

ACCELERATOR DIVISION ES&H PROCEDURE

ADSP-05-1212

BOOSTER GRADIENT MAGNET POWER SUPPLY BUS SYSTEM
LOCKOUT/TAGOUT PROCEDURE

RESPONSIBLE DEPARTMENT ES&H

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REVISION NO. 5 REVISION ISSUE DATE 10/15/19


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REVIEW AND CONCURRENCE RECORD

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Author	Description of Change	Revision Date
Joe Compton	Adjusted titles to reflect organizational changes. Added revision history. Corrected lockbox name from GMPS to Booster. Removed the itemized clothing lists from NFPA 70E class 2. Now it states only that it is required to follow NFPA 70E class 2 requirements. Specified personal use of LOTO locks. Specified training needed for Lead Authorized Person. Added procedure training requirements in sections 8.1 and 8.2. Corrected the name of the Booster HiPot Enable key from HiPot power supply key. Changed some grammar to help clarify. Added Appendix A.	10/15/2019

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1.0 PURPOSE AND SCOPE

The purpose of this Accelerator Division Safety Procedure (ADSP) is to outline and detail the conduct of LOCKOUT/TAGOUT (LOTO) for Group Lockout of the Booster Gradient Magnet Power Supply (GMPS) Bus System. This procedure will only isolate power from the Booster Gradient Magnet bus and is not to be used for maintenance of the GMPS system as covered in ADDP-PR-2011.

2.0 PERFORMANCE OF MAINTENANCE ACTIVITIES

During certain accelerator maintenance activities it is necessary that Lockout/Tagout of the Booster Gradient Magnet bus be conducted. Activities can include any of the following: simple access to the Booster Accelerator Beam Enclosure or work in other locations where the Booster distributed bus is exposed. The Booster Gradient Magnet bus, distributed throughout the Booster beam enclosure, can be powered by any of four GMPS System supplies or by the GMPS HiPot Power Supply. The positive control points for Lockout/Tagout are located at the Booster East and West Transformer Yards and at the GMPS HiPot Power Supply. It would be impractical for every individual performing maintenance on these components to perform Lockout/Tagout at each positive control point. Therefore, Group Lockout by a Lead Authorized Employee is necessary.

3.0 THE NECESSITY OF WRITTEN LOTO PROCEDURE

The need for a written LOTO procedure is due to the necessity to lock out multiple energy sources. This written LOTO procedure allows authorized employees to follow **General** LOTO procedures for the Booster Gradient Magnet bus via the MCR Booster Group Lockbox in the MCR after the Lead Authorized Employee has completed the Lockout/Tagout steps.

4.0 RESPONSIBILITIES

4.1 OPERATIONS DEPARTMENT HEAD

The Operations Department Head shall develop and maintain a list of Authorized Personnel and coordinate their training.

In addition, the Operations Department Head will ensure that the Authorized Personnel implementing this procedure utilize an appropriate lockout form which is developed and maintained by the AD Operations Department and the ES&H Section and approved by the ES&H AD Division Safety Officer prior to use.

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4.2 **AUTHORIZED PERSONNEL**

The role of the Authorized Personnel is to properly Lockout/Tagout power sources to the Booster Gradient Magnet bus. The completion of the Lockout/Tagout is to be documented using a lockout form developed and maintained by the AD Operations Department and the ES&H Section and approved by the ES&H AD Division Safety Officer.

The Authorized Personnel to perform this procedure shall be from the Accelerator Division Operations department and authorized in writing by the Operations Department Head. The MCR Crew Chief shall designate a Lead Authorized Person for the purpose of this procedure.

The Lead Authorized Person shall sign the approved lockout form after all applicable steps have been checked off by Authorized Personnel. A copy of the completed form shall be placed in the Main Control Room (MCR) Electronic log (e-log). Completed original forms shall be maintained for one calendar year.

Lockout at the MCR Booster Group Lockbox shall be conducted by authorized employees who have the necessary knowledge and current Lockout/Tagout training required by FESHM chapter 2100.

5.0 **THE STEPS OF LOCKOUT/TAGOUT PRIOR TO MAINTENANCE ACTIVITY**

Upon desiring to perform LOTO on the Booster Gradient Magnet bus, the MCR Crew Chief will designate a Lead Authorized Person and may designate additional Authorized Personnel from a list of such named personnel maintained by the Operations Department Head to complete this procedure.

- 5.1 **Prepare:** Authorized Personnel shall review the written procedure if necessary and obtain a copy of the approved lockout form. (Copies will be kept in a lockout binder on the Duty Assistants desk.)
- 5.2 **Notify:** Notification shall be given to personnel deemed appropriate by the MCR Crew Chief.
- 5.3 **Shut Down:** An Authorized Person shall shut off all GMPS power supplies (locally or remotely) and check to insure that load current goes to substantially zero either by observing the value of B:VIMIN and B:VIMAX on an ACNET console or by checking the output voltage and current meters at the GMPS rack located in the Booster West Gallery.

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Authorized Personnel shall then remove a Booster GMPS Bypass key from the MCR GMPS Keytree and place this key in the MCR Booster Group Lockbox. Each Authorized Person who shall switch out the GMPS 13.8 KV disconnects shall place his/her personal LOTO padlock and danger tag on that lock box.

- 5.4 **Isolate:** Operation of the disconnects in this step requires NFPA 70E Class 2 activity. The Booster Gradient Magnet bus shall be isolated from the GMPS energy source by opening the four GMPS 13.8 KV disconnects and removing the captured 13.8 KV keys from the disconnects. An Authorized Person shall verify by visual inspection that all three blades of each switch have opened. This inspection requires a flashlight.

If required an Authorized Person shall isolate the GMPS HiPot Power Supply by removing the Booster HiPot Enable key from the GMPS HiPot Power Supply in the Booster West Gallery. This prevents the GMPS HiPot Power Supply from being energized, as this key controls AC power to the GMPS HiPot Power Supply.

- 5.5 **Lock and Tag Out:**
- a) Return ALL FOUR 13.8 KV Brentford disconnect keys to MCR GMPS Keytree.
 - b) Turn each 13.8 KV Brentford disconnect keys to permit removal of power supply door keys. (Door keys should not actually be removed unless needed for maintenance activities.)
 - c) An Authorized Person shall verify that ALL FOUR 13.8 KV Brentford disconnect keys are in place and turned.
 - d) An Authorized Person shall close the cover over ALL FOUR 13.8 KV Brentford disconnect keys and lock the cover with the Booster 13.8 KV Lockout key.
 - e) Each Authorized Person shall remove his/her personal LOTO padlock and tag from the lock box containing the GMPS Bypass key. The bypass key shall be returned to the GMPS Keytree.
 - f) An Authorized Person shall place the Booster HiPot Enable key and the Booster 13.8 KV Lockout key in the MCR Booster Group Lockbox and attach a BT-5 padlock (MCR Crew Chief lock) to the MCR Booster Group Lockbox.
 - g) The MCR Crew Chief or designee shall verify that above steps a through f have been properly completed.

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- 5.6 **Verify:**
Personnel can verify the status of the GMPS by inspection of the GMPS Keytree and MCR Booster Group Lockbox in the MCR. ALL FOUR 13.8 KV Brentford disconnect keys must be in the GMPS Keytree and locked under the cover. The Booster 13.8 KV Lockout key and the Booster HiPot Enable key must be locked in the MCR Booster Group Lockbox.

The equipment is now locked out.

Personnel who are to perform maintenance on components connected to the Booster Gradient Magnet bus shall attach a personal LOTO padlock and danger tag on the MCR Booster Group Lockbox.

6.0 SPECIAL REQUIREMENTS FOR SHIFT/PERSONNEL CHANGE

If the accelerator enclosure activities continue beyond a shift, the next MCR Crew Chief assumes the responsibility and authority of the off-going MCR Crew Chief for this group lockout.

7.0 THE STEPS FOR RETURN TO SERVICE

Upon desiring to return the Booster GMPS system to service, the MCR Crew Chief may designate Authorized Personnel from a list of such named personnel maintained by the Operations Department Head to complete this procedure.

- 7.1 **Check Equipment:** Check the MCR Booster Group Lockbox and ensure that all personnel have removed their locks and tags. Check that the following keys are accounted for in the MCR.

7.1.1 All Booster Tunnel access keys.

7.1.2 Both GMPS Bypass keys.

- 7.2 **Check Work Area:** Check that the Booster tunnel is secure.

- 7.3 **Verify:** Verify that the equipment remains in the off position until the equipment has been re-energized. This is accomplished by locking a GMPS Bypass key in a designated lock box as described below in section 7.5.

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7.4 **Notify:** Notification shall be given to personnel deemed appropriate by the MCR Crew Chief.

7.5 **Remove Padlocks and Tags and Re-energize:**

- a) The MCR Crew Chief shall designate Authorized Personnel to remove the Crew Chief lock and tag from the MCR Booster Group Lockbox.
- b) The Booster HiPot Enable key may be removed and used at this time if required or left in the box unlocked
- c) An Authorized Person shall then place a GMPS Bypass key in the MCR Booster Group Lockbox and remove the Booster 13.8 KV Lockout Key. Each Authorized Person who shall switch on the GMPS 13.8 KV Brentford disconnects shall place their personal LOTO padlock and danger tag on that lockbox.
- d) An Authorized Person shall take the Booster 13.8 KV Lockout key from the MCR Booster Group Lockbox, unlock and open the 13.8 KV key cover, and remove the 13.8 KV Brentford disconnect keys from the GMPS Keytree.
- e) Operation of the disconnects in this step requires NFPA 70E Class 2 activity. The 13.8 KV Brentford disconnect keys shall be returned to the 13.8 KV disconnects and the disconnects shall be switched on by Authorized Personnel.
- f) Each Authorized Person shall remove his/her LOTO lock and tag from the lock box containing the GMPS Bypass key. The Bypass key shall be returned to the GMPS Keytree.

This completes the requirements for returning the equipment to service.

8.0 **PROCEDURE TRAINING REQUIREMENTS**

Initial training shall be coordinated by the Operations Department Head. The time interval for re-qualification will be every year in accordance with Laboratory procedures.

8.1 All personnel performing this procedure are required to be trained in Lockout/Tagout Level 2 (FN000212 / CR).

8.2 All personnel performing this procedure are required to be trained in Electrical Safety in the Workplace (NFPA 70E) (FN000385 / CR).

9.0 **DISTRIBUTION**

An electronic controlled copy of this procedure is maintained on the ESH Department website at:

<http://www-bdnew.fnal.gov/esh/adsp/index.html>

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APPENDIX A: ACCELERATOR DIVISION SAFETY PROCEDURE WRITTEN LOTO
DEVELOPMENT AND REVIEW RESPONSIBILITIES

This appendix describes the responsibilities for drafting and reviewing written procedures used for exposed bus Lock Out/Tag Out (LOTO) with the purpose of accessing accelerator and beamline enclosures.

These procedures are formalized as Accelerator Division Safety Procedures (ADSP) to establish ESH&Q policies for implementation by AD departments¹, in this case as a written LOTO procedure, to control access to AD facilities as needed to protect the health and safety of personnel².

The scale of the systems included in the procedures involve multiple organizational units having only partial knowledge of or responsibility for the overall system. The written LOTO procedure shall be drafted³ and reviewed⁴ by knowledgeable employees from each D/S/P that owns, uses, maintains, or services equipment directly affected by or used to execute the written LOTO procedure, including Energy Isolating Devices and approved by a line manager at the department head level or higher (or designee).

The AD OPS department provides the authorized and lead authorized employees, performs the inspector component of the training and maintains the training of the lead authorized personnel.

The AD EES department acts as the knowledgeable employee for magnet power supplies from the AC service LOTO Energy Isolation Device, through the power supply and to the power supply terminals. In some instances, FESS maintains the LOTO Energy Isolating Device and is the knowledgeable employee for that device.

The department(s) responsible for the enclosure act as the knowledgeable employee for the loads in the beamline enclosure.

The approval of the line manager is recorded in the REVIEW AND CONCURRENCE RECORD of the ADSP indicating that they have reviewed the procedure, provided input for their area of knowledge and recognize their responsibilities as users, owner, maintainers or servicers of a portion of the systems used in the written LOTO procedure.

APPROVAL:  DATE 11/15/2019
Mike Lindgren
Accelerator Division Head

¹ ADAP-01-0001 3.1.2c
² ADAP-01-0001 3.1.2d
³ FESHM 2100 5.7
⁴ FESHM 2100 4.4

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