

Motor Sizing

Proper Motor Sizing



Benefits

- Saves energy
- Reduces downtime
- Maximize motor efficiency
- Save \$\$ - buy what you need

Material courtesy of Robert Repas, Machine Design

Types of Loads

1. Constant Torque
 - Blowers
2. Instantaneous Torque
 - Pipes falling onto rollers
3. Variable Torque
 - Slurry pump



Duty Cycle

1. Motors are rated by output power produced over time without overheating.
2. Duty cycle is the ratio of time the motor produces rated power divided by the total elapsed time.
3. Motors are produced with different duty cycles to match load types.
4. Motors with $< 100\%$ duty must turn off for a specified time – max run time
ex. 50% duty – run 30 mins then off 30 mins

Motor nameplate includes duty cycle and max run time if $< 100\%$ duty.

SIEMENS					
PE•21 PLUS™			PREMIUM EFFICIENCY		
ORD. NO.	1LA02864SE41		SERIAL NO.		
TYPE	RGZESD		FRAME	286T	
H. P.	30.00		SERVICE FACTOR	1.15	3 PH
AMPS	34.9		VOLTS	460	
R.P.M.	1765		HERTZ	60	
DUTY	CONT		40°C AMB.		DATE CODE
CLASS INSUL.	F	NEMA DESIGN	B	KVA CODE	G
				NEMA NOM. EFF.	93.6
SH. END BRG.	50BC03JPP3		OPR. END BRG.	50BC03JPP3	
MILL AND CHEMICAL DUTY QUALITY INDUCTION MOTOR					
Siemens Energy & Automation, Inc. Little Rock, AR				MADE IN U.S.A.	

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Horsepower Equations

Pumps

$$hp = \frac{Q \times H \times s}{3960 \times Eff}$$

Q = liquid flow (gal/min)

H = head (ft)

s = specific gravity (water = 1)

Eff = per unit efficiency of the pump

Fan and Blowers

$$hp = \frac{Q \times P}{229 \times Eff}$$

Q = air flow (cubic ft/min)

P = pressure (lb/in²)

Eff = per unit efficiency of the fan

Lifting

$$hp = \frac{W \times H}{550 \times t}$$

W = weight (lb)

H = height (ft)

t = time (sec)

Linear (sliding or rolling)

$$hp = \frac{W \times K \times d}{550 \times t}$$

W = weight (lb)

K = coefficient of friction

d = distance (ft)

t = time (sec)

Rotating

$$hp = \frac{T \times rpm}{5,252}$$

T = torque (lb-ft)

rpm = speed (rev / min)

Formulas courtesy of Schneider Electric

Sizing Tips for Constant Torque Load

- Determine the load from the driven unit or measure the torque.
- Choose a motor so that the load is within 75-100% of motor rating.
- May size to 95% of motor rating – max efficiency

As the speed decreases, the torque decreases with the square of the speed and the horsepower decreases with the cube of the speed.



Sizing Tips for Variable Torque Load

- Loads that vary slowly from 20% to 100%
- Sized for the highest continuous load (typically highest speed) .
- Important to know peak load and duration.
- Duty cycle must be longer than peak duration, motor bigger than peak load.

As the speed changes, the load torque remains constant and the horsepower changes linearly with speed.

