

The only official copy of this document is the one online in the NSLS-II SharePoint Document Center. Before using a printed copy, verify that it is current by checking the printed document's revision history with that of the online version.

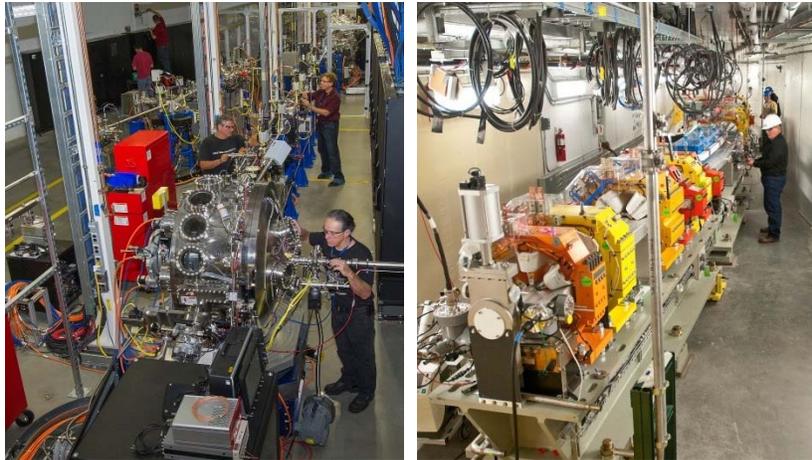
Doc No: NSLSII-ID-PRC-004

NSLS-II PROCEDURE: MEZZANINE-IMPLEMENTED LOTO FOR ALL AXES OF SST U42 UNDULATOR AT RING CELL 7

May 15, 2017

Rev. 1

H. Fernandes



 **Think Safety. Act Safely.**

The only official copy of this document is the one online in the NSLS-II SharePoint Document Center. Before using a printed copy, verify that it is current by checking the printed document's revision history with that of the online version.

National Synchrotron Light Source II, Brookhaven National Laboratory			
Doc No. NSLSII-ID-PRC-004	Author: H. Fernandes	Review Frequency: 3 yrs	Rev. 1
Title: Mezzanine-implemented LOTO for All Axes of SST U42 Undulator at Ring Cell 7			Effective Date: 15MAY2017

ESH Review:

5/17/2017

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:

5/15/2017

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:

5/15/2017

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.

The only official copy of this document is the one online in the NSLS-II SharePoint Document Center. Before using a printed copy, verify that it is current by checking the printed document's revision history with that of the online version.

National Synchrotron Light Source II, Brookhaven National Laboratory			
Doc No. NSLSII-ID-PRC-004	Author: H. Fernandes	Review Frequency: 3 yrs	Rev. 1
Title: Mezzanine-implemented LOTO for All Axes of SST U42 Undulator at Ring Cell 7			Effective Date: 15MAY2017

REVISION HISTORY

REVISION	SECTION(S)	PAGE #	DATE	List of Reviewers	DESCRIPTION
1	All	All	15MAY2017	R. Chmiel B. Lein C. Porretto J. Rank E. Zitvogel	First Issue. Validation performed by H. Fernandes, J. Rank and B. Lein on 05/05/2017.

ACRONYMS

BNL	Brookhaven National Laboratory	LOTO	Lockout/Tagout
CSS	Controls System Studio	NSLS-II	National Synchrotron Light Source II
U42	Undulator with period of 42 mm	PMAC	Program Multi-Axis (motor) Controller
EPS	Equipment Protection System	PPE	Personal Protective Equipment
ESH	Environment, Safety & Health	VAC	Volts Alternating Current
GUI	Graphic User Interface	VDC	Volts Direct Current
ID	Insertion Device	SST	Spectroscopy Soft and Tender

The only official copy of this document is the one online in the NSLS-II SharePoint Document Center. Before using a printed copy, verify that it is current by checking the printed document's revision history with that of the online version.

National Synchrotron Light Source II, Brookhaven National Laboratory			
Doc No. NSLSII-ID-PRC-004	Author: H. Fernandes	Review Frequency: 3 yrs	Rev. 1
Title: Mezzanine-implemented LOTO for All Axes of SST U42 Undulator at Ring Cell 7			Effective Date: 15MAY2017

1 PURPOSE AND SCOPE

The purpose of this procedure is to provide instructions for LOTO of the NSLS-II U42 Undulator from the mezzanine rack, at the open gap position, to protect against radiation when the U42 Undulator 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 U42 Undulator for beam testing and/or ring commissioning absent IDs and 2) performing Centrally Controlled LOTO to safely take the U42 Undulator 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 the U42 Undulator shown in Figure 2-1.



Figure 2-1: U42 Undulator

National Synchrotron Light Source II, Brookhaven National Laboratory			
Doc No. NSLSII-ID-PRC-004	Author: H. Fernandes	Review Frequency: 3 yrs	Rev. 1
Title: Mezzanine-implemented LOTO for All Axes of SST U42 Undulator at Ring Cell 7			Effective Date: 15MAY2017

- 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 U42 Undulator Control Rack in the ring.

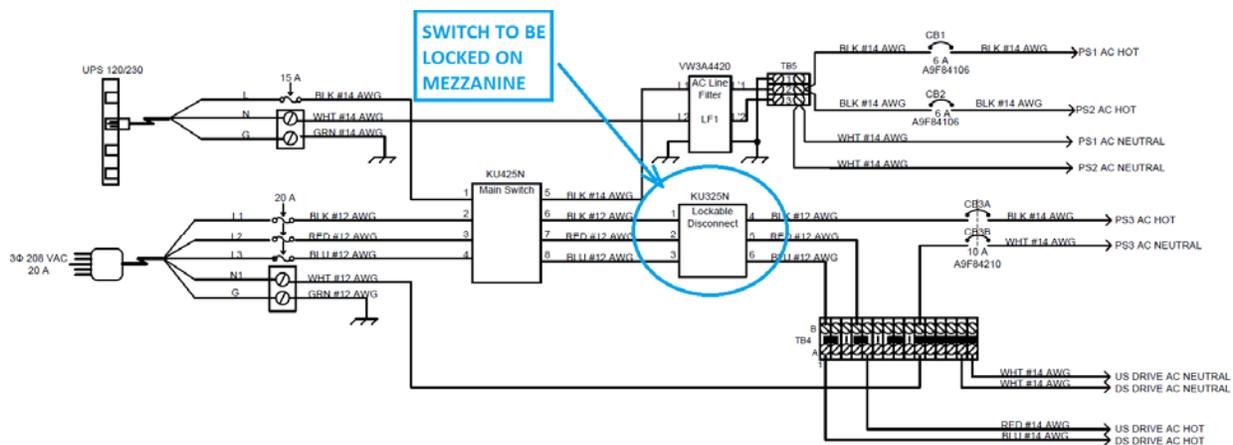


Figure 2-2: Typical Control Rack to U42 Undulator Motor Cabling

- 2.5 The following equipment/tools are required and available to LOTO the U42 Undulator:
 - 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)
 - A red lockout hasp (McMaster Part #12005A61 or equivalent)

The only official copy of this document is the one online in the NSLS-II SharePoint Document Center. Before using a printed copy, verify that it is current by checking the printed document's revision history with that of the online version.

National Synchrotron Light Source II, Brookhaven National Laboratory			
Doc No. NSLSII-ID-PRC-004	Author: H. Fernandes	Review Frequency: 3 yrs	Rev. 1
Title: Mezzanine-implemented LOTO for All Axes of SST U42 Undulator at Ring Cell 7			Effective Date: 15MAY2017

- Manufactured gap gauge (BNL Drawing # ID-ML-7100, see Figure 2-3). The gap gauge used on Damping Wigglers will also be used on the U42 Undulator.

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

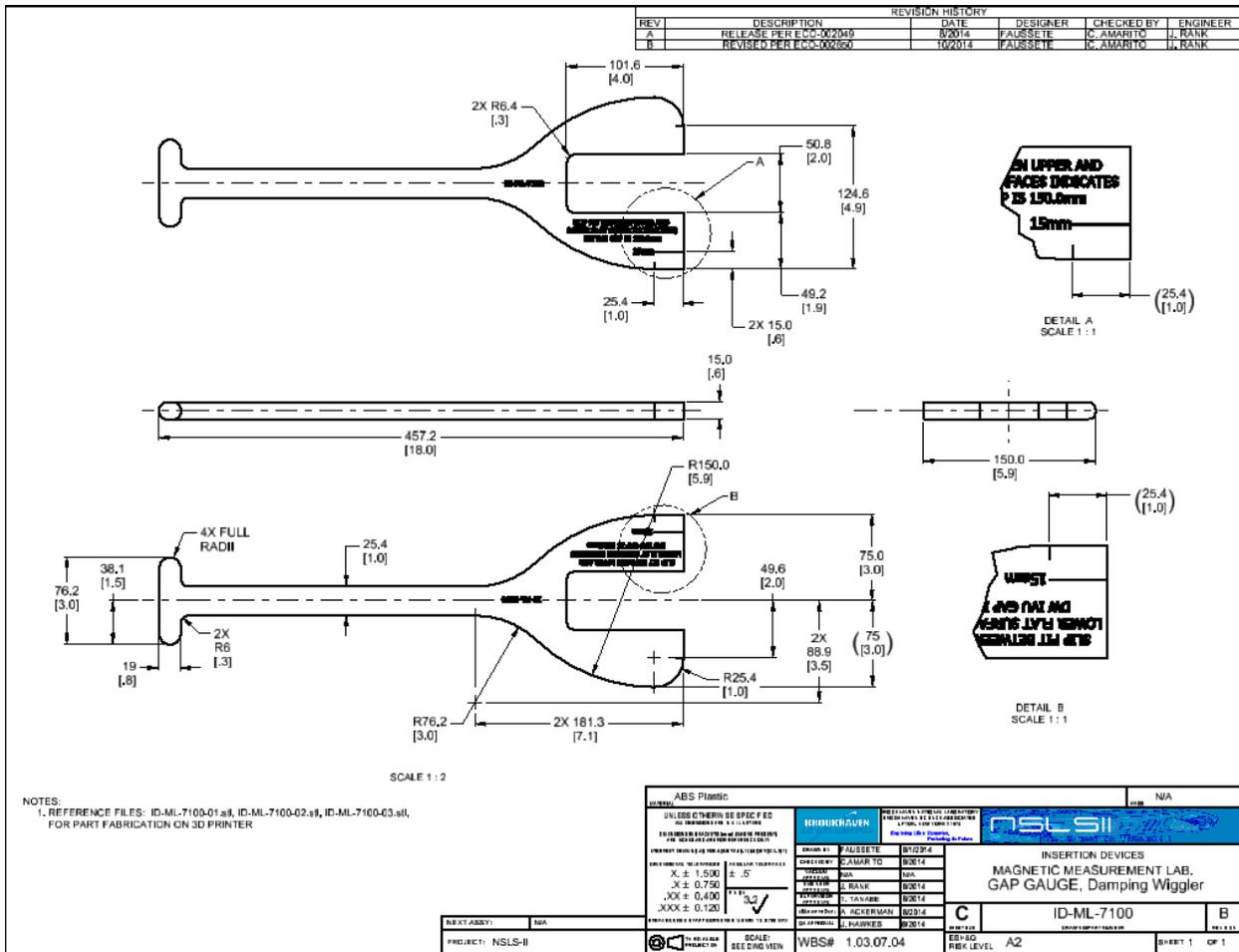


Figure 2-3: BNL Drawing # ID-ML-7100: Gap Gauge (Damping Wiggler Gap Gauge to be used for the U42 Undulator)

National Synchrotron Light Source II, Brookhaven National Laboratory			
Doc No. NSLSII-ID-PRC-004	Author: H. Fernandes	Review Frequency: 3 yrs	Rev. 1
Title: Mezzanine-implemented LOTO for All Axes of SST U42 Undulator at Ring Cell 7			Effective Date: 15MAY2017

- 2.9 The U42 Undulator Control Rack resides on the ring outer side on the mezzanine. Refer to Table 2-1 for the relative position of the U42 Undulator Control Rack installed on the mezzanine and labeled accordingly.

Table 2-1: Rack Location of the U42 Undulator on Mezzanine

Beamline	Undulator Location in Ring	Undulator Rack Location on Mezzanine	Rack Label on Mezzanine
SST	Cell 7	6-ID	MC06-RG-F1

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 U42 Undulator 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 U42 Undulator 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

National Synchrotron Light Source II, Brookhaven National Laboratory			
Doc No. NSLSII-ID-PRC-004	Author: H. Fernandes	Review Frequency: 3 yrs	Rev. 1
Title: Mezzanine-implemented LOTO for All Axes of SST U42 Undulator at Ring Cell 7			Effective Date: 15MAY2017

outlets on one side per bay. Refer to Table 2-1 for the rack label on the mezzanine.

- U42 Undulator resident correction coils
- Absolute gap encoders (for readback of true gap to the U42 Control System)
- All limit switches

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 U42 Undulator 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 red lockout hasps, 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 Engineering Mode from the GUI control screen.
- 4.1.4 In Operational Mode, command the Gap Drive System to drive to a mid-gap position (i.e., 75,000 μm):
 - a. Type 75,000 μm in the Gap Drive Set Point field (see Figure 4-1).
 - b. Press Enter on the screen.
- 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 75,000 μm .

The only official copy of this document is the one online in the NSLS-II SharePoint Document Center. Before using a printed copy, verify that it is current by checking the printed document's revision history with that of the online version.

National Synchrotron Light Source II, Brookhaven National Laboratory			
Doc No. NSLSII-ID-PRC-004	Author: H. Fernandes	Review Frequency: 3 yrs	Rev. 1
Title: Mezzanine-implemented LOTO for All Axes of SST U42 Undulator at Ring Cell 7			Effective Date: 15MAY2017

AND

Note: Gap should be at the mid gap markings on the gap gauge.

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

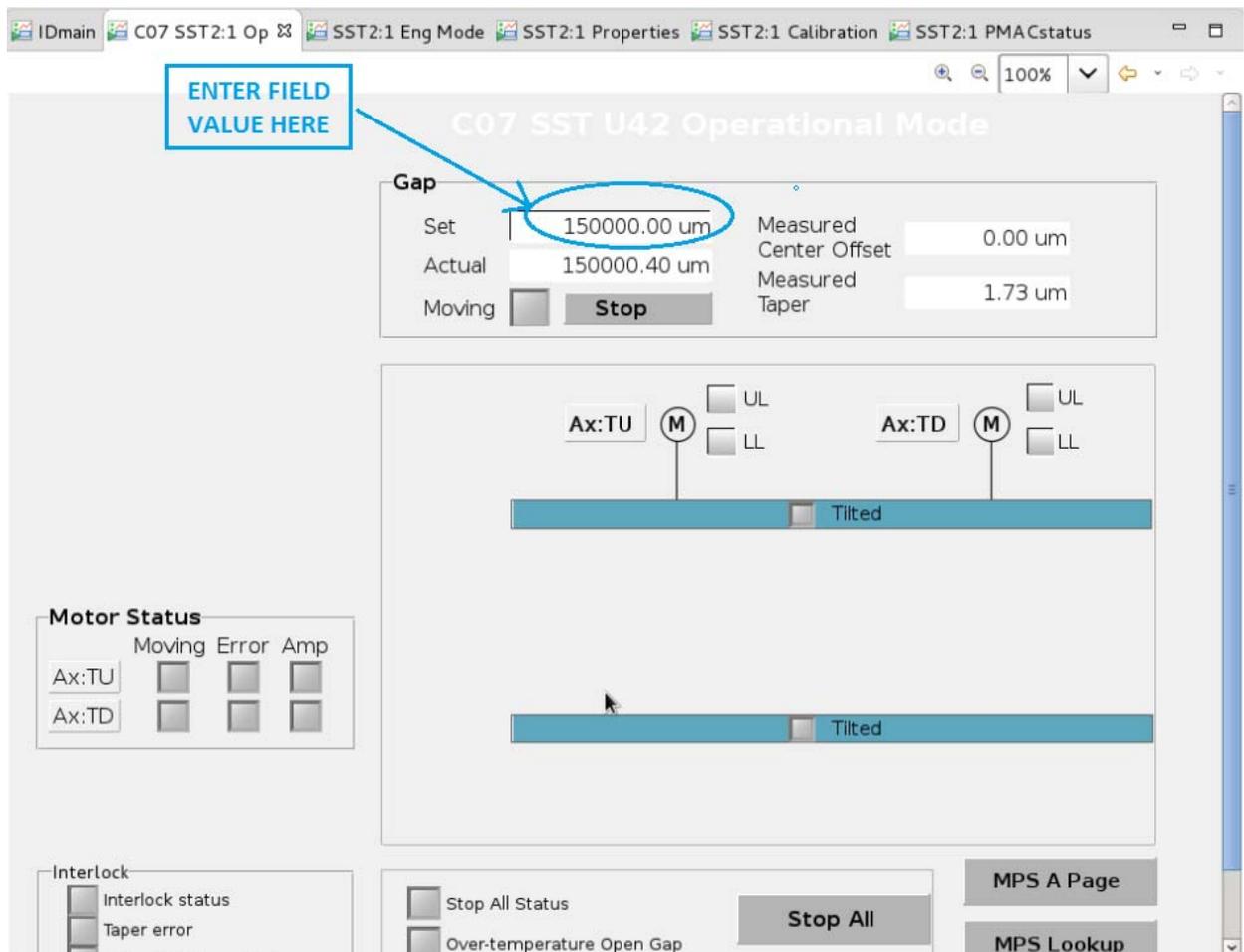


Figure 4-1: Changing U42 Undulator Gap Through CSS

- 4.1.6 In Operational Mode, command the Gap Drive System to drive to open gap (i.e., 150,000 μm):
 - a. Type 150,000 μm in the Gap Drive Set Point field (see Figure 4-1).
 - b. Press Enter on the screen.

National Synchrotron Light Source II, Brookhaven National Laboratory			
Doc No. NSLSII-ID-PRC-004	Author: H. Fernandes	Review Frequency: 3 yrs	Rev. 1
Title: Mezzanine-implemented LOTO for All Axes of SST U42 Undulator at Ring Cell 7			Effective Date: 15MAY2017

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 150,000 μm .

AND

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

AND

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 U42 Undulator Gap

The only official copy of this document is the one online in the NSLS-II SharePoint Document Center. Before using a printed copy, verify that it is current by checking the printed document's revision history with that of the online version.

National Synchrotron Light Source II, Brookhaven National Laboratory			
Doc No. NSLSII-ID-PRC-004	Author: H. Fernandes	Review Frequency: 3 yrs	Rev. 1
Title: Mezzanine-implemented LOTO for All Axes of SST U42 Undulator at Ring Cell 7			Effective Date: 15MAY2017

Note: The gap gauge used on the Damping Wigglers is also used for the U42 Undulator.

- 4.1.8 Notify the Control Room and all Affected Employees of the intent to LOTO the Cell 7 U42 Undulator.
- 4.1.9 Confirm that the Cell 7 U42 Undulator in the affected straight section AND its Control Rack are safe to shut down. Refer to Table 2-1 for the Control Rack location.



Figure 4-3: Cell 7 U42 Undulator Motor Controller Switch to be Locked Out

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

National Synchrotron Light Source II, Brookhaven National Laboratory			
Doc No. NSLSII-ID-PRC-004	Author: H. Fernandes	Review Frequency: 3 yrs	Rev. 1
Title: Mezzanine-implemented LOTO for All Axes of SST U42 Undulator at Ring Cell 7			Effective Date: 15MAY2017

- 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 a red lockout hasp 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.
- 4.1.15 Challenge the red lockout hasp 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., 75,000 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 7-ID U42 Undulator gap is fully open.
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 U42 Undulator 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.
- 4.2.5 Operations Staff OR ESH Staff apply a red bodied padlock and solid red lockout tag to the Lockout Key Lock Box.

National Synchrotron Light Source II, Brookhaven National Laboratory			
Doc No. NSLSII-ID-PRC-004	Author: H. Fernandes	Review Frequency: 3 yrs	Rev. 1
Title: Mezzanine-implemented LOTO for All Axes of SST U42 Undulator at Ring Cell 7			Effective Date: 15MAY2017

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 U42 Undulator 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 U42 Undulator:

- Solid red lockout tag
- Red bodied padlock
- Red lockout hasp

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

4.3.8 In Operational Mode (i.e., Manual), command the Gap Drive System to drive to a mid-gap position (i.e., 75,000 μm).

4.3.9 Check proper gap drive function by performing the following:

National Synchrotron Light Source II, Brookhaven National Laboratory			
Doc No. NSLSII-ID-PRC-004	Author: H. Fernandes	Review Frequency: 3 yrs	Rev. 1
Title: Mezzanine-implemented LOTO for All Axes of SST U42 Undulator at Ring Cell 7			Effective Date: 15MAY2017

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

AND

Note: Gap should be at the mid-gap markings on the gap gauge.

- 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 that in CSS, 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, solid red tags and red lockout hasp 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)*

6 ATTACHMENTS

None.

7 DOCUMENTATION

None.

The only official copy of this document is the one online in the NSLS-II SharePoint Document Center. Before using a printed copy, verify that it is current by checking the printed document's revision history with that of the online version.

National Synchrotron Light Source II, Brookhaven National Laboratory			
Doc No. NSLSII-ID-PRC-004	Author: H. Fernandes	Review Frequency: 3 yrs	Rev. 1
Title: Mezzanine-implemented LOTO for All Axes of SST U42 Undulator at Ring Cell 7			Effective Date: 15MAY2017

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.

[If you have any questions or feedback regarding this document, please click this link.](#)