BUSCH Air Engineering Guide

Fan Engineering Data

Price $5.00

Altitude & Temperature Correction Factors

Air Temp. (°F.)	ALTITUDE (Feet) 0	500	1000	1500	2000	2500	3000	3500	4000	4500	5000
0°	.87	.89	.91	.92	.94	.96	.98	.99	1.01	1.03	1.05
40	.94	.96	.98	1.00	1.02	1.04	1.06	1.08	1.10	1.12	1.14
70	1.00	1.02	1.04	1.06	1.08	1.10	1.12	1.14	1.16	1.18	1.20
80	1.02	1.04	1.06	1.08	1.10	1.12	1.14	1.16	1.19	1.21	1.23
100	1.06	1.08	1.10	1.12	1.14	1.16	1.19	1.21	1.23	1.25	1.28
120	1.09	1.12	1.14	1.16	1.18	1.20	1.23	1.25	1.28	1.30	1.32
140	1.13	1.15	1.18	1.20	1.22	1.25	1.27	1.29	1.32	1.34	1.37
160	1.17	1.19	1.22	1.24	1.26	1.29	1.31	1.34	1.36	1.39	1.42
180	1.21	1.23	1.26	1.28	1.30	1.33	1.36	1.38	1.41	1.43	1.46
200	1.25	1.27	1.29	1.32	1.34	1.37	1.40	1.42	1.45	1.48	1.51
250	1.34	1.36	1.39	1.42	1.45	1.47	1.50	1.53	1.56	1.59	1.62
300	1.43	1.46	1.49	1.52	1.55	1.58	1.61	1.64	1.67	1.70	1.74
350	1.53	1.56	1.59	1.62	1.65	1.68	1.72	1.75	1.78	1.81	1.85
400	1.62	1.65	1.69	1.72	1.75	1.79	1.82	1.85	1.89	1.93	1.96
450	1.72	1.75	1.79	1.82	1.86	1.89	1.93	1.96	2.00	2.04	2.08
500	1.81	1.85	1.88	1.92	1.96	1.99	2.03	2.07	2.11	2.15	2.19
550	1.91	1.94	1.98	2.02	2.06	2.10	2.14	2.18	2.22	2.26	2.30
600	2.00	2.04	2.08	2.12	2.16	2.20	2.24	2.29	2.33	2.38	2.42
650	2.10	2.14	2.18	2.22	2.26	2.31	2.35	2.40	2.44	2.49	2.54
700	2.19	2.23	2.27	2.32	2.36	2.41	2.46	2.50	2.55	2.60	2.65
750	2.28	2.33	2.37	2.42	2.47	2.51	2.56	2.61	2.66	2.71	2.76
800	2.38	2.43	2.48	2.52	2.57	2.62	2.66	2.72	2.76	2.81	2.86

Fans are rated at standard air: .075 lbs./cubic ft.; 70°F at sea level; therefore, pressures corrected to standard must be used when selecting Fans from Fan rating tables or curves. Pressure at operating conditions x factor = pressure at standard. Horsepower at standard ÷ factor = horsepower at operating conditions. Caution: size motor for highest density (lowest factor) condition at which it is expected to operate.

Basic Fan Laws

VARIABLE	WHEN SPEED CHANGES	WHEN DENSITY CHANGES
VOLUME	Varies DIRECT with Speed Ratio $CFM_2 = CFM_1 \left(\frac{RPM_2}{RPM_1}\right)$	Does Not Change
PRESSURE	Varies with SQUARE of Speed Ratio $P_2 = P_1 \left(\frac{RPM_2}{RPM_1}\right)^2$	Varies DIRECT with Density Ratio $P_2 = P_1 \left(\frac{D_2}{D_1}\right)$
HORSEPOWER	Varies with CUBE of Speed Ratio $HP_2 = HP_1 \left(\frac{RPM_2}{RPM_1}\right)^3$	Varies DIRECT with Density Ratio $HP_2 = HP_1 \left(\frac{D_2}{D_1}\right)$

Velocity Pressures (At Std. Density .075 #/Ft.³)

VEL. FPM	VP In. Water	VEL. FPM	VP In. Water	VEL. FPM	VP In. Water
500	.016	1800	.202	4400	1.21
600	.022	2000	.249	4600	1.32
700	.031	2200	.302	4800	1.44
800	.040	2400	.359	5000	1.56
900	.050	2600	.421	5200	1.69
1000	.062	2800	.489	5400	1.82
1100	.075	3000	.561	5600	1.96
1200	.090	3200	.638	5800	2.10
1300	.105	3400	.721	6000	2.24
1400	.122	3600	.808	6200	2.40
1500	.140	3800	.900	6400	2.55
1600	.160	4000	.988	6600	2.72
1700	.180	4200	1.10	6800	2.88

FORMULA: $VP = \left(\frac{Velocity}{4005}\right)^2$

Fan Application Formulas

$$d = 1.322 \times \frac{PB}{°F + 460}$$

$$TP = SP + VP$$

$$VP = \left(\frac{CFM}{A \times 4005}\right)^2 = \left(\frac{V}{4005}\right)^2$$

$$FAN\ BHP = \frac{CFM \times TP}{6356 \times Eff_T} = \frac{CFM \times SP}{6356 \times Eff_S}$$

For 3 phase motors: $BHP\ output = \frac{E \times I \times ME \times Pf \times 1.73}{746}$

For 3 phase motors: $KW\ input = \frac{E \times I \times Pf \times 1.73}{1000}$

For 1 phase motors: $BHP\ output = \frac{E \times I \times ME \times Pf}{746}$

For 1 phase motors: $KW\ input = \frac{E \times I \times Pf}{1000}$

To plot a System Curve where SP_1 and CFM_1 are known, use the folowing formula to find other curve points:

$$SP_2 = SP_1 \left(\frac{CFM_2}{CFM_1}\right)^2$$

To determine round duct equivalent of rectangular duct for same friction loss and volumetric capacity:

$$DR = 1.265 \sqrt[5]{\frac{(ab)^3}{a+b}}$$

SYMBOL	DEFINITION
A	area (Ft²)
a	side a of rectangular duct
b	side b of rectangular duct
BHP	brake horsepower
CFM	air volume flow (Ft³/min.)
d	air density (lb/Ft³)
DR	Diameter of round duct
E	volts
Eff	fan efficiency (decimal)
°F	temperature (degrees Fahrenheit)
I	amps
Kw	kilowatts
ME	motor efficiency (decimal)
PB	barometric pressure (inches mercury)
Pf	power factor
SP	static pressure (inches WG)
TP	total pressure (inches WG)
VP	velocity pressure (inches WG)
V	velocity (Ft/min)

Units Most Used in Fan Application

QUANTITY	STANDARD ENGLISH UNITS	STANDARD METRIC (SI) UNITS	OTHER UNITS				
PRESSURE	In. WG	Pascals	Psi	In. Hg	mm WG	mm Hg	Atm
	1	248.36	.03605	.07341	25.400	1.8627	.00245
	.00403	1	.00015	.00030	.10227	.00750	.00001
	27.736	6894.8	1	2.0361	704.49	51.714	.06805
	13.622	3386.3	.49114	1	346.02	25.400	.03342
	.03937	9.7864	.00142	.00289	1	.07341	.00010
	.53630	133.31	.01934	.03937	13.622	1	.00132
	407.62	101325	14.696	29.923	10354	760.00	1
VOLUME FLOW	CFM	m³/s	m³/min	m³/hr	ℓ/s	ℓ/min	
	1	.000472	.02832	1.6992	.47195	28.316	
	2118.9	1	60.000	3600.0	1000.0	60000	
	35.315	.01667	1	60.000	16.667	1000	
	.58858	.00028	.01667	1	.27778	16.667	
	2.1189	.00100	.06000	3.6000	1	60.000	
	.03532	.00002	.00100	.06000	.01667	1	
VELOCITY	Ft/Min	m/s	m/min	m/hr	mph	Knots	
	1	.00508	.30480	18.288	.01136	.00987	
	196.85	1	60.000	3600.0	2.2369	1.9425	
	3.2808	.01667	1	60.000	.03728	.03238	
	.05468	.00028	.01667	1	.00062	.00054	
	88.000	.44704	26.822	1609.4	1	.86839	
	101.34	.51479	30.887	1853.2	1.1516	1	
ROTATING SPEED	RPM	rps					
	1	.01667					
	60.000	1					
DENSITY	LB/Ft³	Kg/m³					
	1	16.018					
	.06243	1					
POWER	HP	Watts					
	1	745.7					
	.00134	1					

Column 1 lists the English units now in common usage in the air moving industry. Column 2 lists the metric units which have been adopted as the metric standards by the Air Moving and Conditioning Association (AMCA). These units were established as the international standard units (SI) by the International Standards Organization and have been approved as standard by at least thirty countries.

BUSCH INTERNATIONAL

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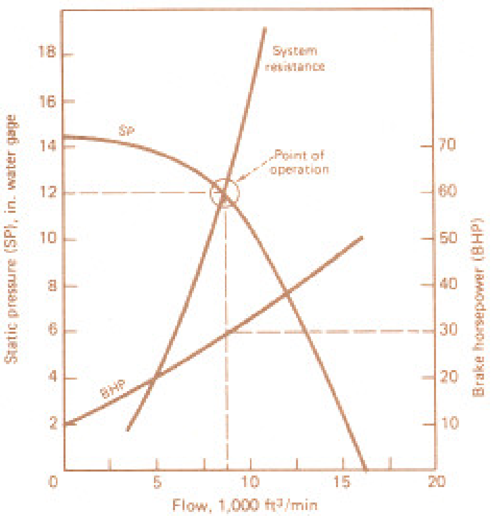
Fan Engineering Data (Cont'd)

NOTE: Data shown in this literature are believed to be correct; however, they are subject to responsible deviation and should not be used for specification purposes. Busch Int'l. cannot take responsibility for its accuracy if this information is used in proposal, manufacturing or other activities.



The fan's actual operating point is at the intersection of its static-pressure curve and the system's resistance curve

Air Density Variations Due to Temperature and Pressure

DENSITY ~ 1/ABSOLUTE TEMP. (°R)
DENSITY ~ ATMOSPHERIC PRESSURE

EFFECTS ON FANS:
SP ~ DENSITY
VP ~ DENSITY
BHP ~ DENSITY

$$DENSITY_{NEW} = 0.075\ LB/FT^3 \left(\frac{530\ ^{\circ}R}{460 + {}^{\circ}F_{NEW}}\right) \times \left(\frac{PRESSURE_{NEW}}{29.92''\ Hg}\right)$$

Chemical Composition & Molecular Weight of Air

78% N_2 (NITROGEN MW 28)
21% O_2 (OXYGEN MW 32)
1% A (ARGON MW 39.9)
100% AIR (MW 28.94)

Fan Efficiency

$$MECH.\ EFF. = \frac{AIR\ HORSEPOWER_{OUT}}{SHAFT\ HORSEPOWER_{IN}} \times 100\%$$

$$MECH.\ EFF. = \frac{TP \times CFM}{6356 \times BHP} \times 100\%$$

$$STATIC\ EFF. = \frac{SP \times CFM}{6356 \times BHP} \times 100\%$$

Total Pressure

SOMETIMES USED FOR RATING A FAN.
ALSO USED TO CALCULATE FAN AIR HORSEPOWER.

$TP = SP + VP$

$TP_{FAN} = TP_{OUTLET} - TP_{INLET}$

$SP_{FAN} = SP_{OUTLET} - SP_{INLET} - VP_{INLET}$

EXAMPLE: IF $VP_{OUTLET} = 0.6''\ H_2O$ and $SP_{OUTLET} = 2.3''\ H_2O$
THEN $TP_{OUTLET} = 2.9''\ H_2O$

System-Effect Pressure Loss for Inlet Obstructions

Distance from inlet to obstruction	Pressure loss, in. water gage		
	3,000 ft/min	4,000 ft/min	5,000 ft/min
3/4 inlet dia.	0.12	0.22	0.34
1/2 inlet dia.	0.23	0.40	0.62
1/3 inlet dia.	0.38	0.68	1.07
1/4 inlet dia.	0.58	1.05	1.55

Fan System Effect Factors

Duct length/ air velocity	Pressure loss, in. water gage						
	Round, mitered elbow			Square-duct elbow			
	Two-piece	Multipieces		Without vanes		With vanes	
		R/D=1	R/D=2	R/D=1	R/D=2	R/D=1	R/D=2
Elbow at inlet							
3,000 ft/min	1.8	0.7	0.6	0.7	0.5	0.3	0.1
4,000 ft/min	3.2	1.3	1.0	1.3	0.8	0.6	0.3
5,000 ft/min	5.0	1.8	1.5	1.8	1.3	0.8	0.4
Elbow 2 duct dia. away							
3,000 ft/min	1.2	0.4	0.3	0.4	0.3	0.2	0.1
4,000 ft/min	2.0	0.7	0.6	0.7	0.5	0.4	0.2
5,000 ft/min	3.0	1.0	0.8	1.1	0.7	0.5	0.3
Elbow 5 duct dia. away							
3,000 ft/min	0.6	0.2	0.2	0.2	0.1	0.1	—
4,000 ft/min	1.0	0.3	0.3	0.4	0.3	0.2	0.1
5,000 ft/min	1.5	0.5	0.5	0.5	0.4	0.3	0.2

Dilution Ventilation

Dilution Air Volumes for Vapors

Cu. ft. air per pint of liquid evaporated =

$$\frac{403 \times 10^6 \times (\text{sp. gr. liquid}) \times K}{\text{molecular weight of liquid} \times (\underline{TLV})}$$

K = Safety factor to maintain concentration well below TLV and varies from 3 to 10

Dilution Air Volumes for Fire and Explosion

Cu. ft. air per pint of liquid evaporated =

$$\frac{403 \times 10^2 \times (\text{sp. gr. liquid}) \times C}{\text{molecular weight of liquid} \times (\underline{LEL}) \times B}$$ (for Standard Air)

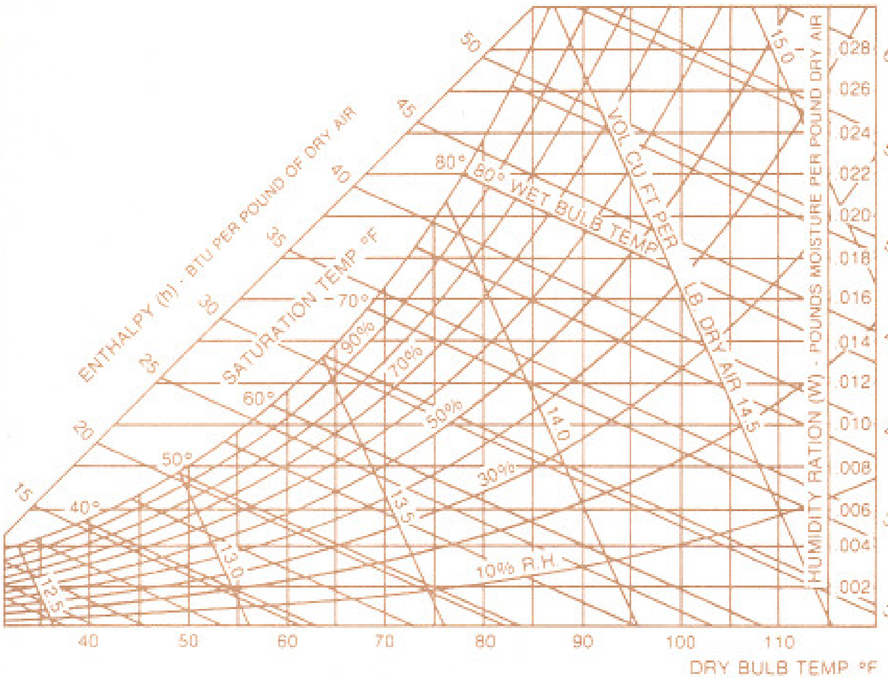
C = Safety factor which depends on percentage of LEL for safe condition. Divide 1.0 by per cent of LEL which is max. allowable. For example, if vapor concentrations are to be maintained at not more than 25% of LEL, C = 1.00 ÷ 0.25 = 4

B = 1.0 for temperatures up to 250°F; B = 0.7 for temperatures above 250°F

WARNING:

Since health and safety are involved in the calculation of dilution air volumes, experts in the field of health and safety should be consulted when making such calculations. The above data are for estimating purposes only.

Psychometric-Related Data

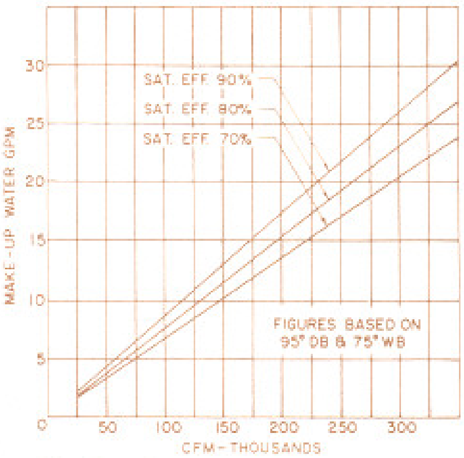


Psychometric Chart Barometric Pressures 29.92" Hg

Properties of Saturated Steam

Gauge Press.	Temp. °F	Latent Heat	Gauge Press.	Temp. °F	Latent Heat
0	211.99	970.40	90	333.16	885.42
2	218.47	966.20	100	337.86	880.82
3	221.50	964.27	110	344.22	874.85
5	227.16	960.54	120	350.09	870.05
8	234.78	955.58	130	355.65	865.48
10	239.41	952.45	140	360.89	861.12
15	249.73	945.49	150	365.92	856.92
20	258.79	939.26	160	370.66	853.62
25	266.85	933.63	175	377.47	847.02
30	274.08	928.50	180	379.60	845.76
35	280.64	923.77	190	383.66	842.02
40	286.74	919.27	200	387.88	838.00
45	292.37	915.14	210	391.67	834.63
50	297.70	911.24	230	399.11	827.64
60	307.30	903.91	260	409.39	817.79
70	316.03	897.28	290	418.81	808.41
80	323.89	891.08	300	421.78	805.37

Evaporative Cooling Make-Up Water Requirements



Quantites shown are based on bleeding off an amount of water for dilution purposes equal to water quantity evaporated.

Electrical Engineering Data

Annual Energy Costs for AC Motors

Electrical Power Rate ($/KWH)

BHP	.05	.06	.07	.08	.09
.5	182	218	254	291	327
.75	272	327	381	436	490
1	363	436	508	581	653
1.5	545	653	762	871	980
2	726	871	1017	1162	1307
3	1089	1307	1525	1743	1960
5	1815	2178	2541	2904	3267
7.5	2723	3267	3812	4357	4901
10	3631	4357	5083	5809	6535
15	5446	6535	7624	8713	9802
20	7261	8713	10165	11618	13070
25	9076	10892	12707	14522	16337
30	10892	13070	15248	17427	19605
40	14522	17427	20331	23235	26140
50	18153	21783	25414	29044	32675
60	21783	26140	30496	34853	39210
75	27229	32675	38121	43566	49012
100	36305	43566	50827	58088	65350
125	45382	54458	63534	72611	81687
150	54458	65350	76241	87133	98024

Above Table Based on 24 Hr. Operation, 365 Days/Year

Above Costs in Dollars Based on Following Formula: $\text{Cost} = \text{BHP} \times \frac{.746\ \text{KW}}{\text{HP}} \times \frac{\$}{\text{KWH}} \times \frac{1}{.90\ \text{Motor EFF}} \times \frac{\text{HRS}}{\text{DAY}} \times \frac{\text{DAYS}}{\text{YEAR}}$

To Find	Alternating Current	
	Single-Phase	Three-Phase
Amperes when horsepower is known	$\frac{HP \times 746}{E \times Eff \times pf}$	$\frac{HP \times 746}{1.73 \times E \times Eff \times pf}$
Amperes when kilowatts are known	$\frac{Kw \times 1000}{E \times pf}$	$\frac{Kw \times 1000}{1.73 \times E \times pf}$
Amperes when kva are known	$\frac{Kva \times 1000}{E}$	$\frac{Kva \times 1000}{1.73 \times E}$
Kilowatts	$\frac{I \times E \times pf}{1000}$	$\frac{1.73 \times I \times E \times pf}{1000}$
Kva	$\frac{I \times E}{1000}$	$\frac{1.73 \times I \times E}{1000}$
Horsepower — (Output)	$\frac{I \times E \times Eff \times pf}{746}$	$\frac{1.73 \times I \times E \times Eff \times pf}{746}$

I = Amperes; E — Volts; Eff = Efficiency;
pf = Power factor; Kva — Kilovolt-amperes; Kw — Kilowatts.

Types of Electrical Enclosures NEMA Classification

TYPE 1 — General Purpose — Indoor
TYPE 2 — Dripproof — Indoor
TYPE 3 — Dusttight, Raintight and Sleet-Resistant (Ice-Resistant) — Outdoor
TYPE 3R — Rainproof and Sleet-Resistant (Ice Resistant) — Outdoor
TYPE 3S — Dusttight, Raintight and Sleet-Proof (Ice Proof) — Outdoor
TYPE 4 — Watertight and Dusttight — Indoor and Outdoor
TYPE 4X — Watertight, Dusttight and Corrosion Resistant — Indoor and Outdoor
TYPE 5 — Dusttight Indoor
TYPE 6 — Submersible, Watertight, Dusttight and Sleet-Resistant (Ice Resistant) — Indoor and Outdoor
TYPE 6P — Submersible, Watertight, Dusttight and Sleet-Resistant (Ice-Resistant) — Indoor and Outdoor
TYPE 7 — CLass I, Group D Hazardous Locations — Indoor
TYPE 9 — Class II, Groups E, F and G Hazardous Locations — Indoor
TYPE 12 — Industriaal Use — Dusttight and Dripproof — Indoor
TYPE 13 — Oiltight and Dusttight — (Indoor)

Rules of Thumb (Approximation)

At 1800 rpm, a motor develops 3 lb-ft per hp
At 1200 rpm, a motor develops 4.5 lb-ft per hp
At 575 volts, a 3-phase motor draws 1 amp per hp
At 460 volts, a 3-phase motor draws 1.25 amp per hp
At 230 volts, a 3-phase motor draws 2.5 amp per hp
At 230 volts, a single-phase motor draws 5 amp per hp
At 115 volts, a single-phase motor draws 10 amp per hp

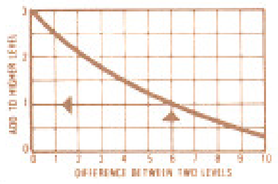
Motor Speeds

H.P.	Synchronous Speed	Full Load RPM	H.P.	Synchronous Speed	Full Load Speed
¾	1200	1140	30	3600 1800 1200	3530 1770 1175
1	1800 1200	1750 1150	40	3600 1800 1200	3550 1770 1180
1½	3600 1800 1200	— — 1165	50	3600 1800 1200	3550 1770 1180
2	3600 1800 1200	3450 1750 1165	60	3600 1800 1200	3560 1780 1180
3	3600 1800 1200	3520 1755 1170	75	3600 1800 1200	3560 1780 1180
5	3600 1800 1200	3500 1750 1170	100	3600 1800 1200	3570 1780 1185
7½	3600 1800 1200	3520 1760 1170	125	3600 1800 1200	3570 1785 1185
10	3600 1800 1200	3515 1760 1170	150	3600 1800 1200	3570 1785 1185
15	3600 1800 1200	3560 1770 1175	200	3600 1800 1200	3570 1785 1185
20	3600 1800 1200	3550 1770 1180	250	3600 1800	3570 1785
25	3600 1800 1200	3530 1765 1180	300	1800	1785

Sound Characteristics

Decibels — Ten times the logarithm (to the base 10) of the ratio of two mean square values of sound pressure, voltage, or current. The abbreviation for "decibels" is dB

Decibel Addition —



Example: 80 dB + 74 dB = 81 dB

Sound Power Level

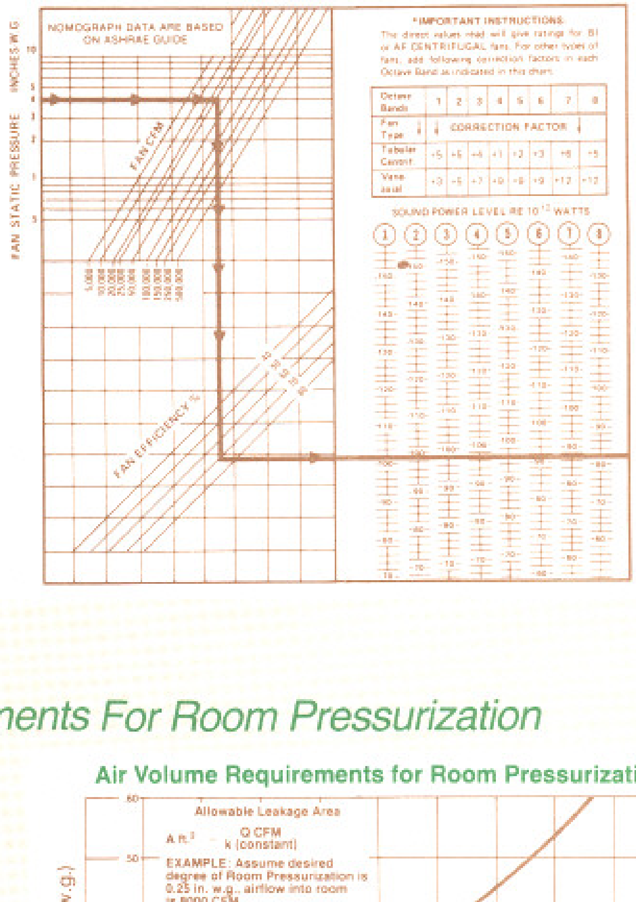
Source	Sound Power watts	L_w, dB re 10^{-12} Watts
Saturn rocket	100,000,000	200
Afterburning jet engine	100,000	170
Large centrifugal fan at 900,000 cfm (848,500 m^3/hr)	100	140
75 piece orchestra vane axial fan at 100,000 cfm (169,900 m^3/hr)	10	130
Large chipping hammer	1	120
Blaring radio	0.1	110
Centrifugal fan at 13000 cfm (22087 m^3/hr)	0.1	110
Auto on highway	0.01	100
Food blenders — upper range	0.001	90
Dishwashers — upper range	0.0001	80
Voice — conversational level	0.00001	70
Quiet Duct silencer, self noise at + 1000 fpm (5.1 m/s)	0.00000001	40
Voice — very soft whisper	0.000000001	30
Quietest audible sound for persons with excellent hearing	0.000000000001	0

Nomograph for Estimating Fan* Sound Power Levels

Fan Sound Power Level Prediction
Fan sound power level should be based on measurements or manufacturer's data whenever available. Otherwise, the nomograph on these pages can be used. To use the nomograph, enter the fan static pressure at left and project horizontal line to fan cfm. Next project a vertical line downwards to fan efficiency and then a horizontal line to the right to read sound power level in each octave band.

Example:

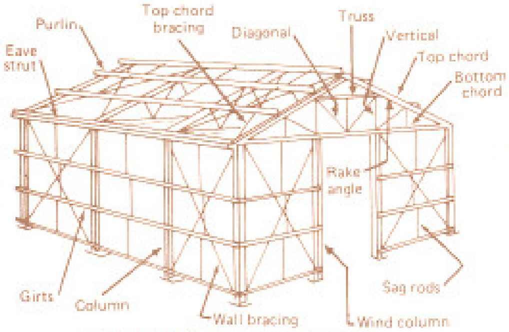
A centrifugal fan is delivering 30,000 cfm (50,970 m^3/hr) at a head of 4 i.w.g. (996.4 N/m^2) and fan efficiency of 72%. The predicted sound power level re 10^{-12} Watts is 102, 99, 98, 97, 96, 91, 87, 82 dB



*IMPORTANT INSTRUCTIONS
The direct values read will give ratings for BI or AF CENTRIFUGAL fans. For other types of fans, add following correction factors in each Octave Band as indicated in this chart.

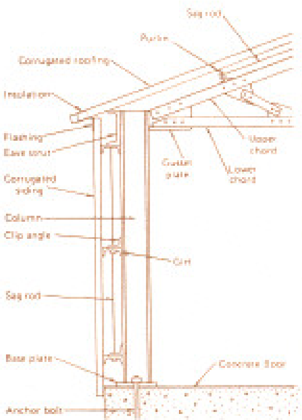
Octave Bands	1	2	3	4	5	6	7	8
Fan Type	CORRECTION FACTOR							
Tubular Centrif.	+5	+6	+4	+1	+2	+3	+6	+5
Vane axial	+3	+5	+7	+9	+8	+9	+12	+12

Building Terminology

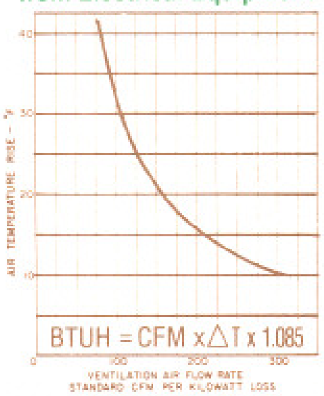


Individual shapes, mechanically fastened

Air Volume Requirements For Room Pressurization

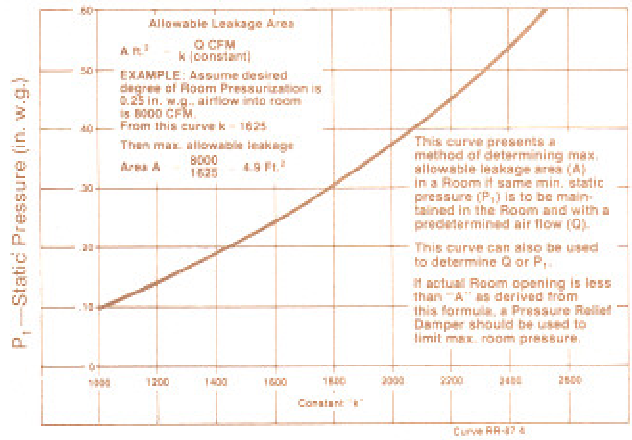


Air Volume Required to Dissipate Heat Losses from Electrical Equipment



$$BTUH = CFM \times \Delta T \times 1.085$$

Air Volume Requirements for Room Pressurization



Curve RR-87 4

Miscellaneous Engineering Data

Conversion Factors

LENGTH
1 in = 2.54 cm
1 Ft = .3048 m
1 yd = .9144 m
1 mi = 1.6093 Km
1 nau. mi = 1.1516 mi

POWER
1 hp = 745.7 W
1 hp = 550 ft-lb/sec
1 hp = 3300 ft-lb/min
1 hp = 76.04 kg-m/sec
1 hpm = 75.00 Kg-m/sec

PRESSURE
1 Pa = 1 N/m²
1 Pa = 10 dy/cm²
1 Pa = .000145 psi
1 psi = 6894.8 Pa
1 psi = .0703 kg/cm²
1 lb/Ft² = 4.886 Kg/m²

FORCE
1 N = 100,000 dy
1 lb = 444,840 dy
1 N = .22480 lb
1 N = 1 Kg-m/sec²
1 dy = 1 g-cm/sec²

VOLUME
1 in³ = 16.3871 cm³
1 Ft³ = .0283 m³
1 Ft³ = 7.48 gal
1 Ft³ = 28.316 ℓ
1 yd³ = .7646 m³

HEAT
1 Btu = 777.97 Ft-lb
1 hp = 2545 Btu/hr
1 hp = 1.014 metric hp
1 hp = .0761 boiler hp
1 kw = 3414 Btu/hr
1 Ton = 12000 Btu/hr

WORK/ENERGY
1 Ft-lb = 1.3558 J
1 W-sec = 1 J
1 Kw-hr = 3.6 x 10⁶ J
1 erg = 10⁻⁷ J
1 erg = 1 dy-cm
1 kw = 10¹⁰ ergs/sec

AREA
1 in² = 6.4516 cm²
1 Ft² = .0929 m²
1 yd² = .8361 m²
1 mi² = 2.5899 Km²

TEMPERATURE
°F = 9/5 °C + 32 °C = 5/9 (°F-32) °R = °F + 460 °K = °C + 273

Weight

1 lb. = 7000 Grains
Grains/Ft³ x 6.4799 x 10⁻² = Grams/Ft³
Grains/Ft³ x 2.288 x 10⁶ = Micrograms/M³
Grains/Ft³ x 2.288 x 10³ = Milligrams/M³
Grams x 2.2046 x 10⁻³ = Pounds
1 Gallon of Water = 8.34 lb.
1 Ft³ Water = 62.4 lb.
1 Ft³ Loose Earth = 75 lb.
1 Ft³ Aluminum = 168.5 lb.
1 Ft³ Steel = 490 lb. ±

Steel Gauges and Weights

GAUGE	THICKNESS		WEIGHT	
	Inches	mm	lb/Ft²	Kg/m²
000	3/8	9.5250	15.300	74.754
2	1/4	6.3500	10.200	49.836
8	.1644	4.1758	6.875	33.591
10	.1345	3.4163	5.625	27.483
12	.1046	2.6568	4.375	21.376
14	.0747	1.8974	3.125	15.268
16	.0598	1.5189	2.500	12.215
18	.0478	1.2141	2.000	9.772
20	.0359	0.9119	1.500	7.329
22	.0299	.7595	1.250	6.107
24	.0239	.6071	1.000	4.886
26	.0179	.4547	.750	3.664

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