SMD Operations Procedures Manual

8.1.1.31 TEST OF SAFETY INTERLOCKS OF DUAL ACME POWER SUPPLIES

Text Pages 1 through 10
Attachments 1, 2

Hand Processed Changes

HPC No.	Date	Page Nos.	Initials

Revision No. 05 Approved:

Signatures on File 9/20/24

Division Head Date

Preparer(s): P. Joshi

8.1.1.31 Test of Safety Interlocks of Dual Acme Power Supplies

1.0 Purpose and Scope

1.1 To provide a procedure for testing the Kirk Locks, electrical door interlocks, "crash" push buttons, water flow interlocks, and warning lights associated with the Dual Acme Power Supplies.

2.0 Responsibilities

2.1 The Cognizant Engineer for the Dual Acme Power Supplies, or the Electrical Support 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".

3.0 Prerequisites

3.1 The Authorized Person shall:

A. Instructed by the Cognizant Engineer, or designee;

B. Trained as a "Authorized Employee", as per SBMS Subject Area, "Lockout/Tagout (LOTO)".

C. Operator must be trained in Qualified Electrical Worker 2, LOTO, & Personal Protective Equipment Requirements and Arc Flash Hazards.

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

E. Operator must follow SBMS LOTO Procedure.

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

3.3 The Authorized Person shall be accompanied by a second Authorized Person who will act as a safety watch while testing the interlocks.

4.0 Precautions

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

4.2 Personal Protective Equipment must be worn as defined in SBMS Subject Area *Electrical Safety* per arc flash label & device marking.

5.0 Procedure

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

NOTE 2 ***If a device fails, stop work and immediately notify the Cognizant Engineer and the ES&H Coordinator.***

Kirk Key Lock Mechanical Interlock

NOTE ***The Supplies do not need to be activated for sections 5.1 and 5.2 of the test.***

A.C. Section

5.1 Start with the main disconnect switch, J-13, configured as follows: switch in open position, lock plungers engaged into switch plate, keys #21, #22, #23, #24 in their respective Kirk locks.

5.1.1 Verify that Access Keys #23 and #24 are removable and that Control Keys #21 and #22 are not removable.

5.1.1 Remove the Access Keys. Verify that the Kirk locks cannot be turned with the Control Keys.

5.1.2 Insert all keys. Turn the keys clockwise to retract the lock plunger.

5.1.3 Verify that Control Keys #21 and #22 are removable and that Access Keys #23 and #24 are not removable.

5.1.4 Insert all keys. Turn the keys counter clockwise to engage the plunger.

5.1.5 Remove the Access Keys. Verify that the switch cannot be placed in the closed position.

WARNING

Failure to perform the next step could result in injury

5.1.6 Operator must follow SBMS LOTO procedure. Deactivate the power supplies. Refer to SMD-OPM 8.1.1.31, "Operation of Dual Acme Power Supplies." for the proper procedure.

5.1.7 Insert the Access Keys in their respective locks on the A.C. compartments at the rear of the Supplies.

5.1.8 Turn the key and open the A.C. compartment door. Verify that the key cannot be removed. Lock the door and remove the key.

5.1.9 Insert Access Key #23 into the Kirk lock on the Step-Down Transformer Link Box.

5.1.10 Turn the key and open the Link Box door. Verify that the key cannot be removed. Lock the door and remove the key.

D.C. Section

5.2 Start with the D.C. contactors of each Supply configured as follows: contactors in closed position (down), Kirk locks engaged (plungers blocking contactor blade), keys #38, #39, #40, #41 in their respective Kirk locks.

5.2.1 Verify that Access Keys #39 and #41 are removable and that Control Keys #38 and #40 are not removable.

5.2.2 Remove the Access Keys. Verify that the Kirk locks cannot be turned with the Control Keys.

5.2.3 Insert all keys. Turn the keys clockwise to retract the lock plunger.

5.2.4 Verify that Control Keys #38 and #40 are removable and that Access Keys #39 and #41 are not removable.

5.2.5 Insert all keys. Turn the keys counter clockwise to engage the plunger and remove the Access keys.

5.2.6 Insert the Access Keys in their respective locks on the D.C. compartments at the front of the Supplies.

5.2.7 Turn the key and open the D.C. compartment door. Verify that the key cannot be removed. Lock the door and remove the key.

5.2.8 Insert the Access Keys into the Kirk lock on the D.C. Output Link Box.

5.2.9 Turn the key to retract the lock plunger. Verify that the key cannot be removed.

Electrical Door Interlocks

CAUTION

Step 5.3 shall be performed by an authorized operator for the Dual Acme Power Supply System. Connecting the load incorrectly could cause damage to the load.

All steps in the remainder of the procedure that involve controlling and operating the Supply shall be performed by an authorized operator for the Dual Acme Power Supply System.

5.3 Connect the Supply output to the dipole calibration magnet.

NOTE ***Remember to connect the P.S. Interlock Cable from J7 to J8.***

5.4 There is only one electrical door interlock, located on the D.C. Output Link Box front cover panel. It is tested by performing the following steps.

5.4.1 Activate the Supplies. Refer to SMD-OPM 8.1.1.30, "Operation of Dual Acme Power Supplies." for the proper procedure.

CAUTION ***In the following step, the wingnuts shall not to be removed.***

5.4.2 Loosen wingnuts from left side of Link-Box. The wingnuts shall not be removed. Jiggle cover.

5.4.3 Verify that the power supply drops out.

5.4.2 Through the PS System Reset button, attempt to reset faults. Verify that the fault does not clear.

5.4.3 Attempt to turn the Supplies on through PS System On. Verify that this cannot be done.

5.4.6 Tighten Link Box Door. Reset faults. Verify that the fault clears.

5.4.7 Activate the Supplies.

5.4.8 Proceed to step 5.5.

Crash Buttons

5.5 The crash buttons are tested by performing the following steps:

5.5.1 Using the PS System Reset Button, reset faults and place the Supplies in the ON state with an output of zero amps. A small idle current will be present.

5.5.2 Depress a crash button. Verify that the Supplies shut off based on the following two events:

5.5.3 Listen for main contacts to open (a loud "thunk" should be heard, indicating that the main input contactor has released and the AC input to the Supplies has been disconnected).

5.5.4 Visually verify that each of two panel lights indicates as GREEN - "OFF".

5.5.5 Repeat steps 5.5.1 and 5.5.2 for the other crash buttons to be tested.

5.5.6 Proceed to step 5.6.

Water Flow Interlocks and Warning Lights

5.6 The water flow interlocks and warning lights are tested for each magnet load. Start with the Supply connected to the dipole calibration magnet.

5.6.1 Turn on the Supply and command an output of 25 amps.

5.6.2 Verify that the "P.S. ON" warning light over the Supply, and the "Magnet On" warning light over the magnet, are both flashing.

5.6.3 Shut off the water supply valve associated with the magnet.

5.6.4 Verify that the Supply turns off.

5.6.5 Connect the Supply to the quadrupole calibration magnet.

5.6.6 Connect P.S. Interlock Cable between J7 and J9.

5.6.7 Repeat steps 5.6.1 to 5.6.4.

DC Overcurrent Verification

5.7 DC overcurrent protection is verified as follows

5.7.1 Set DC overcurrent meter on each supply to 100A.

5.7.2 Using DP41-S-R, verify power supply shuts off @ 200A.

<Authorized Person:

5.8 Complete, date, and sign the Check List.

<Cognizant Engineer:

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

<Cognizant Technician:

5.10 Post a copy of the signed "Interlock Test Approval" form on the front panels of each Supply and next to main disconnect switch I-13.

5.11 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 SBMS Subject Area, "Lockout/Tagout (LOTO) for Installation, Demolition, or Service and Maintenance".
7.2 SBMS Subject Area, “Electrical Safety”
7.3 SMD-OPM 8.1.1.30, "Operation of Dual Acme Power Supplies."
7.4 System Specific SMD LOTO OJT Training.

8.0 Attachments

1. Check List for Test of Safety Interlocks
2. Interlock Test Approval Form

The only official copy of this file is the one on-line on the Superconducting Magnet Division website. Before using a printed copy, verify that this is the most current version by checking the document issue date on the website.

9.0 Version History Log

Revision	Description of Changes	Reviewers	Effective Date
05	• Implemented Version History Log • Updated language to reflect change of controls from PC to physical buttons • Updated training to include in Qualified Electrical Worker 2	P. Doutney P. Joshi H. Hocker M. Anerella M. Samms A. Volk	8/16/2024

Attachment 1 - Check List for Test of Safety Interlocks

Dual Acme Power Supplies

DESIGNATION	DESCRIPTION	√
DAPS KL-1	Kirk lock system on main disconnect switch I-13, consisting of 4 individual locks	
DAPS KL-2	Kirk lock on step-down transformer link box	
DAPS KL-3	Kirk lock on D.C. output link box	
DAPS KL-4	Kirk lock on D.C. output link box	
DAPS KL-5	Kirk lock system on PS #326 D.C. output contactor, consisting of 2 individual locks	
DAPS KL-6	Kirk lock on PS #326 D.C. compartment	
DAPS KL-7	Kirk lock on PS #326 A.C. compartment	
DAPS KL-8	Kirk lock system on PS #327 D.C. output contactor, consisting of 2 individual locks	
DAPS KL-9	Kirk lock on PS #327 D.C. compartment	
DAPS KL-10	Kirk lock on PS #327 A.C. compartment	
DAPS KL-11	Kirk lock on PS #326 front panel	
DAPS KL-12	Kirk lock on PS #327 front panel	
DAPS DIL-1	Door Interlock on D.C. output link box	
DAPS CB-1	Crash button on step-down transformer link box	
DAPS CB-2	Crash button on filter enclosure	
DAPS CB-3	Crash button on wall outside entrance to office	
DAPS CB-4	Crash button on wall next to dipole calibration magnet	
DAPS CB-4	Crash button on remote control rack	
DAPS WL-1	Warning light (full size) over Supplies	
DAPS WL-2	Warning light (half size) over dipole calibration magnet	
DAPS WL-3	Warning light (half size) over quadrupole calibration magnet	
DAPS WF	Water Flow Interlock Check	
DAPS DCO	DC Overcurrent Test	

Test date _____ Tested by_____ Life#_____

Tested by_____ Life#_____

(Attachment 1 cont'd)

Check List for Test of Safety Interlocks (cont'd)

Dual Acme Power Supplies

Notes:

Attachment 2 - Safety Interlock Test Approval

The safety interlocks of the Dual Acme Power Supplies System have been tested and approved

Approval Date_____

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

Expiration Date _____

Approval Signature (CE or ESSH) _____

Post on ps #326 front panel

==========

Safety Interlock Test Approval

The safety interlocks of the Dual Acme Power Supplies System have been tested and approved

Approval Date_____

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

Expiration Date _____

Approval Signature (CE or ESSH) _____

Post on PS #327 front panel

==========

Safety Interlock Test Approval

The safety interlocks of the Dual Acme Power Supplies System have been tested and approved

Approval Date_____

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

Expiration Date _____

Approval Signature (CE or ESSH) _____

Post above main disconnect switch

==========

Safety Interlock Test Approval

The safety interlocks of the Dual Acme Power Supplies System have been tested and approved

Approval Date_____

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

Expiration Date _____

Approval Signature (CE or ESSH) _____

File copy

==========