

Buckling Loads

The maximum force available from a hydraulic cylinder for a given bore diameter is given by:

$$F(kN) = 0.0000785 \times P_{Bar} \times (d_{mm})^2 \quad \text{Metric Bore}$$

$$F(kN) = 0.0507 \times P_{Bar} \times (d_{inch})^2 \quad \text{Inch Bore}$$

Buckling Load Limits on Open Centre Distance

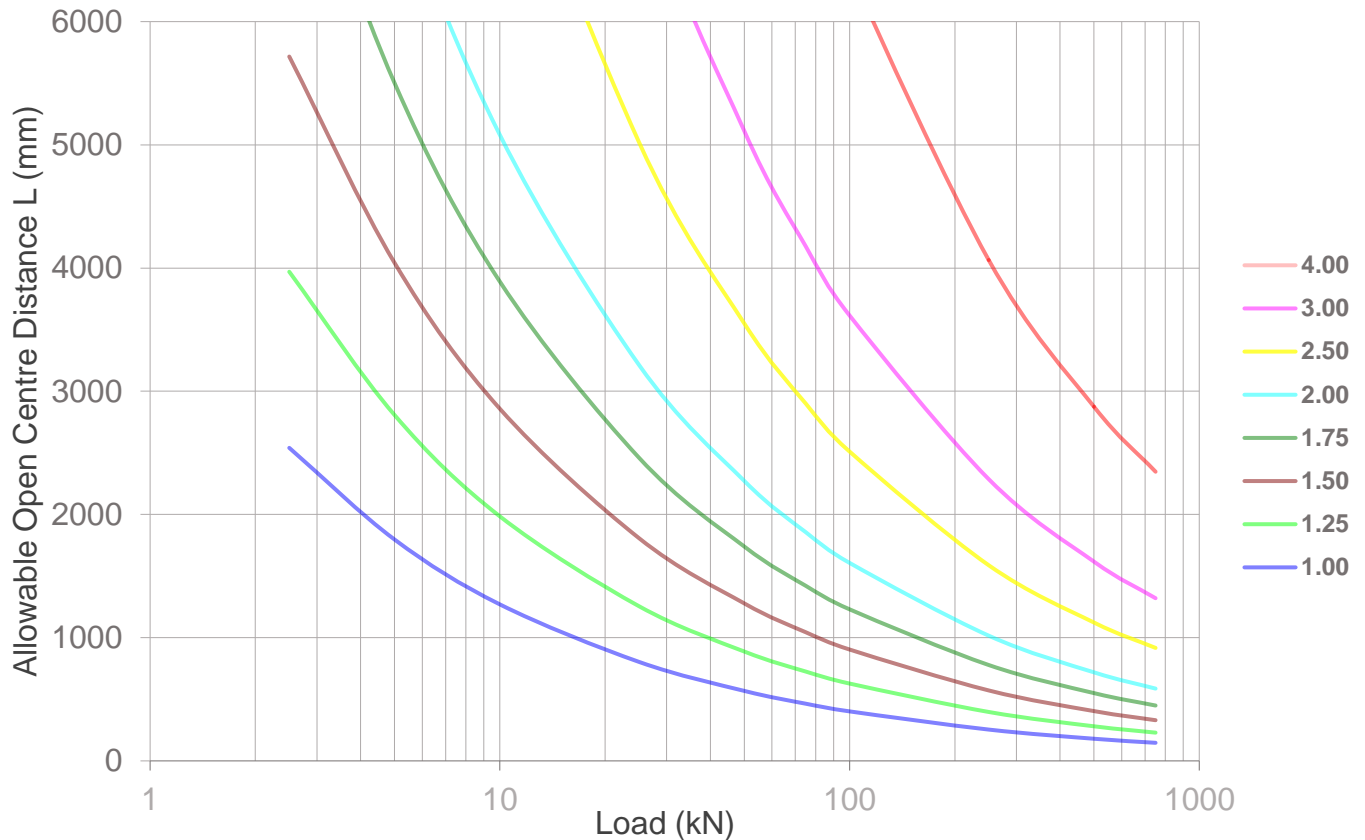


Figure 1. Euler buckling of imperial sized shafts with a F.O.S of 2.5

Useful conversion formulae:

$$F(kN) = F(lbf) \times 0.004448$$

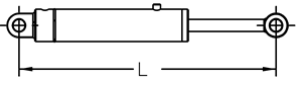
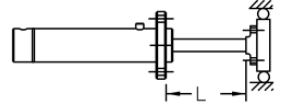
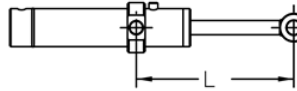
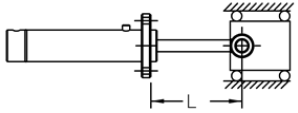
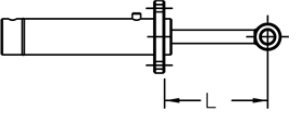
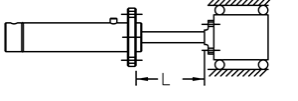
$$F(kN) = F(tonne) \times 9.807$$

The chart in figure 1 determines the maximum permissible open-centre distance for a given standard imperial shaft diameter and load using a **safety factor of 3** (recommended), using CK1045 shaft material. For other factors of safety, multiply the resulting open centre length (L) by one of the values in Table 1.

Table 1. FOS

FACTOR OF SAFETY	MULTIPLY BY
1.5	1.29
2.0	1.12
3.0	0.91
4.0	0.79

Table 2. Euler buckling end conditions

 <p>Tube mount: clevis Shaft mount: clevis</p>	1.0	 <p>Tube mount: flange or foot mount (fixed) Shaft mount: rigidly fixed to shaft with short guide</p>	1.0
 <p>Tube mount: trunnion Shaft mount: clevis</p>	1.0	 <p>Tube mount: flange or foot mount (fixed) Shaft mount: pivoted and well guided</p>	1.4
 <p>Tube mount: flange or foot mount (fixed) Shaft mount: clevis (unguided)</p>	0.5	 <p>Tube mount: flange or foot mount (fixed) Shaft mount: rigidly fixed to shaft with a long guide</p>	2.0

The style in which a cylinder is mounted effects its buckling characteristics. Table 2 shows typical cylinder mounting arrangements. Select from the following mounting arrangements and multiply the critical open centre distance (L), obtained from the graph in Figure 1, by the end condition factor shown in Table 2. Note that these factors are theoretical only.

NOTE: This information should be used as a guide only. For more specific information, please contact Hydrapower