NSLS-II Beamline 2-ID Radiological Interlock Test Checklist

Test Reason: Initial Test

Test Date: 11/13/2017

<table>
<thead>
<tr>
<th>Tester 1: Thomas McDonald</th>
<th>Tester 2: Brian Hennefeld</th>
</tr>
</thead>
</table>

* Tester 1 Signature: Thomas McDonald
* Tester 2 Signature: Brian Hennefeld

Reviewers:

<table>
<thead>
<tr>
<th>Reviewer 1:</th>
<th>Reviewer 2:</th>
</tr>
</thead>
</table>

** Safety Signature 2-ID (Beamline HMI)
A Chain: C1446E22  B Chain: 580A 2899

** Safety Signature Beamline 2 Beamline (SR HMI)
A Chain: P5450PB  B Chain: 56744344

PREPARATION:

I. All hutch door switches have been evaluated by NSLS-II Engineering for proper positioning

II. Inform Control Room Lead Operator that testing will be done

III. Obtain Beamline enable and PPS reset keys from Control Room

IV. Verify that beamline vacuum and water interlocks are satisfied

V. 2-ID Beamline Staff close isolation vacuum valves in preparation for vacuum sensor test steps

VI. Place muffler on beam imminent sounder

VII. Request Lead Operator enable Master shutters

A1 Verify System Lockouts

- Gun HVPS Enable Switch
- Linac modulator line cords (3) OR Booster Dipole F PS 480 V
- Booster RF HVPS 480 V OR Booster low level RF drive termination
- SR System C low level RF drive termination OR SR System C RF output connection to cavity
- SR System D low level RF drive termination OR SR System D RF output connection to cavity

A2 Verify Search and Time Beam Imminent Alarm

Verify that search path is free from obstacles and line of sight is clear in search mirrors in accordance with PS-C-XFD-PRC-010, Beamline Enclosure Search and Secure and Breaking Security Procedure

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Close the Right door

“Entry Permitted” sign is ON

Using the keypad, lock the closed doors

Press SB1

SB1 illuminates

Search sounder sounds

Search yellow beacon flashing

Press SB2

SB2 illuminates

Exit hutch and close main door

Press SBE and begin timing

Beam imminent alarm sounds for 30 seconds

After warning, FOE Interlocked A and B ON (green), HMI

“Interlocked” sign is ON

Maglock A and B ON (green), all doors, HMI

Press the SBE/Access Button

“Interlocked” sign OFF, “Entry Permitted” sign is ON

FOE Interlocked A and B OFF, HMI

Maglock A OFF (may require opening Maglock on key pad)

Open door

Door opens, Maglock B OFF
A3 **Out of Sequence Search in the FOE (A Hutch)**

- **Press SB2**
  - SB2 does not illuminate
- **Press SB1**
  - SB1 illuminates
- **Close hutch door and press SBE**
  - Hutch does NOT secure

A4 **Search Timeout**

- **Press first search button and begin timing**
- **Complete search without pressing Final Search button**
  - Search sounders off in 2 minutes
- **Press Final Search button**
  - Search does not complete

A5 **Shutter Enable**

1. Place actuators on FOE door switches and attach Maglock devices
2. Enable beamline with key and perform a reset
3. Search the FOE
4. Open FE Shutters
5. Close FE Shutters

- **Beamline Online A and B OFF**
- **Beamline Online A and B ON** (green)
- **FE Shutter Permits A and B ON after Beam**
- **Imminent Warning**
- **FE Shutters A and B indicate open** (green)
- **2 “Beam On” signs are ON**
- **FE Shutters A and B indicate closed** (red)
- **2 “Beam On” signs are OFF**
A6 **Emergency Stops (ES) FOE (A Hutch)**

For each ES search FOE hutch

**Open FE Shutters from keypad**

- FE Shutters A and B open (green)  
- FOE Interlocked A and B ON (green)  
- FE Shutter Permits A and B ON (green)  
- FE Critical Device Permits A and B ON  
- Right Maglock A ON (green)  
- Left Maglock A ON (green)  

**Press ES**

- FE Shutters A and B closed (red)  
- FOE Interlocked A and B OFF  
- FE Shutter Permits A and B OFF  
- FE Critical Device Permits A and B OFF  
- Right Maglock A OFF  
- Left Maglock A OFF  

**Pull out ES**

- ES Sum Latch OFF  

**Reset fault**

- ES Sum Latch ON (green)  

A7 **FOE Right Door Switches**

Place actuators on the door switches and Maglock.

Check the corresponding Permits for each switch tested (e.g., A Permit for switch A1).

**Search hutch**

**Open FE Shutters from keypad**

- FE Shutters A and B open (green)  
- FOE Interlocked A and B ON (green)  
- FE Shutter Permits A and B ON (green)  
- FOE Door Switch Sum A and B ON (green)  
- FE Critical Device Permits A and B ON
Remove one switch actuator

- FE Shutters A and B closed (red)
- FOE Interlocked OFF
- FE Shutter Permit OFF
- FOE Door Switch Sum OFF
- FE Critical Device Permits A and B OFF

Replace switch actuator and reset fault

Remove actuators and close door

---

**FOE Left Door Switches**

Place actuators on the door switches and Maglock.

Check the corresponding Permits for each switch tested (e.g., A Permit for switch A1).

Search hutch

Open FE Shutters from keypad

- FE Shutters A and B open (green)
- FOE Interlocked A and B ON (green)
- FE Shutter Permits A and B ON (green)
- FOE Door Switch Sum A and B ON (green)
- FE Critical Device Permits A and B ON

Remove one switch actuator

- FE Shutters A and B closed (red)
- FOE Interlocked OFF
- FE Shutter Permit OFF
- FOE Door Switch Sum OFF
- FE Critical Device Permits A and B OFF

Replace switch actuator and reset fault

Remove actuators and close door
A9 Magnetic Lock Test (FOE)

Connect the FOE test box to the PPS cabinet. Use the box to turn ON the Maglocks (set switches to "Normal").

Repeat steps for each door: Right (R) and Left (L)

<table>
<thead>
<tr>
<th>Search hutch</th>
<th>R</th>
<th>L</th>
</tr>
</thead>
<tbody>
<tr>
<td>FOE Interlocked A and B ON (green)</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>FE Shutter Permits A and B ON (green)</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Door Maglock A and B ON (green)</td>
<td>✓</td>
<td>✓</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Open FE Shutters</th>
<th>R</th>
<th>L</th>
</tr>
</thead>
<tbody>
<tr>
<td>FE Shutters open (green)</td>
<td>✓</td>
<td>✓</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Using FOE test box, turn OFF Maglock</th>
<th>R</th>
<th>L</th>
</tr>
</thead>
<tbody>
<tr>
<td>Door Maglock A OFF</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>FE Shutters closed (red)</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>FOE Interlocked A OFF</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>FE Shutter Permit A OFF</td>
<td>✓</td>
<td>✓</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Turn On Maglock and reset fault</th>
<th>R</th>
<th>L</th>
</tr>
</thead>
<tbody>
<tr>
<td>Search hutch</td>
<td>✓</td>
<td>✓</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Using FE Shutter test fixture, Open FE Shutters</th>
<th>R</th>
<th>L</th>
</tr>
</thead>
<tbody>
<tr>
<td>FE Critical Device Permits A and B ON</td>
<td>✓</td>
<td>✓</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Using FOE test box, turn OFF Maglock</th>
<th>R</th>
<th>L</th>
</tr>
</thead>
<tbody>
<tr>
<td>Within 3 seconds: FE Critical Device Permit A Chain OFF</td>
<td>✓</td>
<td>✓</td>
</tr>
</tbody>
</table>

Close FE Shutters and reset fault

 Disconnect FOE test box

A10 Vacuum Sensors Beamline SW-5

Qualified Beamline Staff will perform vacuum venting.

<table>
<thead>
<tr>
<th>SW5</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Vacuum sensor SW A and B ON (green)</td>
<td>✓</td>
</tr>
<tr>
<td>L1S3 Shutter A and B Permits ON (green)</td>
<td>✓</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Open Beamline Photon Shutter L1S3</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>L1S3 Shutter open (green)</td>
<td>✓</td>
</tr>
</tbody>
</table>
### National Synchrotron Light Source II, Brookhaven National Laboratory

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**Beamline Staff vents up section**

- Vacuum sensor SW A and B OFF  
- L1S3 Shutter A and B Permits OFF  
- L1S3 Shutter closed (red)  
- L1S1 Shutter A and B Permits ON (green)

**Using FE Shutter test fixture, open Shutter L1S3**

- Attempt to open Shutter L1S1  
  - L1S1 Shutter will not open

**Close Shutter L1S3, Beamline Staff returns vacuum**

- Vacuum sensor SW A and B ON (green)
- L1S3 Shutter A and B Permits OFF

**Reset fault**

- L1S3 Shutter A and B Permits ON (green)

---

### A11 Vacuum Sensors Beamline SW1-4

Qualified Beamline Staff will perform vacuum venting.

<table>
<thead>
<tr>
<th></th>
<th>SW1</th>
<th>SW2</th>
<th>SW3</th>
<th>SW4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vacuum sensor SW A and B ON (green)</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>L1S1 Shutter A and B Permits ON (green)</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
</tbody>
</table>

**Open Beamline Photon Shutter L1S1**

- L1S1 Shutter OPEN (green)

**Beamline Staff vents up section**

- Vacuum sensor SW A and B OFF  
- L1S1 Shutter A and B Permits OFF  
- L1S1 Shutter CLOSED (red)  
- FE Shutter A and B Permits ON (green)

**Using FE Shutter test fixture, open Shutter L1S1**

- FE Shutter A and B Permits OFF

**Close Shutter L1S1, Beamline Staff returns vacuum**

- Vacuum sensor SW A and B ON (green)
- L1S1 Shutter A and B Permits OFF
Reset fault

L1S1 Shutter A and B Permits ON (green)

Open Beamline Photon Shutter

L1S1 Shutter open (green)

A12 Water Interlock

Water flow meters for the PPS 1, 2 and 3 are located on top of the hutch (Figure 1).

![Water Flow Meters (PPS 1, 2, and 3)](image)

**Figure 1: Water Flow Meters (PPS 1, 2, and 3)**

The PPS Water Safety Test Amplifiers (STA) are located in the cabinet to the upper right of the meters on top of the hutch (Figure 2).

![PPS Water STAs](image)

**Figure 2: PPS Water STAs**

Record the pretest water flows for the PPS meters in GPM.
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<table>
<thead>
<tr>
<th>Meter Reading</th>
<th>Meter Reading</th>
<th>Current STA A</th>
<th>Current STA B</th>
</tr>
</thead>
<tbody>
<tr>
<td>A1 = 1.37</td>
<td>B1 = 1.29</td>
<td>A STA1 = 1.37</td>
<td>B STA1 = 1.29</td>
</tr>
<tr>
<td>A2 = 0.98</td>
<td>B2 = 0.89</td>
<td>A STA2 = 0.98</td>
<td>B STA2 = 0.89</td>
</tr>
<tr>
<td>A3 = 1.0</td>
<td>B3 = 1.0</td>
<td>A STA3 = 1.0</td>
<td>B STA3 = 1.0</td>
</tr>
</tbody>
</table>

The current programmed trip settings for the amplifiers are in column 1. The STA readouts for each tested A and B chain STAs will be recorded in columns 3 and 4. These recordings should be within 15% of the programmed trip point (column 2).

<table>
<thead>
<tr>
<th>Trip Points</th>
<th>Trip Points (-15%)</th>
<th>Recorded A Trip</th>
<th>Recorded B Trip</th>
</tr>
</thead>
<tbody>
<tr>
<td>PPS 1: 0.9 GPM</td>
<td>0.77 GPM</td>
<td>A STA1 = 0.9</td>
<td>B STA1 = 0.9</td>
</tr>
<tr>
<td>PPS 2: 0.7 GPM</td>
<td>0.6 GPM</td>
<td>A STA2 = 0.7</td>
<td>B STA2 = 0.7</td>
</tr>
<tr>
<td>PPS 3: 0.85 GPM</td>
<td>0.72 GPM</td>
<td>A STA3 = 0.85</td>
<td>B STA3 = 0.85</td>
</tr>
</tbody>
</table>

Repeat each step for all water flow meters

- **Open FE Shutter**
  - FE Shutters A and B open (green)  
  - Water Permits A and B ON (green), HMI  
  - FE Shutter Permits A and B ON (green), HMI

- **Using the valve, lower water flow to trip point**
  - FE Shutters A and B closed (red)  
  - In 5 seconds: FE Shutter Permits A and B OFF, HMI  
  - Water Permits A and B OFF, HMI  
  - Recorded STA A and B levels above; within 15%

- **Return water flow to pretest values**
  - Water Permits A and B remain OFF, HMI

- **Reset fault at PPS cabinet**
  - Water Permits A and B ON (green), HMI  
  - FE Shutter Permits A and B ON (green), HMI
A13 **Water Safety Test Amplifier Faults**

Repeat each step for all water flow meters

<table>
<thead>
<tr>
<th>Step Description</th>
<th>PPS1</th>
<th>PPS2</th>
<th>PPS3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Open FE Shutters with keypad</td>
<td>✔️</td>
<td>✔️</td>
<td>✔️</td>
</tr>
<tr>
<td>FE Shutters A and B open (green)</td>
<td>✔️</td>
<td>✔️</td>
<td>✔️</td>
</tr>
<tr>
<td>Water Permits A and B ON (green), HMI</td>
<td>✔️</td>
<td>✔️</td>
<td>✔️</td>
</tr>
<tr>
<td>FE Shutter Permits A and B ON (green), HMI</td>
<td>✔️</td>
<td>✔️</td>
<td>✔️</td>
</tr>
<tr>
<td>Press A chain fault/reset button</td>
<td>✔️</td>
<td>✔️</td>
<td>✔️</td>
</tr>
<tr>
<td>FE Shutters A and B closed (red)</td>
<td>✔️</td>
<td>✔️</td>
<td>✔️</td>
</tr>
<tr>
<td>Water Permit A OFF, HMI</td>
<td>✔️</td>
<td>✔️</td>
<td>✔️</td>
</tr>
<tr>
<td>In 5 seconds: FE Shutter Permit A OFF, HMI</td>
<td>✔️</td>
<td>✔️</td>
<td>✔️</td>
</tr>
<tr>
<td>Reset fault</td>
<td>✔️</td>
<td>✔️</td>
<td>✔️</td>
</tr>
<tr>
<td>Open FE Shutters with keypad</td>
<td>✔️</td>
<td>✔️</td>
<td>✔️</td>
</tr>
<tr>
<td>FE Shutters A and B open (green)</td>
<td>✔️</td>
<td>✔️</td>
<td>✔️</td>
</tr>
<tr>
<td>Water Permits A and B ON (green), HMI</td>
<td>✔️</td>
<td>✔️</td>
<td>✔️</td>
</tr>
<tr>
<td>FE Shutter Permits A and B ON (green), HMI</td>
<td>✔️</td>
<td>✔️</td>
<td>✔️</td>
</tr>
<tr>
<td>Press B chain fault/reset button</td>
<td>✔️</td>
<td>✔️</td>
<td>✔️</td>
</tr>
<tr>
<td>FE Shutters A and B closed (red)</td>
<td>✔️</td>
<td>✔️</td>
<td>✔️</td>
</tr>
<tr>
<td>Water Permit B OFF, HMI</td>
<td>✔️</td>
<td>✔️</td>
<td>✔️</td>
</tr>
<tr>
<td>In 5 seconds: FE Shutter Permit B OFF, HMI</td>
<td>✔️</td>
<td>✔️</td>
<td>✔️</td>
</tr>
<tr>
<td>Reset fault</td>
<td>✔️</td>
<td>✔️</td>
<td>✔️</td>
</tr>
</tbody>
</table>

A14 **Auxiliary Water Interlock**

Water flow meters for the Auxiliary PPS 4, 5 and 6 are located along the beamline (Figures 3, 4 and 5).
The Auxilirary PPS Water Safety Test Amplifiers (STA) are located in the cabinet on the left front side of the FOE (Figure 6).

```
<table>
<thead>
<tr>
<th>Figure 3: PPS 4 Water Meters</th>
<th>Figure 4: PPS 5 Water Meters</th>
<th>Figure 5: PPS 6 Water Meters</th>
</tr>
</thead>
</table>

**The current programmed trip settings for the amplifiers are in column 1. The STA readouts for each tested A and B chain STAs will be recorded in columns 3 and 4. These recordings should be within 15% of the programmed trip point (column 2).**

<table>
<thead>
<tr>
<th>Trip Points</th>
<th>Trip Points (-15 %)</th>
<th>Recorded A Trip</th>
<th>Recorded B Trip</th>
</tr>
</thead>
<tbody>
<tr>
<td>PPS 4: 0.9 GPM</td>
<td>0.77 GPM</td>
<td>A STA4= 0.9</td>
<td>B STA4= 0.9</td>
</tr>
<tr>
<td>PPS 5: 0.7 GPM</td>
<td>0.6 GPM</td>
<td>A STA5= 0.7</td>
<td>B STA5= 0.7</td>
</tr>
<tr>
<td>PPS 6: 0.4 GPM</td>
<td>0.34 GPM</td>
<td>A STA6= 0.4</td>
<td>B STA6= 0.4</td>
</tr>
</tbody>
</table>
```

Repeat each step for all water flow meters

PPS4  PPS5  PPS6
**Open FE and LIS1 Shutters**
- All Shutters A and B open *(green)*
- AUX Water Permits A and B ON *(green)*, HMI
- LIS1 Shutter Permits A and B ON *(green)*, HMI

**Using the valve, lower water flow to trip point**
- LIS1 Shutters A and B closed *(red)*
- LIS1 Shutter Permits A and B OFF, HMI
- AUX Water Permits A and B OFF, HMI

**Recorded STA A and B levels above within 15%**

**Open Shutter LIS1 with FOE test box**
- FE Shutters A and B closed *(red)*
- FE Shutter Permits A and B OFF, HMI

**Return water flow to pretest values**
- AUX Water Permits A and B remain OFF, HMI

**Reset fault at PPS cabinet**
- AUX Water Permits ON *(green)*, HMI
- FE Shutter Permits A and B ON *(green)*, HMI
- LIS1 Shutter Permits A and B ON *(green)*, HMI

**AUX Water Safety Test Amplifier Faults**
Repeat each step for all water flow meters

**Open LIS1 Shutter with keypad**
- LIS1 Shutter A and B open *(green)*
- AUX Water Permits A and B ON *(green)*, HMI
- LIS1 Shutter Permits A and B ON *(green)*, HMI

**Press A chain fault/reset button**
- LIS1 Shutter A and B closed *(red)*
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</tr>
</thead>
<tbody>
<tr>
<td>NSLSII-2ID-CHK-001</td>
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<td>23DEC2016</td>
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</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Test Case</th>
<th>FOE</th>
<th>L1S1</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>AUX Water Permit A OFF, HMI</strong></td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td><strong>L1S1 Shutter Permit A OFF, HMI</strong></td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td><strong>Reset fault</strong></td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td><strong>Open FE Shutter with keypad</strong></td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>L1S1 Shutter A and B open (green)</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>AUX Water Permits A and B ON (green), HMI</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>L1S1 Shutter Permits A and B ON (green), HMI</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td><strong>Press B chain fault/reset button</strong></td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>L1S1 Shutter A and B closed (red)</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>AUX Water Permit B OFF, HMI</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>L1S1 Shutter Permit B OFF, HMI</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td><strong>Reset fault</strong></td>
<td>✓</td>
<td>✓</td>
</tr>
</tbody>
</table>

#### A16 Observe Beamline Photon Shutter Operation

**Close Beamline Photon Shutter**

- Shutter indicates closed A and B (red), HMI
  - FOE ✓
  - L1S1 ✓

**Open Beamline Photon Shutter**

- Shutter opens smoothly without hesitation
  - FOE ✓
  - L1S1 ✓

**Close Beamline Photon Shutter**

- Shutter indicates closed A and B (red), HMI
  - FOE ✓
  - L1S1 ✓

#### A17 Observe FE Safety Shutter(s) Operation

With Maintenance Door open, connect FE Shutter test fixture

- Shutters are in the closed (down) position ✓
- FE Shutter A and B closed (red), HMI ✓

**Turn the "Air" switch ON**

- FE Shutter A and B closed (red), HMI ✓

**Open FE Photon Shutter and SSs A and B**

- Shutters open freely without hesitation ✓
Shutters are in the open (up) position
FE Shutters A and B open (green), HMI

Actuate Shutters closed
FE Shutters A and B closed (red), HMI

### A18 FE Safety Shutters can only be Closed if FE Photon Shutter is Closed

<table>
<thead>
<tr>
<th>Task</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Search Hutch</td>
<td>FOE Interlocked A and B ON (green), HMI</td>
</tr>
<tr>
<td></td>
<td>FE Critical Device Permits A and B ON (green), HMI</td>
</tr>
<tr>
<td>Open FE SSA</td>
<td>SSA Open</td>
</tr>
<tr>
<td>Open FE Photon Shutter</td>
<td>FE Critical Device Permits A and B OFF, HMI</td>
</tr>
<tr>
<td>Close Shutters</td>
<td></td>
</tr>
<tr>
<td>Reset fault</td>
<td>FE Critical Device Permits A and B ON (green), HMI</td>
</tr>
<tr>
<td>Open FE SSB</td>
<td>SSB Open</td>
</tr>
<tr>
<td>Open FE Photon Shutter</td>
<td>FE Critical Device Permits A and B OFF, HMI</td>
</tr>
<tr>
<td>Close Shutters</td>
<td></td>
</tr>
<tr>
<td>Reset fault</td>
<td>FE Critical Device Permits A and B ON (green), HMI</td>
</tr>
</tbody>
</table>

### A19 Beamline Enable Key (Opening Shutter without key trips SR RF and Dipole PS)

<table>
<thead>
<tr>
<th>Task</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Remove beamline enable key</td>
<td>Beamline Online A and B OFF</td>
</tr>
<tr>
<td>Search FOE</td>
<td>FOE Interlocked A and B ON (green), HMI</td>
</tr>
<tr>
<td>Using FE Shutter test fixture, Open FE Shutters</td>
<td>FE Critical Device Permits A and B ON (green), HMI</td>
</tr>
<tr>
<td>Using FE Shutter test fixture, Close FE Shutters</td>
<td>FE Critical Device Permits A and B OFF</td>
</tr>
<tr>
<td>Replace beamline enable key and reset faults</td>
<td>Beamline Online A and B ON (green)</td>
</tr>
</tbody>
</table>

### Live Testing

### A20 Reach Back FOE Door Switches

<table>
<thead>
<tr>
<th>Task</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Secure P1 through P5</td>
<td>SR Secure, A and B chain, SR HMI</td>
</tr>
<tr>
<td>Place actuators on FOE hutch door switches and Maglock</td>
<td></td>
</tr>
<tr>
<td>Search Hutch</td>
<td>FOE Interlocked A and B ON (green), HMI</td>
</tr>
<tr>
<td>Task</td>
<td>Status</td>
</tr>
<tr>
<td>----------------------------------------------------------------------</td>
<td>--------</td>
</tr>
<tr>
<td>FE Critical Device Permits A and B ON (green), HMI</td>
<td>✔️</td>
</tr>
<tr>
<td>FE Critical Device Permit A and B ON (green), SR HMI</td>
<td>✔️</td>
</tr>
<tr>
<td>FE Critical Device Permits A and B LEDs ON</td>
<td>✔️</td>
</tr>
<tr>
<td>FE Critical Device Permit Sum A and B LEDs ON</td>
<td>✔️</td>
</tr>
<tr>
<td>A and B Permits ON, Dipole PS Pos. Interface</td>
<td>✔️</td>
</tr>
<tr>
<td>A and B Permits ON, Dipole PS Neg. Interface</td>
<td>✔️</td>
</tr>
<tr>
<td>A and B Permits ON, SR RF System C HVPS Interface</td>
<td>✔️</td>
</tr>
<tr>
<td>A and B Permits ON, SR RF System D HVPS Interface</td>
<td>✔️</td>
</tr>
<tr>
<td>SR Dipole PS is ON</td>
<td>✔️</td>
</tr>
<tr>
<td>SR RF System C HVPS is ON</td>
<td>✔️</td>
</tr>
<tr>
<td>SR RF System D HVPS is ON</td>
<td>✔️</td>
</tr>
<tr>
<td>FE Shutters Open</td>
<td>✔️</td>
</tr>
<tr>
<td>Remove an &quot;A chain&quot; door switch actuator from beamline hutch door</td>
<td></td>
</tr>
<tr>
<td>FOE Interlocked A OFF, HMI</td>
<td>✔️</td>
</tr>
<tr>
<td>FE Critical Device Permit A OFF, HMI</td>
<td>✔️</td>
</tr>
<tr>
<td>FE Critical Device Permit A LED OFF</td>
<td>✔️</td>
</tr>
<tr>
<td>FE Critical Device Permit Sum A LED OFF</td>
<td>✔️</td>
</tr>
<tr>
<td>FE Critical Device Permit A OFF (red), SR HMI</td>
<td>✔️</td>
</tr>
<tr>
<td>A Permit OFF, SR RF System C HVPS Interface</td>
<td>✔️</td>
</tr>
<tr>
<td>A Permit OFF, SR RF System D HVPS Interface</td>
<td>✔️</td>
</tr>
<tr>
<td>A Permit OFF, Dipole PS Pos. Interface</td>
<td>✔️</td>
</tr>
<tr>
<td>A Permit OFF, Dipole PS Neg. Interface</td>
<td>✔️</td>
</tr>
<tr>
<td>SR RF System C HVPS is OFF</td>
<td>✔️</td>
</tr>
<tr>
<td>SR RF System D HVPS is OFF</td>
<td>✔️</td>
</tr>
<tr>
<td>SR Dipole PS is OFF</td>
<td>✔️</td>
</tr>
<tr>
<td>Close FE Shutters with FE Shutter test fixture</td>
<td>✔️</td>
</tr>
<tr>
<td>Replace &quot;A chain&quot; door switch actuator and reset fault(s)</td>
<td>✔️</td>
</tr>
</tbody>
</table>
Search hutch

FOE Interlocked A and B ON (green), HMI

FE Critical Device Permits A and B ON (green), HMI

Check Control Room SR HMI (MCR beamline 1)

FE Critical Device Permit A and B ON (green), SR HMI

Check I/O Box 2 Beamline Enable Panel

FE Critical Device Permits A and B LEDs ON

Check I/O Box 28 Beamline Enable Panel

FE Critical Device Permit Sum A and B LEDs ON

Check Dipole PS (positive) Beamline Interface

A and B Permits ON, Dipole PS Pos. Interface

Check Dipole PS (negative) Beamline Interface

A and B Permits ON, Dipole PS Neg. Interface

Check SR RF System C HVPS Beamline Interface

A and B Permits ON, SR RF System C HVPS Interface

Check SR RF System D HVPS Beamline Interface

A and B Permits ON, SR RF System D HVPS Interface

Operator enables SR Dipole PS

SR Dipole PS is ON

Operator enables SR RF System C HVPS

SR RF System C HVPS is ON

Operator enables SR RF System D HVPS

SR RF System D HVPS is ON

Using FE Shutter test fixture, open the FE Shutters (SSA, SSB and Photon)

FE Shutters Open

Remove “B chain” switch actuator

FOE Interlocked B OFF, HMI

FE Critical Device Permit B OFF, HMI

Check I/O Box 2 Beamline Enable Panel

FE Critical Device Permit B LED OFF

Check Control Room SR HMI (MCR beamline 1)

FE Critical Device Permit B OFF (red), SR HMI

Check I/O Box 28 Beamline Enable Panel

FE Critical Device Permit Sum B LED OFF

Check SR RF System C HVPS Beamline Interface

B Permit OFF, SR RF System C HVPS Interface

Check SR RF System D HVPS Beamline Interface

B Permit OFF, SR RF System D HVPS Interface

Check Dipole PS (positive) Beamline Interface

B Permit OFF, Dipole PS Pos. Interface

Check Dipole PS (negative) Beamline Interface

B Permit OFF, Dipole PS Neg. Interface

SR Dipole PS is OFF

SR RF System C HVPS is OFF

SR RF System D HVPS is OFF

Close FE Shutters with FE Shutter test fixture

FE Shutters closed

Remove beamline hutch switch actuators and Maglock actuator
A21 **Water Interlock (Live)**

Search FOE

- FOE Interlocked A and B ON (green), HMI
- FE Shutter Permits A and B ON (green), HMI
- FE Critical Device Permits A and B ON (green), HMI

Check I/O Box 2 Beamline Enable Panel

- FE Critical Device Permits A and B LEDs ON

Check I/O Box 28 Beamline Enable Panel

- FE Critical Device Permit Sum A and B LEDs ON

Check Control Room SR HMI (MCR beamline 1)

- FE Critical Device Permit A and B ON (green), SR HMI

Check Dipole PS (positive) Beamline Interface

- A and B Permits ON, Dipole PS Pos. Interface

Check Dipole PS (negative) Beamline Interface

- A and B Permits ON, Dipole PS Neg. Interface

Check SR RF System C HVPS Beamline Interface

- A and B Permits ON, SR RF System C HVPS Interface

Check SR RF System D HVPS Beamline Interface

- A and B Permits ON, SR RF System D HVPS Interface

Operator enables SR Dipole PS

- SR Dipole PS is ON

Operator enables SR RF System C HVPS

- SR RF System C HVPS is ON

Operator enables SR RF System D HVPS

- SR RF System D HVPS is ON

Using FE Shutter test fixture, turn on air and open Photon then SSs

- FE Shutters indicate open (green), HMI

Using water trip points in Step A12, lower flow to one meter

- Water Permits A and B OFF, HMI
- FE Shutter Permits A and B OFF, HMI

Within 5 seconds

- FE Critical Device Permits A and B OFF, HMI

Check I/O Box 2 Beamline Enable Panel

- FE Critical Device Permits A and B OFF

Check I/O Box 28 Beamline Enable Panel

- FE Critical Device Permit Sum A and B LEDs OFF

Check Control Room SR HMI (MCR beamline 1)

- FE Critical Device Permit A and B OFF, SR HMI

Check SR RF System C HVPS Beamline Interface

- A and B Permits OFF, SR RF System C HVPS Interface

Check SR RF System D HVPS Beamline Interface

- A and B Permits OFF, SR RF System D HVPS Interface

Check Dipole PS (positive) Beamline Interface

- A and B Permits OFF, Dipole PS Pos. Interface

Check Dipole PS (negative) Beamline Interface

- SR RF System C HVPS is OFF
- SR RF System D HVPS is OFF
A22 **Observe All Shutters Closed Sum**

- Close FE Shutters with FE Shutter test fixture
  - FE Shutters closed

- Return water flow to recorded level
  - ✔

- Reset fault(s)
  - ✔

- SR Dipole PS is OFF
  - ✔

A23 **FOE Area Radiation Monitor**

Refer to PS-C-ASD-PRC-008, *NSLS-II Area Radiation Monitor PPS Test and complete Attachment D, NSLS-II Beamline (FOE) Area Radiation Monitor Checklist.*

- FRM 2-ID Test Checklist Completed
  - ✔

A24 **Test Completion**

- Inspect all hutch doors and labyrinths to ensure all PPS switch and Maglock actuators have been removed
  - ✔

- Return Beamline enable key and Beamline PPS reset key to the Control Room
  - ✔

- Remove muffler from beam imminent sounder
  - ✔

- Ensure PPS cabinets are secure and locked; challenge locks
  - ✔

- Remove all LOTO
  - ✔

- Inform Lead Operator that testing is complete
  - ✔

**-END-**
Reviewed by:

1/5/2017

Scott Buda
Scott Buda
Accelerator Safety Systems Group Leader
Signed by: Buda, Scott

12/22/2016

Robert Chmiel
Robert Chmiel
NSLS-II Safety Officer
Signed by: Chmiel, Robert

Approved by:

12/22/2016

Robert Lee
Robert Lee
NSLS-II ESH Manager
Signed by: Lee, Robert

Revision History

<table>
<thead>
<tr>
<th>Revision</th>
<th>Description</th>
<th>Date</th>
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<tr>
<td>1</td>
<td>First Issue.</td>
<td>23DEC2016</td>
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