# **Standard Operating Procedure (SOP) Title: Use of Schlenk Line (Vacuum/Gas manifold)**

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| Assessor:  | Joshua Linfoot | Location of work:  | MSRH 502 |
| Principal Investigator:  | Prof Alan Spivey |
| Date of approval:  | 13/09/2021 | Date for review: | 13/09/2022 |

## **Justifying the hazards:**

The Schlenk Line is used for the handling of air or water sensitive chemicals. It consists of a gas manifold (for delivering either argon or nitrogen) from a gas cylinder or house supply, and a vacuum manifold connected to the pump.

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| Identify hazards with specific risk assessments and a College or a departmental approval process  |
| [Ionising radiation sources](https://www.imperial.ac.uk/safety/safety-by-topic/laboratory-safety/) | [ ]  | [Biological sources](https://www.imperial.ac.uk/safety/safety-by-topic/laboratory-safety/) (microorganisms, human/animal tissues, plants) | [ ]  |
| [Class 3R, 3B or 4 Lasers](https://imperiallondon.sharepoint.com/sites/fons/faculty/safety/lasers/SitePages/laserhome.aspx)  | [ ]  | [Offsite work](http://www.imperial.ac.uk/safety/safety-by-topic/off-site-working/) | [ ]  |
| Confirm if [Lone working](https://www.imperial.ac.uk/safety/safety-by-topic/lone-working/) is permitted with this SOP? [ ]  If it is permitted, describe the control measures for lone workers:  |

## **Preparing for the SOP:**

* **DON’T** use cracked and damaged Schlenk line.
* **Do** inspect the connection to the pump. Refer to the Use of Vacuum Pump SOP.

## **Procedure:**

## **When using the inert gas (N2/Ar) line:**

## 1. Ensure all taps on the line are closed.

## 2. Turn on the inert gas tap slowly, taking careful note of the bubbler’s flow rate. Turn on N2/Ar gas until there is a constant stream from the bubbler.

## 3. Open the appropriate tap connected to the experiment flask requiring inert atmosphere.

## 4. To turn off the gas flow, close the tap connected to the experiment first, and then the tap to the gas source.

5. If two bubblers of different sizes are introduced to the system, switch to the smaller bubbler if a constant positive pressure to a closed system is required, and to the bigger one for flushing system with the inert gas.

**When using the Vacuum line:**

Use dry ice or liquid nitrogen for vacuum trap cooling. Refer to the Dry Ice/Liquid N2 SOPs.

1. Ensure all taps on the line are closed.

2. Open the trap tap slowly to introduce the vacuum to the line. Only poor liquid N2 to the trap dewar after vacuuming the air from the Schlenk line.

3. Slowly open the tap connected to the experiment, whilst monitoring the behaviour of the content attached to the line. Close the tap if necessary to prevent contaminants from entering the line.

4. To turn the vacuum off, first turn the tap connected to the experiment then the tap connected to the trap. Once both are closed, turn off the pump and then release the vacuum from the line by slowly opening the trap tap. Leave one vacuum tap open while not in use.

**When switching between Gas and Vacuum lines:**

1. Following the procedures above, introduce inert gas to the experiment flask.

2. Following the procedures above, introduce the vacuum to the line.

3. Turn the tap to the vacuum side monitoring bubbler and the experiment content very slowly, ensuring that the experiment content is not introduced into the line.

4. When switching from vacuum to nitrogen, ensure that the bubbler does not get sucked up into the line. Close the tap and wait until the oil level in the bubbler is back to its original level before continuing switching.

5. To turn off, follow the shutdown procedures outlined above.

## **Disposal:**

Any waste from the vacuum trap should be emptied after the experiment is completed and disposed of according to the appropriate College Waste route.

Dispose of Schlenk lines as a glassware waste if necessary.

## **Personal Protective Equipment (PPE):**

Lab coat, appropriate gloves, safety glasses

## **Risk Analysis of SOP and emergency procedures:**

### (In addition to [Safe Lab Practice](https://imperiallondon.sharepoint.com/sites/fons/faculty/safety/SitePages/Basic%20Laboratory%20Rules%20for%20All%20Laboratories%20in%20FoNS.aspx))

### **Always remember to include fire associated risks and control measures where appropriate**

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| Hazard | Raw risks | Current control measures | Residual risk(Low/Med/High) |
| Glassware under pressure | Explosion | Always work in a fume cupboard with a lowered sashVisually inspect associated equipment (e.g. glassware and Schlenk line) for cracks and other defects before and after use.Use a source of pressure relief in the pressurised line (if a bubbler is used, it must be mercury free). Pressure in the line is checked with manometer prior to every experiment and can be monitored throughout for improved safety.If gas cylinder is used, open the regulator slowly and in a controlled manner.Use dry ice instead of liquid nitrogen to avoid condensation of gases (such as CO2, O2 and C2H4) in the vacuum trap. If cooling the trap with liquid N2, ensure the line is free of air at all times. **Ensure there are no leaks in your line!****Additional controls:** a Blast Shield or screen can be used for improved safety. | Med |
| Pressurised gas |
| Condensed gases |
| Glassware and glass parts | Cuts and splinters from broken glass  | Visually inspect glassware for cracks and other defects before and after use. If glassware damaged arrange for repair or dispose of. | Low |
| Hazardous materials | Exposure via inhalation of hazardous reagents | No work with hazardous reagents outside of containment, ensure containment has appropriate extraction and filters (where relevant). Ensure the equipment and sample preparation area cleaned after each use.(Include hazards and controls of associated reagents in this or separate risk assessment) | Low |

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| **Additional control measures to minimise residual risks** | **Implementation date** |
| If it is possible, use the original parts of the Schlenk line provided by the same manufacturer to ensure compatibility. Use specially designed glassware capable to work under pressure. |  |

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| **Who may be harmed** |
| Staff / students [x]  | Cleaners / Engineers [ ]  |
| Supporting staff [ ]  | Others (specify):  |

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| **Emergency procedures** – describe the response(s) required by the user and lab members |
| **Glass explosion** – collect the broken glass using a brush and pan and dispose of as a glass waste (clean) or as a chemical waste (contaminated). Small pieces can be collected with snub-nosed tweezers.Clear up **broken glass** using dustpan and brush, tweezers or other suitable equipment to prevent exposure to the glass then place into the appropriate waste bin (clean or contaminated glassware).If anyone is injured while using the equipment contact first aider. If any **cuts or exposures** to hazardous substances, ensure affected area is held under running water for at least 15 mins and the wound is encouraged to bleed, ask for first aid assistance. If water is not available use alcohol free wipe from the First Aid Kit and dress the wound. Seek further medical attention if required.(Include emergency procedures associated with the use of hazardous substances if relevant) |

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| Recommended trainings and records: |
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| List of individuals competent to demonstrate safe work practice and train others (level 1 trainers): | Names of those that have been trained and can work unsupervised (level 2) and date training completed: |
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