Electrical Formulas

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To Find	Alternating Current	
	Single-Phase	Three-Phase
Amperes when horsepower is known	$\frac{Hp \times 746}{E \times Eff \times pf}$	$\frac{Hp \times 746}{1.73 \times E \ \ Eff \times pf}$
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)	$\frac{I \times E \times Eff \times pf}{746}$	$\frac{1.73 \times I \times E \times Eff \times pf}{746}$

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

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

General Information (Approximation)

All values at 100% Load

- At 1800 rpm, a motor develops 36 lb. -In. Per hp
- At 1200 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 amps per hp
- At 230 volts, a 3-phase motor draws 2.5 amps per hp
- At 230 volts, a single-phase motor draws 5 amps per hp
- At 115 volts, a single-phase motor draws 10 amps per hp

Temperature Conversion:
Deg C = (Deg F -32) X 5/9
Deg F = (Deg C X 9/5) + 32

Calculating Yearly Energy Savings

Savings = (Hours Operation/ Year) (Power Cost) (* Kilowatts Saved)

*Kw saved = HP x .746 $\left[\frac{1}{\text{Std. Eff.}} - \frac{1}{\text{XE Eff.}} \right]$

EXAMPLE: 25 HP, 1800 RPM, TEFC, XE vs. Std. Eff. Price Premium @ User

Payback = $\frac{\text{XE Net \$1396 - Std. Eff. Net. \$1061}}{\text{(7200 Hrs/Year) (\$.05/Kwh) (1.6289 Kw)}}$ =

Motor Amps @ Full Load*

HP	Alternating Current		DC	HP	Alternating Current		DC	HP	Alternating Current		DC	HP	Alternating Current		DC
	Single-Phase	3-Phase			Single-Phase	3-Phase			Single-Phase	3-Phase			Single-Phase	3-Phase	
	4.9	2.0	2.7	5	28	14.4	20	25	-	60	92	75	-	180	268
1	8.0	3.4	4.8	7	40	21.0	29	30	-	75	110	100	-	240	355
1	10.0	4.8	6.6	10	50	26.0	38	40	-	100	146	125	-	300	443
2	12.0	6.2	8.5	15	-	38.0	56	50	-	120	180	150	-	360	534
3	17.0	8.6	12.5	20	-	50.0	74	60	-	150	215	200	-	480	712

* Values are for all speeds and frequencies @ 230 volts.
Amperage other than 230 volts can be figured:

$V = \frac{230 \times \text{Amp from Table}}{\text{New Voltage}}$

EXAMPLE:
For 60 hp, 3-phase @ 550 volts: $\frac{(230 \times 150)}{550}$ = 62 amps.

NEMA Electrical Enclosure Types

Type	Description	Type	Description
NEMA Type 1 (General Purpose)	For indoor use wherever oil, dust or water is not a problem.	NEMA Type 5 Dust Tight (Non-Hazardous)	Used for excluding dust. (All NEMA 12 and JIC enclosures are usually suitable for NEMA 5 use).
NEMA Type 2 (Driptight)	Used indoors to exclude falling moisture and dirt.	NEMA Type 9 Dust Tight (Hazardous) ‡	For locations where combustible dusts are present.
NEMA Type 3 (Weatherproof)	Provides protection against rain, sleet and snow.	NEMA Type 12 (Industrial Use)	Used for excluding oil, coolant, flying dust, lint, etc.
NEMA Type 4 (Watertight) **	Needed when subject to great amounts of water from any angle-such as areas which are repeatedly hosed down.		

Note: Joint Industry Conference (JIC) enclosures are similar in design to NEMA 12's.
For more complete details see NEMA or JIC Standards for enclosures.

** Not designed to be submerged.
‡ Class II Groups E, F, and G.