

- 8) After checking initial ignition timing, release ignition timing fixation by using scan tool.
- 9) With engine idling (throttle opening at closed position and vehicle stopped), check that ignition timing is about 5° – 15° BTDC for M13 engine or 3° – 13° BTDC for M15 engine. (Constant variation within a few degrees from 5° – 15° BTDC for M13 engine or

3° – 13° BTDC for M15 engine indicates no abnormality but proves operation of electronic timing control system.) Also, check that increasing engine speed advances ignition timing.
 If the check results are not satisfactory, check CKP sensor and ECM.

Specifications

Tightening Torque Specifications

S4RS0B1807001

| Fastening part | Tightening torque | | | Note |
|--------------------|-------------------|-------|-------|------|
| | N·m | kgf·m | lb·ft | |
| Spark plug | 25 | 2.5 | 18.0 | ☞ |
| Ignition coil bolt | 10 | 1.0 | 7.5 | ☞ |

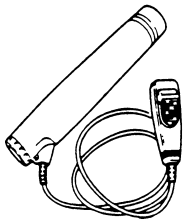
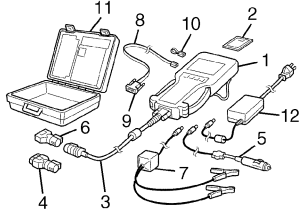
Reference:

For the tightening torque of fastener not specified in this section, refer to “Fasteners Information: in Section 0A”.

Special Tools and Equipment

Special Tool

S4RS0B1808001

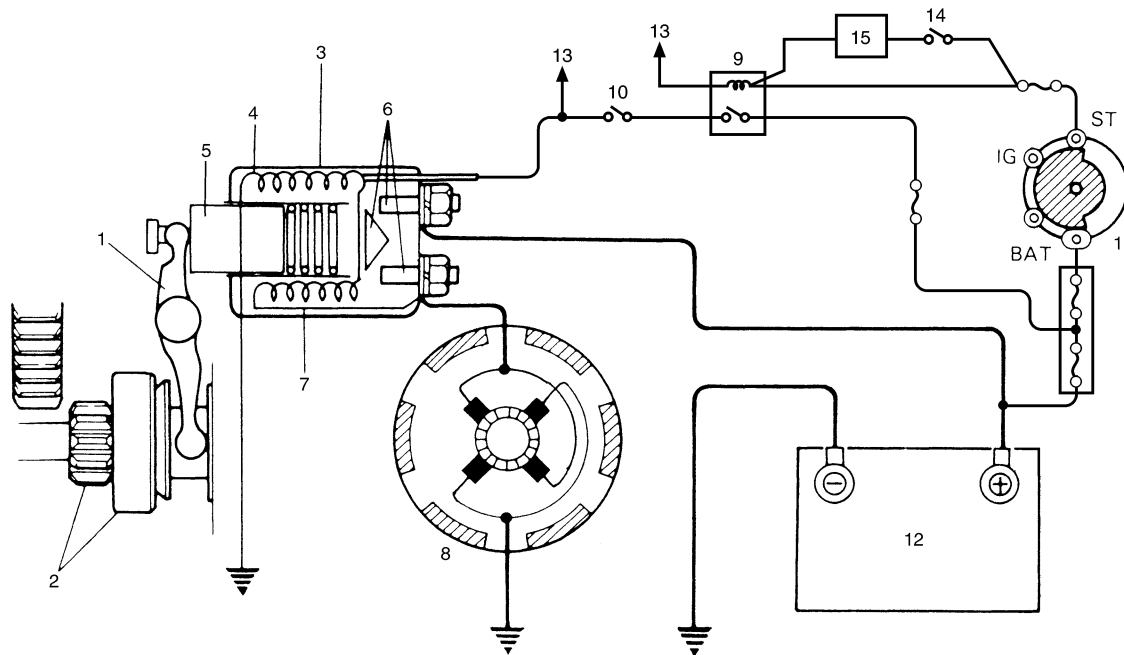
| | | | |
|---|--|---|--|
| <p>09930-76420 Timing-light (dry cell type) ☞</p> |  | <p>SUZUKI scan tool —</p> <p>This kit includes following items. 1. Tech 2, 2. PCMCIA card, 3. DLC cable, 4. SAE 16/19 adapter, 5. Cigarette cable, 6. DLC loopback adapter, 7. Battery power cable, 8. RS232 cable, 9. RS232 adapter, 10. RS232 loop back connector, 11. Storage case, 12. Power supply ☞</p> |  |
|---|--|---|--|

Starting System

Schematic and Routing Diagram

Cranking System Circuit Diagram

S4RS0B1902001



I4RS0B190006-01

| | | |
|---------------------------------|---|---|
| 1. Pinion drive lever | 6. Magnetic switch contacts | 11. Ignition & Starter switch |
| 2. Pinion & Over-running clutch | 7. Pull-in coil | 12. Battery |
| 3. Magnetic switch | 8. Starting motor | 13. To ECM |
| 4. Hold-in coil | 9. Starting motor control relay | 14. Neutral start switch (for Automated Manual Transaxle model) |
| 5. Plunger | 10. Transmission range switch (for A/T model) | 15. TCM (for Automated Manual Transaxle model) |

Diagnostic Information and Procedures

Cranking System Symptom Diagnosis

S4RS0B1904001

Possible symptoms due to starting system trouble would be as follows:

- Starting motor does not run (or runs slowly)
- Starting motor runs but fails to crank engine
- Abnormal noise is heard

Proper diagnosis must be made to determine exactly where the cause of each trouble lies in battery, wiring harness, (including starting motor switch), starting motor or engine.

Do not remove motor just because starting motor does not run. Check the following items and narrow down scope of possible causes.

- 1) Condition of trouble
- 2) Tightness of battery terminals (including ground cable connection on engine side) and starting motor terminals
- 3) Discharge of battery
- 4) Mounting of starting motor

| Condition | Possible cause | Correction / Reference Item |
|--|--|---|
| Motor not running (No operating sound of magnetic switch) | Shift lever switch is not in P or N, or not adjusted (for A/T model) | <i>Shift in P or N, or adjust switch. (for A/T model)</i> |
| | Faulty neutral start switch (for Automated Manual Transaxle model) | <i>"Neutral Start Switch Inspection: in Section 5D".</i> |
| | Faulty stop (brake) lamp switch (for Automated Manual Transaxle model) | <i>"Stop (Brake) Lamp Switch Inspection: in Section 9B".</i> |
| | Battery run down | <i>Recharge battery.</i> |
| | Battery voltage too low due to battery deterioration | <i>Replace battery.</i> |
| | Poor contact in battery terminal connection | <i>Retighten or replace.</i> |
| | Loose grounding cable connection | <i>Retighten.</i> |
| | Fuse set loose or blown off | <i>Tighten or replace.</i> |
| | Poor contacting action of ignition switch and magnetic switch | <i>Replace.</i> |
| | Lead wire coupler loose in place | <i>Retighten.</i> |
| | Open-circuit between ignition switch and magnetic switch | <i>Repair.</i> |
| | Open-circuit in pull-in coil | <i>Replace magnetic switch.</i> |
| | Brushes are seating poorly or worn down | <i>Repair or replace.</i> |
| | Poor sliding of plunger and/or pinion | <i>Repair.</i> |
| | Faulty starting motor control relay | <i>"Main Relay, Fuel Pump Relay, Starting Motor Control Relay and Throttle Actuator Control Relay Inspection: in Section 1C".</i> |
| Faulty ECM and its circuit | <i>"Inspection of ECM and Its Circuits: in Section 1A".</i> | |
| Motor not running (Operating sound of magnetic switch heard) | Battery run down | <i>Recharge battery.</i> |
| | Battery voltage too low due to battery deterioration | <i>Replace battery.</i> |
| | Loose battery cable connections | <i>Retighten.</i> |
| | Burnt main contact point, or poor contacting action of magnetic switch | <i>Replace magnetic switch.</i> |
| | Brushes are seating poorly or worn down | <i>Repair or replace.</i> |
| | Weakened brush spring | <i>Replace.</i> |
| | Burnt commutator | <i>Replace armature.</i> |
| | Layer short-circuit of armature | <i>Replace.</i> |
| Crankshaft rotation obstructed | <i>Repair.</i> | |
| Starting motor running but too slow (small torque) (If battery and wiring are satisfactory, inspect starting motor) | Insufficient contact of magnetic switch main contacts | <i>Replace magnetic switch.</i> |
| | Layer short-circuit of armature | <i>Replace.</i> |
| | Disconnected, burnt or worn commutator | <i>Repair commutator or replace armature.</i> |
| | Worn brushes | <i>Replace brush.</i> |
| | Weakened brush springs | <i>Replace spring.</i> |
| | Burnt or abnormally worn end bush | <i>Replace bush.</i> |
| Starting motor running, but not cranking engine | Worn pinion tip | <i>Replace over-running clutch.</i> |
| | Poor sliding of over-running clutch | <i>Repair.</i> |
| | Over-running clutch slipping | <i>Replace over-running clutch.</i> |
| | Worn teeth of ring gear | <i>Replace flywheel (for M/T and Automated Manual Transaxle models) or drive plate (for A/T model).</i> |

11-3 Starting System:

| Condition | Possible cause | Correction / Reference Item |
|---|---|---|
| Noise | Abnormally worn bush | Replace bush. |
| | Worn pinion or worn teeth of ring gear | Replace over-running clutch, flywheel (for M/T and Automated Manual Transaxle models) or drive plate (for A/T model). |
| | Poor sliding of pinion (failure in return movement) | Repair or replace. |
| | Worn internal or planetary gear teeth | Replace. |
| | Lack of oil in each part | Lubricate. |
| Starting motor does not stop running | Fused contact points of magnetic switch | Replace magnetic switch. |
| | Short-circuit between turns of magnetic switch coil (layer short-circuit) | Replace magnetic switch. |
| | Failure of returning action in ignition switch | Replace. |

Cranking System Test

S4RS0B1904002

⚠ CAUTION

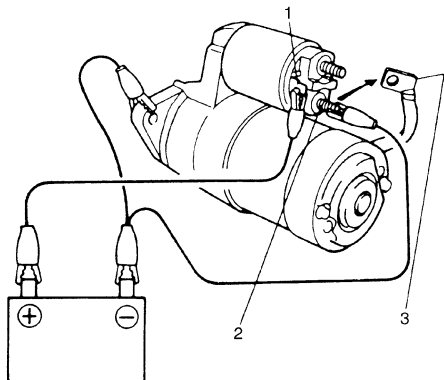
Each test must be performed within 3 – 5 seconds to avoid coil from burning.

Pull-In Test

Connect battery to the magnetic switch as shown. Check that plunger and pinion move outward. If plunger and pinion don't move, replace the magnetic switch.

NOTE

Before testing, disconnect lead wire from terminal "M" (2).

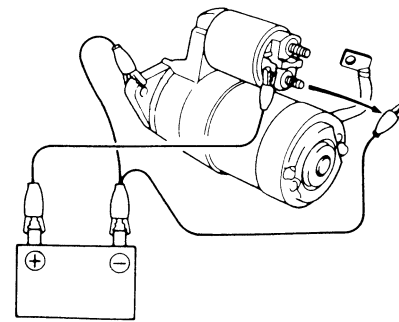


I2RH01190002-01

| |
|--------------------------------|
| 1. Terminal "S" |
| 3. Lead wire (switch to motor) |

Hold-In Test

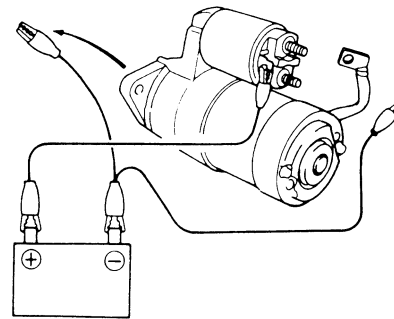
While connected as the figure with plunger out, disconnect negative lead from terminal "M". Check that plunger and pinion remain out. If plunger and pinion return inward, replace the magnetic switch.



I2RH01190003-01

Plunger and Pinion Return Test

Disconnect negative lead from starting motor body. Check that plunger and pinion return inward. If plunger and pinion don't return, replace the magnetic switch.



I2RH01190004-01

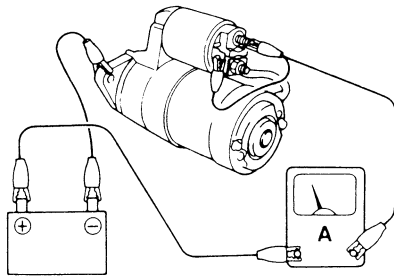
No-Load Performance Test

Connect battery and ammeter to starter as shown. Check that starter rotates smoothly and steadily with pinion moving out. Check that ammeter indicates specified current.

Specified current (No-load performance test)

0.8 kW type: 53A MAX. at 11.5 V

1.2 kW type: 90 A MAX. at 11 V

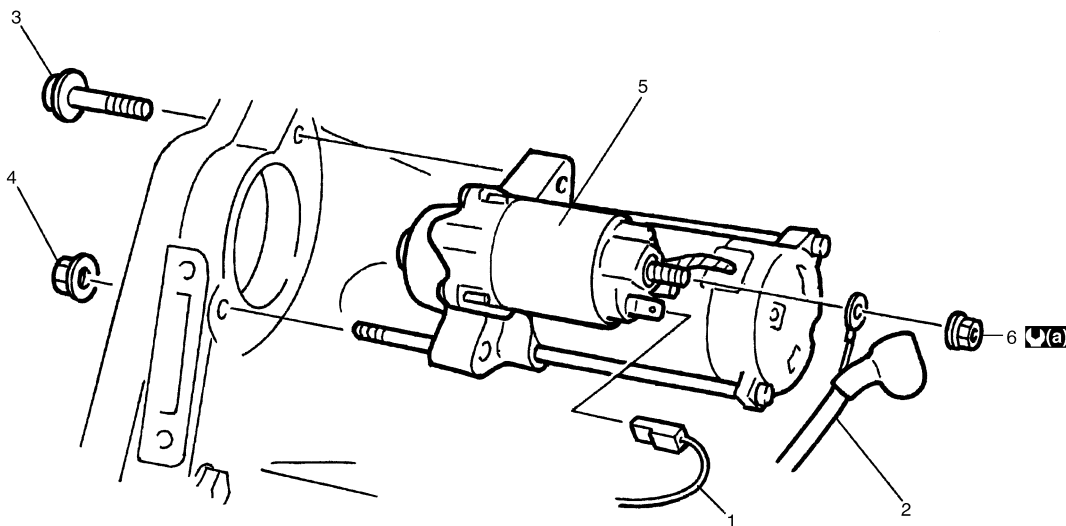


I2RH01190005-01

Repair Instructions

Starting Motor Dismounting and Remounting

S4RS0B1906001



I4RS0A190002-01

(a) : 11 N·m (1.1 kgf·m, 8.0 lb-ft)

Dismounting

- 1) Disconnect negative (-) battery lead at battery.
- 2) Disconnect magnetic switch lead wire (1) and battery cable (2) from starting motor terminals.
- 3) Detach shift & select control cable bracket (for M/T model) or clutch actuator (for Automated Manual Transaxle model) from transaxle.
- 4) Remove starting motor mount bolt (3) and nut (4).
- 5) Remove starting motor (5).

Remounting

Reverse the dismounting procedure noting the following.

- Tighten battery cable nut (6) to specified torque.

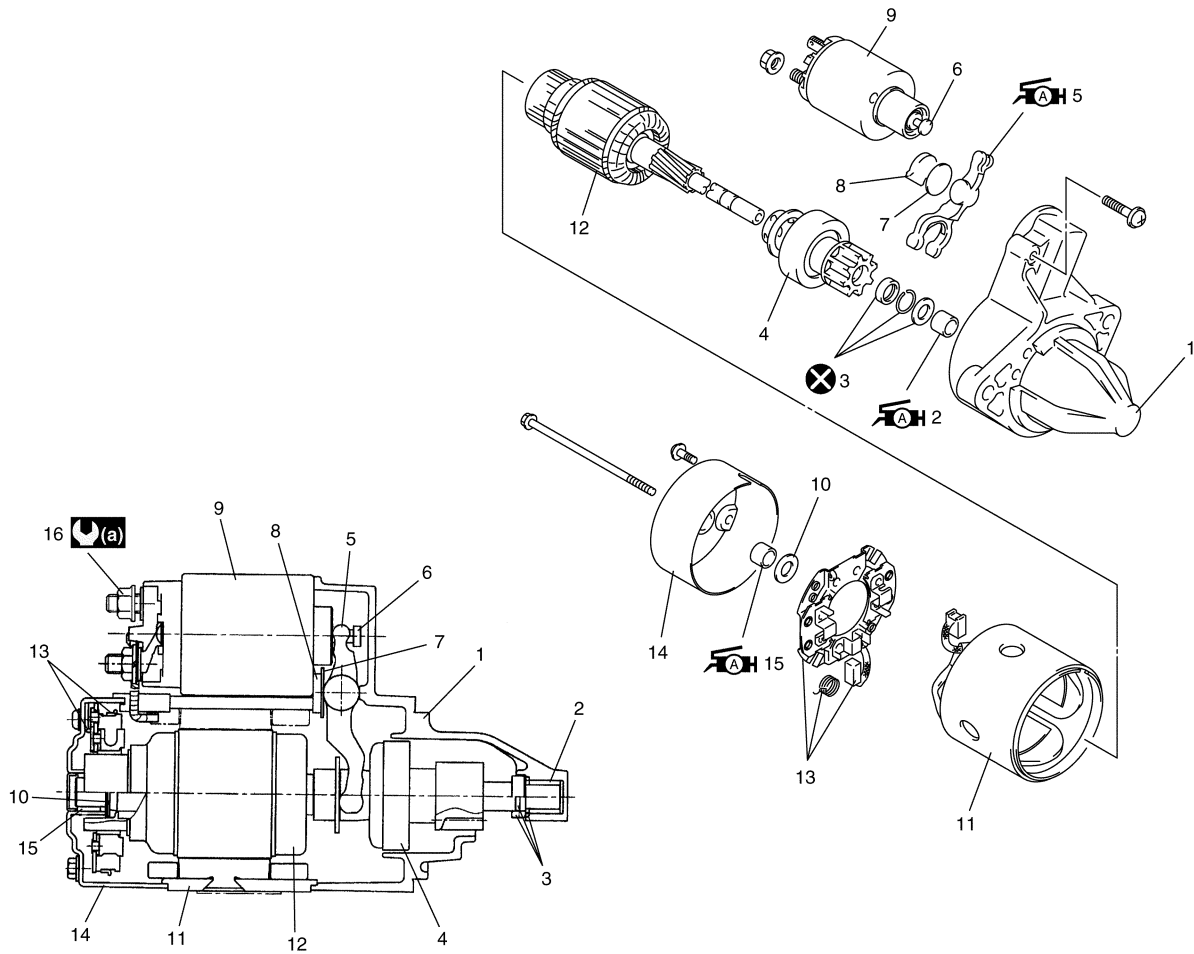
Tightening torque

Starting motor battery cable nut (a): 11 N·m (1.1 kgf·m, 8.0 lb-ft)

Starting Motor Components

S4RS0B1906002

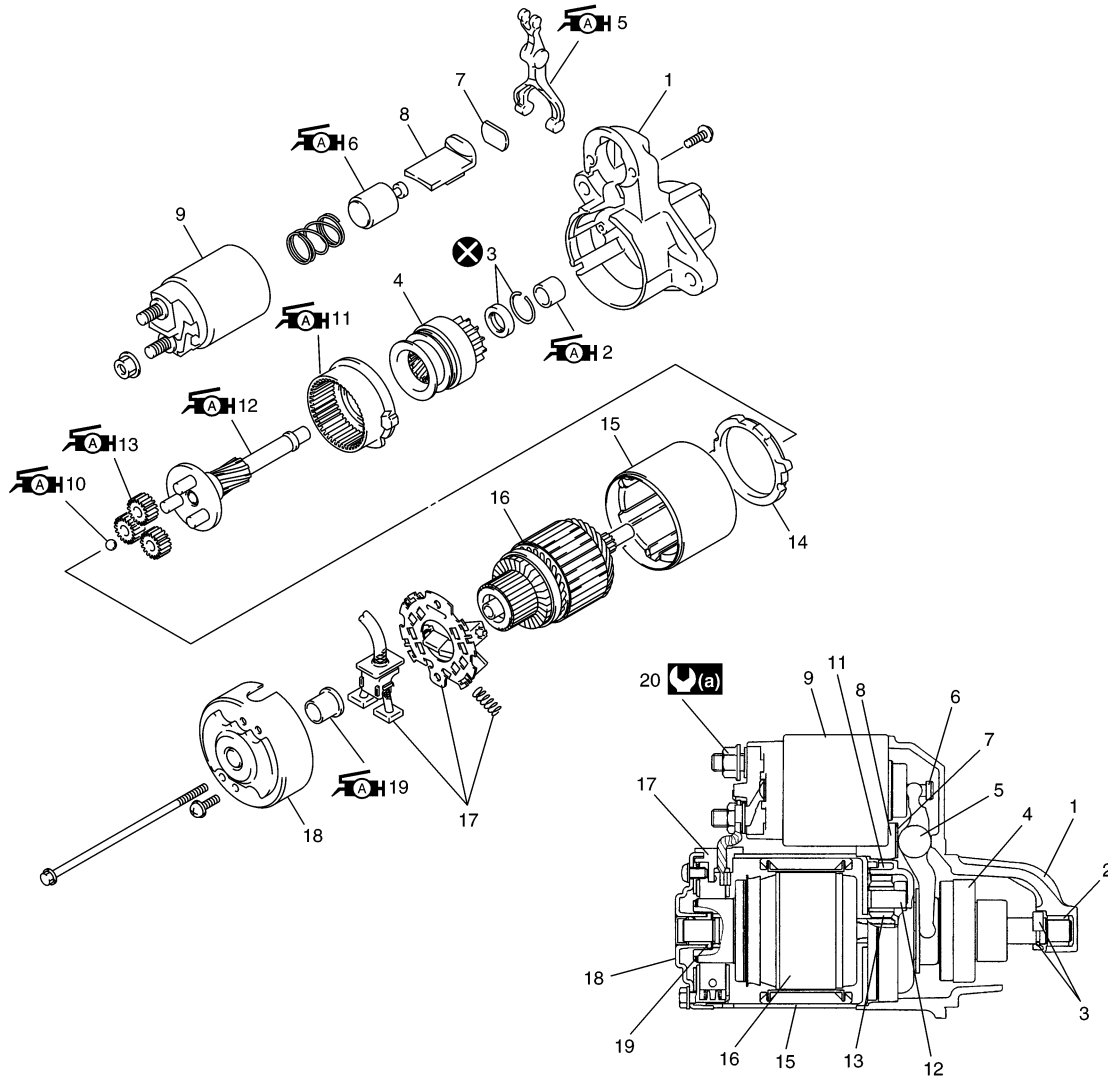
0.8 kW type



I4RS0B190001-01

| | | | |
|------------------------|--------------------|--------------------|--|
| 1. Front housing | 6. Plunger | 11. Yoke | 16. Starting motor battery cable nut |
| 2. Bush | 7. Plate | 12. Armature | (a) : 11 N·m (1.1 kgf-m, 8.0 lb-ft) |
| 3. Pinion stop ring | 8. Seal rubber | 13. Brush assembly | X : Do not reuse. |
| 4. Over-running clutch | 9. Magnetic switch | 14. Rear bracket | AH : Apply grease 99000-25010 to sliding surface of each part. |
| 5. Lever | 10. Washer | 15. Rear bush | |

1.2 kW type



I4RS0A190003-01

| | | | |
|------------------------|-----------------------------|--------------------------------------|--|
| 1. Front housing | 8. Seal rubber | 15. Yoke | ⊗ : Do not reuse. |
| 2. Bush | 9. Magnetic switch | 16. Armature | ⒶH : Apply grease 99000-25010 to sliding surface of each part. |
| 3. Pinion stop ring | 10. Ball | 17. Brush assembly | |
| 4. Over-running clutch | 11. Internal gear | 18. Rear bracket | |
| 5. Lever | 12. Planetary carrier shaft | 19. Rear bush | |
| 6. Plunger | 13. Planetary gear | 20. Starting motor battery cable nut | |
| 7. Plate | 14. Packing | Ⓐ(a) : 11 N·m (1.1 kgf-m, 8.0 lb-ft) | |

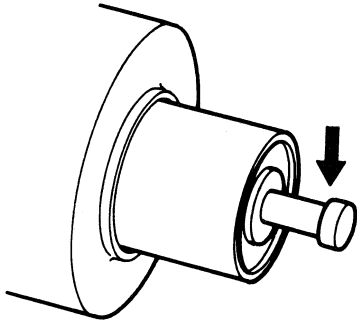
11-7 Starting System:

Starting Motor Inspection

S4RS0B1906003

Plunger

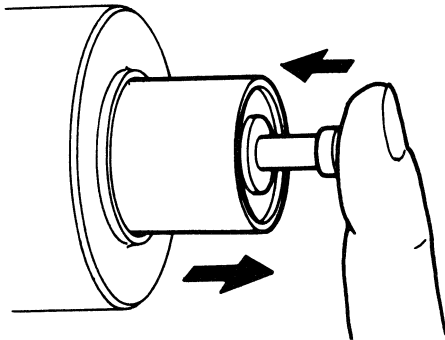
Inspect plunger for wear. Replace if necessary.



I2RH01190008-01

Magnetic Switch

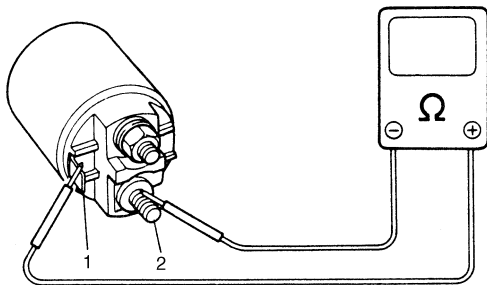
Push in plunger and release it. The plunger should return quickly to its original position. Replace if necessary.



I2RH01190009-01

Pull-in coil open circuit test

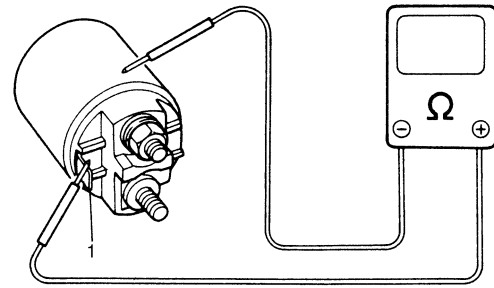
Check for continuity across magnetic switch "S" terminal (1) and "M" terminal (2). If no continuity, coil is open and should be replaced.



I2RH01190010-01

Hold-in coil open circuit test

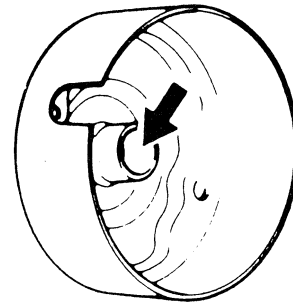
Check for continuity across magnetic switch "S" terminal (1) and coil case. If no continuity, coil is open and should be replaced.



I2RH01190011-01

Rear Bracket Bush

Inspect bush for wear or damage. Replace if necessary.



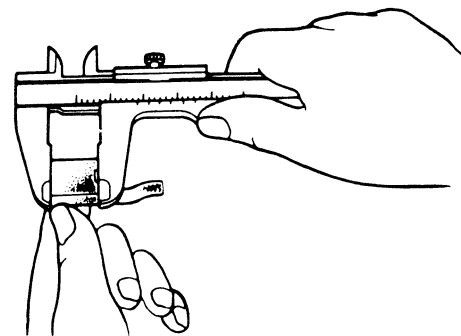
I2RH01190012-01

Brush

- Check brushes for wear. Measure length of brushes and if below the limit, replace the brush.

Brush length

| | 0.8 kW | 1.2 kW |
|----------|--------------------|--------------------|
| Standard | 17.0 mm (0.67 in.) | 12.3 mm (0.48 in.) |
| Limit | 11.5 mm (0.46 in.) | 7.0 mm (0.28 in.) |



I2RH01190013-01

- Install brushes to each brush holder and check for smooth movement.

Spring

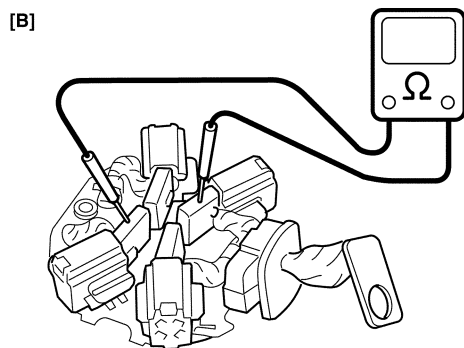
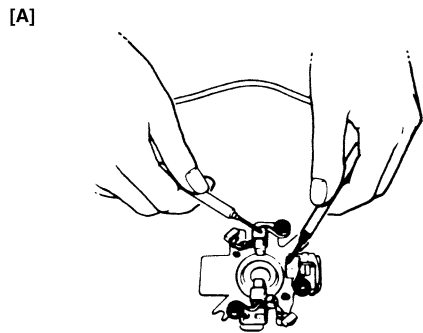
Inspect brush springs for wear, damage or other abnormal conditions. Replace if necessary.

Brush spring tension

| | 0.8 kW | 1.2 kW |
|----------|------------------|------------------|
| Standard | 1.95 kg (4.3 lb) | 2.2 kg (4.85 lb) |
| Limit | 0.9 kg (1.99 lb) | 0.6 kg (1.33 lb) |

Brush Holder

- Check movement of brush in brush holder. If brush movement within brush holder is sluggish, check brush holder for distortion and sliding faces for contamination. Clean or correct as necessary.
- Check for continuity across insulated brush (positive side) and grounded brush (negative side). If continuity exists, brush holder is grounded due to defective insulation and should be replaced.

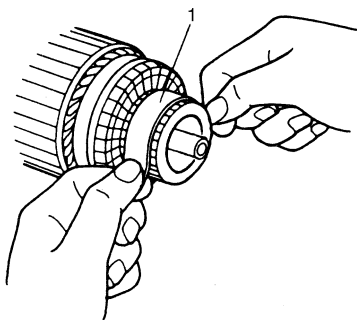


I4RS0B190002-01

| |
|-------------|
| [A]: 0.8 kW |
| [B]: 1.2 kW |

Armature

- Inspect commutator for dirt or burn. Correct with sandpaper or lathe, if necessary.



I4RS0B190003-01

| |
|----------------------------|
| 1. Sandpaper of #300 – 400 |
|----------------------------|

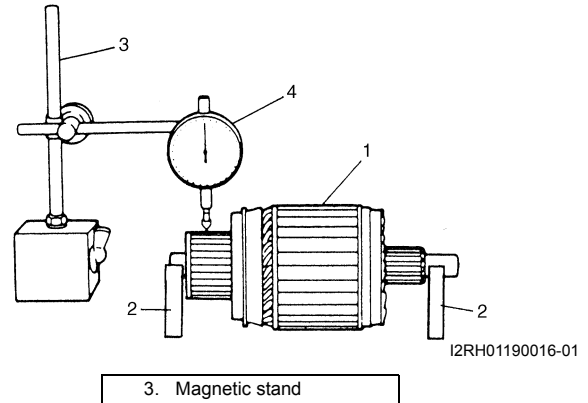
- Check commutator for uneven wear with armature (1) supported on V-blocks (2). If deflection of dial gauge (4) pointer exceeds limit, repair or replace.

NOTE

The following specification presupposes that the armature is free from bend. Bent armature must be replaced.

Commutator out of round

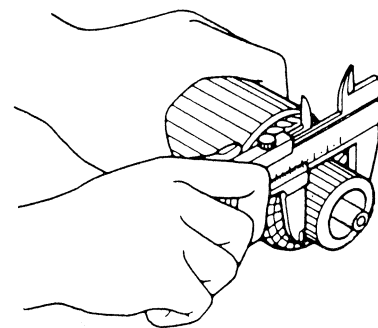
| | | |
|-----------------|------------------------------------|--|
| | 0.8 kW and 1.2 kW | |
| Standard | 0.05 mm (0.002 in.) or less | |
| Limit | 0.4 mm (0.016 in.) | |



- Inspect the commutator for wear. If diameter is below limit, replace the armature.

Commutator outside diameter

| | | |
|-----------------|---------------------------|---------------------------|
| | 0.8 kW | 1.2 kW |
| Standard | 32.0 mm (1.26 in.) | 29.4 mm (1.16 in.) |
| Limit | 31.4 mm (1.23 in.) | 28.8 mm (1.14 in.) |



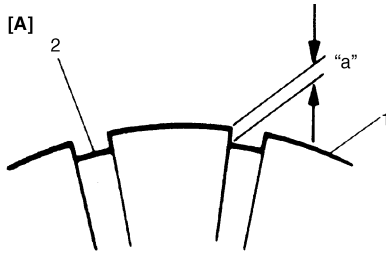
I2RH01190017-01

- Inspect the commutator (1) for insulator (2) depth. Correct or replace if below limit.

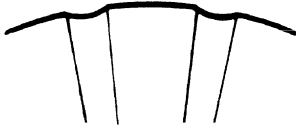
Commutator insulator depth "a"

| | | |
|-----------------|---|--|
| | 0.8 kW and 1.2 kW | |
| Standard | 0.4 – 0.6 mm (0.016 – 0.023 in.) | |
| Limit | 0.2 mm (0.008 in.) | |

11-9 Starting System:



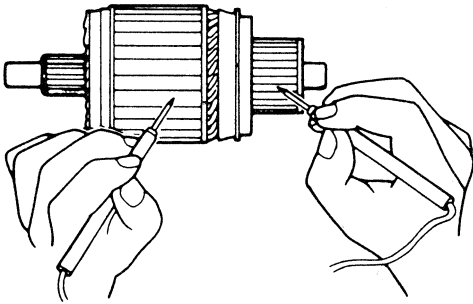
[B]



I3RH0A190005-01

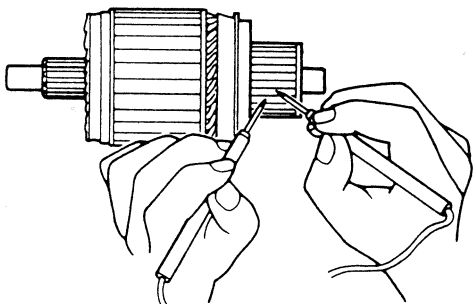
| |
|----------------|
| [A]: Correct |
| [B]: Incorrect |

- Check the commutator and armature core. If there is continuity, the armature is grounded and must be replaced.



I2RH01190019-01

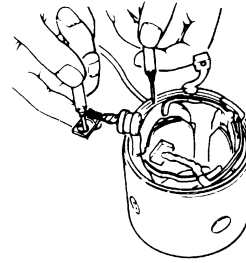
- Check for continuity between segments. If there is no continuity at any test point, there is an open circuit and the armature must be replaced.



I2RH01190020-01

Ground Test of Field Coil (0.8 kW Type)

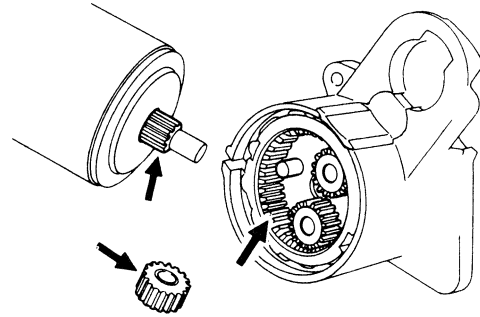
Check continuity between brush and bare surface. If there is continuity, filed windings are grounded. The yoke assembly must be replaced.



I4RS0B190004-01

Gears (1.2 kW Type)

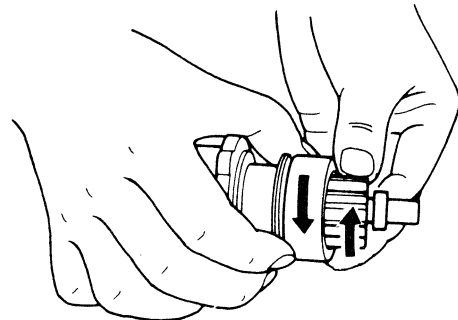
Inspect the internal gear and the planetary gears for wear, damage or other abnormal conditions. Replace if necessary.



I2RH01190021-01

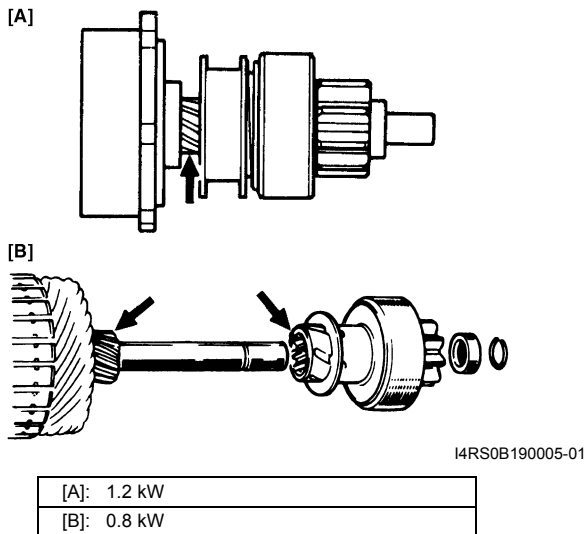
Pinion and Over-Running Clutch

- Inspect the pinion for wear, damage or other abnormal conditions. Check that clutch locks up when turned in direction of drive and rotates smoothly in reverse direction. Replace if necessary.



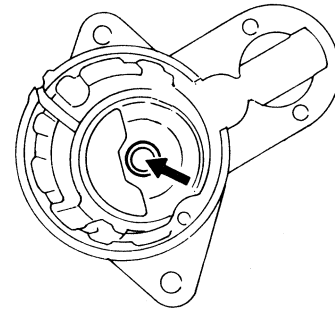
I2RH01190022-01

- Inspect the spline teeth for wear or damage. Replace if necessary. Inspect the pinion for smooth movement.



Front Housing Bush

Inspect the bush for wear or damage. Replace if necessary.



I2RH01190024-01

Specifications

Cranking System Specifications

S4RS0B1907001

0.8 kW type

| | | | |
|-------------------------|-----------------------------------|--------------------------------------|---|
| Voltage | | 12 volts | |
| Output | | 0.8 kW | |
| Rating | | 30 seconds | |
| Direction of rotation | | Clockwise as viewed from pinion side | |
| Brush length | | Standard: 17.0 mm (0.67 in.) | Limit: 11.5 mm (0.46 in.) |
| Number of pinion teeth | | 8 | |
| Performance | | Condition | Guarantee |
| Around at 20 °C (68 °F) | No load characteristic | 11.5 V | 53 A maximum 6,000 rpm minimum |
| | Load characteristic | 9 V 150 A | 2.8 N·m (0.28 kgf-m, 2.0 lb-ft) minimum 2000 rpm minimum |
| | Locked characteristic | 5 V | 360 A maximum 6.86 N·m (0.7 kgf-m, 5.1 lb-ft) minimum |
| | Magnetic switch operating voltage | | 8 volts maximum |

1.2 kW type

| | | | |
|-------------------------|-----------------------------------|--------------------------------------|--|
| Voltage | | 12 volts | |
| Output | | 1.2 kW | |
| Rating | | 30 seconds | |
| Direction of rotation | | Clockwise as viewed from pinion side | |
| Brush length | | Standard: 12.3 mm (0.48 in.) | Limit: 7.0 mm (0.28 in.) |
| Number of pinion teeth | | 8 | |
| Performance | | Condition | Guarantee |
| Around at 20 °C (68 °F) | No load characteristic | 11.0 V | 90 A maximum 2370 rpm minimum |
| | Load characteristic | 7.5 V 300 A | 10.65 N·m (1.065 kgf-m, 7.70 lb-ft) minimum 840 rpm minimum |
| | Locked characteristic | 4.0 V | 780 A maximum 20 N·m (2.0 kgf-m, 14.5 lb-ft) minimum |
| | Magnetic switch operating voltage | | 8 volts maximum |

11-11 Starting System:

Tightening Torque Specifications

S4RS0B1907002

| Fastening part | Tightening torque | | | Note |
|----------------------------------|-------------------|-------|-------|------|
| | N·m | kgf·m | lb-ft | |
| Starting motor battery cable nut | 11 | 1.1 | 8.0 | ⚡ |

NOTE

The specified tightening torque is also described in the following.

“Starting Motor Dismounting and Remounting: ”

“Starting Motor Components: ”

Reference:

For the tightening torque of fastener not specified in this section, refer to “Fasteners Information: in Section 0A”.

Special Tools and Equipment

Recommended Service Material

S4RS0B1908001

NOTE

Required service material is also described in the following.

“Starting Motor Components: ”

Charging System

General Description

Battery Description

S4RS0B1A01001

The battery has three major functions in the electrical system.

- It is a source of electrical energy for cranking the engine.
- It acts as a voltage stabilizer for the electrical system.
- It can, for a limited time, provide energy when the electrical load exceeds the output of the generator.

Carrier and Hold-Down

The battery carrier should be in good condition so that it will support the battery securely and keep it level. Before installing the battery, the battery carrier and hold-down clamp should be clean and free from corrosion and make certain there are no parts in carrier.

To prevent the battery from shaking in its carrier, the hold-down bolts should be tight enough but not over-tightened.

Electrolyte Freezing

The freezing point of electrolyte depends on its specific gravity. Since freezing may ruin a battery, it should be protected against freezing by keeping it in a fully charged condition. If a battery is frozen accidentally, it should not be charged until it is warmed.

Sulfation

If the battery is allowed to stand for a long period in discharged condition, the lead sulfate becomes converted into a hard, crystalline substance, which will not easily turn back to the active material again during the subsequent recharging. "Sulfation" means the result as well as the process of that reaction. Such a battery can be revived by very slow charging and may be restored to usable condition but its capacity is lower than before.

Built-In Indicator (If Equipped)




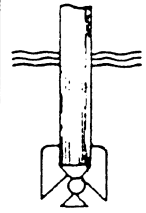
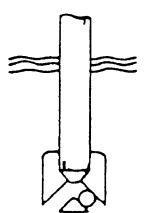
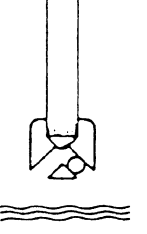
The battery has a built-in temperature compensated indicator in the top of the battery. This indicator is to be used with the following diagnostic procedure. When checking the indicator, make sure that the battery has a clean top. A light may be needed in some poorly-lit areas.

Three types of indication available under normal operation are as follows.

- **Green dot**
Battery is sufficiently charged for testing.
- **Dark**
Battery must be charged before testing. If there is a cranking complaint, battery should be tested as described in "Battery Inspection: ". Charging and electrical systems should also be checked at this time.

- **Clear**

This means that fluid level is below the bottom of hydrometer. Its possible cause is excessive or prolonged charging, a broken case, excessive tipping or normal battery deterioration. When the battery is found in such condition, it is possible that high charging voltage is caused by the faulty charging system and therefore, charging and electrical systems need to be checked. If there is a trouble in cranking and its cause lies in the battery, it should be replaced.

| | | | |
|---|--|---|--|
| D I A G N O S I S | OK | CHARGING NECESSARY | LOW LEVEL ELECTROLYTE REPLACE BATTERY |
| I N D I C A T O R | Green dot  | Dark  | Clear  |
| G R A V I T Y B A L L |  |  |  |

I2RH011A0001-01

1J-2 Charging System:

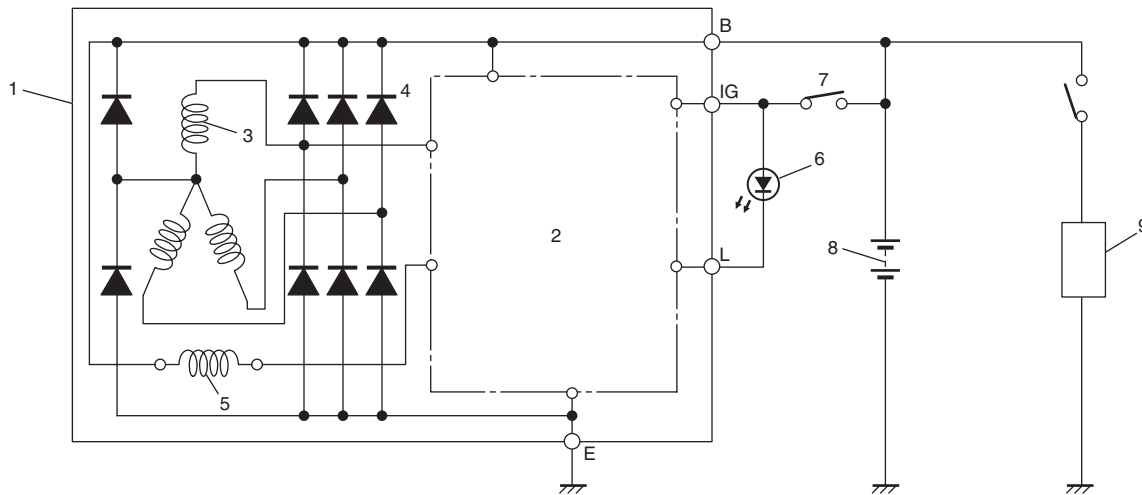
Generator Description

S4RS0B1A01002

The generator is a small and high performance type with an IC regulator incorporated. The internal components are connected electrically as shown in the following figure.

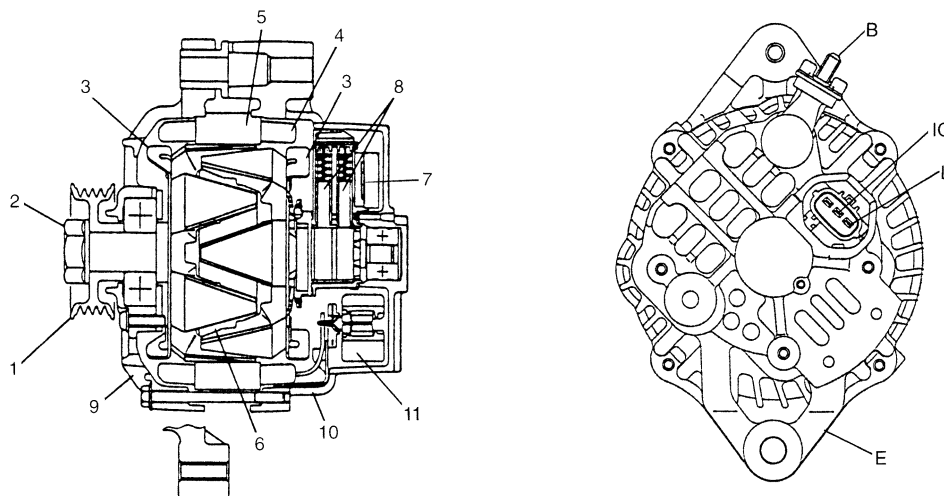
The generator features are as follows:

- Solid state regulator is mounted inside the generator.
- All regulator components are enclosed into a solid mold.
- This unit along with the brush holder assembly is attached to the rear housing.
- The IC regulator uses integrated circuits and controls the voltage produced by the generator, and the voltage setting cannot be adjusted.
- The generator rotor bearings contain enough grease to eliminate the need for periodic lubrication. Two brushes carry current through the two slip rings to the field coil mounted on the rotor, and under normal conditions will provide long period of attention-free service.
- The stator windings are assembled on the inside of a laminated core that forms part of the generator frame.



I4RS0B1A0001-01

| | | | | |
|--------------------------------------|----------------|----------------------------|----------------|---------|
| 1. Generator with regulator assembly | 3. Stator coil | 5. Field coil (rotor coil) | 7. Main switch | 9. Load |
| 2. I.C. regulator | 4. Diode | 6. Charge indicator light | 8. Battery | |



I4RS0B1A0002-01

| | | | |
|----------------|----------------|--|-----------------------|
| 1. Pulley | 5. Stator core | 9. Drive end frame | E: Ground |
| 2. Pulley nut | 6. Field coil | 10. Rear end frame | IG: Ignition terminal |
| 3. Rotor fan | 7. Regulator | 11: Rectifier | L: Lamp terminal |
| 4. Stator coil | 8. Brush | B: Generator output (Battery terminal) | |

Diagnostic Information and Procedures

Battery Inspection

S4RS0B1A04001

Visual Inspection

Check for obvious damage, such as cracked or broken case or cover, that could permit loss of electrolyte. If obvious damage is noted, replace battery. Determine cause of damage and correct as needed.

Generator Symptom Diagnosis

S4RS0B1A04002

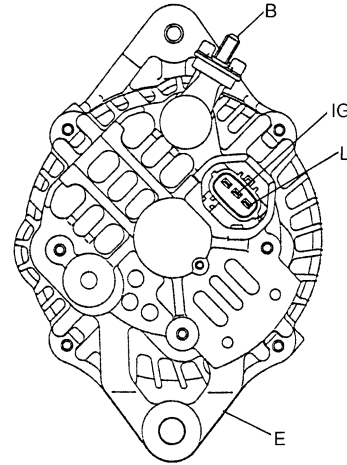
⚠ CAUTION

- Do not mistake polarities of "IG" terminal and "L" terminal.
- Do not create short circuit between "IG" and "L" terminals. Always connect these terminals through a lamp.
- Do not connect any load between "L" and "E" terminals.
- When connecting charger or booster battery to vehicle battery, refer to "Jump Starting in Case of Emergency: ".

Trouble in charging system will show up as one or more of the following conditions:

- 1) Faulty indicator lamp operation.

- 2) An undercharged battery as evidenced by slow cranking or indicator dark.
 - 3) An overcharged battery as evidenced by excessive spewing of electrolyte from vents.
- Noise from generator may be caused by loose drive pulley, loose mounting bolts, worn or dirty bearings, defective diode, or defective stator.



I4RS0B1A0003-01

| | |
|--|-----------------------|
| B: Generator output (Battery terminal) | IG: Ignition terminal |
| E: Ground | L: Lamp terminal |

Charging Indicator Lamp Operation

| Condition | Possible cause | Correction / Reference Item |
|--|--|-------------------------------|
| Charge light does not light with ignition ON and engine off | Fuse blown | Check fuse. |
| | Indicator lamp (LED) faulty | Replace combination meter. |
| | Wiring connection loose | Tighten loose connection. |
| | IC regulator or field coil faulty | Check generator. |
| | Poor contact between brush and slip ring | Repair or replace. |
| Charge light does not go out with engine running (battery requires frequent recharging) | Drive belt loose or worn | Adjust or replace drive belt. |
| | IC regulator or generator faulty | Check charging system. |
| | Wiring faulty | Repair wiring. |

1J-4 Charging System:

Generator Test (Undercharged Battery Check)

S4RS0B1A04003

This condition, as evidenced by slow cranking or low specific gravity can be caused by one or more of the following conditions even though indicator lamp may be operating normal. The following procedure also applies to cars with voltmeter and ammeter.

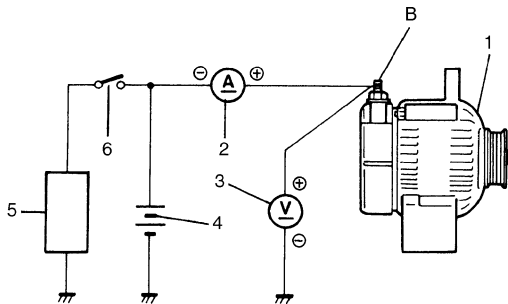
- Make sure that undercharged condition has not been caused by accessories left on for extended period of time.
- Check drive belt for proper tension.
- If battery defect is suspected, refer to "Battery Description: ".
- Inspect wiring for defects. Check all connections for tightness and cleanliness, battery cable connections at battery, starting motor and ignition ground cable.

No-Load Check

- 1) Connect voltmeter and ammeter as shown in the figure.

NOTE

Use fully charged battery.



I2RH011A0006-01

| |
|--|
| 1. Generator |
| 2. Ammeter (between generator "B" terminal and battery (+) terminal) |
| 3. Voltmeter (between generator "B" terminal and ground) |
| 4. Battery |
| 5. Load |
| 6. Switch |

- 2) Run engine from idling up to 2,000 rpm with all accessories turned off and read meters.
If voltage is higher than standard value, check ground of brushes.
If brushes are not grounded, replace IC regulator.
If voltage is lower than standard value, proceed to the following check.

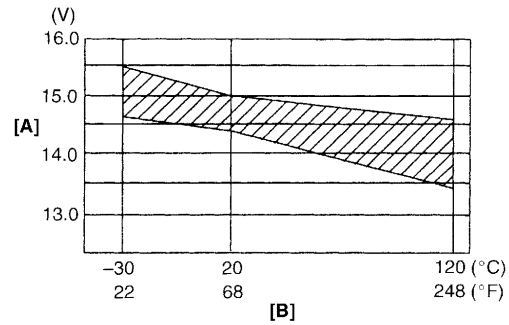
Specification for undercharged battery (No-load check)

Current: 10 A

Voltage: 14.2 – 14.8 V (at 20 °C, 68 °F)

NOTE

Consideration should be taken that voltage will differ somewhat with regulator case temperature as shown in the graph.



I4RS0B1A0004-01

[A]: Regulated voltage (V)

[B]: Heatsink temperature (°C)

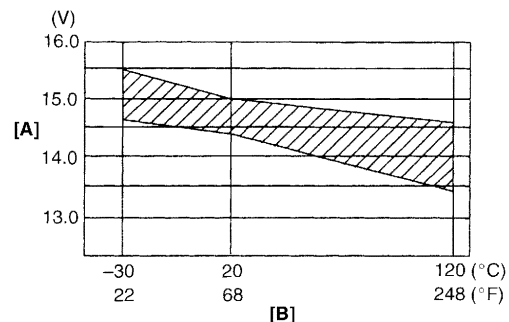
Load Check

- 1) Run engine at 2,000 rpm and turn on head light and heater motor.
- 2) Measure current and if it is less than 20 A, repair or replace generator.

Generator Test (Overcharged Battery Check)

S4RS0B1A04004

- 1) To determine battery condition, refer to "Battery Description: ".
- 2) If obvious overcharged condition exists as evidenced by excessive spewing of electrolyte, measure generator "B" terminal voltage at engine 2000 rpm.
- 3) If measured voltage is higher than upper limit value, disassemble generator.
- 4) Check ground of brushes. If brushes are not grounded, replace IC regulator. Then check field coil for grounds and shorts.



I4RS0B1A0004-01

[A]: Regulated voltage (V)

[B]: Heatsink temperature (°C)

Repair Instructions

Jump Starting in Case of Emergency

S4RS0B1A06001

With Auxiliary (Booster) Battery

⚠ CAUTION

If vehicle is manual transaxle model and has a catalytic converter, do not push or tow it to start. Damage to its emission system and/or to other parts may result.

Both booster and discharged battery should be treated carefully when using jumper cables. Follow the procedure outlined as follows, being careful not to cause sparks.

⚠ WARNING

- Departure from these conditions or procedure described as follows could result in:
 - Serious personal injury (particularly to eyes) or property damage from such causes as battery explosion, battery acid, or electrical burns.
 - Damage to electronic components of either vehicle.
 - Remove rings, watches, and other jewelry. Wear approved eye protection.
 - Be careful so that metal tools or jumper cables do not contact positive battery terminal (or metal in contact with it) and any other metal on vehicle, because a short circuit could occur.
 - Do not connect negative cable directly to negative terminal of dead battery.
- 1) Set parking brake and place automatic transaxle in PARK (NEUTRAL on manual transaxle and automated manual transaxle). Turn off ignition, turn off lights and all other electrical loads.
 - 2) Check electrolyte level. If it is below low level line, add distilled water.
 - 3) Attach end of one jumper cable to positive terminal of booster battery and the other end of the same cable to positive terminal of discharged battery. (Use 12-volt battery only to jump start engine).
 - 4) Attach one end of the remaining negative cable to negative terminal of booster battery, and the other end to a solid engine ground (such as exhaust manifold) at least 45 cm (18 in.) away from battery of vehicle being started.
 - 5) Start engine of vehicle with booster battery and turn off electrical accessories. Then start engine of the vehicle with discharged battery.
 - 6) Disconnect jumper cables in the exact reverse order.

With Charging Equipment

⚠ CAUTION

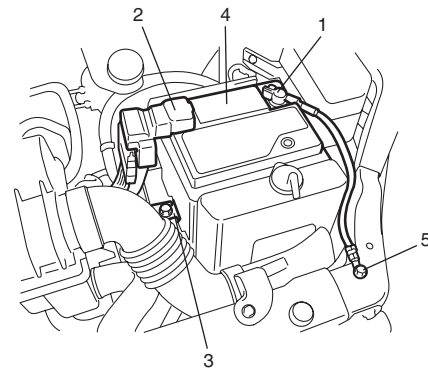
When jump starting engine with charging equipment, be sure equipment used is 12-volt and negative ground. Do not use 24-volt charging equipment. Using such equipment can cause serious damage to electrical system or electronic parts.

Battery Dismounting and Remounting

S4RS0B1A06002

Dismounting

- 1) Disconnect negative cable (1).
- 2) Disconnect positive cable (2).
- 3) Remove retainer (3).
- 4) Remove battery (4).



I4RS0B1A0006-01

5. Body ground bolt

Handling

When handling battery, the following safety precautions should be followed:

- Hydrogen gas is produced by battery. A flame or spark near battery may cause the gas to ignite.
- Battery fluid is highly acidic. Avoid spilling on clothing or other fabric. Any spilled electrolyte should be flushed with large quantity of water and cleaned immediately.

Remounting

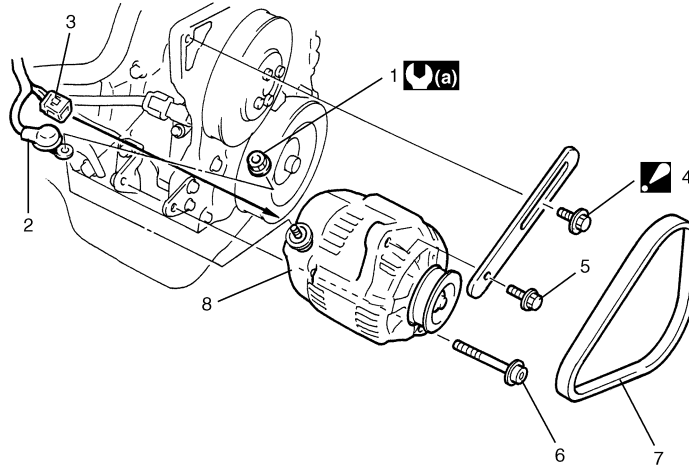
- 1) Reverse removal procedure.
- 2) Tighten battery cables securely.

1J-6 Charging System:

Generator Dismounting and Remounting

S4RS0B1A06003

- 1) Disconnect negative cable at battery.
- 2) Remove right side drive shaft referring to "Front Drive Shaft Assembly Removal and Installation: in Section 3A".
- 3) Dismount in numerical order as shown in the figure.
- 4) Reverse dismounting procedure for remounting.

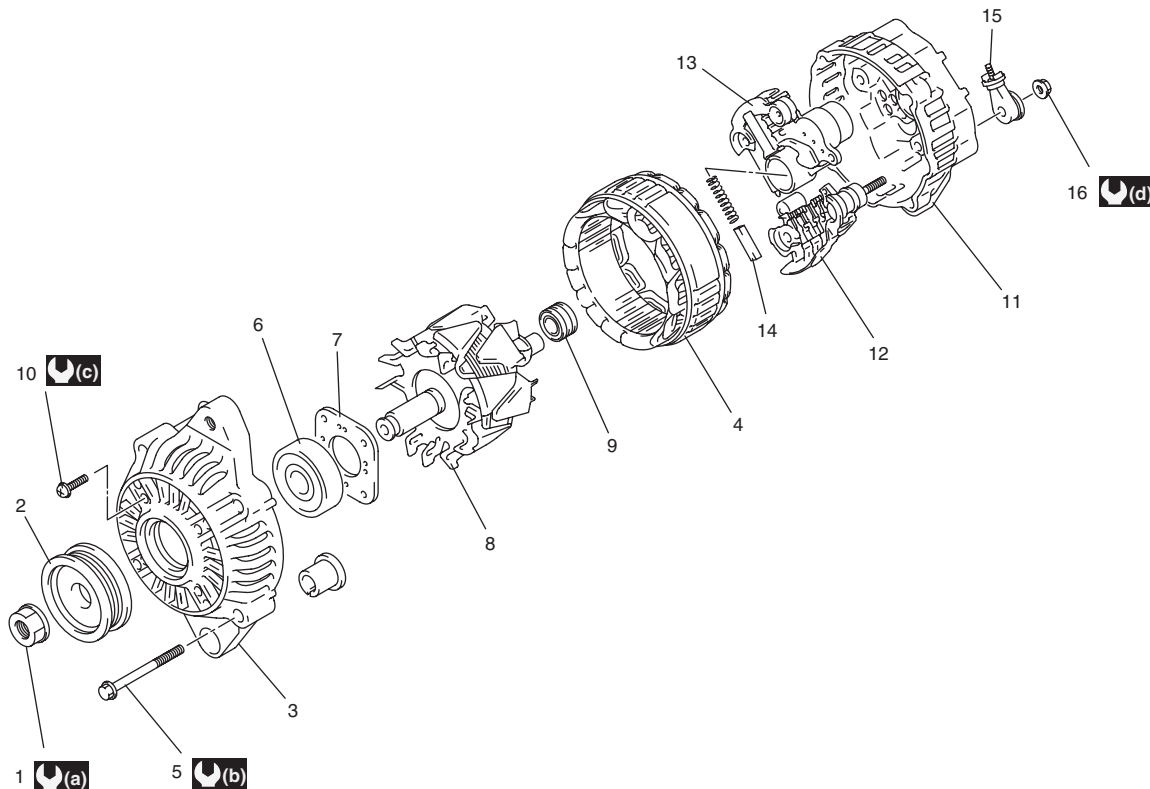


I4RS0A1A0003-01

| | | |
|----------------------|---|-------------------------------------|
| 1. "B" terminal nut | 4. Generator adjusting bolt : Only loosen this bolt. | 7. Generator belt |
| 2. "B" terminal wire | 5. Generator adjusting arm bolt | 8. Generator |
| 3. Connector | 6. Generator pivot bolt | (a) : 8.0 N-m (0.8 kg-m, 6.0 lb-ft) |

Generator Components

S4RS0B1A06004



I4RS0B1A0007-01

| | | | |
|--------------------|---------------------|------------------|---------------------------------------|
| 1. Pulley nut | 7. Bearing retainer | 13. Regulator | (c) : 3.5 N-m (0.35 kgf-m, 2.5 lb-ft) |
| 2. Pulley | 8. Rotor | 14. Brush | (d) : 8.0 N-m (0.8 kgf-m, 6.0 lb-ft) |
| 3. Drive end frame | 9. Rear end bearing | 15. "B" terminal | |

| | | | |
|----------------------|--------------------|--|--|
| 4. Stator | 10. Retainer screw | 16. "B" terminal nut | |
| 5. Frame bolt | 11. Rear end frame | (a) : 118 N·m (11.8 kgf-m, 85.5 lb-ft) | |
| 6. Drive end bearing | 12. Rectifier | (b) : 4.5 N·m (0.45 kgf-m, 3.5 lb-ft) | |

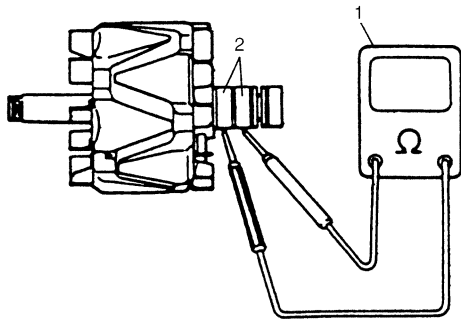
Generator Inspection

S4RS0B1A06005

Rotor

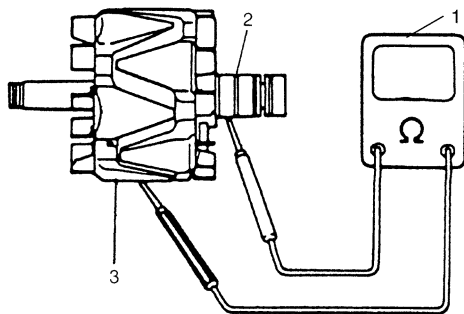
- Using an ohmmeter (1), check for continuity between slip rings (2) of rotor. If there is no continuity, replace the rotor.

Standard resistance between slip rings of rotor
2.5 – 2.9 Ω



I4RS0B1A0005-01

- Using an ohmmeter (1), check that there is no continuity between slip ring (2) and rotor core (3). If there is continuity, replace the rotor.

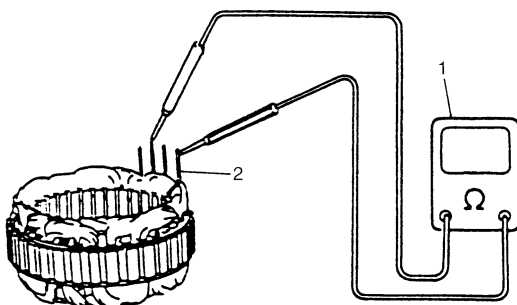


I4RS0B1A0008-01

- Check slip rings for roughness or scoring. If rough or scored, replace the rotor.

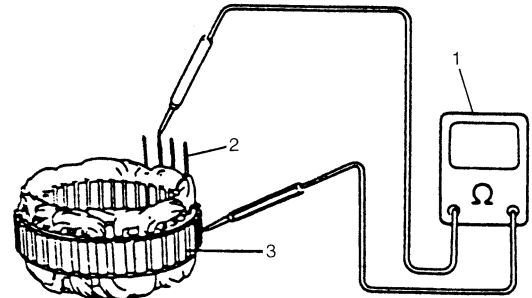
Stator

- Using an ohmmeter (1), check all leads (2) for continuity. If there is no continuity, replace the stator.



I4RS0B1A0009-01

- Using an ohmmeter (1), check that there is no continuity between coil leads (2) and stator core (3). If there is continuity, replace the stator.

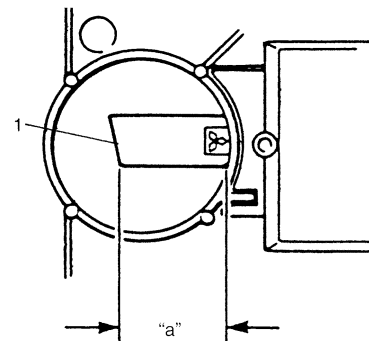


I4RS0B1A0010-01

Brush and Brush Holder

Check each brush (1) for wear by measuring its length as shown. If the brush is found worn down to service limit, replace the brush.

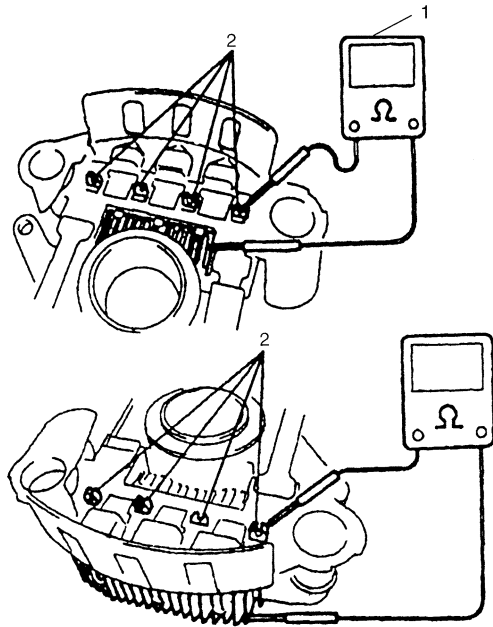
Exposed brush length "a"
Standard: 16 mm (0.63 in.)
Limit: 2.0 mm (0.08 in.)



I4RS0B1A0011-01

Rectifier

Using ohmmeter (1), check continuity between each of upper and lower rectifier bodies and each diode lead (2). Check both directions by reversing probes of ohmmeter and there should be only one-way continuity in each case. If check result is not satisfactory, replace rectifier.



I4RS0B1A0012-01

Specifications

Charging System Specifications

S4RS0B1A07001

Battery

NOTE

The battery used in each vehicle is one of the following tow types, depending on specification.

| Battery Type | CCA 180A | CCA 210A |
|-----------------------|-------------|-------------|
| Nominal output | 12 V | |
| Rated capacity | 36 Ah/20 h | 44 Ah/20 h |
| | 28 Ah/5 h | 36 Ah/5 h |
| Cold cranking amperes | 180 A (DIN) | 210 A (DIN) |
| Battery dimension | | |

I4RS0B1A0013-02

| | |
|--------------------------|------------------------------------|
| "L": 207.8 mm (8.18 in.) | "H" 170 – 175 mm (6.70 – 6.88 in.) |
| "W" 174 mm (6.85 in.) | "a" 10.3 – 10.5 mm (0.406 – 0.413) |

Generator

| | |
|---------------------------------|--|
| Type | 75 A type |
| Rated voltage | 12 V |
| Nominal output | 75 A |
| Permissible max. speed | 18,000 r/min. |
| No-load speed | 1020 r/min. (rpm) |
| Regulated voltage | 14.2 – 14.8 V at 25 °C (77 °F) |
| Exposed brush length | Standard: 16 mm (0.63 in.) Limit: 2.0 mm (0.08 in.) |
| Permissible ambient temperature | –30 to 100 °C (–22 to 212 °F) |
| Polarity | Negative ground |
| Rotation | Clockwise viewed from pulley side |

Tightening Torque Specifications

S4RS0B1A07002

NOTE

The specified tightening torque is also described in the following.

“Generator Dismounting and Remounting: ”

“Generator Components: ”

Reference:

For the tightening torque of fastener not specified in this section, refer to “Fasteners Information: in Section 0A”.

Exhaust System

General Description

Exhaust System Description

S4RS0B1B01001

The exhaust system consists of an exhaust manifold, three-way catalytic converter (TWC) in catalyst case, exhaust pipes, a muffler and seals, gasket and etc.

The three-way catalytic converter is an emission control device added to the exhaust system to lower the levels of Hydrocarbon (HC), Carbon Monoxide (CO), and Oxides of Nitrogen (NOx) pollutants in the exhaust gas.

Diagnostic Information and Procedures

Exhaust System Check

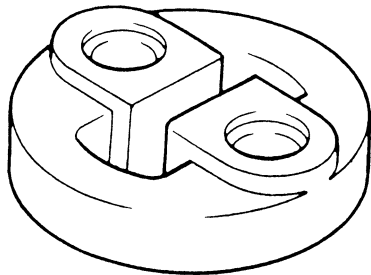
S4RS0B1B04001

▲ WARNING

To avoid the danger of being burned, do not touch the exhaust system when the system is hot. Any service on the exhaust system should be performed when the system is cool.

At every interval of periodic maintenance service, and when vehicle is raised for other service, check exhaust system as follows:

- Check rubber mountings for damage, deterioration, and out of position.



IYSY011B0003-01

- Check exhaust system for leakage, loose connection, dent and damage.
- If bolts or nuts are loosened, tighten them to specified torque referring to "Exhaust System Components: ".
- Check nearby body areas damaged, missing, or mispositioned part, open seam, hole connection or any other defect which could permit exhaust fumes to seep into vehicle.
- Make sure that exhaust system components have enough clearance from underbody to avoid overheating and possible damage to passenger compartment carpet.
- Any defect should be fixed at once.

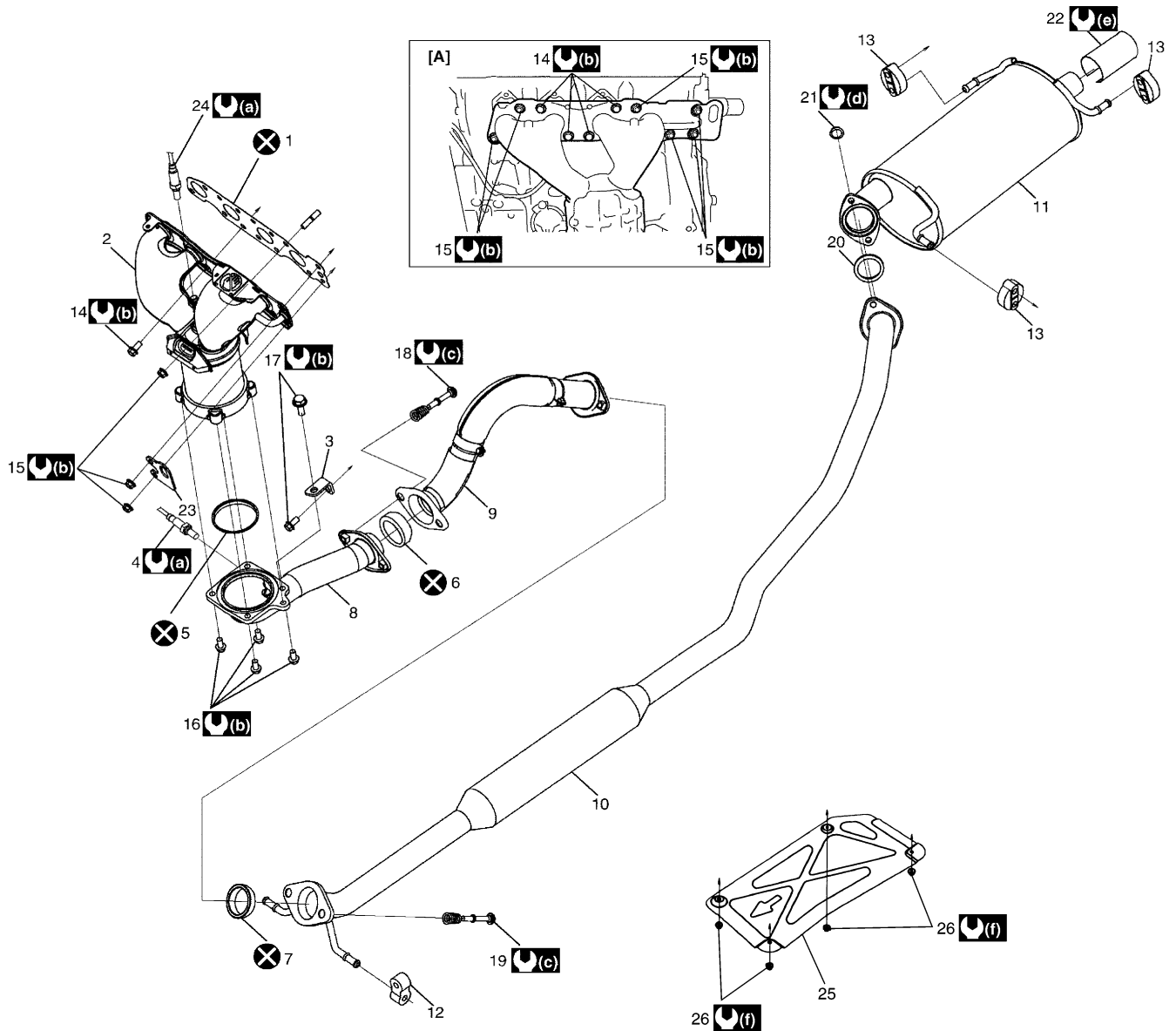
Repair Instructions

Exhaust System Components

S4RS0B1B06001

▲ WARNING

To avoid the danger of being burned, do not touch the exhaust system when the system is hot. Any service on the exhaust system should be performed when the system is cool.



I4RS0A1B0001-01

| | | |
|--|-------------------------------------|---|
| [A]: Installing location of exhaust manifold bolt and nut. | 11. Muffler | 22. Muffler tail pipe |
| 1. Exhaust manifold gasket | 12. Center pipe mounting | 23. Engine hook |
| 2. Exhaust manifold | 13. Muffler mounting | 24. Heated oxygen sensor No.2 (connector color: gray) |
| 3. Exhaust manifold stiffener | 14. Exhaust manifold bolt | 25. Heat insulator |
| 4. Heated oxygen sensor No.1 (connector color: green) | 15. Exhaust manifold nut | ⚙️(a) : 45 N·m (4.5 kgf·m, 32.5 lb-ft) |
| 5. Exhaust pipe No.1 gasket | 16. Exhaust No.1 pipe bolt | ⚙️(b) : 50 N·m (5.0 kgf·m, 36.5 lb-ft) |
| 6. No.1 seal ring | 17. Exhaust manifold stiffener bolt | ⚙️(c) : 43 N·m (4.3 kgf·m, 31.0 lb-ft) |
| 7. No.2 seal ring | 18. Exhaust No.2 pipe bolt | ⚙️(d) : 60 N·m (6.0 kgf·m, 43.5 lb-ft) |
| 8. Exhaust No.1 pipe | 19. Exhaust center pipe bolt | ⚙️(e) : 10 N·m (1.0 kgf·m, 7.5 lb-ft) |
| 9. Exhaust No.2 pipe | 20. Exhaust pipe No.2 gasket | ⚙️(f) : 3 N·m (0.3 kgf·m, 2.5 lb-ft) |
| 10. Exhaust center pipe | 21. Muffler nut | ⊗ : Do not reuse. |

1K-3 Exhaust System:

Exhaust Manifold Removal and Installation

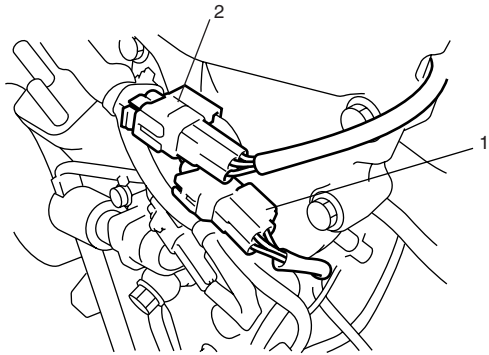
S4RS0B1B06002

Removal

▲ WARNING

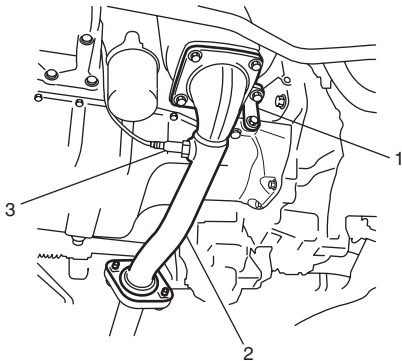
To avoid danger of being burned, do not service exhaust system while it is still hot. Service should be performed after system cools down.

- 1) Disconnect negative cable at battery.
- 2) Remove front bumper with front grille referring to "Front Bumper and Rear Bumper Components: in Section 9K".
- 3) Remove radiator referring to "Radiator Removal and Installation: in Section 1F" for equipped with A/C.
- 4) With hose connected, detach A/C condenser from vehicle body for equipped with A/C.
- 5) Disconnect heated oxygen sensor No.1 connector (1) (connector color: green) and heated oxygen sensor No.2 connector (2) (connector color: gray), and then detach it from its stay.



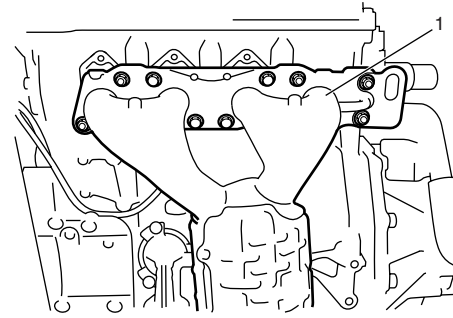
I4RS0A1B0006-01

- 6) Remove exhaust manifold stiffener (1).
- 7) Remove heated oxygen sensors (3) from exhaust manifold and exhaust No.1 pipe, if necessary.
- 8) Disconnect exhaust No.1 pipe (2) from exhaust manifold.



I4RS0A1B0002-01

- 9) Remove exhaust manifold (1) and its gasket from cylinder head.



I4RS0A1B0003-01

Installation

- 1) Install new gasket to cylinder head. Then install exhaust manifold.
Tighten manifold bolts (1) and nuts (2) to specified torque.

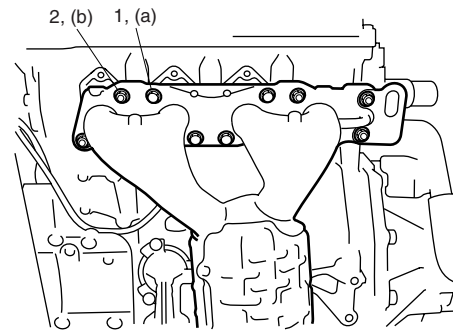
Tightening torque

Exhaust manifold bolt (a): 50 N·m (5.0 kgf·m, 36.5 lb-ft)

Exhaust manifold nut (b): 50 N·m (5.0 kgf·m, 36.5 lb-ft)

NOTE

Be sure to install exhaust manifold bolts and nuts to proper location referring to "Exhaust System Components: ".



I4RS0A1B0004-01

- 2) Install new seal ring and connect exhaust No.1 pipe (1) to exhaust manifold.
Tighten pipe fasteners to specified torque.

Tightening torque

Exhaust No.1 pipe bolt (a): 50 N·m (5.0 kgf·m, 36.5 lb-ft)

- 3) Install exhaust manifold stiffener (2).
Tighten exhaust manifold stiffener bolts to specified torque.

Tightening torque

Exhaust manifold stiffener bolt (b): 50 N·m (5.0 kgf·m, 36.5 lb-ft)

- 4) Install new seal ring and connect exhaust No.1 pipe (1) to exhaust No.2 pipe. Tighten pipe fasteners to specified torque.

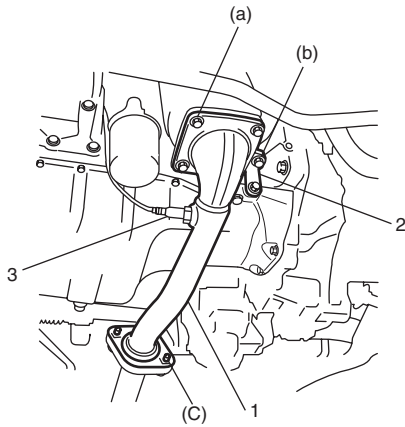
Tightening torque

Exhaust No.2 pipe bolt (c): 43 N·m (4.3 kgf-m, 31.0 lb-ft)

- 5) Install heated oxygen sensors (3) referring to “Exhaust System Components: ”, if removed.

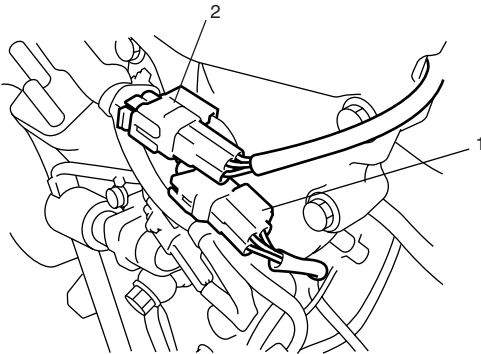
NOTE

Be sure to identify heated oxygen sensor No.1 and No.2 by its connector color.



I4RS0A1B0005-01

- 6) Connect heated oxygen sensor No.1 connector (1) (connector color: green) and heated oxygen sensor No.2 connector (2) (connector color: gray), and then fit coupler to bracket securely.



I4RS0A1B0006-01

- 7) Install A/C condenser to vehicle body for equipped with A/C.
- 8) Install radiator referring to “Radiator Removal and Installation: in Section 1F” for equipped with A/C.
- 9) Install front bumper with front grille by referring to “Front Bumper and Rear Bumper Components: in Section 9K”.
- 10) Connect negative cable at battery.
- 11) Check exhaust system for exhaust gas leakage.

Exhaust Pipe and Muffler Removal and Installation

S4RS0B1B06003

For replacement of exhaust pipe, be sure to hoist vehicle and observe WARNING under “Exhaust System Components: ” and the following.

⚠ CAUTION

**Exhaust manifold have three way catalytic converter in it, it should not be exposed to any impulse.
Be careful not to drop it or hit it against something.**

- Tighten bolts and nuts to specified torque when reassembling. Refer to “Exhaust System Components: ”.
- After installation, start engine and check each joint of exhaust system for leakage.

Specifications

Tightening Torque Specifications

S4RS0B1B07001

| Fastening part | Tightening torque | | | Note |
|---------------------------------|-------------------|-------|-------|------|
| | N·m | kgf-m | lb-ft | |
| Exhaust manifold bolt | 50 | 5.0 | 36.5 | ☞ |
| Exhaust manifold nut | 50 | 5.0 | 36.5 | ☞ |
| Exhaust No.1 pipe bolt | 50 | 5.0 | 36.5 | ☞ |
| Exhaust manifold stiffener bolt | 50 | 5.0 | 36.5 | ☞ |
| Exhaust No.2 pipe bolt | 43 | 4.3 | 31.0 | ☞ |

NOTE

The specified tightening torque is also described in the following.
“Exhaust System Components: ”

Reference:

For the tightening torque of fastener not specified in this section, refer to “Fasteners Information: in Section 0A”.