


**Vacuum System Operation Logic  
(Functional Analysis)  
(5032-SP-9035B)**

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**MODIFICATIONS RECORDING**

ISSUE OF MODIF	DATE	WRITTEN BY	CHECKED BY	EVOLUTION OF THE DOCUMENT (Updated pages)	JUSTIFICATION OF THE MODIFICATION
<p>Note: Recording of modifications are included in document</p>					


	<b>Specification</b>		Document Number: 5032-SP-9035
	Title:	<b>Vacuum System Operational Logic Air Liquide LCLS-II Cold Boxes</b>	Initial Release Date: 10/13/2016
			Revision:      Letter: B Date: 5/3/2017

## Vacuum System Operational Logic Air Liquide LCLS-II Cold Boxes Installed at SLAC Facility

**Customer Document # C1303-NT-401**


Revision Table			
<b>Revision Description</b>	A: Reviewed ALATUS Transmittal-140 and made changes accordingly.		<b>EDR #</b>
	B: Made additional ALATUS requested change.		8598
<b>Sign-Offs:</b>	<b>Name</b>	<b>Title/Position</b>	<b>Initials / Signature</b>
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<b>Reviewers</b>	Steve Willming	Senior Designer	<i>CAF signed for Steve</i>
	Chris Fetty	Project Manager	
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Note: For details on previous revisions, see the archives.

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## 1. SCOPE

This document applies to all (4) of the Vacuum Systems used for the Air Liquide LCLS-II Cold Boxes Installed at the SLAC Facility.

NOTE: X=1 (Upper cold Box)  
X=3 (Lower cold box)


## 2. PRE AUTO PUMPDOWN CHECKLIST:

(AT PUMP SKID)

1. Roughing Pump Disconnect switched "ON".
2. Diffusion Pump Disconnect switched "ON".
3. E-Stop not engaged.
4. Cooling water supply and return valves are open (C-MV-234X1, C-MV-234X9).
5. C-MV-236X1 (Vacuum Gauge Vent) "CLOSED".
6. C-MV-236X0 (Vacuum Gauge Isolation Valve) "OPEN".
7. Instrument air "ON".
8. C-MV-236X3 (Diffusion Pump Oil Add Port) "CLOSED".
9. C-MV-236X2 (Vacuum Cart Valve) "CLOSED"
10. C-MV-236X6 (Vacuum Cart Valve) "CLOSED"
11. C-MV-236X5 (Roughing Pump Isolation Valve) "OPEN"

(AT CONTROL STATION)

12. Set controls to "MANUAL"
13. Check fault status. Clear any faults. (see Fault list below)

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### 3. AUTO PUMPDOWN SEQUENCE:

1. “PRE AUTO PUMPDOWN CHECKLIST” Complete (no faults).
2. Select “AUTO PUMPDOWN” cycle start.
3. Roughing Pump starts.
4. Diffusion Pump Heater HTR-236X0 turns on.
5. When PT-236X8 vacuum is less than PT-236X0 then C-PV-236X6 opens.
6. When PT-236X8 vacuum is less than PT-236X5 then C-PV-236X4 opens.
7. The chamber is now “Roughing Down”.
8. When the chamber reaches a set point of 200 mTorr (Via C-PT-236X0) C-PV-236X1 energizes opening the gate valve.
9. Diffusion Pump Bypass (C-PV-236X6) closes (de-energizes).
10. The Chamber is now entering high vacuum.

### 4. E-STOP MODE


If an E-stop switch is hit the following occurs:

1. System drops out of Automatic Mode returning all valves to their “SAFE” positions:
  - Gate Valve closes (C-PV-236X1 de-energizes)
  - Roughing Pump Isolation Valve closes (C-PV-236X5)
  - Diffusion Pump Isolation Valve de-energizes (C-PV-236X4)
  - Diffusion Pump Bypass Valve de-energizes (C-PV-236X6)
2. The Roughing Pump stops.
3. Diffusion Pump Heater turns off.

### 5. MANUAL/MAINTENANCE MODE(S)

In maintenance mode the following devices can be manually operated with the interlocks noted:

1. C-EH-236X0 (Diffusion Pump Heater)

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- C-FSL-234X8 must be made (water flow detected).
- C-TSH-236X0 must be below safe operating temperature.

If interlock conditions are not met an alarm will be annunciated.

2. C-PV-236X1 (Vacuum Shell Isolation, Gate Valve)

- C-PT-236X0 and C-PT-236X5 must be at same pressure +/- 100 mTorr

If interlock conditions are not met an alarm will be annunciated.

3. C-PV-236X6 (Diffusion Pump Bypass)

- C-PT-236X8 must be at or at a lower pressure than C-PT-236X0.

If interlock conditions are not met an alarm will be annunciated.

4. C-PV-236X4 (Diffusion Pump Isolation)

- C-PT-236X5 and C-PT-236X8 must be at the same pressure plus or minus 100 mTorr.

If interlock conditions are not met an alarm will be annunciated.

5. C-VP-236X0 (Roughing Pump)


- No interlock to start.
- If shut off in manual operation C-PV-236X4, C-PV- 236X6 and C-PV-236X1 must close.

If interlock conditions are not met an alarm will be annunciated.

## 6. AUTOMATIC OPERATION FAULTS/INTERLOCKS

1. System vacuum failure

While in operation C-PT-236X0 should be monitored. If a rate of decrease in vacuum is detected while in automatic operation the gate valve should be closed and the issue resolved before the alarm is reset. The

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rate of decrease to trigger the alarm is 100 mTorr/minute. This alarm could indicate the possibility of the system opening to atmosphere unexpectedly.

2. Gate valve limit switch failure

If both the “Open” and “Closed” limit switches are closed at the same time constitutes a limit switch failure. In this case the gate valve should be closed, C-PV-236X1 de-energized and locked out, until the issue is resolved and the operator resets the alarm.

3. Gate Valve failed to open fault

During operation if C-PV-236X1 in energized to open the Gate Valve and C-ZSL-236X1 does not open and C-ZSH-236X1 does not energize (after a time delay of 4 seconds) indicates the gate valve failed to open.

4. Gate Valve failed to close fault

During operation if C-PV-236X1 in de-energized to close the Gate Valve and C-ZSH-236X1 does not open and C-ZSL-236X1 does not energize (after a time delay of 4 seconds) indicates the gate valve failed to close.


5. Diffusion Pump over temperature fault

If C-TSH-236X0 has an over temperature condition the Gate Valve should close and the Diffusion Pump Heater (C-EH-236X0) should be turned off. Over temperature limit is 46 degrees Celsius plus or minus 3 degrees.

6. Water Cooled Baffle low water flow fault

If Cooling Water Flow Switch (C-FSL-234X8) detects low water flow:

- The Diffusion Pump Heater will shut off.
- The Gate Valve will close (C-PV-236X1 de-energize),
- C-PV-236X4 will de-energize closing the Roughing Pump Isolation Valve.
- C-PV-236X4 will de-energize isolating the diffusion pump.

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7. Roughing Pump Fault

If the Roughing Pump stops:

- C-PV-236X6 and C-PV-236X4 will de-energize closing the valves.
- C-PV-236X1 will de-energize closing the Gate Valve.

END OF DOCUMENT