



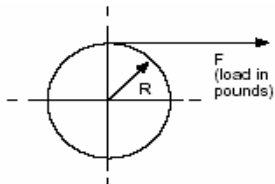
... "A Winch For Every Application"

Mechanical Engineering Formulae

POWER AND TORQUE IMPERIAL STANDARDS

HORSEPOWER (HP)

Common unit of mechanical power, one HP is the rate of work required to raise 33,000 pounds one foot in one minute.



R = Radius (inches)
RPM = Rotational Speed (revolutions per minute)

$$HP = \frac{F \times \pi \times 2R \times RPM}{33000 \times 12}$$

or

$$HP = \frac{F \times R \times RPM}{63025}$$

or

$$HP = \frac{\text{torque} \times RPM}{63025}$$

ONE IMPERIAL HORSEPOWER EQUALS

- 33,000 foot pounds per minute.
- 36 inch pounds torque at 1750 RPM.
- .746 Kilowatts.
- 1.014 Metric Horsepower. (PS)
- 42.4 BTU per Minute.

TORQUE (T)

Torque is a twisting force. Torque causes rotation of a shaft, or it will set up a twist in a stationary shaft. It is generally expressed in foot pounds or in inch pounds. Torque is measured by the load or pull and by the distance of the pull from the center of a shaft.

$$T = F \times R$$

or

$$T = \frac{HP \times 63025}{RPM}$$

CALCULATION EXAMPLES

A cable wrapped around a 6" dia. drum must lift a 2500 pound weight. The drum rotates at 30 RPM.

TO CALCULATE HP:

$$HP = \frac{F \times R \times RPM}{63025}$$

$$HP = \frac{2500 \times 3 \times 30}{63025}$$

$$HP = 3.57$$

TO CALCULATE T:

$$T = F \times R$$

$$T = 2500 \times 3"$$

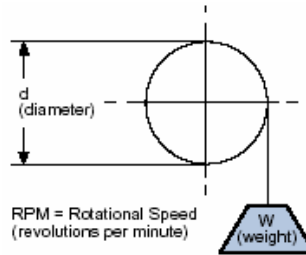
$$T = 7500 \text{ inch pounds}$$

METRIC (SI) STANDARDS

POWER (P)

The basic unit power measurement in the metric (SI) system is the Watt.

1000 Watts = 1 Kilowatt (kW)



RPM = Rotational Speed (revolutions per minute)

Constant g = acceleration of free fall 9.81 m/s²
V = velocity in meters/sec.

$$V = \frac{\pi d \cdot RPM}{60}$$

TORQUE (M)

Torque is a twisting force. Torque causes rotation of a shaft, or it will set up a twist in a stationary shaft. It is generally expressed in Newton-Meters.

$$M = \frac{9550 \cdot P}{RPM}$$

SI SYMBOLS

- M = Torque P = Power in Kilowatts
- N = Newton Kgfm = Kilogram force meter
- m = Meter N - m = Torque in Newton-Meters
- = Multiplication Symbol

CALCULATION EXAMPLES

A cable wrapped around a .5 meter dia. drum must lift 5000 kilograms of weight. The drum rotates 50 RPM.

TO CALCULATE P:

Power in Kilowatts

$$P = \frac{W \cdot q \cdot V}{1000}$$

$$P = \frac{5000 \cdot 9.81 \cdot \frac{\pi \cdot 5 \cdot 50}{60}}{1000}$$

$$P = 64.2 \text{ kilowatts}$$

TO CALCULATE M:

Torque in Newton-Meters

$$M = \frac{9550 \cdot 64.2}{50}$$

$$M = 12262 \text{ Nm}$$

Conversion Factors				
1 kilowatt =	1 N - m =	1 kgfm =	1 lb ft =	1 lb in =
1.341	.10197 kgfm	9.807 N - m	1.356 N - m	.1129 N - m
Imperial	.73756 lb ft	7.233 lb ft	.1883 kgfm	.0115 kgfm
Horsepower	8.8507 lb in	86.796 lb in	12 lb in	.083 lb ft

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