



Determining Groove Top Width And Angle PA NOTE

Need to check sheave grooves but the necessary sheave groove gauges aren't available? Here is an alternate method using tools that most mechanics would have readily available.

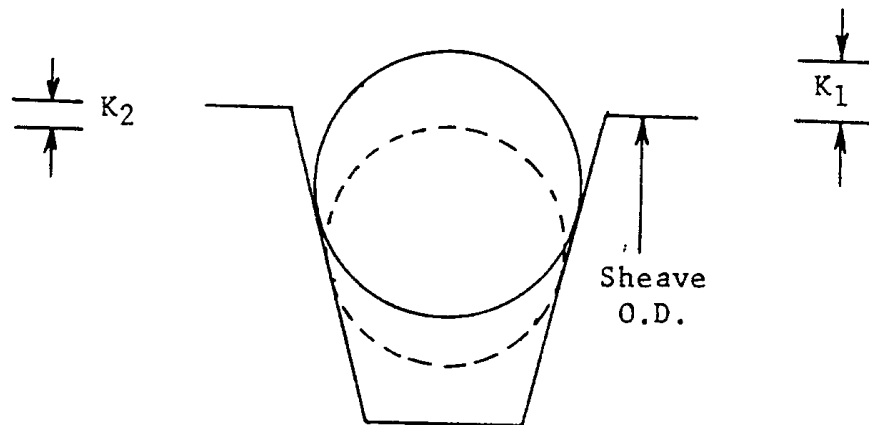
Typically ball ride measurements are used to determine whether a sheave is within specifications. This is particularly true on groove-to-groove measurements of multiple groove sheaves. But it can also be used effectively to determine the groove angle (α) and groove top width (b_g) to very close values.



We can measure the groove angle in a variety of ways which can include cumbersome measuring devices or messy plaster casts.

Using the following method, b_g can be determined more accurately, especially if the outside corners of the sheave are rounded making direct measurement very difficult.

This procedure uses two precision measuring balls or rods of different diameters—one that will ride near the top of the groove and one that will ride near the bottom. The determination of groove angle and groove top width is based on ΔK or difference in ride of the two balls or rods relative to the outside diameter of the sheave.



Using the ball or rod ride formula for the two diameters, we have the following equation:



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$$K1 - K2 = \frac{(D1 - D2)}{2} [1 + \text{CSC}(\infty/2)]$$

Where: D1 & D2 = ball or rod diameters

K1 & K2 = respective ride measurements (positive if ride out;
negative if ride in)

∞ = sheave groove angle, degrees

Solving this equation for groove angle:

$$\infty = 2\text{CSC}^{-1} \frac{2(K1 - K2)}{(D1 - D2)}$$

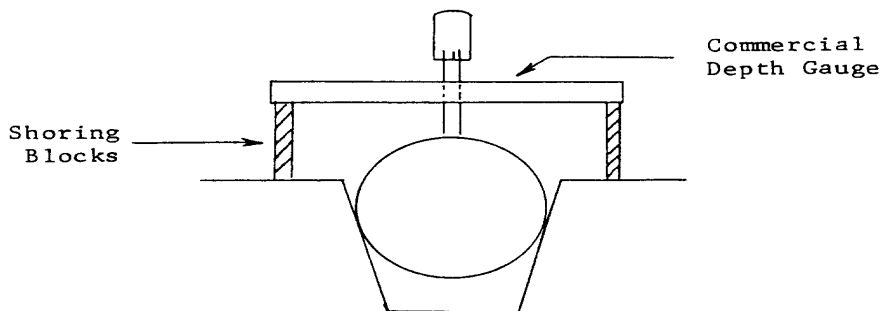
After solving for the angle ∞ , we can find top width, b_g , by using the following formula:

$$b_g = \frac{D1 [1 + \text{CSC}(\infty/2)] - 2K1}{(\text{COT}(\infty/2))}$$

How this procedure is put into actual practice:

First, select balls or rods that will ride as prescribed. A good measuring rod is a drill bit which is available in 1/64" increments. The actual shaft diameter should be verified with a micrometer. Or, you could use ball diameters recommended by RMA.

Set the balls or rods in the groove and measure the ride with a depth gauge. Commercially available gauges will be somewhat harder to use than those specifically made for this purpose. The commercial gauge has a platform that is even with the micrometer head and must be raised above the sheave to measure ride out.



A tool made special for ride measurements, uses a piece of precision machined channel iron with a hole into which the depth gauge can be placed. This eliminates the need for any shoring blocks and minimizes measuring errors.



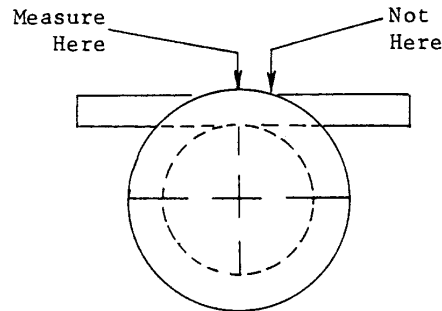
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When making these depth measurements, it is imperative that the gauge is set evenly on the sheave. When the shoring blocks are used, they must be of equal height to get an accurate measurement.

If measuring rods are being used, the depth measurement must be made in such a way as to give a true diameter.



Accuracy of the findings will depend on the tolerances of the ball diameters and the measurement of the ride, K . The industry standard gives ball diameter tolerances of ± 0.005 ". Staying within this range and reading the K value to within $.001$ ", the groove angle, α , would calculate to within 0.02 degrees of actual and the top width, b_g , would be within 0.0008 ".

This is sufficiently close to make a decision whether a sheave groove requires remachining or not; especially since industry standards call for a ± 0.33 degrees on groove angle, α , and a ± 0.005 " on top width, b_g .