

# Vacuum Solutions for Scientists:

## Optimizing Pump Sizing for Filtration



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Vacuum filtration relies on a pressure differential between the atmosphere and the interior of the filtration setup. Proper pump sizing for this process involves understanding key factors influencing flow and pressure stability.

### Flow Requirements for Effective Filtration

The pump must meet two primary flow needs:

1. **Evacuation of Air:** As the air is removed from the apparatus, pressure drops, creating the differential required for filtration.
2. **Overcoming Leakage:** Any vacuum system is susceptible to leaks, which can prevent achieving the deepest vacuum possible.

Common leakage points in lab filtration include:

- Loose connections between tubing and the filtration flask.
- Gaps at the gasket of a Buchner funnel on a side-arm flask.

**Special Consideration for Manifold Filtration:** In multi-sample setups, individual filtrations complete at different times, creating potential leaks (or “break-throughs”) where air enters through an open filter, reducing the pressure differential for remaining samples. Installing stopcocks or valves at each manifold position helps prevent this. A pump with higher rated pumping speed can further compensate for leakage by restoring the vacuum quickly after isolating “break-through” points.

### Using Pump Curves to Evaluate System Performance

Each pump produces a specific flow rate at a given vacuum level. By observing the vacuum level and using the pump’s curve, one can estimate the flow rate and identify the extent of any leakage in the system.

### Troubleshooting Common Filtration Issues

If issues arise during filtration, consider the following diagnostic steps.

- **If the pump achieves near its ultimate vacuum when connected:**
  - Check for blockages in the filter or funnel.
  - Consider a pump with a deeper ultimate vacuum for increased pressure differential (100 mbar is generally sufficient). Ensure that the vacuum level is not deeper than the filtrate’s vapor pressure to avoid evaporation.
- **If the pump does not reach its ultimate vacuum when connected:**
  - Inspect for leaks in the apparatus and address them.
  - Ensure there is no sample “break-through” causing the leak.
  - If necessary, use a pump with a higher pumping speed for increased flow capacity.

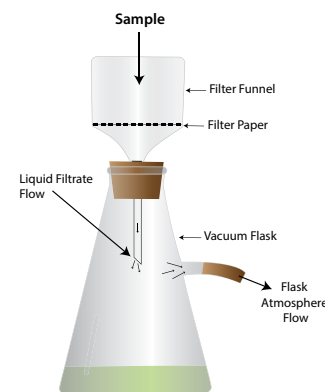


Figure 1

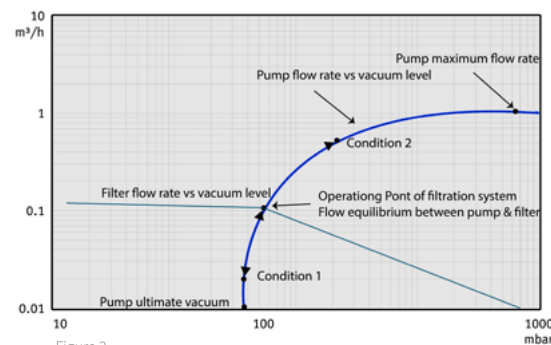


Figure 2

In Conclusion, by carefully sizing and selecting a pump, you can achieve optimal filtration efficiency, even with challenging sample conditions or complex setups.

### VACUUBRAND Pumps Commonly Used for Filtration



[ME 1C chemistry diaphragm vacuum pump #20721103](#)



[ME 2C NT chemistry diaphragm vacuum pump #20730103](#)



[ME 4C NT chemistry diaphragm vacuum pump #20731203](#)



[ME 1 diaphragm vacuum pump #20721003](#)



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Find the right pump for your application with the Vacuum Pump Selection Guide

Header photo: Depicts a basic of filtratEion set-up with a Buchner funnel placed atop a Buchner flask with a vacuum pump connected to the side arm of the flask. The bottom of the funnel has either filtration paper or a membrane filter. Figure 1: Represents a typical filtration system. Figure 2: A pump curve for a filtration system showing both the flow rate and the pump speed. For Reference only, not actual data.