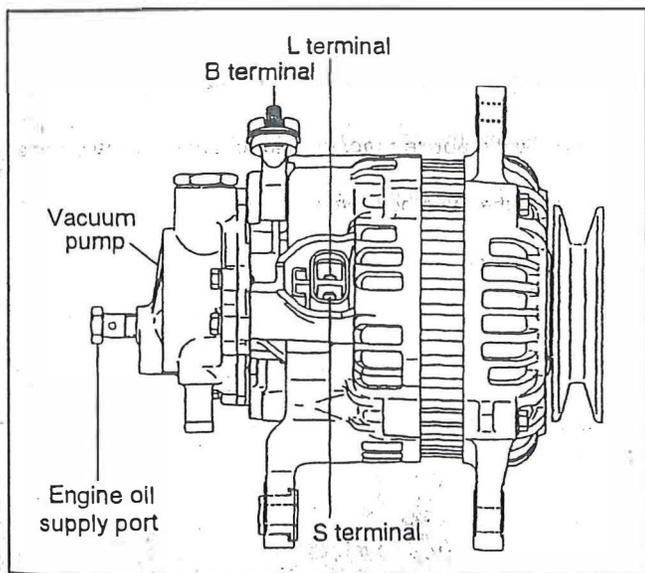


ALTERNATOR

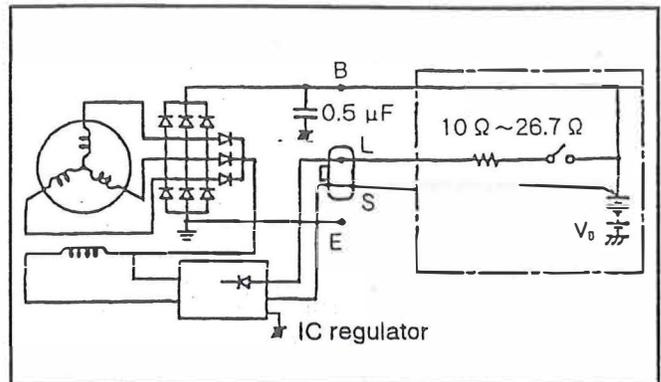
ALTERNATOR SPECIFICATIONS

Model name		A002T19384	
Manufacturer		Mitsubishi Electric	
Nominal output		12 volt 50 amp	
Ground polarity		Negative ground (-)	
Pulley rotation direction		CW (Clockwise) (from pulley side)	
Output current	Voltage	13.5 volts	
	Hot	16 amps	41 amps
	Cold	22 amps	48 amps
	Revolution	1300 rpm	2500 rpm
Regulator type		IC regulator	
Unloaded regulated voltage		14.4 ± 0.3 volt	
Brush	Quantity	2	
	Standard size new	23 mm / (.9055 in)	
	Wear limit	8 mm / (.3150 in)	

ALTERNATOR CONNECTION ILLUSTRATION



ALTERNATOR CIRCUIT SCHEMATIC



CAUTION: Do not reverse the battery connections. (The rectifier will be damaged.)



CAUTION: Battery voltage is supplied to the alternator's B and S terminals at all times. Avoid short circuits. (Disconnect the negative (-) battery terminal prior to removing the alternator.)



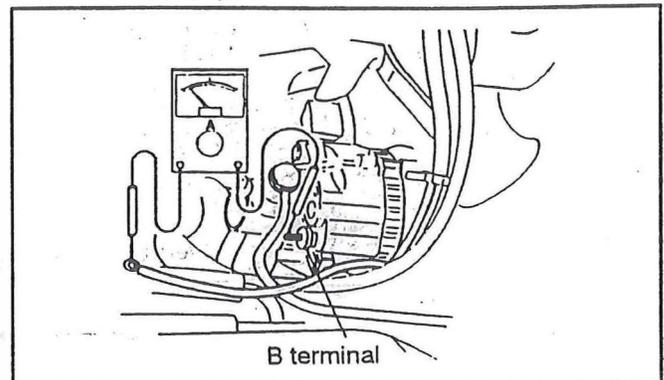
CAUTION: Do not ground the L or B terminals during engine operation.



CAUTION: Do not start engine with the wiring to the IC regulator and the LS connector disconnected.

ALTERNATOR NO-LOAD OUTPUT TEST

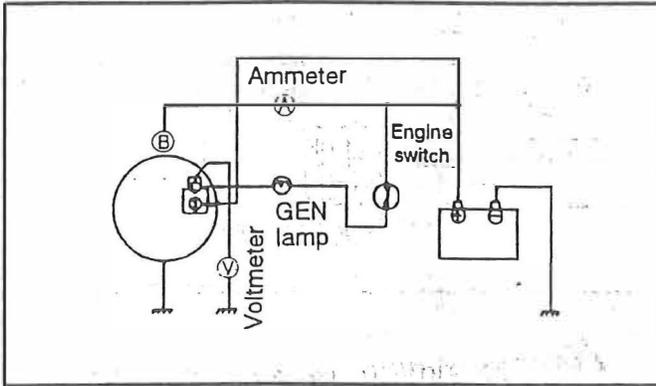
1. Verify that the battery is completely charged.



2. Disconnect the negative (-) battery cable.

3. Connect the volt-ohmmeter and ammeter as shown in the circuit diagram.

ALTERNATOR CIRCUIT DIAGRAM



NOTE: Connect the voltmeter (+) terminal to the alternator L terminal.

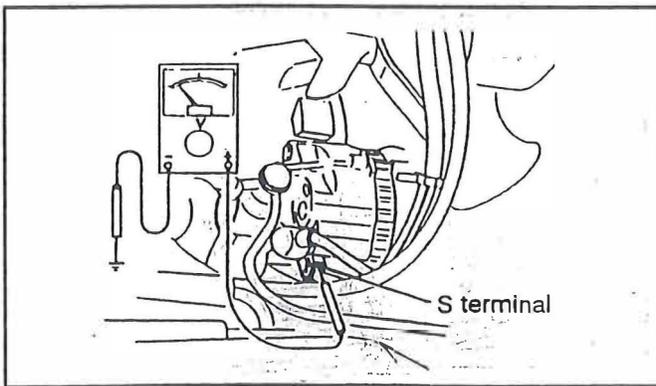
4. Reconnect the negative (-) battery terminal, and turn the key switch "ON". Verify that the voltmeter's reading is less than battery voltage.

Standard value: 0.5-4.0 volts.

If battery voltage is present, the alternator may be defective.

5. Remove the voltmeter (+) terminal from the alternator L terminal.

6. Connect the voltmeter (+) terminal to the alternator S terminal.



7. Start the engine and raise the alternator speed to 5000 rpm (engine speed 2000-2400 rpm) in the no-load state (lights and all electrical accessories "OFF"):

8. Read the ammeter and voltmeter readings.

Standard value with fully charged battery:

Ammeter 5 amps or less

Voltmeter 14.4 ± 0.3 volts @ 20°C / (68°F)

NOTE: The ammeter reading may be higher than the standard value if the battery is not completely charged.

ALTERNATOR LOADED OUTPUT TEST

1. Connect the volt-ohmmeter and ammeter as shown in the circuit diagram. Start the engine.

2. Raise the engine speed to 2000-2400 rpm with all electrical accessories "ON".

3. Read the ammeter. Alternator output current should be greater than the value recorded on the ammeter during the no-load test. Maximum alternator output current should be greater than 90% of the rated output current.

NOTE: It may be necessary to apply an artificial load (Carbon pile load tester, etc.) to the electrical system to obtain maximum alternator output. Follow manufacturer's instructions.

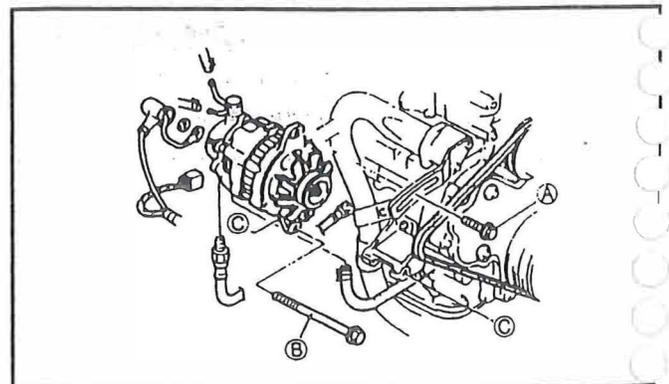
ALTERNATOR REMOVAL AND INSTALLATION

1. Disconnect the negative (-) battery terminal.
2. Remove the alternator wiring (B terminal, L,S connector).
3. Remove bolt A.
4. Remove the drive belt.
5. Remove the oil lines.
6. Remove bolt B, and remove the alternator.
7. Follow the above procedure in reverse to install.
8. Adjust the drive belt tension.
9. Tighten bolts A and B.

Tightening torque:

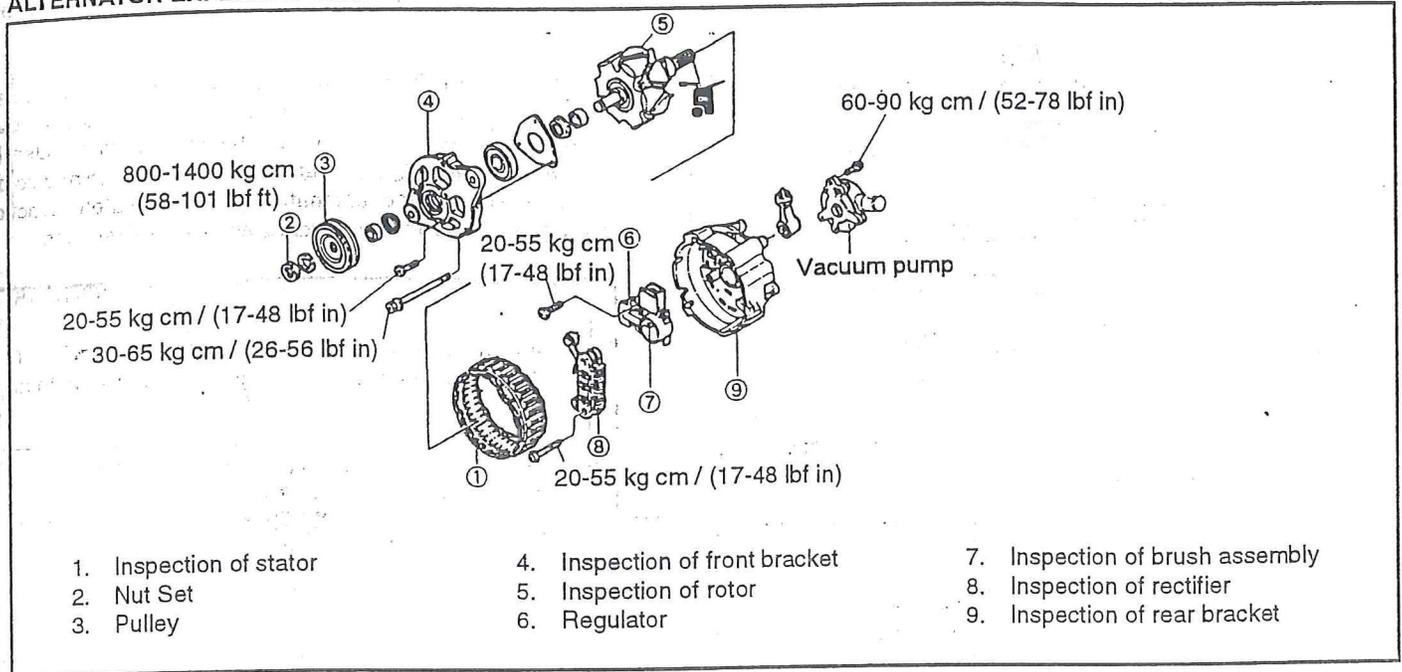
Bolt A: 1.9-2.6 kgm / (165-226 lbf in)

Bolt B: 3.8-5.3 kgm / (330-460 lbf in)



ALTERNATOR DISASSEMBLY

ALTERNATOR EXPLODED VIEW

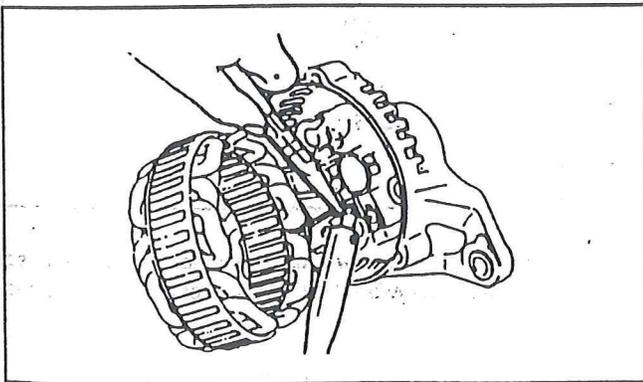


STATOR REMOVAL



CAUTION: The semiconductors for the regulator and rectifier may be damaged if the parts are overheated during the soldering operation. Use low heat and a heat sink (pliers, etc.) when performing any soldering operations on the alternator. Standard safety practices should be observed to prevent damage to the rectifier.

1. Un-solder the stator lead wires from the rear bracket and remove the stator.

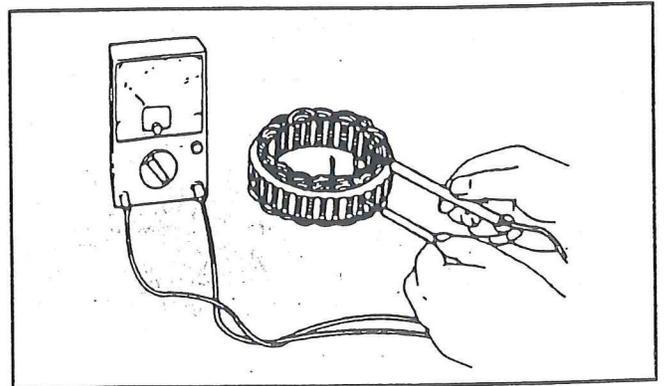


STATOR INSPECTION

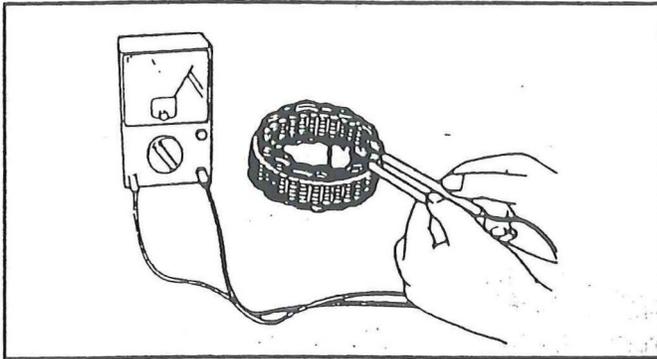
1. Check the continuity between the core and each lead wire with an ohm meter.

The parts are normal if there is no continuity.

NOTE: The parts of the core painted with green paint have been insulated. Place the probe terminal on other areas during testing.



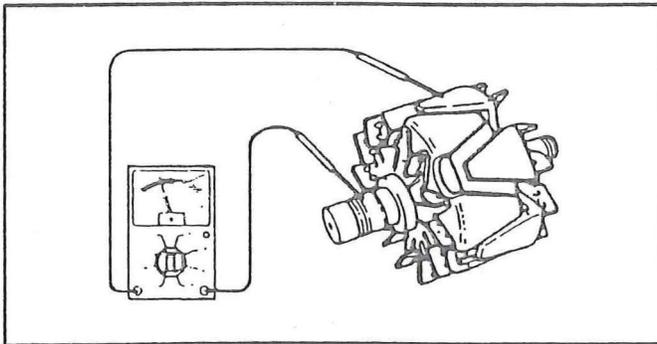
2. Check the continuity between the lead wires with an ohm meter.
Standard value: .16 Ω



The parts are normal if there is continuity.

ROTOR INSPECTION

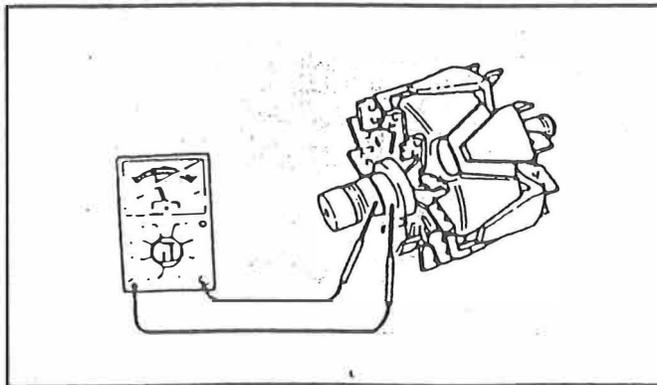
1. Check the continuity between the core and each slip ring with an ohm meter.



The parts are normal if there is no continuity.

2. Check the resistance between both slip rings with a volt-ohmmeter.

Standard value: $4-5 \Omega$ @ 20°C / (68°F)

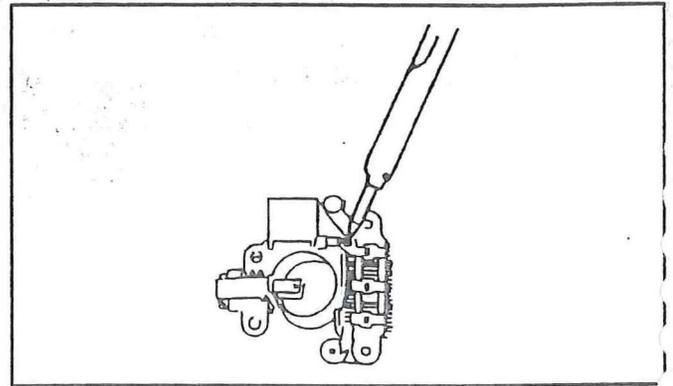


RECTIFIER REMOVAL

1. Un-solder the rectifier from the brush assembly and separate.

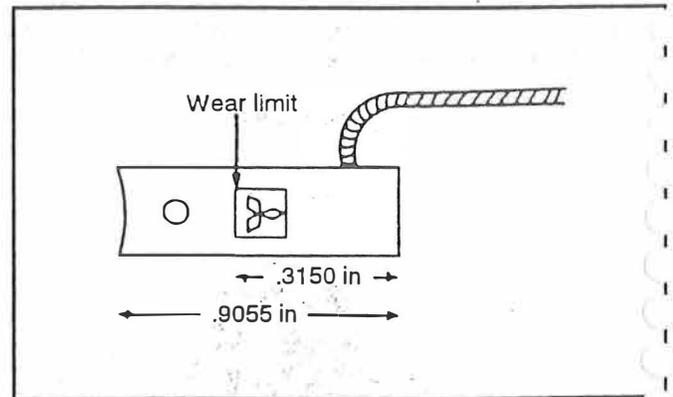


CAUTION: The semiconductors for the regulator and rectifier may be damaged if the parts are overheated during the soldering operations. Use low heat and a heat sink (pliers, etc.) when performing any soldering operation on the alternator. Standard safety practices should be observed to prevent damage to the rectifier.



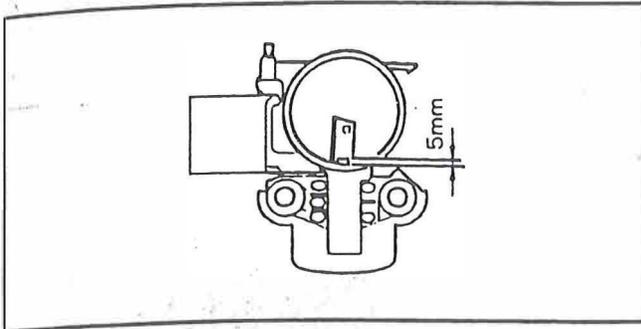
BRUSH INSPECTION AND REPLACEMENT

1. Measure the brush length. If the length is below the limit value, replace the brush. Un-soldering the old brush to replace.
Limit value: 8 mm / (.3150 in)



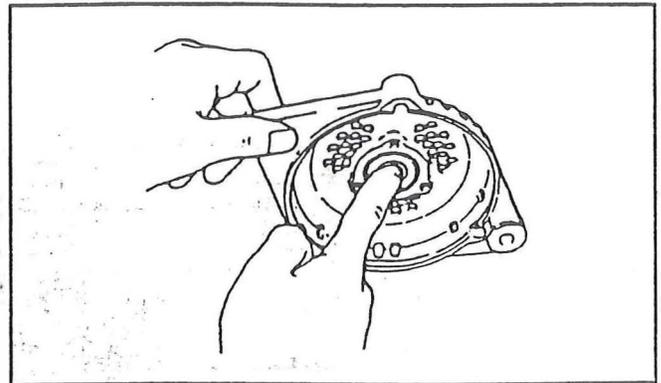
2. When installing a new brush, pull the lead wire and sold so that approximately 5 mm / (.1969 in) of the brush fits into the holder.

NOTE: Replace both brushes at the same time.



FRONT BEARING INSPECTION

1. If the front bearing is loose or makes an abnormal sound when turned with a finger, replace the bearing.



RECTIFIER INSPECTION

1. Set the ohm meter in the resistance range, and check the continuity of each rectifier at the test points listed below.

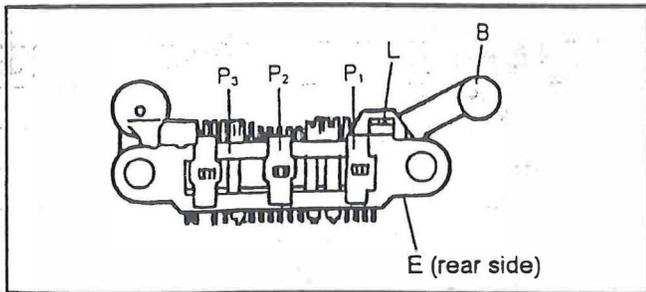
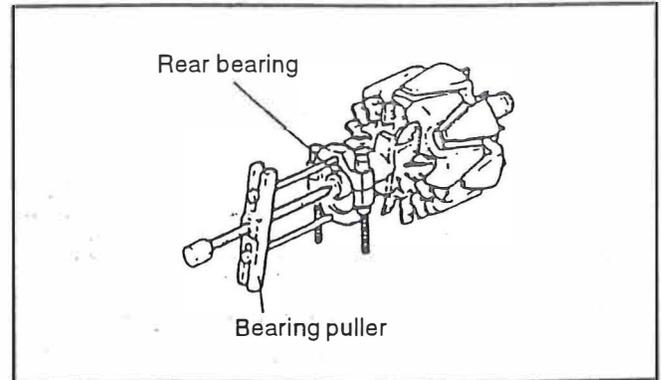
Ohm meter (-) terminal	Ohm meter (+) terminal	Standard value
E	P ₁ P ₂ P ₃	Continuity
B		No continuity
L		No continuity
P ₁ P ₂ P ₃	E	No continuity
	B	Continuity
	L	Continuity

If the measured values differ from the standard test values, replace the rectifier.

REAR BEARING INSPECTION

1. If the rear bearing is loose or makes an abnormal sound when turned with a finger, replace the rear bearing.

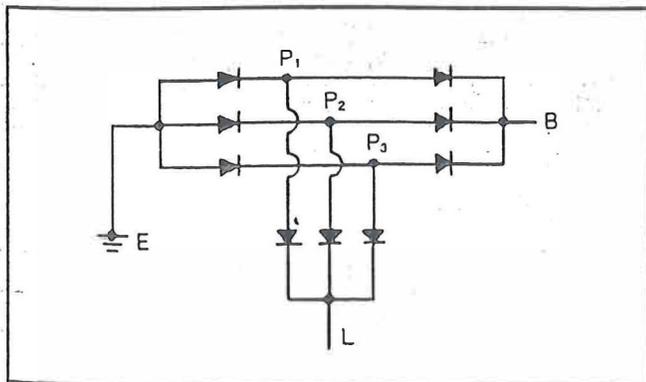
Use a commercial bearing puller for bearing removal.



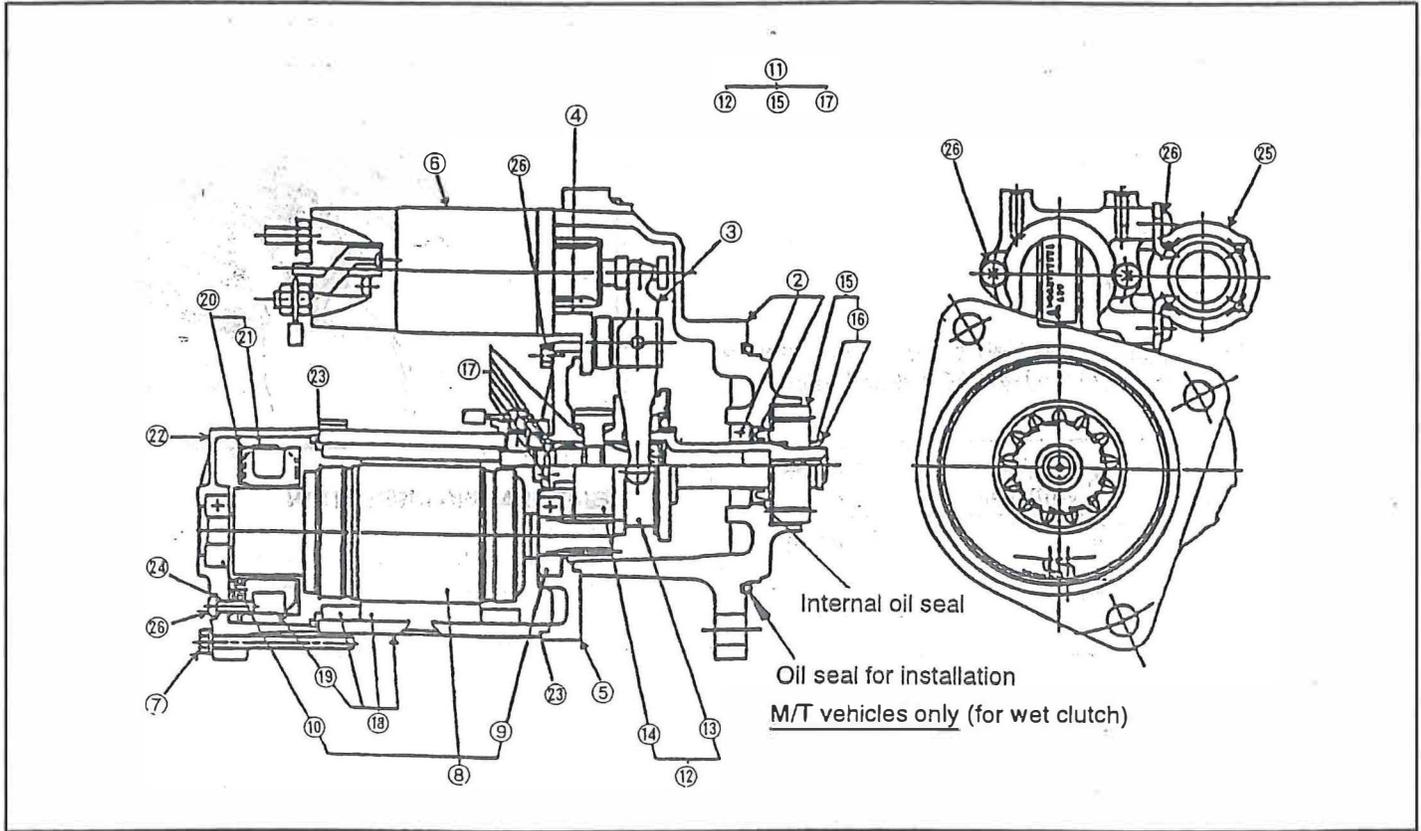
ALTERNATOR REASSEMBLY

Reverse the disassembly procedures to reassemble.

NOTE: Before installing the rotor in the rear housing, retract the brushes into the brush holder. Hold the brushes in this position using a piece of wire inserted through the hole in the rear of the housing. Remove the wire and verify that the brushes are contacting the slip ring after installing the rotor.



STARTER
STARTER ASSEMBLY ILLUSTRATION

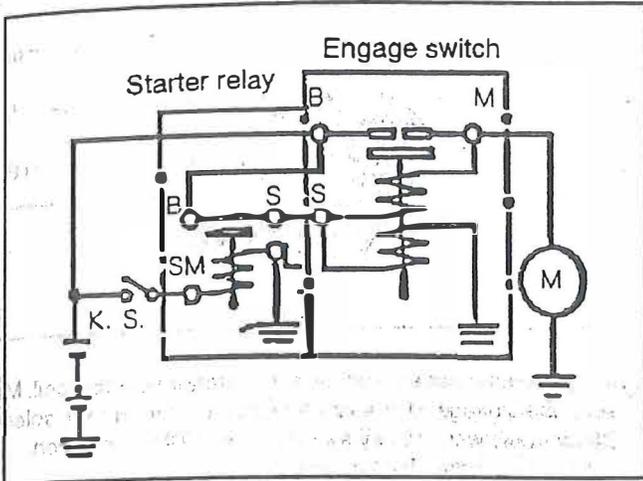


STARTER COMPONENTS LIST

#	Component	Description	Qty.
1		Starter assembly	1
2		Front bracket assembly	1
3		Shift lever assembly	1
4		Packing	1
5		Center bracket assembly	1
6		Switch assembly	1
7		Bolt set	1
8		Armature set	1
9		Bearing	1
10		Bearing	1
11		Shaft assembly clutch set	1
12		Gear set	1
13		Pinion shaft assembly	1

#	Component	Description	Qty.
14		Gear	1
15		Pinion set	1
16		Stopper set	1
17		Cover set	1
18		Field coil and frame assembly	1
19		Brush	2
20		Brush holder assembly	1
21		Spring brush	4
22		Rear bracket	1
23		Packing	2
24		Rubber ring	2
25		Switch assembly	1
26		Screw set	1

STARTER CIRCUIT DIAGRAM



STARTER SPECIFICATIONS

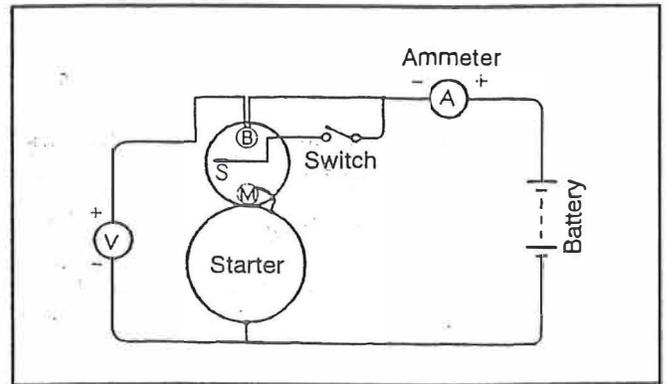
Model name	M003T67771	
Manufacturer	Mitsubishi Electric	
Applicable engine	TM	
Nominal output	12 volt, 2.2 kw	
Rated time	30 sec.	
Rotation direction	CW (Clockwise) (from pinion side)	
No-load test	Voltage	11 volt
	Current	180 amp or less
	Speed	3,800 rpm
Lock test	Voltage	2 volt
	Current	1050 amp
	Torque	3.0 kgm / (260 lbf in) or more
Magnet switch operation voltage	8 volt or less	
Brush	Quantity	4
	Standard size (new)	18 mm (.71 in)
	Wear limit	11 mm / (.43 in)
Commutator groove depth ⁴	0.5-0.8 mm (.0197-.0315 in)	

STARTER INSPECTION (ON VEHICLE)

Special tools required

Volt-ohmmeter	For starter inspection
Ammeter	To measure current draw

1. Verify that the battery is completely charged. Connect the voltmeter and ammeter as shown in the illustration. Connect a tachometer to measure engine rpm. Follow the manufacturer's recommendations when installing the tachometer.



2. Turn the key switch to engage the starter (start the engine). Measure current draw, battery voltage and engine rpm. Make note of any abnormal noise. Verify that there are no external conditions causing the starter malfunction. Check that the engine, transmission and hydraulic pump are free to rotate normally.

STARTER CURRENT DRAW SPECIFICATIONS

Standard (on vehicle):

Ambient Temperature	Current (amps)	Volts (approx.)	Minimum Speed (engine rpm)
0 °C / (32 °F)	650-700	8	200
-15 °C / (5 °F)	900-950	8	100

TEST RESULTS			Possible cause
Current draw	Battery voltage	Engine speed	
High	Low	Low / none	A,B,C
Low	High	Low	D,E
High	Low / normal	High	F

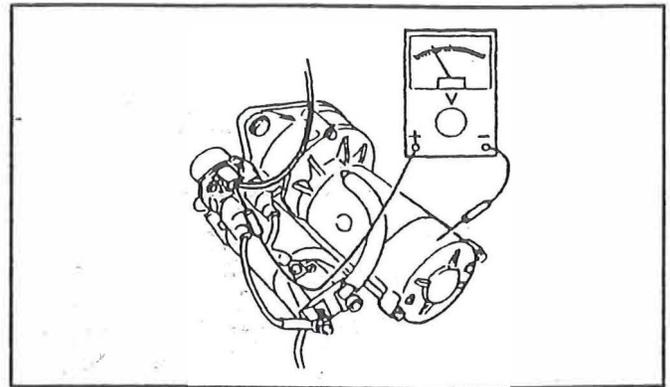
- A. Discharged or defective battery.
- B. Starter overload.
Tight or binding engine, transmission or hydraulic pump.

- C. Malfunctioning starter.
 - Armature or field coil shorted to ground.
 - Armature coil internal short.
 - Worn, damaged or seized bearings.
 - External short (solenoid to starter wiring).
 - Solenoid shorted to ground.
- D. Excessive voltage drop in the starter circuit.
 - High resistance or open in power wiring, battery connections, starter relay, starter solenoid, etc.
- E. Malfunctioning starter.
 - Armature or field coil open, brushes worn or sticking, commutator worn or dirty.
- F. Malfunctioning starter.
 - Shorted field coil.

NOTE: Proceed with the following steps to check the truck wiring if the starter will not operate.

STARTER CIRCUIT INSPECTION

1. Check for battery voltage at the starter solenoid input contact. Measure the voltage between the solenoid terminal (large red wire) and ground (starter body). Use a volt-ohmmeter.
Standard value: Battery voltage
If the correct voltage is not present, check the power cables (+) and (-) from the battery and the ground cable from the starter to the frame.
2. Check for battery voltage at the starter relay input contact. Measure the voltage between the terminal (black/white wire) and battery (-) (ground).
Standard value: Battery voltage
If the correct voltage is not present, check the power wire (black/white) from the starter solenoid to the relay.
3. Check for battery voltage at the starter relay coil. Measure the voltage between the coil (+) terminal (black/yellow wire) and ground (starter body). Measure the voltage with the key switch in the "START" position.
Standard value: Battery voltage
(approximately 8 volts during cranking)
If voltage is not present, check the fusible link, key switch, direction switches, neutral relay number 1, the associated wiring and the relay ground.



4. Check for battery voltage at the starter solenoid coil. Measure the voltage at the coil terminal on the starter solenoid (black wire) with the key switch in the "START" position.
Standard value: Battery voltage

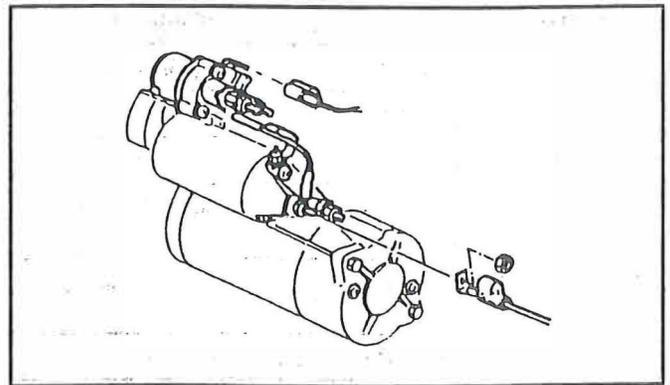
(approximately 8 volts during cranking)

If the correct voltage is not present, check the connections and the wire (black) between the starter relay output contact and the starter solenoid coil. Check the solenoid ground. If voltage is still not present, the starter relay may be defective.

5. If the correct voltage is present and the starter does not operate properly, remove the starter assembly, and inspect it.

STARTER REMOVAL AND INSTALLATION

1. Remove the negative battery (-) terminal.
2. Label the wiring to the starter, relays and solenoid. Remove the wiring from the starter assembly.

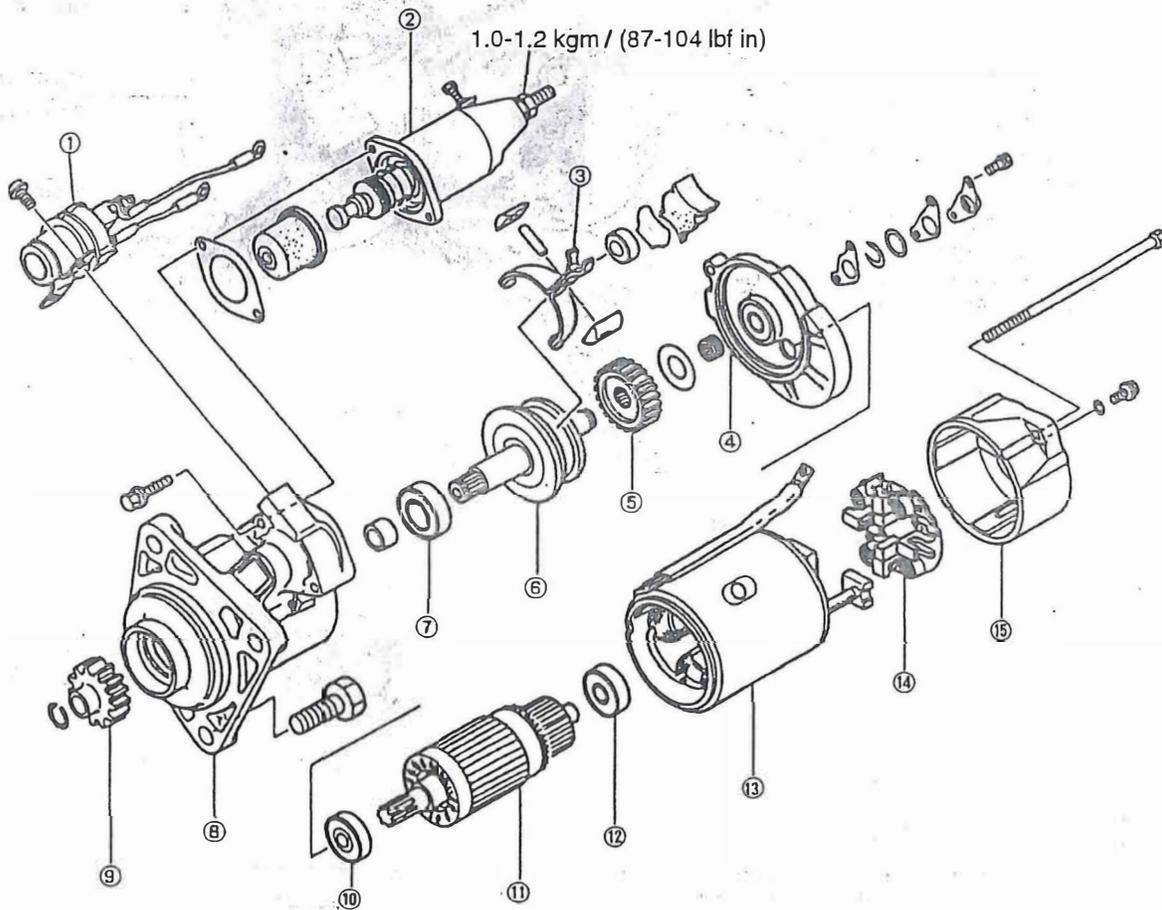


3. Remove the mounting bolts, and remove the starter from the engine.
4. Follow the above procedure in reverse to install.
Tightening torque: 7.3-8.8 kgm / (53-64 lbf ft)
See: "STARTER ASSEMBLY WIRING LAYOUT" for wire connections.

STARTER DISASSEMBLY

1. Disassemble the starter with the procedure shown in the exploded view.
2. Reverse the disassembly procedure to reassemble.

STARTER EXPLODED VIEW

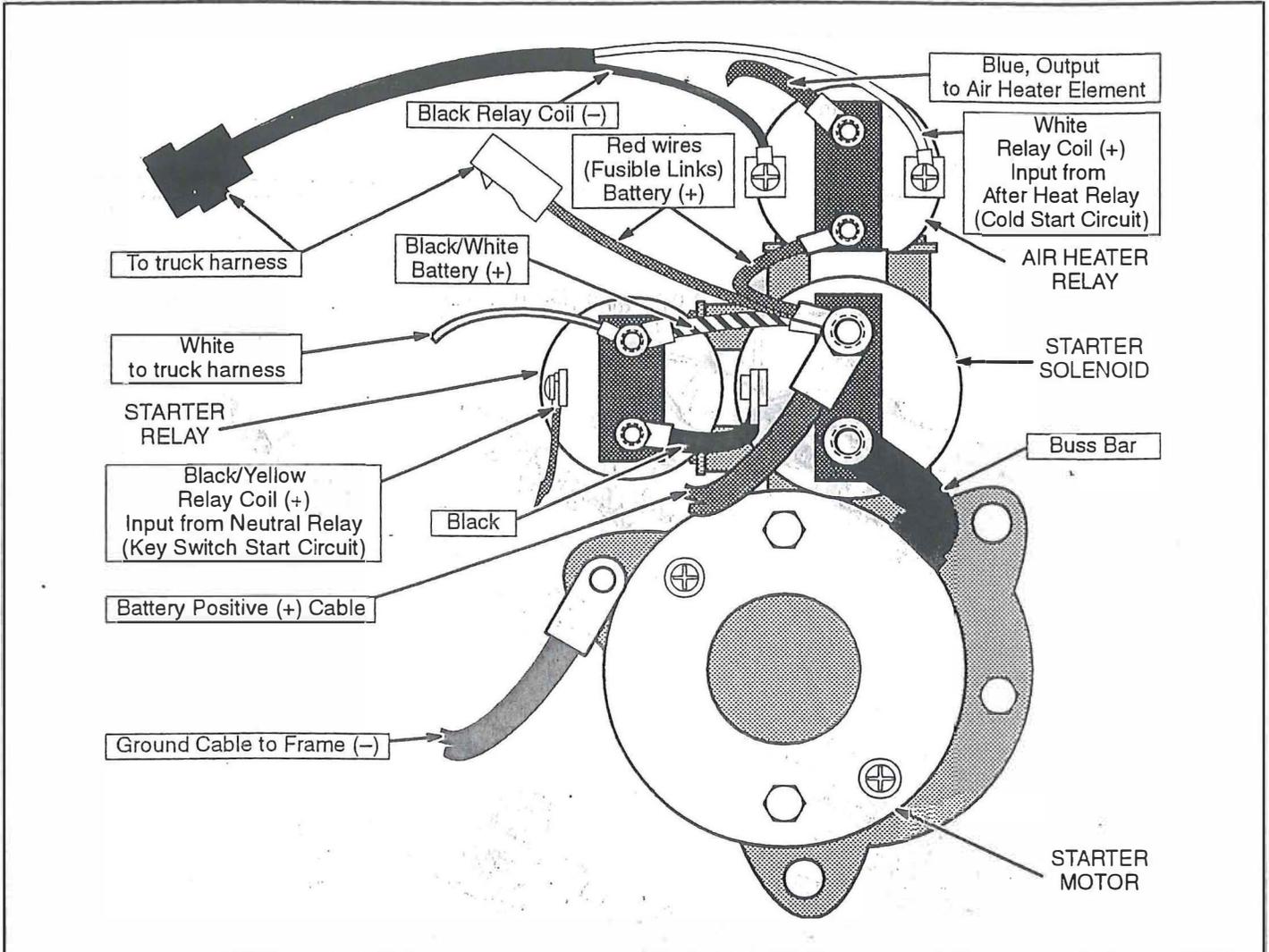


1. Inspection of auxiliary relay
2. Inspection of magnetic switch
3. Lever
4. Center bracket
5. Driving gear
6. Over running clutch

7. Bearing
8. Front bracket
9. Pinion gear
10. Bearing
11. Inspection of armature
12. Bearing

13. Inspection of field coil and frame
Replacement (brush)
14. Inspection of brush, brush holder
Replacement (brush)
15. Rear bracket

STARTER ASSEMBLY WIRING LAYOUT



STARTER RELAY BENCH TEST

NOTE: Disconnect all wires from the relay before performing the following test.

1. Check the continuity between the coil (+) terminal and ground (solenoid body) with the volt-ohmmeter. Standard coil resistance value: $2.96 \Omega @ 20^{\circ}\text{C} / (68^{\circ}\text{F})$. Replace the relay if there is no continuity. Check the continuity between each of the two (2) contact terminals and ground (relay metal body). Replace the relay if there is continuity. Check the continuity between the two (2) contact terminals. Replace the relay if there is continuity (relay coil deenergized).

