

Angstrom Tool Shut down and Start Up Procedure Spring/Summer 2020

Many users ask about proper shut down and start up procedures for their tools. Most of our tools will self-protect if there is a problem either electrically or with a utility like water so there is usually no concern leaving them running unattended. If tools are left running, it is recommended that any power supply that has a fan in it be turned off. This would include sputter and e-beam power supplies where typically there is a power switch on the front. Most power supplies should be warmed up for a few minutes before using them.

For peace of mind and to be environmentally conscience, or to reduce wear/maximize utilization it may make sense to turn tools off if they are not going to be used or are going to be unattended for more than a week or two. Because the procedures differ slightly with cryo pumped versus turbo pumped tools, separate instructions for each tool type are noted.

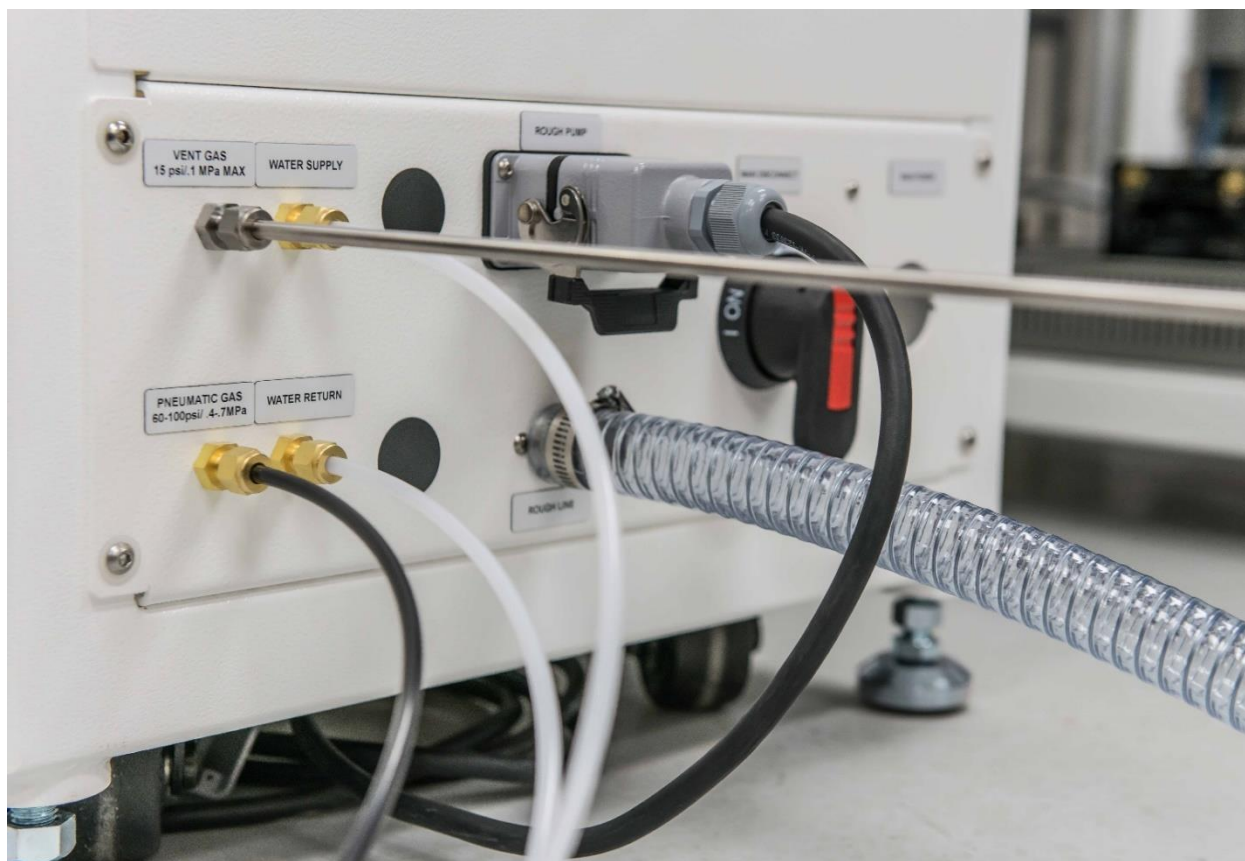


Image shows typical utility connections and Main Disconnect Switch (Black with red inlay on handle) on utility panel for Covap/NexDep tools.

Cryo Pumped Tool Shut Down

All of our cryo pumped tools will have computer control. Many of our EvoVac and Amod, models are cryo pumped. Some Nexdep tools are and many of our custom tools also utilize a cryo pump. Tools are equipped with different control interfaces but all of them will allow for manual control/manual mode or have overrides that can be used to control individual items like valves and pumps. If you are unable to determine how to control items manually contact us for assistance and let us know your system serial number. In some cases the user login level assigned to users may not allow them to control items manually. A supervisor may have a login that will allow/enable manual controls.

To shut down a cryo pumped tool:

- Pump down the chamber.
- Manually close the cryo pump gate valve and any transfer valve to the chamber (where applicable) in the control software. This will leave the chamber isolated and under vacuum.
- Turn off the cryo pump/compressor in the control software.
- If there is a separate load lock pump like a small turbo pump, I would use the vent routine to turn this pump off properly.
- Turn off the rough pump(s) (where applicable) in the control software.
- Close all the software on the computer.
- Turn off the computer.
- Open the main disconnect switch to the OFF position. The main disconnect switch is typically on the utility panel. Some tools have two utility panels, one on each end but always only one disconnect switch unless clearly labelled differently. Others may have the disconnect at the back or even on the front of the tool.
- Where possible turn off utilities to the tool such as gases and water. If a stand-alone recirculating chiller is used this can also be turned off.

In rare cases there may be a desire to purge the cryo pump as soon as it is turned off understanding the tool may have been used extensively with oxygen. If this is a concern the cryo pump once turned off can then immediately be purged by opening the cryo pump purge valve using manual control or an override.

On some older tools the temperature may need to be above the regeneration temperature setpoint before the cryo purge valve can be opened. This value may be 20-50 Kelvin and doesn't need to be higher. Be sure that purge gas is available to the tool and purge the cryo pump until the temperature is close to room temperature. This can take up to an hour or more to do so. Once you are close to room temperature (>250 Kelvin) you can turn off the purge and then rough the cryo pump for a few minutes so that it can be left under vacuum. As some water vapor may be present in the cryo pump it may be advisable to run the rough pump for some time to remove any water in the pump (60 minutes). Some tools have a timer that will automatically keep the rough pump running for a period of time after the foreline valve has been opened.

Turbo Pumped Tool Shut Down

Most of our turbo pumped tools do not have a gate valve between the turbo and the chamber. This would include many Nexdep tools and all Covap. For these tools because we normally have a purge orifice on the turbo pump to purge the turbo pump bearings when it is running the chamber will not maintain vacuum even if it is rough pumped only. The tool should simply be vented to stop the turbo pump. In some cases where the rough pump is shared with a load lock for example there will be an isolation valve on the purge port of the turbo. This would allow the chamber to be rough pumped after venting to leave the chamber under vacuum.

To shut down a turbo pumped tool:

- Use the vent routine to vent the chamber and turn off the turbo pump or press the pump controller button to stop the turbo on a Covap.
- Rough pump the chamber with manual controls if the turbo has an isolation valve on the turbo purge orifice gas supply line (not applicable to Covap).
- Close all software on the computer (where applicable).
- Turn off the computer (where applicable).
- Open the main disconnect switch to the OFF position. The main disconnect switch is typically on the utility panel. Some tools have two utility panels, one on each end but always only one disconnect switch unless clearly labelled differently. Others may have the disconnect at the back or even on the front of the tool.
- Where possible turn off utilities to the tool such as gases and water. If a stand-alone recirculating chiller is used this can be turned off.

Cryo Pumped Tool Start Up

If the water has been turned off to the tool or a recirculating chiller is being used and is off, it is recommended that water is turned on first and the tool is checked for leaks before turning the electrical power on. If the tool utilizes a recirculating chiller this may be an excellent opportunity to backflush the water system through the tool to a bucket and replace the water in the chiller (recommended annually). If the tool is supplied with house water check that there are any filters on the inlet side that could be changed before water flow is restored. If your cryo compressor adsorber is due for a change (recommended annually in 08200 compressors) you may consider performing this before you start the tool up. With power remaining off one consideration may be to open a panel on the tool cabinet to observe for any water leaks when the water flow is restored. This may not be allowed in some facilities and should always be performed by

a qualified person. Otherwise run the water for 30 minutes and check for any leaking out the bottom of the tool. Check that the static helium pressure in the compressor is at an acceptable level (~250 psi on an 8200 compressor). This may also be a good time to perform some preventative maintenance in the chamber such as a good vacuum or a debris shield change. Consider changing the rough pump oil (suggested at least annually) where applicable. Check all your sources and see that all the shutters are secure in the chamber. Replace any QCM crystals close to failing if you have the chamber open.

For cryo pumped tool start up:

- If you are satisfied with the water to the tool, then go ahead and close the main disconnect switch to the on position to power the tool.
- Restore any gas to the tool including process gases, purge gas and pneumatic gas.
- Power the computer on and open the control software and deposition software (where applicable).
- Log in to the control software (where applicable) and clear any warnings or alarms. If any warnings or alarms return such as pneumatic pressure or water flow, then these items may need to be looked at and resolved.
- When all warnings and alarms are clear perform a cryo regeneration or on older tools a full pump down where the regeneration is part of this routine.

- Let the tool pump at least to base pressure or longer/lower in pressure if possible to clean out the chamber and ready it for a deposition.
- Note that if you want to save a bit of time you can vent the chamber first and load your substrates and materials. With the chamber vented you should be able to start a regeneration even with a chamber door open on most tools.

Turbo Pumped Tool Start Up

If the water has been turned off to the tool or a recirculating chiller is being used and is off, it is recommended that water is turned on first and the tool is checked for leaks before turning the electrical power on. If the tool utilizes a recirculating chiller this may be an excellent opportunity to backflush the water system through the tool to a bucket and replace the water in the chiller (recommended annually). If the tool is supplied with house water check that there are any filters on the inlet side that could be changed before water flow is restored. With power remaining off one consideration may be to open a panel on the tool cabinet to observe for any water leaks when the water flow is restored. This may not be allowed in some facilities and should always be performed by a qualified person. Otherwise run the water for 30 minutes and check for any leaking out the bottom of the tool. This may also be a good time to perform some preventative maintenance in the chamber such as a good vacuum or a debris shield change. Consider changing the rough pump oil (suggested at least annually) where applicable. Check all your sources and see that all the shutters are secure in the chamber. Replace any QCM crystals close to failing if you have the chamber open.

Load materials and substrates and then pump down the chamber.

For turbo pumped tool start up:

- If you are satisfied with the water to the tool, then go ahead and close the main disconnect switch to the on position to power the tool.
- Restore any gas to the tool including process gases, purge gas and pneumatic gas.
- Power the computer on and open the control software and deposition software (where applicable).
- Log in to the control software (where applicable) and clear any warnings or alarms. If any warnings or alarms return such as pneumatic pressure or water flow, then these items may need to be looked at and resolved.
- When all warnings and alarms are clear perform a full pump down or on a Covap push the turbo controller button to pump down the chamber.
- Let the tool pump at least to base pressure or longer if possible to clean out the chamber and ready it for a deposition.

Challenges and Troubleshooting

Sometimes things can go wrong when a tool is powered up after being off for a while. The chamber vacuum gauge may need to be cleaned or water flow may need to be adjusted to satisfy all the water interlocks. Although rare, cryo compressor and pump failures are more typical to occur on older components at start up.

If you find you need some extra information or clarity for your specific tool or situation, or you run into any difficulties along the way please do not hesitate to contact us for assistance. We are here to help.

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Or by phone at 1.519.894.4441 ext. 7712