ELECTRICAL SYSTEM RP-7

This section of the manual does not include integral electrical components of the engine. Refer to section “Engine RP-1” for details. This section of the manual is divided into three separate sections.

SAFETY PRECAUTIONS

BEFORE DIAGNOSING OR REPAIRING ANY ELECTRICAL COMPONENT OR SYSTEM, BE AWARE OF BATTERY AND 110 VOLT POWER. DISCONNECT ALL POWER SOURCES BEFORE SERVICING ANY ELECTRICAL SYSTEM. FAILURE TO DO SO CAN RESULT IN PERSONAL INJURY OR PRODUCT DAMAGE. OBSERVE ALL CAUTIONS, WARNINGS AND NOTES IN THIS SECTION.

ENGINE - 12 VDC RP-7

The heart of the engine control system is the printed circuit board located on the heater/air conditioning unit. In conjunction with the control panel switches and the engine components, the circuit board becomes the centre of the diagnostic process. The following information provides a detailed description of each circuit and function of the components involved.

OPERATION: ENGINE RUN CIRCUIT

Power to the engine control switch is fed from the #1 terminal on the 8 point terminal strip (see “Engine Circuit Board” figure 12). When the “On/Off” switch is turned on, power is directed back to the circuit board to terminal #2 on the 8 point terminal strip. At this point, the circuit board energizes terminal #7 on the 12 point terminal strip. Terminal #7 is an output that energizes the run solenoid and the regulator (see “Engine Harness Wiring” figure 13). Terminal #7 will stay energized for approximately 45 seconds after which the oil pressure by-pass timer times out and the run circuit now is de-energized.

The oil pressure by-pass timer is set for 45 seconds. This allows the operator to turn on the “On/Off” switch, operate the glow plug switch and then operate the start switch before the run circuit de-energizes.

NOTE: IF AFTER THE START SEQUENCE THE ENGINE DOES NOT START, IT MAY BE NECESSARY TO TURN THE “ON/OFF” SWITCH OFF, AND THEN BACK TO ON, TO RESET THE BY-PASS TIMER. WHEN THIS OCCURS, DO NOT RE-GLOW THE ENGINE, GO DIRECTLY TO THE START MODE AND CRANK THE ENGINE.

GLOW PLUG CIRCUIT

When the “On/Off” switch is turned on, power is directed to the glow plug switch via wire #2 (see “Control Panel Wiring” figure 14). When the glow/start switch is operated in the glow position, power is directed to wire #7 and then to terminal #7 on the 8 point terminal strip located on the circuit board. The circuit board will then energize terminal #3 on the 12 point terminal strip (see “Engine Circuit Board” figure 12). Terminal #3 is an output that energizes the glow plug relay located on the electrical

backplate in the generator unit (see “Engine Backplate Wiring” figure 15). From the glow plug relay, power is sent through wire #12 to the glow plugs (see “Engine Harness Wiring” figure 13).

START CIRCUIT

The start switch is powered from the “On/Off” switch via wire #2 (see “Control Panel Wiring” figure 14). When the glow/start switch is operated in the start mode, power is directed via wire #6 to terminal #6 on the 8 point terminal strip on the circuit board.

The circuit board will then have an output on terminal #5 on the 12 point terminal strip (see “Engine Circuit Board” figure 12). Power is then directed to the starter solenoid via wire #5 (see “Engine Harness Wiring” figure 13).

OIL AND WATER WARNING LIGHTS

The shut down system is powered from the “On/Off” switch. When the “On/Off” switch is turned on, power is directed to both warning lights via wire #2 (see “Control Panel Wiring” figure 14). In the event of an engine **overheat** condition, the water temperature switch grounds the #8 wire which is connected to the circuit board at terminal #8 on the 12 point terminal strip (see “Engine Circuit Board” figure 12). At the same time, the warning light is grounded and turns on.

The oil shut down system is much the same as the water system, except the oil pressure switch does not ground the circuit at the engine. Electrically the oil pressure switch is isolated from the ground system. In relation to the circuit board the pressure switch controls either the hour meter/run light circuit or the fault light. When the oil pressure switch is sensing **low oil pressure** (below 30 PSI), the NC (wire #10) contact will be closed to the C (wire #9) terminal (see “Engine Harness Wiring” figure 13). At this pressure, the run circuit will be de-energized and the engine will shut down. Also the oil warning light circuit, wire #3, which is connected to terminal #3 on the 8 point terminal strip will be grounded within the circuit board (see “Engine Circuit Board” figure 12). When the oil pressure switch is sensing **normal oil pressure** (above 30 PSI) the NO (wire #11) contact on the oil pressure switch will be closed to the C (wire #9) terminal. Now the negative input at terminal #8 on the 8 point terminal strip is grounded within the circuit board. Grounding this circuit will turn on the hour meter/run light in the control panel (see “Engine Control Panel” figure 14).

FAULT SYSTEM TESTING

To test the high **Water** temperature shut down system, remove wire #8 from the engine temperature switch and ground it to the block. This should stop the engine and turn on the water warning light.

To test the low **Oil** warning system, start and allow the engine to run for one minute. This will allow the oil pressure by-pass timer to time out. Using a short jumper wire, connect the C terminal to the NC terminal on the oil pressure switch (wire #9 and #10). This should stop the engine immediately and turn on the oil warning light.

A quick check of the operation of the circuit can also be performed by observing the following conditions:

1) When the "On/Off" switch is first turned on, the oil warning light must be illuminated.

2) When the engine is started and oil pressure rises above 30 PSI, the oil warning light must turn off, and the hour meter and run light in the "On/Off" switch must turn on.

WARNING: IF THE ABOVE SEQUENCE IS NOT CORRECT, THE ENGINE WILL HAVE NO PROTECTION FROM LOW OIL PRESSURE AND ENGINE DAMAGE MAY RESULT.

HOUR METER/RUN LIGHT

When the "On/Off" switch is turned on, power is supplied to the hour meter via wire #2. The ground for the hour meter and run light (wire #8) is connected to terminal #8 on the 8 point terminal strip of the engine control circuit board. When the NO contacts of the oil pressure switch are closed, wires #9 and #11 are connected, causing the engine control circuit board to ground terminal #8 on the 8 point terminal strip internally.

ENGINE CIRCUIT BOARD

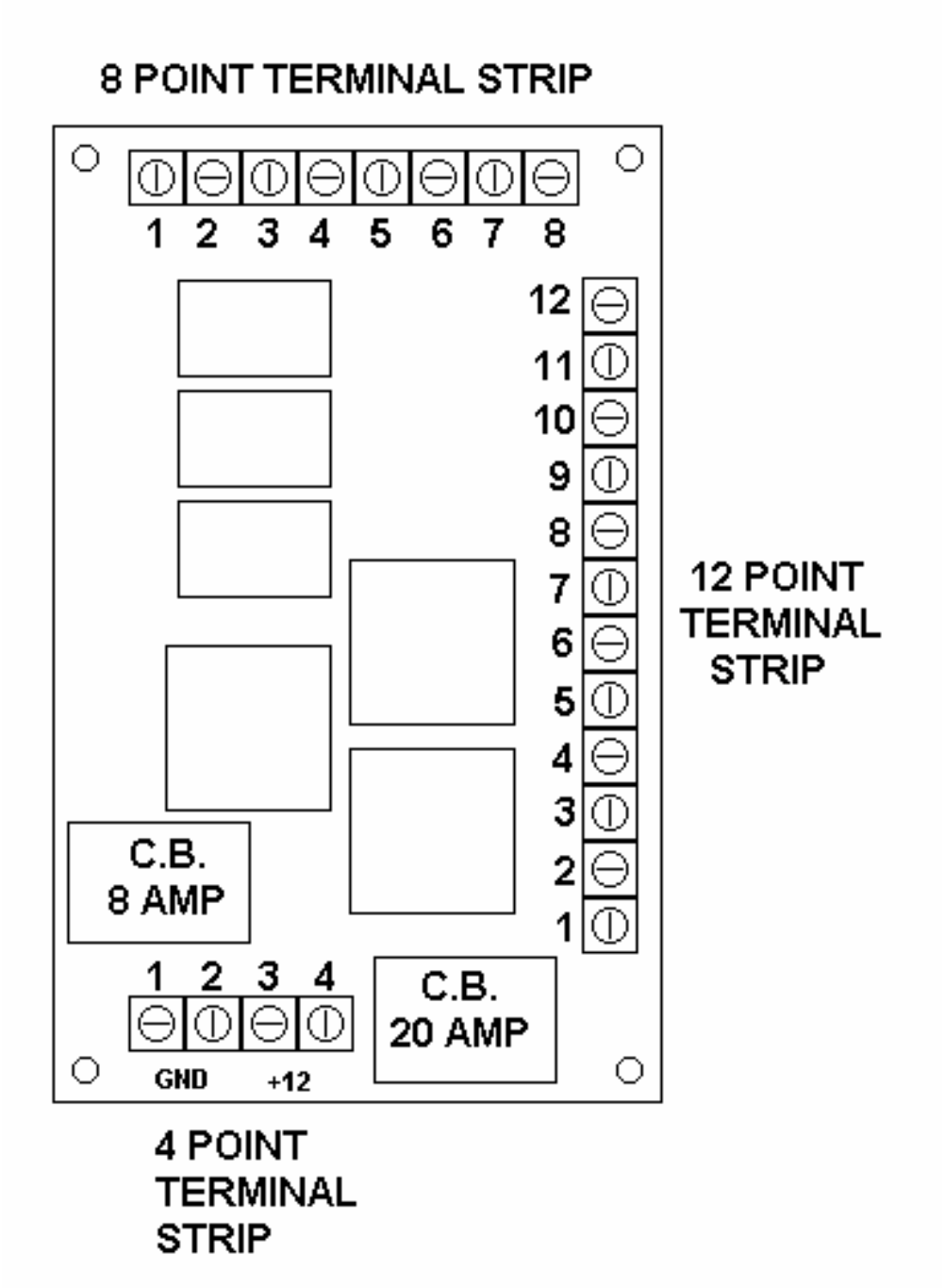


FIGURE 12

NOTE: REFER TO CIRCUIT BOARD LEGEND PAGE 7:14:0 FOR POSITION IDENTIFICATION

FIGURE 13A

ENGINE COMPARTMENT WIRING - VERSION #1

UNITS PRODUCED BEFORE JANUARY 1998
SERIAL NO.: RMP 0300

FOR SYSTEM INTERCONNECTIONS
SEE DRAWING
"ELECTRICAL INTERCONNECTIONS"

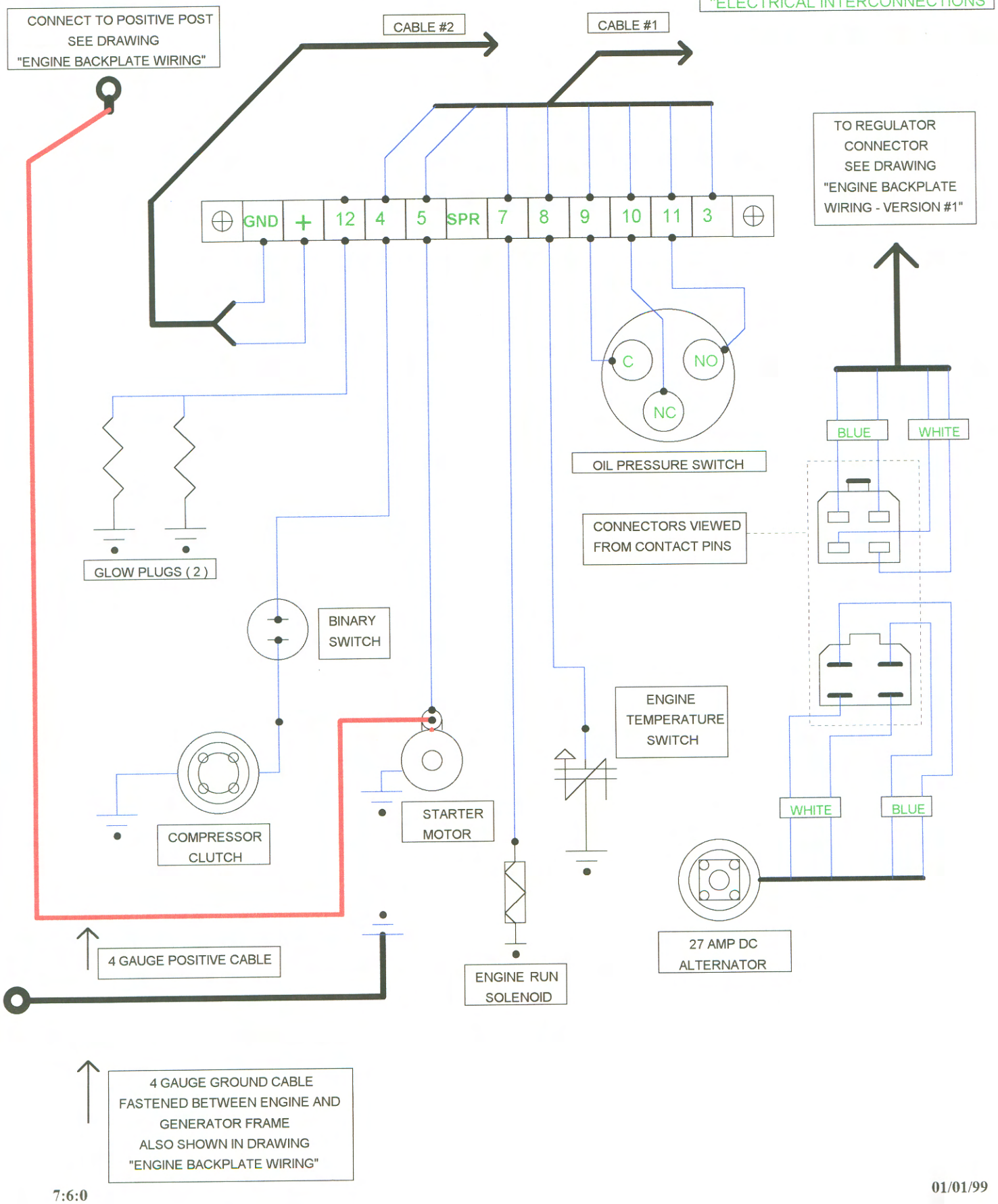


FIGURE 13B

ENGINE COMPARTMENT - VERSION #2

UNITS PRODUCED 1998 AND NEWER

SERIAL NO.: RMP 0300

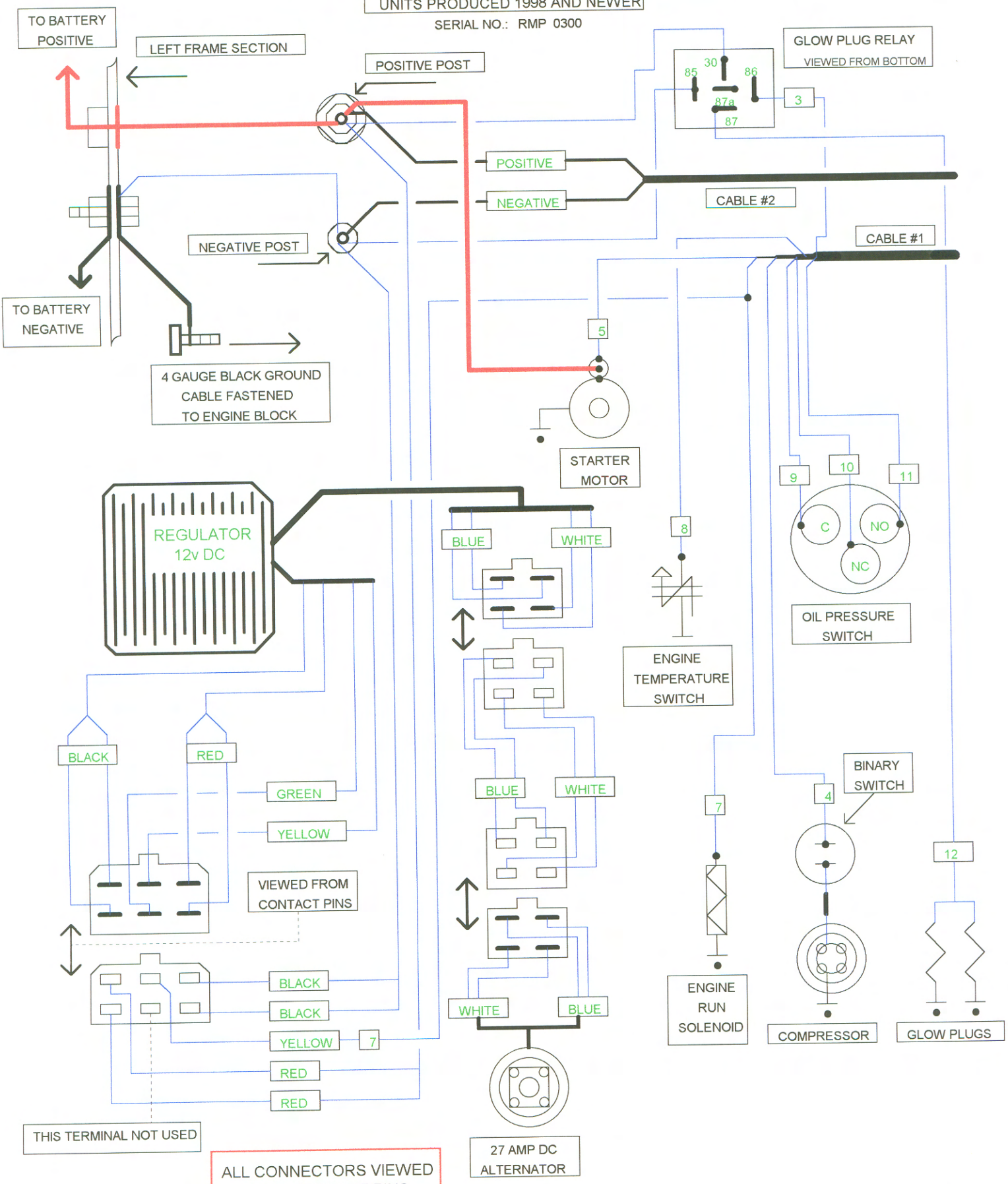


FIGURE 14

CONTROL PANEL WIRING

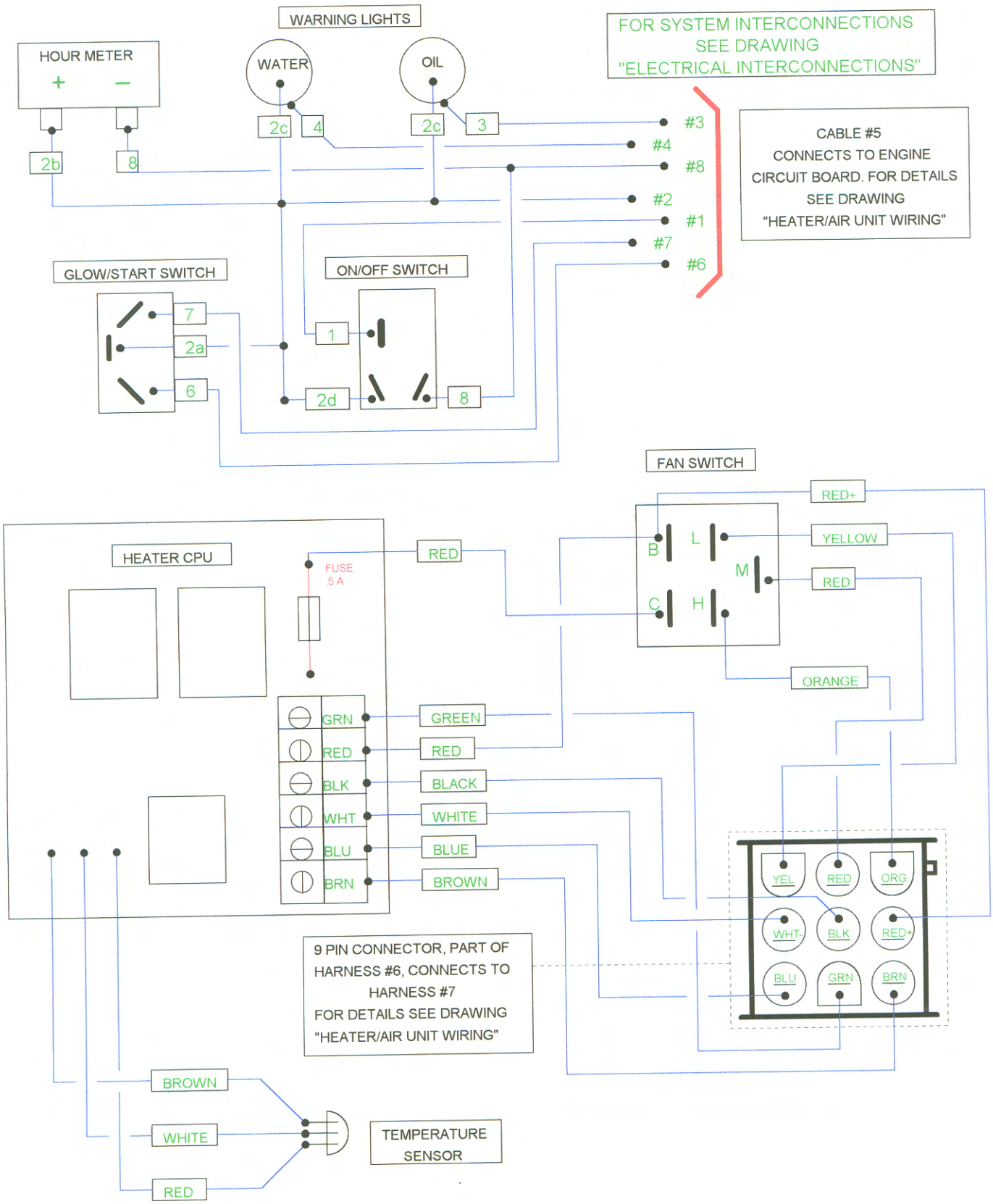


FIGURE 15

ENGINE BACKPLATE WIRING - VERSION #1

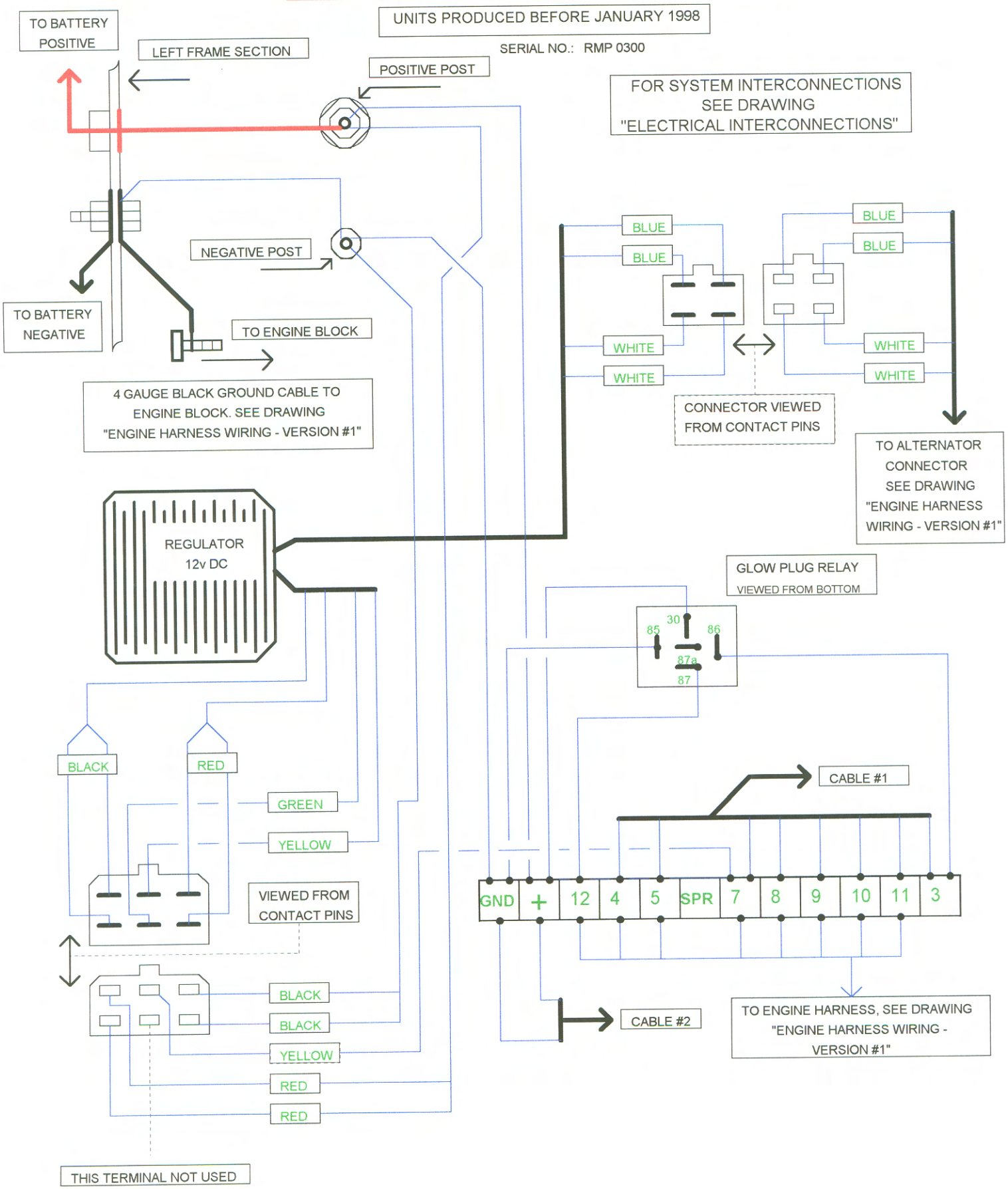
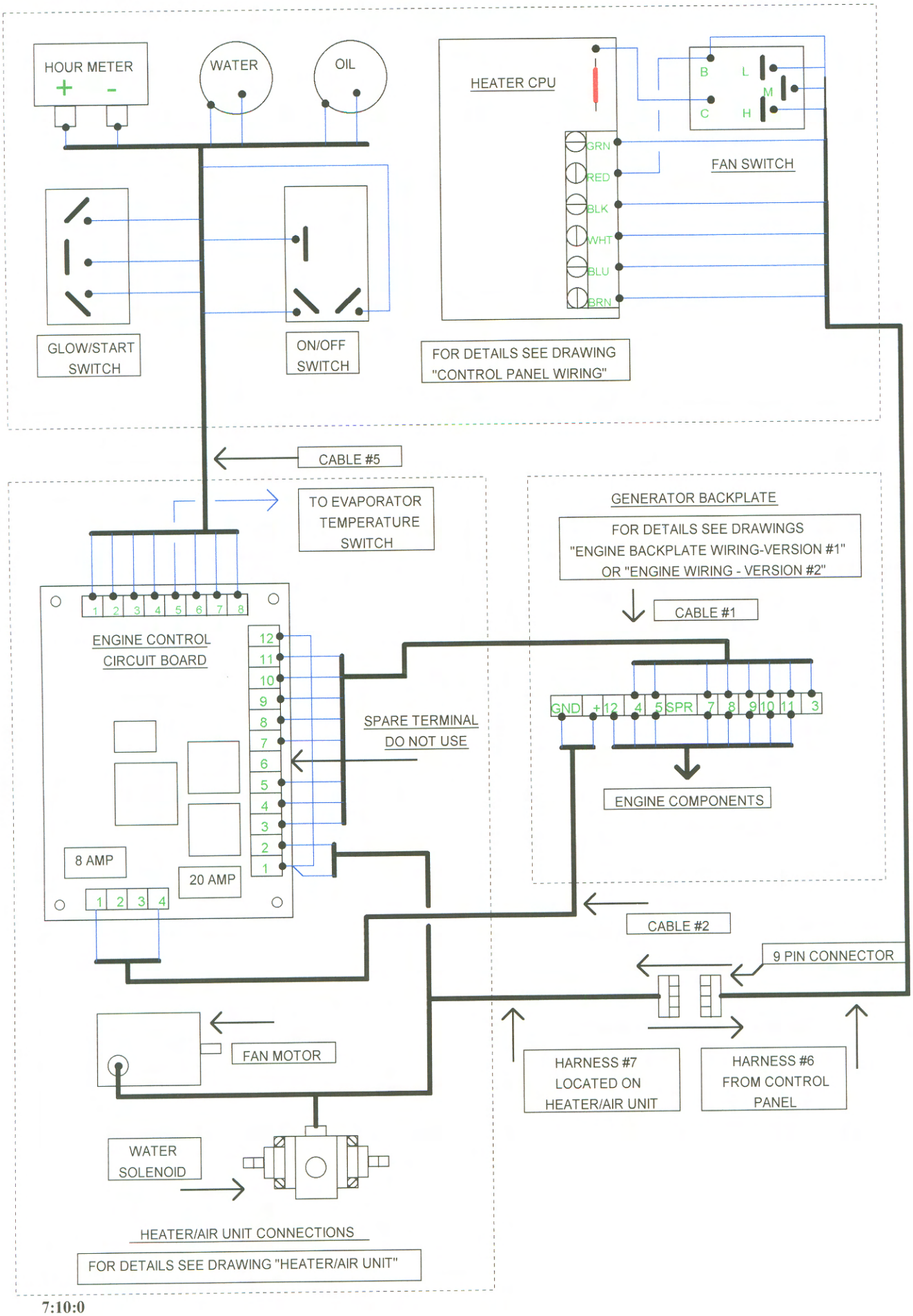


FIGURE 16

ELECTRICAL INTERCONNECTIONS



HEATING/AIR CONDITIONING SYSTEM

This section of the manual will be broken into each operating circuit, with details as to the proper sequence of operation for each function.

FAN OPERATION

The fan speed selector switch works in conjunction with the heater/air conditioning CPU. When the fan switch is operated, 12 volt "+" is supplied to either the Low (yellow wire), Medium (red wire) or the High speed (orange wire) fan motor circuits. The fan ground (black wire) is an isolated ground circuit that is connected to the CPU terminal identified as BLK.

HEATER/AIR CONDITIONING CPU

The CPU internally connects the BLK terminal to the WHT terminal during the heat or cool mode only. The white wire which is connected to the WHT CPU terminal then provides the ground for the fan only. The other end of the white wire is connected to terminal #1 on the 12 point terminal strip located on the engine circuit board (see "Heater/Air Unit Wiring" figure 17). This terminal is connected internally to the negative terminals at the 4 point terminal strip (see "Engine Circuit Board" figure 12). From there the circuit is grounded into the generator unit (see "Engine Backplate Wiring" figure 15).

Power is supplied to the CPU from two sources. One is an unswitched 12 volt "+" fed from the red fan wire that is connected to the B terminal on the fan switch. This wire connects to the B terminal and has a 4 inch 18 gauge auxiliary red lead that is connected to the CPU RED terminal.

The other power source is from the C terminal on the fan switch. This 12 volt "+" is only energized in the 1, 2, or 3 position.

On units built after December 1997, the connection of the red jumper lead is no longer to the fan switch (C terminal). The short red lead from the heater CPU is now connected to the #2 wire in the engine control circuit (See "Control Panel Wiring" figure 14).

The green wire connected to the GRN terminal provides a ground for the CPU sensing circuitry. At the other end of the heater harness this green wire is connected to the heater air conditioning case (See “Heater/Air Unit Wiring” figure 17).

NOTE: THE HEATER/AIR CONDITIONING UNIT MUST BE GROUNDED TO FRAME WORK OF THE BUNK. WITHOUT THIS GROUND, THE HEATER/AIR CONDITIONING CPU WILL NOT OPERATE PROPERLY.

HEAT MODE OPERATION

With the fan in the 1, 2, or 3 position, power is supplied to the CPU via the fan switch terminal C, or the #2 wire from the engine controls when the On/Off switch is turned on. After 6 - 8 seconds the heater/air conditioning CPU will select the proper mode depending on the ambient temperature and the temperature range selected by the temperature selector. In the situation were the heat is selected the red light will be illuminated, and the fan will operate.

The CPU will have 12 volt “+” output at the BRN terminal (see “Control Panel Wiring” figure 14) which through the brown wire will energize the water solenoid located on the heater/air conditioning unit (see “Heater/Air Unit Wiring” figure 17). When the desired temperature is met, the CPU will de-energize the BRN terminal closing the water solenoid. The fan will continue to operate for an additional 10 - 15 seconds before shutting off.

NOTE: FOR PROPER PERFORMANCE OF THE HEATING SYSTEM, IT IS NECESSARY FOR THE COOLANT TO BE AS HOT AS POSSIBLE. PLUGGING IN THE 110 VOLT BLOCK HEATER WILL PROVIDE APPROXIMATELY 3 HORSEPOWER LOAD, FORCING THE ENGINE TO WARM UP.

AIR CONDITIONING MODE

In this mode the green light will illuminate and the fan operates in the selected setting. For fan operation (see Page # “Fan Operation”). The CPU will have a 12 volt “+” output on the terminal identified as BLU which is connected to the blue wire in the heater/air harness (see “Control Panel Wiring” figure 14). This other end of the blue wire is connected to the evaporator temperature switch (see “Heater/Air Unit Wiring”). The evaporator temperature switch now controls the signal from the CPU depending on the evaporator core temperature. The contact opening temperature for this switch is approximately 30ºF and a contact closing temperature of 40ºF.

Power is then sent to the engine circuit board via wire #5. Wire #5 is connected to terminal #5 on the 8 point terminal strip. When the engine circuit board receives a signal to the #5 terminal on the 8 point terminal strip, it now energizes the #4 terminal on the 12 point terminal strip. This output now feeds the binary pressure switch located in the receiver drier in the generator unit. This pressure switch prevents the compressor from operating with too high or too low refrigerant pressures (see “Engine Harness Wiring” figure 13). At this point, power is directed to the compressor via a short interconnecting wire.

CIRCUIT BOARD LEGEND

8 Point terminal Strip

1: 12 volt Positive Output to On/Off Switch
2: 12 volt Positive Input from On/Off Switch
3: 12 volt Negative From Low Oil Light
4: 12 volt Negative From High Water Temperature Light
5: 12 volt Positive From Evaporator Temperature Switch
6: 12 volt Positive From Engine Start Switch
7: 12 volt Positive From Glow Plug Switch attached
8: 12 volt Negative From Hour Meter/Run Light Circuit

12 Point Terminal Strip

1: Negative
2: 12 volt Positive (Supply To Heater System)
3: 12 volt Positive Output To Glow Plug Relay
4: 12 volt Positive Output To Air-conditioning Pressure Switch
5: 12 volt Positive Output To Starter Solenoid (Crank Terminal)

6: SPARE TERMINAL, DO NOT USE

7: 12 volt Positive Output To Engine Run Solenoid
8: 12 volt Negative Output To High Temperature Switch
9: 12 volt Negative Input From Oil Pressure Switch
10: 12 volt Negative Output To Oil Pressure Switch
11: 12 volt Negative Output To Oil Pressure Switch
12: 12 volt Negative Output Jumped to Term. # 1

4 Point Terminal Strip

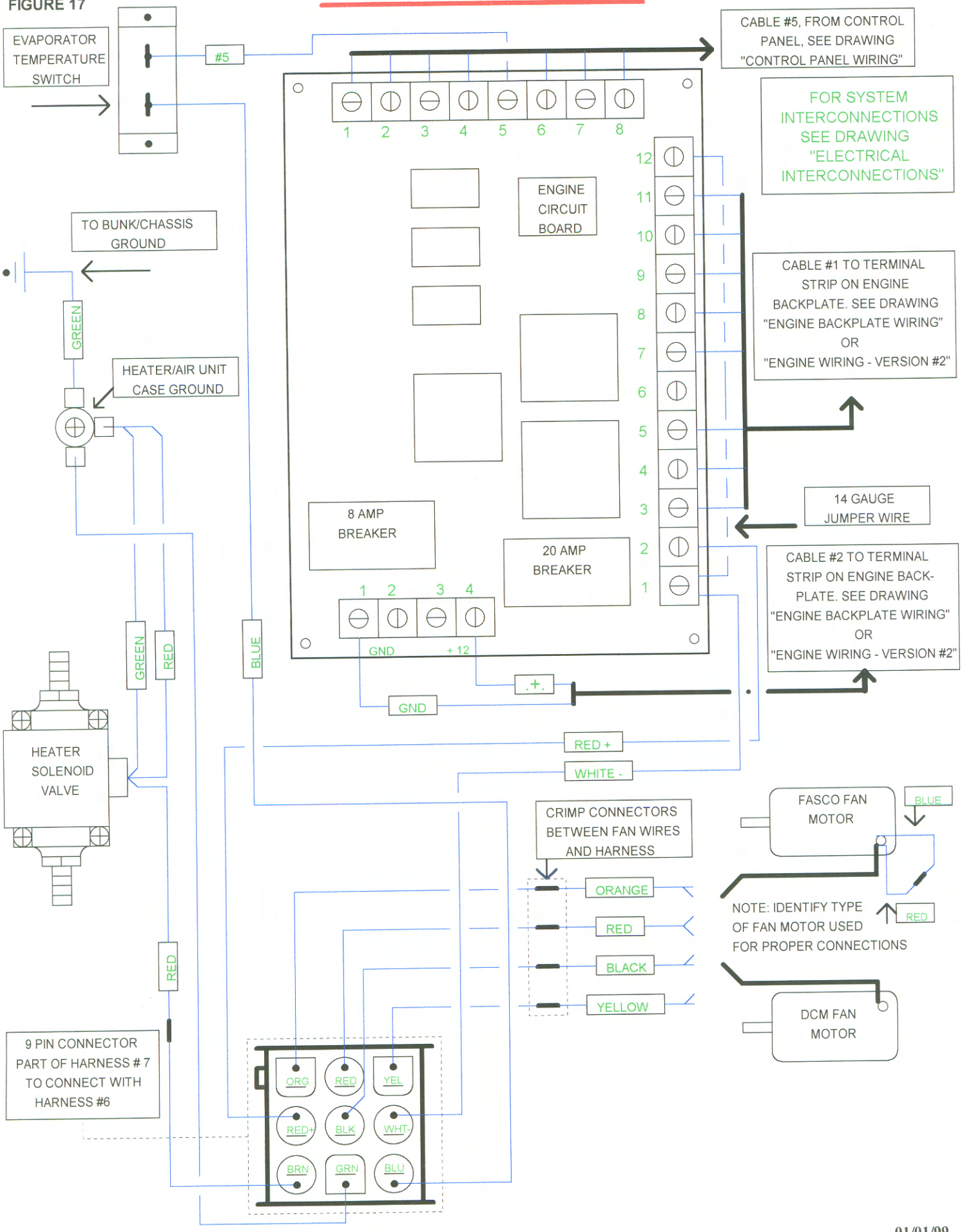
1: 12 volt Negative (Circuit Board Ground) *
2: 12 volt Negative (Circuit Board Ground) *
3: 12 volt Positive (Circuit Board Positive) *
4: 12 volt Positive (Circuit Board Positive) *

* **Note :** WHEN CONNECTING CABLE #5 , EITHER TERMINAL 1 OR 2 CAN BE USED FOR POSITIVE TERMINATION,AND EITHER 3 OR 4 FOR NEGATIVE TERMINATION.

FOR ENGINE CIRCUIT BOARD CONNECTIONS , SEE DRAWING "ELECTRICAL INTERCONNECTIONS".

HEATER/AIR UNIT WIRING

FIGURE 17



110 VOLT GENERATOR RP-7

This section of the manual does not include information on the internal testing and repair of the generator. Please refer to the manufacturer's manual included in the back of this section. When using the generator manual, refer to information on the **B105B** model.

CAUTION: DO NOT SERVICE OR TEST THIS GENERATOR UNLESS YOU ARE FAMILIAR WITH GENERATING SYSTEMS. ELECTRICAL SHOCK CAN CAUSE SEVERE PERSONAL INJURY OR DEATH!

BREAKER RATINGS

The breakers located in the 110 volt generator connection box are rated at 15 amps. These breakers are a thermal trip breaker, which means they are fairly forgiving on overloads for short periods of time. Each breaker is dedicated to a specific cord assembly. In the event of a continuous breaker trip problem, confirm that the load is not greater than 15 amps (1800 watts). Watts is calculated by multiplying the voltage (120) x amps (15) = 1800 watts. For breaker connections see "110 Volt Wiring" figure 18.

GENERATOR TESTING

Speed (RPM or Hz)

The AC generator is rated at 4kW, 110 volt, 60 Hz. For the generator to produce this power it is necessary for the proper speed to be maintained. For 60 Hz operation, the generator must rotate at 3600 rpm. The proper method of setting the speed is to use a multimeter equipped with Hz or frequency capability. Measure the output at one of the cord's ends by inserting one of the test leads into the neutral opening and one into the line opening.

With no load on the generator, the Hz should be 61.5 Hz minimum. The ideal method is to set the speed to 60.5 Hz while the generator is under partial load such as the block heater.

FIGURE 19

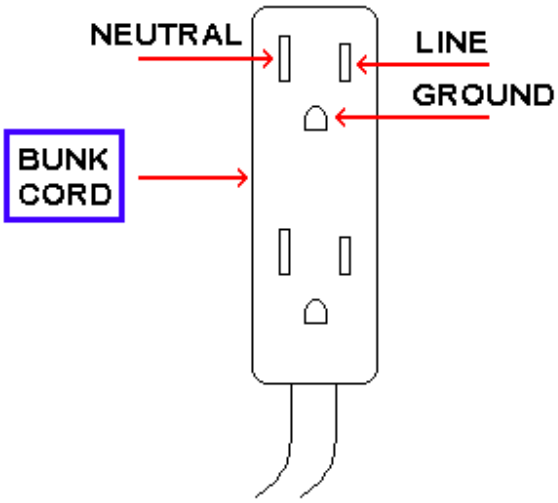
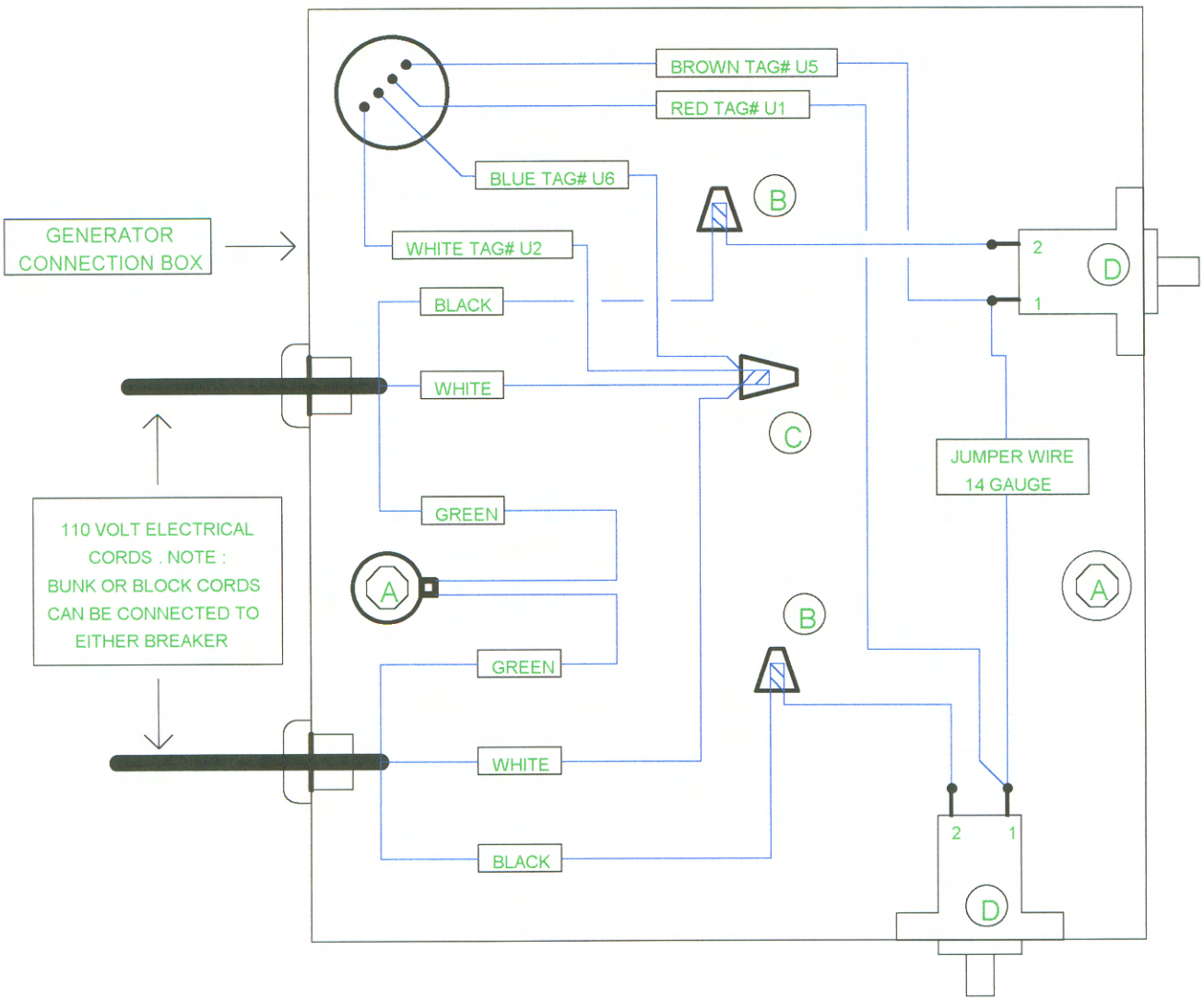


FIGURE 18

110 VOLT GENERATOR WIRING



ITEM A: GENERATOR CONNECTION BOX HOLD DOWN BOLTS

B: 2 WIRE TWIST-ON CONNECTORS

C: 4 WIRE TWIST-ON CONNECTOR

D:15 AMP - 110 VOLT BREAKER

ELECTRICAL SYSTEM RP–7
TROUBLE SHOOTING GUIDE

	ENGINE CRANKS BUT DOES NOT START	
Confirm proper starting sequence being performed by operator.	See owners manual for starting sequence..	Inform customer of the 45 second oil pressure time delay and glow plug operation.
Check for air in fuel system.	See section “Fuel System” RP – 2.	Fuel sediment bowl must be completely full of fuel
Check for 12 Vdc + at the run solenoid.	See this section, drawing “Engine Harness ”.	Also confirm that the run solenoid is energizing . See engine section “Engine RP – 1”.
Check for 12 Vdc + at the #7 terminal on the terminal strip located in the generator unit.	See this section, drawing “Engine Backplate”.	Possible corrosion or broken wires at the terminal strip.
Check for 12 Vdc + from the engine circuit board . Terminal #7 on the 12 point terminal strip.	See drawing “Engine Circuit Board”.	Confirm oil pressure timer has not timed out and check for 12 + output at terminal #7 (12 point terminal strip).
	ENGINE CRANKS SLOWLY	
Check condition of batteries.		System must have a minimum of 10 - 12 Vdc.
Check all grounds and ground cables in system .	See this section, drawings “Electrical Backplate and Engine Harness ”.	Possible ground strap failure between engine block and side frame section.
Check all positive cable connections between the starter and the positive post on the back plate and then to the batteries.	See this section, drawings “Engine Harness and Engine Backplate ”.	Possible corrosion at the cable connections at batteries or positive connection post on backplate.
	ENGINE DOES NOT CRANK	
Check for power to system.	See this section, “Engine Controls”.	Oil light must be on when on/off switch is turned on.
Check for 12 Vdc power to starter.	See this section, “Starter Circuit”.	12 Vdc+ at the starter (wire #5) when the start switch is depressed.
Check starter operation.	See section “Engine RP–1 ”.	Possible starter failure.

	ENGINE DOES NOT CRANK (Cont'd)	
Check for 12 Vdc power at the #5 terminal in the generator unit.	See this section, "Starter system".	Possible corroded or broken wires at the terminal strip.
Check for 12 Vdc power from the engine control panel.	See this section, "Starter circuit" and drawing "Engine Circuit Board".	Confirm output at the #5 terminal on the 12 point terminal strip.
Check for signal from the start switch .	See this section, drawing "Engine Circuit Board".	Confirm 12 Vdc signal from the start switch to the #6 terminal on the 8 point terminal strip.
<u>NOTE</u> : IF THERE IS A SIGNAL FROM THE START SWITCH TO THE #6 TERMINAL ON THE 8 POINT TERMINAL STRIP AND NO OUTPUT FROM THE #5 TERMINAL ON THE 12 POINT TERMINAL STRIP, THE CIRCUIT BOARD IS FAULTY		

<u>110 VOLT SYSTEM</u>

	NO POWER TO BUNK OR BLOCK HEATER CORD	
Check generator circuit breakers.	See this section "110 volt system".	Possible breaker tripped due to overload condition.
Generator breakers continually trips.	See this section for breaker ratings.	Maximum 15 amps or 1850 Watts . Check ratings on oil pan heater and block heater. .
No power present to breaker.	See this section "110 Volt Generator Manual".	Possible internal damage or failure.