

Sheave Size & Wire Rope Strength

Strength Efficiency

Bending wire rope reduces its strength. To account for the effect of bend radius on wire rope strength when selecting a sheave, use the table below:

Ratio A	Strength Efficiency Compared to Catalog Strength in %
40	95
30	93
20	91
15	89
10	86
8	83
6	79
4	75
2	65
1	50

$$\text{Ratio A} = \frac{\text{Sheave Diameter}}{\text{Rope Diameter}}$$

Example

To determine the strength efficiency of 1/2" diameter wire rope using a 10" diameter sheave:

$$\text{Ratio A} = \frac{10'' \text{ (sheave diameter)}}{1/2'' \text{ (wire rope diameter)}} = 20$$

Refer to ratio A of 20 in the table then check the column under the heading "Strength Efficiency Compared to Catalog Strength in %"...91% strength efficiency as compared to the catalog strength of wire rope.

Fatigue Life

Repeated bending and straightening of wire rope causes a cyclic change of stress called "fatiguing." Bend radius affects wire rope fatigue life. A comparison of the relative effect of sheave diameter on wire rope fatigue life can be determined as shown below:

Ratio B	Relative Fatigue Bending Life
30	10.0
25	6.6
20	3.8
18	2.9
16	2.1
14	1.5
12	1.1

$$\text{Ratio B} = \frac{\text{Sheave Diameter}}{\text{Rope Diameter}}$$

$$\text{Relative Fatigue Bending Life} = \frac{\text{Relative Fatigue Bending Life Sheave \#1}}{\text{Relative Fatigue Bending Life (Sheave \#2)}}$$

Example

To determine the extension of fatigue life for a 3/4" wire rope using a 22.5" diameter sheave versus a 12" diameter sheave:

$$\text{Ratio B} = \frac{22.5'' \text{ (sheave diameter)}}{3/4'' \text{ (wire rope diameter)}} = 30$$

$$\text{Ratio B} = \frac{12'' \text{ (sheave diameter)}}{3/4'' \text{ (wire rope diameter)}} = 16$$

The relative fatigue bending life for a ratio B of 16 is 2.1 (see above Table) and ratio B of 30 is 10.

$$\text{Relative Fatigue Bending Life} = \frac{10}{2.1} = 4.7$$

Therefore, we expect extension of fatigue life using a 22.5" diameter sheave to be 4.7 times greater than that of a 12" diameter sheave.