

Definitions

SPM = Strokes per Minute RPM = Revolutions per Minute-Prime Mover FPM = Feet per Minute R = Gear Reducer Ratio D = Gear Reducer Sheave Pitch Diameter(<i>inches</i>) d = Prime Mover Sheave Pitch Diameter(<i>inches</i>) v = Belt Velocity, Feet per Minute $\pi = (\text{Pi}) 3.1416$	PI = Belt Pitch Length (<i>inches</i>) CD = Shaft Center Distance (<i>inches</i>) U = see General Dimensions V = see General Dimensions AB = see General Dimensions UU = see General Dimensions VV = see General Dimensions AA = see General Dimensions	b - Prime Mover Backing (vertical distance from mounting feet to center of shaft) (<i>inches</i>) HP = Horse Power BPD = Barrels per Day at 100% Pump Efficiency Depth = Pump Setting (<i>feet</i>) L = Stroke Length (<i>inches</i>)
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Strokes Per Minute

Formula	Example
$\text{SPM} = \frac{\text{RPM}}{R} \times \frac{d}{D}$	$\text{SPM} = \frac{1170}{30.12} \times \frac{12}{47} = 9.9$

Where: SPM = 1170 Revolutions per Minute of Prime Mover
 R = 30.12 Ratio (320D Gear Reducer)
 d = 12" Pitch Diameter of Prime Mover Sheave
 D = 47" Pitch Diameter of Gear Reducer Sheave

Prime Mover Sheave Diameter

Formula	Example
$d = \frac{\text{SPM} \times R \times D}{\text{RPM}}$	$d = \frac{12 \times 30.12 \times 47}{1170} = 14.5 \text{ inches}$

Where: SPM = 12 Strokes per Minute
 R = 30.12 Ratio (320D Gear Reducer)
 D = 47" Pitch Diameter of Gear Reducer Sheave
 RPM = 1170 Revolutions per Minute of Prime Mover

Use nearest size available depending upon belt section and number of grooves in sheave.

Belt Velocity

Formula	Example
$v = \frac{\pi \times d \times \text{RPM}}{12}$	$v = \frac{3.1416 \times 14.5 \times 1170}{12} = 4441 \text{ FPM}$

Where: d = 14.5 inch Pitch Diameter
 RPM = 1170 Revolutions per Minute of Prime Mover
 Limit between 2000 and 5000 feet per minute (FPM)
 Belt Velocity less than 2000 FPM results in poor belt life. Belt Velocity greater than 5000 FPM requires dynamically balanced sheaves.

Belt Length

Formula
$PL = 2CD + 1.57(D + d) = \frac{(D-d)^2}{4 \times CD}$
Example
$PL = 2 \times 66.21 + 1.57(47 + 14.5) = \frac{(47-14.5)^2}{4 \times 66.21} = 232.96 \text{ inches}$

Where: CD = 66.21 inch Center Distance of Shafts
 D = 47 inch Pitch Diameter of Gear Reducer Sheave
 d = 14.5 inch Pitch Diameter of Prime Mover Sheave

Use nearest belt size available depending on type of sheave selected.

Center Distance

Formula	Also
$CD = \sqrt{\left(U + \frac{V}{2}\right)^2 + (AB - b)^2}$	$CD = \sqrt{\left(UU + \frac{VV}{2}\right)^2 + (AA - b)^2}$

Example: Assumes Hi-Prime Electric Motor Driven C-320D-256-100 Conventional Unit

$$CD = \sqrt{\left(31 + \frac{33.25}{2}\right)^2 + (54 - 8)^2} = 66.21 \text{ inches}$$

Where: UU = 31 (see General Dimensions)
 VV = 33.25 (see General Dimensions)
 AA = 54 (see General Dimensions)
 b = 8 (assume 25 HP, Frame 324T Motor)

Horsepower of Prime Mover (these values are approximate)

Formula A	Formula B
$\text{HP} = \frac{\text{BPD} \times \text{Depth}}{56000}$	$\text{HP} = \frac{\text{BPD} \times \text{Depth}}{45000}$

Example: Assumes High Slip (NEMA D) Motor.

$$\text{HP} = \frac{217 \times 5600}{56000} = 21.7 \text{ (Use 25 HP motor)}$$

Where: BPD = 217 @ 1--% Pump Efficiency
 Depth = 5600 feet, Pump Setting

Formula A: For high slip (NEMA D) electric motors and slow speed engines.
 Formula B: For normal slip electric motors and multi-cylinder engines.

Multiply HP by 0.8 for Mark II units.

Maximum Strokes per Minute (based on the free fall speed of the rod)

Formula
Conventional Units: Air Balanced Units: Mark II Units:

Example: Assumes a C-320D-256-100 Conventional Unit.

$$\text{SPM} = .7 \sqrt{\frac{60000}{L}} \quad \text{SPM} = .63 \sqrt{\frac{60000}{L}} \quad \text{SPM} = .56 \sqrt{\frac{60000}{L}}$$

$$\text{SPM} = .7 \sqrt{\frac{60000}{100}} = 17.15 \text{ SPM Maximum}$$