

Testing 2001 of the 108" Bell Jar Vacuum System

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1.0 System Checkout

System checkouts of the MWO Vacuum Coating Lab began on June 12, 2001 with the identification of tasks to be completed in preparation for aluminizing the 100-inch telescope mirrors. On June 18, 2001, the first pumpdown of the roughing stage were performed along with checks of vacuum gauges, oil levels and site glasses. The Kinney pump requires oil to be added, the diffusion pump refrigeration system site glass was clear, turned red and appears to be operating correctly.

June 20, 2001 is the first full pump down of the system to take the tank down to the high vacuum regime. The system has not yet been opened to atmosphere as there are several large components with loose surface rusting that need to be controlled prior to opening.

Reference Sheet: [Pumpdown History](#)

1.1 Pumpdown Coating Run

July 16, 2001

Mirror was removed from its cell on 15/7/01 and lowered to cleaning area. Mirror was stripped by 0900, cleaned and dried by 1500 and in the tank by 1730. Main roughing pump had a minor failure prior to pumpdown with put tank, caused 3 hour delay to track down. Complication was a failure of the roughing pump thermocouple gauge for the run. Aluminizing of the 100-inch optics is completed and the coatings came out perfect! Vacuum chamber performance was excellent. All aluminum charges evaporated without sputtering.

Table 1: Pump Down for 100-inch Mirror

Time	Delta Time (hrs)	Kinney Vacuum (μm)	DPO Vacuum (μm)	DPI Vacuum (Torr)	Tank Vacuum (Torr)	Description
1. 2100	0	?	50	-	-	Pressurized gate valve systems. Cooling water on. Turned on Kinney Pump. Gate valve checks. Opened Kinney gate valve.
2. 2130	+0.5	?	55	0.1	0.1	DP on. Cooling systems on.
3. 2200	+1	?	130	0.1	0.1	DP at 120F, holding pump on.
4. 2230	+1.5	?	100	1×10^{-4}	<0.1	DP at 120F, valve open.

5.	2300	+2	?	85	2.5x10 ⁻⁵	3x10 ⁻⁴	Routine check.
6.	2330	+2.5	?	80	1x10 ⁻⁵	-	Plasma discharge cleaning set.
7.	2350	+2.8	?	90	0.05	-	O2 plasma, 7A.
8.	0017	+3.3	?	80	0.07	-	N2 plasma, 7A.
9.	0038	+3.6	?	90	<0.5	-	Filament melt in complete.
10.	0045	+3.8	?	100	<0.5	-	Plasma discharge complete.
11.	0100	+4	?	75	2.5x10 ⁻⁵	1x10 ⁻⁴	Routine check.
12.	0130	+4.5	?	70	1.5x10 ⁻⁵	6x10 ⁻⁵	Routine check.
13.	0200	+5	?	75	1.3x10 ⁻⁵	5x10 ⁻⁵	Routine check.
14.	0230	+5.5	?	70	1x10 ⁻⁵	4.6x10 ⁻⁵	Routine check.
15.	0300	+6	?	65	1x10 ⁻⁵	4.4x10 ⁻⁵	Routine check.
16.	0330	+6.5	?	70	1x10 ⁻⁵	4x10 ⁻⁵	Routine check.
17.	0400	+7	?	70	9.5x10 ⁻⁶	3.6x10 ⁻⁵	Deposition to min 240A, 15s.
18.	0415	+7.3	?	80	8.5x10 ⁻⁶	-	O2 backflow to presurize tank/ oxide.

There are several other pump down curves, these will not be posted at the present time.

1.2 Pumpdown Testing Cycles

July 12, 2001

Melt in cycle for small optic aluminization. All filament sets followed the curve for the melt in. Chamber is set to receive small optics in the am tomorrow.

Table 1: Pump Down Test History

Time	Delta Time (hrs)	Kinney Vacuum (μm)	DPO Vacuum (μm)	DPI Vacuum (Torr)	Tank Vacuum (Torr)	Description
1. 1000	0	300	20	.1	.1	Pressurized gate valve

							systems. Cooling water on. Turned on Kinney Pump.Gate valve checks. Opened Kinney gatevalve.
2.	1030	+0.5	30	45	6×10^{-3}	8×10^{-3}	DP on. Cooling systems on.
3.	1116	+1.25	50	80	1×10^{-4}	$< 10^{-3}$	DP at 120F, valve open.
4.	1130	+1.5	50	60	4×10^{-5}	4×10^{-4}	Routine check.
5.	1230	+2.5	50	55	2×10^{-5}	9.0×10^{-5}	Routine check.
6.	1300	+3	50	55	2×10^{-5}	6.8×10^{-5}	Routine check.
7.	1400	+4	45	50	1.5×10^{-5}	5×10^{-5}	Routine check.
8.	1430	+4.5	45	50	1.5×10^{-5}	4.6×10^{-5}	Filament melt in start.
9.	1500	+5.0	45	50	1×10^{-5}	4.6×10^{-5}	Filament melt in complete.

July 11, 2001

The crane is repaired and we are ready to proceed with the coating run. The next step was to install new filaments and to burn them in, hang new aluminum charges and rough out for the melt in tomorrow.

Table 1: Pump Down Test History

	Time	Delta Time (hrs)	Kinney Vacuum (μm)	DPO Vacuum (μm)	DPI Vacuum (Torr)	Tank Vacuum (Torr)	Description
1.	1430	0	15	20	-	-	Pressurized gate valve systems. Cooling water on. Turned on Kinney Pump.Gate valve checks. Opened Kinney gatevalve.
2.	1530	+1	40	55	1×10^{-2}	0.1	Filament burn in start.
3.	1600	+1.5	45	55	1×10^{-2}	0.1	Filament burn in complete.
4.	1800	+3.5	-	-	-	-	Hang aluminum charges.
5.	1900	+4.5	30	40	-	-	Pressurized gate valve systems. Cooling water on. Turned on Kinney Pump.Gate valve checks.

							Opened Kinney gatevalve.
6.	1945	+5.25	40	60	1×10^{-2}	0.15	Roughed out for melt in.

July 8, 2001

Inspected old filaments, wire leads and hung aluminum charges, everything looks okay.

Tested cold trap system while open and no leaks could be seen.

Inspected all seals, the main bell jar O-ring is showing a little wear and will likely need replacing before 2003.

Cleaned and inserted test slides and test glass plate into system.

The 2-ton bell jar hoist failed and testing the system revealed that the slow speed windings in the motor are blown. This will need to be repaired. Repair of the windings was attempted but abandoned. The hope is a new set of windings will be available for easy replacement.

Roughed out bell jar.

Backfilled with air to 50 microns and successfully ran the glow discharge system test, the purple plasma was once again.

Pumped down to HV levels and ran deposition test. Not the most elegant as the filaments were old.

Quality checks will happen later. Pumpdown history was recorded, but did not follow the norm due to simultaneous repairs and when the plasma was initiated.

July 7, 2001

Overhaul and repair of the vacuum chamber subsystems completed. This included filling Kinney pump, repairing the electrostatic dust controller, testing of filament power system and repair of rusted surfaces.

Final cleaning in preparation of the start of the coating runs is underway. The system was reassembled and the bell jar was roughed out to 10^{-2} torr.

June 20, 2001

This is the first full pumpdown run of 2001. Basically, this is a full system check out of the pumping system to try to catch any deficiencies in time for them to be repaired prior to the major coating runs. Little or no maintenance was performed on the system over the last winter so it is necessary to be cautious and thorough at this point.

Table 1: Pump Down Test History

Time	Delta Time (hrs)	Kinney Vacuum (μm)	DPO Vacuum (μm)	DPI Vacuum (Torr)	Tank Vacuum (Torr)	Description
1. 0950	0	-	-	0.5	0.5	Pressurized gate valve systems. Cooling water on. Turned on Kinney Pump.
2. 0955	+0.1	30	60	0.5	0.5	Gate valve checks. Opened Kinney gatevalve.
3. 1015	+0.4	30	60	0.1	0.1	DP turned on.
4. 1115	+1.4	60	75	0.1	0.1	DP reached 150F and fell to

							120F. DP poppet valve opened.
5.	¹¹²⁵	+1.6	60	75	2×10^{-4}	0.1	Pumping. Penning gauge on scale.
6.	¹¹⁴⁰	+1.9	60	75	4×10^{-5}	1×10^{-4}	Pumping. Hot cathode gauge on scale.
7.	¹²¹⁵	+2.45	60	75	2×10^{-5}	8×10^{-5}	Pumping. Operating within specs.
8.	¹²⁴⁵	+3	60	70	1.5×10^{-5}	6×10^{-5}	Pumping. Operating within specs.
9.	¹³¹⁵	+3.45	60	70	1.5×10^{-5}	5×10^{-5}	Pumping. Operating within specs.
10.	¹³³⁰	+3.7	55	65	9×10^{-6}	4.6×10^{-5}	Pumping. Operating within specs.
11.	¹⁴⁰⁰	+4.2	55	65	8.5×10^{-6}	4.2×10^{-5}	Pumping. Operating within specs.
12.	¹⁴³⁰	+4.7	55	60	8×10^{-6}	3.8×10^{-5}	Pumping. Operating within specs.
13.	¹⁵⁰⁰	+5.2	55	60	8×10^{-6}	2.8×10^{-5}	Closed DP poppet valve. Refer off.
14.	¹⁵³⁰	+5.7	55	60	<0.1	<0.1	Closed Kinney gate valve. Kinney off.
15.	¹⁶⁰⁰	+6.2	-	-	<0.1	<0.1	Shutdown sequence complete.