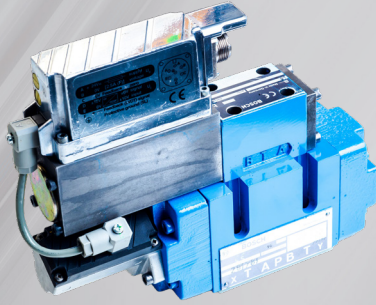


## The Useful Complexity of Proportional Control Valves



A proportional control valve, also known as a variable displacement valve, can be used to provide variable hydraulic outputs proportional to an electric input signal in direction, flow, or pressure. It can hold from 4% to 100% open value.

Simply put, a proportional valve offers great power and adjustable control.

PCVs, for all their power and diverse functionality, may also present some issues that need troubleshooting and service.

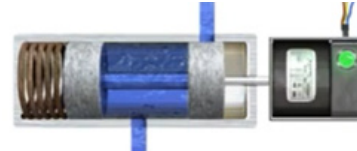
To help understand proportional valves, let's first look at how they work, then list their diverse uses by design within hydraulics systems. Finally, HPS offers hard-to-find expert troubleshooting and repair assistance for its Servo and proportional valves.

### Control Valve Design Differences and Uses

There are many types of control valves, and they all function by converting an electric current into a magnetic field that interacts with the valve's coiled wire to change fluid flow and pressure. This action can be either directional or non-directional.

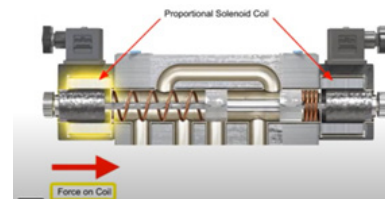
Directional control valves are useful in complex hydraulics systems, and are available in two main designs options:

- Directional (Traditional):
  - AC or DC current
  - Fully open or fully closed between flow paths, or On / Off.



Fully Open or Fully Closed

- Proportional - allows infinite positioning of spools and flow volumes:
  - DC current only
  - Varies voltage with variable spool position



Servo valves regulate highly accurate opening and closing through small incremental changes within some range. Include a feedback loop from a linear force transducer to confirm speed or position via an internal feedback wire.

### How Do Proportional Control Valves Work?

A proportional valve is a valve that regulates the flow of fluid based on some input signal.

A proportional valve consists of an actuator and a two-port or three-port valve. The actuator is usually a piston or diaphragm with a rod attached to it.

The rod is connected to the stem at one end and pivots in the center of the two-port or three-port design.

For a proportional control valve to work properly, it needs an input signal, which can either be analog or digital. The signal determines how much pressure is required for the desired output.

A coil inside the PCV changes its shape when there is an electric current running through it. The coil then moves two plates inside the valve to direct the proportionate amount of fluid through the output.

Proportional valves, in many cases, look exactly like the spool valve they're based upon. The difference between standard solenoid valves might be the spool and coil in many cases.

Solenoid valves shift between two or three discrete positions where one or two coils pull the spool from its spring-biased position to its fully open position. Proportional valves are the electrical alternative to traditional lever valves that take multiple users and manual precision.

The function of proportional valves falls into a wide spectrum somewhere between manual on/off solenoid valves and servo valves, with a nonlinear output flow in relation to the control signal.

However, proportional valves offer:

- An inexpensive way to control force, velocity, and position on machinery needing high-speed responses at high flow rates
- Control over flow, actuator position, velocity, and torque
- Synchronized action of many different cylinders
- Nominal filtration (10 micron)
- Low-pressure operation (~ 10 bar)
- An open loop hysteresis (3% – 6%)
- Positive overlap – dead zones around null (zero) position

In the past, proportional valves couldn't match servo valves' performance and were mass produced, whereas servos needed meticulous and precise manufacturing, which made them up to 10 times more expensive.

Today, technology has advanced the performance of proportional valves, to the point that some manufacturers make them like servo valves with larger tolerance allowances and looser fits.

In comparison to proportional valves, servo valves offer:

- The same functions as DCVs, but with automatically incorporated flow control
- A low power torque motor (~ 0.1-0.3 W)
- Nominal filtration (3 micron)
- A typical response of 200Hz +
- A high pressure drop operation (~70 bar)
- A hysteresis of approx. 0.1% due to high power at the pilot stage and by position control of main stage
- Zero overlap due to high manufacturing precision
- Relatively high cost due to precision manufacturing

### Help With Servo and PCV Repairs

Technical expertise is critical when repairs are needed for servo and proportional valve repairs and it may be difficult to find qualified help.

Luckily, HPS offers repair assistance on proportional valves, providing a one-stop shop for repairing the SYDFEE series using the A10VSO DFEE proportional controls. If more or different help is needed, we offer advice on how to choose adequate Servo and proportional valve repair facilities.

For all their complexities that lead to end-users seeking professional repair help, the proportional control valve is one of the most useful and powerful tools for a hydraulic company's production line.

The functionality of proportional valves lies between manual on/off solenoid valves and servo valves.

PCVs have great power and control at a lower cost than Servo valves, making them ideal valves for providing accurate force, velocity, and position on machinery needing high-speed responses at high flow rates.



[sales@hydparts.com](mailto:sales@hydparts.com)  
[www.hydparts.com](http://www.hydparts.com)



41350 Production Drive  
Harrison Township, MI 48045



Toll Free:  
(888) 477-7278