

Vacuum Pumps Standard Operating Procedure

Revision: April 15, 2022

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This standard operating procedure (SOP) outlines the handling and use of vacuum pumps. Review this document and supply the information required in order to make it specific to your laboratory. In accordance with this document, laboratories should use appropriate controls, personal protective equipment, and disposal techniques when working with vacuum pumps.

Description [Provide additional information as it pertains to your research protocol]

Vacuum pumps are commonly used in a variety of experimental setups to remove air and chemical vapors from a vessel or system. Applications that use vacuum pumps include rotary evaporators, vacuum ovens, drying manifolds, freeze-dryers, aspirators, desiccators, and filtration equipment.

Process [Write the steps for using the chemical in your research protocol]

Potential Hazards [Provide additional information as it pertains to your research protocol]

Vacuum pumps can pose chemical, mechanical, electrical, and fire hazards. Chemical exposure can occur from improper installing, trapping, and exhausting or from off gassing of contaminated pump oil. Mechanical hazards can occur from the moving parts of the vacuum pump. Fire can result if the pump malfunctions or overheats and ignites nearby combustible materials or if improperly vented chemical vapors create a flammable atmosphere. Electrocution can occur from faulty or defective switches and wiring.

Many vacuum pumps use oil which can be easily contaminated and result in pump damage and hazards. Additionally, vacuum oil presents a slipping hazard if allowed to spill or leak onto the lab floor.

Engineering and Work Practice Controls [Provide additional information as it pertains to your research protocol]

Pump selection and installation

- Select the appropriate pump type for your application. The [Vacuum Pump Selection Guide](#) from Labconco provides a general overview of vacuum pump applications for laboratories.
- Whenever possible, locate pumps in designated vacuum pump cabinets or in another ventilated enclosure, such as a fume hood. Otherwise, locate pumps out of aisle ways and avoid creating trip hazards. Avoid placing pumps in an unventilated, enclosed receptacle.
- Some vacuum pump cabinets have a built-in cooling fan. If present, ensure the fan is operational and free

of excessive dust or debris. **Cooling fans do not provide adequate ventilation for hazardous chemical exhausts, they are for cooling of the pump only.**

- Vacuum pumps that use oil must be placed on a spill tray or containment to contain oil spills. An oil mist separator is necessary to prevent oil loss.
- Electrical cords and switches must be free from defects. Pumps must be connected directly to an outlet; do not use power strips or extension cords.
- Pumps must be physically separated from flammable and combustible materials.
- Ensure that pumps have belt guards. Shield any glassware under vacuum.
- Close the valve between the vessel and pump before turning off the pump to avoid introducing oil into the system.

Use with hazardous chemicals

- Vacuum pumps used to evacuate systems containing toxic, volatile, or corrosive substances must be vented to the building exhaust ventilation system. Pumps in vacuum cabinets must be connected directly to the cabinet exhaust port, not vented into the cabinet interior. Do not allow venting of pump exhausts into the general lab space. Contact EHS for specific guidance on connecting vacuum pump exhaust to building ventilation.
- Vapor traps, such as a *cold trap*, should be used in line with high vapor loads to minimize the amount of volatile chemicals being evacuated and reaching the pump. Oil-using pumps require cold traps to prevent collection of solvent vapors in the pump oil. Additionally, corrosive or water vapors will damage the vacuum pump if allowed to collect in the oil. Use of cold traps with oil-free pumps prevents vapors from passing through the pump and into the environment.
 - Ensure the cold trap is appropriate for the situation and follows all manufacturer and safety guidelines. Refer to this [Cold Trap Selection Guide](#) from Labconco for guidance on selecting the correct cold trap.
 - Refer to the [U-M Cryogenic Liquids SOP](#)

Ensure pump oil is compatible with vapors that will pass through the pump (i.e. avoid hydrocarbon pump oil and oxidizing gases/vapors). Ensure gases or vapors will not damage the pump.

Pump service and maintenance

- Follow manufacturer's instructions and precautions for your specific pump and related equipment. Adhere to the maintenance and service schedule prescribed by the manufacturer.
- Use correct vacuum tubing and replace old, cracked, or damaged tubing.
- Check oil levels and change oil when necessary. Change oil when it begins to turn a dark brown color. Replace oil mist filter at prescribed interval.
- If cold traps are used, check for blockage.

Personal Protective Equipment [Provide additional information as it pertains to your research protocol]

Wear safety glasses, lab coat, long pants, close-toed shoes and gloves when performing all vacuum operations. Additional PPE requirements will vary by application.



Waste Disposal [Provide additional information as it pertains to your research protocol]

All used vacuum pump oils must be disposed of through Environment, Health & Safety (EHS) Hazardous Materials Management (HMM). Pump oils used with hazardous chemicals are considered hazardous wastes. Collect, label, and store waste oil in accordance with hazardous waste regulations. Contact EHS-HMM at (734) 763-4568 for waste containers, labels, manifests, waste collection and for any questions regarding proper waste disposal. Also, refer to the [EHS Hazardous Waste Web page](#) for more information.

I have read and understand the above SOP. I have received approval from my Lab Director to perform this procedure. I agree to contact my Lab Director if I plan to modify this procedure.

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Laboratory Director

Revision Date

Revision History (Do not print as part of SOP)		
04/15/2022	Annual Revision	Reformatting, removed emergency info, expanded controls sections (JMW)
03/04/2019	Annual Revision	Updated links and format (DML).
05/02/2018	Partial Revision	Removed the Spill Procedures section (AKJ).
04/19/2018	Partial Revision	Revised formatting (AKJ).
03/26/2018	Partial Revision	Put into EHS format, changed department name, and fixed links. Revised Spill Procedure section (AKJ).