Sheave Sizing Tool
For Sherman & Reilly Transmission Sheaves

The following formulas come directly from the IEEE Standard 524™ Guide to the Installation of Overhead Transmission Line Conductors. The accompanying discussion is derived from the same source and from Sherman & Reilly’s 75+ years of design, manufacturing, and field experience with transmission stringing blocks. If there is any doubt as to which sheave size is appropriate for the anticipated application, the reader is encouraged to consult the 524 Standard directly and/or Sherman & Reilly.

For a more detailed discussion, refer to the Sherman & Reilly whitepaper Sheave, Block, and Accessory Selection for Transmission Conductor Installation, which can be found in the Publications section of most product pages at www.sherman-reilly.com

Sheave Sizing in Four Steps

1. Calculate minimum sheave diameter at the bottom of the sheave groove.
2. Calculate & verify minimum groove radius.
3. Calculate and verify minimum groove depth.
4. Verify proper groove flare angle.

1. Minimum Sheave Diameter
Most block/sheave manufacturers name their sheaves based on the OD (Outside Diameter) of the sheave. For example, a 28” sheave has an OD of 28”. However, the OD is not the critical dimension when determining minimum sheave size. Rather, the critical dimension is the diameter at the bottom of the groove.

Referring to Figure 1, the critical dimension is D_{BG} (circled in red).

Figure 1. Critical Sheave Dimensions – Diameter at Groove Bottom

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The minimum bottom-of-groove diameter is calculated using one of three simple formulas, as listed in Table 1. One simply uses the formula from Table 1 that most closely matches the conductor being used and the conditions that prevail for the stringing project.

<table>
<thead>
<tr>
<th>Terrain Conditions &amp; Conductor Factors</th>
<th>Ruling Span</th>
<th>Formula</th>
<th>Formula Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>even, flat</td>
<td>&lt; 2 miles</td>
<td>(D_{BG} = 20D_C - 8)</td>
<td>1</td>
</tr>
<tr>
<td>uneven</td>
<td>&gt; 2 miles</td>
<td>(D_{BG} = 20D_C - 4)</td>
<td>2</td>
</tr>
<tr>
<td>uneven or specialty conductors</td>
<td>exceptionally long or difficult</td>
<td>(D_{BG} = 20D_C)</td>
<td>3</td>
</tr>
</tbody>
</table>

\(D_{BG}\) = diameter at bottom of groove, in inches  
\(D_C\) = diameter of the conductor, in inches

### Table 1. Formulas for Determining Sheave Diameter

For example, perhaps an upcoming job is for the installation of 1272 “Pheasant” ACSR conductor over some fairly uneven terrain, where the pull will be 2.5 miles, and with 800-foot spans. These specifications indicate that the second sheave-diameter formula should be used to determine the minimum sheave size.

So, the formula is to use is: \(D_{BG} = 20D_C - 4\).

From IEEE 524\(^3\) (or manufacturers’ tables):

\(D_C = 1.382\) in. (conductor diameter)

So, using the formula:

\(D_{BG} = 20 \times 1.382 - 4 = 23.64\) in.

So, in this example, the minimum diameter at the bottom of the groove needs to be 24”.

Referring to the Sherman & Reilly 78 Series Block dimensions, this 24” minimum diameter would be satisfied by ordering/using this block with the 28” sheave, for the stringing conditions used.

### 2. Minimum Groove Radius

While determining the correct minimum diameter of the bottom of the groove is extremely important, it is not the only important sheave dimension. One of the other important dimensions is the minimum radius at the bottom/base of the groove.

Referring to Figure 2, the minimum groove radius is: \(R_{Gmin} = 0.55D_C\).

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\(^2\) Per IEEE 524: A calculated span length that will have the same changes in tension due to temperature and loaded changes will be found in a series of spans of varying lengths between deadends.

Using the previous example of the 1272 “Pheasant” ACSR conductor (with a 1.382” diameter):

\[ R_{G\text{min}} = 0.55 \times 1.382 = 0.7601 \text{ in.} \]

In other words, the groove radius minimally must be slightly greater than the radius of the conductor.

Referring to the Sherman & Reilly 78 Series, the 28” sheave determined above has a 7/8” (0.875”) bottom-of-groove radius. Since this is larger than the minimum calculated above, this block with the 28” sheave could be used for stringing this conductor.

3. Minimum Groove Depth

The third dimension that must be considered is the depth of the groove. Specifically, the minimum depth of the groove should be 25% greater than the diameter of the conductor. So, referring to Figure 3, the formula for minimum groove depth is:

\[ \text{Depth}_{\text{Gmin}} = 1.25 \times D_c \]
Again using the previous example of the 1272 “Pheasant” ACSR conductor (with a 1.382” diameter):

\[ \text{Depth}_{\text{min}} = 1.25 \times 1.382 = 1.7257 \text{ in.} \]

Referring again to the Sherman & Reilly 78 Series, the 28” sheave determined above has a groove depth of 2”, well above the minimum requirement for this conductor. So, this block with the 28” sheave could be used for stringing this conductor.

4. Groove Flare Angle

Referring again to Figure 2, the final sizing factor that must be considered is the shape of the groove. Specifically, the sides of the groove should flare between 15 and 20 degrees, regardless of conductor size. Refer to Figure 4.

![Figure 4. Critical Sheave Dimensions – Groove Flare Angle](image)

All Sherman & Reilly transmission sheaves have a flare angle between 15 and 20 degrees.

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