Hydraulic Control Systems

Many mechanical systems are controlled by hydraulic lines containing hydraulic oil whose purpose is to communicate a desired control signal from an operator (usually human) to the component whose activation is desired. These systems are commonly seen in the braking and steering systems of motor vehicles but are also extensively used in large machines such as cranes, earth-moving equipment and aircraft. Indeed a modern passenger plane is said to be equipped with more than 7 miles of hydraulic control line. These hydraulic systems can consist of a positive displacement pump to supply high pressure oil, a control valve activated by a human or some sensor to control the oil pressure in a hydraulic line and an actuator at the other end of the line that performs the desired mechanical action. Figure 1 is a typical schematic of a hydraulic control system. One of the advantages of hydraulic control systems is the ability to handle very

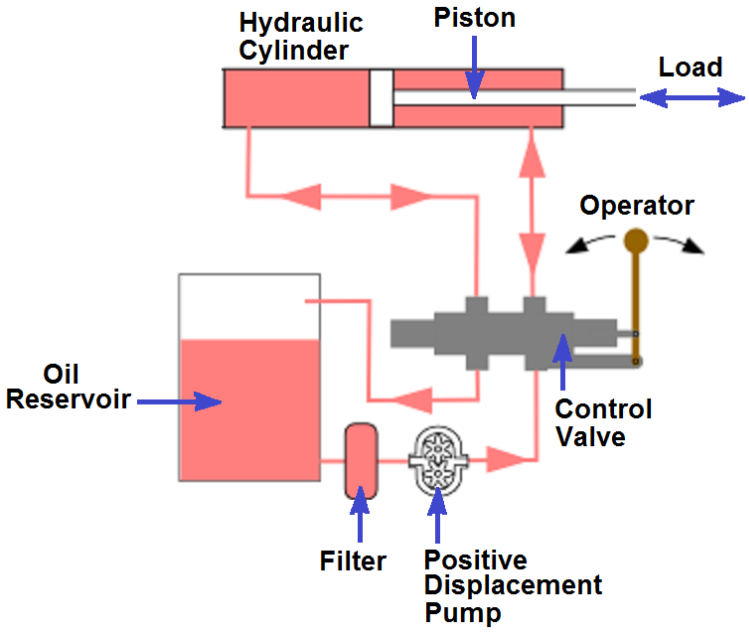

Figure 1: Typical hydraulic system.

large loads or accommodate tremendous forces. One important limit to the response time in hydraulic control systems is the occurence of cavitation (called column separation) in the hydraulic oil. This is particularly a problem in fighter aircraft.

Figure 2 is a simple example of a hydraulic control valve.

There also exist pneumatic control systems such as air brakes that use air rather than oil to communicate the control. These are similar in many ways and somewhat simpler but limited to much smaller loads and slower in response times. An example of a pneumatic control valve is included in Figure 3.

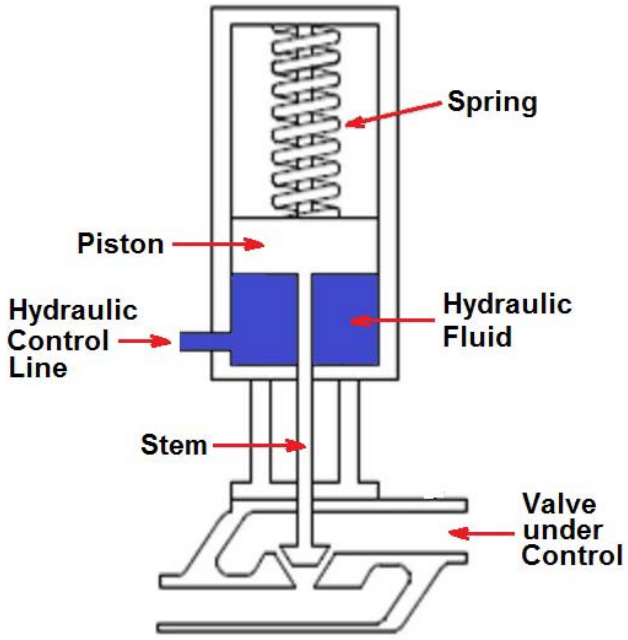

Figure 2: Hydraulically actuated valve.

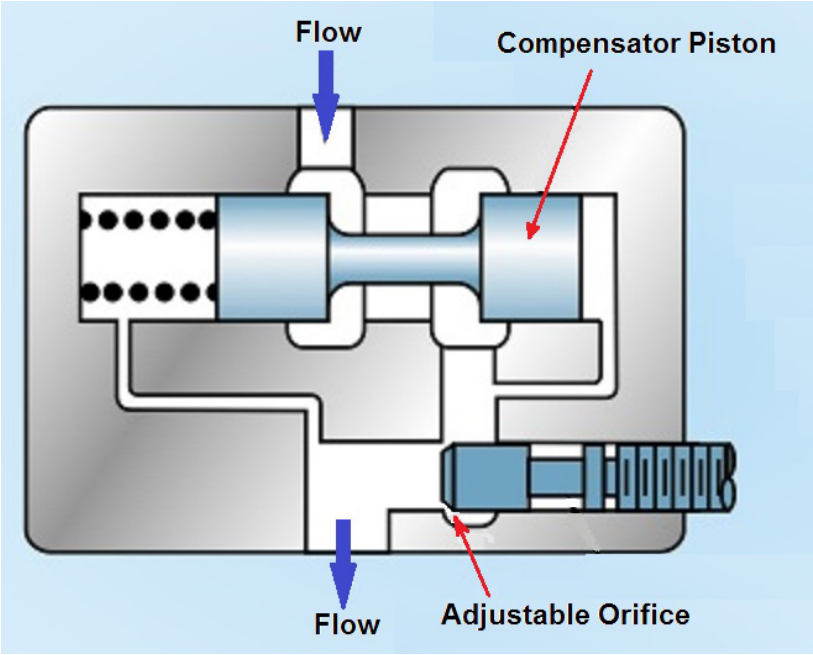

Figure 3: Typical pneumatic valve.