

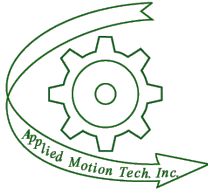
# Understanding Proportional Valves

## UPV

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### Topical Outline

- Proportional valve fundamentals
  - Non-electronic proportional valve control?
  - Discuss solenoid operation; fixed force versus variable force
  - Battle of forces; solenoid versus fluid and solenoid versus spring
  - Compare and contrast standard directional control valves and electro-hydraulic proportional valves
  - Force-controlled versus stroke-controlled solenoids
    - Differences in valve characteristics and operation
- Proportional valve schematic symbols (on-going throughout the seminar)
- Understanding electro-proportional relief valves
  - Direct-operated vs. pilot-operated relief valves
  - Valve uses
    - Variable, adjustable, automated control of system pressure
    - Pilot pressure signally for pumps and other pilot pressure spool shifted DCV's
- Understanding proportional relief valve construction
- Functional operation of relief valve drive amplifiers
- Drive amplifier control of proportional relief valves – on board vs. separately installed
- Understanding proportional pressure reducing valves
- Compare and contrast prop. relief valves to prop. reducing valves – operation and application
- Understanding electro-proportional directional control valves
  - Discuss valve ANSI/ISO patterns and importance of proper valve sizing
  - Understanding of throttle valve principle and benefit of simultaneous meter-in and meter-out speed control
  - Introduction to directional control spool types and their intended application
  - The purpose and application of 2:1 DCV spools
  - Direct operated version
    - Using force-controlled solenoids
    - Using stroke-controlled solenoids
  - Pilot Operated version
    - Using force-controlled solenoids
    - Using stroke-controlled solenoids
  - On-board electronic driver amplifiers vs. separately installed electronics
- Understanding proportional flow control operation and application



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- Proportional valve pump and motor applications
  - Remote pressure control – optimizing system pressure for the immediate needs of the hydraulic system
  - Controlling pump displacement – hydraulic system flow for the immediate ‘speed’ needs of a hydraulic actuator, actuator acceleration/deceleration rates
  - Controlling hydrostatic transmission flow direction, actuator accel/decel rates, speed, starting and stopping of the hydraulic motor that is connected to the pump
  - Controlling hydraulic motor displacement for the purpose of controlling hydraulic motor torque (and hydraulic motor HP demand)
- For Bosch Rexroth valve users – understanding the requirements if any for changing to new series valves
- Understanding the functional operation of separately installed valve driver amplifiers – voltage signals – use for monitoring operation and troubleshooting (specific information provided for each valve for each lab exercise)
- Lab exercises – dispersed throughout course
  - Operation and control of a direct operated electro-proportional relief valve
  - Operation and control of a pilot operated electro-proportional relief valve
  - Operation of a direct operated proportional relief for the control of a variable displacement pressure regulating pump’s system pressure
  - Function, operation of a direct operated non-feedback DCV valve + voltage measuring exercise
  - Function and operation of a spool position feedback direct operated DCV
  - Using a ‘breakout’ box for troubleshooting on-board electronic valves
  - Function and operation of a non-feedback pilot operated DCV
  - Lab or demonstration of a proportional pressure reducing valve
  - Lab or demonstration of a proportional flow control
- Ideas for proper valve selection that will meet the performance needs of the hydraulic axis
- Compare and contrast open process loop control vs. closed process loop control – fundamental understanding of the difference between valve driver amplifier and a hydraulic axis controller – PID
- Why is valve sizing so critical and what does this mean for the maintenance person?