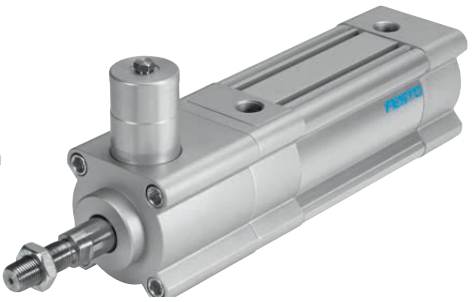
Blue Star Pneumatics – Top Tips: Cylinders

Clamping



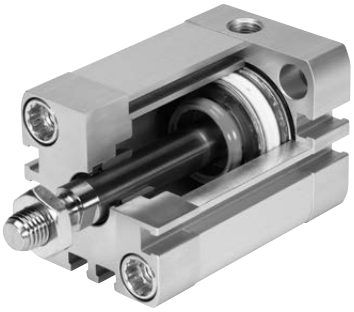
When designing a machine often one or more cylinders need to be used in a vertical orientation. But how do you ensure safe use of the cylinder? Normally this would be done by clamping the cylinder in some way however, each solution has its own safety considerations.

The preferred method is to dump the air leaving the cylinder at the bottom of its stroke before the guard door is opened or the operator exposed to the working areas.
If this is not possible and the load needs to be clamped in place then the cylinder motion should first be stopped using a brake then a clamp can hold the load in place. Various clamping mechanisms are available. One of these, end locks, comprises of a mechanical pin moved using compressed air which engages into a specific groove in the piston rod.

The next safest method is to stop and lock the load but this time using air to assist. This can be done by trapping air in the cylinder with lock valves at the cylinder ports or for more security using 5/3 way mid-position closed valves. However, both of these methods can potentially create another hazard by leaving air trapped in the system should the mechanics fail. This can lead to unplanned movements which could injure the operator of the machine or to maintenance staff who may accidentally release the air. Venting valves can be added but this doesn't always provide a suitable solution.

With all of these scenarios, we need to take into account EN ISO standard 13849-1 which states that the specific risk must be calculated to ensure that the clamping used to hold the load in place is sufficient. For more information on this see our website or join one of our range of safety courses.

Cushioning



Cushioning at the end positions of pneumatic cylinders ensures the cylinder can be used at as high a speed as possible whilst reducing the wear and shock on the piston. This is essential as the faster the speed the higher the productivity. Cushioning can be achieved in many different ways. Mechanical and elastic cushioning uses coil springs or elastic buffers to literally create a sprung stop. With pneumatic cushioning a braking effect is achieved by air compression or a controlled current of air. Hydraulic cushioning systems work in a similar way but using a viscous fluid, such as oil, to produce the brake.

Both elastomer buffers and pneumatic cushioning offer good performance at a reasonable price. Elastic cushioning is normally integrated as part of the cylinder piston or as a separate part in the end cap of the cylinder. It reduces the impact forces when the piston reaches the end of its stroke, however only a small amount of kinetic energy can be absorbed. Therefore it's mainly used for slow operating speeds and applications with short working strokes. When the dynamics and loads are larger, additional cushioning is required and this can be provided by pneumatics. Here the air in the cylinder is compressed to provide the braking effect. A needle valve can be adjusted to alter the flow of exit air from the cylinder. This is a very effective way of providing cushioning but each end of the cylinder needs to be adjusted separately to provide the optimum effect and readjusted through the life time of the cylinder to maintain the correct cushioning.

To avoid this issue, self-adjusting cushioning is available. This enables the cushioning to automatically adjust depending on the load and stroke; on a stroke by stroke basis. No adjustment is necessary as the exhaust air escapes through slots in the cushioning boss which automatically compensates by design. This provides optimum cushioning results for 80% of all industrial applications with no effort at all. With no dirt traps and being maintenance-free, self-adjusting cushioning is the go-to solution for all cylinders.

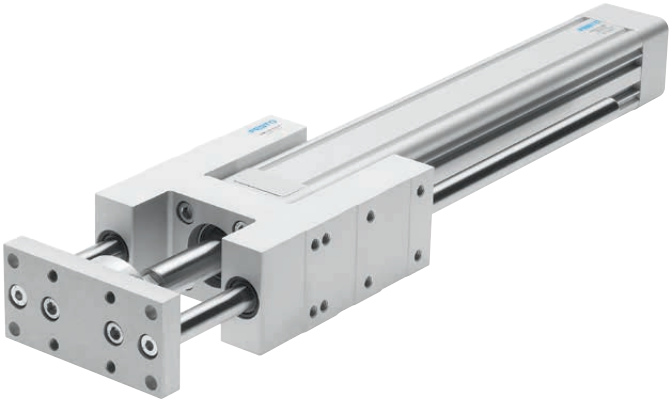
Guides

Cylinders are great when the load they are moving is central to the piston that is moving it. But what can you do when the load is unbalanced or exerts lateral forces on the piston rod? In this case, you can very quickly get excessive wear on the seals, bearings and even the piston rod itself leading to premature failure.

You could use a standard cylinder with a through rod – this ensures the load is not just centred on the front bearing but is spread across two bearings – one at the front of the cylinder and one at the back. But this solution is only really suitable for light loads.

For heavier loads a cylinder guide should be used. There are a number of different guides available – the most basic is the type that can be fitted onto a standard cylinder – a good solution if you need to retrofit once a machine has been designed or built. But a better solution, if you know that guides are needed at the design stage, is to order a cylinder with a guide built in. These come in different guises.

The rodless cylinder allows the movement that the cylinder makes to be contained within its length unlike a piston rod which extends out from the body, and the design provides greater rigidity and stiffness.



Alternatively a standard cylinder with an inbuilt guide can also provide the stability needed.

With the inbuilt guides and the rodless cylinder there are choices such as the choice of plain bearings or ball bearing. The plain bearings provide high load capacity and resistance to dirt particles and are a lower cost solution. Ball-bearing guides provide high precision and are backlash free with a constant accuracy throughout the service life.

Standards

There is some misunderstanding regarding ISO standards in the selection and use of pneumatic cylinders. If a cylinder carries an ISO standard label what does this actually mean?

It does mean interchangeability. Being able to change from one manufacturers ISO cylinder to anothers offers benefits in breakdown situations. The interchangeability includes the cylinder dimensions for the mountings - foot and clevis- and for certain accessories such as rod mounts. And it includes electric as well as pneumatic cylinders.

However, although the physical dimensions are covered by the standard other things like materials and performance are not. Make sure you check that the life expectancy, reliability, load capacity and speed of your chosen cylinder are correct for your application. The construction methods, materials, finishes and quality of the cylinder are also excluded so if you need a specific material finish on the surface of your cylinder or perhaps bellows on the piston rod, ensure you check the materials specification is what you require, rather than what the manufacturer wants to give you. For instance the ISO standard for profile cylinders, ISO 15552, specifies a maximum pressure of 10 bar but Festo's cylinders manufactured to this standard exceed this requirement and can operate to 12 bar.

When you compare cylinders manufactured to an ISO standard, it doesn't necessarily mean that you are comparing like for like. Overall ISO standards are great - but just use them with caution!

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