Industrial Hydraulic Principles

IHP

Topical Outline

- What is a hydraulic powered and controlled machine
- Introduction to Industrial Hydraulics Technology
- Understanding hydraulic energy & hydraulic power – Heat production of hydraulic systems
- Relationship of force, area, and pressure – Pressure to develop force and tonnage
- Relationship of torque, displacement, and pressure for hydraulic motors
- Relationship of fluid flow, GPM, and actuator speed
- Hydraulic component symbol interpretation (on-going throughout the seminar)
- Reading and interpreting hydraulic schematics – techniques (on-going throughout the seminar)
- Basic fluid power calculations related to fluid pressure, fluid flow, actuator velocity/rpm, hydraulic power, and heat production
- How hydraulic speed control works (throttle valve principle)
- Hydraulic shock, how it is caused and requirements to control actuator acceleration and deceleration
- Understanding relief valves – direct operated, pilot operated and venting options – piloting and draining options and they effect the function and application
- System relief circuits, multiple system pressure relief circuits, port relief circuits, cross port relief circuits
    a. Lab exercise – comparing pressure relief characteristics between 3 different relief valves
    b. Lab exercise – setting system pressure
    c. Lab exercise – externally piloted relief valve with venting option
    d. Lab exercise– multiple system pressure
- Understanding directional control valves – direct operated and pilot operated types – spool – spool types and their uses – 2 position vs. 3 position valves – piloting and draining options and how they affect the function and application
    a. Lab exercise - meter-in vs. meter-out speed control
    b. Lab exercise – understanding pilot operated directional control valves
- Regenerative circuits
- Pressure reducing valves, application and operation
- Load sensing with hydrostats (pressure reducing valves)
    a. Lab exercise – pressure reducing valves, Lab exercise – load sensing

- Multi-function valves, function, and application
- Sequence circuits, counterbalance, unloading applications
    a. Lab exercise – counterbalance Lab exercise – sequence circuit requiring force limitation
- Hydraulic cylinder and hydraulic motors – how to identify cylinder piston seal failures
- Hydraulic pumps – fixed displacement, variable displacement types – basic pump controls
- Pressure compensated pumps with spike pressure relief valves
    a. Lab exercise – setup of a pressure compensated pump and safety relief circuit
- Introduction to electro-proportional hydraulic pressure control valves and directional control valves – understanding the process control function of proportional valves
- PLC interface with and control of fluid power systems (time permitting)
    a. What are the basic PLC control program instructions for hydraulic axis operation
    b. Understanding the PLC structure – processor, analog and discrete I/O
    c. Control of electro-proportional directional control valves with analog voltage or current output modules