

Hands-On-Hydraulics – (HOH) – Topical Outline + *Extras*

- Compare and contrast Fixed displacement pumps and system relief vs. Variable displacement pumps with pressure regulating controls
- Using pressure regulating variable displacement pumps and setup
- Understanding remote pressure control with pressure compensated pumps and setup
- Understanding load sensing control with pressure compensated pumps and setup
- Using HP control with pressure compensated pumps
- Pressure regulating pump pressure compensation and spike pressure relief **lab exercise**
- **Pressure regulating pump lab exercises** – remote pressure control & load sensing control
- Review of hydraulic principles – pressure, flow, power, throttle valve speed control
- Using relief valves as...
- System relief valves with fixed pumping equipment
- Spike pressure reliefs with pressure compensated pumps
- Protecting cylinders – port reliefs
- Protecting hydraulic motors – crossport reliefs
- Standard or proportional relief for remote pressure control for a variable displacement pressure compensated pump
- **Relief valve lab exercises** – demonstrate proper set up procedures for relief valve applications (above)
- Using reducing valves as
- Motor torque control
- Cylinder force control
- Circuit pressure reducing with a sandwich reducing valves
- **Reducing valve lab exercises** – demonstrate proper setup and adjustment with subplate mounted valves and with sandwich style valves
- Understanding *stack/sandwich valves* (DO3)
- **Sandwich valve lab exercises**
- Reducing valves used as a hydrostat for *meter-in pressure compensation* (regulated flow)
- Understanding load control with counterbalance valves
- Understanding load holding with pilot operated check valves
- Using directional control valves – understanding spool types uses with various circuit functions
- Understanding pilot operated directional control valves
- Evaluating pilot operated D.C.V. model code, function and options
- **Pilot operated D.C.V. lab exercise** – disassemble, compare to the model code, assemble and put into an operating circuit

- Understand the requirements for fluid condition and cleanliness – ISO 4406 standards
- Understanding the operation and use of bladder type accumulators
- Checking and setting accumulator precharge pressure – **Accumulator lab exercise**
- Understanding and using proportional relief valves understanding interface electronics
- **Proportional relief valve lab exercises** (*discretion of instructor & needs of students*)
 - Understanding and using direct operated proportional D.C.V.'s with spool position feedback
 - Checking the operation and setting up feedback direct operated D.C.V.'s (lab)
- Reading and interpreting industrial machine hydraulic schematics
- **Lab exercises - Round-Robin troubleshooting exercises**

EXTRA – 20+ ideas that the student will learn and use on the job

1. System relief valve setup considerations for fixed displacement pumps
2. How to properly set a spike pressure relief valve when used with a pressure compensated variable displacement pump
3. How to evaluate hot running hydraulic systems
4. Determine why the hydraulic pump's electric drive motor shuts down on overload
5. Troubleshooting worn pumps
6. What's the difference between meter-in and meter out speed control
7. When meter-out speed control cannot be used
8. Understand stack valve systems by properly reading and interpreting a hydraulic schematic
9. Properly assemble D03 stack valve systems according to a hydraulic schematic
10. Understand and properly setup a pressure compensated pump
11. Understand and properly setup a remote pressure compensated pump
12. Understand and properly setup a load sensing/meter in pressure compensated pump
13. Understand the concept of a horse power controlled pump
14. Properly check accumulator precharge pressure
15. Add nitrogen to an accumulator
16. Setup a counterbalance circuit
17. Understand the proper configuration of a hydraulic circuit when flow controls, counterbalance and load holding valves are all used to control the operation of a cylinder circuit
18. Understand the application of various directional control spool types
19. Evaluate hydraulic system fluid condition and cleanliness
20. Understanding the universally accepted ISO 4406 contamination code and what it means for pump and valve life expectancy
21. BONUS - How clean up hydraulic fluid to specific system cleanliness requirements and what these requirements are for any hydraulic system – when is it necessary to change fluid
22. BONUS - Develop troubleshooting techniques
23. BONUS - Develop schematic reading and interpretation techniques – how does the circuit work
24. BONUS – Determine if a cylinder has a piston seal leak
25. BONUS – troubleshoot proportional relief and directional control valve systems (*discretion of instructor & needs of students*)