October 11, 2018
One day, 8 hours with hands-on exercises

Troubleshooting a pneumatic system should be a step-by-step procedure. Every pneumatic circuit has a logical sequence of operation that can involve timing logic, pressure sensing, position sensing, and speed regulation. Troubleshooting is initiated when the circuit does not operate properly, and certain general diagnostic and testing steps can be applied to any troubleshooting.

During this eight hour course, participants will cover all of the topics listed below and achieve the following course objectives:

**Course Objectives**
- Develop an organized and methodical system of troubleshooting
- Recognize the inherent dangers of stored energy
- Follow best safety practices
- Observe common faults in pneumatic systems
- Learn failure modes of specific components
- Learn Preventive Maintenance skills
- Hands on troubleshooting exercise pneumatic circuits

**Topics Include:**
- Troubleshooting
  - Definition
  - Preparation
  - How to Cope with Distractions
- Systematic Procedures
  - Safety: Lock-out, tag-out, Stored Energy, OSHA Regulations
  - Questions to ask
  - Visual Inspections
- Common Faults and Associated Components
  - Compressed Air Filtration: Common Problems, Plumbing Design, Pressure Regulators, Coalescing Filters, Water Removal Filters, Lubricators more
  - Directional Control Valves: Common Problems, Electrical

**Training Schedule**

7:45 a.m. - 8:00 a.m.     Continental Breakfast Provided
8:00 a.m. - 12:00 noon    Training Class includes Hands-on Trainers
12:00 noon - 12:45 p.m.   Lunch Provided
12:45 p.m. - 5:00 p.m.    Training Class includes Hands-on Trainers
Fluid Power Training

CMA/Flodyne/Hydradyne offers economical four day hydraulic training classes in Basic Hydraulics, Advanced Hydraulics and Understanding Proportional Valves.

Our experienced hydraulics instructors Jim Trinkle and Steve Bogush have worked with the hydraulic systems for stamping presses, press forges, machine tools, bridge and dam hydraulic equipment, mobile hydraulic equipment, oil drilling equipment, steel mills, cement mills, plastic injection and blow molding machines, railroad equipment and more. They are skilled in presenting hydraulic concepts in a way that students can relate to. Our students come out of training ready to apply specific knowledge that will immediately save their company time and money!

We also offer low cost single day courses in pneumatics: Introduction to Pneumatic Technology, Pneumatic Troubleshooting and 40 Typical Circuits. Experienced instructor Sean Smith, SMC, has developed an effective hands-on curriculum that condenses the most useful pneumatics know-how into a practical eight hour course.

Our fluid power classes are held at our Hanover Park, IL Training Center, and all CMAFH classes qualify for PDU credits. Please visit our website at www.cmafh.com to learn more or to register.

Custom Training

For training that is tailored to your people and machinery, we offer custom training held at your facility or ours. Our instructors provide in-depth custom training based on your schematics and machine manuals; we can train your employees on start-up procedures, component function and analysis, programming, troubleshooting and overall system operation. Please call or email to inquire about price and availability.

Product Specific Training

Our vendors often schedule product training which our customers are invited to attend. Bosch Rexroth, Balluff and SMC regularly offer a wide variety of specialized training classes at many of their US locations. To learn more, please visit our website and click on the Training tab/Vendor Training. Additional product training may be arranged through your CMAFH sales engineer. Let us know if you would like to receive more information on product training.

How to register or cancel

Register online at www.cmafh.com under the Training tab. If you are registering to attend a for-fee training please provide a purchase order or arrange for payment at the time of registration. Registrants will receive a confirmation via email. You may change or cancel your registration up to ten days before the start of the class in order to receive a refund or credit for another date. To cancel or modify a registration, please call 630-563-3628 or email training@cmafh.com.
BASIC HYDRAULIC TRAINING

January 22-25, 2018 • May 14-17, 2018
July 16-19, 2018 • September 17-20, 2018

This is a level one training for equipment maintenance personnel who have had no formal training in industrial hydraulics and are new to hydraulically powered and controlled machines and equipment. This course is also recommended for plant engineering personnel and mobile equipment engineering personnel who are tasked with hydraulic system improvement, system modification and system design.

Basic Hydraulic Training was developed with the idea that hydraulic systems are best maintained by those who understand the physical principles that apply to industrial hydraulics. Learn the principles of industrial hydraulic technology in a small class environment utilizing real world examples, components for inspection and disassembly, and a hands on lab.

Approximately 50% of the course involves hands-on lab training and attendees will receive a certificate upon successful completion of the course. Maximum class size is 16, please register early to guarantee seating.

Topics Include:

• Standard hydraulic valve functions
• Basic setup and trouble-shooting
• Principles of fluid flow and pressure, work, power, actuator speed for hydraulic systems
• Hydraulic component symbols for reading and interpreting schematics
• The 10-12 basic hydraulic circuits used in most hydraulic systems
• Fixed displacement and variable displacement pumps
• Pressure type pump controls commonly used in open loop industrial systems
• Principles of fluid pressure and fluid flow, hydraulic power, heat generation
• Throttle valve speed control
• Hydraulic shock and how to limit its destructive effects
• Introduction to electro-proportional hydraulic valves
• Components for Inspection and/or Disassembly

Basic Hydraulic Training Daily Schedule

<table>
<thead>
<tr>
<th>Time</th>
<th>Activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>7:30 a.m.</td>
<td>Doors Open, Continental Breakfast</td>
</tr>
<tr>
<td>8:00 a.m.</td>
<td>Training Class and Hands-on Lab</td>
</tr>
<tr>
<td>12:00 noon</td>
<td>Lunch Provided</td>
</tr>
<tr>
<td>12:45 p.m.</td>
<td>Training Class and Hands-on Lab</td>
</tr>
</tbody>
</table>

Tuition

$825 per person, 2+ attendees

Tuition includes

• seminar fee
• all student materials
• custom workbook
• continental breakfast
• lunch & refreshments

Cancellation Policy

You may change or cancel your registration up to ten days before the start of the class in order to receive a refund or credit for another date.

Register

Online at www.cmafh.com
ADVANCED HYDRAULIC TRAINING

June 18-21, 2018 • October 15-18, 2018

Advanced Hydraulics is a level two two training for equipment maintenance personnel who have attended Basic Hydraulic Training or have equivalent knowledge or experience in Hydraulics. This course is also recommended for plant engineering personnel who are tasked with hydraulic system improvement, system modification and system design.

Learn the principles of industrial hydraulic technology in a small class environment utilizing real world examples, components for inspection and disassembly and a hands on lab. This is a four day training held once during the year. Maximum class size is 16, please register early to guarantee seating.

Completion of Basic Hydraulic Training is recommended before taking this course.

Topics Include:
- Logical schematic reading and interpreting
- Proper fluid requirements
- In depth study of component operation
- System setup for improved efficiency and reliability
- Why hydraulic systems get hot and what to do about excessive heat
- Hydraulic fluid cleanliness and condition standards
- Understanding relief valves—disassembly, inspection, assembly, and testing
- Understanding reducing valves—disassembly, inspection, testing
- Understanding directional control valves—disassembly, inspection, assembly
- The use and set up of pilot chokes for pilot operated controls
- Controlling pilot pressure with pilot operated directional controls
- Troubleshooting exercises to develop troubleshooting skills
- Understanding variable displacement pumps, basic pressure regulating controls, setup and commissioning
- Review fundamental circuits used in many industrial systems and learn to setup
- Knowledge reinforcement with hands on lab exercises
- Components for Inspection and/or Disassembly

Advanced Hydraulic Training Daily Schedule

<table>
<thead>
<tr>
<th>Time</th>
<th>Activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>7:30 a.m. -</td>
<td>Doors Open, Continental Breakfast</td>
</tr>
<tr>
<td>8:00 a.m. -</td>
<td>Training Class &amp; Hands-on Lab</td>
</tr>
<tr>
<td>12 noon -</td>
<td>Lunch Provided</td>
</tr>
<tr>
<td>12:45 p.m. -</td>
<td>Training Class &amp; Hands-on Lab</td>
</tr>
</tbody>
</table>

Training Dates
June 18-21, 2018
October 15-18, 2018

Training Location
1000 Muirfield Drive
Hanover Park, IL 60133

Tuition
$850 per person, 1 attendee
$825 per person, 2+ attendees

Tuition includes
- seminar fee
- all student materials
- custom workbook
- continental breakfast
- lunch & refreshments

Cancellation
You may change or cancel your registration up to ten days before the start of the class in order to receive a refund or credit for another date.

Register
Online at www.cmafh.com
UNDERSTANDING PROPORTIONAL VALVES

November 5-8, 2018

Proportionally controlled components have become a standard component on most hydraulic systems. Therefore, it has become necessary for today's maintenance mechanic to be able to install, setup, configure, and troubleshoot these components.

During this four-day seminar, participants will work with the most popular types of proportionally controlled components and their associated controller/amplifier cards. Valves with and without LVDTs will be included in a selection of lab exercises as well as valves with and without on-board electronics.

This class is an appropriate seminar for both electrical and mechanical maintenance personnel. It is recommended that the participant bring a selection of proportional valve model codes with them to class. Advanced Hydraulic Training is a prerequisite for this course.

Topics Include:

- Discussion of operational similarities of standard and variable force solenoids
- Function and operation of controller/amplifier cards
- Introduction to function of circuitry on amplifier cards
- Review function and operation of amplifier card’s on-board adjustment potentiometers
- Use standard proportional directional control valves to control hydraulic actuators
- Discover the operational differences between valves with and without spool position monitoring (i.e. “feedback”, LVDT)
- Discover the differences between proportional valves which use separate electronics and those which use on-board electronics (OBE)
- Learn how to test functionality and operation of OBE valves
- Introduction to proportionally controlled directional control valve and spool sizing considerations
- Use proportionally controlled pressure controls to limit maximum allowed operational pressures
- Proportionally controlled pressure reducing valve operation and uses
- Review high performance proportionally controlled directional control valves
- Knowledge reinforcement with hands-on lab exercises
- Troubleshooting proportionally controlled valves and associated amplifier cards

Understanding Proportional Valves Training Daily Schedule

<table>
<thead>
<tr>
<th>Time</th>
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</tr>
<tr>
<td>5:00 p.m.</td>
<td></td>
</tr>
</tbody>
</table>

Training Dates

November 5-8, 2018

Training Location

1000 Muirfield Drive
Hanover Park, IL 60133

Tuition

$1000 per person, 1 attendee
$ 975 per person, 2+ attendees

Tuition includes

- seminar fee
- all student materials
- custom workbook
- continental breakfast
- lunch & refreshments

Cancellation

You may change or cancel your registration up to ten days before the start of the class in order to receive a refund or credit for another date.

Register

Online at www.cmafh.com
INTRODUCTION TO PNEUMATICS

October 9, 2018

One day, 8 hours with 14 hands-on exercises

Introduction to Pneumatics will introduce you to basic concepts, terminology, applications and automation processes used throughout the pneumatics industry - not much math, just the basics!

During this eight hour course, participants will complete 14 lab exercises, cover all of the topics listed below and achieve the following course objectives:

**Course Objectives**

1. Understand compressed air production, purification, and distribution
2. Understand the construction/operation of components in a pneumatic control system
3. Identify and use control schematics
4. Build and troubleshoot pneumatic circuits

**Topics Include:**

**Air Compression and Distribution**
- Air Distribution
- Compressors and Accessories
- After Coolers
- Dryers
- Filters

**Directional Control Valves**
- Valve Styles
- Valve Construction
- Valve Operators
- Valve Mountings
- ISO Valve Symbols
- Valve Sizing

**Schematic, Symbol and Circuits**
- Drawing Schematics
- Cylinder Control
- Basic Air Logic
- Circuit Troubleshooting

**System Sizing Application**
- Sizing Software Demonstrations

**Compressed Air Theory**
- Units of Pressure
- Understanding Gas Laws
- Compressions Ratio
- Pressure vs Flow
- Relative Humidity & Dew Pt
- Impact of Moisture
- The Cost of Air

**Air Treatment**
- Filters & Filtration Requirements
- Coalescing Filters & Micro Filters
- Automatic Drains
- Regulators
- Lubricators

**Actuators**
- Linear Cylinders, Cylinder Types
- Special Cylinders & Options
- Cylinder Sizing, Speed Control
- Application Considerations

**40 Typical Circuits** is an in-depth study of 40 commonly used pneumatic circuits. This course will benefit anyone who designs, assembles or troubleshoots circuits and/or applications and automation processes used throughout the pneumatics industry.

You would like to have a better understanding of pneumatic circuits. During this eight hour course, participants will complete 14 lab exercises, cover all of the topics listed below and achieve the following course objectives:

**Course Objectives**

1. Understand compressed air production, purification, and distribution
2. Understand the construction/operation of components in a pneumatic control system
3. Identify and use control schematics
4. Build and troubleshoot pneumatic circuits

**Topics Include:**

**Air Compression and Distribution**
- Air Distribution
- Compressors and Accessories
- After Coolers
- Dryers
- Filters

**Directional Control Valves**
- Valve Styles
- Valve Construction
- Valve Operators
- Valve Mountings
- ISO Valve Symbols
- Valve Sizing

**Schematic, Symbol and Circuits**
- Drawing Schematics
- Cylinder Control
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- Circuit Troubleshooting

**System Sizing Application**
- Sizing Software Demonstrations

**Compressed Air Theory**
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**Air Treatment**
- Filters & Filtration Requirements
- Coalescing Filters & Micro Filters
- Automatic Drains
- Regulators
- Lubricators

**Actuators**
- Linear Cylinders, Cylinder Types
- Special Cylinders & Options
- Cylinder Sizing, Speed Control
- Application Considerations

**40 TYPICAL CIRCUITS**

- 1. 3-Way Valve Controlling a Single Acting Cylinder without Speed Control
- 2. Metering-In to a Single Acting Cylinder for Speed Control
- 3. Metering-out of a Single Acting Cylinder for Speed Control
- 4. Quick Exhaust Extending & Retracting of a Single Acting Cylinder
- 5. Quick Exhaust Extending, Speed Control Retracting of a Double Acting Cylinder
- 6. Air Spring Return of a Double Acting Cylinder
- 7. Single Push Button Valve Control of a Double Acting Cylinder
- 8. Metering-in to a Double Acting Cylinder for Speed Control
- 9. Metering-out of a Double Acting Cylinder for Speed Control
- 10. Automatic Drains
- 11. Quick Exhaust Extending, Speed Control Retracting of a Double Acting Cylinder
- 12. Quick Exhaust Extending & Retracting of a Double Acting Cylinder
- 13. 3-Position, Closed Center, Control of a Double Acting Cylinder
- 14. 2-Position, Open Center, 5-Way Valve Control of a Double Acting Cylinder
- 15. 3-Position, Pressure Center, Control of a Double Acting Cylinder
- 16. 3-Position, Pressure Center, Control of a Double Acting Cylinder
- 17. 3-Position, Pressure Center, Control of a Double Acting Cylinder
- 18. 3-Position, Open Center, 5-Way Valve & Check Valve Control of a Double Acting Cylinder
- 19. Automatic Return of a Cylinder
- 20. “OR” Logic Function on the Manual Override of the Automatic Return of a Cylinder
- 21. “AND” Logic Function on the Automatic Return of a Cylinder
- 22. “NOT” Logic Function on the Automatic Return of a Cylinder
- 23. “AND” Logic Function with Valves Piped In-Series
- 24. Automatic Return of a Cylinder with Short Delay
- 25. And More including Auto Cycle, E Stop, Sequential and Cascade
- 26. “AND” Logic Function on the Automatic Return of a Cylinder
- 27. “AND” Logic Function on the Automatic Return of a Cylinder
- 28. Automatic Return of a Cylinder
- 29. Automatic Return of a Cylinder
- 31. “AND” Logic Function on the Automatic Return of a Cylinder
- 32. “AND” Logic Function on the Automatic Return of a Cylinder
- 33. “AND” Logic Function on the Automatic Return of a Cylinder
- 34. “AND” Logic Function on the Automatic Return of a Cylinder
- 35. “AND” Logic Function on the Automatic Return of a Cylinder
- 36. “AND” Logic Function on the Automatic Return of a Cylinder
- 37. “AND” Logic Function on the Automatic Return of a Cylinder
- 38. “AND” Logic Function on the Automatic Return of a Cylinder
- 40. “AND” Logic Function on the Automatic Return of a Cylinder

**Intake to Pneumatics Training Schedule**

- 7:30 a.m. - 8:00 a.m. Doors Open, Continental Breakfast
- 8:00 a.m. - 12:00 noon Training Class includes Hands-on Trainers
- 12:00 noon - 12:45 p.m. Lunch Provided
- 12:45 p.m. - 5:00 p.m. Training Class includes Hands-on Trainers

**Register**

Online at www.cmafh.com

**Tuition**

$50 Materials Fee

**Cancellation**

You may change or cancel your registration up to ten days before the start of the class in order to receive a refund or credit for another date.

**Training Dates**

October 9, 2018

**Training Location**

1000 Muirfield Drive
Hanover Park, IL 60133

**Class includes**

- all student materials
- custom workbook
- continental breakfast
- lunch & refreshments
PNEUMATIC TRAINING

40 TYPICAL CIRCUITS

October 10, 2018

One day, 8 hours with pneumatic symbol basics

40 Typical Circuits is an in-depth study of 40 commonly used pneumatic circuits. This course will benefit anyone who designs, assembles or troubleshoots circuits and/or would like to have a better understanding of pneumatic circuits. During this eight hour course, participants will cover the topics listed below and achieve the following course objectives:

Course Objectives

- Understand pneumatic symbols for different components
- Understand operation of components in a typical pneumatic control system.
- Identify and use control schematics
- Design, build and troubleshoot 40 typical pneumatic circuits

Partial List of Circuits to be Covered

1. 3-Way Valve Controlling a Single Acting Cylinder without Speed Control
2. Metering-In to a Single Acting Cylinder for Speed Control
3. Metering-out of a Single Acting Cylinder for Speed Control
4. Metering-in and Out of a Single Acting Cylinder for Speed Control
5. Dual 3-Way Valve Control of a Double Acting Cylinder
6. Air Spring Return of a Double Acting Cylinder
7. Single Push Button Valve Control of a Double Acting Cylinder
8. Metering-in to a Double Acting Cylinder for Speed Control
9. Metering-out of a Double Acting Cylinder for Speed Control
10. Dual Push Button Valve Control of a Double Acting Cylinder
11. Quick Exhaust Extending, Speed Control Retracting of a Double Acting Cylinder
12. Quick Exhaust Extending & Retracting of a Double Acting Cylinder
13. 3-Position, Closed Center, Control of a Double Acting Cylinder
14. 3-Position, Open Center, Control of a Double Acting Cylinder
15. 3-Position, Pressure Center, Control of a Double Acting Cylinder
16. 3-Position, Pressure Center, Control of a Double Acting Cylinder, Balanced
17. 3-Position, Open Center, 5-Way Valve Control of a Double Acting Cylinder
18. 3-Position, Open Center, 5-Way Valve & Check Valve Control of a Double Acting Cylinder
19. Automatic Return of a Cylinder
20. “OR” Logic Function on the Manual Override of the Automatic Return of a Cylinder
21. “AND” Logic Function on the Automatic Return of a Cylinder
22. “NOT” Logic Function on the Automatic Return of a Cylinder
23. “AND” Logic Function with Valves Piped In-Series
24. Automatic Return of a Cylinder with Short Delay
25. And More including Auto Cycle, E Stop, Sequential and Cascade

40 Common Circuits Training Schedule

7:30 a.m. - 8:00 a.m.   Doors Open, Continental Breakfast
8:00 a.m. - 12:00 noon  Training Class includes Hand-on Trainers
12:00 noon - 12:45 p.m. Lunch Provided
12:45 p.m. - 5:00 p.m.  Training Class includes Hand-on Trainers

Training Dates

October 10, 2018

Training Location

1000 Muirfield Drive
Hanover Park, IL 60133

Tuition

$50 Materials Fee

Class includes

- all student materials
- custom workbook
- continental breakfast
- lunch & refreshments

Cancellation

You may change or cancel your registration up to ten days before the start of the class in order to receive a refund or credit for another date.

Register

Online at www.cmafh.com
PNEUMATIC TROUBLESHOOTING

October 11, 2018

One day, 8 hours with hands-on exercises

Troubleshooting a pneumatic system should be a step-by-step procedure. Every pneumatic circuit has a logical sequence of operation that can involve timing logic, pressure sensing, position sensing, and speed regulation. Troubleshooting is initiated when the circuit does not operate properly, and certain general diagnostic and testing steps can be applied to any troubleshooting.

During this eight hour course, participants will cover all of the topics listed below and achieve the following course objectives:

Course Objectives
• Develop an organized and methodical system of troubleshooting
• Recognize the inherent dangers of stored energy
• Follow best safety practices
• Observe common faults in pneumatic systems
• Learn failure modes of specific components
• Learn Preventive Maintenance skills
• Hands on troubleshooting exercise pneumatic circuits

Topics Include:

Troubleshooting
• Definition
• Preparation
• How to Cope with Distractions

Systematic Procedures
• Safety: Lock-out, tag-out, Stored Energy, OSHA Regulations
• Questions to ask
• Visual Inspections

Common Faults and Associated Components
• Compressed Air Filtration: Common Problems, Plumbing Design, Pressure Regulators, Coalescing Filters, Water Removal Filters, Lubricators more
• Directional Control Valves: Common Problems, Electrical

Pneumatic Troubleshooting Training Schedule

7:45 a.m. - 8:00 a.m.    Continental Breakfast Provided
8:00 a.m. - 12:00 noon  Training Class includes Hands-on Trainers
12:00 noon - 12:45 p.m.  Lunch Provided
12:45 p.m. - 5:00 p.m.   Training Class includes Hands-on Trainers

Training Dates
October 11, 2018

Training Location
1000 Muirfield Drive
Hanover Park, IL 60133

Tuition
$50 Materials Fee

Class includes
• all student materials
• custom workbook
• continental breakfast
• lunch & refreshments

Cancellation
You may cancel your registration up to ten days before the start of the class in order to receive a refund.

Register
Online at www.cmafh.com

www.cmafh.com       Toll-free: 800-426-5480