# **Level I Industrial Hydraulics**

**In-Depth Fundamentals** 

# COURSE OUTLINE

## Who will benefit?

No prerequisites required. Any and all newcomers will benefit from this course. Fluid power industry professionals, maintenance technicians, machine operators, and sales representatives will be empowered with foundational knowledge. Even seasoned personnel will likely experience increased understanding of their core competencies.

### What is it about?

This course correlates core fluid power principles with practical machine operation and maintenance duties. Procedures to ensure the safety of personnel and to prevent damage to machinery will be discussed. Introductory physics and fluid mechanics will be explained. Fluid power symbols appearing in schematics will be correlated to real-world componentry. The location of components in a hydraulic system will be identified and proper adjustment procedures demonstrated. Hands-on lab exercises will reinforce fluid power concepts, component locations, proper connections, and the effects of adjustments on system operations. Elimination of leaks by proper fitting selection and installation will be discussed. The significance of fluid cleanliness to system longevity and techniques to minimize ingression of contaminants will be presented.

#### OUTLINE

#### Safety

-Lock-Out/Tag-Out -Confirming de-pressurized hydraulic lines **Conductors & Connectors** -Hose connectors, construction, sizing, ratings -Steel tubing **Hydraulic Fundamentals** Fluids & Reservoirs -Conductor flows and sizing -Filter use, locations and sizing, intake, return and pressure Actuators (Telescoping, Rams, Single Acting, etc.) -Construction, operation and applications -Regeneration circuits **Pressure Controls** -Construction, operation, and applications -Proper use of relief, reducing, sequence, counterbalance, unloading, and brake valves **Pumps & Pumping Principles** -Construction, operation, and applications of gear, vane, and piston pumps -Start-up and troubleshooting techniques Flow Controls & Flow Dividers -Construction, theory, and operation -Pressure-comp. vs. non-compensated Directional Controls -Construction, operation, and applications -Single and pilot operated designs Accumulators & Accessories -Construction, theory, and operation -Pre-charge requirements and maintenance

#### OBJECTIVES

- Practice safe procedures to ensure trapped fluids have been relieved internally and suspended loads have been lowered or properly blocked to permit safe maintenance operations
- Explain hydraulic pressure-force and flow-speed relationships
- Identify and correlate the standard schematic symbols to the hydraulic components and typical locations in a hydraulic system
- Use charts to determine actuator force and speed for given pressure and flow
- Recognize typical cylinder construction and utilize diagnostic procedures
- Identify/classify relief, sequence, unloading, reducing, and counterbalance valves.
- Distinguish between meter-in vs. meter-out flow control
- Identify schematic symbol and operational differences of directional control valves
- Identify/classify the different types of hydraulic pumps
- Proper installation of hydraulic components with respect to alignment, connections, and pre-filling with fluids
- Identify and work with the fluid conductors used to carry hydraulic fluid to ensure proper pressure ratings, routing, and to reduce failures
- Implement leak prevention using proper fittings, assembly techniques, and seal materials
- Identify different types of filtration and understand contamination levels



#### HYDRAULIC

