

TROOPER

ENGINE

STARTING AND CHARGING SYSTEM

CONTENTS

Service Precaution	6D3-1	General Description	6D3-18
Starting System	6D3-2	General On-Vehicle Inspection	6D3-18
General Description	6D3-2	Generator	6D3-19
Diagnosis	6D3-4	Removal	6D3-19
Starter	6D3-5	Inspection	6D3-19
Removal	6D3-5	Installation	6D3-19
Installation	6D3-5	Disassembled View	6D3-20
Disassembled View	6D3-6	Disassembly	6D3-21
Disassembly	6D3-7	Inspection and Repair	6D3-23
Inspection and Repair	6D3-9	Reassembly	6D3-25
Reassembly	6D3-13	Bench Test	6D3-25
Main Data and Specifications	6D3-15	Main Data and Specifications	6D3-26
Charging System	6D3-18		

Service Precaution

WARNING: THIS VEHICLE HAS A SUPPLEMENTAL RESTRAINT SYSTEM (SRS). REFER TO THE SRS COMPONENT AND WIRING LOCATION VIEW IN ORDER TO DETERMINE WHETHER YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING. WHEN YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING, REFER TO THE SRS SERVICE INFORMATION. FAILURE TO FOLLOW WARNINGS COULD RESULT IN POSSIBLE AIR BAG DEPLOYMENT, PERSONAL INJURY, OR OTHERWISE UNNEEDED SRS SYSTEM REPAIRS.

CAUTION: Always use the correct fastener in the proper location. When you replace a fastener, use **ONLY** the exact part number for that application. ISUZU will call out those fasteners that require a replacement after removal. ISUZU will also call out the fasteners that require thread lockers or thread sealant. **UNLESS OTHERWISE SPECIFIED**, do not use supplemental coatings (Paints, greases, or other corrosion inhibitors) on threaded fasteners or fastener joint interfaces. Generally, such coatings adversely affect the fastener torque and the joint clamping force, and may damage the fastener. When you install fasteners, use the correct tightening sequence and specifications. Following these instructions can help you avoid damage to parts and systems.

Starting System

General Description

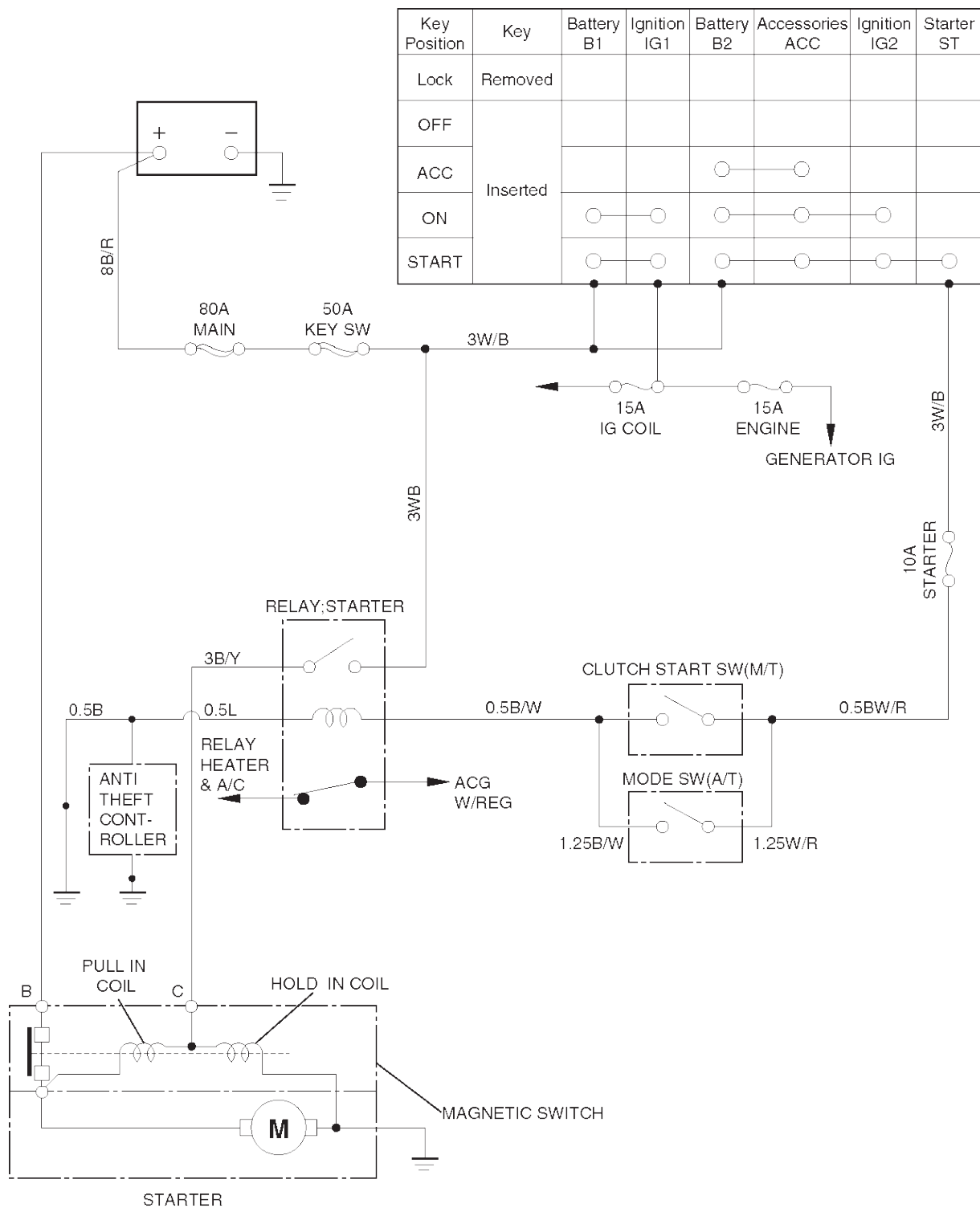
Cranking Circuit

The cranking system consists of a battery, starter, starter switch, starter relay, etc. These main components are connected.

Starter

The cranking system employs a magnetic type reduction starter in which the motor shaft is also used as a pinion shaft. When the starter switch is turned on, the contacts of magnetic switch are closed, and the armature rotates. At the same time, the plunger is attracted, and the pinion is pushed forward by the shift lever to mesh with the ring gear.

Then, the ring gear runs to start the engine. When the engine starts and the starter switch is turned off, the plunger returns, the pinion is disengaged from the ring gear, and the armature stops rotation. When the engine speed is higher than the pinion, the pinion idles, so that the armature is not driven.



6D3-4 STARTING AND CHARGING SYSTEM

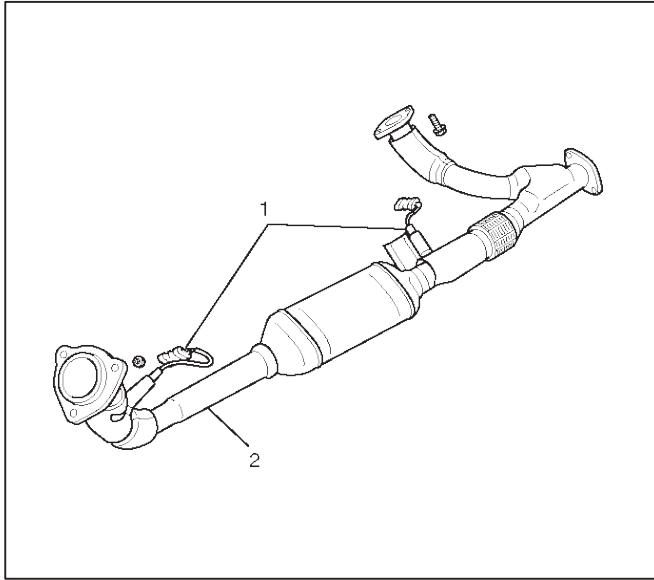
Diagnosis

Condition	Possible cause	Correction
Starter does not run	Charging failure	Repair charging system
	Battery Failure	Replace Battery
	Terminal connection failure	Repair or replace terminal connector and/or wiring harness
	Starter switch failure	Repair or replace starter switch
	Starter failure	Repair or replace starter

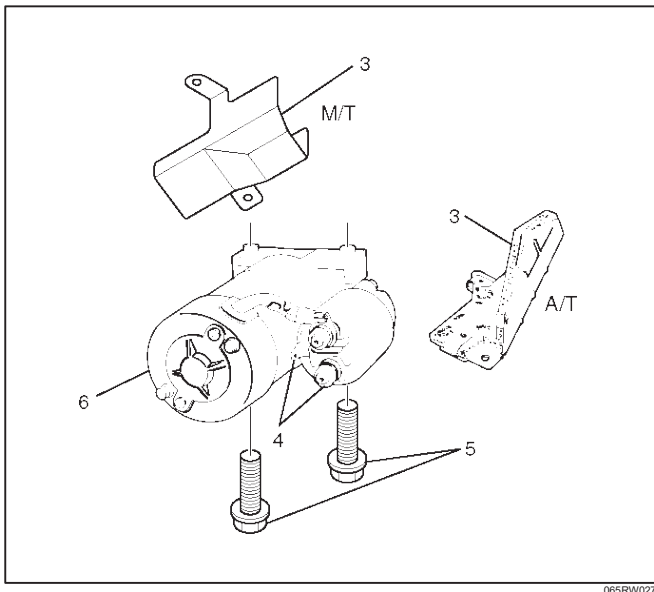
Starter

Removal

1. Battery ground cable.
2. Disconnect Heated O₂ Sensor connector (1).
3. Remove exhaust front left pipe(2).



4. Remove heat protector(3).
5. Disconnect starter wiring connector from terminals "B" and "S"(4).
6. Remove starter assembly mounting bolts on inside and outside(5).
7. Remove starter assembly toward the bottom of engine(6).



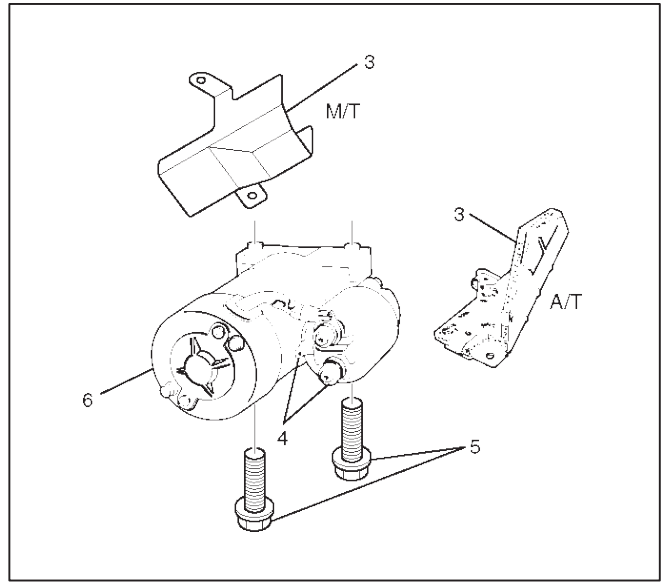
Installation

1. Install starter assembly(6).
 2. Install mounting bolts and tighten bolts to specified torque(5).
- Torque: 40 N·m (30 lb ft)**

3. Reconnect the connectors to terminals "B" and "S" and tighten Terminals "B" to specified torque.

Torque: 9 N·m (78 lb in)

4. Install heat protector(3).



5. Install exhaust front left pipe (2) and tighten bolts and nuts to specified torque.

Stud Nuts

Torque: 67 N·m (49 lb ft)

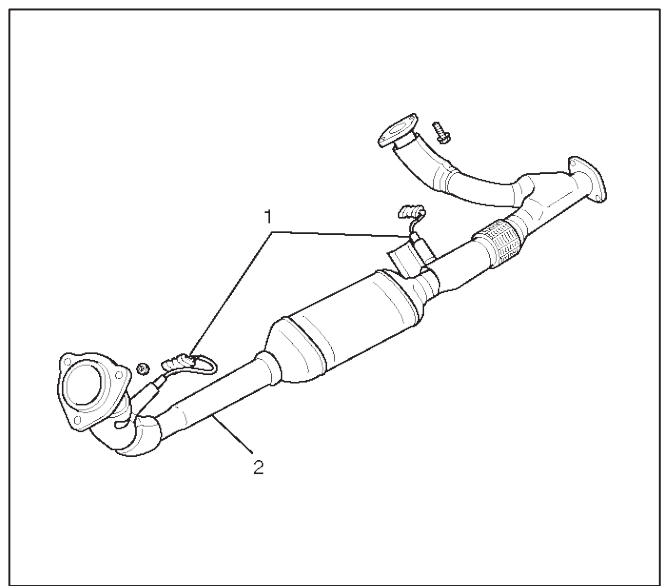
Nuts (Exhaust front left pipe-Right pipe)

Torque: 57 N·m (42 lb ft)

Nuts (Exhaust front left pipe-Silencer)

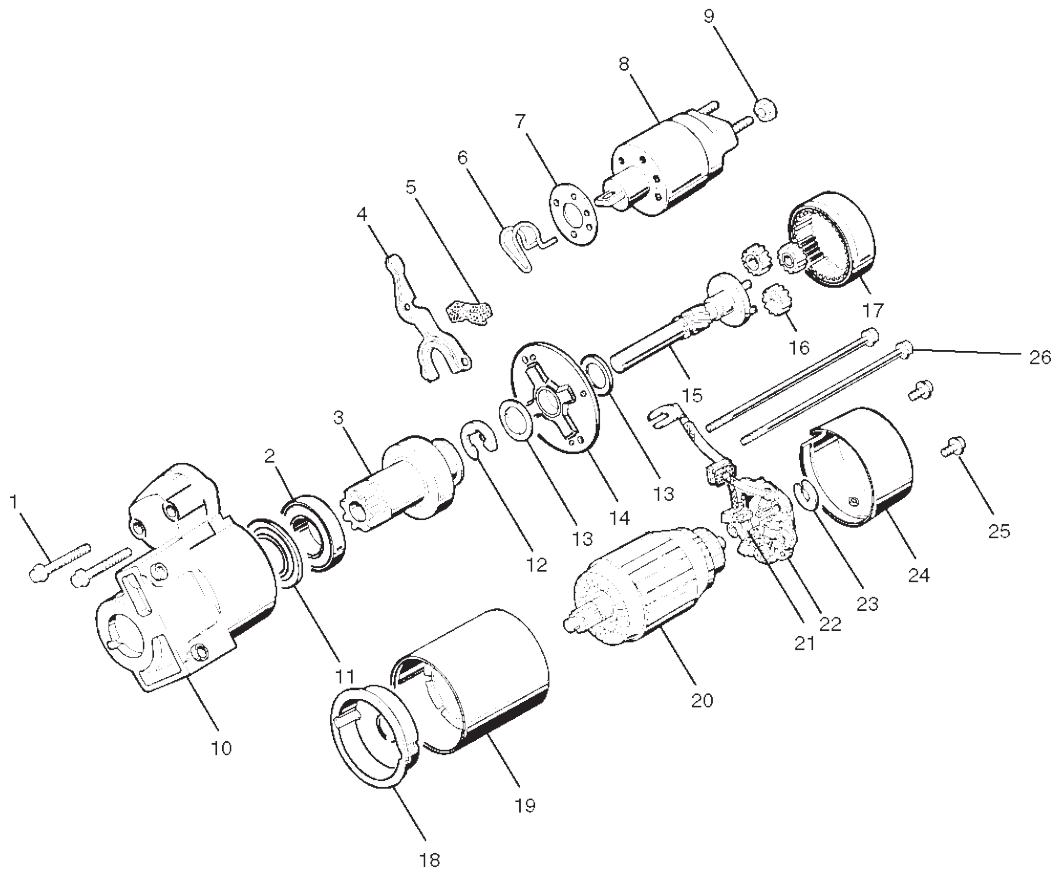
Torque: 43 N·m (32 lb ft)

6. Connect Heated O₂ Sensor connector (1).



7. Reconnect the battery ground cable.

Disassembled View



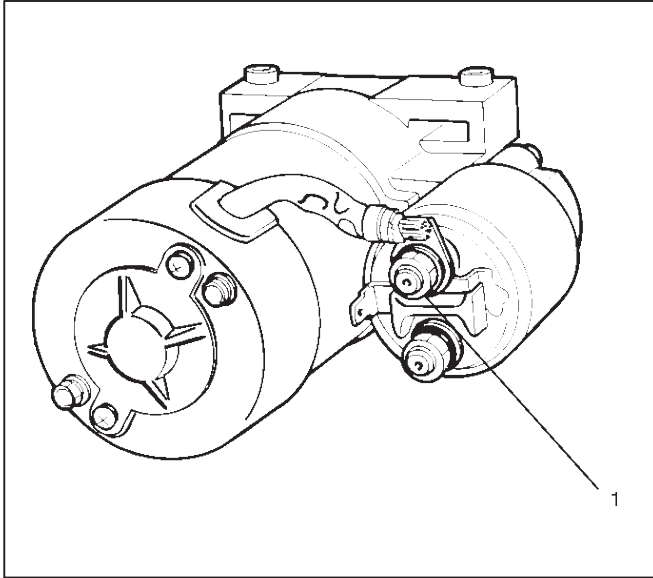
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Legend

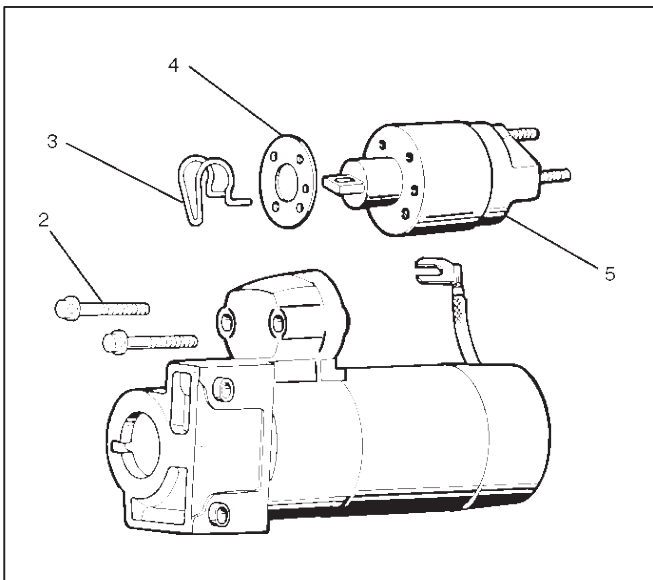
- | | |
|------------------------|---------------------------|
| (1) Bolt (2 pcs) | (14) Center Bracket |
| (2) Ball Bearing | (15) Pinion Shaft |
| (3) Pinion | (16) Planet Gear (3) |
| (4) Shift Lever | (17) Internal Gear |
| (5) Dust Cover | (18) Center Bracket (A) |
| (6) Torsion Spring | (19) Yoke Assembly |
| (7) Dust Cover | (20) Armature |
| (8) Magnetic Switch | (21) Brush |
| (9) Nut | (22) Brush Holder |
| (10) Gear Case | (23) Thrust Washer |
| (11) Bearing Cover | (24) Rear Cover |
| (12) E-Ring | (25) Screw (2 pcs) |
| (13) Thrust Washer (2) | (26) Through Bolt (2 pcs) |

Disassembly

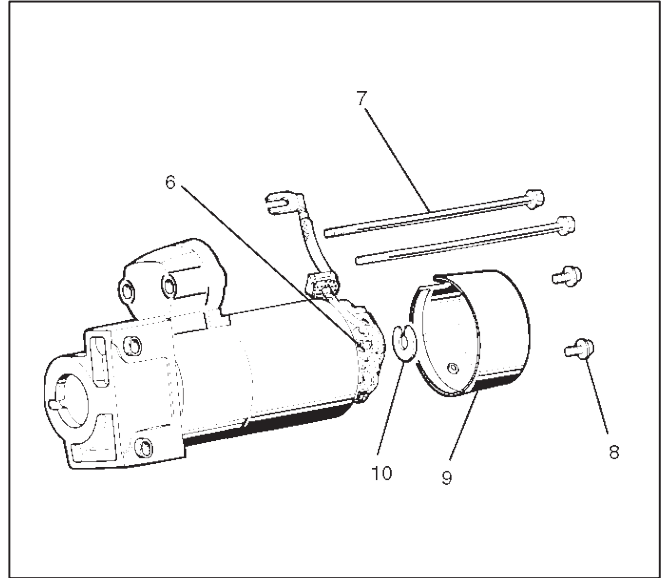
1. Loosen the nut(1) on terminal "M" of magnetic switch and disconnect the connector cable.
2. Remove bolt (2 pcs) (2).



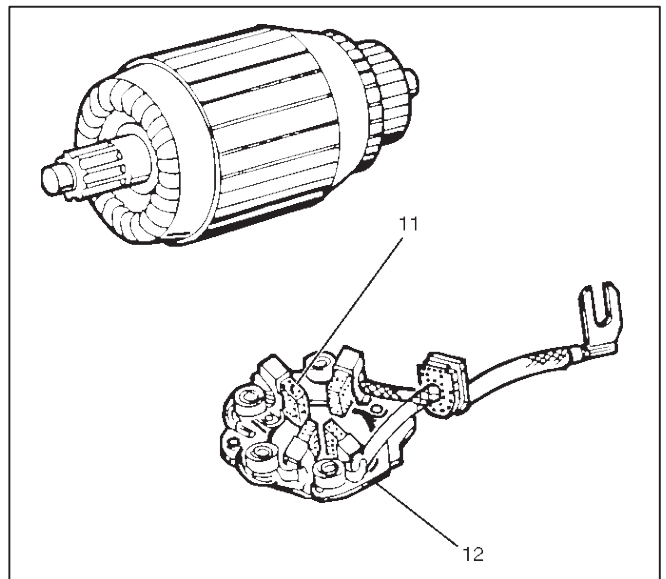
3. Remove magnetic switch(5).
4. Remove dust cover(4).
5. Remove torsion spring bolts, then the magnetic switch assembly.
6. Remove torsion spring(3) from magnetic switch assembly(5).



7. Remove screw (2 pcs) (8).
8. Remove through bolt (2 pcs) (7).
9. Remove screws and through bolts, then the rear cover(9) then remove thrust washer(10).
10. Remove brush holder(6).



11. Raise a brush spring to detach brushes (4 pcs) from the commutator face and pull off the brush holder(12) and brush(11).



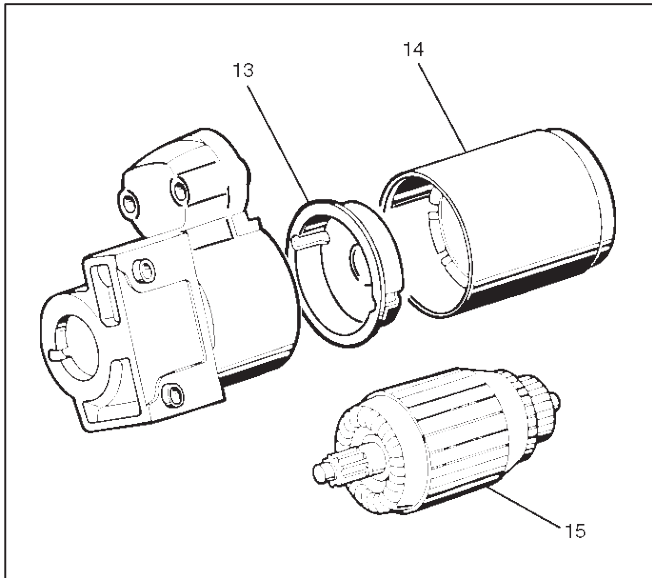
6D3-8 STARTING AND CHARGING SYSTEM

12. Remove yoke assembly(14).

13. Remove armature(15).

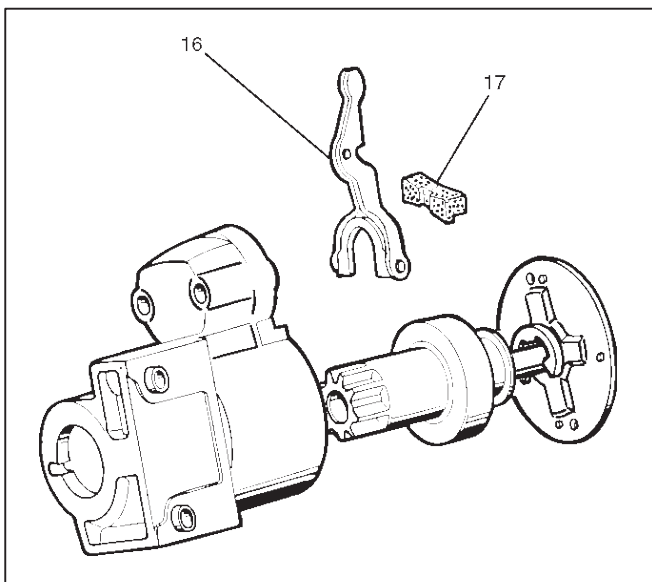
14. Pull off the yoke assembly, then remove armature, washer and center bracket.(A) (13).

NOTE: In disassembling the yoke assembly, hold the armature and pull off slowly the yoke assembly. Because of strong magnetic force, avoid placing a metallic part near armature.



15. Remove dust cover(17).

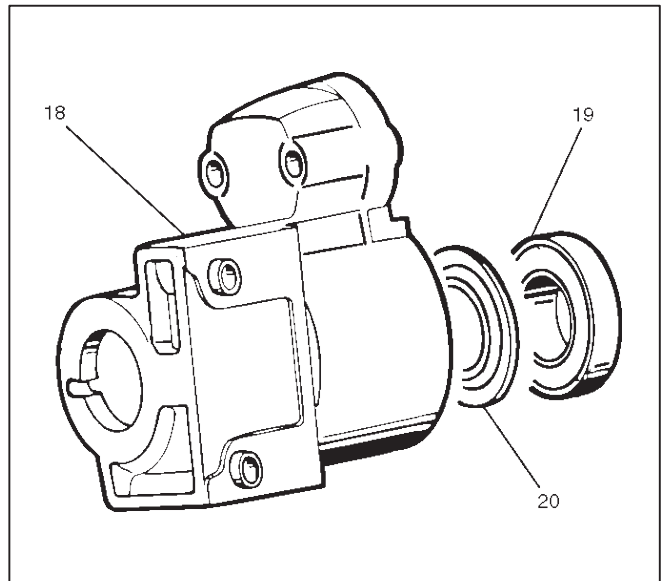
16. Remove a dust cover and shift lever(16) from the gear case.



17. Remove ball bearing(19).

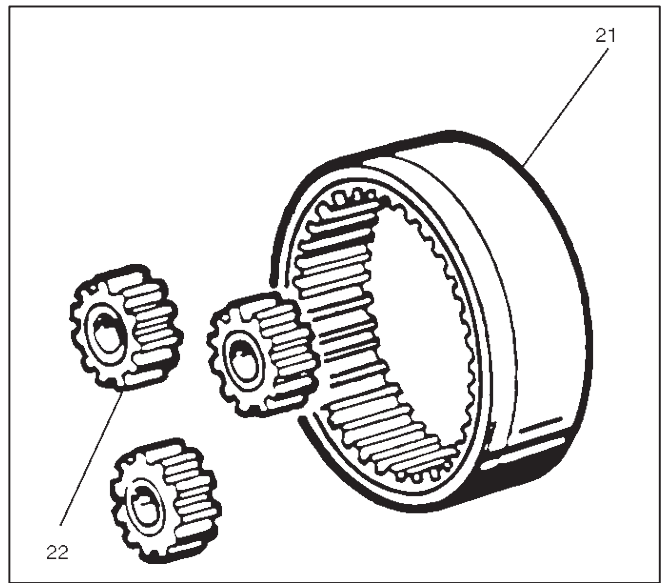
18. Remove bearing cover(20).

19. Remove a ball bearing and bearing cover from the gear case(18).

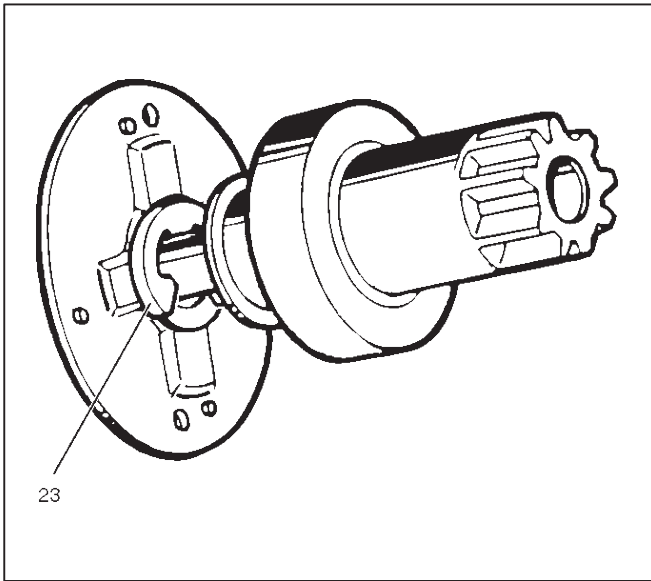


20. Internal gear(21).

21. Remove internal gear and planet gear(3) (22).



22. Remove an E-ring(23) from the pinion shaft using a flat blade screwdriver.

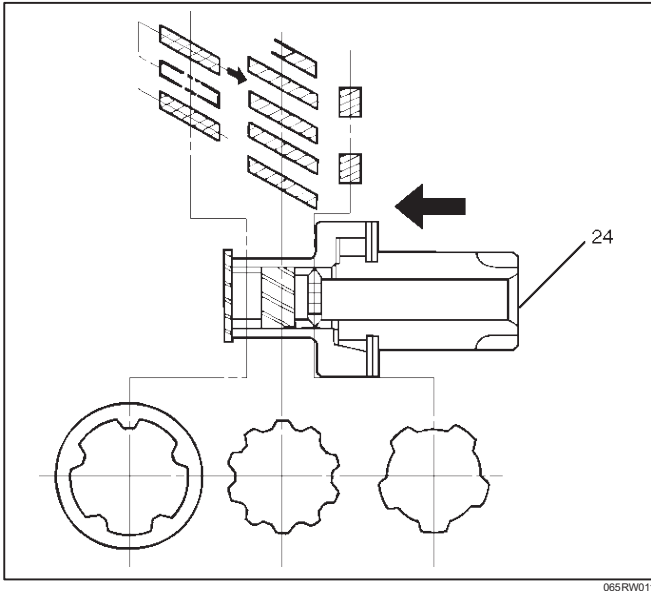


23. Holding the pinion shaft, push pinion toward the center bracket, and turn the pinion clockwise or counterclockwise by one tooth of spline, then pull off the pinion.

24. Remove thrust washer(24).

25. Remove center bracket

26. Remove pinion shaft.



Inspection and Repair

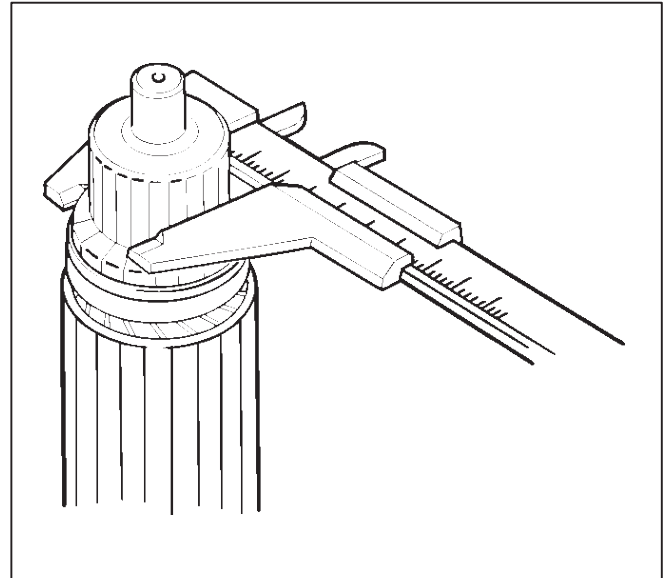
Repair or replace necessary parts if extreme wear or damage is found during inspection.

Armature

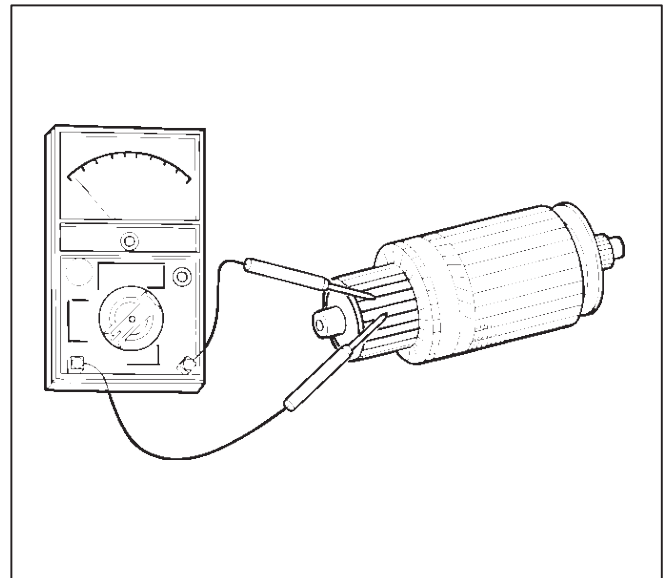
Measure the outer diameter of commutator, and replace with a new one if it is out of the limit.

Standard: 33.0 mm (1.30 in)

Limit: 32.0 mm (1.26 in)

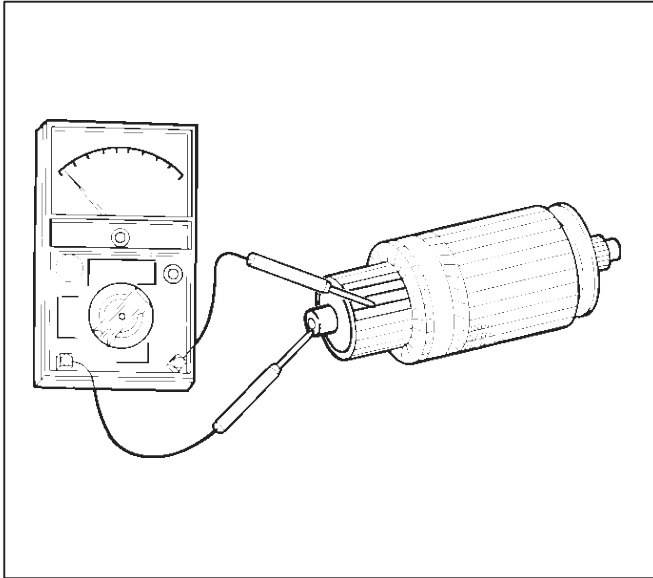


Check for continuity between commutator and segment. Replace commutator if there is no continuity (i.e., disconnected).



6D3-10 STARTING AND CHARGING SYSTEM

Check for continuity between commutator and shaft. Also, check for continuity between commutator and armature core, armature core and shaft. Replace commutator if there is continuity (i.e., internally grounded).



Measure runout of armature core and commutator with a dial gauge. Repair or replace, if it exceeds the limit.

Armature

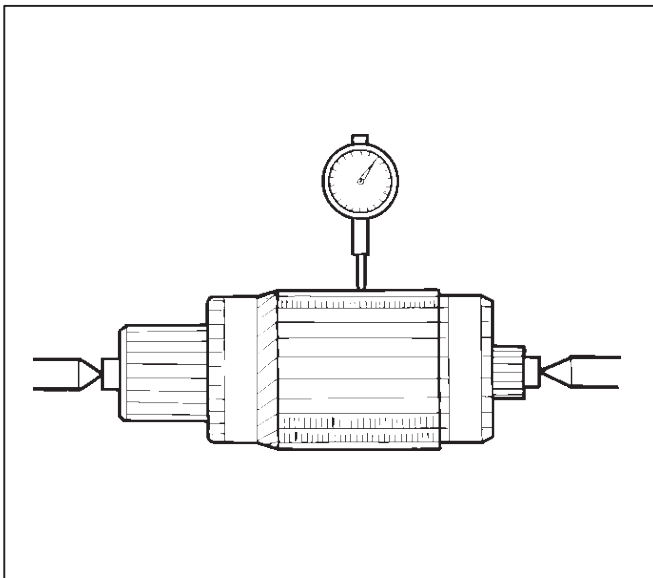
Standard: 0.05 mm (0.002 in) Max.

Limit: 0.10 mm (0.004 in)

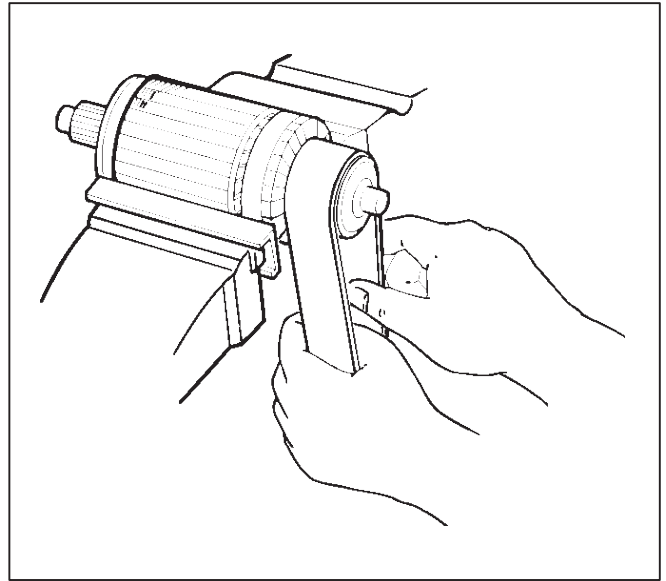
Commutator

Standard: 0.05 mm (0.002 in) Max.

Limit: 0.10 mm (0.004 in)



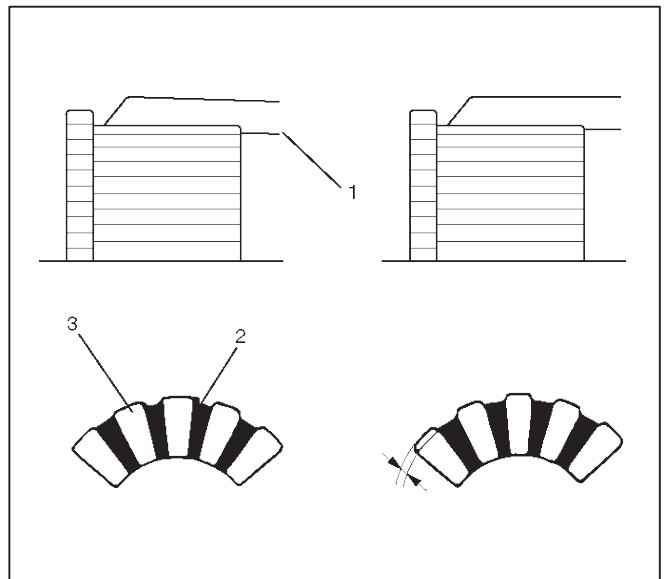
Polish the commutator surface with sandpaper #500 to #600 if it is rough.



Measure the depth of insulator in commutator. Repair, if it is below the limit.

Standard: 0.5 mm to 0.8 mm (0.02 in to 0.03 in)

Limit: 0.2 mm (0.008 in)



Legend

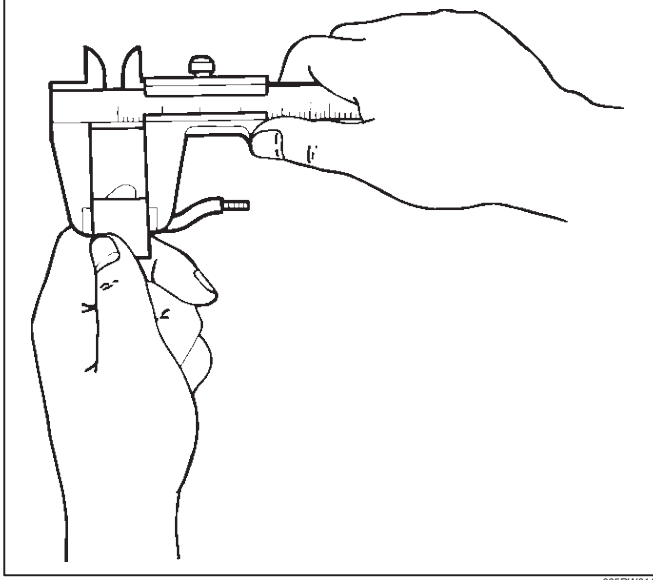
- (1) Steel Saw
- (2) Insulator
- (3) Commutator Segments

Brush

Measure the length of brush.
Replace with a new one, if it is below the limit.

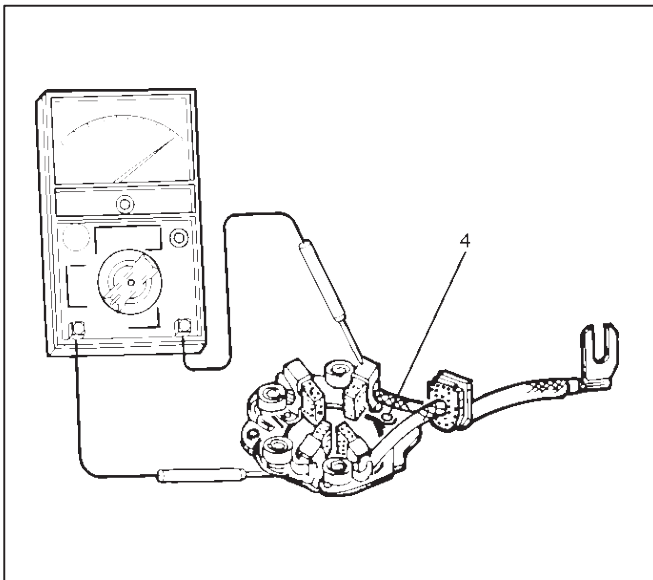
Standard: 16 mm (0.63 in)

Limit: 11 mm (0.43 in)



Brush Holder

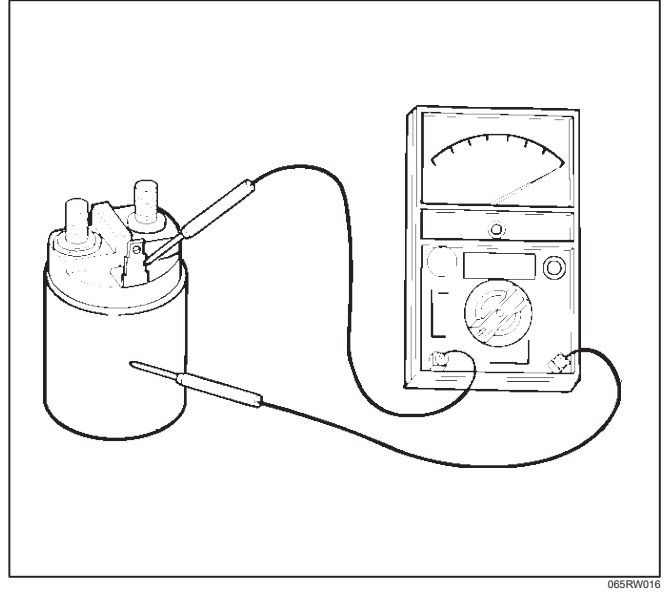
Check for continuity between brush holder (+) (4) and base (-). Replace, if there is continuity (i.e., insulation is broken).



Magnetic Switch

Check for continuity of shunt coil between terminals S and M.

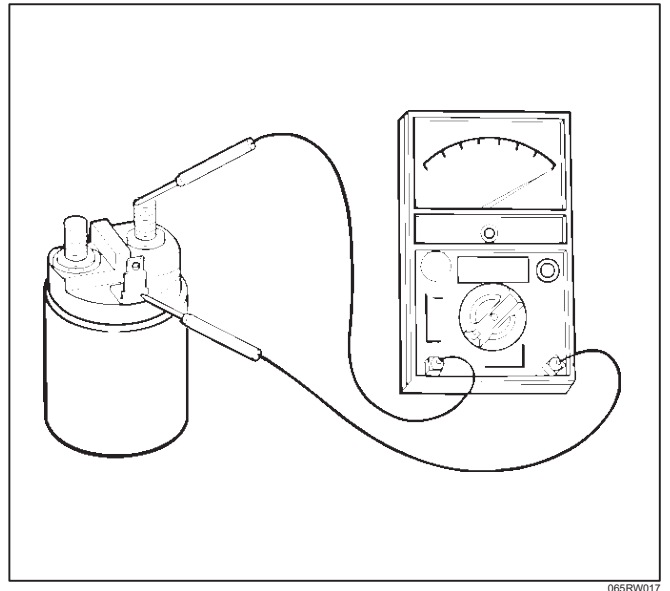
Replace, if there is no continuity (i.e., coil is disconnected).



Continuity of Series Coil

Check for continuity between terminals S and M.

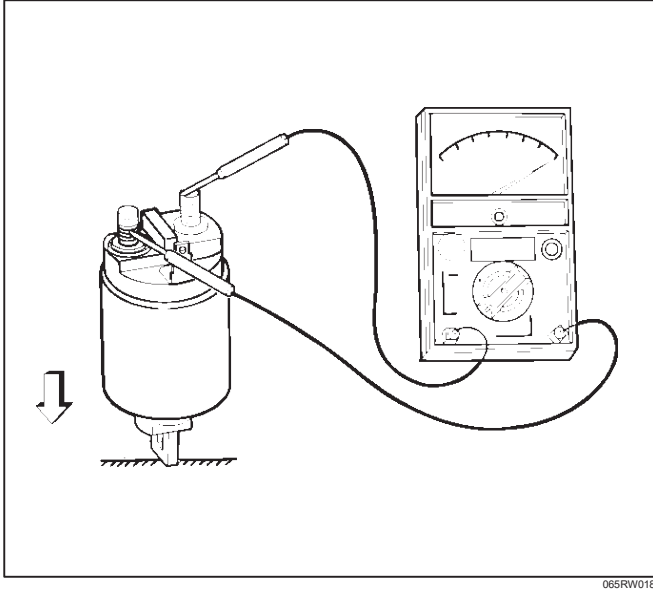
Replace, if there is no continuity (i.e., coil is disconnected).



6D3-12 STARTING AND CHARGING SYSTEM

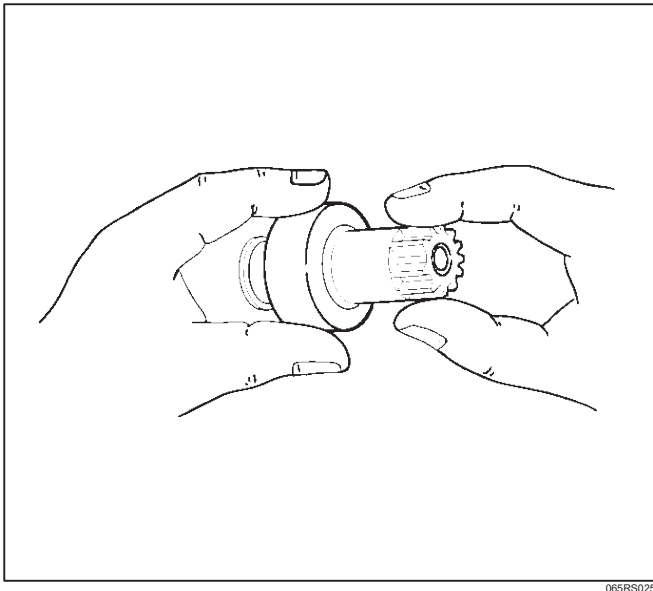
Continuity of Contacts

With the plunger faced downward, push down the magnetic switch. In this state, check for continuity between terminals B and M. Replace, if there is no continuity (i.e., contacts are faulty).



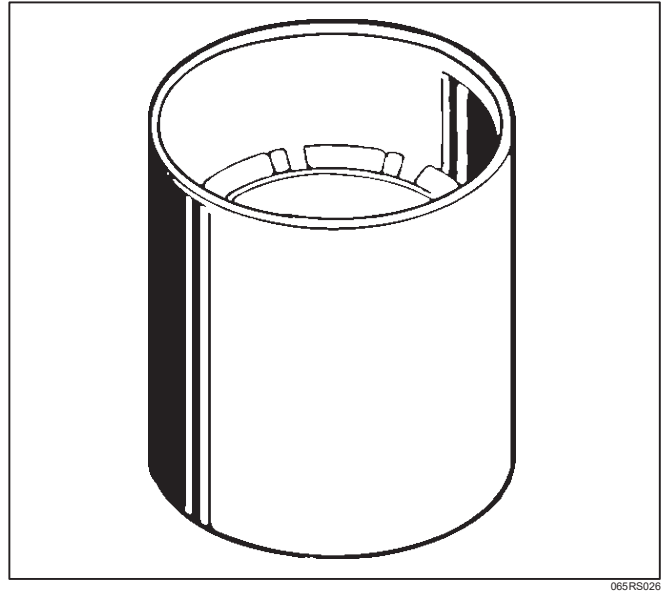
Pinion

Check if the pinion rotates smoothly in drive direction by hand, or if it is locked when it is rotated in reverse. If not, replace the pinion.



Yoke Assembly

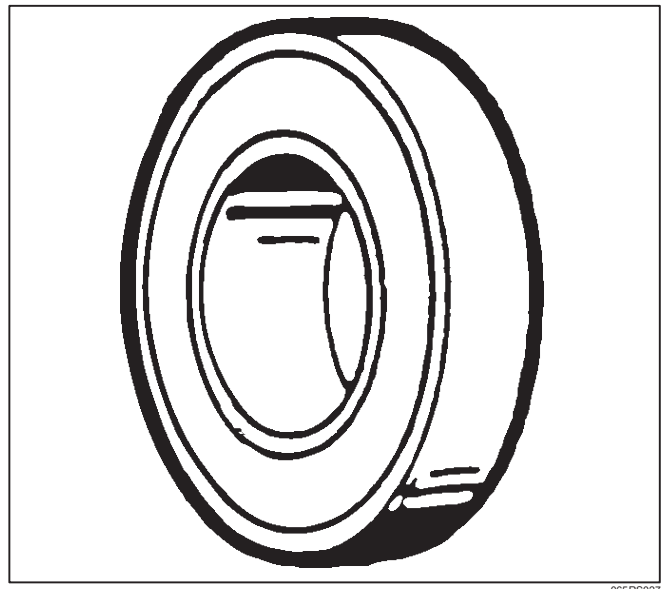
Check a magnet inside the yoke.
Replace the yoke assembly if it is broken.



Ball Bearing

Clamp the inner race of the ball bearing with your finger, and check for sticking or play when rotating the outer race.

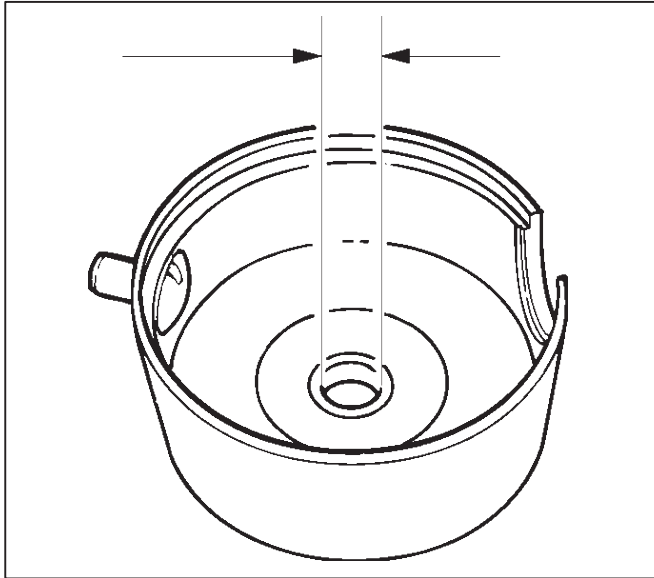
Replace, if abnormality is found.



Measure inner diameter of bushing in the rear cover, and replace if it exceeds the limit.

Standard: 12.50 mm to 12.527 mm (0.492 in to 0.4932 in)

Limit: 12.60 mm (0.4961 in)

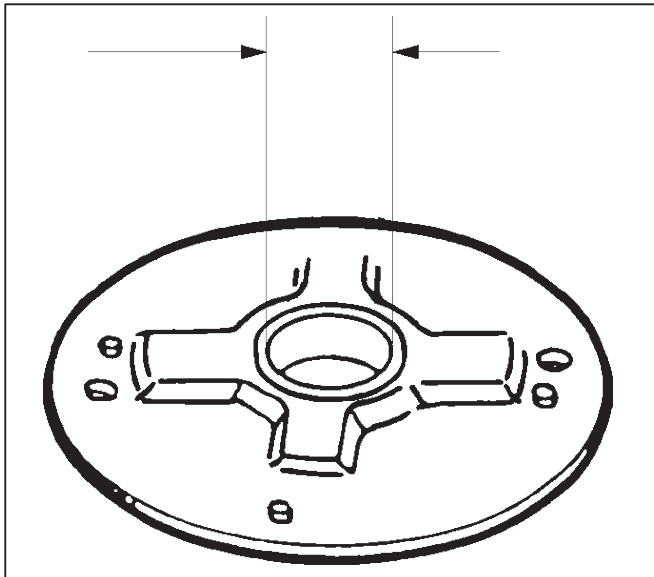


065RS028

Measure inner diameter of bushing in the center bracket (P), and replace if it exceeds the limit.

Standard: 18.01 mm to 18.127 mm (0.7091 in to 0.7137 in)

Limit: 18.15 mm (0.7146 in)



065RS029

Reassembly

To install, follow the removal steps in the reverse order, noting the following points:

Grease application places

- Bushing in rear cover and center bracket
- Gears in reduction gear
- Shift lever operating portion
- Sliding portion of pinion
- Plunger sliding portion of magnetic switch

Reassembling Yoke Assembly

Before reassembly, make sure that no metallic parts attach to the yoke assembly. Because of strong magnetic force, hold the yoke assembly and insert it slowly into the armature.

Torque

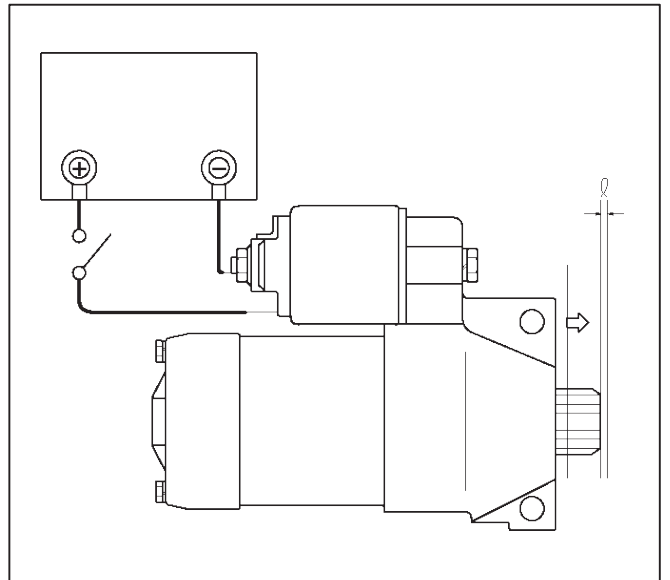
Torque for each part (See Torque Specifications in this section)

Pinion Jump-out Dimension

Connect the “+” cable of battery to terminal S and the “-” cable to terminal M. Turn the switch on, and measure pinion travel dimension in thrust direction from the jump-out position.

In measuring the dimension, pull the pinion out a little in the arrow direction.

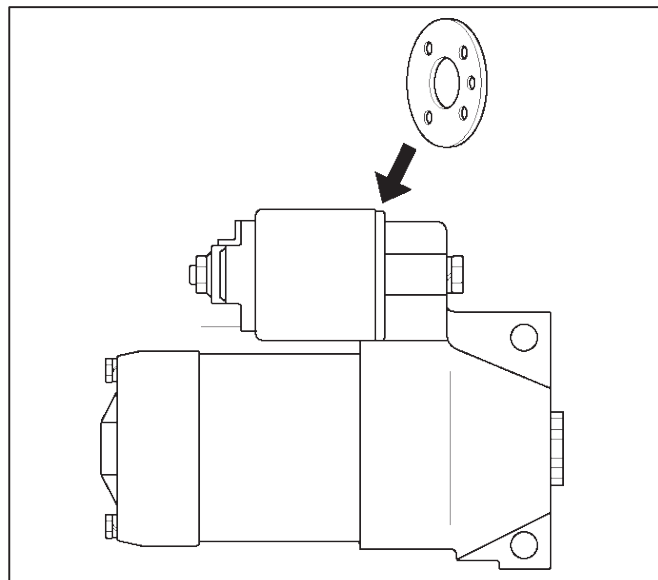
Dimension(L): 0.05 mm to 1.5 mm (0.002 in to 0.06 in)



065RS030

6D3-14 STARTING AND CHARGING SYSTEM

If the measured value is out of standard, insert dust cover, or disassemble and adjust.



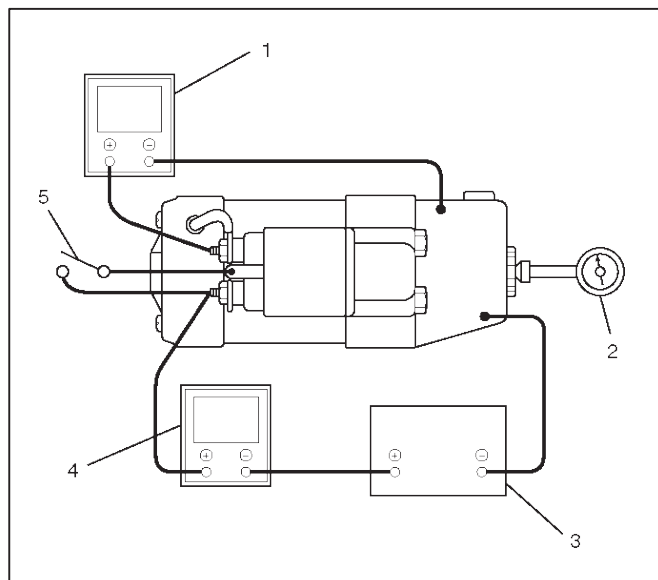
065RW019

Characteristic Test

For easily confirming the characteristics, conduct the no load test as follows:

Rating as short as 30 seconds requires rapid testing.

Fix the starter on the test bench, and wire as shown in illustration. When the switch is closed, the current flows and the starter runs under no load. At this time, measure current, voltage and speed to check if they satisfy the standard.



065RW020

Legend

- (1) Volt Meter
- (2) Tachometer
- (3) Battery
- (4) Ammeter
- (5) Switch

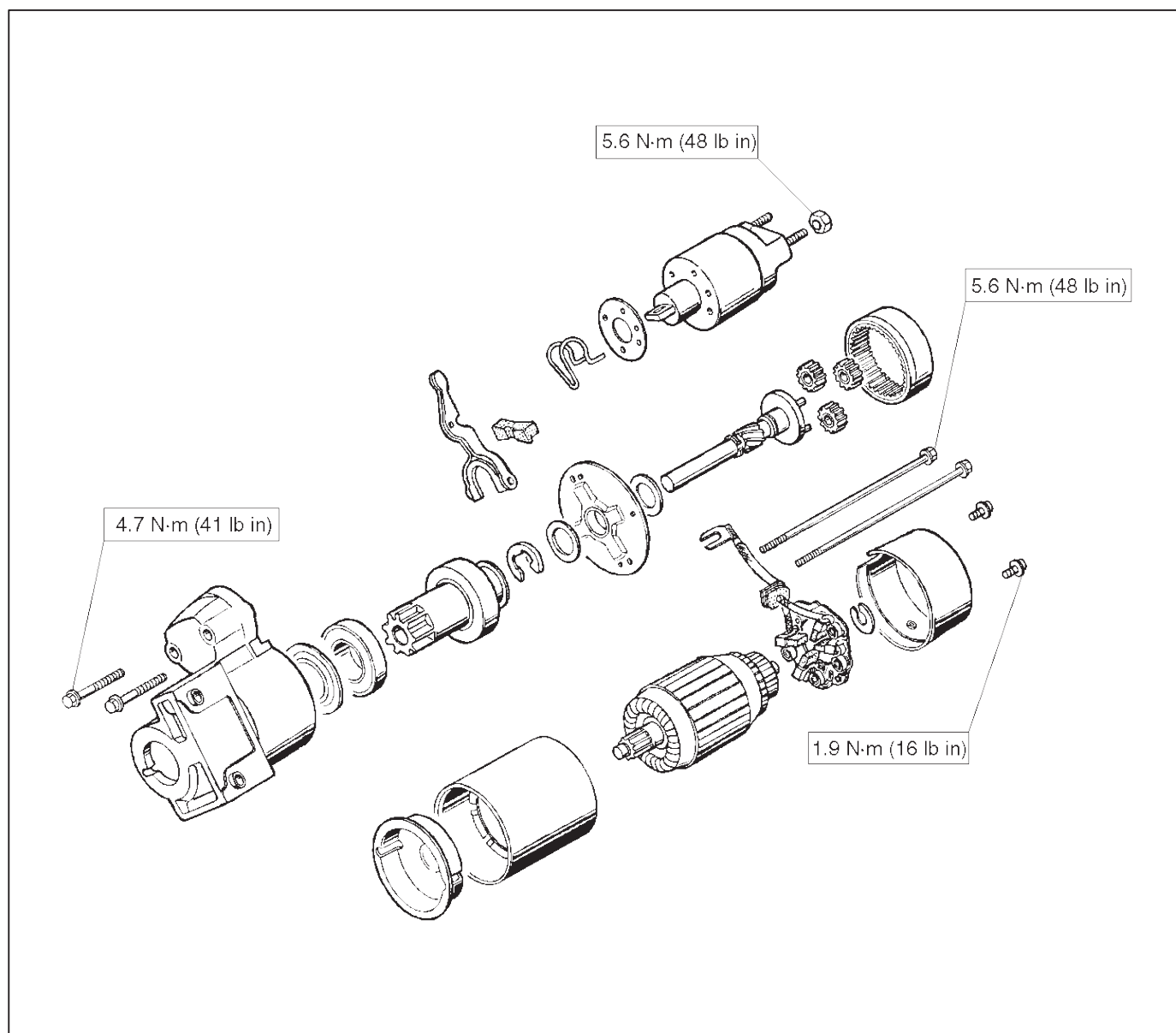
Main Data and Specifications

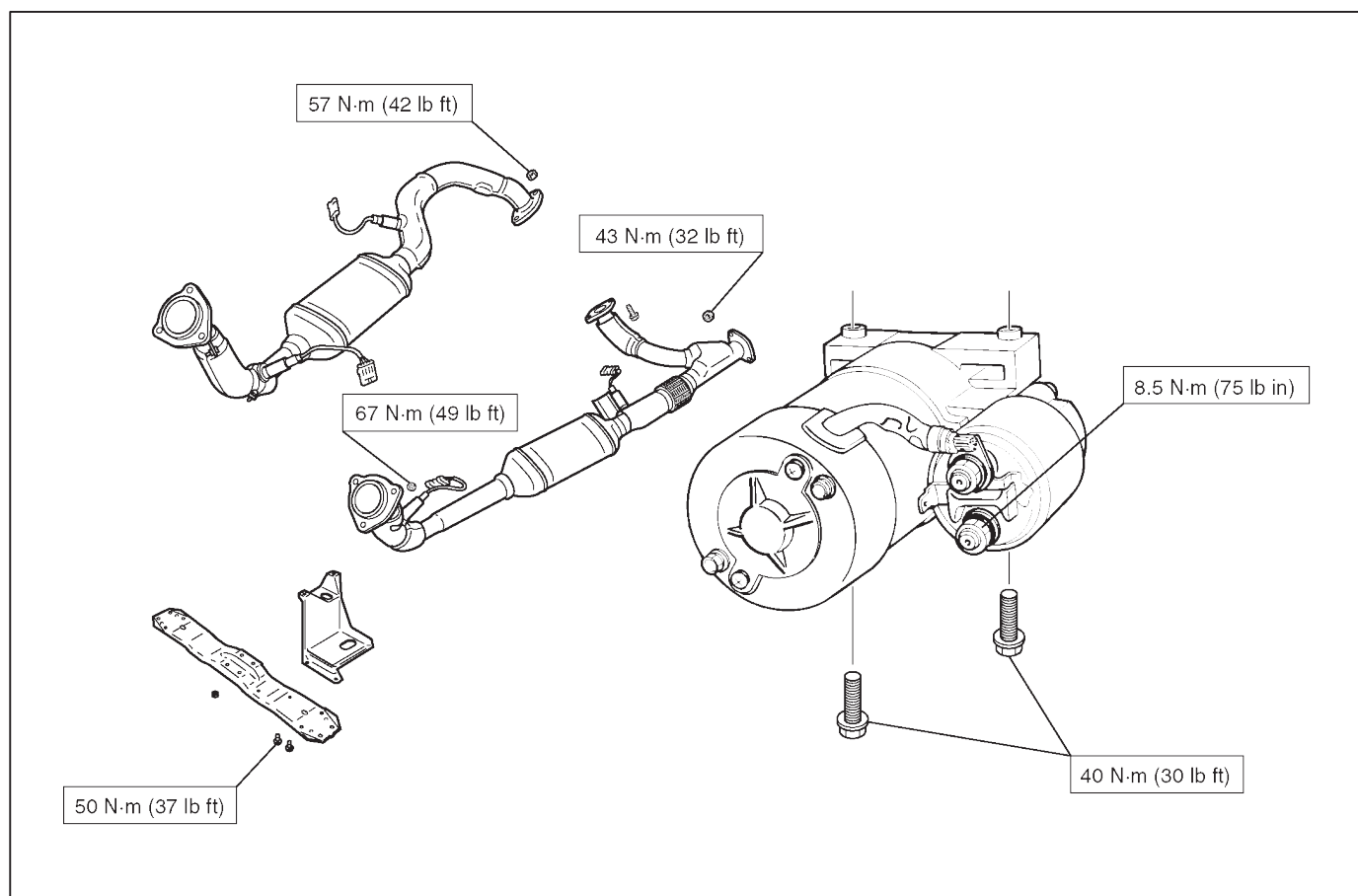
General Specifications

Model	HITACHI GD003138
Rating	
Voltage	12 V
Output	1.4 Kw
Time	30 sec
Number of teeth of pinion	9
Rotating direction(as viewed from pinion)	Clockwise
Weight(approx.)	34 N (7.6 lb)
No load characteristics	
Voltage /Current	11V/90A or less
Speed	2700rpm or more
Load characteristics	
Voltage/current	8.4V/250A
Torque	7.3N·m(64lb·in.) or more
Speed	1200rpm or more
Locking characteristics	
Voltage/current	3V/750A or less
Torque	19N·m(14 lb ft) or more

6D3-16 STARTING AND CHARGING SYSTEM

Torque Specifications





Charging System

General Description

The IC integral regulator charging system and its main components are connected as shown in the illustration. The regulator is a solid state type and it is mounted along with the brush holder assembly inside the generator installed on the rear end cover.

The generator does not require particular maintenance such as voltage adjustment.

The rectifier connected to the stator coil has eight diodes to transform AC voltage into DC voltage.

This DC voltage is connected to the output terminal of generator.

General On-Vehicle Inspection

The operating condition of charging system is indicated by the charge warning lamp. The warning lamp comes on when the starter switch is turned to "ON" position. The charging system operates normally if the lamp goes off when the engine starts.

If the warning lamp shows abnormality or if undercharged or overcharged battery condition is suspected, perform diagnosis by checking the charging system as follows:

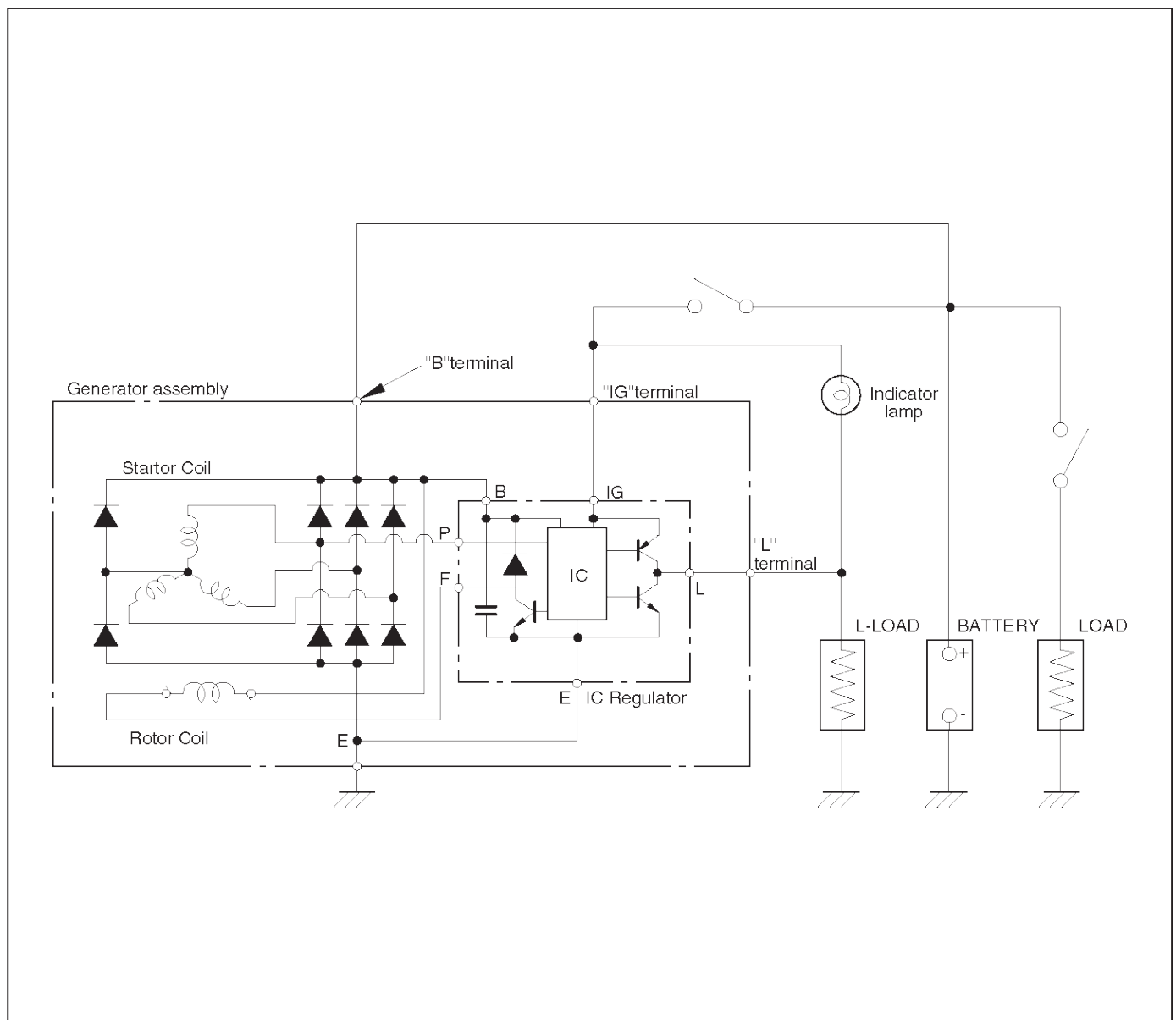
1. Check visually the belt and wiring connector.
2. With the engine stopped, turn the stator switch to "ON" position and observe the warning lamp.

If lamp does not come on:

Disconnect wiring connector from generator, and ground the terminal "L" on connector side.

If lamp comes on:

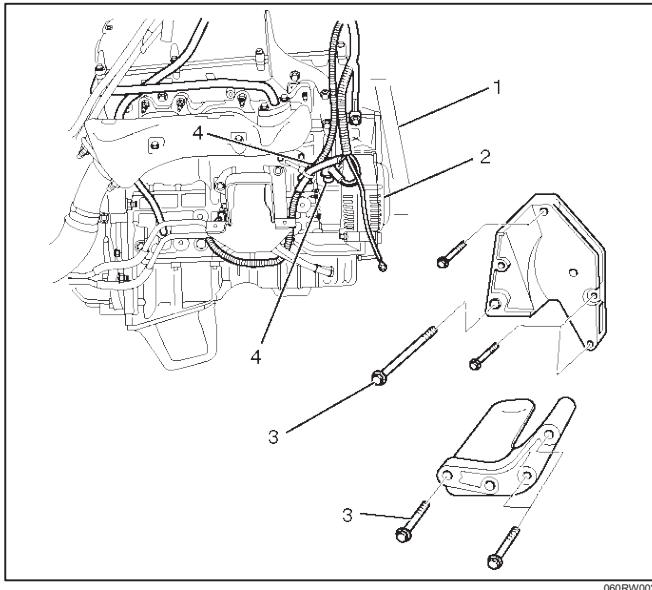
Repair or replace the generator.



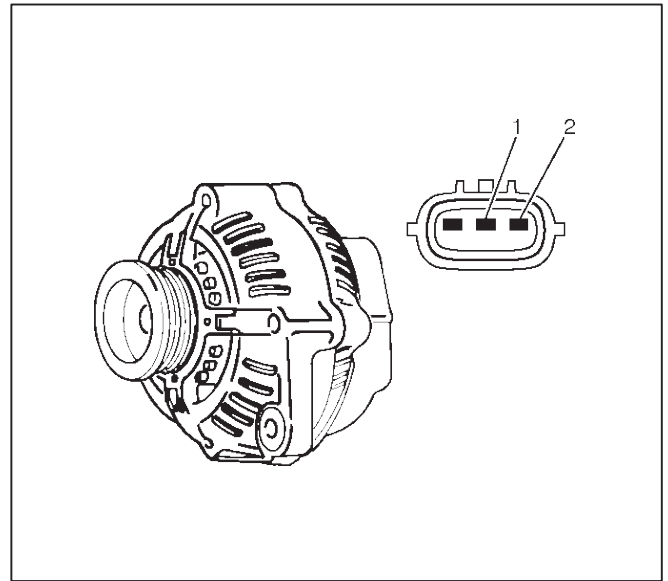
Generator

Removal

1. Disconnect battery ground cable.
2. Move drive belt tensioner to loose side using wrench then remove drive belt (1).
3. Disconnect the wire from terminal "B" and disconnect the connector (4).
4. Remove generator fixing bolt (3).
5. Remove generator assembly (2).



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If voltage is not present, the line between battery and connector is disconnected and so requires repair.

3. Reconnect the wiring connector to the generator, run the engine at middle speed, and turn off all electrical devices other than engine.
4. Measure battery voltage. If it exceeds 16V, repair or replace the generator.
5. Connect an ammeter to output terminal of generator, and measure output current under load by turning on the other electrical devices (eg., head lights). At this time, the voltage must not be less than 13V.

Inspection

1. Disconnect the wiring connector from generator.
2. With the engine stopped, turn starter switch to "ON" and connect a voltmeter between connector terminal L (2) and ground or between terminal IG (1) and ground.

Installation

1. Install generator assembly to the position to be installed.
2. Install generator assembly and tighten the fixing bolts to the specified torque.

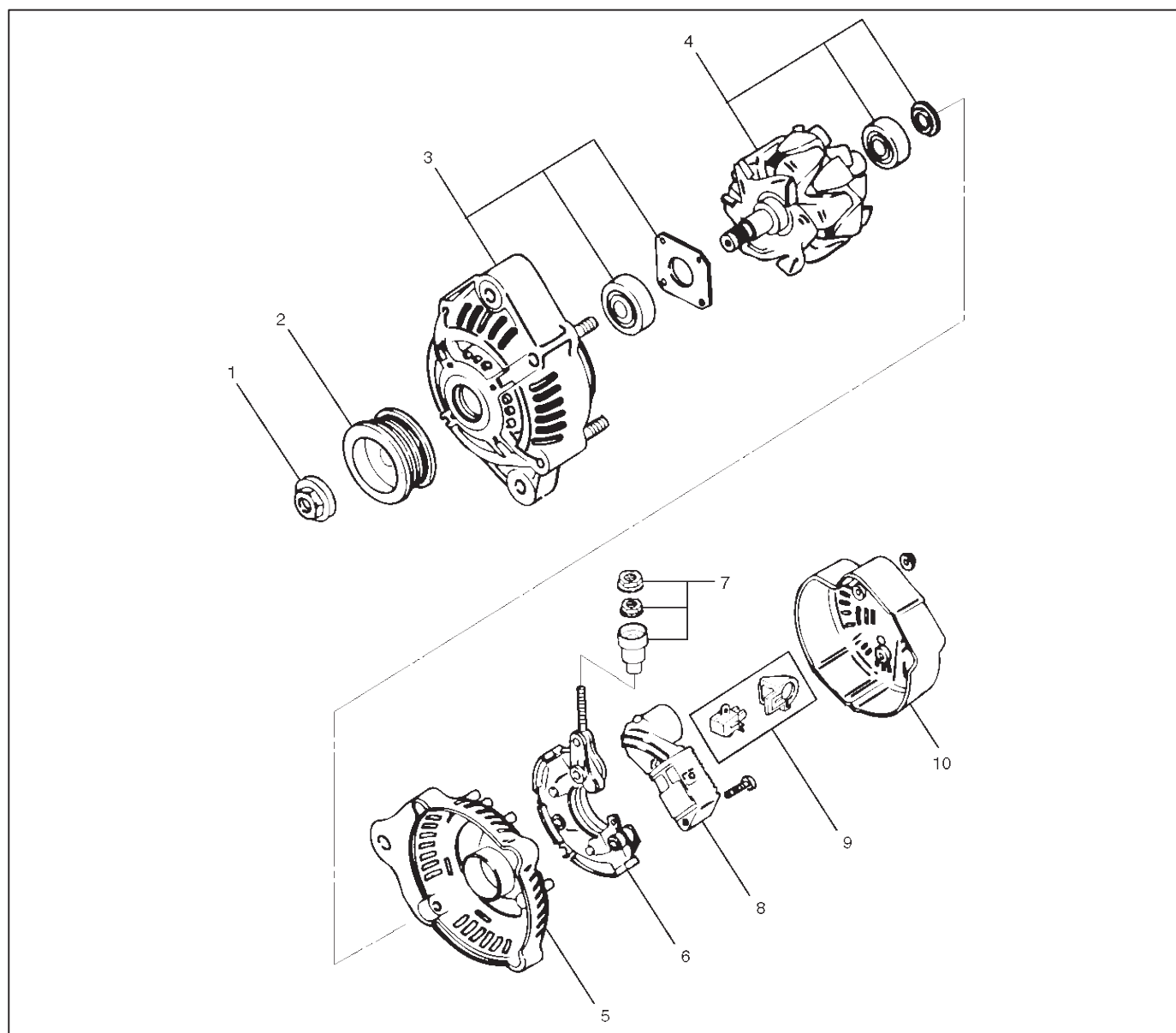
Torque:

M10 bolt: 41 N·m (30 lb ft)

M8 bolt: 21 N·m (15 lb ft)

3. Connect wiring harness connector and direct terminal "B".
4. Move drive belt tensioner to loose side using wrench, then install drive belt to normal position.
5. Reconnect battery ground cable.

Disassembled View



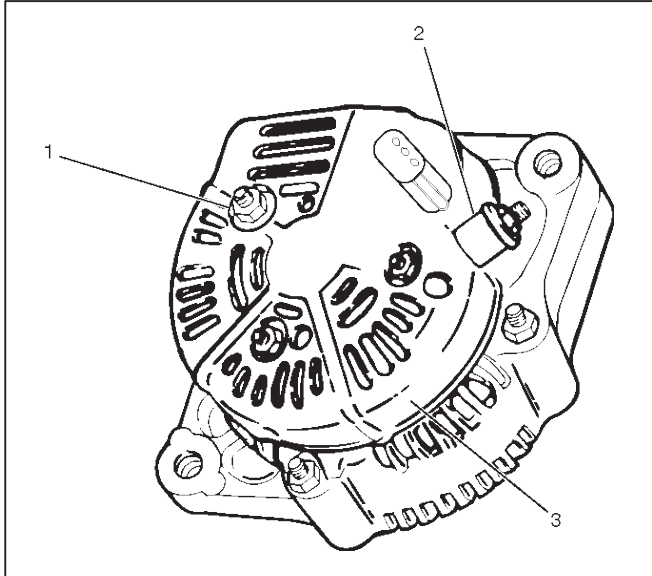
066RW007

Legend

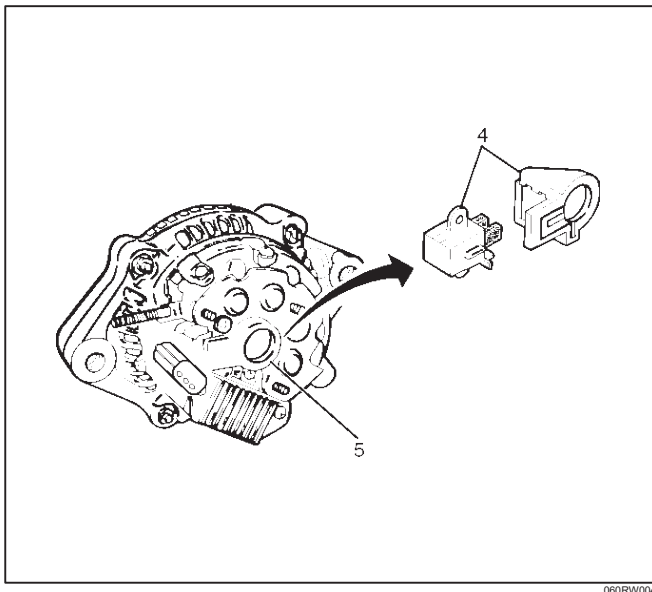
- | | |
|--------------------------|--------------------------------|
| (1) Pulley Nut | (6) Rectifier |
| (2) Pulley | (7) Terminal Insulator and Nut |
| (3) Front Cover Assembly | (8) Regulator Assembly |
| (4) Rotor Assembly | (9) Brush Holder Assembly |
| (5) Rear End Cover | (10) Rear Cover |

Disassembly

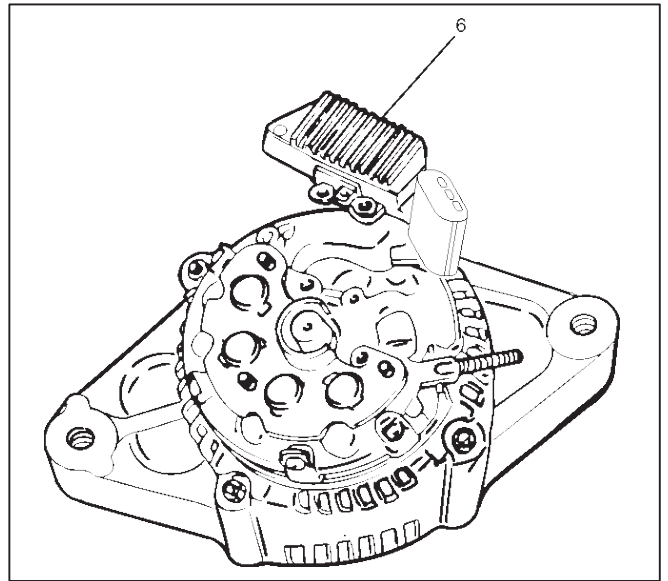
1. Terminal insulator and nut(2).
2. Remove three nuts(1) on the rear cover and a nut on terminal B and insulator, then remove the rear cover(3).



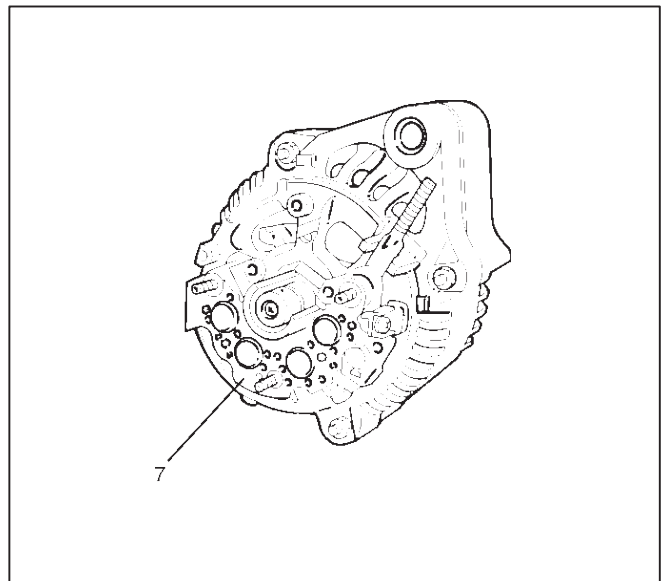
3. Remove two screws that fix the brush holder(5) and rectifier, then remove the brush holder assembly(4).



4. Remove three screws on the IC regulator, then the IC regulator assembly(6).

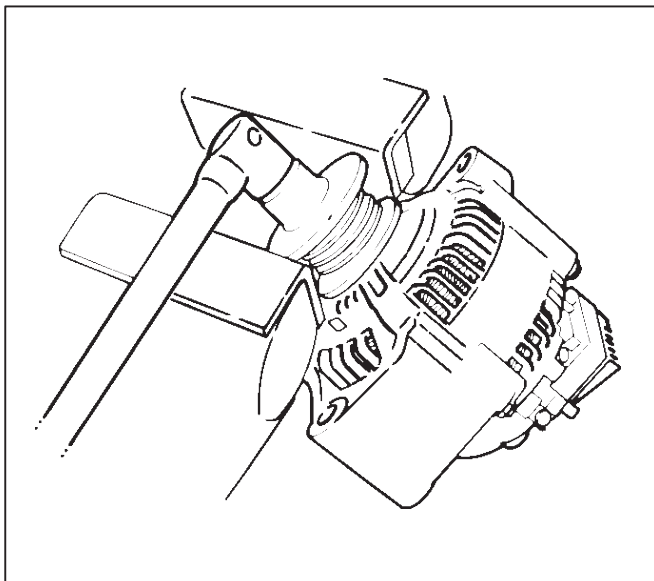


5. Remove four screws that fix rectifier(7) and stator lead wires.

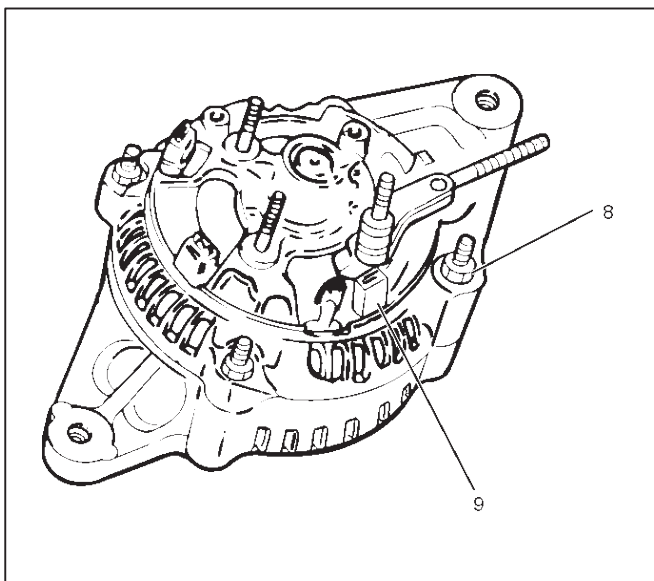


6D3-22 STARTING AND CHARGING SYSTEM

6. Secure the pulley directly in the vise between two copper plates, and remove the nut and pulley.

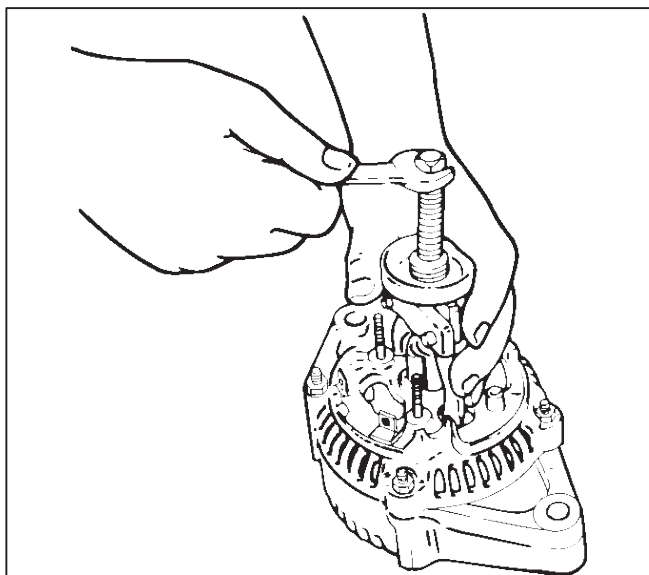


7. Remove four nuts(8) that secure the front cover assembly and rear end cover, and an insulator(9).

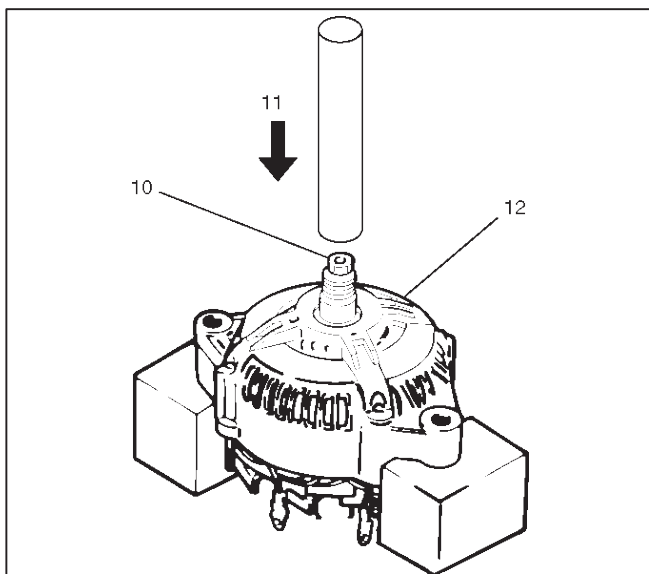


8. Use the puller to remove the rear end cover.

9. Rotor assembly



10. Pull the rotor assembly(10) off the front cover assembly(12) using a bench press(11).

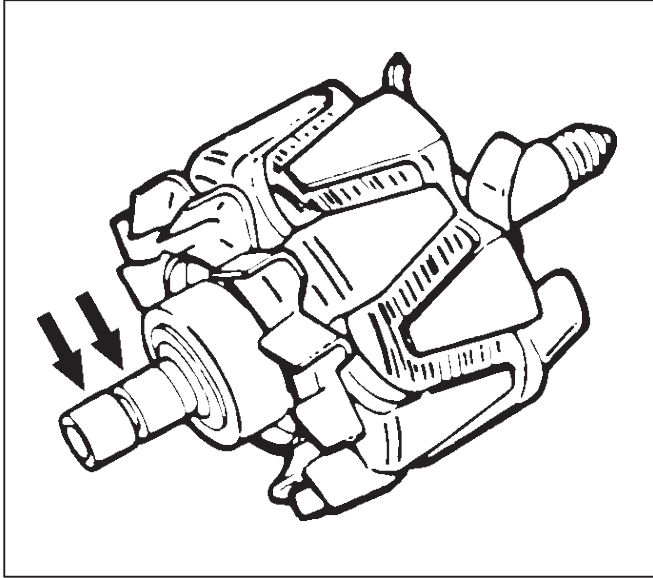


Inspection and Repair

Repair or replace necessary parts if extreme wear or damage is found during inspection.

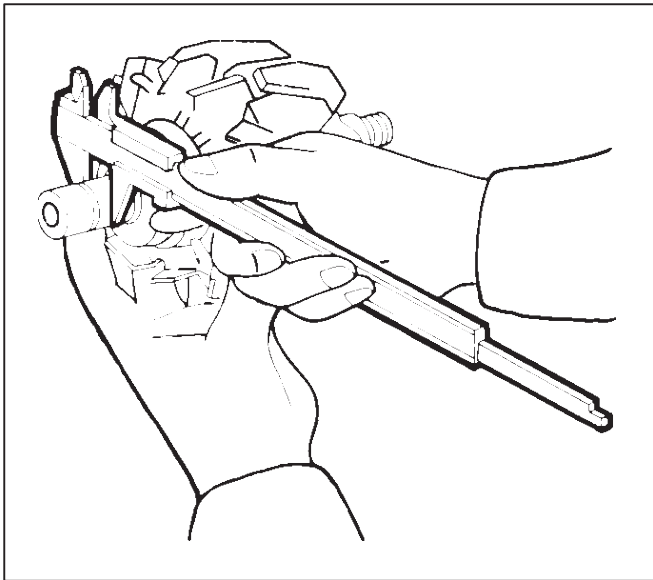
Rotor Assembly

1. Check the rotor slip ring surfaces for contamination and roughness. If rough, polish with #500—600 sandpaper.



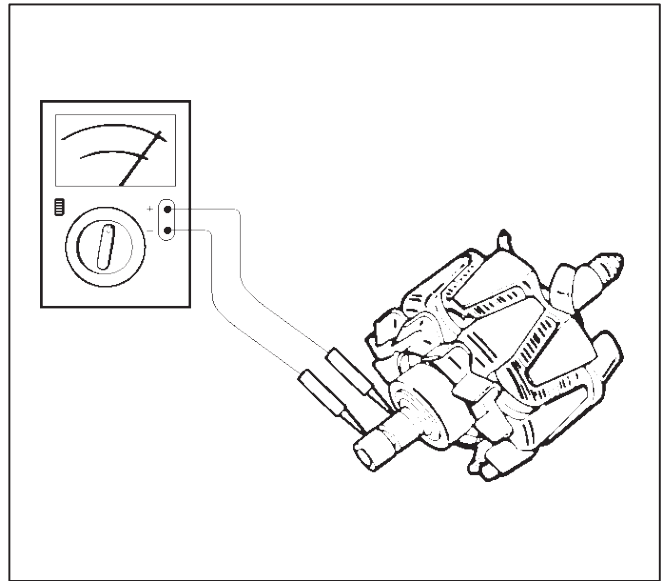
066RS014

2. Measure the slip ring diameter, and replace if it exceeds the limit.



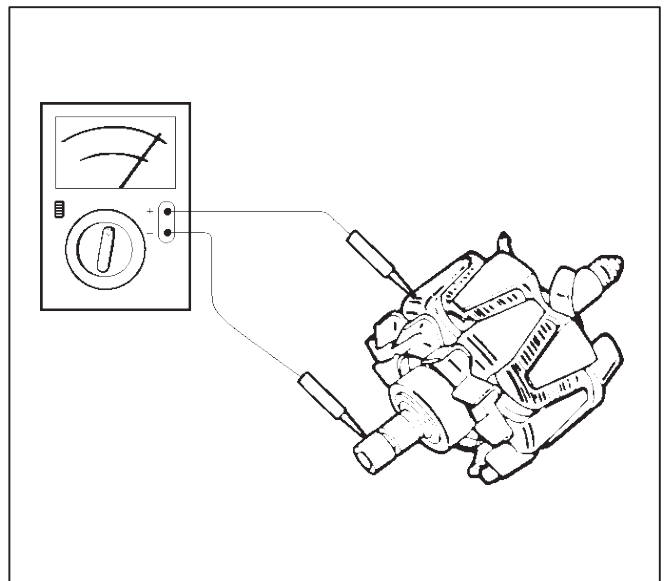
066RS015

3. Check resistance between slip rings, and replace if there is no continuity.



066RS016

4. Check for continuity between slip ring and rotor core. In case of continuity, replace the rotor assembly.

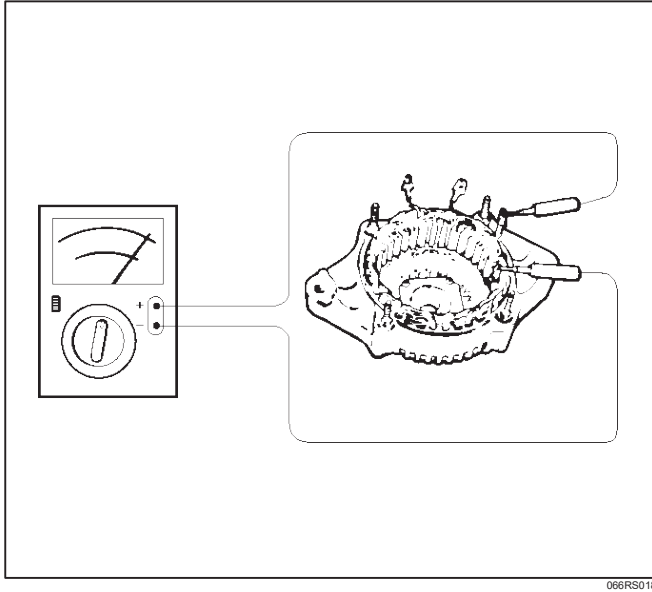


066RS017

6D3-24 STARTING AND CHARGING SYSTEM

Stator Coil

1. Measure resistance between respective phases.
2. Measure insulation resistance between stator coil and core with a mega-ohmmeter.
If less than standard, replace the coil.

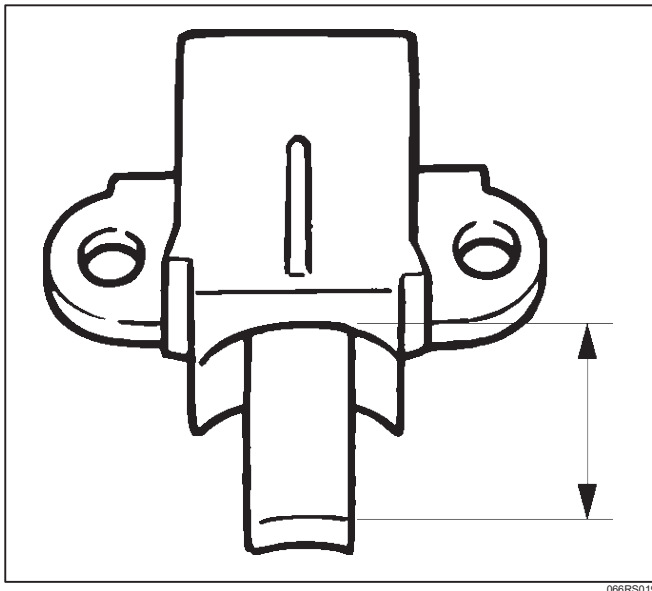


Brush

Measure the brush length.
If more than limit, replace the brush.

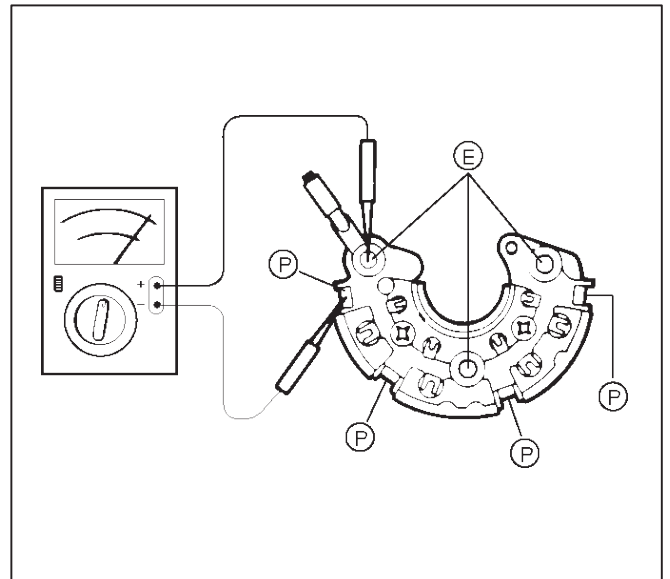
Standard: 10.mm (0.4134 in)

Limit: 8.4.mm (0.3307 in)



Rectifier Assembly

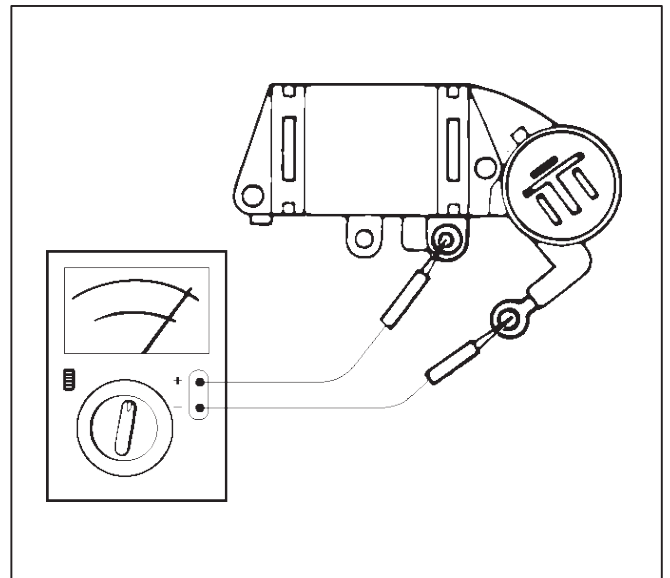
Check for continuity across "P" and "E" in the $\times 100W$ range of multimeter.



Change polarity, and make sure that there is continuity in one direction, and not in the reverse direction. In case of continuity in both directions, replace the rectifier assembly.

IC Regulator Assembly

Check for continuity across "B" and "F" in the $\times 100W$ range of multimeter.

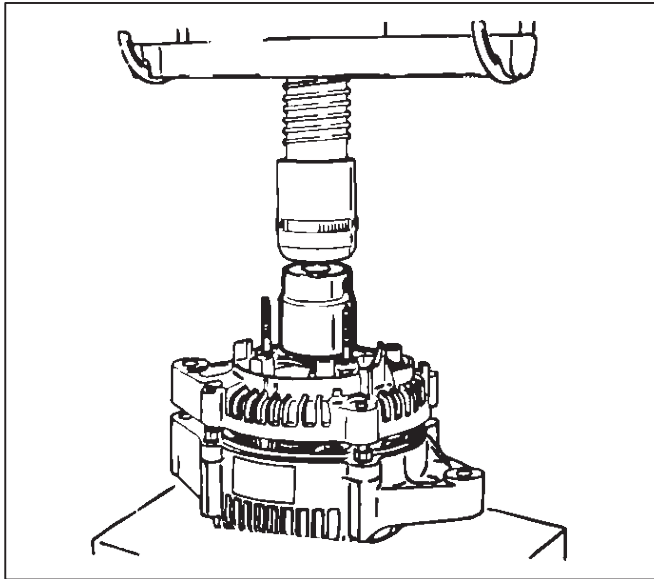


Change polarity, and make sure that there is continuity in one direction, and not in the reverse direction. In case of continuity in both directions, replace the IC regulator assembly.

Reassembly

To reassemble, follow the disassembly steps in the reverse order, noting the following points:

1. Using a press with a socket wrench attached, reassemble rotor and rear end cover assembly in the front cover.

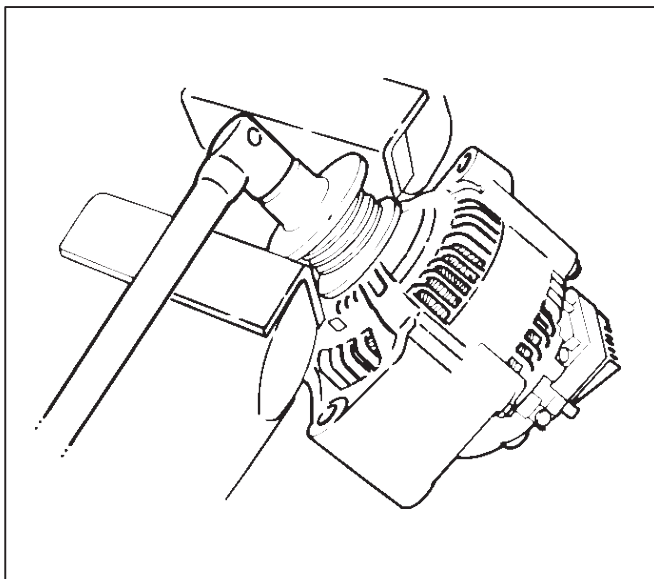


066RS022

2. Install pulley on the rotor.

Secure the pulley directly in the vise between two copper plates, and tighten nut to the specified torque.

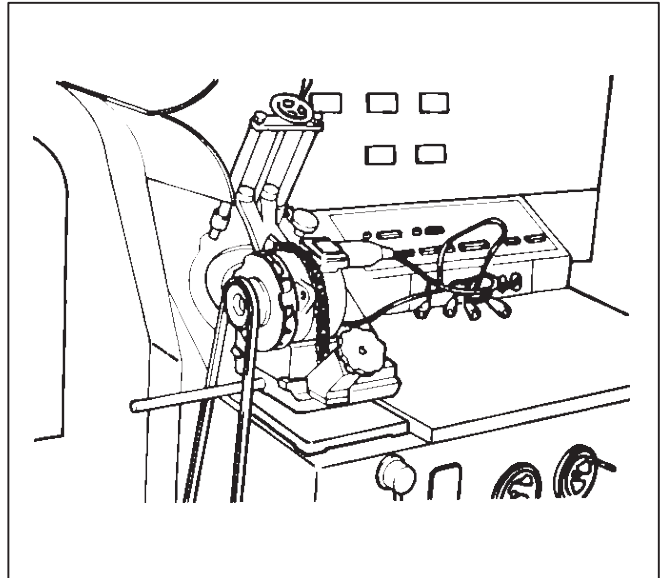
Torque: 111 N·m (82 lb ft)



066RS010

Bench Test

Conduct a bench test of the generator.



066RS023

Preparation

Remove generator from the vehicle (see "Generator removal").

1. Secure generator to the bench test equipment and connect wires.

Terminal "IG" for energization

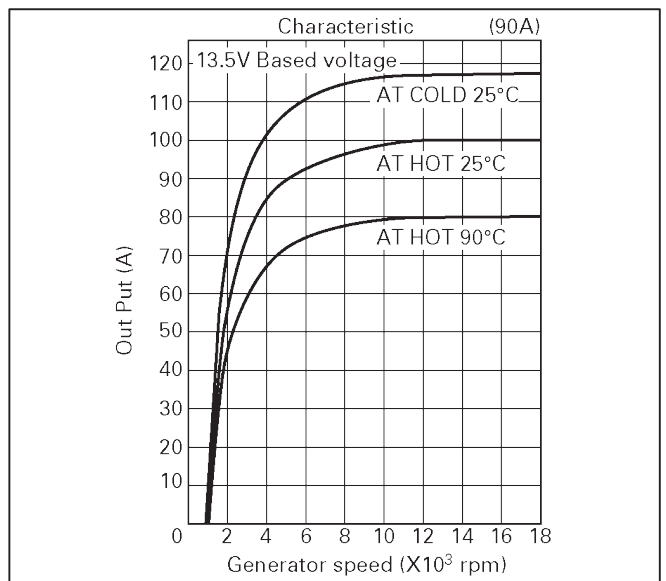
Terminal "L" for neutral (warning lamp)

Terminal "B" for output

2. Conduct the generator characteristic test.

Characteristics of generator are shown in illustration.

Repair or replace the generator if its outputs are abnormal.



B06RX001

Main Data and Specifications**General Specifications**

Parts Number (Nippon denso)	102211—1740
Model	ACJV74
Rated voltage	12 V
Rated output	90 A
Rotating direction (As viewed from pulled)	Clockwise
Pulley effective diameter	57.5 mm (2.26 in)
Weight	49.7 N (11.2 lb)