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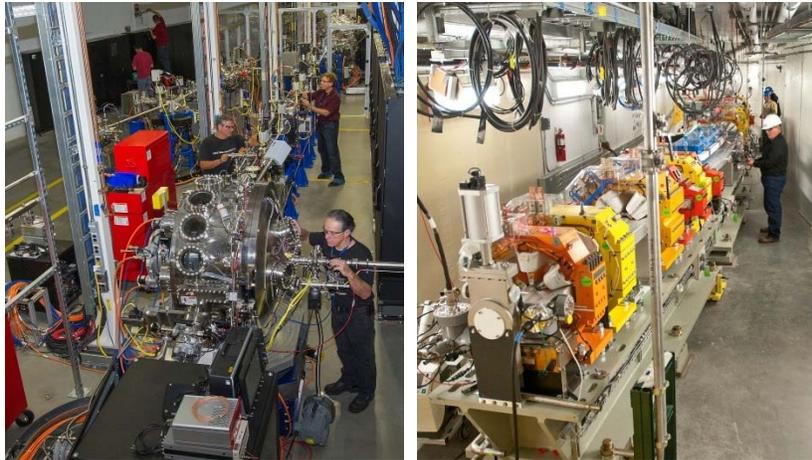
Doc No: NSLSII-ID-PRC-001

NSLS-II PROCEDURE: MEZZANINE-IMPLEMENTED LOTO FOR NYX IVU AT RING CELL 19

October 10, 2016

Rev. 1

H. Fernandes



 **Think Safety. Act Safely.**

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Title: Mezzanine-implemented LOTO for NYX IVU at Ring Cell 19			Effective Date: 10OCT2016

ESH Review:

10/11/2016

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:

10/7/2016

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:

10/14/2016

X Toshiya Tanabe

Toshi 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	10OCT2016	C. Chmiel B. Lein C. Porretto J. Rank K. Rubino T. Shaftan	First Issue. Validation performed by H. Fernandes, J. Rank and K. Rubino on 9/22/16.

ACRONYMS

BNL	Brookhaven National Laboratory	LOTO	Lockout/Tagout
CSS	Controls System Studio	NSLS-II	National Synchrotron Light Source II
EPS	Equipment Protection System	NYX	New York State Biology Center Microdiffraction
ESH	Environment, Safety & Health	PMAC	Program Multi-Axis (motor) Controller
GUI	Graphic User Interface	PPE	Personal Protective Equipment
ID	Insertion Devices	VAC	Volts Alternating Current
IVU	In-vacuum Undulator	VDC	Volts Direct Current
lb	Pound		

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1 PURPOSE AND SCOPE

The purpose of this procedure is to provide instructions for LOTO of the NSLS-II 19-ID NYX IVU from the mezzanine rack, at the “open gap” position, to protect against radiation when the IVU 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 19-ID NYX IVU for beam testing and/or ring commissioning absent IDs and 2) performing Centrally Controlled LOTO to safely take the NYX IVU 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 IVUs like the 19-ID shown in Figure 2-1.

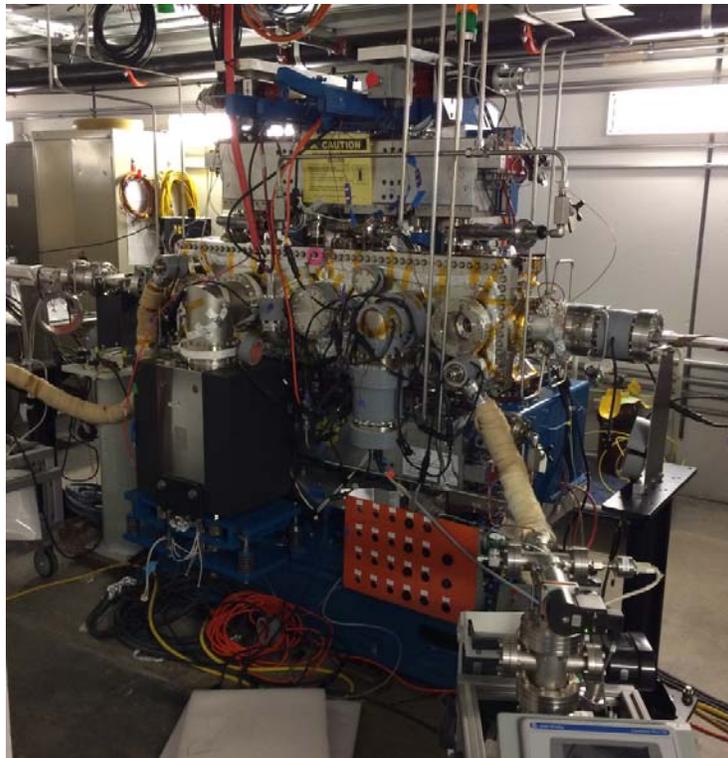


Figure 2-1: 19-ID NYX IVU

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- 2.2 Primary Authorized Employees performing this procedure have completed training for PS-C-ASD-PRC-005, *Centrally Controlled Lockout/Tagout (LOTO) Procedure*.
- 2.3 Each Primary Authorized Employee performing this procedure has facility specific PPE available.
- 2.4 Refer to Figures 2-2a and 2.2b, when necessary, for a wiring diagram depicting the motor amplifier disconnect that would be turned OFF (circled in red) for LOTO at the NYX IVU rack, residing on the mezzanine at 18-ID rack group "E."

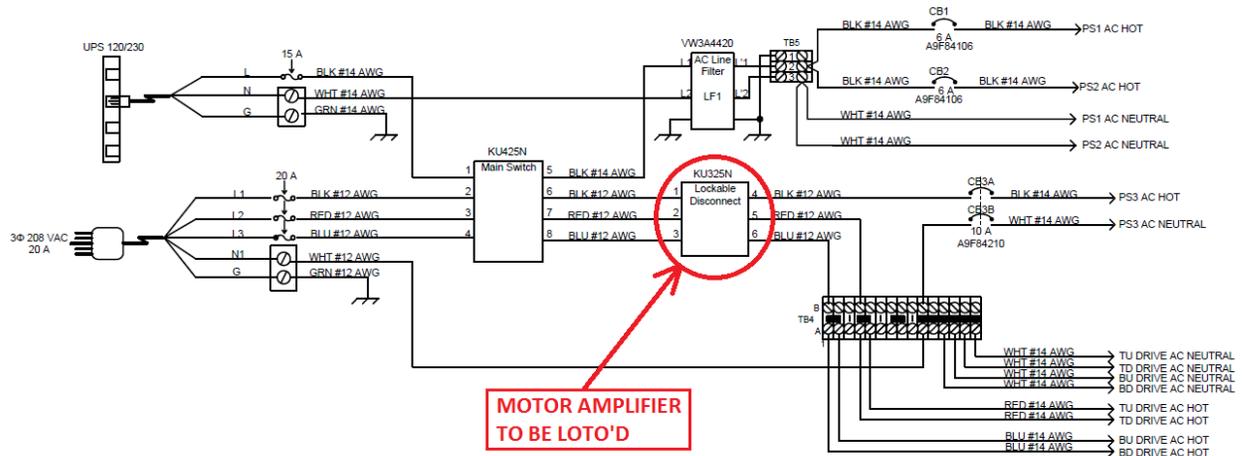


Figure 2-2a: NYX Control Rack Motor Amplifier Disconnect (sheet 1)

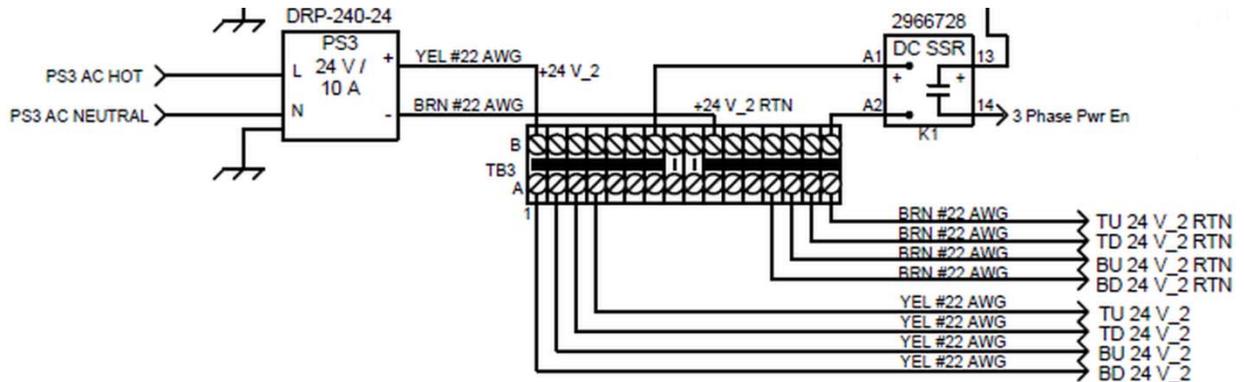


Figure 2-2b: NYX Control Rack Motor Amplifier Disconnect (sheet 1 cont.)

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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.

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 that require Centrally Controlled LOTO shall be performed in accordance with PS-C-ASD-PRC-005, *Centrally Controlled Lockout/Tagout (LOTO) Procedure*. 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 NYX IVU 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 disconnect is turned off and on throughout procedure, as necessary, to perform LOTO)
 - The NYX IVU Control Racks for Straight Sections at Cell 19 (reside on the mezzanine level above Cell 18) 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
 - Linear gap encoders (for readback of true gap to the NYX IVU Control System and CSS)
 - 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. The ID Group Cognizant Engineer/Technical Authority provides or directs System Expert support and clarification on any 19-ID NYX IVU system related issues.

4 PROCEDURE

Note: The following procedure shall be performed by Authorized and Qualified ID Group Personnel only, unless otherwise noted.

4.1 Apply Centrally Controlled LOTO

Caution: During and after completion of this procedure, the 19-ID NYX IVU and its Control Rack remain energized possibly resulting in a shock hazard; only the motor amplifier disconnect which energizes each of the motors/brakes is powered off.

- 4.1.1 Obtain the appropriate LOTO padlocks and solid red lockout tags and lockout hasp tree for LOTO of NYX IVU.
- 4.1.2 IF the ring is accessible, THEN visually verify the position of the ID Gap Drive.
- 4.1.3 Switch to Operational Mode from the GUI control screen (see Figure 4-1).
- 4.1.4 In Operational Mode, command the Gap Drive System to drive to a mid-gap position (i.e., 10,000 μm):
 - a. Type 10 mm in the Gap Set field as indicated in Figure 4-1.
 - b. Press the Enter Key on the keyboard.

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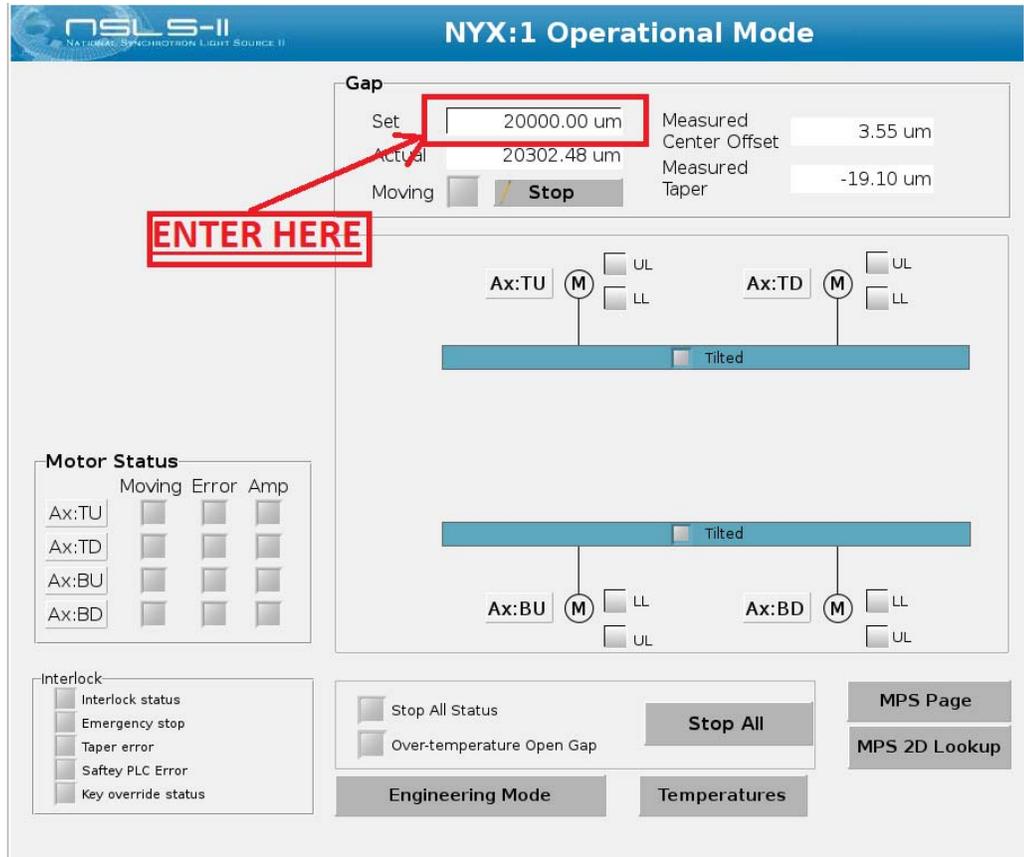


Figure 4-1: CSS Operational Screen to Control Gap Motion

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 set point of 10,000 μm , as indicated in Figure 4-1.

AND

Note: Gap should be at the mid gap marking on the gap gauge. The gap gauge (see Figure 2-3) shall be inserted at four locations as indicated in Figure 4-2.

- b. IF the ring is accessible, THEN confirm that mid-gap is reached by attempting to insert the gap gauge (ID-ML-7300) in the locations shown in Figure 4-3.

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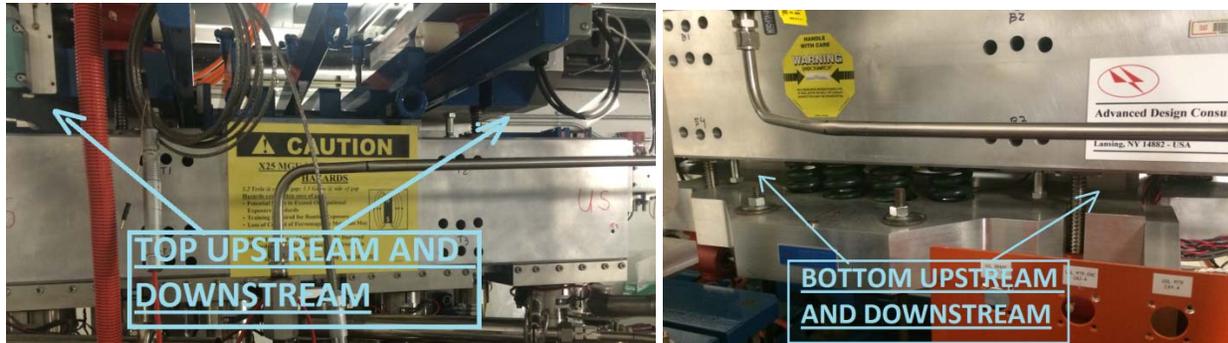


Figure 4-2: Gap Gauge Inserted at Four Locations

4.1.6 In Operational Mode, command the Gap Drive System to drive to open gap:

- a. Enter 20,000 μm in the Gap Set field as indicated in Figure 4-1.
- b. Press the Enter Key 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 set point of 20,000 μm as indicated in Figure 4-1.

AND

- b. Check the EPS switch status in CSS to ensure that open gap is indicated.

AND

Note: Gap gauge should slide inside gap (see Figure 4-3).

- c. IF the ring is accessible, THEN confirm that fully open gap is reached by inserting the gap gauge ID-ML-7300 at four locations, as indicated in Figures 4-2 and 4-3.

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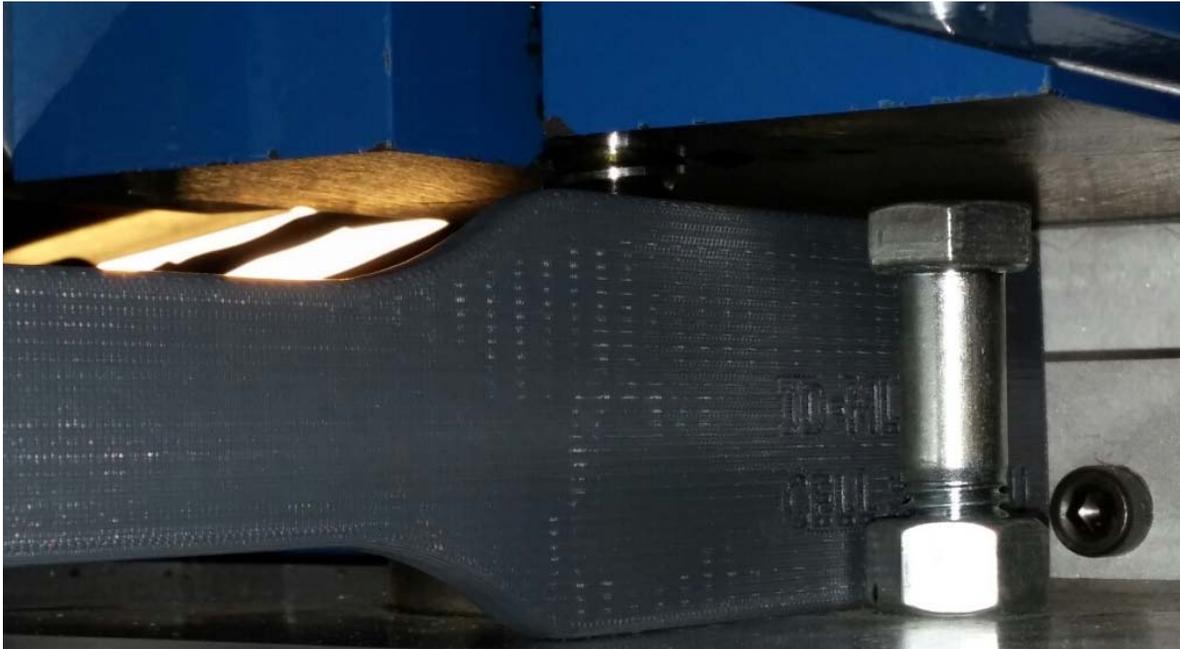


Figure 4-3: Gap Gauge Inserted at Top Downstream Girder

- 4.1.8 Notify all Affected Employees of the intent to LOTO the 19-ID NYX IVU.
- 4.1.9 Confirm that the 19-ID NYX IVU in the affected straight section AND its Control Rack are safe to shut down.

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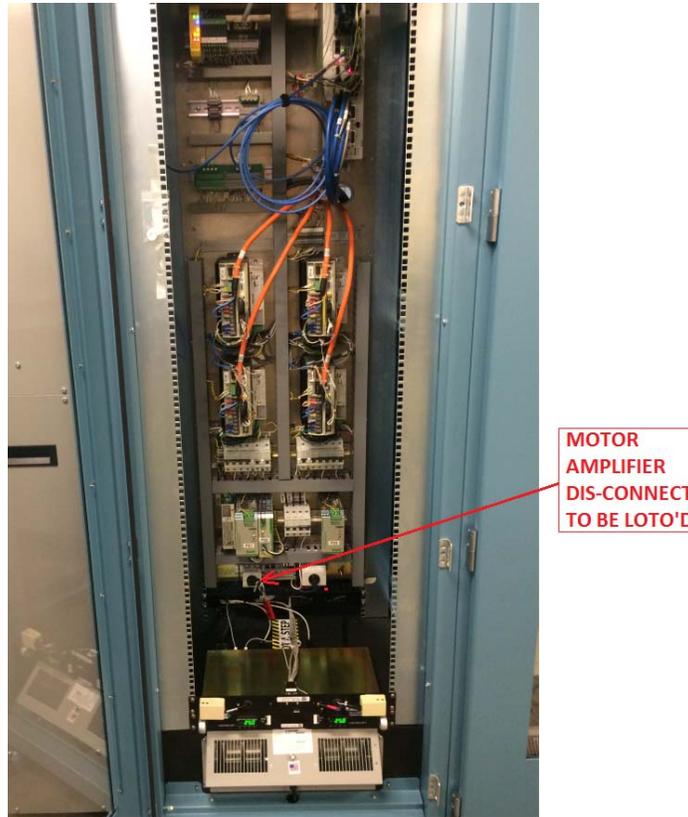


Figure 4-4: NYX IVU Control Rack

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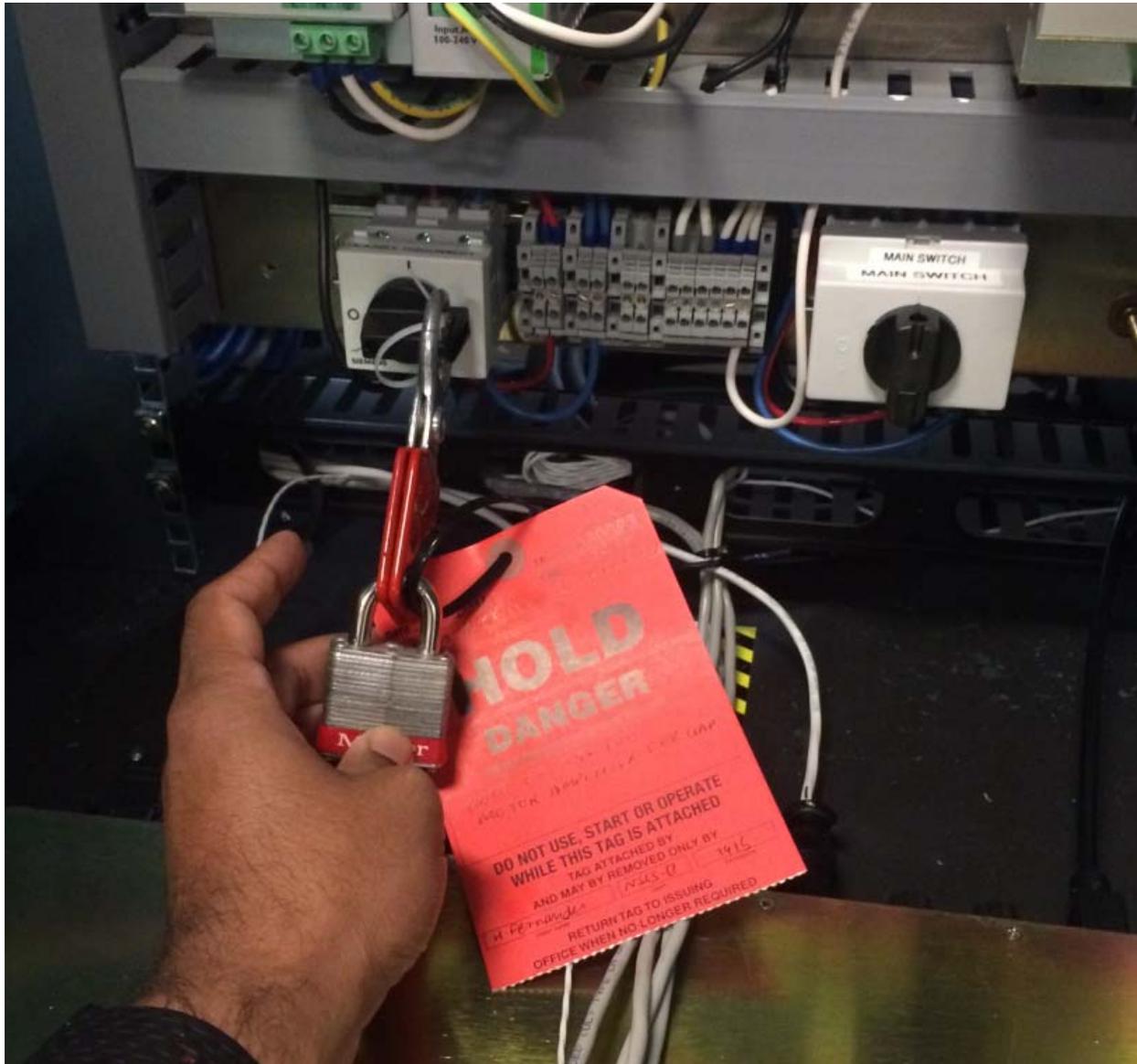


Figure 4-5: NYX IVU Motor Amplifier Disconnect to be Locked Out

- 4.1.10 At the rack (see Figures 2-2a, 2-2b and 4-4), identify the motor amplifier disconnect for all the motors.
- 4.1.11 De-energize the motor amplifier disconnect by turning to the off position.
- 4.1.12 Enter all information required on the face of the solid red lockout tag.

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4.1.13 Apply a lockout hasp tree and padlock to the de-energized motor amplifier disconnect as shown in Figure 4-5, in accordance with PS-C-ASD-PRC-005, *Centrally Controlled Lockout/Tagout (LOTO) Procedure*.

4.1.14 Hang the solid red lockout tag using a 50 lb. rated zip-tie from the padlock.

4.1.15 Challenge the padlock and lockout hasp tree to ensure it is installed securely.

4.2 Test Centrally Controlled LOTO

4.2.1 In Operational Mode, attempt to close the gap to confirm proper LOTO by commanding the Gap Drive System to drive to mid gap position (i.e., 10,000 μ m).

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 NYX IVU gap is fully open.

AND

Note: Gap gauge should slide inside gap (see Figure 4-3).

- b. IF the ring is accessible, THEN confirm fully open gap by inserting the gap gauge ID-ML-7300 at four locations as indicated in Figures 4-2 and 4.3.

AND

- c. Contact ESH OR Operations Staff to witness AND confirm that the position of the NYX IVU remains at open gap, using the gap gauge.

4.2.3 Place all padlock keys in the IVU Lockout key Lock Box.

4.2.4 Apply a padlock AND solid red lockout tag to the IVU Lockout key Lock Box.

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Note: After the Operations or ESH Staff apply their padlocks to the IVU Lockout key Lock Box, it will be kept in the Control Room for the duration of the LOTO.

4.2.5 Operations OR ESH Staff applies a padlock and solid red lockout tag to the IVU Lockout key Lock Box.

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

4.2.7 Document Centrally Controlled LOTO in accordance with PS-C-ASD-PRC-005, *Centrally Controlled Lockout/Tagout (LOTO) Procedure*.

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 NYX IVU and Control Rack in the affected straight section are safe to enable.

4.3.3 Contact Operations OR ESH Staff for removal of their padlock from the IVU 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 LOTO padlock keys from the IVU Lockout key Lock Box in accordance with PS-C-ASD-PRC-005, *Centrally Controlled Lockout/Tagout (LOTO) Procedure*.

4.3.6 Remove the following from the rack for the 19-ID NYX IVU:

- Solid red lockout tag
- Padlock
- Red lockout hasp tree

4.3.7 Energize the motors by turning the motor amplifier disconnect to the on position.

4.3.8 In Operational Mode (i.e., Manual), command the Gap Drive System to drive to a mid-gap position (i.e., 10,000 μm) as indicated in Figure 4-1.

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

- a. Confirm that the readout on the encoder "Actual" position has reached the set point of 10,000 μm , as indicated in Figure 4-1.

AND

Note: Gap should be at the mid gap marking on the gap gauge. The gap gauge (see Figure 2-3) shall be inserted at four locations as indicated in Figure 4-2.

- b. IF the ring is accessible, THEN confirm that mid-gap is reached by attempting to insert the gap gauge (ID-ML-7300) in the locations shown in Figure 4-3.

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 padlocks, lockout hasp tree and solid red tags to the LOTO station.

4.3.13 Document the clearing of Centrally Controlled LOTO in accordance with PS-C-ASD-PRC-005, *Centrally Controlled Lockout/Tagout (LOTO) Procedure*.

5 REFERENCES

- 5.2 PS-C-ASD-PRC-005, *Centrally Controlled Lockout/Tagout (LOTO) Procedure*

6 ATTACHMENTS

None.

7 DOCUMENTATION

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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 a 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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