



TEXAS TECH UNIVERSITY

Environmental Health *and* Safety

TRAPS FOR VACUUM LINES

Always place an appropriate trap between experimental apparatus and the vacuum source. The vacuum trap:

- Protects the pump, pump oil, and piping from the potentially damaging effects of the material;
- Protects personnel from materials in the apparatus; and
- Prevents vapors and related odors from being emitted back into the work area or vacuum system exhaust.

Improper trapping can allow vapor to be emitted from the exhaust of the vacuum system resulting in potential personnel exposure and/or entry into the work environment.

Proper Trapping Techniques

All lines leading from the equipment to the vacuum source must be equipped with a trap or filter as appropriate.

Particulates

- Vacuum lines should be fitted with filtration capable of efficiently trapping the particulates in the size range being generated.

Aqueous or Non-Volatile Liquids

- A filter flask at room temperature is sufficient for vacuum lines using aqueous or other non-volatile liquids.
- An in-line hydrophobic filter may be added for additional protection to the vacuum system.

Solvents and Other Volatile Liquids

- A cold trap (see Figure 2) of sufficient size and cold enough to condense vapors generated followed by a filter flask capable of collecting fluid that could be aspirated out of the cold trap should be used.
- A cold trap using a cooling bath of dry ice and isopropanol or ethanol is sufficient for most volatile liquids (temperatures as low as -78°C). Glycols may also be used as the bath liquid.
- Avoid using an acetone-dry ice cooling bath. The alternatives mentioned above are less flammable, less prone to foaming and splattering and less likely to degrade trap components (*i.e.* O-rings, plastic).
- Use caution when handling dry ice and preparing cooling baths. Wear splash goggles, cryogenic gloves, and a lab apron when handling cryogenic liquids to avoid any skin exposure.

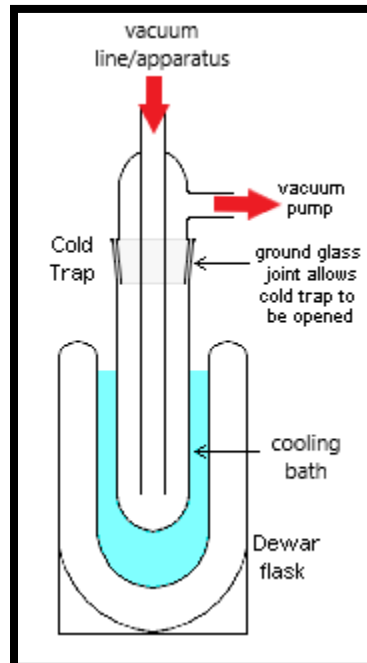


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- Dry ice and liquified gases used in cooling baths should always be open to the atmosphere. Never use them in closed systems where they may develop uncontrolled pressures.
- Perform procedures in a well-ventilated area. Never lower the head into a dry ice chest as asphyxiation can occur.
- Add dry ice slowly to the bath liquid to avoid foaming.
- Check cold traps frequently to make sure they do not become plugged with frozen material.
- A cold trap using liquid nitrogen may only be used with sealed or evacuated equipment. If the system is opened while the cooling bath is in contact with the trap, oxygen may condense from the atmosphere and react explosively with any organic material present.
- Wrap Dewar flasks and cold traps with screens, friction tape, or a metal jacket.
- Select equipment used at low temperatures carefully because temperature can dramatically change the characteristics of materials.
- After completion of a procedure using a cold trap under pressure, isolate the trap from the vacuum source, remove from the cooling bath and vent to atmospheric pressure in a safe and environmentally acceptable manner.

Figure 2: An example of a cold trap in a vacuum line immersed in a cooling bath.



Highly Reactive, Corrosive or Toxic Gases

- A sorbent canister or scrubbing device capable of trapping the gas should be used.
- Chemical traps for specified chemicals are available from laboratory supply vendors. These traps contain neutralizers that mitigate the hazards of the chemical being collected.

Glassware

- Glassware under vacuum should be kept behind a shield or closed hood sash, taped or resin (plastic) coated.
- Check glass vessels for star cracks, scratching and etching marks each time a vacuum apparatus is used.
- Use only round-bottom or thick-walled (e.g. Pyrex) evacuated reaction vessels specifically designed for operations at reduced pressures.
- Do not use glass vessels with angled or squared edges in vacuum applications unless specifically designed for that purpose (e.g. extra thick glass).
- Repaired glassware should be inspected under polarized light before use in vacuum or thermal operations.
- Never evacuate thin-walled, Erlenmeyer or round-bottom flasks larger than one liter.



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- Glass components of rotary evaporators should be made of Pyrex or similar glass. Enclose apparatus in a shield. Gradually increase rotation speed and vacuum to the flask whose solvent is to be evaporated.
- Glass vacuum desiccators should be made of Pyrex or similar glass and be completely enclosed in a shield or wrapped with friction tape in a grid pattern so as not to conceal the contents. Never carry or move an evacuated desiccator.

Dewar Flasks

- Dewar flasks are under high pressure and can collapse from thermal or mechanical shock. Shield Dewar flasks using a layer of fiber-reinforced friction tape or by enclosure in a wooden or metal jacket. This reduces the risk of flying glass should the container collapse.
- Use metal Dewar flasks when there is a possibility of breakage.
- Styrofoam buckets with lids are a safer alternative for short-term storage and transport of cryogenic liquids.

Other Vacuum Considerations

- An in-line hydrophobic filter may be added to any vacuum line for additional protection to the vacuum system.
- Assemble vacuum apparatus to avoid strain. Joints should allow various sections to be moved without transmitting strain to the flask neck(s).
- Support heavy apparatus by the bottom as well as by the neck.
- Equipment or apparatus under pressure should be located behind a blast shield or inside a closed fume hood.
- If solvents or corrosive substances are drawn into the pump, change the oil before further use to prevent damage to the vacuum. Oil contaminated with solvents and corrosive substances must be handled as hazardous waste.
- Oil and pumps contaminated with mercury must be handled as hazardous waste. Contact EHS immediately at 742-3876 for disposal.
- Keeping a log of pump usage may be desirable to guide length of oil use and potential contaminants in the pump oil.

References

CDC/NIH. *Biosafety in Microbiology and Biomedical Laboratories*. 5th ed. (2009). Appendix A. <https://www.cdc.gov/biosafety/publications/bmbl5/>.

National Research Council. *Prudent Practices in the Laboratory: Handling and Management of Chemical Hazards, Updated Version*. (2011). <https://www.nap.edu/catalog/12654/prudent-practices-in-the-laboratory-handling-and-management-of-chemical>.