



## VACUUM SIZING FOR ALTITUDE

When sizing vacuum systems for altitude, it is important to note that all manufacturers' standard specifications are given at sea level conditions. There are two main affects of altitude on vacuum performance that should be taken into consideration: maximum end vacuum level and flow capacity.

- 1) **Maximum End Vacuum:** The maximum amount of vacuum that can be achieved is reduced at increased elevations. This can be of particular concern with some pump technologies that have lower end vacuum levels to begin with (claw and dry vane for instance). It is important to know the minimum required vacuum level for a particular application so you can determine if a particular pump technology is suitable (keep in mind control strategies and start/stop pressures). You should consult the manufacturer of a particular pump for acceptable end vacuum ratings at various altitudes, but a good "rule of thumb" is to reduce the end vacuum level by 1" Hg per 1,000 feet. For example, a pump rated for 29" Hg at sea level can achieve 25" Hg at 5,000 feet. Below is a sample chart of approximate end vacuum levels at different altitudes for various Powerex vacuum pump technologies.

Pump Type	Maximum End Vacuum ( Inches Hg)		
	Sea Level	5,000 feet	8,000 feet
Lubricated Rotary Vane 1-25 HP	29.3	24.3	21.3
Dry Rotary Vane 1-2 HP	25.5	20.5	17.5
Dry Rotary Vane 3-5 HP	27	22	19
Dry Rotary Vane 7.5 HP	22	17	14
Dry Rotary Vane 10 HP	25	20	17
Dry Claw 2-5 HP	28.4	23.4	20.4
Dry Claw 7.5 HP	27	22	19
Dry Claw 10 HP	25.35	20.5	17.5
Dry Claw 15 HP	23.4	18.4	15.4



2) **Flow Capacity:** The performance of a vacuum pump must also be corrected for altitude due to atmospheric variations in air pressure, temperature and density. The chart below provides correction factors to determine the required flow at different altitudes. Simply multiply the required system capacity by the multiplier shown below.

**Example:** Hospital at 5,000 feet has a capacity requirement of 64 SCFM @ 19" Hg

$$64 \text{ SCFM} \times 1.20 = 76.8 \text{ SCFM}$$

Select a vacuum pump/system that has a capacity rating of 76.8 SCFM @ 19" Hg.

Altitude (feet)	Normal Barometric Pressure	Multiplier for Required SCFM
Sea level	29.92" Hg	1.00
500	29.39" Hg	1.02
1,000	28.86" Hg	1.04
1,500	28.33" Hg	1.06
2,000	27.82" Hg	1.08
2,500	27.32" Hg	1.10
3,000	26.82" Hg	1.12
3,500	26.33" Hg	1.14
4,000	25.84" Hg	1.16
5,000	24.90" Hg	1.20
6,000	23.98" Hg	1.25
7,000	23.09" Hg	1.30
8,000	22.23" Hg	1.35
9,000	21.39" Hg	1.40
10,000	20.58" Hg	1.45