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# PRACTICAL HYDRAULIC SYSTEMS OPERATION AND TROUBLESHOOTING



## **YOU WILL LEARN HOW TO:**

- Identify hydraulic systems components
- Describe essential hydraulic terms and understand their key applications
- Recognise the impact hydraulic fluids have on components
- Describe the correct operation, control sequences and procedures for the safe operation of various simple hydraulic systems
- Initiate an effective inspection and maintenance program
- Minimise forced outages and prevent serious damage to hydraulic equipment
- Explain the latest technologies available for electro hydraulic systems

## **WHO SHOULD ATTEND:**

- Plant Engineers
- Operation, Maintenance, Inspection and Repair Managers, Supervisors and Engineers
- Mechanical Engineers
- Design Engineers
- Consulting Engineers
- Plant Operations and Maintenance Personnel
- Process Technicians
- Mechanical Technicians

## The Workshop

Whatever your hydraulic applications, you can increase your knowledge of the fundamentals, maintenance programs and trouble-shooting skills by attending this information-packed workshop. Cutaways of all major components are brought to the sessions to visually demonstrate the components' construction and operation. Developing an understanding of "how" it works leads to an understanding of "how" and "why" it fails. Multimedia views of the equipment are given to you as a realistic view of hydraulic systems as possible.

The Hydraulics workshop is a highly practical, comprehensive and interactive two-day workshop. You will have an opportunity to discuss hydraulic systems construction, design-applications, operations, maintenance and management issues. You will also be provided with the most up-to-date information and best practice in dealing with the subject. Towards the end of the workshop, you will have developed the skills and ability to recognize and solve hydraulic problems in a structured and confident manner.

### Pre-requisites

Fundamental knowledge of basic mechanical plant and operation will be required.

## The Program

### INTRODUCTION TO HYDRAULICS

- Origin of hydraulics and classification

### FUNDAMENTALS

- Force, work, power, energy, mass, weight, torque, density, specific gravity and specific weight

### PRESSURE AND FLOW

- Definition and units of pressure measurement
- Pascal's law and applications
- Pressure-force relationship
- Fluid flow and discharge
- Steady and unsteady flows
- Bernoulli's principle
- Laminar and turbulent flows
- Pressure flow relationship

### HYDRAULIC PUMPS

- Principles of pump operation
- Classification (positive and non-positive displacement)
- Gear pump
- Vane pump (variable volume and pressure compensated variable volume pumps)
- Piston pump (axial/inline, bent axis, radial, variable volume, pressure compensated and over centre axial pumps)
- Gerotor pump
- Rating of pumps
- Pressure, flow and efficiencies of pumps

### HYDRAULIC MOTORS

- Principle of motor operation
- Classification (rotating and piston type)
- Gear motors
- Vane motors
- Piston motors
- Difference between hydraulic motors and hydraulic pumps
- Specification of hydraulic motors
- Efficiency of hydraulic motors
- Motor slippage

### HYDRAULIC CYLINDERS

- Classification (single and double acting)
- Construction of cylinders
- Cylinder mounting
- Seals
- Cylinder design checklist
- Common cylinder problems

### CONTROL VALVES

- Purpose
- Classification (direction, pressure and flow control valves)
- Valve symbols

### DIRECTION CONTROL VALVES

- Poppet valve
- Check valve
- Spool valve (rotary and sliding valves)
- Direct and indirect operated valves
- Valve actuation methods (manual, electrical, pilot, pneumatic, electro hydraulic and electro-pneumatic)
- 2, 3 and 4 way direction control valves
- Positive and negative overlapping
- Centre conditions (open center, closed center, tandem center and float center valves)

### PRESSURE CONTROL VALVES

- Relief valves (pressure regulating and emergency relief)
- Meaning of surge pressure
- Sequence valves
- Counterbalance valves
- Pressure reducing valves
- Unloading valves

### FLOW CONTROL VALVES

- Classification (non-pressure compensated and pressure compensated)
- Location of flow control valve (meter-in, meter-out and bleed-off circuits)

### ELECTRO-HYDRAULIC SYSTEMS

- Proportional solenoid
- Proportional valves (direction control, flow control and pressure control valves)
- Servo valves (direction and pressure servo valves, single stage and multi stage servo valves)
- Use of transducers in hydraulic systems

### HYDRAULIC ACCESSORIES

- Need for breather and baffle plates
- Role of hydraulic oil tank in heat dissipation
- Function and types (dead weight, spring load and hydro-pneumatic)
- Accumulator sizing
- Application of accumulators in hydraulic circuits
- Function and types (air cooled and water cooled)
- Pipe specification and materials
- Pipe fittings
- Recommended oil speeds for selecting pipe sizes
- Construction of hoses
- Reinforcement and cover variations
- Criteria for hose selection
- Sizing of hoses
- Maintenance of pipes and hoses

### HYDRAULIC FLUIDS

- Cavitation
- Aeration
- Locations of filters and strainers
- Filter terminology
- Measurement of contamination levels

### APPLICATION OF HYDRAULIC CIRCUITS

- Symbols of hydraulic components
- Need for check valve in hydraulic circuits
- Regenerative circuit
- Flow equalizer
- Counterbalance circuit
- Pre-fill and compression relief circuit
- Decompression circuit
- Circuits of open center, closed center, Tandem center and indirect control
- Hydraulic circuits of various machines

### TROUBLESHOOTING HYDRAULIC SYSTEMS

- Flow chart analysis of hydraulic circuits
- Maintenance