

PENNTEx FOUR-STEP CHARGING SYSTEM TEST AND GENERAL INFORMATION FOR 2009-UP FORDS WITH A PENNTEx CHARGING SYSTEM AND A PX-7000 VOLTAGE REGULATOR

PennTex Industries, Inc. is a manufacturer of Heavy Duty Charging Systems, High Idler Devices, and Charging System Monitors. Parts are available nationwide through our network of Warehouse Distributors. This information refers to 2009-up Ford vehicles with a PennTex PX-2 or PX-5 Series 12-volt Charging System using a PX-7000 Voltage Regulator in very specific applications. For PennTex systems with other than a PX-7000 voltage regulator, contact us or refer to our web site at www.penntexusa.com/tests.

All PennTex charging systems use an external voltage regulator. They are usually mounted inside the body of the vehicle under the right side of the dash away from moisture and heat. To help find the regulator location, follow the charging system harness with a normal length of 72 inches from the alternator to the regulator. There should be a white or tan pass-through conduit surrounding the black plastic split-loom on the charging system harness where it goes through the firewall.

The PX-7000 system uses a different style regulator connection than any previous PennTex system. In the engine compartment, the PennTex harness is plugged in to what was the original Ford 3-wire alternator connector. Except when specified, all wire colors mentioned here are PennTex Charging System wire harness colors.

Check these PennTex harness items first: BLACK (ground): check for loose or corroded connections at the regulator. Ohms on the ground connection should be ZERO. BLUE (Field) & ORANGE (Stator): if possible, inspect or actually pull the harness T-connector out of the brush holder and inspect the two terminals. Look for corrosion and be sure that one of the terminals isn't bent over. Plug the T-connector back in. Check for loose cables or discoloration at the large alternator posts and repair as required. Inspect the regulator for corrosion or water damage. Look for damaged fusible links. Check the alternator pulley for blue discoloration that indicates a slipping belt. Check for proper alternator drive belt routing.

Use the attached **PennTex PX-7000 Four-Step Charging System Test Form & Full Field Test Forms** to check the system condition. See the attached PX-7000 information for the best way to probe the wires in the regulator connectors.

TEST	WIRE	VOLTS	REMARKS
1	RED		
2	RED		
3	RED		
4	RED		
5	RED		
6	RED		
7	RED		
8	RED		
9	RED		
10	RED		
11	RED		
12	RED		
13	RED		
14	RED		
15	RED		
16	RED		
17	RED		
18	RED		
19	RED		
20	RED		
21	RED		
22	RED		
23	RED		
24	RED		
25	RED		
26	RED		
27	RED		
28	RED		
29	RED		
30	RED		
31	RED		
32	RED		
33	RED		
34	RED		
35	RED		
36	RED		
37	RED		
38	RED		
39	RED		
40	RED		
41	RED		
42	RED		
43	RED		
44	RED		
45	RED		
46	RED		
47	RED		
48	RED		
49	RED		
50	RED		

For the **Four-Step Test**, check the system voltages at the regulator connector, with the connector still plugged in. The readings must be taken at the regulator and not at the alternator. BLUE Wire: Field Terminal, ORANGE Wire: Stator Terminal, LARGE RED: Power Terminal. Get the battery voltage right at the batteries during each step. A difference in voltage readings between the batteries might uncover a problem. All of these tests rely on the ground connections being in good condition. For a second opinion on your voltage readings, you can fax

the test results to the PennTex technical Department at 817-590-0398, or email them to tech@penntexusa.com for assistance during normal business hours.

During the **First Step**, the Large RED wire will show battery voltage. The regulator is tied to the battery at all times through this wire. The Blue & Orange wires should show zero volts or a few millivolts. Note: a few bus companies wire the system through a main shut-off switch so there's no voltage on the RED wire with the key off. Voltage on the BLUE wire could indicate an open rotor or worn-out brushes. It could also indicate a bad regulator. Voltage on the ORANGE wire might be a diode problem. A bad ground can cause intermittent charging. A disconnected or weak ground connection might cause voltage on the Large RED wire to pulse when checked with the key off and the meter set on the "Manual Range". Make sure the voltage regulator case is also securely mounted.

During the **Second Step** with the key on and the engine not running, the regulator then connects the RED and BLUE wires together. The RED wire will again show battery voltage and be slightly less than in the previous test because of electrical system demand. The BLUE wire voltage should be about one-half volt less than the RED wire voltage. The BLUE wire is sending voltage to the rotor and magnetizing it. If there is more than a one-volt difference between the voltages on the RED wire on the first and second tests, you may have a battery condition problem. Charge the batteries for 45 minutes and rerun the test. The ORANGE wire should show no voltage because the rotor isn't spinning and producing electrical power. Voltage on the ORANGE wire on the second test may indicate diode problems. A bad diode will show voltage on the ORANGE wire, usually on both the first and second test, even if the voltage on the ORANGE on the third test is normal. There may also be an overnight draw on the battery with one or more bad diodes.

During the **Third Step**, have the engine running at idle with all accessories off. At idle, the rotor is turning and the stator will put out AC voltage to the ORANGE wire coming back to the regulator from the alternator. Ideally, the ORANGE wire will have exactly half the voltage of the RED wire. If the ORANGE wire has 1 or 2 volts less than half the voltage of the RED wire, there is a possible stator problem. If the ORANGE wire has close to zero volts, there may be an open rotor or worn-out brushes. If this is the case, there may also be battery voltage on the BLUE wire on the first test. If there is voltage on the BLUE wire on the first test, in addition to very low voltage on the ORANGE wire on the third test, that's another indicator of a loss of field continuity from a possible rotor or brush problem.

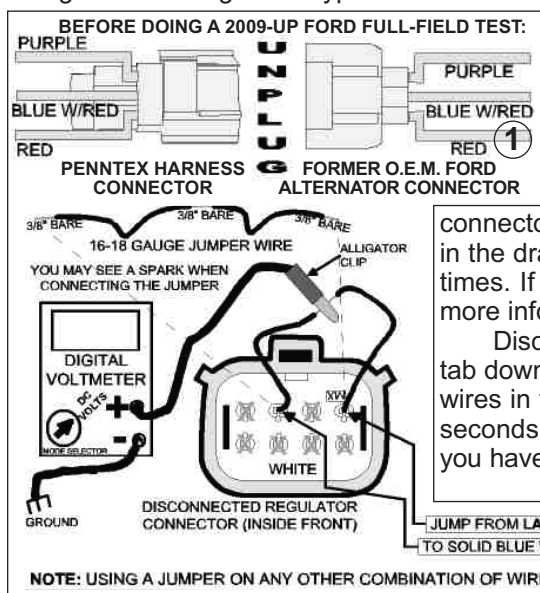
IMPORTANT: if the ORANGE wire voltage multiplied by 2 is even a little more than the RED wire voltage, there is probably a connection problem with the main output cable of the alternator. This could be a loose connection, a burned output post, or other wiring problem. Check for loose connections and continuity on the ORANGE and BLUE wires between the alternator and the regulator.

The BLUE wire voltage during the third test is an indication of how hard the alternator is charging. This reading may fluctuate up and down, so set your meter to "average". If the BLUE wire voltage is close to zero, you may have a rotor or

brush problem. If the BLUE wire voltage is 3 to 8 volts, the alternator is working at low output. If the BLUE wire voltage is at 10 volts or above, the alternator is working at high output to keep up with charging system demand. A discharged or defective battery could cause this. One dead battery cell can cause a great amperage load. Some Ford auxiliary batteries are mounted underneath on the frame. Because of the work involved with dropping them down for inspection, some don't get regularly checked. Load test with a battery tester capable of testing large truck batteries. Smaller hand-held testers will not be as accurate, but are better than nothing. We recommend testing the batteries one at a time with any connections between the batteries removed to be sure of an accurate test. If your vehicle has one, it is possible that the battery isolator is not working correctly. Check the isolator condition by using the testing procedures from the isolator manufacturer. Some isolators can drop as much as one volt between the in & out connections and still be good.

The Fourth Step should be done at about 1000 engine RPM. If the system starts charging now, you may have a low engine idle RPM issue or it could be that the vehicle electrical system requirements exceed the output of the charging system. It's believed that charging system demand increases by 15% per year due to corrosion, loose connections, and resistance built up in circuits. The red light on the dash may be coming on at idle simply because the engine idle speed is too low. 50 or 100 RPM can be the difference in alternator output at idle. To help this, the engine may benefit from a throttle body cleaning. Check to see if the vehicle has a idle-up system that raises the engine in cases of low charging system output. Make sure it is set up properly. If you have almost battery voltage on the BLUE wire on all 4 tests, there might be a rotor or brush problem.

If there is no, or very low, voltage on both the BLUE and ORANGE wires, check the BLACK ground wire that should be connected inside the vehicle near the regulator. If the ground is okay, do a Full-Field Test to see if the alternator will charge with the regulator bypassed.



Full-Field Test on Ford Systems With a PX-7000 Regulator: this PX-7000 Full-Field Test requires that the 3-wire connection from the PennTex harness to the O.E.M. Ford connector be unplugged first. This O.E.M. Ford connector is the connector that would have originally been plugged into the stock Ford alternator. This connection must be unplugged to prevent serious electrical system damage to the vehicle PCM, wiring harness, and the charging system.

Only after the PennTex harness is unplugged from the O.E.M. Ford 3-wire connector, check for voltage at the Ford Red wire in the Ford 3-wire connector (wire #1 in the drawing at the left). That OEM Ford Red wire should have battery voltage at all times. If not, an OEM Ford fuse link may have been damaged. Contact PennTex for more information.

Disconnect the PennTex PX-7000 Voltage regulator connector by pushing the black tab down and pulling the regulator connector away from the regulator. Jumper the two wires in the connector as shown. Start the vehicle and let it run for no longer than 30 seconds while checking the voltage at the jumper wire. If the voltage doesn't go up, you have an alternator problem. If the voltage does go up, you may have a regulator problem or a rotor that is bleeding voltage. Contact PennTex for the Rotor Test or download the test from our web site.

NOTE: Electrical system demand that equals or exceeds alternator output at idle is not good, but is

really not unusual. When the bus was built, the build specification might have called for a smaller alternator to save money. The problem is that the smaller alternator has to work harder. This produces more heat and reduces alternator life. Adding extra batteries or a smaller pulley to a charging system that isn't producing enough amperage is not the best way to fix the problem. Alternator output has to exceed charging system demand in order for the alternator to keep up.

If your vehicle has a PX-2 Series alternator, check with a PennTex Distributor listed on our web site to see if a more powerful 230 amp or 250 amp PX-5 Series alternator will fit in your application. A PX-5 Series alternator of the same model will have all the same dimensions as a PX-2 series, except for an increase in overall length of approximately 1-1/2 inches, measured in line with the rotor shaft. For exact dimensional differences, contact PennTex. If your PX-2 is mounted on a bracket rather than in the stock location, there is a good chance you can upgrade to more powerful PX-5.

PERFORMANCE, ENDURANCE AND SATISFACTION

PennTex
INDUSTRIES, INC.

Manufacturers of
High Efficiency Alternators and
Mobile Electronic Devices.

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Fax: 717-266-7803

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7620 Flagstone Drive
Fort Worth, TX 76118
Ph: 817-590-2818
Toll Free: 877-590-7366
Fax: 817-590-0505
Tech Fax: 817-590-0398

www.penntexusa.com
Email: sales@penntexusa.com
tech@penntexusa.com

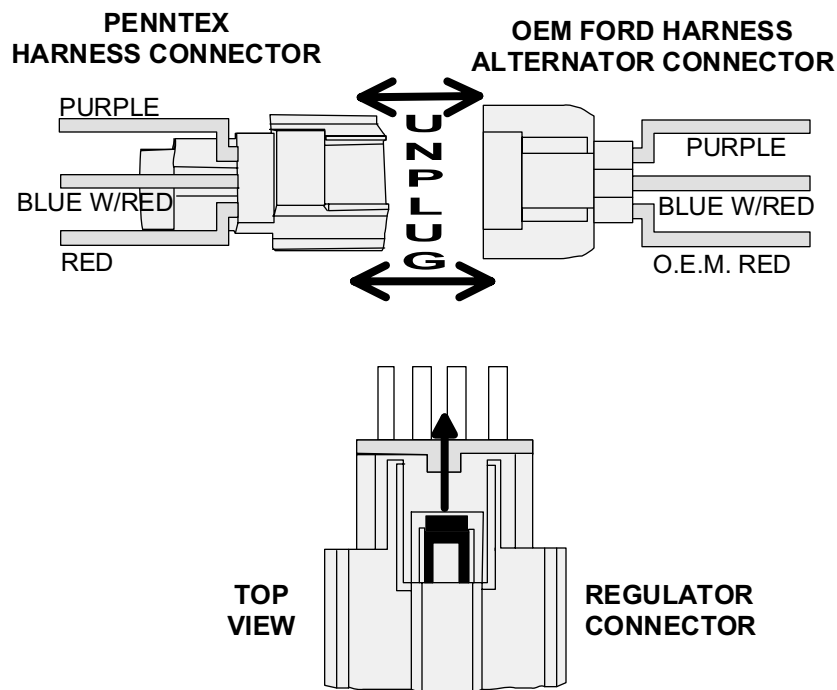


PX-7000 REGULATOR FOUR-STEP & FULL-FIELD TEST DIFFERENCES

Do the PX-7000 Four-Step Voltage Tests first.

Nothing is disconnected when doing the 4-Step Voltage Tests. You are checking voltages at the Regulator with the engine off and the engine running per the instructions on that test page. If any connections are unplugged during the 4-Step Tests, the voltage readings you get won't mean anything.

Do the Full-Field Tests after doing the 4-Step Tests. Unlike the 4-Step Tests, several connectors are unplugged for the Full-Field Tests. The Regulator connector is unplugged and the 3-wire connector to the PennTex Harness is unplugged for the Full-Field Test. The 3-wire connector must be unplugged during the Full-Field Test or serious vehicle PCM damage can occur.



**TO REMOVE CONNECTOR FROM REGULATOR
PUSH BLACK TAB DOWN AND PULL
CONNECTOR AWAY FROM REGULATOR**

PENNTEX INDUSTRIES, INC. TECH LINE: 877-590-7366 FAX: 817-590-0398
www.penntexusa.com
tech@penntexusa.com

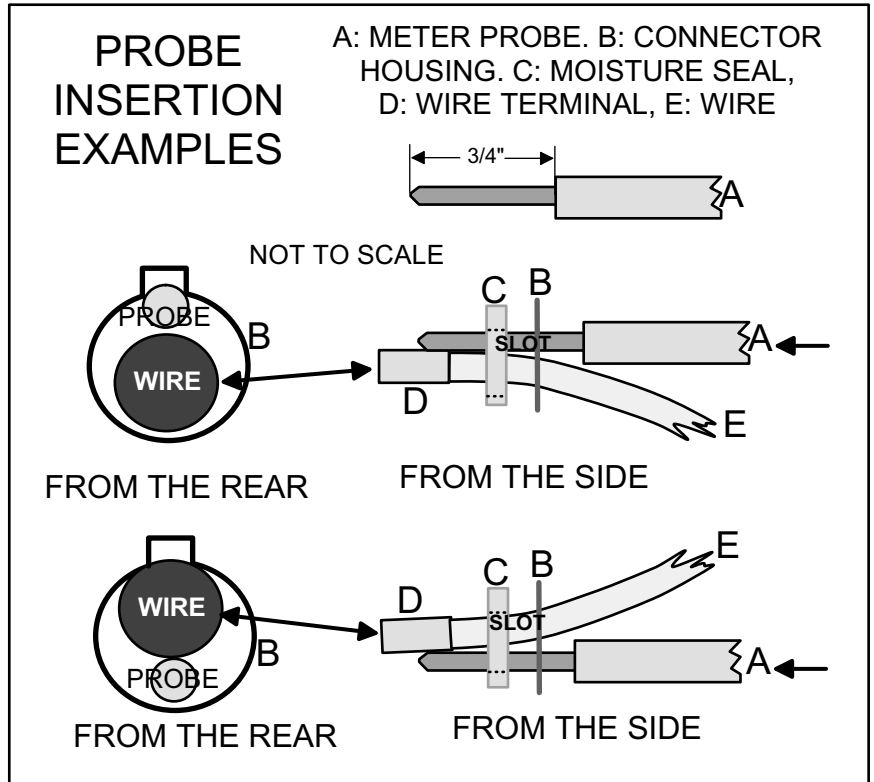
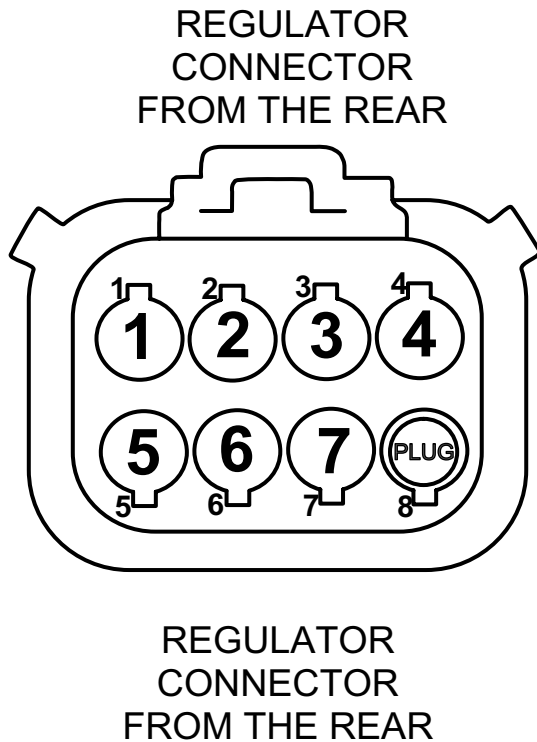
SCALE: NONE

10-28-11



TESTING A PENNTEX CHARGING SYSTEM WITH A PX-7000 VOLTAGE REGULATOR

The standard PennTex 4-Step Voltage Test has been revised for PX-7000 voltage regulators. The regulator may have to be taken loose from the vehicle for access to the regulator connector. Voltage readings for the tests can be taken by firmly inserting a digital voltmeter positive probe into the wire holes in the back of the regulator connector. There is a moisture seal inside the connector that each wire passes through before coming out of the back of the connector. If the meter probe is inserted through the same hole that the wire passes through the seal will not be damaged.



The connector moisture seal is the same shape as the rear of the connector housing. It has eight holes and is about 1/8" thick. Inserting a meter probe will stretch the seal hole but it will regain its previous shape. There are 3 steps to getting good probe/wire terminal contact: **1)** Have the regulator where the connector is accessible. **2)** Line the positive meter probe (A) up with the wire. **3)** Slide the probe firmly through the connector (B) along the wire until about 1/2" of the probe is inside the connector. You may have to move the probe in and out just a little to get probe/wire terminal contact. The best wire to get a feel for how this works is wire #1 (large Red). Have the meter turned on with a good ground for the negative probe, and the meter set to DC Volts. There should be voltage on wire #1 all of the time. Follow this 3-step procedure to get a meter reading and it will be easier to do the other wires.

PX-7000 WIRE CONNECTOR COLORS AND LOCATIONS

- | | |
|--------------|-------------------------|
| 1: Large Red | 5: Small Red |
| 2: Orange | 6: Blue with Red Stripe |
| 3: Blue | 7: Purple |
| 4: Black | 8: Plug/no wire |

PennTex
INDUSTRIES, INC.
 FT. WORTH, TX MANCHESTER, PA
 TOLL FREE: WEB SITE:
 877-590-7366 www.penntexusa.com
 DRAWING BY DMc UPDATED 12-10-08

CHARGING SYSTEM TEST FOR VEHICLES WITH A PX-7000 REGULATOR

Your Company Name: _____

Testers Name: _____

Phone: _____ Ext: _____

Alternator Model Number: _____

Alternator Serial Number: _____

PX-7000 Serial Number: _____

Vehicle Mileage: _____

Vehicle Year: _____ Make: _____ Engine: _____



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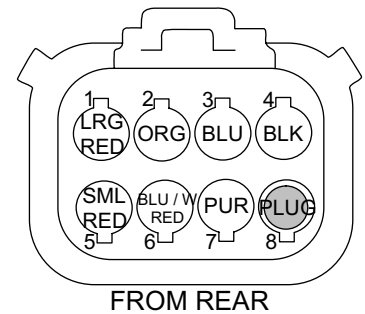
Warranty Flat Rate Schedule
(If Warranty Verified)
-Test Charging System using this form: 1/2 (.5) Hour
-R&R Alternator: 1.0 Hour
-R&R Regulator: 1/2 (.5) Hour
-Any additional time is not payable by PennTex Industries, Inc.

Your Shop Hourly Labor Rate:
\$ _____

Locate the external voltage regulator, make sure that everything is properly connected and that the charging system harness has a good ground.
Complete the following chart using a digital volt meter set on the DC Volts scale.

VOLTAGE READINGS

Regulator Terminals ↓	Test # 1 Ignition Off Engine Off	Test # 2 Ignition On Engine Off	Test # 3 Ignition On Engine On	Test # 4 Ignition On High Idle
Field Terminal (Blue Wire) # 3				
Stator Terminal (Orange) # 2				
Power Terminal (Large Red) #1				
Voltage At The Battery				



**PX-7000
CONNECTOR
WIRE COLORS
AND LOCATIONS:**

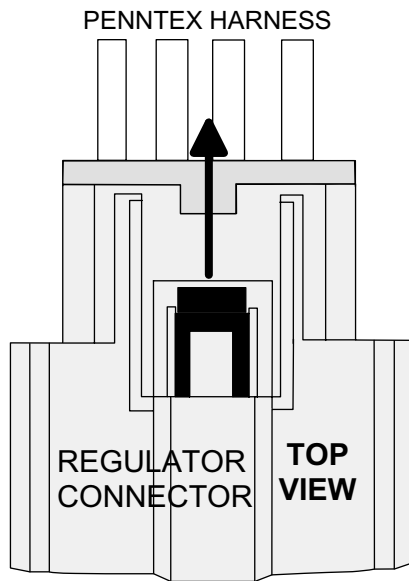
- 1: Large Red
- 2: Orange
- 3: Blue
- 4: Black
- 5: Small Red
- 6: Blue with Red Stripe
- 7: Purple
- 8: Plug/no wire

When this test is completed fax it and the Full-Field Test to 817-590-0398.
We will review it and contact you.

PennTex INDUSTRIES, INC.

PX-7000 REGULATOR FULL-FIELD TEST

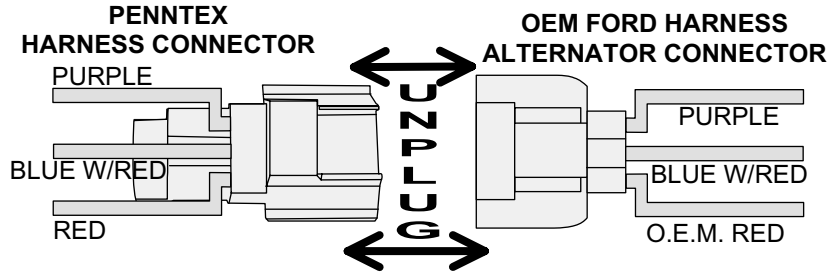
PX-4000, PX-5000, AND PX-6000 REGULATORS USE A DIFFERENT TEST



TO REMOVE CONNECTOR FROM REGULATOR
PUSH BLACK TAB DOWN AND PULL
CONNECTOR AWAY FROM REGULATOR

IMPORTANT!!! THE PENNTEX HARNESS PLUGS INTO THE 3-WIRE OEM ALTERNATOR CONNECTOR. UNPLUG THAT CONNECTOR BEFORE DOING THE FULL-FIELD TEST

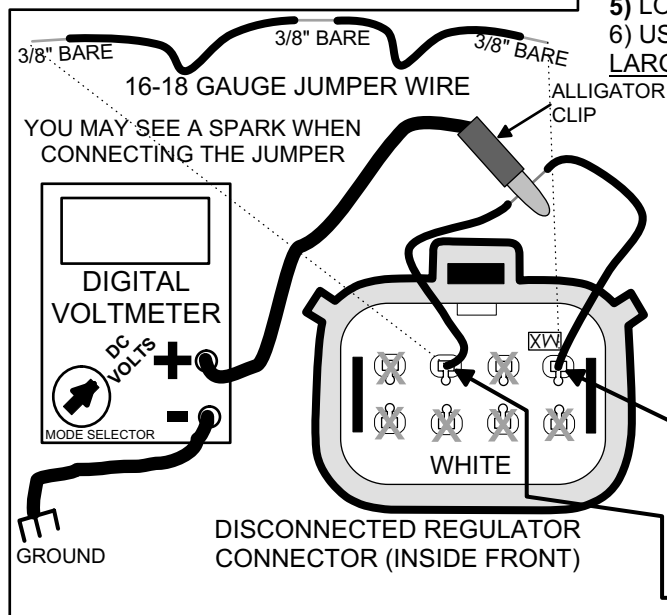
WHEN DISCONNECTING THESE PLUGS LOOK FOR LOOSE TERMINALS



- 1) DISCONNECT THESE CONNECTORS
- 2) CHECK THE VOLTAGE AT THE O.E.M. RED WIRE TERMINAL
- 3) DO FULL THE FIELD TEST

FULL-FIELD TEST PROCEDURE:

- 1) TURN OFF ALL ACCESSORIES.
- 2) DISCONNECT THE PENNTEX HARNESS 3-WIRE CONNECTOR AT THE OEM ALTERNATOR PLUG. **DO NOT OMIT THAT STEP!!**
- 3) WITH THEM UNPLUGGED, CHECK THE VOLTAGE ON THE RED WIRE IN THE OEM FORD 3-WIRE CONNECTOR.
- 4) THAT VOLTAGE IS: _____.
- 5) LOCATE & DISCONNECT THE VOLTAGE REGULATOR.
- 6) USING A 16-18 GA. WIRE, JUMP THE SOLID BLUE AND LARGE RED WIRE TERMINALS AS SHOWN TO THE LEFT.
- 7) START THE VEHICLE; RUN AT IDLE.
- 8) CHECK THE VOLTAGE AT THE JUMPER WIRE.
- 9) THAT VOLTAGE IS: _____.
- 10) RAISE ENGINE RPM TO 1000 RPM.
- 11) CHECK THE VOLTAGE AT THE JUMPER WIRE.
- 12) THAT VOLTAGE IS NOW: _____.
- 13) SHUT THE ENGINE OFF.
- 14) REMOVE THE JUMPER WIRE.
- NOTE:** DO NOT RUN THE ENGINE MORE THAN 30 SECONDS IN FULL-FIELD MODE. DAMAGE TO THE VEHICLE ELECTRICAL SYSTEM COULD RESULT.
- 15) RECONNECT THE 3-WIRE CONNECTORS.



JUMP FROM **LARGE RED WIRE LOCATION ONLY**
TO SOLID BLUE WIRE LOCATION

NOTE: USING A JUMPER ON ANY OTHER COMBINATION OF WIRES MAY CAUSE ELECTRICAL DAMAGE
A FULL-FIELD TEST DETERMINES IF AN ALTERNATOR WILL CHARGE WITH THE
REGULATOR BYPASSED. AFTER COMPLETING THIS TEST AND THE FOUR-STEP
VOLTAGE TEST, FAX THEM TO OUR TECHNICAL DEPARTMENT AT 817-590-0398.
WE WILL CONTACT YOU WITH THE RESULTS.

PENNTEX INDUSTRIES, INC. TECH LINE: 877-590-7366 FAX: 817-590-0398

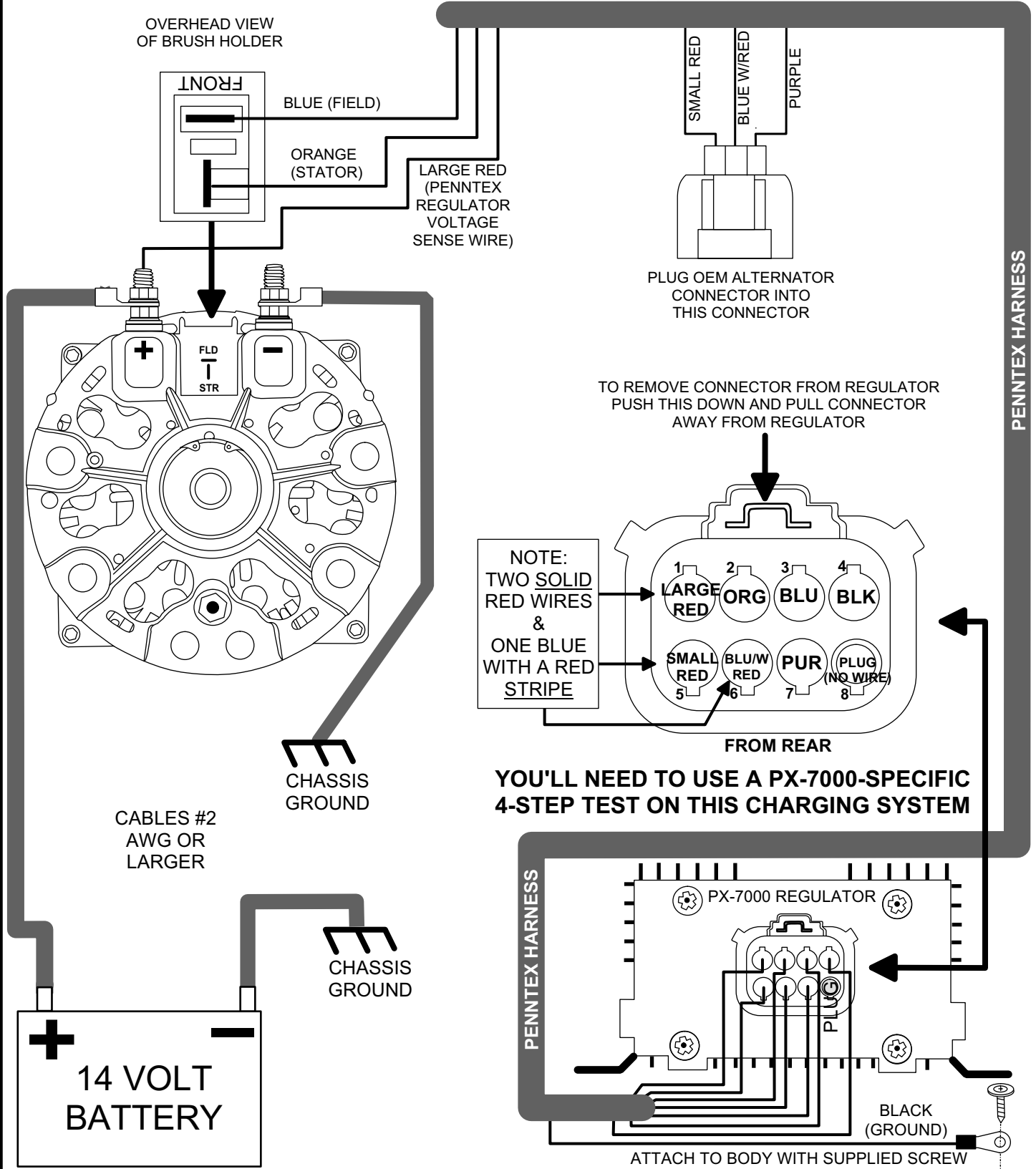
SCALE: NONE

tech@penntexusa.com

05-08-11



PX-220RC-A & PX220RC-T ALTERNATORS



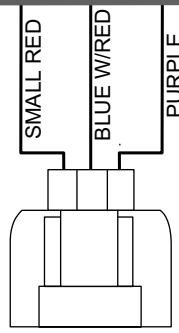
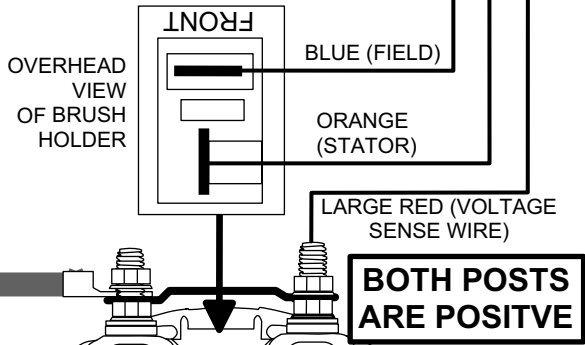
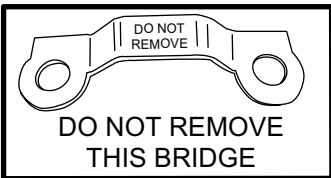
NOTES: THIS IS A GENERIC WIRING SCHEMATIC FOR THE PX-220RC-A AND PX-220RC-T ALTERNATORS WITH A PX-7000 REGULATOR. THIS IS NOT SPECIFIC TO ANY CERTAIN MAKE, MODEL, OR ENGINE.
CHARGING CABLE SIZE: MINIMUM #2 AWG OR LARGER

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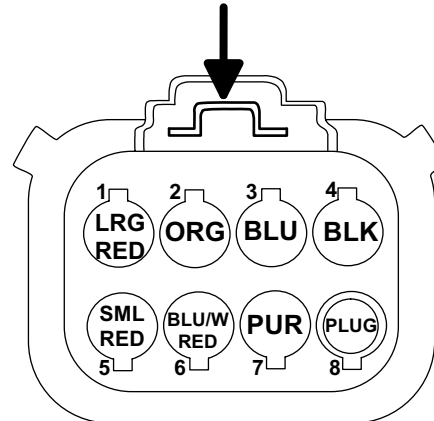
TITLE/DESC. GENERIC WIRING DIAGRAM FOR PX-220RC-A or 220RC-T ALTERNATOR WITH PX-7000 REGULATOR		
DATE: 09-16-08	DRAWING NUMBER:	
DRAWN BY: DMc	REVISION:	CHECKED BY:
SCALE: NONE		PAGE: 1 OF 1

**PX-520RDC & PX525RDC
ALTERNATORS**



PLUG OEM ALTERNATOR CONNECTOR INTO THIS CONNECTOR

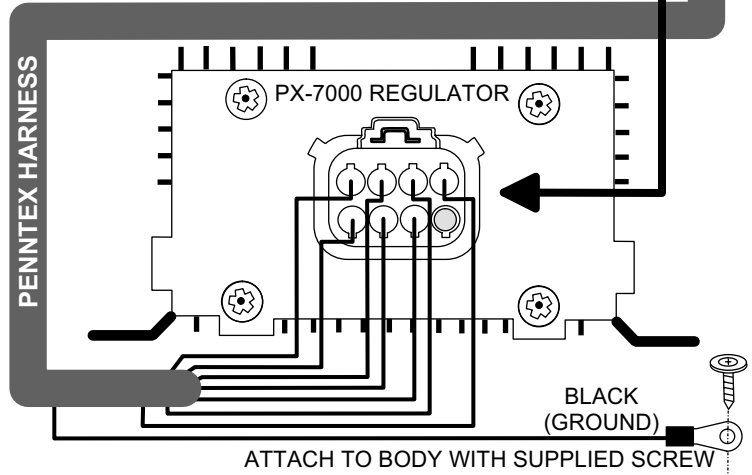
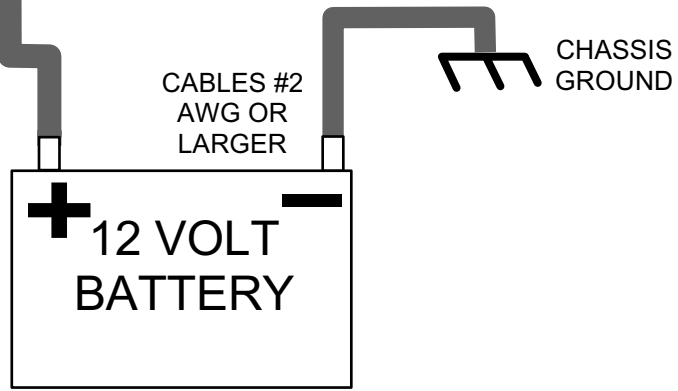
TO REMOVE CONNECTOR FROM REGULATOR PUSH THIS DOWN AND PULL CONNECTOR AWAY FROM REGULATOR



FROM REAR

USE A "PX-7000 4-STEP TEST" ON THIS REGULATOR

NOTE:
CONNECT ALTERNATOR GROUND CABLE TO ALTERNATOR MOUNTING BOLT OR GOOD ENGINE GROUND.
CABLES #2 AWG OR LARGER



PENNTEX HARNESS

NOTES: THIS IS A GENERIC WIRING SCHEMATIC FOR THE PX-520RDC AND PX-525RDC ALTERNATORS WITH A PX-7000 REGULATOR. THIS IS NOT SPECIFIC TO ANY CERTAIN MAKE, MODEL, OR ENGINE.
CHARGING CABLE SIZE: MINIMUM #2 AWG OR LARGER

Penntex INDUSTRIES, INC.

FT. WORTH, TX MANCHESTER, PA

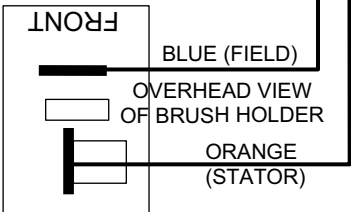
877-590-7366 www.penntexusa.com

TITLE/DESC. GENERIC WIRING DIAGRAM FOR 2009-UP FORD PX-520-RDC or 525RDC ALTERNATOR WITH PX-7000 REGULATOR	
DATE: 03-11-09	DRAWING NUMBER:
DRAWN BY: DMc	REVISION:
	CHECKED BY:
SCALE: NONE	PAGE: 1 OF 1

PX-723RDC & PX-725RDC ALTERNATORS



DO NOT REMOVE THIS BRIDGE



BLUE (FIELD)

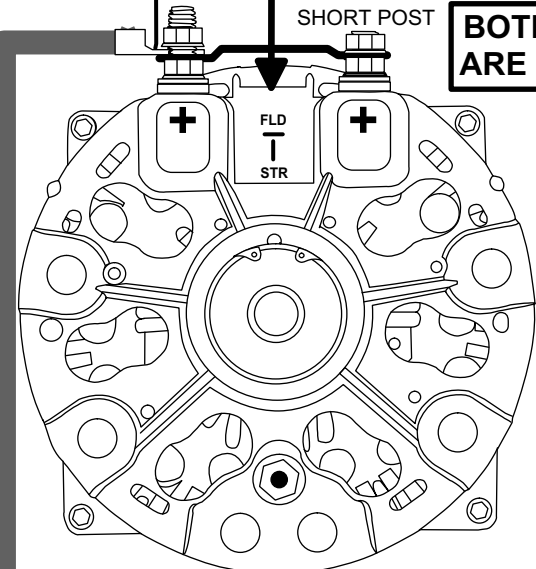
OVERHEAD VIEW OF BRUSH HOLDER

ORANGE (STATOR)

LARGE RED (VOLTAGE SENSE WIRE)

SHORT POST

BOTH POSTS ARE POSITIVE

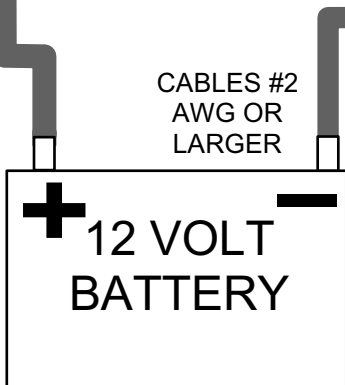


NOTE:
CONNECT ALTERNATOR GROUND CABLE TO ALTERNATOR MOUNTING BOLT OR GOOD ENGINE GROUND.



CHASSIS GROUND

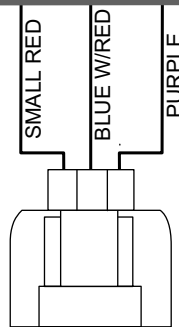
CABLES #2 AWG OR LARGER



CABLES #2 AWG OR LARGER

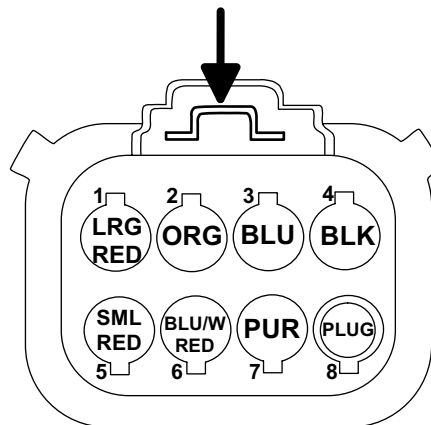


CHASSIS GROUND



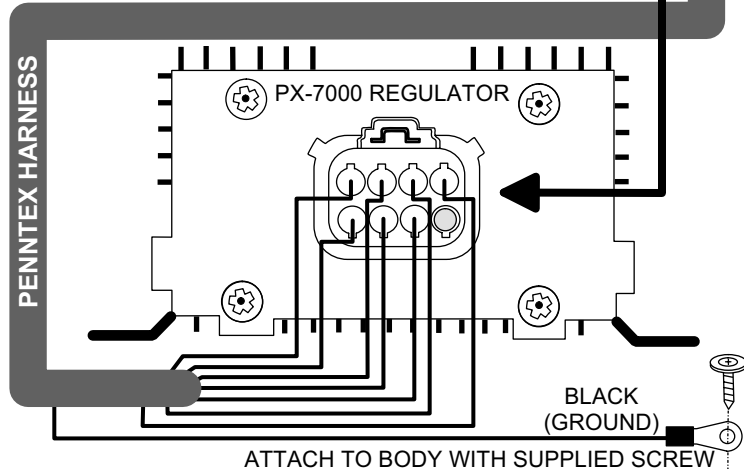
PLUG OEM ALTERNATOR CONNECTOR INTO THIS CONNECTOR

TO REMOVE CONNECTOR FROM REGULATOR PUSH THIS DOWN AND PULL CONNECTOR AWAY FROM REGULATOR



FROM REAR

USE A "PX-7000 4-STEP TEST" ON THIS REGULATOR



PENNTEx HARNESS

BLACK (GROUND)

ATTACH TO BODY WITH SUPPLIED SCREW

NOTES: THIS IS A GENERIC WIRING SCHEMATIC FOR THE PX-723RDC AND PX-725RDC ALTERNATORS WITH A PX-7000 REGULATOR. THIS IS NOT SPECIFIC TO ANY CERTAIN MAKE, MODEL, OR ENGINE.
CHARGING CABLE SIZE: MINIMUM #2 AWG OR LARGER

Penntex INDUSTRIES, INC.

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877-590-7366 www.penntexusa.com

TITLE/DESC. GENERIC WIRING DIAGRAM FOR 2009-UP FORD PX-723-RDC or 725RDC ALTERNATOR WITH PX-7000 REGULATOR

DATE: 07-07-10	DRAWING NUMBER:	
DRAWN BY: DMc	REVISION:	CHECKED BY:

SCALE: NONE

PAGE:
1 OF 1

PENNTEx HARNESS