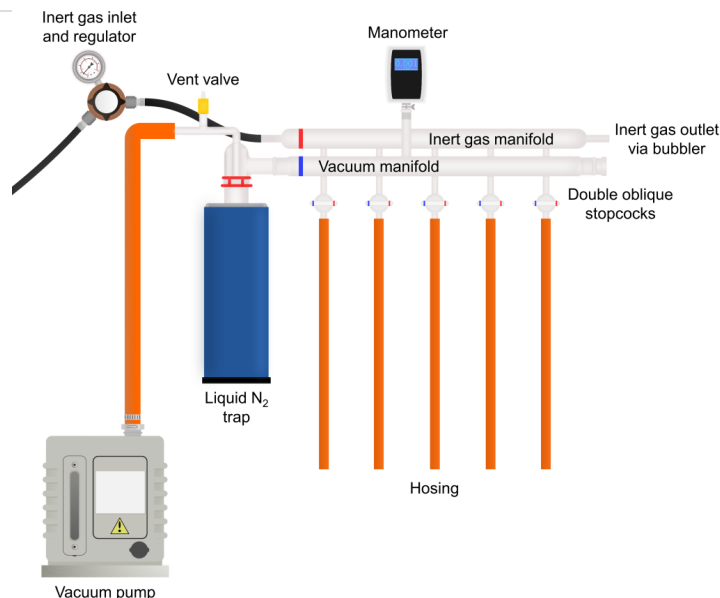


1: The Schlenk Line

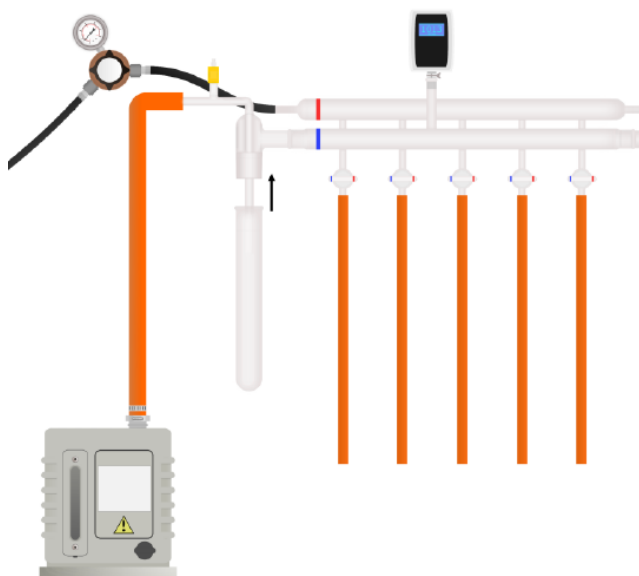


A typical Schlenk line.

Schlenk lines are versatile pieces of laboratory equipment that enable the safe and convenient manipulation of air- and moisture-sensitive compounds. Schlenk lines are dual manifold systems in which the vacuum manifold is connected to a vacuum pump, whilst the inert gas manifold is connected to a source of purified and dry inert gas (typically nitrogen or argon). The two manifolds have several ports which are interconnected via double oblique stopcocks or Teflon taps, which allow sealed vessels attached to the Schlenk line to be evacuated under vacuum or back-filled with inert gas. Schlenk flasks feature a side-arm (with a greased stopcock or greaseless Teflon tap) that can be attached to the Schlenk line using flexible hosing, alongside a standard ground glass joint to attach other glassware or to simply insert a stopper or septum. Schlenk lines may also be equipped with suitable ground glass adapters to enable the direct attachment of appropriate glassware, without the need for hosing. A slight over-pressure of inert gas is employed, and this exits the Schlenk line through a bubbler (oil or mercury) which acts as a pressure relief system, allows the gas flow rate to be monitored, and prevents the ingress of air back into the Schlenk line. A cryogenic trap (typically liquid nitrogen, $-196\text{ }^{\circ}\text{C}$) is used to condense solvent vapours and other volatiles, which protects and prevents contamination of the vacuum pump. The vacuum manifold may be fitted with a manometer to measure the vacuum pressure – for a typical Schlenk line equipped with a rotary vane vacuum pump, a pressure between 10^{-2} – 10^{-4} mbar is often reached which is suitable for standard manipulations. Schlenk lines are often custom made for specific research laboratories, meaning that numerous designs and adaptations are possible depending on the intended applications.

Starting up the Schlenk line

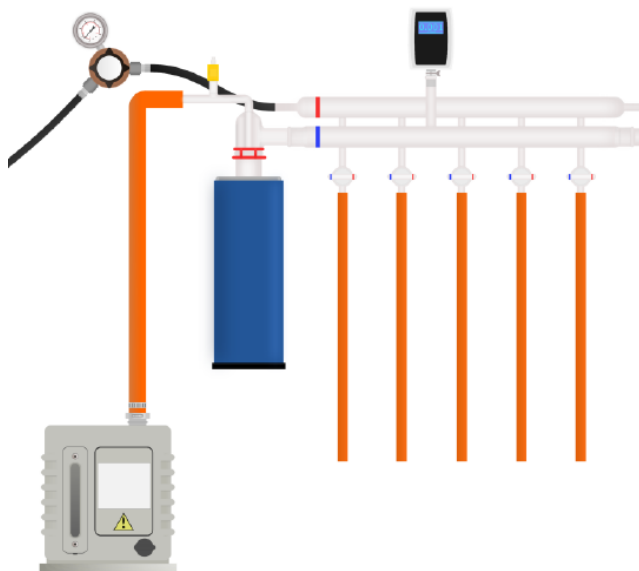
Step 1: Attach a clean and dry solvent trap to the Schlenk line ensuring that the male ground-glass joint is sufficiently greased. Twist the solvent trap to evenly coat the grease and then secure it in place with a clip. Solvent traps may instead be connected to the Schlenk line via greaseless O-ring joints.



Attaching the solvent trap to the Schlenk line.

Step 2: Ensure that the vent valve and all double-oblique stopcocks or Teflon taps are closed (or turned to inert gas if a vessel is already attached to the Schlenk line hosing). Turn on the vacuum pump.

Step 3: Wait for 5–15 minutes for the trap and vacuum manifold to be evacuated before submerging the solvent trap in a Dewar of liquid nitrogen – a manometer reading below 0.1 mbar is recommended to ensure there are no leaks within the Schlenk line assembly. The inert gas supply can now be opened and the Schlenk line is ready for operation; the inert gas supply can also be established independently of the vacuum for other applications (i.e. bubbling inert gas through a solvent to degas it).



Schlenk line equipped with a liquid nitrogen trap.

If the Schlenk line has just been assembled after cleaning, it is recommended to purge the inert gas manifold by passing inert gas through it for 15-30 minutes prior to use. Some Schlenk lines are designed to allow the inert gas manifold to be fully evacuated without any risk of oil suck-back or regulator damage.

Shutting down the Schlenk Line

Step 1: Ensure that all Schlenk flasks and vessels connected to the Schlenk line are under inert gas and that all other stopcocks and taps are closed if not in use.

Step 2: Turn off the vacuum pump then remove the Dewar of liquid nitrogen from the solvent trap. Open the vent valve to quench the vacuum and re-pressurise the vacuum manifold. Schlenk lines may have an additional Teflon tap to isolate the vacuum pump from the solvent trap and vacuum manifold.

Step 3: Allow any collected solvent in the trap to thaw before discarding into an appropriate waste container.

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