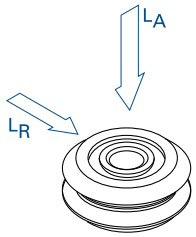
Load/Life Relationship

Several factors influence the service life of a DualVee linear guide. Through research and development spanning over thirty years, BishopWisecarver has devised a simple method to estimate the load/life relationship for a specific DualVee guide mechanism under defined loading conditions. The methodology accounts for the size of the DualVee bearing elements, relative spacing, and the orientation, location, and magnitude of the load. The equation is based upon clean and well lubricated track conditions; so for applications where lubrication is prohibitive, a derating factor must be applied.

It is important to note that secondary considerations such as maximum velocity, acceleration rates, duty cycle, stroke length, environmental conditions, the presence of shock and vibration, and extreme temperature ranges can all impact service life to varying degrees. As such, the sizing method is considered only as a guideline for the sizing of DualVee components and assemblies.

Load/Life Equation – Sizing and Selection

The load/life estimation requires a basic understanding of the principles of statics, the ability to work with free body diagrams, and the capacity to resolve externally applied forces on a carriage assembly into the radial and axial reaction forces at each guide wheel in the design. The life of a DualVee guide will be limited to the life of the most heavily loaded bearing in the design.



Step 1: Calculate the resultant radial and axial loads reflected to each bearing element in the linear guide design

All standard considerations involved in statics calculations must be accounted for, including inertial forces, gravitational forces, external forces such as tool pressure, bearing element spacing, and magnitude and direction of the payload. Any external forces that generate a reaction through the wheel/track interface need to be considered. If assistance is required in resolving specific loads into the resultant reaction forces at the guide wheel interface, contact our Applications Engineering staff for support. It is recommended that the Application Data Sheet on page 33 or online form be submitted beforehand, with as much application information detailed as possible.

Step 2: Calculate the load factor for the most heavily loaded bearing

$$L_F = L_A/L_{Amax} + L_R/L_{Rmax}$$

Where L_F = Load Factor
L_A = Resultant axial load on the guide wheel
L_{Amax} = The maximum axial working load capacity of the guide wheel
L_R = Resultant radial load on the guide wheel
L_{Rmax} = The maximum radial working load capacity of the guide wheel

- Bearings should be sized such that $L_F \leq 1$
- The most heavily loaded bearing will have the highest load factor

Due to varying application load and speed parameters and environmental conditions, the appropriate adjustment factor must be applied to the life equation.

Adjustment Factor (A_F)	Application Conditions
1.0-0.7	Clean, low speed, low shock, low duty
0.7-0.4	Moderate contaminants, medium duty, medium shock, low to medium vibration, moderate speed
0.4-0.1	Heavy contamination, high acceleration, high speed, medium to high shock, high vibration, high duty cycle

Step 3: Calculate life by applying the load factor to the load/life equation below:

DualVee Size	Life Constant	
	Inches of Travel Life	Kilometers of Travel Life
0	1.65×10^6	41
1	2.19×10^6	55
2	3.47×10^6	87
3	5.19×10^6	130
4	6.84×10^6	151
4XL	8.58×10^6	215

$$\text{Life} = [L_C/(L_F)^3]\ A_F$$

Where L_F = Load Factor
L_C = Life Constant
A_F = Adjustment Factor