Free-Flex® Pivot Selection Tutorial

Selecting a Free-Flex® Pivot for an application is not as simple as selecting other types of bearings. This tutorial attempts to explain how to select a Free-Flex® Pivot for a simple radial loading situation. For more complex loading, aerospace, or life safety applications, contact Riverhawk Engineering so we can ensure the proper margins of safety are met.

Radial loads on a Free-Flex® Pivot pass perpendicular to the rotating axis while axial loads pass parallel to the axis. If applied loads on the Free-Flex® Pivot are anything other than simple static radial loads, the user should consult Riverhawk Engineering. When you have a combination of axial loads, radial loads, and/or bending moments on the pivot, it is simply not feasible to publish selection charts to handle all combinations. Riverhawk has a proprietary stress analysis program that calculates combined stresses in the flexures and the resultant margin of safety for your application. Our engineers can usually run this calculation for you in minutes.

See the steps below to select a Free-Flex® Pivot for a simple static loading condition:

Step 1 – Identify applied loads and what direction the load is applied in. See the Riverhawk Engineering Data Book (go to for example azg-consulting.com/sizing&data and scroll down) for the nomenclature used to define the load directions. If you have a simple radial load and are unsure of the direction, design to load the pivot with a Vt load. It is strongest in that direction.

Step 2 – Decide if you need a Double-Ended design or a Cantilever design. Simply pick the design that suits your application.

Step 3 – Go to azg-consulting.com and click on the either “Single-Ended Pivots” or “Double ended Pivots,” then scroll down to the Characteristics Chart.

Step 4 – From the chart, identify which pivots have a Vt or Vc load capacity higher than your applied load. There may be several. The outside diameter of each pivot is in the left-hand

column. Pick one or more with a size that suits your application. Note the “Size-Type” and the radial load capacity for use in the next step.

Step 5 – Now you must consider the cyclic life of the pivot. Scroll down further on the website to the Life Cycle Curves. If your radial load is in the Vt direction, use the tension loading curves on the right. If your radial load is in the Vc direction, use the compression loading curves on the left. You will use the curve that matches the “Type” of the pivot you selected (400, 600, or 800).

Step 6 – Calculate the percent radial load as shown on the horizontal axis of the Life Cycle Curve. You can then enter the curve at that percentage and determine your maximum angle of rotation for infinite life, 200,000 cycles, or 35,000 cycles from the curves shown.

Step 7 – If the maximum angle or life cycles do not meet the requirements of your application, you will need to select another pivot and check the chart again, repeat until you have identified a pivot that meets your angular rotation and radial load requirements.

Step 8 – You may also want to consider the torsional stiffness (shown in the last column on the Characteristics Chart). Your application may require a very stiff or very soft spring. Note that as the applied radial load increases, the torsional stiffness will change. To see how torsional spring rate changes with radial loads, see page 11 of the Riverhawk Engineering Data Book (go to for example azg-consulting.com/sizing&data and scroll down).

Not all combinations of requirements are possible. Often, the designer wants a very high applied radial load, but also wants a high angular rotation. As you can see form the charts, that is the tradeoff. As with other types of springs, a very stiff Pivot will support higher loads but cannot be cycled at high angles for very long.

We are very proud to have supplied Free-Flex® Pivots to thousands of applications for over 50 years and counting. We would love to help you choose yours! Contact Riverhawk Engineering for assistance with your Free-Flex® Pivot selection

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