

White Paper

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# WELCH VACUUM FILTRATION

Maximizing Productivity in Lab Filtering Processes



# MAXIMIZING PRODUCTIVITY IN LAB FILTERING PROCESSES

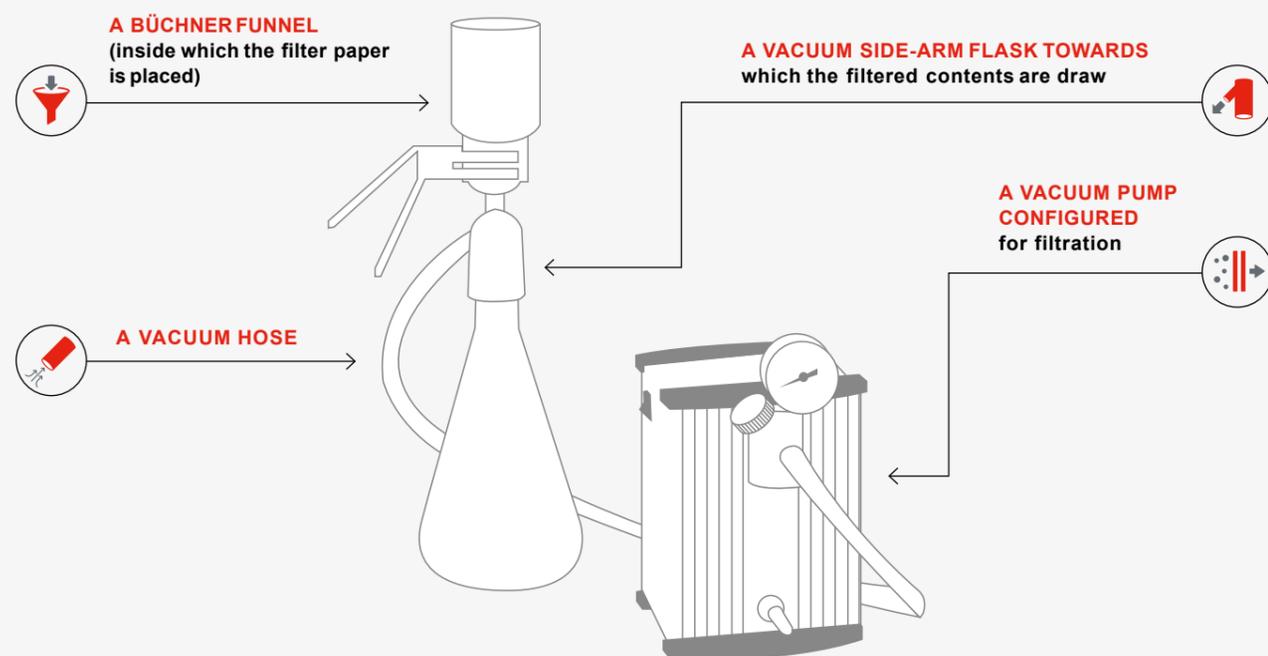
## Durable and Efficient Pumps for Vacuum Filtration Applications

**Vacuum filtration**, also known as suction filtration, is a chemistry laboratory technique that allows for accelerating and streamlining filtration processes with the help of a pressure differential. **The method is commonly used for separating solids from liquids** (for example, for recovering a product of synthesis when the product is a solid in suspension) and purifying solvents, and plays a major role in sample preparation in research and analyses carried out in the food and beverage, pharmaceutical and water and wastewater treatment industries, among others.

**The application of vacuum** enables the achievement of much higher process rates than are possible in gravity-assisted filtration, with the vacuum source creating a difference (maximum one atmosphere) in pressure on both sides of the filter and thus helping increase the speed with which the solution is forced through it.

**In a traditional filtration procedure**, it is gravity that provides the force which draws the liquid through the filter medium. Thanks to the complex multi-layer structure of the filter, only the liquid and small particles can pass through it becoming the so-called filtrate, whereas larger solid particles (the so-called oversize) are retained on the filter paper's surface. High (hot filtration) or low (cold filtration) temperatures are sometimes applied to deal with solutions which can only be effectively filtered in a special thermal environment.

### The procedure requires the use of:



The mixture to be filtered is poured into the funnel. The latter is fitted into the flask, with a rubber conical seal ensuring an air-tight connection of the two elements. When the vacuum pump, which is connected through tubing to the side spout of the flask, is turned on, vacuum pulls the mixture down through the filter paper. The filtrate is captured in the flask, while the solids are collected on top of the filter paper.

# SELECTING THE EQUIPMENT

Depending on the application, the right type of filter paper has to be selected, with qualitative paper letting more material through and filtering faster, and quantitative paper filtering finer particles but lowering the filtration speed. The glassware needs to be vacuum rated so that it can withstand one atmosphere to which it is subjected. When it comes to the vacuum source itself, a number of important considerations have to be taken into account to make sure that the filtration procedure is performed in an effective and efficient manner to bring the desired process results.

**Vacuum level** modest vacuum levels of between 40 Torr (53 mbar) and 200 Torr (266 mbar) are normally sufficient to meet the needs of most vacuum filtration applications. Too deep a vacuum can lead the filter paper to tear or the filtrate to boil in the vacuum flask.

**Free air displacement** the requirement depends on the size of the filter and the number of the filter holders, the leak rate of the system and the condition of the solid particles collected on the filter's surface (the so-called filter cake).

**Vacuum pump type** the substance to be filtered determines the choice, with economical standard duty dry vacuum pumps typically handling aqueous solutions and chemical duty diaphragm pumps with corrosion-resistant construction able to deal with aggressive vapors being used for filtering organic solvents and acid solutions.



# WOB-L® PUMP EFFICIENCY

Welch, a brand of Ingersoll Rand, a leading provider of pressure and vacuum solutions for numerous industries, offers a wide range of state-of-the-art vacuum pumps configured for vacuum filtration of liquid mixtures. Our portfolio includes WOB-L® piston models 2522, 2534 and 2546 which:

- ✓ Offer vacuum pressure from 60 Torr (80 mbar) to 100 Torr (133 mbar)
- ✓ Provide free air displacement ranging from 22 l/min to 45 l/min
- ✓ Are ideal for filtering aqueous or buffer solutions in environmental and life science labs

Our standard duty WOB-L® piston pumps incorporate a number of features designed to make vacuum filtration safe and simple, including:



# DIAPHRAGM PUMP RESISTANCE

For vacuum filtration applications in which resistance to weak acid/base solutions is necessary, Welch offers the MPC 090 E chemical duty diaphragm pump with an ultimate vacuum level of 75 Torr (100 mbar) and free air displacement of 13l/min. This high-quality, oil-free pump uses our well-proven diaphragm technology which ensures ultra-quiet operation, low vibration and a long service life. Its compact and sturdy design makes it easily portable, requiring a minimal amount of bench space.

The MPC 090 E is equipped with a high-accuracy regulator that allows for soft-start filtration to avoid filter membrane damage, while providing a powerful final vacuum level to help achieve fast process results. The pump also features a built-in catch pot preventing accidental liquid ingestion and can be supplied with a vacuum filtration kit including an in-line hydrophobic filter and a vacuum hose. It offers a complete solution for filtering mildly corrosive substances in chemical and life science labs.



# COMPARISON – GAS PUMP TECHNOLOGY



| Technology | Pressure / Vacuum | Leak Tightness | Lifetime | Pulsation | Particle emission |
|------------|-------------------|----------------|----------|-----------|-------------------|
| WOB-L®     | ●                 | ●              | ●        | ●         | ●                 |
| Diaphragm  | ●                 | ●              | ●        | ●         | ●                 |



| Filtrations Solvent / Media | Technology  | Technology |
|-----------------------------|---|------------|
| AQUEOUS VAPORS              | SUSPENDED SOLIDS SAMPLES / FOOD SLURRY ANALYSIS                 | WOB-L      |
|                             |   | WOB-L      |
|                             |   | WOB-L      |
|                             |   | WOB-L      |
| MILD CHEMICAL VAPORS        | WEAK ACID / BASE SOLUTIONS                                      | MPC        |
|                             | FIELD ENVIRONMENTAL SAMPLES                                     | MPC        |
| LOW – VOLUME ORGANIC VAPORS | ALCOHOL SOLUTIONS   | MPC        |
| STRONG CHEMICAL VAPORS      | CHLORINATED SOLVENTS<br>STRONG ACID / BASE SOLUTIONS<br>KETONES | MPC        |
|                             |   | MPC        |

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