Metric/Decimal Equivalents

			Inches	Millimeters
		1/64	.015625	0.3969
	1/32		.031250	0.7938
			.039370	— 1
		3/64	.046875	1.1906
1/16			.062500	1.5875
		5/64	.078125	1.9844
			.078740	— 2
	3/32		.093750	2.3812
		7/64	.109375	2.7781
			.118110	— 3
1/8			.125000	3.1750
		9/64	.140625	3.5719
	5/32		.156250	3.9688
			.157480	— 4
		11/64	.171875	4.3656
3/16			.187500	4.7625
			.196850	— 5
		13/64	.203125	5.1594
	7/32		.218750	5.5562
		15/64	.234375	5.9531
			.236220	— 6
1/4			.250000	6.3500
		17/64	.265625	6.7469
			.275591	— 7
	9/32		.281250	7.1438
		19/64	.296875	7.5406
5/16			.312500	7.9375
			.314961	— 8
		21/64	.328125	8.3344
	11/32		.343750	8.7312
			.354331	— 9
		23/64	.359375	9.1281
3/8			.375000	9.5250
		25/64	.390625	9.9219
			.393701	— 10
	13/32		.406250	10.3188
		27/64	.421875	10.7156
			.433071	— 11
7/16			.437500	11.1125
		29/64	.453125	11.5094
	15/32		.468750	11.9062
			.472441	— 12
		31/64	.484375	12.3031
1/2			.500000	12.7000
			.511811	— 13

			Inches	Millimeters
		33/64	.515625	13.0969
	17/32		.531250	13.4938
		35/64	.546875	13.8906
			.551181	— 14
9/16			.562500	14.2875
		37/64	.578125	14.6844
			.590551	— 15
	19/32		.593750	15.0812
		39/64	.609375	15.4781
5/8			.625000	15.8750
			.629921	— 16
		41/64	.640625	16.2719
	21/32		.656250	16.6688
			.669291	— 17
		43/64	.671875	17.0656
11/16			.687500	17.4625
		45/64	.703125	17.8594
			.708661	— 18
	23/32		.718750	18.2562
		47/64	.734375	18.6531
			.748031	— 19
3/4			.750000	19.0500
		49/64	.765625	19.4469
	25/32		.781250	19.8438
			.787402	— 20
		51/64	.796875	20.2406
13/16			.812500	20.6375
			.826775	— 21
		53/64	.828125	21.0344
	27/32		.843750	21.4312
		55/64	.859375	21.8281
			.866142	— 22
7/8			.875000	22.2250
		57/64	.890625	22.6219
			.905512	— 23
	29/32		.906250	23.0188
		59/64	.921875	23.4156
15/16			.937500	23.8125
			.944882	— 24
		61/64	.953125	24.2094
	31/32		.968750	24.6062
			.984252	— 25
		63/64	.984375	25.0031
1			1.00000	25.4000

Decimal Equivalents of Millimeters

mm	Inches	mm	Inches	mm	Inches	mm	Inches	mm	Inches	mm	Inches
25	0.98425	38	1.49606	51	2.00787	64	2.51968	77	3.03149	90	3.54330
26	1.02362	39	1.53543	52	2.04724	65	2.55905	78	3.07086	91	3.58267
27	1.06299	40	1.57480	53	2.08661	66	2.59842	79	3.11023	92	3.62204
28	1.10236	41	1.61417	54	2.12598	67	2.63779	80	3.14960	93	3.66141
29	1.14173	42	1.65354	55	2.16535	68	2.67716	81	3.18897	94	3.70078
30	1.18110	43	1.69291	56	2.20472	69	2.71653	82	3.22834	95	3.74015
31	1.22047	44	1.73228	57	2.24409	70	2.75590	83	3.26771	96	3.77952
32	1.25984	45	1.77165	58	2.28346	71	2.79527	84	3.30708	97	3.81889
33	1.29921	46	1.81102	59	2.32283	72	2.83464	85	3.34645	98	3.85826
34	1.33858	47	1.85039	60	2.36220	73	2.87401	86	3.38582	99	3.89763
35	1.37795	48	1.88976	61	2.40157	74	2.91338	87	3.42519	100	3.93700
36	1.41732	49	1.92913	62	2.44094	75	2.95275	88	3.46456		
37	1.45669	50	1.96850	63	2.48031	76	2.99212	89	3.50393		

1 Inch = 25.400 mm

Temperature Conversions

°C – °F 0 to 40				°C – °F 41 to 80				°C – °F 81 to 250				°C – °F 260 to 600		
C	C or F	F		C	C or F	F		C	C or F	F		C	C or F	F
-17.80	0	32.0		5.00	41	105.8		27.2	81	177.8		127	260	500
-17.20	1	33.8		5.56	42	107.6		27.8	82	179.6		132	270	518
-16.70	2	35.6		6.11	43	109.4		28.3	83	181.4		138	280	536
-16.10	3	37.4		6.67	44	111.2		28.9	84	183.2		143	290	554
-15.60	4	39.2		7.22	45	113.0		29.4	85	185.0		149	300	572
-15.00	5	41.0		7.78	46	114.8		30.0	86	186.8		154	310	590
-14.40	6	42.8		8.33	47	116.6		30.6	87	188.6		160	320	608
-13.90	7	44.6		8.89	48	118.4		31.1	88	190.4		166	330	626
-13.30	8	46.4		9.44	49	120.2		31.7	89	192.2		171	340	644
-12.80	9	48.2		10.00	50	122.0		32.2	90	194.0		177	350	662
-12.20	10	50.0		10.60	51	123.8		32.8	91	195.8		182	360	680
-11.70	11	51.8		11.10	52	125.6		33.3	92	197.6		188	370	698
-11.10	12	53.6		11.70	53	127.4		33.9	93	199.4		193	380	716
-10.60	13	55.4		12.20	54	129.2		34.4	94	201.2		199	390	734
-10.00	14	57.2		12.80	55	131.0		35.0	95	203.0		204	400	752
-9.44	15	59.0		13.30	56	132.8		35.6	96	204.8		210	410	770
-8.89	16	60.8		13.90	57	134.6		36.1	97	206.6		216	420	788
-8.33	17	62.6		14.40	58	136.4		36.7	98	208.4		221	430	806
-7.78	18	64.4		15.00	59	138.2		37.2	99	210.2		227	440	824
-7.22	19	66.2		15.60	60	140.0		37.8	100	212.0		232	450	842
-6.67	20	68.0		16.10	61	141.8		43.0	110	230.0		238	460	860
-6.11	21	69.8		16.70	62	143.6		49.0	120	248.0		243	470	878
-5.56	22	71.6		17.20	63	145.4		54.0	130	266.0		249	480	896
-5.00	23	73.4		17.80	64	147.2		60.0	140	284.0		254	490	914
-4.44	24	75.2		18.30	65	149.0		66.0	150	302.0		260	500	932
-3.89	25	77.0		18.90	66	150.8		71.0	160	320.0		266	510	950
-3.33	26	78.8		19.40	67	152.6		77.0	170	338.0		271	520	968
-2.78	27	80.6		20.00	68	154.4		82.0	180	356.0		277	530	986
-2.22	28	82.4		20.60	69	156.2		88.0	190	374.0		282	540	1004
-1.67	29	84.2		21.10	70	158.0		93.0	200	392.0		288	550	1022
-1.11	30	86.0		21.70	71	159.8		99.0	210	410.0		293	560	1040
-0.56	31	87.8		22.20	72	161.6		100.0	212	413.0		299	570	1058
0.00	32	89.6		22.80	73	163.4		104.0	220	428.0		304	580	1076
0.56	33	91.4		23.30	74	165.2		110.0	230	446.0		310	590	1094
1.11	34	93.2		23.90	75	167.0		116.0	240	464.0		316	600	1112
1.67	35	95.0		24.40	76	168.8		121.0	250	482.0				
2.22	36	96.8		25.00	77	170.6								
2.78	37	98.6		25.60	78	172.4								
3.33	38	100.4		26.10	79	174.2								
3.89	39	102.2		26.70	80	176.0								
4.44	40	104.0												

Temperature Conversion Formulas

NEED TO FIND	FORMULA
DEGREES (IN CELSIUS)	.56 X (DEGREES F – 32)
DEGREES (IN FAHRENHEIT)	(1.8 X DEGREES C) + 32

General Formulas

Drive System Mechanical Formulas

	NEED TO FIND:	FORMULA:
Mechanical	**CIRCUMFERENCE** OF A CIRCLE	3.1416 X DIAMETER
	DIAMETER OF A CIRCLE	$\dfrac{\text{CIRCUMFERENCE}}{(3.1416)}$
	VELOCITY IN FEET PER MINUTE	FPM = .262 X DIAMETER X RPM
	RPM REVOLUTIONS PER MINUTE	$\dfrac{\text{FEET PER MINUTE}}{(.262 \text{ X DIAMETER})}$
	TORQUE IN/LBS	$\dfrac{\text{HP X 63,025}}{\text{RPM}}$
	TORQUE IN/LBS	FORCE (LBS) X RADIUS (IN)
	HORSEPOWER	$\dfrac{\text{TORQUE (IN.LBS) X RPM}}{63,025}$
	HORSEPOWER	$\dfrac{\text{FORCE X FPM}}{33,000}$
	BELT LENGTH	[1.57 X (DIA + DIA)] +(2 X CENTER DIST)
	MOTOR RPM SYNCHRONOUS	$\dfrac{120 \text{ X } 60 \text{ (HZ)}}{\text{NUMBER OF MOTOR POLES}}$
	PUMP MOTOR HP	$\dfrac{\text{GPM X HEAD IN FEET X SPEC GRAVITY}}{3960 \text{ X EFFICIENCY OF PUMP}}$
	FAN MOTOR HP	$\dfrac{\text{CFM X PRESSURE (LB/SQ FT)}}{33000 \text{ X EFFICIENCY}}$

Formulas and Constants

1 hp = 33,000 / Foot-pounds of work per minute.

1 hp = .746 K.W. = K.W. ÷ 1.341.

1 hp = 2,547 B.T.U. per hour.

1 B.T.U. = Heat required to raise 1 lb. water 1 ˚F.

1 B.T.U. = 777.6 / Foot-pounds work.

1 Kilowatt Hour = 3,415 B.T.U.

Heat Value of Carbon = 14,600 B.T.U. per pound.

Latent Heat of Fusion of Ice = 143.15 B.T.U per pound.

Latent Heat of Evaporation of Water at 212 ˚F.
 = 970.4 B.T.U. per pound.

Total Heat of Saturated Steam at Atmospheric Pressure
 = 1,150.4 B.T.U. per pound.

1 Ton of Refrigeration = 288,000 B.T.U. per 24 hours.

g = Acceleration of Gravity
 (commonly taken as 32.16 feet per second per second).

1 Radian = 57.296 degrees.

1 Meter = 100 cm. = 39.37 inches.

1 Kilometer = .62137 miles.

1 Gallon = 231 cubic inches.

1 Barrel = 42 gallons.

Atmospheric Pressure = 14.7 pounds per sq. in.
 = 29.92 inches mercury at 32 ˚F.

1 Lb. Per Sq. In. Pressure = 2.3095 feet fresh water at 62 ˚F.
 = 2.0355 inches mercury at 32 ˚F.
 = 2.0416 inches mercury at 62 ˚F.

Water Pressure (pounds per sq. in.)
 = .433 X height of water in feet (Fresh water at 62 ˚F).

Weight of 1 cu. ft. Fresh Water
 = 62.355 lbs. at 62 ˚F. = 59.76 lbs. at 212 ˚F.

Weight of 1 cu. ft. Air at 14.7 lbs. per sq. in. Pressure
 = .07608 lbs. at 62 ˚F = .08073 lbs. at 32 ˚F.

Horsepower

SPEED, in the science of bearing application and power transmission, is expressed in terms of the revolutions per minute (rpms) of a rotating object.

VELOCITY is speed in a designated direction and is usually expressed in terms of feet per minute (fpm).

FORCE is the element that produces a change in the velocity of an object. It is usually expressed in pounds.

WORK occurs when a force moves an object through a distance. It is usually expressed in foot-pounds or inch-pounds.

POWER is the rate of doing work. It is usually expressed in foot-pounds per minute (fppm).

HORSEPOWER is the unit of power. It is the power required to lift 33,000 pounds one foot in one minute.

Illustration of Horsepower

$$\frac{33,000\# \times 1}{33,000} = 1\ hp \qquad \frac{1,000\# \times 33}{33,000} = 1\ hp$$
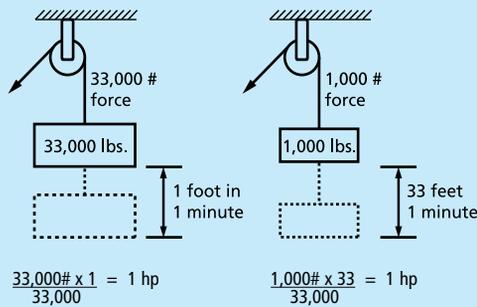
A **POUND-FOOT** is the moment created by a force of one pound applied to the end of a lever arm one foot long. Pound-feet indicate torque.

Example:
25 hp at 150 rpm = 10,504 Pound-Inches Torque
25 hp at 1.50 rpm = 1,050,400 Pound-Inches Torque
2.5 hp at 1.50 rpm = 105,040 Pound-Inches Torque

$$HORSEPOWER\ (hp) = \frac{pounds\ (\#) \times feet}{33,000 \times no.\ minutes}$$

$$hp = \frac{Force\ (lb\text{-}in) \times fpm}{33,000}$$

$$hp = \frac{Torque\ (in\ lb\text{-}in) \times rpm}{63,025}$$

$$hp = \frac{Torque\ (in\ lb\text{-}ft) \times rpm}{5,252}$$

Torque

TORQUE is the turning moment or twisting effort in a shaft or an object that tends to cause rotation. It is the measure of rotational force and is expressed in foot-pounds.

Torque = force in pounds x radius in inch or foot

$$Torque\ (pound\text{-}inch) = \frac{63,025 \times hp}{rpm}$$

$$Torque\ (pound\text{-}foot) = \frac{5,252 \times hp}{rpm}$$

$$Horsepower = \frac{TORQUE\ (lb\text{-}in) \times rpm}{63,025}$$

$$Horsepower = \frac{TORQUE\ (lb\text{-}ft) \times rpm}{5,252}$$

HORSEPOWER TO TORQUE CONVERSION TABLE
Torque lb-in @ 1 hp

rpm	LB-IN	rpm	LB-IN	rpm	LB-IN	rpm	LB-IN
3450	18	580	109	68	927	7.5	8,403
3000	21	520	121	56	1,125	6	10,504
2500	25	420	150	45	1,401	4.7	13,410
2000	32	350	180	37	1,703	4	15,756
1750	36	280	225	30	2,101	3.2	19,695
1430	44	230	274	25	2,521	2.7	23,343
1170	54	190	332	20	3,151	2.2	28,648
950	66	155	407	16.5	3,820	1.8	35,014
870	72	125	504	13.5	4,669	1.5	42,017
780	81	100	630	11	5,730	1.2	52,521
640	98	84	750	9	7,003	1	63,025

To compute torque at any horsepower, multiply torque values above by horsepower required.

Example:
10 hp @ 580 rpm, torque = 10 x 109, or 1,090 lb-ins
1/2 hp @ 100 rpm, torque = 1/2 x 630, or 315 lb-ins

For intermediate speeds, approximate the torque from table, or apply standard torque formula above.

Electrical Formulas

Drive System Electrical Formulas

NEED TO FIND	FORMULA
HORSEPOWER – DC	$\dfrac{\text{VOLTS X AMPS X EFFICIENCY}}{746}$
HORSEPOWER – AC	$\dfrac{\text{VOLTS X AMPS X 1.732 X EFF X PF}}{746}$
WATTS-DC	VOLTS X AMPS
WATTS-AC	VOLTS X AMPS X PF X 1.732
KILOWATTS	$\dfrac{\text{VOLTS X AMPS X PF X 1.732}}{1000}$
AMPERES (DC)	$\dfrac{\text{WATTS}}{\text{VOLTS}}$
AMPERES (AC)	$\dfrac{\text{746 X HORSEPOWER}}{\text{VOLTS X EFF X PF X 1.732}}$
KVA	$\dfrac{\text{VOLTS X AMPS X 1.732}}{1000}$
PUMP MOTOR HP	$\dfrac{\text{GPM X HEAD IN FEET X SPEC GRAVITY}}{\text{3960 X EFFICIENCY OF PUMP}}$
FAN MOTOR HP	$\dfrac{\text{CFM X PRESSURE (LB/SQ FT)}}{\text{33000 X EFFICIENCY}}$

To Find	Alternating Current		Direct Current
	Single-Phase	**Three-Phase**	
Amperes when horsepower is known	$\dfrac{\text{hp X 764}}{\text{E X Eff X pf}}$	$\dfrac{\text{hp X 746}}{\text{1.73 X E X Eff = pf}}$	$\dfrac{\text{hp X 746}}{\text{E X Eff}}$
Amperes when kilowatts are known	$\dfrac{\text{Kw X 1000}}{\text{E X pf}}$	$\dfrac{\text{Kw X 1000}}{\text{1.73 X E X pf}}$	$\dfrac{\text{Kw X 1000}}{\text{E}}$
Amperes when Kva are known	$\dfrac{\text{Kva X 1000}}{\text{E}}$	$\dfrac{\text{Kva X 1000}}{\text{1.73 X E}}$	-
Kilowatts	$\dfrac{\text{I X E X pf}}{1000}$	$\dfrac{\text{1.73 X I X E X pf}}{1000}$	$\dfrac{\text{I X E}}{1000}$
Kva	$\dfrac{\text{I X E}}{1000}$	$\dfrac{\text{1.73 X I X E}}{1000}$	-
Horsepower = (Output)	$\dfrac{\text{I X E X Eff X pf}}{746}$	$\dfrac{\text{1.73 X I X E X Eff X pf}}{746}$	$\dfrac{\text{I X E X Eff}}{746}$

I = Amperes; E = Volts; Eff = Efficiency; pf = power factor;
Kva = Kilovolt Amperes; Kw = Kilowatts; R = Ohms.

To Find	Alternating or Direct Current
Amperes when voltage and resistance are known	$\dfrac{\text{E}}{\text{R}}$
Voltage when resistance and current are known	I R
Resistance when voltage and current are known	$\dfrac{\text{E}}{\text{I}}$

RULES OF THUMB

All Values At 100 % Load

1 hp = 746 Watts or (.746 Kilowatts)

At 3,600 rpm, a motor develops 18 lb.-in. per hp
At 1,800 rpm, a motor develops 36 lb.-in. per hp
At 1,200 rpm, a motor develops 54 lb.-in. 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