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HYDRAULIC AND PNEUMATIC SYSTEM

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Abstract

In a hydraulic and pneumatic system in which is consisting the fluids have been use to pressurized in a terms of as a fluid power. Fluids are either gas or liquid. They are termed hydraulics for a liquids and pneumatics for a gases. Hydraulics system use petroleum oil, synthetic oil, water etc., while pneumatics use air as the most prime medium. The fluid power is one of the methods of energy transfer. Energy transfer is form the power source to an actuator. In these power transmission system both the hydraulic and pneumatic system. Hydraulics vs. pneumatics pressurized fluids acts in a certain manner in most situation. However, there are instances where a gas-type fluid does not perform as it liquid counterpart does. In electrical transmission, energy in the form of electricity) is transmitted through conductor to an electric actuator (motor) where work is to be done. In hydraulic transmission, energy in the form pressurized liquid (oil) is transmitted through piping to a hydraulic actuator (cylinder) where work is to be done. In pneumatic transmission, energy in the form of compressed air its transmitted through piping to a pneumatic actuator (cylinder) where work is to be done.

keywords: Hydraulic system, pneumatic system, Pascal law

1. INTRODUCTION

The fluids have been used to help human from ancient time. Even before man developed an understanding of the science and knowledge of how it can be usefully used, it had been used as an application to reduced burden. The primitive application known is the water wheel used in irrigation and the driving of ship with the aid of wind, using logs of wood to cross the river etc. but once the science of fluids and industrial revolution joined hands the application of the fluids have been wide and ever growing and now it is used in a all the fields of engineering, biomedical, space, automobile, defense, agriculture. and all.

The greatest advantage of this system it is versatility to be control by feather touch and drive a large power (in tons) and its precision in its application when used in a repeated loading with close tolerances (in microns). In this fast growing computer / electronic world, its still advantageous and easy to control this powerful muscle remotely, smoothly, efficiently, safely and precisely to accomplish useful work. The development in the designing of a hydraulic and pneumatic system is today integrating with resent development namely the electronics and computers. The use of fluids power system in industrial sectors had helped in producing quality components at less cost and less time. Fluids power is not used only in industrial sectors but also in household application. They are available in small size which are portable and easy to operate.

Hydraulic System

The type of system use for transporting the fluids from one place to another via pipe accessories in household and industrial application are termed as fluids transport system. Fluid power system are specifically used to perform the work. In this system, the prime mover (electric motors) are coupled to components (pumps or compressors) to supply pressurized fluids to produce translation motion (using cylinder) or rotary motion (using motors).

1.1 Law Of Conservation Of Energy

“Energy can either be created nor destroyed but can be change from one form to another form”. In fluids power, energy not used in converted to heat. The heat generated in the system is controlled using heat exchangers.

1.2 Flows

The centrifugal pumps are non-positive displacement pumps, flows required at the actuator to make it go. The rate of flow (depends on the pumps) determine the speed of actuator. For a constant flow rate, depending on actuator volume the speed of the actuator changes (variable speed of extension and retraction is due to difference in area of the piston).

1.3 Pressure

Pressure $P = \text{force} / \text{area}$

Pressure in hydraulic system comes from resistance to flow. Pump produces flow and not pressure. If the flow is restricted

(a) When passing through the components of the system (pipe, elbows, etc.)

(b) Loaded induce by the actuator then it result it pressure .

1.4 Pascal's Law

“Pressure applied on a confined fluid at rest is transmitted undiminished in a all direction and acts with equal force on equal areas , and at right angles to them .”

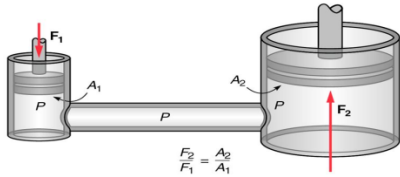


Fig-1: Pascal law of pressure

1.5 Fluids

The most important components in the hydraulic system is the fluids they are primarily used as

- Lubricants –fluids as lubricant allow the relatively sliding block to moved with less friction and wear of parts
- Energy transfer – They transfer the energy from the input to output devices as they are incompressible .
- Heat transfer – The heated fluids enters and radiates the heat energy out and keeps the system cooler .
- Sealant – The fluid between the sliding spool of the walls and the outer cylinder acts as sealant because of its viscosity .

2. PNEUMATIC SYSYTEM

In pneumatic system the pressurized air used to transmitting the power system .

The term ‘ pneumatic ’ is derived from the Greek word *pneuna*, meaning wind or breath hence pneumatic may be defined as the study of moment of the air. Pneumatic power is the power that is transmitted by pressurized air . It may be used to power machines or to control or regulate machine

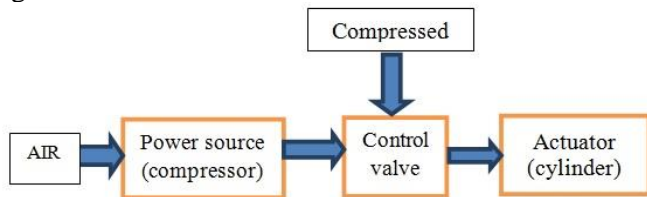


Fig-2.1: A simplified pneumatic system

A simplified pneumatic system with only three block given figure 2.1 in industries , pneumatic medium usually employed for transmitting power is the highly compressible air . Since gaseous are compressible in the ratio of decrease volume to increase in pressure , a compressor use an energy source . The compressed air is then prepared or created several stages to remove under desirable contaminants present in it and stored in a tank called receiver tank.

The compress air medium is subsequently use to do work in a control manner it allow to expand back to the atmosphere pressure . the work done in this expansion is transmitted to load surface such as a piston or a vane ,

which will be moved by the expanding air with a force equal to the product of air pressure acting the piston and area of the piston (force = pressure . area)

2.1 Pressure In Pneumatic

Pneumatic system have been developed as low – pressure systems in compression to hydraulic power system . Pneumatic air consuming devices such as valve and cylinders are designed for a maximum operating pressure of 8 to 10 bar . However , practical experience has showed that 6 bar is the ideal pressure for the operation of pneumatic system .

2.2 There ids following laws are applicable or used to the compression systems.

- Pascal's law we had discuss the beginning of the slide
- Gas law :it's important to understand three variable of pressure , volume and temperature , and their relationship in the operation of a pneumatic system.
- Boyle's law: The relation between the pressure and volume of a gas is a given by Boyle's law . Mathematically, $P_1V_1 = P_2V_2$ (T is constant)
- Gay- Lussac's law : if the volume of given mass of gas is held constant , the absolute pressure various directly with the absolute temperature . The relation can be expressed as $P_1/T_1 = P_2/T_2$ (V is constant)
- Charl's law : it's said that at constant pressure , the volume of given mass of gas is proportional to the absolute temperature . Mathematically as $V_1/V_2 = T_1/T_2$
- Combined Gas law : The variables of pressure , volume and temperature are related to a fixed mass of the gas . This law is expressed mathematically as $P_1V_1/T_1 = P_2V_2/T_2$.

CONCLUSION

The both system of hydraulic and pneumatic system are use the transmission the power to do some useful work for the various purposes. The hydraulic operation are used to large power transmission the system are working media higher than the pneumatic system .The pneumatic operation are used to low working operation up to 10 bar. Both the system are easy to operation.

REFERENCES

[1] Pneumatic control (JOJI P.)
 [2] Hydraulic control and pneumatic controls (K. Shanmuga Sundaram)
 [3] Hydraulic and pneumatic system A Technician's and Engineer's Guide