

## Getting Started with Hydraulics *Expanded for 2019 - 1<sup>st</sup> step in mastering industrial hydraulics –*

This 5-day training course is the **first step** (step 1) in the development of competent maintenance mechanics that are capable of understanding, maintaining, troubleshooting and repairing complex hydraulic systems. This includes proper pump setup and commissioning techniques.

This **first step** hydraulic training seminar concentrates on developing students' in-depth understanding of industrial hydraulic fundamentals. These fundamentals include: characteristics of fluid pressure, fluid flow, fluid power, cylinder and hydraulic motor speed control, system heat production. Students will understand the purpose, function, operation and hydraulic schematic symbol for all major hydraulic valves and pumps. This training includes ample hands-on lab exercises to reinforce the classroom lecture. We want our students to come, prepared to be challenged in the classroom and the lab.

### Getting Started with Hydraulics – Topical Outline

- Characteristics of fluid pressure – creates force to move loads through cylinders, creates torque to turn loads with hydraulic motors, provides additional energy for acceleration, provides flow through restrictions, excessive pressure will create excess heat and cylinder and hyd. motor control problems
- Calculating force, cylinder piston area and pressure relationships – calculating torque, hydraulic motor displacement and pressure relationships
- Understanding cylinder construction – understanding hyd. motor construction
- Cylinder area ratios – cylinders can magnify pressure
- Characteristics of fluid flow – created by positive displacement pumping equipment (unyielding flow), determines cylinder speed and hydraulic motor speed (rpm), flow can be controlled by throttle valves or by variable 'flow' pumps
- Calculating cylinder area, flow and cylinder velocity (speed) relationships
- Calculating hydraulic motor displacement, flow rate and rpm relationships
- Fluid power schematic symbols (on-going throughout the seminar)
- Meter-in vs. meter-out unregulated speed control
- Hydraulic cylinders can magnify flow or reduce flow
- Understanding fluid flow/pressure differential relationships
- Pascal's Law of pressure in a trapped volume and how this is applied in practice – when there is fluid flow, there must be a pressure 'drop'
- Understanding directional control valves – direct operated compared to pilot operated types
- Understanding the purpose and function of various types of spools used in directional control valves
- Controlling fluid pressure with pressure relief valves – relief valve characteristics and types

- Pressure reducing valve function, operation of pressure reducing valves – when, where and why are they used
- Compare and contrast pressure relief valves to pressure reducing valves
- Fixed displacement pumps, popular types, characteristics, typical applications
- Variable displacement pumps typically used in industrial hydraulic systems
- Hydraulic horse power - calculating hydraulic horse power and its relationship to electric motor horse power
- Understanding metric measurements of pressure, flow, power and conversion to and from the imperial system
- Basic industrial hydraulic circuits
- Student work problems
- Hands-on lab exercises to reinforce practical fluid power principles as described in this topical outline
- End of seminar evaluation for certified competency credit or for self-evaluation