g GE Energy	**Functional Testing Specification**
Parts & Repair Services ***Louisville, KY***	**LOU-GED-DS5220HSAA**

Test Procedure for a DS5220HSAA cell stack assembly

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

REV.	DESCRIPTION	SIGNATURE	REV. DATE
A	Initial release	M. Starling, R. Johnson, J. Archibald	7/31/2009
B	Inserted Scientific Tester Test for SCR Stack 6.4	S. Cash	8/14/2009
C	Added Peg Module SCR test step at the beginning of Electronic Testing	R. Johnson	10/21/2010
D	Added SCR gate/cathode resistance check step 6.1, removed testing on the Scientific Tester and added final resistance check to Step 6.5.	C. Wade	9/12/2012
E	Added gate/cathode resistance reading 10 to 22 ohms to steps 6.1.1 & 6.5.1, added G/C waveform to step 6.4.1.11, added label checks of resistance, SCR lot, and part # 68A7628P44 to QA Inspector check sheet in section 8. Added new label criteria to step 6.5.2.	C. Wade	9/21/2012
F	Added gate/cathode resistance reading 10 to 20 ohms to steps 6.1.1 & 6.5.1, added G/C waveform to step 6.4.1.11. This was the agreed to number from Silicon Power, GE, & Amtrak.	C. Wade	10/5/2012
G	Added special note to section 6.2 about verifying alignment pins during assembly.	C. Wade	4/9/2013

PREPARED BY	REVIEWED BY	REVIEWED BY	QUALITY APPROVAL
M. Starling	J. Archibald	R. Johnson	Charlie Wade
DATE	**DATE**	**DATE**	**DATE**
7/20/2009	8/14/2009	10/21/2010	7/20/2009

1. SCOPE

1.1 This is a functional test and assembly procedure for the listed Cell Stack assembly.

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 Silicon Power Corporation Mounting Instructions

3.1.2 68A7628 Silicon Control Rectifier Standard

3.1.3 DS5220HSAA – Assembly of Thyristor Stack

3.1.4 C781 – Silicon Power High Power 77mm Thyristors Spec sheet

4. ENGINEERING REQUIREMENTS

4.1 Equipment Cleaning

4.1.1 Plated surfaces and PRESSPAKS should be clean and free of debris. They should be lightly sanded with 600 grit-paper and then oil or grease compound (G322L) applied before assembly. Refer to SPCO mounting instructions for more information.

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, cracked, or loosely connected

4.2.1.2 Terminal strips / connectors – broken or cracked

4.2.1.3 Components – visually damaged

4.2.1.4 Capacitors – bloated or leaking

4.2.1.5 Solder joints – damaged or cold

4.2.1.6 Circuit board – burned or de-laminated

4.2.1.7 Printed wire runs / Traces – burned or damaged

4.2.1.8 Improperly pressed cell stack

4.2.1.9 Loose hardware

4.2.1.10 Solder splash on aluminum buss bars

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	H188791	SCR Press
1	H188773	SCR Stack alignment plate
1	H188792	SCR Pressure Adaptor
1	H188686	Torque Wrench or equivalent
2		480VAC with cables
1	H188761	Load Cart with GE Firebox
1		115VAC Power Cord
1		SCR Firing Box
1		O-Scope
1	H188955	Peg Module - Functional Tester
6		228B6709G2 Transformers
1		Fan
1		Variable Transformer
1		HPTP Tester Box
1		DMM

6. TESTING PROCESS

6.1 SCR Check

6.1.1 Measure the resistance of the gate/cathode leads, should be between 10 to 20 ohms. If not put aside and get another.

6.1.2 Before installing SCR between heat sinks, record Lot # of SCR, this will be written on completion label affixed to boot of assembly later on

6.2 Assembly

6.2.1 Refer to assembly drawing DS5220HSAA for proper configuration and assembly. Special Note: Verify proper alignment of dowel pins for SCR and black shroud.

6.2.2 Tighten the top nuts on the assembly to keep unit together until proper pressing has been accomplished.

6.2.3 Place and connect the assembled unit onto the SCR stack alignment plate.

6.3 Applying pressure to SCR cell stacks

6.3.1 Since the fully assembled SCR stack with plate weighs over 40 pounds, have someone assist in moving the assembly into and out of the alignment plate and SCR press. The second person will also be used to validate SCR pressure readings on assembly.

6.3.2 Place SCR stack with connected plate into the SCR Press. See following picture for proper placement.

SCR Assembly

SCR Pressure Adaptor

6.3.3 The SCR Pressure adaptor and washer/spacer shall be placed at the top of the assembly within the black boot area. The washer goes in the middle of the springs and the pin on the pressure adaptor goes into the washer. Two sockets with finger adjustors shall be placed into the side holes. See picture of SCR Pressure Adaptor on this page.

6.3.4 Visually line up aluminum heat sinks.

6.3.5 Once sinks are aligned, apply pressure to ram until it aligns up and fits into hole on the Pressure Adaptor.

6.3.6 Once unit is fully aligned, apply pressure to assembly until it reaches 8500 +/- 50 pounds. Be sure to let the meter, reading the applied pressure to the SCR Stack settle out before end nuts are tighten.

6.3.7 Finger-tighten both sides of the SCR stack.

6.3.8 Insert torque wrench into each socket and tighten both sides in quarter turn increments alternating between sides until both nuts reach 75 inch pounds. **Note: Once the SCR stack has a chance to equalize, it should read approximately 8000 lbs, +/- 500 lbs. This can only be measured if a load cell has been inserted between heat sinks in place of the SCR.**

6.3.9 Visually verify that sinks are still aligned.

6.3.10 Release pressure on ram.

6.3.11 Remove pressure adaptor, washer, and sockets.

6.3.12 Remove SCR Cell Stack from press.

6.3.13 Torque both nuts at opposite end from the boot to 205 inch/pounds and place tamper cream on both nuts. This is only at the cathode end of the assembly, opposite from the black boot. This should be witness by the addition helper.

6.3.14 Have second person apply pressure verification sticker to boot with their Compas ID Code Number and today's date.

6.4 Electronic Testing

6.4.1 Transformer/Peg Module Test. (See section 8 for picture)

6.4.1.1 Before connecting the SCR's to the transformer outputs, check that the variable transformer voltage is adjust to the correct voltage.

6.4.1.2 Connect a DMM to TB2-A to TB1-1 check for 120VAC and TB2-C to TB1-1 for 120VAC.

6.4.1.3 Power down the Variable transformer and the HPTP box

6.4.1.4 Connect the SCR firing box to the HPTP board (PEG module).

6.4.1.5 From the firing box the cathode connects to TP5 and the Gate connects to TP1.

6.4.1.6 Power up the Variable transformer, HPTP box, and the firing box; both led's on the HPTP board should come on.

6.4.1.7 Power down all supplies and firing box

6.4.1.8 Connect the 6 SCR's to the 6 transformer outputs, the SCR's white wire connects the cathode of the diode that is connected to the output of each transformer and the SCR's red wire connects to the burden resistor.

6.4.1.9 Connect the O-scope to the SCR's white wire (CURRECT PROBE).

6.4.1.10 Place the fan to blow air across the output circuit of the HPTP board (VERY IMPORTANT WITHOUT THE FAN THE HPTP BOARD WILL BURN UP)

6.4.1.11 Power up all supplies then power up the SCR firing box the scope should read 9-10 amp peak pulse current at 20.8khz, See waveform below.

6.4.2 Setup Motor Panel

6.4.2.1 Connect two cables from 480VAC to Inductor plugs on the Motor Panel wall.

6.4.3 Test Stand Setup

Warning closest disconnect for main power is the STB01 Trip Breaker on wall across from the motor cage access.

6.4.3.1 Initial Switch settings Test Stand (Side Panel)

6.4.3.1.1 Load switch to “Parallel”.

6.4.3.1.2 Turn fan power switch to “ON”

6.4.3.2 Initial Switch settings GE SCR Load Station

6.4.3.2.1 Master Power Switch to “OFF”.

6.4.3.2.2 Pulse Select Switch to “ISOLATED”.

6.4.3.3 Initial Switch settings GE Firebox

6.4.3.3.1 Firing Knob is fully counterclockwise.

6.4.3.3.2 Power On Switch “ON”.

6.4.3.3.3 Input Voltage Select Switch “480”

6.4.3.3.4 Switch by Red LED & Firing Knob “ON”

6.4.3.3.5 Boost/Normal switch to “NORMAL”.

6.4.3.4 Connect cables from the GE Firebox to SCR Test Stand Rear Wall.

6.4.3.4.1 Phase 1 on GE Firebox to Phase 1 on Test Stand Rear Wall.

6.4.3.4.2 Phase 2 on GE Firebox to Phase 2 on Test Stand Rear Wall.

6.4.3.4.3 Transformer Primary on the GE Firebox White wire to white connector on both GE Firebox and Test Stand.

6.4.3.4.4 Transformer Primary on the GE Firebox Red wire to red connector on both GE Firebox and Test Stand.

6.4.3.4.5 Transformer Secondary on the GE Firebox White wire to white connector on both GE Firebox and Test Stand.

6.4.3.4.6 Transformer Secondary on the GE Firebox Red wire to red connector on both GE Firebox and Test Stand.

6.4.3.4.7 White SCR Gate Lead on GE Firebox white gate connector on test stand.

6.4.3.4.8 Red SCR Cathode Lead on GE Firebox red gate connector on test stand.

6.4.3.4.9 White lead from test stand's Gate lead to the white SCR lead under test.

6.4.3.4.10 Red lead from test stand's cathode lead to the red SCR lead under test.

6.4.3.5 Place unit under test into chamber.

6.4.3.5.1 Connect white gate & red cathode lead to SCR's white and red leads.

6.4.3.5.2 Connect large buss cables to each side of SCR cell being tested and to the black plugs of the test stand's rear inside wall. Does not matter which side they are connected.

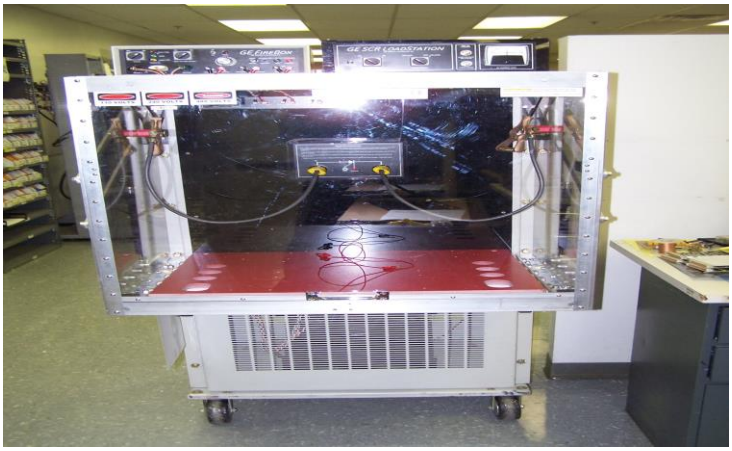
6.4.3.5.3 Close front panel.

6.4.3.6 Volt and current Meters

6.4.3.6.1 Connect voltmeter (VAC) across the SCR.

6.4.3.6.2 Connect voltmeter (VDC) across load.

6.4.3.6.3 Connect current clamp (DC amps) on one end of the load.



6.4.4 Power ON

6.4.4.1 Turn GE SCR Load Station On/Off switch to "ON"

6.4.4.2 Slowly adjust the GE Firebox Firing Knob to 100 amps across current meter. Voltmeter should read about 306VAC +-15V. Run for one minute.

6.4.4.3 After one minute reduce the GE Firebox Firing Knob to read 50 amps across current meter by turning the firing knob counterclockwise. Voltmeter should read about 419VAC +-15V. Run for nine more minutes.

6.4.4.4 Once time has elapsed, turn Firing Knob completely counterclockwise and turn GE SCR Load Station On/Off Switch to "OFF".

6.4.4.5 Remove unit and mark validation sticker with date and Compas ID number.

6.5 Final cell stack resistance check

6.5.1 Record gate/cathode resistance on sticker, should be 10 to 20 ohms.

6.5.2 If unit passes all tests, update validation sticker with compression and test dates & initials, G/C resistance reading, SCR lot#, and SCR part#. Complete sticker.

6.6 ***TEST COMPLETE ***

7. NOTES

7.1 GE Firing Box Fault Lights

7.1.1 There are three LEDs on the GE Firebox, Fault High, Good, and Fault Low.

7.1.1.1 Ideal condition is "GOOD", where voltages are not too high or too low for the Firing Box.

7.1.1.2 If voltage has been selected that is too high for the Firing Box the Fault High Light will illuminate.

7.1.1.3 If voltage has been selected that is too low for the Firing Box the Fault Low Light will illuminate.

8. Attachment

8.1 Check sheet for QA Inspectors. See next page

Check for DS5220HSAA Heat Sink assemblies

- Model Number
- Serial Number
- Job Number
- Compression Validation Label signed off
- Functional Test Label signed off
- Gate/Cathode resistance check & Label signed off
- SCR Lot# recorded on Label
- SCR part # recorded on Label
- SCR Stack Orientation – Black Boot to Anode End of SCR Stack
- No Welding Splatter on buss bars
- SCR leads rolled up and held by plastic tie wrap.
- Versilube on rivets between endplates and springs
- Gate/Cathode lead orientation of SCR pointing towards Cathode buss bar
- Gage bar facing up toward cathode buss bar side of end plate
- Verify model number of the SCR 68A7628P44