

Section 5.23 Title: Vacuum Pump Maintenance
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Revision Date: 11/01/19
P.I.: Prof. John F. Berry

Prior Approval: This procedure is NOT considered hazardous enough that prior approval is needed from the Principal Investigator.

Involves Use of Particularly Hazardous Substance (PHS)? No
 Carcinogen Reproductive Toxin High Acute Toxicity
Does this procedure require medical surveillance? No
Does this require use of a fit-tested respirator? No

Brief Description of Procedure:

Standard maintenance of laboratory vacuum pumps - to be performed as needed.

Location: *List the locations (buildings/rooms) where this procedure may be performed. For use of a PHS indicate a more precise location within the room, if appropriate, as a designated area.*

Daniels Chemistry - All Berry group labs

Chemicals Involved:

Chemical	Physical or Health Hazard (e.g. carcinogen, corrosive)
Vacuum Pump Oil	N/A
Vacuum Flushing Fluid (TKO-FF)	N/A

Other Hazards: *Include hazards, other than chemical, that may be present during operation of the procedure.*

N/A

Exposure Controls: *(Check all that apply)*

PPE: Safety Glasses Face Shield Chemical Splash Goggles
 Chemical Apron Gloves (Nitrile) Lab Coat
 Respirator (type) Other:

Engineering Controls:

Fume Hood Biosafety Cabinet Glove box
 Vented gas cabinet Other:

Administrative Controls: *List any specific work practices needed to perform this procedure (e.g., cannot be performed alone, must notify other staff members before beginning, etc.).*

N/A

Task Hazard Control Table: *For procedures involving numerous steps, it may be convenient to indicate specific requirements for individual tasks in the table below:*

N/A

Waste Disposal: *Describe any chemical waste generated and the disposal method used.*

Used vacuum pump oil and flushing fluid are collected in containers located near the eyewash in 6325. These containers are given to EH&S for disposal.

Accidental Spills: *Describe the procedure for handling small chemical spills that may occur during this procedure. Note that for large spills it may be appropriate to call 911.*

Spills can be cleaned with paper towels. Acetone or soap and water will remove residual oil.

Decontamination Procedures (required for PHS use): *Describe the procedure for decontamination of personnel and equipment.*

N/A

Training: *Describe any training needed prior to performing this procedure. Include training performed in-lab and any required demonstrations of competency.*

No formal training or documentation is required. This procedure should be demonstrated by experienced lab members. New members should talk through their procedures with experienced lab members.

Principle Investigator Approval: I have reviewed this procedure and approved it for use. Note: Modifications to the procedure may require update to this form.

Name: John F. Berry

Signature: _____

Date: _____

Vacuum Pump Maintenance

Vacuum pump oil serves both to protect the pump by catching much of the solvent vapor that is drawn off the line, to lubricate the pump, and to generate the vacuum. Regularly changing the vacuum pump oil will improve the quality of the vacuum and prolong the lifetime of the pump. The theoretical minimum for the vacuum a vacuum pump can draw (assuming no leaks in the system) is determined by the vapor pressure of the vacuum pump oil (typically, 10^{-3} torr @ 100 °C).

The vacuum pump oil should be changed every month if the pump is being used daily, or every six weeks to two months for pumps that receive less use. If you believe that the pump oil has taken up a significant quantity of solvent, (i.e. a flask full of solvent was evacuated without LN₂ traps present), then the pump oil should be replaced before further use.

Vacuum pump oil and flushing fluid are both available from the machine shop. Because the machine shop orders both in bulk, the pricing is considerably better than from other vendors.

Changing Vacuum Pump Oil

1. To more easily drain the pump, allow it to run for 20-30 minutes to warm up the oil prior to an oil change, as this will make the oil less viscous.
2. Turn the pump off and unplug it. Disconnect the flange connecting the pump to your line.
3. Move the pump to a benchtop where a container can be placed under the oil outlet. If you are not confident in your ability to lift the pump, get assistance from another lab member.
4. Put a thin layer of paper towels or the bin in which the oil is stored under the pump's oil outlet to catch any oil drops that may fall. Open the pump's oil intake. This will allow the oil to flow out of the pump freely.
 - a. As there are multiple types of pumps in the lab, inspect yours and find the pumps oil intake, oil outlet, and oil level gauge. The intake should be on top of the pump. The outlet should be near the bottom on one of the sides. The oil level gauge should be on one of the sides near the top.
5. Position the "used-pump-oil" labeled container, located by the solvent system in 6325, under the oil outlet and open the outlet to allow the vacuum pump oil drain. Be careful not to drop the outlet cap into the used oil.
 - a. The vacuum pump will need to be tilted to drain residual oil.
6. If the vacuum pump oil appears opaque, smells of chemicals/solvents, black, or contains debris, you will need to do a vacuum flush. If the vacuum pump is regularly maintained, skip to step 10.
7. Close the vacuum pump's oil **outlet** and fill the vacuum pump with flushing fluid, located by the solvent system in 6325. Fill to the upper mark on the pump's oil gauge.
8. Close the pump oil intake, connect it to a closed vacuum line, and run the pump for at least 24 hours.
9. Drain the cleaning fluid into the used pump cleaning fluid container, located by the solvent system, and close the oil outlet.
10. Refill the pump with fresh pump oil using a funnel of plastic cup. Fill to the upper mark on the pump's oil gauge.

11. Wipe down the vacuum pump with a few paper towels, seal up the oil intake, and return it to its original position. Reconnect the flange from your line to the pump. Plug in the pump.
12. Turn the pump on and let the oil warm up (~10-15 minutes). During this time, clean up any oil that may have spilled, along with the funnel used to fill the vacuum pump. Soap and water are sufficient for cleaning up the new oil, but acetone can also be quite effective.
13. Once the pump has warmed up, check the vacuum level of the system. Ideally, a pressure of 10^{-1} to 10^{-2} should be obtained. If not, check the lines for leaks and repeat. It takes several hours to achieve maximum vacuum.
14. Mark near the pump when the oil was last changed.

Notes:

1. Oil makes a huge mess if it spills, try to avoid this. With soap and water or acetone, most objects that contact the oil can be cleaned.
2. Clean pump oil is clear, if the oil draining from the pump is black, opaque, or contains debris, you waited too long to change the pump oil. Readjust the frequency at that you change your pump oil accordingly.
3. Dirty vacuum pump oil contacted and absorbed almost every solvent used on the system the vacuum pump was associated with, so consider it to have the same safety concerns as the solvents used in lab, if not worse.
4. If the container with the used vacuum pump oil is full, place it in the chemical disposal collection bin in 6319.
5. The oil gauge is connected directly to the pump oil reservoir, so do not try to clean the oil gauge while the pump is full of oil.

Troubleshooting: There are a variety of reasons why the pump might stop work, and many of these problems can be fixed by the machine shop. We are not mechanics, so don't waste several days trying to fix a pump that won't start.