

BASIC DESIGN SELECTION TABLES

Critical Speed

All mechanical devices have several vibration frequencies. If a ballscrew or ball nut rotates at an angular velocity equal to one of the ballscrew's natural frequencies, a severe vibration will be set up in the screw. The first order critical speed of the screw is the lowest natural traverse frequency. (The second, and higher, order natural frequencies are normally an order of magnitude above all ballscrew operating speeds.)

Critical Speed Formula

$N = C_S \times 4.76 \times 10^6 \times \frac{D}{L^2}$

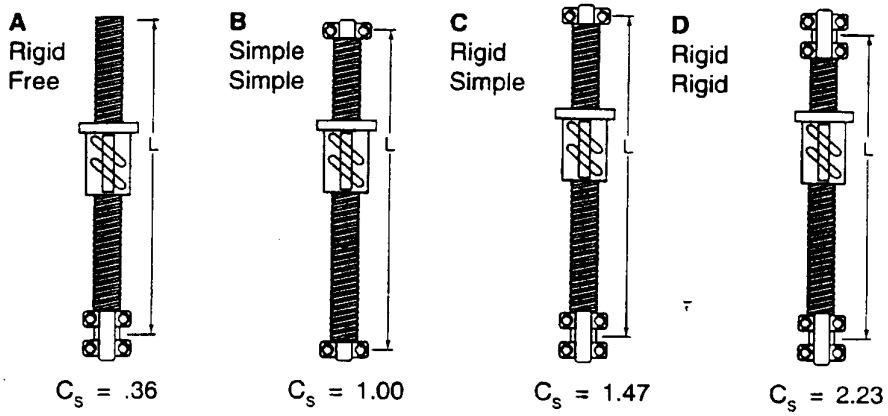
NS = N x FS

Where:

N	=	Critical Speed (RPM)
NS	=	Safe Drive Speed
D	=	Minor (root) Diameter (inches)
L	=	Length between Bearing Supports (inches)
FS	=	Factor of Safety (.80 maximum)
CS	=	End Fixity Factor for Critical Speed

CS	End Supports
.36	One end rigid, one end free
1.00	Both ends simple
1.47	One end rigid, one end simple
2.23	Both ends rigid

Bearing support arrangements



The maximum safe operating speed of a ballscrew assembly for normal operation is 80% of the critical speed provided the ball speed limit has not been exceed. The critical speed is a function of the unsupported screw length, the screw diameter, and the end bearing supports.
The unsupported length is the dominate factor, because the critical speed is inversely proportional to the square of the unsupported length.
Using a fixed unsupported screw length, the critical speed can be varied by the selection of the screw diameter, lead and end bearing supports.