Eurocom Pumping System Maintenance Schedule

4845 W ROYAL LANE, IRVING, TX 75063

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Eurocom Pumping System - Maintenance

The below schedule represents the minimum recommended frequency. The importance of hygiene in the pumping system cannot be overemphasized. Production of quality luminous tubes requires scrupulous attention to maintaining a clean system.

I. Daily:
- a. Check atmospheric pressure
- b. Check Gauge Calibration

II. Weekly:
- a. Check oil mist filter - if applicable
- b. Check pump oil level (Look on sight glass on side of pump)
- c. In-Line Mercury Filter check & clean-up
- d. Gas Ballast vacuum pump for 10-20 minutes (see manual), more frequently during periods of high humidity.

III. Monthly:
- a.Remove and clean Y-piece

IV.Quarterly:
- a. Check for oil in back stream filter (lower port). Clean filter if oil is detected.
- b. Change vacuum pump oil (or every 500 hours)
- c. Clean inside of fan cover on vacuum pump. Remove build up of oil and dirt deposits.

V. Every 6 Month:
- a. Replacement of In-Line Mercury filter (more frequently if using a lot of coated tubing)

VI. Annually:
- a. Manifold maintenance.
- b. Vacuum fittings and Hose Bellows
- c. VAP5 and DVR5

- ☑ After draining the oil from your rotary vane pump, fill to the minimum mark, run for five minutes, drain & fill to maximum mark. **The use of flushing oil is not recommended!**
- ☑ Keep the work surfaces around your pump system clean at all times. **Clean up mercury immediately!** Mercury is an extremely toxic substance and freely releases dangerous vapor in to the atmosphere. **Use HG+ Mercury Capsule Electrodes whenever possible!**
- ☑ **When changing out Gas canisters on the Gas Transfer Unit, check upper and lower O-rings for cracks or deformation. Replace if needed!**
- ☑ VAP-5 Pirani Sensor and VAP-5 Torr sensor require **NO** cleaning or maintenance!
- ☑ Any questions you may have, **Eurocom** will gladly answer. We are here to serve the industry and help it achieve and maintain the highest standards!

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I. Daily Maintenance

a. Vacuum Gauge DVR 5

Adjustment at Atmospheric Pressure:
Admit air to the vacuum gauge. Make sure that the vacuum connection at the vacuum gauge is at atmospheric pressure. Note: Determine exact actual atmospheric pressure, (25.4 x Barometric Pressure) inches/mercury e.g. by using an accurate barometer, e.g. call local airport or weather station, etc. (take into account the difference in altitude between e.g. airport and neon shop)
Refer to the Operations Manuals for DVR2/DVR5.

Adjustment under Vacuum - Optional:
Evacuate the vacuum gauge to a pressure < 0.5 mbar (<0.4 Torr) by applying a good rotary vane pump. Press key UP/DOWN simultaneously with key ON/OFF. The vacuum gauge then switches to the **adjustment mode** (indicated by a warning triangle).The reading is adjusted automatically to "zero".
Note: *Adjustment under vacuum with an actual pressure higher than 0.5 mbar (0.4 Torr) reduces the accuracy of measurement. If the pressure is significantly higher than 0.5 mbar (0.4 Torr), adjustment to a reference pressure is recommended.*
Press key ON/OFF to confirm adjustment and to terminate the adjustment mode. Press key UP/DOWN to increase the reading to actual atmospheric pressure.
To reduce the reading: Press key MODE to change arrow direction to the left. Then press key UP/DOWN to reduce the reading. Press key ON/OFF to confirm adjustment and to terminate mode. Refer to VAP 5 Operation Manual for additional information.

Adjustment at Reference Vacuum:
Evacuate the vacuum gauge to an exactly known reference pressure within the range of 0-20 mbar (0-15 Torr). Switch vacuum gauge to adjustment mode (see "Adjustment under Vacuum"). Press key UP/DOWN to adjust the display from "0" ("zero") to the actual reference pressure in the vacuum line in the range of 0-20 mbar (0-15 Torr). Press key ON/OFF to confirm adjustment and to terminate mode.
Note: *The accuracy of the value of the reference pressure will directly affect the accuracy of the adjustment. IF the nominal ultimate vacuum of a diaphragm pump is used as a "reference" vacuum, the accuracy of adjustment of the vacuum gauge might be doubtful. The diaphragm pump may not achieve the specified value (due to condensate, poor state, failure of the valves or the diaphragm).*

b. Re-calibration VAP 5

Re-adjustment "Atmospheric Pressure" - Optional
Vent vacuum system resp. gauge head - make sure that gauge head is exposed to atmospheric pressure. Status indication "atmospheric pressure" is displayed. Push key at the side of the housing with a pencil tip or a small screwdriver. Status indication readjustment is displayed. Push key again in order to adjust pressure reading tp atmospheric pressure. Status indication "readjustment" vanishes.

Re-adjustment "Vacuum"

Evacuate gauge head to a pressure $<1.10^{-3}$ mbar. Status indication "vacuum" is displayed. Push key at the side of the housing with a pencil tip or small screwdriver. Status indication readjustment is displayed. Push key again in order to adjust pressure reading to 1.10^{-3} mbar. Status indication "readjustment" vanishes. Readjustment "vacuum" at a pressure greater than 1.10^{-3} mbar reduces the accuracy of the measurement.

II. Weekly Maintenance

a. Check Oil Mist Filter - If Applicable

b. Check Pump Oil Filter (Look on sight glass on side of pump)

c. In-Line Mercury Filters

It is recommended to remove and clean these filters at the end of each week when there is continuous daily usage of the system. Powdered glass and phosphors will quickly accumulate in these filters to reduce their air flow rate and the quality of evacuation. Please remember that the vacuum displayed on the Pirani is routed in the manifold where the gauge sensor is located. The pads in these filters should also be replaced at least two or three times each year, again determined by use. Always install them in the system the same way, with the retaining c-washer facing away from the manifold. In this way the technician will always know which direction the debris entered the filter therefore he cannot accidentally drive the phosphors deeper into the filter. In addition, the retaining ring or the filter components must not be allowed to enter the manifold, particularly with a turbo-molecular pump.

The in-line centering ring filters (frequently referred to as "mercury filters") in your **Eurocom Manifold System** are there to perform many important functions to protect and maintain cleanliness within the system:

a) To block mercury vapor from reaching the vacuum gauges, manifolds, and pumps.
b) To block glass particles from entering the rotary pump, which degrades the vanes.
c) To block loose phosphors from reaching the gauges and pumps in the system.
d) To protect the turbo-molecular pump from glass particles and other debris.

However, if the filters themselves become blocked by phosphors and glass splinters, the pump cannot evacuate the tubes well and this will adversely affect the quality of the tubing.

Blow out with dry compressed air or dry nitrogen to remove accumulated debris. Naturally, the air should be blown in the direction opposite that which the debris entered the filter. **Be aware that material in the filter may contain trace amounts of mercury. Handle it accordingly!**
Please be aware that what you see on the Pirani gauge is only an indication of the vacuum level in the manifold. When there is a partially blocked filter it is entirely another story in the tubes being pumped. This filter performs a very important task, however it must remain clean and open at all times, much the same as the oil filter in your car. Replacement pads are available for this filter from Eurocom and should be replaced about every three to six month depending on usage. Always install the filter in the manifold with the retaining c-washer facing outward away from the manifold. Additional information on the subject is available from our corporate office at any time by calling **1-800-888-0932.**

d. Gas Ballast Procedure

Accumulation of water vapor in the pump oil requires the gas ballasting procedure, which should be done at least every month or more frequently during periods of high activity and in areas of the country with high levels of humidity. Water with oil in the vacuum chamber of the pump adversely affects efficiency and back-streams along with the oil into the system and will accelerate degradation of the pump as well.
Procedure:
Disconnect exhaust filter (if one is connected) from the pump and switch pump into gas ballast mode for approximately 10-20 minutes, which allows moisture to expel from the gas port. DO NOT EXECUTE THIS WHILE PROCESSING TUBES OR WITH THE MAIN STOPCOCK OPEN. Connect a hose to direct this vapor away from working area, as it will contain oil as well as water.
When this is completed, switch the pump to operating mode (make sure the sound of the pump returns to normal and vapor from exhaust port has ceased). THIS ROUTINE SHOULD BE EXECUTED DURING TUBE PROCESSING. Each tube that is heated and welded together has a significant amount of condensed water inside, which is converted to vapor when heated during pumping and collects in the oil reservoir of the pump. A vane pump depends on the oil to produce a seal between the vanes and the wall of the vacuum chamber. Water does not make a good seal and therefore must be continually removed from the pump. The RZ5 has been engineered for easy removal of the water from the pump. The small black rubber cap on top of the pump must be turned so the hole aligns with the hole in the back of the metal tube allowing outside air into the pump. This elevates the temperature within the pump causing the water to vaporize and exit through the exhaust port.

III. Monthly Maintenance

a. The Glass Manifold "Y" Sections

This portion of the glass manifold system is not protected by the filters therefore is subject to contamination sooner. It would be desirable to remove and clean these sections about every two or three months or as required to maintain a clean visual appearance. An advantage to a manifold constructed of glass as opposed to metal is that the operator can see an unclean condition and remedy it sooner.
Depending on the operating conditions, type of application and accuracy requirements, an inspection and readjustment may become necessary.

IV. Quarterly Maintenance

a. Backstream and Exhaust Filters

These filters contain mediums or cartridges that accumulate oil vapor and other debris and therefore hamper the flow rate or backstream if not changed periodically. A decrease in the ultimate vacuum on the Pirani Vacuum Gauge may be a symptom of this accumulation. Frequency of change or cartridges or mediums depends on activity. Discarded filters may contain trace amount of mercury, so handle accordingly.

b. Rotary Vane Pump - Oil Changes

Initial Oil Change (break in): 100 HOURS after start up and approximately every three months or 500 hours, relative to use. Use only the high-grade oil (available from Eurocom), specifically designed for the pump. The use of low-grade oils, often not suitable for the pump is a point commonly overlooked and is false economy. Better quality oils engineered for your pump perform better and last longer. Frequency of oil change should be determined by usage and ambient temperature.
Note: Color change of the oil and gradual decrease in the ultimate vacuum achieved on the Pirani Gauge. **DO NOT USE FLUSHING OIL** because it is much thinner lower grade oil with a higher vapor pressure, some of which will surely remain in the pump to mix with and degrade your oil.
Recommended Procedure: Disconnect the pump from the system, preferably at the union of the hose bellows to the Tee with the manual venting valve or hose bellows from the turbo pump exhaust port. Remove the entire component assembly from above the pump. Disconnect pump from Backstream Filter or Hose Bellow. Remove the cap from the oil fill port on top of the pump at the front. Place a container underneath and remove the drain plug allowing the oil to flow out. Replace the drain plug. Pour just 50-cc of new oil into the vacuum intake port of the pump as you switch it on, allowing it to run for no more than 10 seconds. This flushes the accumulation of debris from the working parts that have entered the pump. Using a clean funnel, refill the pump with new oil to just below the maximum level line adjacent to the sigh glass on the front of the pump. DO NOT OVER FILL! When the oil change is overdue and the oil has turned very dark, it is advisable to add just a small amount of new oil into the filling port at the front of the pump and allow it to run for a brief period to cleanse the pump interior, drain this oil out and then fill as described above.

c. Clean Inside of Fan Cover on Vacuum Pump. Remove Build-Up of Oil and Dirt Deposits.

V. Every 6 Month

a. Replace Mercury Filters (More Frequently if Using a Lot of Coated Tubing).

VI. Annually

a. Manifold Maintenance

Disconnect T's or Crosspieces from manifold to avoid breakage. Uncouple the two stainless steel hose bellows connecting the pump and vacuum gauges to manifold. Disconnect the cables connected to grounding electrodes in "Y" section (BE CERTAIN TO WRITE YOURSELF A MEMO AND TAPE IT TO THE TABLE REMINDING YOU TO RECONNECT THEM AGAIN) GAUGE WARRANTIES VOID IF GROUNDING CABLE IS DISCONNECTED AND FLASHBACK OCCURS.

Disassemble the connection between the gas port of the manifold and gas transfer system. Remove screws in upper portion of the acrylic manifold stands making sure to mark each portion for correct reassembly (avoids misalignment, which may cause mechanical strain or breakage to the manifold).

Uncouple and separate the glass manifold; carefully remove stopcock spindles and wipe clean with a lint free paper towel. DO NOT USE ANY SOLVENTS, AS IT WILL DESTROY THE O-RINGS. Apply a very small amount of the lubricant to the o-rings and wipe of any excess. Place them on a clean paper towel until you are ready to install them.

EXCESS AMOUNTS OF LUBRICANT WITHIN THE MANIFOLD ENTRAPS DEBRIS EXITING THE TUBES, SOME OF WHICH MAY BE LATER ENFORCED BACK INTO THE TUBES.

If silicone high vacuum lubricant has been used, remove all traces of this material from STOPCOCK INTERIORS at this time with a soft, clean cotton cloth, a wooden dowel and xylene (Xylol). METAL OBJECTS MAY SCRATCH INTERIOR SURFACE OF STOPCOCK.

Remove any mercury that may have lodged in the grounding electrodes. Check condition of the o-rings on centering rings at all unions in the system from cracks. They do dry out with time. Simply remove them from the metal or plastic ring and twist to inspect them. When cracks are found, these rings should be replaced to insure a proper seal. These replacement o-rings are available from EUROCOM.

When the temperature in the shop reaches very high levels, especially in the summer month, Apiezon or other lubricants that do not tolerate the heat should be avoided. Clean the interior of the entire glass manifold, hose bellows, and metal components with Methanol (available through local commercial solvent distributor) or isopropyl alcohol 99.9%. Methanol would be preferable when available. When Methanol is not available, use this series of products:

1. For stopcocks (where oil, grease, or silicon grease has been used) clean first with XYLOL or XYLENE (available at hardware stores or chemical companies)
2. If manifold has a milky white film, a build up of phosphors which neither Xylol nor alcohol will remove, use Windex to clean phosphors away.

Finally, clean all areas, even those previously cleaned as above with 99.99 IPA (100% pure isopropyl alcohol), which can be bought from industrial chemical companies or medical supply companies. Pure isopropyl alcohol has a proper evaporation to clean and not to contaminate your manifold system. **Xylene, Xylol, Methanol, and Alcohol must be used only in a well-ventilated area with no open flames and stored where highly flammable liquids are kept. KEEP OUT OF REACH OF CHILDREN AND EXCESSIVE HEAT! Avoid inhalation of the fumes. When using Apiezon the Xylene step is unnecessary.**

C-Ring Mercury Filters see weekly maintenance for check & clean up or 6 months maintenance for replacement.

During re-assembly, inspect the condition of the centering rings for any scratches, cracks, or imperfections. The o-rings will dry out and crack after a period of time causing an imperfect seal. Apply a liberal amount of the silicone high vacuum lubricant to THE THREADS ON THE OUTSIDE OF THE STOPCOCKS. Reassemble manifold making sure each connection is absolutely clean and dry (no grease). Pertinax acrylic clamps should be snug, but not over-tightened. Install manifold on the

acrylic supports exactly as originally mounted to avoid strain as previoiusly mentioned. DO NOT DRAW THE SCREWS DOWN TIGHLY IN THE TOP OF THE PLASTIC MANIFOLD SUPPORTS AS THIS MAY PUT THE GLASS UNDER STRAIN CONDITION CAUSING IT TO CRACK LATER. THE TOP OF THE SUPPORT SHOULD BE VERY SLIGHTLY MOVEABLE WHEN COMPLETELY ASSEMBELED.

b. Vacuum Fittings and Hose Bellows

Though these portions of the system will remain relatively clean, they too require cleaning with methanol in order to remove anything that might be there. It is part of a methanol conditioning to keep the system functioning at an optimum level. SEE BACKSTREAM AND EXHAUST FILTERS.

c. VAP-5/DVR-5

Do not clean the sensor head (Gauge Tube)

d. Notes

Ultimate vacuum levels between 1 and 6 Millitorr (Microns) achieved in the manifold while the tube remains above approximately 150 Degrees Celsius, produces a good quality gas discharge tube, that will operate for many years, (providing other factors are an on optimum level). Without question, when a turbo molecular pump in connected to attain a higher level of vacuum in the same timer frame or less, it will be a decidedly higher grade product.
Oil diffusion pumps are not recommended for this application. The use of an oil diffusion pump (condensation pump) for the production of gas discharge tubing was abandoned long ago in scientific communities where this device was originally conceived. Total suppression of back-streaming oil vapor into the manifold can **never** be attained. Adequate vacuum levels required for tube diameter up to 15 or 18-mm of reasonable length (eight feet or under) operating on current levels of 60mA or less can be easily achieved with a good upscale design direct drive rotary vane pump.

Remember: Three major factors determine the quality of a finished gas discharge tube:

i. The Electrode Technology
ii. A Pumping System that is regularly maintained.
iii. Correct processing procedure by a technician with a good understanding of the application and the technology.

Other contributing factors:

i. Cleanliness of the tubing and electrodes (free of dust and moisture)
ii. Prompt processing after bending (same day is ideal)
iii. Clean and uncontaminated mercury,
iv. The right mixture and quality of noble gases,
v. the general cleanliness of the the work area.

AVOID EXCESS LONG TUBING!