DEFLECTION CALCULATION

Use the formula:

$$D = N \times W \times L^3$$

WHERE:

N = value from fig.13

W = load in pounds

L = length (in inches) of unsupported shaft section

CALCULATE MISALIGNMENT ANGLE

PowerTrax™ linear bearings allow for 1/2 degree misalignment. To determine the amount of misalignment due to shaft deflection use the formula:

$$\theta = \sin^{-1}(D/L)$$

WHERE:

θ = angle in degrees

D = shaft deflection

L = length (in inches) of unsupported shaft section.

If misalignment is greater than 1/2 degree, then:

- Reduce the Length of the shaft.
- Use a larger shaft diameter.

FIG.13

"N" VALUE FOR NOOK SHAFTS		
SHAFT DIAMETER (in.)	SIMPLE	FIXED
1/4	3620×10^{-9}	905×10^{-9}
3/8	715×10^{-9}	179×10^{-9}
1/2	226×10^{-9}	56.6×10^{-9}
3/4	44.7×10^{-9}	11.2×10^{-9}
1	14.1×10^{-9}	3.54×10^{-9}
1-1/2	2.79×10^{-9}	$.698 \times 10^{-9}$
2	0.866×10^{-9}	$.0220 \times 10^{-9}$
3	0.168×10^{-9}	$.432 \times 10^{-10}$
4	0.052×10^{-9}	$.136 \times 10^{-10}$

APPLICATION EXAMPLES

Application #1 – PACKAGING LINE

An appliance manufacturer needs to move products in boxes so that they can be presented to a transfer conveyor after final assembly.

Specifications:

- The boxes weigh 200 pounds
- The unit reciprocates 8 times per minute
- 4.5 inch stroke
- 365 days per year, ten year design life.
- Slightly corrosive environment

What is the proper size EXCEL™ Bearing which will satisfy this application?

ANALYSIS:

Configuration: There is enough space available for four linear bearings. The system will use stainless steel shafting with a hardness of Rc 55. The load can be centered between four standard Excel™ linear bearings

Travel Life:

4.5 in./stroke x 8 strokes/min. x 60 min./hr x 24 hrs/day x 365 days/year x 10 years = 189,000,000 inches.

Load-Life Ratio Factor (R_L): Based on the computed travel life and the load-life curve R_L = .22.

Shaft Hardness Ratio Factor (R_h):

For PowerTrax™ HG Stainless shafting with a hardness of Rc 55, R_h = .70.

Applied Load (L_a): Per bearing, L_a = 200/4 = 50 lbs.

Equivalent Load (L_e): Substituting in the load formula and solving for L_e = 50 / (.22 x .70) = 325 pounds

SELECTION:

From the EXCEL™ Bearing load tables, the smallest bearing which exceeds this load rating is the 3/4 inch bearing. However, if the application is such that the bearing could be oriented for maximum capacity, then the 5/8 inch bearing could be used.

The Parts List Is:

4 XLEC12 EXCEL™ Linear bearings

2 PowerTrax™ HG Stainless shafting, 9.25 inch minimum length

2 PowerTrax™ NSB-12 End supports

APPLICATION EXAMPLE

Application #2 – SCANNER POSITIONING

A vision system scanner is mounted to the center of the carriage of a vertically mounted slide system. The customer wants to use one inch open pillow blocks to guarantee a long life.

Specifications:

- Scanner weight is 100 pounds
- The center of gravity is offset 4 inches from the carriage plate
- The adjustment distance is 36 inches
- Minimal deflection desired
- Hand adjustment with future automation planned
- A travel life of 10 million inches is desired

ANALYSIS:

Configuration: A standard system with carriage plate and fully supported shafts will assure minimal deflection.

Load per Bearing: The load is centered and offset four inches. Use the equations from the load condition figure "Vertically Mounted" to determine the worst case force through a bearing. The distance from the load to the centerline of the shaft (d_2) is 4 + 1.187 or 5.187 inches. The bearing spacing (d_0) is set by the carriage plate; d_0 = 7 inches. Based on a design factor of 2, the load per bearing is 74 pounds. This is far below the rated value of a one inch open bearing.

NOTE: When using open-style bearings, if the direction of loading force is through the opening of the bearing, it is necessary to de-rate the bearing capacity by 50%.

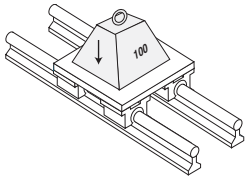
SELECTION:

PowerTrax™ Series 133 consisting of a double shaft fully supported system with Carriage 1 and four (4) single bearing blocks.

The Parts List Is:

133-16-L36

FIG.14



LOAD / LIFE

Lines indicate limiting load for given shaft size