NSLS-II

NATIONAL SYNCHROTRON LIGHT SOURCE II

Beamline EPS Acceptance Testing

Rev Date: 09/16/2015
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Approved: 09/16/2015

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Serial No	Part No	Part Rev	ECN	Rev	ECN	Rev
	Beamline: 04-ID ISR					

Deviation & Waiver: _____

OP	Description	Name/Life #	Date	DR
10	Follow the ES&H and Personal Protective Equipment Requirements for the area.	R Kadyrov 25392	05/30/16	
20	Verify measuring and test equipment used for this procedure contains a valid calibration label in accordance with NSLS-II Calibration Procedure PS-QAP-0901, where applicable. The technician is responsible for notifying the technical supervisor and/or the cognizant engineer of any discrepancies occurring during the performance of this procedure. All discrepancies shall be identified and reported in accordance with NSLS-II Discrepancy Reporting Procedure PS-QAP-0002.	R Kadyrov 25392	06/06/16	
30	BEAMLINE INFORMATION - This step shall be performed by the cognizant EPS Engineer. A) Record the relevant Beamline name on this sheet, in the box for "Part No". B) Review this entire traveler and write in the relevant drawing, software, and procedure numbers where required	R Kadyrov 25392	06/16/16	
40	INSTALLATION VERIFICATION A) List the relevant drawing(s): Drawing No.: LT-EL-BL-ET-EPS_1040-90 Rev. No.: A Drawing No.: _____ Rev. No.: _____ B) Verify the following items are acceptable: ✓ System layout configured per drawing(s) ✓ System Labeled / Tagged	R Kadyrov 25392	06/16/16	

OP	Description	Name/Life #	Date	DR
50	SOFTWARE CONFIGURATION A) Download PLC software to controller and verify it was accepted by the controller. B) Record the software part number: Part No.: LT-EL-BL-ET-EPS-1040-70 Rev. No.: A	R Kadyrov 25392	06/16/16	
60	ACCEPTANCE TESTING A) List relevant testing procedure Procedure No.: PS-R-XFD-EPS-CHK-001 Rev. No.: 1 B) Verify acceptable completion of test procedure C) Attach test report to this traveler	R. Kadyrov 25392	06/16/16	
65	WATER LEAK DETECTION SYSTEM TEST Verify water leak detection system, as designed for this beamline, functions correctly.	R. Kadyrov 25392	06/16/16	
70	Verify All Traveler Operations Complete	R. Kadyrov 25392	06/23/16	
80	REVISION HISTORY (This step is informational and does not require signoff) Rev - Description - Date A First Release 8/27/2014 B OP#65 added 9/16/15 Joe Delong removed as approver Ruslan Kadyrov added as approver			

Beam Line: 4-ID ISR

Test Date: 06/16/16

EPS Engineer: Ruslan Kadyrov

BL Group Leader: Christie Nelson

Beam Line master spreadsheet: LT-R-XFD-CO-DR-ISR-002_Rev1

The Beam Line Master Spreadsheet contains a comprehensive list of all EPS related signals. As this test plan is executed note the results in the "test results" column of this spreadsheet.

Test Set 1: Vacuum

Vacuum Section:

Starting conditions: pressure at or below acceptable limits, GVs open.

Simulate pressure rise (toward poor vacuum) by disabling the vacuum gauge controller channel. Ensure EPICS PVs enter proper alarm states, photon shutter closes[1] and vacuum section is isolated. Two local gate valves or more, if it is required to isolate upstream section, e.g. section branching, upstream gate valve close. Record results for the following:

EPICS PV Alarm

EPS fault

Photon Shutter closes

GVx closes

GVy closes

GVz closes

Attempt to open the front end shutter and gate valves through EPICS.

Photon shutter and gate valves cannot be opened through EPICS (1)

Enable vacuum gauge controller and ensure EPICS alarms clear. Open gate valves and photon shutter through EPICS.

Photon shutter and gate valves can be opened through EPICS (2)

[1] if the intensity of the beam in the section cannot cause damage to its valves, poor vacuum doesn't have to cause shutter close

Gauge Name	EPS fault:				(1)	(2)
	Shutter:	d/s GV:	u/s GV:	D u/s:		
XF:04IDA-VA{Msk:1-CCG:1}	FE SH	✓	✓	n/a	✓	✓
XF:04IDA-VA{Msk:1-TCG:1}	—	—	—	n/a	✓	✓
XF:04IDA-VA{BPM:1-CCG:1}	FE SH	✓	✓	n/a	✓	✓
XF:04IDA-VA{BPM:1-TCG:1}	—	—	—	n/a	✓	✓
XF:04IDA-VA{Mir:HFM-CCG:1}	FE SH	✓	✓	—	✓	✓
XF:04IDA-VA{Mir:HFM-TCG:1}	—	—	—	—	✓	✓
XF:04IDA-VA{Scr:1-CCG:1}	FE SH	✓ RK	✓	—	✓	✓
XF:04IDA-VA{Scr:1-TCG:1}	—	—	—	—	✓	✓
XF:04IDA-VA{Mono:DCM-CCG:1}	FE SH	✓	✓	—	✓	✓
XF:04IDA-VA{Mono:DCM-TCG:1}	—	—	—	—	✓	✓
XF:04IDA-VA{DPP-CCG:1}	FE SH	✓	✓	*	✓	✓
XF:04IDA-VA{DPP-TCG:1}	—	—	—	**	✓	✓
XF:04IDA-VA{DPP-CCG:2}	FE SH	✓	✓	*	✓	✓
XF:04IDA-VA{DPP-TCG:2}	—	—	—	**	✓	✓
XF:04IDA-VA{BPM:2-CCG:1}	FE SH	✓	*	—	✓	✓
XF:04IDA-VA{BPM:2-TCG:1}	—	—	**	—	✓	✓
XF:04IDA-VA{Mir:VFM-CCG:1}	FE SH	✓	✓	—	✓	✓
XF:04IDA-VA{Mir:VFM-TCG:1}	—	—	—	—	✓	✓
XF:04IDA-VA{Scr:2-CCG:1}	FE SH	✓	✓	—	✓	✓
XF:04IDA-VA{Scr:2-TCG:1}	—	—	—	—	✓	✓
XF:04IDA-VA{BT:1-CCG:1}	FE SH	✓	✓	—	✓	✓
XF:04IDA-VA{BT:1-TCG:1}	—	—	—	—	✓	✓

FE SH – Front End shutter
* – Be window opens
** – Be window cannot be closed

Gauge Name	EPS fault:				(1)	(2)
	Shutter:	d/s GV:	u/s GV:	D u/s:		
XF:04IDB-VA{BPM:3-CCG:1}	PSH1	✓	✓	—	✓	✓
XF:04IDB-VA{BPM:3-TCG:1}	PSH1	—	—	—	✓	✓
XF:04IDB-VA{Mir:DHRM-CCG:1}	PSH1	✓	✓	—	✓	✓
XF:04IDB-VA{Mir:DHRM-TCG:1}	PSH1	—	—	—	✓	✓
XF:04IDB-VA{BT:2-CCG:1}	PSH1	✓	✓	—	✓	✓
XF:04IDB-VA{BT:2-TCG:1}	PSH1	—	—	—	✓	✓
XF:04IDC-VA{BT:2-CCG:2}	PSH1	✓	✓	—	✓	✓
XF:04IDC-VA{BT:2-TCG:2}	PSH1	—	—	—	✓	✓
XF:04IDC-VA{Be:2-CCG:1}	PSH2	n/a	✓	—	✓	✓
XF:04IDC-VA{Be:2-TCG:1}	PSH2	n/a	—	—	✓	✓
XF:04IDC-VA{BT:3-CCG:1} *	n/a	n/a	n/a	n/a	n/a	n/a
XF:04IDC-VA{BT:3-TCG:1} *	n/a	n/a	n/a	n/a	n/a	n/a
XF:04IDD-VA{Mir:KB-CCG:1} *	n/a	n/a	n/a	n/a	n/a	n/a
XF:04IDD-VA{Mir:KB-TCG:1} *	n/a	n/a	n/a	n/a	n/a	n/a

* Not in scope
PSH1 – A hutch shutter
PSH2 – B hutch shutter

Simulate pressure rise (toward poor vacuum) by disabling the vacuum pump controller channel. Ensure EPICS PVs enter proper alarm states, photon shutter closes[2] and vacuum section is isolated. Two local gate valves or more, if it is required to isolate upstream section, e.g. section branching, gate valve close. Record results for the following:

EPICS PV Alarm

EPS fault

Photon Shutter closes

GVx closes

GVy closes

GVz closes

Attempt to open the front end shutter and gate valves through EPICS.

Photon shutter and gate valves cannot be opened through EPICS (1)

Enable vacuum pump controller and ensure EPICS alarms clear. Open gate valves and photon shutter through EPICS.

Photon shutter and gate valves can be opened through EPICS (2)

[2] if the intensity of the beam in the section cannot cause damage to its valves, poor vacuum doesn't have to cause shutter close

Pump name:	EPS fault: Shutter:	d/s GV:	u/s GV:	D u/s:	(1)	(2)
XF:04IDA-VA{Msk:1-IP:1}	FE SH	✓	✓	n/a	✓	✓
XF:04IDA-VA{BPM:1-IP:1}	FE SH	✓	✓	n/a	✓	✓
XF:04IDA-VA{Mir:HFM-IP:1}	FE SH	✓	✓	—	✓	✓
XF:04IDA-VA{Scr:1-IP:1}	FE SH	✓	✓	—	✓	✓
XF:04IDA-VA{Mono:DCM-IP:1}	FE SH	✓	✓	—	✓	✓
XF:04IDA-VA{DPP-IP:1}	FE SH	✓	✓	*	✓	✓
XF:04IDA-VA{DPP-IP:2}	FE SH	✓	✓	*	✓	✓
XF:04IDA-VA{BPM:2-IP:1}	FE SH	✓	*	—	✓	✓
XF:04IDA-VA{Mir:VFM-IP:1}	FE SH	✓	✓	—	✓	✓
XF:04IDA-VA{Scr:2-IP:1}	FE SH	✓	✓	—	✓	✓
XF:04IDB-VA{BT:1-IP:1}	FE SH	✓	✓	—	✓	✓
XF:04IDB-VA{Mir:DHRM-IP:1}	PSH1	✓	✓	—	✓	✓
XF:04IDB-VA{Mir:DHRM-IP:2}	PSH1	✓	✓	—	✓	✓
XF:04IDB-VA{BT:2-IP:1}	PSH1	✓	✓	—	✓	✓
XF:04IDD-VA{Mir:KB-IP:1} *	n/a	n/a	n/a	n/a	n/a	n/a

FE SH – Front End Shutter
PSH1 – FOE Shutter
* not in scope

Repeat for each vacuum section on beam line. For the sections adjacent to Front end and End Station, also simulate poor vacuum signal from remote systems.

EPS fault:	Front end:	End station:
Photon Shutter closes	✓	n/a
GVx closes FE GV:2	✓	n/a
GVy closes	n/a	n/a
GVz closes	n/a	n/a
Shutter and GVs cannot be opened	✓	n/a

Test Set 2: Water flow

Water flow Section:

Record initial flow through section with all valves fully open.

Slowly close supply valve and record the LOW and LOW LOW PV Alarm levels.

If the channel is associated with an EPS action, also register the flow at which the EPS fault occurs. Ensure cable disconnection results in EPS action.

Repeat for each water circuit on beam line.

Sensor name:	Nominal flow: GPM	GPM LOW:	GPM LOLO:	EPS:
XF:04IDA-UT{DI}F-I	7.49	—	—	—
XF:04IDA-BI:0{BPM:1_SR:1}F-I	0.33	0.3	0.3	FE SH
XF:04IDA-BI:1{Scr:1}F-I	0.49	0.4	0.3	FE SH
XF:04IDA-PPS{DI}F:B1-I	1.28	—	—	—
XF:04IDA-PPS{DI}F:B2-I	1.57	—	—	—
XF:04IDA-PPS{DI}F:B3-I	1.65	—	—	—
XF:04IDA-OP:1{Mir:HFM3}F-I	0.62	0.4	0.2	FE SH

Test Set 3: Thermal

For each temperature transducer ensure the temperature measurement reports expected value.

Attach an appropriate adaptor and transducer simulator to the temperature input of the EPS system (remote IO chassis or Armor Block). Raise the temperature above each of the HI and HIHI PV alarm limits and ensure the alarm is reported. If the transducer is associated with an EPS interlock, continue to raise the temperature until the EPS trip level is exceeded. Ensure the appropriate EPS mitigation process occurs. Ensure channel cable disconnection results in EPS action.

Sensor name:	EPICS PV:	Temperature:	HI: °C	HIHI: °C	EPS:
Mask Upstream	XF:04IDA-OP:1{Msk:1}T:U-I	28.5 °C	80.0	90.0	FE SH
Mask Downstream	XF:04IDA-OP:1{Msk:1}T:D-I	28.4 °C	80.0	90.0	FE SH
Mask Center	XF:04IDA-OP:1{Msk:1}T:C-I	28.7 °C	80.0	90.0	FE SH
Mask Outboard	XF:04IDA-OP:1{Msk:1}T:O-I	28.6 °C	80.0	90.0	FE SH
Mask Upstream Inboard	XF:04IDA-OP:1{Msk:2}T:UI-I	28.8 °C	80.0	90.0	FE SH
Mask Upstream Outboard	XF:04IDA-OP:1{Msk:2}T:UO-I	28.8 °C	80.0	90.0	FE SH
Mask Downstream Inboard	XF:04IDA-OP:1{Msk:2}T:DI-I	28.6 °C	80.0	90.0	FE SH
Mask Downstream Outboard	XF:04IDA-OP:1{Msk:2}T:DO-I	29.0 °C	80.0	90.0	FE SH
HFM Ax:X1	XF:04IDA-OP:1{Mir:HFM}T:Ax:X1-I	24.0 °C	—	—	—
HFM Ax:X2	XF:04IDA-OP:1{Mir:HFM}T:Ax:X2-I	24.3 °C	—	—	—
HFM X1_Stage	XF:04IDA-OP:1{Mir:HFM}T:X1_Stage-I	24.9 °C	80.0	90.0	FE SH
HFM X2_Stage	XF:04IDA-OP:1{Mir:HFM}T:X2_Stage-I	25.2 °C	80.0	90.0	FE SH
HFM Cooling_1	XF:04IDA-OP:1{Mir:HFM}T:Cooling_1-I	19.9 °C	80.0	90.0	FE SH
HFM Cooling_2	XF:04IDA-OP:1{Mir:HFM}T:Cooling_2-I	20.0 °C	80.0	90.0	FE SH
HFM Cooling_3	XF:04IDA-OP:1{Mir:HFM}T:Cooling_3-I	20.2 °C	80.0	90.0	FE SH
HFM Cooling_4	XF:04IDA-OP:1{Mir:HFM}T:Cooling_4-I	20.2 °C	80.0	90.0	FE SH

Sensor name:	EPICS PV:	Temperature:	HI: °C	HIHI: °C	EPS:
HFM Bend_Stg Mtr	XF:04IDA-OP:1{Mir:HFM}T:Bend_Stg Mtr-I *	n/a	n/a	n/a	—
HFM Bend_Stg 1	XF:04IDA-OP:1{Mir:HFM}T:Bend_Stg 1-I *	n/a	n/a	n/a	—
HFM Bend_Stg 2	XF:04IDA-OP:1{Mir:HFM}T:Bend_Stg 2-I *	n/a	n/a	n/a	—
HFM Bend_Stg 3	XF:04IDA-OP:1{Mir:HFM}T:Bend_Stg 3-I *	n/a	n/a	n/a	—
HFM Bend_Stg 4	XF:04IDA-OP:1{Mir:HFM}T:Bend_Stg 4-I *	n/a	n/a	n/a	—
WB:BS Upstream Inboard	XF:04IDA-OP:1{BS:WB}T:UI-I	28.6 °C	80.0	90.0	FESH
WB:BS Upstream Outboard	XF:04IDA-OP:1{BS:WB}T:UO-I	28.7 °C	80.0	90.0	FESH
WB:BS Downstream Inboard	XF:04IDA-OP:1{BS:WB}T:DI-I	28.7 °C	80.0	90.0	FESH
WB:BS Downstream Outboard	XF:04IDA-OP:1{BS:WB}T:DO-I	28.6 °C	80.0	90.0	FESH
Mono Ax:Z	XF:04IDA-OP:1{Mono:DCM}T:Ax:Z-I	25.4 °C	—	—	—
Mono Ax:Y2	XF:04IDA-OP:1{Mono:DCM}T:Ax:Y2-I	26.4 °C	—	—	—
Mono Ax:th2	XF:04IDA-OP:1{Mono:DCM}T:Ax:th2-I	26.1 °C	—	—	—
Mono Ax:chi2	XF:04IDA-OP:1{Mono:DCM}T:Ax:chi2-I	26.0 °C	—	—	—
Mono Crys1_1	XF:04IDA-OP:1{Mono:DCM}T:Crys1_1-I	25.3 °C	80.0	90.0	FESH
Mono Crys1_2	XF:04IDA-OP:1{Mono:DCM}T:Crys1_2-I	25.4 °C	80.0	90.0	FESH
Mono Crys1_3	XF:04IDA-OP:1{Mono:DCM}T:Crys1_3-I	25.2 °C	80.0	90.0	FESH
Mono Crys1_4	XF:04IDA-OP:1{Mono:DCM}T:Crys1_4-I	25.3 °C	80.0	90.0	FESH
Mono Crys2_1	XF:04IDA-OP:1{Mono:DCM}T:Crys2_1-I	25.9 °C	80.0	90.0	FESH
Mono Crys2_2	XF:04IDA-OP:1{Mono:DCM}T:Crys2_2-I	26.1 °C	80.0	90.0	FESH
Mono Crys2_3	XF:04IDA-OP:1{Mono:DCM}T:Crys2_3-I	26.2 °C	80.0	90.0	FESH
Mono Crys2_4	XF:04IDA-OP:1{Mono:DCM}T:Crys2_4-I	26.1 °C	80.0	90.0	FESH
BS:PB Upper	XF:04IDA-OP:1{BS:PB}T:Upper-I	28.6 °C	80.0	90.0	FESH
BS:PB Lower	XF:04IDA-OP:1{BS:PB}T:Lower-I	28.4 °C	80.0	90.0	FESH

* Temperature sensors were excluded from design and do not exist

Sensor name:	EPICS PV:	Temperature:	°C HI:	°C HIHI:	EPS:
VFM Ax:X1	XF:04IDA-OP:1{Mir:VFM}T:Ax:X1-I	25.7 °C	—	—	—
VFM Ax:X2	XF:04IDA-OP:1{Mir:VFM}T:Ax:X2-I	28.7 °C	—	—	—
VFM Bend_Stg_Mtr	XF:04IDA-OP:1{Mir:VFM}T:Bend_Stg_Mtr-I *	n/a	—	—	—
VFM Bend_Stg 1	XF:04IDA-OP:1{Mir:VFM}T:Bend_Stg 1-I *	n/a	—	—	—
VFM Bend_Stg 2	XF:04IDA-OP:1{Mir:VFM}T:Bend_Stg 2-I *	n/a	—	—	—
VFM Bend_Stg 3	XF:04IDA-OP:1{Mir:VFM}T:Bend_Stg 3-I *	n/a	—	—	—
VFM Bend_Stg 4	XF:04IDA-OP:1{Mir:VFM}T:Bend_Stg 4-I *	n/a	—	—	—
DHRM Ax:X1	XF:04IDB-OP:1{Mir:DHRM}T:Ax:X1-I	23.6 °C	—	—	—
DHRM Ax:X2	XF:04IDB-OP:1{Mir:DHRM}T:Ax:X2-I	23.4 °C	—	—	—

FE SH – Front End Shutter

"–" for Hi and HiHi means the sensor used for monitoring only

* Temperature sensors were excluded from design and do not exist

Test Set 4: EPS/PPS interface

For the primary Photon Shutter:

Front End: If *FRONT END ENABLE STATUS* and *FOE PERMIT* and not *USER INTERLOCK* command the front end shutter to open.

Front end opens and ***FRONT END OPEN STATUS*** = OPEN: ✓

Command the front end shutter to close.

Front end closes and ***FRONT END OPEN STATUS*** = CLOSED: ✓

With the front end open force a user interlock.

Front end closes and ***FRONT END OPEN STATUS*** = CLOSED: ✓

Attempt to open the front end shutter through EPICS while not all gate valves in white-beam region down to next secondary shutter are open.

Front end cannot be opened through EPICS:

For the secondary photon shutter:

If PHOTON SHUTTER x ENABLE STATUS = 1 (ABILITY TO OPEN) and ESEE x PERMIT command the shutter to open.

Shutter opens and **PHOTON SHUTTER x *OPEN STATUS*** = OPEN ✓ ✓

Command the shutter to close.

Shutter closes and **PHOTON SHUTTER x *OPEN STATUS*** = CLOSED ✓ ✓

Attempt to open the shutter through EPICS while not all gate valves in white-beam region downstream the shutter are open.

Shutter cannot be opened through EPICS: ✓ ✓

Prepared by:

X

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Appendix A:

Ancillary interlocks:

Remove these ancillary interlock alarms. Verify that an "OPEN" Front End shutter closes and cannot be opened via EPICS command when each signal is lost. Restore signal and verify Front End shutter enabled.

EPICS interlock name	FE Closes & disabled	FE Enabled
XF:04IDA-BI:1{Scr:1} is in undefined state (neither inserted nor retracted)	✓	✓
XF:04IDA-BI:1{Scr:2} is in undefined state (neither inserted nor retracted)	✓	✓

Rk

Appendix B:

Cooling Interlocks

Remove these cooling interlock alarms. Verify that an "OPEN" Front End shutter closes and cannot be opened via EPICS command when each signal is lost. Restore signal and verify Front End shutter enabled.

Cooling interlock name	FE Closes & disabled	FE Enabled
Loss Flow Alarm Pump #1 *	✓	✓
Loss Flow Alarm Pump #2 *	✓	✓
Low Liquid Level Alarm *	—	—
Hi Temp Alarm *	—	—

* Tested to the terminal block

Appendix C:

Vacuum Window Interlocks

Verify that when each of the following vacuum trip conditions happens that a closed Beryllium window will open and an EPICS command fails to close the Beryllium window.

EPICS vacuum	BE Opens *	EPICS Disabled
XF:04IDA-VA{DPP-IP:1}	✓	✓
XF:04IDA-VA{DPP-CCG:1}	✓	✓
XF:04IDA-VA{DPP-TCG:1}	✓	✓
XF:04IDA-VA{DPP-IP:2}	✓	✓
XF:04IDA-VA{DPP-CCG:2}	✓	✓
XF:04IDA-VA{DPP-TCG:2}	✓	✓

Verify that an "OPEN" Front End shutter closes and cannot be opened via EPICS command when both the diamond and Beryllium windows no longer provide "CLOSE" status bits. ✓ *

* tested with simulator