Person: Butler, Jessie (jbutler@jlab.org) Org: PHALLA	Status: PROCESSED Saved: 4/19/2016 4:00:10 PM Submitted: 4/19/2016 4:00:10 PM

Jefferson Lab Thomas Jefferson National Accelerator Facility	Operational Safety Procedure Review and Approval Form # 59403 (See ES&H Manual Chapter 3310 Appendix T1 Operational Safety Procedure (OSP) and Temporary OSP Procedure for Instructions)

Type:	***OSP*** Click for OSP/TOSP Procedure Form Click for LOSP Procedure Form		
Serial Number:	***ENP-16-59403-OSP***		
Issue Date:	***5/12/2016***		
Expiration Date:	***4/12/2019***		
Title:	***Left Dipole Polarity Reversal***		
Location: (where work is being performed)	***Experimental Hall A***	Location Detail: (specifics about where in the selected location(s) the work is being performed)	***Left Power Supply Platform***
Risk Classification: (See ES&H Manual Chapter 3210 Appendix T3 Risk Code Assignment)	Without mitigation measures (3 or 4): With mitigation measures in place (N, 1, or 2):		***3*** ***1***
Reason:	This document is written to mitigate hazard issues that are : ***Determined to have an unmitigated Risk code of 3 or 4***		
Owning Organization:	***PHALLA***		
Document Owner(s):	***Butler, Jessie (jbutler@jlab.org)*** Primary		

Supplemental Technical Validations

Lock, Tag, Try (Paul Powers, Todd Kujawa)

Document History

Revision	Reason for revision or update	Serial number of superseded document

Comments for reviewers/approvers:	***Implemented recommended changes to the procedure and THA.***

Attachments

Procedure: ***Procedure (L-Dipole Polarity Reversal).pdf***

THA: ***THA (Dipole Polarity Reversal).pdf***

Additional Files:

Convert to PDF

Review Signatures

Person : Personal Protective Equipment	**Signed** on 4/21/2016 4:31:43 PM by Jennifer Williams (jennifer@jlab.org)
Person : Physics ES&H Liaison	**Signed** on 4/19/2016 4:22:10 PM by Bert Manzlak (manzlak@jlab.org)
Subject Matter Expert : Lock-> Tag-> Try	**Signed** on 4/21/2016 9:02:45 AM by Todd Kujawa (kujawa@jlab.org)

Approval Signatures	
Division Safety Officer : PHALLA	**Signed** on 4/22/2016 6:40:08 AM by Ed Folts (folts@jlab.org)
Org Manager : PHALLA	**Signed** on 5/12/2016 2:40:07 PM by Thia Keppel (keppel@jlab.org)
Safety Warden : Experimental Hall A	**Signed** on 4/25/2016 3:56:36 PM by Jessie Butler (jbutler@jlab.org)

L-HRS Dipole Polarity Reversal Procedure

This procedure outlines the physical switching of the L-HRS Dipole main current polarity reversal switch and the polarity reversal of all related equipment. Individuals performing the task will be exposed to potential electrical hazards. While this task is being executed, no other work is allowed within the hazard boundary. Only personnel who are current in the specific training outlined in this OSP will be allowed to perform the L-HRS Dipole polarity change.

Note:

Please Note: The Left Dipole is in (-)(electron) polarity when the polarity reversal switch handle is in the up position, and in (+)(hadron) polarity when the polarity reversal switch handle is in the down position. The convention for all of the polarity switches/boxes is to *match* the positions of the devices (i.e., all handles/connectors in the up position = electron polarity).

Danger

The Left Dipole is a low-voltage, superconductive magnet system capable of storing lethal amounts of energy. *Energy can be stored even when the power supply is turned off*. You must be extremely careful to ensure that all energy has been extracted from the magnet system prior to moving the polarity reversal switch to a different position. *Failure to do so could result in severe injury or death to the person moving the switch.*

1. Set the power supply current to 0 amps DC, +/- 1 amp DC as read from the DC CURRENT meter on the front of the Dynapower power supply. This can be done from the tools page on the computer or locally on the front panel of the power supply.

2. Check that both the M3 and M4 lamps are lit on the front of the Dynapower power supply, PD171.

   Note:

   M3 indicates that the power supply output is turned on. If the lamp is off, the power supply may simply be turned off (no output). This can be verified by the software control screen, and by using the LAMP TEST switch on the front of the Dynapower. M4 indicates that the system is in slow – dump mode. If M4 is already extinguished, the system may be in fast – dump mode already. For the purposes of this procedure, ensure that both M3 and M4 are lit, or verify that the lamps work by pressing the LAMP TEST switch.

3. Place the magnet system in the fast dump mode by performing a hard reset on either of the helium lead flow controllers located in rack 0D171Q: To do this, remove the bezel guard, press the menu button, and then press the reset button. Be sure to replace the bezel guard. The Dynapower's output should now be off, and the system should be in fast – dump mode. On the front of the Dynapower, observe a quench protection fault, and both the M3 and M4 lamps extinguish. (Please note: Fast Dump should only be used if time is a factor; if not, please ramp the magnet down normally and wait…)

4. Verify that the DC CURRENT meter on the front of the Dynapower power supply reads 000 or 001.

5. The Shock Protection Boundary and the Flash Protection Boundary shall now be established by closing the "Danger – Restricted Area" signed gate at the entrance to the power supply platform. All work shall be accomplished within this boundary except for step 19.

6. Prior to turning off power to the power supply verify that the Voltage Verification Unit (VVU) is operational by moving the phase switch and observing the voltage meter is reading a voltage in all three phases of 480VAC. If the VVU meter does not correctly read all of the voltages, stop and contact the system owner and the Hall coordinator.

7. Turn off the main input power switch on the front of the Dynapower power supply; this is the large lever-type switch with a red and black handle on the right side of the front panel.

8. While wearing the minimally required PPE turn off the "DIPOLE MAGNET SAFETY DISCONNECT SWITCH" marked and lock it out in accordance with Jlab Lock, Tag and Try (LTT) procedures. All personnel who physically touch the polarity reversal switch shall lock out the switch in accordance with Jlab Lock, Tag and Try (LTT) procedures. ***(Required PPE: long sleeve shirt and long pants that are non-melting or untreated natural fiber, safety glasses, and leather gloves)

9. Verify the lack of 480VAC by selecting all three phases on the VVU and reading 0 VAC.

10. Unplug the 120VAC plug which provides uninterruptible power to the Dynapower. This plug is located inside rack OD171Q. It is plugged into a rack-mount uninterruptible power supply and is marked by an administrative tag "NOTICE" – Uninterruptible power supply for the Left Dipole power supply – do not disconnect". Lock out the plug in a suitable plug lockout mechanism in accordance with JLab safety lockout procedures. Verify that no status/annunciator lights are lit on the front of the Dynapower power supply, PD171.

Note

For steps 11-20: The minimum personal protective equipment used shall be safety glasses or goggles, Electrical safety mat (500V), rubber high voltage (500V) gloves with leather outer gloves, long sleeved cotton or fire retardant shirt, long cotton or fire retardant pants, closed-toe shoes and an arc rated face shield.

11. Inspect the clamp-type DC amp meter for serviceability prior to use. Turn on the clamp-type DC amp meter by turning the rotary switch to the 200A range, and with the meter operating in free air (nothing in the clamp jaws) adjust the meter to read zero "0" amps DC. Make a test circuit with a short piece of at least 22 AWG wire and a 1.5v flashlight battery. Pass a loop of wire through the amp meter and connect it to the flashlight battery. You should be able to see a current of several amps DC with this test setup.

After verifying the operation of the amp meter, remove the wire and observe the readout return to 0.0 amps DC.

12. Taking great care not to bump or accidentally misadjust the zero setting, place the clamp-type DC amp meter on one of the large (535 MCM) main current leads between the Dynapower and the magnet. Ensure that the jaws of the clamp are completely closed and the meter is turned on to its lowest DC amperage range Verify a reading of 0.0 amps DC on the clamp-type DC amp meter.

Danger

Place the clamp-type DC amp meter on one of the cables between the Dynapower polarity reversal switch and the magnet, not between the Dynapower and the dump resistor cabinet. The correct cable can be found in the cable tray marked ">>TO MAGNET>>". It is wrapped with red tape, and on the red tape appear the words "PUT CLAMP METER HERE".

13. With the clamp meter in place, make another test circuit with the same piece of wire and a 1.5v flashlight battery. Pass a loop of wire through the amp meter and connect it to the flashlight battery. You should be able to see a current of several amps DC with this test setup. After verifying the operation of the amp meter, again observe that the reading returns to 0.0 amps DC.

14. Position an electrical safety mat rated at 500V or more behind the power supply, below the polarity reversal switch door. Put a fiberglass ladder on top of the mat.

15. Verify the proper operation of the DC voltmeter by measuring the voltage from a 1.5v battery.

16. Unlock and open the polarity reversal switch door. Place the DC voltmeter, (set to read milli-volts, typically the 300mV switch position) across the center contacts of the switch (the moving handle pivot points). In this step you are reading the voltage drop (if any) across the dump resistor from any current which may be flowing through it. Any significant difference of potential means that a significant current is still flowing. Observe a reading of 10mVDC or less. If the voltage is higher than 10mV, and the voltage is decreasing, the magnet is still discharging. You must wait until the voltage is 10mVDC or less!

17. Once you've received a voltage of 10mVDC or less, re-verify the proper operation of the DC voltmeter by measuring the voltage from a 1.5v battery.

18. If all of the previous steps have been successfully completed, the magnet has been sufficiently discharged, and is now safe to proceed with polarity reversal.

19. Using at least an 18 gauge wire (a Voltmeter-lead type wire is fine) and alligator clips, short across the polarity reversal switch from pivot point to pivot point. This is a safety device which provides a path for several amps of current if for any reason all of the previous precautions overlooked 10 amps or less in the magnet. With the shorting jumper in place, move the polarity reversal switch to the new position.

20. Remove the shorting jumper. Make sure all tools and meters are removed. Close and lock the switch box.

21. PPE may now be removed. Change the plugs on the current limiting resistor box to the correct box for the polarity you are changing to. The boxes are marked "(Electron) polarity" and "reverse (Hadron) polarity". Ensure both cables, labeled P1 and P2, are plugged into the same box.

22. Change the polarity of the Field Gradient Compensating Coils for the Dipole NMR probe by first turning off the Kepco power supply in rack 1H71B06 and then moving the Field Gradient Compensating Coil Polarity Reversal Switch, located in the same rack, to the appropriate position. The convention for all of the polarity switches is to match the positions of the switches (i.e., all handles in the up position = electron polarity) Make sure the Kepco is turned back on!

23. Unlock and restore 120VAC uninterruptible power to the Dynapower power supply.

24. While wearing the minimally required PPE, unlock and restore 480VAC power to the Dynapower power supply. Turn on lever-type switch on the power supply. Ensure that all tools and supplies that belong in the polarity reversal tool box are put back into it, and that the meters and source are turned off. ***(Required PPE: long sleeve shirt and long pants that are non-melting or untreated natural fiber, safety glasses, and leather gloves)

25. Using Hall A EPICS software, or local controls, reset faults and test for proper operation. Ensure that you leave the Dynapower in remote control mode.

Jefferson Lab
Thomas Jefferson National Accelerator Facility

Task Hazard Analysis (THA) Worksheet

(See ES&H Manual Chapter 3210 Appendix T1
Work Planning, Control, and Authorization Procedure)

Click For Word

Author:	Jessie Butler	**Date:**	April 18, 2016	**Task #:** If applicable	N/A

Complete all information. Use as many sheets as necessary

Task Title:	L-HRS Dipole Polarity Reversal			**Task Location:**	Hall A
Division:	Physics	**Department:**	Hall A	**Frequency of use:**	Weekly
Lead Worker:	Jessie Butler & Jack Segal				
Mitigation already in place: Standard Protecting Measures Work Control Documents	Hazard boundary is established at the top of the stairs leading to power supply platform.				

Sequence of Task Steps	Task Steps/Potential Hazards	Consequence Level	Probability Level	Risk Code (before mitigation)	Proposed Mitigation (Required for Risk Code >2)	Safety Procedures/ Practices/Controls/Training	Risk Code (after mitigation
1	Electrical Shock	H	L	3	✓ The power supply and magnet can store high levels of power even after the power has been turned off – The 480VAC "Main Disconnect" and 120VAC must be secured IAW SAF 104 (Lock, Tag & Try).	• This OSP • Equipment specific training by qualified Hall A technician • ES&H Manual 6200 • SAF 100 • SAF 104 • SAF 108 • SAF 603A • SAF 603N1-3 • SAF 110	1

Highest Risk Code before Mitigation:	3	Highest Risk Code after Mitigation:	1

When completed, if the analysis indicates that the Risk Code before mitigation for any steps is "medium" or higher (RC≥3), then a formal Work Control Document (WCD) is developed for the task. Attach this completed Task Hazard Analysis Worksheet. Have the package reviewed and approved prior to beginning work. (See ES&H Manual Chapter 3310 Operational Safety Procedure Program.)

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Task Hazard Analysis (THA) Worksheet

(See ES&H Manual Chapter 3210 Appendix T1
Work Planning, Control, and Authorization Procedure)

Form Revision Summary

Periodic Review – 08/13/15 – No changes per TPOC
Revision 0.1 – 06/19/12 - Triennial Review. Update to format.
Revision 0.0 – 10/05/09 – Written to document current laboratory operational procedure.

ISSUING AUTHORITY	TECHNICAL POINT-OF-CONTACT	APPROVAL DATE	REVIEW DATE	REV.
ESH&Q Division	Harry Fanning	08/13/15	08/13/18	0.1

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By signing this page, you testify that you have read, understand, and agree to abide by the procedure specified in the above referenced work control document:

Serial Number: ENP-16-59403-OSP

Title: Left Dipole Polarity Reversal

Name	Signature	Date