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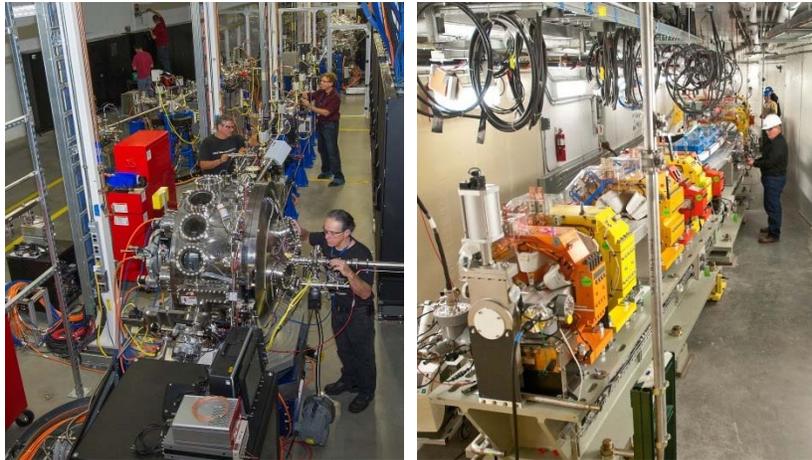
Doc No: NSLSII-ID-PRC-007

NSLS-II PROCEDURE: MEZZANINE-IMPLEMENTED LOTO FOR ALL AXES OF SST EPU60 AT RING CELL 7

October 19, 2017

Rev. 1

H. Fernandes



 **Think Safety. Act Safely.**

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ESH Review:

10/20/2017

X 

Robert Lee
ESH Manager
Signed by: Lee, Robert J

By signing this Procedure I acknowledge that it complies with all ESH requirements and if performed correctly, will not present a significant hazard to personnel or equipment.

Authorization Basis Review:

10/19/2017

X 

Steve Moss
Authorization Basis Manager
Signed by: Moss, Steven H

By signing this Procedure I acknowledge that a USI Screening/Evaluation has been performed and this Procedure does not adversely impact the NSLS-II Authorization Basis Documents.

Approved:

10/20/2017

X Toshiya Tanabe

Toshiya Tanabe
Insertion Devices Group Leader
Signed by: Tanabe, Toshiya

By approving this Procedure I agree that the appropriate personnel have reviewed this document and I authorize this work to commence as written.

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REVISION HISTORY

REVISION	SECTION(S)	PAGE #	DATE	List of Reviewers	DESCRIPTION
1	All	All	19OCT2017	R. Chmiel B. Lein C. Porretto J. Rank E. Zitvogel	First Issue. Validated by H. Fernandes and J. Rank on 9/26/17.

ACRONYMS

BNL	Brookhaven National Laboratory	MC	Motor Controller
CSS	Controls System Studio	NSLS-II	National Synchrotron Light Source II
EPS	Equipment Protection System	PMAC	Program Multi-Axis (motor) Controller
EPU	Elliptically Polarizing Undulator	PPE	Personal Protective Equipment
EPU60	EPU with period of 60 mm	RG	Rack Group
ESH	Environment, Safety & Health	SST	Spectroscopy Soft and Tender
GUI	Graphic User Interface	VAC	Volts Alternating Current
ID	Insertion Device	VDC	Volts Direct Current
LOTO	Lockout/Tagout		

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1 PURPOSE AND SCOPE

The purpose of this procedure is to provide instructions for LOTO of the NSLS-II EPU60 from the mezzanine rack, at the open gap position, to protect against radiation when the EPU60 is not in use. The method outlined below continues to power all instrumentation useful for readback of the state (position) of each of the driven axis.

The scope of this procedure includes 1) performing Centrally Controlled LOTO on the EPU60 for beam testing and/or ring commissioning absent IDs and 2) performing Centrally Controlled LOTO to safely take the EPU60 out of service prior to beginning ring operations.

2 PREREQUISITES

- 2.1 Personnel performing this procedure have prior experience and training with implementation of LOTO on similar EPUs (like the EPU60 shown in Figure 2-1).

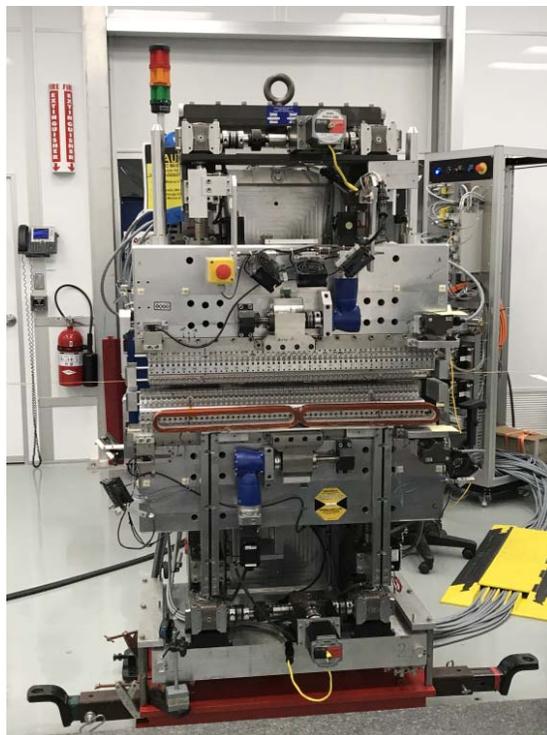


Figure 2-1: EPU60

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- 2.2 Primary Authorized Employees performing this procedure have completed training for NSLSII-ESH-PRC-006, *Centrally Controlled Lockout/Tagout (LOTO)*.
- 2.3 Each Primary Authorized Employee performing this procedure has facility specific PPE available.
- 2.4 Refer to Figure 2-2, when necessary, for a wiring diagram depicting the switch that would be turned OFF (circled in blue) for LOTO of the Cell 7 EPU60 Control Rack in the ring.

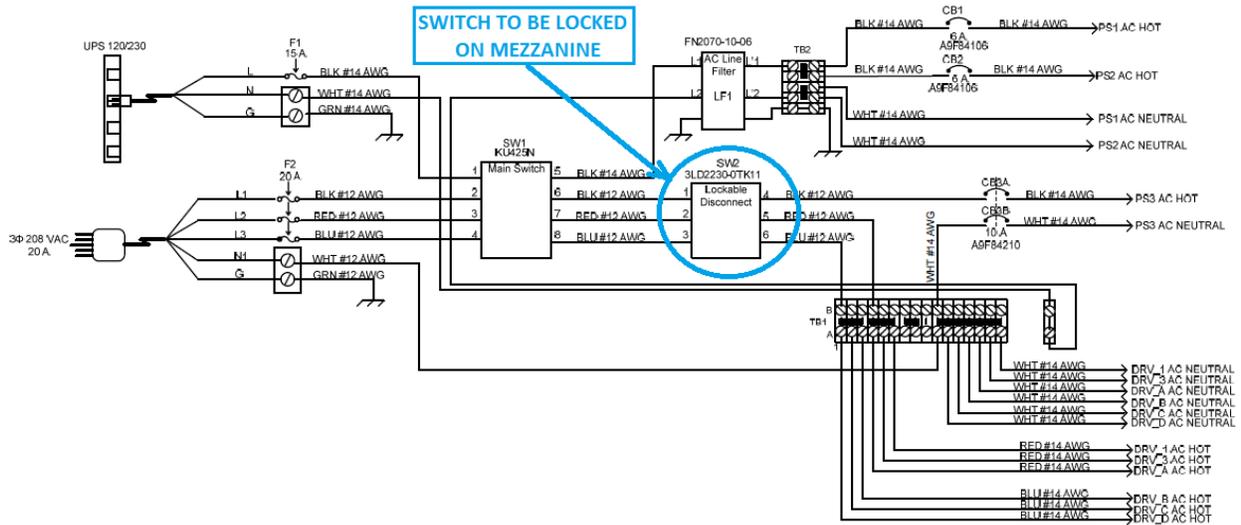


Figure 2-2: Typical Control Rack to EPU60 Motor Cabling

- 2.5 The following equipment/tools are required and available to LOTO the EPU60:
 - A red bodied padlock in accordance with NSLSII-ESH-PRC-006, *Centrally Controlled Lockout/Tagout (LOTO)*
 - A solid red lockout tag for Centrally Controlled LOTO in accordance with NSLSII-ESH-PRC-006, *Centrally Controlled Lockout/Tagout (LOTO)*
 - Lockout Key Lock Box, (Emedco MGB11, size: 6"h x 9"w x 3-1/2"d or equivalent)
 - Adjustable Cable Lockout (Master Lock Model #S806 or equivalent)
 - Manufactured gap gauge (BNL Drawing # ID-ML-7400, see Figure 2-3)

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- 2.6 The gap gauge has been internally inspected within the past 12 months and documented with an inspection report.
- 2.7 Contact Operations Staff or ESH Staff to confirm availability to assist with the LOTO.
- 2.8 Notify the Control Room, Mechanical Engineering Group Leader and Lead Beamline Scientist of the impending LOTO.

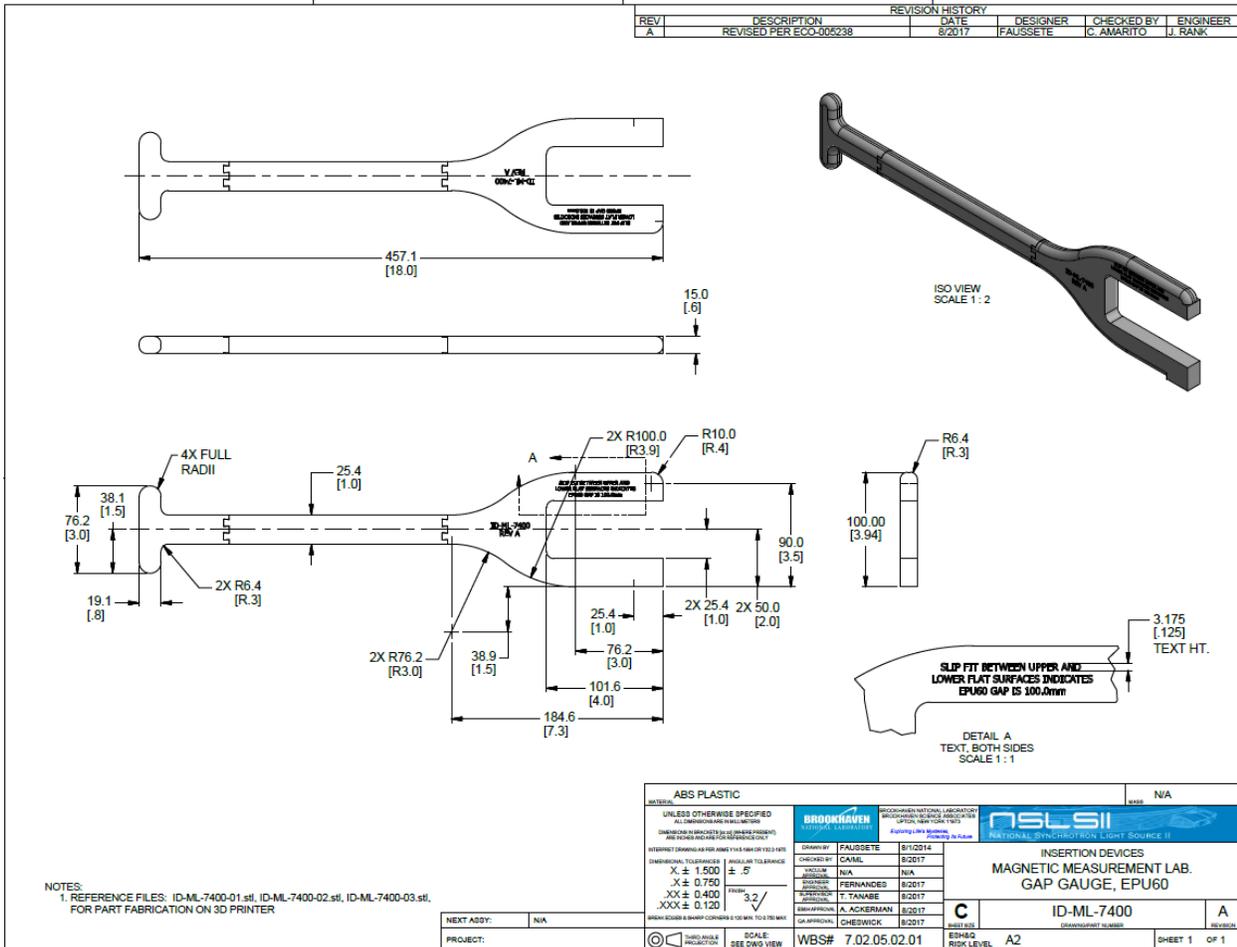


Figure 2-3: BNL Drawing # ID-ML-7400: Gap Gauge

- 2.9 The EPU60 Control Rack resides on the ring outer side on the mezzanine. Refer to Table 2-1 for the relative position of the EPU60 Control Rack installed on the mezzanine and labeled accordingly.

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Table 2-1: Control Rack Location of the EPU60 on the Mezzanine

Beamline	EPU Location in Ring	EPU Rack Location on Mezzanine	Rack Label on Mezzanine
SST	Cell 7	Cell 6	MC06-RG-F3

3 HAZARDS, CONTROLS AND LIMITS

- 3.1 IDs are constructed with permanent magnets that do not have an on/off switch. Internal magnetic loads of several tons may be present. Though the magnetic gap is guarded, magnetic materials shall be kept clear of the “beam centerline” area. A selection of non-magnetic tools is available from the ID Group.
- 3.2 All steps in this procedure require that Centrally Controlled LOTO shall be performed in accordance with NSLSII-ESH-PRC-006, *Centrally Controlled Lockout/Tagout (LOTO)*. LOTO for any other purpose shall not be performed as part of this procedure.
- 3.3 Only a person that is identified as a Primary Authorized Employee may perform Centrally Controlled LOTO on the EPU60 and Control Rack.
- 3.4 The following equipment remains powered during the performance of this procedure:
 - The PMAC motor controllers (24 VDC output; motor amplifier is turned off and on throughout the procedure, as necessary, to perform LOTO)
 - The EPU60 Control Rack for straight section at Cell 7, resides in the mezzanine level above Cell 6-ID; is powered by a floor-mounted 208 VAC junction box (to the coil power supplies only) and 110 VAC power strip outlets on one side per bay. Refer to Table 2-1 for the Control Rack label on the mezzanine.
 - EPU60 resident correction coils
 - Absolute gap encoders (for readback of true gap to the U60 Control System)
 - All limit switches

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3.5 Deviations from expected configuration(s) require a halt to this procedure for evaluation by the ID Group Cognizant Engineer.

4 PROCEDURE

4.1 Apply Centrally Controlled LOTO

Caution: During and after completion of this procedure, the Cell 7 EPU60 and its Control Rack remain energized and present a shock hazard; only the motor controller switch which energizes each of the motors is powered off.

4.1.1 Obtain the appropriate Adjustable Cable Lockout, red bodied padlocks and solid red lockout tags.

4.1.2 IF the ring is accessible, THEN visually verify the position of the ID Gap Drive System and Elevator Base System (High or Low).

4.1.3 Switch to Operational Mode from the GUI control screen.

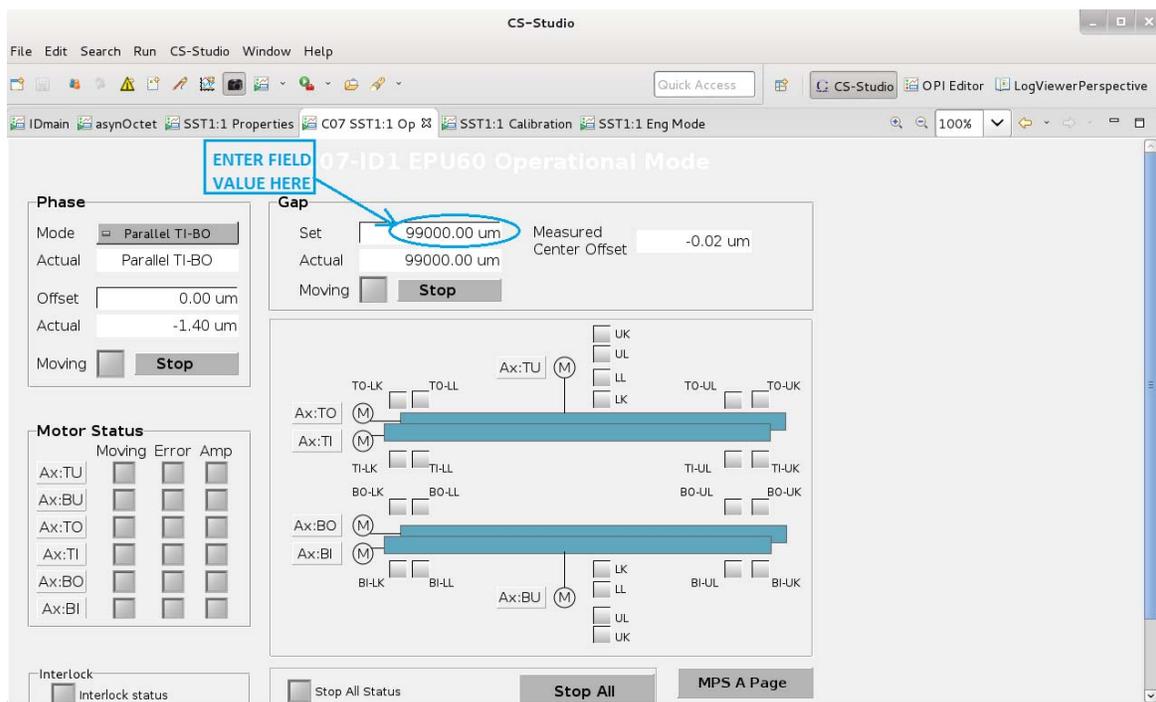


Figure 4-1: Changing U60 Gap Through CSS

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4.1.4 In Operational Mode, command the Gap Drive System to drive to a mid-gap position (i.e., 50,000 μm):

- a. Type 50,000 μm in the Gap Drive Set Point field (see Figure 4-1).
- b. Press Enter on the keyboard.

4.1.5 Check that the commanded gap has been reached as follows:

- a. Confirm that the readout on the encoder "Actual" position has reached the setpoint of 50,000 μm (see Figure 4-1).

AND

Note: Gap gauge should not pass through between magnet arrays.

- b. IF the ring is accessible, THEN confirm that mid gap is reached by attempting to insert the gap gauge (see Figure 4-2).

4.1.6 In Operational Mode, command the Gap Drive System to drive to open gap (i.e., 100,000 μm):

- a. Type 100,000 μm in the Gap Drive Set Point field (see Figure 4-1).
- b. Press Enter on the keyboard.

4.1.7 Check that the commanded gap has been reached as follows:

- a. Confirm that the readout on the encoder "Actual" position has reached the setpoint of 100,000 μm (see Figure 4-1).

AND

- b. Check the EPS switch status in CSS and ensure that EPS indicates that gap is open.

AND

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Note: The gap gauge should slide inside the gap (see Figure 4-2).

- c. IF the ring is accessible, THEN confirm that fully open gap is reached by inserting the gap gauge.

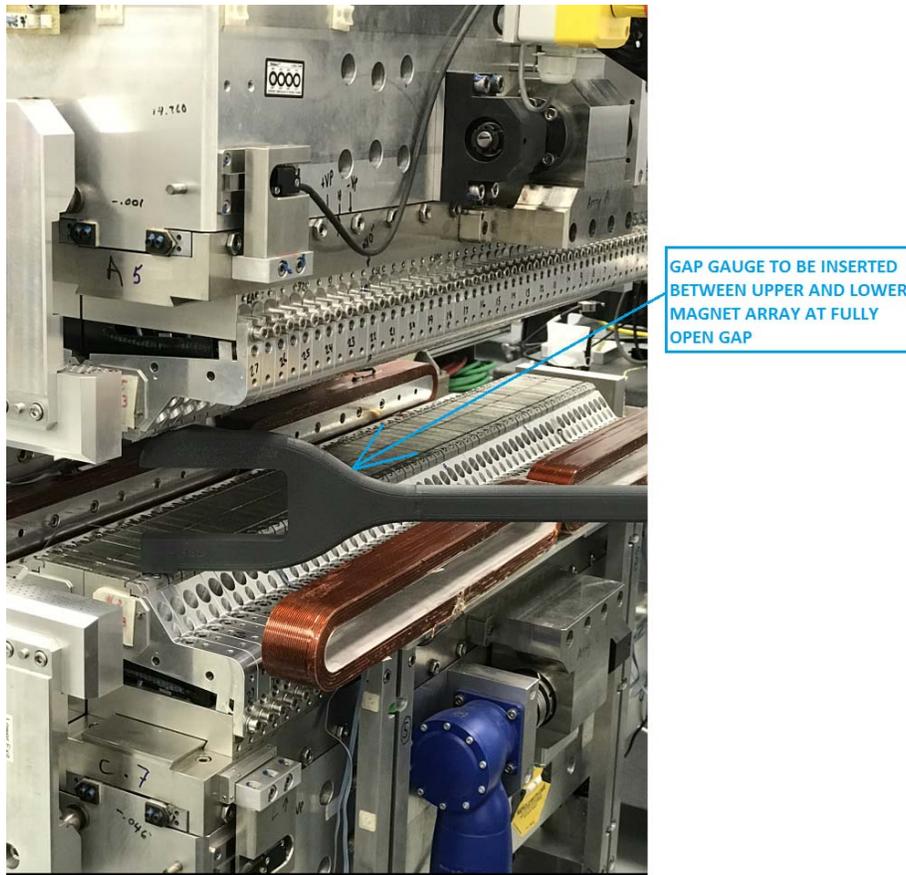


Figure 4-2: Gap Gauge Inserted in EPU60 Gap

- 4.1.8 Notify the Control Room and all Affected Employees of the intent to LOTO the Cell 7 EPU60.
- 4.1.9 Confirm that the Cell 7 EPU60 in the affected straight section AND its Control Rack are safe to shut down (see Table 2-1 for the Control Rack location).

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Figure 4-3: Cell 7 EPU60 Motor Controller Switch to be Locked Out

4.1.10 At the Control Rack, whose location and label is identified in Table 2-1 (refer to Table 2-1 and Figure 4-3), identify the switch for all the motors.

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- 4.1.11 De-energize the motors (see Figure 4-3) by turning the switch to the OFF position.
- 4.1.12 Complete all information required on the face of the solid red lockout tag.
- 4.1.13 Apply the Adjustable Cable Lockout and a red bodied padlock to the de-energized switch as indicated in Figure 4-3, in accordance with NSLSII-ESH-PRC-006, *Centrally Controlled Lockout/Tagout (LOTO)*.
- 4.1.14 Hang the solid red lockout tag from the red bodied padlock in accordance with NSLSII-ESH-PRC-006, *Centrally Controlled Lockout/Tagout (LOTO)*.
- 4.1.15 Challenge the Adjustable Cable Lockout and the red bodied padlock to ensure they are installed securely.

4.2 Test Centrally Controlled LOTO

- 4.2.1 In Operational Mode (i.e., Manual), attempt to close the gap to confirm proper LOTO by commanding the Gap Drive System to drive to mid gap position (i.e., 50,000 μm).
- 4.2.2 To confirm that the Gap Drive motors were not actuated:
 - a. Ensure that the EPS switch status in CSS shows that the Cell 7 EPU60 gap is fully open.

AND
 - Note:** The gap gauge should slide inside the gap (see Figure 4-2).
 - b. IF the ring is accessible, THEN contact Operations Staff OR ESH Staff to witness and confirm that the position of the Cell 7 EPU60 remains at open gap using the gap gauge.
- 4.2.3 Place all red bodied padlock keys in the Lockout Key Lock Box.
- 4.2.4 Apply a red bodied padlock AND solid red lockout tag to the Lockout Key Lock Box.

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4.2.5 Operations Staff OR ESH Staff apply a red bodied padlock AND solid red lockout tag to the Lockout Key Lock Box.

Note: After the Operations Staff or ESH Staff apply their red bodied padlock to the Lockout Key Lock Box, it will be kept in the Control Room for the duration of the LOTO.

4.2.6 Notify the Control Room that LOTO has been successfully applied.

4.2.7 Document Centrally Controlled LOTO in accordance with NSLSII-ESH-PRC-006, *Centrally Controlled Lockout/Tagout (LOTO)*.

4.3 Restoring Equipment to Service - Clear LOTO

4.3.1 Verify that the reason for the LOTO is complete.

4.3.2 Confirm that the Cell 7 EPU60 and Control Rack in the affected straight section are safe to enable.

4.3.3 Contact Operations Staff OR ESH Staff for removal of their red bodied padlock from the Lockout Key Lock Box.

4.3.4 Notify the Control Room, Mechanical Engineering Group Leader and Lead Beamline Scientist of the intent to return to service.

4.3.5 Recover the red bodied padlock keys from the Lockout Key Lock Box in accordance with NSLSII-ESH-PRC-006, *Centrally Controlled Lockout/Tagout (LOTO)*.

4.3.6 Remove the following from the Control Rack for the Cell 7 EPU60:

- Solid red lockout tag
- Red bodied padlock
- Adjustable Cable Lockout

4.3.7 Energize the motors by turning the switch to ON (see Figure 4-3 and refer to Table 2-1 for the Control Rack location and label).

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4.3.8 In Operational Mode (i.e., Manual), command the Gap Drive System to drive to a mid-gap position (i.e., 50,000 μm).

4.3.9 Check proper gap drive function by performing the following:

- a. Confirm that the CSS readout on encoder position of gap has reached the set point.

AND

Note: Gap gauge should not pass through, between magnet arrays.

- b. IF the ring is accessible, THEN confirm that mid gap is reached by attempting to insert the gap gauge (see Figure 4-2).

AND

- c. Ensure in CSS that the EPS switch status indicates that the gap is no longer open.

4.3.10 Notify Affected Employees that the work is complete and equipment is ready for use.

4.3.11 Notify the Control Room, Mechanical Engineering Group Leader and Lead Beamline Scientist that LOTO has been successfully removed.

4.3.12 Return group LOTO red bodied padlocks and solid red lockout tags to the LOTO station.

4.3.13 Document the clearing of Centrally Controlled LOTO in accordance with NSLSII-ESH-PRC-006, *Centrally Controlled Lockout/Tagout (LOTO)*.

5 REFERENCES

- 5.1 NSLSII-ESH-PRC-006, *Centrally Controlled Lockout/Tagout (LOTO)*

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6 ATTACHMENTS

None.

7 DOCUMENTATION

None.

8 DEFINITIONS

- 8.1 Centrally Controlled LOTO: LOTO of systems or equipment to prevent personnel injury and/or exposure to hazardous energy, for operational reasons.
- 8.2 Equipment Protection System (EPS): The engineered interlocks that protect ring-resident equipment during NSLS-II operations.
- 8.3 Affected Employees: Employees who are required to use machines or equipment on which LOTO is being performed. For the NSLS-II, this is typically the Operations Staff.
- 8.4 Primary Authorized Employee: An Authorized Employee who is designated by their department/division to coordinate complex-group LOTO procedures. The Primary Authorized Employee coordinates workforces and ensures continuity of LOTO protection for all involved (both Authorized and Affected Employees). They are the first to apply their lock and the last to remove their lock from a group LOTO. At the NSLS-II, Primary Authorized Employees apply Centrally Controlled LOTO for the protection of other workers as well.

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