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| <p>ARCS PROCEDURE</p> <p>Author: M. Aguilar</p> | <p>REPLACING PRINTED CIRCUIT BOARD IN GENERATOR TRANSFER SWITCH COMPARTMENT</p> | <p>PRO(GEN)-011.000</p> <p>16 April 2002 Page 1 of 6</p> |
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Replacing Printed Circuit Board in Generator Transfer Switch Compartment

I. Purpose:

This procedure describes how to replace printed circuit board in the Generator transfer switch compartment at the CART site in Manus, Nauru, and Darwin.

II. Cautions and Hazards:

None.

III. Requirements:

This procedure is to be performed only by a technician qualified to work on Caterpillar generators and transfer switch equipment.

IV. Procedure:

A. Replacing Printed Circuit Board

1. The ARCS-1 instruments and computer systems must be turned off prior to beginning this procedure. Once this equipment is powered down and you have received authority to proceed with the repair, check that the two UPS supplies (I-van and D-van) are shut down (red switch on the front of these supplies switched to "Emergency Off" position). Switch the main service disconnect switches at the entrance to each ARCS van to the "O" or off position.
2. Enter Utility Van generator compartment and go to the "generator electronic control panel" and rotate the rotary **on / off** switch to the **off** position. This can be done by rotating the switch counter clockwise from auto to off. This switch is located at the upper right area of the control panel.
3. Go to the "service entrance circuit breaker", which is located at the lower right hand side of the generator room as you enter the utility generator room. Place this circuit breaker to the O position. This will open the breaker and disconnect utility grid power to the entire system.
4. Place lockout device over the circuit breaker switch and padlock. This lockout device and padlock is included with repair kit provided.
5. Open the transfer switch compartment door and measure voltages at E1,E2,E3,E4, N1,N2,N3,N4, T1,T2,T3,T4 terminal lugs. No voltage should be present at these terminal lugs. Work in transfer switch compartment can now be performed safely.

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6. Remove the clear lexan cover from the transfer switch control electronic box which is mounted on the inside door of the transfer switch compartment. This box is white and contains the printed circuit boards that are to be replaced.
7. Identify the three PC boards to be replaced (refer the pictures sent along with this procedure). The top board is to be replaced first, this is the system control board. Do not concern yourself with potentiometer settings. These settings will be repositioned to given values after replacement of all boards has been done and are stated at the end of this procedure.
8. Disconnect the Molex 15 pin connector from the mating connector using a flat thin but wide screwdriver. Carefully remove the connector as not to damage any pins or wiring.
9. Remove the black cover labeled "System Control" by using a 1/4" nut driver which is supplied along with the kit. It may be necessary to rotate the potentiometer knobs to slide the cover over them. It is not necessary to remove these knobs to remove this cover, but a small allen wrench is provided with the repair kit if it becomes necessary to remove these knobs. The new boards have their own knobs.
10. Now that the cover has been removed, the PC board can be removed with a 1/4" nut driver and replaced with the new board supplied in the kit. (Note: This board is labeled 63904 System control board on outside of box.)
11. Reverse the procedure to install the new board.
12. Make sure to reinstall the 15 pin connector to the mating connector and that it is seated and locked firmly in place.
13. **Place the potentiometer knobs according to the following positions:**
 - Engine Minimum run-----6 min (Fully Counterclockwise)
 - Engine Warm-up-----6 sec (Fully counterclockwise)
 - Return to utility-----1 min (Fully counterclockwise)
 - Engine Cooldown-----1 min (Fully counterclockwise)
 - Standby voltage-----85%(Approx. 12 o'clock position)
 - Standby Frequency-----80%(fully counterclockwise)
 - Time delay-----5 sec(Approx. 12 O'clock position)
 - Transfer when exercising----- (To Off position)
 - Engine warm-up timer bypass----- (To Off position)

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14. This completes the installation for the system control board.
15. The middle board, labeled the "Programmable Exerciser" can now be replaced using the same procedures performed with the system control board, with the exception of removing the 9 volt battery prior to the removal of this board.
16. After replacement of this board replace the 9 volt battery with the new battery which is supplied in the kit. Insure that this connector is firmly seated in place check to insure that the Molex connectors are properly connected.
17. Do not concern yourself with programming the exerciser board at this time. This will be done later on in this procedure.
18. Repeat procedure for the third board, labeled "Utility Voltage Sensor".
19. **After installation of this board place the potentiometers to the following positions:**
 - Voltage Pickup-----95%
 - Voltage Dropout--- 95% of Pickup
 - Line Interrupt delay-----5 seconds
20. Review installation of all three boards and verify that all connections have been done properly ,that the connectors are firmly in place and that mounting the hardware is tight (Careful not to strip or overtighten plastic screws)
21. Do not replace lexan cover over control electronic boards at this time, do to the fact that the exerciser board has not been programmed at this time.
22. Close the transfer switch compartment door.
23. Execute the "Functional tests" described in section 9.5, Part 9, of the "WN Type Automatic Transfer Switch" manual. You will need to remove the Lock/out padlock and lockout device from service entrance circuit breaker to perform this test. Place lever to the position 1. Power from grid to the transfer switch is now present.
24. The following steps repeat parts of the "Functional Tests" of section 9.5. These steps will verify transfer switch operation.
25. Observe lights on the Transfer Switch compartment door. The Normal light should be lit.
26. Go to the Electronic control panel at the generator and rotate the switch to the AUTO position.
27. The generator may start but will cycle through and should shut itself off in approx.15 minutes.

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28. Allow the generator to shut down and then simulate a grid failure by opening the service entrance breaker (place breaker to the "0" position)
29. The Generator should start and after a short period (approx. 5 minutes),the system will be powered by the generator.
30. Successful transfer can be verified by viewing the indicator lights on the Transfer switch door. The red light should be lit and the normal light off when the genset is providing power to the the site.
31. Voltage measurements can be made at the terminal boxes at each respective van. These terminal boxes are located next to each van near the right front of each van
32. Voltage levels should be nominally 416 volts phase to phase, 220-240 phase to neutral.
33. Reapply grid power,by placing service entrance circuit breaker to the 1 position and verify retransfer to grid by observing door panel lights in generator room.Normal light should come on and standby light should go off after approximately 5 minutes.
34. Generator will shut done automatically after approximately 15 minutes.
35. Repeat simulated grid failures until satisfied that the transfers to and from standby, return to grid, and automatic shut down of generator is working as designed.
36. Once the normal grid power light is on and the generator has shut down, open the transfer switch compartment door and program the exerciser board according to instruction on the exercisor board.
37. **Program to the following:**
 - Set time of day----time of programming
 - Set time of day engine to exercise -----10:00 AM
 - Set day-----Wednesday
38. Place lexan cover through slots over PC board compartment.
39. This concludes the board replacement procedure.
40. Review all your work. At the electronic control panel on the generator make sure that the rotary switch is in the AUTO position.
41. Return the two UPS front panel switches (red) to "ON" position. Return main service disconnect switches at the entrance to each van to "1" or ON position.
42. Notify Los Alamos point of contact that repair operation is completed.

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V. References:

None.

VI. Attachments:

1. ARCS Generator Setpoints Table.

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Attachment 1: ARCS Generator Setpoints Table

| Setpoints | Description | Default Values | Actual Values | Comments |
|-----------|--|----------------|---------------|---|
| P01 | Fuel Solenoid Type | 0 | 0 | 0 = ETR |
| P02 | Units Shown | 0 | 0 | 0 = English |
| P03 | Shutdown Override For Engine Fault | 0 | 0 | 0 = shutdown |
| P04 | Shutdown Override For Sensor Fault | 0 | 0 | 0 = override |
| P05 | Coolant Loss Sensor | 0 | 0 | 0 = not installed |
| P06 | Shutdown Override For Coolant Loss Fault | 0 | 0 | 0 = shutdown |
| P07 | System Voltage | 0 | 0 | 0 = 0 (24 V) |
| P08 | Upper Display Enable/Disable | 0 | 0 | 0 = enable |
| P09 | Ring Gear Teeth | 136 teeth | 156 teeth | |
| P10 | Engine Overspeed | 2120 rpm | 1880 rpm | |
| P11 | Crank Terminate Speed | 400 rpm | 400 rpm | |
| P12 | Oil Step Speed | 1350 rpm | 1130 rpm | Division point between Rated Speed & Idle Speed |
| P13 | Low Oil Pressure Shutdown At Rated Speed | 30 psi | 24 psi | Changed from 12 psi on 8/30/95 |
| P14 | Low Oil Pressure Shutdown At Idle Speed | 10 psi | 10 psi | |
| P15 | High Water Temperature Shutdown | 225 degrees F | 225 degrees F | |
| P16 | Low Water Temperature Alarm | 70 degrees F | 70 degrees F | |
| P17 | Total Cycle Crank Time | 90 seconds | 90 seconds | |
| P18 | Cycle Crank Time | 10 seconds | 10 seconds | |
| P19 | Cooldown Time | 5 minutes | 5 minutes | |
| P20 | AC Voltage Full Scale | 700 volts | 700 volts | |
| P21 | AC Current Full Scale | 600 amps | 200 amps | |
| P22 | GSC Engine Number | 1 | 1 | |
| P23 | Engine Type | N/A | N/A | |
| P24 | Crank Time Delay | N/A | N/A | |

Jumper #63 in the Electronic Control Module on the Caterpillar Generator has been disconnected. Disconnecting this jumper prevents battery discharge from occurring while ECM is in the remote position (Auto Start). It is necessary for this switch to be in auto start so in the event grid power goes below or above specified values. Refer to the Caterpillar Service Manual (Electronic Control Panel Page 128) for further information in locating and performing this procedure. **CAUTION: All input power must be disconnected and locked out prior to performing this procedure.** The configuration will be applicable for ARCS 1, 2, 3, etc.