Blower horsepower requirements

Blower horsepower increases with the air flow delivered and the pressure developed. The four equations below can be used to predict blower horsepower consumption. They differ only in the flow and pressure units used. The term "efficiency" is the overall blower efficiency – a composite of fan, motor and drive train efficiencies – expressed as a decimal.

$$hp = \frac{scfm \times "wc}{6356 \times efficiency} \qquad hp = \frac{scfm \times osi}{3670 \times efficiency}$$

$$hp = \frac{scfh \times "wc}{381{,}360 \times efficiency} \qquad hp = \frac{scfh \times osi}{220{,}200 \times efficiency}$$

Blowers used as suction fans

When a blower is used as a suction device discharging to atmosphere, the amount of suction or vacuum developed can be calculated from this relationship:

$$V = \left(P - \frac{P^2}{B+P} \right) \times 27.7, \text{ where}$$

V = suction or vacuum, " wc

P = Absolute atmospheric pressure, psia, at the location where the blower is operated

B = Rated blower discharge pressure, psig (psig = " wc ÷ 27.7)

Example: A blower with a catalog pressure rating of 21" wc is used as a suction fan on an installation at 1500 ft altitude. How much suction will it develop?

P at 1500 ft = 13.9 psia (from table below)

B = 21 ÷ 27.7 = .76 psig

$$V = \left(13.9 - \frac{(13.9)^2}{.76+13.9} \right) \times 27.7 = 20 \text{ "wc.}$$

THE EFFECT OF PRESSURE ON AIR

Basis: 70°F dry air at sea level (29.92" Hg) barometric pressure

Gauge Pressure, PSIG	Absolute Pressure, PSIA	Density Lb./Cu. Ft.	Specific Gravity	Specific Volume Cu. Ft./Lb.
0	14.7	0.07500	1.000	13.33
1	15.7	0.08010	1.068	12.48
2	16.7	0.08520	1.136	11.74
3	17.7	0.09031	1.204	11.07
4	18.7	0.09541	1.272	10.48
5	19.7	0.10051	1.340	9.95
10	24.7	0.12602	1.680	7.94
15	29.7	0.15153	2.020	6.60
20	34.7	0.17704	2.361	5.65
25	39.7	0.20255	2.701	4.94
30	44.7	0.22806	3.041	4.38
35	49.7	0.25357	3.381	3.94
40	54.7	0.27908	3.721	3.58
45	59.7	0.30459	4.061	3.28
50	64.7	0.33010	4.401	3.03
60	74.7	0.38112	5.082	2.62
70	84.7	0.43214	5.762	2.31
80	94.7	0.48316	6.442	2.07
90	104.7	0.53418	7.122	1.87
100	114.7	0.58520	7.802	1.71
125	139.7	0.71276	9.503	1.40
150	164.7	0.84031	11.204	1.19
175	189.7	0.96786	12.905	1.03
200	214.7	1.09541	14.605	0.91
250	264.7	1.35051	18.007	0.74
300	314.7	1.60561	21.408	0.62
400	414.7	2.11582	28.211	0.47
500	514.7	2.62602	35.014	0.38

THE EFFECT OF ALTITUDE ON AIR

Basis: 70°F dry air at sea level (29.92" Hg) barometric pressure

Altitude, Ft.	Barometric Pressure " Hg	Barometric Pressure PSIA	Density, Lb./Cu. Ft.	Specific Gravity	Specific Volume, Cu. Ft./Lb.
0	29.92	14.7	.07500	1.00	13.33
500	29.38	14.4	.07365	.98	13.58
1000	28.86	14.2	.07234	.96	13.82
1500	28.33	13.9	.07101	.95	14.08
2000	27.82	13.7	.06974	.93	14.34
2500	27.31	13.4	.06846	.91	14.61
3000	26.81	13.2	.06720	.90	14.88
3500	26.32	12.9	.06598	.88	15.16
4000	25.84	12.7	.06477	.86	15.44
4500	25.36	12.5	.06357	.85	15.73
5000	24.89	12.2	.06239	.83	16.03
5500	24.43	12.0	.06124	.82	16.33
6000	23.98	11.8	.06011	.80	16.64
6500	23.53	11.6	.05898	.79	16.95
7000	23.09	11.3	.05788	.77	17.28
7500	22.65	11.1	.05678	.76	17.61
8000	22.22	10.9	.05570	.74	17.95
8500	21.80	10.7	.05465	.73	18.30
9000	21.38	10.5	.05359	.71	18.66
9500	20.98	10.3	.05259	.70	19.01
10000	20.58	10.1	.05159	.69	19.38
15000	16.88	8.29	.04231	.56	23.63
20000	13.75	6.76	.03447	.46	29.01

Helpful conversions:
Altitude in meters x 3.28 = Altitude in feet
Barometric pressure in " Hg ÷ 2.036 = Barometric pressure in psia.