Pneumatics systems

SECTION 3.6

Pneumatic and Hydraulic circuits

These are fluid power systems that use fluids to control and transmit power, this is done by using components such as pumps and compressors, values, actuators and conductors.

The two types are Hydraulic systems and Pneumatic systems.

Hydraulic systems use a liquid like oil or water
Pneumatic systems use a compressed gas such as air.

Pneumatic vs Hydraulic

Things to consider when choosing:

- Speed of operation
- Power
- Suitability for environment

Pneumatics operate faster because air flows quickly through a system with less resistance. Air can also be vented into the atmosphere while Hydraulic liquid needs to go back to a storage area. Another advantage is that air is cleaner while Hydraulic liquids can leak out causing pollution.

However, Hydraulic systems are more powerful and produce more force, making these systems good for daggering and lifting.

Pneumatic systems are more expensive because of the amount of energy needed to compress the gas.

Common pneumatic circuits and components

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Single and double-acting cylinders

These are components that are used in Pneumatics that produce a linear or reciprocating motion, they do this by moving a piston.

There are two types:

- Single-acting cylinders
- Double-acting cylinders

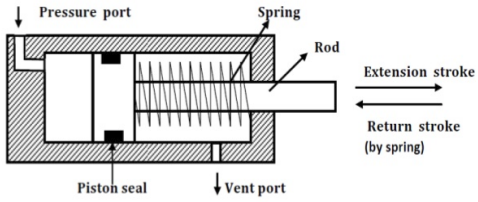
Single acting cylinders

These are pneumatic components that create a force in one direction, in a linear motion. This is usually outwards only and needs a spring to return the cylinder to its original position, this is a disadvantage because it requires more force.

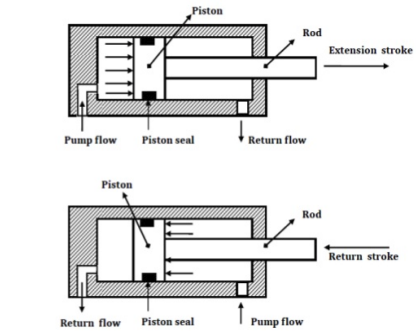
Double acting cylinders

These are both extend and retract using pneumatic pressure producing a reciprocating motion. This is done using two ports, one for bring air in for the outwards motion and the other for inwards motion.

SINGLE ACTING CYLINDER



DOUBLE ACTING CYLINDER



Calculating force

The force output from the cylinder can be calculated using the formula:

Force = Pressure x Area

The surface area may need to be calculated before using the formula

$A=\pi r^2$

Calculating force example

The radius of the piston is 10mm and the pressure in the cylinder is 0.5N mm2.

Calculate area: 3.14 x 10x10 – 314mm2
Force = 0.5 x 314
Force = 157N

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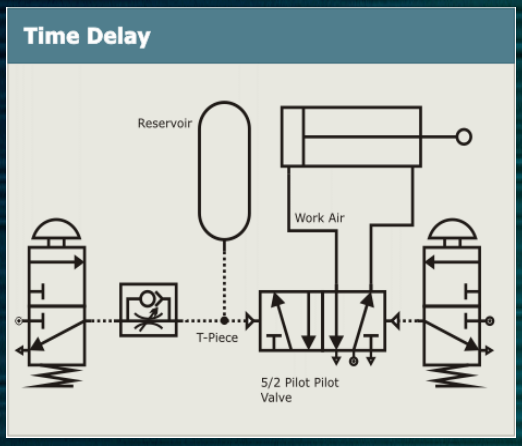
Pneumatic and Hydraulic circuits

Delay circuits

A delay circuit can be created by using a unidirectional flow control valve and a reservoir connected in series. The valve restricts the flow of air into the reservoir. This causes the reservoir to fill up slowly., resulting in a time delay. The length of this can be increased or decreased using an adjustable control valve.

The example to the right shows a five point valve is operated when the pressure in the reservoir reaches the required level. Air is then released and the piston in the cylinder moves. The three point valve can be used to both start the time delay and reset the system.



Logic circuits

Valves placed in series or in parallel can be used to create simple logic circuits.

An AND circuit consists of two valves connected in series. The button on each of both valves must be pressed for the cylinder to operate. E.g. The cylinder wil only operate when both A and B valves are pressed.

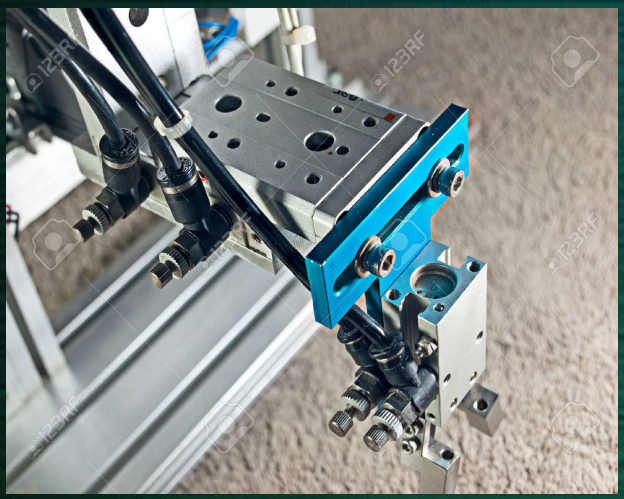
An OR circuit consists of two valves connected in parallel. The cylinder will operate if any of the two buttons are pressed. E.g. the cylinder will operate when button on either A or B are pressed.

Application of Pneumatics

The high speed, accuracy and precision of pneumatic systesm makes them ideal for robotics applications.

They are also used in factory production lines, increasing automation. Assembly tools can also be powered by pneumatics reducing human involvement increasing speed and accuracy.

Tools like drills, saws, screw drivers and hammers can be pneumatically controlled for greater power and speed. A jack hammer is a good example.



Pneumatics systems

SECTION 3.6

What is the difference between a Pneumatic and hydraulic system

Which would be better in a Health care or Food environment?

Why

Draw down some common Pneumatic components and explain them

Draw down a delay circuit and explain how it works

Draw down an AND and OR Pneumatic circuit and explain how they work