KU | Wonderful Institute for Sustainable Engineering

Lab Refresher

Attendance Check-In

WEDNESDAY, JUNE 17 AT 9:00AM

Presented by: WISE Safety Committee

2026 Spring

wise.ku.edu

INTRODUCTION

Meet the KU-WISE Safety Committee

The mission of the Safety Committee is to promote a culture of safety within the Wonderful Institute for Sustainable Engineering. The Safety Committee organizes Safety Meetings on the third Wednesday of each month.


Berlyn Mellein


Tiffany Oquendo


Kevin Turner


Kipling Len


Nick Gorschak


Emily Weiss


Diego Melfi


Lacee Roe

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Table of Contents

Wonderful Institute for Sustainable Engineering

OBJECTIVE

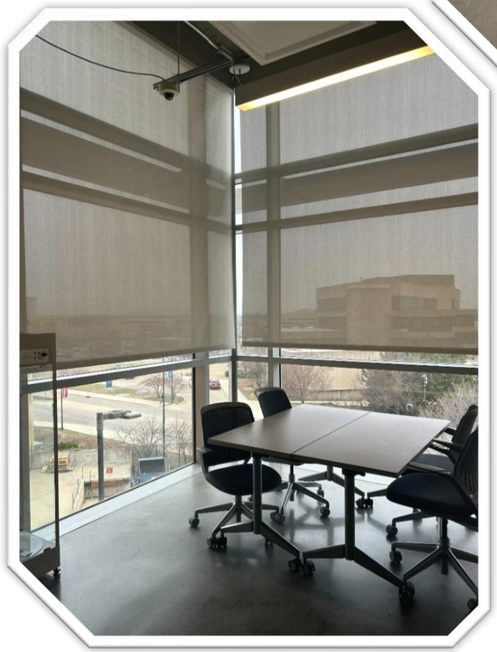
Objectives

- Highlight common safety concerns
- Reinforce proper operation and handling procedures
- Increase awareness of hazards associated with shared lab equipment and spaces
- Identify points of contact for lab safety questions and equipment-related assistance

Shiflett Group

General Housekeeping

- **Obstructed Walkways**
  - Keep chairs pushed in walkways free of clutter
- **Community Area Blinds**
  - Raise blinds when you're done using the space
  - Closed blinds block visibility in case of an emergency
  - Enforced by fire marshal
- **Paper Towels & Gloves**
  - Restock when supplies are running low (Lab 2430)



Experiment In Progress

Best Practices

- Ensure visibility
- End date should be no longer than two weeks from start date
- Update immediately when an experiment ends or changes status
- Include a brief process description

Experiment in Progress

Name: _____ Emergency Phone # _____

Alt Name: _____ Emergency Phone # _____

Lab Notebook: _____ Page # _____

Start Date: _____ Start Time: _____

End Date: _____ End Time: _____

Extra Hazard: Yes / No (circle one)

Specify Hazard(s):

____ Flammable ____ Explosive

____ High Pressure ____ Toxic Fumes

____ High Temperature ____ Strong Acid

____ Potential Water Leak ____ Strong Base

____ Other: _____

Experiment Description: (Please include all relevant details)

Interlock Tags

Interlock → device used to prevent an undesired event from occurring by halting operation if required circumstances are not met

- Required circumstances = measured variable with a defined limit
- When interlock is activated
  - Operation is halted
  - Operation may resume when measured variable returns to acceptable value, or may require operator acknowledgment
- Overtemperature interlocks are the most common in Shiflett labs
  - High temperature limit is set by user
  - If temperature reaches limit, heating stops or equipment shuts off
- Other types of interlocks include
  - Temperature deviation
  - Air actuated valve shuts off gas lines when flammable gas levels are above a defined limit (for IGA, Xemis enclosures)

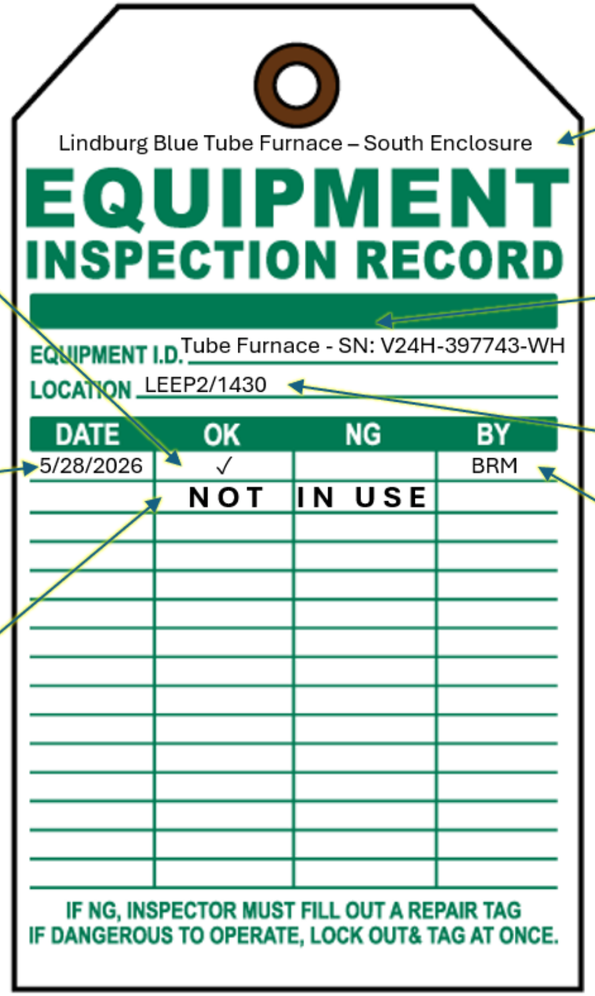
Interlock Tags

Interlocks must be tested twice a year (SAFETY DAY)

Indicate OK (interlock works) or NG (interlock doesn't work). If interlock doesn't work, equipment MUST NOT BE USED

Date MUST include year

If equipment is not being used, write "NOT IN USE" over row. If inspection says not in use, then the interlock MUST BE CHECKED prior to use



Can include more information about equipment here

Equipment ID – item and serial number (if available)

Location (building, lab #)

Your initials

Vacuum Ovens

Primary Hazards

- Chemical & Material Compatibility
- Overpressure & Pressurization
- Solvent Vapors
- Hot Surfaces

Operating Considerations

- Powders need special handling (see SOP)
- Inspect before use: vacuum lines, gaskets, etc.
- Ensure materials are rated for vacuum and temperature
- Avoid rapid pressure changes
- PPE: safety glasses, thermal gloves

Karl Fischer

Operating Considerations

- Use log to record samples added
- Two Karl-Fischer titrators available
- C20s
  - **NOT SUITABLE FOR ALDEHYDES OR KETONES**
  - Sample must be soluble in methanol
- DL32
  - Reagent suitable for aldehydes and ketones
  - **Contact Berlyn if you need to measure the water content for an aldehyde/ketone**

Primary Hazards

- Chemical
  - Flammable liquid
  - Acute toxicity (inhalation)
  - Some components can be absorbed through skin (**USE GLOVES**)
- Needles/sharps

Allgeier Group

Vacuum Pumps

- Vacuum Pumps are an important part in lab equipment used in vacuum ovens, gloveboxes, mass spectrophotometers, etc.
- They remove air and gases to create low-pressure environments which are needed to run these instruments

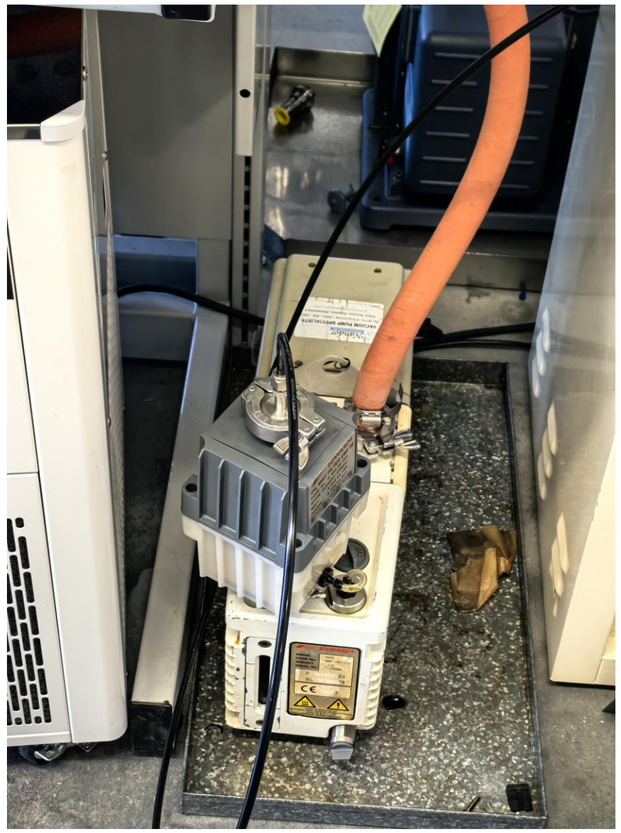
Vacuum Pumps

Maintaining Oil Changes

- One important aspect is to regularly change the oil in a vacuum pump
- The time to change the oil varies which how much use and which type of vacuum pump is used
- Neglecting to change the oil can lead to several problems:
  - Increases wear on the moving parts
  - Shorten the lifespan of the pump
  - Cause breakdowns and mechanical damage

Vacuum Pumps

- Vacuum pump broke down and wasn't pulling a vacuum for the oven
- Disassembled the entire vacuum pump to determine the cause of the issue
- Found that while most of the oil was still liquid, some oil had solidified and become crud on the inside walls of the pump
- It is believed that this was part of the reason as to why the machine broke down



Vacuum Pumps

- This image shows the various components and parts for the pump
- Important to keep track of each component as it can be easy to lose where things belong

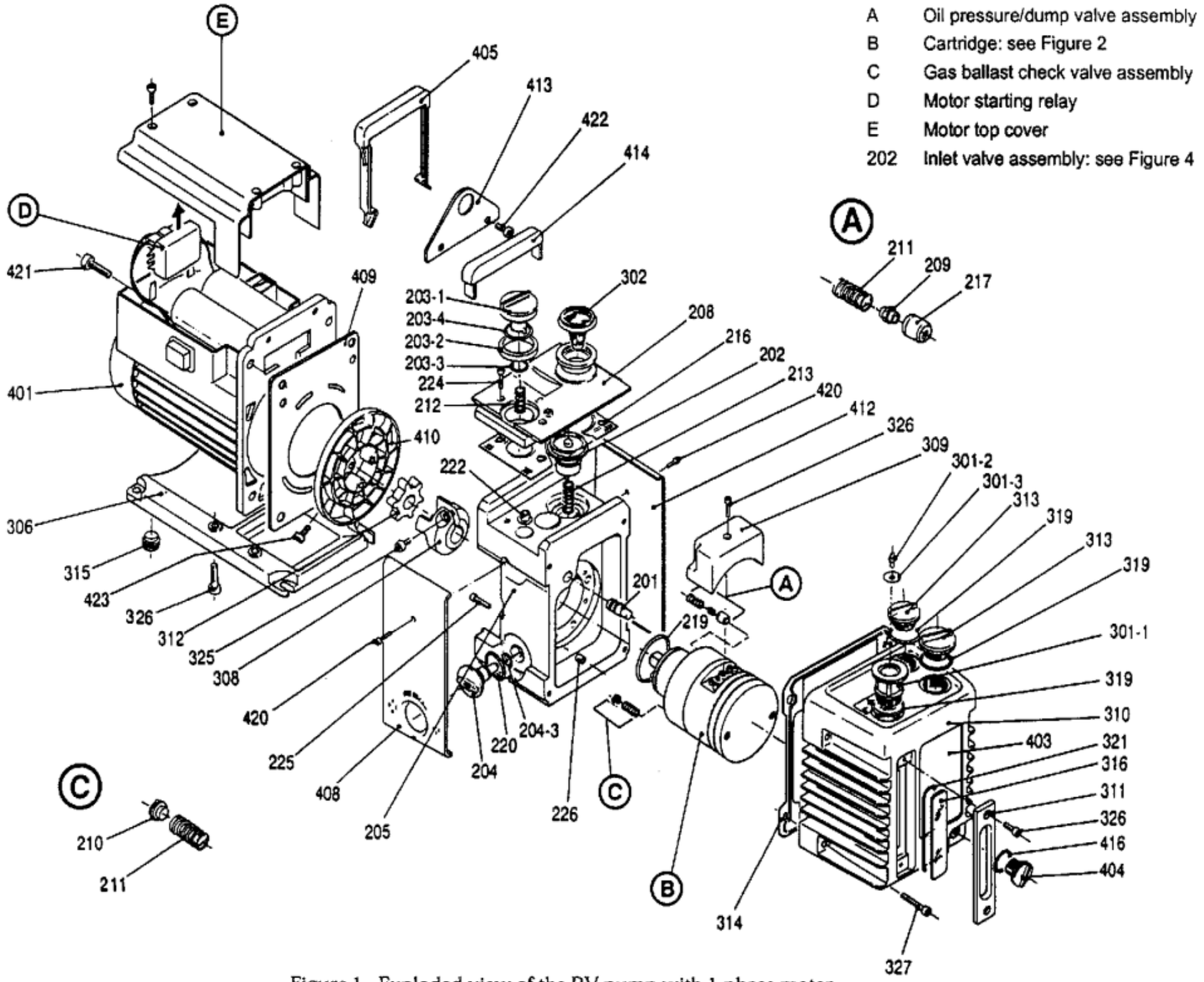
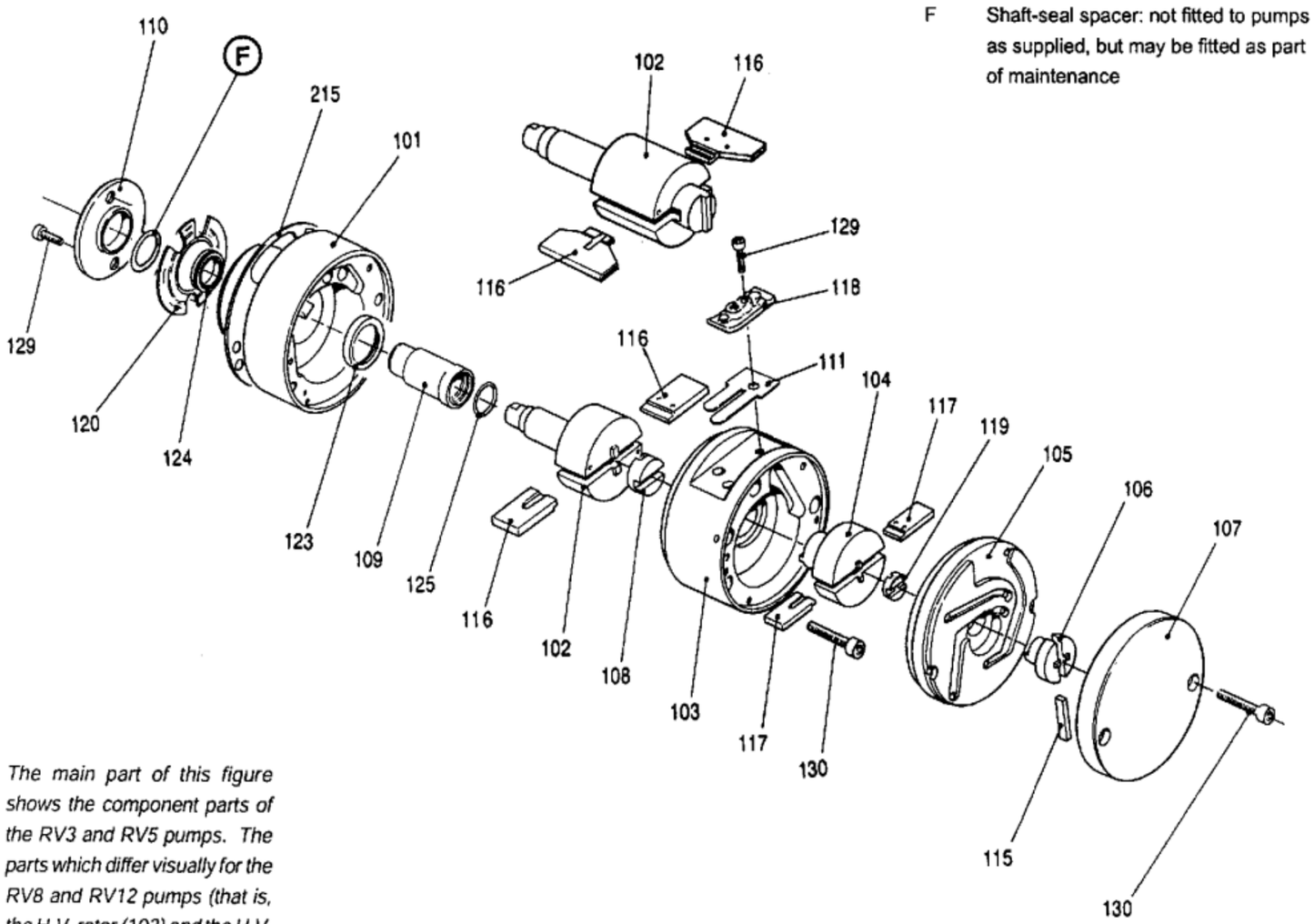


Figure 1 - Exploded view of the RV pump with 1-phase motor

Vacuum Pumps

- This image is the expanded Part B from the previous image
- We found that Part 117 was broken when disassembling the pump

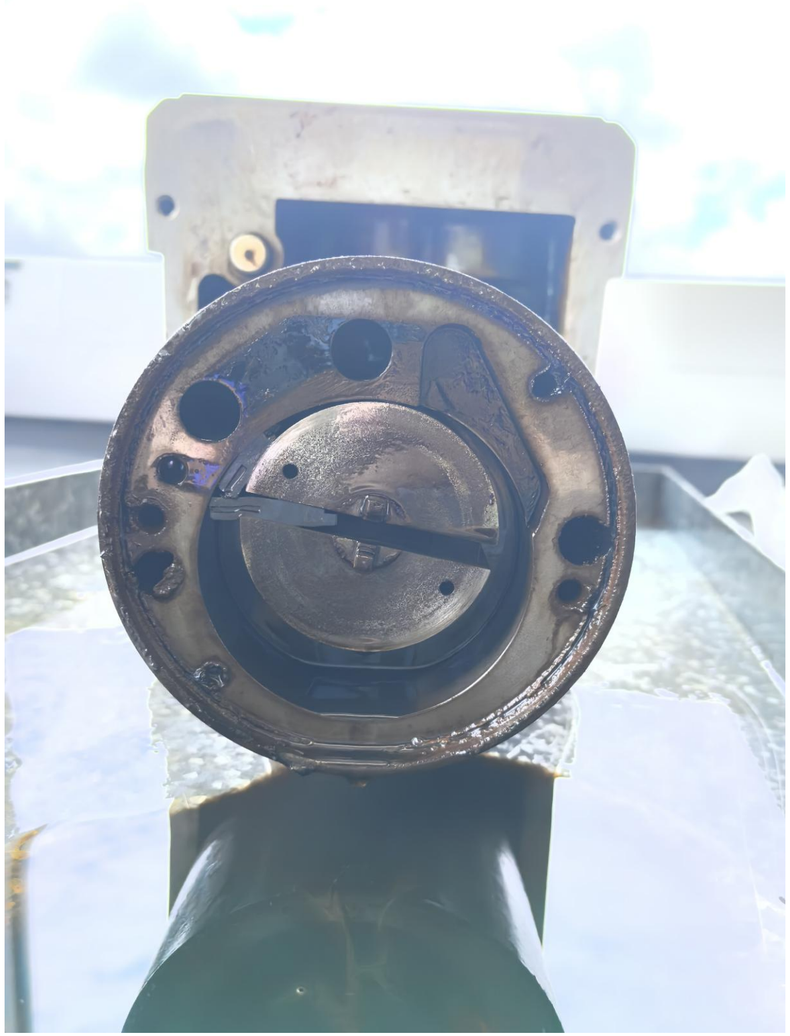


Note: *The main part of this figure shows the component parts of the RV3 and RV5 pumps. The parts which differ visually for the RV8 and RV12 pumps (that is, the H.V. rotor (102) and the H.V. blades (116)) are shown above the main exploded view.*

Figure 2 Exploded view of the cartridge

Vacuum Pumps

- While one part was intact, the other part broke in half
- This was the primary cause as to why the pump was not functioning
- The crud seen in the other parts of the pump was also likely due to this part slowly eroding
- After buying a replacement and reassembling the pump was working again



Vacuum Pumps

- Another instance, the oil in the pump turned into a jello-like consistency
  - Possible some unknown material got into the oil causing it to become viscous
- Extremely important to consistently change to oil to prevent issues from arising

Scurto Group

O-ring/Gasket failure

- Normal wear and tear
- Temperature rating
- Material compatibility
  - Working fluids
  - **Wash solvents!**

Heating tape failure

- Normal wear and tear
- Electrical connections
- **Fluid leak!**
  - Wetting the tape
    - Short circuit
    - Triggering the breaker
- **Always pressure test!!**

Syringe filter “slip”

- Luer slip filters may slip or pop off

- If the filter is clogged
  - Use a new one
  - Don’t force it
  - Filter may collapse

- Prefer Luer locks (threaded)

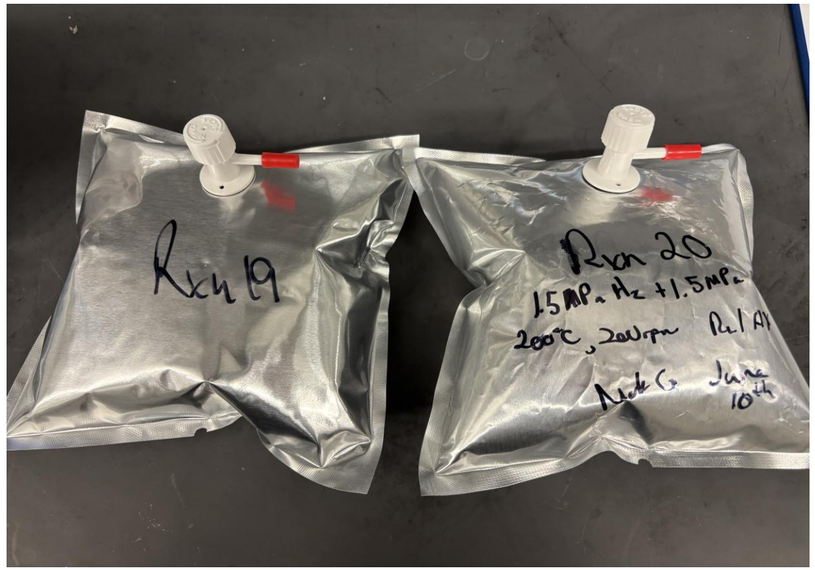
- Consider working in the hood

- **Always wear PPE!**

Morais Group

Sample Labeling

- Proper labeling and storage of samples is an important part of lab upkeep.
- Labels should include
  - Owners name/initials
  - Identify its contents
  - Date
  - Lab notebook numbers



Initials
Date (DD-MM-YYYY)
Sample Name
Notebook #/Page #
Sample #

Contaminated Gloves

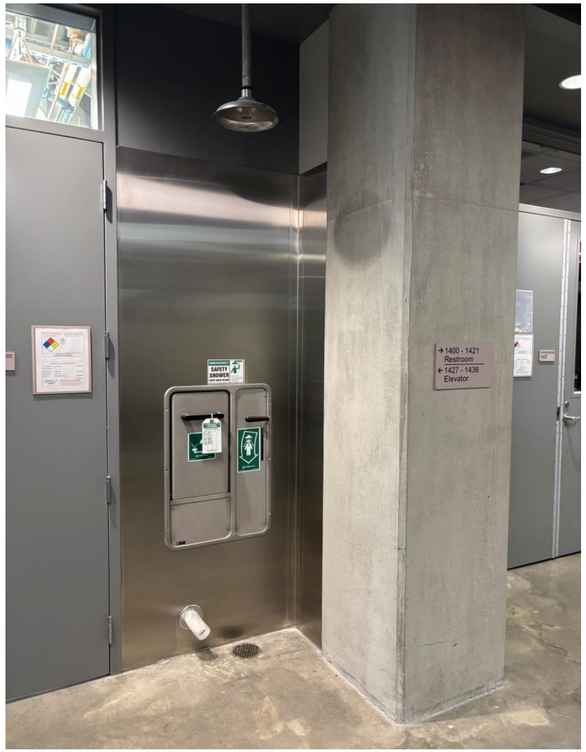
- Gloves are a vital aspect of PPE
- But knowing when to take them off is also important

- Take off gloves before using designated glove free workspaces
  - Keyboards, tools, and some equipment

- Be conscious of what others may have used with contaminated gloves

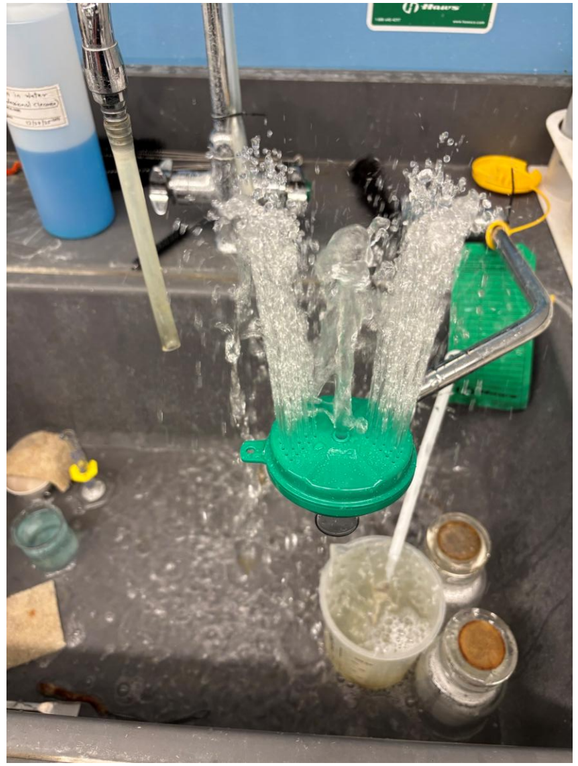
Emergency Equipment

Safety Shower



- Know nearest shower to working location

Eyewash Station



- Usually attached to lab sinks
- Check them regularly

External Safety Incident

Laboratory Vacuum Pump Exhaust Explosion UPenn, 2020

What Happened?

- Chemistry graduate student attempted to evaporate an ethyl acetate/hexane mixture using a Buchi Rotavapor connected to a Savant VP100 rotary-vane roughing pump
- Vacuum pump was located in designated pump cabinet under the hood
- Student turned pump on but it wasn't pulling vacuum
- After observing no physical problems with the pump, the student turned pump off and on again
- When the pump was turned on, there was a loud bang and the cabinet door burst open – vacuum pump was on fire
- Fire Marshal – evidence supports chemical vapor explosion

PUMP FIRE AND EXPLOSION

No injuries

Cost to repair damage: $70,000

Time to repair damage: 5 months

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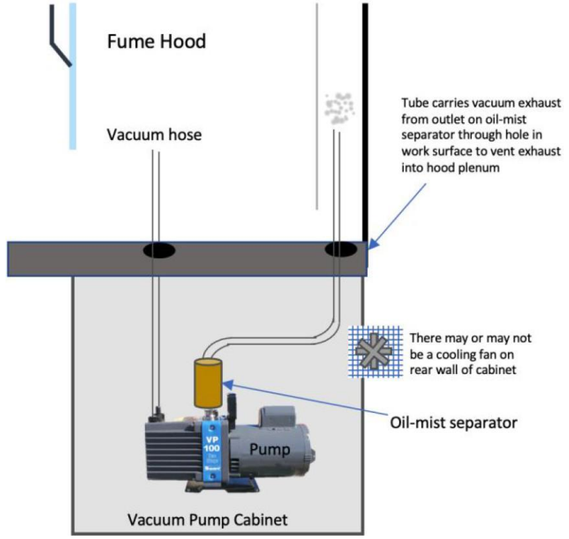
Laboratory Vacuum Pump Exhaust Explosion UPenn, 2020

Cause:

Ignition of explosive concentration of flammable chemical vapor expelled from pump exhaust

Contributing Factors:

1. Diethyl ether was evaporated in the system earlier in the day
2. Rotary evaporator condenser was allowed to warm to room temperature with diethyl ether still in the system, but was emptied prior to using the pump
3. Exhaust from vacuum pump was vented into the cabinet, not the fume hood
4. Source of ignition may have been a spark from either the pump motor or cooling fan
5. Vacuum pump delivered more vacuum than recommended, with no direct control of vacuum pressure
6. Student inherited set up from previous user two months prior



DIETHYL ETHER

Low boiling point: 35.6 °C

High vapor pressure: 563 nPa @ 20 °C

Broad explosive range: 1.8-48%

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Laboratory Vacuum Pump Exhaust Explosion UPenn, 2020

LEARNINGS

Engineering Controls:

1. **Equipment selection** – select appropriate equipment for process. Over or under specified can be a problem
2. Pump exhaust venting – all vacuum exhaust of potentially hazardous materials MUST be vented to laboratory exhaust duct or fume hood
3. Adequate condensing – recommended using two cold traps with appropriate cooling (dry/ice solvent vs. cold-water)

Administrative Controls:

1. Selecting the right temperature and pressure – cooling temperature should be 20 ˚C lower than the vapor temperature
2. **Proper maintenance**
   - Follow manufacturer's recommendations
   - Keep records of all pump maintenance (routine, repairs, vendor-provided services)
3. Empty condenser trap immediately
4. **New-worker review of equipment and facility** – review safety procedures, SOP, and physically inspect prior to using

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Who to Contact for Training and Resources

Where To Go For Questions

If you do not feel comfortable with a process or procedure in lab, reach out to your supervisor or senior lab personnel

When to seek out information/training:

- New to laboratory work
- New process or procedure
- Out of practice, need a refresher
- Current process/procedure has been changed, does not feel safe, or needs to be updated

Examples:

- Moving gas cylinders
- Fittings & tubing
- Electrical connections
- Setting up and using a water bath

Equipment Overview

Shiflett Lab

Equipment	Contact
Vacuum Oven	CJ Ponge
Karl Fischer	Berlyn Mellein
Viscometer	Berlyn Mellein
Densitometer	Berlyn Mellein
Glove Box	Michael Lundin
TGA*	Berlyn Mellein

Morais Lab

Equipment	Contact
GCs	Nick Gorschak
TGA*	Jared Bartlett

Allgeier Lab

Equipment	Contact
Glove Box	Tom Gonzales
Vacuum Oven	Prathusha Kothinti
UV-Vis	Prathusha Kothinti
TGA*	Prathusha Kothinti
Low Field NMR	Kipling Len
Reduction Furnace	John Styers
Pycnometer	John Styers
Micromeritics 3flex	John Styers
Micromeritics 2920	John Styers

* **TGA** (thermogravimetric analysis) is located in Dr. William's lab – each group should have a designated trainer

QUIZ

Kahoot

https://create.kahoot.it/share/wise-safety-meeting-lab-refresher-2026/1991d8fe-db71-480e-9f98-276a00965381

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Thank you for listening!
Questions?

Attendance Check-In

WEDNESDAY, JUNE 17 AT 9:00AM

Contact:

wise@ku.edu

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All safety presentations are available on https://wise.ku.edu/2026-presentations