FORMULAS

TO DETERMINE SELECTION

1) How to calculate torque when horsepower and speed are known

$$\text{torque ft lb} = \frac{5252 \text{ x horsepower x service factor}}{\text{speed}} \qquad T = \frac{5252 \text{ x hp x k}}{n}$$

2) Inertia - How to determine inertia when material and shape are known.

(Total system inertia is total inertia of all the components. If the components are not simple shafts or flanges, break down each of the components into its basic shape and calculate inertia of that individual component. When inertia is being calculated in relation to the clutch or brake, remember to adjust for reflected inertia amounts which may have a significant increase or decrease on the inertia that the clutch has to handle based upon a speed differential.)

(Inertia constants lb. in.^{3})

ρ (aluminum) = 0.0924

ρ (bronze) = 0.321

ρ (cast iron) = 0.26

ρ (steel) = 0.282

Values

wk^2 = lb. ft.^{2}

D, D_0, D_1, L = in.

Formula to determine inertia of a solid shaft

$wk^2 = .000681 \text{ x p x Length x Diameter}^4$

$wk^2 = .000681 \text{ x p x L x } D^4$

Formula to determine inertia of a hollow shaft

$wk^2 = .000681 \text{ x p x length x (outer diameter}^4 - \text{inner diameter}^4)$

$wk^2 = .000681 \text{ x P x L x } (D_O{}^4 - D_I{}^4)$

Reflected inertia via gears, chain or belt

reflected inertia = load inertia divided by the square of the speed ratio

$$wk^2_R = \frac{wk^2_L}{r^2}$$

3) How to calculate the amount of torque required to accelerate or decelerate a load when inertia value is known (t = time to speed or time to stop depending if you are using a clutch or a brake.)

$$\text{torque ft lb} = \frac{\text{(inertia x the change in rpm)}}{308 \text{ x the time required}} \qquad T = \frac{wk^2 \text{ x } \Delta \text{ rpm}}{308t}$$

4) Heat Dissipation

Quick reference for determining slip watts for magnetic particle applications. (Magnetic particle clutches are normally limited to heat dissipation rather than torque when they are involved in a constant slip application.)

$$\text{watts} = .0118 \text{ x torque in inch lbs. x the change in rpm} \qquad W = .0118 \text{ x t x } \Delta \text{ rpm}$$

5) Linear Speed to Rotational Speed

$$\text{RPM} = \frac{\text{speed in feet per minute}}{3.14 \text{ x diam. in feet}} \qquad \text{RPM} = \frac{\text{FPM}}{3.14 \text{ x D}}$$