2002-03 STARTING & CHARGING SYSTEMS

Generators & Regulators - Explorer & Mountaineer

DESCRIPTION

System consists of generator, regulator, battery, fuses, PCM and associated wiring. Generators have an electronic voltage regulator. Voltage regulator is fastened to rear of generator with brush holder assembly. Voltage regulator incorporates temperature compensation circuitry, so battery charging voltage is maintained at the optimum level. Charge rate is 13-15 volts.

Warning indicator should illuminate with key on, engine off. Warning indicator should not illuminate with ignition off, or with engine running.

VIN CODE IDENTIFICATION

VIN Code (1)	Engine Displacement
E	4.0L PFI SOHC V6
K	4.0L PFI SOHC V6 (Flex Fuel)
W	4.6L PFI SOHC V8
(1) Use 8th digit, for engine displacement identification.	

ADJUSTMENTS

BELT TENSION

Vehicles are equipped with automatic drive belt tensioner. Drive belt does not require adjustment. Inspect condition and tension of generator drive belt prior to performing any on-vehicle charging system tests. Replace belt and/or repair tensioner mechanism if necessary.

TROUBLE SHOOTING

NOTE: For trouble shooting charging system, see BASIC TROUBLE SHOOTING article in GENERAL INFORMATION.

PRELIMINARY INSPECTION

Ensure battery posts and cables are clean and tight. Inspect drive belt. Ensure connections at generator, regulator and engine ground are clean and tight. Inspect fusible links (2 Gray 12 gauge and one Brown 18 gauge) and central junction box fuse No. 21 (5-amp). Turn ignition on and ensure warning light operates. Check bulb and circuit, if necessary. Start engine and verify charge warning light goes out. If problem is found, repair as necessary. If problem is not found, repair by symptom. See **SYMPTOM INDEX** table under SYSTEM TESTS.

ON-VEHICLE TESTING

BATTERY LOAD TEST

Connect battery tester according to tool manufacturer's instructions. Load test battery at approximately one-half cold-cranking amperage rating for 15 seconds while observing battery voltage. If voltage reading is 9.6 volts or more, battery is okay. If voltage reading is less than 9.6 volts, charge battery and retest. If loaded battery voltage is still less than 9.6 volts after charging battery, replace battery.

BATTERY TEST WITH DIGITAL BATTERY ANALYZER

Connect digital battery analyzer to battery and follow on screen instructions. If battery test good, return to service. If battery does not test good, replace battery.

GENERATOR LOAD TEST

1. Ensure drive belt is in good condition. Replace belt as necessary. If belt is okay, connect charging system load tester in accordance with manufacturer's instructions. Start and run engine at 2000 RPM and apply load until generator output levels off.
2. Record maximum generator output current. See **GENERATOR OUTPUT SPECIFICATIONS** . With engine running, turn A/C (if equipped) and headlights on, turn blower motor to high speed. Voltage should increase a minimum of .5 volt. If generator output is 10-20 percent of rated amperage, generator output is okay. If generator does not produce rated output, go to **NO-LOAD TEST** .

GENERATOR NO-LOAD TEST

Connect voltmeter positive lead to generator B+ terminal, or battery and negative lead to ground. Start and run engine at 2000 RPM with all accessories off. Read voltmeter when voltage stabilizes. Voltage should be 13-15 volts.

PARASITIC DRAW TEST

Check for current drains on the battery in excess of 50 milliamps (0.050 amp) with all the electrical accessories off and the vehicle at rest. Current drains can be tested with the following procedure:

1. Make sure the junction box/fuse panels are accessible without turning on interior and underhood lights.
2. Drive the vehicle at least 5 minutes and over 30 MPH to turn on and exercise vehicle systems.
3. Allow the vehicle to sit with the key off for at least 40 minutes to allow modules to time out/power down.
4. Connect a fused jumper wire between the negative battery cable and the negative battery post to prevent modules from resetting and to catch capacitive drains.
5. Disconnect the negative battery cable from the post without breaking the connection of the jumper wire.

NOTE: It is very important that continuity is not broken between the battery and the negative battery cable when connecting the meter. If this happens, the entire procedure must be repeated.

6. Connect the tester between negative battery cable and the post. The meter must be capable of reading milliamps and should have a 10 amp capability.

NOTE: If the meter settings need to be switched or the test leads need to be moved to another jack, the jumper wire must be reinstalled to avoid breaking continuity.

7. Remove the jumper wire.

NOTE: Amperage draw will vary from vehicle to vehicle depending on the equipment package. Compare to a comparable vehicle for reference. A periodic pulsing of up to 80 mA (0.080 amp) is caused by the integrated control panel (ICP) and should be considered normal. However, no production vehicle should have more than a 50 mA (0.050 amp) draw.

8. If the draw is found to be excessive, pull fuses from the battery/central junction box one at a time and note the current drop. Do not reinstall the fuses until you are finished testing.
9. Check the wiring schematic in the wiring diagram for any circuits that run from the battery without passing through the battery/central junction box. Disconnect these circuits if the draw is still excessive.

ELECTRONIC MODULE PARASITIC DRAW TEST

1. Repeat the steps of the battery drain testing.
2. Make sure all doors are closed and accessories are off. Without starting the engine, turn the ignition switch to RUN for a moment and then OFF. Wait a few minutes for the illuminated entry lamps to turn off if equipped.
3. Connect the ammeter and read the amperage draw.

The current reading (current drain) should be less than 50 mA (0.05 amp). If the current drain exceeds 50 mA (0.05 amp) after a few minutes, and if this drain did not show in previous tests, the drain is most likely caused by an inoperative electronic component. As in previous tests, remove the fuses from the battery/central junction box one at a time to locate the problem circuit.

SELF-DIAGNOSTIC SYSTEM

NOTE: All diagnostic tests are written specifically for New Generation Star (NGS) tester. Most generic OBD-II compliant scan tools should be able to perform all test procedures.

RETRIEVING & CLEARING DIAGNOSTIC TROUBLE CODES

For retrieving and clearing DTCs, see SELF-DIAGNOSTIC SYSTEM in appropriate SELF-DIAGNOSTICS - EEC-V - GASOLINE & NGV in ENGINE PERFORMANCE.

Using NGS tester, perform PCM self-test. Perform appropriate test under SYSTEM TEST in accordance with DTC retrieved. See **POWERTRAIN CONTROL MODULE DIAGNOSTIC TROUBLE CODE INDEX** table. Codes listed in this table are only for testing covered in this article. For complete DTC listing, see DIAGNOSTIC TROUBLE CODE DEFINITIONS in appropriate SELF-DIAGNOSTICS - EEC-V -

GASOLINE & NGV in ENGINE PERFORMANCE. If no DTCs are retrieved, repair by symptom. See **SYMPTOM INDEX** table under SYSTEM TESTS.

POWERTRAIN CONTROL MODULE DIAGNOSTIC TROUBLE CODE INDEX

DTC (1)	Description	Perform Test
P1246	System Voltage Failure	(2)

(1) Codes listed in this table are only for testing covered in this article. For complete DTC listing, see appropriate SELF-DIAGNOSTICS article in ENGINE PERFORMANCE.

(2) See TEST HY: GENERATOR/REGULATOR SYSTEM under SYSTEM TESTS in appropriate SELF-DIAGNOSTICS article.

SYSTEM TESTS

CAUTION: When battery is disconnected, vehicle computer and memory systems may lose memory data. Driveability problems may exist until computer systems have completed a relearn cycle. See appropriate COMPUTER RELEARN PROCEDURES article in GENERAL INFORMATION before disconnecting battery.

NOTE: For proper diagnostics, see VIN CODE IDENTIFICATION table.

SYMPTOM INDEX

Symptom	Perform Test
Battery Voltage Is Discharged Or Battery Voltage Is Low	A
Warning Indicator Is On With Engine Running, System Is Not Charging	B
System Overcharges	C
Warning Indicator Is On With Engine Running, System Is Charging	D
Warning Indicator Is Off With Ignition On, Engine Not Running	E
Warning Indicator Flickers Or Operates Intermittently	F
Generator Is Noisy	G
Radio Interference	H

TEST A: BATTERY IS DISCHARGED OR BATTERY VOLTAGE IS LOW

1. **Check The Battery Condition**
   Perform Battery Test to determine if the battery can hold a charge and is okay for use. See **BATTERY LOAD TEST** or **BATTERY TEST WITH DIGITAL BATTERY ANALYZER** under ON-VEHICLE TESTING. Is the battery okay? If yes, go to next step. If no, install new battery. Test the system for normal operation.

2. **Check The Generator Output**
   Perform generator tests. See **GENERATOR LOAD TEST** and **GENERATOR NO-LOAD TEST** under ON-VEHICLE TESTING. Is the generator okay? If yes, go to next step. If no, go to **TEST B:**

THE CHARGING SYSTEM WARNING INDICATOR IS ON WITH THE ENGINE RUNNING (THE CHARGING SYSTEM VOLTAGE DOES NOT INCREASE) to diagnose the charging system.

3. **Check For Current Drains**
   Perform battery drain test. See **PARASITIC DRAW TEST** . Are there any excessive current drains? If yes, repair as necessary. Test the system for normal operation. If no, go to next step.

4. **Check For Current Drains Which Shut Off When The Battery Is Disconnected**
   Perform electronic module parasitic draw test. See **ELECTRONIC MODULE PARASITIC DRAW TEST** . Are there any current drains which shut off when the battery is disconnected? If yes, repair as necessary. Test the system for normal operation. If no, go to **TEST B: THE CHARGING SYSTEM WARNING INDICATOR IS ON WITH THE ENGINE RUNNING (THE CHARGING SYSTEM VOLTAGE DOES NOT INCREASE)** to diagnose the charging system.

TEST B: THE CHARGING SYSTEM WARNING INDICATOR IS ON WITH THE ENGINE RUNNING (THE CHARGING SYSTEM VOLTAGE DOES NOT INCREASE)

1. **Check Generator B+ Circuit (Black/Orange Wire)**
   Measure the voltage between the generator B+ terminal and ground. See **Fig. 1** . Is the voltage equal to battery voltage? If yes, go to next step. If no, repair Black/Orange wire. Test the system for normal operation.

2. **Check Generator "A" Circuit (Orange/Light Blue Wire)**
   Measure the voltage between the generator connector terminal "A" and ground. See **Fig. 2** . Is the voltage equal to battery voltage? If yes, go to next step. If no, repair Orange/Blue wire. Test the system for normal operation.

3. **Check "I" Circuit (Light Green/Red wire) For An Open**
   With the ignition switch in the RUN position and the engine running, measure the voltage between the generator connector terminal "I" and ground. Is the voltage 8-10 volts? If yes, go to step 5 . If no go to next step.

4. **Check "I" Circuit (Light Green/Red wire) For Continuity**
   Measure the resistance between the generator connector terminal "I", harness side and the PCM connector "A", terminal No. 8, harness side. See **Fig. 3** . Is the resistance less than 5 ohms? If yes, install a new PCM. Test the system for normal operation. If no, repair Light Green/Red wire. Test the system for normal operation.

5. **Check For Voltage Drop In B+ Circuit (Black/Orange wire)**
   With the engine at 2,000 RPM, turn the headlamps and the rear defroster on and the blower motor to high, measure the voltage drop between the generator connector B+ terminal (Black/Orange wire), component side and positive battery terminal. Is the voltage drop less than 0.5 volt? If yes, install a new generator. Test the system for normal operation. If no, repair high resistance in the B+ circuit. Test the system for normal operation.

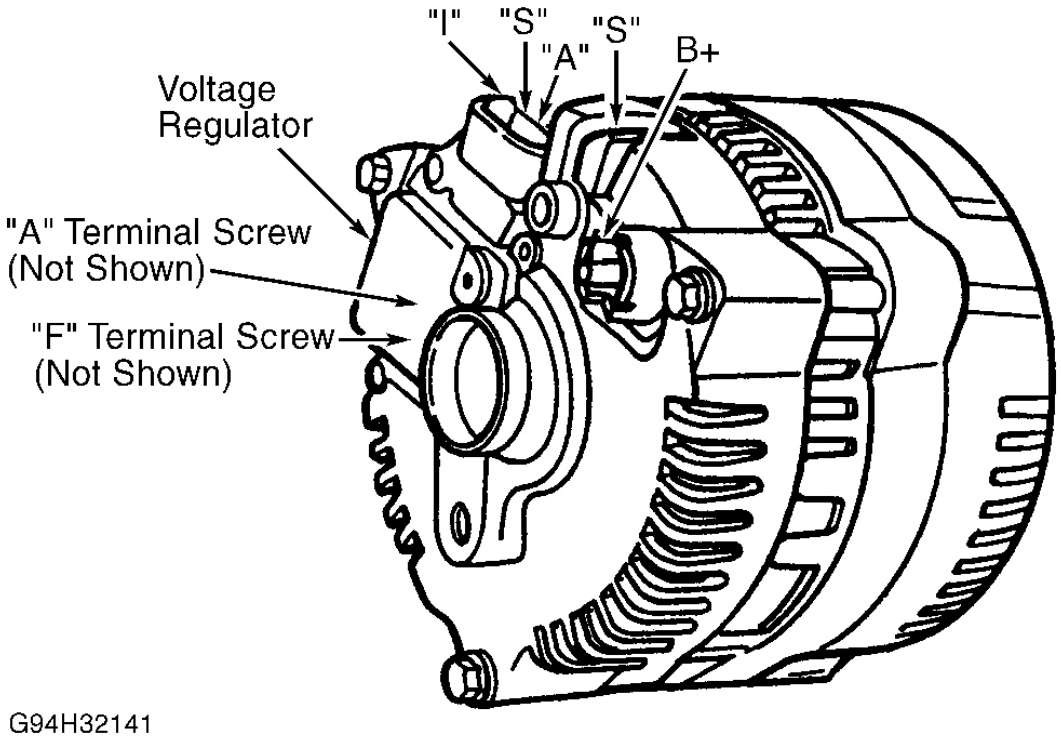

Fig. 1: Identifying Generator Terminals
Courtesy of FORD MOTOR CO.

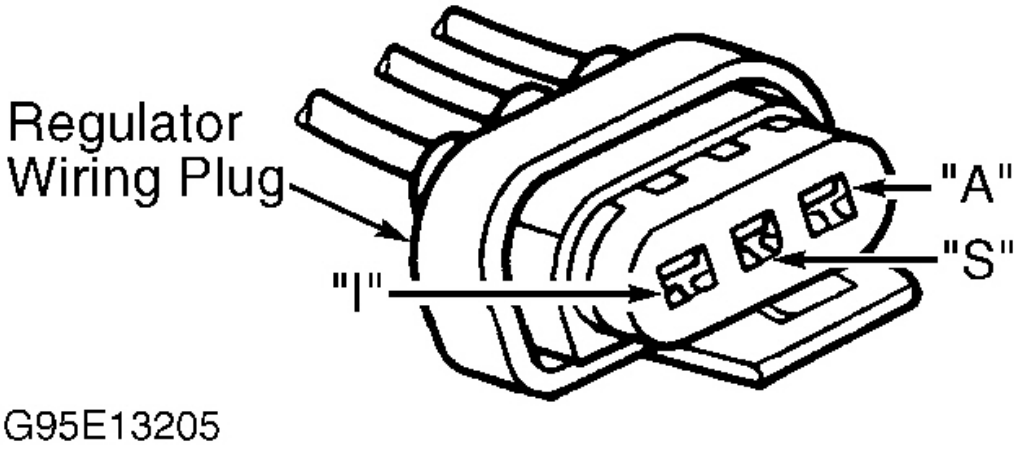

Fig. 2: Identifying Generator 3-Pin Connector Terminals

Courtesy of FORD MOTOR CO,

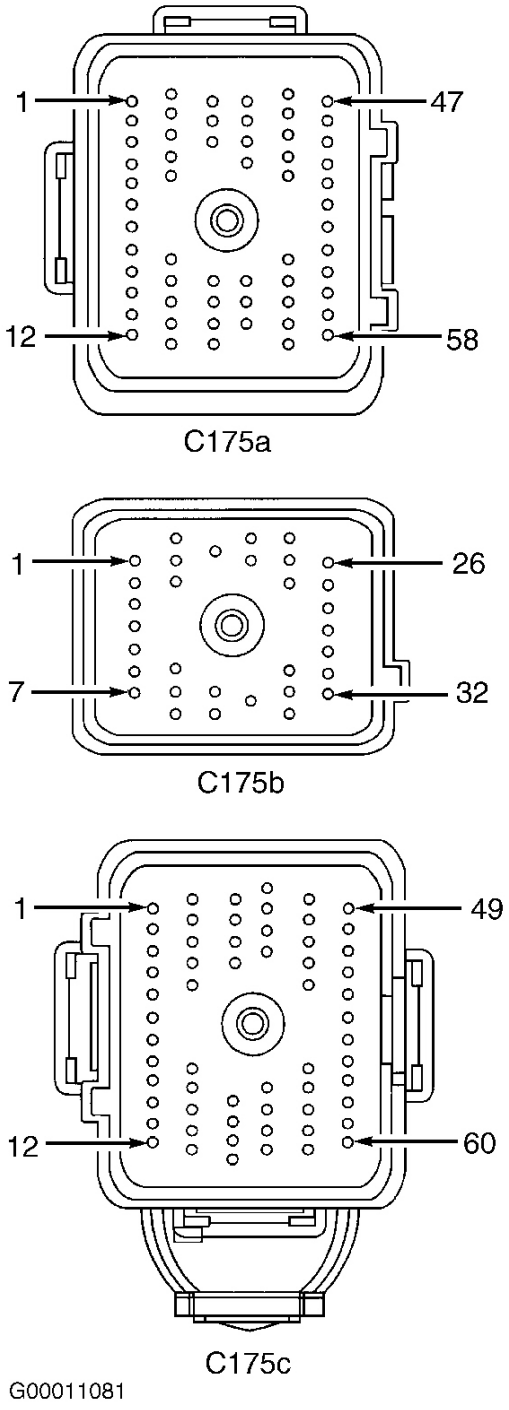

Fig. 3: Identifying Powertrain Control Module Harness Connector Terminals
Courtesy of FORD MOTOR CO.

TEST C: THE CHARGING SYSTEM OVERCHARGES (BATTERY VOLTAGE IS GREATER THAN 15.5 VOLTS)

1. **Check For Voltage Drop In "A" Circuit (Orange/Light Blue wire)**
   With the engine running, turn the headlamps and rear defroster ON and the blower motor on HIGH; measure the voltage drop between the generator connector terminal "A", harness side and positive battery terminal. See **Fig. 2** . Is the voltage drop less than 0.5 volt? If yes, go to next step. If no, repair the high resistance in the Orange/Light blue wire. Test the system for normal operation.

2. **Check Generator & Battery Ground Connections**
   Check the ground connections between the voltage regulator and the generator and the engine, and the battery and the engine. See **WIRING DIAGRAMS** . Are all ground connections clean and tight? If yes, install a new generator. Test the system for normal operation. If no, repair ground connections as necessary. Test the system for normal operation.

TEST D: THE CHARGING SYSTEM WARNING INDICATOR IS ON WITH THE ENGINE RUNNING AND THE BATTERY INCREASES VOLTAGE

1. **Check "I" Circuit (Light Green/Red Wire) For An Open**
   Turn the ignition off. Disconnect generator connector. With the engine running, measure the voltage between the generator terminal "I", harness side and ground. See **Fig. 2** . Is the voltage 8-10 volts? If yes, go to step 4 . If no, go to next step.

2. **Check "I" Circuit (Light Green/Red Wire) For Continuity**
   Turn ignition off. Disconnect PCM connector "A". Measure the resistance between the generator connector terminal "I", harness side and the PCM connector "A", terminal No. 8, harness side. See **Fig. 3** . Is the resistance less than 5 ohms? If yes, go to next step. If no, repair Light Green/ Red wire. Test the system for normal operation.

3. **Check "I" Circuit (Light Green/Red Wire) For A Short To Ground**
   Measure the resistance between the generator connector terminal "I", harness side and ground. Is the resistance greater than 10,000 ohms? If yes, install a new PCM. Test the system for normal operation. If no, repair circuit. Test the system for normal operation.

4. **Check Generator Integrity**
   Turn ignition off. connect generator connector. Measure the voltage between the generator connector terminal "I" and ground. Is the voltage less than 2 volts? If yes, install a new generator. Test the system for normal operation. If no, see appropriate ANALOG INSTRUMENT PANEL article in ACCESSORIES & EQUIPMENT for diagnosis of the instrument cluster.

TEST E: THE CHARGING SYSTEM WARNING INDICATOR IS OFF WITH THE IGNITION SWITCH IN THE RUN POSITION AND THE ENGINE OFF

1. **Check The Charging System Warning Indicator Lamp**
   Disconnect generator connector. With the engine off, connect a fused jumper wire (15A) between the generator connector terminal "I" (Light Green/Red wire), harness side and ground. See **Fig. 2** . Turn ignition on, engine off. Is the charging system warning indicator illuminated? If yes, install a new generator. Test the system for normal operation. If no, see appropriate ANALOG INSTRUMENT

PANEL article in ACCESSORIES & EQUIPMENT for diagnosis of the instrument cluster.

TEST F: THE CHARGING SYSTEM WARNING INDICATOR FLICKERS OR IS INTERMITTENT

1. **Check For Loose Connections**
   Check all generator, battery, and power distribution connections for looseness, corrosion, loose or bent terminals, or loose eyelets. See **WIRING DIAGRAMS** . Are all connections clean and tight? If yes, go to next step. If no, repair as necessary. Test the system for normal operation.

2. **Check Fuse**
   With the engine running, check fuse No. 21 (5A) in central junction box looseness by wiggling the fuse and noting the charging system warning indicator operation. Does the charging system warning indicator flicker? If yes, repair loose fuse connections as necessary. Test the system for normal operation. If no, go to next step.

3. **Check "A" Circuit (Orange/Light Blue Wire) Connections**
   Turn ignition off. Connect a fused jumper wire between the generator connector terminal "A", harness side and the positive battery terminal. See **Fig. 2** . With the engine running, note the charging system warning indicator operation. Does the charging system warning indicator flicker? If yes, install a new generator. Test the system for normal operation. If no, repair loose connection(s) in circuits. Test the system for normal operation.

TEST G: THE GENERATOR IS NOISY

1. **Check For Accessory Drive Noise**
   Check the accessory drive belt for damage and correct installation. Check the accessory mounting brackets and generator pulley for looseness or misalignment. Is the accessory drive okay? If yes, go to next step. If no, repair as necessary. Test the system for normal operation.

2. **Check Generator Mounting**
   Check the generator mounting for loose bolts or misalignment. Is the generator mounted correctly? If yes, go to next step. If no, repair as necessary. Test the system for normal operation.

3. **Check Generator For Electrical Noise**
   Turn ignition off. Disconnect generator connector. With the engine running, using a stethoscope or equivalent listening device, probe the generator. Is the noise still present? If yes, go to next step. If no, install a new generator. Test the system for normal operation.

4. **Check Generator For Mechanical Noise**
   With the engine running, use a stethoscope or equivalent listening device to probe the generator area for unusual mechanical noise. Is the generator the noise source? If yes, install a new generator. Test the system for normal operation. If no, diagnose the source of engine noise.

TEST H: RADIO INTERFERENCE

1. With the engine running, tune the radio to a station where the interference is present. Turn ignition off. Disconnect generator connector. Start engine. With the engine running, note any radio interference. Is the interference present with the generator disconnected? If yes, diagnose the in-vehicle entertainment

system. If no, install a new generator. Test the system for normal operation.

REMOVAL & INSTALLATION

CAUTION: When battery is disconnected, vehicle computer and memory systems may lose memory data. Driveability problems may exist until computer systems have completed a relearn cycle. See COMPUTER RELEARN PROCEDURES article in GENERAL INFORMATION before disconnecting battery.

GENERATOR

Removal & Installation (4.0L SOHC)

1. Disconnect negative battery cable. Remove air cleaner outlet tube. Remove drive belt from generator pulley. Disconnect generator electrical connector. Remove B+ terminal cover, nut and disconnect electrical connector. Remove wire harness retainer.
2. Remove 2 mounting bolts, stud bolt and generator from vehicle. To install, reverse removal procedure. Tighten fasteners to specification. See **TORQUE SPECIFICATIONS** .

Removal & Installation (4.6L SOHC)

1. Disconnect negative battery cable. Remove drive belt from generator pulley. Disconnect generator electrical connector. Remove B+ terminal cover, nut and disconnect electrical connector. Remove wire harness retainer.
2. Remove stud bolts and bolts and remove generator bracket. Remove 2 generator mounting bolts and generator from vehicle. To install, reverse removal procedure. Tighten fasteners to specification. See **TORQUE SPECIFICATIONS** .

GENERATOR SPECIFICATIONS

2002

GENERATOR SPECIFICATIONS - 2002

Application	Maximum Amperage Output Rating
Generator Amperage Rating	
Standard	95 Amp
58/120	65 Amp
45/110	60 Amp
35/90	45 Amp
Load Test (1)	
With Tester Load (2)	58 Amps Or More
Without Tester Load (3)	(4)
No-Load Test (1)(2)	13-15 Volts

(1) All tests are performed with engine running at 2000 RPM.

(2) All accessories off.

(3) Perform this test with engine running, A/C on, blower motor on high speed, and headlamps on high beam.

(4) With accessories on, voltage should increase a minimum of 0.5 volt above base voltage.

2003

GENERATOR SPECIFICATIONS - 2003

Application	Maximum Amperage Output Rating
Generator Amperage Rating	120 Amp
Load Test (1)	
With Tester Load (2)	76 Amps Or More
Without Tester Load (3)	(4)
No-Load Test (1)(2)	13-15 Volts

(1) All tests are performed with engine running at 2000 RPM.

(2) All accessories off.

(3) Perform this test with engine running, A/C on, blower motor on high speed, and headlamps on high beam.

(4) With accessories on, voltage should increase a minimum of 0.5 volt above base voltage.

TORQUE SPECIFICATIONS

TORQUE SPECIFICATIONS

Application	Ft. Lbs. (N.m)
Generator Mounting Bolts	
4.0L	35 (47)
4.6L	18 (25)
Generator Pulley Nut	80 (109)
	INCH Lbs. (N.m)
Generator Bracket Bolts (4.6L)	89 (10)
Generator B+ Terminal Nut	71 (8)

WIRING DIAGRAMS

2002

Explorer

For wiring diagrams, see **STARTING/CHARGING** in SYSTEM WIRING DIAGRAMS article.

Mountaineer

For wiring diagrams, see **STARTING/CHARGING** in SYSTEM WIRING DIAGRAMS article.

2003

Explorer

For wiring diagrams, see **STARTING/CHARGING** in SYSTEM WIRING DIAGRAMS in ELECTRICAL.

Mountaineer

For wiring diagrams, see **STARTING/CHARGING** in SYSTEM WIRING DIAGRAMS in ELECTRICAL.

