SMD Operations Procedures Manual

8.1.1.7 TEST OF SAFETY INTERLOCKS OF THE TWIN 15 kA POWER SUPPLIES

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Attachments 1, 2

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8.1.1.7 Test of Safety Interlocks of the Twin 15 kA Power Supplies

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 overcurrent protection circuits, and warning lights associated with the twin 15kA power supplies.

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 Review the completed "Interlock Test Check-List" (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 Operator shall have the following qualifications and training:

3.1.1 Be instructed by the Cognizant Engineer for the power supplies;

3.1.2 Be trained as an "Authorized Employee", as defined by SBMS Subject Area, "Lockout/Tagout (LOTO) for Installation, Demolition, or Service and Maintenance".

3.1.3 Operator must be trained in NFPA 70E Personal Protective Equipment Requirements and Arc Flash Hazards.

3.1.4 Operator LOTO OJT Training on Power Supply System must be current.

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.

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.

5.4 Kirk Key Lock Mechanical System Test

NOTE

FOR A DESCRIPTION OF THE KIRK LOCK SYSTEM FOR THE TWIN 15 KA POWER SUPPLIES, REFER TO OPM 8.1.1.4

5.4.1 Test of the Kirk Locks

5.4.1.1 Unlock all dewar power and magnet leads safety covers (S+,S-,M) and verify that the Kirk Keys cannot be removed.

5.4.1.2 Unlock dewar gate and verify that the Kirk key cannot be removed.

5.4.1.3 In the "Magnet Cover Interlock Logic Panel" in the Vertical Test Control Room, verify that these (MS#) keys cannot be removed from the locks without the logic condition be satisfied.

5.4.1.4 In the "Power Supply Interlock Logic Panel" in the Vertical Test Control Room, verify that these PS# and PM# keys cannot be removed from the locks without the logic condition be satisfied.

5.4.1.5 Lock the dewar gate and remove Kirk lock key G6.

5.4.1.6 In the twin 15 kA Link Box, place the twin 15 kA supplies into a shorted condition.

5.4.1.7 Insert the dewar gate Kirk keys into the bypass Kirk Locks in the "Power Supply Interlock Logic Panel." When this condition is satisfied, remove the PS and PM Kirk Keys.

5.4.1.8 Use the PS & #98(17262) Kirk key to open the Main Lock at the Disconnect Switch and energize the Main Disconnect Switches.

5.4.1.9 Attempt to turn each of the 2 keys to remove. Attempt to remove the keys by re-closing the door. Verify that this cannot be done.

5.4.1.10 De-energize the Main Disconnect Switches, re-close the door and remove the keys.

5.4.1.11 Use the Kirk key #98(17262) to open the door of the Transformer Link Box for each of the Power Supplies and 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.

5.5 Door Interlocks

PS1 and PS2 of the Vertical Test Power Supply System have electrical Door Interlocks on each of the four doors of the Main P.S. Enclosure and one on each Control Cabinet door. There is also one on the Link Box.

In addition, there are captive Kirk key locks on the Vertical Test Link Box, the Control Cabinet doors and one of the Main Enclosure doors at the 480VAC input which make it impossible to enter those doors with power ON without defeating the captive lock.

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

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

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

5.5.1.3 Energize the control circuits and RESET the faults.

5.5.1.4 Verify that there is a DOOR interlock fault.

5.5.1.5 De-energize the control circuits and lock the door.

5.5.1.6 Energize the control circuits and verify that a READY state can be obtained.

5.5.1.7 Repeat the process for each of the doors equipped with Kirk key locks.

5.5.2 The electrical Door Interlocks on doors without Kirk key locks can be checked as follows:

5.5.2.1 With input power OFF, unlock and open the door enough to activate the Interlock switch.

5.5.2.2 Energize the control circuits and RESET the faults.

5.5.2.3 Verify that there is a DOOR interlock fault.

5.5.2.4 Close and lock the door and verify that the fault indication remains until the fault is RESET and that the P.S. is then READY.

5.5.2.5 Repeat the process for each of the doors without Kirk key locks.

5.6 DC Overcurrent

5.6.1 Personal Protective Equipment must be worn as defined in NFPA 70E for verifying LOTO; 480V is a category 2 hazard.

The DC Overcurrent of each P.S. is checked as follows:

5.6.1.1 Connect a shorting bar across the P.S. output.

5.6.1.2 Enter the control cabinet of the power supply and defeat the Kirk key lock.

NOTE

MEASURE THE DC VOLTAGE FIRST FROM TP6 AND TP1 BEFORE ANY ADJUSTMENT ARE MADE. RECORD THESE READING SO THAT THE OVERCURRENT TRIP VOLTAGE CAN BE SET TO ITS CORRECT SETTING AFTER OVERCURRENT TESTING ARE COMPLETED.

5.6.1.3 Energize the control circuits and reduce the DC Overcurrent trip voltage from TP6 and TP1 of the P.S. AUX CARD from its initial value to 1.0Vdc by adjusting R33 (see Drawing No. 33E-26.01-3).

5.6.1.4 Before turning on the DC, make sure the manual/DAC switch is set to manual mode and the current potentiometer is set to ZERO.

5.6.1.5 Increase the output current and monitor the DCCT output at DVM.

5.6.1.6 With TP1 and TP6 voltage set to 1 volt, the DC power supply should cause an Overcurrent at 1500 Amps.

5.6.1.6.1 Verify that DCCT voltage equals one half of set at trip for individual power supply.

5.6.1.7 Verify that the READY state can be obtained with a RESET.

5.6.1.8 Return the DC Overcurrent trip setting to its initial value.

5.6.1.9 Turn the DC ON and increase the output current while monitoring the Shunt Buffer voltage at TP6 and TP1. Increase the current to its

maximum value (12kA, PS1; 12kA, PS2).

5.6.1.10 De-energize the power supply, restore the Kirk key lock on the control cabinet.

5.7 P.S. CRASH Push Buttons

5.7.1 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 their proper positions.

5.7.1.1 Energize PS1 and PS2, clear faults with a RESET and go to the DC ON state for both Supplies. Increase the output current to 100A.

5.7.1.2 Depress the CRASH push button at the SAMPLE PS Interface Panel and verify that both power supplies go to a Fault state and that PS1 CRASH and PS2 CRASH are indicated on the monitor.

5.7.1.3 Repeat steps 5.7.1.1and 5.7.1.2 above for the CRASH push buttons on the MAGNET PS Interface Panel, the two CRASH push buttons in the P. S. room, O22A, and the CRASH push button in the Cryogenic Controls area.

5.8 "PS ON" Light Box Test

5.8.1 The "PS ON" Light Box on the Vertical Test Link Box is tested as follows:

5.8.1.1 Energize the Vertical Test Power Supply (PS1), bringing it to a READY state by means of the Computer controls. Verify that the "PS ON" light is still OFF.

5.8.1.2 Put PS1 in the ON state at minimum current. Verify that the "PS ON" light is ON.

5.8.1.3 De-energize PS1 and verify that the "PS ON" light goes out.

5.8.1.4 Repeat steps 5.8.1.1 through 5.8.1.3 for PS2, the Magnet Power Supply.

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 Twin 15 Ka Power Supplies, the Vertical Test Link Box, and in the Vertical Test 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 SBMS Subject Area, "Lockout/Tagout (LOTO) for Installation, Demolition, or Service and Maintenance”

7.2 SBMS Subject Area, “Electrical Safety”.

7.3 Drawing No. 33E-26.01-3

7.4 NFPA 70E.

7.5 System Specific SMD LOTO OJT Training.

8.0 Attachments

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

2. Interlock Test Approval Form

Attachment 1

TEST OF SAFETY INTERLOCKS - TWIN 15 kA POWER SUPPLIES

ID#	DISCRIPTION	LOCATION	CHK
KL-1	Dewar Vertical Test Power lead covers interlock (S+,S-)	DEWAR 4	
KL-2	Dewar Vertical Test Power lead covers interlock (S+,S-)	DEWAR 5	
KL-3	Dewar Vertical Test Power lead covers interlock (S+,S-)	DEWAR 6	
KL-4	Kirk lock in SSCR interlock cover master key (M4)	SSCR	
KL-5	Kirk lock in SSCR interlock cover master key (M5)	SSCR	
KL-6	Kirk lock in SSCR interlock cover master key (M6)	SSCR	
KL-9	Kirk lock gate key (G6)	DEWAR 6	
KL-10	Kirk lock in SSCR interlock power supply master key (PS)	SSCR	
KL-11	Kirk lock in SSCR interlock power supply master key (PS)	SSCR	
KL-12	Kirk lock in SSCR interlock power supply master key (PS)	SSCR	
KL-13	Kirk lock on main disconnect switch (PS Key)	P.S. Room	
KL-14	Kirk lock on main disconnect switch (98(17262))	P.S. Room	
KL-15	Kirk lock on PS1 XFMR1 link box	P.S. Room	
KL-16	Kirk lock on PS1 control cabinet door	P.S. Room	
KL-17	Kirk lock on PS2 XFMR2 link box	P.S. Room	
KL-18	Kirk lock on PS2 control cabinet door	P.S. Room	
KL-19	Kirk lock on PS2 door	P.S. Room	
KL-20	Kirk lock on Vertical Test P.S. link box	DEWAR AREA	
UPA-100	Verify LED Meter UPA-100 goes to zero		
DIL-1	Interlock on PS1 control cabinet door	P.S. Room	
DIL-2	Interlock on PS1 door	P.S. Room	
DIL-3	Interlock on PS1 door	P.S. Room	
DIL-4	Interlock on PS1 door	P.S. Room	
DIL-5	Interlock on PS1 door	P.S. Room	
DIL-6	Interlock on PS2 control cabinet door	P.S. Room	
DIL-7	Interlock on PS2 door	P.S. Room	
DIL-8	Interlock on PS2 door	P.S. Room	
DIL-9	Interlock on PS2 door	P.S. Room	
DIL-10	Interlock on PS2 door	P.S. Room	
DIL-11	Interlock on Vertical Test P.S. link box	DEWAR AREA	
DCO-1	DC overcurrent interlock – PS1 Initial _____	P.S. Room	
DCO-2	DC overcurrent interlock – PS2 Initial _____	P.S. Room	
CB-1	Crash button	P.S. Room	
CB-2	Crash button	P.S. Room	
CB-3	Crash button	VTCR	
CB-4	Crash button	VTCR	
CB-5	Crash button	CRYO AREA	
WL-1	Flashing warning light	DEWAR AREA	

Date of Test_____ Tested by _____ Life #_____

_____ Life #_____

Cognizant Engineer _____ Life # _____

Attachment 2

Safety Interlock Test Approval

The safety interlocks of the Short Sample Power Supply System have been tested and approved

Approval Date_____

The approval is valid until the expiration date shown. DO NOT OPERATE THE SHORT SAMPLE POWER SUPPLIES AFTER THE EXPIRATION DATE.

Expiration Date_____

Approval Signature (CE or ESSH) _____

Post on PS1 Control Cabinet

Safety Interlock Test Approval

The safety interlocks of the Short Sample Power Supply System have been tested and approved

Approval Date_____

The approval is valid until the expiration date shown. DO NOT OPERATE THE SHORT SAMPLE POWER SUPPLIES AFTER THE EXPIRATION DATE.

Expiration Date_____

Approval Signature (CE or ESSH) _____

Post on PS2 Control Cabinet

Safety Interlock Test Approval

The safety interlocks of the Short Sample Power Supply System have been tested and approved

Approval Date_____

The approval is valid until the expiration date shown. DO NOT OPERATE THE SHORT SAMPLE POWER SUPPLIES AFTER THE EXPIRATION DATE.

Expiration Date_____

Approval Signature (CE or ESSH) _____

Post on Short Sample Link Box

Safety Interlock Test Approval

The safety interlocks of the Short Sample Power Supply System have been tested and approved

Approval Date_____

The approval is valid until the expiration date shown. DO NOT OPERATE THE SHORT SAMPLE POWER SUPPLIES AFTER THE EXPIRATION DATE.

Expiration Date_____

Approval Signature (CE or ESSH) _____

Post on SSCR Control Panel

Safety Interlock Test Approval

The safety interlocks of the Short Sample Power Supply System have been tested and approved

Approval Date_____

The approval is valid until the expiration date shown. DO NOT OPERATE THE SHORT SAMPLE POWER SUPPLIES AFTER THE EXPIRATION DATE.

Expiration Date_____

Approval Signature (CE or ESSH) _____

File Copy