

Vacuum Pumps Welch-Ilmvac

MRC Ltd.



Vacuum Basics

Vacuum means that the pressure of a gas or a mixture of gases is lower than the pressure of the atmosphere

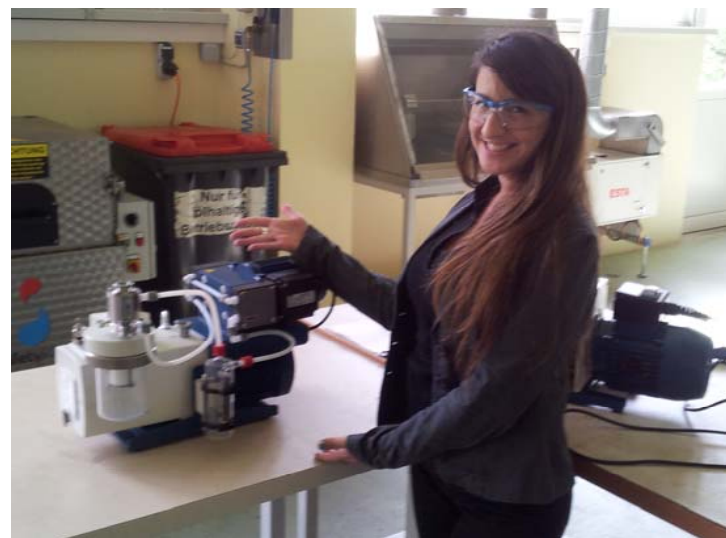
Pressure ranges in vacuum technology:

Low vacuum: 1000 - 1 mbar

Medium-High vacuum: 1 - 10^{-3} mbar

High vacuum: 10^{-3} - 10^{-7} mbar

Ultra-high vacuum: 10^{-7} mbar and less

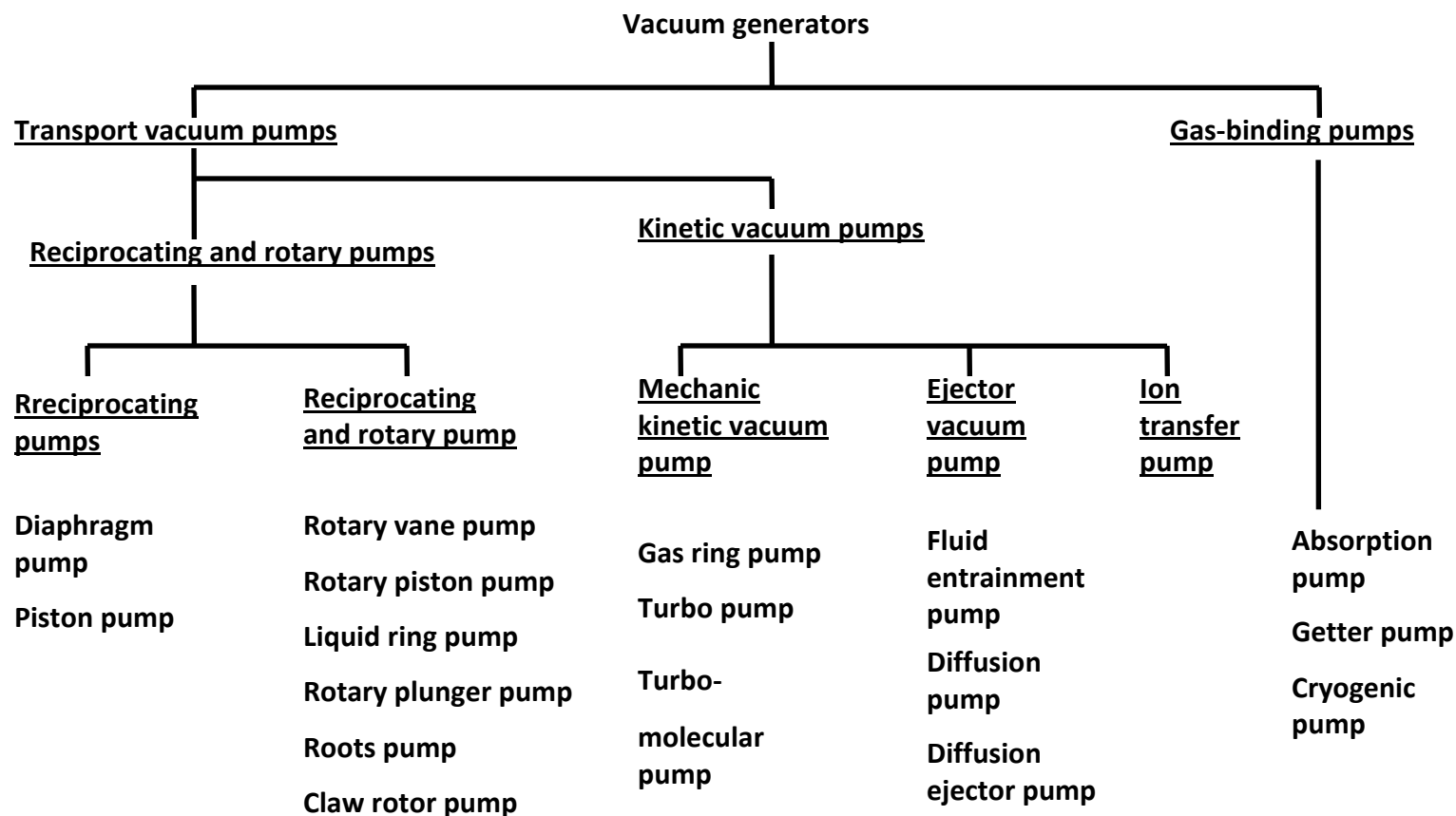


Vacuum Generation Methods

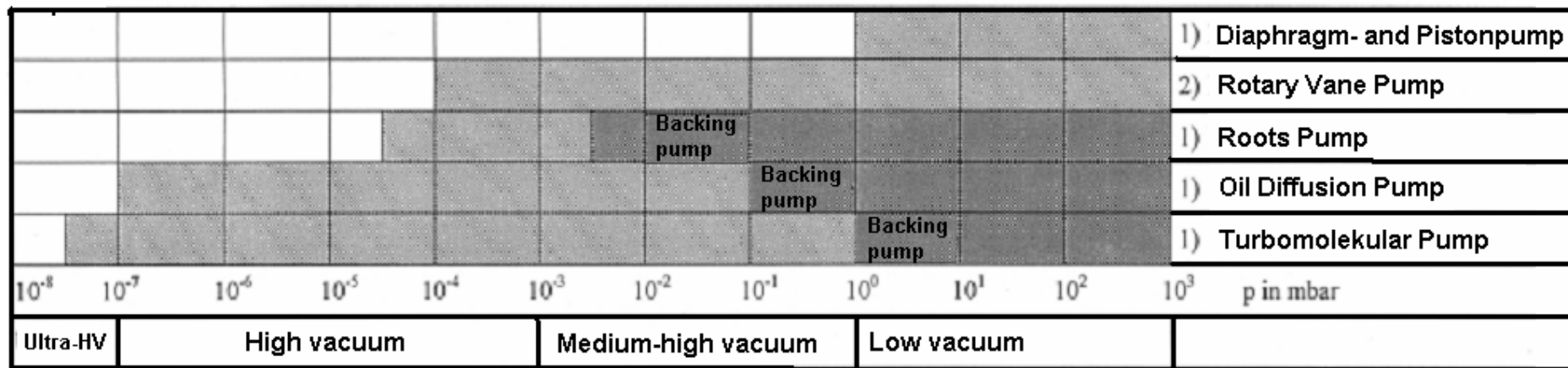
Vacuum Generation Methods

A solid blue horizontal bar spans the bottom of the slide, with a thin vertical line separating the left and right halves.

Division of vacuum generators



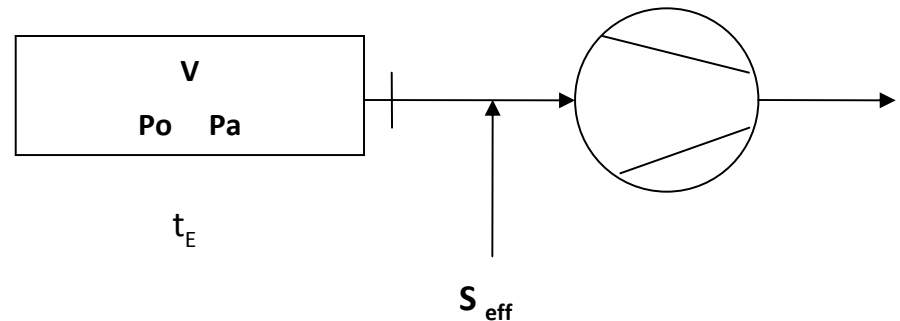
Work areas of important vacuum pump - designs



Determination of the suction property within the rough vacuum range up to 10 mbar

A container volume is to be evacuated in a certain time from an initial pressure on an operating pressure final printing). For this case for the determination of the suction property the equation is valid:

$$S_{\text{eff}} = \frac{V}{t} * \ln \frac{P_o}{P_a}$$



V in m^3 : Volume in container

T in h : Evacuation time

P_o in mbar : Initial pressure in the container

P_a in mbar : Operating pressure (total pressure) in the container

S_{eff} in $\text{m}^3 \cdot \text{h}^{-1}$: necessary effective suction property of the vacuum pump and/or Pumping combination

Pump Selection

Criteria for the selection of the correct vacuum pump or pump combination:

- Which medium or which media are to evacuate (gases, steams,...)?
- How is the chemical compatibility of the media with lubrication and sealing means?
- What are important physical characteristics and as are the temperature of the medium which can be evacuated?
- Which quantity of these media is to be evacuated in which time
- Which operating pressure is to be achieved by the pumping aggregate?
- Is the ambient temperature of the pumping aggregate how high?
- Current supply, running costs, size of the pick-up flanges,....

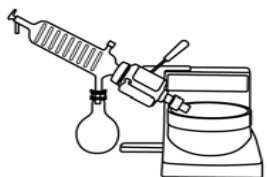
Which pump for which purpose?

Which application should the pump apply for?

- Concentration
- Filtration
- Vacuum-drying
- Freeze-drying
- Distillation
- Degassing processes
- Plasmatechnology
- Research & development
- Freeze technology
- Evaporation processes
- Extraction
- Aspiration

The most important applications in the overview





Rotary Evaporation App.

Model Selector Rotary Evaporators								
Boiling Point, Atmospheric Pressure	80° C		110° C		160° C		195° C	
Example Solvents	Methylene chloride Acetone Chloroform Ethanol		Trichloroethylene n-Propyl alcohol Heptane Water Toluene Acetic Acid		1,1,2,2-Tetrachloroethane DMF Pentachloroethane		DMSO Polymers	
RotoVap Flask Volume	Pump Models	System Models	Pump Models	System Models	Pump Models	System Models	Pump Models	System Models
1 L	↑	↑	↑	↑	↑	2200	↑	↑
2 L			2034	↑	2032	2210		
10 L			2044	2025	2042	2026, 2027, 2028	1400	8890A-70
20 L	2014	2025	2042	2026, 2027	2052, 2062	2220, 2230	1402	1402

- Select a chemical resistant dry diaphragm vacuum pump for routine evaporations.
- Buy a vacuum pump capable of quickly evaporating your least volatile solvent. Fast stripping of DMF requires a 2 torr pump. See Model Selector.
- The ability to adjust vacuum level and react quickly to bumping / foaming conditions are keys to preserving your sample and using your time efficiently.
- Automated vacuum systems can help you save both sample and time



Freeze Dryer App.

Chemical resistance requirements for your freeze dryer vacuum pump depend upon the aggressiveness of your solvent. In all cases, a high gas flow is required at a low operating vacuum level. Collector temperatures and cleanliness must be considered and maintained to protect your pump.

Model Selector | Freeze Dryers

Freeze Dryer Size (volume)	Economy	Acidi/Organic Vapors	High Organic Vapors	Highly Corrosive Vapors
< 4 L	8912A	8917A-80	8960	1402N-01
4 to 12 L	8917A	8917A-80	8965	1402N-01
12 to 25 L	8925A	1376N-01	8970	1376N-01



Vacuum Oven App.

Select a pump for your vacuum oven based on the size of the oven and the nature of the vapors emitted.

Select from standard duty pumps for aqueous vapors or choose a PTFE diaphragm vacuum pump for resistance to harsh chemicals.

Through drying of certain samples requires a deep vacuum, often produced by an oil-seal pump; a cold trap is required to protect the pump. Where sample properties

Model Selector | Vacuum Ovens

Oven Volume	Oil-Free Vacuum 1.5 to 35 torr		Oil-Seal Deep Vacuum 0.0001 to 0.002 torr	
	Aqueous Vapors	Chemical Vapors	Portable Direct Drive	Durable Belt-Drive
0.6 to 1.5 ft ³	WOB-L 2561B-50	DRYFAST 2042	8905A	DUCSEAL 1400B-01
2.5 to 4.5 ft ³	WOB-L 2581B-50	DRYFAST 2047	8912A	DUCSEAL 1405B-01
4.5 to 9.0 ft ³	WOB-L 2581B-50	2054	8917A	DUCSEAL 1402B-01



Vacuum Filtration App.

- Deep vacuum is not required
- Vacuum pump flow required is roughly proportional to the total surface area of filters being used.
- Choose a standard duty vacuum pump for aqueous vapors; use a PTFE pump for resistance to harsh chemicals.

Model Selector Filtration				
Filtration Solvent / Media	Chemical Examples	Vacuum Regulation	Number of Filters	Model
Aqueous Vapors	Suspended solids samples Food slurry analysis	Yes	1-2	WOB-L 2522
		Yes	1-4	WOB-L 2534
		Yes	1-6	WOB-L 2546
		Yes	6 funnel manifold	WOB-L 2567
Mild Chemical Vapors	Weak acid /base solutions Field environmental Samples	No	1	GEMINI 2050
		Yes	1	GEMINI 2060
Low-volume Organic Vapors	Alcohol Solutions Solid Phase Extractions	No	1	2019
		Yes	1-2	DryFast 2014
Strong Chemical Vapors	Chlorinated solvents Strong acid /base solutions Ketones	Yes	1-6	DryFast 2037
		Yes	6 funnel manifold	DryFast 2047
		Yes	6 funnel manifold	DryFast 2047





Glove Boxes App.

Strong vacuum pump gas flow characteristics contribute to the efficiency and time utilization of your glove box applications.

Model Selector Glove Box		
Oil-Free Vacuum for Acrylic Glove Boxes	Oil-Seal Deep Vacuum for Metal Glove Boxes	
Aqueous Vapors	Portable Direct Drive	Durable Belt-Drive
WOB-L 2581B-50	8917A	DUCSEAL 1402B-01



Vacuum Pumps Types

Three Main Types:

ROTARY VANE



DIAPHRAGM



**WOB-L[®]
PISTON**

