

Brookhaven National Laboratory/National Synchrotron Light Source			
Subject:	VACUUM PROCEDURES FOR BEAMLINE X-1A		
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		Effective:	08/17/2011
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The following procedures must be followed when bleeding up different beamline sections and when returning these sections to operation (refer to Beamline Layout Drawing):

NOTE: In the following, designations “i” and “inboard” refer to beamline X1A2, while “o” and “outboard” refer to beamline X1A1

I. FRONT-END (PROCEDURE TO BE PERFORMED BY NSLS VACUUM GROUP ONLY)

A. Bleed-Up

1. Notify the Coordinator (Beeper 5824).
2. Refer to Front-End Vacuum Procedures (SLS-07.19-13-1).

B. Return to Operation

1. Notify the Coordinator (Beeper 5824).
2. Refer to Front-End Vacuum Procedures (SLS-07.19-13-1).

II. SECTION BETWEEN VALVES V1 AND V2, X-1A MIRROR CHAMBER

A. Bleed-Up

1. Notify the Coordinator (Beeper 5824).
2. Close and seal Front End Valve and Valve V1.
3. Hook up turbo pump to this section and isolate turbo.
4. Coordinator places Yellow Tags on Front End Valve and Valve V1.
5. Slowly bleed up with boil-off N₂ while Coordinator monitors pressure between Front End and Valve V1. (Gauge IGFE)

B. Return to Operation

1. Pump to $< 2 \times 10^{-9}$ Torr (gauge IG1)
2. Notify the Coordinator (Beeper 5824).
3. Prepare for RGA scan.*
4. Open Valve V1 provided pressure $< 2 \times 10^{-9}$ Torr downstream of the valve.
5. Perform RGA scan.*
6. If RGA scan or pressure reading (if no RGA scan required) is satisfactory, Coordinator removes Yellow Tags from Valves V1 and Front-End Valve.
7. Remove any unprotected turbo pump from this section or valve off the turbo pump and place a Yellow Tag on the valve.**

III. SECTION BETWEEN VALVES V2 AND V3, X-1B MIRROR CHAMBER

A. Bleed-Up

1. Notify the Coordinator (Beeper 5824).
2. Close and seal Valves V1 and V2.
3. Hook up turbo pump to this section and isolate turbo.
4. Coordinator places Yellow Tags on Valves V1 and V2.
5. Slowly bleed up with boil-off N₂ while Coordinator monitors pressure between Valves V1 and V2 (gauge IG1).

B. Return to Operation

1. Pump to $< 2 \times 10^{-9}$ Torr (gauge IG2)
2. Notify the Coordinator (Beeper 5824).
3. Prepare for RGA scan.*

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4. Open Valve V2 and then Valve V1 provided pressure $< 2 \times 10^{-9}$ Torr downstream of these valves.
5. Perform RGA scan.*
6. If RGA scan or pressure reading (if no RGA scan required) is satisfactory, Coordinator removes Yellow Tags from Valves V1 and V2.
7. Remove any unprotected turbo pump from this section or valve off the turbo pump and place a Yellow Tag on the valve.**

IV. SECTION BETWEEN VALVES V3 AND V4i, V4o: OUTBOARD BRANCH TOROIDAL MIRROR

A. Bleed-Up

1. Notify the Coordinator (Beeper 5824).
2. Close and seal Valve V2 and Valve V3.
3. Hook up turbo pump to this section and isolate turbo.
4. Coordinator places Yellow Tags on Valve V2 and Valve V3.
5. Slowly bleed up with boil-off N₂ while Coordinator monitors pressure between Valve V2 and Valve V3 (gauge IG2).

B. Return to Operation

1. Pump to $< 2 \times 10^{-9}$ Torr (gauge IG3).
2. Notify the Coordinator (Beeper 5824).
3. Prepare for RGA scan.*
4. Open Valves V3, and then Valve V2 provided pressure $< 2 \times 10^{-9}$ Torr downstream of these valves.
5. Perform RGA scan.*
6. If RGA scan or pressure reading (if no RGA scan required) is satisfactory, Coordinator removes Yellow Tags from Valve V2 and Valve V3.
7. Remove any unprotected turbo pump from this section or valve off the turbo pump and place a Yellow Tag on the valve.**

V. SECTION BETWEEN VALVES V4i, V4o and V5i, V5o: INBOARD BRANCH TOROIDAL MIRROR CHAMBER

A. Bleed-Up

1. Notify the Coordinator (Beeper 5824).
2. Close and seal Valves V3 and V4i, V4o.
3. Hook up turbo pump to this section and isolate turbo.
4. Coordinator places Yellow Tags on Valves V3 and V4i, V4o.
5. Slowly bleed up with boil-off N₂ While Coordinator monitors pressure between Valves V3 and V4i, V4o (gauge IG3).

B. Return to Operation

1. Pump to $< 2 \times 10^{-9}$ Torr (gauge IG4).
2. Notify the Coordinator (Beeper 5824).
3. Prepare for RGA scan.*
4. Open Valves V4i, V4o and then V3 provided pressure $< 2 \times 10^{-9}$ Torr downstream of these valves.
5. Perform RGA scan.*
6. If RGA scan or pressure reading (if no RGA scan required) is satisfactory, Coordinator removes Yellow Tags from Valves V3 and V4i, V4o.
7. Remove any unprotected turbo pump from this section or valve off the turbo pump and place a Yellow Tag on the valve.**

VI. SECTION BETWEEN VALVES V5o, V5i AND VALVES V6o, V6i: OUTBOARD BRANCH ENTRANCE SLIT, OUTBOARD GRATING CHAMBER, AND INBOARD BRANCH ENTRANCE SLIT

A. Bleed-Up

1. Notify the Coordinator (Beeper 5824).
2. Close and seal Valves V4i, V4o and V5i, V5o.

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- Hook up turbo pump to this section and isolate turbo.
- Coordinator places Yellow Tags on Valves V4i, V4o and V5i, V5o.
- Slowly bleed up with boil-off N₂ while Coordinator monitors pressure between Valves V4i, V4o and V5i, V5o (gauge IG4)

B. Return to Operation

- Pump to $< 2 \times 10^{-9}$ Torr (gauges IG5o, IG6o).
- Notify the Coordinator (Beeper 5824).
- Prepare for RGA scan.*
- Open Valves V5i, V5o and then V4i, V4o provided pressure $< 2 \times 10^{-9}$ Torr downstream of these valves.
- Perform RGA scan.*
- If RGA scan or pressure reading (if no RGA scan required) is satisfactory, Coordinator removes Yellow Tags from Valves V4i, V4o, and V5i, V5o.
- Remove any unprotected turbo pump from this section or valve off the turbo pump and place a Yellow Tag on the valve.**

VII. SECTION BETWEEN VALVES V6o AND V7o, OUTBOARD BRANCH STRAIGHT PIPE

Since this section does not have an ion pump, it can only be bled up and pumped together with the section between V7o and V8o.

VIII. SECTION BETWEEN VALVES V6o and V8o, OUTBOARD BRANCH STRAIGHT PIPE AND EXIT SLITS

A. Bleed-Up

- Notify the Coordinator (Beeper 5824).
- Close and seal Valves V5o and V6o.
- Hook up turbo pump to this section and isolate turbo.
- Coordinator places Yellow Tags on Valves V5o and V6o.
- Slowly bleed up with boil-off N₂ while Coordinator monitors pressure between Valves V5o and V6o (gauges IG5o, IG6o).

B. Return to Operation

- Pump to $< 2 \times 10^{-9}$ Torr (gauge IG7o).
- Notify the Coordinator (Beeper 5824).
- Prepare for RGA scan.*
- Open Valves V6o and then V5o provided pressure $< 2 \times 10^{-9}$ Torr downstream of these valves.
- Perform RGA scan.*
- If RGA scan or pressure reading (if no RGA scan required) is satisfactory, Coordinator removes Yellow Tags from Valves V5o and V6o.
- Remove any unprotected turbo pump from this section or valve off the turbo pump and place a Yellow Tag on the valve.**

IX. SECTION BETWEEN VALVES V8o AND V9o

Note: Depending on the experiment running, there may be a valve V10o between V9o and the SiN Exit Window. The experiments themselves are downstream of the Exit Window. They either operate in atmosphere (STXM) or require frequent venting (AP-XPS).

A. Bleed-Up

- Notify the Coordinator (Beeper 5824).
- Close and seal Valves V7o and V8o.
- Hook up turbo pump to this section and isolate turbo.
- Coordinator places Yellow Tags on Valves V7o and V8o.
- Slowly bleed up with boil-off N₂ while Coordinator monitors pressure between Valves V7o and V8o (gauge IG8o).

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B. Return to Operation

1. Pump section to $< 5 \times 10^{-7}$ Torr (gauge IG8o).
2. Notify the Coordinator (Beeper 5824).
3. Prepare for RGA scan.*
4. Open Valves V8o and then V7o provided pressure $< 5 \times 10^{-7}$ Torr downstream of these valves.
5. Perform RGA scan.*
6. If RGA scan or pressure reading (if no RGA scan required) is satisfactory, Coordinator removes Yellow Tags from Valves V7o and V8o.
7. Remove any unprotected turbo pump from this section or valve off the turbo pump and place a Yellow Tag on the valve.**

X. OUTBOARD AP-XPS ENDSTATION AND DOWNSTREAM OF V9o**A. Bleed-Up**

1. Notify the Coordinator (Beeper 5824).
2. Close and seal Valves V10o and V9o (if V10o is installed), otherwise Close and seal Valves V9o and V8o.
3. Coordinator places Yellow Tags on Valves V10o and V9o (if V10o is installed), otherwise Coordinator places yellow tags on V9o and V8o.
4. Slowly bleed-up end-station with boil-off N₂ while Coordinator monitors pressure upstream of Valve V10o (if V10o is installed) otherwise Coordinator monitors pressure upstream of Valve V9o.

B. Return to Operation

1. Pump endstation to $< 5.0 \times 10^{-7}$ Torr.
2. Notify the Coordinator (Beeper 5824).
3. Prepare for RGA scan.*
4. Open Valve V10o (if V10o is installed) otherwise open Valve V9o provided pressure $< 5.0 \times 10^{-7}$ Torr downstream of Valve V10o or V9o (PG9o).
5. Open Valve V9o (if V10o is installed) otherwise open valve V8o provided pressure $< 1.0 \times 10^{-8}$ Torr downstream of this Valve V9o or V8o (IG8o).
6. If RGA scan or pressure reading (if no RGA Scan required) is satisfactory, Coordinator Removes Yellow Tags from Valves V10o and V9o (if V10o is installed) otherwise Coordinator Removes Yellow Tags from Valves V9o and V8o.

XI. SECTION BETWEEN VALVES V6i and V7i, INBOARD BRANCH SGM CHAMBER**A. Bleed-Up**

1. Notify the Coordinator (Beeper 5824).
2. Close and seal Valves V5i, V5o and V6i, V6o.
3. Hook up turbo pump to this section and isolate turbo.
4. Coordinator places Yellow Tags on Valves V5i, V5o and V6i, V6o.
5. Slowly bleed up with boil-off N₂ while Coordinator monitors pressure between Valves V5i and V6i (gauges IG5o, IG6o).

B. Return to Operation

1. Pump to $< 2 \times 10^{-9}$ Torr (gauge IG6i).
2. Notify the Coordinator (Beeper 5824).
3. Prepare for RGA scan.*
4. Open Valves V6i, V6o and then V5i, V5o provided pressure $< 2 \times 10^{-9}$ Torr downstream of these valves.
5. Perform RGA scan.*

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- If RGA scan or pressure reading (if no RGA scan required) is satisfactory, Coordinator removes Yellow Tags from Valves V5i, V5o and V6i, V6o.
- Remove any unprotected turbo pump from this section or valve off the turbo pump and place a Yellow Tag on the valve.**

XII. SECTION BETWEEN VALVES V7i and V8i, INBOARD BRANCH STRAIGHT PIPE

Since this section does not have an ion pump, it can only be bled up and pumped together with the section between V8i and V9i.

XIII. SECTION BETWEEN VALVES V7i and V9i, INBOARD BRANCH STRAIGHT PIPE AND ION PUMP

A. Bleed-Up

- Notify the Coordinator (Beeper 5824).
- Close and seal Valves V6i and V7i.
- Hook up turbo pump to this section and isolate turbo.
- Coordinator places Yellow Tags on Valves V6i and V7i.
- Slowly bleed up with boil-off N₂ while Coordinator monitors pressure between Valves V6i and V7i (gauge IG6i).

B. Return to Operation

- Pump to $< 2 \times 10^{-9}$ Torr (gauge IG7i).
- Notify the Coordinator (Beeper 5824).
- Prepare for RGA scan.*
- Open Valves V7i and then V6i provided pressure $< 2 \times 10^{-9}$ Torr downstream of these valves.
- Perform RGA scan.*
- If RGA scan or pressure reading (if no RGA scan required) is satisfactory, Coordinator removes Yellow Tags from Valves V6i and V7i.
- Remove any unprotected turbo pump from this section or valve off the turbo pump and place a Yellow Tag on the valve.**

XIV. SECTION BETWEEN VALVES V9i AND V10i, INBOARD BRANCH EXIT SLIT

A. Bleed-Up

- Notify the Coordinator (Beeper 5824).
- Close and seal Valves V8i and V9i.
- Hook up turbo pump to this section and isolate turbo.
- Coordinator places Yellow Tags on Valves V8i and V9i.
- Slowly bleed up with boil-off N₂ while Coordinator monitors pressure between Valves V8i and V9i (on ion pump P7i).

B. Return to Operation

- Pump to $< 5 \times 10^{-9}$ Torr (gauge IG9i).
- Notify the Coordinator (Beeper 5824).
- Prepare for RGA scan.*
- Open Valves V9i and then V8i provided pressure $< 5 \times 10^{-9}$ Torr downstream of these valves.
- Perform RGA scan.*
- If RGA scan or pressure reading (if no RGA scan required) is satisfactory, Coordinator removes Yellow Tags from Valves V8i and V9i.
- Remove any unprotected turbo pump from this section or valve off the turbo pump and place a Yellow Tag on the valve.**

XV. INBOARD ENDSTATION

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A. Bleed-Up

1. Notify the Coordinator (Beeper 5824).
 2. Close and seal Valves V10i and V9i.
 3. Coordinator places Yellow Tags on Valves V10i and V9i.
- Slowly bleed-up with boil-off N₂ while Coordinator monitors pressure upstream of Valve V10i.

B. Return to Operation

1. Pump endstation to $< 5.0 \times 10^{-7}$ Torr.
2. Notify the Coordinator (Beeper 5824).
3. Prepare for RGA scan.*
4. Open Valve V10i provided pressure $< 5.0 \times 10^{-7}$ Torr downstream of this valve.
5. Open Valve V9i provided pressure $< 1.0 \times 10^{-8}$ Torr downstream of this valve.
6. If RGA scan or pressure reading (if no RGA Scan required) is satisfactory, Coordinator Removes Yellow Tags from Valves V10i and V9i.

*** NSLS POLICY FOR RGA SCANS (24 HOUR NOTICE REQUIRED)**

An RGA scan is required before returning to operation if there is a major change of hardware in the vacuum system, i.e. changing of samples, mirrors, windows, monochromator crystals or gratings, manipulators, detectors, etc., **with the following two exceptions:**

1. After UHV sample chambers have been bled up for replacing components, an RGA scan will not be required if the chamber pressure is returned to $< 2 \times 10^{-9}$ Torr and the Front End pressure remains $< 2 \times 10^{-9}$ Torr when vacuum sections upstream of the chamber are opened into the Front End.
2. If any vacuum section upstream of the bled-up section remains at a pressure of $< 9 \times 10^{-10}$ Torr as read using a hot-filament ion gauge, when the entire beamline is opened into the Front End, and the Front End pressure does not increase, no RGA is required.

**** NSLS TURBO PUMP POLICY**

An unprotected turbo pump is one not separated from the Front End by a beamline valve which automatically closes in the event of a power loss or a pressure increase at the turbo pump. **No unprotected turbo pump can share a contiguous vacuum with the Front End.**

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Rev	Description	Date
B	Initial release into the Controlled Document System	06/02/2004
C	Changed Approver from Conrad Foerster to Eugene Hu. Procedures re-written from Sect. XV on, to represent the installation of the new End Station.	06/25/2009
D	Sections XIV, XV and XVI removed to reflect re-configured Beamline with the removal of the STXMIV Microscope, original Section XVII renamed Section XIV.	06/28/2010
E	Added the clarification “i” inboard is X-1A2, “o” outboard is X-1A1. All references to the Holography Section has been removed. Section X re-written to describe the addition of the Outboard AP-XPS End Station. All sections re-numbered after Section X.	08/17/2011

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