Electrical Formulas

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; R = Ohms

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	$\frac{E}{I}$

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 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

Temperature Conversion:

Deg C = (Deg F - 32) x ⅝
Deg F = (Deg C x ⅝) + 32

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	
½	4.9	2.0	2.7	5	28	14.4	20	25	....	60	92	75	....	180	268
1	8.0	3.4	4.8	7½	40	21.0	29	30	....	75	110	100	....	240	355
1½	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.

Power Factor estimated @ 80% for most motors. Efficiency is usually 80-90%.

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.