

THE VEECO EVAPORATION SYSTEM OPERATION MANUAL

Department of Electrical and Computer Engineering
Oregon State University

1 HISTORY

Date	Name	Changes
1989	John Ebner, Hyungmo Yoo, Tagore Kollipara, and Leon Ungier	Document created.
July 4, 2001	Jeff Bender	Revised to reflect current system state and procedure.
Nov. 17, 2002	Jeff Bender	Comments regarding venting and contamination.

2 INTRODUCTION

The system can be divided into five basic sections: a diffusion pump system, a mechanical pump, a chamber consisting of a bell jar and hoist, system controls, and cabinetry.

The diffusion pump system consists of a 4-stage oil diffusion pump, a water-cooled baffle/cold combination, a liquid nitrogen tank for pumping of condensable vapors, a high vacuum valve, a baseplate onto which the vacuum chamber is mounted, and the manifolding required to valve the mechanical pump between the foreline of the diffusion pump and the chamber roughing valve. The manifold also includes thermocouple gauges which are used to monitor foreline and roughing pressures, a leak test quick coupling, and a vent valve. The mechanical pump is used to evacuate the chamber from atmospheric pressure to a level at which the diffusion pump can be utilized.

The system controls consist of a single lever valve control, two stations thermocouple gauge, and an ionization gauge control. The control panel includes circuit breakers for the mechanical and diffusion pumps, readouts for the roughing and foreline thermocouple gauges, a vacuum system logic schematic with lights that indicate valve positions, and a single-lever valve control with adequate interlocks and time delays to assure proper sequencing.

The ionization gauge control is connected to a Bayard-Alpert type ionization gauge tube that can be mounted in quick couplings either in the chamber or below the high vacuum valve.

The evaporation power supply is located at the right of the gauge controls and is used to provide and monitor evaporation current to selected current feedthroughs. These are located at the bottom left front of the unit. A current cord is attached to the hole whose numbers correspond to the boats inside the chamber, numbered from left to right. The power supply voltage is selected by rotated the Variac dial; current is read out on the gauge.

The bell jar hoist is a manual counterbalanced type. The counterweight is within the support mast and is connected by a steel cable via pulleys to the top of the bell jar. The bell jar is guided by two guide rods and is self-aligning with the base plate.

3 EVAPORATION PROCEDURE

All operators must be thoroughly checked out on the use of this machine by trained personnel before operating equipment! Also, please communicate with other users when evaporation of a non-routine material is desired as its presence in the system may interfere with the devices of others!

3.1 Starting up from STANDBY mode

1. Before starting, make sure that the mechanical and diffusion pumps have been working at least for 1 hour.
2. Write down legibly your name, the date, and what material you are evaporating in the log book.
3. The machine settings should follow the table below:

Mode	STBY
Bell Jar	Firmly down
Mechanical Pump	ON
Diffusion Pump	ON
Ion Gauge	OFF
Degassing	OFF
Foreline Pressure	Less than 100 mTorr
Rough Line Pressure	Less than 500 mTorr
Cooling Water	Running

If any item is out of the above specifications call the key operator.

4. Add liquid nitrogen to the cold trap (large funnel at rear of machine). After a few minutes, add more. Continue until you see liquid emerge from the overflow hose at the rear left of the machine. Wait about 30 min.
5. Switch the single lever knob to VENT.
6. Open the nitrogen vent line valve slightly and hold it open until the chamber is completely vented. (If the valve is simply opened all the way, the high pressure of the line can cause unwanted disturbance inside the vacuum chamber.)
7. Turn off the nitrogen vent line.
8. Lift bell jar carefully. If you want to keep the bell jar open for a while, put the single lever knob to STBY.
 - NOTE: For lower ultimate pressure, minimize exposure to humid atmospheric air. Also, when placing samples and boats in position use gloves!
9. Load samples, masks, and material in positions 2 and 3. When material is loaded but bell jar is not going to be closed immediately, put a micro-glass over the boats for protecting the material.
10. If using the thickness monitor, remove the glass plate from under the monitor.
11. Ensure that all areas around the sample are covered with glass plates to prevent material from being deposited on the bell jar.

12. Inspect bell jar gasket and sealing surface for foreign particles.
13. Lower bell jar carefully. Make sure of the contact between the gasket of the bell jar and evaporator.
14. Switch knob to ROUGH.
 - If you hear noisy mechanical pumping sound more than 10 sec, adjust bell jar position in order to seal the leaking.
 - The Foreline pressure will start to rise as indicated by the Foreline thermocouple guage.
 - CAUTION: Do not allow the Foreline pressure to rise above 100 mTorr. If for some reason a longer roughing time is required, rotate control arm to STBY until the diffusion pump foreline pressure recovers, then go back to the ROUGH position to complete the roughing cycle.
15. Pump until 50-100 mTorr. (Don't leave in this position too long. If roughing line does not fall into this range within 15 min, put system into STBY mode and call key operator.)
16. Add liquid nitrogen if needed.
17. Switch knob to HI-VAC (high vacuum).
18. Turn on filament on high vacuum ionization gauge when pressure falls down (1 E-4 range).
19. Evaporation can commence once ~ 1 micron is reached.

3.2 Evaporation

1. When using thickness monitor, ensure that the proper density and impedance are set.
2. Make sure the shutter is in the closed position.
3. Plug the current cord into the hole corresponding to the boat number desired for evaporation.
4. Turn on the evaporation power supply.
5. Slowly increase the voltage until a rate appears on the thickness monitor.
6. When the desired evaporation rate is achieved, reset the thickness monitor and open the shutter.
7. When desired thickness is achieved (or material runs out), close the shutter, stop the thickness monitor, and reduce the voltage slowly.
8. Turn off power supply and unplug current cord. If material from another boat is to be evaporated, repeat the relevant steps above.
9. Turn off ionization guage filament current.
10. Put knob to STBY and leave it there for some minutes in order to allow the system to cool down.
 - While waiting, write the thickness indicated by the thickness monitor after entry in the log book.

11. Put knob to VENT. Turn on nitrogen vent line and wait for complete vent. Turn off nitrogen vent line.
12. Lift bell jar carefully.
13. Remove sample and boats. If you used the thickness monitor, replace glass sheet under it.

3.3 Shutdown

1. Lower down bell jar carefully.
2. Rotate lever to ROUGH.
3. When roughing line pressure reaches 100 mTorr, switch to STBY mode. Wait a few sec, when the foreline valve light turns on (click sound), your job is done.