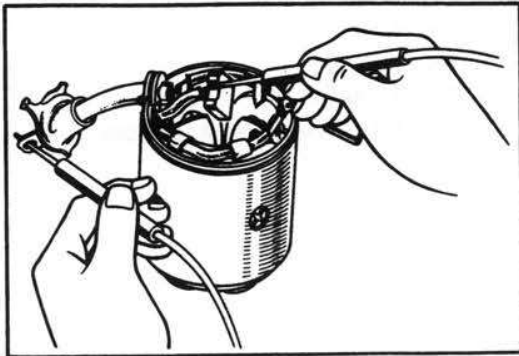


2. Short-circuit test:
Place the armature on the armature tester
and hold a hacksaw blade against the
armature core while turning the armature.
If the hacksaw blade is attracted or
vibrates, the armature is shorted and must
be replaced.

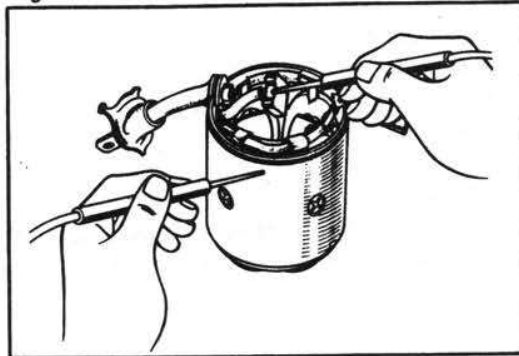
Fig. 8-35



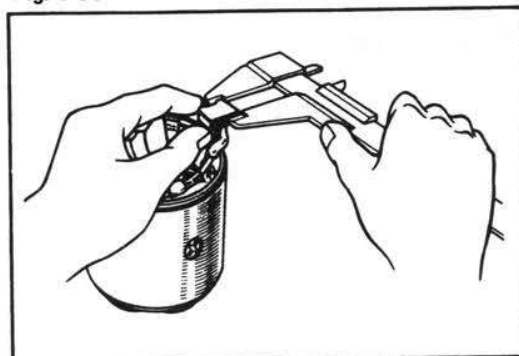
3. Open-circuit test:
Using the armature tester or a circuit
tester, check for continuity between the
segments.
If there is no continuity at any test point,
there is an open-circuit and the armature
must be replaced.

STARTING SYSTEM – Starter**8-13****Fig. 8-36****Field Coil**

1. Open-circuit test:
Check for continuity between the "C" terminal lead wire and field coil brush. If there is no continuity, there is an open-circuit in the field coil, and it should be replaced.

Fig. 8-37

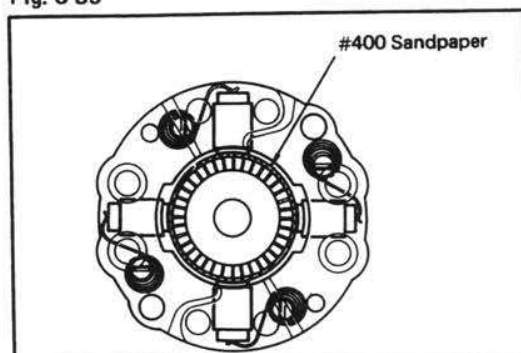
2. Ground test:
Check for continuity between the brush and yoke core. If there is continuity, repair or replace the field coil.

Fig. 8-38**Brushes**

1. Measure the brush length and replace if below the limit.

Brush length

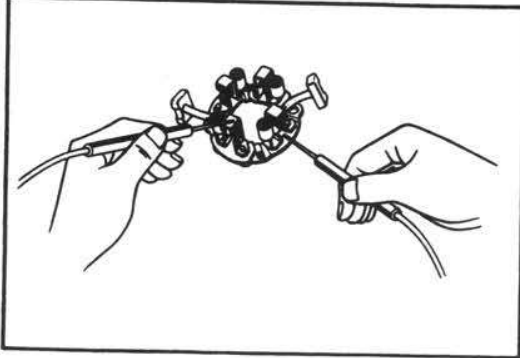
Limit	13 mm (0.51 in.)
STD	19 mm (0.75 in.)

Fig. 8-39

2. Using # 400 sandpaper, clean or fit the brushes to make proper contact with the commutator.

8-14 STARTING SYSTEM — Starter

Fig. 8-40

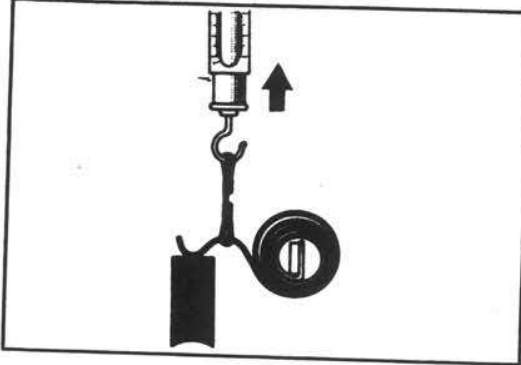


Brush Holder

Check insulation between the (+) side brush holder and holder plate.

If there is continuity, repair or replace the brush holder.

Fig. 8-41



Brush Spring

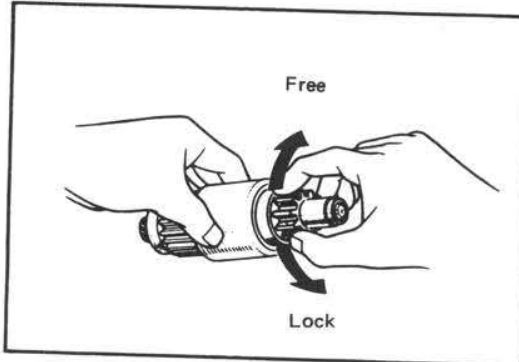
Measure the brush spring load with a pull-scale. If the reading is below standard, replace the spring.

— Note —

Take the pull-scale reading at the very instant the brush spring separates from the brush.

Tension 3.2 – 4.0 kg (7.1 – 8.8 lb)

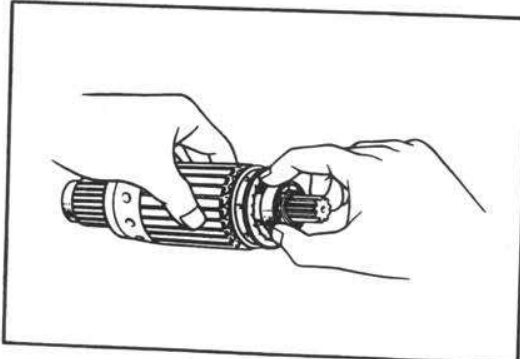
Fig. 8-42



Clutch & Gears

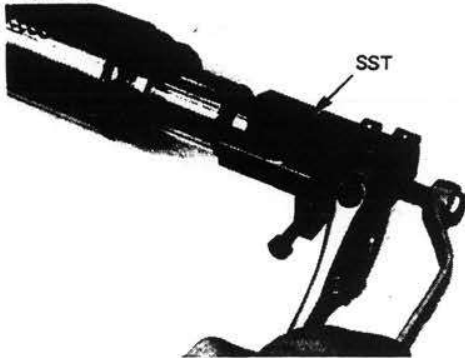
1. Inspect the gear teeth for wear and damage. Replace if damaged. If damaged, also inspect flywheel ring gear for same.
2. Rotate pinion. It should turn freely in clockwise direction and lock when turned counterclockwise.

Fig. 8-43

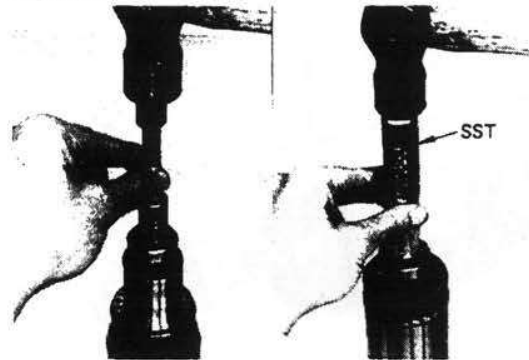


Bearings

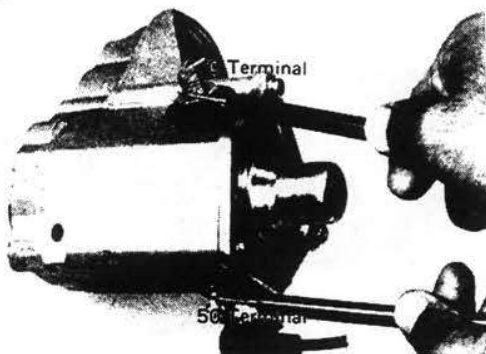
1. Check for sticking and abnormal noise while turning rapidly.

STARTING SYSTEM – Starter **8-15****Fig. 8-44**

2. Replace armature bearing if defective.
 - (1) Remove the bearing by using SST [09286-46011].

Fig. 8-45

- (2) Replace the front bearing, and using SST [09285-76010] drive in the rear bearing.

Fig. 8-46**Magnetic Switch**

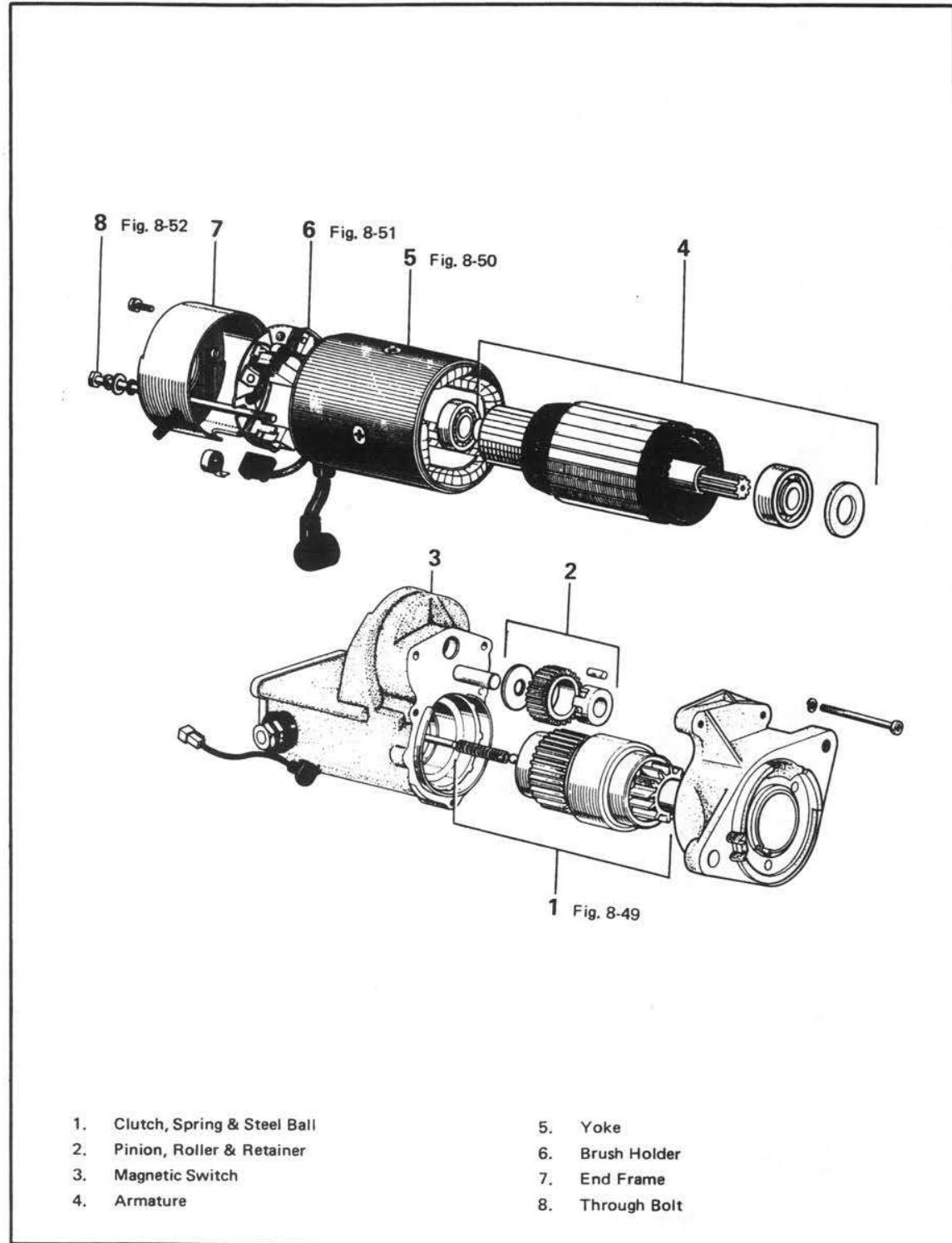
1. Pull-in coil open circuit test:
Check for continuity between "50" terminal and "C" terminal.

Fig. 8-47

2. Hold-in coil open circuit test:
Check for continuity between "50" terminal and magnetic switch body.

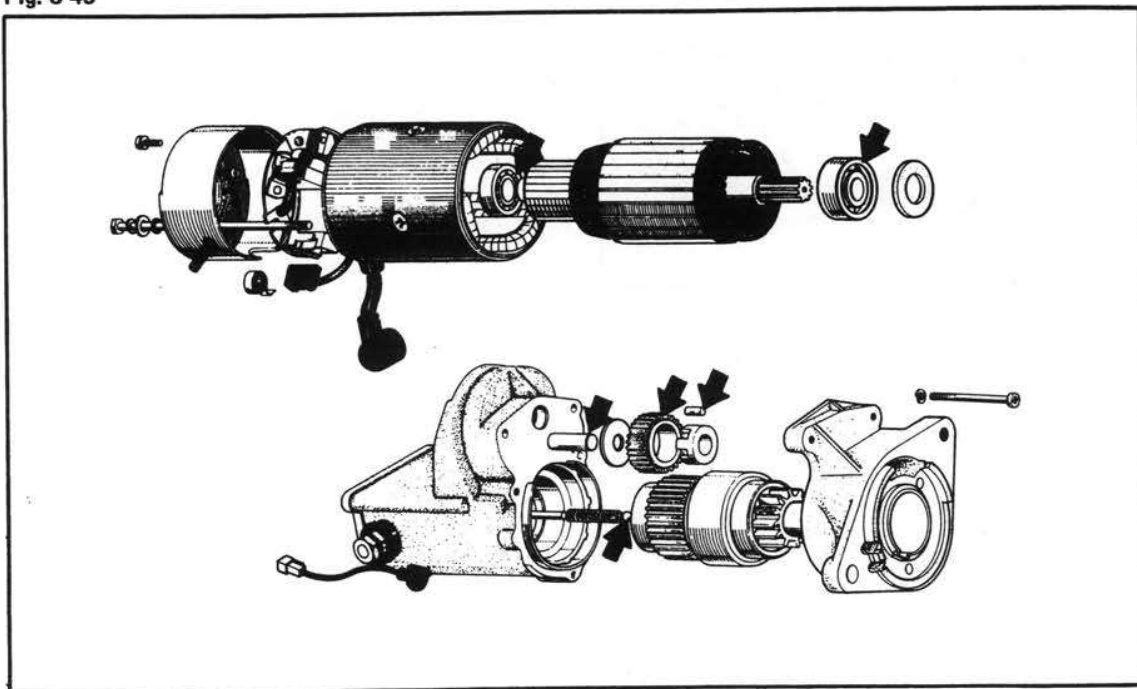
8-16 **STARTING SYSTEM – Starter****ASSEMBLY**

Assemble in numerical order.

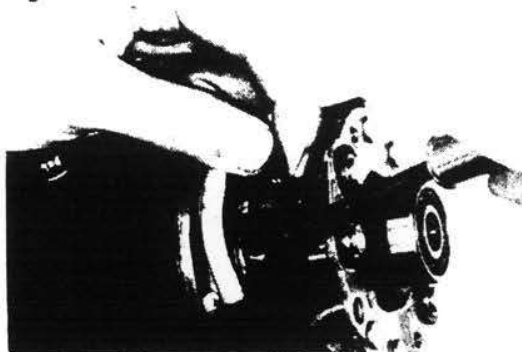
Fig. 8-48

STARTING SYSTEM – Starter**8-17**

Use high temperature grease to lubricate bearings and gears as shown below.

Fig. 8-49**Fig. 8-50**

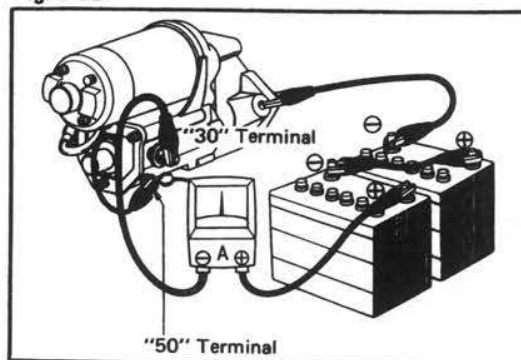
Match the protrusion of the yoke core with the starter housing notch.

Fig. 8-51

Assemble the brush holder.

— Caution —

Use care not to damage or get oil on the brushes and commutator.

8-18 STARTING SYSTEM – Starter**Fig. 8-52**

Check performance of the starter after assembling.

Specified current

12V type	Less than 180A
24V type	Less than 90A

