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This file was not scanned to deprive Mazda of any money – it was scanned due to the rareness of the original manuals and the overwhelming need of the RX-7 owner to have this information so that they can accurately troubleshoot problems. Perhaps if Mazda's dealerships could support the Rotary Engine it wouldn't be so necessary for the owners to do so.



Many thanks to Scott89t2 and www.1300cc.com for scanning this file.

1989 Mazda RX-7 Factory Service Manual

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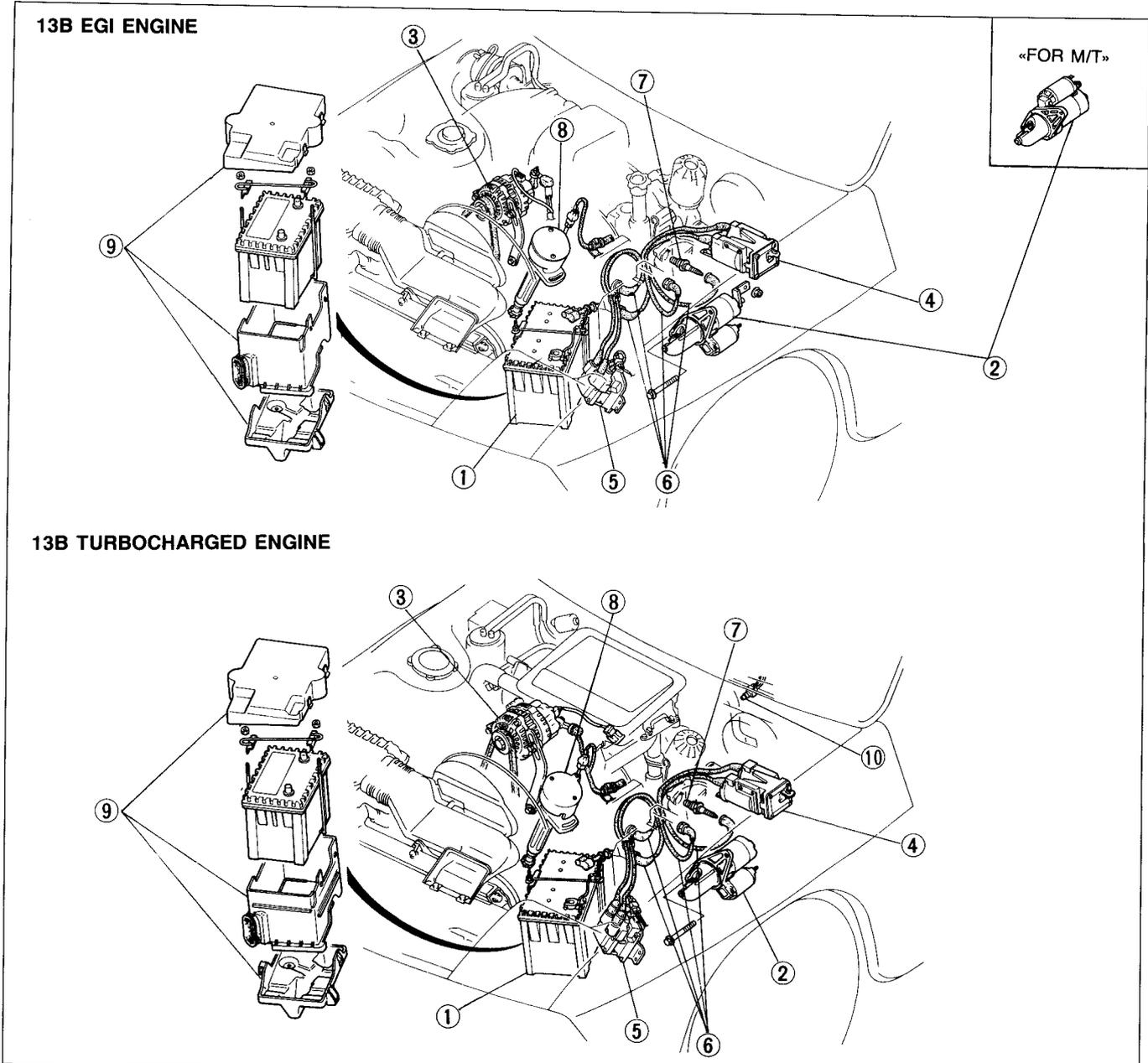
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ENGINE ELECTRICAL SYSTEM

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OUTLINE

STRUCTURAL VIEW



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| <p>1. Battery
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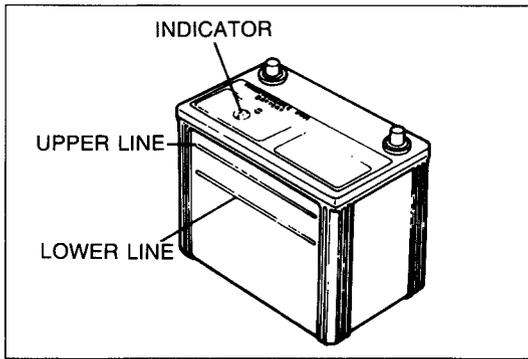
SPECIFICATIONS

Item		Engine models		13B EGI Engine		13B Turbocharged Engine	
				M/T	A/T	M/T	
Voltage		V		12, Negative ground			
Battery	Type and capacity (20-hour rate) (Maintenance free)		55D23L: 60 AH 65D23L: 55 AH (Coldproof area)				
Ignition system	Distribution		Control Unit				
	Spark timing (Test connector grounded)		Leading: 5° ± 1° ATDC Trailing: 20° ± 2° ATDC at idle (A/T: N range)				
	Spark advance		Control unit				
	Spark plug	Type	Trailing ; NGK BUR9EQ Leading ; NGK BUR7EQ				
Plug gap		mm (in)	1.4 (0.056)				
Alternator	Output		V-A		12-80		
	Regulated voltage		V		14.1—14.7 (with temperature—gradient characteristics)		
	Brush length	Standard	mm (in)	16.5 (0.650)			
		Wear limit	mm (in)	8.0 (0.315)			
Starter	Type		Coaxial reduction				
	Output		KW		1.2	2.0	1.2
	Output(No load)	Voltage	V	11.0			
		Current	A	Max. 90			
		Speed	rpm	Min. 3,000			
	Brush length	Standard	mm (in)	17.5 (0.689)			
Wear limit		mm (in)	10.0 (0.394)				

97U0GX-003

TROUBLESHOOTING GUIDE

Problem	Possible cause	Remedy	Page
Starter does not turn at all, or its turning speed is too slow to start the engine.	Battery and related parts Poor contact of battery terminals Poor grounding of negative cable Voltage drop caused by discharged battery Insufficient voltage caused by battery malfunction	Clean and tighten Clean and repair Recharge Replace	G- 5 — G- 5 G- 5
	Ignition switch and related parts Poor contact of ignition switch Loose ignition switch wiring or connector Broken wire between ignition switch and magnetic switch	Replace Repair Repair or replace	Section T G-22
	Magnetic switch and related parts Loose wiring and/or connectors Burnt magnetic switch contact plate or improper contact Broken wire in magnetic switch pull-in coil Broken wire in magnetic switch holding coil	Repair Replace Replace Replace	G-22 G-22 G-22 G-22
	Starter Poor contact of brushes Fatigued brush spring Commutator malfunction Grounded armature Worn parts Interlock switch malfunction	Adjust contact or replace Replace Repair or Replace Replace Replace Replace	G-23 G-24 G-21, 22 — — G-26
Starting problem	Insufficient battery capacity Malfunction of spark plug(s) Loose positive terminal Malfunction of coil with igniter	Recharge Clean, adjust or replace Tighten Replace	G- 5 G-27 — G-28,29,30
Starter turns but pinion gear does not mesh with ring gear	Starter Tip of overrunning clutch pinion is worn Weakened overrunning clutch drive spring Worn overrunning clutch Improper sliding of spline Worn bushing Worn ring gear	Replace Replace Replace Adjust contact and re- pair, or replace Replace Replace	— — — G-25 —
Starter turns continuously (does not stop)	Magnetic switch Sticking contact place of magnetic switch Layer shorting coil of magnetic switch Ignition switch does not return	Replace Replace Replace	G-22 G-22 Section T
Misfiring	Dirty or damaged spark plug(s) Malfunction of wiring, or open circuit Malfunction of coil with igniter	Clean or replace Repair or Replace Replace	G-27 G-27 G-28,29,30
Discharging of battery	Alternator Loose V belt Grounded or broken stator coil Broken rotor coil Poor contact of brush and slip ring Malfunction of rectifier Malfunction of IC regulator Battery and related parts Insufficient or unsuitable battery electrolyte Malfunction of battery electrode (internal short-circuit) Poor contact of battery terminal(s) Excessive electric load	Adjust Replace Replace Clean, repair or replace Replace Replace Adjust Replace Clean and tighten Check power consumption and short circuit	G-17 G-15 G-14 G-15 G-16 — G- 5 G- 5 G- 5 —
Overcharging of battery	IC regulator malfunction Operating at extremely high temperature	Replace Repair	— —



67U05X-005

BATTERY

INSPECTION Indicator Sign

1. Remove the battery cover.
2. Check that the indicator sign is blue.
3. If the blue indicator sign is not visible, check that the electrolyte level lies between the upper and lower lines.
4. If low, add distilled water, being careful not to overfill.
5. If the electrolyte level is acceptable and yet the blue indicator sign is not visible, the battery must be recharged.

Terminal and cable

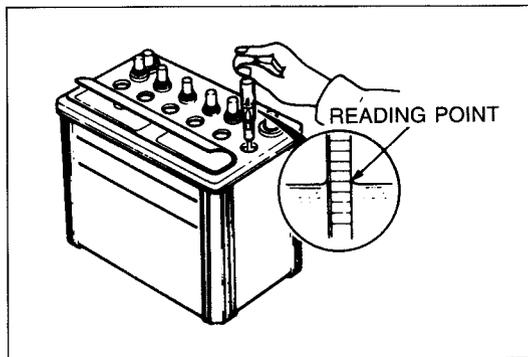
1. Check the tightness of the terminals to ensure good electrical connections. Clean the terminals and coat them with grease.
2. Inspect for corroded or frayed battery cables.
3. Check the rubber protector on the positive terminal for proper coverage.

67U05X-006

Temperature °C (°F)	Specific gravity of electrolyte
-40 (-40)	1.322
-30 (-22)	1.315
-20 (- 4)	1.308
-10 (14)	1.301
0 (32)	1.294
10 (50)	1.287
20 (68)	1.280
30 (86)	1.273
40 (104)	1.266
50 (122)	1.259
60 (140)	1.252

Charged rate ; 100%

97U0GX-005



67U05X-008

RECHARGING

Battery	Slow charge (A)	Quick charge (A)
55D23L	Under 6	Max. 20
65D23L	Under 5.5	

Quick Charging

Remove the battery from the vehicle and remove all the vent caps to perform a quick charge.

Slow Charging

It is not necessary to remove the vent caps to perform a slow charge.

Warning

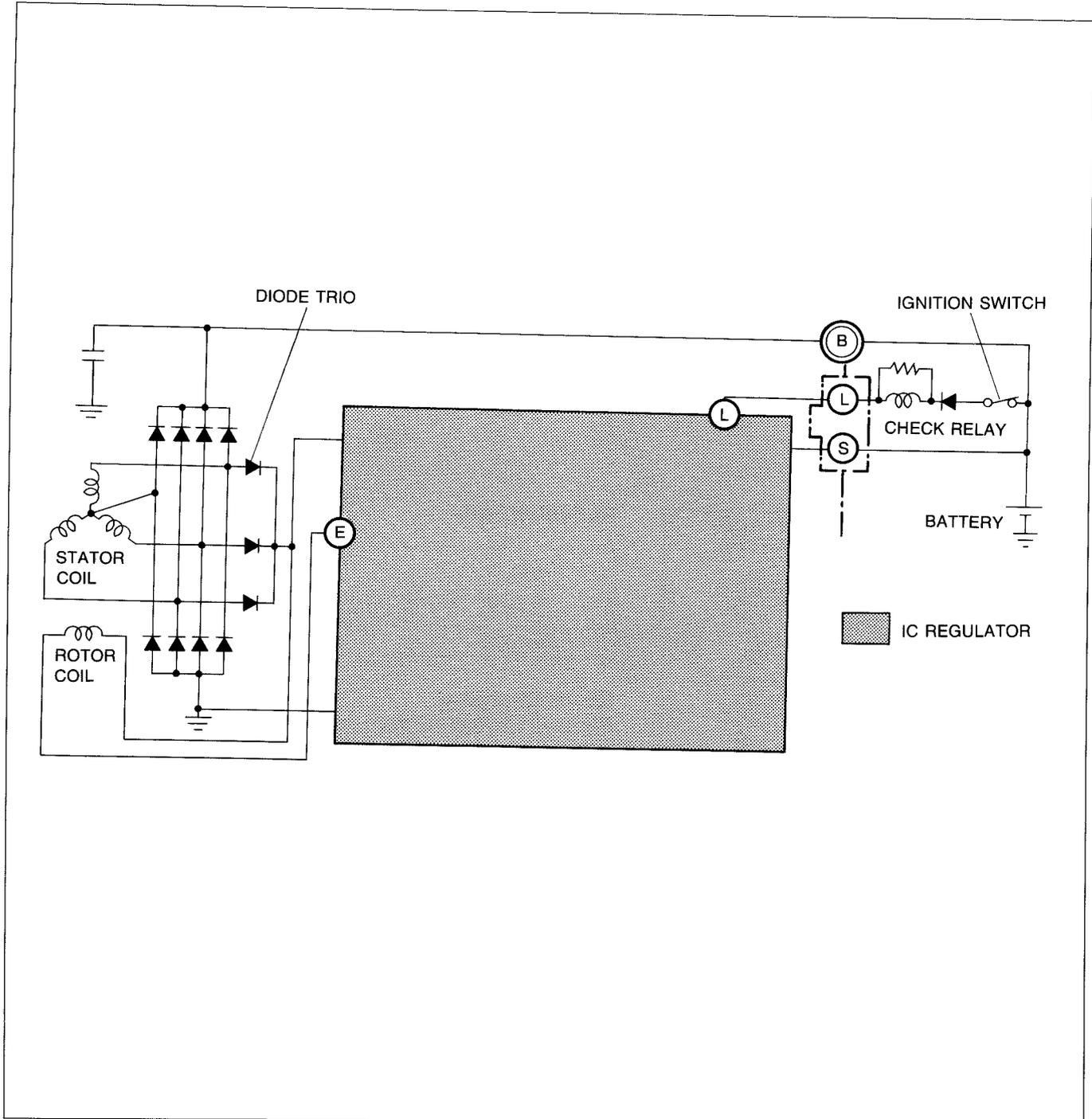
- a) Before performing maintenance or recharging the battery, turn off all accessories and stop the engine.
- b) The negative cable must be removed first and installed last.

Note

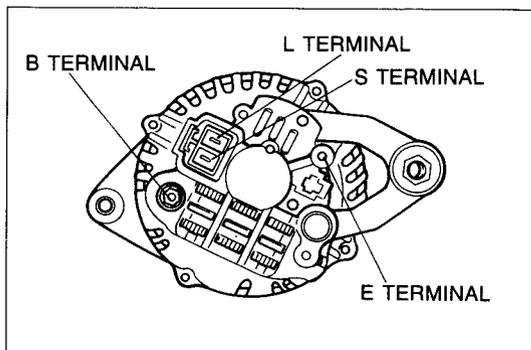
- a) If the indicator sign does not turn blue even after being charged, measure the specific gravity with a hydrometer. If the specific gravity is under 1.230, charge once more.
- b) If the indicator sign does not turn blue when the specific gravity is normal, the indicator could be defective.

ALTERNATOR

CHARGING SYSTEM



67U05X-009



97U0GX-017

Caution

- Be sure the battery connections are not reversed, because this will damage the rectifier.
- Do not use high-voltage testers, such as a megger, because they will damage the rectifier.
- Remember that battery voltage is always present at the alternator (B) terminal.
- Do not ground the (L) terminal while the engine is running.
- Do not start the engine while the coupler is disconnected from the (L) and (S) terminals.

ON-VEHICLE INSPECTION

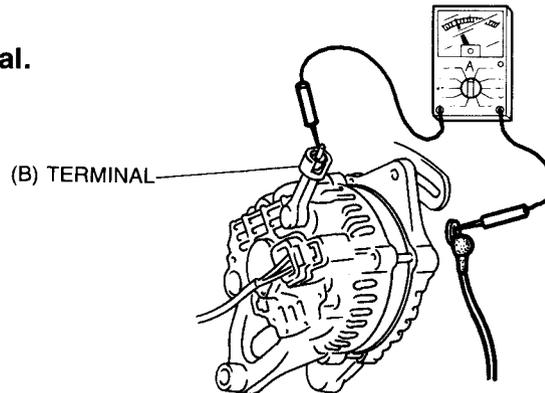
Battery Discharges

TEST 1: Output current inspection (Load condition)

1. Disconnect the battery \ominus terminal.
2. Disconnect the wire connected to the alternator (B) terminal, and connect an ammeter (**60A or more**) between the wire and the terminal.
3. Reconnect the battery \ominus terminal.
4. Turn all headlights and accessories on, and depress the brake pedal.
5. Start the engine and read indication at **2,500—3,000 rpm**.

Caution

Do not ground the (B) terminal.



97U0GX-006

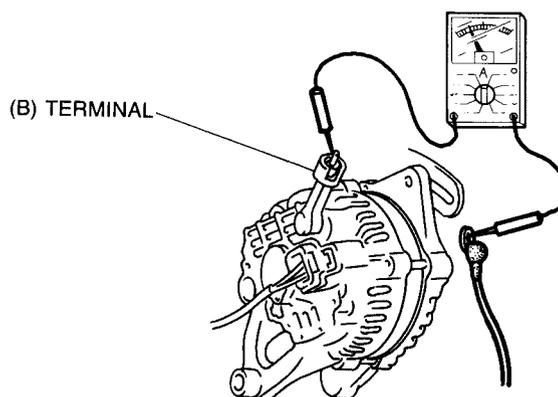
Max. 60A or less

60A or more

Alternator normal

TEST 2: Output current inspection (No-load condition)

1. Turn all electric loads off and release the brake pedal.
2. Charge the battery until the charging rate indication becomes **less than 5A**, or replace the battery with a fully charged one. Then read the ammeter indication at approx **2,500 rpm**.



97U0GX-007

Less than 5A

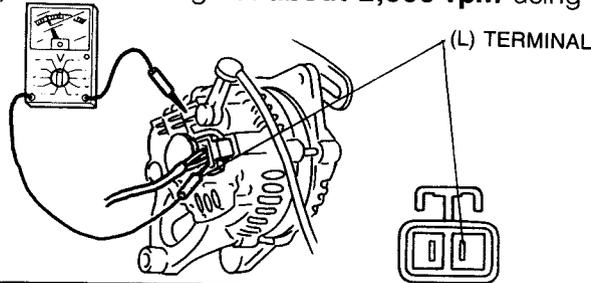
More than 5A

Go to TEST 4

Go to TEST 3

TEST 3: Regulated voltage inspection

1. Stop the engine and disconnect the battery \ominus terminal.
2. Reconnect the alternator (B) terminal.
3. Reconnect the battery \ominus terminal and then restart the engine.
4. Measure the (L) terminal voltage at **about 2,500 rpm** using a voltmeter.



97U0GX-008

14.1V—14.7V
(At 20°C, 68°F)

Less than 14.1V or more than 14.7V
(At 20°C, 68°F)

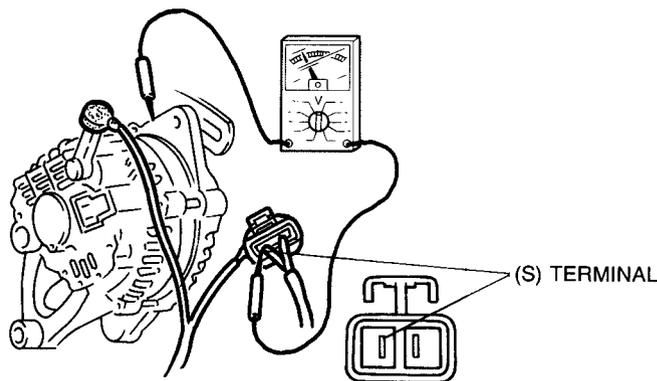
- Poor connection between (B) terminal and battery positive cable (Go to TEST 4)
- Poor connection of battery negative cable (Go to TEST 4)

Poor connection between 2-prong (S, L) connector and the battery positive cable (Go to TEST 3)

Problem in the stator coil or diodes (Refer to page G-15 or 16)

TEST 4: IC regulator power source inspection

1. Turn the ignition switch OFF.
2. Disconnect the (S) connector from the alternator terminal.
3. Turn the ignition switch on and measure the (S) terminal voltage at the connector.



97U0GX-009

Battery voltage

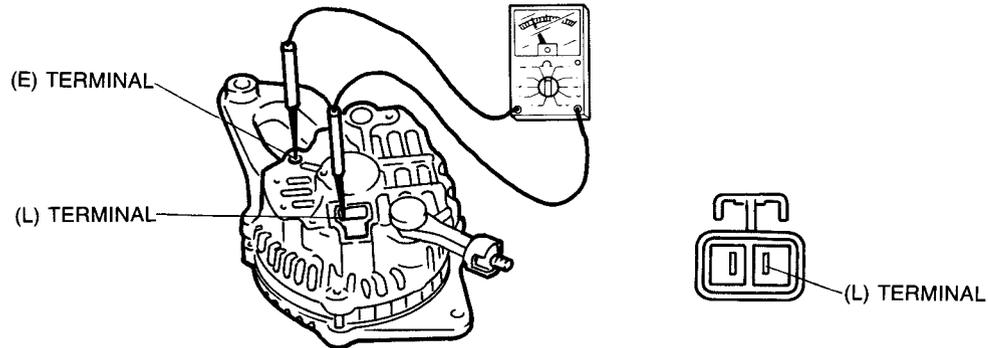
Go to TEST 5

Less than battery voltage

Problem in wiring harness

TEST 5: Rotor coil inspection

1. Turn the ignition switch off.
2. Disconnect the battery \ominus terminal.
3. Disconnect the (B) terminal from the alternator.
4. Measure the resistance with an ohmmeter between alternator (L) and (E) terminals.



97U0GX-010

2.0—4.0 Ω

Other than 2.0—4.0 Ω

Rotate pulley and inspect resistance between alternator (L) and (E) terminals again.

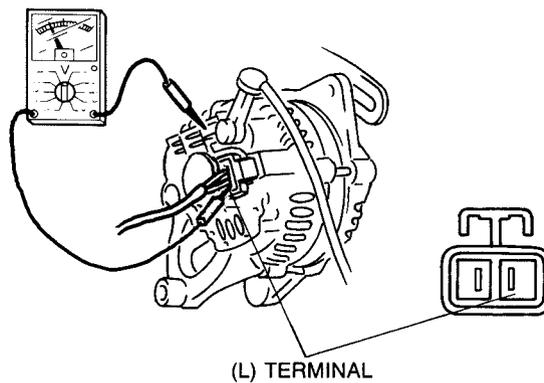
2.0—4.0 Ω

Other than 2.0—4.0 Ω

Problem in rotor coil or brush
(Refer to page G-14)

TEST 6: Alternator (L) terminal voltage inspection

1. Connect the (B) connector to the alternator.
2. Reconnect the battery \ominus terminal.
3. Turn the ignition switch on.
4. Measure the alternator (L) terminal voltage with a voltmeter.



97U0GX-011

1—3V

Over 3V

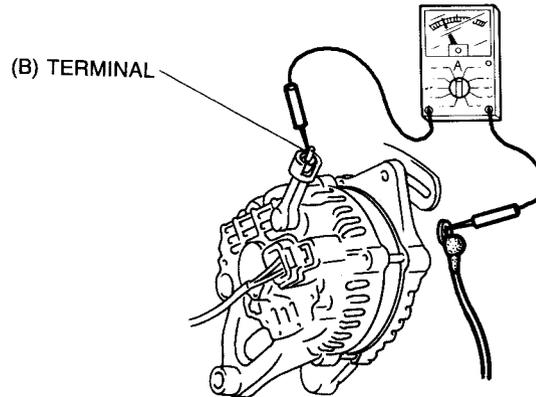
Alternator normal

Problem in IC regulator or rotor coil
(Refer to page G-14)

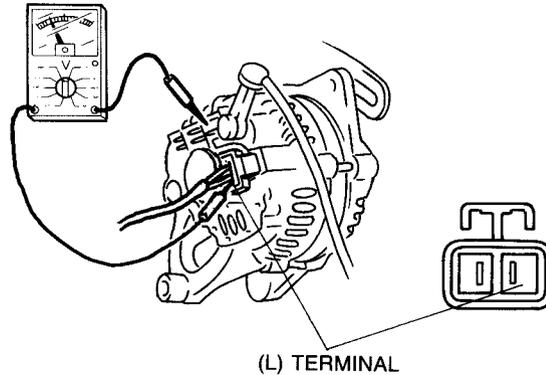
Battery Overcharge Problem

TEST 1: Output voltage inspection

1. Turn all electric loads off.
2. Disconnect the battery \ominus terminal.
3. Disconnect the wire connected to the alternator (B) terminal, and connect an ammeter (**60A or more**) between the wire and the terminal.
4. Reconnect the battery \ominus terminal.
5. Charge the battery until the charging rate becomes **less than 5A**, or replace the battery with a fully charged one. Run the engine at approx. **2,500 rpm**, and then read the meter, if it indicates less than 5A, go to TEST 5 and TEST 6.



6. If (B) terminal is less than 5A, measure the (L) terminal voltage at **about 2,500 rpm**.



97U0GX-012

More than 14.7V
(At 20°C, 68°F)

Problem in alternator

14.1—14.7V
(At 20°C, 68°F)

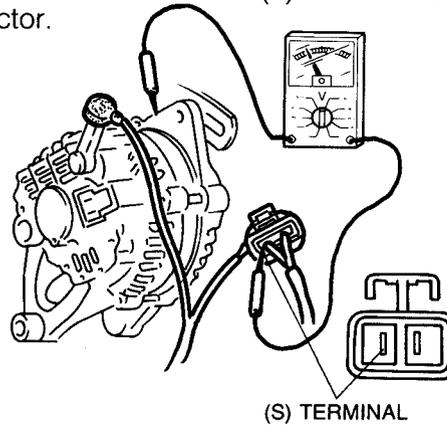
Alternator OK

If the battery discharges, perform TEST 2 and TEST 3.

77U05X-035

TEST 2: IC regulator power source inspection

1. Turn the ignition switch OFF.
2. Disconnect the (S) connector from the alternator.
3. Turn the ignition switch on and measure the (S) terminal voltage at the connector.
4. Reconnect the (S) connector.



97U0GX-018

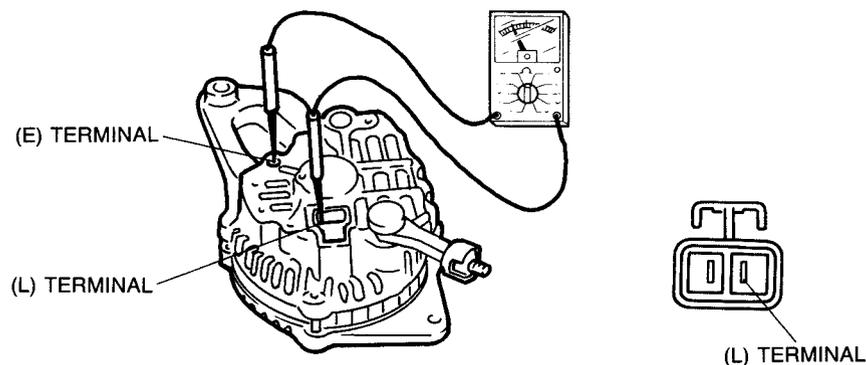
Battery voltage

Less than battery voltage

Problem in wiring harness

TEST 3: Rotor coil inspection

1. Turn the ignition switch off.
2. Disconnect the battery \ominus terminal.
3. Disconnect the (B) terminal from the alternator.
4. Measure the resistance between the alternator's (L) and (E) terminals.



97U0GX-013

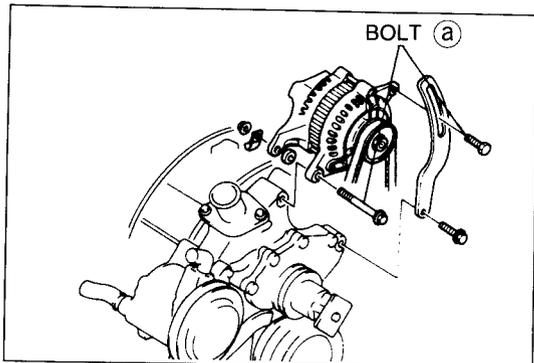
2.0—4.0 Ω

Other than 2.0—4.0 Ω

Problem in IC regulator
(Refer to page G-14)

Problem in rotor coil or brush
(Refer to page G-14)

G ALTERNATOR

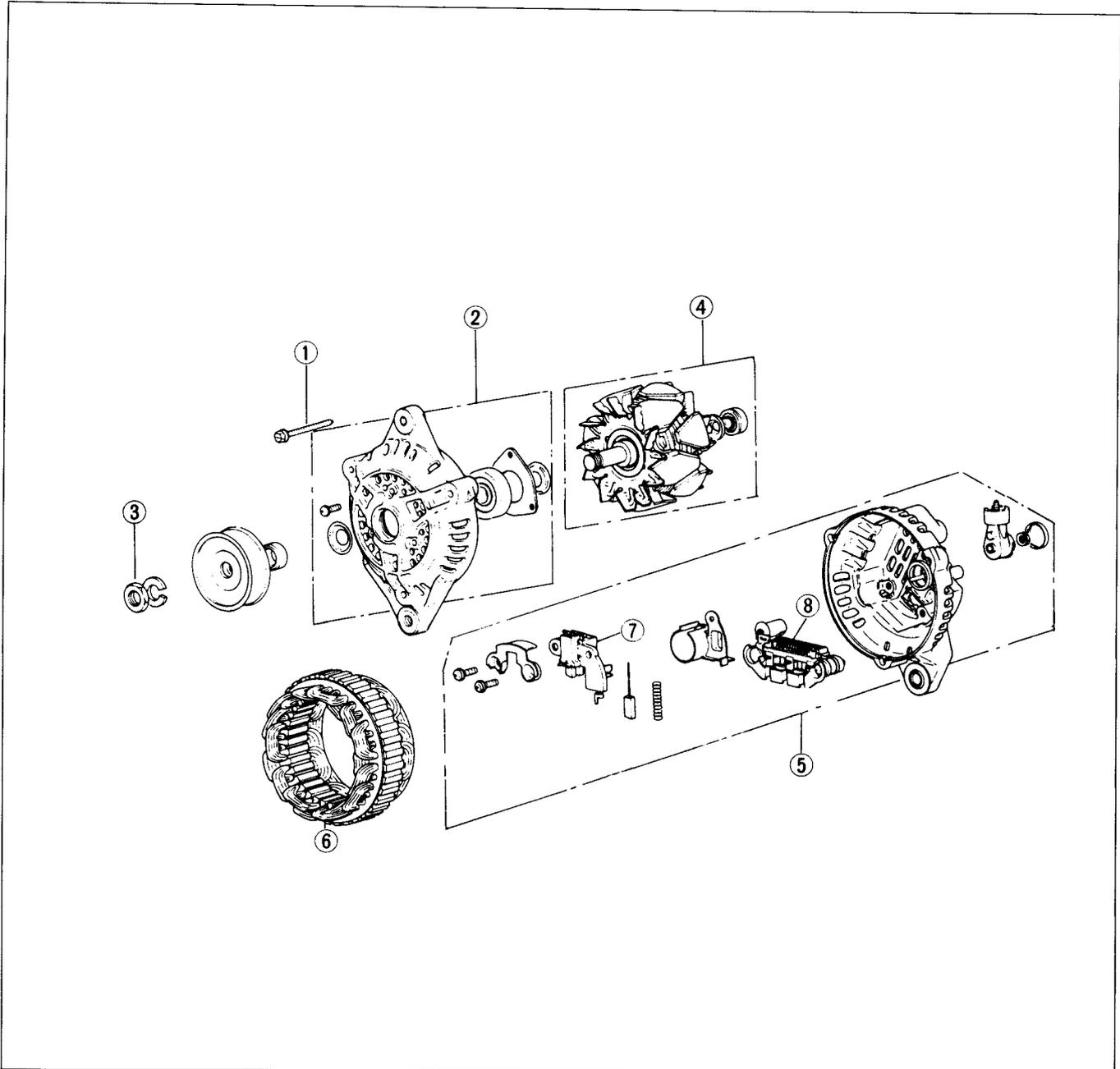


67U05X-011

REMOVAL

1. Disconnect the negative battery terminal.
2. Disconnect the wire and connector from the alternator.
3. Remove bolts (a).
4. Remove the following parts.
 - (1) V-belt.
 - (2) Alternator.

DISASSEMBLY

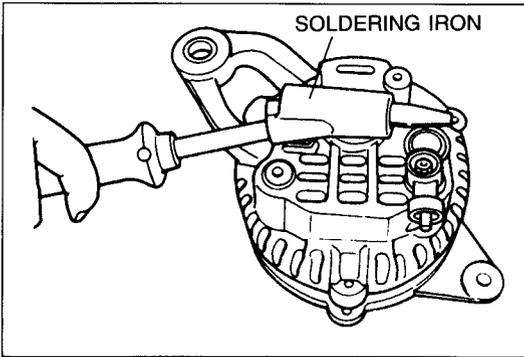


87U05X-011

1. Bolt
2. Front bracket assembly
3. Locknut and washer

4. Rotor and fan
5. Rear bracket assembly
6. Stator

7. Brush holder assembly
8. Rectifier and IC regulator

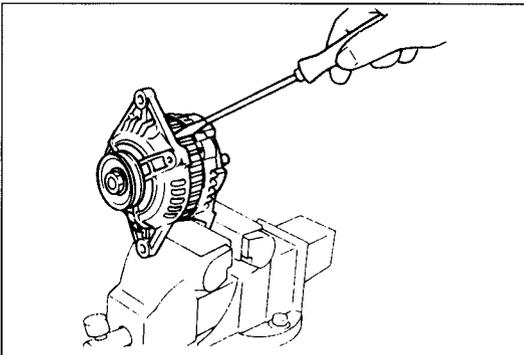


87U05X-012

Place a soldering iron (200W class) on the bearing box for **3 or 4 minutes** to heat to about **50—60°C (122—140°F)**.

Note

If the bearing box is not heated, the bearing cannot be pulled out, because the rear bearing and rear bracket fit together very tightly.



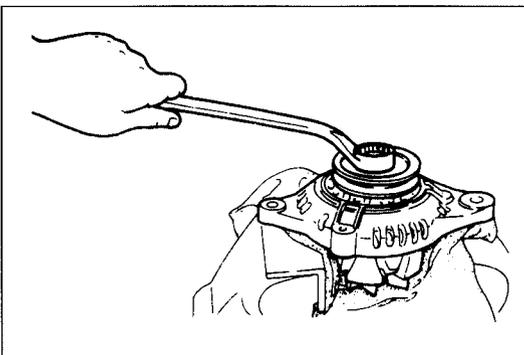
67U05X-014

Front Bracket and Rotor

1. Remove the three bolts, and insert a flat-tip screwdriver between the stator core and front bracket and separate them.

Note

Be careful not to force the screwdriver in too far, because the stator may be scratched.

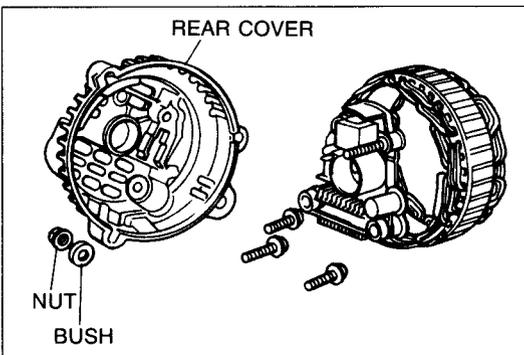


87U05X-013

2. Remove the locknut, and remove the pulley, rotor and front bracket.

Tightening torque:

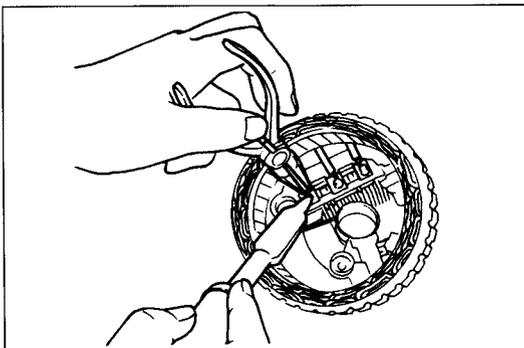
58.8—73.5 N·m (6—7.5 m·kg, 44—54 ft·lb)



67U05X-016

Rear Bracket and Stator

1. Remove the following parts.
 - (1) The nut of the B terminal.
 - (2) Insulation bushing.
 - (3) Rectifier holding screws.
 - (4) Brush holder holding screw.

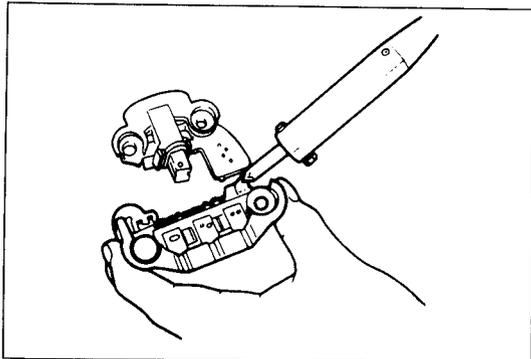


67U05X-017

2. Use a soldering iron to remove the solder from the rectifier and the stator lead.

Caution

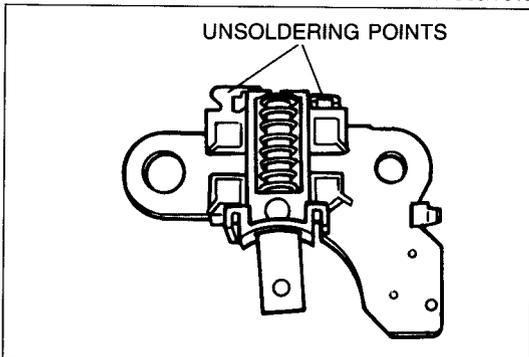
Disconnect quickly, use the soldering iron no more than about 5 seconds, because the rectifier may be damaged if it is overheated.



67U05X-018

IC Regulator and Rectifier

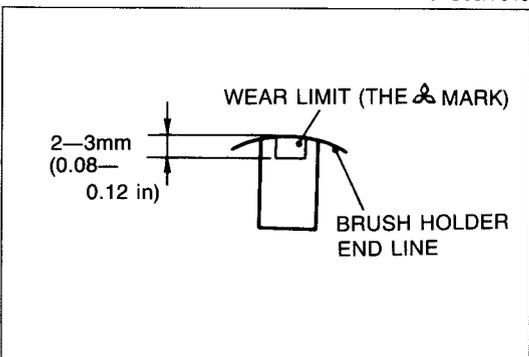
Use a soldering iron to remove the IC regulator from the rectifier.



67U05X-019

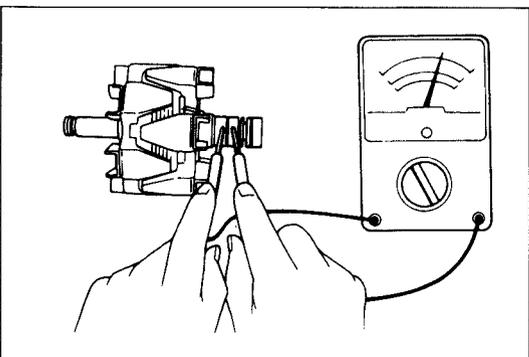
Brush

1. Remove the solder from the pigtail, then remove the brush.



67U05X-020

2. When soldering the brush, solder the pigtail so that the wear limit line of the brush projects **2 or 3mm (0.08—0.12 in)** out from the end of the brush holder.



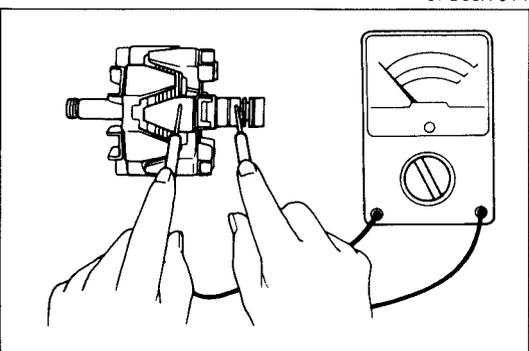
87U05X-014

INSPECTION

Rotor

1. Wiring damage

Check the resistance between the slip rings by using a circuit tester. It should be **2.0—4.0Ω**. Replace the rotor if it is not within this range.



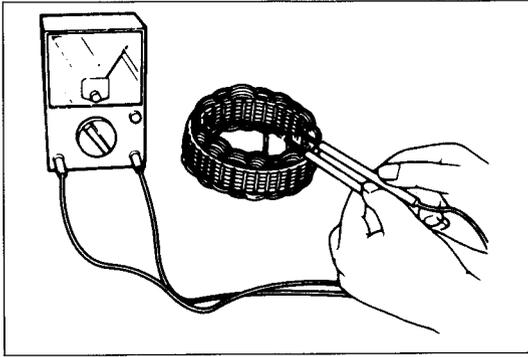
67U05X-022

2. Ground of rotor coil

Check for continuity between the slip ring and the core by using a circuit tester. Replace the rotor if there is continuity.

3. Slip ring surface

If the slip ring surface is rough, use a lathe or fine sandpaper to repair it.

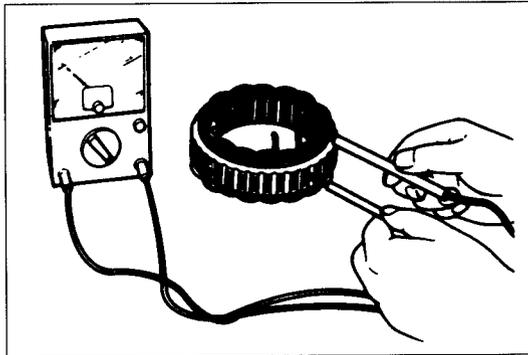


67U05X-023

Stator

1. Wiring damage

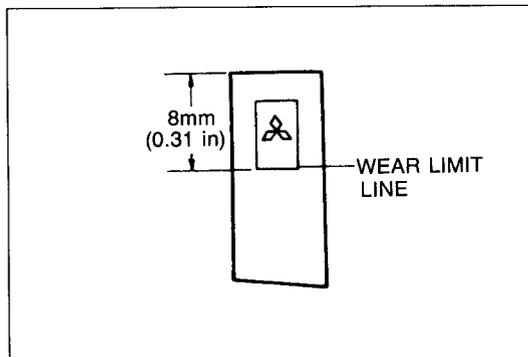
Check for continuity between the stator coil leads by using a circuit tester. Replace the stator if there is no continuity.



67U05X-024

2. Ground of stator

Check for continuity between the stator leads and the core by using a circuit tester. Replace the stator if there is continuity.

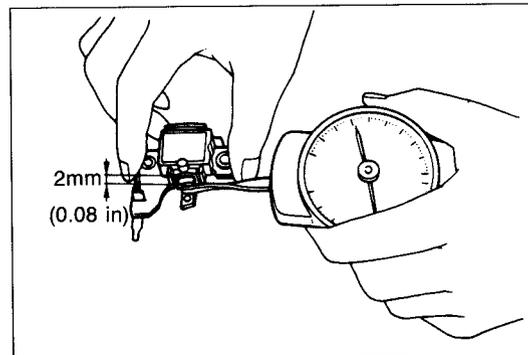


87U05X-015

Brush

Replace the brush if it is worn almost to or beyond the limit.

Length: 8mm (0.31 in) min.



87U05X-016

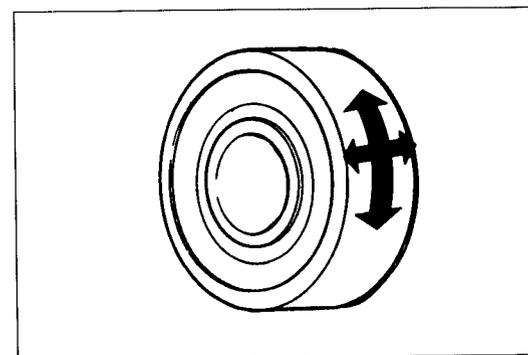
Brush spring

Measure the force of the brush spring by using a spring pressure gauge. Replace the spring if the force is less than **2.0 N (210 g, 0.46 lb)**.

Note

a) For a new brush the force is **2.9—4.3 N (300—440 g, 0.66—0.97 lb)**.

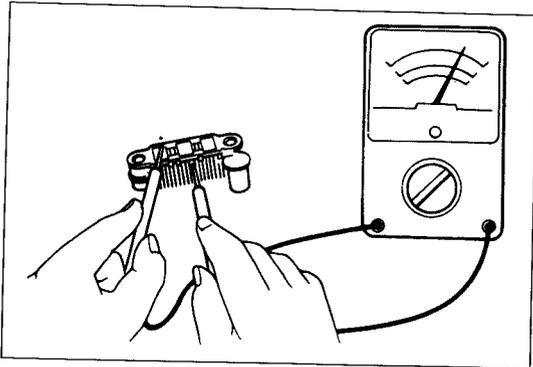
b) When making the measurement, use the spring pressure gauge to push the brush into the brush holder until the tip projects **2mm (0.08 in)**, read the force at that time.



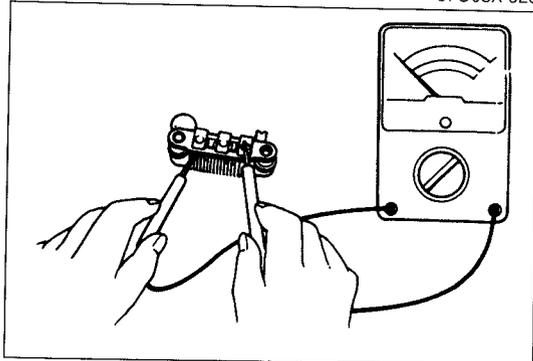
67U05X-027

Bearing

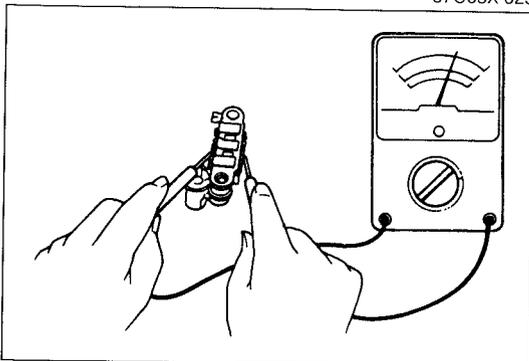
Check for abnormal noise, looseness, binding, etc. Replace the bearing if there is any abnormality.



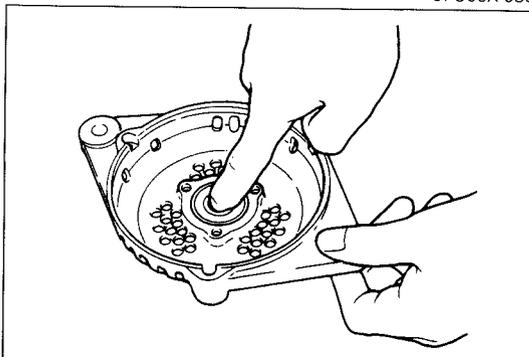
67U05X-028



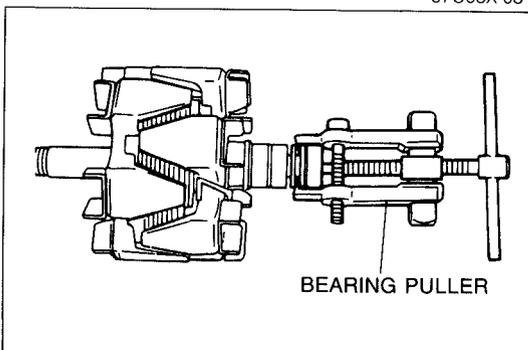
67U05X-029



67U05X-030



67U05X-031



67U05X-032

Rectifier

1. Positive diode

Check for continuity between the diode lead and the heat sink at the positive side by using a circuit tester. There should be continuity only in the direction from the diode lead to the heat sink.

2. Negative diode

Check for continuity between the diode lead and the heat sink at the negative side using a circuit tester. There should be continuity only in the direction from the heat sink to the diode.

3. Diode trio

Check for continuity using a circuit tester. There should be continuity in one direction only.

Front bearing

Check for abnormal noise, looseness, binding, etc. Replace the bearing if there is any problem.

Note

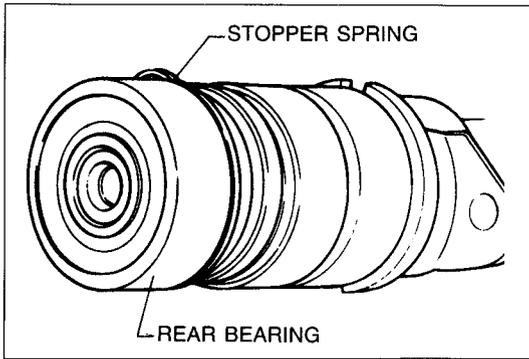
Use a hand press or "S" vice to remove it.

Rear bearing

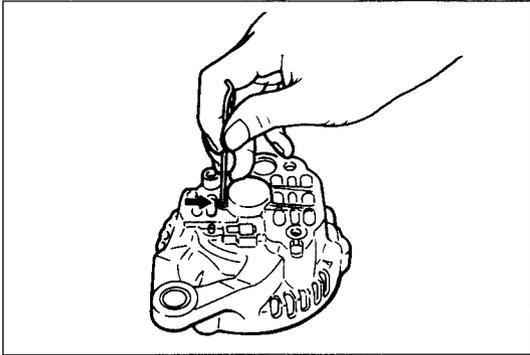
Check for abnormal noise, looseness, binding, etc. Replace the bearing if there is any problem.

Note

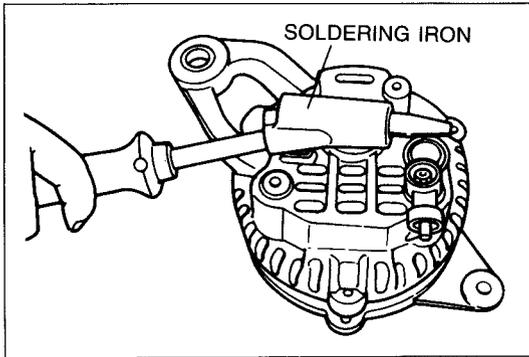
Use a bearing puller to remove it.



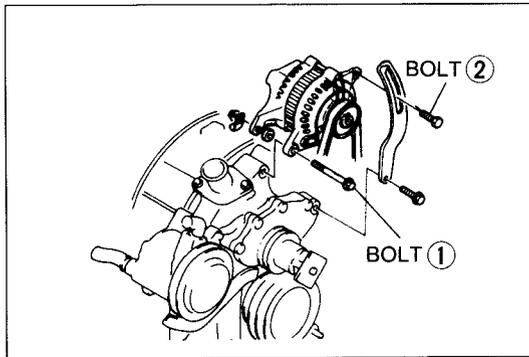
67U05X-033



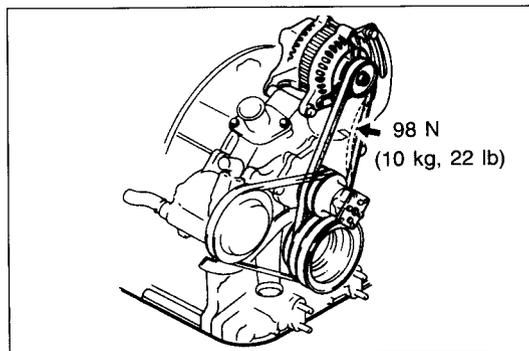
67U05X-034



77U05X-036



97U0GX-019



97U0GX-020

ASSEMBLY

Assemble in the reverse order of disassembly. There are no lubrication points.

1. Fit the stopper spring into the eccentric groove of the rear bearing circumference. The protruding part of the spring should be fit into the deepest groove. Note that for easy recognition the edge of the deepest groove is chamfered.

Note

By fitting the stopper spring in this way, the amount of spring protruding from the groove is lessened, so that assembly becomes easier. In addition, no strain is exerted upon the spring and thus its stopping effect is greater.

2. Brush lifting

Before assembly, push the brush into the brush holder and pass a wire ($\phi 2\text{mm}$, 40—50mm [$\phi 0.08$ in, 1.6—2.0 in]) through the hole shown in the figure to secure the brush in position.

Note

Be sure to pull the wire out after the assembly is completed.

3. When the rear bearing is pressed into the rear bracket, heat the bracket before pressing it in.
4. After assembly is completed, rotate the pulley manually and check that the rotor turns easily.

INSTALLATION

1. Install in the reverse order of removal.

Tightening torque

Bolts ①:

37—53 N·m (3.8—5.3 m·kg, 27—38 ft·lb)

Bolts ②:

19—25 N·m (1.9—2.6 m·kg, 14—19 ft·lb)

2. Adjust the tension of the V-belt.

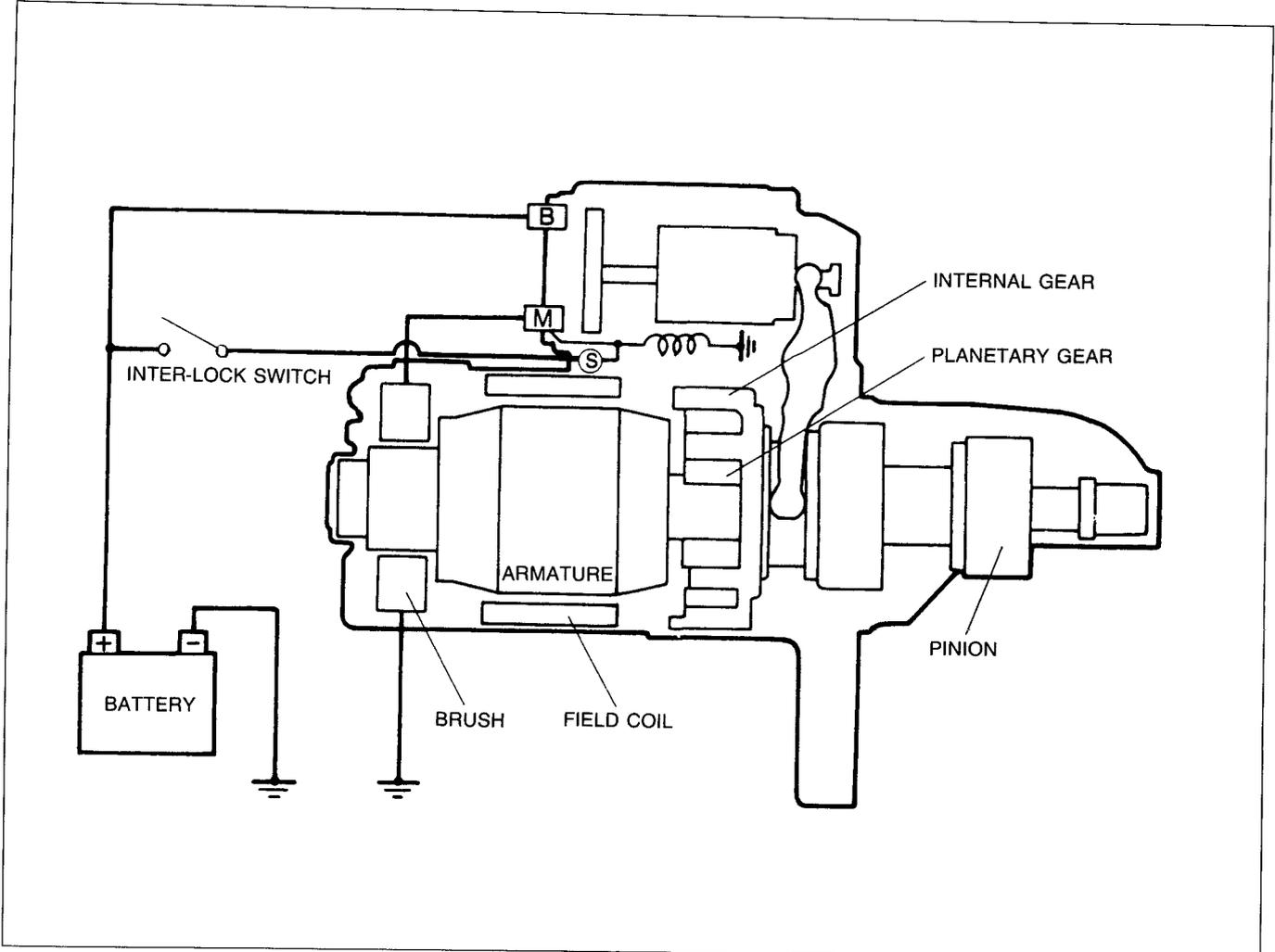
Deflection

New belt : 12—15mm (0.47—0.59 in)

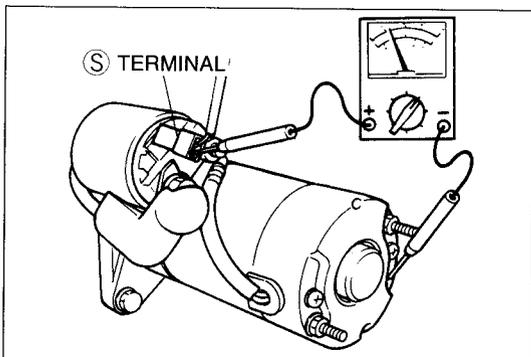
Used belt: 14—17mm (0.55—0.67 in)

STARTER

STARTING SYSTEM



67U05X-038



67U05X-039

ON-VEHICLE INSPECTION

Before this inspection, measure the specific gravity of the battery, and check that the battery is at or near full-charge.

A. If the magnetic switch doesn't function during starting

With the ignition switch at the start position, measure the voltage between the S terminal and ground. If the measured value is 8V or more, there is a starter malfunction; if it is less than 8V, there is a malfunction in the wiring.

Caution

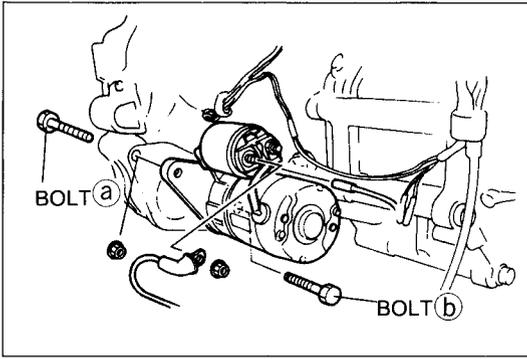
If the magnetic switch is excessively hot, it may not function even though the voltage is 8V or more.

B. If the starter won't crank, or if the cranking speed is slow

The problem may be a malfunction of the starter or in the wiring

Note

The cranking speed is greatly affected by the viscosity of the engine oil.



97U0GX-021

REMOVAL

1. Disconnect the negative battery terminal
2. Disconnect the wiring from the starter.
3. Remove bolts (a) and (b).
4. Remove the starter.

INSTALLATION

Install in the reverse order of removal.

Tightening torque

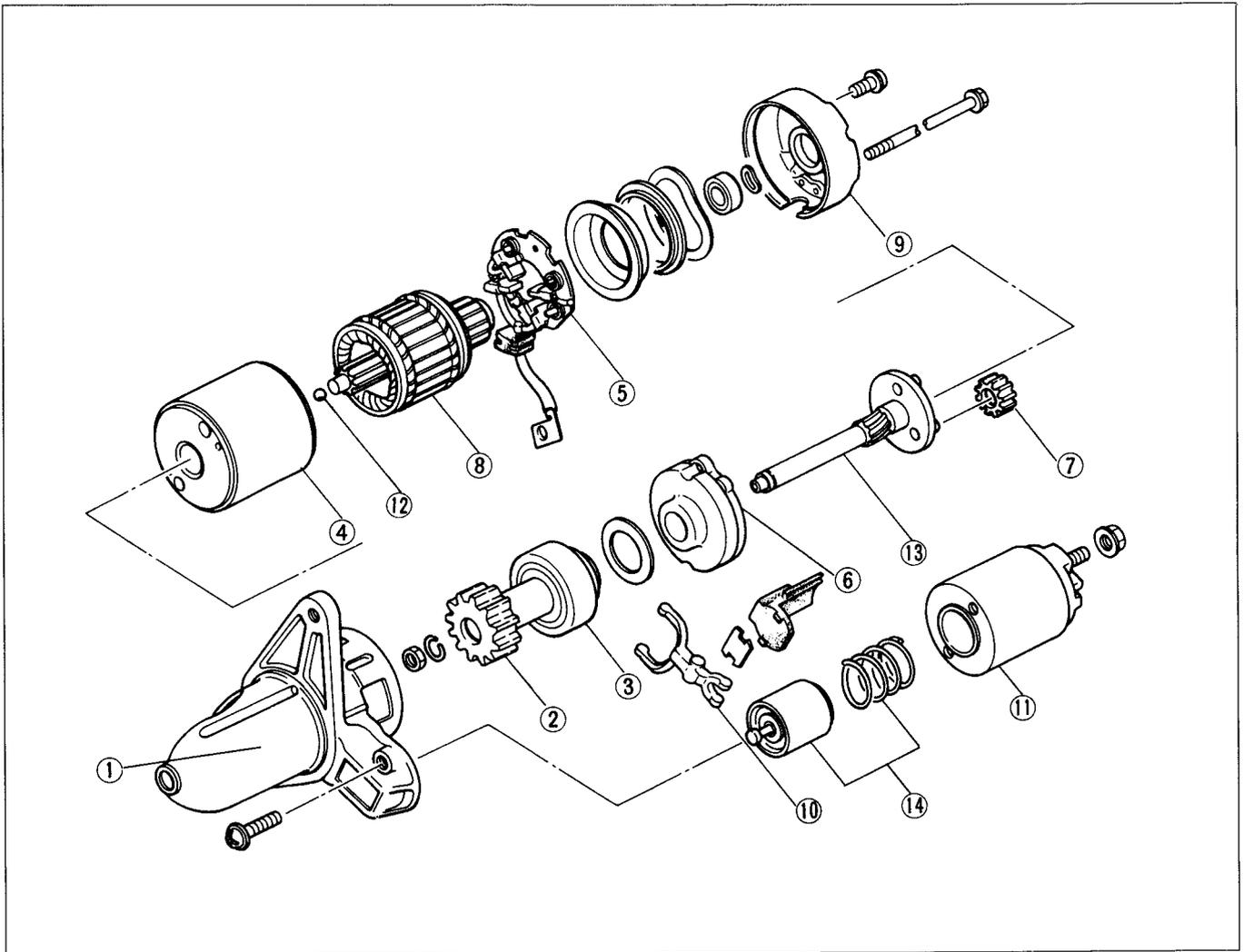
Bolts (a) and (b):

31—46 N·m (3.2—4.7 m·kg, 23—34 ft·lb)

B terminal:

9.8—12 N·m (87—120 cm·kg, 87—104 in·lb)

DISASSEMBLY



67U05X-038

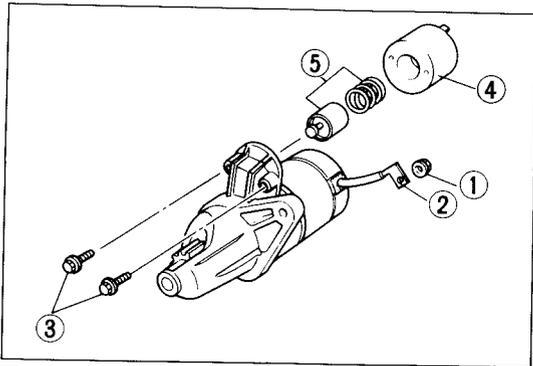
1. Drive housing front cover
2. Drive pinion
3. Overrunning clutch
4. Yoke assembly
5. Brush holder assembly

6. Internal gear
7. Planetary gear
8. Armature
9. Rear housing
10. Lever

11. Magnetic switch
12. Ball
13. Gear shaft
14. Plunger and spring

Caution

Do not strike the yoke with a hammer, drop it or put it in a vice when disassembling the starter.

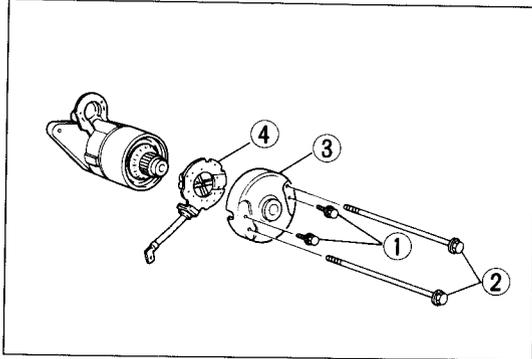


67U05X-039

Magnetic Switch

Remove the following parts.

- (1) The nut for the switch (M) terminal.
- (2) Wire.
- (3) Switch installation screws.
- (4) Magnetic switch.
- (5) Plunger and plunger spring.



77U05X-037

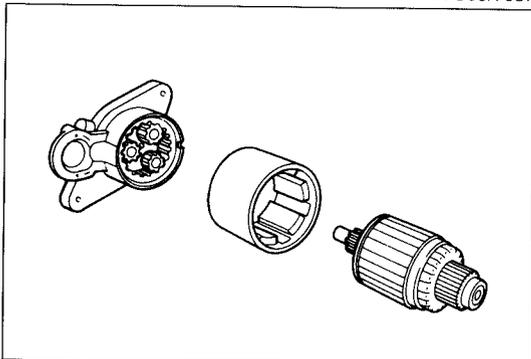
Rear Bracket and Brush Holder

Remove the following parts.

- (1) Brush holder installation screws.
- (2) Through bolts.
- (3) Rear bracket.
- (4) Brush holder.

Note

Put an aligning mark on the yoke and rear bracket before removing the rear bracket.



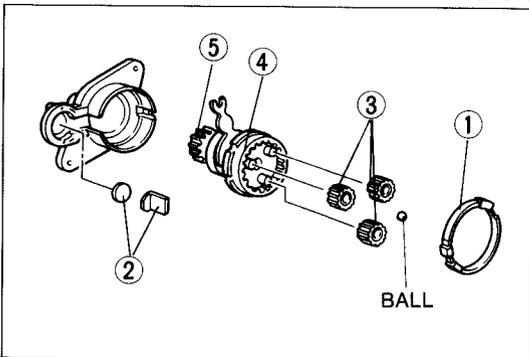
67U05X-041

Yoke and Armature

Remove the armature and yoke.

Note

Put an aligning mark on the yoke and front bracket before removing the front bracket.



67U05X-042

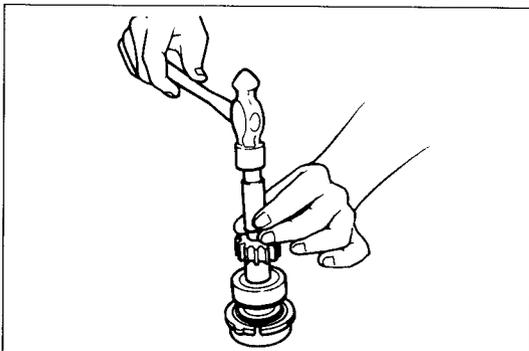
Overrunning Clutch, Planetary Gears and Internal Gear.

Remove the following parts:

- (1) Gasket.
- (2) Plate.
- (3) Planetary gears.
- (4) Internal gear.
- (5) Overrunning clutch.

Note

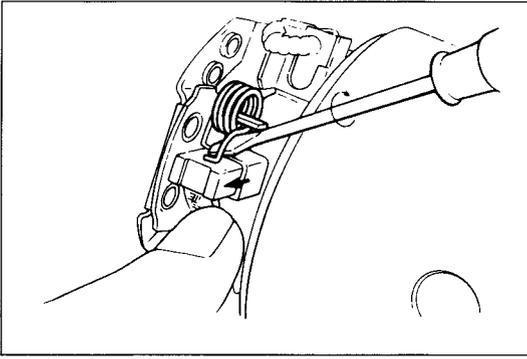
Do not lose the ball.



67U05X-046

Stopper of the Overrunning Clutch

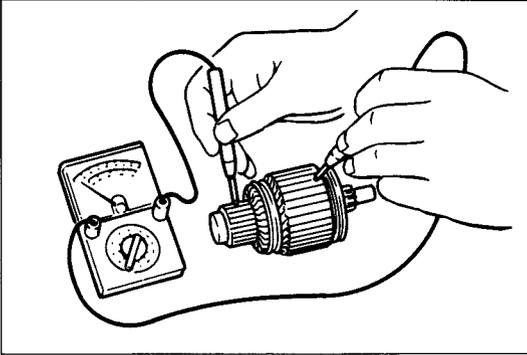
Remove the stopper of the overrunning clutch using a pipe, and then remove the ring and overrunning clutch.



67U05X-047

Brush and Brush Holder

Remove the brush from the brush holder using a flat-tip screwdriver.



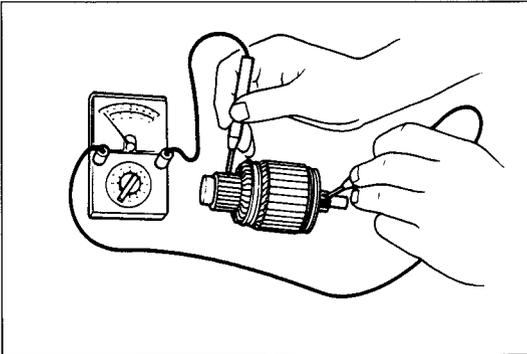
67U05X-048

INSPECTION

Armature

1. Ground of armature coil

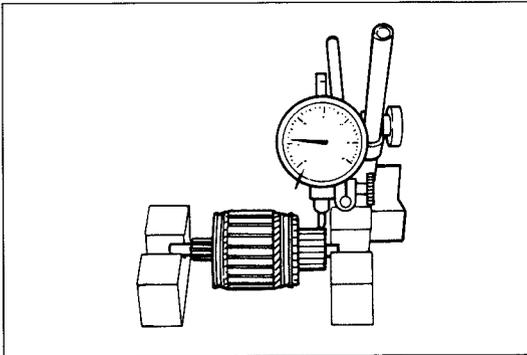
Check for continuity between the commutator and the core using a circuit tester. Replace the armature if there is continuity.



67U05X-049

2. Insulation of armature coil

Check for continuity between the commutator and the shaft using a circuit tester. Replace the armature if there is continuity.



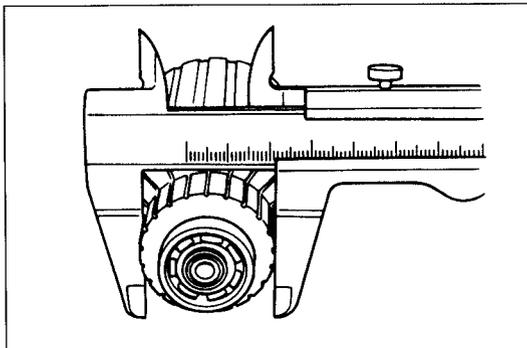
87U05X-019

3. Runout of commutator

Place the armature on V blocks, and measure the runout using a dial gauge. If the runout is **more than 0.1mm (0.004 in)**, repair it using a lathe, or replace the armature.

Note

Replace only when the outer diameter of the commutator is less than 28.4mm (1.12 in) or runout of the commutator cannot be repaired to 0.05mm (0.002 in).



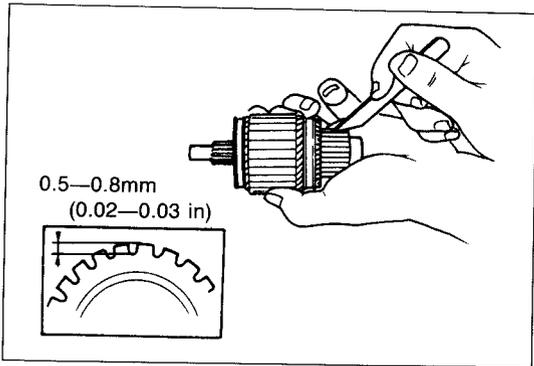
67U05X-051

4. Outer diameter of commutator

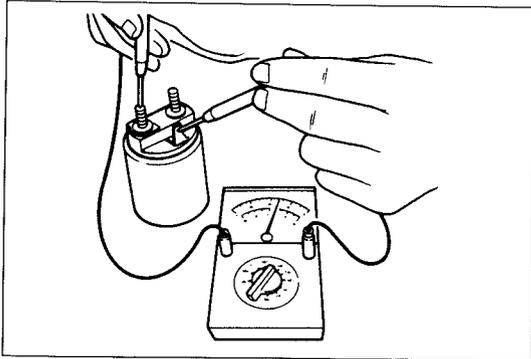
Replace the armature if the outer diameter of the commutator is less than **28.4mm (1.12 in)**.

5. Roughness of commutator surface

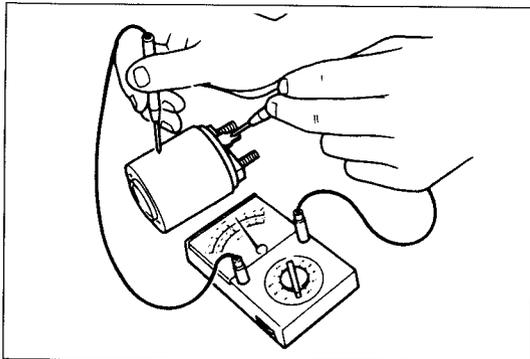
Repair using a lathe or fine sandpaper if it is rough; wipe it with a rag if it is dirty.



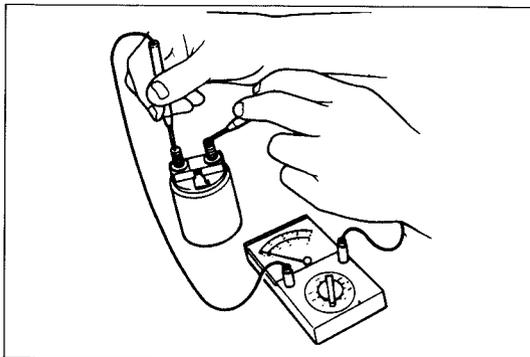
67U05X-052



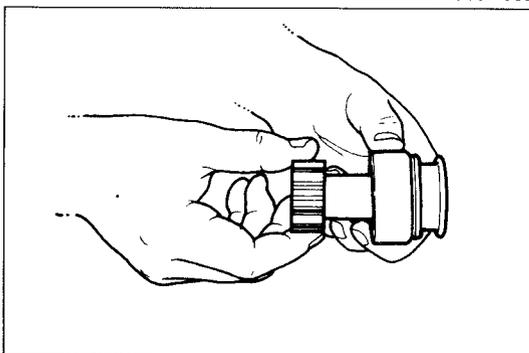
67U05X-053



67U05X-054



67U05X-055



77U05X-038

6. Segments

Undercut by **0.5—0.8mm (0.020—0.03 in)** if the depth of the mold between segments is **less than 0.2mm (0.008 in)**.

Magnetic Switch

1. Wiring damage (Ⓢ terminal — Ⓜ terminal).
Check for continuity between the Ⓢ terminal and the Ⓜ terminal using a circuit tester. Replace the magnetic switch if there is no continuity.
2. Wiring damage (Ⓢ terminal — body)
Check for continuity between Ⓢ terminal and body using a circuit tester.
Replace the magnetic switch if there is no continuity.
3. Ground of magnetic switch
Check for continuity between Ⓜ and Ⓟ terminals using a circuit tester. Replace the magnetic switch if there is continuity.

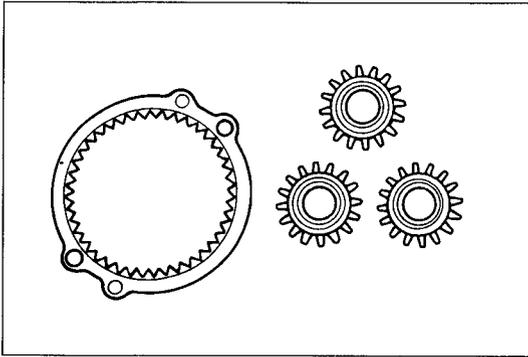
Overrunning Clutch

Turn the pinion shaft by hand while holding the overrunning clutch.

Replace the overrunning clutch if the pinion turns in both directions or in neither direction.

Note

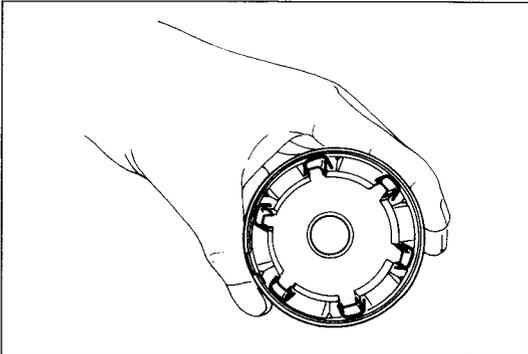
Do not wash the overrunning clutch with solvent, as the overrunning clutch is packed with grease.



67U05X-057

Internal Gear and Planetary Gears

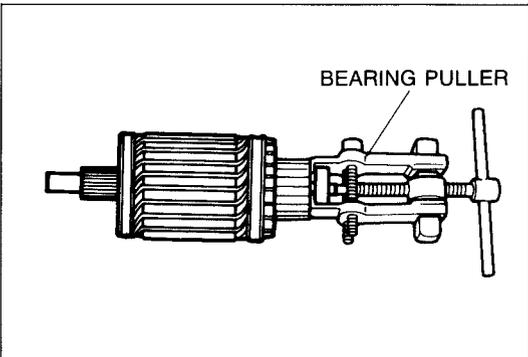
1. Internal gear
Check for wear or damage. Replace if necessary.
2. Planetary gears
Check for wear or damage. Replace if necessary.



67U05X-058

Yoke

Check for damage, replace if necessary.



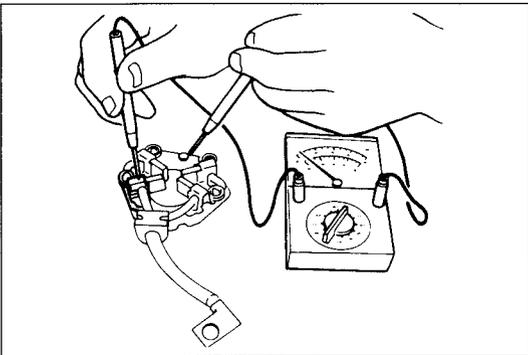
67U05X-059

Bearing

Check for abnormal noise, looseness, binding, etc. Replace the bearing if there is any problem.

Note

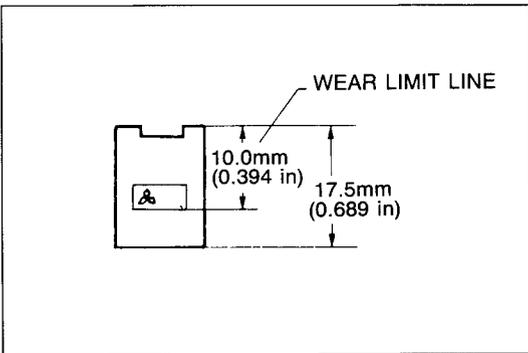
Use a bearing puller to remove the bearings.



67U05X-060

Brush and Brush Holder

1. Insulation of brush holder
Check for continuity between the insulated brush and the plate using a circuit tester. Replace the brush holder if there is continuity.

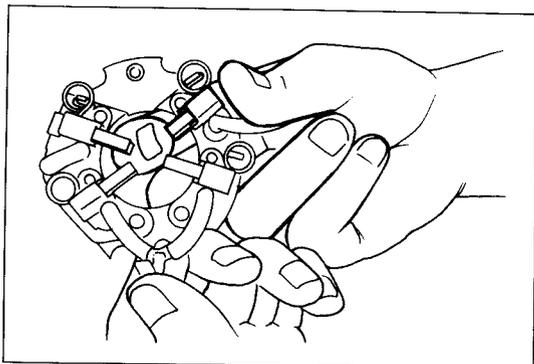


67U05X-061

2. Brush

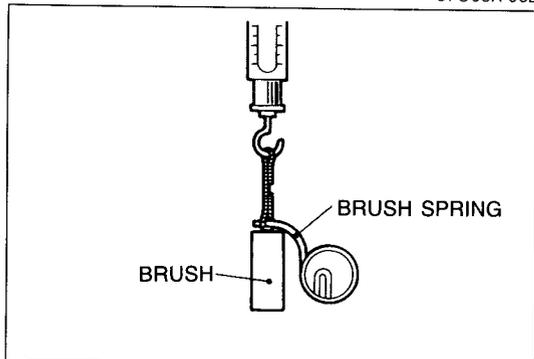
Replace the brushes if the brushes are worn beyond the wear limit, or if the wear is near the limit.

Wear limit : 10.0mm (0.394 in)
New brush: 17.5mm (0.689 in)



67U05X-062

3. Brush holder
Check that the brush slides smoothly inside the brush holder.



87U05X-020

4. Brush spring
Check the force of the brush spring using a spring balance. Replace the brush spring if the force is **less than 6.9 N (700 g, 1.54 lb)**.

Note

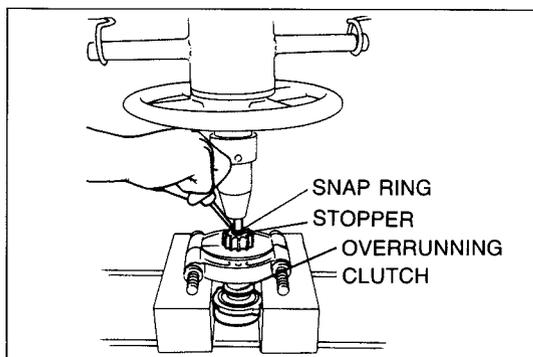
- a) The force is to be measured at the moment the brush spring separates from the brush.
- b) The force must be 14–23 N (1.4–2.4 kg, 3.1–5.2 lb) for a new brush spring.

ASSEMBLY

Assemble in the reverse order of disassembly. During assembly lubricate the following points.

1. Gear of armature shaft.
2. Internal gear and planetary gears.
3. Plunger circumference.
4. Lever.
5. Ball.
6. Gear shaft spline.
7. Front bracket bushing.

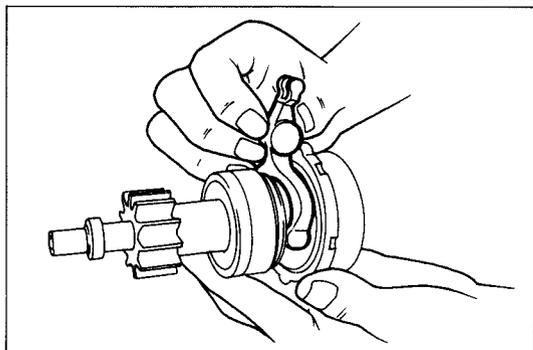
67U05X-064



67U05X-065

Installation of Overrunning Clutch

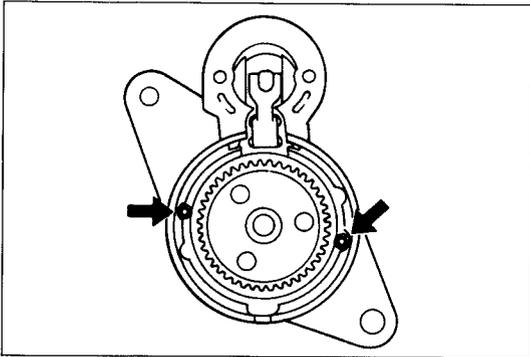
1. Install the overrunning clutch, stopper, and the snap ring on the armature shaft.
2. Set the stopper and the snap ring shown in the figure.



67U05X-066

Installation of lever

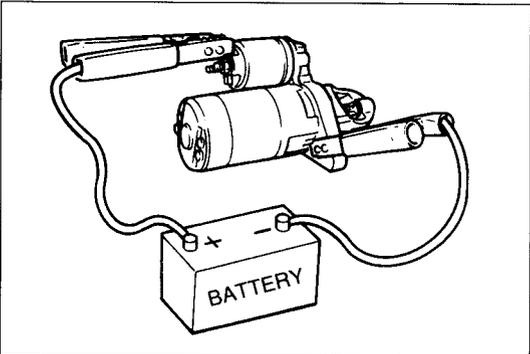
Be sure the lever faces in the correct direction.



67U05X-067

Installation of Brush Holder

Install the brush holder while carefully checking the position of the through bolt.



67U05X-068

CHECKING OPERATION

Magnetic Switch

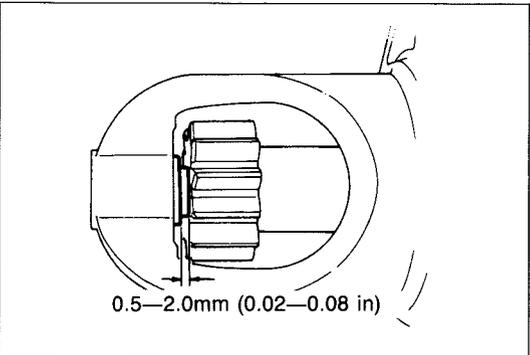
Make the following tests.

Pull-out test

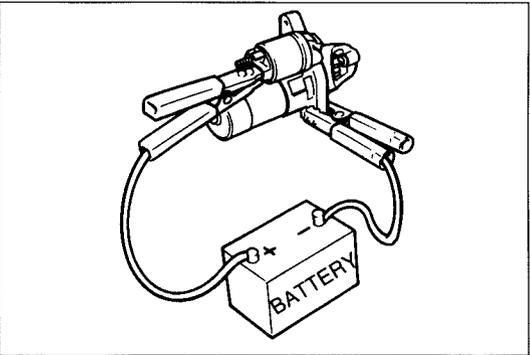
1. Check that the pinion is pulled out when the battery power is applied between the \textcircled{S} terminal and the body.
2. Measure the pinion gap while the pinion is pulled out.

Standard: 0.5—2.0mm (0.02—0.08 in)

3. Adjust the pinion gap with an adjustment washer (drive housing front cover—magnetic switch) if it is not within standard value.



67U05X-069



67U05X-070

Return test

1. Disconnect the wire from the \textcircled{M} terminal, and then connect the battery between the \textcircled{M} terminal and the body, as shown in the figure.
2. Pull out the overrunning clutch with a flat-tip screwdriver, and then check that the overrunning clutch returns to its original position when released.

No-Load Test

1. Form a test circuit with a voltmeter and an ammeter.

Note

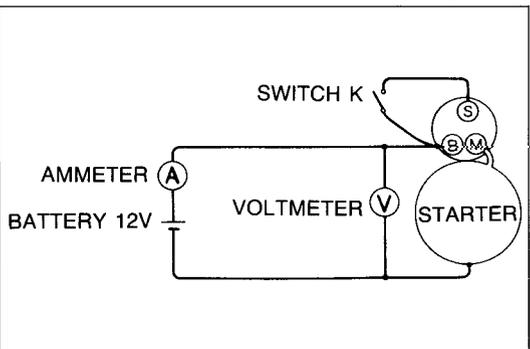
Use wires as thick as possible and tighten each terminal fully.

2. Close switch "K" to run the starter until its speed rises about 3,000 rpm (gear shaft rpm). Check the following values;

Battery voltage: 11.0V

Current: 90A and less

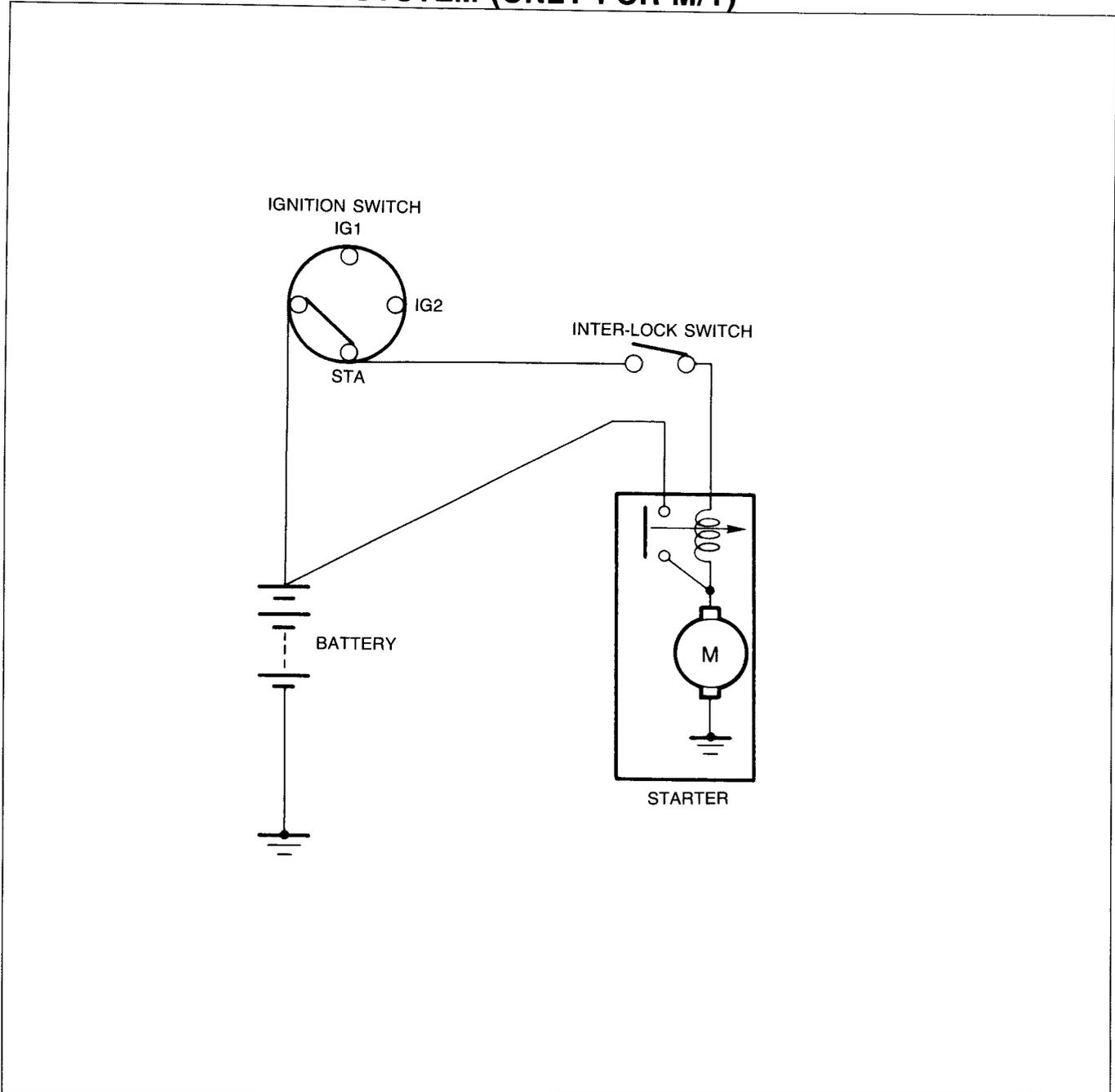
3. If any abnormality is noted, check it according to "INSPECTION".



77U05X-038

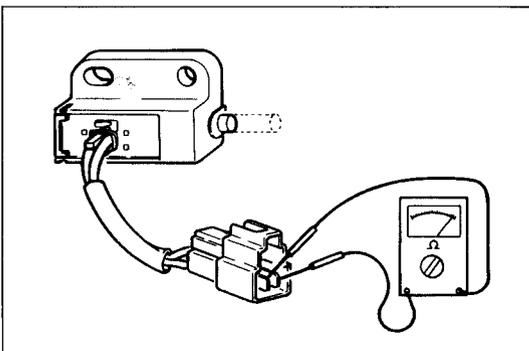
G STARTER INTERLOCK SYSTEM (ONLY FOR M/T)

STARTER INTERLOCK SYSTEM (ONLY FOR M/T)



77U05X-039

This system is similar to that of the inhibitor switch on an A/T vehicle. If the clutch pedal is not depressed during starting, battery power will not be supplied to the starter and it will not operate.



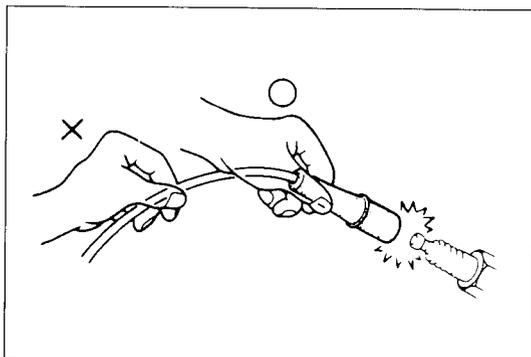
77U05X-016

INTERLOCK SWITCH Inspection

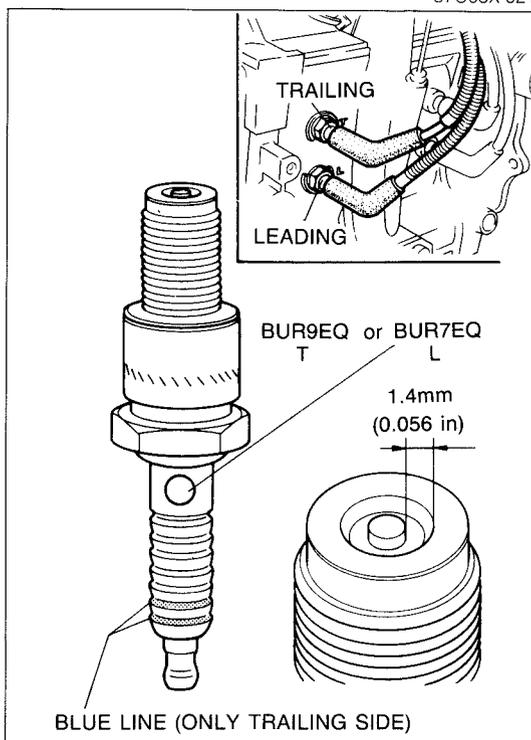
1. Disconnect the interlock switch connector.
2. Connect a circuit tester to the switch.
3. Check the continuity.

Pedal	Continuity
Depressed	Yes
Released	No

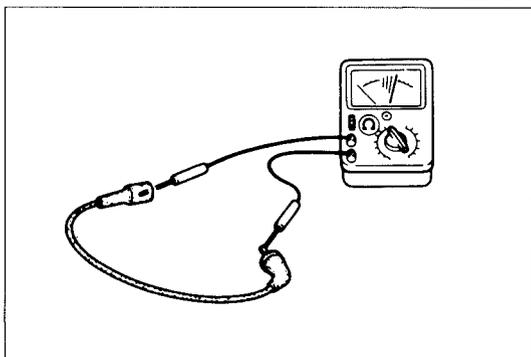
4. Replace the switch, if necessary.



87U05X-021



97U0GX-014



67U05X-074

SPARK PLUGS

REMOVAL AND INSTALLATION

Note the following points:

1. When the high-tension lead is to be pulled off, be sure to pull the boot itself, and not the wire.
2. Tighten the spark plugs to the specified torque.

Spark plug tightening torque:

12.7–17.7 N·m (1.3–1.8 m·kg, 10–13 ft·lb)

INSPECTION

Check the following points. Replace the spark plug if a problem is found.

1. Damaged insulation
2. Worn electrodes
3. Carbon deposits
If cleaning is necessary, use a wire brush. Clean the upper insulator also.
4. Damaged gasket

Plug gap: 1.4mm (0.056 in)

Note

Don't use a plug cleaner because cleaning sand may be lodged in the plug.

	NGK	Identification line
Trailing	BUR9EQ	Blue line
Leading	BUR7EQ	—

Caution

Install the correct type spark plug after confirming the identification mark.

Never misinstall the spark plug.

HIGH-TENSION LEADS

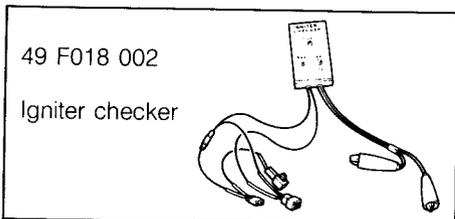
INSPECTION

Use a tester to measure the resistance.

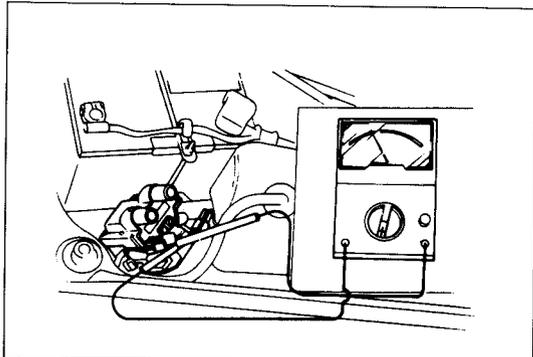
Resistance: 16 kΩ per 1 m (3.28 ft)

COIL WITH IGNITER

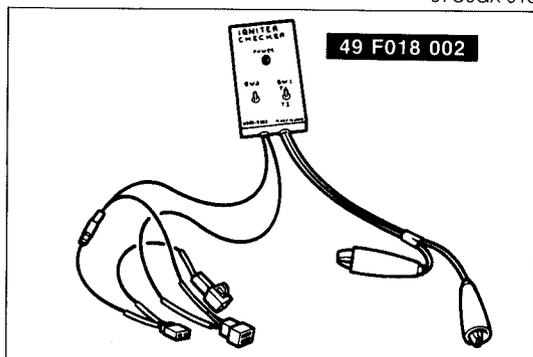
PREPARATION SST



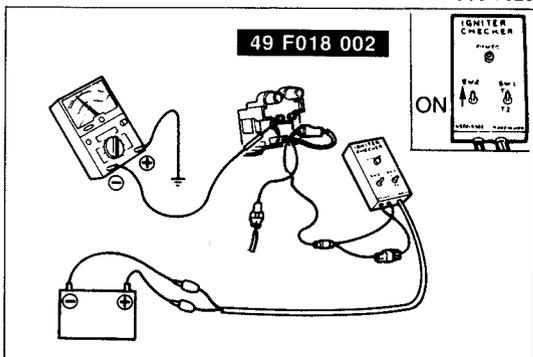
97U0GX-015



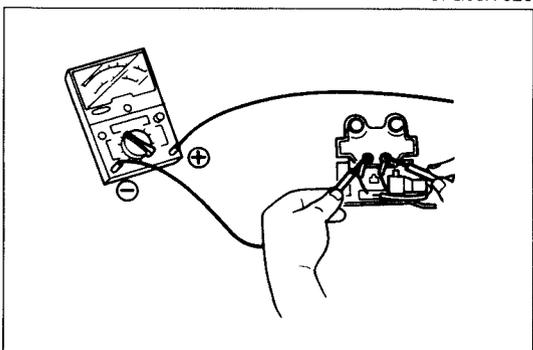
97U0GX-016



87U05X-023



57G05X-026



INSPECTION

Before this inspection, check the specific gravity of the battery, and that it is at or near full charge.

Note

Igniter Checker is used for inspection of the igniter.

Leading Side Igniter

1. Disconnect the 2-prong connector, and connect the voltmeter in series with the (BY) wire terminals.
2. Turn the ignition switch ON.
3. Check that the voltage is **approx. 12V**.

Caution

a) Do not misconnect the ohmmeter leads.

They should be connected as follows:

+ lead to ground

- lead to (B) wire

b) Disconnect the negative battery cable before removing the (B) wire from the coil with igniter, or damage will result.

c) Do not disconnect the (Br) wire from the coil

4. Turn the ignition switch OFF, and disconnect the voltmeter and negative battery cable.
5. Connect **Igniter Checker** (49 F018 002) between the 2-prong connectors.
6. Disconnect the (B) wire from the coil with igniter.
7. Reconnect the negative battery cable.
8. Connect an ohmmeter between (B) wire and ground.
9. Turn the ignition switch ON.
10. Push up the "SW2" switch on the igniter checker while observing the ohmmeter. The pointer needle on the ohmmeter should jump up to the **approx. 1/3rd scale on the X1 scale** and then return.
11. Replace the igniter, if necessary.

Warning

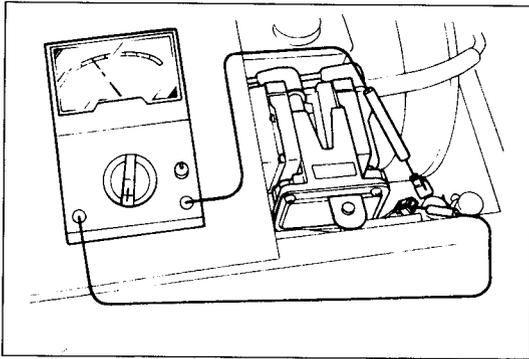
While checking the coil with igniter as outlined above, the high-tension leads must remain connected to the coil. If the high-tension leads are disconnected, high voltage ignition sparks may occur.

Coil

1. Disconnect the negative battery cable.
2. Connect the ohmmeter as shown in the figure.
3. Check the resistance of the coil.

Resistance: below 1Ω

4. Replace the coil, if necessary.



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Trailing Side Igniter

1. Disconnect the 2-prong connector, and connect the voltmeter in series with one side of the 2-prong connectors.
2. Turn the ignition switch ON.
3. Check that the voltage is **approx. 12V**.

Caution

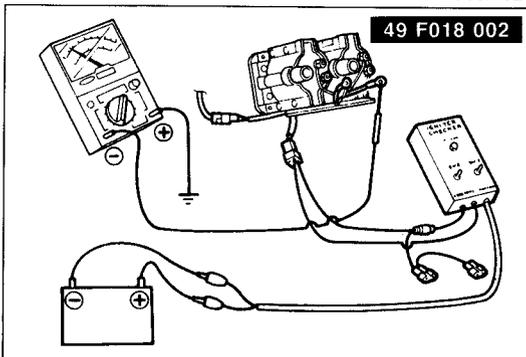
a) Do not misconnect the ohmmeter leads.

They should be connected as follows:

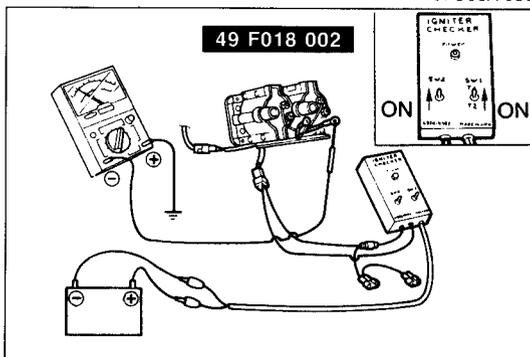
- + lead to ground
- lead to (B) wire

b) Disconnect the negative battery cable before removing the (B) or (L) wires from the coil with igniter, or damage will result.

c) Do not disconnect the (Br) wires from the coils.

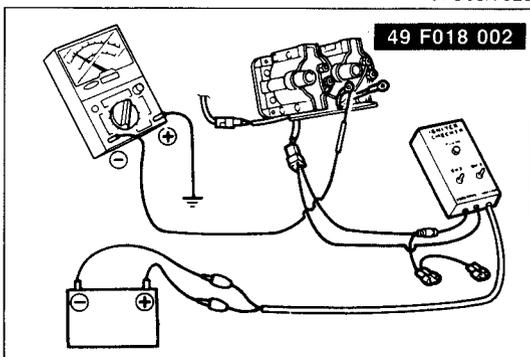


67U05X-080



57G05X-028

4. Turn the ignition switch OFF, and disconnect the voltmeter and negative battery cable.
5. Reconnect the 2-prong connector.
6. Disconnect the 4-prong connector, and connect **Igniter Checker** (49 F018 002) to the 4-prong connector of the coil with igniter.
7. Disconnect the (B) and (L) wires from the coil with igniter.
8. Reconnect the negative battery cable.
9. Connect an ohmmeter between (B) wire and ground.
10. Turn the ignition switch ON.
11. Set the "SW1" switch of the igniter checker to the "T1" position. While observing the ohmmeter, push up the "SW2" switch and the ohmmeter pointer needle should jump up to **approx. 1/3rd scale on the X1 scale** and then return.



67U05X-082

12. Turn the ignition switch OFF, and disconnect the ohmmeter.
13. Connect the ohmmeter between (L) wire and ground.

Caution

Do not misconnect the ohmmeter leads.

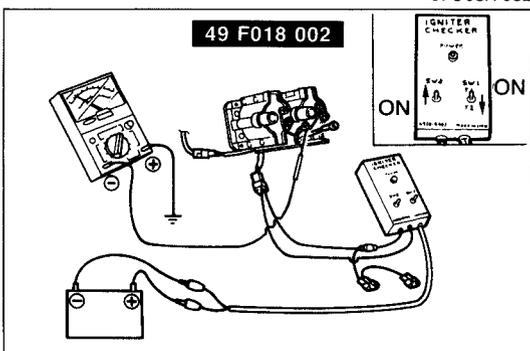
They should be connected as follows:

- + lead to ground
- lead to (L) wire

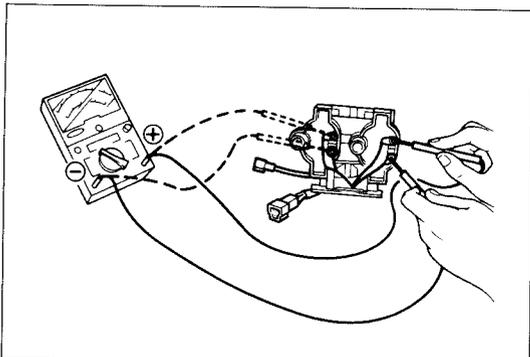
14. Turn the ignition switch ON.
15. Set the "SW1" switch of the igniter checker to the "T2" position. While observing the ohmmeter, push up the "SW2" switch and the ohmmeter pointer needle should jump up to **approx. 1/3rd scale on the X1 scale** and then return.
16. Replace the igniter, if necessary.

Warning

While checking the coil with igniter as outlined above, the high-tension leads must remain connected to the coil. If the high-tension leads are disconnected, high voltage ignition sparks may occur.



57G05X-029



87U05X-026

Coil

1. Disconnect the negative battery cable.
2. Connect the ohmmeter as shown in the figure.
3. Check the resistance of the coil.

Resistance: below 1Ω

4. Replace the coil, if necessary.

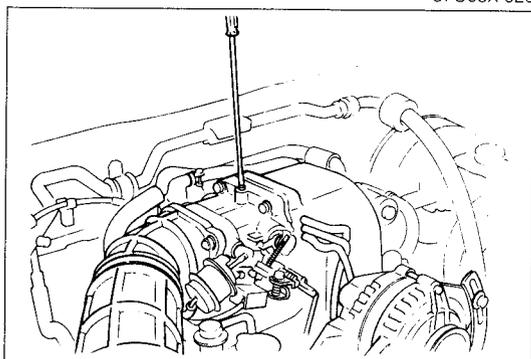
ADJUSTMENT OF IGNITION TIMING

Warning

When inspecting and adjusting the ignition timing, keep hands, clothing, hair and tools away from the P/S drive belt.

Note

Self powered timing lights might not function. Use a vehicle-battery-powered timing light for checking ignition timing.

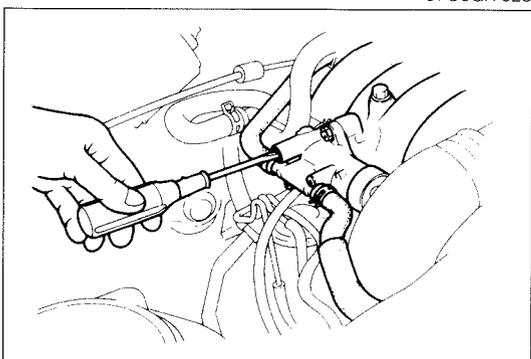


97U0GX-023

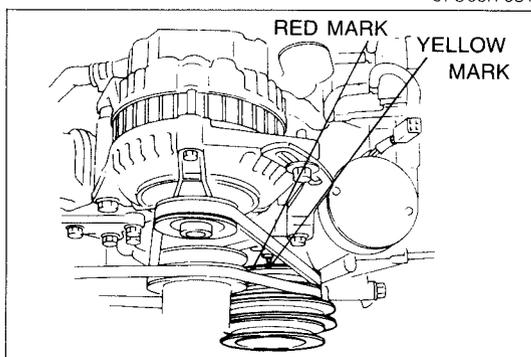
Initial

Note

To check or adjust ignition timing ground the test connector (Green: 1-pin) to the body with a jumper wire.



67U05X-081



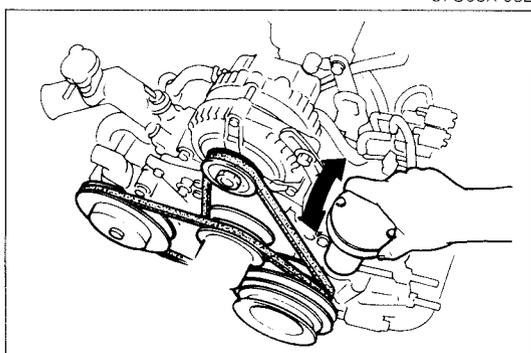
67U05X-082

1. Run the engine until it is at operating temperature.
2. Turn all electric loads OFF.
3. Connect a tachometer.
4. Check the idle speed. Set to the specified idle speed if necessary. (Refer to Section F1 and F2.)
5. Connect a timing light to the "L-1" high-tension lead.
6. Check that the marks on the pulley and indicator pin are aligned.

Ignition timing:

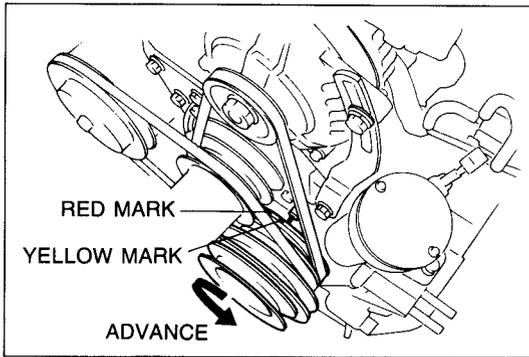
Leading $5^\circ \pm 1^\circ$ ATDC (Yellow mark)

Trailing $20^\circ \pm 2^\circ$ ATDC (Red mark)



87U05X-028

7. If they aren't aligned, remove the blind cap and loosen the crank angle sensor installation bolt and turn it to make the adjustment.
8. Check the trailing side with the same procedure as the leading side.
9. Install a new blind cap.



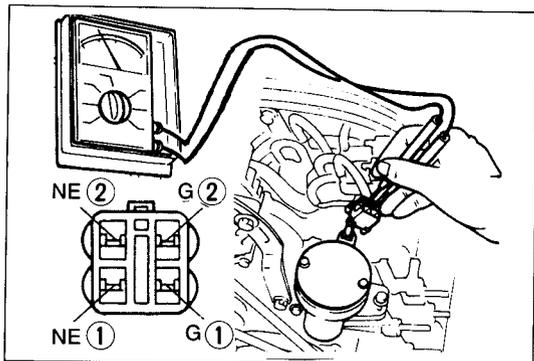
67U05X-084

Advance

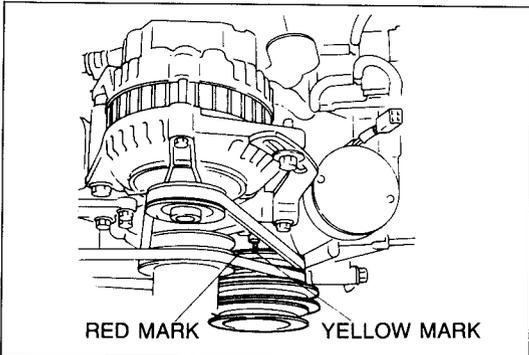
1. Connect a timing light to the "L-1" high-tension lead.
2. Increase the engine speed and check that the ignition timing advances.
3. Disconnect the timing light.

Note

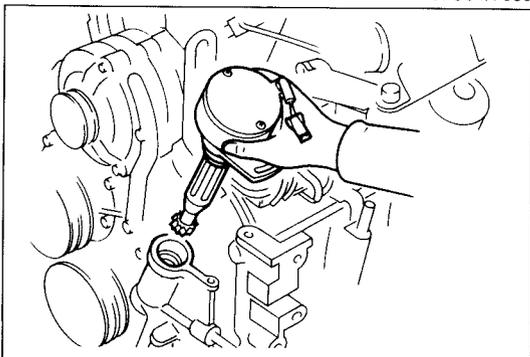
When decelerating, the ignition timing will drop to a certain point and stay momentarily, and then return to normal.



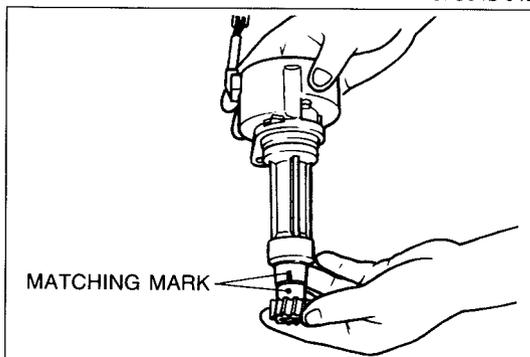
77U04B-119



67U04X-089



87U04B-049



97U0GX-022

ELECTRONIC SPARK ADVANCE (ESA) CONTROL SYSTEM

CRANK ANGLE SENSOR

Inspection

1. Disconnect the crank angle sensor connector.
2. Connect a circuit tester to the terminals of the crank angle sensor connector.
3. Check the resistance of the following.

Terminal	Resistance
G ① (G) — G ② (B)	110—210Ω
Ne ① (R) — Ne ② (W)	110—210Ω

Removal

1. Set the eccentric shaft pulley to the leading mark (Yellow mark) by turning the pulley.

2. Disconnect the crank angle sensor connector.
3. Remove the blind cap and the lock bolt.
4. Remove the sensor.

Installation

1. Align the matching mark on the crank angle sensor housing and driven gear.
2. Check that the eccentric shaft pulley is set to the leading mark (Yellow mark).
3. Install the sensor and lock bolt.
4. Check the ignition timing. (Refer to section G)
5. Tighten the lock bolt.

Tightening torque:

7.8—10.8 N·m (80—110 cm·kg, 69—95 in·lb)

6. Install a new blind cap.