Since the beginning of time and long before written history, humankind has searched for ways to conveniently transmit energy from its source to where it is needed and then convert the energy into a useful form to do useful work. One of these processes is known as ***FLUID POWER.***

FLUID POWER is one of three types of common power transfer systems**. MECHANICAL** and **ELECTRICAL** are the other two.

The **BASIS OF FLUID POWER is** PRESSURIZED FLUIDS. These fluids may be LIQUID or GAS.

PNEUMATIC SYSTEMS use a gas - air, nitrogen or some other inert gas.

HYDRAULIC SYSTEMS use a liquid **-** oil, water or some other liquid.

FLUID POWER SYSTEMS use a prime mover (electric motor, PTO, diesel or gasoline engine) to drive a PUMP that pressurizes the fluid and the valving that allows the system to do the required functions.

Energy can neither be created nor destroyed; it merely changes state. What is increased in force applied — is sacrificed in distance moved.

According to the **Fluid Power Safety Institute**, **less than 2% of fluid power workers are properly trained,** including those who have worked in the industry for years.

Our courses introduce fluid power as an effective means of transferring, controlling and converting energy, its advantages, disadvantages, and modern usage with specific examples.

Applications range from brute force in heavy industry to the sensitive positioning of parts in precision machining operations.

You will gain new knowledge and respect for the term **FLUID POWER** and how to handle all aspects of it... and do it **SAFELY**.

We present TWO 2-DAY COURSES: **HYDRAULIC AND PNEUMATICS** which includes CONTAMINATION, the cause of 75%-85% of fluid power failures and problems.

Being able to operate, maintain and troubleshoot your own hydraulic/pneumatic equipment and systems safely, starts with a simple understanding of how and why all the various components work. That is what this course is about. We offer the basic building blocks and information you need to become proficient in working with industrial pneumatics, hydraulics and fluid power in general, whether it be a small mobile unit or a large industrial installation. Students attending this course are expected to go back to their workplace and immediately apply what they have learned to their own fluid power systems.

Training Outcomes

1. Identify hydraulic and pneumatic components by their schematic symbols.
2. Understand the applications of both primary and auxiliary components.
3. Select the correct valves, motors and actuators to obtain the desired results.
4. Design simple fluid power circuits using proper symbols and schematics.
5. Diagnose and avoid common system and component issues.
6. Understand the differences and commonness of hydraulics and pneumatics.
7. Determine applications for installing and charging surge tanks and accumulators.
8. Select, size, seal and route pipes and hoses.
9. Control heat, filtration and contamination in fluid power systems.
10. Work with hydraulic and pneumatic components in a safe and environmentally friendly manner.
11. Properly test and inspect fluid power systems
12. Diagnose system vs. component problems.
13. Evaluate the cause and effect of changing or resizing system components.

PNEUMATIC: COURSE AGENDA

DAY 1: PNEUMATIC SYSTEMS & COMPONENTS: *WHAT THEY ARE AND HOW THEY WORK*

We provide an overview of hydraulic and pneumatic principles, showing their commonness and differences, and progress through pneumatic system components including receiver tanks, compressors, dryers, coolers, valves, cylinders, motors, rotary actuators and filters, with emphasis placed on component structure and the identification of the components by the proper symbol as standardized by ANSI and ISO.

Instruction includes lecture, an in-depth discussion of components and systems, using audio-visual material including Power Point presentation and demo equipment.

Discussion Topics

- Hydraulic/Pneumatic Principles
- Hydraulic Preferences
- Pneumatic Preferences
- Compressors
- Heat Exchangers
- Types of Dryers
- Separator/Filters
- Accumulators (aka: Receivers/Surge Tanks)
- Needle Valves
- Check Valves
- Flow Control Valves
- Directional Control Valves
- Pressure Control Valves
- Pressure Relieving Valves
- Pneumatic Cylinders
- Pneumatic Motors

- Pneumatic Rotary Actuators
- Introduction to Air Logic
- Boosters & Air/Oil Systems
- Fluid Conductors
- Filters, Regulators and Lubricators at Point of Use

DAY 2: TROUBLESHOOTING: *HOW TO IDENTIFY AND FIX COMMON PROBLEMS*

On Day 1, students gained a basic "working knowledge" of industrial pneumatic components and their function within an operational system. They compared the operation of hydraulics vs. pneumatics. Day 2 builds on that knowledge and is designed to help the student become aware of the decision-making process that is part of a logical troubleshooting procedure, including pneumatic safety.

The instructor focuses the class on the pneumatic troubleshooting process and the inspection and testing tasks that are part of a systematic approach to locating malfunctions and their underlying causes.

A discussion of OSHA requirements Part 1910 and Reference 3120 - In Sub-heading "Scope and Application" - "Control of Hazardous Energy", OSHA specifically mentions pneumatic systems.

This allows the student insight as to how to troubleshoot real world system problems safely. Probable applications are discussed in class and totally dissected in form, function and application. This discussion allows the instructor to explain pressure, flow, torque, load and even how to upsize and downsize components such as valves and cylinders.

Discussion Topics

- Applications of Pneumatics
- Preparation of the Air Supply
- Proper Selection of Components
- Pneumatic Safety
- Contamination and Effect on System's Performance and Longevity
- Basic Troubleshooting Techniques
- Generalization of Pneumatic Troubleshooting
- Noisy Systems
- No System Pressure
- Low or Erratic System Pressure
- No Movement of Actuator
- Slow or Erratic Actuator Movement
- Common Cylinder Problems
- Common Valve Problems
- Solenoid Failure
- Reading and Understanding Schematic Drawings
- Maintenance
- Applications
- Internal and External Leakage Control
- The Cost of Leaks

- Energy Conservation
- Safety

HYDRAULIC: COURSE AGENDA

DAY 1: HYDRAULIC SYSTEMS AND COMPONENTS: *WHAT THEY ARE AND HOW THEY WORK*

We provide an overview of hydraulic and pneumatic principles, showing their commonness and differences, and progress through hydraulic system components. This includes pumps, valves, motors, coolers, cylinders, rotary actuators and filters, with emphasis placed on component structure and the identification of the components by the proper symbol as standardized by ANSI and ISO.

Instruction includes lecture, an in-depth discussion of components and systems, with audio-visual material including Power Point presentation and demo equipment.

Discussion Topics

- Hydraulic/Pneumatic Principles
- Hydraulic Preferences
- Pneumatic Preferences
- Pump Types: Gear, Vane, and Piston
- Pumps - Positive Displacement, Variable Volume, Pressure Compensated
- Heat Exchangers: Radiator, Shell & Tube
- Accumulators (Bladder, Piston Type & Weighted Types)
- Needle Valves
- Check Valves
- Flow Control Valves
- Directional Control Valves: 2, 3 & 4 Way
- Pressure Control Valves - Relief, Sequence, Unloading, Counterbalance (aka) Over-center, Pressure Reducing, Brake
- Hydraulic Cylinders: Tie Rod, Round & Welded
- Hydraulic Motors
- Hydraulic Rotary Actuators
- Fluid Conductors: Pipes and Hoses
- Filters: Suction Strainer, Return, Pressure

DAY 2: TROUBLESHOOTING: *HOW TO IDENTIFY AND FIX COMMON PROBLEMS*

On Day 1, students gained a basic "working knowledge" of industrial hydraulic components and their function within an operational system. They compared the operation of hydraulics vs. pneumatics. Day 2 builds on that knowledge and helps the student become aware of the decision-making process that is part of a logical troubleshooting procedure, including hydraulic safety.

The instructor focuses the class on the hydraulic troubleshooting process and the inspection and testing tasks that are part of a systematic approach to locating malfunctions and their underlying causes.

A discussion of OSHA requirement: Part 1910 and Reference 3120 - In Sub-heading "Scope and Application" - "Control of Hazardous Energy", OSHA specifically mentions hydraulic systems.

This allows the student insight as to how to troubleshoot real world system problems safely. Probable applications are discussed in class and totally dissected in form, function and application. This discussion allows the instructor to explain pressure, flow, torque, load and even how to upsize and downsize components such as valves and cylinders.

Discussion Topics

- Applications of Hydraulics
- Preparation of the Liquid
- Proper Selection of Components
- Basic Troubleshooting Techniques
- Noisy Systems
- No System Pressure
- Low or Erratic System Pressure
- No Movement of Actuator
- Slow or Erratic Actuator
- Common Cylinder Problems
- Common Valve Problems
- Solenoid Failure
- Reading and Understanding Schematic Drawings
- Maintenance
- Applications
- Internal and External Leakage Control
- The Cost of Leaks
- Energy Conservation
- Safety
- Contamination and Effect on System Performance and Longevity

CONTAMINATION

Contamination is the cause of 75-85% of hydraulic failures. We need to **CLEAN IT UP!**

COURSE AGENDA

- Where the Particulate Comes From
- Water as a Contaminant
- Cavitation vs. Aeration
- New Oil vs. Properly Filtered Oil
- Types of Filters - Suction Strainers/Suction Filters/Return Line Filters/Pressure Filters/Off-Line (Kidney Loop) Filters
- Fluids & TOW (Temperature Operating Window)
- ISO Codes and What They Mean
- Oil Sampling Methods
- What is that "Stuff" in My Oil?
- You Can't Have Oil That's Too Clean
- Life-Cycle Testing