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## SMD Operations Procedures Manual

### 8.1.1.42 TEST OF SAFETY INTERLOCKS OF THE 5kA AXION POWER SUPPLY

Attachments 1, 2

#### Hand Processed Changes

<u>HPC No.</u>	<u>Date</u>	<u>Page Nos.</u>	<u>Initials</u>
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Date

Prepares(s) J. McNeil

SMD-OPM  
Category A

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## **Test of Safety Interlocks of the 5kA Axion Power Supply**

### **1.0 Purpose and Scope**

- 1.1 The purpose of this Procedure is to provide step by step instruction in testing the Kirk Locks, electrical door interlocks, "crash" push buttons, DC over current protection circuits, and warning lights associated with the 5kA Axion Power Supply.

### **2.0 Responsibilities**

- 2.1 The Cognizant Engineer (CE) for the power supplies, or the Electrical Systems Section Head, shall:
  - 2.1.1 Designate those persons authorized to perform the procedure.
  - 2.1.2 Establish and maintain a list of authorized persons.
  - 2.1.3 Appoint a Cognizant Technician for the Interlock Test database.
  - 2.1.4 Review the completed "Interlock Test CheckList" (Attachment 1) and sign the "Interlock Test Approval Form" (Attachment 2).
- 2.2 The Cognizant Technician shall:
  - 2.2.1 Initiate the procedure, when required.
  - 2.2.2 Establish and maintain a paper database for the interlock test.
  - 2.2.3 Arrange for the "Interlock Test Approval Form" to be posted at the appropriate locations.
- 2.3 Persons performing the procedure shall:
  - 2.3.1 Complete the "Interlock Test Check List."

### **3.0 Prerequisites**

- 3.1 Authorized persons shall have the following qualifications and training:
  - 3.1.1 Be instructed by the Cognizant Engineer for the power supplies;

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3.1.2 Have a generic "working hot" permit for Range B hazards, as defined by ESH Standard 1.5.0, section IV.;

3.1.3 Be trained as a "Responsible Employee", as defined by ESH Standard 1.5.1, "Lockout/Tagout Requirements".

#### **4.0 Precautions**

4.1 The procedure requires that the Kirk Lock system be bypassed, or "defeated", during some tests. The Kirk Lock system shall be restored to full working order after the procedure is completed.

4.2 All doors that were unlocked for the purpose of testing the interlocks shall be locked when the procedure is completed.

#### **5.0 Procedure**

5.1 The procedure shall be performed half-yearly, (6 month intervals).

5.2 As each step is completed, check the appropriate boxes on the Interlock Test Check List (Attachment 1).

5.3 If a failure occurs, stop work, write "fail", and immediately notify the Cognizant Engineer and ESH Coordinator immediately.

##### **5.4 Door Interlocks**

The 5kA Axion Power Supply system has three electrical Door Interlocks, one on the Main power supply front door and one each on both Transfer Link Boxes.

In addition, there are four captive Kirk key locks. One of them controls both Link Boxes and another on the Main power supply cabinet door. There is also one on the 460 Vac main power disconnects.

5.4.1 The electrical Door Interlocks on those doors with Kirk key locks can be checked as follows:

5.4.1.1 With input power OFF, defeat the captive key lock permitting access with power ON.

5.4.1.2 Leave the door open enough to activate the Interlock switch.

5.4.1.3 Energize the control circuits and RESET the faults.

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- 5.4.1.4 Verify that there is a DOOR interlock fault.
- 5.4.1.5 De-energize the control circuits and lock the door.
- 5.4.1.6 Energize the control circuits and verify that a READY state can be obtained.
- 5.4.1.7 Repeat the process for each of the doors equipped with Kirk key locks.

## 5.5 DC Overcurrent

- 5.5.1 The DC Over current in the 5kA Axion P.S. is checked as follows:
  - 5.5.1.1 With the main 460 VAC switch open and locked, connect a shorting bar across the P.S. output in the Link Box.
  - 5.5.1.2 Secure Link Box cabinet door(s), turn on the main 460 VAC switch to energize the power supply.
  - 5.5.1.3 Wait for four (4) minutes until the Omega Indicator goes through its self test.

**NOTE:**

***The DC overcurrent is sensed by a shunt resistor in series with the output power lead to the main link box. This shunt resistor is calibrated for 50 millivolts per 5000 amperes. An Omega strain gauge indicator is used to sense the over current from the shunt resistor and sends the necessary fault signal to the control circuit to shut down the power supply when a preset over current is sensed. The value of the preset over current is programmed into the Omega Indicator using four (4) set points.***

- 5.5.1.4 Press SETPTS once. The previously programmed set point value of set point 1 is displayed on the Omega indicator. With the Min or Max push button adjust the LED display for the DC current (100) to be displayed.
- 5.5.1.5 Repeat step 5.5.1.4 for SETPTS 2,3, and 4

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**NOTE:** *Unless the 'SETPTS' button is pressed, each of the four set points values is displayed for approximately 10 seconds after the last press of the 'SETPTS' button. Holding the 'SETPTS' button depressed stalls the automatic sequence, retaining the most recent set point number on the display.*

- 5.5.1.6 Once step 5.5.1.4 is completed for all set point. Turn the power supply **ON** in local mode. On the **current regulator** card, place the "**Inductive-Resistive**" switch into the "**Resistive**" position. Increase the power supply current and monitor the output current for an over current and power supply shutdown.
- 5.5.1.7 Verify what over current was monitored. Note this current on Attachment 1 "Interlock check off sheet."
- 5.5.1.8 Return the DC Over current trip setting and **current regulator** card switch to there initial settings.

## 5.6 P.S. CRASH Push Buttons

- 5.6.1 The following test of the P.S. CRASH push buttons can be conducted only while the system is being operated remotely by the computer.

**NOTE:** *While the system is being operated remotely and before any CRASH buttons tests are performed, the MANUAL/DAC switch and current potentiometer are in there proper positions.*

- 5.6.1.1 Energize the 5kA Axion Power Supply, clear faults with a RESET and go to the DC ON state for the supply. Increase the output current to 100A.
- 5.6.1.2 Depress the **CRASH** push button at the Control Console and verify that the power supply goes to a **Fault** state and that a **CRASH** is indicated on the computer monitor and electronic status panel..
- 5.6.1.3 Repeat steps 5.6.1.1 and 5.6.1.2 above for the CRASH push buttons on the 5kA Magnet PS Interface Panel, PS Console Control cabinet, Link Box and other magnet control areas.

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5.6.1.4 Remove shorting bars from link box.

5.7 Kirk Key Lock Mechanical System Test

There are (4) Kirk Key Locks associated with the 5kA Power Supply System. One is on the handle of the Main Disconnect Switch (460 Vac), one on each of the doors of both power distribution Link Boxes, one on the Control Cabinet door of the 5Ka Axion power supply.

5.7.1 The Kirk Locks are tested as follows:

5.7.1.1 Use the key to open the Main Lock at the Disconnect Switch and energize the Main Disconnect Switches.

5.7.1.2 Attempt to turn the key to remove it. Verify that this cannot be done.

5.7.1.3 De-energize the Main Disconnect Switches and remove the key.

5.7.1.4 Use the key to open the door of the Transformer Link Box an attempt to remove the key while the door is still open. Verify that this cannot be done. Re-close the door, remove the key and verify that the door cannot be opened.

5.7.1.5 Repeat the above for each of the other Kirk Key Locks in the System.

5.8 "PS ON" Light Box Test

5.8.1 The "PS ON" Light Box on the 5kA Axion P.S. Link Box, and other magnet control areas.

5.8.1.1 Energize the 5kA Axion P.S., bringing it to a READY state by means of the Remote controls. Verify that the "PS ON" light is still OFF.

5.8.1.2 Put the P.S. in the ON state at minimum current. Verify that the "PS ON" light is ON.

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5.8.1.3 De-energize the P.S. and verify that the "PS ON" light goes out.

5.9 Complete, date, and sign the Interlock Test Check List.

5.10 The CE/ESSH shall review the Check List and sign an "Interlock Test Approval" form (Attachment 2), which shall be posted on the Short Sample Power Supplies, the Short Sample Link Box, and in the Short Sample Control Room.

5.11 The Cognizant Technician shall maintain a file containing:  
A. One copy of the Check List;  
B. One copy of the Approval Form.

## **6.0 Documentation**

6.1 Interlock Test Check List.

6.2 Interlock Test Approval Form

## **7.0 References**

7.1 ESH Standard 1.5.1, "Lockout/Tagout Requirements".

7.2 ESH Standard 1.5.0, section IV.

7.3 Drawing No. 33E-26.01-3

## **8.0 Attachments**

1. Interlock Test Check List, "TEST OF SAFETY INTERLOCKS"

2. Interlock Test Approval Form

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**Attachment 1**

**TEST OF SAFETY INTERLOCKS  
5kA AXION POWER SUPPLY**

ID#	DESCRIPTION	LOCATION	CHK
KL-1	Kirk lock on main disconnect switch	Floor - North Wall	
KL-2	Kirk lock on PS link box	Power Supply Area	
KL-3	Kirk lock on PS link box near vertical test	Vertical Test Area	
KL-4	Kirk lock on PS door	Power Supply	
DIL-1	Interlock PS cabinet door	Power Supply	
DIL-2	Interlock PS link box	Power Supply Area	
DIL-3	Interlock PS link box near vertical test area	Vertical Test Area	
DCO-1	DC Over current Interlock - PS	Power Supply	
CB-1	Crash button	Power Supply	
CB-2	Crash button	Link Box (P.S. Area)	
CB-3	Crash button	Link Box (P.S. Area)	
CB-5	Crash button	SNS Area	
CB-6	Crash button	SNS Area	
CB-7	Crash button	Control Center	
WL-1	Flashing warning light	Power Supply	
WL-2	Flashing warning light	Link Box	
WL-3	Flashing warning light	SNS Area	

Date of test \_\_\_\_\_

Tested by \_\_\_\_\_ Life# \_\_\_\_\_

Tested by \_\_\_\_\_ Life# \_\_\_\_\_

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**Attachment 2**

**Safety Interlock Test Approval**

The safety interlocks of the 5kA Axion Power Supply System have been tested and approved.

Approval Date \_\_\_\_\_

The approval is valid until the expiration date shown. **DO NOT OPERATE THE 5kA AXION POWER SUPPLY AFTER THE EXPIRATION DATE.**

Expiration Date \_\_\_\_\_

Approval Signature (CE or ESSH) \_\_\_\_\_  
Post on PS Cabinet Door

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Expiration Date \_\_\_\_\_

Approval Signature (CE or ESSH) \_\_\_\_\_  
Post on PS Link Box (PS Area)

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Expiration Date \_\_\_\_\_

Approval Signature (CE or ESSH) \_\_\_\_\_  
Post on PS Link Box (Vertical Test Area)

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**Safety Interlock Test Approval**

The safety interlocks of the 5kA Axion Power Supply System have been tested and approved.

Approval Date \_\_\_\_\_

The approval is valid until the expiration date shown. **DO NOT OPERATE THE 5kA AXION POWER SUPPLY AFTER THE EXPIRATION DATE.**

Expiration Date \_\_\_\_\_

Approval Signature (CE or ESSH) \_\_\_\_\_  
Post on PS Control Center

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**Safety Interlock Test Approval**

The safety interlocks of the 5kA Axion Power Supply System have been tested and approved.

Approval Date \_\_\_\_\_

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Expiration Date \_\_\_\_\_

Approval Signature (CE or ESSH) \_\_\_\_\_  
Post on SNS Control Center

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