

TARGET STARTING PROCEDURE

Summary:

The cool down requires a few steps. The first step includes a few basic checks to make sure components are working. Next the insulation vacuum is prepared. This must be done before pumping on the flasks at all, as the flask may implode otherwise. Make sure all computer-controlled valves are closed before beginning. Only open or close them as instructed. The flask is cleaned by filling and purging hydrogen/deuterium in the system. Then the cold trap is filled and the Cryomech cooler is activated, which starts filling the target with liquid. Heaters are used to stabilize the system once the cells are filled.

This document uses the original safety procedures and Josh's "Target Operation for Bozo's". Valves may be labeled with two names in different colors: in black is the name in the schematic and in red is the name on the computer controlled GUI (Figure 1). Figures 3 and 4 contain the full flow diagram with valve names. The very last page has a conceptual target flow diagram for quick reference to help understand where a valve is in reference to other components.

H₂ Target Filling Procedure

Note: Steps 1 and 2 may be completed at any point before step 26, the start of the first evacuation of the target flask.

1. _____ Access Target Cave to:
 - A. _____ Open MV-12-H
 - B. _____ Close MV-13-H
2. _____ If target area is open, secure the area around the target. Close access gates.

Note: Steps 3 and 4 may be completed any time before step 53, powering the cryo coolers.

3. _____ Check water chiller. Flow should be > 3 Gal/min. Note flow _____. Note temperature _____. Temperature should be < 15°C. If not, adjust temperature setting.
4. _____ On interlock page enable the following interlocks with these values:

Enabled	Sensor	Sign	Value
	H ₂ Compressor Water Supply	<	15.0
	H ₂ Compressor Water Return	<	4.0

Note: Beginning of sequential steps.

5. _____ Check oil level in mechanical vacuum pumps on the pump cart.
6. _____ Set manual valves to their initial status:

Check	Valve Tag	Status
	Capped Valves	
	MV-01-V	Closed
	MV-02-V	Closed
	MV-03-V	Closed
	Pneumatic system Valves	
	MV-01-N	Opened

	MV-02-N	Opened
	MV-03-N	Closed
	MV-04-N	Opened
	MV-05-N	Opened
	MV-07-N	Closed
	MV-08-N	Opened
	H ₂ Valves	
	MV-01-H	Closed
	MV-02-H	Closed
	MV-04-H	Opened
	MV-05-H	Closed
	MV-06-H	Opened
	MV-07-H	Closed
	MV-12-H	Set in Step 4
	MV-13-H	Set in Step 4
	MV-14-H	Opened

Note: For completeness, there are no valves MV-03-H, MV-08-H, MV-09-H, MV-10-H, MV-11-H.

7. _____ Set computer controlled pumps to their initial state:

Check	Pump Name	State	Color
	H ₂ Rough Pump	Off	Red
	H ₂ Fore Pump	On	Green
	H ₂ Diffusion Pump	Off	Red

8. _____ Set computer controlled valves to their initial state in the Valve GUI:

Check	Valve		Status	
	Tag	Name	State	Color

	EP-FORVLVH	H ₂ Fore Valve	Open	Green
	EP-H2PURGE	H ₂ Purge Valve	Closed	Red
	EP-RUFVLVH	H ₂ Rough Valve	Closed	Red
	PV-H2SUP	H ₂ Supply Valve	Closed	Red
	PV-H2FILL	H ₂ Fill Valve	Closed	Red
	EV-RPVENTH	H ₂ Rough Vent	Closed	Red
	EV-FPVENTH	H ₂ Fore Vent	Closed	Red
	PV-H2VV	H ₂ Flask Relief	Closed	Red
	EP-HIVACH	H ₂ Gate Valve	Closed	Red

9. _____ Note the high _____ and low _____ pressure sides of the N₂ bottle regulator. High pressure must be above 500 psi. If not replace bottle. Low pressure must be between 90 and 100 psi. If not adjust regulator.
10. _____ Note Pneumatic Supply Pressure on pump cart gauge, PI-05-N, _____ psig.
11. _____ Close EV-FPVENTH (*Fore Vent Valve*) using the valve GUI. (It should already be closed from step 8.)
12. _____ Turn on fore pump using the Valve GUI. (It should already be on from step 7.) Pressure should reach approximately 20-40 microns on PE-FPVACH in about 2 minutes. The pressure will appear on the Main page of the iFix system (Figure 2) and will be labeled "*Fore Line*".
13. _____ Open fore line valve EP-FORVLVH (*Fore Valve*) in Valve GUI. (It should already be open from step 8.)
14. _____ Close EV-RPVENTH (*Rough Vent Valve*) using Valve GUI. (It should already be closed from step 8.)
15. _____ Close EP-H2PURGE (*Purge Valve*) using Valve GUI. (It should already be closed from step 8.)
16. _____ Turn on roughing pump using the Valve GUI. Pressure should reach approximately 40-60 microns on PE-RPVACH in about 3 minutes. The pressure will appear on the Main page of the iFix system (Figure 2) and will be labeled "*Rough Line*".
17. _____ Open roughing valve EP-RUFVLVH (*Rough Valve*) in Valve GUI to target insulating

vacuum. Wait until the insulation vacuum (H_2 Baratron) pumps down to about 50 microns or below. This should take approximately an hour.

18. _____ Turn on power to diffusion pump in Valve GUI. Run for at least 20 minutes to heat up. It is not necessary, but one can check NM3 to ensure the diffusion pump is hot and the fan blowing.
19. _____ On interlock page enable the following interlocks with these values:

Enabled	Sensor	Sign	Value
	H_2 Baratron	>	75.0
	H_2 Fore line TC Vacuum	>	20.0

20. _____ Enable high vacuum valve, EP-HIVACH (*Gate Valve*). The HIVAC valve on/off switch will blink until target insulating vacuum pressure is low enough for it to open. Close EP-RUFVLVH (*Rough Valve*) though it closes automatically at 75 microns.
21. _____ Open MV-04-H (Figure 6), MV-06-H (Figure 6), MV-10-H and MV-14-H. (These should be this way from step 6.)
22. _____ Close MV-05-H (Figure 6), MV-07-H (Figure 6) and MV-11-H. (These should be this way from step 6.)
23. _____ Wait for H_2 Baratron to read below 30 microns. Record time _____. At this point, you are approaching the minimum vacuum that the Baratron can read, but well above the maximum value of the Cold Cathode Gauge.
24. _____ Wait 3-4 hrs (or overnight).
25. _____ Measure pressure with Cold Cathode Gauge (CCG). Note that
- The PLC interlock prevents the CCG from turning on while the Baratron reads above 40 as this will break the CCG
 - The CCG is an ignition source so it should NOT be turned on with H_2 in the flask as it is in principle an ignition source. The interlocks prevent this while the target is filled though not while purging.
- _____ Plug the CCG into its special socket on a line and turn it on at its power source (Figure 7).
 - _____ On the valve GUI turn on the CCG 15VDC
 - _____ On the valve GUI, turn on the CCG itself. A clicking should be heard and the

numbers should change. The CCG should turn itself off in a couple of seconds allowing one to take a measurement and then it protects itself. The CCG should read in the 10^{-4} – 10^{-5} Torr range. Record pressure _____

D. _____ Turn off CC H₂ HV on Valve GUI.

E. _____ Turn off the CC Gauge 15VDC.

F. _____ Unplug the CCG.

26. _____ Check that EP-RUFVLVH (Rough Valve) in Valve GUI is closed. This should have been done in step 15.

27. _____ Open purge valve EP-H2PURGE (*Purge Valve*); open target fill valve PV-H2FILL (*Fill Valve*). Note that the PLC interlocks will not allow PV-H2SUP (*Supply Valve*) and EP-H2PURGE (*Purge Valve*) to be open at the same time.

28. _____ On interlock page enable the following interlocks with these values:

Enabled	Sensor	Sign	Value
	H ₂ Supply Pressure	>	1050
	H ₂ Vent Pressure	>	1050

29. _____ Verify that the Valve GUI has CC H₂ HV and CC Guage 15VDC red.

30. _____ Open MV-01-H and MV-02-H.

31. _____ Open H₂ cylinder, set pressure to less than 5 psig (RV-01-H). Note pressures_____. Close cylinder valve. High pressure gauge must show no noticeable drop for 5 minutes. This indicates no leaks. If no leaks are present, reopen cylinder valve.

32. _____ Set RV-02-H to less than 3 psig. Note pressure _____.

33. _____ Wait for the H₂ supply line and cold trap to be pumped out to 40 microns.

34. _____ Close purge valve, EP-H2PURGE. Open H₂ PV-H2SUP (*Supply Valve*) (EP-H2FILL, H₂ fill valve, is already open from step 27).

35. _____ Check that target pressure on pressure transducer PT-H2VENT (Vent Pressure) has reached approximately 17.5 psia (900 Torr).

36. _____ Close H₂ PV-H2SUP (*Supply Valve*). Note that this is a good break point if the procedure is divided over multiple days. If this break is used,

- A. _____ Close the H₂ cylinder.
- B. _____ Upon continuation, open the H₂ cylinder.
37. _____ Open EP-H2PURGE (*Purge Valve*); Wait for PE-RPVACH (*H₂ Rough Line*) to reach 40 microns. (End of purge cycle 1)
38. _____ Repeat step 34.
39. _____ Repeat step 35.
40. _____ Repeat step 36. *Note that this is a good break point if the procedure is divided over multiple days. If this break is used,*
- A. _____ Close the H₂ cylinder.
- B. _____ Upon continuation, open the H₂ cylinder
41. _____ Repeat step 37. (End of purge cycle 2)
42. _____ Repeat step 34.
43. _____ Repeat step 35.
44. _____ Repeat step 36. *Note that this is a good break point if the procedure is divided over multiple days. If this break is used,*
- A. _____ Close the H₂ cylinder.
- B. _____ Upon continuation, open the H₂ cylinder
45. _____ Repeat step 37. (End of purge cycle 3)
46. _____ Repeat step 34.
47. _____ Repeat step 35.
48. _____ Repeat step 36. *Note that this is a good break point if the procedure is divided over multiple days. If this break is used,*
- A. _____ Close the H₂ cylinder.
- B. _____ Upon continuation, open the H₂ cylinder
49. _____ Repeat step 37. (End of purge cycle 4)

50. _____ End the pump and purge procedure by leaving PV-H2SUP (Supply Valve) closed and EP-H2PURGE (Purge Valve) open. (You should already have it this way from step 49.)
51. _____ Fill H₂ cold trap with liquid N₂ until is approx. 2 in. above the coils. Replace the Styrofoam.
52. _____ Remove Hewart from area, unless it will be used to fill the H₂ cold trap. In this case, **no beam should be delivered until the LN₂ Hewart is removed from the target area.**
53. _____ Turn on power to H₂ compressor by turning on electrical box switch on wall and the green button on the compressor.
54. _____ Turn on the level sensors from the Valve GUI.
55. _____ Check valve and pump positions in Valve GUI:

check	Valve	Color
	H ₂ Rough Pump	Green
	H ₂ Fore Pump	Green
	H ₂ Fore Valve	Green
	H ₂ Purge Valve	Red
	H ₂ Rough Valve	Red
	H ₂ Supply Valve	Red
	H ₂ Fill Valve	Green
	H ₂ Rough Vent	Red
	H ₂ Fore Vent	Red
	H ₂ Flask Relief	Red
	H ₂ Gate Valve	Green
	H ₂ Diffusion Pump	Green

56. _____ Open H₂ PV-H2SUP (Supply Valve). H₂ is now being filled into the target.
57. _____ Turn on CryoMech cooler in Main GUI.
58. _____ Do regular checks on the system. Every 30 minutes, record the following (see notes below):

Notes:

- a. The bottle pressure should drop by no more than 150 psi/hr
- b. Level Sensor 2 should read $\approx 190 \Omega$ within 4 hrs. It should show a step function transition.
- c. For the valve check, the valve page should show the following

Valve	Color
H ₂ Rough Pump	Green
H ₂ Fore Pump	Green
H ₂ Fore Valve	Green
H ₂ Purge Valve	Red
H ₂ Rough Valve	Red
H ₂ Supply Valve	Green
H ₂ Fill Valve	Green
H ₂ Rough Vent	Red
H ₂ Fore Vent	Red
H ₂ Flask Relief	Red
H ₂ Gate Valve	Green
H ₂ Diffusion Pump	Green

59. _____ Continue filling target for 1.5 hours **after** TE-H2FLUP (*Level 1*) sees liquid—when the resistance jumps to ≈ 190 ohms. This should be a step function jump.
60. _____ Close the H₂ PV-H2SUP (Supply Valve), and the H₂ fill valve, PV-H2FILL. Close the H₂ cylinder supply valve and the manual valve, MV-01-H.
61. _____ Plug in the heater (Figure 8) with it in Manual mode on the Main GUI.
62. _____ Gradually adjust the flask pressure to 14.7psig (800 Torr) using the heater current (in the Main GUI). Close MV-14H. The system should stabilize at *about* 8 mA in the Read back column on the Main GUI page, first row. Patience is important here, as there is a lag between adjusting the heater current and seeing the effect on pressure.
63. _____ Turn on the PID mode (Main GUI) to start the feedback loop set at 800 Torr.
64. _____ On interlock page enable the following interlocks with these values:

Enabled	Sensor	Sign	Value
	H ₂ Heater	>	40

65. _____ Close MV-06-H (MV-05-H is already closed).

66. _____ Pump out the cold trap by opening EP-H2PURGE and PV-H2FILL. Evacuate cold trap until warm.
67. _____ After trap is warm (this may take more than 48 hrs), close EP-H2PURGE, and PV-H2FILL. Open MV-06-H.
68. _____ Scan and enter this sheet into the logbook. (Somewhat hard to initial after you have it in the logbook.)

D₂ Target Filling Procedure

Note: Steps 1 and 2 may be completed at any point before step 26, the start of the first evacuation of the target flask.

1. _____ Access Target Cave to:
 - A. _____ Open MV-112-D
 - B. _____ Close MV-113-D
2. _____ If target area is open, secure the area around the target. Close access gates.

Note: Steps 3 and 4 may be completed any time before step 53, powering the cryo coolers.

3. _____ Check water chiller. Flow should be > 3 Gal/min. Note flow _____. Note temperature _____. Temperature should be < 15°C. If not, adjust temperature setting.
4. _____ On interlock page enable the following interlocks with these values:

Enabled	Sensor	Sign	Value
	D ₂ Compressor Water Supply	<	15.0
	D ₂ Compressor Water Return	<	4.0

Note: Beginning of sequential steps.

5. _____ Check oil level in mechanical vacuum pumps on the pump cart.
6. _____ Set manual valves to their initial status:

Check	Valve Tag	Status
	Capped Valves	
	MV-101-V	Closed
	MV-102-V	Closed
	MV-103-V	Closed
	Pneumatic system Valves	
	MV-01-N	Opened

	MV-102-N	Opened
	MV-03-N	Closed
	MV-04-N	Opened
	MV-05-N	Opened
	MV-07-N	Closed
	MV-108-N	Opened
	D ₂ Valves	
	MV-101-D	Closed
	MV-102-D	Closed
	MV-104-D	Opened
	MV-105-D	Closed
	MV-106-D	Opened
	MV-107-D	Closed
	MV-111-D	Closed
	MV-112-D	Set in Step 4
	MV-113-D	Set in Step 4
	MV-114-D--2 valves	Opened

Note: For completeness, there are no valves MV-103-D, MV-108-D, MV-109-D, MV-110-D.

7. _____ Set computer controlled pumps to their initial state:

Check	Pump Name	State	Color
	D ₂ Rough Pump	Off	Red
	D ₂ Fore Pump	On	Green
	D ₂ Diffusion Pump	Off	Red

8. _____ Set computer controlled valves to their initial state in the Valve GUI:

Check	Valve	Status

	Tag	Name	State	Color
	EP-FORVLVD	D ₂ Fore Valve	Open	Green
	EP-D2PURGE	D ₂ Purge Valve	Closed	Red
	EP-RUFVLVD	D ₂ Rough Valve	Closed	Red
	PV-D2SUP	D ₂ Supply Valve	Closed	Red
	PV-D2FILL	D ₂ Fill Valve	Closed	Red
	EV-RPVENTD	D ₂ Rough Vent	Closed	Red
	EV-FPVENTD	D ₂ Fore Vent	Closed	Red
	PV-D2VV	D ₂ Flask Relief	Closed	Red
	EP-HIVACD	D ₂ Gate Valve	Closed	Red

9. _____ Note the high _____ and low _____ pressure sides of the N₂ bottle regulator. High pressure must be above 500 psi. If not replace bottle. Low pressure must be between 90 and 100 psi. If not adjust regulator.
10. _____ Note Pneumatic Supply Pressure on pump cart gauge, PI-05-N, _____ psig.
11. _____ Close EV-FPVENTD (*Fore Vent Valve*) using the valve GUI. (It should already be closed from step 8.)
12. _____ Turn on fore pump using the Valve GUI. (It should already be on from step 7.) Pressure should reach approximately 20-40 microns on PE-FPVACD in about 2 minutes. The pressure will appear on the Main page of the iFix system (Figure 2) and will be labeled "*Fore Line*".
13. _____ Open fore line valve EP-FORVLVD (*Fore Valve*) in Valve GUI. (It should already be open from step 8.)
14. _____ Close EV-RPVENTD (*Rough Vent Valve*) using Valve GUI. (It should already be closed from step 8.)
15. _____ Close EP-D2PURGE (*Purge Valve*) using Valve GUI. (It should already be closed from step 8.)
16. _____ Turn on roughing pump using the Valve GUI. Pressure should reach approximately 40-60 microns on PE-RPVACD in about 3 minutes. The pressure will appear on the Main page of the iFix system (Figure 2) and will be labeled "*Rough Line*".

17. _____ Open roughing valve EP-RUFVLVD (*Rough Valve*) in Valve GUI to target insulating vacuum. Wait until the insulation vacuum (D_2 Baratron) pumps down to about 50 microns or below. This should take approximately an hour.
18. _____ Turn on power to diffusion pump in Valve GUI. Run for at least 20 minutes to heat up. It is not necessary, but one can check NM3 to ensure the diffusion pump is hot and the fan blowing.
19. _____ On interlock page enable the following interlocks with these values:

Enabled	Sensor	Sign	Value
	D ₂ Baratron	>	75.0
	D ₂ Foreline TC Vacuum	>	20.0

20. _____ Enable high vacuum valve, EP-HIVACD (*Gate Valve*). The HIVAC valve on/off switch will blink until target insulating vacuum pressure is low enough for it to open. Close EP-RUFVLVD (*Rough Valve*) though it closes automatically at 75 microns.
21. _____ Open MV-104-D (Figure 6), MV-106-D (Figure 6), MV-110-D and MV-114-D. (These should be this way from step 6.)
22. _____ Close MV-105-D (Figure 6), MV-107-D (Figure 6) and MV-111-D. (These should be this way from step 6.)
23. _____ Wait for D₂ Baratron to read below 30 microns. Record time _____. At this point, you are approaching the minimum vacuum that the Baratron can read, but well above the maximum value of the Cold Cathode Gauge.
24. _____ Wait 3-4 hrs (or overnight).
25. _____ Measure pressure with Cold Cathode Gauge (CCG). Note that
- The PLC interlock prevents the CCG from turning on while the Baratron reads above 40 as this will break the CCG.
 - The CCG is an ignition source so it should NOT be turned on with D₂ in the flask, as it is in principle an ignition source. The interlocks prevent this while the target is filled though not while purging.
- A. _____ Plug the CCG into its special socket on a line and turn it on at its power source (Figure 7).
- B. _____ On the valve GUI turn on the CCG 15VDC

- C. _____ On the valve GUI, turn on the CCG itself. A clicking should be heard and the numbers should change. The CCG should turn itself off in a couple of seconds allowing one to take a measurement and then it protects itself. The CCG should read in the 10^{-4} – 10^{-5} Torr range. Record pressure _____
- D. _____ Turn off CC D₂ HV on Valve GUI.
- E. _____ Turn off the CC Gauge 15VDC.
- F. _____ Unplug the CCG.
26. _____ Check that EP-RUFVLVD (Rough Valve) in Valve GUI is closed. This should have been done in step 15.
27. _____ Open purge valve EP-D2PURGE (*Purge Valve*); open target fill valve PV-D2FILL (*Fill Valve*). Note that the PLC interlocks will not allow PV-D2SUP (*Supply Valve*) and EP-D2PURGE (*Purge Valve*) to be open at the same time.
28. _____ On interlock page enable the following interlocks with these values:

Enabled	Sensor	Sign	Value
	D ₂ Supply Pressure	>	1050
	D ₂ Vent Pressure	>	1050

29. _____ Verify that the Valve GUI has CC D₂ HV and CC Guage 15VDC red.
30. _____ Open MV-101-D and MV-102-D.
31. _____ Open D₂ cylinder, set pressure to less than 5 psig (RV-101-D). Note pressures_____. Close cylinder valve. High pressure gauge must show no noticeable drop for 5 minutes. This indicates no leaks. If no leaks are present, reopen cylinder valve.
32. _____ Set RV-102-D to less than 3 psig. Note pressure _____.
33. _____ Wait for the D₂ supply line and cold trap to be pumped out to 40 microns.
34. _____ Close purge valve, EP-D2PURGE. Open D₂ PV-D2SUP (*Supply Valve*) (EP-D2FILL, D₂ fill valve, is already open from step 27).
35. _____ Check that target pressure on pressure transducer PT-D2VENT (Vent Pressure) has reached approximately 17.5 psia (900 Torr).

36. _____ Close D₂ PV-D2SUP (*Supply Valve*). *Note that this is a good break point if the procedure is divided over multiple days. If this break is used,*
- A. _____ Close the D₂ cylinder.
- B. _____ Upon continuation, open the D₂ cylinder.
37. _____ Open EP-D2PURGE (*Purge Valve*); Wait for PE-RPVACD (*D₂ Rough Line*) to reach 40 microns. (End of purge cycle 1)
38. _____ Repeat step 34.
39. _____ Repeat step 35.
40. _____ Repeat step 36. *Note that this is a good break point if the procedure is divided over multiple days. If this break is used,*
- A. _____ Close the D₂ cylinder.
- B. _____ Upon continuation, open the D₂ cylinder
41. _____ Repeat step 37. (End of purge cycle 2)
42. _____ Repeat step 34.
43. _____ Repeat step 35.
44. _____ Repeat step 36. *Note that this is a good break point if the procedure is divided over multiple days. If this break is used,*
- A. _____ Close the D₂ cylinder.
- B. _____ Upon continuation, open the D₂ cylinder
45. _____ Repeat step 37. (End of purge cycle 3)
46. _____ Repeat step 34.
47. _____ Repeat step 35.
48. _____ Repeat step 36. *Note that this is a good break point if the procedure is divided over multiple days. If this break is used,*
- A. _____ Close the D₂ cylinder.
- B. _____ Upon continuation, open the D₂ cylinder

49. _____ Repeat step 37. (End of purge cycle 4)
50. _____ End the pump and purge procedure by leaving PV-D2SUP (Supply Valve) closed and EP-D2PURGE (Purge Valve) open. (You should already have it this way from step 49.)
51. _____ Fill D₂ cold trap with liquid N₂ until is approx. 2 in. above the coils. Replace the Styrofoam.
52. _____ Remove Dewar from area, unless it will be used to fill the D₂ cold trap. In this case, **no beam should be delivered until the LN₂ Dewar is removed from the target area.**
53. _____ Turn on power to D₂ compressor by turning on electrical box switch on wall and the green button on the compressor.
54. _____ Turn on the level sensors from the Valve GUI.
55. _____ Check valve and pump positions in Valve GUI:

check	Valve	Color
	D ₂ Rough Pump	Green
	D ₂ Fore Pump	Green
	D ₂ Fore Valve	Green
	D ₂ Purge Valve	Red
	D ₂ Rough Valve	Red
	D ₂ Supply Valve	Red
	D ₂ Fill Valve	Green
	D ₂ Rough Vent	Red
	D ₂ Fore Vent	Red
	D ₂ Flask Relief	Red
	D ₂ Gate Valve	Green
	D ₂ Diffusion Pump	Green

56. _____ Open D₂ PV-D2SUP (Supply Valve). D₂ is now being filled into the target.
57. _____ Turn on CryoMech cooler in Main GUI.
58. _____ Do regular checks on the system. Every 30 minutes, record the following (see

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Notes:

- The bottle pressure should drop by no more than 150 psi/hr
- Level Sensor 2 should read $\approx 190 \Omega$ within 4 hrs. It should show a step function transition.
- For the valve check, the valve page should show the following

Valve	Color
D ₂ Rough Pump	Green
D ₂ Fore Pump	Green
D ₂ Fore Valve	Green
D ₂ Purge Valve	Red
D ₂ Rough Valve	Red
D ₂ Supply Valve	Green
D ₂ Fill Valve	Green
D ₂ Rough Vent	Red
D ₂ Fore Vent	Red
D ₂ Flask Relief	Red
D ₂ Gate Valve	Green
D ₂ Diffusion Pump	Green

- _____ Continue filling target for 1.5 hours **after** TE-D2FLUP (*Level 1*) sees liquid—when the resistance jumps to ≈ 190 ohms. This should be a step function jump.
- _____ Close the D₂ PV-D2SUP (Supply Valve) , and the D₂ fill valve, PV-D2FILL. Close the D₂ cylinder supply valve and the manual valve, MV-101-D.
- _____ Plug in the heater (Figure 8) with it in Manual mode on the Main GUI.
- _____ Gradually adjust the flask pressure to 14.7psig (800 Torr) using the heater current (in the Main GUI). Close MV-114D. The system should stabilize at *about* 8 mA in the Read back column on the Main GUI page, first row. Patience is important here, as there is a lag between adjusting the heater current and seeing the effect on pressure.
- _____ Turn on the PID mode (Main GUI) to start the feedback loop set at 800 Torr.
- _____ On interlock page enable the following interlocks with these values:

Enabled	Sensor	Sign	Value
	D ₂ Heater	>	40

65. _____ Close MV-106-D (MV-105-D is already closed).
66. _____ Pump out the cold trap by opening EP-D2PURGE and PV-D2FILL. Evacuate cold trap until warm.
67. _____ After trap is warm (this may take more than 48 hrs), close EP-D2PURGE, and PV-D2FILL. Open MV-106-D.
68. _____ Scan and enter this sheet into the logbook. (Somewhat hard to initial after you have it in the logbook.)

Figure 1

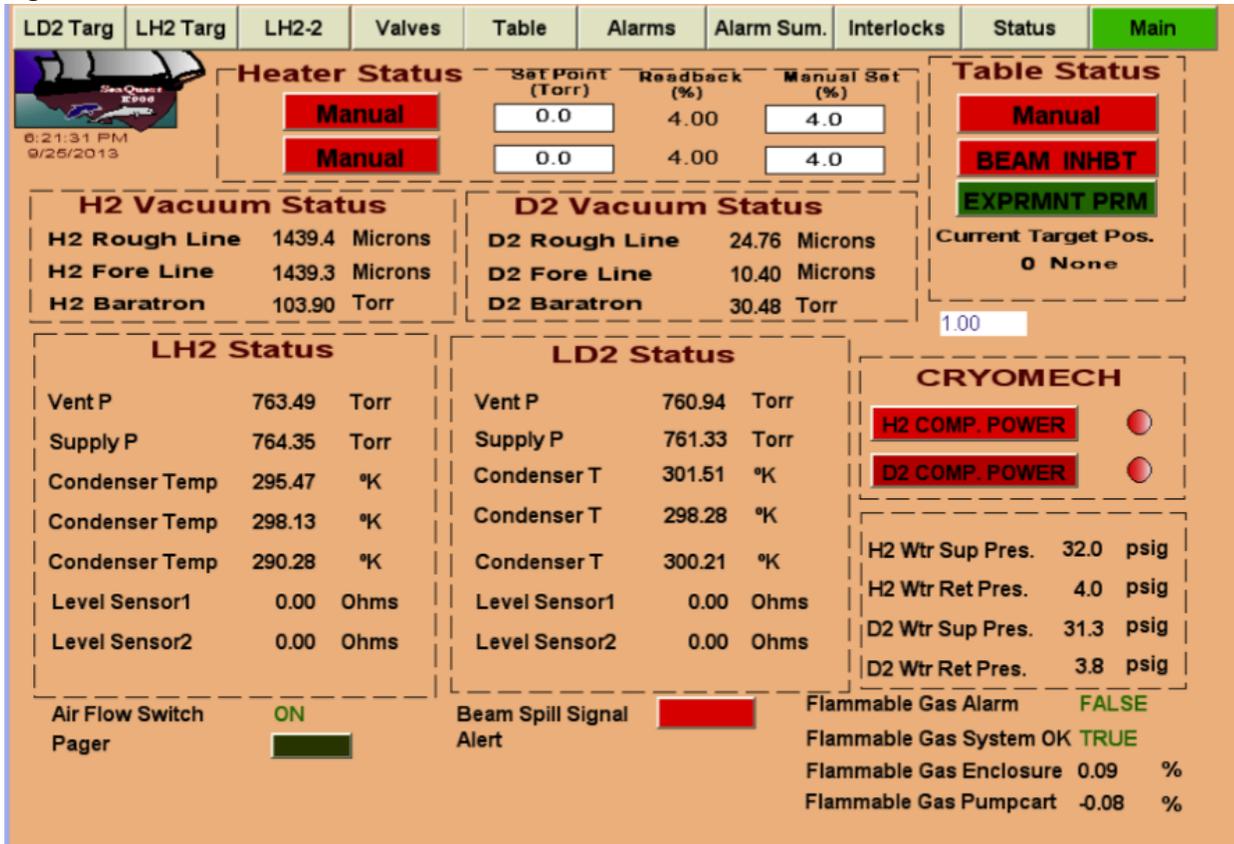


Figure 2

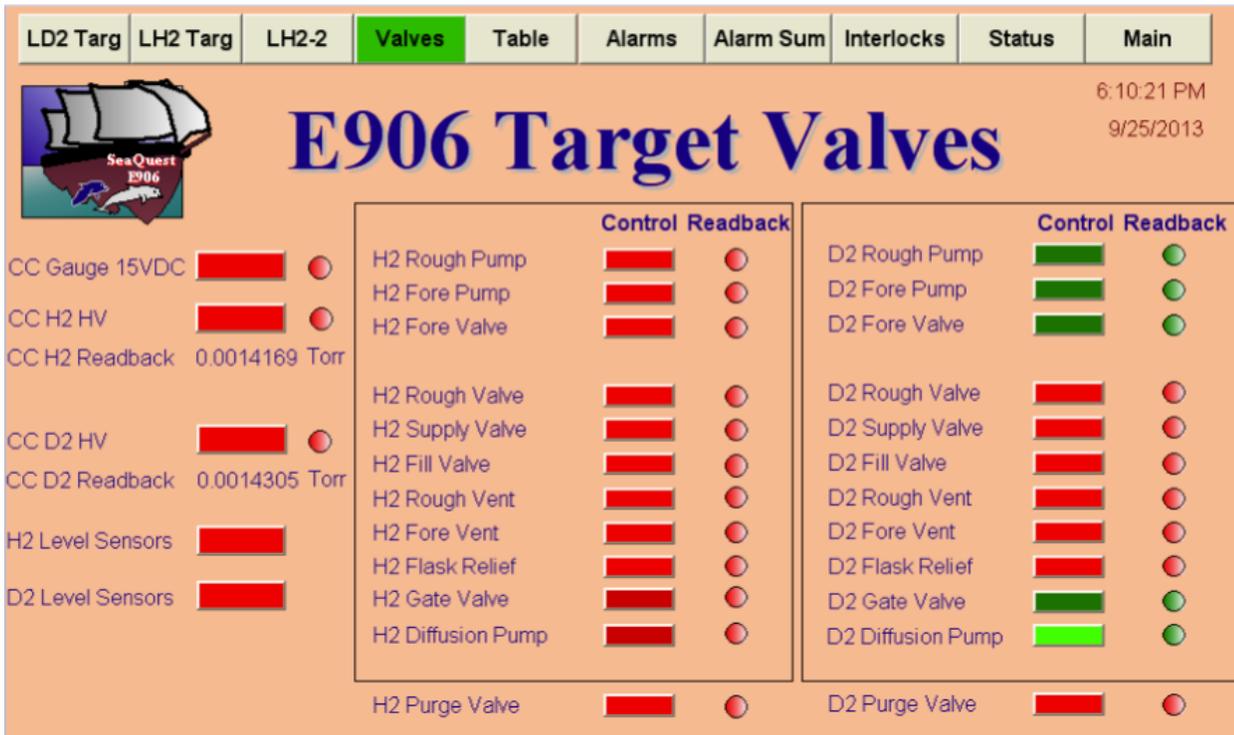
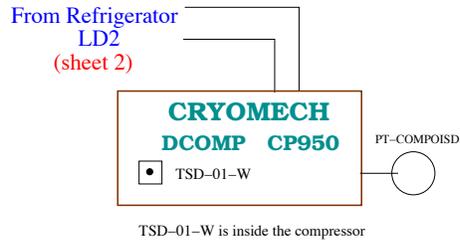
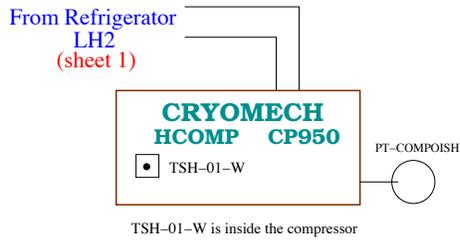
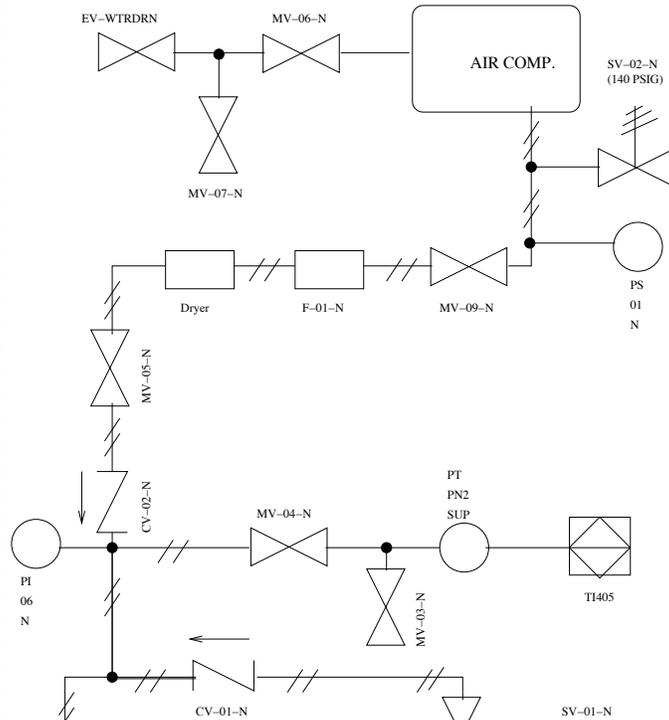
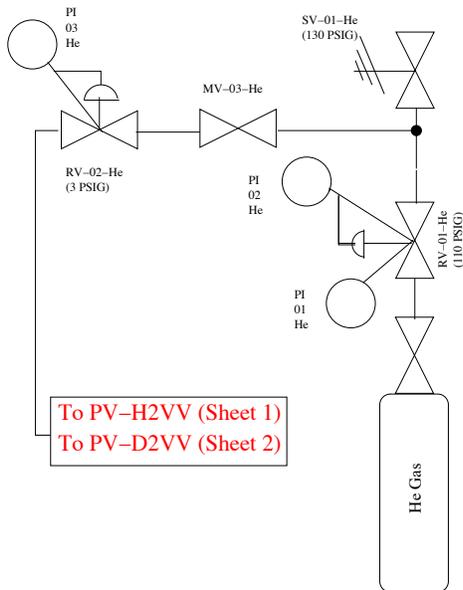


Figure 5



Two compressors used for the targets



To sheet 1
(LH2 system flow diagram)

N2 Gas

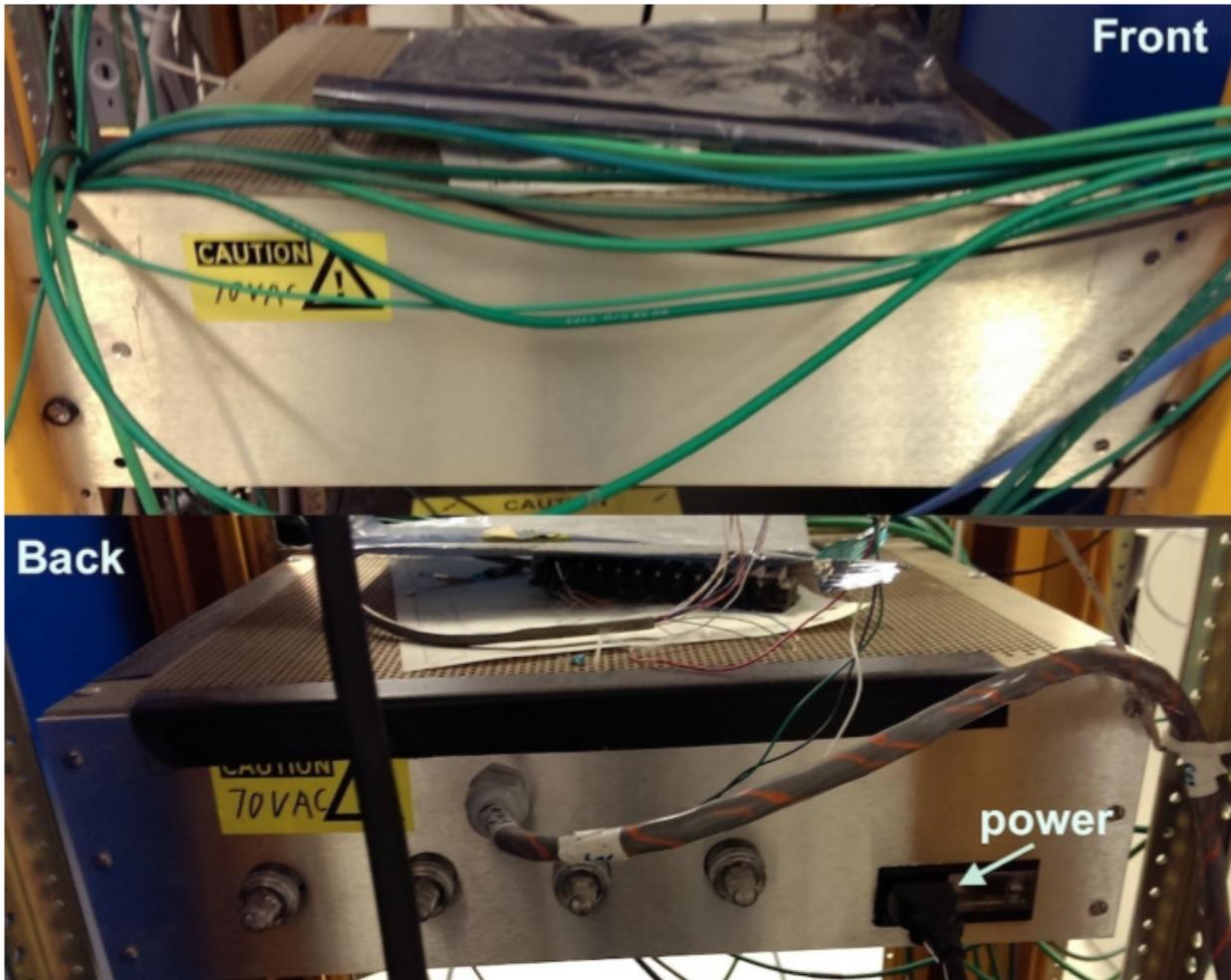
N2 system
Compressors
He supply system
Version 4
Date : 11/22/2010

(Sheet # 3)

Figure 6



Figure 8



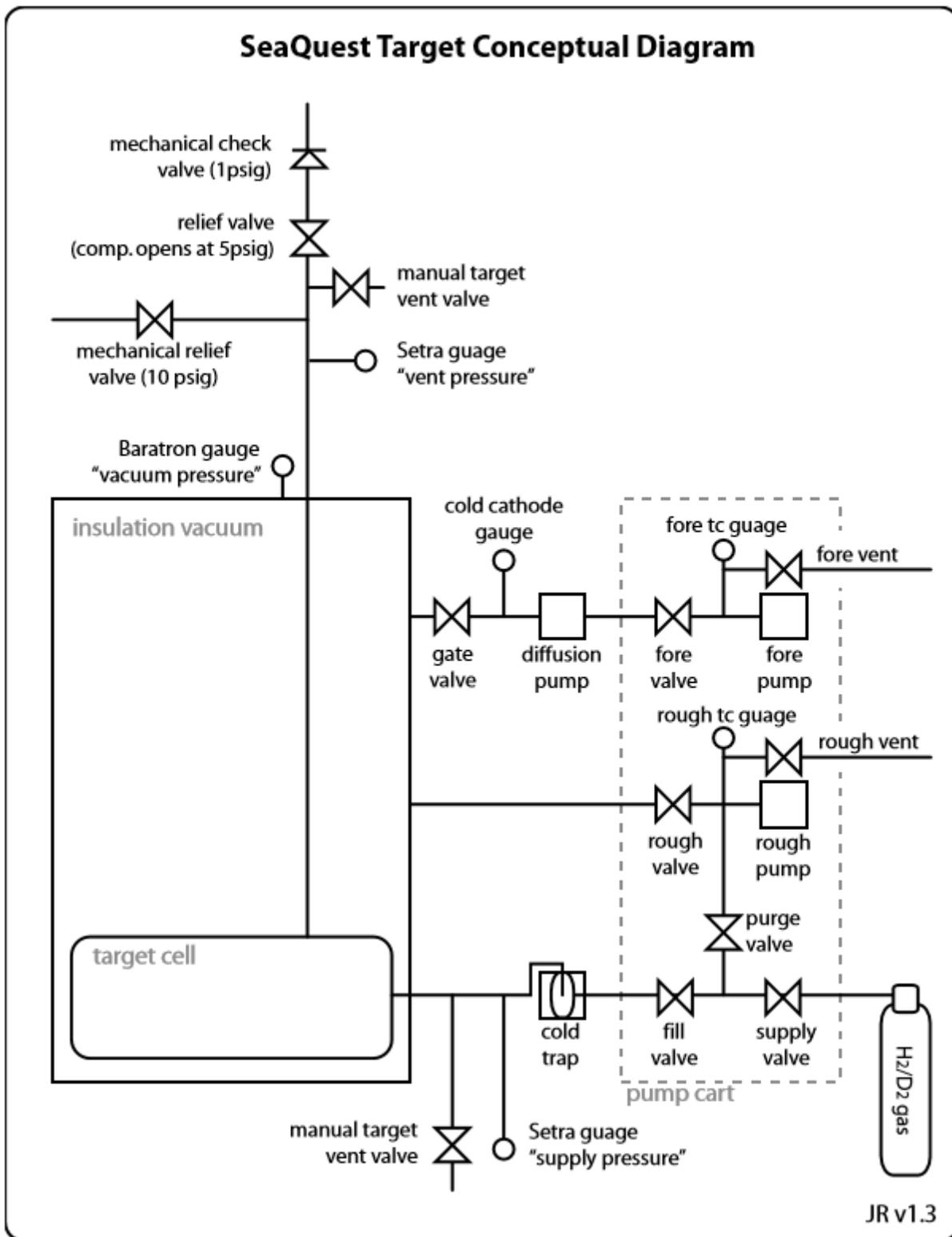


Figure 1: The SeaQuest target system.