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SMD Operations Procedures Manual

8.1.1.9 TEST OF SAFETY INTERLOCKS OF MAGCOOL 10 kA POWER SUPPLY

Text Pages 1 through 9
Attachments 1, 2, 3

Hand Processed Changes

HPC No.	Date	Page Nos.	Initials

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8.1.1.9 Test of Safety Interlocks of MAGCOOL 10 kA 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 overcurrent protection circuits, and warning lights associated with the MAGCOOL 10 kA Power Supply.

2.0 Responsibilities

2.1 The Cognizant Engineer for the MAGCOOL 10 kA Power Supply, or the Electrical Systems Section Head, shall:

A. designate those persons authorized to perform the procedure;

B. establish and maintain a list of authorized persons;

C. appoint a Cognizant Technician for the interlock test database;

D. review the completed "Check List for Safety Interlock Test" (Attachment 1) and sign the "Interlock Test Approval Form" (Attachment 2).

2.2 The Cognizant Technician shall:

A. initiate the procedure, when required;

B. establish and maintain a paper database for the interlock test;

C. arrange for the "Interlock Test Approval Form" to be posted at the required locations.

2.3 The Authorized Person shall:

A. perform the main actions of the procedure;

B. complete the "Check List for Safety Interlock Test".

2.4 The Magnet Test Control Room Operator (Operator) shall perform those actions involving remote operation of the Supply.

3.0 Prerequisites

3.1 The Authorized Person shall:

A. be trained by the Cognizant Engineer;

B. have a generic energized work permit for Range B hazards, as per SEAPPM 1.5.0, section IV.;

C. be trained as a "Responsible Employee", as per SEAPPM 1.5.1, "Lockout/Tagout Requirements".

3.2 The Magnet Test Operator shall be an authorized control room operator for the Horizontal Test Facility.

3.3 As a safety precaution, the Authorized Person shall be accompanied by a second person while testing the interlocks.

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.

4.3 The Supply must be in a "short" condition before performing this procedure or any section of this procedure.

5.0 Procedure

NOTE 1 ***The test shall be performed every six months.***

NOTE 2 ***Use the Check List (Attachment 1) as a guide in locating each safety device. As each device is tested successfully, check it off.***

NOTE 3 ***If a device fails, stop work and immediately notify the Cognizant Engineer and the ES&H Coordinator.***

NOTE 4 ***The 10 kA Magcool Power Supply is a dual 5 kA System. The individual 5 kA supplies are referred to as PS1 and PS2.***

5.1 Configure the Supply in a "short" condition, by performing the following steps:

WARNING

Failure to follow proper Lock Out/Tag Out procedures while configuring the Link Box could result in severe injury.

5.1.1 Lock and tag the 460V Input Disconnect Switches for the Supply. The Switches are located on the west wall behind the Supply. They are labeled "R16-2" and "R17-1".

5.1.2 Remove Kirk lock keys #29 and #30 from the Switches.

5.1.3 Open the HTF Distribution Box by unlocking Kirk locks RE11384 (key #29) and RE11534 (key #30).

5.1.4 Verify that the system is de-energized by using a "Wiggy".

5.1.5 Verify that all mating surfaces are clean and free of debris.

5.1.6 Configure the links so that the output of the Supply is shorted.

5.1.7 Tighten all nuts.

5.1.8 Close the Distribution Box, lock the Kirk Locks, and install and secure all cover panels.

5.1.9 Fill out a "Warning" sheet, describing the supply configuration (Attachment 3). Affix it to the outside of the Distribution Box.

5.2 Configure the 10 kA Remote Control Racks (racks "HTF 1" and "HTF 2") for resistive load.

5.3 In the HCR, start the control software for the 10 kA Supply. Verify that communication is established with the Remote Control Racks.

5.4 Set the "LOCAL/REMOTE" selector switches, located on the outside of the Control Cubicles of PS1 and PS2, to "LOCAL".

5.5 Remove locks and tags from Input Disconnect Switches "R16-2" and "R17-1".

5.6 Kirk Key Lock Mechanical Interlock

The Kirk Key Lock Mechanical Interlock is tested by performing the following steps:

5.6.1 Use Key #29 to open Kirk Lock #RE11384 at Input Disconnect Switch R16-2.

5.6.2 Place the Switch in the "ON" position.

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

5.6.4 Place the Switch in the "OFF" position.

5.6.5 Repeat steps 5.6.1 to 5.6.4 for Key #30, Kirk Lock #RE11534, and Switch R17-1.

5.6.6 Remove Keys #29 and #30 from the Disconnect Switches and use them to unlock the doors of the HTF Distribution Box.

5.6.7 Attempt to remove the keys while the doors are unlocked. Verify that this cannot be done.

5.6.8 Relock the doors and remove the keys.

5.6.9 Use the keys to unlock the Control Cubicle doors on the left side of PS1 and PS2.

5.6.10 Attempt to remove the keys while the doors are unlocked. Verify that this cannot be done.

5.6.11 Relock the doors and remove the keys.

5.7 Electrical Door Interlocks

The Electrical Door Interlocks on those doors with Kirk key locks are tested by performing the following steps:

NOTE 1 ***The Supply must be operated remotely by an authorized control room operator for this test.***

NOTE 2 ***The Authorized Person may assist the Operator by tripping the interlocks while the Operator monitors and controls the Supply.***

NOTE 3 ***Refer to Attachment 1 ("Check List for Test of Safety Interlocks") for locations of all of the Door Interlocks. Interlocks on doors with Kirk Locks are noted as such on the Check List.***

5.7.1 Defeat the captive key lock permitting access with power on.

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

5.7.3 Place both Input Disconnect Switches in the "ON" position. The red "POWER ON" light, and all of the white fault lights, should illuminate.

5.7.4 With the REMOTE/LOCAL selector switch in the LOCAL position, depress the black "STANDBY/RESET" push button.

5.7.5 Place the REMOTE/LOCAL switch in the REMOTE position.

5.7.6 Through computer command in the HCR, attempt to reset faults. Verify that the annunciator panel indicates a "door" fault.

5.7.7 Attempt to turn the Supply on through computer command. Verify that this cannot be done.

5.7.8 Place both Input Disconnect Switches in the "OFF" position.

5.7.9 Close the door and lock the Kirk key lock.

5.7.10 Place both Input Disconnect Switches in the "ON" position.

5.7.11 Through computer command in the HCR, reset faults. Verify that the "door" fault resets.

5.7.12 Place both Input Disconnect Switches in the "OFF" position.

5.7.13 Repeat steps 5.7.1 to 5.7.12 for all electrical Door Interlocks on those doors with Kirk key locks.

5.8 The electrical Door Interlocks on those doors or panels <u>without</u> Kirk key locks are tested by performing the following steps:

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

5.8.2 Place both Input Disconnect Switches in the "ON" position. The red "POWER ON" light, and all of the white fault lights, should illuminate.

5.8.3 With the REMOTE/LOCAL selector switch in the LOCAL position, depress the black "STANDBY/RESET" push button.

5.8.4 Place the REMOTE/LOCAL switch in the REMOTE position.

5.8.5 Through computer command in the HCR, attempt to reset faults. Verify that the annunciator panel indicates a "door" fault.

5.8.6 Attempt to turn the Supply on through computer command. Verify that this cannot be done.

5.8.7 Close the door or panel.

5.8.8 Through computer command in the HCR, reset faults. Verify that the "door" fault resets.

5.8.9 Repeat steps 5.8.1 to 5.8.8 for all electrical Door Interlocks on those doors without Kirk key locks.

5.9 Crash Buttons

The crash buttons are tested by performing the following steps:

5.9.1 Through computer command, energize the Supply, reset faults, and turn the DC output on.

5.9.2 Command an output of 25 amps.

5.9.3 Depress a crash button. Verify that the Supply shuts off, "MPSH CRASH" is displayed on the computer monitor, and the "CRASH" light on the annunciator panel illuminates.

5.9.4 Repeat steps 5.9.1 to 5.9.3 for the other crash buttons to be tested.

5.10 DC Overcurrent

The DC Overcurrent interlock of each power supply is tested by performing the following steps:

5.10.1 With the Input Disconnect Switches in the "OFF" position, remove the Kirk keys from the Switches.

5.10.2 Using the Kirk keys, enter the Control Cubicle of PS1 and PS2.

5.10.3 Note the DC Overcurrent relay trip level (so that it can be restored). Reduce the DC Overcurrent relay trip level of PS1 and PS2 to 500A.

5.10.4 Lock the Cubicle doors.

5.10.5 Through computer command, energize the Supply, reset faults, and turn the DC output on.

5.10.6 Command an output current of 2,000A and monitor the output current.

5.10.7 Verify that at 1,000A output current, the Supply shuts off, and the "DC OVERCURRENT" indicator light on the annunciator panel illuminates.

5.10.8 Reset the fault and verify that a "READY" state can be obtained.

5.10.9 Shut down the power supplies.

5.10.10 Restore the DC Overcurrent relay trip level to the original setting.

5.11 "PS ON" Warning Lights

The "PS ON" Warning Lights are tested by performing the following steps:

5.11.1 Through computer command, energize the control circuits and bring the Supply to a "READY" state by means of the computer controls.

5.11.2 Verify that the Warning Lights are still off.

5.11.3 Turn the Supply on at minimum current.

5.11.4 Verify that the Warning Lights are flashing.

5.11.5 Turn off the Supply.

5.11.6 Verify that the Warning Lights extinguish.

5.12 "NO ENTRY WHEN P.S. ON" Signs

5.12 Verify that "NO ENTRY WHEN P.S. ON" signs are posted as follows:

A. east and west entrances to the trench;

B. next to warning lights in middle of trench;

C. on orange cage above trench.

▸*Authorized Person:*

5.13 Complete, date, and sign the Check List.

▸*Cognizant Engineer:*

5.14 Review the Check List and, if approved, sign the "Interlock Test Approval" form (Attachment 2).

▸*Cognizant Technician:*

5.15 Post a copy of the signed "Interlock Test Approval" form on the Control Cubicles of PS1 and PS2, on the HTF Distribution Box, and in the Horizontal Control Room.

5.16 File one copy of the Check List and one copy of the Approval Form.

6.0 Documentation

6.1 Check List for Test of Safety Interlocks.

6.2 Interlock Test Approval Form

7.0 References

7.1 SEAPPM 1.5.1, "Lockout/Tagout Requirements".

7.2 SEAPPM 1.5.0, section IV, generic energized work permit requirements..

8.0 Attachments

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1. Check List for Test of Safety Interlocks

2. Interlock Test Approval Form

3. Warning Sheet for Distribution Box

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Attachment 1

CHECK LIST FOR TEST OF SAFETY INTERLOCKS 10 kA MAGCOOL POWER SUPPLY

DESIGNATION	DESCRIPTION	√
HTF KL-1	Kirk lock on R16-2 Disconnect Switch	
HTF KL-2	Kirk lock on R17-1 Disconnect Switch	
HTF KL-3	Kirk lock on PS1 control cubicle door	
HTF KL-4	Kirk lock on PS2 control cubicle door	
HTF KL-5	Kirk lock on HTF Distribution Box	
HTF KL-6	Kirk lock on HTF Distribution Box	
HTF DIL-1	Door Interlock on PS1 control cubicle door (w/ Kirk Lock)	
HTF DIL-2	Door Interlock on PS1 front access panel (near wall)	
HTF DIL-3	Door Interlock on PS1 rear access panel (away from wall)	
HTF DIL-4	Door Interlock on PS2 control cubicle door (w/ Kirk Lock)	
HTF DIL-5	Door Interlock on PS2 front access panel (near wall)	
HTF DIL-6	Door Interlock on PS2 rear access panel (away from wall)	
HTF DIL-7	Door Interlock on HTF Distribution Box (w/ Kirk Lock)	
HTF DIL-8	Door Interlock on HTF Distribution Box (w/ Kirk Lock)	
HTF DIL-9	Door Interlock on Control Cabinet HTF 1	
HTF DIL-10	Door Interlock on Isolation Ampl Cabinet (upper level)	
HTF DIL-11	Door Interlock on SCR Switch Assy (upper level)	
HTF DIL-12	"	
HTF DIL-13	"	
HTF DIL-14	"	
HTF DIL-15	"	
HTF DIL-16	"	
HTF DCO-1	DC overcurrent interlock for PS1	
HTF DCO-2	DC overcurrent interlock for PS2	
HTF CB-1	Crash button on Control Cabinet HTF 1	
HTF CB-2	Crash button in HCR	
HTF CB-3	Crash button in HCR	
HTF CB-4	Crash button in cryo area	
HTF CB-5	Crash button in trench (west end, bottom of stairs)	
HTF CB-6	Crash button in trench (west end, at lead end of magnet stand)	
HTF CB-7	Crash button in trench (middle)	
HTF CB-8	Crash button in trench (east end)	
HTF CB-9	Crash button in trench (east end)	

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Attachment 1 (cont'd)

CHECK LIST FOR TEST OF SAFETY INTERLOCKS 10 kA MAGCOOL POWER SUPPLY

DESIGNATION	DESCRIPTION	√
HTF WL-1	Warning light at HTF Distribution Box	
HTF WL-2	Warning light at Bay A lead end	
HTF WL-3	Warning light at Bay A return end	
HTF WL-4	Warning light at Bay B lead end	
HTF WL-5	Warning light on beam between Bays C & D	
HTF WL-6	Warning light at Bay E lead end	
HTF WL-7	Warning light in trench (west end)	
HTF WL-8	Warning light in trench (middle)	
HTF WL-9	Warning light in trench (middle)	
HTF WL-10	Warning light in trench (east end)	
HTF WL-11	Warning light over trench at orange cage	
HTF WL-12	Warning light at bottom of stairs, east end of trench	
HTF WL-13	Warning light at bottom of stairs, west end of trench	
HTF WL-14	Warning light at Bay E return end	
None	"NO ENTRY" signs posted	

Test date _____ Tested by_____ Life#_____

Tested by_____ Life#_____

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Attachment 2
Safety Interlock Test Approval

The safety interlocks of the 10 kA MAGCOOL Power Supply System have been tested and approved

Approval Date_____

The approval is valid until the expiration date shown. DO NOT OPERATE THE 10 kA MAGCOOL POWER SUPPLIES AFTER THE EXPIRATION DATE.

Expiration Date_____

Approval Signature (CE or ESSH) _____
Post on PS1 Control Cubicle

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Safety Interlock Test Approval

The safety interlocks of the 10 kA MAGCOOL Power Supply System have been tested and approved

Approval Date_____

The approval is valid until the expiration date shown. DO NOT OPERATE THE 10 kA MAGCOOL POWER SUPPLIES AFTER THE EXPIRATION DATE.

Expiration Date_____

Approval Signature (CE or ESSH) _____
Post on PS2 Control Cubicle

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Safety Interlock Test Approval

The safety interlocks of the 10 kA MAGCOOL Power Supply System have been tested and approved

Approval Date_____

The approval is valid until the expiration date shown. DO NOT OPERATE THE 10 kA MAGCOOL POWER SUPPLIES AFTER THE EXPIRATION DATE.

Expiration Date_____

Approval Signature (CE or ESSH) _____
Post on 10 kA MAGCOOL Link Box

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Safety Interlock Test Approval

The safety interlocks of the 10 kA MAGCOOL Power Supply System have been tested and approved

Approval Date_____

The approval is valid until the expiration date shown. DO NOT OPERATE THE 10 kA MAGCOOL POWER SUPPLIES AFTER THE EXPIRATION DATE.

Expiration Date_____

Approval Signature (CE or ESSH) _____
Post in HCR Control Room

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Safety Interlock Test Approval

The safety interlocks of the 10 kA MAGCOOL Power Supply System have been tested and approved

Approval Date_____

The approval is valid until the expiration date shown. DO NOT OPERATE THE 10 kA MAGCOOL POWER SUPPLIES AFTER THE EXPIRATION DATE.

Expiration Date_____

Approval Signature (CE or ESSH) _____File Copy

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Attachment 3

Warning Sheet for Distribution Box