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Application Note Number 10: Using the Extorr XT Series RGA during Pump-down

Abstract: The Extorr XT Series RGA has unique advantages in monitoring the pressure of a vacuum chamber during pump-down. The built-in Pirani gauge, Bayard / Alpert ion gauge, and the quadrupole mass analyzer allow for pressure measurement from Atmosphere to UHV with a single instrument.

With the Extorr XT Series RGA, the user always has the proper tool for trouble shooting vacuum system problems. The built in convection type Pirani gauge measures from Atmosphere to below 10^{-3} Torr allowing large leaks to be located at pressures too high for other RGAs to operate. With the Pirani gauge, a slow pump-down rate will be instantly apparent.

Some problems, such as a leak caused by a particle on a loading door O-ring, can appear suddenly. These types of leaks may be located using the Pirani gauge and a leak detecting gas such as helium, argon, or freon. Leaks as small as 10^{-4} atm-cc/sec can be found with the Pirani gauge eliminating the need for a very expensive leak detector.

Other problems that develop slowly over time, such as water accumulating in a roughing pump, can be identified using a pump-down curve. This curve is a record of pressure verses time observations taken during pump-down, when the system is operating properly. A graph is created from the data that is used as the "standard" to which all newly generated curves are compared. The new curves should closely match the standard plot. A continuing change in the same direction may be an early warning of future problems.

The Extorr XT Series RGA with its built in Pirani gauge and B /A ion gage provides the data for these curves that allow the user to compare pump-down rates from one pump-down cycle to the next.

The graph in Figure 1 below shows the data from two separate pump-down cycles as recorded using the Pirani and B /A ion gauges. The blue line represents a new system which has been baked and taken back up to atmosphere using a dry nitrogen backfill. After several weeks of cycling the system, the pump-down curve is now as shown in magenta. A pump-down lag due to water in the roughing pump is observed. A further lag at lower pressures due to water on the chamber walls may also be seen.

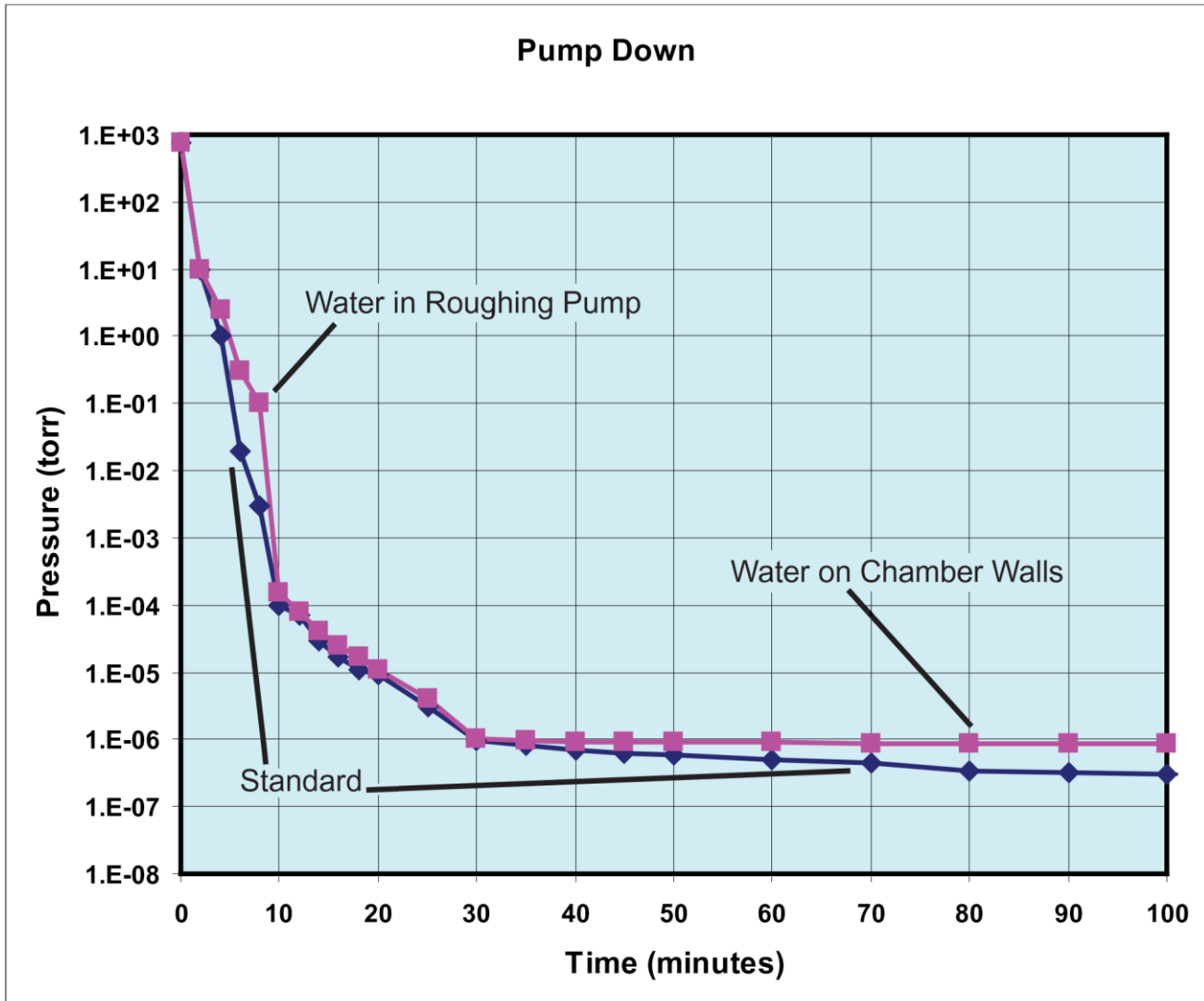


Figure 1

Once the pressure in the system is low enough for the quadrupole to operate, a mass spectrum of the background gases may be used to check for air leaks. If N₂ at 28 amu and O₂ at 32 amu are shown at a ratio of 4:1, an air leak is likely. Especially if N₂ is also the largest of the background peaks, larger than water vapor at 18 amu.

If a leak is present, the RGA can be used to find its location. The RGA is set to monitor the intensity of a leak detect gas as it is sprayed on the outside of the vacuum chamber. The intensity will increase as the spray passes over the site of the leak and then will decrease as it is moved away. Helium or any other leak detect gas may be used.

From finding large leaks at pressures too high for other RGAs to operate, to measuring UHV partial pressures down to the detection limit of 5×10^{-12} Torr, the Extorr XT Series RGA is the single gauge solution for vacuum system monitoring and trouble-shooting.