

Useful Motor Formulas

Nominal Input Power

The nominal power of an electric motor is that given to the shaft at nominal voltage and frequency in continuous duty (S1). The unit of power is kW or HP and they are related as follows:

$$1 \text{ HP} = 0.736 \text{ kW (at 50Hz)}$$

$$1 \text{ HP} = 0.746 \text{ kW (at 60Hz)}$$

Continuous Duty S1

Constant load running with life at least sufficient to reach the thermic equilibrium. Running with a continuous overload is not scheduled in the specifications. With correct voltage and frequency an overload capacity of 106% (min.) of the nominal torque for 2 minutes is permitted. If the overload is higher then the time must be reduced proportionally.

Voltage and Supply Frequency

CEI 2-3 and IEC 34-1 specifications allow a nominal voltage change of $\pm 5\%$ and a max. temperature rise of 10°C higher than the permissible values of the different insulation classes.

The motors wound at 50 Hz for a certain voltage, can be used without modifications at 60 Hz but the characteristics will change in accordance with the example in the table below.

	<i>Voltage</i>	<i>Power</i>	<i>Power</i>	<i>Current</i>	<i>RPM</i>
At 50 Hz	380 V	11 kW	15 HP	23 A	1450
Conversion ratios	—	1.15	1.15	1.0	1.20
At 60 Hz	440 V	12.7 kW	17.3 HP	23 A	1740

Note: A motor wound for use at 60 Hz cannot be used at 50 Hz. The current increase can damage the motor and become a fire hazard.

Approximate Motor Full-Load Current Rating

Ampères

Three Phase Induction Motors
60 cycles
full load current

HP	RPM	230V	460V	575V
1/4	1800	.96	.48	.38
1/3	1800	1.16	.58	.47
1/2	1800	1.68	.84	.67
3/4	1800	2.33	1.17	.93
1	3600	2.75	1.38	1.10
	1800	3.05	1.53	1.22
1-1/2	3600	4.17	2.09	1.67
	1800	4.28	2.14	1.71
2	3600	5.56	2.78	2.22
	1800	5.76	2.88	2.30
3	3600	7.87	3.94	3.14
	1800	8.29	4.14	3.32
5	3600	12.7	6.34	5.08
	1800	13.2	6.60	5.28
7-1/2	3600	19.2	9.6	7.68
	1800	19.3	9.7	7.72
10	3600	24.5	12.3	9.8
	1800	25.2	12.6	10.1
15	3600	36.7	18.4	14.7
	1800	50.5	25.3	20.2
25	3600	59.2	29.6	23.6
	1800	62.7	31.3	25.0
30	1800	72.8	36.4	29.2
	1200	771.	38.6	30.8
40	1800	98	49.0	39.2
	1200	99	49.5	39.6
50	1800	121	60.5	48.4
	1200	122.	61.0	48.8
60	1800	143	71.5	57.2
	1200	148	74.0	59.2
75	1800	178	89.0	71.2
	1200	181	90.5	72.4
100	1800	233	116	93.2
	1200	239	120	95.6
125	1800	289	144	115
	1200	298	149	119
150	1800	346	173	138
	1200	350	175	140
200	1800	460	230	184
	1200	466	233	186
250	1800	572	286	229
	1200	580	290	232
300	1800	685	343	274
	1200	696	348	278

Single Phase Induction Motors
60 cycles
full load current

HP	RPM	115V	230V
1/8	3600	2.52	1.26
	1800	2.80	1.40
1/6	3600	2.88	1.44
	1800	3.20	1.60
1/4	3600	4.00	2.00
	1800	4.60	2.30
1/3	3600	4.70	2.35
	1800	5.20	2.60
1/2	3600	6.50	3.25
	1800	7.40	3.70
3/4	3600	9.05	4.52
	1800	10.20	5.10
1	3600	11.70	5.85
	1800	13.00	6.50
1-1/2	3600	17.80	8.90
	1800	18.40	9.20
2	3600	23.00	11.50
	1800	24.00	12.00
3	3600	32.30	16.15
	1800	34.00	17.00
5	3600	54.00	27.00
	1800	56.00	28.00
7-1/2	3600	79.20	39.60
	1800	80.00	40.00
10	3600	97.50	48.75
	1800	100.00	50.00