



SPECIFY THE ORIGINAL

- *Frictionless*
- *Stiction-Free*
- *No Lubrication Required*
- *Maintenance-Free*
- *Infinite Cycle Life*

FLEXURAL PIVOTS



The Free-Flex® Pivot

The Free-Flex® Pivot is a simply packaged, compact and easily installed limited rotation bearing with predictable and repeatable performance. The pivot is made of flat, crossed springs supporting rotating sleeves. Originally patented by the Bendix Company in 1961, to date over eight million pivots have been put into service. The product line was purchased by the Riverhawk Company in 2004.

The Free-Flex® Pivot is a frictionless, stiction-free bearing uniquely suited for limited angular travel. Flex pivots are designed for applications that do not permit lubrication yet demand precise positioning and require infinite life. Along with a wide range of industrial applications, additional applications include guidance systems for missiles, scanning mirror assemblies for both satellites and ground applications, jet engine fuel control, and vibration sensors. Flexural pivots are the product of choice any time reliable, predictable rotation is needed.

A variety of pivot sizes and ratings are available in both cantilevered (Series 5000) and double-ended (Series 6000) designs. We are also fully capable of special designs and have all the testing equipment necessary to examine every mechanical property of our flexural pivots to include: fatigue testing, center shift testing, torsional spring rate testing, concentricity, roundness, radial/axial spring rate and static load testing. We also have a full metallurgy lab to perform a metallographic analysis.

Flexural pivots are made from 410 and 420 stainless steel for standard construction. Special materials have included Custom 455 Stainless, Inconel 718, Titanium and Maraging Steel. Special configurations have included flanges, grooves, flats, special spring rates, special lengths and gold plating.

Major Performance Characteristics

- High radial stiffness
- High axial stiffness
- Frictionless
- Stiction-free
- Not susceptible to false brinelling
- Low hysteresis
- Low center shift
- Exceptional repeatability
- Predictable performance
- Lubrication not required
- Maintenance not required
- Electrical continuity
- Infinite cycle life
(See life curves)
- Ambient temperature range
of - 400°F to +1200°F



Cutaway of Double-Ended Design

Additional Characteristics

- Radiation Resistance
- Low Thermal drift
- No Rubbing surfaces
- Contaminant tolerant
- Operates in vacuum of space
- Self-centering
- Resolution to the micro inch range

Evolution of the Free-Flex® Pivot

- Bendix 1955
- Allied 1982
- Allied Signal 1988
- Lucas 1990
- Lucas Varity 1996
- TRW 2000
- Goodrich 2002
- Riverhawk 2004

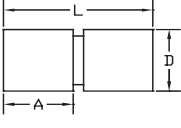
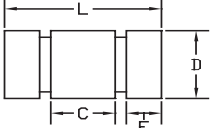


Cutaway of Cantilevered Design

Visit our website at: www.flexpivots.com

Dimensions & Characteristics

Typical Units

Nominal Outside Diameter (Inch) D +0.00 -0.0005	Catalog Number Series 5000 Cantilevered (size-type)	Load Capacity - (Pounds) Load At Center of "A". See Note (1)				Catalog Number Series 6000 Double Ended (size-type)	Load Capacity - (Pounds) Load At Center of "C". See Note (1)					Torsional Spring Rate (in - lb) Degree See Note (2)
		Vc	Vt	L +/- 0.003	A +/- 0.005		Vc	Vt	L +/- 0.003	B +/- 0.005	C +0.005 -0.015	
	5004-400	25.5	25.5			6004-400	28.0	28.0				0.0140
0.1250	5004-600	8.9	13.0	0.200	0.095	6004-600	17.7	25.0	0.200	0.045	0.085	0.0017
	5004-800	0.97	3.7			6004-800	2.20	4.7				0.0002
	5005-400	39.5	39.5			6005-400	44.0	44.0				0.0279
0.1562	5005-600	13.8	20.0	0.250	0.120	6005-600	27.6	39.0	0.250	0.057	0.110	0.0035
	5005-800	1.50	6.0			6005-800	3.50	7.4				0.0004
	5006-400	56.0	56.0			6006-400	63.0	63.0				0.0473
	5006-600	19.8	28.0	0.300	0.142	6006-600	39.6	56.0	0.300	0.067	0.130	0.0057
0.1875	5006-660	12.2	20.2									0.0037
	5006-800	2.1	8.0			6006-800	4.9	9.0				0.0007
	5008-400	101.0	101.0			6008-400	113.0	113.0				0.1141
0.2500	5008-600	35.5	51.0	0.400	0.190	6008-600	70.7	100.0	0.400	0.090	0.175	0.0143
	5008-800	3.7	14.5			6008-800	8.5	19.0				0.0018
	5010-400	158.0	158.0			6010-400	176.0	176.0				0.2234
0.3125	5010-600	55.0	79.0	0.500	0.238	6010-600	110.0	156.0	0.500	0.112	0.220	0.0286
	5010-800	5.8	23.0			6010-800	14.0	29.0				0.0036
	5012-400	228.0	228.0			6012-400	253.0	253.0				0.3840
0.3750	5012-600	80.0	114.0	0.600	0.285	6012-600	159.0	225.0	0.600	0.135	0.265	0.0480
	5012-800	8.4	32.8			6012-800	19.8	42.0				0.0058
	5016-400	403.0	403.0			6016-400	450.0	450.0				0.9080
0.5000	5016-600	141.0	202.0	0.800	0.380	6016-600	283.0	400.0	0.800	0.180	0.355	0.1134
	5016-800	14.6	58.0			6016-800	35.4	75.0				0.0142
	5020-400	634.0	634.0			6020-400	703.0	703.0				1.8500
0.6250	5020-600	222.0	317.0	1.000	0.475	6020-600	442.0	625.0	1.000	0.225	0.445	0.2321
	5020-800	23.0	93.0			6020-800	55.0	117.0				0.0295
	5024-400	910.0	910.0			6024-400	1013.0	1013.0				3.1800
0.7500	5024-600	318.0	455.0	1.200	0.570	6024-600	636.0	900.0	1.200	0.270	0.535	0.3980
	5024-800	33.0	130.0			6024-800	78.0	169.0				0.0500
	5032-400	1620.0	1620.0			6032-400	1800.0	1800.0				7.5200
1.0000	5032-600	567.0	815.0	1.600	0.770	6032-600	1131.0	1600.0	1.600	0.370	0.735	0.9390
	5032-800	60.0	236.0			6032-800	141.0	300.0				0.1175

(1) Pounds at zero deflection based on pure radial load. When the load is applied directly through a single spring, multiply capacity shown by 0.707.

(2) At zero load.

• Standard Materials:

Pivot Body: AISI 410 or AISI 420 corrosion-resistant steel.
Flex elements: AISI 420 corrosion-resistant steel.
Braze Construction.

• Tighter Diameter Tolerance:

If a tighter diameter tolerance of (+0 / -0.0002) is required, specify T2 after the catalog number.

• Torsional Spring Rate:

Torsional Spring rates are generally within +/- 10% or less of the nominal values, however spring rates that are 0.0018 lb-in/degree or less may have significantly higher tolerances.

• General:

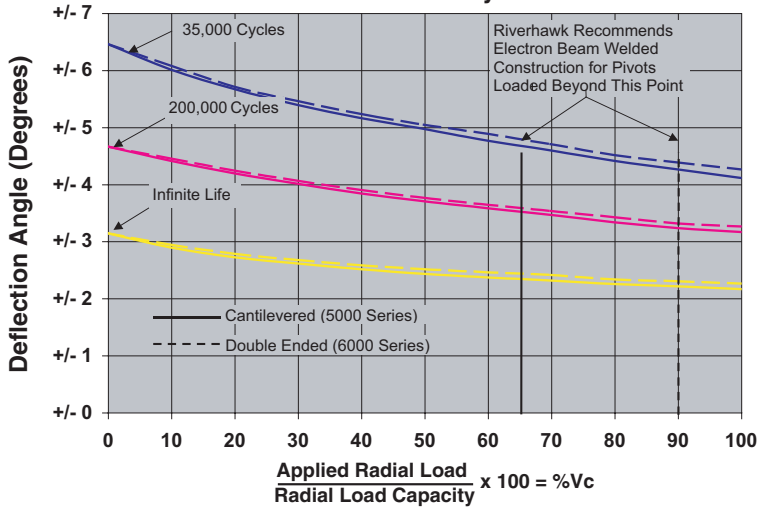
The correct pivot for a specific application can be selected only after determination of required angle of deflection, load, and life expectancy as these are interdependent. When unusual environments or multiplane loading conditions exist consult Riverhawk.

• Welded Construction:

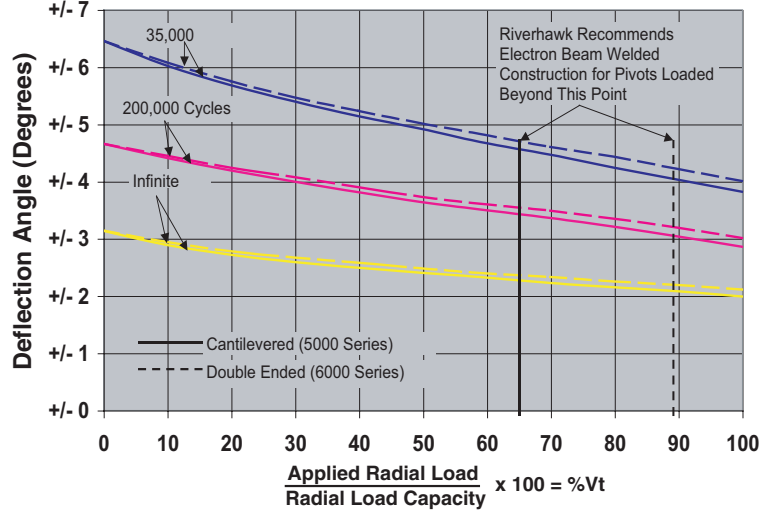
Welded construction pivots are available. Consult Riverhawk for application engineering.

Cycle Life Curves

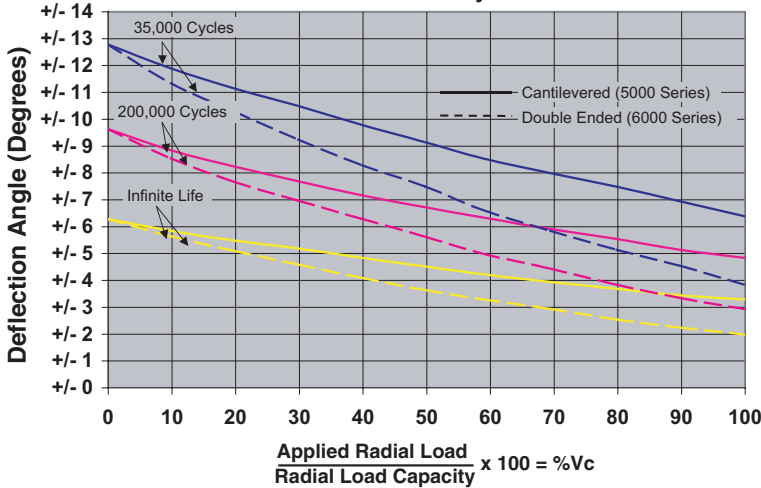
400 Type Pivot Bearing Loaded in Compression (Vc)
Factor of Safety = 1.0



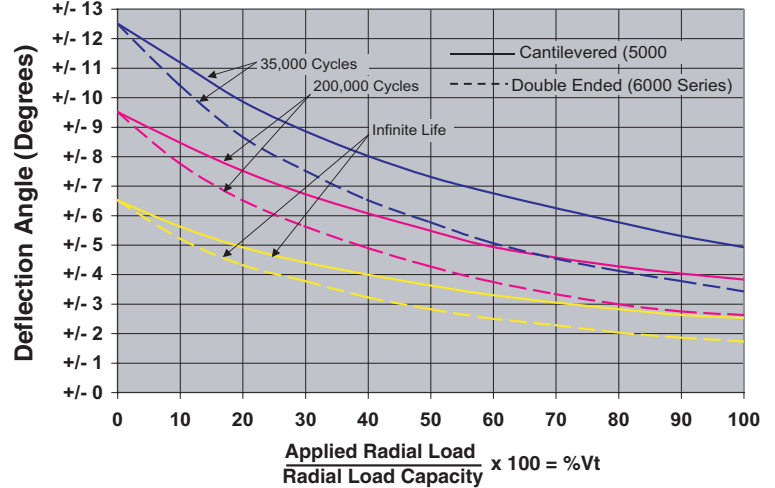
400 Type Pivot Bearing Loaded in Tension (Vt)
Factor of Safety = 1.0



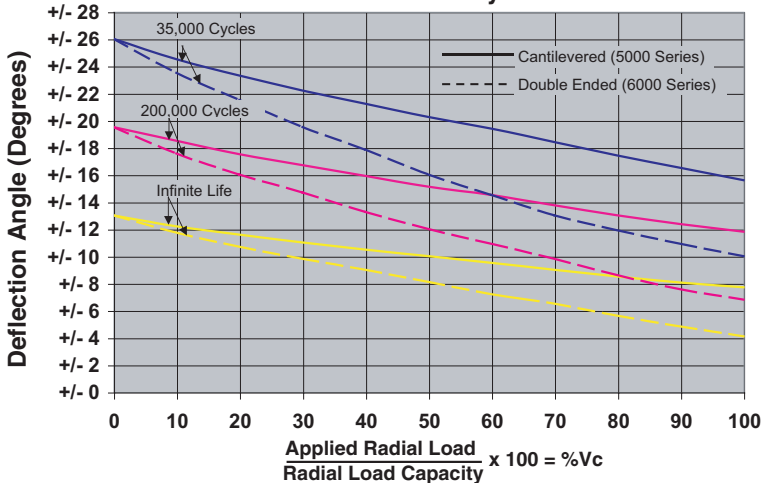
600 Type Pivot Bearing Loaded in Compression (Vc)
Factor of Safety = 1.0



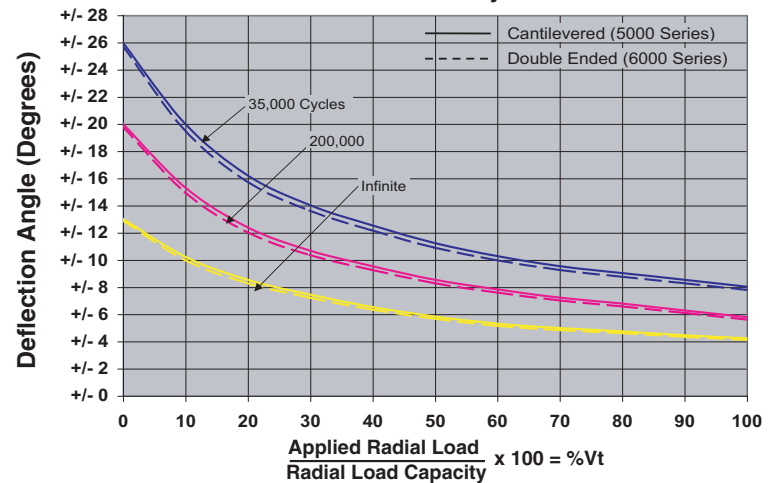
600 Type Pivot Bearing Loaded in Tension (Vt)
Factor of Safety = 1.0



800 Type Pivot Bearing Loaded in Compression (Vc)
Factor of Safety = 1.0



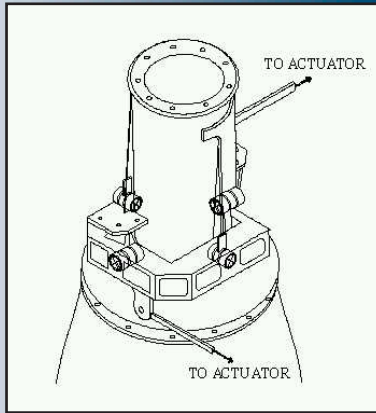
800 Type Pivot Bearing Loaded in Tension (Vt)
Factor of Safety = 1.0



Flexural Pivot Applications

• Gimbal Ring Mount:

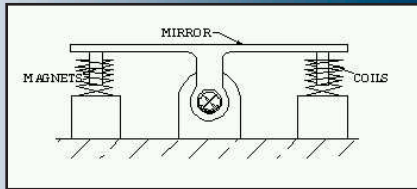
The Free-Flex® Pivot is particularly suited for omnidirectional applications. Also, the lack of lubrication permits operation in a hard vacuum. The pivot can operate at higher temperatures than other bearings and provides a relatively constant opposing spring force. Thus the actuator can be sized to accommodate only the force required to position the rocket motor without having to consider high friction caused by space welding.



Gimbal Ring Mount

• Scanning Mirror:

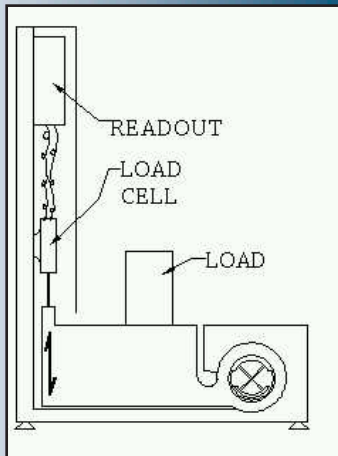
No friction and symmetrical springs allow smooth motion at the natural frequency, with low input required to sustain the oscillation.



Scanning Mirror

• Scale:

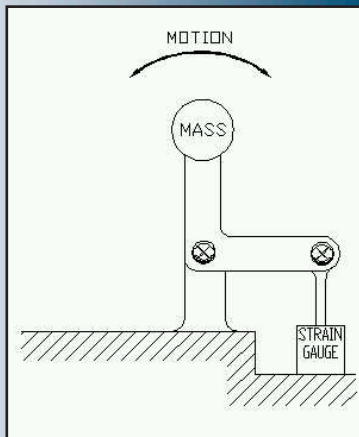
After selecting the proper pivot it is possible to design a scale that has no deflection in radial direction, all motion of the system is purely rotational.



Scale

• Vibration Accelerometer:

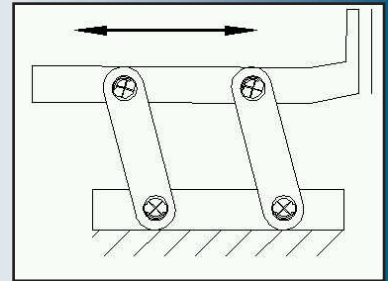
An accelerometer has to endure billions of cycles in its sensing lifetime. The Free-Flex® Pivot is ideal for this application as it can provide infinite life without maintenance. Because the pivot requires no lubrication, an extremely clean instrument is possible.



Vibration Accelerometer

• Perpendicular Mirror:

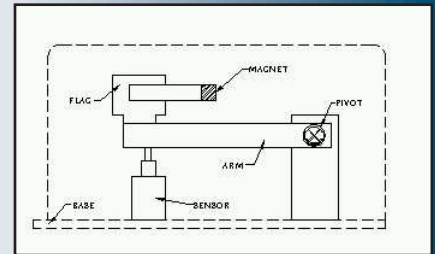
Four or eight Free-Flex® Pivots used in a parallelogram will maintain a mirror or other optics perpendicular to any surface for applications that require lateral motion.



Perpendicular Mirror

• Seismic Vibration Amplitude Sensor:

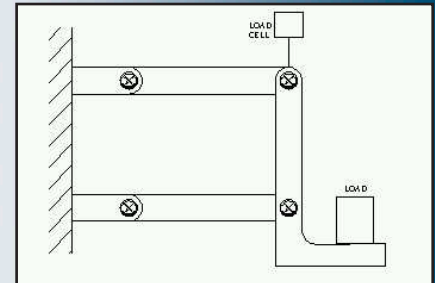
Free-Flex® Pivots are used as a damping system. A transducer converts the motion of the sensor base to a proportional signal.



Seismic Vibration Amplitude Sensor

• Weigh Station:

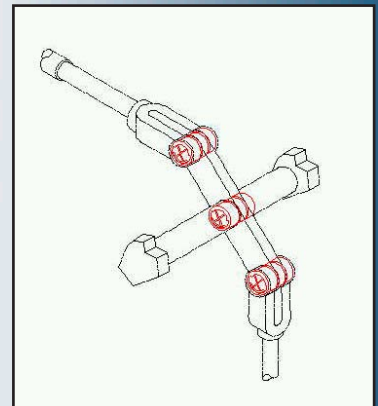
This represents an automatic filling mechanism which controls the quantities of materials packaged.



Weigh Station

• Throttle Linkage:

Pivots selected for different throttle systems are tailored to performance requirements for the particular application. For instance, we have aerospace applications where high temperature stability is as much a selection factor as are no lubrication and contamination tolerance. For industrial applications, pivot selection often permits elimination of assembly parts and results in a cost reduction.



Throttle Linkage

These illustrations are solely for the purpose of stimulating the designer in the application of Free-Flex® Pivots. No representation or warrant is made that the specific devices depicted in these illustrations may be manufactured, used or sold without infringing patents of others.

Special Pivot Designs

Over the years we have made many pivots that are outside the realm of our standard product. Such designs have included: longer lengths, flanges for mounting, tailored torsional and radial spring rates, grooves for adhesive mounting and flats for set screw mounting. We are fully capable of special designs and sub-assembly integration.



Mission Statement

Our mission at Riverhawk is a mission of desire – every product Riverhawk makes will raise the standard for each and every product that follows. We will be the quality standard by which the industries we serve measure products and services. We will accomplish this by using dedicated, highly technically trained staff, the best machinery, and the finest raw material. We will do this not by policy decree but by personal desire to excel.

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