

POWERLINE

HEAVY DUTY ALTERNATORS, REGULATORS

The **POWERLINE** series is a product of extensive heat-chamber engineering and testing. The performance is far superior to comparable labels on the market.

POWERLINE alternators are labeled both SAE, or cold, as well as 200 F, or hot.

In selecting an alternator for your special application, always select an alternator with 15% to 20% more amperage capabilities than the vehicle load.

Larger output wire is necessary when installing a higher output alternator on any vehicle. Refer to the wiring chart.

The factory amp meter will be by-passed when installing the larger output wire. A volt meter should be installed and relied on to monitor the charging system.

Please contact our engineering or service department assistance is desired.



HEHR

POWER SYSTEMS

A DIVISION OF HEHR INTERNATIONAL INC.

4616 Fairlane Avenue, Ft. Worth, TX 76119

817/535-0284 - FAX 817/531-2755

Canada 905/852-5417

E-MAIL: sales@hehrpowersystems.com

WEBSITE: www.hehrpowersystems.com

AN ISO 9001 COMPANY



CONGRATULATIONS!

... for choosing this high quality **POWERLINE** product. The latest state-of-the-art engineering plus years of experience has gone into each **POWERLINE** product.

The attached instructions are provided to assist you with step by step installation. Test procedures are also provided to be kept with your equipment should future reference be desired.

Every effort has been made to use the finest materials and workmanship. In the event that service is ever needed or if you have questions regarding either the product, installation or performance, please give us a call.

Your Friends at the Factory

LIMITED WARRANTY

HEHR POWER SYSTEMS warrants each new product against factory defects in material and workmanship for a period of time as outlined in the Warranty Period schedule (Form W1000A - 4/95). Exclusions from this warranty for damage or failure due to accident, misuse, negligence or improper installation.

Material required for repair or replacement for defective part is to be supplied at no charge upon delivery of the defective part to **HEHR POWER SYSTEMS**, 4616 Fairlane Avenue, Fort Worth, Texas, 76119 or an authorized service center. The customer is responsible for all freight on returned parts.

There are no warranties, expressed or implied (including any implied warranties or merchantability or fitness), which extend beyond this warranty period. The loss of use of the product, loss of time, inconvenience, commercial loss or consequential damages are not covered.

HEHR POWER SYSTEMS reserves the right to change the design or any product without assuming any obligation to modify any product previously manufactured.

This warranty gives you specific legal rights. You may also have other rights which vary from state to state. Some states do not allow limitations on how long an implied warranty lasts. Some states do not allow the exclusion or limitation of incidental or consequential damages. Therefore, the above limitation(s) or exclusion(s) may not apply to you.

IMPORTANT INSTALLATION INFORMATION

PROPER / SAFE OPERATION OF 10-170 FAMILY REGULATORS

MAXIMUM REGULATOR CASE TEMPERATURE

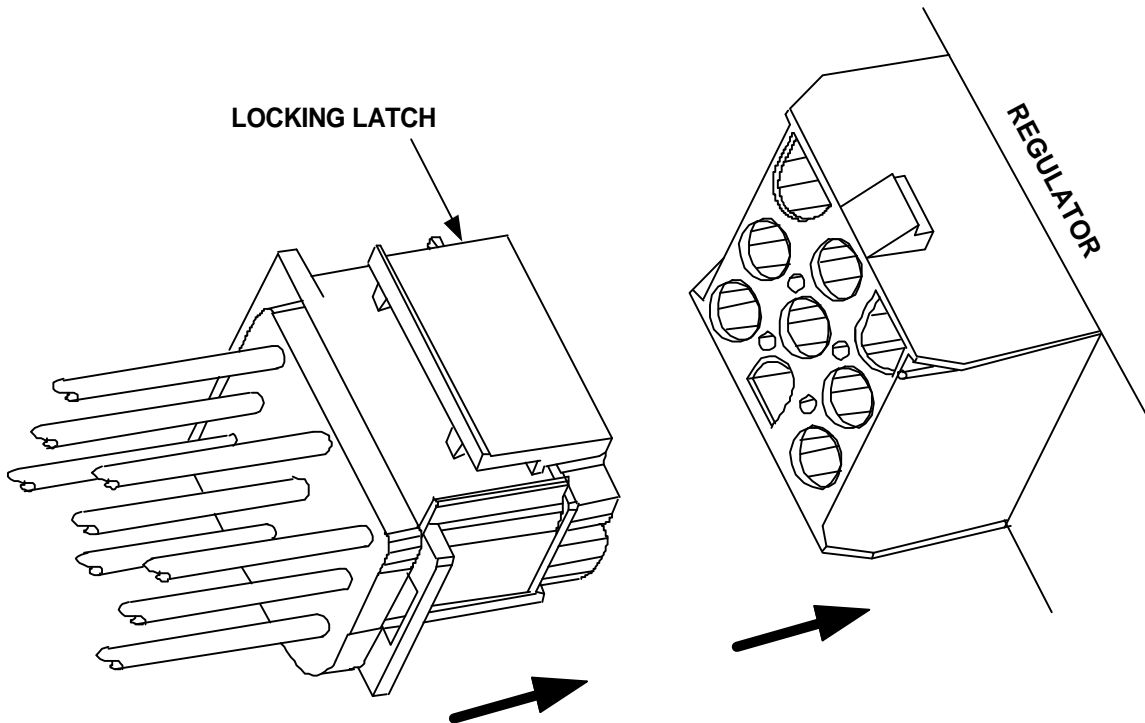
- A. For a single alternator system, the regulator should be mounted in a location where its maximum case temperature will not exceed 250° F (100° C).
- B. For a dual alternator system, the regulator should be mounted in a location where its maximum case temperature will not exceed 250° F (100° C).

PROPER CONNECTOR ENGAGEMENT / LATCHING

When you plug the connector on the wiring harness into the mating connector on the regulator, ***you must verify that the two connector halves are fully engaged and that the plastic latches are securely locked in place.*** If the plastic latches are not locked, the two halves of the connector may separate slightly during temperature and vibration exposure – resulting in a high resistance connection.

After aligning the halves of the connector, hold the wiring harness connector by the panel latches and push the plug connector forward with your thumb until it bottoms out and an audible click is heard. Do this on both latches. Then pull back on the harness to ***make sure it will not disconnect.*** The latches will lay parallel to the body of the connector when properly engaged.

FAILURE TO OBSERVE THE RULES ABOVE MAY RESULT IN THE CONNECTOR PIN / SOCKET GETTING TOO HOT AND MELTING DOWN OR BURNING!!!



INSTALLATION INSTRUCTIONS: 10-170 SERIES REGULATORS & **POWERLINE** ALTERNATORS

REGULATOR CONFIGURATION AND PIN FUNCTION: (Refer to Figure 1)

- PIN 7 (the A terminal) is the regulator's power supply. **It must be connected to battery voltage at all times to work.**
- PIN 5 is the GROUND connection. It must be a good electrical ground or the regulator will shut down.
- PIN 3 is the Ignition terminal. A DC turn on signal for the regulator is applied here. Key-switched battery voltage applied directly (if you have a voltmeter on the vehicle) or through a warning lamp.
- PIN 6 **MUST HAVE A STATOR CONNECTION** from the alternator to function properly. This signal:
- * "kicks" the regulator into full operation & will, in fact, turn the regulator ON by itself
 - * turns off the warning / indicator lamp, if you have one in the circuit.
- PIN 4 (S I) is the primary remote sense and must be connected directly to the POS post of the main battery -the most heavily loaded battery or the one you most want to control.
- PIN 1 (S2) the second remote sense is, is to be **USED ONLY IF** the vehicle has a second battery connected thru an isolator. Connect it to the POS post of the second battery. The primary purpose of the second sense is to prevent a runaway condition if diodes in one leg of the isolator should fail.
- PIN 2 is the field connection and goes to the high side of the rotor (alternator field winding).
- PINS 8 AND 9 have nothing to do with the normal operation of the regulator.** They are part of the diagnostic LEDs, and can be used to extend signals to the dashboard. Call Factory for help if you want to do this.

CONNECTIONS AND WIRING DIAGRAMS

1. Disconnect the negative battery cable to remove vehicle power during installation.
2. If upgrading alternator, remove the OEM unit and mount **POWERLINE** alternator. Re-adjust or replace the fan belt so that it is tight, but not exerting side thrust on the bearings. Run the engine and retighten.
3. Battery cables must be sized to match alternator Output. See chart on page 5 - change cables if necessary.
4. Mount the regulator in a location midway between the alternator and battery(les) Such that the wiring harness will reach both. Choose a location (frame, fender, bulkhead) where the maximum case temperature will not exceed 250 F / 121 C for a single alternator system or 212F / 100 C for a dual alternator system.
5. Orient the connector plug of the harness over the regulator and plug it in. **VERIFY THAT BOTH LATCHES ARE ENGAGED & CONNECTORS CANNOT SEPARATE.** Connect all the wires in the harness per attached drawings. (Assumes you bought our wiring harness for your alternator)
 - A. SERIES 24 ALTERNATORS (Figure 2)
 - Single battery systems - use an 11-81 harness and wire connections per Figure 2A.
 - Multiple battery systems with isolator - use 11-81 harness wired per Figure 2B.

NOTE - LTC limos use 11-84 harness where IGNITION wire is green / red stripe, not brown. See Figure 2C.
 - B. SERIES 23 and 25 ALTERNATORS (Figure 3) The basic wiring diagrams of Figures 2A and 2B apply to all alternators by function. The only difference will be in making the connections at the alternator itself. Figure 3 shows Pictures of the Series 23 and 25 alternators with connection points labeled by wire color and regulator pin function. Insert the appropriate alternator Picture in place of the S24 in Figures 2A or 2B. The 11-80 harness for Series 23 and 11-82 harness for S25 alternators will provide the correct connection mechanisms.

NOTE - On S25 alts, make Sure the F NEG screw on the field cover plate is jumpered to ground.

OPERATION

Reconnect the negative battery cable and make sure the 3 fuses in the wiring harness are all in place and good - 20 amp ATC fuse in the red wire (A) and 5 amp fuses each in the red / white stripe (S I) and red / yellow stripe (S2) leads.

Now go thru a normal start sequence and watch the LEDs on the regulator to make sure they display the sequence shown at bottom on FIG. 1. This should be done Under a minimum load condition - turn off all unnecessary electrical loads.

If all LED signals are correct, measure the voltage directly across each battery - It should be 13.6 to 14.4 volts (double for 28 V system). If it is low, speed the engine up to a fast idle and hold it for several minutes. The battery voltage Should rise. If voltages are correct, installation is complete. If LED signals or battery voltages are wrong, run the complete voltmeter tests shown in the charts on Figure 7 to determine where the problem is.

VOLTAGE SET POINTS: SI = 14.2 VDC, S2 = 14.6. Open Sense = 14.8-15 VDC. SI is user adjustable by the exposed potentiometer (I 3.6 to 14.6 Under NO LOAD) & S2 and OS are 0.4 and 0.8 volts higher respectively. Voltages in a 28 volt system are S1 = 28.4, S2 = 28.8, OS = 29-30 VDC.

RECOMMENED BATTERY CABLE SIZE - BASED ON CURRENT AND WIRE LENGTH

Length of cable shown is for either POS or GND lead, not total length. Cable size does apply to both wires.

SYSTEM RATED OUTPUT		MINIMUM CABLE SIZE TO USE (AWG)					
VOLTAGE	AMPS	UP TO 5 FT.	5-10 FT.	10- 15 FT.	15-20 FT.	20-25 FT.	25-30 FT.
12 VOLT	0- 60	8 AWG	4 AWG	2 AWG	2 AWG	1 AWG	0 AWG
	60- 100	6 AWG	2 AWG	1 AWG	0 AWG	0 AWG	00 AWG
	100- 150	4 AWG	2 AWG	0 AWG	00 AWG	00 AWG	000 AWG
	150- 190	4 AWG	1 AWG	00 AWG	000 AWG	4/0 AWG	4/0 AWG
	190-250	2 AWG	0 AWG	00 AWG	4/0 AWG	4/0 AWG	4/0 AWG
	250-300	0 AWG	00 AWG	3/0 AWG	4/0 AWG	4/0 AWG	4/0 AWG
24 VOLT	0- 50	12 AWG	10 AWG	8 AWG	6 AWG	6 AWG	4 AWG
	50 - 75	10 AWG	8 AWG	6 AWG	4 AWG	4 AWG	2 AWG
	75 - 100	6 AWG	6 AWG	4 AWG	4 AWG	2 AWG	1 AWG
	100- 125	4 AWG	4 AWG	4 AWG	2 AWG	2 AWG	1 AWG
	125 - 150	2 AWG	2 AWG	1 AWG	1 AWG	0 AWG	0 AWG

TROUBLE-SHOOTING SUGGESTIONS

A. NO ALTERNATOR OUTPUT can be caused by:

1. ALTERNATOR PROBLEMS Open or shorted rotor. With power off & wiring harness disconnected from alternator, make ohmmeter measurement from F to GND. Should read 2 to 5 ohms. Less than 2 ohms typically means a shorted field winding; an open circuit could be a broken brush / contaminated slip rings or a broken wire / termination. If shorted, R&R. If not shorted, do a full field by-pass test. Full Field / Regulator By-Pass Test: With Field terminal on the alternator (blue wire) disconnected, start the engine and run at a fast idle with most electrical loads turned OFF. Attach a voltmeter across the output terminals of the alternator, and monitor the voltage there while you momentarily connect the F terminal to battery voltage. Do not hold the jumper wire with your fingers because it will get hot. If the alternator is good, it will "roar to life" and the voltage will quickly climb to 15 or 16 volts. End the test after 5 to 10 seconds before voltage climbs high enough to damage anything. If there is no output, R&R alternator.

2. REGULATOR PROBLEMS Loss of correct inputs:

- a) NO GREEN LED could indicate loss of power at A terminal / pin 7 (blown or missing fuse in red wire), loss of Ignition signal at I terminal / pin 3 (burned open warning lamp or damaged brown wire), or open ground connection (check black wire and connections). If all OK and no green LED - dead regulator.

- b) Green and Orange LEDs On but NO YELLOW LED, could mean loss of stator Signal input to pin 6/ S terminal of regulator. Check for voltage (greater than 20 mili-volts) at regulator pin 6 and at stator tap on alternator. If not there, do ohmmeter continuity check on white wire & / or wiggle stator spade on alternator to see if loose. Shorted F terminal or Open Ground connection causes the regulator to shut down. With all wires connected but power off, disconnect, the harness plug at the regulator connector. Make the following ohmmeter measurements by probing into the harness plug receptacles:

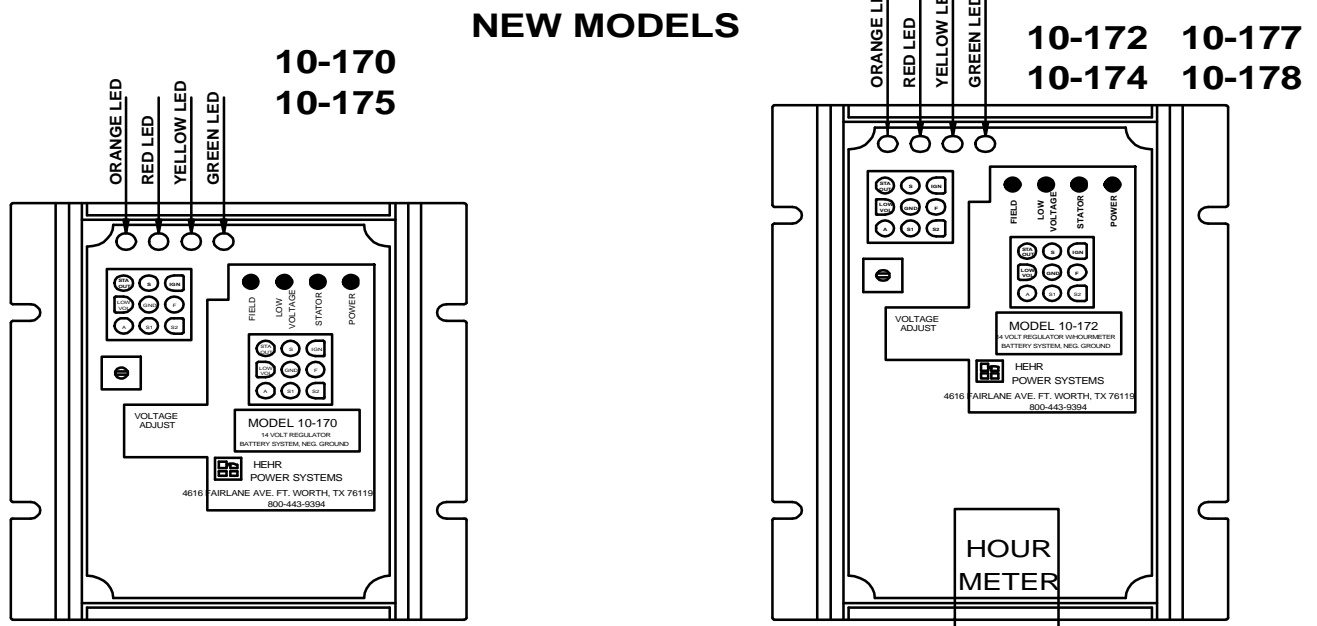
- a) From F/pin 2/blue wire to GND/pin5/black wire should be 2 to 6 ohms.

- b) From GND pin 5/black wire to NEG battery post should be less than 5 ohms.

B. LOW VOLTAGE CONDITIONS (red LED ON) are usually a result of system problems. **Do not remove the alternator from the truck until you have checked for** 1) alternator turning too slowly to handle load (could be result of low engine RPM bad, pulley ratio, or belt slippage); 2) an over-loaded alternator -resulting in current being pulled out of the battery); or 3) inadequately sized battery cables / bad connections. C. HIGH VOLTAGE CONDITIONS are usually caused by one of the following:

- * an Open Sense condition. Restore S I or S2 connections or turn pot, screw CCW to reduce voltage.
- * regulator stuck in full field. Voltage at F/pin 2 should increase as load increases. If always 8-12 VDC the regulator is bad.

FIGURE 1A - REGULATOR CONFIGURATION - TOP VIEW



PIN #	NAME	HARNESS WIRE COLOR	FUNCTION	PIN LOCATION TOP VIEW OF REGULATOR CONNECTOR
1	S2	RED/YEL	REMOTE SENSE 2	<p>(NOT THE HARNESS CONNECTOR)</p>
2	F	BLUE	FIELD OUTPUT	
3	IGN	BROWN	IGNITION TURN ON	
4	S1	RED/WHT	REMOTE SENSE 1	
5	GND	BLACK	GROUND	
6	S	WHITE	STATOR TURN ON	
7	A	RED	POWER SUPPLY	
8	LOW VOL	WHT PLUG	OUTPUT FOR REMOTE LED (LOW VOLTAGE)	
9	STA OUT	WHT PLUG	OUTPUT FOR REMOTE LED (STATOR)	

DIAGNOSTIC LED FUNCTIONS

GREEN (POWER) LED ON indicates that the regulator has power, has received a turn on signal, and that the internal 5 volt regulator is working. It should be ON when the ignition key is ON.

ORANGE (FIELD) LED ON indicates the output transistor is on and can power the field winding. This does not guarantee that the alternator will work - it could have an open rotor for example. It should be dimly lit, flickering with the key ON and engine not running and will brighten with engine running. Brightness depends on loads and battery charge condition.

YELLOW (STATOR) LED ON indicates the presence of a stator voltage, which shows that the alternator is working. It should be ON whenever the engine is running and the alternator should be ON.

RED LED ON indicates a low voltage condition - less than 12.6 volts in a 14 volt system or less than 25 volts in a 28 volt system. It may be ON with the key ON and the engine OFF, but it should be OFF when the alternator is running.

KEY OFF / ENGINE OFF - all LEDs should be OFF.

KEY ON / ENGINE OFF - green ON, yellow OFF, red may be ON or OFF, and ORANGE should be dim or flickering.

KEY ON / ENGINE ON - green, yellow, and orange LEDs should be ON, but red should be OFF.

With all wiring connections in place and power applied, make voltage measurements (relative to Ground) at the locations shown for the conditions shown. Typical good values are shown in the table for 12/24 volt systems. IF you do not get these values, investigate the "links". Example: No F voltage or green LED with both A terminal and I terminal voltage present means a bad regulator. IF I terminal voltage is missing, problem is in wiring/lamp/ or IGN switch. DO THESE TESTS WITH ALL NON-ESSENTIAL VEHICLE LOADS OFF (light load condition). Voltages shown are approximate/ no tolerance intended.

	VEHICLE CONDITIONS				VOLTAGE AT REGULATOR/ ALTERNATOR TERMINALS						REGULATOR LED'S			
	IGNITION SWITCH	ENGINE CONDITION	ENGINE RPM	DASH LAMP	A PIN 7	I PIN 3	S1 PIN 4	S2 PIN 1	F PIN 2	STA PIN 6	GREEN IGNITION	ORG. FIELD	YEL STATOR	RED LOW VLT
1. DC TURN ON Single Battery System	OFF	OFF	0	NO	12/24	0	12/24	0	0	0	OFF	OFF	OFF	OFF
	OFF	OFF	0	YES	12/24	0	12/24	0	0	0	OFF	OFF	OFF	OFF
	ON	NOT	0	NO	12/24	12/24	12/24	0	.8/2.4	0	ON	ON *	OFF	OFF (1)
	DC	RUNNING	0	YES	12/24	1.5-3	12/24	0	.8/2.4	0	ON	ON *	OFF	OFF (1)
2. AC TURN ON	ON	ON	1000	NO	14/28	14/28	14/28	0	3/4	6/12	ON	ON	ON	OFF
	DC		1000	YES	14/28	14/28	14/28	0	3/4	6/12	ON	ON	ON	OFF
	ON	NOT	0	NOT	12/24	—	12/24	0	0	0	OFF	OFF	OFF	OFF
	AC	RUNNING		USED										
2. AC TURN ON	ON	ON	1000	NOT	14/28		14/28	0	3/4	6/12	ON	ON	ON	OFF
	AC			USED										

APPLY ELECTRICAL LOADS. AT THE POINT WHERE LOAD EXCEEDS ALTERNATOR OUTPUT AND SYSTEM VOLTAGE DROPS TO 12.6/24 VOLTS, THE RED LED SHOULD COME ON.

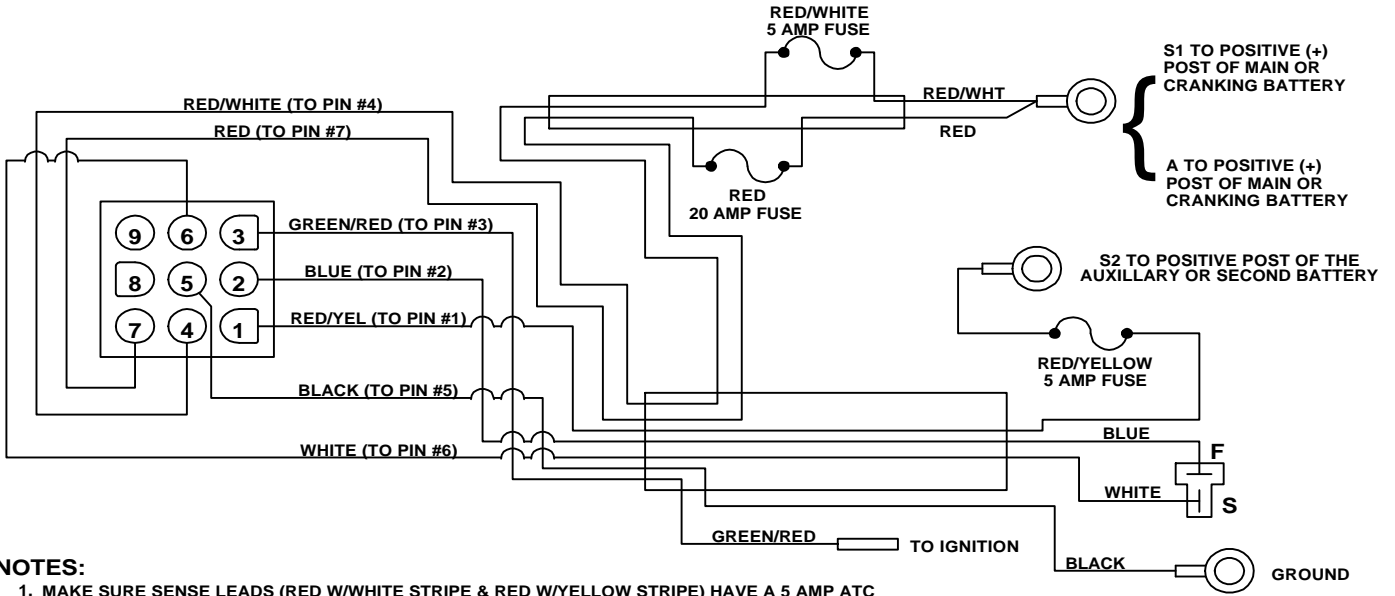
1. DC TURN ON Multiple Battery System With Isolator	OFF	OFF	0	NO	12/24	0	12/24	12/24	0	0	OFF	OFF	OFF	OFF
				YES	12/24	0	12/24	12/24	0	0	OFF	OFF	OFF	OFF
	ON	NOT	0	NO	12/24	12/24	12/24	12/24	.8/2.4	0	ON	ON *	OFF	OFF
	DC	RUNNING		YES	12/24	3/3	12/24	12/24	.8/2.4	0	ON	ON *	OFF	OFF
2. AC TURN ON	ON	ON	1000	NO	14/28	14/28	14/28	14/28	3/4	6/12	ON	ON	ON	OFF
	DC	ON	1000	YES	14/28	14/28	14/28	14/28	3/4	6/12	ON	ON	ON	OFF
	ON	NOT	0	NOT	12/24	0	12/24	12/24	0	0	OFF	OFF	OFF	OFF
	AC	RUNNING	0	USED										
2. AC TURN ON	ON	ON	1000	NOT	14/28	0	14/28	14/28	3/4	6/12	ON	ON	ON	OFF
	AC			USED										

APPLY ELECTRICAL LOADS. AT THE POINT WHERE LOAD EXCEEDS ALTERNATOR OUTPUT AND SYSTEM VOLTAGE DROPS TO 12.6/24 VOLTS, THE RED LED SHOULD COME ON.

NOTES: * Orange LED may be dimly lit or flickering
(1) Red LED may be on if battery voltage is below 12.8 VDC

FOR USE WITH SERIES 24 ALTERNATORS

LINCOLN TOWN CAR APPLICATIONS



NOTES:

1. MAKE SURE SENSE LEADS (RED W/WHITE STRIPE & RED W/YELLOW STRIPE) HAVE A 5 AMP ATC FUSE IN THE IN-LINE FUSE HOLDER, AND A 20 AMP ATC FUSE IN THE RED LEAD FUSE HOLDER.
2. CONNECT THE 9 PIN CONNECTOR TO THE MATING PLUG ON THE REGULATOR.
3. CONNECT THE OTHER ENDS OF THE HARNESS TO THE PLACES LABELED AS SHOWN. IF THE VEHICLE DOES NOT HAVE AN AUX OR SECOND BATTERY, TAPE THE SENSE 2 (S2) CONNECTOR/WIRE TO PREVENT SHORTING AND TAPE TO THE S1 HARNESS SO THAT IT IS OUT OF THE WAY.

FIGURE 2C
11-84 WIRING HARNESS

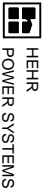
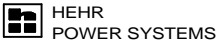
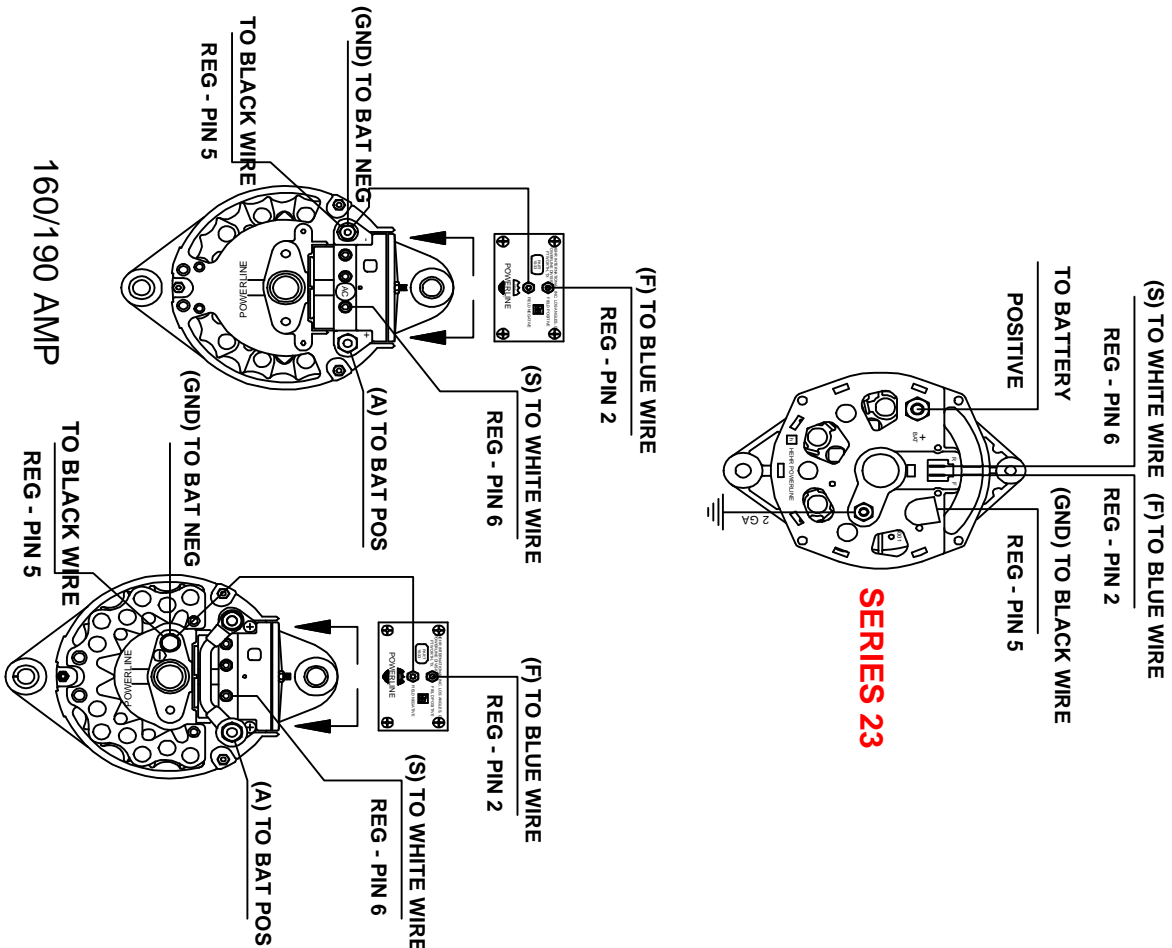


FIGURE 3 - CONNECTION POINTS FOR OTHER ALTERNATORS

(IF YOU HAVE A SERIES 23 OR A SERIES 25 ALTERNATOR, INSERT THESE PICTURES IN PLACE OF THE ALTERNATOR IN FIGURE 2A OR 2B)



SERIES 23

SERIES 25

160/190 AMP
200/250 AMP

