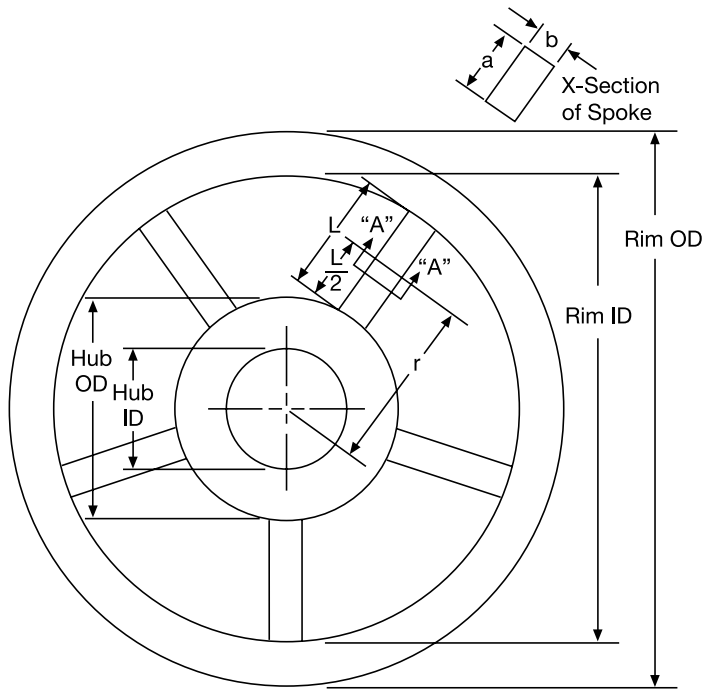


# Engineering Data

## How to Calculate Inertia (WR<sup>2</sup>) of a Spoked Wheel



$$WR_{2S} \text{ of Spokes} = \left[ \left( \frac{b^2 + L^4}{1728} \right) + \left( \frac{r^2}{144} \right) \right] \times (\text{wt of Spokes}) \times (\text{No. of Spokes}), \text{ lb.ft.}^2$$

$$WR_2 \text{ of Rim} = \left[ \frac{(\text{Rim OD})^2 + (\text{Rim ID})^2}{1152} \right] \times (\text{wt of Rim}), \text{ lb.ft.}^2$$

$$WR_2 \text{ of Hub} = \left[ \frac{(\text{Hub OD})^2 + (\text{Hub ID})^2}{1152} \right] \times (\text{wt of Hub}), \text{ lb.ft.}^2$$

$$\text{Total Flywheel Inertia} = WR_{2S} + WR_{2R} + WR_{2H}$$

**Note:** All dimensions are in inches.

### Clutch heat horsepower absorption rate

Absorption rate/in.<sup>2</sup> 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	$\frac{\text{lb.ft.}}{\text{in.}^2}$	380	617	820	1000	1175	1330	1485	1630	1770	1900
	$\frac{\text{HP}}{\text{in.}^2}$	.7	.56	.5	.45	.43	.4	.38	.37	.36	.34
	$\frac{\text{btu}}{\text{in.}^2}$	.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.



### Definitions

T	Torque-The moment of a system tends to cause rotation lb.in. % forces.
WR <sup>2</sup>	Inertia-weight times radius of gyration <sup>2</sup> lb.ft. <sup>2</sup>
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 <sup>3</sup> .
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 = $\frac{(\text{Unit required Torque lb.in.}) (100 \text{ PSI})}{(\text{Unit rated torque lb.in.})}$
Contact velocity FPM = $\frac{(\text{Unit diameter in.}) (\pi)(RPM)}{(12)}$
Unit heat HP = $\frac{(\text{Total } WR^2) (RPM)^2 (CPM)}{1.9 \times 10^6}$

# 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
<b>Paper and Laminations</b>	
20#/R—32.54 gm/m <sup>2</sup>	0.50 to 1.0
40#/R—65.08 gm/m <sup>2</sup>	1.0 to 2.0
60#/R—97.62 gm/m <sup>2</sup>	1.5 to 3.0
80#/R—130.0 gm/m <sup>2</sup>	2.0 to 4.0
<b>Paper</b>	
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
<b>Laminations</b>	
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.	
<b>Coating Thickness</b>	
0.0005" to 0.0001	0.12
0.0011" to 0.002	0.25
<b>Cellophane</b>	
.00075"	0.5
.001"	0.75
.002"	1.0

Material	Tension (lb.in. of web width)
<b>Nylon and Cast Propylene (non-Oriented)</b>	
.00075"	0.15
.001"	0.25
.002"	0.5
<b>Mylar and Oriented Propylene</b>	
0.0005"	0.25
0.001"	0.5
0.002"	1.0
<b>Paperboard</b>	
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)
<b>Aluminum Wire</b>	
#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
<b>Copper Wire</b>	
#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