

National Synchrotron Light Source II, Brookhaven National Laboratory			
Doc No. PS-C-XFD-PRC-043	Author: T. McDonald	Effective Date: 22Jan2016 Review Frequency: 3 yrs	Version 1
Title: Beamline 8-ID Radiological Interlock Test			Technical

Attachment A

NSLS-II Beamline 8-ID Radiological Interlock Test Checklist

Test Reason: <i>Initial Test</i>	Test Result: <input checked="" type="checkbox"/> Passed <input type="checkbox"/> Failed
	Test Type: <input type="checkbox"/> Pre-Certification <input checked="" type="checkbox"/> Certification <input type="checkbox"/> Partial
Test Date: <i>1/26/16 - 2/22/16</i>	Start Time: <i>1300 (1/26)</i> Finish Time: <i>1600 (2/22)</i>
Tester 1: <i>Thomas McDonald, Brian Henereld</i>	Assistant 1: <i>Accelerator Division staff</i>
Tester 2: <i>Robert Chmiel, Gabrielle Stone</i>	Assistant 2:
Tester 1 Signature: <i>Thomas P. McDonald</i>	Tester 2 Signature: <i>Rust Chmiel</i>
*Reviewer 1:	Reviewer 1 sig.:
Reviewer 2:	Reviewer 2 sig.:
** Safety Signature 8-ID (Beamline HMI) A Chain: <i>3E56F443</i> B Chain: <i>40C97D86</i>	Previous 8-ID SS# Date: / / A Chain: B Chain:
** Safety Signature Pentant 3 Beamline (SR HMI) A Chain: <i>939F8D09</i> B Chain: <i>02E633AD</i>	Previous Pentant 3 SS# Date: / / A Chain: B Chain:

* A review by an Accelerator Safety Systems Engineer and a designated specialist (Reviewer 2) is only required upon a Test failure.
 **If Current Safety Signature number (found in top left corner on HMI) is different from previous number, contact the Accelerator Safety Systems Cognizant Engineer.

PREPARATION:

I. All hutch door switches have been evaluated by Mechanical 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. Place muffler on beam imminent sounder	✓
VI. Request Lead Operator enable Master shutters	✓

A1 Verify System Lockouts

- Gun HVPS output cable connector ✓
- Linac modulator line cords (3) OR Booster Dipole F PS 480V ✓
- 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

Repeat steps for each 8-ID Hutch

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	<u>A</u>	<u>B1</u>	<u>B2</u>
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, <i>Beamline Enclosure Search and Secure and Breaking Security Procedure</i>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
<i>Close all hutch secondary doors</i>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
"Entry Permitted" signs ON (2 signs on B2)	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
<i>Using the keypad, lock the closed doors</i>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
<i>Press SB1</i>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
SB1 illuminates	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Search sounder sounds	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Search yellow beacon flashing	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
<i>Press SB2</i>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
SB2 illuminates	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
<i>Exit hutch and close main door</i>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
<i>Press SBE and begin timing</i>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Beam imminent alarm sounds for 30 seconds	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
After warning, (FOE, B1, B2) Interlocked A and B ON (green), HMI	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
"Interlocked" signs ON (2 signs on B2)	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Maglock A and B ON (green), all doors, HMI	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
<i>Press the SBE/Access Button</i>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Interlocked signs OFF, "Entry Permitted" signs are ON (2 signs on B2)	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
FOE, B1, B2 Interlocked A and B OFF, HMI	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Maglock A OFF (may require opening Maglock on key pad)	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
<i>Open door</i>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Door opens, Maglock B OFF door	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>

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A3 Out of Sequence Search in the FOE (A hutch) and B hutches

Repeat steps for each 8-ID hutch

Press SB2

SB2 does not illuminate

Press SB1

SB1 illuminates

Close hutch door and press SBE

Hutch does NOT secure

<u>A</u>	<u>B1</u>	<u>B2</u>
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>

A4 Search timeout

Repeat steps for each 8-ID hutch

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

<u>A</u>	<u>B1</u>	<u>B2</u>
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>

A5 Disconnected Partition Wall Connectors will not allow search in the B hutches

In the B1 hutch disconnect the 2 connectors near the beam stop

Attempt a search of the hutch

Search does not complete on either Chain

Reconnect the 2 connectors

<input checked="" type="checkbox"/>		
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
		<input checked="" type="checkbox"/>

A6 Shutter enable

Place actuators on FOE door switches and attach Maglock devices

Beamline Online A and B OFF

Enable beamline with key and perform a reset

Beamline Online A and B ON (green)

Search the FOE

FE Shutter Permits A and B ON after Beam

Imminent Warning

Open FE shutters

FE Shutters A and B indicate open (green)

"Beam On" sign is ON

Close FE shutters

FE Shutters A and B indicate closed (red)

<input checked="" type="checkbox"/>

A7 Emergency Stops (ES) FOE (A hutch)

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Rear Maglock ON A and B (green) <i>1.2M 1/26/16</i>	<u> </u>	<u> </u>	<u> </u>
<i>Press ES</i>	<u>✓</u>	<u>✓</u>	<u>✓</u>
FE Shutters A and B closed (red)	<u>✓</u>	<u>✓</u>	<u>✓</u>
L1S1 Shutter A and B closed (red)	<u>✓</u>	<u>✓</u>	<u>✓</u>
B1 Interlocked A and B permits OFF	<u>✓</u>	<u>✓</u>	<u>✓</u>
L1S1 Shutter Permit A and B OFF	<u>✓</u>	<u>✓</u>	<u>✓</u>
FE Critical Device Permits A and B OFF	<u>✓</u>	<u>✓</u>	<u>✓</u>
Front Right Maglock A OFF	<u>✓</u>	<u>✓</u>	<u>✓</u>
Front Left Maglock A OFF	<u>✓</u>	<u>✓</u>	<u>✓</u>
Rear Maglock A OFF <i>1.2M 1/26/16</i>	<u> </u>	<u> </u>	<u> </u>

<i>Pull out ES</i>	<u>✓</u>	<u>✓</u>	<u>✓</u>
ES Sum Latch OFF	<u>✓</u>	<u>✓</u>	<u>✓</u>
<i>Reset fault</i>	<u>✓</u>	<u>✓</u>	<u>✓</u>
ES Sum Latch ON (green)	<u>✓</u>	<u>✓</u>	<u>✓</u>

A9 **Emergency Stops (ES) B2 hutch**

For each ES search hutch. Open beam stop in B1.	<u>ES1</u>	<u>ES2</u>	<u>ES3</u>
<i>Open FE and L1S1 shutters from keypad</i>	<u>✓</u>	<u>✓</u>	<u>✓</u>
FE Shutters A and B open (green)	<u>✓</u>	<u>✓</u>	<u>✓</u>
L1S1 Shutter A and B open (green)	<u>✓</u>	<u>✓</u>	<u>✓</u>
B2 Interlocked A and B ON (green)	<u>✓</u>	<u>✓</u>	<u>✓</u>
L1S1 Shutter Permit A and B ON (green)	<u>✓</u>	<u>✓</u>	<u>✓</u>
FE Critical Device Permits A and B ON	<u>✓</u>	<u>✓</u>	<u>✓</u>
<i>1.2M 1/26/16</i> Front Right Maglock ON A and B (green)	<u>✓</u>	<u>✓</u>	<u>✓</u>
<i>1.2M 1/26/16</i> Front Left Maglock ON A and B (green) <i>REAR RIGHT AND</i>	<u>✓</u>	<u>✓</u>	<u>✓</u>
<i>Press ES</i>	<u>✓</u>	<u>✓</u>	<u>✓</u>
FE Shutters A and B closed (red)	<u>✓</u>	<u>✓</u>	<u>✓</u>
L1S1 Shutter A and B closed (red)	<u>✓</u>	<u>✓</u>	<u>✓</u>
B2 Interlocked A and B permits OFF	<u>✓</u>	<u>✓</u>	<u>✓</u>

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L1S1 Shutter Permit A and B OFF	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
FE Critical Device Permits A and B OFF	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Front Right Maglock A OFF	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
<i>TM REAR RIGHT AND</i> <i>126 118</i> Front Left Maglock A OFF	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Pull out ES	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
ES Sum Latch OFF	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Reset fault	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
ES Sum Latch ON (green)	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>

A10 Hutch B1 Labyrinth 1 Switches and Latches

Place actuators on the labyrinth switches/latches and ownstream left door switches and Maglock. ✓

Check the corresponding Permits for each switch tested (e.g., A Permit for switch A1). Latch trips on both A and B Permits. **Note:** B chain reed and push button switches must be cycled together for reset.

	A1	A2	B1	B2	Latch
Search hatch	<input checked="" type="checkbox"/>				
Open FE and L1S1 Shutters from keypad	<input checked="" type="checkbox"/>				
L1S1 Shutter A and B open (green)	<input checked="" type="checkbox"/>				
B1 Interlocked A and B Permit ON (green)	<input checked="" type="checkbox"/>				
L1S1 Shutter Permit A and B ON (green)	<input checked="" type="checkbox"/>				
Cable Lab 1 Switches/Latch A and B ON (green)	<input checked="" type="checkbox"/>				
FE Critical Device Permits A and B ON	<input checked="" type="checkbox"/>				
Remove one switch actuator	<input checked="" type="checkbox"/>				
Cable Lab 1 Switch/Latch Permit OFF	<input checked="" type="checkbox"/>				
B1 Interlocked Permit OFF	<input checked="" type="checkbox"/>				
L1S1 Shutter Permit OFF	<input checked="" type="checkbox"/>				
L1S1 Shutter A and B closed (red)	<input checked="" type="checkbox"/>				
FE Critical Device Permits A and B OFF	<input checked="" type="checkbox"/>				
Replace switch actuator and reset fault	<input checked="" type="checkbox"/>				
Remove labyrinth actuators and close labyrinth door					<input checked="" type="checkbox"/>

A11 Hutch B2 Labyrinth 1 Switches and Latches

Place actuators on the labyrinth switches/latches and downstream left door switches and Maglock. ✓

Check the corresponding Permits for each switch tested (e.g., A Permit for switch A1). Latch trips on both A and B Permits. **Note:** B chain reed and push button switches must be cycled together for reset.

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	<u>A1</u>	<u>A2</u>	<u>B1</u>	<u>B2</u>	<u>Latch</u>
Open beam stop in B1.	✓	✓	✓	✓	✓
Search hutch	✓	✓	✓	✓	✓
Open FE and LIS1 Shutters from keypad	✓	✓	✓	✓	✓
LIS1 Shutter A and B open (green)	✓	✓	✓	✓	✓
B2 Interlocked A and B Permit ON (green)	✓	✓	✓	✓	✓
LIS1 Shutter Permit A and B ON (green)	✓	✓	✓	✓	✓
Cable Lab 1 Switches/Latch A and B ON (green)	✓	✓	✓	✓	✓
FE Critical Device Permits A and B ON	✓	✓	✓	✓	✓
Remove one switch actuator	✓	✓	✓	✓	✓
Cable Lab 1 Switch/Latch Permit OFF	✓	✓	✓	✓	✓
B2 Interlocked Permit OFF	✓	✓	✓	✓	✓
LIS1 Shutter Permit OFF	✓	✓	✓	✓	✓
LIS1 Shutters A and B closed (red)	✓	✓	✓	✓	✓
FE Critical Device Permits A and B OFF	✓	✓	✓	✓	✓
Replace switch actuator and reset fault	✓	✓	✓	✓	✓
Remove labyrinth actuators and close labyrinth door					✓

A12 **Hutch B2 Labyrinth 2 Switches and Latches**

THERE IS ONLY ONE LABYRINTH IN B2 TM 2/22/16

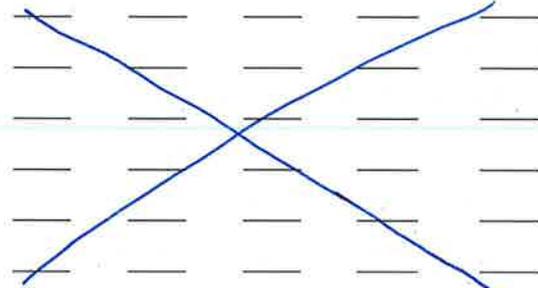
Place actuators on the labyrinth switches/latches and downstream left door switches and maglock. ✓

Check the corresponding Permits for each switch tested (e.g., A Permit for switch A1). Latch trips on both A and B Permits. **Note:** B chain reed and push button switches must be cycled together for reset.

	<u>A1</u>	<u>A2</u>	<u>B1</u>	<u>B2</u>	<u>Latch</u>
Open beam stop in B1.	—	—	—	—	—
Search hutch	—	—	—	—	—
Open FE and LIS1 Shutters from keypad	—	—	—	—	—
LIS1 Shutter A and B open (green)	—	—	—	—	—
B2 Interlocked A and B Permit ON (green)	—	—	—	—	—
LIS1 Shutter Permit A and B ON (green)	—	—	—	—	—
Cable Lab 1 Switches/Latch A and B ON (green)	—	—	—	—	—
FE Critical Device Permits A and B ON	—	—	—	—	—
Remove one switch actuator	—	—	—	—	—

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- Cable Lab 1 Switch/Latch Permit OFF
- B2 Interlocked Permit OFF
- L1S1 Shutter Permit OFF
- L1S1 Shutters A and B closed (**red**)
- FE Critical Device Permits A and B OFF



Replace switch actuator and reset fault

Remove labyrinth actuators and close labyrinth door

*THERE IS ONLY ONE LABYRINTH
IN THE B2 HUTCH
1/21
2/22/16*

A13 FOE Upstream 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).

	<u>A1</u>	<u>A2</u>	<u>B1</u>	<u>B2</u>	<u>Reed</u>
<i>Search hutch</i>	✓	✓	✓	✓	✓
<i>Open FE Shutters from keypad</i>	✓	✓	✓	✓	✓
FE Shutters A and B open (green)	✓	✓	✓	✓	✓
FOE Interlocked A and B Permit ON (green)	✓	✓	✓	✓	✓
FE Shutter Permit A and B ON (green)	✓	✓	✓	✓	✓
FOE Door Switch Sum A and B ON (green)	✓	✓	✓	✓	✓
FE Critical Device Permits A and B ON	✓	✓	✓	✓	✓
<i>Remove one switch actuator</i>	✓	✓	✓	✓	✓
FE Shutters A and B closed (red)	✓	✓	✓	✓	✓
FOE Interlocked Permit OFF	✓	✓	✓	✓	✓
FE Shutter Permit OFF	✓	✓	✓	✓	✓
FOE Door Switch Sum OFF	✓	✓	✓	✓	✓
FE Critical Device Permits A and B OFF	✓	✓	✓	✓	✓
<i>Replace switch actuator and reset fault</i>	✓	✓	✓	✓	✓
Remove actuators and close door					✓

A14 FOE Upstream Left Door Switches

Place actuators on the door switches and Maglock. ✓

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

	<u>A1</u>	<u>A2</u>	<u>B1</u>	<u>B2</u>	<u>Reed</u>
<i>Search hutch</i>	<input checked="" type="checkbox"/>				
<i>Open FE Shutters from keypad</i>	<input checked="" type="checkbox"/>				
FE Shutters A and B open (green)	<input checked="" type="checkbox"/>				
FOE Interlocked A and B Permit ON (green)	<input checked="" type="checkbox"/>				
FE Shutter Permit A and B ON (green)	<input checked="" type="checkbox"/>				
FOE Door Switch Sum A and B ON (green)	<input checked="" type="checkbox"/>				
FE Critical Device Permits A and B ON	<input checked="" type="checkbox"/>				
<i>Remove one switch actuator</i>	<input checked="" type="checkbox"/>				
FE Shutters A and B closed (red)	<input checked="" type="checkbox"/>				
FOE Interlocked Permit OFF	<input checked="" type="checkbox"/>				
FE Shutter Permit OFF	<input checked="" type="checkbox"/>				
FOE Door Switch Sum OFF	<input checked="" type="checkbox"/>				
FE Critical Device Permits A and B OFF	<input checked="" type="checkbox"/>				
<i>Replace switch actuator and reset fault</i>	<input checked="" type="checkbox"/>				
Remove actuators and close door					<input checked="" type="checkbox"/>

A15 FOE Downstream 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).

	<u>A1</u>	<u>A2</u>	<u>B1</u>	<u>B2</u>	<u>Reed</u>
<i>Search hutch</i>	<input checked="" type="checkbox"/>				
<i>Open FE Shutters from keypad</i>	<input checked="" type="checkbox"/>				
FE Shutters A and B open (green)	<input checked="" type="checkbox"/>				
FOE Interlocked A and B Permit ON (green)	<input checked="" type="checkbox"/>				
FE Shutter Permit A and B ON (green)	<input checked="" type="checkbox"/>				
FOE Door Switch Sum A and B ON (green)	<input checked="" type="checkbox"/>				
FE Critical Device Permits A and B ON	<input checked="" type="checkbox"/>				
<i>Remove one switch actuator</i>	<input checked="" type="checkbox"/>				
FE Shutters A and B closed (red)	<input checked="" type="checkbox"/>				

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FOE Interlocked Permit OFF	<input checked="" type="checkbox"/>				
FE Shutter Permit OFF	<input checked="" type="checkbox"/>				
FOE Door Switch Sum OFF	<input checked="" type="checkbox"/>				
FE Critical Device Permits A and B OFF	<input checked="" type="checkbox"/>				
<i>Replace switch actuator and reset fault</i>	<input checked="" type="checkbox"/>				
Remove actuators and close door					<input checked="" type="checkbox"/>

A16 FOE Downstream 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).

	<u>A1</u>	<u>A2</u>	<u>B1</u>	<u>B2</u>	<u>Reed</u>
<i>Search hutch</i>	<input checked="" type="checkbox"/>				
<i>Open FE Shutters from keypad</i>	<input checked="" type="checkbox"/>				
FE Shutters A and B open (green)	<input checked="" type="checkbox"/>				
FOE Interlocked A and B Permit ON (green)	<input checked="" type="checkbox"/>				
FE Shutter Permit A and B ON (green)	<input checked="" type="checkbox"/>				
FOE Door Switch Sum A and B ON (green)	<input checked="" type="checkbox"/>				
FE Critical Device Permits A and B ON	<input checked="" type="checkbox"/>				
<i>Remove one switch actuator</i>	<input checked="" type="checkbox"/>				
FE Shutters A and B closed (red)	<input checked="" type="checkbox"/>				
FOE Interlocked Permit OFF	<input checked="" type="checkbox"/>				
FE Shutter Permit OFF	<input checked="" type="checkbox"/>				
FOE Door Switch Sum OFF	<input checked="" type="checkbox"/>				
FE Critical Device Permits A and B OFF	<input checked="" type="checkbox"/>				
<i>Replace switch actuator and reset fault</i>	<input checked="" type="checkbox"/>				
Remove actuators and close door					<input checked="" type="checkbox"/>

A17 B1 Hutch 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).

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	<u>A1</u>	<u>A2</u>	<u>B1</u>	<u>B2</u>	<u>Reed</u>
<i>Search hutch</i>	✓	✓	✓	✓	✓
<i>Open FE and LIS1 Shutter s from keypad</i>	✓	✓	✓	✓	✓
FE Shutters A and B open (green)	✓	✓	✓	✓	✓
LIS1 Shutter A and B open (green)	✓	✓	✓	✓	✓
B1 Interlocked A and B Permit ON (green)	✓	✓	✓	✓	✓
LIS1 Shutter Permit A and B ON (green)	✓	✓	✓	✓	✓
B Door Switch Sum A and B ON (green)	✓	✓	✓	✓	✓
FE Critical Device Permits A and B ON	✓	✓	✓	✓	✓
<i>Remove one switch actuator</i>	✓	✓	✓	✓	✓
LIS1 Shutter A and B closed (red)	✓	✓	✓	✓	✓
B1 Interlocked Permit OFF	✓	✓	✓	✓	✓
LIS1 Shutter Permit OFF	✓	✓	✓	✓	✓
B Door Switch Sum Permit OFF	✓	✓	✓	✓	✓
FE Critical Device Permits A and B OFF	✓	✓	✓	✓	✓
<i>Replace switch actuator and reset fault</i>	✓	✓	✓	✓	✓
Remove actuators and close door					✓

A18 B1 Hutch 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).

	<u>A1</u>	<u>A2</u>	<u>B1</u>	<u>B2</u>	<u>Reed</u>
<i>Search hutch</i>	✓	✓	✓	✓	✓
<i>Open FE and LIS1 Shutters from keypad</i>	✓	✓	✓	✓	✓
FE Shutters A and B open (green)	✓	✓	✓	✓	✓
LIS1 Shutter A and B open (green)	✓	✓	✓	✓	✓
B1 Interlocked A and B Permit ON (green)	✓	✓	✓	✓	✓
LIS1 Shutter Permit A and B ON (green)	✓	✓	✓	✓	✓
B Door Switch Sum A and B ON (green)	✓	✓	✓	✓	✓
FE Critical Device Permits A and B ON	✓	✓	✓	✓	✓
<i>Remove one switch actuator</i>	✓	✓	✓	✓	✓

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L1S1 Shutter A and B closed (red)	<input checked="" type="checkbox"/>				
B1 Interlocked Permit OFF	<input checked="" type="checkbox"/>				
L1S1 Shutter Permit OFF	<input checked="" type="checkbox"/>				
B Door Switch Sum Permit OFF	<input checked="" type="checkbox"/>				
FE Critical Device Permits A and B OFF	<input checked="" type="checkbox"/>				
<i>Replace switch actuator and reset fault</i>	<input checked="" type="checkbox"/>				
Remove actuators and close door					<input checked="" type="checkbox"/>

A19 **B2 Hutch Front 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).

Open beam stop in B1.

Search hutch

Open FE and L1S1 Shutter s from keypad

	A1	A2	B1	B2	Reed
FE Shutters A and B open (green)	<input checked="" type="checkbox"/>				
L1S1 Shutter A and B open (green)	<input checked="" type="checkbox"/>				
B2 Interlocked A and B Permit ON (green)	<input checked="" type="checkbox"/>				
L1S1 Shutter Permit A and B ON (green)	<input checked="" type="checkbox"/>				
B2 Door Switch Sum A and B ON (green)	<input checked="" type="checkbox"/>				
FE Critical Device Permits A and B ON	<input checked="" type="checkbox"/>				

Remove one switch actuator

L1S1 Shutter A and B closed (red)	<input checked="" type="checkbox"/>				
B2 Interlocked Permit OFF	<input checked="" type="checkbox"/>				
L1S1 Shutter Permit OFF	<input checked="" type="checkbox"/>				
B2 Door Switch Sum Permit OFF	<input checked="" type="checkbox"/>				
FE Critical Device Permits A and B OFF	<input checked="" type="checkbox"/>				

Replace switch actuator and reset fault

Remove actuators and close door ✓

A20 **B2 Hutch Right Rear 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).

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	<u>A1</u>	<u>A2</u>	<u>B1</u>	<u>B2</u>	<u>Reed</u>
Open beam stop in B1.	<input checked="" type="checkbox"/>				
<i>Search hutch</i>	<input checked="" type="checkbox"/>				
<i>Open FE and L1S1 Shutter s from keypad</i>	<input checked="" type="checkbox"/>				
FE Shutters A and B open (green)	<input checked="" type="checkbox"/>				
L1S1 Shutter A and B open (green)	<input checked="" type="checkbox"/>				
B2 Interlocked A and B Permit ON (green)	<input checked="" type="checkbox"/>				
L1S1 Shutter Permit A and B ON (green)	<input checked="" type="checkbox"/>				
B2 Door Switch Sum A and B ON (green)	<input checked="" type="checkbox"/>				
FE Critical Device Permits A and B ON	<input checked="" type="checkbox"/>				
<i>Remove one switch actuator</i>	<input checked="" type="checkbox"/>				
L1S1 Shutter A and B closed (red)	<input checked="" type="checkbox"/>				
B2 Interlocked Permit OFF	<input checked="" type="checkbox"/>				
L1S1 Shutter Permit OFF	<input checked="" type="checkbox"/>				
B2Door Switch Sum Permit OFF	<input checked="" type="checkbox"/>				
FE Critical Device Permits A and B OFF	<input checked="" type="checkbox"/>				
<i>Replace switch actuator and reset fault</i>	<input checked="" type="checkbox"/>				
Remove actuators and close door					<input checked="" type="checkbox"/>

A21 **B2 Hutch Left Rear 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).

	<u>A1</u>	<u>A2</u>	<u>B1</u>	<u>B2</u>	<u>Reed</u>
Open beam stop in B1.	<input checked="" type="checkbox"/>				
<i>Search hutch</i>	<input checked="" type="checkbox"/>				
<i>Open FE and L1S1 Shutter s from keypad</i>	<input checked="" type="checkbox"/>				
FE Shutters A and B open (green)	<input checked="" type="checkbox"/>				
L1S1 Shutter A and B open (green)	<input checked="" type="checkbox"/>				
B2 Interlocked A and B Permit ON (green)	<input checked="" type="checkbox"/>				
L1S1 Shutter Permit A and B ON (green)	<input checked="" type="checkbox"/>				
B2 Door Switch Sum A and B ON (green)	<input checked="" type="checkbox"/>				
FE Critical Device Permits A and B ON	<input checked="" type="checkbox"/>				
<i>Remove one switch actuator</i>	<input checked="" type="checkbox"/>				
L1S1 Shutter A and B closed (red)	<input checked="" type="checkbox"/>				

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B2 Interlocked Permit OFF	<u>✓</u>	<u>✓</u>	<u>✓</u>	<u>✓</u>	<u>✓</u>
L1S1 Shutter Permit OFF	<u>✓</u>	<u>✓</u>	<u>✓</u>	<u>✓</u>	<u>✓</u>
B2 Door Switch Sum Permit OFF	<u>✓</u>	<u>✓</u>	<u>✓</u>	<u>✓</u>	<u>✓</u>
FE Critical Device Permits A and B OFF	<u>✓</u>	<u>✓</u>	<u>✓</u>	<u>✓</u>	<u>✓</u>
<i>Replace switch actuator and reset fault</i>	<u>✓</u>	<u>✓</u>	<u>✓</u>	<u>✓</u>	<u>✓</u>
Remove actuators and close door					<u>✓</u>

A22 Beam Stop

Place actuators on the beam stop switches and latch. ✓

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

	<u>A1</u>	<u>B1</u>	<u>Latch</u>
<i>Search FOE, B1 and B2 hatches</i> TM <i>2/22/16</i>	<u>✓</u>	<u>✓</u>	<u>✓</u>
<i>Open FE and L1S1 Shutter s from keypad</i>	<u>✓</u>	<u>✓</u>	<u>✓</u>
FE Shutters A and B open (green)	<u>✓</u>	<u>✓</u>	<u>✓</u>
FE Critical Device Permits A and B ON	<u>✓</u>	<u>✓</u>	<u>✓</u>
L1S1 Shutter A and B open (green)	<u>✓</u>	<u>✓</u>	<u>✓</u>
Beam Stop indicates Open (green)	<u>✓</u>	<u>✓</u>	<u>✓</u>
B2 Interlocked A and B Permit ON (green)	<u>✓</u>	<u>✓</u>	<u>✓</u>
L1S1 Shutter Permit A and B ON (green)	<u>✓</u>	<u>✓</u>	<u>✓</u>
<i>Remove one actuator</i>	<u>✓</u>	<u>✓</u>	<u>✓</u>
Beam Stop Does Not indicate Open	<u>✓</u>	<u>✓</u>	<u>✓</u>
L1S1 Shutter A and B closed (red)	<u>✓</u>	<u>✓</u>	<u>✓</u>
L1S1 Shutter Permit OFF	<u>✓</u>	<u>✓</u>	<u>✓</u>
FE Critical Device Permits A and B OFF	<u>✓</u>	<u>✓</u>	<u>✓</u>
Remove actuators and close beam stop			<u>✓</u>

A23 Magnetic Lock Test (FOE)

Connect the FOE test box (Attachment B Figure B4) to the PPS cabinet (Attachment B Figure B7). Use the box to turn ON the Maglocks (set switches to "Normal"). ✓

Repeat steps for each door: Upstream Right (USR), Upstream Left (USL), Downstream Right (DSR) and Downstream Left (DSL).

	<u>USR</u>	<u>USL</u>	<u>DSR</u>	<u>DSL</u>
<i>Search hatch</i>	<u>✓</u>	<u>✓</u>	<u>✓</u>	<u>✓</u>
FOE Interlocked A and B Permit ON (green)	<u>✓</u>	<u>✓</u>	<u>✓</u>	<u>✓</u>

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FE Shutter Permit A and B ON (green)	<u>✓</u>	<u>✓</u>	<u>✓</u>	<u>✓</u>
Door Maglock A and B ON (green)	<u>✓</u>	<u>✓</u>	<u>✓</u>	<u>✓</u>
<i>Open FE Shutters</i>	<u>✓</u>	<u>✓</u>	<u>✓</u>	<u>✓</u>
FE Shutters open (green)	<u>✓</u>	<u>✓</u>	<u>✓</u>	<u>✓</u>
<i>Using FOE test box, turn OFF Maglock</i>	<u>✓</u>	<u>✓</u>	<u>✓</u>	<u>✓</u>
Door Maglock A OFF	<u>✓</u>	<u>✓</u>	<u>✓</u>	<u>✓</u>
FOE Shutters closed (red)	<u>✓</u>	<u>✓</u>	<u>✓</u>	<u>✓</u>
FOE Interlocked A Permit OFF	<u>✓</u>	<u>✓</u>	<u>✓</u>	<u>✓</u>
FE Shutter Permit A OFF	<u>✓</u>	<u>✓</u>	<u>✓</u>	<u>✓</u>
<i>Turn On Maglock and reset fault</i>	<u>✓</u>	<u>✓</u>	<u>✓</u>	<u>✓</u>
<i>Search hutch</i>	<u>✓</u>	<u>✓</u>	<u>✓</u>	<u>✓</u>
<i>Using FE Shutter test fixture, Open FE Shutters</i>	<u>✓</u>	<u>✓</u>	<u>✓</u>	<u>✓</u>
<i>Using FOE test box, turn OFF Maglock</i>	<u>✓</u>	<u>✓</u>	<u>✓</u>	<u>✓</u>
<i>Within 3 seconds: FE Critical Devices Permits A Chain OFF</i>	<u>✓</u>	<u>✓</u>	<u>✓</u>	<u>✓</u>

A24 **Magnetic Lock Test (B1 Hutch)**

Connect the FOE test box (Attachment B Figure B4) to the PPS cabinet (Attachment B Figure B7). Use the box to turn ON the Maglocks (set switches to "Normal").

Repeat steps for the door: Front Right (FR)

	<u>FR</u>	<u>FL</u>	<i>TM</i>
			<i>2/22/16</i>
<i>Search hutch</i>	<u>✓</u>	<u>✓</u>	
B1 Interlocked A and B Permit ON (green)	<u>✓</u>	<u>✓</u>	
L1S1 Shutter Permit A and B ON (green)	<u>✓</u>	<u>✓</u>	
Door Maglock A and B ON (green)	<u>✓</u>	<u>✓</u>	
<i>Open FE and L1S1 Shutters</i>	<u>✓</u>	<u>✓</u>	
Shutters open (green)	<u>✓</u>	<u>✓</u>	
<i>Using FOE test box, turn OFF Maglock</i>	<u>✓</u>	<u>✓</u>	
Door Maglock A OFF	<u>✓</u>	<u>✓</u>	
Shutters closed (red)	<u>✓</u>	<u>✓</u>	
B1 Interlocked A Permit OFF	<u>✓</u>	<u>✓</u>	
L1S1 Shutter Permit A OFF	<u>✓</u>	<u>✓</u>	
<i>Turn On Maglock and reset fault</i>	<u>✓</u>	<u>✓</u>	

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Figure 1: Water Meters

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).

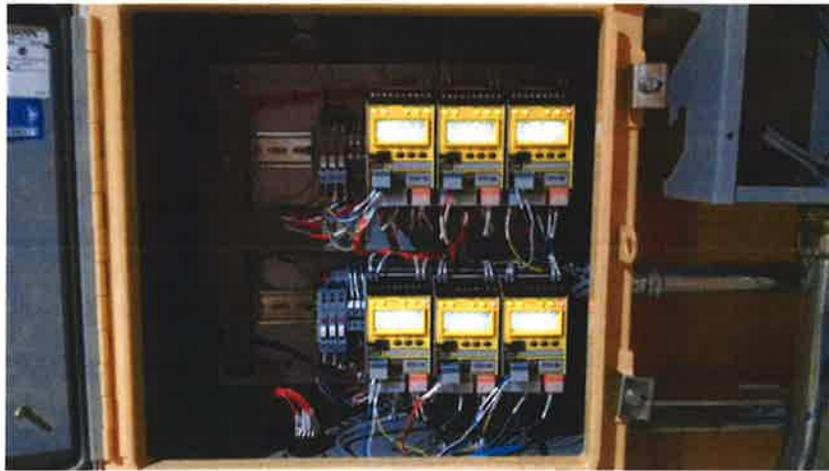


Figure 2: PPS Water STAs

Record the pretest water flows for the 3 PPS meters in GPM.

Meter Reading	Meter Reading	Current STA A	Current STA B
A1 = <u>1.83</u>	B1 = <u>1.80</u>	A STA1 = <u>1.83</u>	B STA1 = <u>1.80</u>
A2 = <u>1.81</u>	B2 = <u>1.89</u>	A STA2 = <u>1.81</u>	B STA2 = <u>1.89</u>
A3 = <u>2.01</u>	B3 = <u>1.99</u>	A STA3 = <u>2.01</u>	B STA3 = <u>1.99</u>

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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).

Trip Points	Trip Points (- 15 %)	Recorded A Trip	Recorded B Trip
PPS 1: 1.0 ^{1.5} GPM <i>2/22/16</i>	0.85 GPM	A STA1= <u>1.50</u>	B STA1= <u>1.50</u>
PPS 2: 1.0 ^{1.5} GPM <i>2/22/16</i>	0.85 GPM	A STA2= <u>1.50</u>	B STA2= <u>1.50</u>
PPS 3: 1.0 ^{1.5} GPM <i>2/22/16</i>	0.85 GPM	A STA3= <u>1.50</u>	B STA3= <u>1.50</u>

Repeat each step for all water flow meters

	<u>PPS1</u>	<u>PPS2</u>	<u>PPS3</u>
<i>Open FE Shutters</i>	<u>✓</u>	<u>✓</u>	<u>✓</u>
FE Shutters A and B open (green)	<u>✓</u>	<u>✓</u>	<u>✓</u>
Water Permits A and B ON (green), HMI	<u>✓</u>	<u>✓</u>	<u>✓</u>
FE Shutter Permits A and B ON (green), HMI	<u>✓</u>	<u>✓</u>	<u>✓</u>
<i>Using the valve, turn water flow to trip point</i>	<u>✓</u>	<u>✓</u>	<u>✓</u>
FE Shutters A and B closed (red)	<u>✓</u>	<u>✓</u>	<u>✓</u>
In 5 seconds FE Shutter Permits A and B OFF, HMI	<u>✓</u>	<u>✓</u>	<u>✓</u>
Water Permits A and B OFF, HMI	<u>✓</u>	<u>✓</u>	<u>✓</u>
Recorded STA A and B levels above; within 15%	<u>✓</u>	<u>✓</u>	<u>✓</u>
<i>Return water flow to pretest values</i>	<u>✓</u>	<u>✓</u>	<u>✓</u>
Water Permits A and B remain OFF, HMI	<u>✓</u>	<u>✓</u>	<u>✓</u>
<i>Reset fault at PPS cabinet</i>	<u>✓</u>	<u>✓</u>	<u>✓</u>
Water Permits ON (green), HMI	<u>✓</u>	<u>✓</u>	<u>✓</u>
FE Shutter Permits A and B ON (green), HMI	<u>✓</u>	<u>✓</u>	<u>✓</u>

A27 **Water Safety Test Amplifier Faults**

Repeat each step for all water flow meters

	<u>PPS1</u>	<u>PPS2</u>	<u>PPS3</u>
<i>Open FE Shutters with keypad</i>	<u>✓</u>	<u>✓</u>	<u>✓</u>
FE Shutters A and B open (green)	<u>✓</u>	<u>✓</u>	<u>✓</u>
Water Permits A and B ON (green), HMI	<u>✓</u>	<u>✓</u>	<u>✓</u>
FE Shutter Permits A and B ON (green), HMI	<u>✓</u>	<u>✓</u>	<u>✓</u>
<i>Press A chain fault/reset button</i>	<u>✓</u>	<u>✓</u>	<u>✓</u>

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FE Shutters A and B closed (red)	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Water Permit A OFF, HMI	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
In 5 seconds FE Shutter Permit A OFF, HMI	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
<i>Reset Fault</i>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
<i>Open FE Shutters with keypad</i>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
FE Shutters A and B open (green)	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Water Permits A and B ON (green), HMI	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
FE Shutter Permits A and B ON (green), HMI	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
<i>Press B chain fault/reset button</i>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
FE Shutters A and B closed (red)	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Water Permit B OFF, HMI	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
In 5 seconds FE Shutter Permit B OFF, HMI	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
<i>Reset fault</i>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>

A28 Observe Beamline Photon Shutter Operation

	<u>L1S1</u>
<i>Close Beamline Photon Shutter</i>	<input checked="" type="checkbox"/>
Shutter indicates closed A and B (red), HMI	<input checked="" type="checkbox"/>
<i>Open Beamline Photon Shutter</i>	<input checked="" type="checkbox"/>
Shutter opens smoothly without hesitation	<input checked="" type="checkbox"/>
Shutter indicates open A and B (green), HMI	<input checked="" type="checkbox"/>
<i>Close Beamline Photon Shutter</i>	<input checked="" type="checkbox"/>

A29 Observe FE Safety Shutter(s) Operation

With Maintenance Door open, connect FE Shutter test fixture (Attachment B Figure B5).

Shutters are in the closed (down) position	<input checked="" type="checkbox"/>
FE Shutter Closed A and B (red), HMI	<input checked="" type="checkbox"/>
<i>Turn the "Air" switch ON</i>	<input checked="" type="checkbox"/>
<i>Open FE Photon Shutter and SSs A and B</i>	<input checked="" type="checkbox"/>
Shutters open freely without hesitation	<input checked="" type="checkbox"/>
Shutters are in the open (up) position	<input checked="" type="checkbox"/>
FE Shutter Open A and B (green), HMI	<input checked="" type="checkbox"/>

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	<i>Actuate Shutters closed</i>	FE Shutter Closed A and B (red), HMI	✓
A30	FE Safety Shutters can only be Closed if FE Photon Shutter is Closed		
	<i>Search hutch</i>	FOE Interlocked A and B chain (green), HMI FE Critical Devices Permits A and B ON (green), HMI	✓ ✓
	<i>Open FE SSA</i>	SSA Open	✓
	<i>Open FE Photon Shutter</i>	FE Critical Devices Permits A and B OFF, HMI	✓
	<i>Close Shutters</i>		✓
	<i>Reset Fault</i>	FE Critical Devices Permits A and B ON (green), HMI	✓
	<i>Open FE SSB</i>	SSB Open	✓
	<i>Open FE Photon Shutter</i>	FE Critical Devices Permits A and B OFF, HMI	✓
	<i>Close shutters</i>		✓
	<i>Reset fault</i>	FE Critical Devices Permits A and B ON (green), HMI	✓
A31	Beamline Enable Key (Opening shutter without key trips SR RF and Dipole PS)		
	<i>Remove beamline enable key</i>	FOE Enabled OFF, HMI	✓
	<i>Search FOE</i>	FOE Interlocked A and B chain (green), HMI FE Critical Devices Permits A and B ON (green), HMI	✓ ✓
	<i>Using FOE test box, Open FE Shutters</i>	FE Critical Devices Permits A and B OFF	✓
	<i>Replace beamline enable key and reset faults</i>		✓
	Live Testing		
A32	Reach Back FOE Door Switches		
	<i>Secure P1 through P5</i>	SR Secure, A and B chain, SR HMI	✓
	<i>Accelerator Safety Systems Staff disables top energy limiter (set to 0) or check if completed on concurrent test</i>		NA
	<i>Place actuators on FOE hutch downstream left door switches and Maglock</i>		✓
	<i>Search hutch</i>	FOE Interlocked A and B chain (green), HMI FE Critical Devices Permits A and B ON (green), HMI	✓ ✓
	<i>Check Control Room SR HMI (MCR beamline 1)</i>	FE Critical Device Permit A and B ON (green) SR HMI	✓
	<i>Check I/O Box 8 Beamline Enable Panel</i>	FE Critical Devices Permits A and B LEDs ON	✓

LOW LIMIT ENERGY LIMITER
REMOVED IN DEC 2015

7.2m
2/2/16

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<i>Check I/O Box 28 Beamline Enable Panel</i>	FE Critical Device Permit Sum A and B LEDs ON	<input checked="" type="checkbox"/>
	FE Shutters Closed A and B LEDs ON	<input checked="" type="checkbox"/>
<i>Check Dipole PS (positive) Beamline Interface</i>	A and B Permits ON, Dipole PS Pos. Interface	<input checked="" type="checkbox"/>
<i>Check Dipole PS (negative) Beamline Interface</i>	A and B Permits ON, Dipole PS Neg. Interface	<input checked="" type="checkbox"/>
<i>Check SR RF System C HVPS Beamline Interface</i>	A and B Permits ON, SR RF System C HVPS Interface	<input checked="" type="checkbox"/>
<i>Check SR RF System D HVPS Beamline Interface</i>	A and B Permits ON, SR RF System D HVPS Interface	<input checked="" type="checkbox"/>
<i>Operator enables SR Dipole PS</i>	SR Dipole PS is ON	<input checked="" type="checkbox"/>
<i>Operator enables SR RF System C HVPS</i>	SR RF HVPS C is ON	<input checked="" type="checkbox"/>
<i>Operator enables SR RF System D HVPS</i>	SR RF HVPS D is ON	<input checked="" type="checkbox"/>
<i>Using FE Shutter test fixture, open the FE Shutters (SSA, SSB and Photon)</i>		<input checked="" type="checkbox"/>
	FOE Shutters Open	<input checked="" type="checkbox"/>
<i>Remove an "A chain" door switch actuator from beamline hutch door</i>		<input checked="" type="checkbox"/>
	FOE Interlocked OFF A chain, HMI	<input checked="" type="checkbox"/>
	FE Critical Devices Permits A chain OFF, HMI	<input checked="" type="checkbox"/>
<i>Check I/O Box 8 Beamline Enable Panel</i>	FE Critical Devices Permit A LED OFF	<input checked="" type="checkbox"/>
<i>Check I/O Box 28 Beamline Enable Panel</i>	FE Critical Device Permit Sum A LED OFF	<input checked="" type="checkbox"/>
<i>Check Control Room SR HMI (MCR beamline 1)</i>	FE Critical Device Permit A (red), SR HMI	<input checked="" type="checkbox"/>
<i>Check RF System C HVPS Beamline Interface</i>	A Permits OFF, SR RF System C HVPS Interface	<input checked="" type="checkbox"/>
<i>Check RF System D HVPS Beamline Interface</i>	A Permits OFF, SR RF System D HVPS Interface	<input checked="" type="checkbox"/>
<i>Check Dipole PS (positive) Beamline Interface</i>	A Permits OFF, Dipole PS Pos. Interface	<input checked="" type="checkbox"/>
<i>Check Dipole PS (negative) Beamline Interface</i>	A Permits OFF, Dipole PS Neg. Interface	<input checked="" type="checkbox"/>
	SR RF System C HVPS is OFF	<input checked="" type="checkbox"/>
	SR RF System D HVPS is OFF	<input checked="" type="checkbox"/>
	SR Dipole PS is OFF	<input checked="" type="checkbox"/>
<i>Close Shutters</i>	Shutters closed	<input checked="" type="checkbox"/>
<i>Replace A chain door switch holder and reset fault(s)</i>		<input checked="" type="checkbox"/>
<i>Search hutch</i>		<input checked="" type="checkbox"/>

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	FOE Interlocked A and B chains ON (green), HMI	<u>✓</u>
	FE Critical Devices Permits A and B ON (green), HMI	<u>✓</u>
<i>Check Control Room SR HMI (MCR beamline 1)</i>	FE Critical Device Permit A and B ON (green), SR HMI	<u>✓</u>
<i>Check I/O Box 8 Beamline Enable Panel</i>	FE Critical Device Permit Sum A and B LEDs ON	<u>✓</u>
<i>Check I/O Box 28 Beamline Enable Panel</i>	FE Shutters Closed A and B LEDs ON	<u>✓</u>
<i>Check Dipole PS (positive) Beamline Interface</i>	A and B Permits ON, Dipole PS Pos. Interface	<u>✓</u>
<i>Check Dipole PS (negative) Beamline Interface</i>	A and B Permits ON, Dipole PS Neg. Interface	<u>✓</u>
<i>Check SR RF System C HVPS Beamline Interface</i>	A and B Permits ON, SR RF System C HVPS Interface	<u>✓</u>
<i>Check SR RF System D HVPS Beamline Interface</i>	A and B Permits ON, SR RF System D HVPS Interface	<u>✓</u>
<i>Operator enables SR Dipole PS</i>	SR Dipole PS is ON	<u>✓</u>
<i>Operator enables SR RF System C HVPS</i>	SR RF System C HVPS is ON	<u>✓</u>
<i>Operator enables SR RF System D HVPS</i>	SR RF System D HVPS is ON	<u>✓</u>
<i>Using FE Shutter test fixture, open the FE Shutters (SSA, SSB and Photon)</i>		<u>✓</u>
	FOE Shutters Open	<u>✓</u>
<i>Remove "B chain" switch actuator</i>	FOE Interlocked B chain OFF, HMI	<u>✓</u>
	FE Critical Devices Permits B OFF, HMI	<u>✓</u>
<i>Check I/O Box 8 Beamline Enable Panel</i>	FE Critical Devices Permit B LED OFF	<u>✓</u>
<i>Check Control Room SR HMI (MCR beamline 1)</i>	FE Critical Device Permits B OFF (red), SR HMI	<u>✓</u>
<i>Check I/O Box 28 Beamline Enable Panel</i>	FE Critical Device Permit Sum B LED OFF	<u>✓</u>
<i>Check SR RF System C HVPS Beamline Interface</i>	B Permits OFF, SR RF System C HVPS Interface	<u>✓</u>
<i>Check SR RF System D HVPS Beamline Interface</i>	B Permits OFF, SR RF System D HVPS Interface	<u>✓</u>
<i>Check Dipole PS (positive) Beamline Interface</i>	B Permits OFF, Dipole PS Pos. Interface	<u>✓</u>
<i>Check Dipole PS (negative) Beamline Interface</i>	B Permits OFF, Dipole PS Neg. Interface	<u>✓</u>
	SR Dipole is OFF	<u>✓</u>
	SR RF System C HVPS is OFF	<u>✓</u>
	SR RF System D HVPS is OFF	<u>✓</u>
<i>Close FE Shutters with test fixture</i>		<u>✓</u>
<i>Remove beamline hutch switch holders and Maglock actuator</i>		<u>✓</u>

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A33 **Water Interlock (Live)**

<i>Search FOE</i>	FOE Interlocked A and B chains ON (green), HMI	<input checked="" type="checkbox"/>
	FE Shutter Permits ON A and B permits (green), HMI	<input checked="" type="checkbox"/>
	FE Critical Devices Permits A and B ON (green), HMI	<input checked="" type="checkbox"/>
<i>Check I/O Box 8 Beamline Enable Panel</i>	FE Critical Devices Permits A and B LEDs ON	<input checked="" type="checkbox"/>
<i>Check I/O Box 28 Beamline Enable Panel</i>	FE Critical Device Permit Sum A and B LEDs ON	<input checked="" type="checkbox"/>
<i>Check Control Room SR HMI (MCR beamline 1)</i>	FE Critical Device Permit A and B ON (green), SR HMI	<input checked="" type="checkbox"/>
<i>Check Dipole PS (positive) Beamline Interface</i>	A and B Permits ON, Dipole PS Pos. Interface	<input checked="" type="checkbox"/>
<i>Check Dipole PS (negative) Beamline Interface</i>	A and B Permits ON, Dipole PS Neg. Interface	<input checked="" type="checkbox"/>
<i>Check RF System C HVPS Beamline Interface</i>	A and B Permits ON, RF System C HVPS Interface	<input checked="" type="checkbox"/>
<i>Check RF System D HVPS Beamline Interface</i>	A and B Permits ON, RF System D HVPS Interface	<input checked="" type="checkbox"/>
<i>Operator enables SR Dipole PS</i>	SR Dipole PS is ON	<input checked="" type="checkbox"/>
<i>Operator enables SR RF System C HVPS</i>	SR RF System C HVPS is ON	<input checked="" type="checkbox"/>
<i>Operator enables SR RF System D HVPS</i>	SR RF System D HVPS is ON	<input checked="" type="checkbox"/>
<i>Using FE Shutter test fixture, turn on air and open Photon then SSs</i>		
	FE Shutters indicate Open (green), HMI	<input checked="" type="checkbox"/>
<i>Using water trip points in Step A26, lower flow to one meter</i>		<input checked="" type="checkbox"/>
	Water Permits A and B OFF, HMI	<input checked="" type="checkbox"/>
	FE Shutter Permits OFF A and B Permits, HMI	<input checked="" type="checkbox"/>
Within 3 seconds	FE Critical Devices Permits A and B OFF, HMI	<input checked="" type="checkbox"/>
<i>Check I/O Box 8 Beamline Enable Panel</i>	FE Critical Devices Permit A and B OFF	<input checked="" type="checkbox"/>
<i>Check I/O Box 28 Beamline Enable Panel</i>	FE Critical Device Permit Sum A and B LED OFF	<input checked="" type="checkbox"/>
<i>Check Control Room SR HMI (MCR beamline 1)</i>	FE Critical Device Permit A and B OFF, SR HMI	<input checked="" type="checkbox"/>
<i>Check RF System C HVPS Beamline Interface</i>	A and B Permits OFF, RF System C HVPS Interface	<input checked="" type="checkbox"/>
<i>Check RF System D HVPS Beamline Interface</i>	A and B Permits OFF, RF System D HVPS Interface	<input checked="" type="checkbox"/>
<i>Check Dipole PS (positive) Beamline Interface</i>	A and B Permits OFF, Dipole PS Pos. Interface	<input checked="" type="checkbox"/>
<i>Check Dipole PS (negative) Beamline Interface</i>	A and B Permits OFF, Dipole PS Neg. Interface	<input checked="" type="checkbox"/>
	SR RF System C HVPS is OFF	<input checked="" type="checkbox"/>

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1.2m
2/22/16

-
-
-
-
-

SR RF System D HVPS is OFF

SR Dipole PS is OFF

Close Shutters

Shutters closed

Return water flow to recorded level

Reset fault(s)

A34 **Return Energy Limiter**

Low
NA - Energy Limiter removed from PPS in Dec. 2015 7.2m. 2/22/16

Check if completed on concurrent test

Accelerator Safety Systems Staff returns energy limiter

Request Operator: Set Dipole PS to operating current

Dipole PS set at operating current

Turn on SR RF System C and D HVPS

SR RF System C HVPS is ON

SR RF System D HVPS is ON

Raise the Dipole PS set point to **372.8 A**

SR RF A and B Permits are ON (**green**), SR HMI

Dipole PS at **372.8 A (3.3 GeV)** value

SR RF System C HVPS shuts OFF

SR RF System D HVPS shuts OFF

SR A and B Permits OFF, HMI

Return Dipole PS to operating current

Dipole PS at operating current

Reset Energy Limiter faults

Turn on SR RF System C and D HVPS

SR RF System C HVPS is ON

SR RF System D HVPS is ON

SR RF A and B Permits are ON (**green**), SR HMI

Lower the Dipole PS set point to **356.72 A**

Dipole PS at **356.72 A (2.0 GeV)** value

SR RF System C HVPS shuts OFF

SR RF System D HVPS shuts OFF

SR RF A and B Permits OFF, HMI

Return Dipole PS to operating current

Dipole PS at operating current

Reset Energy Limiter faults

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A35 **Observe All Shutters Closed Sum**

- Check I/O Box 28 Beamline Enable Panel
 - FE Shutters closed A chain light ON ✓
 - FE Shutters closed B chain light ON ✓
- Using FE Shutter test fixture open both FE SSs and then Photon Shutter ✓
- FE Shutters open (**green**), HMI ✓
- Check I/O Box 28 Beamline Enable Panel
 - FE Shutters closed A chain light OFF ✓
 - FE Shutters closed B chain light OFF ✓
- Close Shutters and remove test device ✓

A36 **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 8-ID Test Checklist Completed ✓

A37 **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 ATTACHMENT A -

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Title: NSLS-II Area Radiation Monitor PPS Test			Technical

Attachment D NSLS-II Beamline (FOE) Area Radiation Monitor Checklist

Note: Signatures below indicate that the test has been completed.

Monitor # <i>FRM - ID08</i>	ID # <i>INO 7315</i>	Beamline: <i>ID-8</i>
Test Reason: <input checked="" type="checkbox"/> Beamline Certification <input type="checkbox"/> Replacement/Repair		
Test Date: <i>Fail + High 1/8/16 Low - 1/26/16</i>	Test Result	<input checked="" type="checkbox"/> Passed <input type="checkbox"/> Failed
Tester: <i>Tom McDonald</i>	RCD:	<i>KIMBERLY O'NEILL</i>
Tester Signature: <i>Tom McDonald</i>	RCD Signature:	<i>Kimberly O'Neill</i>

Fail Alarm: Place checkmark (✓) in checkbox (☐) for each correct response.

	Local Expected Observation	HMI/CR Expected Observation	Linac HMI	CR HMI
Operator turns on Gun	Gun HVPS is ON <input checked="" type="checkbox"/>	Gun Contactor ON A Chain	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
RCD Disables Monitor		Alarm sounds in Control Room		<input checked="" type="checkbox"/>
	Fail alarm ON HMI (yellow border around ARM icon)		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Silence CR Alarm		Alarm silences		<input checked="" type="checkbox"/>
Gun turns OFF	Gun HVPS is OFF <input checked="" type="checkbox"/>	Gun Contactor OFF A Chain	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Return monitor to normal	Gun HVPS remains OFF <input checked="" type="checkbox"/>	Fail alarm remains ON HMI	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Reset fault in Control Room		Monitor normal HMI	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
RCD ensures ARM is locked	ARM is locked <input checked="" type="checkbox"/>			

Low Alarm: Place checkmark (✓) in checkbox (☐) for each correct response.

	Local Expected Observation	HMI/CR Expected Observation	Beamline HMI	CR HMI/EPICS
Opens FE shutter (w/keypad)	FE Shutters open <input checked="" type="checkbox"/>		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Apply source until low alarm	Yellow light on Monitor <input checked="" type="checkbox"/>	Radiation level increases on EPICS		<input checked="" type="checkbox"/>
	FE Shutters Closed <input checked="" type="checkbox"/>	Alarm sounds in Control Room		<input checked="" type="checkbox"/>
		Low level alarm ON, HMI	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Return monitor to normal		Monitor normal, HMI	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
	FE Critical Device Permit A chain ON		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Apply source until low alarm	Yellow light on Monitor <input checked="" type="checkbox"/>			<input checked="" type="checkbox"/>
	FE Critical Device Permit A chain OFF		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Return monitor to normal		Monitor normal, HMI	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>

High Alarm: Place checkmark (✓) in checkbox (☐) for each correct response.

	Local Expected Observation	HMI/CR Expected Observation	Linac HMI	CR HMI/EPICS
Operator turns on Gun	Gun HVPS is ON <input checked="" type="checkbox"/>	Gun Contactor ON A Chain	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Apply source until high alarm	Red light on Monitor <input checked="" type="checkbox"/>	Radiation level increases on EPICS		<input checked="" type="checkbox"/>
	Monitor alarm sounds	Alarm sounds in Control Room		<input checked="" type="checkbox"/>
		High level alarm ON, HMI	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Silence Alarm		Alarm silences		<input checked="" type="checkbox"/>
Gun turns OFF	Gun HVPS is OFF <input checked="" type="checkbox"/>	Gun Contactor OFF A Chain	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Return monitor to normal	Gun HVPS remains OFF <input checked="" type="checkbox"/>	High level alarm remains ON, HMI	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Reset fault in Control Room		Monitor normal, HMI	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>

Description of Test Failures (if any): _____