

Hydraulic Cylinders



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Hydraulic Cylinder Overview

Hydraulic cylinders generate power by compressing hydraulic fluid using a piston and rod within a hydraulic cylinder. The hydraulic cylinder consists of a closed end, referred to as a cap, and an open end which the cylinder rod fits through known as a cylinder head.

It is because of the straight line power generation method used by hydraulic cylinders that they are referred to as linear actuators. Actuators are components of an application that provide movement.

There are advantages to using hydraulic cylinders to generate power. In comparison to alternative power generation methods like electromechanical options, hydraulic power is capable of creating far more energy within a smaller space. Indeed, hydraulic cylinders have been shown to generate a power density (a measure of power produced by volume) in the area of ten times that of other alternatives.

Types of Hydraulic Cylinders



Welded Cylinders

Welded Cylinders are typically more compact and lighter than tie-rod cylinders. As a result of this compressed footprint, welded cylinders are frequently found in mobile applications where space is at a premium.

In terms of construction, these cylinders have the end flanges welded directly to the cylinder barrel. End caps are attached to each end flanges and held in place by bolts that are inserted through holes in the end cap and flange.

Tie-rod Cylinders



Typically these cylinders have end caps that are attached to the end of the cylinder barrel via a rod that is inserted through holes in the end caps. Once through the hole, the rods are secured in place by nuts threaded onto the end of the rod.

Tie-rod Cylinders tend to be used in heavy industrial/manufacturing operations due to their robust nature as well as Agricultural applications.

Telescoping Cylinders



Telescoping Cylinders are comprised of multiple tubular sections that fit together. The tube-based sections function independently as small cylinders. By adopting this design, it is possible to vary the size of the individual tubing sections to create long overall cylinders. At the same time, the ability to telescope down into a small footprint makes this type of cylinder desirable for mobile applications in which the cylinder mounting area is restricted.

Bushing Cylinders



Commonly found in hydraulic applications the bushing cylinder is often described as being similar to the clevis cylinder. A key point of differentiation, however, is that the bushings are what is used to provide the connection to the moving arms

Hydraulic Cylinder Components

Cylinder Base

The cylinder base provides a closed end to the hydraulic cylinder. Cylinder bases also serve as mounting components in hydraulic cylinder applications. There are several different options for connecting the cylinder base to the hydraulic cylinder, including bolts, tie rods or welding.

Cylinder Head

The cylinder head is located at the top of the hydraulic cylinder. The primary purpose of the cylinder head is to facilitate the piston rods access to the cylinder chamber. By doing so, the cylinder is split into two sections to accommodate the movement of the piston within the cylinder to create pressure.

Seal Gland

Seals are attached to the cylinder head as a means of preventing the pressurized hydraulic fluid from leaking out from the piston rod and the cylinder head. In some hydraulic cylinders, the seal and the rod are a single unit.

Once in place, the hydraulic cylinder the section of the cylinder between the seal and the cylinder head is referred to as the seal gland.

Cylinder barrel

Cylinder barrels are seamless tubes which are used to contain the pressure created from the liner power created by the piston and rod compressing the fluid in the cylinder. The cylinder is seamless to maximize the structural integrity of the cylinder as it comes under pressure,

Piston

The piston performs the role of dividing the cylinder into two separate sections. With the cylinder divided, pressure differences are created on the opposite sides of the cylinder allowing for the piston to push and pull. The piston is connected to a piston rod which helps to drive the piston within the cylinder creating straight line power.

Piston rod

Piston rods connect the piston, as noted above, and can be configured as either a single rod-end with the rod going through only one end of the cylinder or as a double rod-end configuration in which the piston rod extends through both ends of the cylinder. Piston rods are highly polished to ensure as tight a seal as possible at the cylinder ends to maximize power.

Hydraulic Cylinder Mounting Options

There are four main ways in which cylinders are mounted; these being flange mounted, side-mounted, centerline lug mounts and

pivot mounts. The type of mounting method employed can have a significant impact on the efficiency of the cylinder. To reach peak efficiency, a fixed mounting arrangement along the centerline of the cylinder will produce the most significant linear force.



Pivot mounts

As the name implies pivot mounts allow the cylinder to pivot in one direction. The pivoting capability of these mounts means that a pivoting rod-end must be used as well. Some of the more common types of pivot mounts include clevises, spherical bearings and trunions.

Flange mounts

These mounts are among the most robust mounting arrangements. Flanges come in three configurations; these being the head square flange, rectangular head flange and the rectangular head flange. As flange mounts are very rigid, they require particular attention to be paid to their installation as proper alignment of the mount is critical for their effective operation.

Centerline lug mounts

With centerline lug mounts dowel pins are utilized to hold the flange to the machine when operating under high pressure.

Side-mounted cylinders

These cylinders generate a twisting motion as the cylinder comes under pressure. As a result of this action, side-mounted cylinders are placed under more strenuous operation than other mounting types. To manage this aspect of side-mounted cylinders, proper alignment is required as is proper load management support. This mounting arrangement does have the benefit of simplified installation and servicing.

Hydraulic Cylinder Features

Single Acting Hydraulic Cylinders

One of the main features of a single-acting piston hydraulic cylinder is that the operating stroke is one-directional; whereas, the return stroke is enabled by the load, spring or some other exterior force. The working stroke for a single-acting cylinder can be created either through cylinder extension, making the cylinder a push cylinder, or through cylinder contraction. This type of cylinder is also known as a pull cylinder.

Double Acting Hydraulic Cylinders

These types of cylinders have two opposite facing piston surfaces that control the application of force to the hydraulic liquid. The hydraulic energy in these cylinders is converted through the compression of the hydraulic fluid into mechanical energy for the movement of the pistons. Pistons

usually have separate connections that enable movement in both directions allowing the force to be applied in both directions.



Hydraulic Cylinder Applications

The matching of a particular hydraulic cylinder with a specific application requires the consideration of several variables, including:

Space: In applications where there is limited space for the installation consideration of the mounting option and cylinder type is essential. Telescoping cylinders may deliver a more compact footprint for cramped spaces.

Environment: The environment in which the hydraulic cylinder is to operate will have an impact on the selection of the appropriate cylinder — for example, humidity, temperature and salt water exposure all impact the selection of the hydraulic cylinder.

Material: The specifics of the application may also determine the type of material used for the cylinder. In those applications

featuring more demanding performance, it may make sense to consider a more rugged material such as ductile iron for the hydraulic cylinder.

Hydraulic cylinders are in extensive use across a large number of industries. It is hydraulic cylinders that support the very necessary capabilities in machinery to provide lifting, pulling or pushing. Being responsible for such generic functionality means that hydraulic cylinders cross many boundaries in terms of their application within various industries. A summary of some of the industries and machines supported by hydraulic cylinders is provided below:

Agriculture

- Earthmovers
- Harrows
- Harvesters
- Log splitters
- Plows
- Rotary blades
- Seed drills
- Soil tillers
- Tipping trailers
- Wood chippers

Construction



- Articulating trucks
- Backhoes

- Cranes
- Crushers
- Dozers
- Excavators
- Graders
- Haulers
- Land scrapers
- Pavers
- Pay loaders

Forestry

- Rotators
- Swivel fittings

Material Handling



- High capacity lifts
- Hydraulic floor cranes
- Hydraulic jacks
- Hydraulic post tables
- Overhead cranes
- Pallet jacks
- Scissor lifts
- Stackers
- Tilters
- Vertical reciprocating conveyors

Mining

- Articulated trucks
- Dozers
- Frontless hydraulic shovels
- Hydraulic mining shovels
- Mining excavators
- Rock breakers
- Underground loaders

- Wheel loaders
- Wheel Tractor-Scrapers

Oil & Gas

- Ballast control systems
- Cathead actuators
- Deck crane systems
- Hydraulic fracturing equipment
- Mooring systems
- Motion compensation systems
- Platform drills

Snow Equipment

- Snow plows

Truck & Trailer

- Boom trucks
- Crawler cranes
- Dump bodies
- Heavy lift cranes
- Lift gates
- Salt spreaders
- Truck cranes

Waste Equipment



- Cable hoist truck
- Garbage trucks
- Hook hoist trucks
- Lift trucks
- Luger hoist trucks
- Roll off trucks
- Stationary compactors
- Tarper systems
- Vertical balers

Seaway Fluid Power (SFP), was established in 1976. Based in St. Catharines, Ontario, SFP provides its customers with quality fluid power products and services. SFP carries an extensive parts inventory of fluid power products such as hydraulics, hydraulic cylinders, pneumatics, hose and fittings, stainless steel fittings, instrumentation and compressed air.