Refurbishing a Scanning Transmission Electron Microscope

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Outline

- **History**
- **Goals**
- **Apparatus**
  - *Electron beam column*
  - *Vacuum System*
- **Troubleshooting**
- **Conclusion and Future Plans**

History

- Wave/particle duality
  - Knoll and Ruska 1932

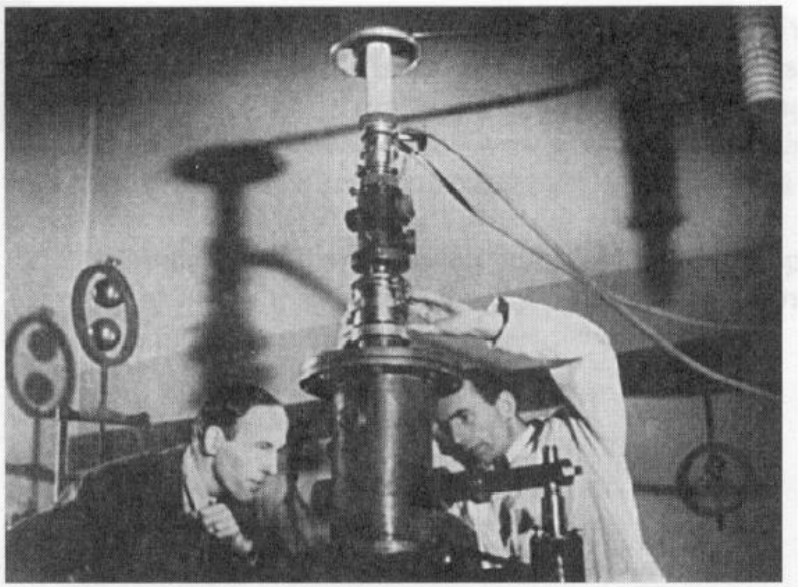
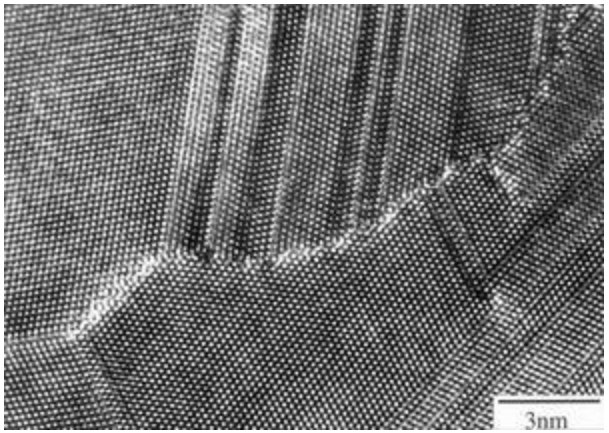
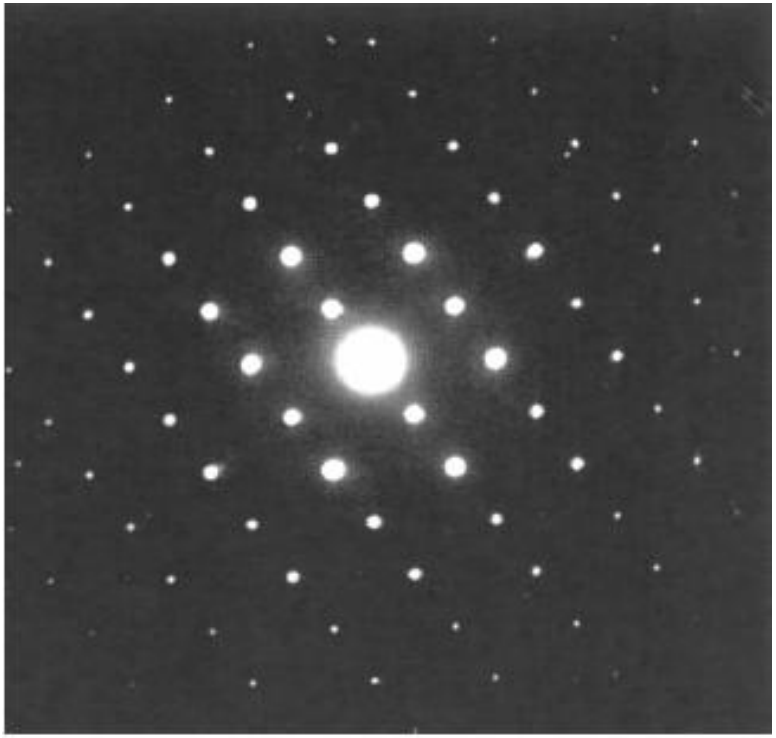


Figure 1.1. The electron microscope built by Ruska and Knoll in Berlin in the early 1930s.

Goals

- Analysis of thin metal films (Ag, Ta)
  - Microstructure
    - Electron diffraction
  - Surface topography
    - STEM





http://web.pdx.edu/~jiaoj/phy452/lect1.pdf
http://www.msre.kumamoto-u.ac.jp/~mdie/Projects_en.html

Cross Section of column

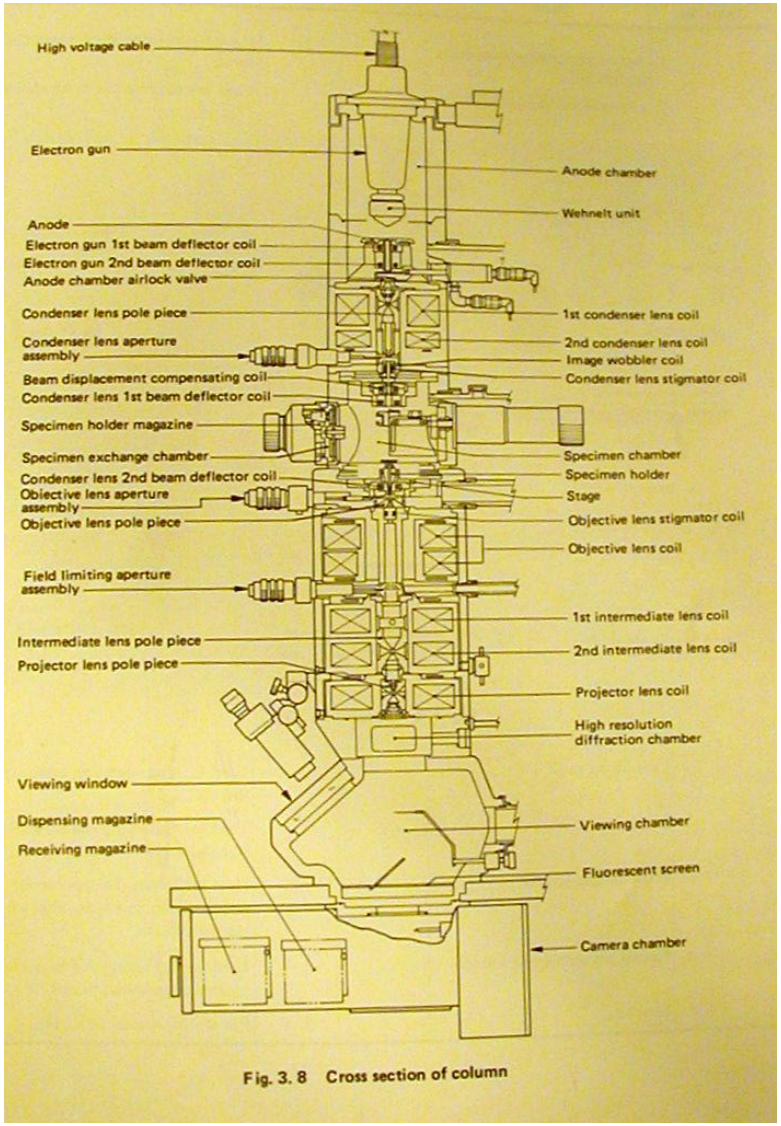
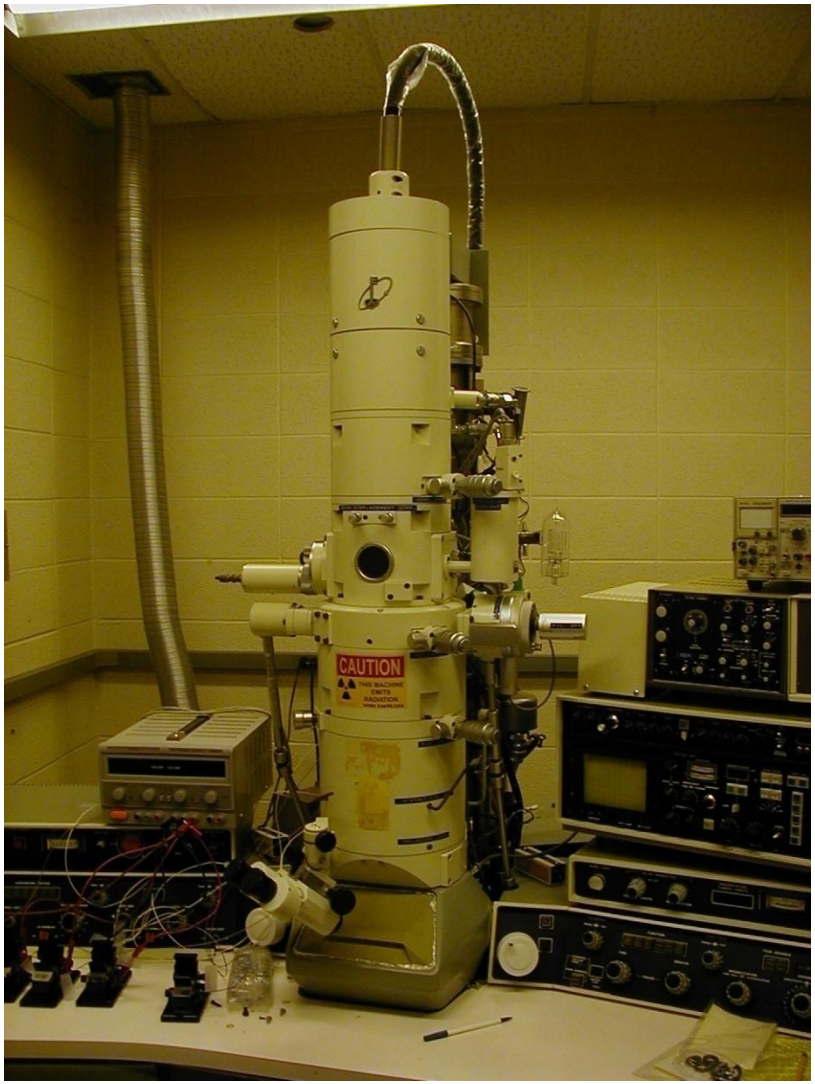
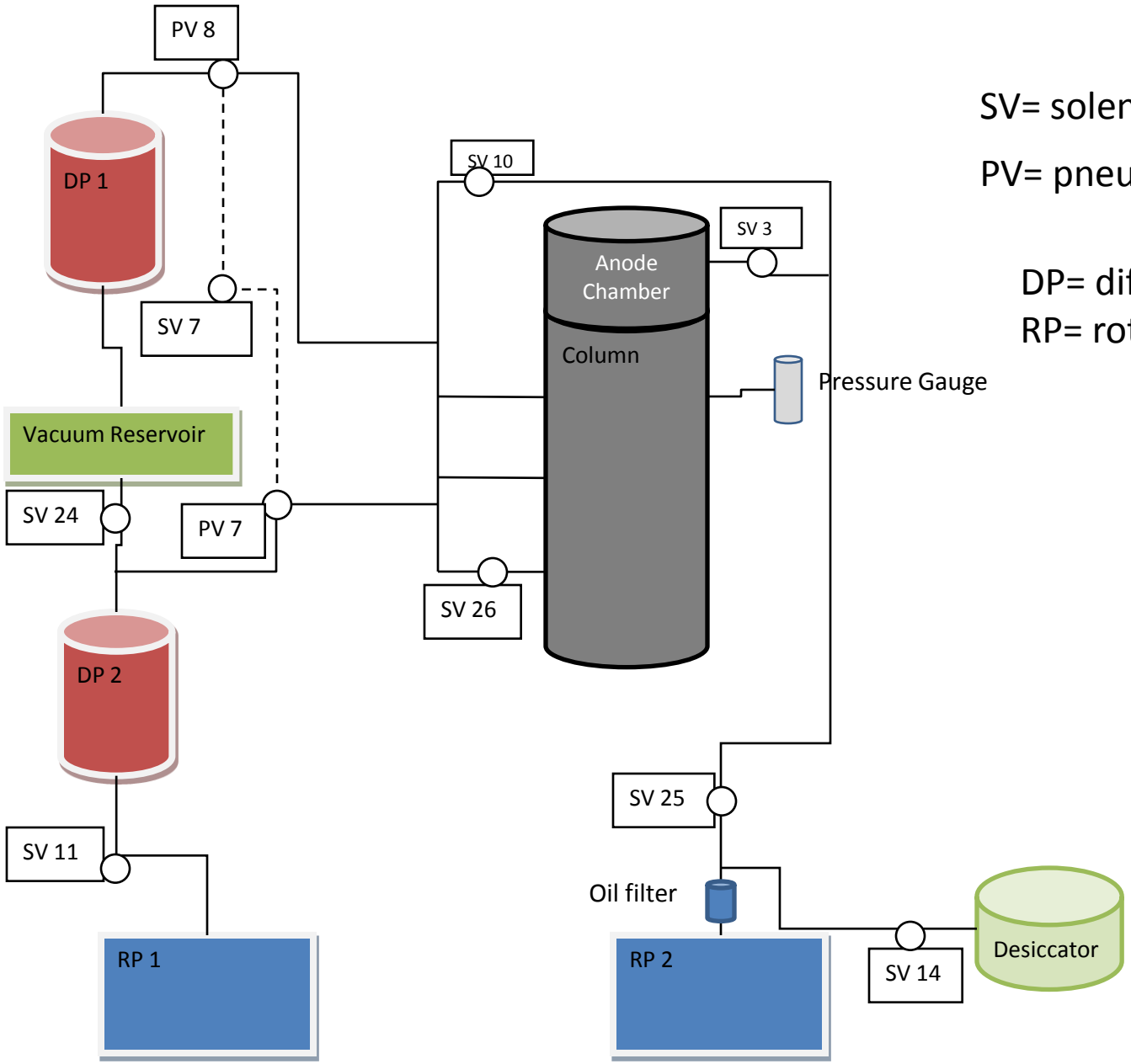


Fig. 3. 8 Cross section of column



Vacuum System Diagram



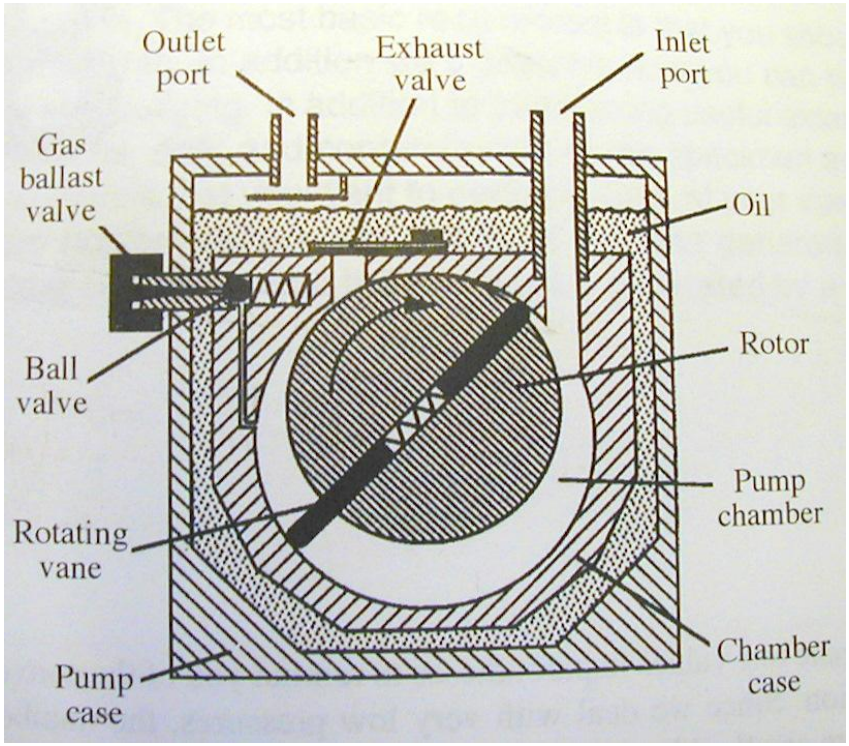
SV= solenoid valve

PV= pneumatic valve

DP= diffusion pump

RP= rotary pump

Rotary Vane Pumps and Diffusion Pumps



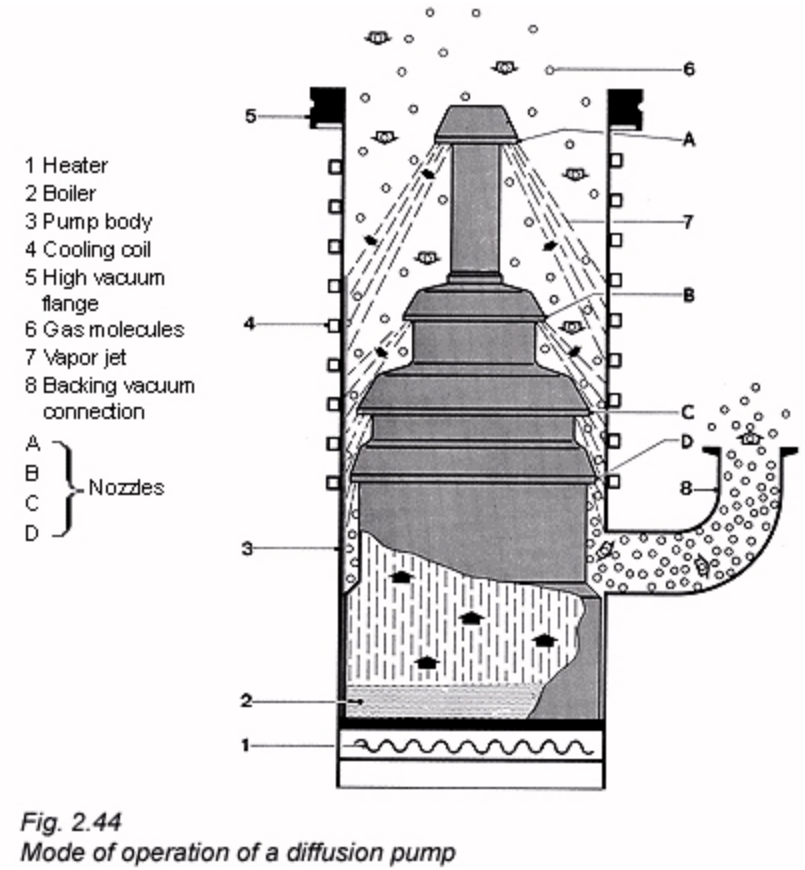
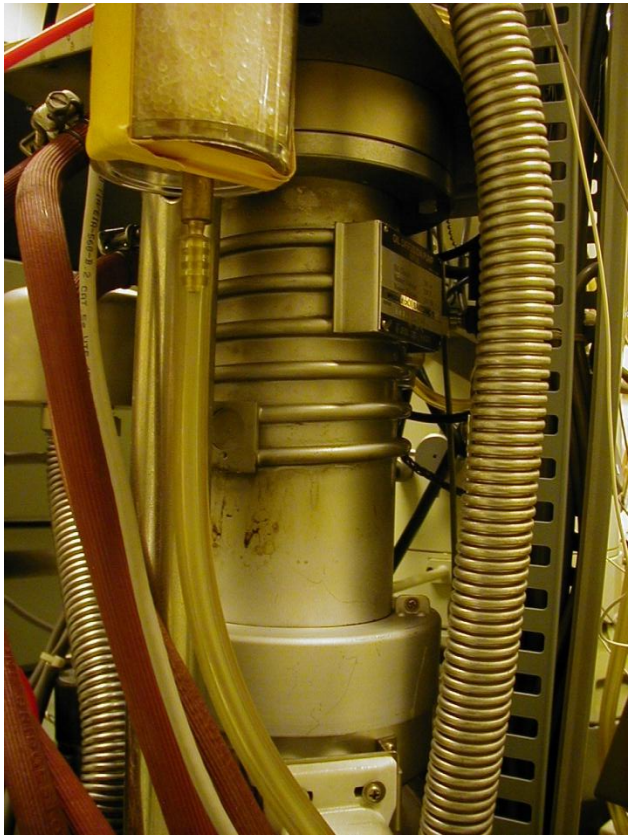


Fig. 2.44
Mode of operation of a diffusion pump

http://www.cbem.ic.ac.uk/EM_Faculty/Equipment/Oil_Diffusion_Pump.htm
Transmission Electron Microscopy, D. B. Williams, C. B. Carter, 1996.

Rotary Vane Pumps and Diffusion Pumps

•Operational pressure
~760 - 1 x 10^{-3} Torr



•Operational pressure
~1 x 10^{-3} - 1 x 10^{-7} Torr

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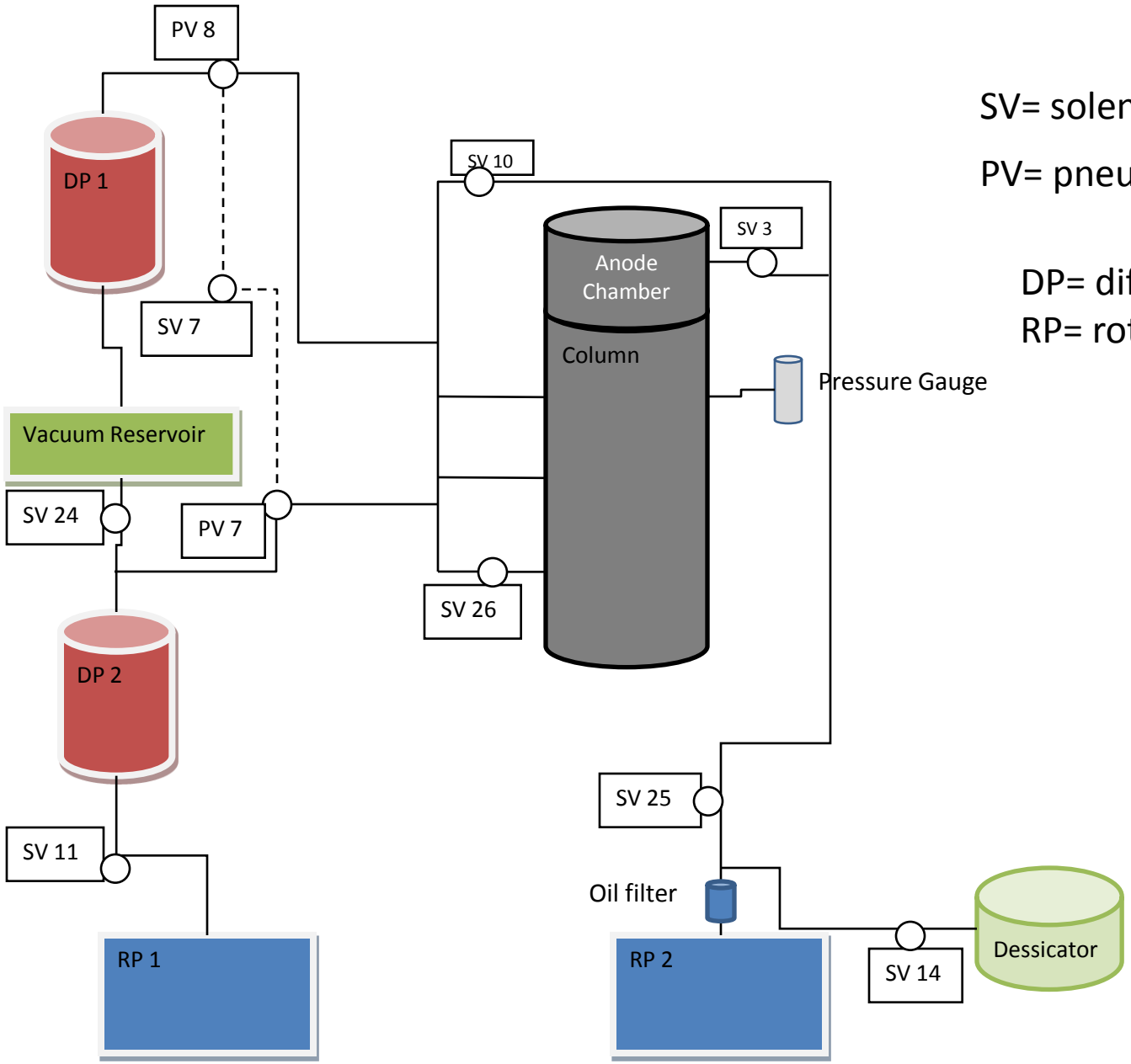

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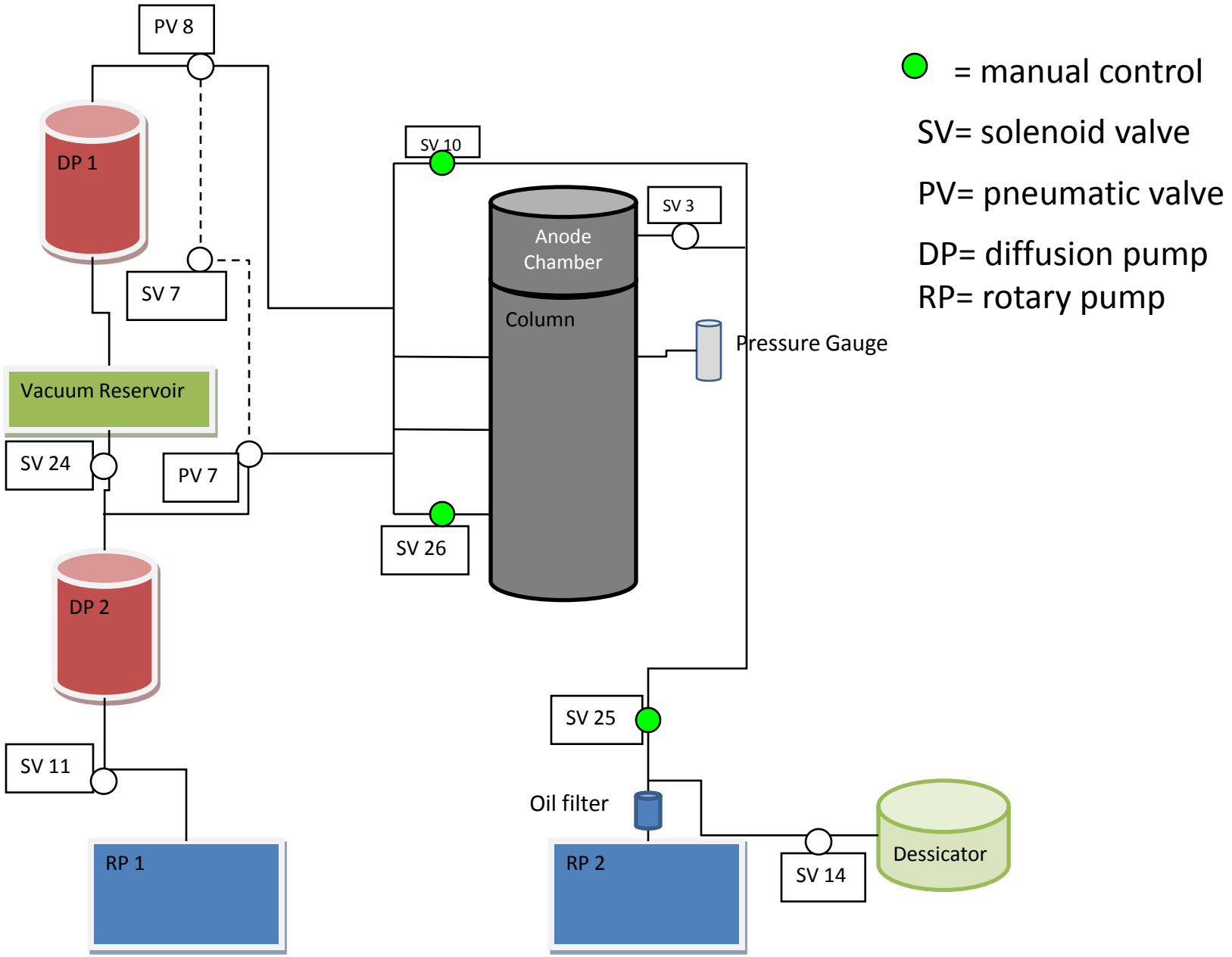

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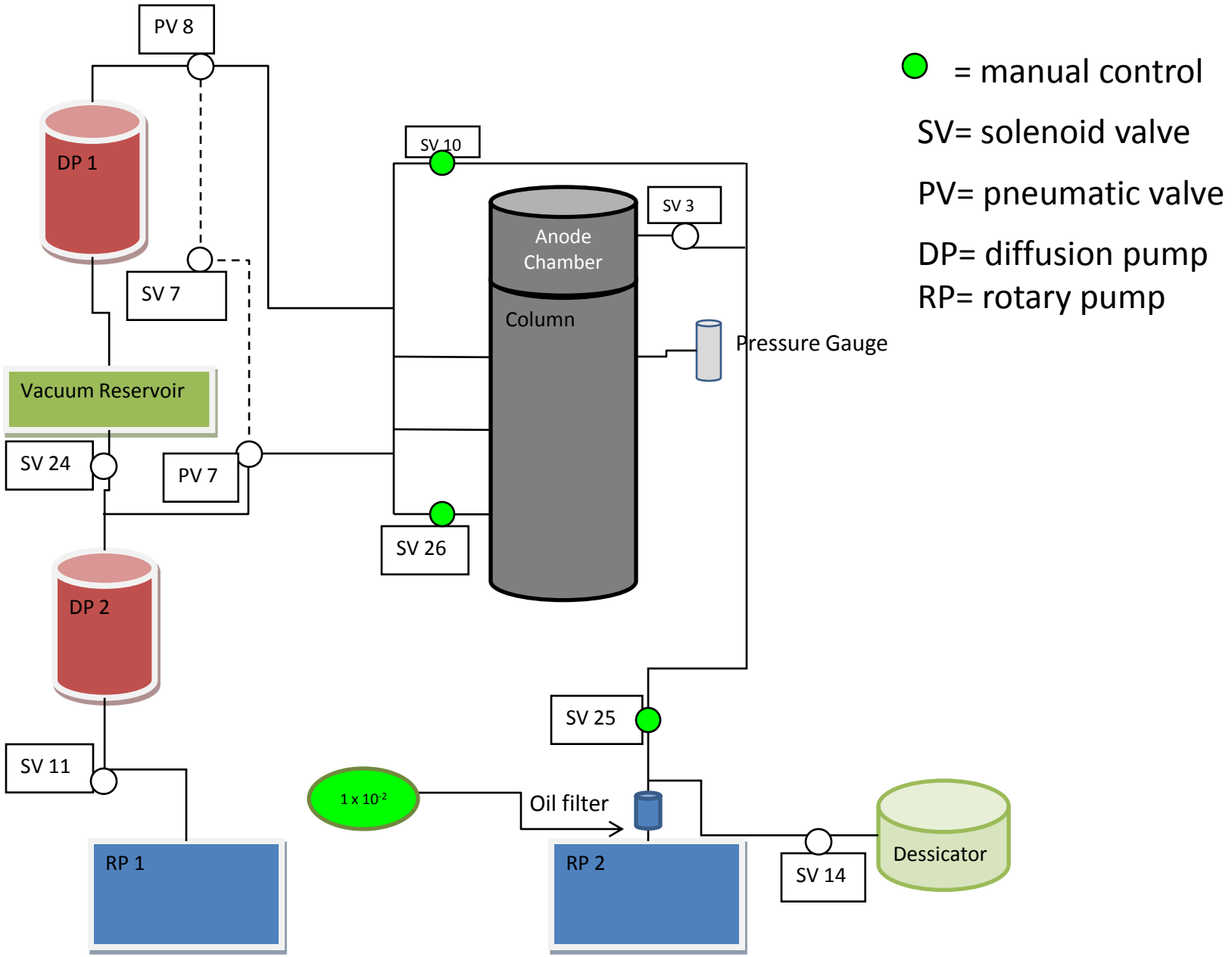

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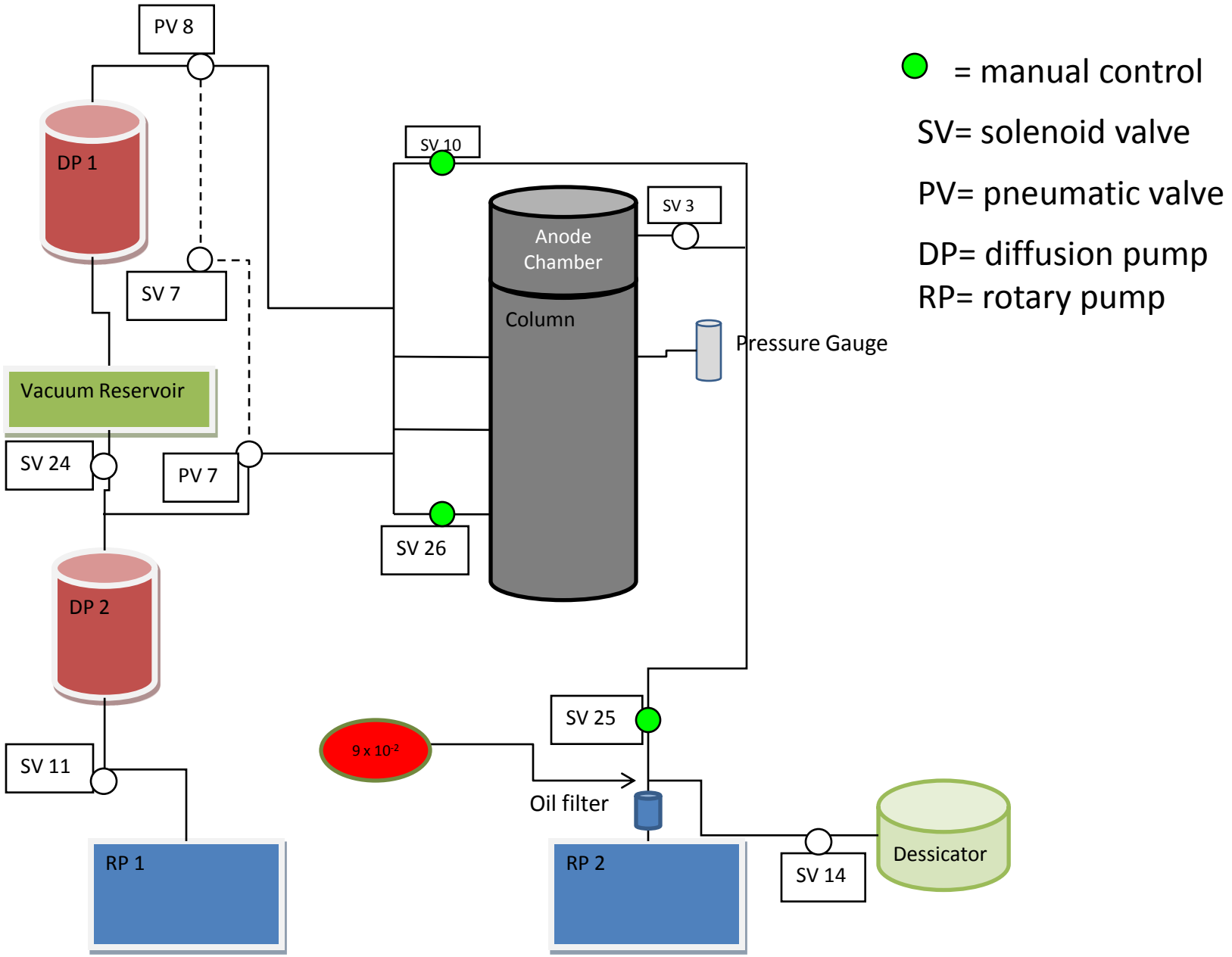
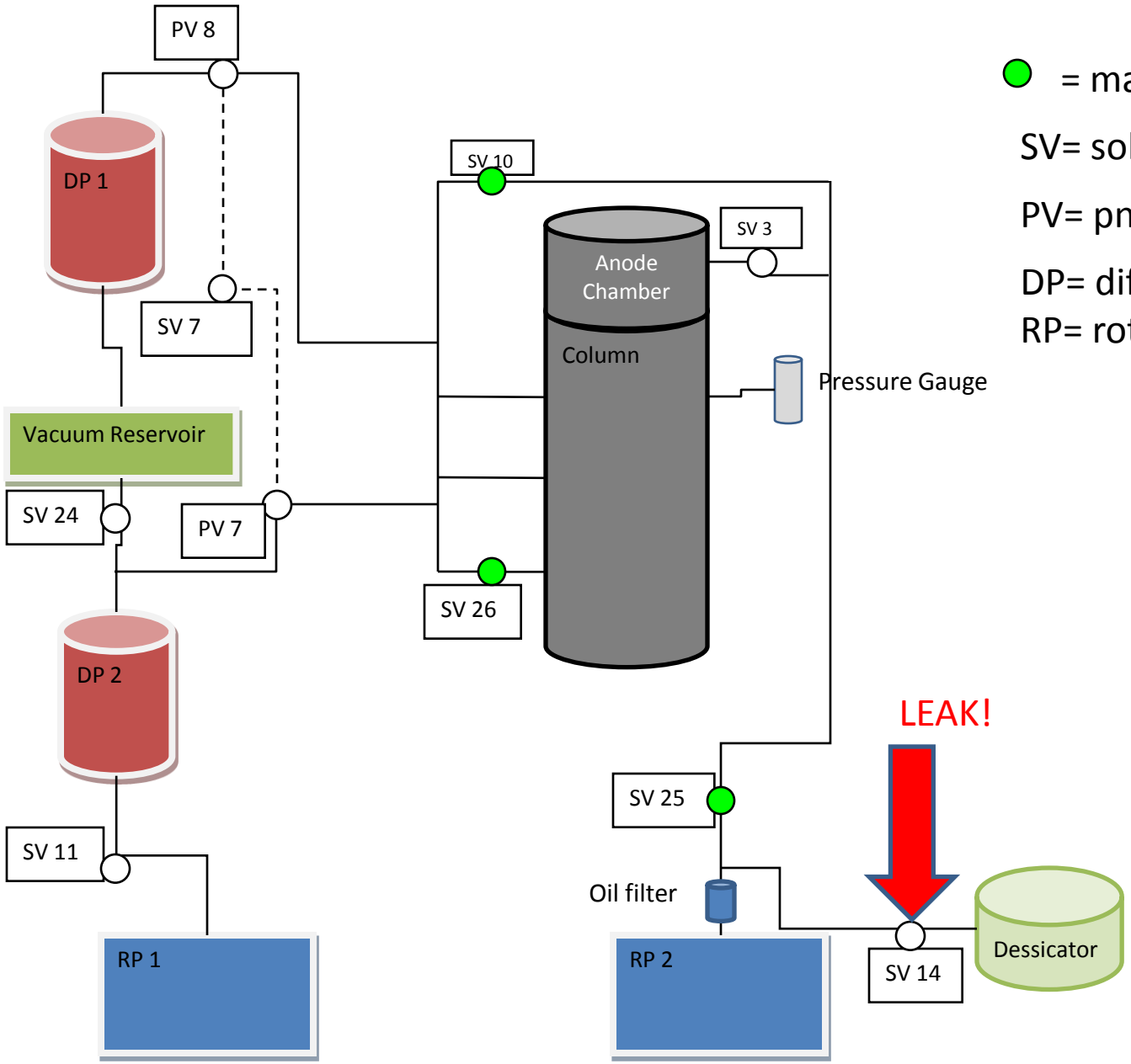



Molecular
Sieve
Adsorbents

Vacuum System Diagram



= manual control

SV= solenoid valve

PV= pneumatic valve

DP= diffusion pump

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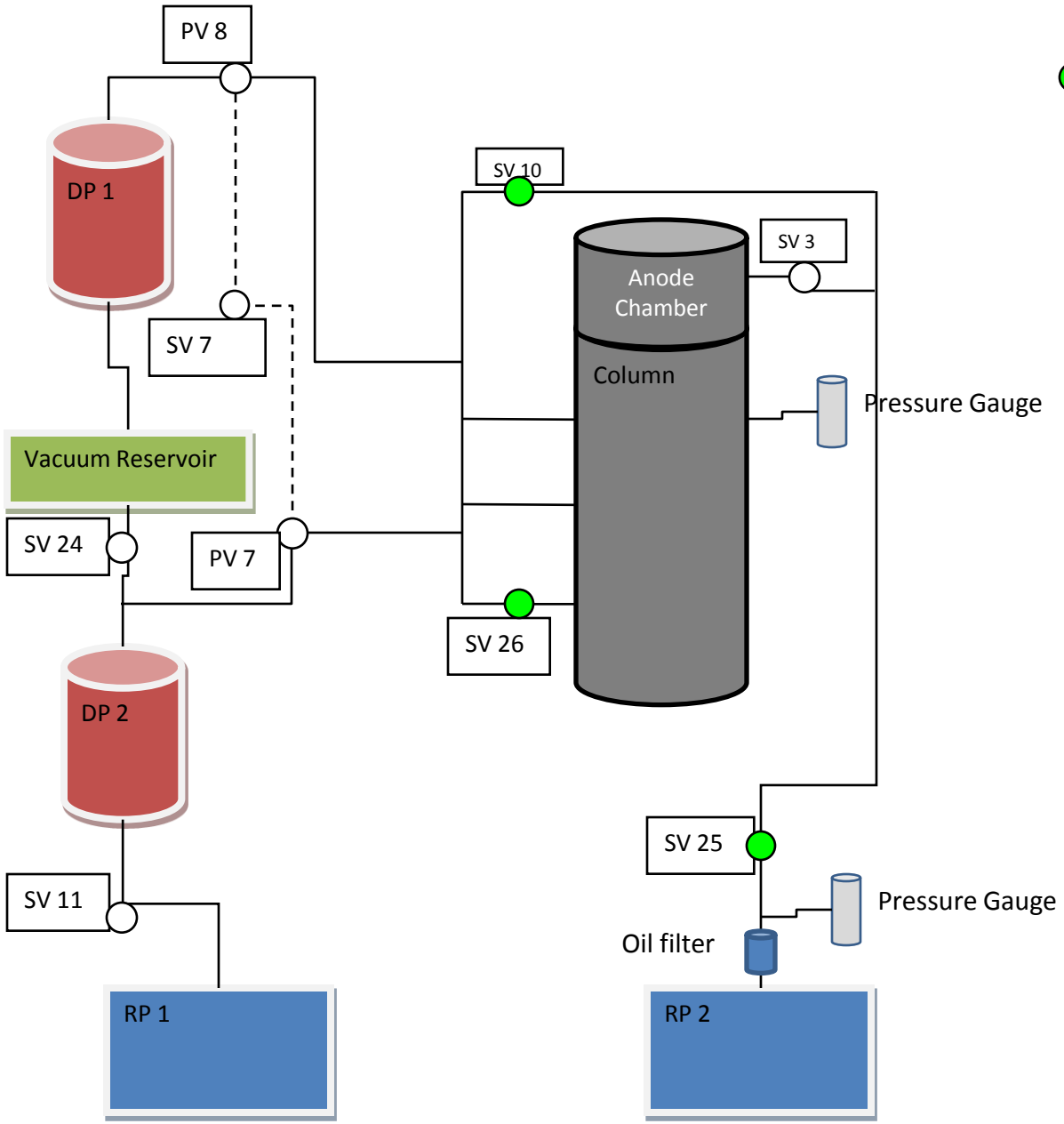

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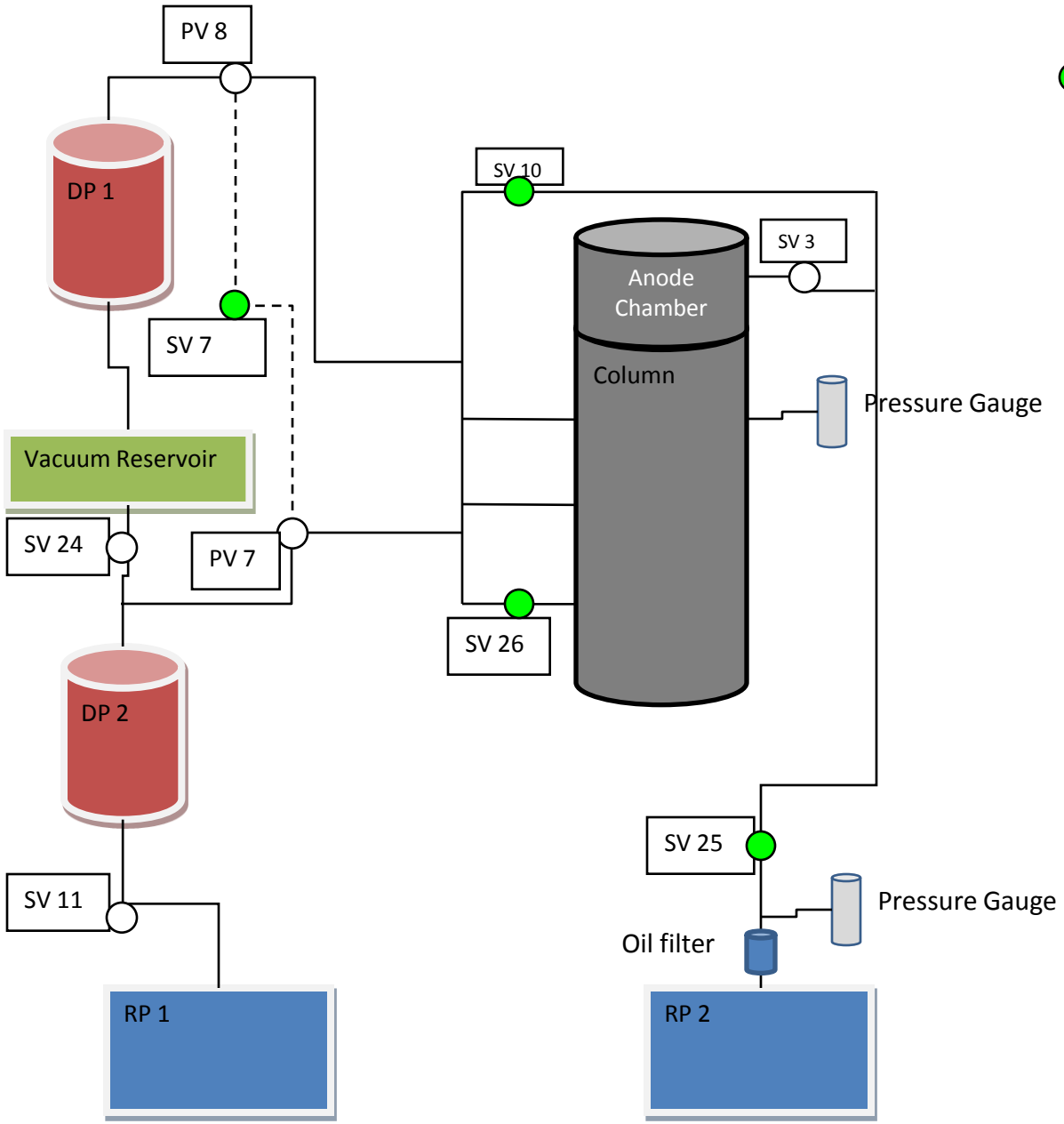

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Conclusion and Future Plans

- Vacuum system is operational in the roughing pump range
  - ~ 1 x 10^{-3} Torr
- Manual control eases maintenance
  - Continued valve switch over
  - Power supply for Diffusion Pumps