GE Energy	**Functional Testing Specification**
Parts & Repair Services ***Louisville, KY***	**LOU–GED-DS3820CPSx**

Test Procedure for a Card

DOCUMENT REVISION STATUS: Determined by the last entry in the "REV" and "DATE" column

REV.	DESCRIPTION	SIGNATURE	REV. DATE
A	Initial release, Compiled multiple procedures into this document.	R. Duvall	4/23/03
B	Added steps 6-3-7 thru 6-3-13 to calibrate NHFB card and header	S Pharris	7/8/2008
C			

PREPARED BY	REVIEWED BY	REVIEWED BY	QUALITY APPROVAL
R. Duvall			Robert Duvall
DATE 4/23/03	**DATE**	**DATE**	**DATE** 4/23/03

Functional test procedure for

1. SCOPE

1.1 This is a functional testing procedure for a.

2. STANDARDS OF QUALITY

2.1 Refer to the current revision of the IPC-A-610 standard for workmanship standards.

3. APPLICABLE DOCUMENTS

3.1 The following document(s) shall form part of this specification to the extent specified herein. Unless otherwise indicated, the latest issue shall apply.

3.1.1

4. ENGINEERING REQUIREMENTS

4.1 Equipment Cleaning

4.1.1 Equipment should be clean and free of debris prior to applying power unless performing an initial check. Refer to the local documented procedures for cleaning guidelines.

4.2 Equipment Inspection

4.2.1 Equipment should be visually inspected for any defects prior to applying power. This inspection should include the following as a minimum:

4.2.1.1 Wires broken or cracked
4.2.1.2 Terminal strips / connectors broken or cracked
4.2.1.3 Loose wires
4.2.1.4 Components visually damaged
4.2.1.5 Capacitors leaking
4.2.1.6 Solder joints damaged or cold
4.2.1.7 Circuit board burned or de-laminated
4.2.1.8 Printed wire runs burned or damaged

5. EQUIPMENT REQUIRED

5.1 The following equipment is required to perform the process requirements. Equipment may be substituted provided that all accuracy's and test ratios are equivalent or better.

Qty	Reference #	Description
1		Fluke 85 DMM (or Equivalent)
1	H033633	Chopper Supply Test Stand

6. TESTING PROCESS

6.1 Setup

6.1.1

6.2 Testing Procedure – Whole Unit – refer to section 9

6.2.1 9.0 – Introduction to Module test

6.2.2 9.1 – Inverter test Setup

6.2.3 9.2 – Inverter circuit Test Procedure

6.2.4 9.3 – Chopper test Setup

6.2.5 9.4 – Chopper Circuit test

6.2.6 9.5 – Under-voltage Protection Test

6.2.7 9.6 – Over-current Protection test

6.3 Gate Driver Card Testing

6.3.1 Place UUT on shelf under transformer.

6.3.2 Connect leads from load resistor to NGTE card, negative to cathode, positive to gate.

6.3.3 Connect fiber optic transmitter and receiver leads to NGSE card, making sure to follow color-coded connections.

6.3.4 Connect leads from transformer to JA connector on NGTE card.

6.3.5 Connect scope leads across load resistor.

6.3.6 Plug test fixture power cord into a 120VAC outlet.

6.3.7 Make all connections to NHFB except JC.

6.3.8 Turn on test fixture with E-Stop button.

6.3.9 Turn on fiber optic switch.

6.3.10 Turn on chopper supply.

6.3.11 Adjust R20 for 2.5VDC on pin 2 of U1.

6.3.12 Power down and connect JC.

6.3.13 Reapply power to UUT.

6.3.14 Verify proper waveform on scope.

6.3.15 Verify –15VDC from P1 (+) to P2 (-). Adjust with potentiometer P40 if necessary.

6.3.16 Test complete.

Note: On certain models supplied with transformer, bypass transformer on test stand by unplugging CAC connectors and plug in connectors from test stand into transformer on UUT.

6.4 ***TEST COMPLETE ***

7. NOTES

8. Oscilloscope Verification Examples:

Fig. 1

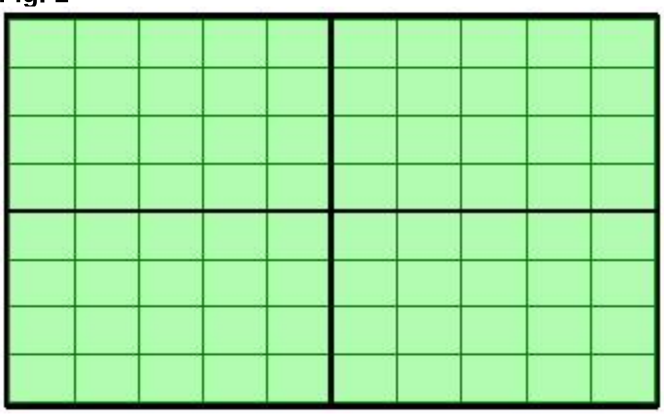
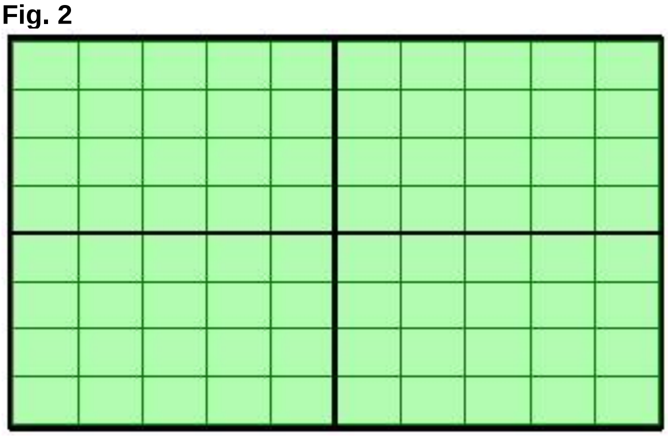


Fig. 2



9.0 Introduction to Module Test Procedures.

These instructions apply to the test of FORM C Module. FORM A and FORM B Modules are being obsoleted at this time.

The following is a list of test equipment required for the procedure:

1 - 120 VAC 60HZ distribution transformer rated 1.2 KVA minimum. The transformer will be used as isolation for the test setup. the transformer primary should be fused for a 1200 VA load.

2 - Dual channel oscilloscope.

3 - Digital voltmeter.

4 - A 75 ohm, 50 watt resistor with attached clip-leads and with a No.8 mounting rod mounted through the resistor body.

5 - A single-phase diode bridge capable of 10A full load to be used with the load bank, below.

6 - A load bank. Ideally it should be a three step bank consisting of three resistors with three swithes to optionally connect the resistors in parallel combinations. The recommeded resistor values are 60,40 and 30 ohm. The load currents will be 2, 3 and 4 ampere respectivelly. The power dissipations are 240, 360 and 480 watt respectivelly.

7 - A 15000 Mfd Capacitor bank (electrolytic capacitors) rated for 120 WVDC operation. The capacitor bank must be fused with 15A CLF fuse/s. A bleeder resistor must be connected at all times across each capacitor terminals (1K 25 Watt resistor across each of the 15000 MFD cans will discharge the capacitor to 50 volt in less than 15 sec). This bank should have switches for connection in parallel with the above described resistor load bank.

9.1 Inverter Test Set Up.

Connect the frame of the CPS Module to the building ground. Connect the NEGATIVE terminal of C1 (15000 Mfd electrolytic capacitor) to the Module frame. CAUTION: check that no other ground connection exists in the ISOLATION transformer secondary circuit (see 9.0 above).

Connect the load bank to the secondary terminals of OUTPUT transformer T1. Close the load switch corresponding to the 60 ohm resistor (2A load). All other switches should be left open, including the one for the capacitor bank.

Remove fuses FU1 and FU2 from the NHFA PWB. Connect the 75 ohm resistor across the FU2 fuse clips, clip-leads will be adequate. Support the resistor by using one of the holes of the top card guide of NHFA. During the test, the resistor will become heated. USE CAUTION when handling the resistor after the test. Hold the resistor by the mounting rod.

Connect the DVM positive lead to TP10 (P15) of the NHFA PWB. Connect the negative lead to TP1 (COM). The DVM range should be set for 20 VDC.

Connect one of the CRO probes to TP3 (IN1) and the probe shield to TP1 (COM). This probe will serve as the SYNC INPUT for the CRO. Set the attenuattor scale to 1V/DIV. Adjust the other Controls for external sync.

Connect the other CRO probe to the anode of diode CR18 (TP8) on the NHFA board. Set the CRO attenuator scale to 50V/div.

9.2 Inverter Circuit Test Procedure.

Energize the Module with the 120 VAC supply. The AC voltage input to the Module should be 120VAC +/- 6 volt.

Check the DVM reading (TP10). It should be +15 VDC, +/- 1.5 volt. This establishes that there are no shorts in the P15 control bus. The IMOK amber indicator lamp should be ON, indicating that the P5 bus is energized.

Set the DVM scale to 200VDC. Connect the positive lead to the positive terminal of C1 in the CPS module. The meter should read 165VDC, +/- 10%.

Adjust the CRO so that the voltage at the anode of CR18

(TP8) can be observed. It should be a square wave of approximatelly 160 volt amplitude. The period of the square wave should measure 2.5 milliseconds, +/- 10%.

Move the CRO probe to the anode of CR19 (TP9). An identical waveform as the one seen on CR18 should be observed, except that it will be displaced by 180 electrical degrees. Any differences indicates that the inverter is not operating correctly. Should the waveforms be different, check the wiring from the T1 transformer primary through plug JB to the inverter circuit FET's.

If the test is passed sucessfuly, turn off the AC incoming power, remove the 75 ohm resistor and install the 12A fuse in the FU2 position. Set the resistor load bank to 5 AAC. Turn the AC power back ON. Using the DVM, set for the 200V AC range, read the voltage across the inverter transformer (T1) secondary terminals. it should read approximately 120 VAC. Using the oscilloscope, observe the output waveform; it should be a square wave with amplitude between 115 and 125 volt; an overshoot spike should be observed. The spike amplitude should be less than 60 volts above the flat top of the square wave. A greater amplitude indicates that the snubber (C2 and R4) across the transformer output winding may be open.Increase the output AC load to 9 AAC (All three load resistors connected). DVM reading should not drop more than 10 VAC. Leave Module operating for 5 to 10 minutes. This completes the preliminary inverter test. Turn OFF incoming AC power.

9.3 Chopper Test Set Up.

Connect the 75 ohm resistor to the terminals of the FU1 fuse clip. Set the R20 REFERENCE pot to full CCW. Set the R19 LIMIT pot to full CW.

Set the inverter load to 2A. Set the AC input voltage to 102VAC.

Connect the CRO probe to TP6 (CHPR). Set the CRO Sync to LINE.

9.4 Chopper Circuit Test.

Turn ON incoming AC power. The waveform should look like the familiar unfiltered full wave rectified function, except that the peaks, instead of being rounded, are flat-topped at about 145 volt. If no chopping is observed it indicates a failure in the control circuit. Replace or troubleshoot NHFA.

If the above test is sucessful, turn OFF incoming AC power. Disconnect the 75 ohm resistor and install the 12A fuse in position FU1. Load the inverter output with the 9 AAC load resistors.Turn the AC power back on and observe the chopper waveform. Adjust the R20 pot to obtain 165 vdc across the C1 capacitor. Adjust R19 CCW until the C1 capacitor voltage begins to drop, then back-up slightly. By changing the load switch setting from 9 to 2 AAC and back to 9 AAC, the C1 voltage should not change more than +/-1volt steady state or +/-5volts transiently. The inverter output should be 119 VAC +/-3v. Reduce output load back to 2 AAC and reset AC input voltage to 120VAC. Turn OFF incoming AC power.

This completes the chopper test.

9.5 <u>Undervoltage</u> <u>Protection</u> <u>Test.</u>

With input AC power OFF, connect a jumper from P9 (NHFA4DA41) to common (TP1). Connect the DVM across the C1 Module capacitor (200 VDC range). Energize the Module. No steady voltage will appear across C1, except a surge when the power is first applied.

Turn OFF power and remove the jumper. Connect the DVM across the Module resistor cluster R1-3 (DVM range still set for 200 VDC). Turn ON AC input power. No voltage should be detected. Turn OFF input AC power. Voltage will appear momentarily across the resistors. This completes the undervoltage protection test.

9.6 <u>Overcurrent</u> <u>Protection</u> <u>Test.</u>

Adjust the load bank resistors for a 5 AAC load. Set the CRO sync channel to INTERNAL. Connect the signal probe to P2 (NHFA4CA29). Set voltage range to 1 v/div. Turn AC input power ON. The waveform on the screen will be the voltage drop across the R50-54 shunt resistors (NHFA4AA95). Since the output load current is set for 5 AAC, the signal amplitude should be 0.5 volt. the signal should be a dc wave with notches every 1.25 milliseconds. The amplitude of the notches will appear greater than normal because the CRO ground clip is at TP1, a fairly remote point, electrically. Set the load for 9 AAC. The signal amplitude will about double to 1 volt. Turn

OFF input AC power.

Connect a 15000 MFD load capacitor across the load resistor bank. To optionally observe the next test, set the CRO to SINGLE SWEEP. Set the SWEEP RATE to 20 milliseconds/div. Turn up the CRO BRIGHTNESS control. Observe the CRO screen while AC input power is turned ON. The screen will flash one sweep; it will have a "bump", showing the inrush current to the 15000 Mfd capacitor when power is first applied, indicating that the overcurrent sensor network is operating. The module should continue to operate normally, however. Turn OFF input AC power.

The following test simulates an overcurrent trip. Connect a clip-lead to the positive terminal of C2 (NHFA4BA79D). This is the P5 bus. With the module operating, touch terminal P2 (NHFA4CA29G) with the other end of the clip-lead. The module should instantly suppress. The FAULT lamp (CR32, NHFA4DADA77) should light. The Module will remain locked in this mode until the AC input power is removed. Turn the AC power OFF. Turn the AC power ON. The Module will operate normally.

The following is the Module short circuit test. DISCONNECT THE 15000 MFD CAPACITOR LOAD. This is an important precaution because this next test would short-circuit a charged capacitor bank if it were still present in the circuit.. Connect a wire jumper across one of the three resistor sections of the load bank. Leave the switch to that bank OPEN. Turn the AC input power ON. Let The Module operate for a few seconds. Close the switch. The module should stop operation and the red FAULT lamp should turn ON. The Module circuit will remain locked out until AC input power is removed and reapplied. Remove AC input puwer. Remove wire jumper short circuit. Load the output with 9 AAC. Turn ON AC input power. The Module should then resume normal operation.

This completes the Module tests.