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*Approval signatures on file with master copy.

The following procedures must be followed when bleeding up different beam line sections and when returning these sections to operation (refer to Beam Line Layout Drawing):

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 VALVE 1A AND VALVE 2A, MIRROR TANK

A. Bleed-Up

1. Notify the Coordinator (Beeper 5824).
2. Close and seal Valve 1A, Front-End Vat Valve and downstream Valve 2A.
3. Coordinator places Yellow Tag on Valve 1A.
4. Hook up Turbo Pump to this section.
5. Slowly bleed-up with boil-off N_2 while Coordinator monitors Front-End pressure.

B. Return to Operation

1. Bake and pump to $<2x10^{-9}$ Torr.
2. Notify the Coordinator (Beeper 5824).
3. Prepare for RGA scan.*
4. Open Valve 1A if pressure $<2x10^{-9}$ Torr downstream of valve.
5. Perform RGA scan.*
6. If RGA scan or pressure reading (if no RGA scan required) is satisfactory, Coordinator removes Yellow Tag from Valve 1A.
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 VALVE 2A AND VALVE 3A, BENCH 2 AND BENCH 3

A. Bleed-Up

1. Notify the Coordinator (Beeper 5824).
2. Close Valve 2A, Valve 1A and downstream Valve 3A.
3. Coordinator places Yellow Tags on Valve 2A and Valve 1A.
4. Hook up Turbo Pump to this section.
5. Slowly bleed-up with boil-off N_2 while Coordinator monitors pressure between Valve 2A and Valve 1A (Mirror Tank).

B. Return to Operation

1. Bake and pump to $<2x10^{-9}$ Torr.
2. Notify the Coordinator (Beeper 5824).
3. Prepare for RGA scan.*
4. Open Valve 2A. If pressure $<2x10^{-9}$ Torr downstream of Valve 1A (Mirror Tank), open Valve 1A.
5. Perform RGA scan.*
6. If RGA scan or pressure reading (if no RGA scan required) is satisfactory, Coordinator

removes Yellow Tags from Valve 2A and Valve 1A.

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 VALVE 3A AND VALVE 4A (OR VALVE 3A AND VALVE 5A) BENCH 4

A. Bleed-Up

1. Notify the Coordinator (Beeper 5824).
2. Close Valves 3A, 2A, 1A and downstream Valve 4A (or downstream Valve 5A).
3. Coordinator places Yellow Tags on Valve 3A and Valve 2A.
4. Coordinator disables the Fast Valve at the arming module and Yellow Tags the module against enabling.
5. Hook up Turbo Pump to this section.
6. Slowly bleed-up with boil-off N_2 while Coordinator monitors pressure between Valve 3A and Valve 2A (Bench 3 or Bench 2).

B. Return to Operation

1. Bake and pump to $<2x10^{-9}$ Torr.
2. Notify the Coordinator (Beeper 5824).
3. Prepare for RGA scan.*
4. Open Valve 3A. If pressure $<5x10^{-9}$ Torr downstream of Valve 2A (Bench 3 or Bench 2) open Valve 2A. If pressure $< 2 \times 10^{-9}$ Torr downstream of Valve 1A (Mirror Tank) open Valve 1A.
5. Perform RGA scan.*
6. Coordinator enables the Fast Valve at the arming module and Yellow Tags the module against disabling.
7. If RGA scan or pressure reading (if no RGA scan required) is satisfactory, Coordinator removes Yellow Tag from Valve 3A and Valve 2A.
8. Remove any unprotected turbo pump from this section or valve off turbo pump and place a Yellow Tag on the valve.**

V. SECTION BETWEEN VALVE 4A AND VALVE 6A, MONOCHROMATOR AND BEAM PIPE

A. Bleed-Up

1. Notify the Coordinator (Beeper 5824).
2. Close Valves 4A, 3A, 1A and downstream Valve 6A.
3. Coordinator places Yellow Tags on Valve 4A and Valve 3A.
4. Hook up Turbo Pump to this section.
5. Slowly bleed-up with boil-off N_2 while Coordinator monitors pressure between Valve 4A and Valve 3A (Bench 4).

B. Return to Operation

1. Pump to $< 2x10^{-6}$ Torr.
2. Notify the Coordinator (Beeper 5824).
3. Prepare for RGA scan.*
4. Open Valve 4A. If pressure $< 1 \times 10^{-7}$ Torr downstream of Valve 3A (Bench 4) open Valves 3A and 2A. If pressure $< 2 \times 10^{-9}$ Torr downstream of Valve 1A (Mirror Tank) open Valve 1A.
5. Perform RGA scan.*
6. If RGA scan or pressure reading (if no RGA scan required) is satisfactory, Coordinator removes Yellow Tag from Valve 4A.
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 VALVE 5A AND VALVE 6A, MONOCHROMATOR

A. Bleed-Up

1. Make sure endstation is pumped and valve 7A is open (to keep downstream section pumped).
2. Make sure valves 2A, 3A, 5A and 6A are all closed. Leave photon shutter and valve 4A open. Valves 3 and 5 will get tagged by the Coordinator.
3. Notify the Coordinator(Beeper 5824) at x3456 -5824 -5708 & ask permission to start the auto-venting (should take 10-15 minutes for spin-down, ask Coordinator if they prefer to wait 10 minutes before coming out to the beamline or for you to wait for them to arrive before starting spinning down the turbo).
4. Coordinator places Yellow Tags on Valves 3A and 5A.
5. Set mono turbo gate valve control to bypass (to keep open).
6. Turn off mono ion gauge controller.
7. Turn off the power strip controlling foreline pump and flow control valve.
8. Connect the N2 vent line to the vent valve and open the black-knob N2 control valve (all valves open).
9. Check that the vent option from turbo DCU controller has the following setup:
   012: vent enabled <<**ON**>>
   030: vent mode <<**0**>> for automatic venting (1 is manual off, 2 is manual on)
   720: vent frequency (40% -98%): <<**65%**>>;
   721: vent time (0-3600s): <<**2200s**>>.
10. Push "power off" from controller to start spin-down of the turbo.
11. When controller shows 596 Hz @ turbo speed, the controller should automatically open the vent valve and let the N2 gas in. (If not, then go to page **030** vent mode and select <<**2**>> to force vent valve open; if after this the vent valve is still closed, remove the vent valve from the turbo vent port by unscrewing the screw slowly to let air in to vent).
12. If the mono will be vented for more than 4 hours, turn off the chiller.
13. Close N2 supply valve and stow hose.

B. Return to Operation

1. Verify that valves 5A, 3A and 6A remain closed, mono turbo gate valve remains open, and photon shutter is open (to help pumping).
2. Make sure the vent valve is closed (by checking on N2 regulator pressure ~10 psi when closed). (If not, go to page **030** and select <<**1**>> to close vent valve manually).
3. Turn on the foreline pump and flow valve using the power strip switch.
4. Monitor the foreline and mono TC gauges as the pressure drops.
5. Turn on the turbo pump and wait for spin-up (to 833 Hz @ full speed).
6. When the mono TC gauge shows < 1 mTorr, turn on the ion gauge and observe the pressure.
7. Monitor the ion gauge pressure as it drops below 1.8×10^{-6} Torr.
8. Close valve 7A.
9. Notify the Coordinator (Beeper 5824) to remove yellow tags from valves 5A and 3A and re-enable the beamline.
10. Make sure the chiller is on and warmed up before operating the mono.

VII. SECTION BETWEEN VALVE 6A AND VALVE 7A, DIFFERENTIAL PUMP

A. Bleed-Up

1. Notify the Coordinator (Beeper 5824).
2. Close Valves 6A, 5A, 1A and downstream Valve7A.
3. Coordinator places Yellow Tags on Valve 6A and Valve 5A.
4. Hook up Turbo Pump to this section.
5. Slowly bleed-up with boil-off N_2 while Coordinator monitors pressure between Valve 6A and

Valve 5A (Monochromator).

B. Return to Operation

1. Pump to < $2x10^{-6}$ Torr.
2. Notify the Coordinator (Beeper 5824).
3. Prepare for RGA scan.*
4. Open Valve 6A. If pressure < $2x10^{-6}$ Torr downstream of Valve 5A (Monochromator) open Valves 5A, 4A, 3A and 2A. If pressure < 2 x 10^{-9} Torr downstream of Valve 1A (Mirror Tank) open Valve 1A. If vacuum in section downstream of valve 7A (endstation) is fully recovered see section VIII), re-open valve 7A.
5. Perform RGA scan.*
6. If RGA scan or pressure reading (if no RGA scan required) is satisfactory, Coordinator removes Yellow Tags from Valve 6A and Valve 5A.
7. Remove any unprotected turbo pump from this section or valve off the turbo pump and place a Yellow Tag on the valve.**

VIII. SECTION DOWNSTREAM OF VALVE 7A, END STATION

A. Bleed-Up

1. If valve 8A is installed, close valve 8A. Open extension pumping valve if desired.
2. Verify that the end station turbo gate valve is open.
3. Close valve 6A.
4. Close valve 7A.
5. Close the turbo foreline valve.
6. Verify that the vent line is connected to the dewar; manual valve (right before the yellow turbo vent line) should be opened fully and all vent valves open.
7. Loosen hinged window flange on end station to allow for overpressure relief.
8. Turn off turbo by pushing turbo controller start/stop button (at lower right corner).
9. When turbo spins down enough, the controller should automatically open the vent valve and let the N_2 gas in. This step should take 5 minutes or less. If not, summon beamline staff for assistance.
10. During the vent, observe the pressure gauges in the end station and DPS section: end station pressure should rise, but DPS pressure should not (stop if any leak is found!).
11. Wait for the end station to fully vent and hinged window flange to open.
12. Close the vent inlet valve (the manual valve right before the yellow turbo vent line).

B. Return to Operation

1. Verify that valve 8A is closed (if equipped).
2. Verify that the end station turbo gate valve is open.
3. Verify that valve 6A and 7A controls are in closed state.
4. Verify that the turbo vent valve is closed by checking on N2 regulator pressure ~10 psi when closed (you must wait at least 5 minutes seconds from when vent valve is first opened for the controller to do this automatically. If vent valve does not close, go to page **030** in the turbo controller and select <<**1**>> to close vent valve manually).
5. Verify that the gas inlet valve (before the yellow venting line) is closed.
6. Close and gently tighten hinged window flange.
7. Verify foreline pump is operating and open turbo foreline valve.
8. Start turbo pump using turbo controller start/stop button. If you observe red LED and/or error message at turbo controller then summon beamline staff.
9. Wait until end station pressure is 1.8x10 $^{-6}$ Torr or lower (typically 20 minutes).
10. Reset valve 7A control interlocks (end station pressure and turbo speed limits should be faulted after the bleed-up).
11. Open valve 7A.

11. Verify that the upstream (DPS) pressure is below $2x10^{-6}$ Torr.
12. Open valve 6A to return operations.

IX. SECTION DOWNSTREAM OF VALVE 8A, END STATION EXTENSION CHAMBER

A. Bleed-Up

1. Verify that Valve 8A control is properly interlocked to extension pressure (<30 mTorr) and Valve 7A status (closed).
2. Close Valves 6A , 7A and 8A.
3. Close extension pump valve.
4. Enable overpressure relief by loosening flange bolts on the extension body or attached component.
5. Attach provided vent line to dedicated vent port on the extension chamber and verify all N2 vent line valves are open.
6. Bring extension chamber to atmosphere by opening extension vent valve.

B. Return to Operation

1. Verify that Valves 6A, 7A and 8A remain closed.
2. Verify End Station pressure is less than 1.8×10^{-6} Torr, turbo is running, and endstation turbo gate valve is open (normal end station operations).
3. Close extension vent valve.
4. Verify roughing pump is operating and open extension pump valve.
5. Monitor extension chamber pressure as it drops to set point (<30 mTorr).
6. Open Valve 8A.
7. Close extension pump valve.
8. Monitor pressure of the end station until it is below $1.8x10^{-6}$ Torr .
9. Open Valve 7A and 8A to recover operations (reset end station pressure interlock as needed).

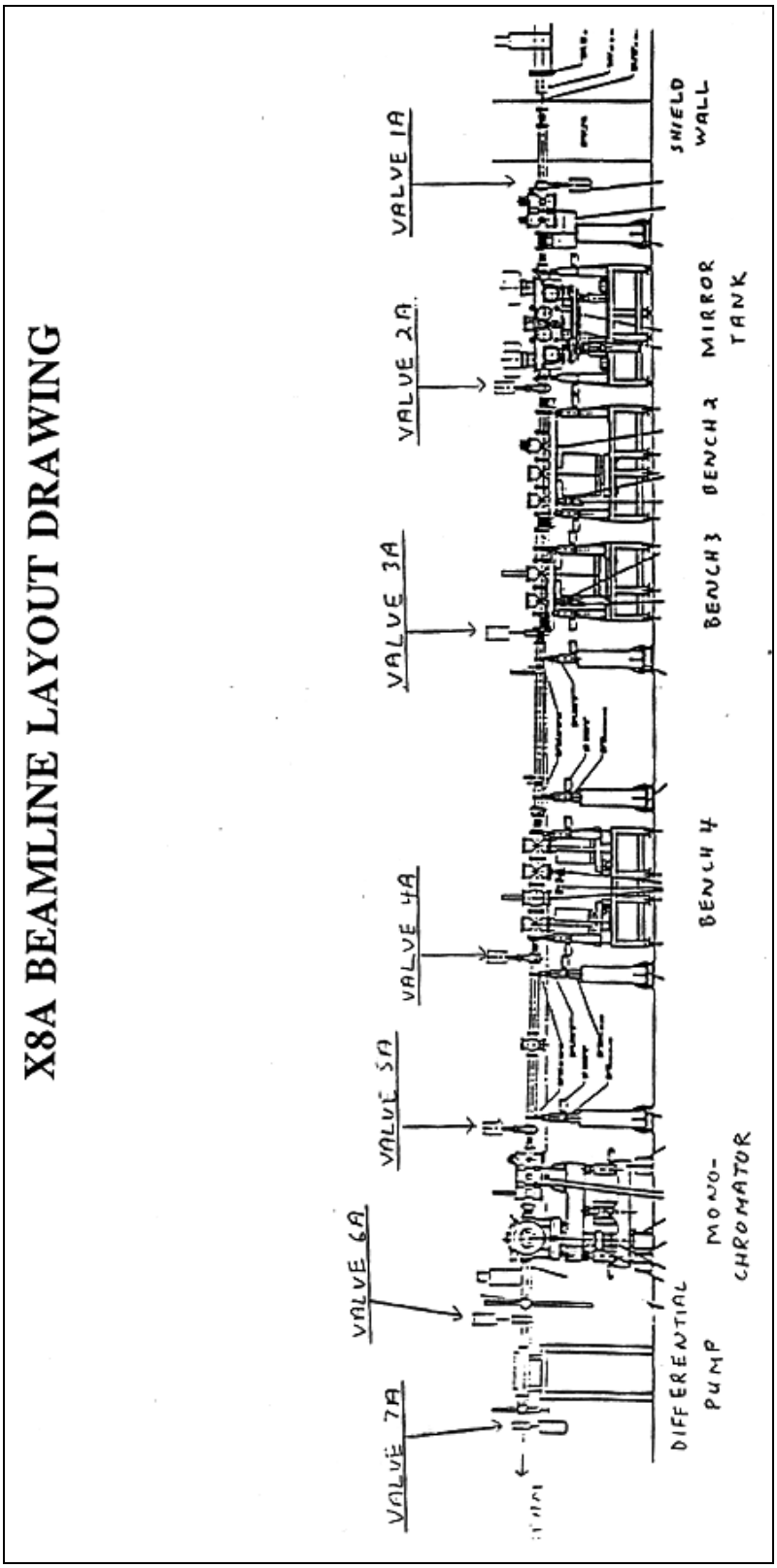
*** NSLS POLICY FOR RGA SCANS** (24 HOUR NOTICE REQUIRED)

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:**

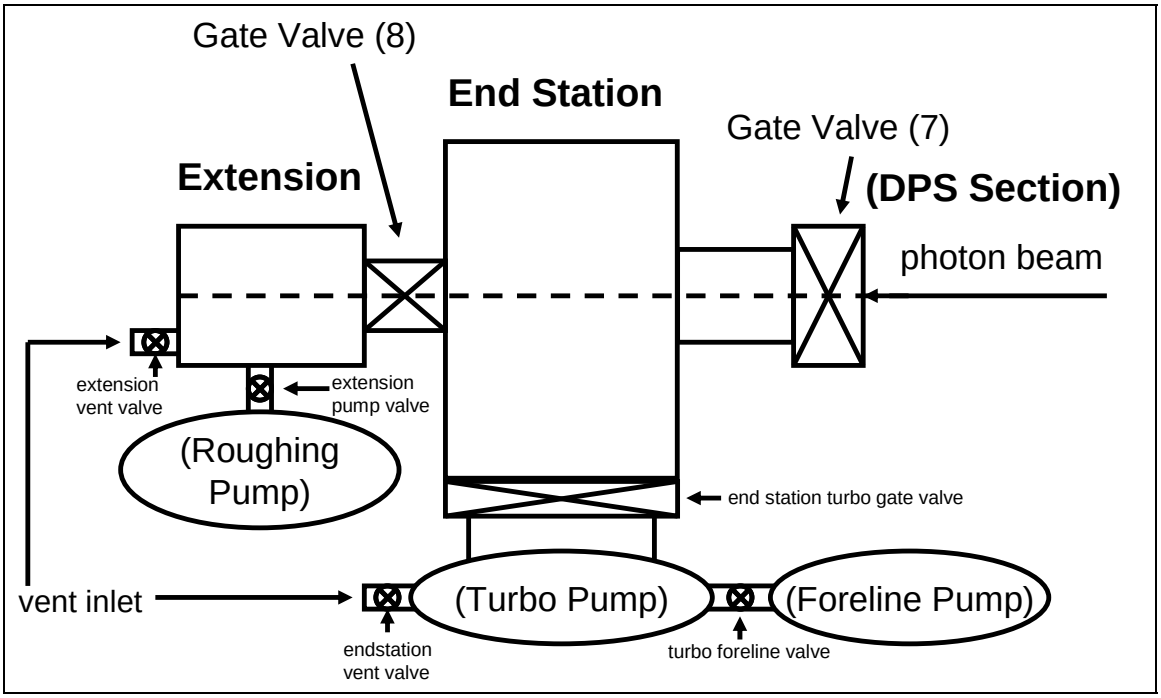
1. After UHV sample chambers have been bled up for replacing components, an RGA scan will not be required if the chamber pressure is returned to $< 2\times10^{-9}$ Torr and the Front End pressure remains $< 2\times10^{-9}$ Torr when vacuum sections upstream of the chamber are opened into the Front End.
2. If any vacuum section upstream of the bled-up section remains at a pressure of $< 9\times10^{-10}$ 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.**



X8a beamline layout and valves



End Station and Extension Valves

Document Review Frequency	
3	Years

Review signatures on file with master copy of controlled document

NSLS REVISION LOG

Document Number:	LS-OPS-0073
Subject:	Vacuum Procedures for Beamline X8A

Rev	Description	Date
B	Modification of Sect. VIII. Removal of old sect. IX and addition of new sect. IX. Initial Release into controlled document system.	4/2/2004
C	Modification of Sect. VIII	8/25/2004
D	No beamline re-configuration or RTO changes-revised for clarification in Sections VI A&B; VIII A&B and IX A&B. Section IX A&B revised further allowing Bleed-Up and Return to Operation without Operations Coordinator presence.	12/12/2007