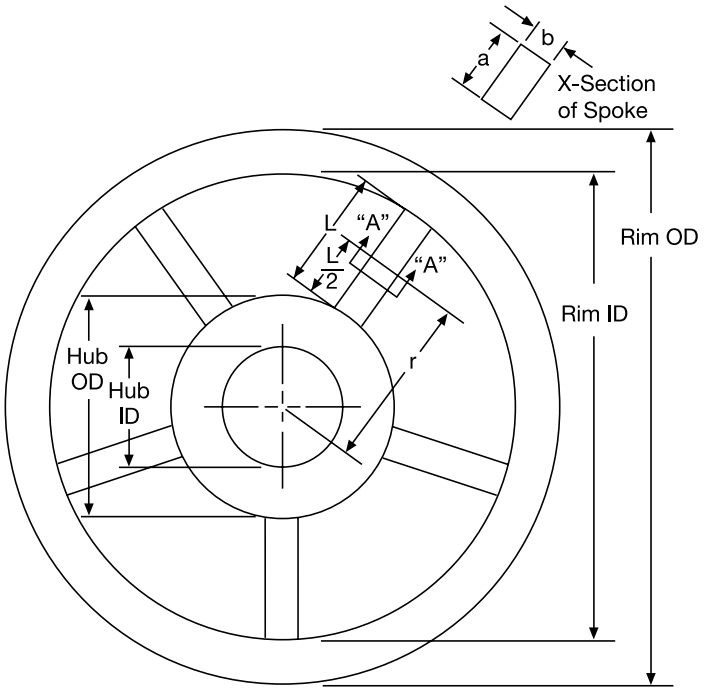
Engineering Data

How to Calculate Inertia (WR^2) of a Spoked Wheel



$$WR^2_S \text{ of Spokes} = \left[\left(\frac{b^2 + L^2}{1728}\right) + \left(\frac{r^2}{144}\right)\right] \text{ x (wt of Spokes) x (No. of Spokes), lb.ft.}^2$$

$$WR^2 \text{ of Rim} = \left[\frac{(\text{Rim OD})^2 + (\text{Rim ID})^2}{1152}\right] \text{ x (wt of Rim), lb.ft.}^2$$

$$WR^2 \text{ of Hub} = \left[\frac{(\text{Hub OD})^2 + (\text{Hub ID})^2}{1152}\right] \text{ x (wt of Hub), lb.ft.}^2$$

$$\text{Total Flywheel Inertia} = WR^2_S + WR^2_R + WR^2_H$$

Note: All dimensions are in inches.

Clutch heat horsepower absorption rate

Absorption rate/in.² of lining area. For one stop at 70°F ambient temperature.

Slip time seconds		0 to 1	2	3	4	5	6	7	8	9	10
Heat Input	lb.ft./in.²	380	617	820	1000	1175	1330	1485	1630	1770	1900
	HP/in.²	.7	.56	.5	.45	.43	.4	.38	.37	.36	.34
	btu/in.²	.49	.79	1.05	1.29	1.51	1.71	1.91	2.09	2.27	2.4

Consult factory for slip time over 10 seconds.

Engineering Formulas

Definitions

T	Torque-The moment of a system tends to cause rotation lb.in. % forces.
WR^2	Inertia-weight times radius of gyration^2 lb.ft.^{2}
PSI	Pounds per square inch.
Wt.	Weight-lbs.
Btu	British Thermal Unit = 778 lb.ft. or one Btu.
CPM	Cycles per minute.
CF	Coefficient of friction.
C°	Degrees Celcius.
F°	Degrees Fahrenheit.
LN	Natural base log.
K and U	Inflation coefficients for specific clutch and brake. See specification tables.
R, E and V	Exhaust coefficient for specific clutch and brake. See specification tables.
KW	Keyway.
RPM	Revolutions per minute.
t	Seconds.
TIR	Total Indicator run out.
V	Volume-in^3.
HP	Given amount of work in a specific time. 1 horsepower = 33,000 lb.ft. per minute.

Formulas

Torque lb. in. = $\frac{(HP)\ (63{,}000)}{RPM}$

Horsepower HP = $\frac{(\text{Torque lb.in.})\ (RPM)}{(63{,}000)}$

Acceleration Torque (lb.in.) = $\frac{(WR^2)\ (RPM)}{(25.6)(t)}$

t= time in seconds for acceleration or deceleration.

HP/100 RPM = $\frac{(HP)\ (100)}{(RPM)} = \frac{\text{Required Torque lb.in.}}{(630)}$

Required Unit PSI = $\frac{(\text{Unit required Torque lb.in.})\ (100\ PSI)}{(\text{Unit rated torque lb.in.})}$

Contact velocity FPM = $\frac{(\text{Unit diameter in.})\ (\pi)(RPM)}{(12)}$

Unit heat HP = $\frac{(\text{Total } WR^2)\ (RPM)^2\ (CPM)}{1.9 \times 10^8}$

Engineering Data

Tension Value Charts

Material	Tension (lb.in. of web width)
Steel foils	1.5 to 4
Aluminum foils	0.5 to 1.5 (1.0 aver.)/mil
Cellophanes	0.5 to 1.0/mil
Acetate	0.5/mil
Mylar (Polyester)	0.25 to 0.30/mil
Polyethylene	0.25 to 0.30/mil
Polypropylene	0.25 to 0.30/mil
Polystyrene	1.0/mil
Saran	0.05 to 0.20 (0.10 aver.)/mil
Vinyl	0.05 to 0.20 (0.10 aver.)/mil
Paper and Laminations	
20#/R—32.54 gm/m2	0.50 to 1.0
40#/R—65.08 gm/m2	1.0 to 2.0
60#/R—97.62 gm/m2	1.5 to 3.0
80#/R—130.0 gm/m2	2.0 to 4.0
Paper	
15 lbs./ream (3000 sq.ft.)	0.5
20 lbs./ream	0.75
30 lbs./ream	1.0
40 lbs./ream	1.5
80 lbs./ream	2.5
Laminations	
25 LB. PAPER/.005 PE/.00035" FOIL/.001"PE	3.0
.001" Cello/.0005"PE/.001" Cello	1.5
When these substrates are coated with polyethylene, nylon polypropylene EVA, EAA, and EEA, add the following tension to the values listed above for the substrate only.	
Coating Thickness	
0.0005" to 0.0001	0.12
0.0011" to 0.002	0.25
Cellophane	
.00075"	0.5
.001"	0.75
.002"	1.0

Material	Tension (lb.in. of web width)
Nylon and Cast Propylene (non-Oriented)	
.00075"	0.15
.001"	0.25
.002"	0.5
Mylar and Oriented Propylene	
0.0005"	0.25
0.001"	0.5
0.002"	1.0
Paperboard	
8 pt.	3.0
12 pt.	4.0
15 pt.	5.0
20 pt.	7.0
25 pt.	9.0
30 pt.	11.0
Material	**Tension (lb./strand)**
Aluminum Wire	
#20 AWG	4.00
#18 AWG	5.50
#16 AWG	9.00
#14 AWG	10.00
#12 AWG	12.00
#10 AWG	15.00
#8 AWG	25.00
Copper Wire	
#20 AWG	8.00
#18 AWG	10.00
#16 AWG	12.00
#14 AWG	15.00
#12 AWG	18.00
#10 AWG	20.00
#8 AWG	25.00