Comparing the Current and New Versions of the Vacuum Control Unit

Applicable Products	CryoAdvance™ 50, 100	Cryostation® s200	
Document Status	Approved	**Last Updated Date**	4/3/2024

Purpose

This tech note is intended to present the improvements made in the new Montana Instruments vacuum control unit compared to the previous version. These improvements include faster time to achieve vacuum, better overall vacuum performance, cleaner cooldowns to base temperature, and faster time to reach base temperature.

Background

Cryostat systems work by applying a helium compressor, a cold head, and a vacuum system to achieve cryogenic temperatures. The vacuum system is required to achieve the coldest base temperatures, as they can only be reached in near perfect vacuum conditions with the least amount of matter (typically gas particles)[1] present in the sample chamber. The vacuum module begins pulling vacuum in the sample chamber at room temperature to help avoid gases from condensing inside the sample chamber during cooldown. Cryopumping, an inherent process in which molecules stick to cold surfaces inside the vacuum chamber (provided the surface is at the right temperature for a given species of gas molecule to stick and that the chamber is at the right pressure), also helps to reduce gases in the chamber that would otherwise transfer heat convectively from the warmer chamber walls to the cold surfaces.

Applicable Theory

While the Montana Instruments previous vacuum control unit achieved vacuum levels up to 10^{-7} Torr at base cryogenic temperatures, the new vacuum control unit can achieve the same and better vacuum levels in a shorter amount of time. The following figures compare the current unit (model number VC1110) and new unit's (model number VCM24) vacuum performance over time, through a full cooldown (only vacuum being pulled before the cold head and compressor are turned on and the system begins cooling down from room temperature).

Figure 1 compares the performance of the new vacuum control unit to the previous version.

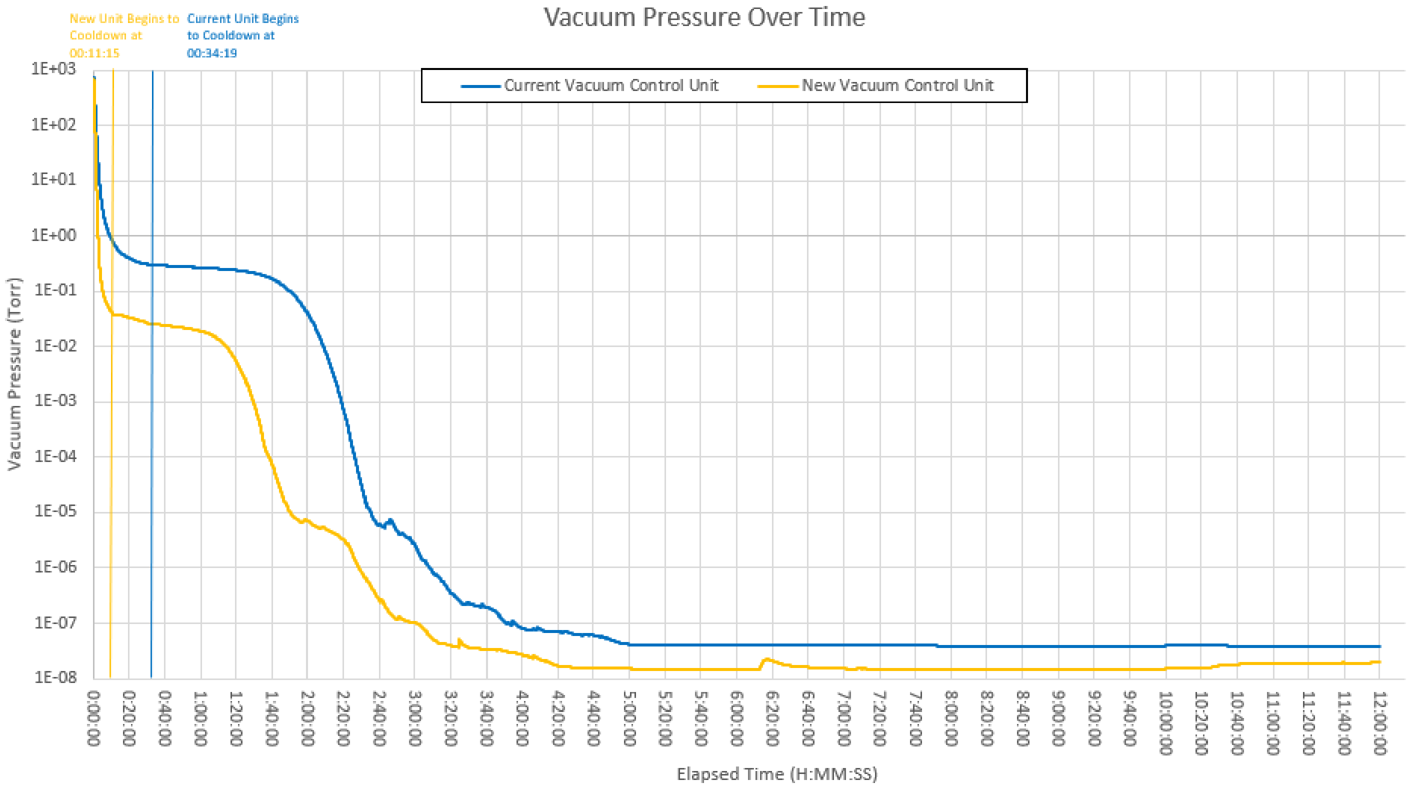

Figure 1: Vacuum pressure over time compared between the current vacuum control unit and the new unit.

As Figure 1 shows, the new vacuum control unit pulls a higher vacuum sooner than the current unit, as well as beginning to cooldown approximately 23 minutes sooner than the current control unit. The new vacuum control unit also reaches a higher ultimate vacuum pressure (near 10^{-8} Torr) than the current unit during the full 12-hour test duration.

Figure 2 shows the difference in platform temperature between the current vacuum control unit and the new unit.

© Montana Instruments | INTERNAL USE ONLY

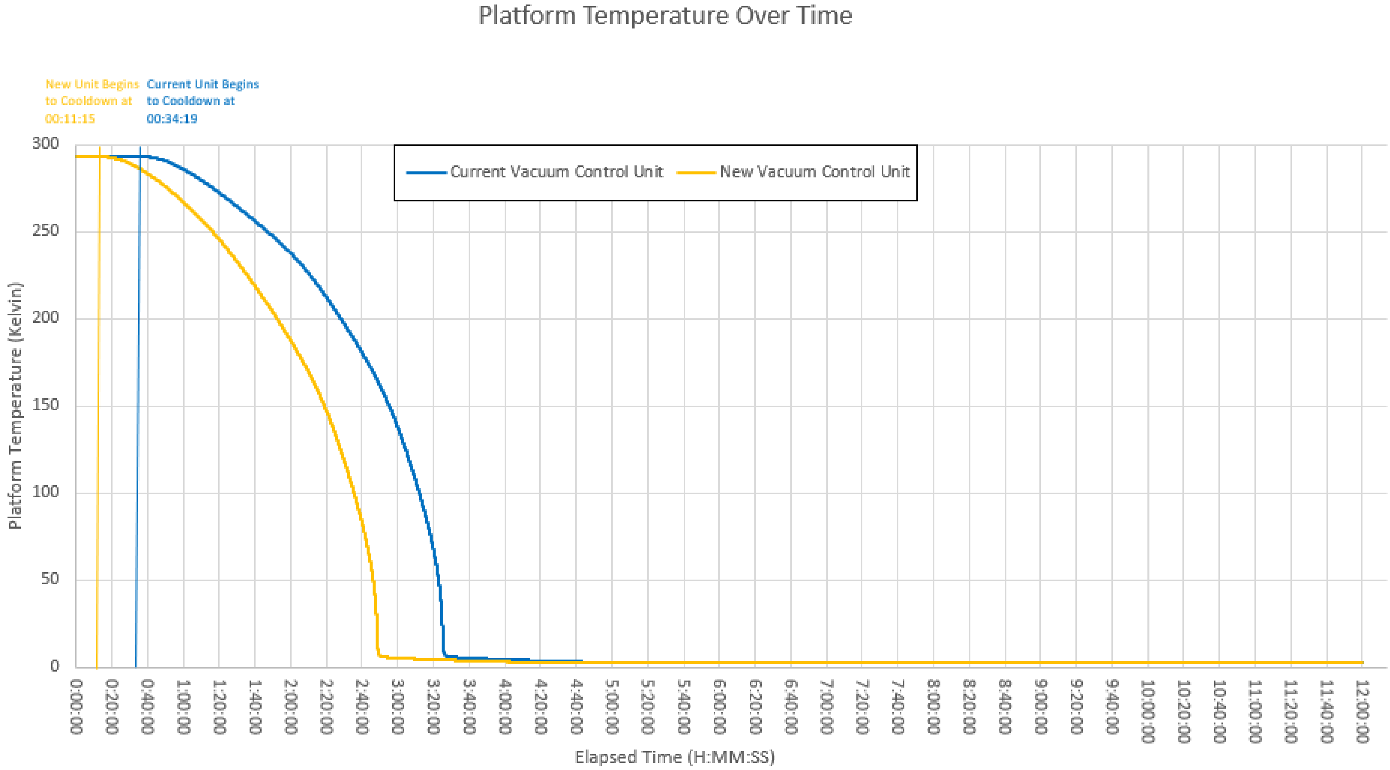

Figure 2: Platform temperature over time compared between the current vacuum control unit and the new unit.

While both the current unit and the new unit achieve the same base platform temperature, the new control unit reaches base temperature approximately 40 minutes sooner than the current unit. Note that time to temperature can vary based on installed system accessories, lab environment, cleanliness of sample space, and handling of the cryostat system prior to cooldown.

Summary

The new vacuum control unit from Montana Instruments allows users to achieve better vacuum performance in their cryostats. These improvements to the vacuum control unit also allow for faster vacuum pulls and cleaner cooldowns to base system temperatures, as well as less time to reach base temperature. For further questions about the new vacuum control unit, please contact a sales engineer.

References

[1] https://www.vacuumscienceworld.com/blog/cryopumps

[2] All other data and information internal to Montana Instruments.

© Montana Instruments | INTERNAL USE ONLY