Technical Information

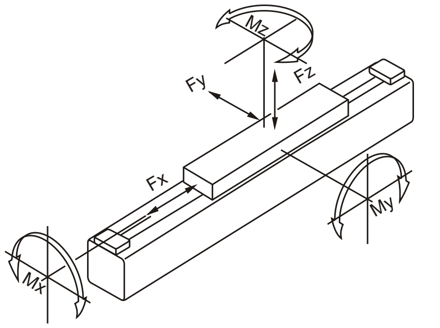
For Rodless Cylinders

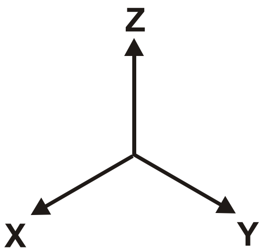
Further Information

- The Ultraline sizing CD with selection programme and complete 2D and 3D drawing files is available from your Ultraline sales office
- This information is intended to assist in the selection of an Ultraline rodless cylinder to suit your application. For further assistance please contact your nearest Ultraline sales office

Load Carrying

Rodless cylinders are primarily designed to CARRY a load, rather than to produce THRUST. Loads are transferred on to the cylinder by the MOMENTS created when a mass is supported or moved. Moments can be either STATIC or DYNAMIC, and act around one of the three axes of the cylinder.





Once calculated, the moments can be compared with the figures quoted in the product catalogue.

Careful consideration must be given to the actual loadings applied to the cylinder. Masses attached to the cylinder will often induce loadings in unforeseen directions during acceleration and deceleration phases.

In order to maximize the life of the cylinder, loads should be externally supported and guided wherever possible. This has the added benefit that a smaller cylinder can often be used, which will minimise air consumption and thereby running costs.

Rodless cylinders are Precision Engineered components designed to move loads in a smooth shock free manner. Rapid deceleration of loads can exert extremely large forces on the cylinder. These need careful evaluation as they can lead to premature catastrophic failure of cylinder components. Shock loading on the cylinder must be kept to a minimum. In the case of heavy loads, deceleration forces are best applied by external means directly to the load, in line with the centre of mass.

As with all mechanical equipment, the figures quoted in the catalogue are only a general guide as the circumstances of application are so diverse. Values quoted in the tables relate to dynamic loading conditions and must not be exceeded.

Information Required

To accurately select a rodless cylinder, the following information needs to be available.

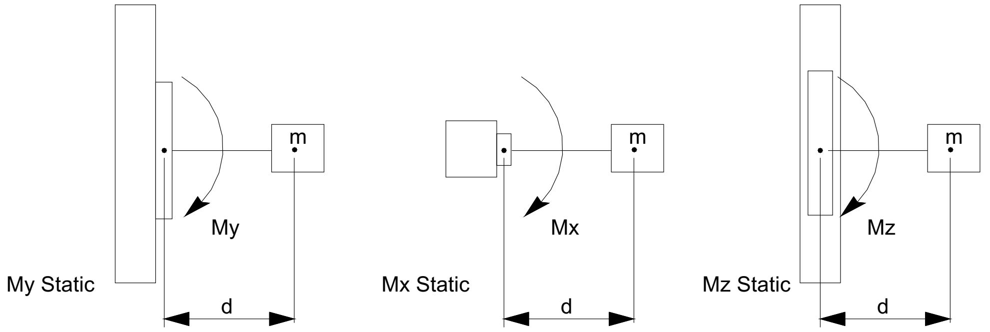
m (kg) The mass in kilograms which is supported or moved by the cylinder.
v (m/s)The velocity in metres per second of the moving load. Note that the peak velocity of a moving load will not be the same as the average velocity (obtained by dividing the stroke by transit time.) Use the appropriate velocity value when calculating moments/forces.
d (m) The offset distance in metres from the cylinder carriage to the centre of mass of the load (not necessarily the geometric centre)
s (m) The distance in metres over which the moving load is accelerated or decelerated (e.g effective cushion length, cylinder mounted shock absorber stroke)

Static Loading

In general static moments are generated by the effect of gravity on a mass supported at a distance from the cylinder carriage:

$$M_{X,Y,Z} = 10 \cdot m \cdot d$$

Static Moment Diagrams



Dynamic Loading.

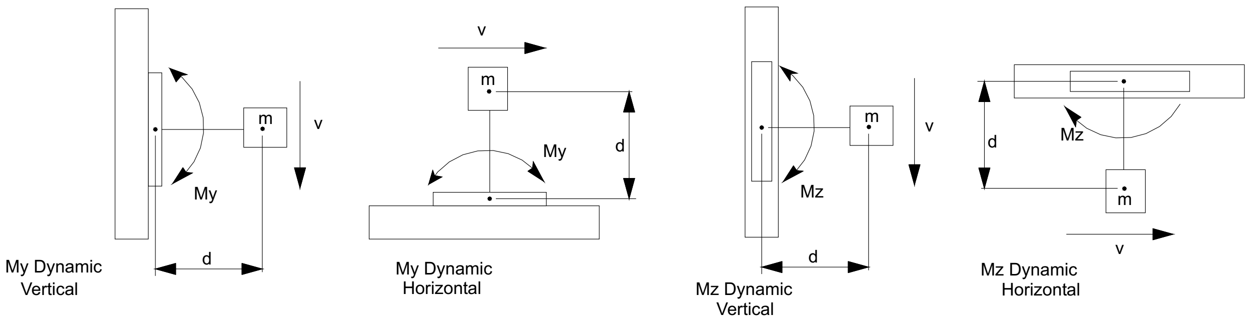
Dynamic moments are created by changes in speed of the moving load. Unless external shock absorbers are fitted separate from the cylinder, the rate of DECELERATION using pneumatic cushioning or cylinder mounted shock absorbers is far higher than piston ACCELERATION. The maximum dynamic moment is therefore that created when stopping the load rather than initial movement.

Where external structure mounted shock absorbers are fitted, directly acting on the centre of mass of the load, the highest loading on the cylinder is usually generated during load acceleration.

Note that the orientation of the cylinder is important when calculating dynamic moments.

Cylinder Horizontal: $$M_{Y,Z} = \frac{m \cdot v^2 \cdot d}{2 \cdot s}$$

Cylinder vertical: $$M_{Y,Z} = m \cdot d \cdot \left(10 + \frac{v^2}{2 \cdot s}\right)$$



Speed

All loading capabilities quoted in this catalogue are based on a maximum cylinder speed of 0.35m/s. Speeds up to 2m/s are routinely possible but loadings must be progressively reduced as the speed increases. The potential range of applications for rodless cylinders is so diverse, that each case needs to be considered on its own merits. As a general rule the loads given in the catalogue should be multiplied by the ratio:

$$\frac{0.35^2}{v^2}$$

Combined Loading
In many cases a cylinder is subjected to a combination of loads in different directions. In this case the following criteria should be applied.

$$\frac{M_x}{M_{X\max}} + \frac{M_y}{M_{Y\max}} + \frac{M_Z}{M_{Z\max}} \le 1$$

$$\frac{F_X}{F_{X\max}} + \frac{F_Y}{F_{Y\max}} + \frac{F_Z}{F_{Z\max}} \le 1$$