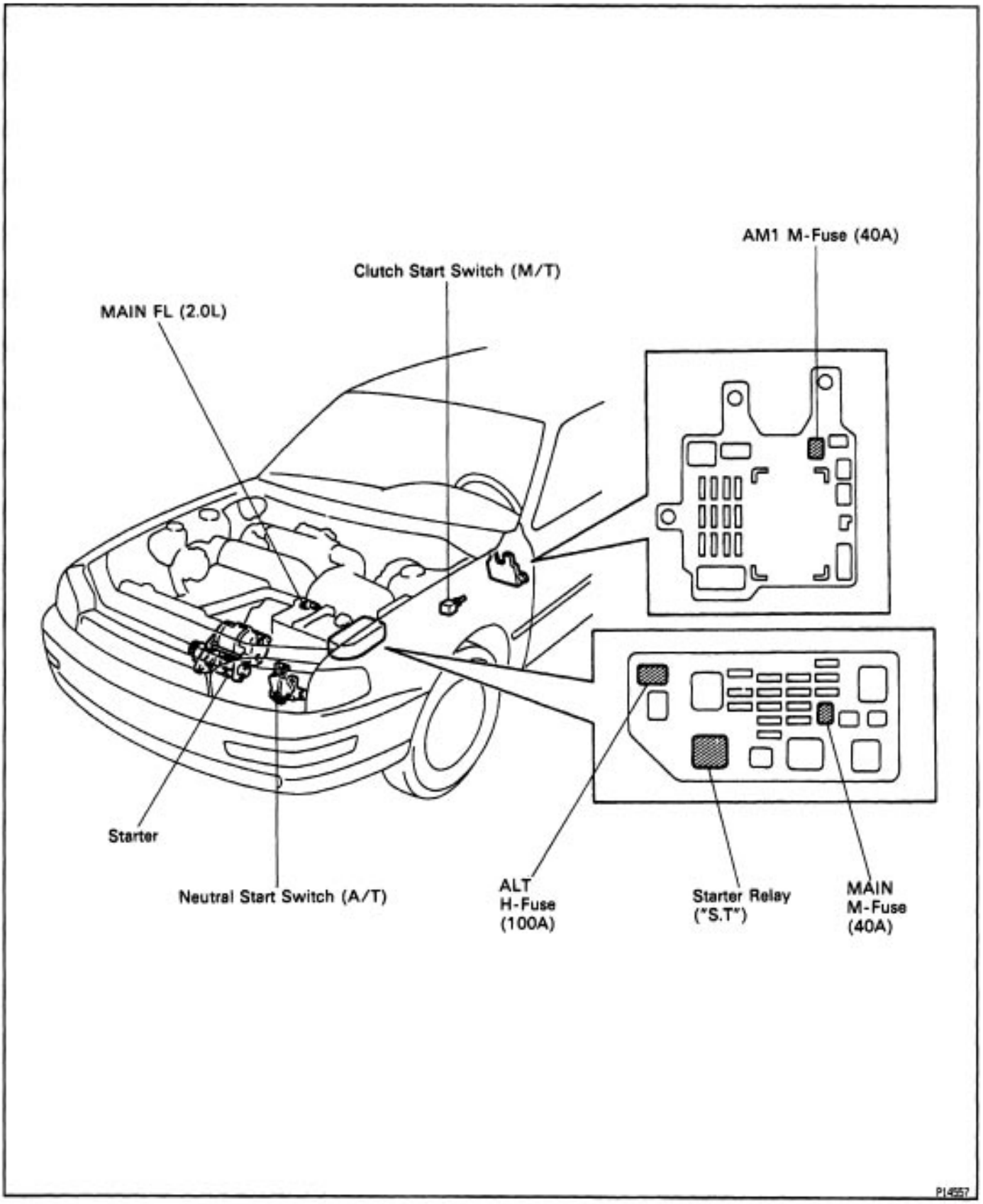
STARTING SYSTEM

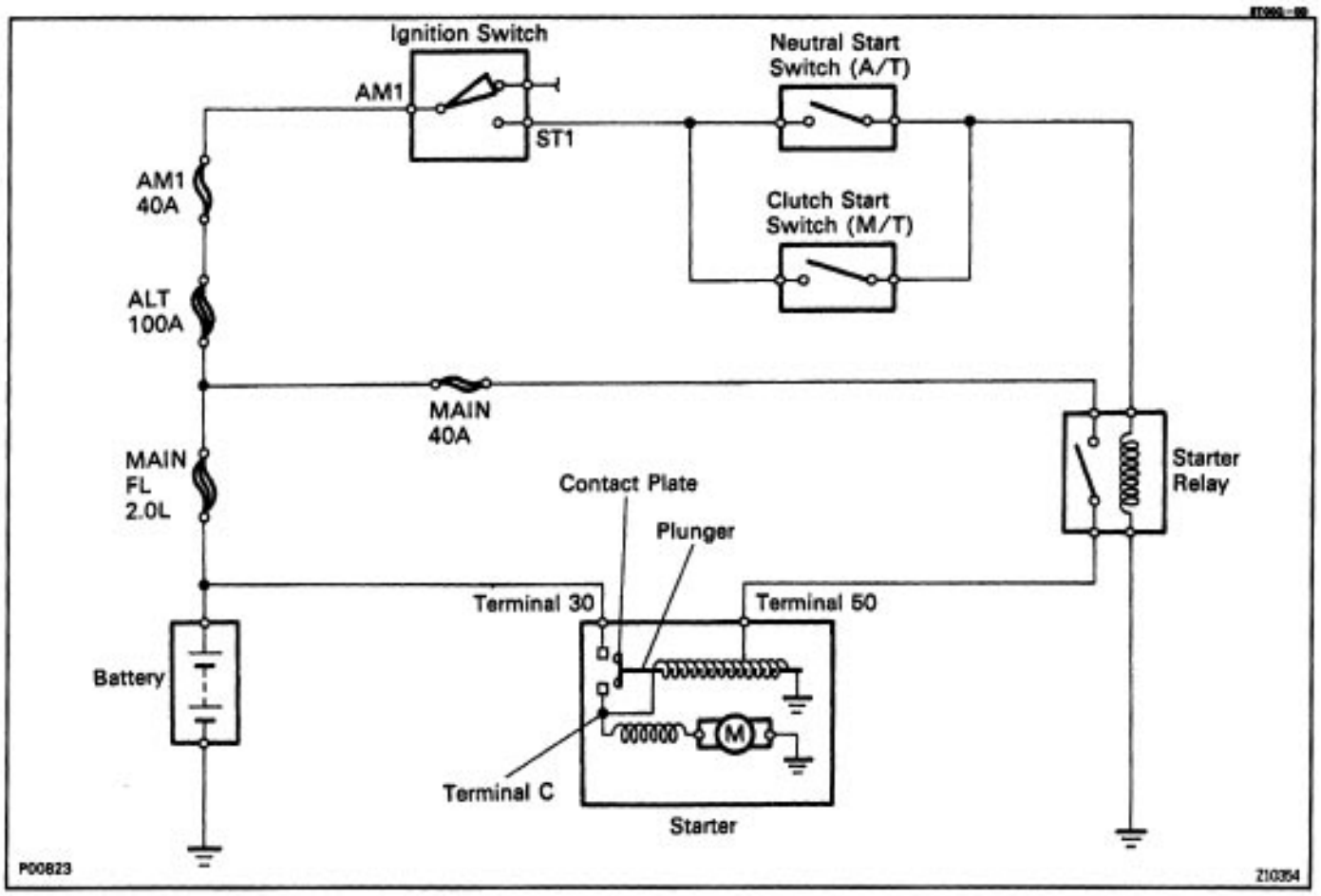
(5S–FE)

DESCRIPTION

The starter is a reduction type with a small, high–speed motor used to drive the pinion gear.



SYSTEM CIRCUIT



OPERATION

When the ignition switch is turned to START position, current flows from terminal 50 to the coil of the solenoid and the plunger is pulled by the magnetic force of the coil. When the plunger is pulled to the left, the contact plate of the plunger allows current from the battery to flow directly from terminal 30 to the motor, and the starter rotates.

When the engine is running and the ignition switch is returned to ON, the magnetic force of the coil disappears and the contact plate of the plunger is returned to its original position by the return spring. Battery voltage no longer flows from terminal 30, so the motor stops.

PREPARATION

SST (SPECIAL SERVICE TOOLS)

	09286–46011 Injection Pump Spline Shaft Puller	Armature bearing
	09820–00030 Alternator Rear Bearing Replacer	Armature front bearing

RECOMMENDED TOOLS

	09082–00050 TOYOTA Electrical Tester set	

EQUIPMENT

Dial indicator	Commutator
Magnetic finger	
Pull scale	Brush spring
Sandpaper	Commutator
Torque wrench	
V – block	
Vernier calipers	Commutator, Brush

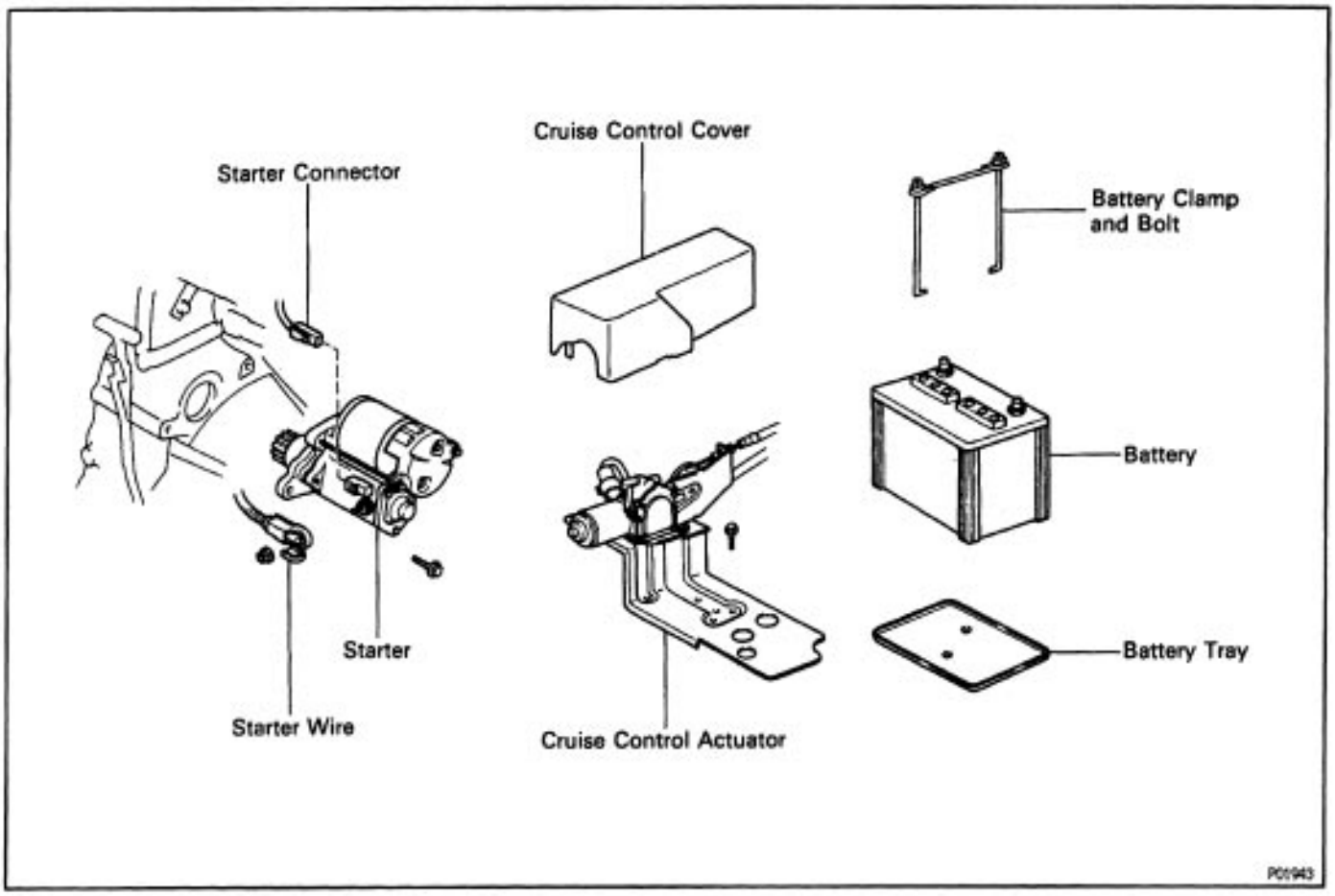
ON–VEHICLE INSPECTION

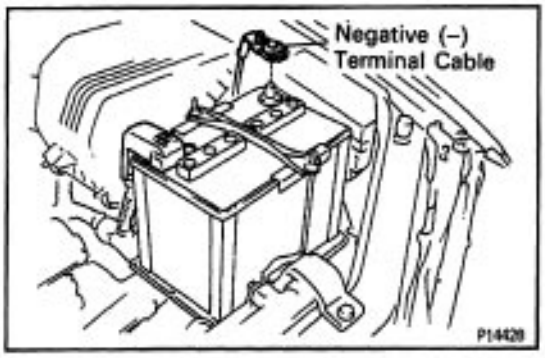
NOTICE: Before changing the starter, check the following Items again:

- **Connector connection**
- **Accessory Installation, e.g.: theft deterrent system**

STARTER

COMPONENTS FOR REMOVAL AND INSTALLATION



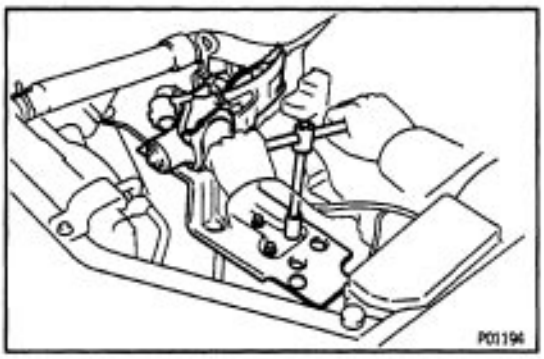


STARTER REMOVAL

1. DISCONNECT NEGATIVE (–) TERMINAL CABLE FROM BATTERY

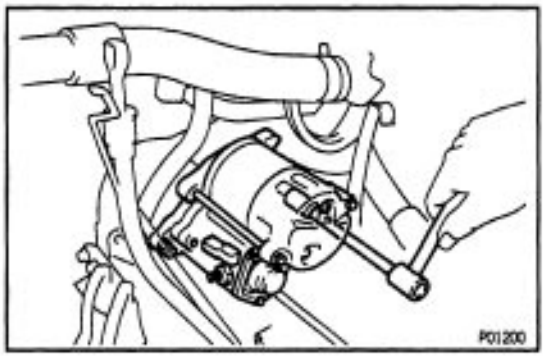
CAUTION: Work must be started after 90 seconds from the time the ignition switch is turned to the 'LOCK' position and the negative (–) terminal cable Is discon–nected from the battery.

2. w/ CRUISE CONTROL SYSTEM:
REMOVE BATTERY



3. w/ CRUISE CONTROL SYSTEM:
REMOVE CRUISE CONTROL ACTUATOR

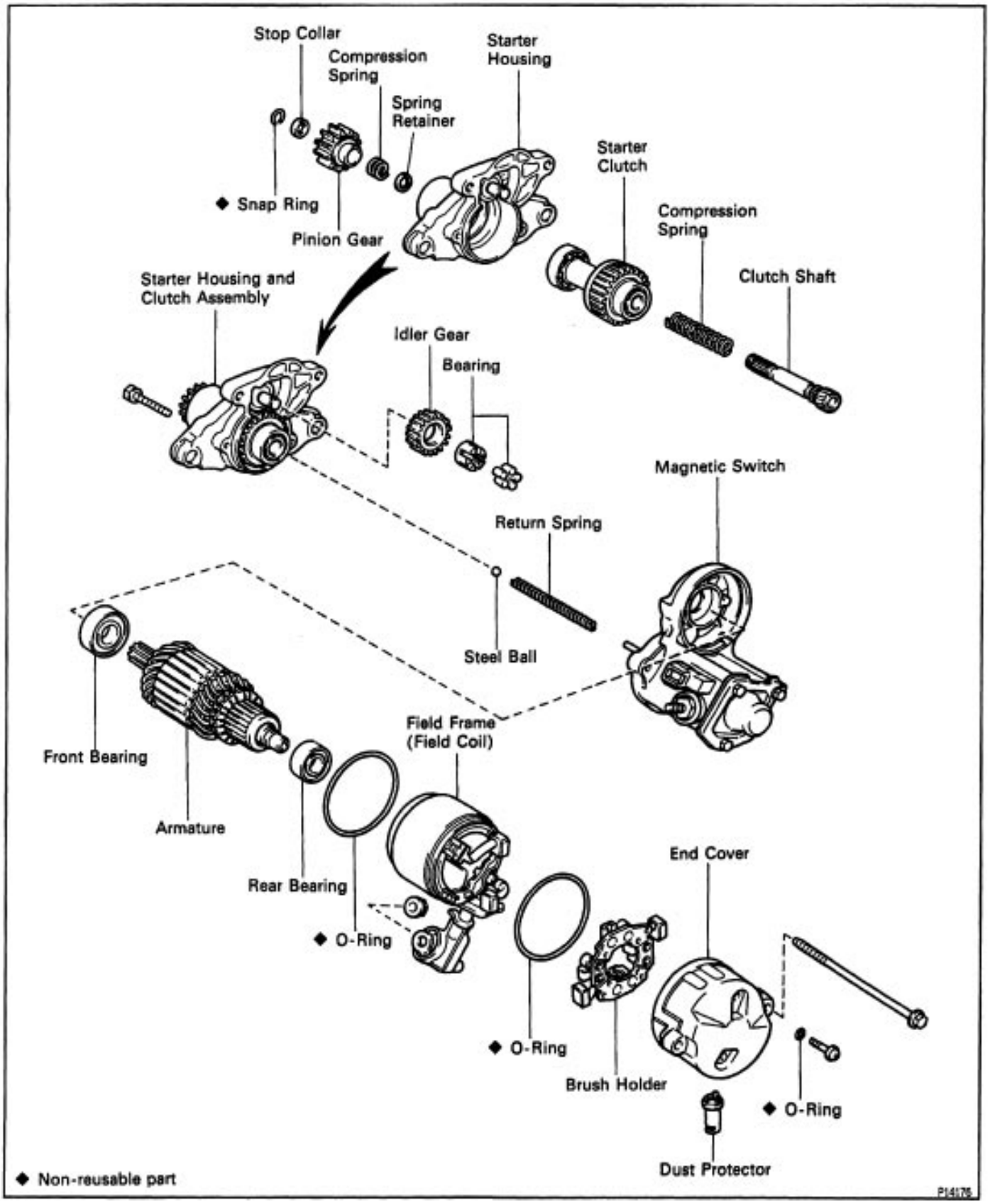
(a) Remove the actuator cover.
(b) Disconnect the actuator connector.
(c) Remove the 3 bolts and cruise control actuator.



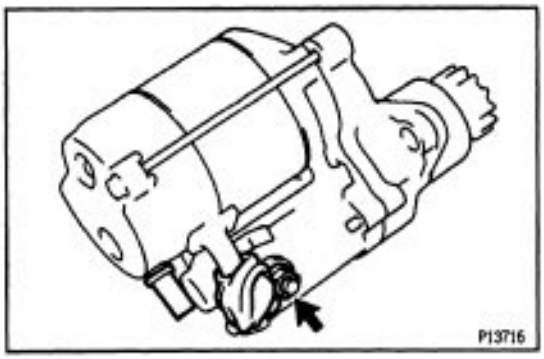
4. REMOVE STARTER

(a) Disconnect the starter connector.
(b) Remove the nut, and disconnect the starter wire.
(c) Remove the 2 bolts and starter.

COMPONENTS FOR DISASSEMBLY AND ASSEMBLY



STARTER DISASSEMBLY

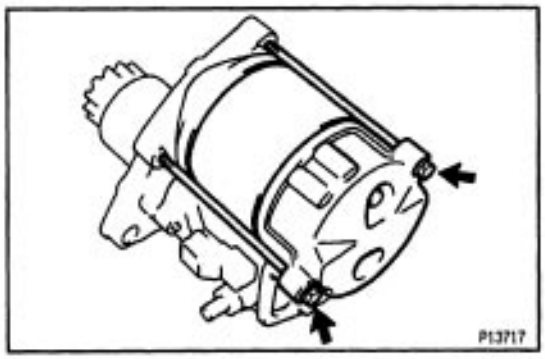


(See Components for Disassembly and Assembly)

1. REMOVE DUST PROTECTOR

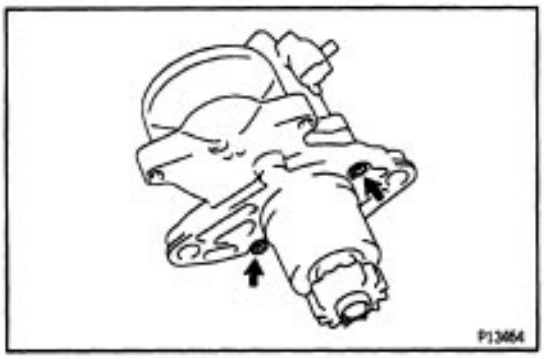
2. REMOVE FIELD FRAME AND ARMATURE

(a) Remove the nut, and disconnect the lead wire from the magnetic switch terminal.



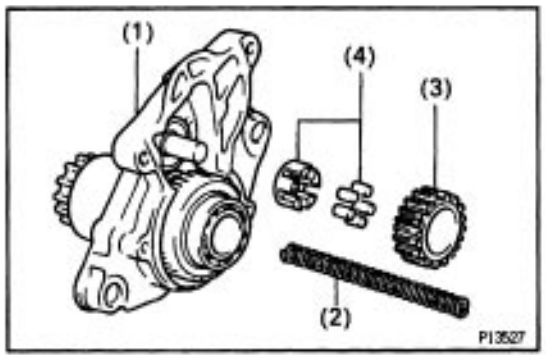
(b) Remove the 2 through bolts, and pull out the field frame together with the armature.

(c) Remove the O–ring from the field frame.



3. REMOVE STARTER HOUSING, CLUTCH ASSEMBLY AND GEAR

(a) Remove the 2 screws.



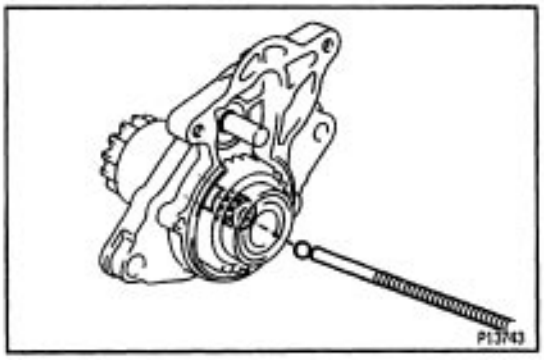
(b) Remove the following parts from the magnetic switch:

(1) Starter housing and clutch assembly

(2) Return spring

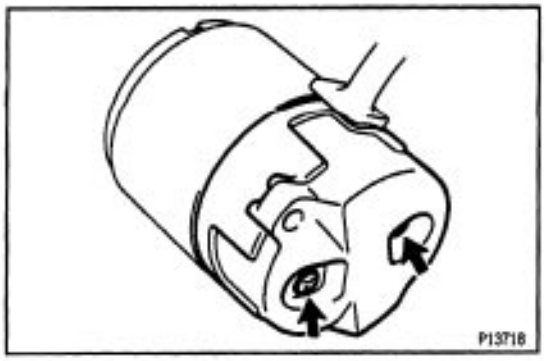
(3) Idler gear

(4) Bearing



4. REMOVE STEEL BALL

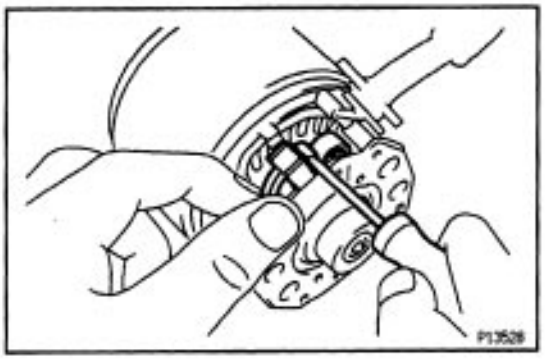
Using a magnetic finger, remove the steel ball from the clutch shaft hole.



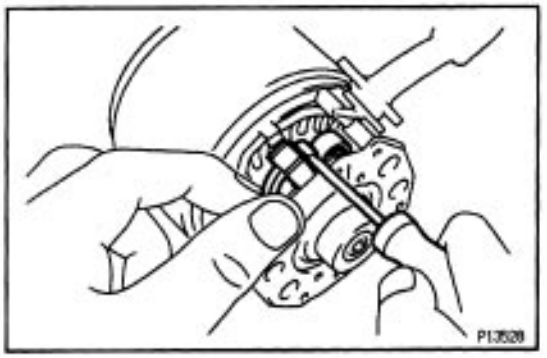
REMOVE BRUSH HOLDER

(a) Remove the 2 screws, 2 O–rings and end cover from the field frame.

(b) Remove the O–ring from the field frame.

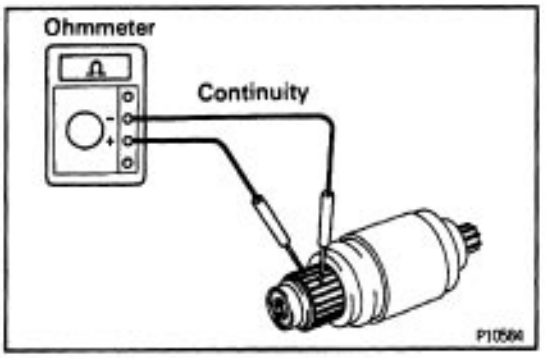


(c) Using a screwdriver, hold the spring back and disconnect the brush from the brush holder.
Disconnect the 4 brushes, and remove the brush holder.



6. REMOVE ARMATURE FROM FIELD FRAME

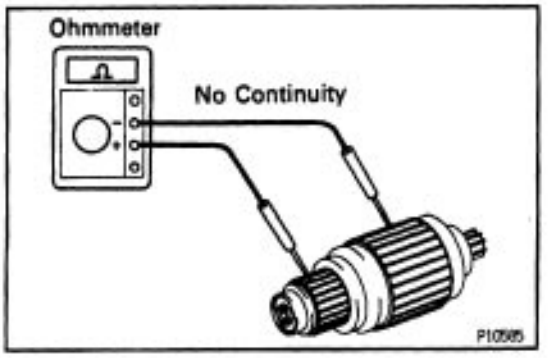
STARTER INSPECTION AND REPAIR



Armature Coil

1. INSPECT COMMUTATOR FOR OPEN CIRCUIT

Using an ohmmeter, check that there is continuity between the segments of the commutator.
If there is no continuity between any segment, replace the armature.



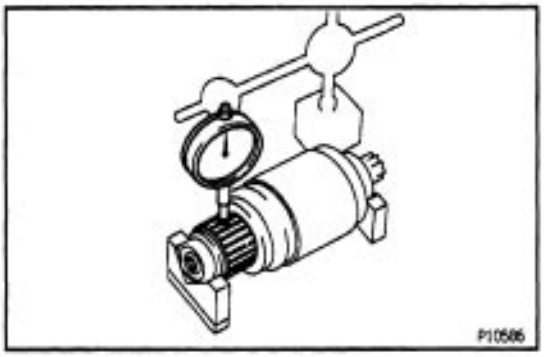
2. INSPECT COMMUTATOR FOR GROUND

Using an ohmmeter, check that there is no continuity between the commutator and armature coil core.
If there is continuity, replace the armature.

Commutator

1. INSPECT COMMUTATOR FOR DIRTY AND BURNT SURFACES

If the surface is dirty or burnt, correct it with sandpa–per (No.400) or on a lathe.



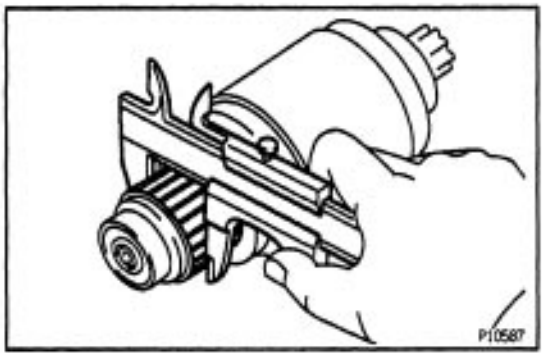
2. INSPECT COMMUTATOR CIRCLE RUNOUT

(a) Place the commutator on V – blocks.

(b) Using a dial gauge, measure the circle runout.

Maximum circle runout:
0.05 mm (0.0020 in.)

If the circle runout is greater than maximum, correct it on a lathe.

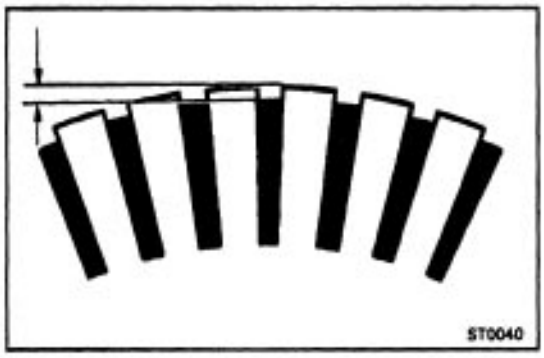


3. INSPECT COMMUTATOR4R DIAMETER

Using a vernier caliper, measure the commutator di–ameter.

Standard diameter:
30 mm (1.18 In.)
Minimum diameter:
29 mm (1.14 in.)

If the diameter is less than minimum, replace the armature.



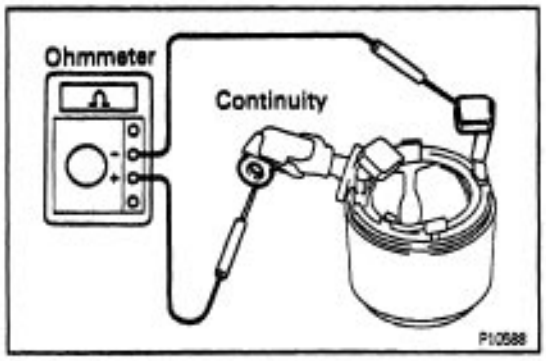
4. INSPECT UNDERCUT DEPTH

Check that the undercut depth is clean and free of foreign materials. Smooth out the edge.

Standard undercut depth:
0.6 mm (0.024 in.)
Minimum undercut depth:
0.2 mm 10.008 In.)

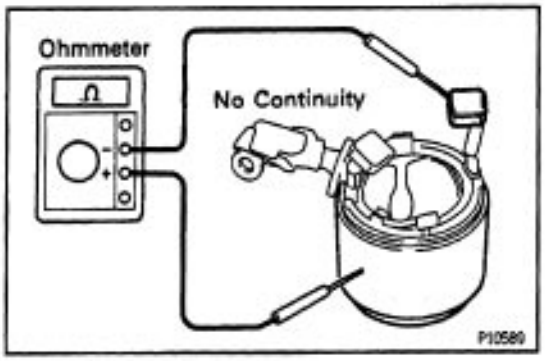
If the undercut depth is less than minimum, correct it with a hacksaw blade.

Field Frame (Field Coil)



1. INSPECT FIELD COIL FOR OPEN CIRCUIT

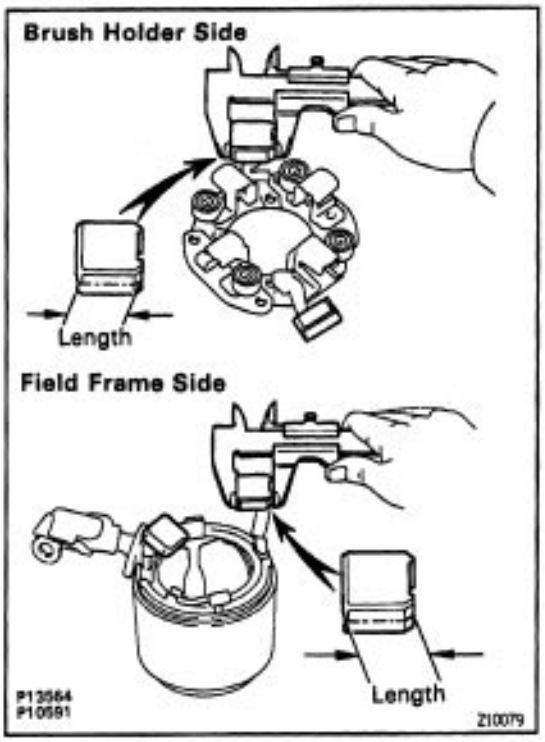
Using an ohmmeter, check that there is continuity between the lead wire and field coil brush lead.
If there is no continuity, replace the field frame.



2. INSPECT FIELD COIL FOR GROUND

Using an ohmmeter, check that there is no continuity between the field coil end and field frame.

If there is continuity, repair or replace the field frame.



Brushes

INSPECT BRUSH LENGTH

Using a vernier caliper, measure the brush length.

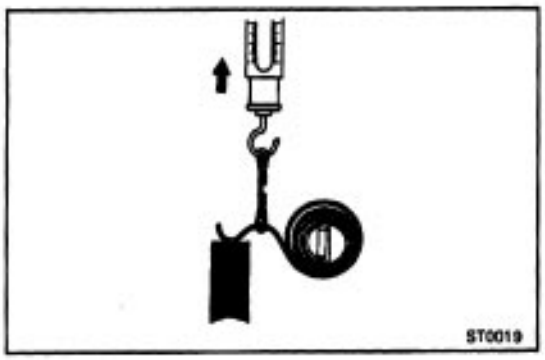
Standard length:

15.5 mm (O.610 In.)

Minimum length:

8.5 mm (0.335 in.)

If the length is less than minimum, replace the brush holder and field frame.



Brush Springs

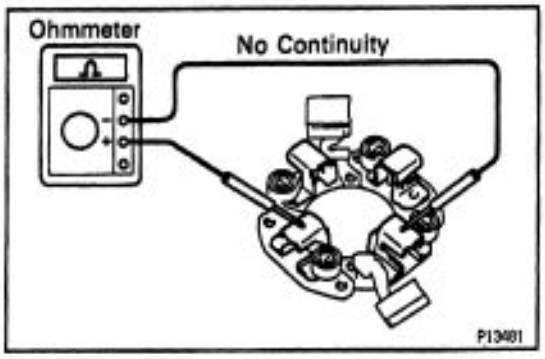
INSPECT BRUSH SPRING LOAD

Take the pull scale reading the instant the brush spring separates from the brush.

Spring installed load:

18–24N(1.79–2.41kgf,3.9–5.31bf)

If the installed load is not within specification, replace the brush springs.



Brush Holder

INSPECT BRUSH HOLDER INSULATION

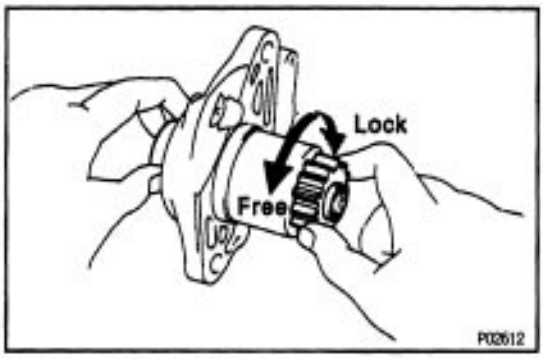
Using an ohmmeter, check that there is no continuity between the positive (+).and negative (–) brush hol–ders.

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

Clutch and Gears

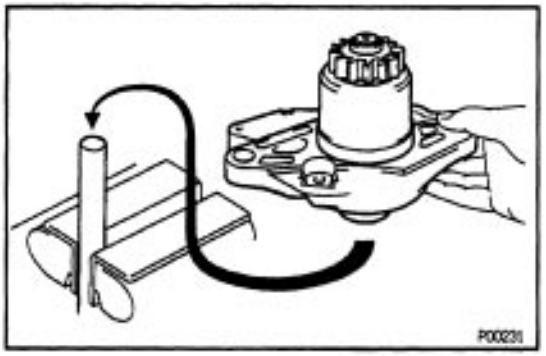
1. INSPECT GEAR TEETH

Check the gear teeth on the pinion gear, idle gear and clutch assembly for wear or damage.
If damaged, replace the gear or clutch assembly.
If damaged, also check the drive plate ring gear for wear or damage.



2. INSPECT CLUTCH PINION GEAR

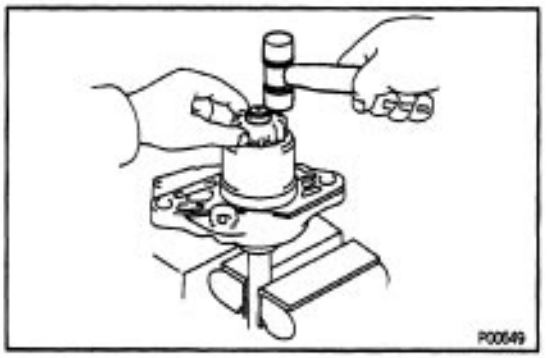
Hold the starter clutch and rotate the pinion gear counterclockwise, and check that it turns freely. Try to rotate the pinion gear clockwise and check that it locks.
If necessary, replace the clutch assembly.



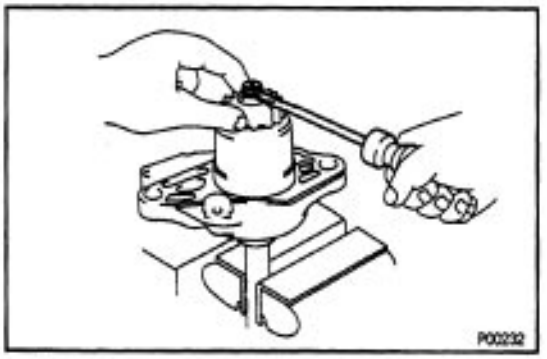
3. IF NECESSARY, REPLACE CLUTCH ASSEMBLY

A. Disassemble starter housing and clutch assembly

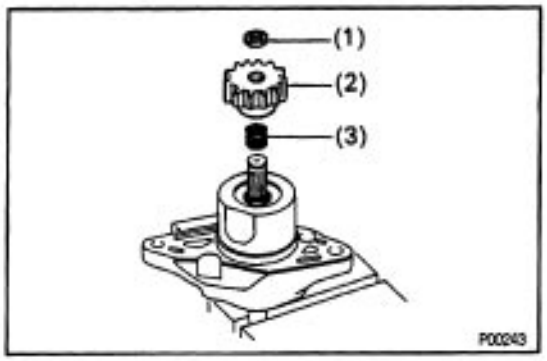
(a) Mount a brass bar in a vise, and install the starter housing and clutch assembly to the brass bar.



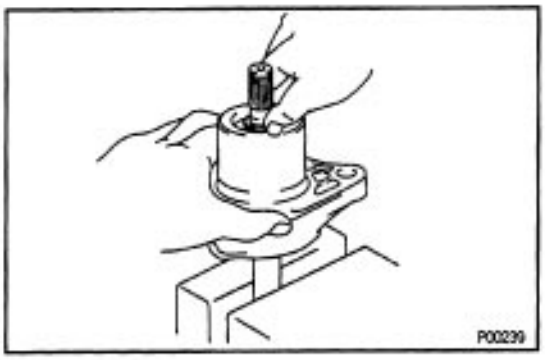
(b) Push down the pinion gear.
(c) Using a plastic–faced hammer, tap down the stop collar.



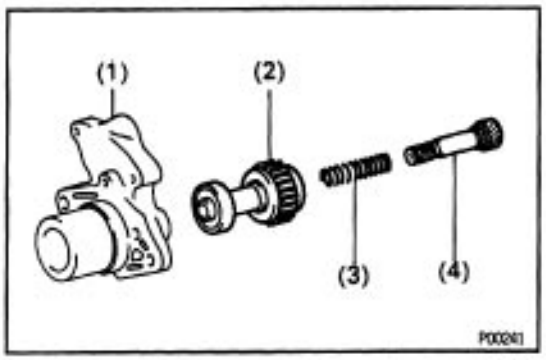
(d) Using a screwdriver, pry out the snap ring.



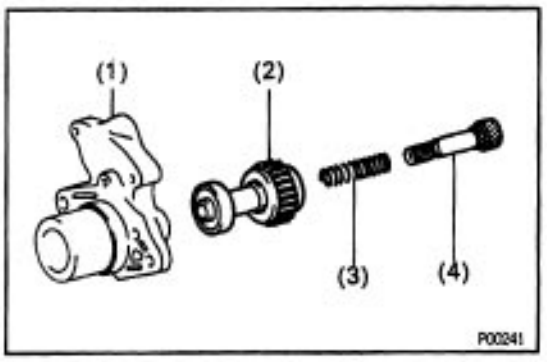
(e) Remove the following parts:
(1) Stop collar
(2) Pinion gear
(3) Compression spring



(f) Push down the starter housing, and remove the spring retainer.

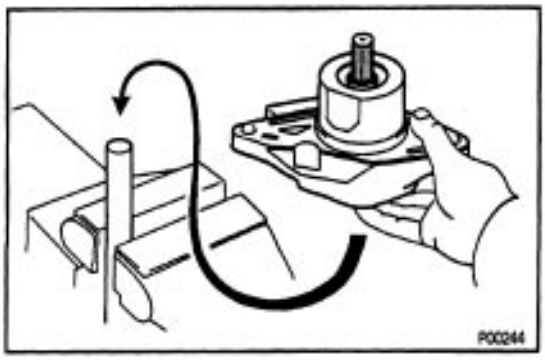


(g) Disassemble the following parts:
(1) Starter housing
(2) Starter clutch
(3) Compression spring
(4) Clutch shaft

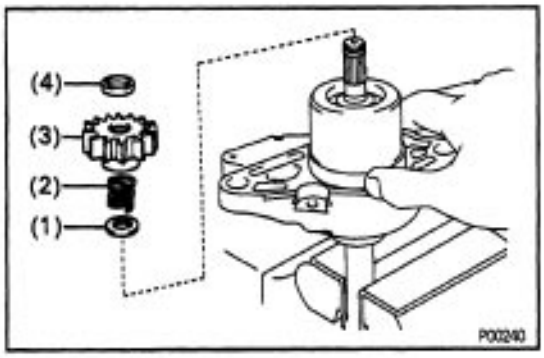


B. Assemble starter housing and clutch assembly

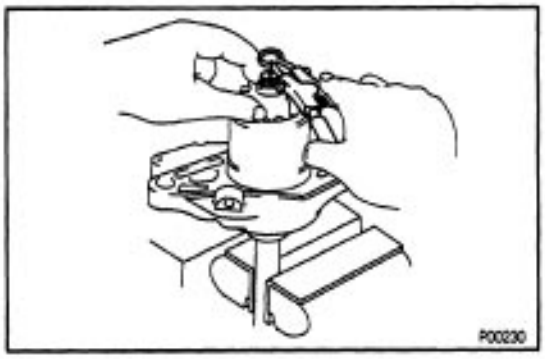
(a) Assemble the following parts:
(1) Starter housing
(2) Starter clutch
(3) Compression spring
(4) Clutch shaft



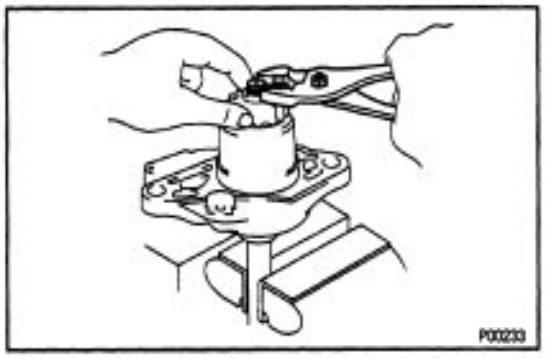
(b) Mount a brass bar in a vise, install the starter housing and clutch assembly to the brass bar.



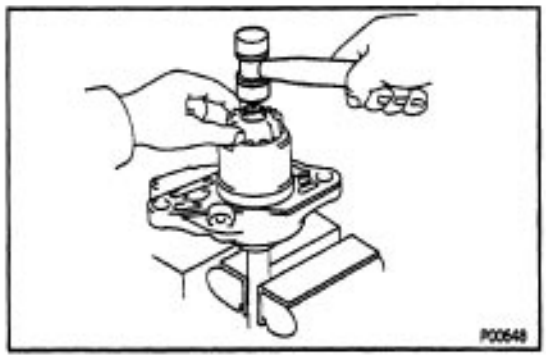
(c) Push down the starter housing, and install the following parts:
(1) Spring retainer
(2) Compression spring
(3) Pinion gear
(4) Stop collar



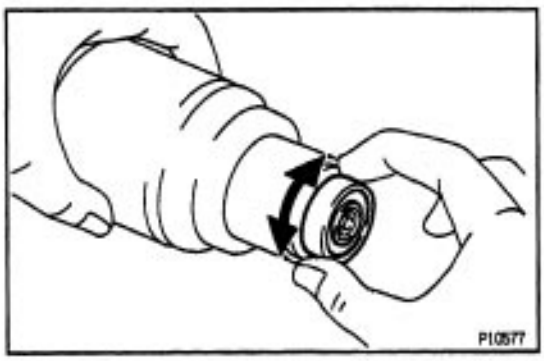
(d) Push down the pinion gear.
(e) Using snap ring pliers, install a new snap ring.



(f) Using pliers, compress the snap ring.
(g) Check that the snap ring fits correctly.



(h) Remove the starter housing and clutch assembly from the brass bar.
(i) Using a plastic–faced hammer, tap the clutch shaft and install the stop collar onto the snap ring.

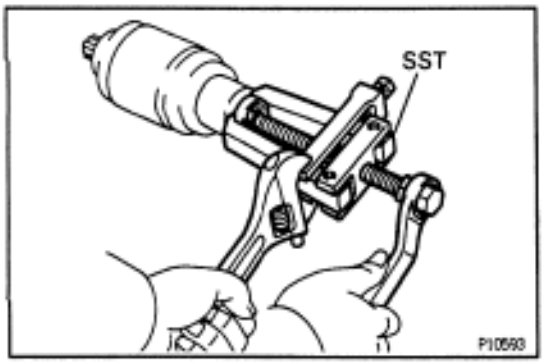


Bearings

1. INSPECT REAR BEARINGS

Turn each bearing by hand while applying inward force.

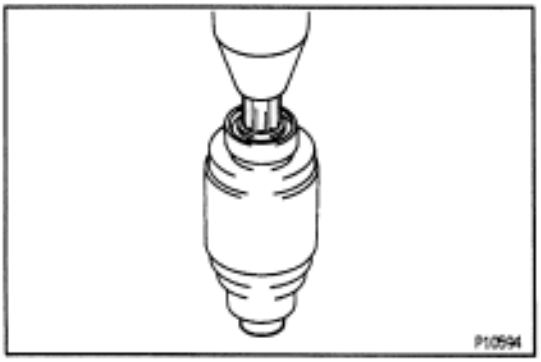
If resistance is felt or the bearing sticks, replace the bearing.



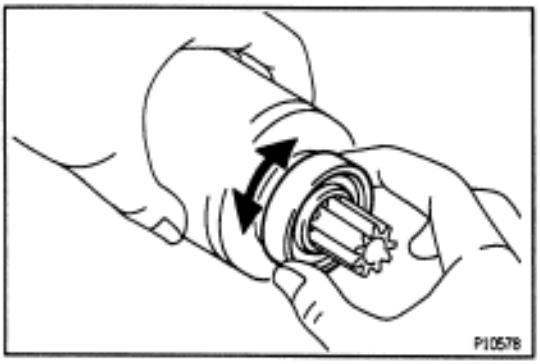
2. IF NECESSARY, REPLACE REAR BEARING

(a) Using SST, remove the bearing.

SST 09286–46011



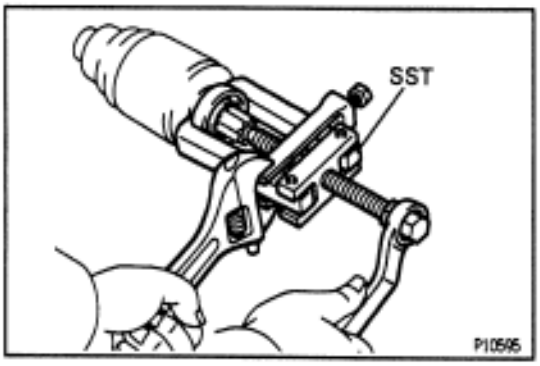
(b) Using a press, press in a new front bearing.



3. INSPECT FRONT BEARING

Turn each bearing by hand while applying inward force.

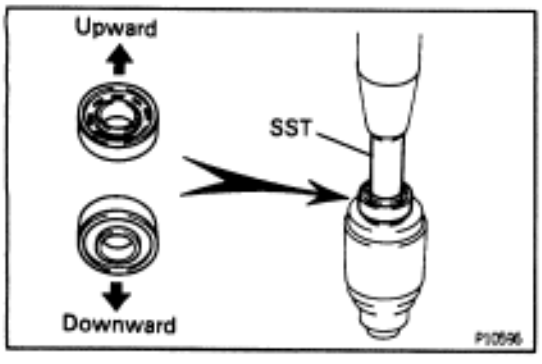
If resistance is felt or the bearing sticks, replace the bearing.



4. IF NECESSARY, REPLACE FRONT BEARING

(a) Using SST, remove the bearing.

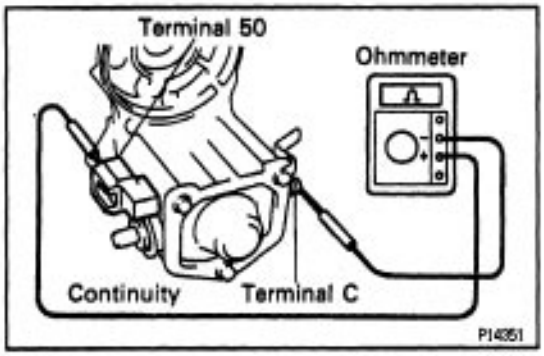
SST 09286 – 46011



(b) Using SST and a press, press in a new bearing.

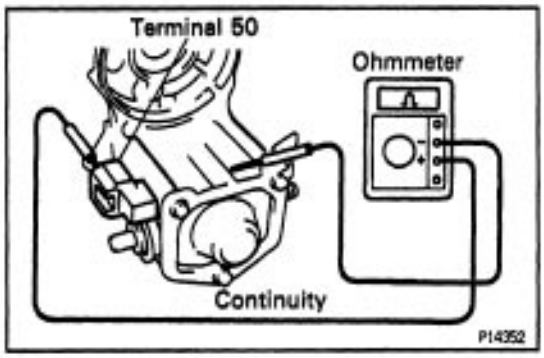
NOTICE: Be careful of the bearing Installation direction.

SST 09820–00030

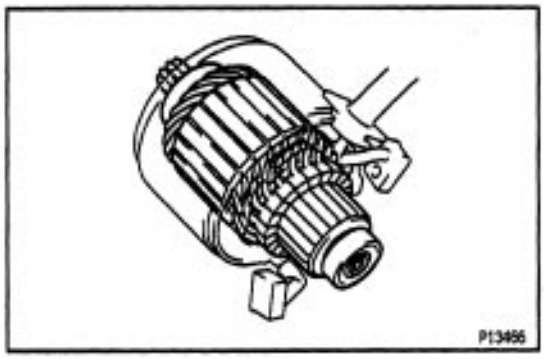


Magnetic Switch

1. PERFORM PULL–IN COIL OPEN CIRCUIT TEST
Using an ohmmeter, check that there is continuity between terminals 50 and C.
If there is no continuity, replace the magnetic switch.

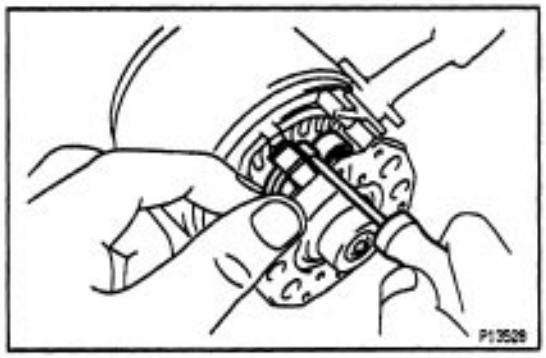


2. PERFORM HOLD–IN COIL OPEN CIRCUIT TEST
Using an ohmmeter, check that there is continuity between terminal 50 and the switch body.
If there is no continuity, replace the magnetic switch.

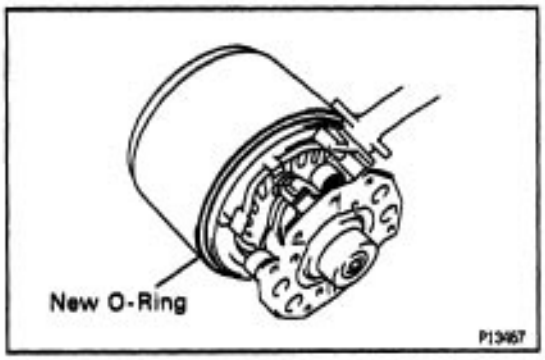


STARTER ASSEMBLY

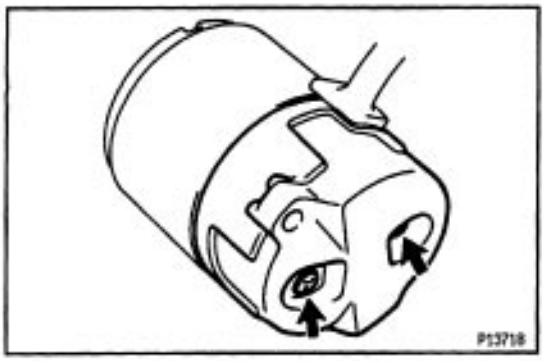
(See Components for Disassembly and Assembly)
HINT: Use high–temperature grease to lubricate the bearings and gears when assembling the starter.
1. PLACE ARMATURE INTO FIELD FRAME
Apply grease to the armature bearings, and insert the armature into the field frame.



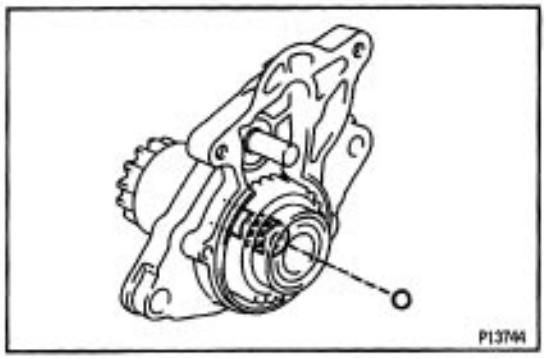
2. INSTALL BRUSH HOLDER
(a) Place the brush holder in position on the armature.
(b) Using a screwdriver, hold the brush spring back, and connect the brush into the brush holder. Connect the 4 brushes.
NOTICE: Check that the positive (+) lead wires are not grounded.



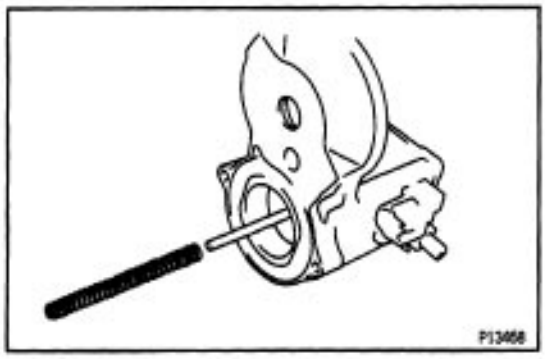
(c) Place a new O–ring in position on the field frame.



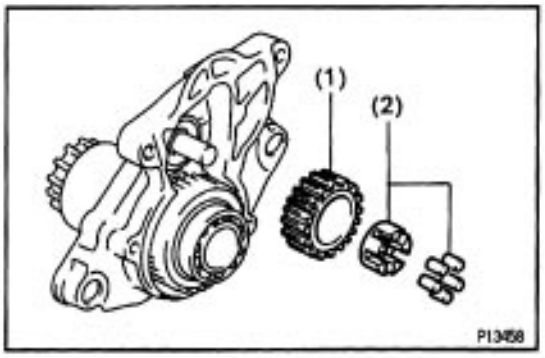
(d) Install a new O–ring to the screw.
(e) Install the end cover to the field frame with the 2 screws.
Torque: 1.5 N·m (15 kgf·cm, 13 in.·lbf)



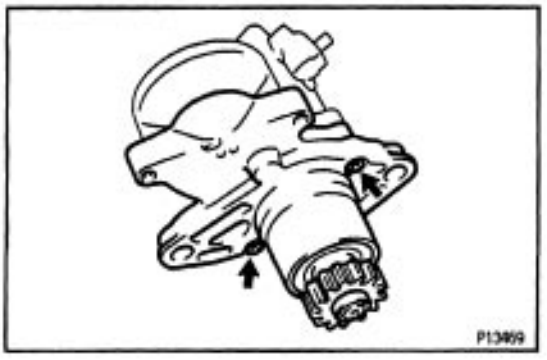
3. INSERT STEEL BALL INTO CLUTCH SHAFT HOLE
(a) Apply grease to the steel ball.
(b) Insert the steel ball into the clutch shaft hole.



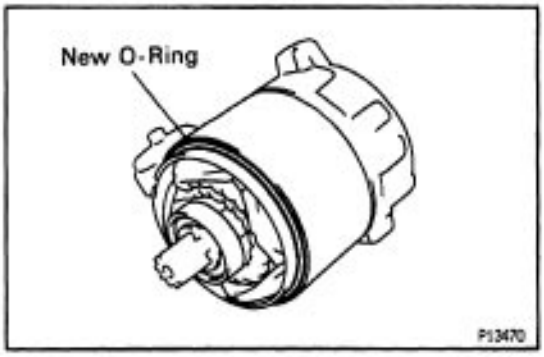
4. INSTALL STARTER HOUSING, CLUTCH ASSEM–
BLY AND GEAR
(a) Apply grease to the return spring.
(b) Insert the return spring into the magnetic switch hole.



(c) Place the following parts in position on the starter housing:
(1) Idler gear
(2) Retainer

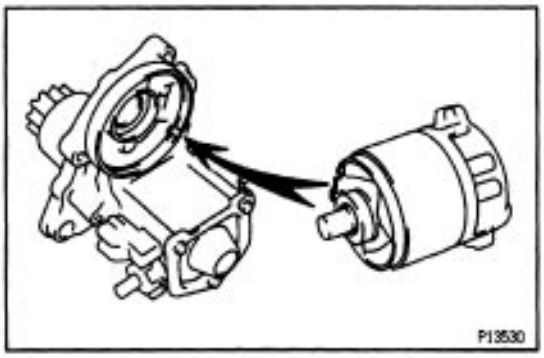


(d) Install the starter housing to the magnetic switch with the 2 screws.
Torque: 5.9 N·m (60 kgf·cm. 62 in.·lbf)

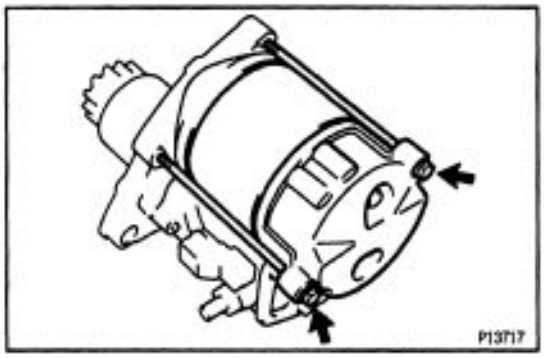


5. INSTALL FIELD FRAME AND ARMATURE ASSEMBLY

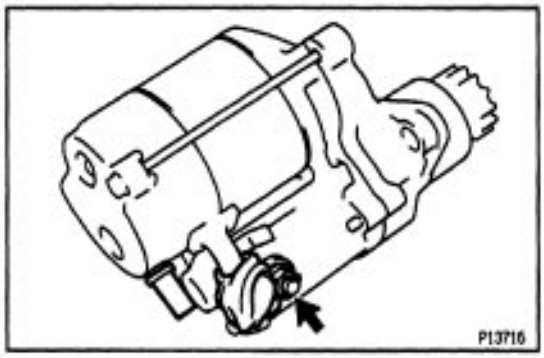
(a) Place a new O–ring in position on the field frame.



(b) Align the protrusion of the field frame with the cutout of the magnetic switch.

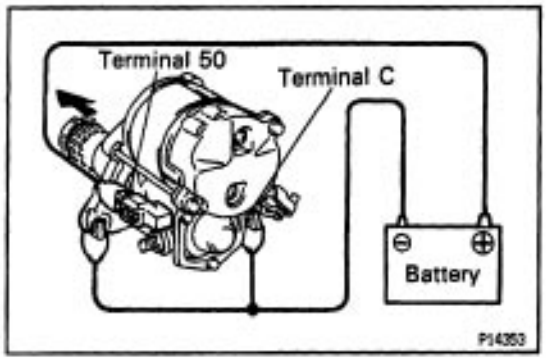


(c) Install the field frame and armature assembly with the 2 through bolts.
Torque: 6.9 N·m (60 kgf·cm, 52 in.·lbf)



(d) Connect the lead wire to terminal C, and install the nut.
Torque: 7.9 N·m (81 kgf·cm, 70 In.·lbf)

6. INSTALL DUST PROTECTOR



STARTER PERFORMANCE TEST

NOTICE: These tests must be performed within 3 to 5 seconds to avoid burning out the coil.

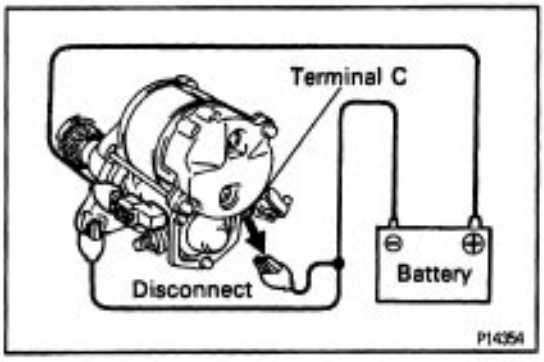
1. PERFORM PULL–IN TEST

(a) Disconnect the field coil lead wire from terminal C.

(b) Connect the battery to the magnetic switch as shown.

Check that the clutch pinion gear moves outward.

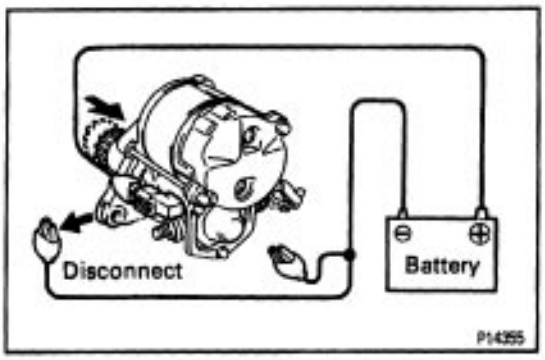
If the clutch pinion gear does not move, replace the magnetic switch assembly.



2. PERFORM HOLD–IN TEST

With battery connected as above with the clutch pinion gear out, disconnect the negative (–) lead from terminal C. Check that the pinion gear remains out.

If the clutch pinion gear returns inward, replace the magnetic switch assembly.

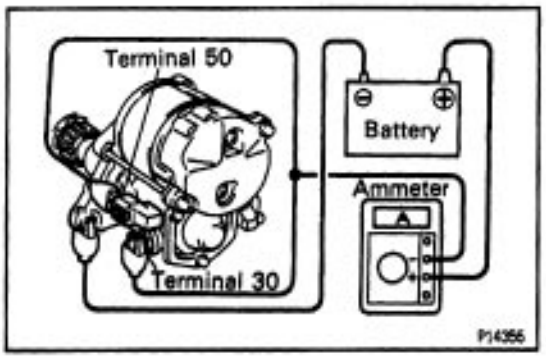


3. INSPECT CLUTCH PINION GEAR RETURN

Disconnect the negative (–) lead from the switch body.

Check that the clutch pinion gear returns inward.

If the clutch pinion gear does not return, replace the magnetic switch assembly.



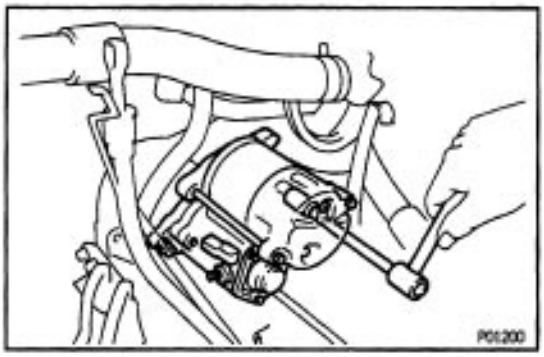
4. PERFORM NO–LOAD PERFORMANCE TEST

(a) Connect the battery and ammeter to the starter as shown.

(b) Check that the starter rotates smoothly and steadily with the pinion gear moving out. Check that the am–meter shows the specified current.

Specified current:

90 A or less at11.6V



STARTER INSTALLATION

(See Components for Removal and Installation)

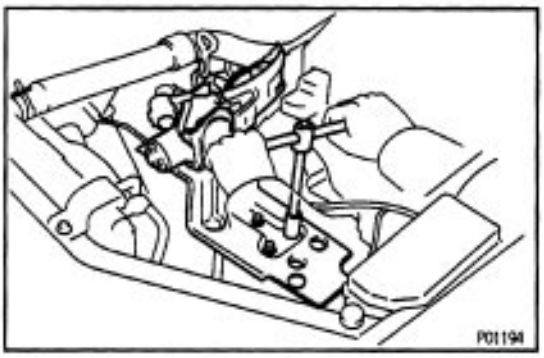
1. INSTALL STARTER

(a) Install the starter with the 2 bolts.

Torque: 39 N·m (400 kgf·cm, 29 ft·lbf)

(b) Connect the starter wire with the nut.

(c) Connect the starter connector.



2. w/ CRUISE CONTROL SYSTEM:
INSTALL CRUISE CONTROL ACTUATOR

(a) Install the cruise control actuator with the 3 bolts.

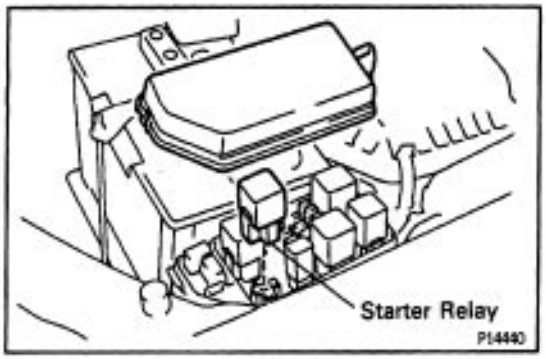
(b) Connect the actuator connector.

(c) Install the actuator cover.

3. w/ CRUISE CONTROL SYSTEM:
INSTALL BATTERY

4. CONNECT NEGATIVE (–) TERMINAL CABLE TO BATTERY

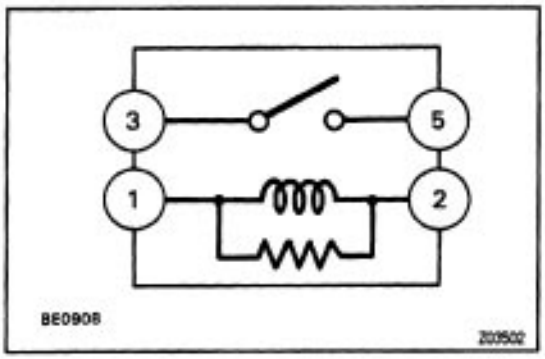
6. CHECK THAT ENGINE STARTS



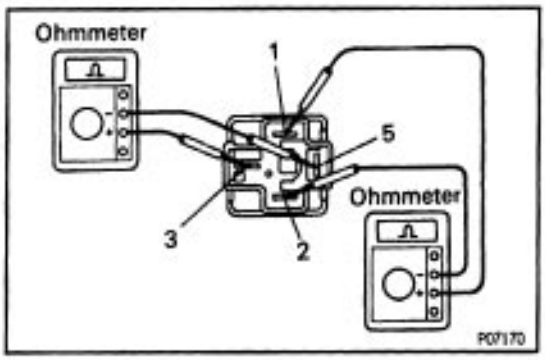
STARTER RELAY

STARTER RELAY INSPECTION

1. REMOVE STARTER RELAY



2. INSPECT STARTER RELAY

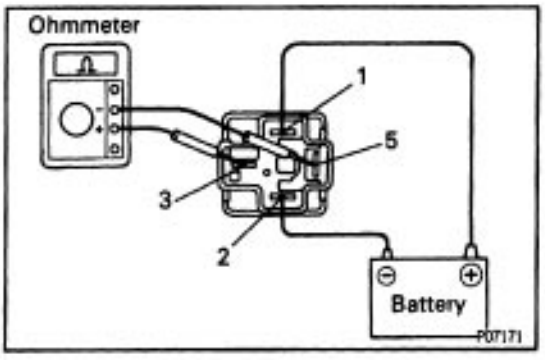


A. Inspect relay continuity

(a) Using an ohmmeter, check that there is continuity between terminals 1 and 2.

(b) Check that there is no continuity between terminals 3 and 5.

If continuity is not as specified, replace the relay.



B. Inspect relay operation

(a) Apply battery voltage across terminals 1 and 2.

(b) Using an ohmmeter, check that there is continuity between terminals 3 and 5.

If operation is not as specified, replace the relay.

3. REINSTALL STARTERT RELAY

CLUTCH START SWITCH (M/T)

(See page CL–7)

PARK/NEUTRAL POSITION (PNP) SWITCH (A/T)

(See page AX–92)

SERVICE SPECIFICATIONS

SERVICE DATA

Starter	Rated voltage and output power		12 V 1.4 kW
	No–load characteristics	Current	90 A or less at 11.5 V
		rpm	3,000 rpm or more
	Brush length	STD	15.5 mm (0.610 in.)
		Limit	8.5 mm (0.335 in.)
	Spring installed load		18 – 24 N (1.79 – 2.41 kgf, 3.9 – 5.3 lbf)
	Commutator Diameter		
		STD	30 mm (1.18 in.)
		Limit	29 mm (1.14 in.)
	Undercut depth	STD	0.6 mm (0.024 in.)
		Limit	0.2 mm (0.008 in.)
	Circle runout	Limit	0.05 mm (0.0020 in.)

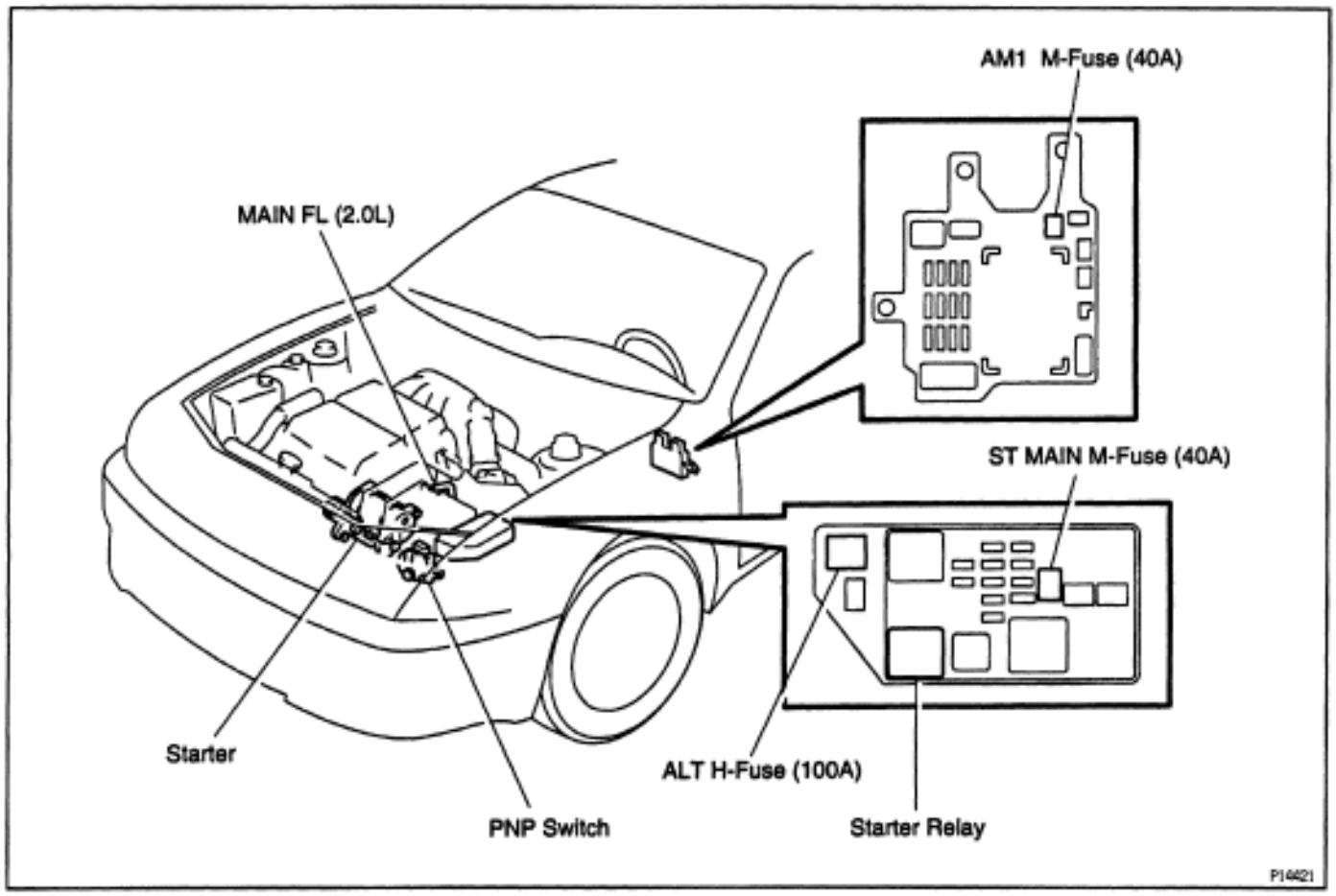
TORQUE SPECIFICATIONS

Pert tightened	N·m	kgf-cm	ft-lbf
End cover x Brush holder	1.5	15	13 in.-lbf
Starter housing x Magnetic switch	5.9	60	52 in.-lbf
End cover x Starter housing (Through bolt)	5.9	60	52 in.-lbf
Lead wire x Terminal C of starter	7.9	81	70 in.-lbf
Starter x Transaxle	39	400	29

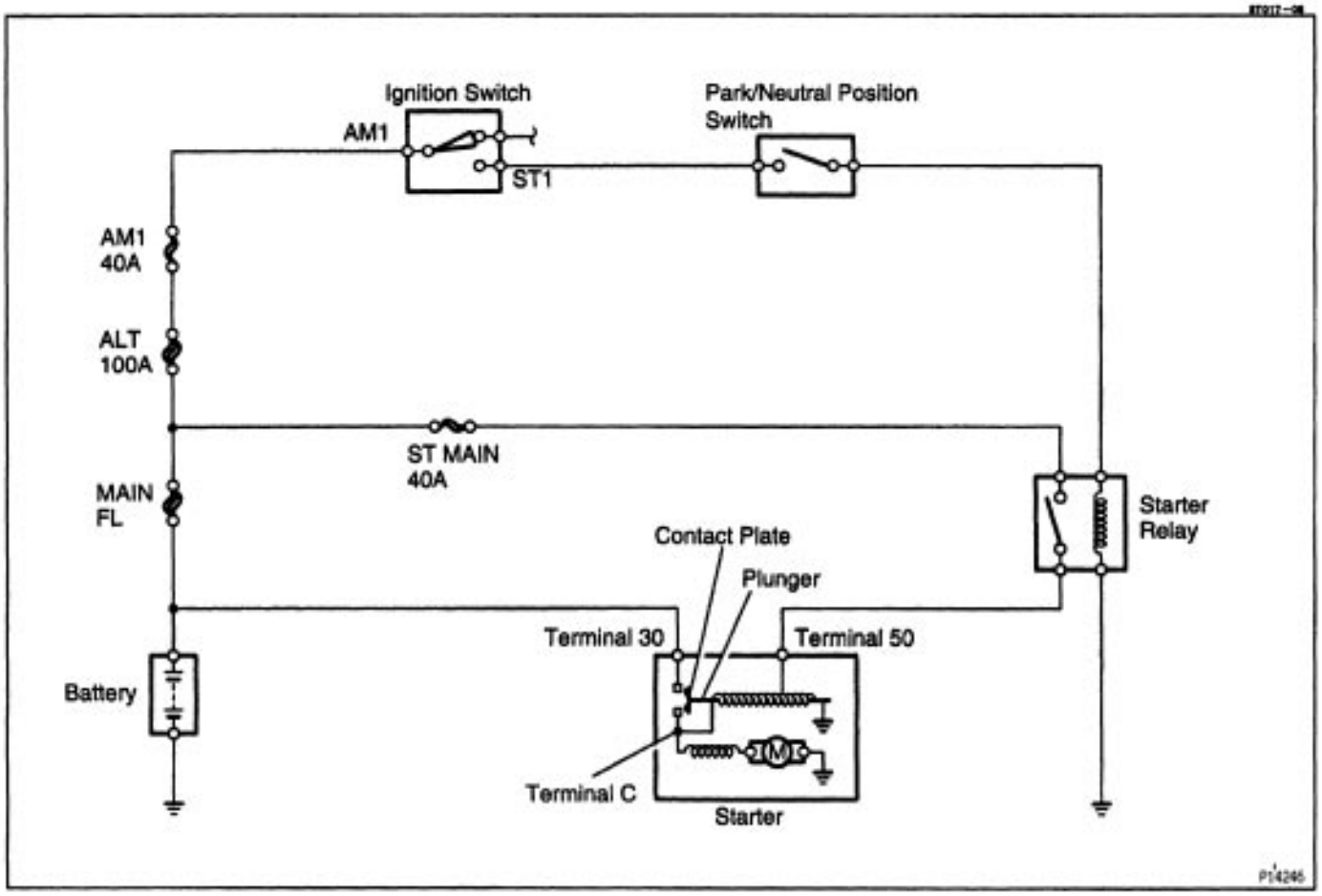
(1 MZ–FE)

DESCRIPTION

The starter is a reduction type with a small, high–speed motor used to drive the pinion gear.



SYSTEM CIRCUIT



OPERATION

When the ignition switch is turned to START position, current flows from terminal 50 to the coil of the solenoid and the plunger is pulled by the magnetic force of the coil. When the plunger is pulled to the left, the contact plate of the plunger allows current from the battery to flow directly from terminal 30 to the motor, and the starter rotates.

When the engine is running and the ignition switch is returned to ON, the magnetic force of the coil disappears and the contact plate of the plunger is returned to its original position by the return spring. Battery voltage no longer flows from terminal 30, so the motor stops.

PREPARATION

SST (SPECIAL SERVICE TOOLS)

	09286–46011 Injection Pump Spline Shaft Puller	Armature bearing
	09820–00030 Alternator Rear Bearing Replacer	Armature front bearing

RECOMMENDED TOOLS

	09082–00050 TOYOTA Electrical Tester set	

EQUIPMENT

Dial indicator	Commutator
Magnetic finger	Steel bell
Pull scale	Brush spring
Sandpaper	Commutator
Torque wrench	
V–block	Commutator
Vernier calipers	Commutator, Brush

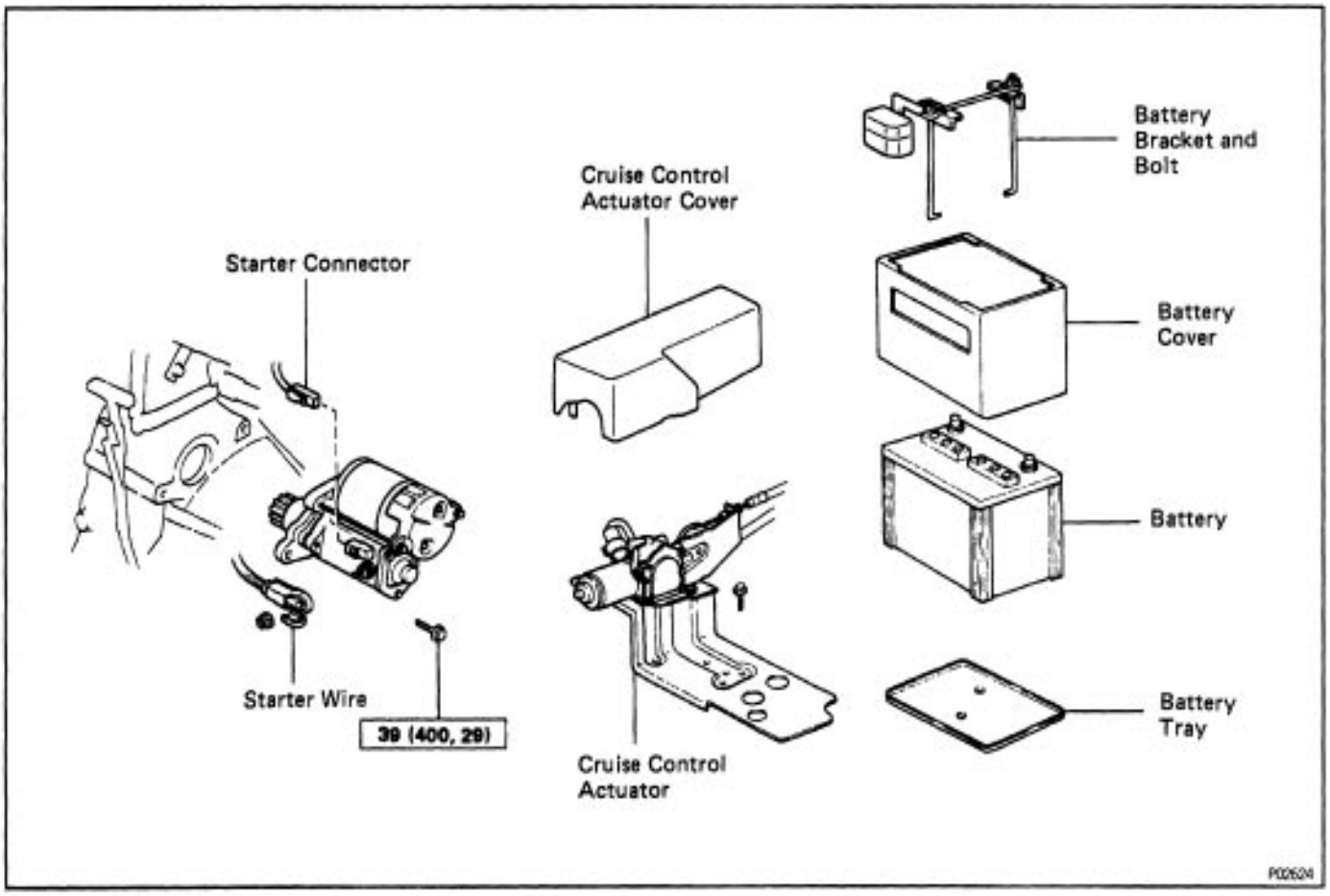
ON –VEHICLE INSPECTION

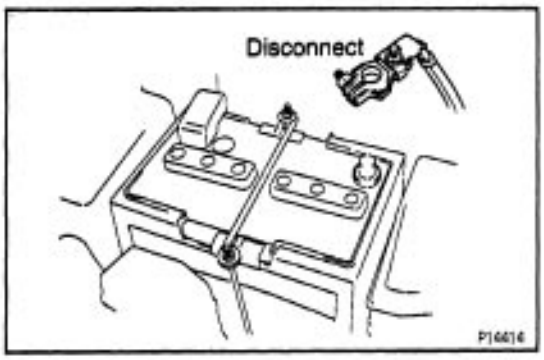
NOTICE: Before changing the starter, check the following items again:

- **Connector connection**
- **Accessory installation, e.g.: theft deterrent system**

STARTER

COMPONENTS FOR REMOVAL AND INSTALLATION





STATER REMOVAL

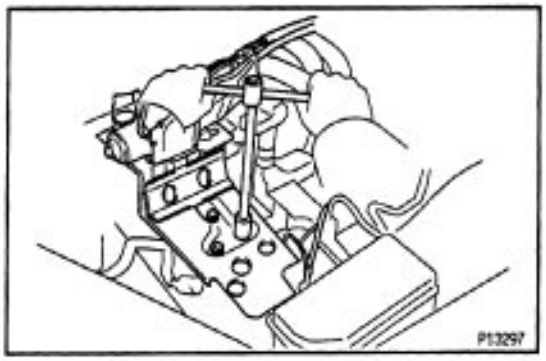
(See Components for Removal and installation)

1. DISCONNECT NEGATIVE (–) TERMINAL CABLE FROM BATTERY

CAUTION: Work must be started after 90 seconds from the time the ignition switch is turned to the ”LOCK” position and the negative (–) terminal cable is dis–connected from the battery.

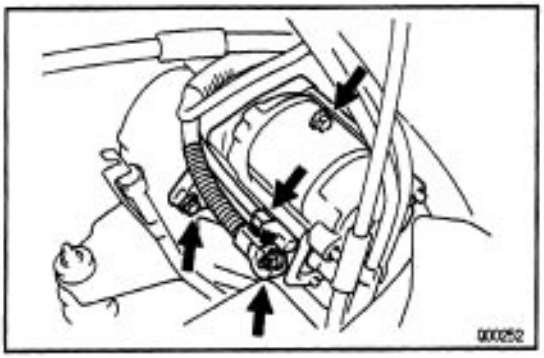
2. w/ CRUISE CONTROL SYSTEM:

REMOVE BATTERY AND TRAY



3. w/ CRUISE CONTROL SYSTEM:
REMOVE CRUISE CONTROL ACTUATOR

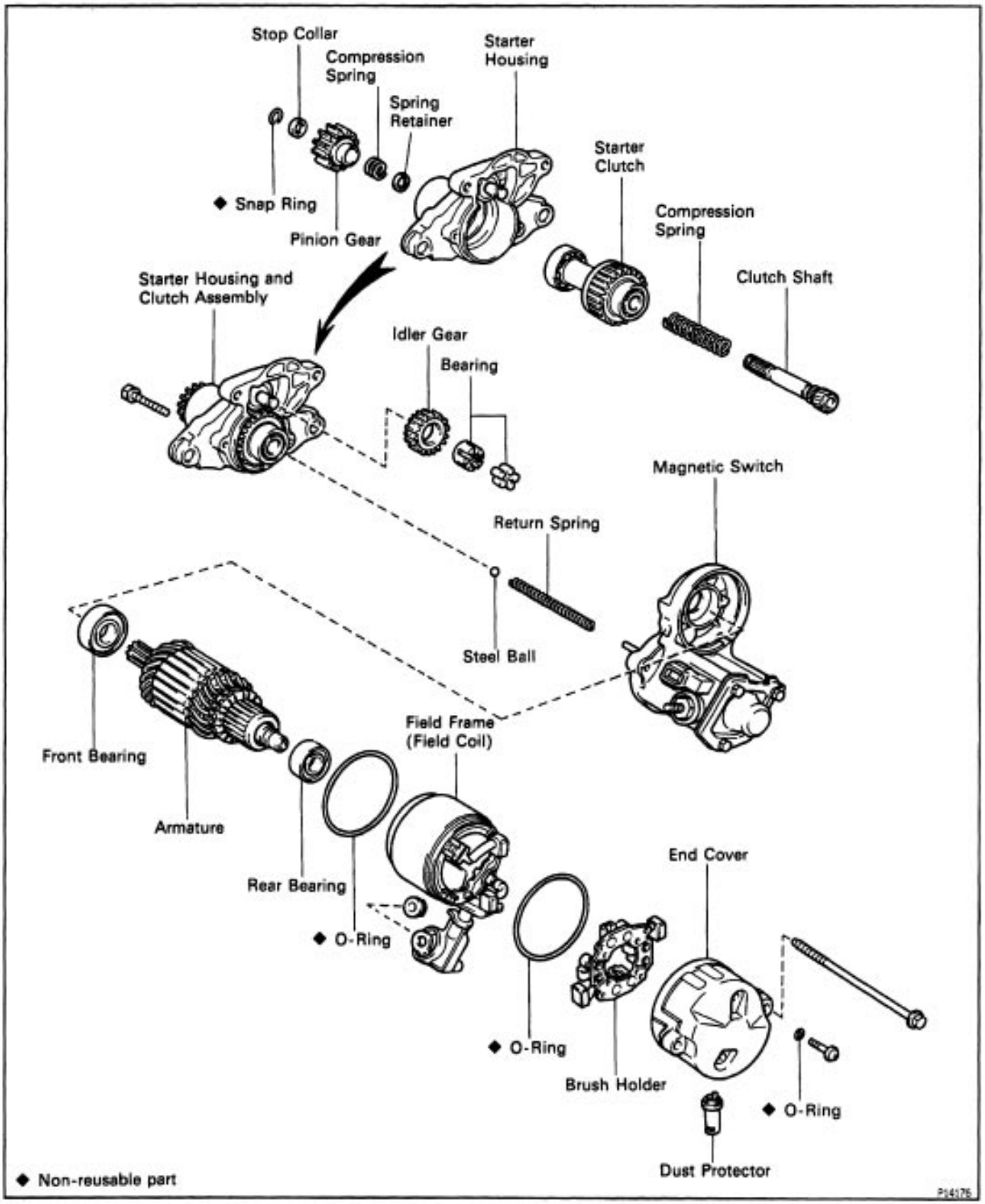
(a) Remove the bolt, clip and actuator cover.
(b) Disconnect the actuator connector and clamp.
(c) Remove the 3 bolts, and disconnect the actuator with the bracket.



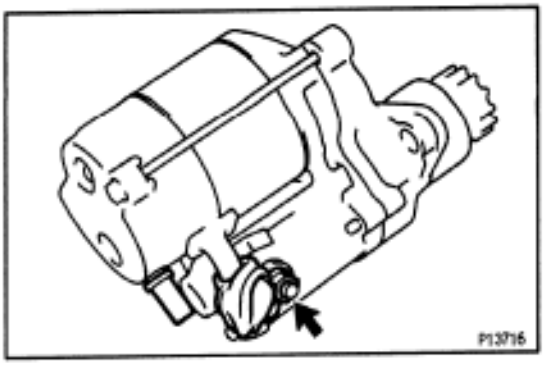
4. REMOVE STARTER

(a) Disconnect the starter connector.
(b) Remove the nut, and disconnect the starter wire.
(c) Remove the 2 bolts and starter.

COMPONENTS FOR DISASSEMBLY AND ASSEMBLY



STARTER DISASSEMBLY

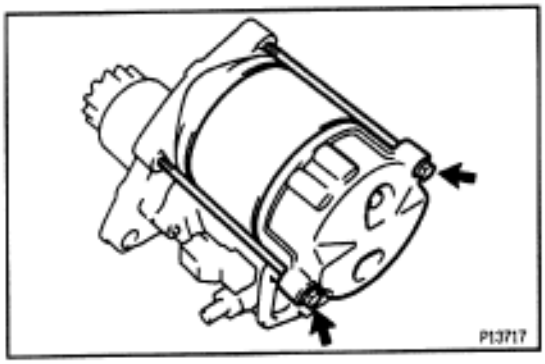


(See Components for Disassembly and Assembly)

1. REMOVE DUST PROTECTOR

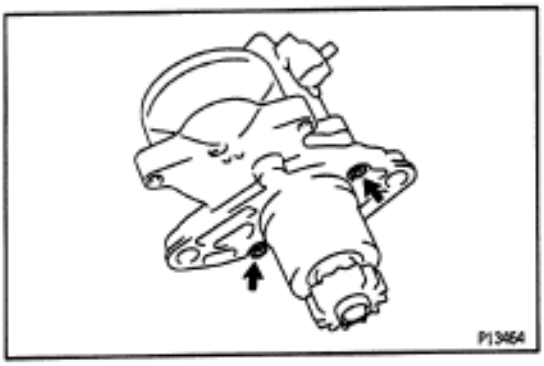
2. REMOVE FIELD FRAME AND ARMATURE

(a) Remove the nut, and disconnect the lead wire from the magnetic switch terminal.



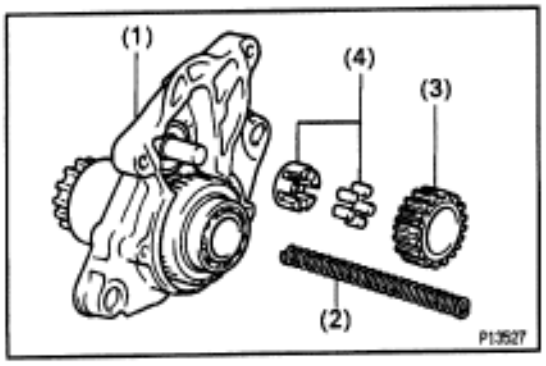
(b) Remove the 2 through bolts, and pull out the field frame together with the armature.

(c) Remove the O–ring from the field frame.



3. REMOVE STARTER HOUSING, CLUTCH ASSEMBLY AND GEAR

(a) Remove the 2 screws.



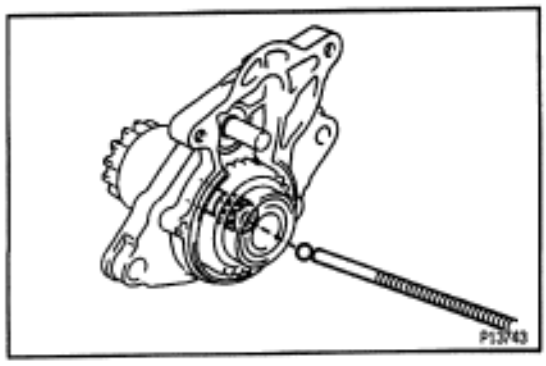
(b) Remove the following parts from the magnetic switch:

(1) Starter housing and clutch assembly

(2) Return spring

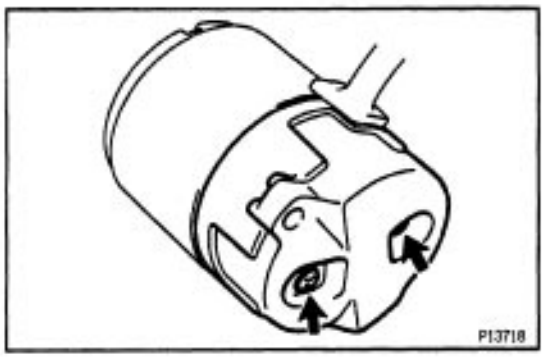
(3) Idler gear

(4) Bearing



4. REMOVE STEEL BALL

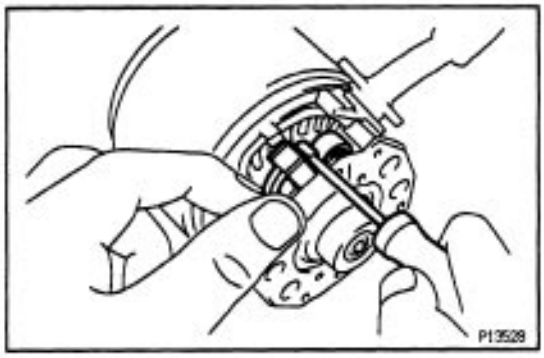
Using a magnetic finger, remove the steel ball from the clutch shaft hole.



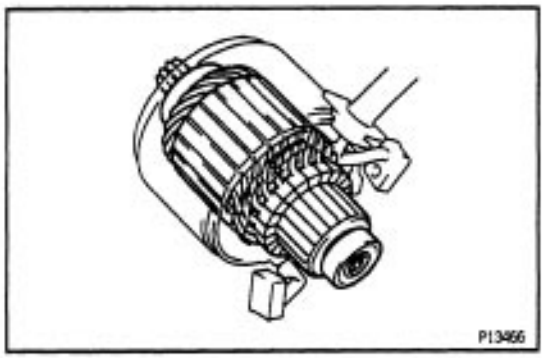
5. REMOVE BRUSH HOLDER

(a) Remove the 2 screws, 2 O–rings and end cover from the field frame.

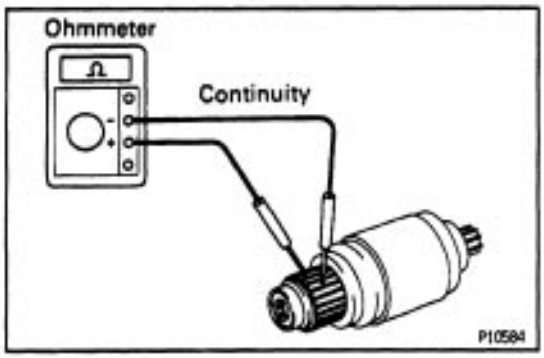
(b) Remove the O–ring from the field frame.



(c) Using a screwdriver, hold the spring back and disconnect the brush from the brush holder.
Disconnect the 4 brushes, and remove the brush holder.



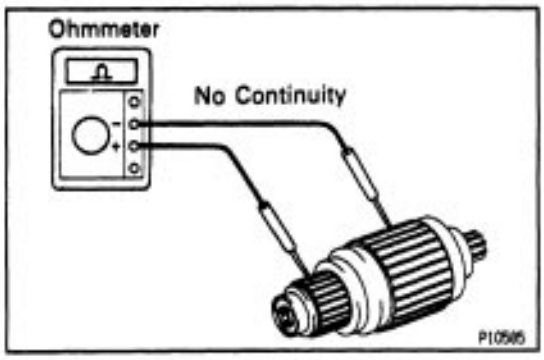
6. REMOVE ARMATURE FROM FIELD FRAME



STARTER INSPECTION AND REPAIR
Armature Coil

1. INSPECT COMMUTATOR FOR OPEN CIRCUIT

Using an ohmmeter, check that there is continuity between the segments of the commutator.
If there is no continuity between any segment, replace the armature.



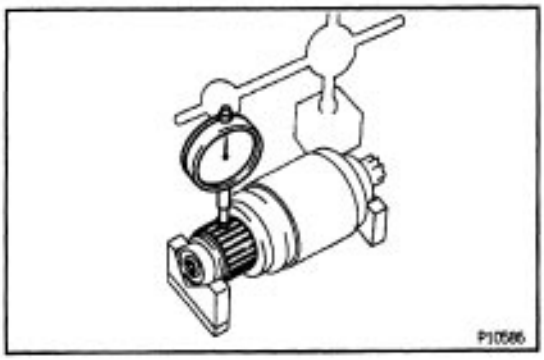
2. INSPECT COMMUTATOR FOR GROUND

Using an ohmmeter, check that there is no continuity between the commutator and armature coil core.
If there is continuity, replace the armature.

Commutator

1. INSPECT COMMUTATOR FOR DIRTY AND BURNT SURFACES

If the surface is dirty or burnt, correct it with sandpaper (No.400) or on a lathe.



2. INSPECT COMMUTATOR CIRCLE RUNOUT

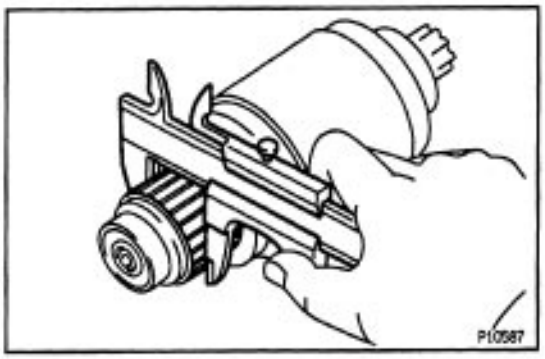
(a) Place the commutator on V – blocks.

(b) Using a dial gauge, measure the circle runout.

Maximum circle runout:

0.05 mm (0.0020 in.)

If the circle runout is greater than maximum, correct it on a lathe.



3. INSPECT COMMUTATOR DIAMETER

Using a vernier caliper, measure the commutator diameter.

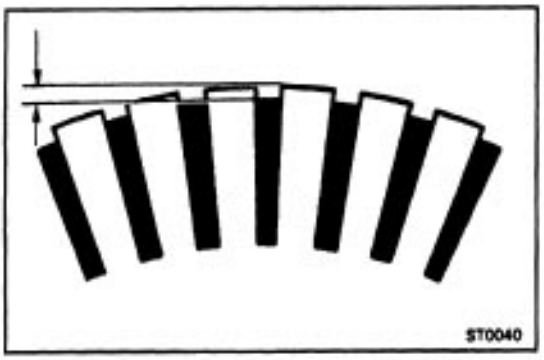
Standard diameter:

30.0 mm 0.181 In.)

Minimum diameter:

29.0 mm (1.142 In.)

If the diameter is less than minimum, replace the armature.



4. INSPECT UNDERCUT DEPTH

Check that the undercut depth is clean and free of foreign materials. Smooth out the edge.

Standard undercut depth:

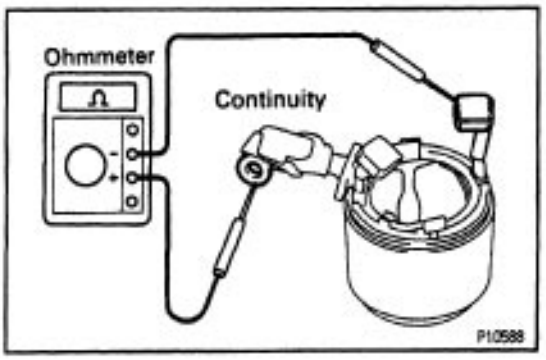
0.6 mm (0.024 In.)

Minimum undercut depth:

0.2 mm (0.008 In.)

If the undercut depth is less than minimum, correct it with a hacksaw blade.

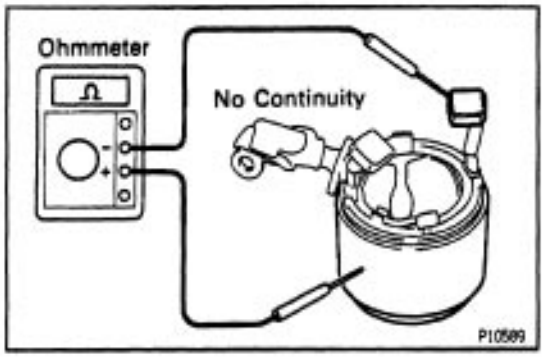
Field Frame (Field Coil)



1. INSPECT FIELD COIL FOR OPEN CIRCUIT

Using an ohmmeter, check that there is continuity between the lead wire and field coil brush lead.

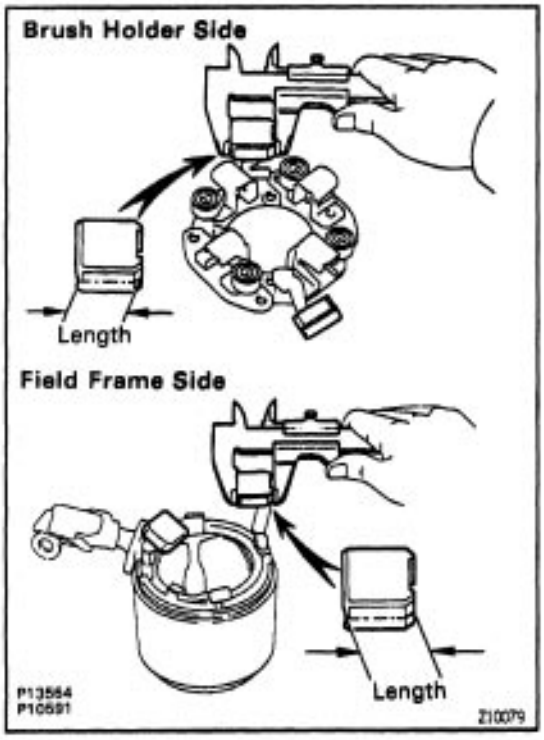
If there is no continuity, replace the field frame.



2. INSPECT FIELD COIL FOR GROUND

Using an ohmmeter, check that there is no continuity between the field coil end and field frame.

If there is continuity, repair or replace the field frame.



Brushes

INSPECT BRUSH LENGTH

Using a vernier caliper, measure the brush length.

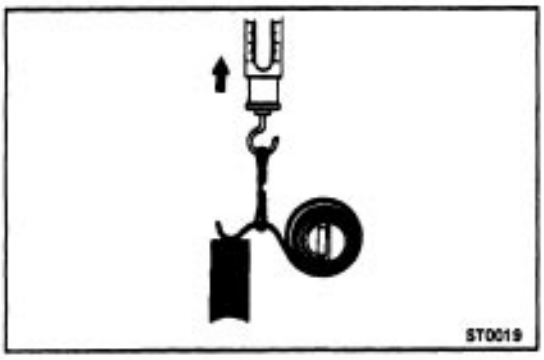
Standard length:

15.5 mm (O.610 In.)

Minimum length:

8.5 mm (0.335 In.)

If the length is less than minimum, replace the brush holder and field frame.



Brush Springs

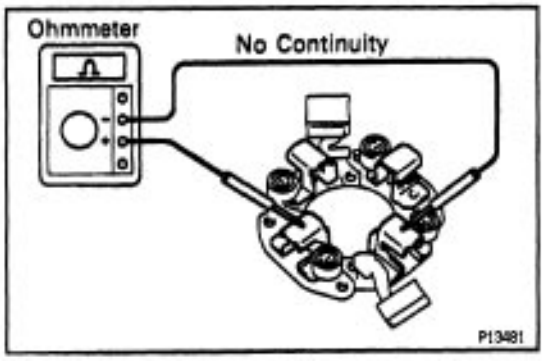
INSPECT BRUSH SPRING LOAD

Take the pull scale reading the instant the brush spring separates from the brush.

Spring installed load:

18 – 24 N (1.79 – 2.41 kgf. 3.9 – 5.3 lbf)

If the installed load is not within specification, replace the brush springs.



Brush Holder

INSPECT BRUSH HOLDER INSULATION

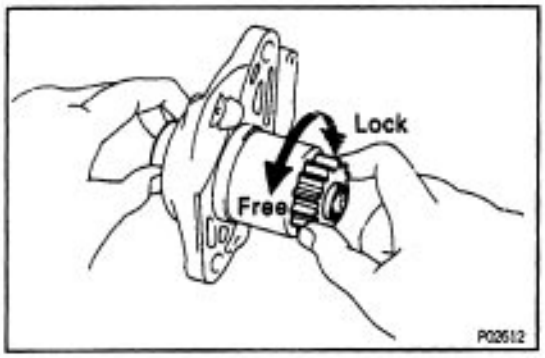
Using an ohmmeter, check that there is no continuity between the positive (+) and negative (–) brush hol–ders.

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

Clutch and Gears

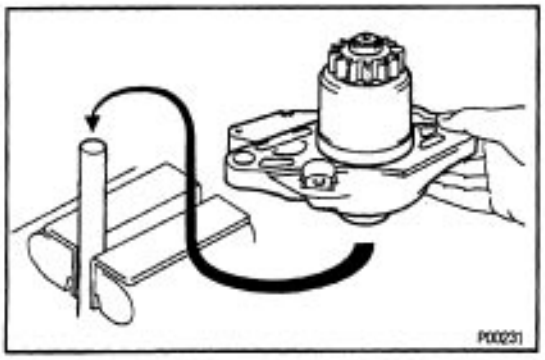
1. INSPECT GEAR TEETH

Check the gear teeth on the pinion gear, idler gear and clutch assembly for wear or damage.
If damaged, replace the gear or clutch assembly.
If damaged, also check the drive plate ring gear for wear or damage.



2. INSPECT CLUTCH PINION GEAR

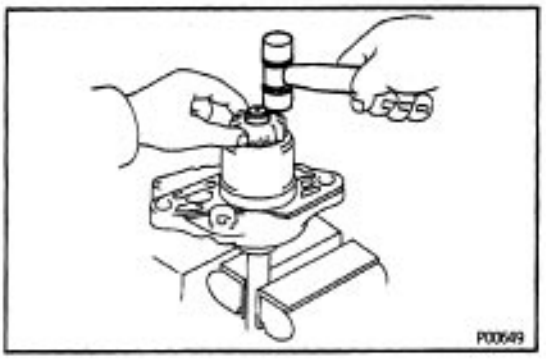
Hold the starter clutch and rotate the pinion gear counterclockwise, and check that it turns freely. Try to rotate the pinion gear clockwise and check that it locks.
If necessary, replace the clutch assembly.



3. IF NECESSARY, REPLACE CLUTCH ASSEMBLY

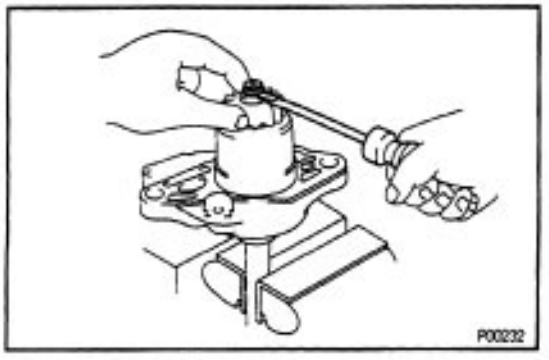
A. Disassembly of starter housing and clutch assembly

(a) Mount a brass bar in a vise, and install the starter housing and clutch assembly to the brass bar.

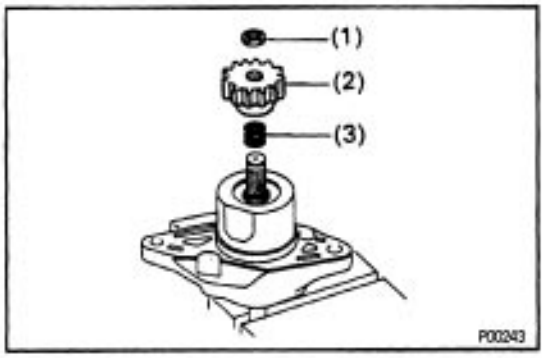


(b) Push down the pinion gear.

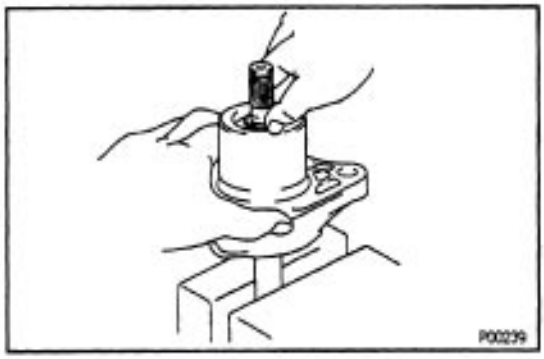
(c) Using a plastic–faced hammer, tap down the stop collar.



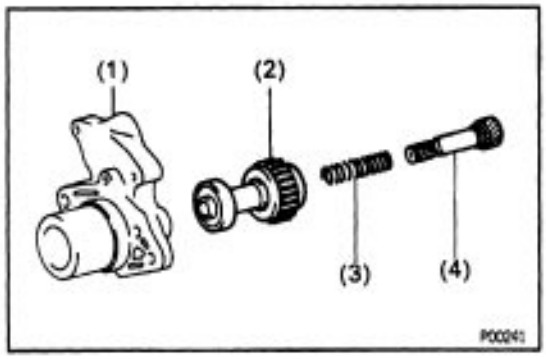
(d) Using a screwdriver, pry out the snap ring.



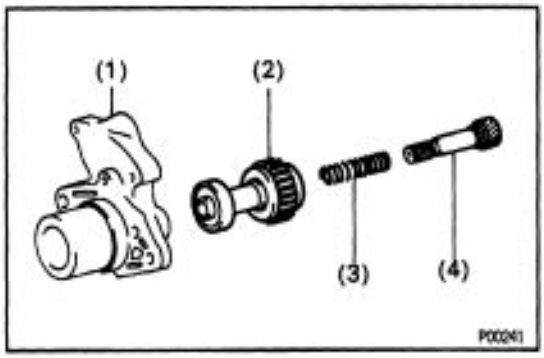
(e) Remove the following parts:
(1) Stop collar
(2) Pinion gear
(3) Compression spring



(f) Push down the starter housing, and remove the spring retainer.

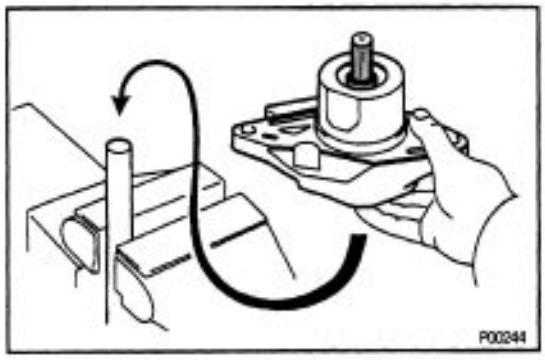


(g) Disassemble the following parts:
(1) Starter housing
(2) Starter clutch
(3) Compression spring
(4) Clutch shaft

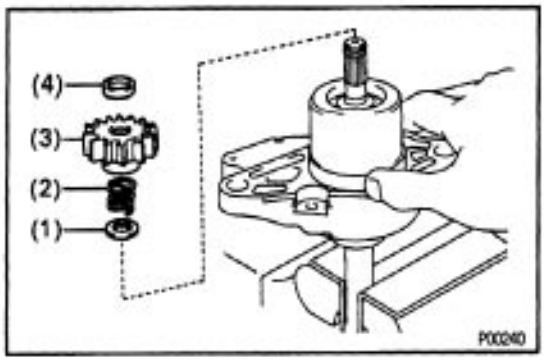


B. Assemble starter housing and clutch assembly

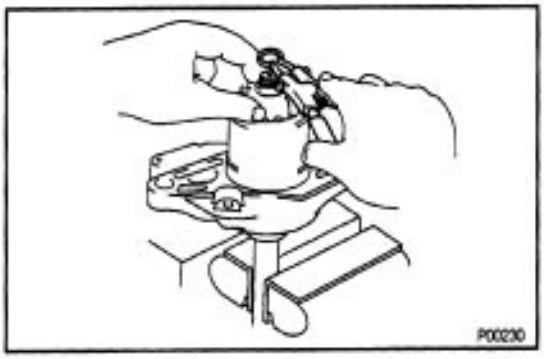
(a) Assemble the following parts:
(1) Starter housing
(2) Starter clutch
(3) Compression spring
(4) Clutch shaft



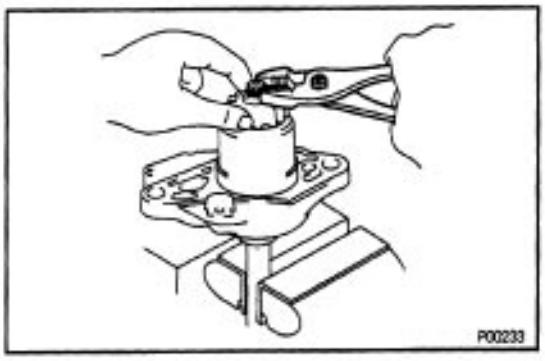
(b) Mount a brass bar in a vise, install the starter housing and clutch assembly to the brass bar.



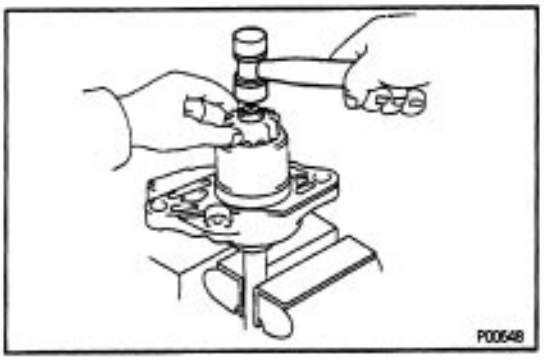
(c) Push down the starter housing, and install the following parts:
(1) Spring retainer
(2) Compression spring
(3) Pinion gear
(4) Stop collar



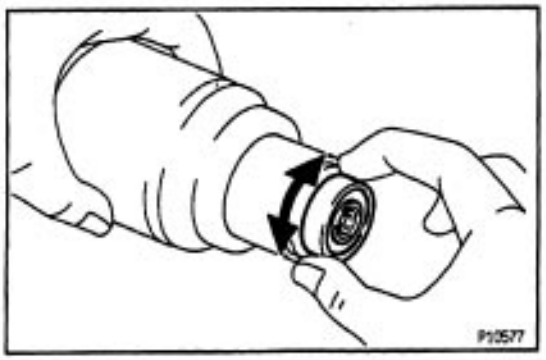
(d) Push down the pinion gear.
(e) Using snap ring pliers, install a new snap ring.



(f) Using pliers, compress the snap ring.
(g) Check that the snap ring fits correctly.



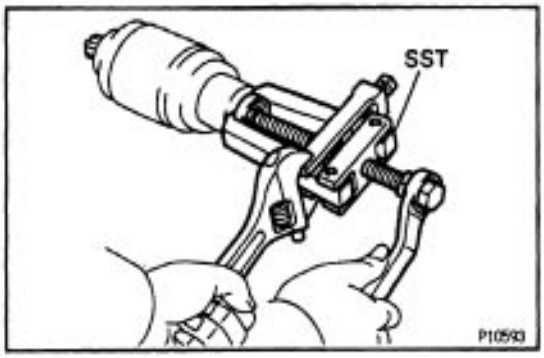
(h) Remove the starter housing and clutch assembly from the brass bar.
(i) Using a plastic–faced hammer, tap the clutch shaft and install the stop collar onto the snap ring.



Bearings

1. INSPECT REAR BEARINGS

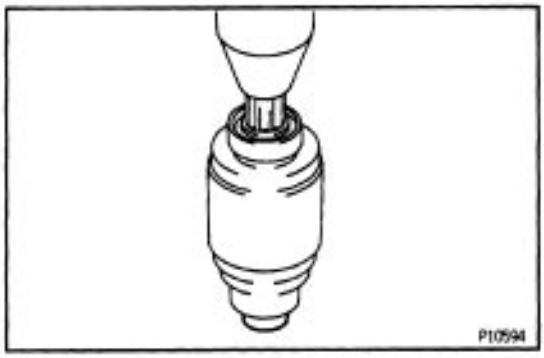
Turn each bearing by hand while applying inward force.
If resistance is felt or the bearing sticks, replace the bearing.



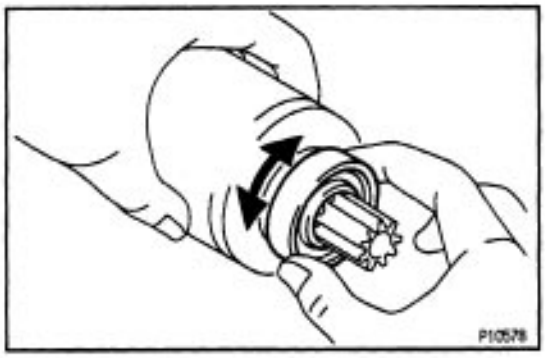
2. IF NECESSARY, REPLACE REAR BEARING

(a) Using SST, remove the bearing.

SST 09286–46011



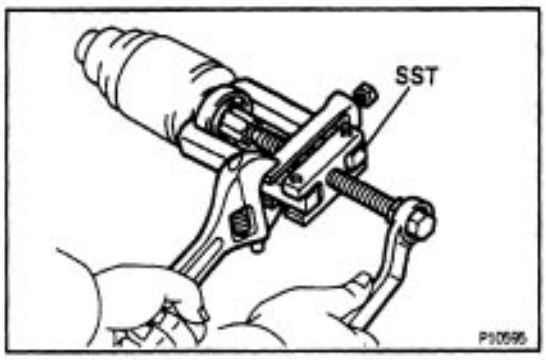
(b) Using a press, press in a new front bearing.



3. INSPECT FRONT BEARING

Turn each bearing by hand while applying inward force.

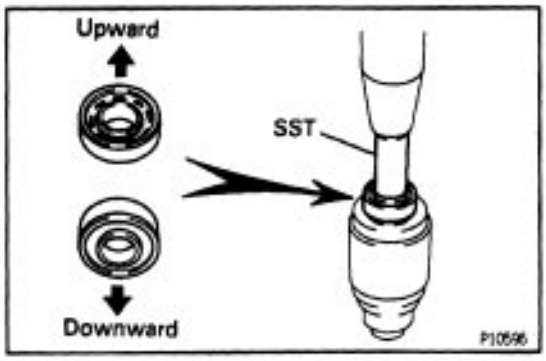
If resistance is felt or the bearing sticks, replace the bearing.



4. IF NECESSARY, REPLACE FRONT BEARING

(a) Using SST, remove the bearing.

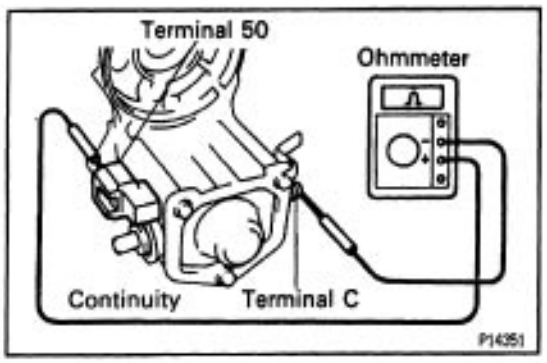
SST 09286–46011



(b) Using SST and a press, press in a new bearing.

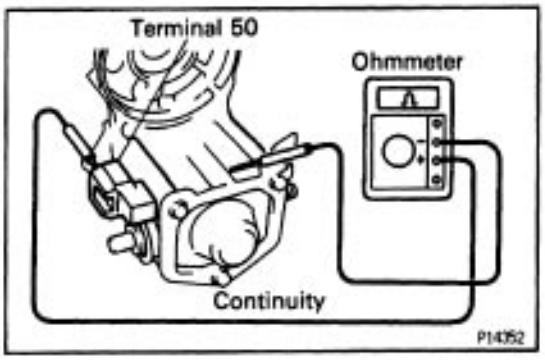
NOTICE: Be careful of the bearing Installation direction.

SST 09820–00030

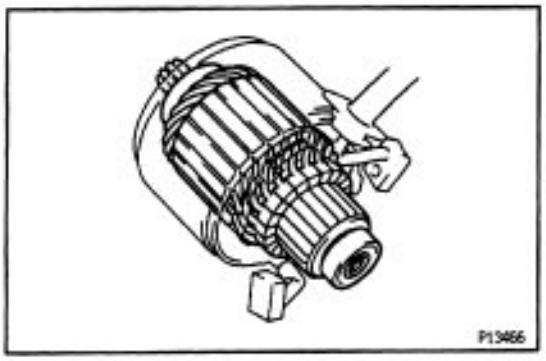


Magnetic Switch

1. PERFORM PULL–IN COIL OPEN CIRCUIT TEST
Using an ohmmeter, check that there is continuity between terminals 50 and C.
If there is no continuity, replace the magnetic switch.

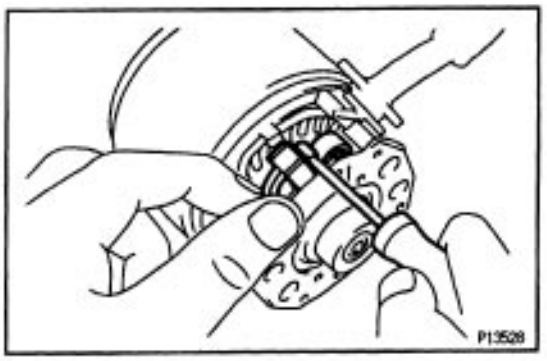


2. PERFORM HOLD –IN COIL OPEN CIRCUIT TEST
Using an ohmmeter, check that there is continuity between terminal 50 and the switch body.
If there is no continuity, replace the magnetic switch.

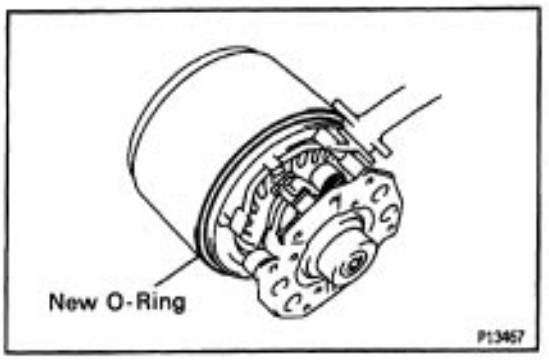


STARTER ASSEMBLY

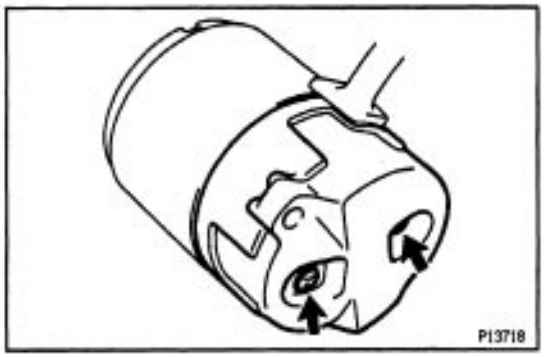
(See Components for Disassembly and Assembly)
HINT: Use high –temperature grease to lubricate the bearings and gears when assembling the starter.
1. PLACE ARMATURE INTO FIELD FRAME
Apply grease to the armature bearings, and insert the armature into the field frame.



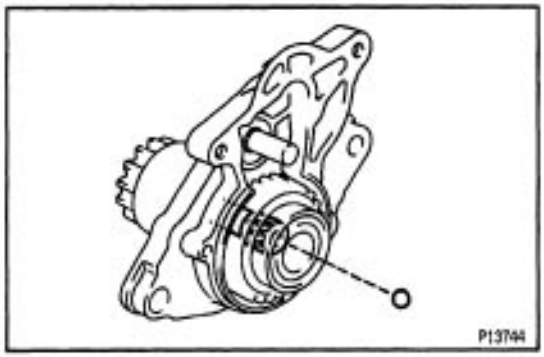
2. INSTALL BRUSH HOLDER
(a) Place the brush holder in position on the armature.
(b) Using a screwdriver, hold the brush spring back, and connect the brush into the brush holder. Connect the 4 brushes..
NOTICE: Check that the positive (+) load wires are not grounded.



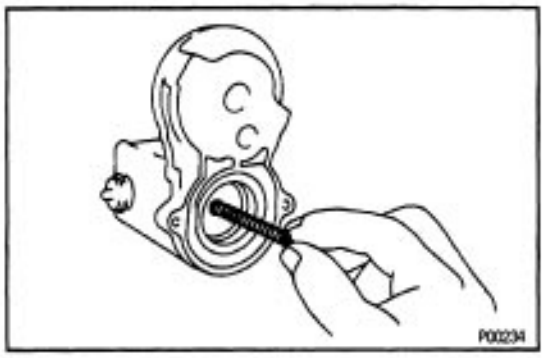
(c) Place a new O–ring in position on the field frame.



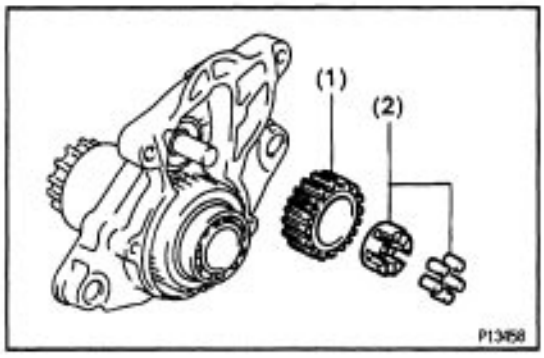
(d) Install a new 0 – ring to the screw.
(e) Install the end cover to the field frame with the 2 screws.
Torque: 1.5 N·m (15 kgf·cm, 13 in.·lbf)



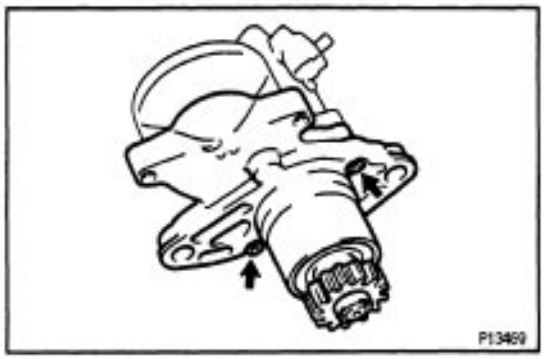
3. INSERT STEEL BALL INTO CLUTCH SHAFT HOLE
(a) Apply grease to the steel ball.
(b) Insert the steel ball into the clutch shaft hole.



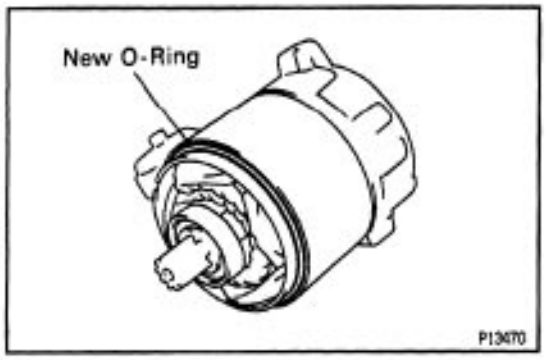
4. INSTALL STARTER HOUSING, CLUTCH ASSEM–BLY AND GEAR
(a) Apply grease to the return spring.
(b) Insert the return spring into the magnetic switch hole.



(c) Place the following parts in position on the starter housing:
(1) Idler gear
(2) Retainer



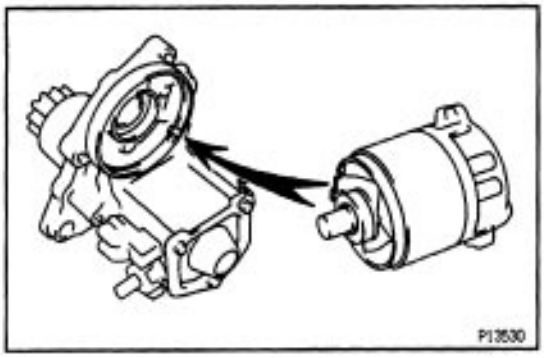
(d) Install the starter housing to the magnetic switch with the 2 screws.
Torque: 5.9 N·m (60 kgf·cm, 52 In.·lbf)



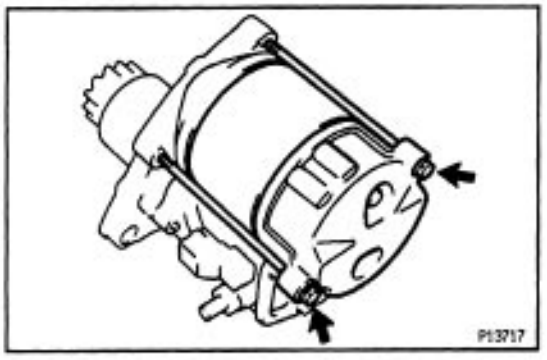
5. INSTALL FIELD FRAME AND ARMATURE

ASSEMBLY

(a) Place a new 0 – ring in position on the field frame.

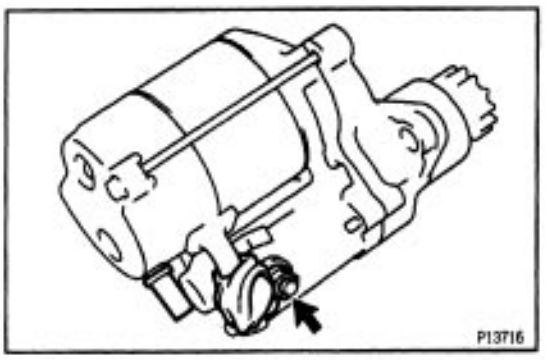


(b) Align the protrusion of the field frame with the cutout of the magnetic switch.



(c) Install the field frame and armature assembly with the 2 through bolts.

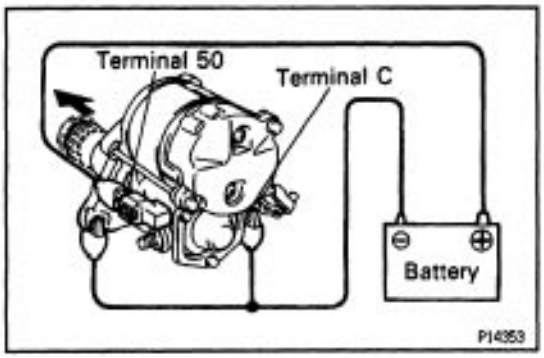
Torque: 5.9 N·m (60 kgf·cm. 52 in.·lbf)



(d) Connect the lead wire to terminal C, and install the nut.

Torque: 7.9 N·m (87 kgf·cm, 70 in.·lbf)

STARTER PERFORMANCE TEST

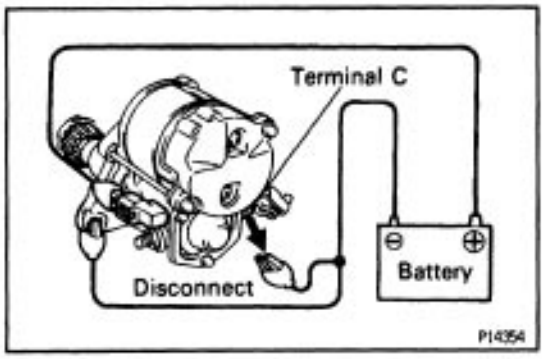


NOTICE: These tests must be performed within 3 to 5 seconds to avoid burning out the coil.

1. PERFORM PULL–IN TEST

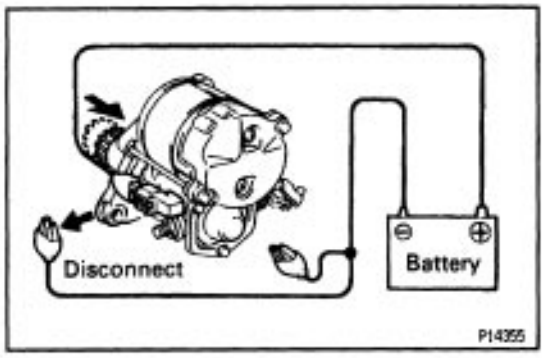
(a) Disconnect the field coil lead wire from terminal C.

(b) Connect the battery to the magnetic switch as shown.
Check that the clutch pinion gear moves outward.
If the clutch pinion gear does not move, replace the magnetic switch assembly.



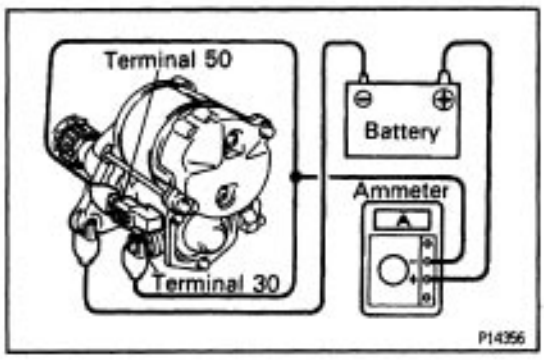
2. PERFORM HOLD–IN TEST

With battery connected as above with the clutch pinion gear out, disconnect the negative (–) lead from terminal C. Check that the pinion gear remains out.
If the clutch pinion gear returns inward, replace the magnetic switch assembly.



3. INSPECT CLUTCH PINION GEAR RETURN

Disconnect the negative (–) lead from the switch body.
Check that the clutch pinion gear returns inward.
If the clutch pinion gear does not return, replace the magnetic switch assembly.



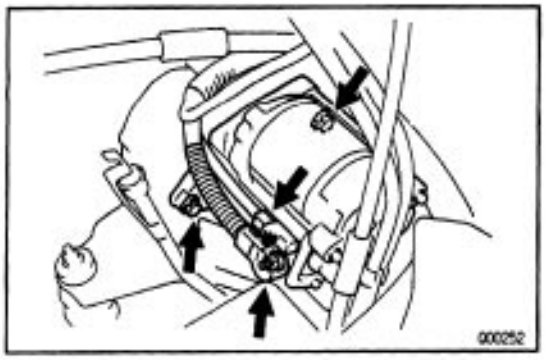
4. PERFORM NO –LOAD PERFORMANCE TEST

(a) Connect the battery and ammeter to the starter as shown.

(b) Check that the starter rotates smoothly and steadily with the pinion gear moving out. Check that the am–meter shows the specified current.

Specified current:

90 A or less at 11.5 V



STARTER INSTALLATION

(See Components for Remove and Installation)

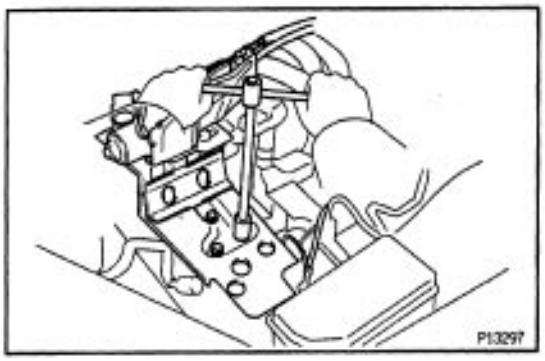
1. INSTALL STARTER

(a) Install the starter with the 2 bolts.

Torque: 39 N·m (400 kgf·cm. 29 ft·lbf)

(b) Connect the starter wire with the nut.

(c) Connect the starter connector.



2. w/ CRUISE CONTROL SYSTEM:
INSTALL CRUISE CONTROL ACTUATOR

(a) Connect the actuator and bracket with the 3 bolts.

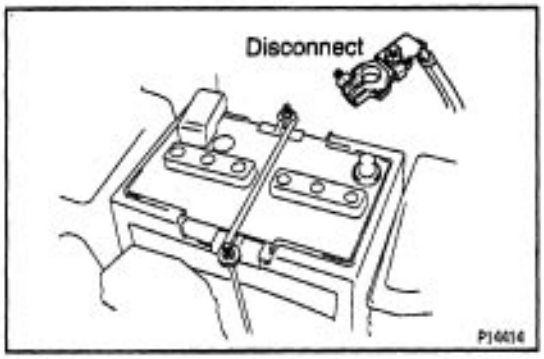
(b) Connect the actuator connector and clamp.

(c) Install the actuator cover with the bolt and clip.

3. w/ CRUISE CONTROL SYSTEM:
INSTALL BATTERY TRAY AND BATTERY

4. CONNECT NEGATIVE (–) TERMINAL CABLE TO BATTERY

5. CHECK THAT ENGINE STARTS

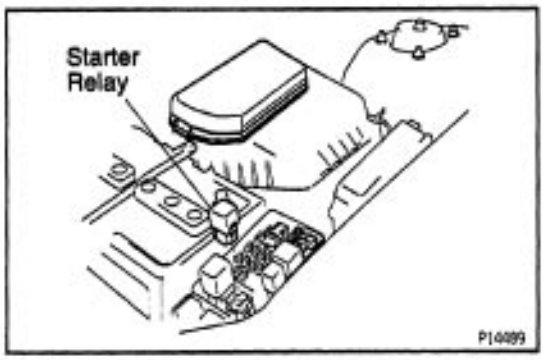


STARTER RELAY

STARTER RELAY INSPECTION

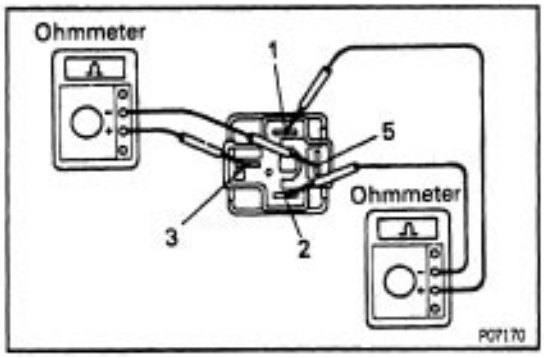
1. DISCONNECT NEGATIVE (–) TERMINAL CABLE FROM BATTERY

CAUTION: Work must be started after 90 seconds from the time the ignition switch Is turned to the 'LOCK' position and the negative (–) terminal cable is disconnected from the battery.



2. REMOVE STARTER RELAY

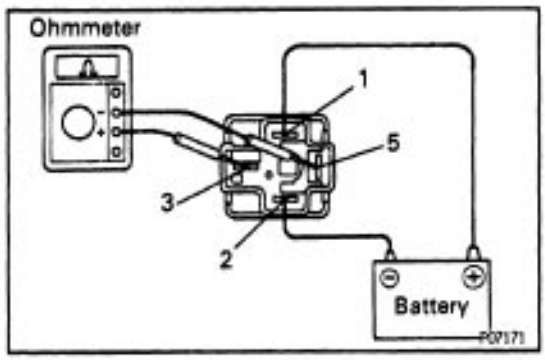
LOCATION: In the engine compartment relay box.
Remove the relay box cover and starter relay.



3. INSPECT STARTER RELAY

A. Inspect relay continuity

(a) Using an ohmmeter, check that there is continuity between terminals 1 and 2.
(b) Check that there is no continuity between terminals 3 and 5.
If continuity is not as specified, replace the relay.



B. Inspect relay operation

(a) Apply battery voltage across terminals 1 and 2.
(b) Using an ohmmeter, check that there is continuity between terminals 3 and 5.
If operation is not as specified, replace the relay.

4. REINSTALL STARTER RELAY

6. RECONNECT NEGATIVE (–) TERMINAL CABLE TO BATTERY

PARK NEUTRAL POSITION (PNP) SWITCH

(See page AX–116)

SERVICE SPECIFICATIONS

SERVICE DATA

Starter	Rated voltage and output power		12 V 1.4 kW
	No–load characteristics	Current	90 A or less at 11.5 V
		rpm	3,000 rpm or more
	Brush length	STD	15.5 mm (0.610 in.)
		Limit	8.5 mm (0.335 in.)
	Spring installed load		18 – 24 N (1.79 – 2.41 kgf, 3.9 – 5.3 lbf)
	Commutator Diameter		
		STD	30.0 mm (1.181 in.)
		Limit	29.0 mm (1.142 in.)
	Undercut depth	STD	0.6 mm (0.024 in.)
		Limit	0.2 mm (0.008 in.)
	Circle runout	Limit	0.05 mm (0.0020 in.)

TORQUE SPECIFICATIONS

Part tightened	N·m	kgf·cm	ft·lbf
End cover x Field frame	1.5	15	13 in.·lbf
Starter housing x Magnetic switch	5.9	60	52 in.·lbf
Field frame x Armature assembly	5.9	60	52 in.·lbf
Lead wire x Terminal C of starter	7.9	81	70 in.·lbf
Starter mounting bolt	39	400	29