

# Mechanical Industrial Training

## Tuition \$795

Certification: Clemson University

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Working with mechanical machinery requires knowledge of not only the overall function of the equipment but the parts within it, as well. This includes every part down to the nuts and bolts of a machine. The Mechanical Series consists of 13 core subject areas required to succeed in industry operations and maintenance: Industrial Hydraulic Fundamentals, Industrial Pneumatic Fundamentals, Precision Measurement Instruments, Pumps, Static and Dynamic Sealing, Valve Fundamentals, Pipes and Pipefitting, Lubrication Concepts, Bearing Maintenance, Mechanical Transmission Systems, Rigging, Shaft Alignment, and Welding Fundamentals. These subject areas comprise a total of 75 modules that are divided into objective-driven topics. The topics focus on the skills and knowledge, presented within an industrial context, necessary to achieve the requisite competency for further specialization.

### **Industrial Hydraulic Fundamentals**

The use of hydraulics to transmit power has reached almost every facet of the industrial world. Modern hydraulic theory is used to describe the physical behavior of all liquids. This includes that area of hydraulics in which confined liquids are used under controlled pressure to do work. This area of hydraulics, sometimes referred to as power hydraulics, is discussed in this subject area. In addition, these modules introduce the different types of components found in hydraulic systems, as well as how to prevent common failures within the systems.

### **Industrial Pneumatics Fundamentals**

Industrial Pneumatics is designed to give maintenance personnel a complete understanding of the operation and maintenance principles involved with pneumatic systems. Subjects such as compressed air safety, component design and installation, and system cleanliness will be the primary focus of this topic. All maintenance personnel who work on compressors or are involved with the daily repair and operation of pneumatic systems are strongly encouraged to participate in these modules.

### **Precision Measurement Instruments**

The term precision measurement is applied to the measurement field beyond the scope of line-graduated, non-precision measuring instruments such as the ruler and scale. It refers to the art of reproducing and controlling dimensions expressed in thousandths of an inch, or millimeter. This subject area begins with an overview of the purpose of precision measurement instruments, including the difference between direct and indirect measurements, how accuracy is defined, and the categories of precision measurement tools. The subsequent modules introduce specific instruments, such as micrometers, vernier calipers, dials and indicators, and gauges.

### **Pumps**

The supply of liquid is one of the fundamental needs of any society, be it human or animal. The need to transfer water has, therefore, generated the design of a myriad of mechanical devices throughout history, which can be categorized as pumps. Millennium old designs for bucket wheels and paddle devices have not, to a significant degree, been carried forward into modern technology. With the exception of open screw pumps, all of today's devices act to force water into the desired channels or pipes. The modules in this subject area discuss the different pump classifications and designs, as well as provide specific information about centrifugal, positive-displacement, and special-purpose pumps.

### **Static and Dynamic Sealing**

A seal is a barrier between a fluid contained within a system and the atmosphere around that system. Packing has been used as the simplest form of seal in conditions where relative motion occurs between parts. Various types of packing material are also used to seal stationary parts such as flanges and cylinder heads. Mechanical seals, however, are replacing packing as the predominant sealing device

because they are designed for zero leakage. The modules in this subject area provide participants with information on the various methods of sealing fluids into equipment.

### **Valve Fundamentals**

Valves are used throughout industry to direct, control, or regulate the flow of fluids by opening or closing passageways totally or partially. When a valve is open, fluid flows in the direction from higher pressure to lower pressure. This subject area introduces the operation of typical industrial valves and provides an overview of actuators, relief valves, and safety valves.

### **Pipes and Pipefitting**

Technology in the industrial marketplace has taken remarkable strides in the last one hundred years. The technological breakthroughs have required piping systems to be capable of handling much higher temperatures and pressures. These conditions have made it necessary for industry to generate economical, safe, and efficient plant and piping systems. The modules in this subject area begin by presenting the industry standards that regulate pipefitting specifications. After this, participants learn about the different types of pipe materials, manufacturing methods, insulating materials, and supports in a piping system.

### **Lubrication Concepts**

Lubrication reduces friction between moving parts by substituting solid friction with fluid friction. By reducing friction, and thereby reducing the amount of energy that is dissipated as heat, lubrication reduces the amount of energy required to perform mechanical actions. This subject area introduces the different types of friction and their relation to lubrication requirements of machinery. In addition, these modules provide an overview of the selection of proper lubricant for operating machinery as well as how to determine the cause of component failure.

### **Bearing Maintenance**

Rotating mechanical equipment in industry today is faster, more efficient, and carries greater loads than the machinery of 20 years ago. Component parts of today's machines are designed and built to minimize the necessity of frequent replacement and repairs. Bearings, by the nature of the service they perform in a rotating device, are expendable and only have a finite life span. The modules presented in this subject area provide a thorough understanding of the operation, maintenance, and installation of different bearing types.

### **Mechanical Transmission Systems**

Mechanical transmission systems vary widely in design however they serve the same basic purpose, to connect a machine's power source to its driven component. The speed and direction of rotation of a machine can be controlled through the use of gear boxes, chain drives, clutches, and belt drives. Maintenance personnel should be familiar with each type of transmission system and how to properly inspect, maintain, and repair them. These modules will provide valuable information on the theory of operation of each type of transmission system and where they are used in industry. From transmission through the meshing of gear teeth to the frictional belt drive, mechanical transmissions are key to long and efficient equipment life.

### **Rigging**

Any time large, heavy, or awkward items need to be moved within a plant, rigging is required. The fundamentals of rigging revolve around one main theme: safety. Whenever a rigging job is to be performed, safety must be the principle concern. Time and expense are secondary to safety. To provide for the necessary level of safety and to ensure a timely operation, a rig must be approached through certain fundamental elements. The modules in this subject area provide an overview of planning a rigging job, selecting rigging equipment, rigging techniques, and the proper use of signals.

### **Shaft Alignment**

Alignment is basic to all rotating mechanical equipment because of the need to connect driven equipment with driving equipment. The proper alignment of coupled equipment greatly improves its operating life and decreases the cost of maintenance. Learning how to perform an accurate alignment, therefore, is an

essential skill of all maintenance personnel. The topics in this module provide participants with an in-depth overview of the shaft alignment process, starting with a discussion of the types and indications of misalignment and continuing through the different alignment methods and procedures.

### **Welding Fundamentals**

Welding is not new. The earliest known form of welding, called forge welding, dates back to the year 2,000 BC. Forge welding is a primitive process of joining metals by heating and hammering until the metals are fused, or mixed, together. Although forge welding still exists, it is mainly limited to the blacksmith trade. Today, there are many welding processes available in industry. The modules in this topic introduce participants to these processes as well as the preparation, quality requirements, and testing involved with them.

### **OUTLINE**

#### **Bearing Maintenance**

- Bearing Fundamentals
- Rolling Contact Bearings I
- Rolling Contact Bearings II
- Sliding Surface Bearings

#### **Industrial Hydraulic Fundamentals**

- Hydraulic Components I
- Hydraulic Components II
- Hydraulic Systems
- Hydraulic Theory

#### **Industrial Pneumatics Fundamentals**

- Pneumatic Components I
- Pneumatic Components II
- Pneumatic Systems
- Pneumatic Theory I
- Pneumatic Theory II

#### **Lubrication Concepts**

- Bearing System Lubrication
- Lubricant Properties
- Machinery Lubrication
- Preventing Wear and Erosion
- Principles of Lubrication

#### **Mechanical Transmission Systems**

- Belt Drives I
- Belt Drives II
- Belt Drives III
- Belt Drives IV
- Belt Drive Maintenance
- Chain Drives I
- Chain Drives II
- Gear Drives
- Gear Maintenance

#### **Pipes and Pipefitting**

- Codes and Standards
- Pipe Insulation

- Piping & Tubing
- Piping Materials and Manufacturing Methods

### **Pumps**

- Centrifugal Pumps

### **Mechanical Seals**

- Positive Displacement Pumps
- Pump Design
- Pump Maintenance
- Special-Purpose Pumps

### **Rigging**

- Basic Rigging I
- Advanced Rigging I
- Advanced Rigging II

### **Shaft Alignment**

- Alignment Tools and Methods
- Cross and Reverse Dial Alignment
- Laser Alignment
- Moving the Machine
- Rim and Face Alignment
- Soft Foot and Bar Sag
- Types and Effects of Shaft Misalignment

### **Static and Dynamic Sealing**

- Bolted Joints I
- Bolted Joints II
- Gaskets
- Packing
- Threaded Fasteners
- Torque & Tension

### **Valve Fundamentals**

- Actuators
- Basic Types and Operations I
- Basic Types and Operations II
- Basic Types and Operations III
- Relief & Safety Valves I
- Relief & Safety Valves II

### **Welding Fundamentals**

- Brazing
- Gas Metal Arc Welding
- Gas Tungsten Arc Welding
- General Welding Safety
- Introduction to Welding
- Oxyacetylene Welding and Cutting
- Shielded Metal Arc Welding
- Weld Joint Inspection

## **ASSESSMENTS/TESTING**

Each module contains numerous Knowledge Checks along the way to help you measure your understanding. At the end of each module there is a final quiz. A score of 80% or higher is required to earn a certificate of completion.

#### OUTCOME

All industrial facilities use mechanical equipment in one form or another. Although the types of mechanical equipment can run the gamut from simple open/close valves to ultra complex specialized purpose-built machinery, the underlying operating principles and concepts are rooted in solid mechanical fundamentals. The Mechanical series of modules features 13 modules, which include Bearing Maintenance, Industrial Hydraulic Fundamentals, Industrial Pneumatic Fundamentals, Lubrication Concepts, Mechanical Transmission Systems, Pipes and Pipefitting, Precision Measuring Instruments, Pumps, Rigging, Shaft Alignment, Static and Dynamic Sealing, Valve Fundamentals, and Welding Fundamentals. IACET CEU's awarded along with certificate of completion

#### FORMAT

Self-directed lessons using Visual Demonstrations & Multimedia Presentations

#### TIME ALLOWED FOR COMPLETION

1 year