

2004 STARTING & CHARGING SYSTEMS**Generators & Regulators - RAV4****DESCRIPTION & OPERATION**

The generator is a small, high RPM, high performance type with an internal Integrated Circuit (IC) voltage regulator which controls charging system voltage. A transistor inside IC regulator controls generator voltage output to maintain a constant voltage. Charging system voltage is maintained within an operating range of 13.2-14.8 volts.

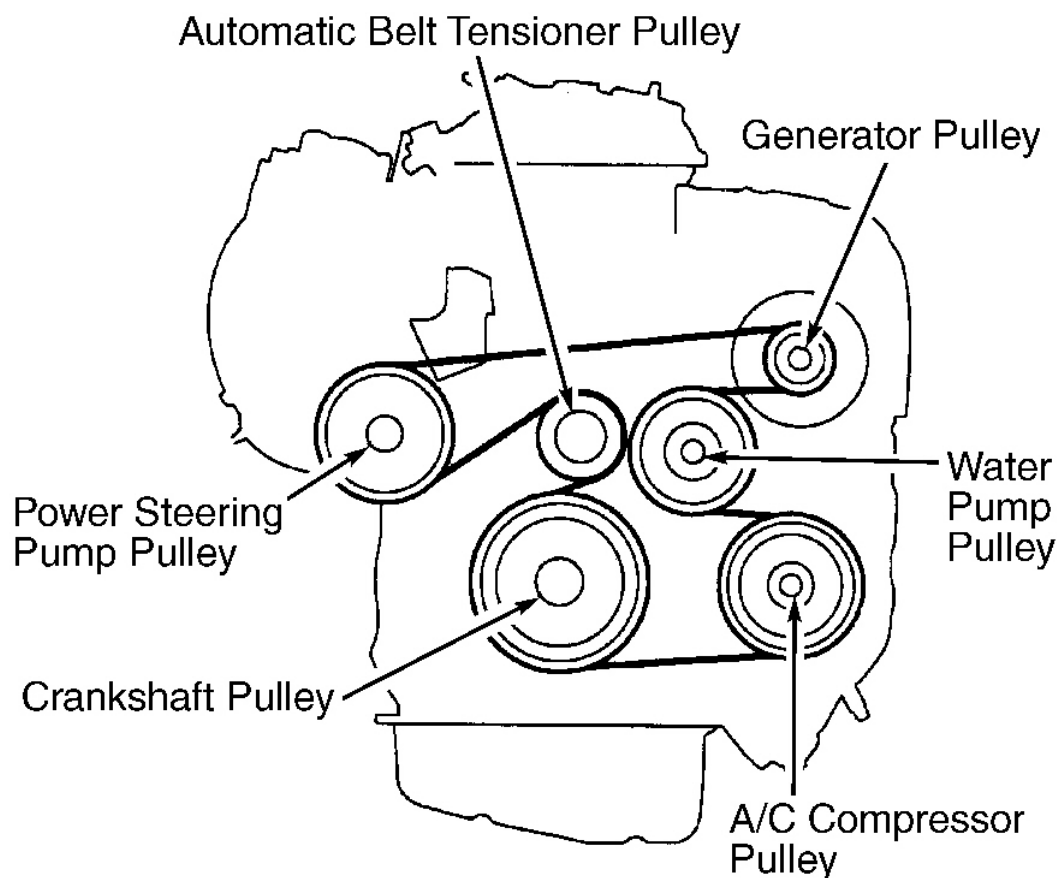
When ignition is turned on, battery voltage flows from generator terminal "L" through IC regulator to ground, causing discharge warning light to come on. When engine starts, generator RPM increases, which increases generator output voltage. When generator output voltage is greater than battery voltage, voltage to recharge battery flows from terminal "B". At the same time, voltage at terminal "L" increases and the potential difference between battery and terminal "L" ceases, causing discharge warning light to go off.

ADJUSTMENTS

NOTE: New belt refers to a belt which has been used 5 minutes or less on a running engine. Used belt refers to a belt which has been used more than 5 minutes on a running engine. After installing new belt, run engine for at least 5 minutes and recheck tension.

BELT TENSION**4-Cylinder**

Engine uses a serpentine drive belt. Serpentine drive belt uses an automatic belt tensioner. No adjustment is necessary, but must be properly installed. For belt routing, see **Fig. 1**.



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Fig. 1: Serpentine Drive Belt Routing (2.4L)

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

TROUBLE SHOOTING

NOTE: See **CHARGING SYSTEM - GENERAL TROUBLE SHOOTING** article in **GENERAL INFORMATION**.

Check all fuses, fusible links, ignition switch and appropriate relays (if equipped). Check generator output. See **NO-LOAD TEST** under ON-VEHICLE TESTING.

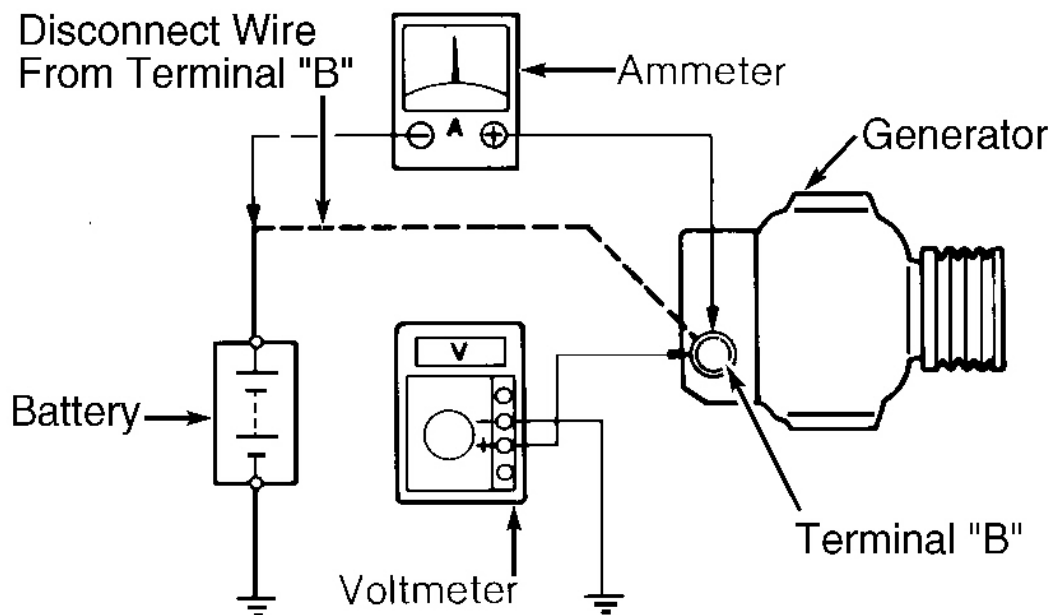
ON-VEHICLE TESTING

NO-LOAD TEST

1. Disconnect battery-to-generator terminal "B" wire. See **Fig. 2** . Using an ammeter and voltmeter, connect

negative ammeter lead to disconnected generator terminal "B" wire end, and connect positive ammeter lead to generator terminal "B".

2. Connect voltmeter positive lead to generator terminal "B" and negative lead to ground. See **Fig. 2** . Start engine and increase engine speed to 2000 RPM. Both meters should read within specification. See **GENERATOR SPECIFICATIONS** . If voltage is more than specified, replace voltage regulator. If voltage reading is less than specified, check voltage regulator. See **VOLTAGE REGULATOR** .



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Fig. 2: Testing Charging Circuit

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

LOAD TEST

NOTE: If battery is fully charged, generator load test results may be less than 30 amps.

1. Connect an ammeter as described in **NO-LOAD TEST** , step 1 . See **Fig. 2** . Start engine. Turn on high beam headlights and place heater blower control on H. Increase engine speed to 2000 RPM.
2. Check ammeter reading. See **GENERATOR SPECIFICATIONS** . If amperage is less than specified, repair or replace generator.

BENCH TESTING

BRUSHES

1. Brushes should slide smoothly in holders. Replace brushes if damaged or worn. See **GENERATOR SPECIFICATIONS** .
2. If exposed brush length is less than minimum, replace brush holder assembly.

DIODES

NOTE: **Procedure given, applies to 90-amp generator only. Information not available for 100-amp generator.**

1. With diode/rectifier assembly removed and on bench, contact positive diode plate terminal with one ohmmeter probe. Using other ohmmeter probe, contact each diode lead in same plate. Note ohmmeter reading. Reverse ohmmeter probes, and repeat tests for all diodes.
2. All diodes should show continuity in one direction and no continuity in opposite direction. If any diode is defective, replace diode/rectifier assembly.

ROTOR

1. Check rotor for open field windings by using an ohmmeter across slip rings. Rotor resistance should be within specification. See **GENERATOR SPECIFICATIONS** .
2. Check rotor for shorts to ground by connecting ohmmeter between slip ring and rotor shaft. Ohmmeter should indicate no continuity. Check slip rings for wear or pitting. See **GENERATOR SPECIFICATIONS** . If slip rings are rough or scored, replace rotor.

STATOR

NOTE: **Procedure given, applies for 90-amp generator only. Information not available for 100-amp generator.**

Connect ohmmeter between stator leads. Continuity should exist between all stator leads. Connect ohmmeter between each stator lead and drive end frame. Continuity should not exist. If stator does not test as indicated, replace drive end frame assembly.

VOLTAGE REGULATOR

NOTE: **When positive and negative probes between terminals are exchanged, there is continuity in one direction but not in the other direction.**

Using ohmmeter, check for continuity between following:

- Terminals "F" and "B"
- Terminals "F" and "E"

If continuity is not as specified, replace voltage regulator. See **Fig. 3** or **Fig. 4** .

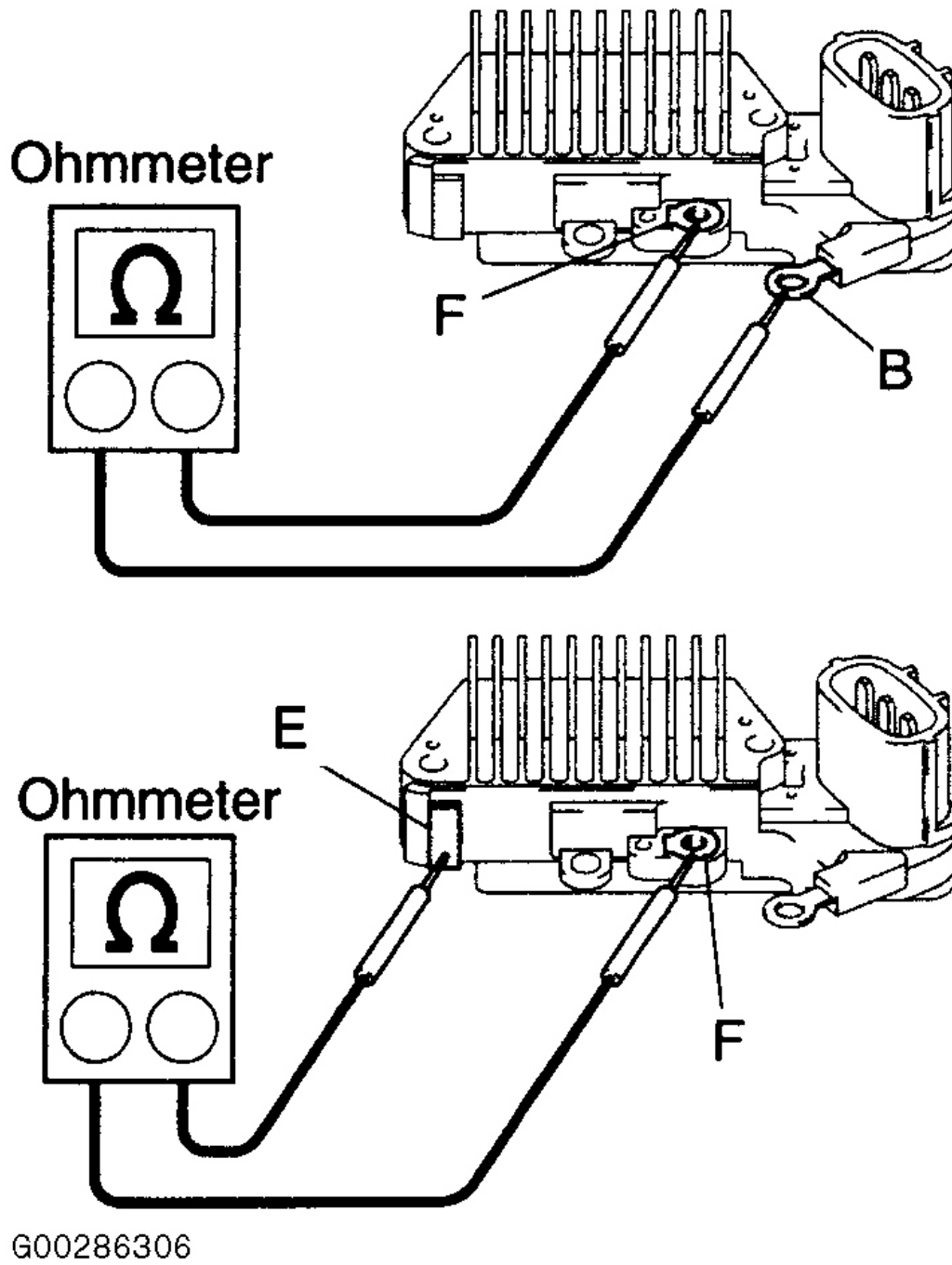


Fig. 3: Testing Voltage Regulator (W/90-Amp Generator)
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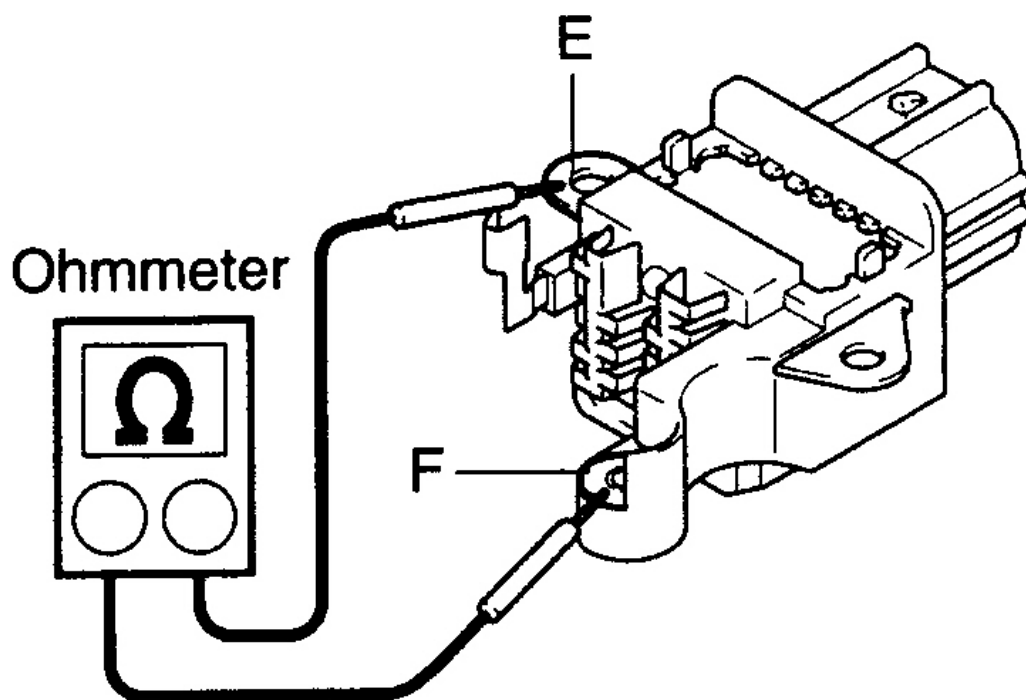
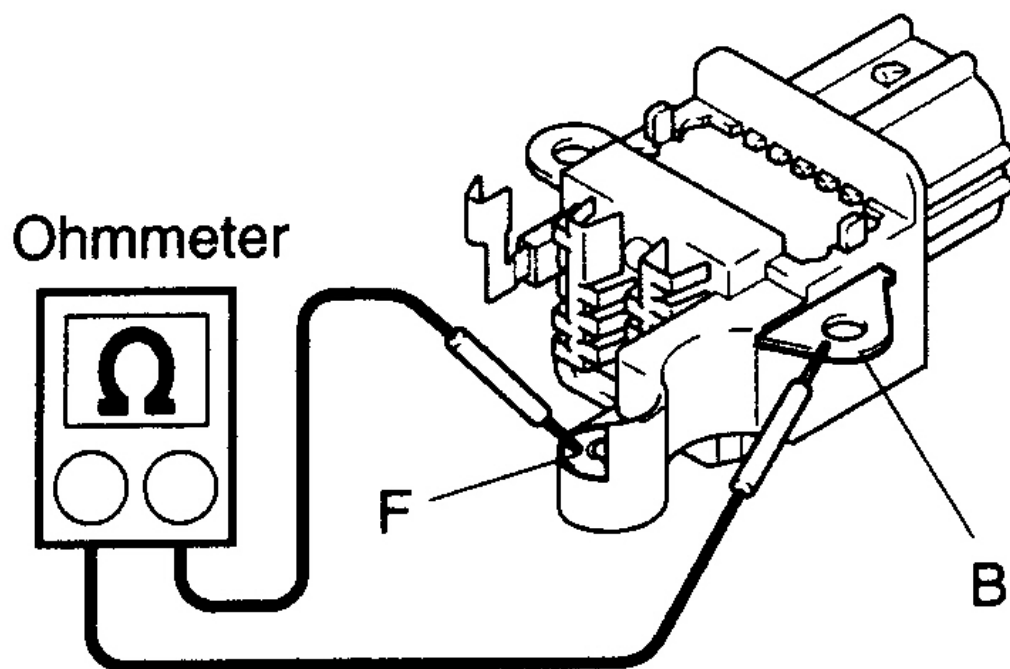


Fig. 4: Testing Voltage Regulator (W/100-Amp Generator)

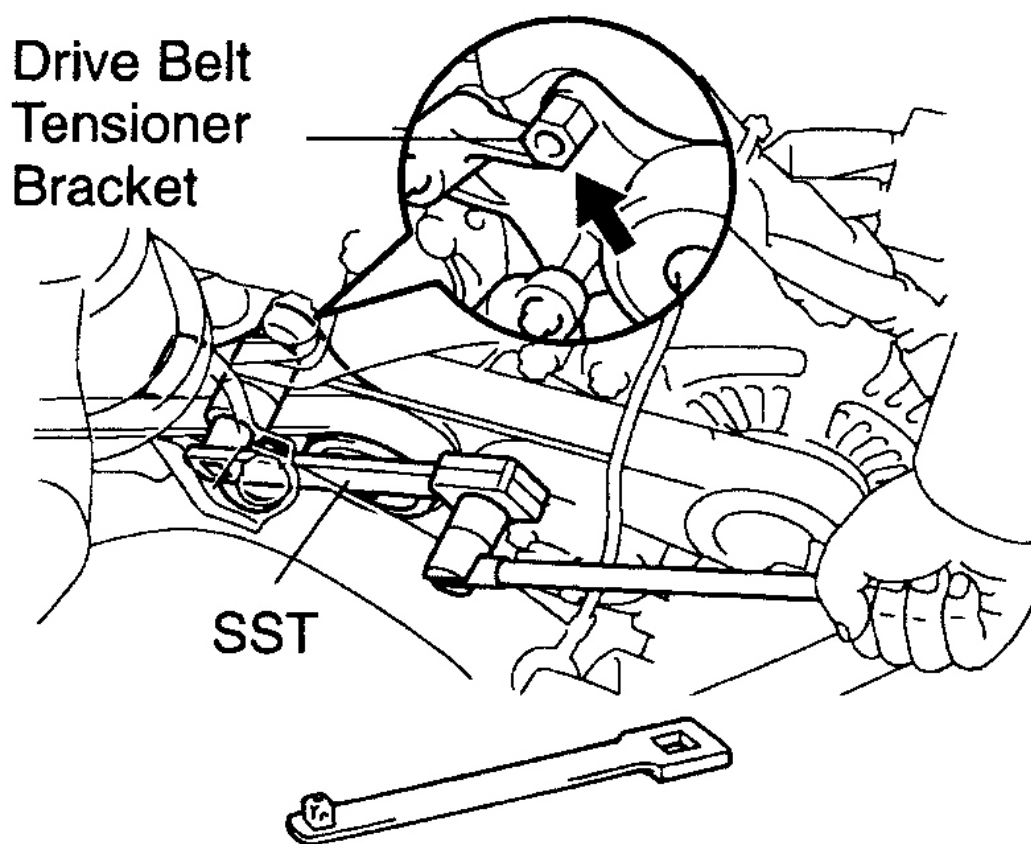
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REMOVAL & INSTALLATION

GENERATOR

Removal & Installation

Disconnect negative battery cable. Use Torque Wrench Adaptor (SST 09249-63010) to aid in removing serpentine drive belt. See **Fig. 5** . Disconnect generator wire harness connector. Remove battery nut and wire from back of generator. Remove generator mounting bolts. Remove generator. To install, reverse removal procedure. Tighten generator bolts to specification. See **TORQUE SPECIFICATIONS** . Install serpentine drive belt.



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Fig. 5: Identifying Torque Wrench Adapter

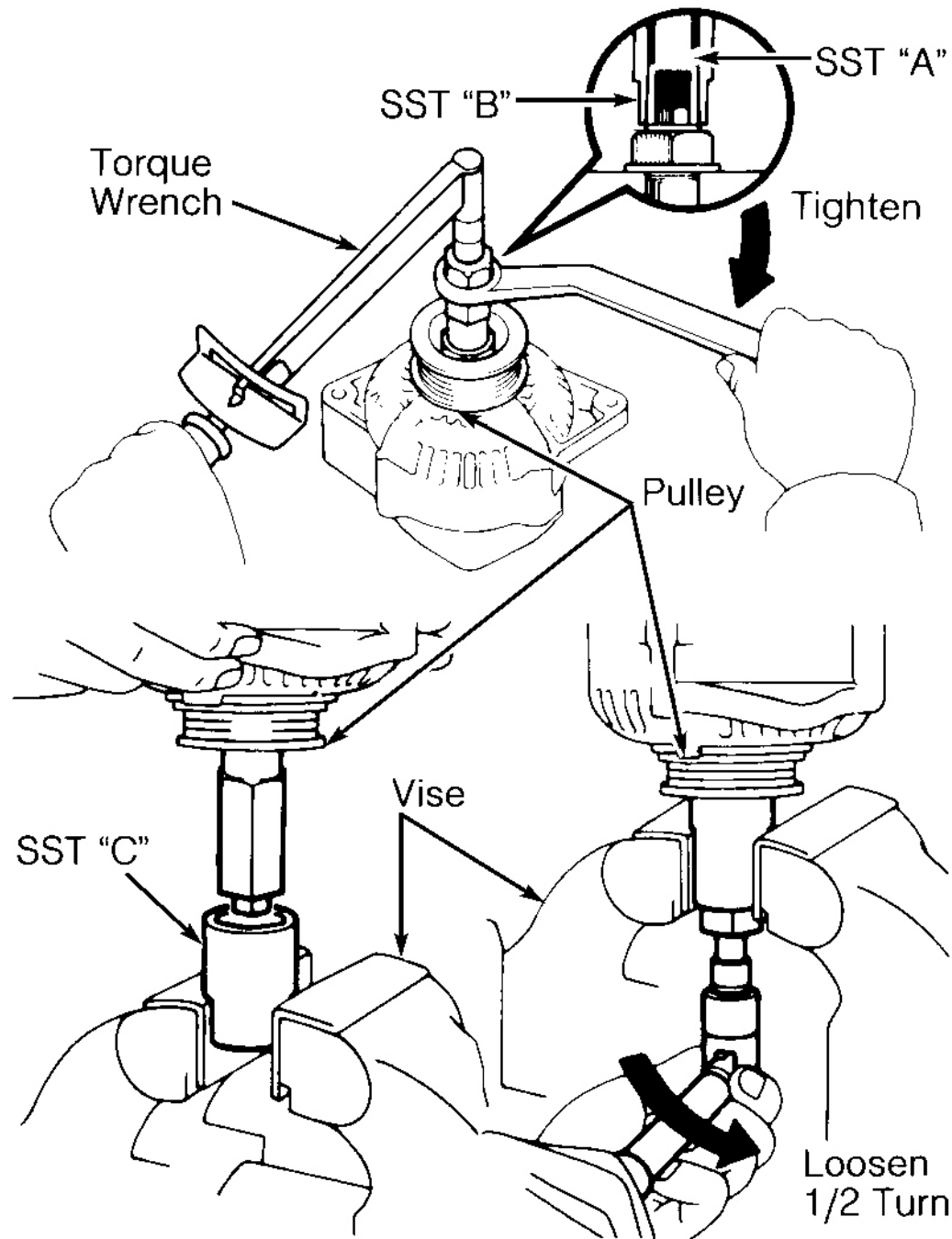
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OVERHAUL

GENERATOR

Disassembly (90-Amp)

1. Use generator Pulley Set Nut Wrench Set (SST 09820-63011) to remove generator pulley. Install SST "A" and "B" to rotor shaft and tighten SST "B" clockwise to 29 ft. lbs. (39 N.m). See **Fig. 6** . Place SST "C" securely into a vise. Verify that SST "A" is secured to rotor shaft and install SST "A" and "B" and generator into SST "C". Turn SST "A" in correct direction to loosen pulley nut. To prevent damage to rotor shaft, DO NOT loosen pulley nut more than 1/2 turn. Remove generator from SST "C". Turn SST "A" and "B", remove pulley nut and pulley.
2. Remove nut and terminal insulator. Remove bolt, 3 nuts, plated terminal and rear end cover. See **Fig. 7** . Remove 2 screws and brush holder. Remove 3 screws and voltage regulator. Remove 4 screws and diode (rectifier) holder. Remove 4 rubber insulators.
3. Remove 4 nuts and wire clip. Using Bearing Puller (SST 09286-46011), remove rectifier end frame. Remove generator washer from rotor. Remove rotor from drive end frame.



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Fig. 6: Removing Generator Pulley
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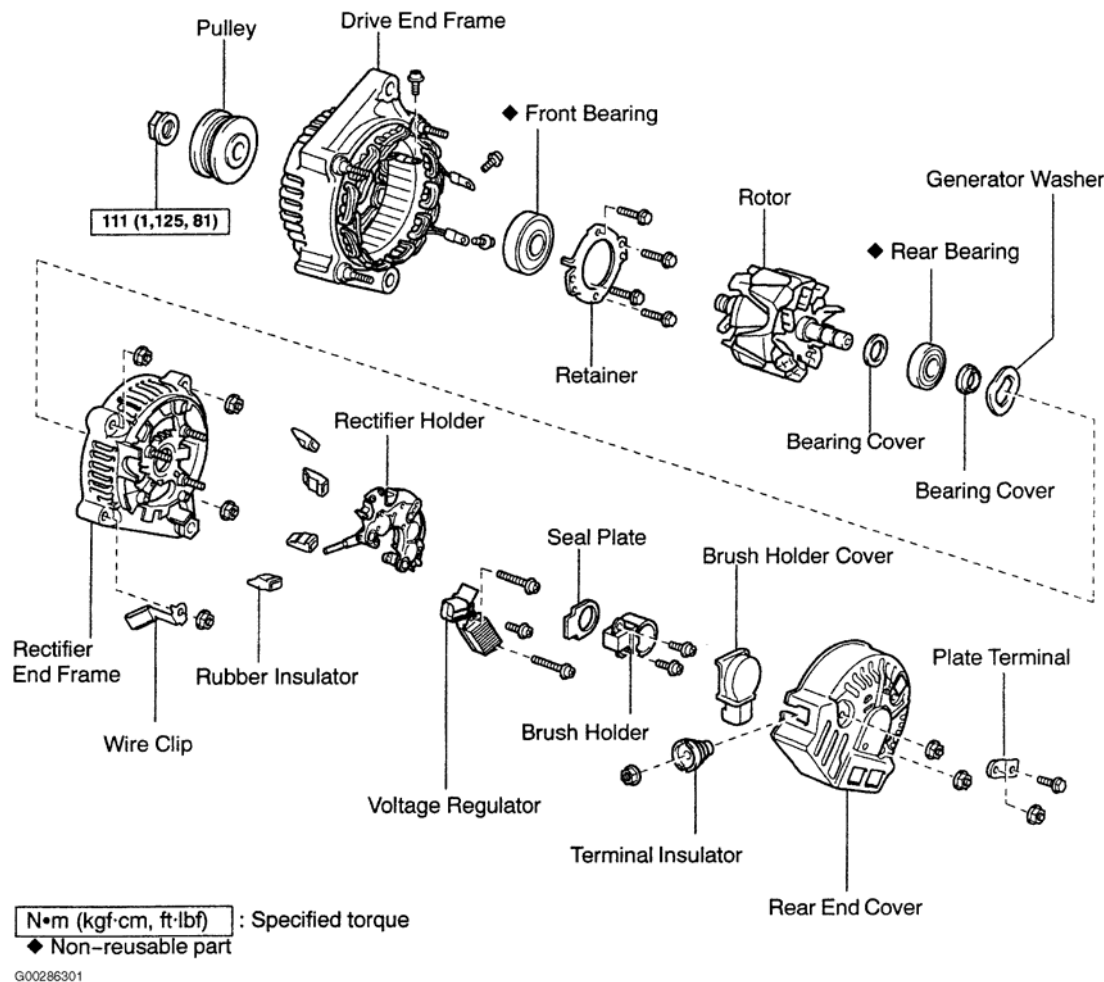


Fig. 7: Exploded View Of Generator (90-Amp)

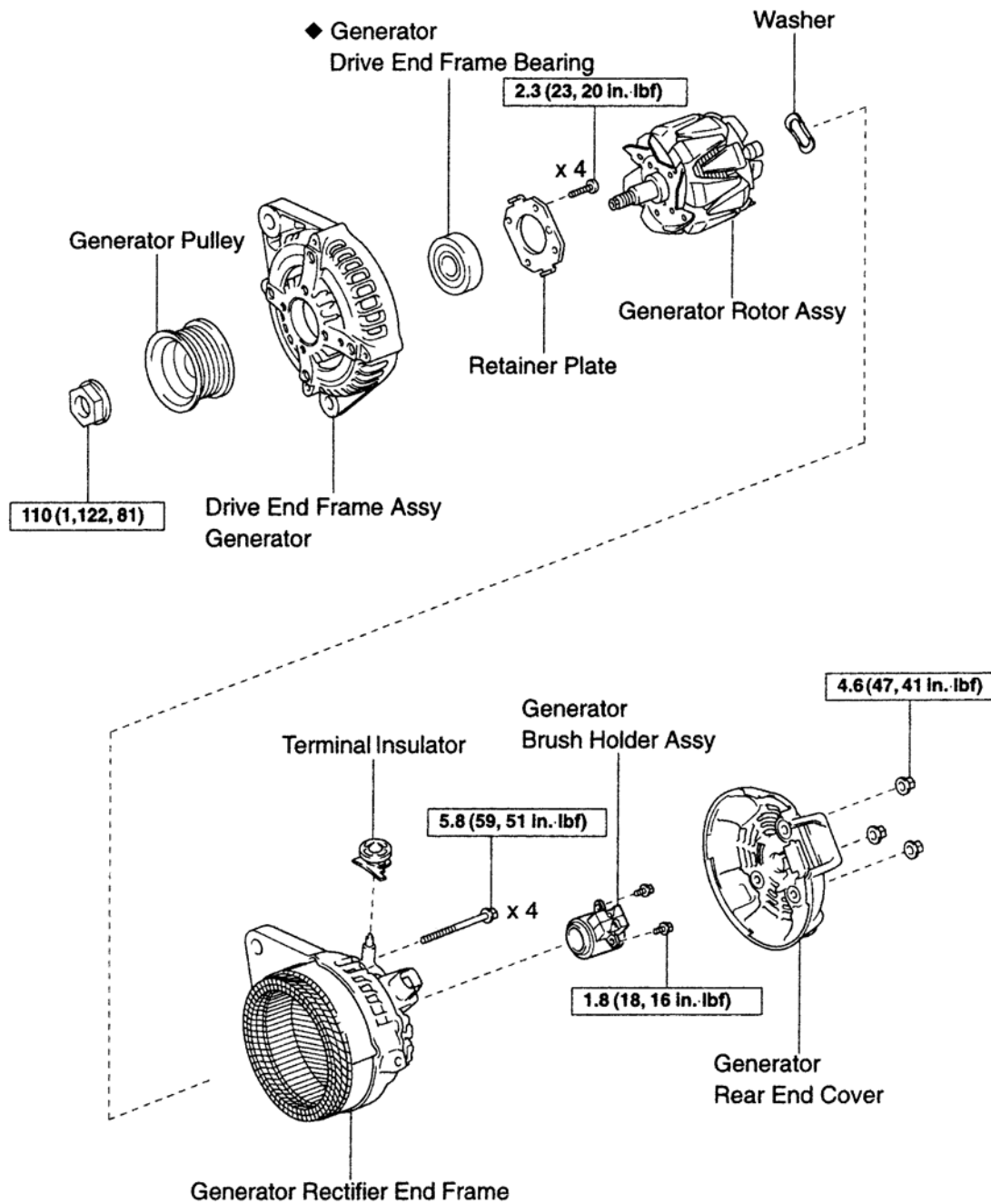
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Disassembly (100-Amp)

1. Use generator Pulley Set Nut Wrench Set (SST 09820-63011) to remove generator pulley. Install SST "A" and "B" to rotor shaft and tighten SST "B" clockwise to 29 ft. lbs. (39 N.m). See **Fig. 6** . Place SST "C" securely into a vise. Verify that SST "A" is secured to rotor shaft and install SST "A" and "B" and generator into SST "C". Turn SST "A" in correct direction to loosen pulley nut. To prevent damage to rotor shaft, DO NOT loosen pulley nut more than 1/2 turn. Remove generator from SST "C". Turn SST "A" and "B", remove pulley nut and pulley.
2. Remove 3 nuts and rear end cover. See **Fig. 8** . Remove nut and terminal insulator. Remove 2 screws and brush holder.
3. Remove bolt and cord clip. Remove 4 bolts and rectifier end frame. Remove coil assembly using Puller (SST 09950-40011). See **Fig. 9** . Remove generator washer from rotor. Remove rotor from drive end frame.

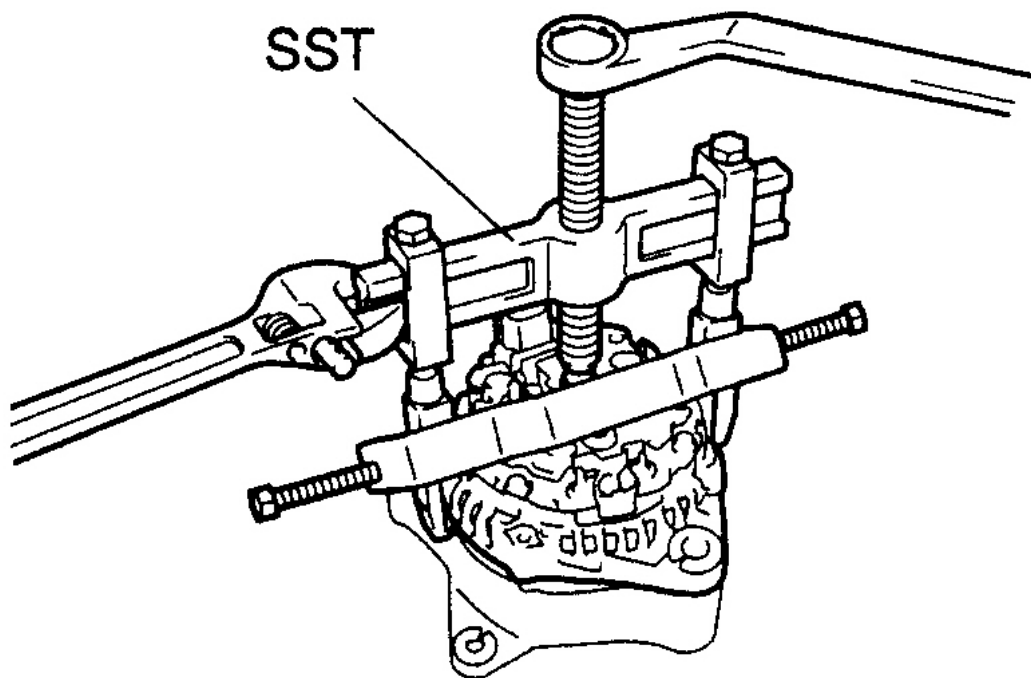
2004 Toyota RAV4

2004 STARTING & CHARGING SYSTEMS Generators & Regulators - RAV4



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Fig. 8: Exploded View Of Generator (100-Amp)
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Fig. 9: Removing Rectifier End Frame

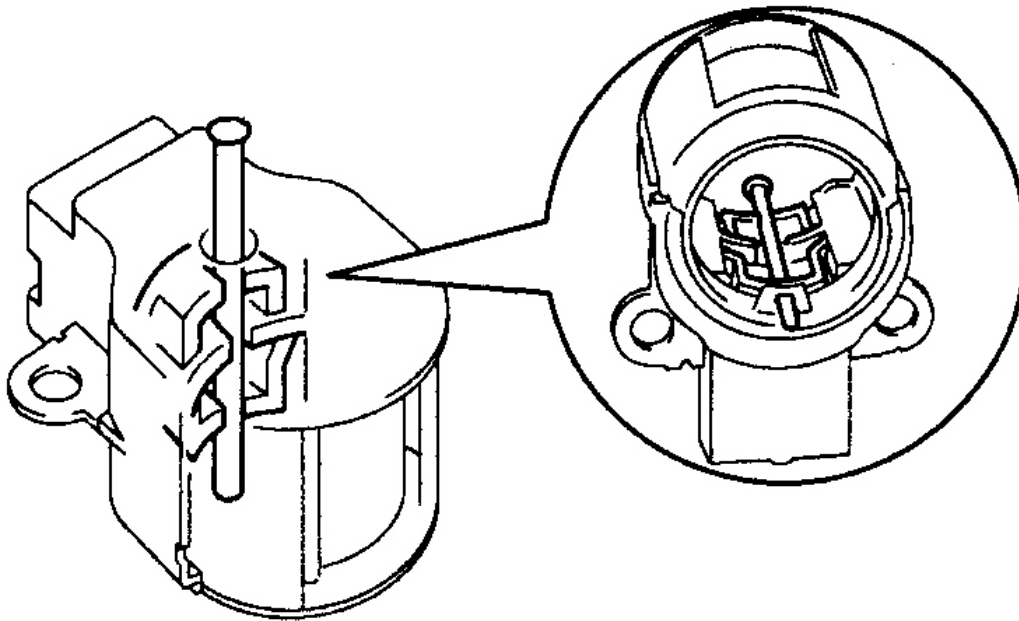
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Assembly (90-Amp)

Place drive end frame on pulley and install rotor in drive end frame. Place generator washer on rotor and position rectifier end frame on rotor. Using 29 mm socket, slowly press in rectifier end frame. Use generator Pulley Set Nut Wrench Set (SST 09820-63011) to install generator pulley. Place SST "C" securely into a vise. Install SST "A" and "B" and generator into SST "C". See **Fig. 6** . Tighten pulley nut in the opposite direction of disassembly. See **TORQUE SPECIFICATIONS** . To complete reassembly, reverse disassembly procedure. After completing assembly, verify rotor turns smoothly.

Assembly (100-Amp)

Place drive end frame on pulley and install rotor in drive end frame. Place generator washer on rotor and position rectifier end frame on rotor. Using 29 mm socket, slowly press in rectifier end frame. Use generator Pulley Set Nut Wrench Set (SST 09820-63011) to install generator pulley. Place SST "C" securely into a vise. Install SST "A" and "B" and generator into SST "C". See **Fig. 6** . Before installing brush holder, push brushes back into holder and install .039" (1 mm) pin into brush holder hole. See **Fig. 10** . Tighten pulley nut in the opposite direction of disassembly. See **TORQUE SPECIFICATIONS** . To complete reassembly, reverse disassembly procedure. After completing assembly, verify rotor turns smoothly.



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Fig. 10: Securing Brushes In Brush Holder

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

GENERATOR SPECIFICATIONS

GENERATOR SPECIFICATIONS

Application	Specification
Brush Length	
Standard	.374-.453 Inch (9.5-11.5 mm)
Limit (Minimum)	More Than .059 Inch (1.5 mm)
Rotor	
Resistance ⁽¹⁾	
90-Amp	2.1-2.5 Ohms
100-Amp	2.3-2.7 Ohms
Slip Ring Diameter	
Standard	.551-.567 Inch (14.0-14.4 mm)
Minimum	
90-Amp	.504 Inch (12.8 mm)
100-Amp	.551 Inch (14.0 mm)
Generator Regulated Output	

Amperage	
Without Load	10 Or Less Amps
With Load	30 Or More Amps
Voltage	13.2-14.8 Volts
(1) Measured @ 68°F (20°C).	

TORQUE SPECIFICATIONS

TORQUE SPECIFICATIONS

Application	Ft. Lbs. (N.m)
Generator Mounting Bolt	
8-mm	15 (21)
10-mm	38 (52)
Pulley Nut	81 (111)
INCH Lbs. (N.m)	
Battery Wire Terminal Nut	36 (4.1)
Bearing Retainer Bolt	
90 amp	27 (3.0)
100 amp	20 (2.3)
Brush Holder Screw	16 (1.8)
Drive End Frame Bolt/Nut	
With Cord Clip	40 (4.5)
Without Cord Clip	51 (5.8)
Generator Holder With Rectifier	26 (2.9)
Generator Rear End Cover	
Screw	35 (3.9)
Nut	41 (4.6)
Regulator Assembly	18 (2.0)

WIRING DIAGRAMS

Refer to CHARGING CIRCUIT under **STARTING/CHARGING** in SYSTEM WIRING DIAGRAMS article in ELECTRICAL.