

Critical buckling force of the screw

Explanatory notes:

I = 2nd moment of area expressed in mm^4

F = Max. load/gearbox in N

L = Free screw length in mm

E = Modulus of elasticity for steel ($210,000\text{N/mm}^2$)

v = Safety factor (normally 3)

d = Minimum core diameter of the screw

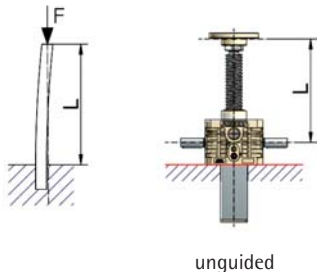
Example:

$F = 45,000\text{N/gearbox}$

$L = 1320\text{ mm}$

$v = 3$

Euler 1



Formula:

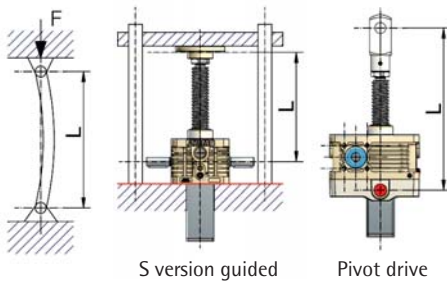
$$I = \frac{F \times v \times (L \times 2)^2}{\pi^2 \times E} \quad \text{then} \quad d = \sqrt[4]{\frac{I \times 64}{\pi}}$$

Example:

$$I = \frac{45,000\text{ N} \times 3 \times (1,320\text{ mm} \times 2)^2}{\pi^2 \times 210,000\text{ N/mm}^2} = \frac{9.0896^{11}\text{ mm}^4}{2,072,616.924} = 453,965.22\text{ mm}^4$$

$$d = \sqrt[4]{\frac{453,965.22\text{ mm}^4 \times 64}{\pi}} = 55.15\text{ mm minimum core diameter} \\ = \text{Z-250 (screw core } \varnothing = 59.6\text{ mm)}$$

Euler 2



Formula:

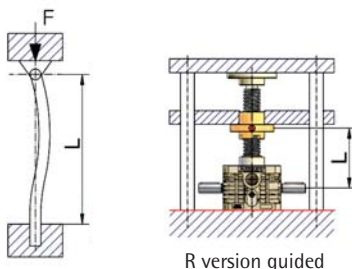
$$I = \frac{F \times v \times L^2}{\pi^2 \times E} \quad \text{then} \quad d = \sqrt[4]{\frac{I \times 64}{\pi}}$$

Example:

$$I = \frac{45,000\text{ N} \times 3 \times (1,320\text{ mm})^2}{\pi^2 \times 210,000\text{ N/mm}^2} = \frac{2.35224^{11}\text{ mm}^4}{2,072,616.924} = 113,491.305\text{ mm}^4$$

$$d = \sqrt[4]{\frac{113,491.305\text{ mm}^4 \times 64}{\pi}} = 38.99\text{ mm minimum core diameter} \\ = \text{Z-100 (screw core } \varnothing = 43.6\text{ mm)}$$

Euler 3



Formula:

$$I = \frac{F \times v \times (L \times 0.7)^2}{\pi^2 \times E} \quad \text{then} \quad d = \sqrt[4]{\frac{I \times 64}{\pi}}$$

Example:

$$I = \frac{45,000\text{ N} \times 3 \times (1,320\text{ mm} \times 0.7)^2}{\pi^2 \times 210,000\text{ N/mm}^2} = \frac{1.15259^{12}\text{ mm}^4}{2,072,616.924} = 55,610.7396\text{ mm}^4$$

$$d = \sqrt[4]{\frac{55,610.739\text{ mm}^4 \times 64}{\pi}} = 32.62\text{ mm minimum core diameter} \\ = \text{Z-50/Tr50 (screw core } \varnothing = 39.8\text{ mm)}$$

	GSZ-2	Z-5	Z-10	Z-25	Z-35/50	Z-50/Tr50	Z-100	Z-150	Z-250	Z-350	Z-500	Z-750	Z-1000
Trapezoidal screw Tr	16x4	18x4	20x4	30x6	40x7	50x8	55x9	60x9	80x16	100x16	120x16	140x20	160x20
Core \varnothing in mm (minimum)	10.9	12.9	14.9	22.1	31.0	39.8	43.6	48.6	59.6	80.6	99.6	115.0	135.0
Ball screw KGT \varnothing mm	16	16	25	32	40	-	50	63	80	100	125	140	160
Core \varnothing in mm (minimum*)	12.9	12.9	21.5	27.3	34.1	-	43.6	51.8	67	87.4	107.8	117	132.8

*Depending on the pitch, the core \varnothing may be even larger. See the KGT pages in Sections 2 and 3 for the exact core \varnothing values.