



Mechanical Series

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.

Bearing Maintenance - 0.2 CEUs

Bearing Fundamentals

- Bearing Functions
- Bearing Categories
- Bearing Lubrication
- Types of Bearing Failure

Rolling Contact Bearings I

- Function and Design
- Common Types of Rolling Contact Bearings
- Bearing Lubrication

Rolling Contact Bearings II

- Rolling Contact Bearing Failures
- Installing Rolling Contact Bearings
- Removing Rolling Contact Bearings

Sliding Surface Bearings

- Common Sliding Surface Bearings
- Journal Bearings
- Thrust Bearings
- Sliding Surface Bearing Lubrication

Industrial Hydraulic Fundamentals - 0.2 CEUs

Hydraulic Components I

- Hydraulic Filters
- Hydraulic System Piping
- Hydraulic Seals
- Hydraulic System Pumps

Hydraulic Components II

- Reservoirs
- Accumulators
- Control Valves
- Relief Valves
- Cylinders and Actuators

Hydraulic Systems

- Basic Hydraulic Systems
- Hydraulic Fluid Properties
- Types of Hydraulic Fluids
- Hydraulic Schematic Symbols
- Hydraulic Circuit Operation

Hydraulic Theory

- Development and Applications of Modern Hydraulics
- Pressure and Force
- Pascal's Law
- The Role of Pressure and Force in Hydraulic Systems
- Volume and Velocity of Flow

Industrial Pneumatic Fundamentals - 0.3 CEUs

Pneumatic Components I

- Purification Equipment
- Pneumatic System Filters
- Moisture-Removing Equipment
- Compressed Air System Lubricating Devices
- Pneumatic Cylinders

Pneumatic Components II

- Pneumatic Control Valves
- Elements of Pneumatic Control Valves
- Air Receivers
- Pneumatic Motors
- Classification of Pneumatic Tools

Pneumatic Systems

- Simple Pneumatic Systems
- Simple Pneumatic Circuits
- Complex Pneumatic Circuits

Pneumatic Theory I

- Advantages of Fluid Power
- Differences Between Liquids and Gases
- Formulas for Force and Pressure
- Changes in a Pneumatic System
- Fluid Flow in a Pneumatic System

Pneumatic Theory II

- Physical Factors that Act Upon a Fluid
- Advantages of Pneumatic Systems
- Common Pneumatic Applications
- Pneumatic Symbols on a Schematic

Lubrication Concepts - 0.2 CEUs

Bearing System Lubrication

- Common Lubrication Methods
- Drip Feed Lubrication
- Splash Feed Lubrication
- Force Feed Lubrication
- Grease Lubricant Applications

Lubricant Properties

- Lubricant Types
- Lubricating Oil Properties
- Properties of Grease
- Oil and Grease Selection Criteria
- Lubricant Additive Uses

Machinery Lubrication

- Lubricant Types and Functions
- Selecting the Proper Lubricant
- Improper Lubricant Effects
- Obtaining Proper Oil Samples

Preventing Wear and Erosion

- Effects of Lubrication
- Types of Wear
- Maintaining Proper Lubrication

Principles of Lubrication

- Lubrication
- Modes of Lubrication
- Viscosity
- Common Lubrication Methods

Mechanical Transmission Systems - 0.4 CEUs

Belt Drives I

- Belt Drive Purpose
- Belt Selection
- Advantages and Disadvantages of Belt Drives
- Belt Tensioning

Belt Drives II

- V-Belt Components
- Types of V-Belts
- Poly V-Belts

Belt Drives III

- Variable Speed Belts
- Variable Speed Drives
- Flat Belts

Belt Drives IV

- Positive Belt Drives
- Linked V-Belts
- Flat Belt Fastening Methods

Belt Drives Maintenance

- Checking Belt Alignment
- Taper Lock Bushings
- Belt Life

Chain Drives I

- Purpose of Chain Drives
- Construction of Roller Chains
- Variables of Roller Chains
- Applications of Leaf Chains
- Hardened Sprockets

Chain Drives II

- Installation and Removal of Bushings and Sprockets
- Chain Tension and Alignment
- Conditions for Chain and Sprocket Inspection
- Methods of Lubrication
- Methods for Link Replacement

Gear Drives

- Purpose of Gear Drives
- Types of Gears
- Gear Drive Terminology
- Characteristics of Gearboxes and Gearsets
- Lubrication and Gear Erosion

Gearbox Maintenance

- Gearbox Disassembly
- Gearbox Reassembly Precautions
- Gearbox Inspections
- Worm Gear Actuators

Pipes and Pipefitting - 0.4 CEUs

Codes and Standards

- Purpose of Piping Codes and Standards
- Codes, Standards, Practices, and Guidelines
- Regulatory Authorities
- Quality Assurance

Pipe Hangers and Supports

- Pipe Hangers, Supports, and Symbols
- Pipe Clamps
- Pipe Hanger Connecting Units and Supports
- Uses of Pipe Anchors

Pipe Insulation

- Insulation and Thermal Conductivity
- Types of Piping Insulation
- Insulation Safety Precautions
- Installation and Removal

Piping & Tubing

- Piping and Tubing
- Piping Schedule Numbers
- Classification of Tubing
- Major Advantages of Tubing
- Flared and Flareless Tubing Joints

Piping Materials and Manufacturing Methods

- Selecting Piping Materials
- Mechanical and Physical Properties of Metal
- Physical Composition and Heat Treating Practices of Steel
- Pipe Manufacturing Methods

Precision Measuring Instruments - 0.2 CEUs

Dials Indicators

- Purpose of Dial Indicators
- Types of Dial Indicators
- Taking Measurements with Dial Indicators
- Dial Indicator Maintenance

Fixed Gauges

- Common Types of Fixed Gauges
- Limit Gauges for Length Dimensions
- Cylindrical Limit Gauges
- Fixed Gauges for Multiple Dimensions

Micrometers

- Parts of a Micrometer
- Reading a Micrometer
- Types of Micrometers
- Micrometer Maintenance

Precision Measuring Instruments

- Precision Measuring Tools
- Direct Versus Indirect Measurements
- Accuracy, Precision, and Error
- Precision Tools

Vernier Calipers

- Parts of a Vernier Caliper
- Reading a Vernier Caliper
- Taking Measurements
- Vernier Caliper Maintenance

Pumps - 0.3 CEUs

Centrifugal Pumps

- Centrifugal Pump Operation
- Major Components
- Common Design Aspects
- Centrifugal Pump Laws

Mechanical Seals

- Mechanical Seal Operation
- Mechanical Seal Properties and Component Functionality
- Mechanical Seal Types and Arrangements

Positive Displacement Pumps

- Positive Displacement Pump Operation
- Reciprocating Pumps
- Rotary Pumps

Pump Design

- Purpose of Pumps
- Pump Classification
- Pump Terminology

Pump Maintenance

- Common Pump Failures
- Pump Failure Causes
- Preventive Maintenance
- Predictive Maintenance

Special-Purpose Pumps

- Metering Pumps
- Screw Pumps
- Peristaltic Pumps

Rigging - 0.1 CEUs

Advanced Rigging I

- Rigging Hardware
- Bridge Cranes
- Boom Cranes
- Crane Inspections

Advanced Rigging II

- Capacity Charts
- Load Balancing
- Heavy Lifting Procedures

Basic Rigging

- Introduction to Rigging
- Block and Tackle
- Hoists, Jacks, and Winches
- Slings
- Rigging Safety

Shaft Alignment - 0.3 CEUs

Alignment Tools and Methods

- Alignment Fundamentals
- Pre-Alignment Checks
- Alignment Methods

Cross and Reverse Dial Alignment

- Cross and Reverse Dial Alignment Methods
- Using Graphs for Dial Alignments
- Calculating Misalignment

Laser Alignment

- Safety Precautions
- Shaft Misalignment
- Advantages of Laser Alignment
- Computer Interfaces with the Alignment Rig

Moving the Machine

- Alignment methods
- Vertical Moves
- Horizontal Moves

Rim and Face Alignment

- Rim and Face Alignment
- Advantages of Rim and Face Alignment
- How to Measure Angular Misalignment
- How to Measure Parallel Misalignment

Soft Foot and Bar Sag

- Soft Foot
- Detecting and Connecting
- Bar Sag

Types and Effects of Shaft Misalignment

- Alignment Fundamentals
- Misalignment Causes
- Misalignment Indicators and Effects

Static and Dynamic Sealing - 0.3 CEUs

Bolted Joints I

- Proper Fastener Torque
- Stresses on Fasteners
- Types of Bolted Joints
- Joint Integrity
- Effects of Vibration

Bolted Joints II

- Maintaining Tightening Joints
- Bolt Joint Relaxation
- Flange Surface Finish
- Flange Face Designs
- Stud Bolts

Gaskets

- Gasket Fundamentals
- Gasket Installation and Replacement
- Gasket Cutting

Packing

- Compression Packing
- Packing Construction
- Packing Renewal Techniques

Threaded Fasteners

- Terminology for Screw Threads
- Classes of Fit
- Mechanical Properties
- Fastener Materials

Torque and Tension

- Torque and Tension
- Controlling Torque
- Measuring Torque
- Torque Calculations

Valve Fundamentals - 0.3 CEUs

Actuators

- Purpose of a Valve Actuator
- Types of Actuators
- Pneumatic Actuator Principles of Operation
- Electric Actuator Principles of Operation
- Hydraulic Actuator Principles of Operation

Basic Types and Operations I

- Purpose of Valves
- Valve Components
- Valve Mounting Methods

Basic Types and Operations II

- Gate Valves
- Globe Valves
- Needle Valves
- Butterfly Valves

Basic Types and Operations III

- Ball Valves
- Plug Valves
- Check Valves
- Regulating Valves

Relief & Safety Valves I

- Purposes of Relief and Safety Valves
- Safety and Relief Valve Terms
- Safety vs. Relief Valves

Relief & Safety Valves II

- Direct-Acting Relief Valves
- Pilot Actuated Relief Valves
- Safety Relief Valves

Welding Fundamentals - 0.4 CEU's

Brazing

- Brazing Theory
- Advantages and Disadvantages of Brazing
- Brazing Equipment
- Brazing Process

Gas Metal Arc Welding

- GMAW Theory
- GMAW Advantages and Disadvantages
- GMAW Equipment
- GMAW Process

Gas Tungsten Arc Welding

- Gas Tungsten Arc Welding Theory
- Gas Tungsten Arc Welding Advantages and Disadvantages
- Gas Tungsten Arc Welding Equipment
- Gas Tungsten Arc Welding Process

General Welding Safety

- Hazards Associated with Welding
- Welding PPE
- Additional Protective Equipment
- Welding Ventilation

Introduction to Welding

- Purpose of Welding
- Common Welding Terms
- Types of Welding Joints
- Filler Metal Selection
- Welding Procedure Symbols

Oxyacetylene Welding and Cutting

- Oxyacetylene Welding and Cutting Principles
- Oxyacetylene Welding and Cutting Equipment
- Oxyacetylene Welding and Cutting Process

Shielded Metal Arc Welding

- SMAW Theory
- SMAW Advantages and Disadvantages
- SMAW Equipment
- SMAW Process

Weld Joint Inspection

- Importance of Quality Welded Joints
- Common Types of Weld Failures
- Common Methods to Test Welds