

Cryostat Cleanliness Guide

Applicable Products	CryoAdvance 50 CryoAdvance 100	Cryostation s200	Cryostation 200 PT RapidCycle 100 EC
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Purpose

The purpose of this document is to help guide users of Montana Instruments cryostat systems on cleanliness best practices and the benefits of keeping a clean system.

Background

Cryostat cleanliness is critical to maintaining optimal system performance. Improperly maintained components can severely impact system performance and operation, and in some cases can cause damage to parts of the cryostat. Critical components that need to be kept clean include helium line fittings and vacuum chamber components (radiation shield, platform, windows). Lab cleanliness is also an important factor, as contaminants in the air or on surfaces can potentially enter the system, affecting performance. Not following cleanliness guidelines can appear as poor system performance at higher temperatures, worse vacuum, and condensing on samples/windows. To avoid these issues and to ensure your Montana Instruments cryostat maintains optimal performance, follow our system cleanliness tips below.

Applicable Theory

Cleanliness Tips and Best Practices:

1. Wear nitrile or latex gloves when accessing the sample chamber and exchanging samples
Oils from our hands can stay on surfaces in the sample chamber, which can cause condensing issues during a cooldown due to off gassing in the chamber. To combat this, wear nitrile or latex gloves anytime you access the sample chamber and exchange samples. This is good practice in general when working with your cryostat, but especially in the sample chamber.

2. Keep the system under vacuum

When not actively accessing the sample space, it is recommended to keep the system configured (chamber and chamber lid installed) and under vacuum. This prevents dust and other airborne particles from building up on surfaces in the sample chamber. Failure to minimize these contaminants in the sample space can lead to increased base temperature, worse vacuum levels, and condensing on samples and windows during a cooldown. The system can be put under or kept under vacuum in two ways. First, when warming up from base temperature, the system will remain under vacuum unless vented. The other method is using the Pull Vacuum function when at room temperature. Figure 1 shows the Pull Vacuum function on the User Interface screen.

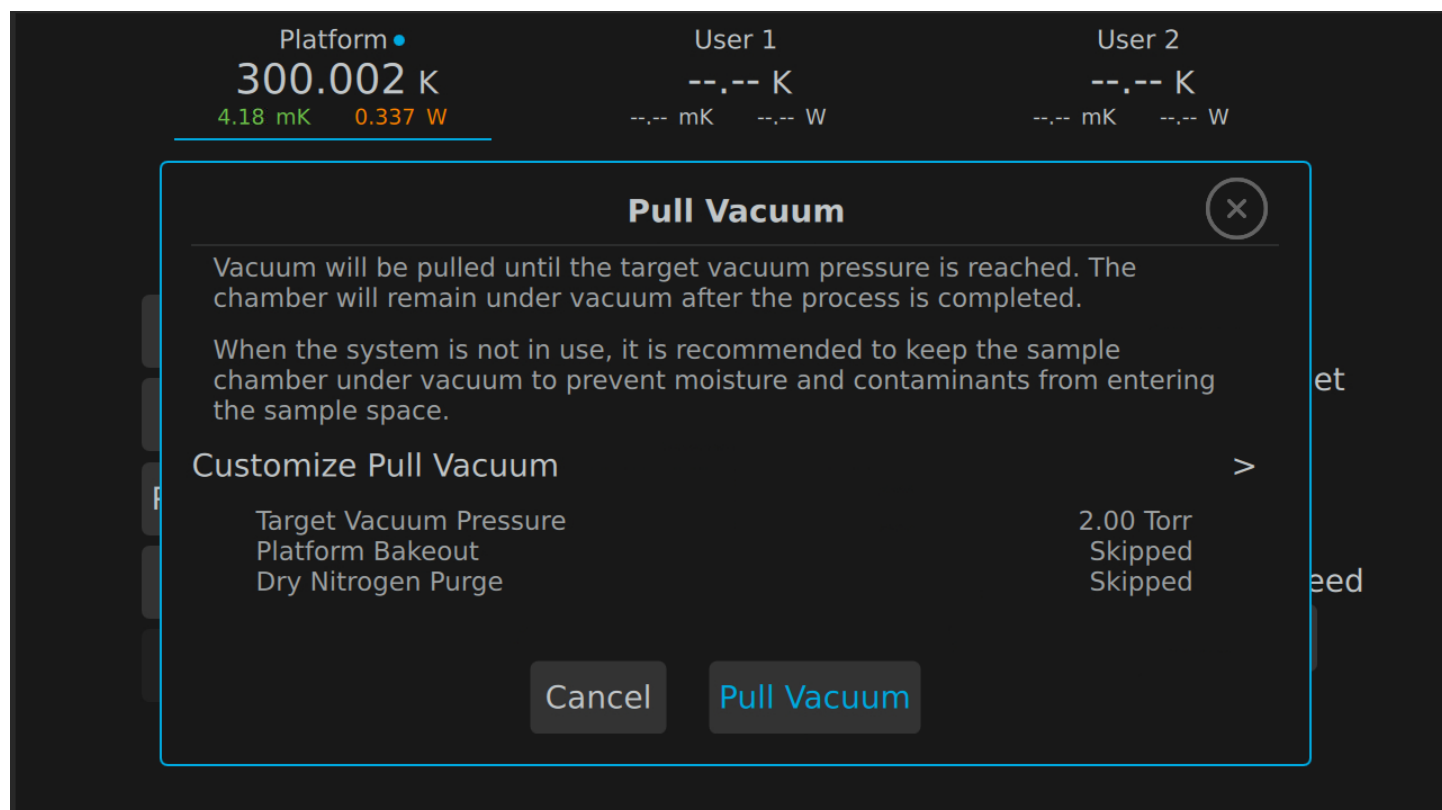


Figure 1: Pull Vacuum function when system is at room temperature

Improper sealing on the O-ring surfaces can also degrade vacuum performance. This can happen if O-rings pick up dust or debris. Ensure O-ring-contacting surfaces are never placed directly on other surfaces. Many systems have support bosses on these critical features to ensure these surfaces do not touch potentially contaminated surfaces such as tabletops. Using a gloved finger, run along any O-rings to pick up any debris that may have settled on them, such as dust or hairs. O-rings can also become worn after a long use period. Inspect your O-rings periodically to ensure their condition and replace them as necessary.

3. Nitrogen purges the system

Nitrogen purging the system can help remove any airborne particles still present in the sample chamber. It is recommended to do a purge if the system has been sitting out of vacuum for an extended period of time or if there has been a noticeable degradation in vacuum level, which could be caused by additional dust and particles present in the system. A nitrogen purge can be initiated as part of the start of a cooldown, in Customize Cooldown or when pulling vacuum when at room temperature, in Customize Vacuum. Figure 2 shows the Nitrogen Purge settings on the User Interface screen.

Platform •
300.001 K

User 1
--.-- K

User 2
--.-- K

< Back

Customize Pull Vacuum

(x)

Target Vacuum Pressure

2.00 Torr

Customizes the target pressure threshold that specifies when the Pull Vacuum procedure will be completed. Set a target of 0 Torr to pull vacuum indefinitely until the procedure is stopped manually.

Platform Bakeout

Skipped ☐

325 K

60 minutes

Platform Bakeout removes contaminants from the platform using a thermal vacuum bakeout procedure.

Dry Nitrogen Purge

Enabled ☒

3 times

Dry nitrogen purging removes contaminants such as moisture/water vapor and oxygen from the system by repeatedly filling the vacuum space with dry nitrogen and then pumping out the gas to create a dry environment. While nitrogen is optional, it is recommended for optimal vacuum performance.

Figure 2: Nitrogen Purge settings (Customize Pull Vacuum option)

4. Bakeout the sample chamber

Baking out the sample chamber can help remove contamination from the system if it has been sitting for a long period of time or if the system previously had condensation in the sample chamber. This process can be done in tandem with a nitrogen purge to ensure as many potential contaminants as possible are removed from the sample chamber. To initiate a bakeout, select the Bakeout option when pulling vacuum from room temperature in Customize Pull Vacuum or when starting a cooldown in Customize Cooldown. If the bakeout is selected, the system will run the bakeout at the start of both operations. Figure 3 shows the Bakeout settings on the User Interface screen. The bakeout settings should not exceed 350 K.

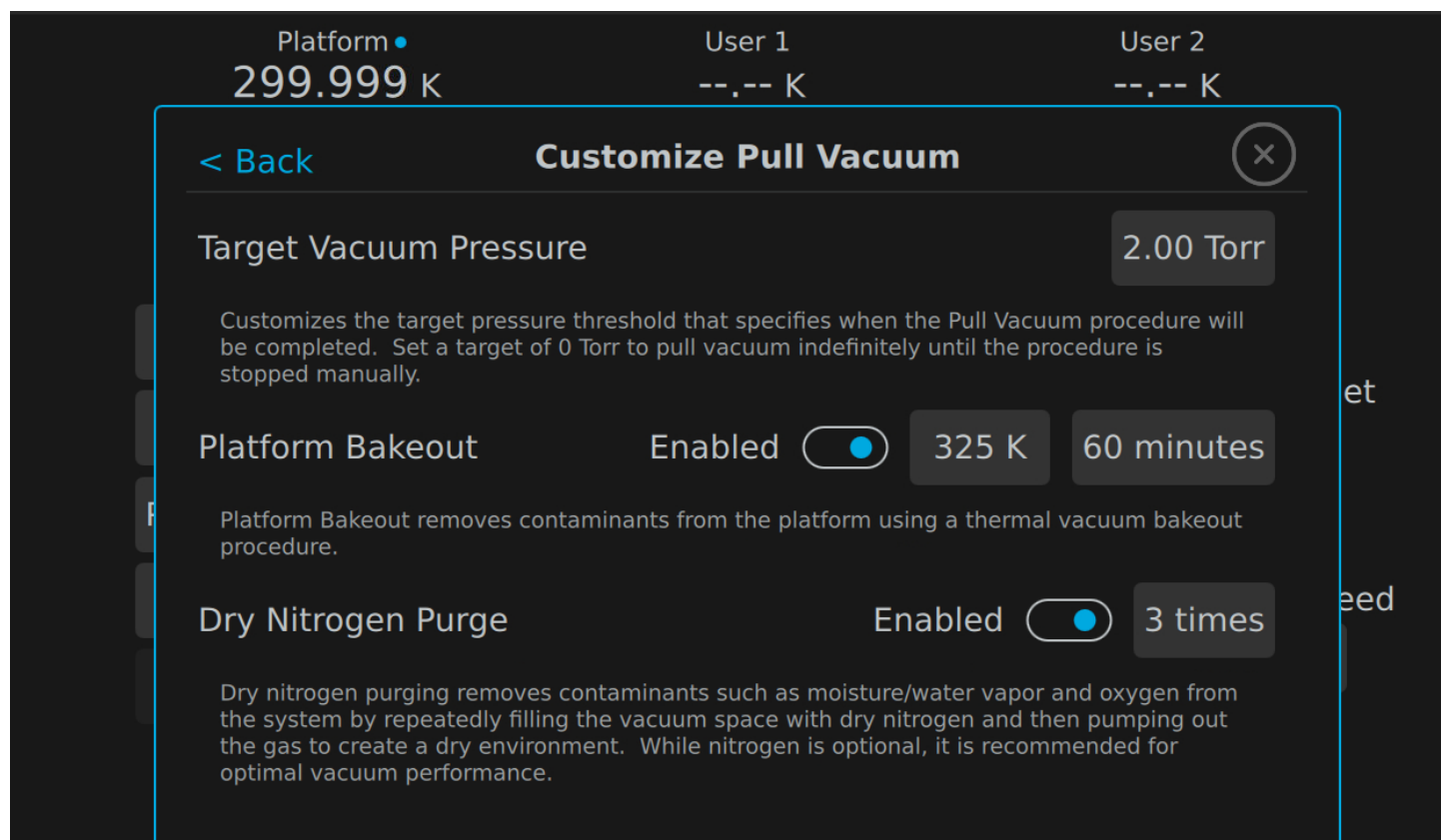


Figure 3: Platform Bakeout settings (Customize Pull Vacuum option)

5. Keep the area around the system and compressor clean

Multiple components of the Montana Instruments system such as the system controller, vacuum controller, and compressor all have minimum surrounding free space and air flow requirements. For example, dusty surfaces near the fan or improper air flow to the compressor can cause it to not run correctly, possibly damaging internal components. These requirements ensure optimal system performance, and failure to meet them can have a detrimental effect on the performance of your cryostat system. For more information on minimum space and air flow requirements, refer to your [system user manual](#).

6. Keeping helium and vacuum line fittings clean

When helium and vacuum lines are first installed, or if they are disconnected to move the location of the system or compressor, they can be easily contaminated. It is recommended to keep the protective caps on all the end fittings until ready to install the lines. Visual inspection of the fittings on both ends of the line is recommended to ensure they are free from debris. Inspection of the fittings on the compressor and cryostat are also an important step. Minimizing contaminants in the lines during installation can help prevent poor

system performance and avoids causing potential damage to the coldhead and vacuum pump. Figure 4 shows proper installation of vacuum and helium lines.

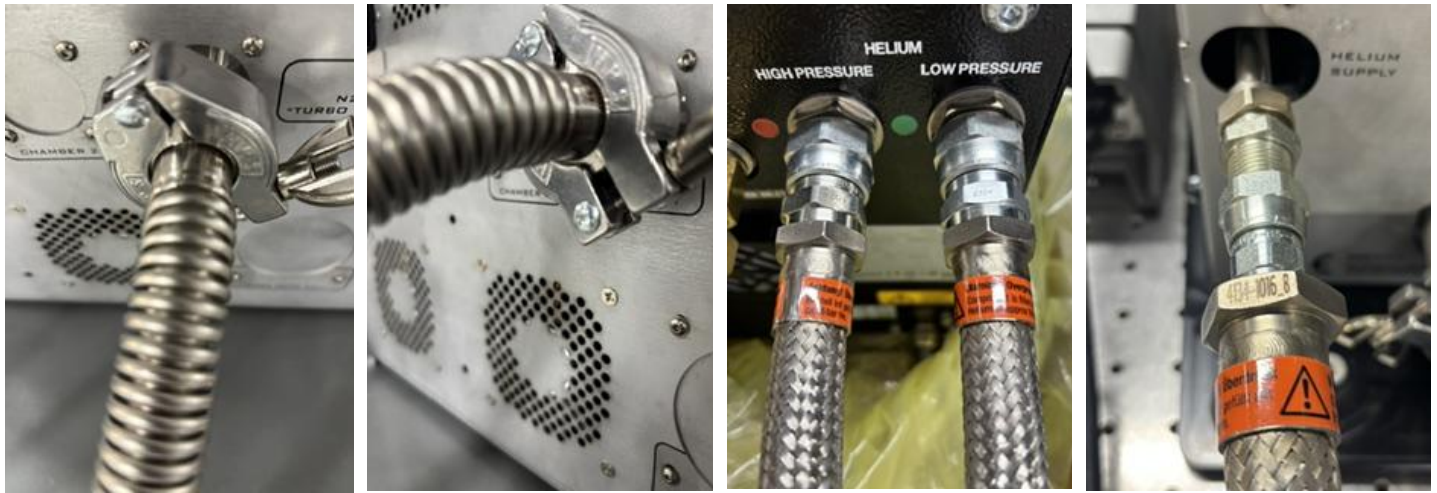


Figure 4: Properly installed KF fitting vacuum lines (far, center left) and helium lines (far, center right)



Figure 5: Properly installed VCO vacuum line

Benefits of a Clean Cryostat:

- ✓ Better system performance (vacuum and base temperature)
- ✓ Longer life of components
- ✓ Longer time between maintenance
- ✓ Less system downtime troubleshooting potential issues due to contamination of system components (helium and vacuum lines, chamber surfaces)

Summary

Keeping your cryostat clean ensures that it will maintain peak performance. By following the tips and suggestions in this guide, system cleanliness will be a non-issue. For more information on system cleanliness or to troubleshoot any issues with your system, contact [Customer Support](#).