



**The Manufacturers Association**

**TRAINING PLAN – Maintenance Mechanic (YEAR 2)**

**Total Related Training Instruction (RTI) Hours: 144**

<b>Learning Unit</b>	<b>Hrs. of Instruction</b>
<b>Unit 2-1: Introduction to Industrial Maintenance</b> <ul style="list-style-type: none"> <li>➤ Approaches to Maintenance</li> <li>➤ Lean Manufacturing</li> <li>➤ Troubleshooting</li> </ul>	12
<b>Unit 2-2: Industrial Maintenance Safety</b> <ul style="list-style-type: none"> <li>➤ Rigging and Lifting Safety</li> <li>➤ Hand and Power Tool Safety</li> <li>➤ Fall Protection</li> <li>➤ Machine Shop Safety</li> <li>➤ Mechanical Safety</li> <li>➤ Electrical Safety</li> </ul>	16
<b>Unit 2-3: Lifting and Moving Equipment</b> <ul style="list-style-type: none"> <li>➤ Machine Rigging</li> <li>➤ Lifting and Moving Equipment</li> </ul>	14
<b>Unit 2-4: Production Equipment and Machines Overview</b> <ul style="list-style-type: none"> <li>➤ Work Order Procedures</li> <li>➤ Machine Safety</li> <li>➤ Machine Components</li> <li>➤ Basic Machine Operations</li> <li>➤ Machine and Product Quality</li> <li>➤ Faults and Issues</li> <li>➤ Corrective Actions</li> </ul>	66
<b>Unit 2-5: Machine Shop: Cutting and Drilling</b> <ul style="list-style-type: none"> <li>➤ Workholding</li> <li>➤ Cutting Basics</li> <li>➤ Drilling Basics</li> </ul>	36

**Unit 2-1: Introduction to Industrial Maintenance**

The learning unit introduces variety of topics associated with industrial maintenance including common industrial manufacturing maintenance strategies, the impact of Kaizen events, the metrics for Lean, and basic troubleshooting strategies.

Learning Outcomes and Content

1. Discuss the benefits, limitations, and goals of various maintenance approaches.
2. Explain why Kaizen events are held.
3. Describe what happens during a kaizen event.
4. distinguish between broad and narrow metrics and calculate key values such as takt time and OEE.
5. Describe various troubleshooting techniques.

Learning Modules





## The Manufacturers Association

### TRAINING PLAN – Maintenance Mechanic (YEAR 2)

Module	Hrs. of Instruction	Provider
<b><u>Approaches to Maintenance</u></b> – This learning module introduces common manufacturing maintenance strategies, including reactive, corrective, predictive, preventive, reliability-centered, and total productive maintenance. This class describes the advantages and disadvantages of each method, the benefits of planned downtime.	1.5	ToolingU-SME
<b><u>Conducting Kaizen Events</u></b> - This learning module provides a comprehensive overview of kaizen events and how they work. A kaizen event is a focused project conducted by a cross-functional team that targets a problem area. Kaizen events produce both quantitative and qualitative benefits.	1.5	ToolingU-SME
<b><u>Metrics for Lean</u></b> - This learning module introduces the information and data used to track processes in lean manufacturing facilities, including takt time, cycle time, total time of operations, overall equipment effectiveness (OEE), and first-time quality.	1.5	ToolingU-SME
<b><u>Troubleshooting Overview</u></b> - This learning module will help students to solve problems and understand how to work to prevent them in many different settings.	1.5	ToolingU-SME
<b><u>Critical and Creative Thinking</u></b> – This learning module will develop skills as a critical thinker and problem solver and recognize and leverage thinking preferences, as well as those on a team, to find different solutions to everyday problems. Focus of this course will also include common troubleshooting techniques documented by the facility.	6	Facility

## Unit 2-2: Industrial Maintenance Safety

The learning unit focuses on the specific safety precautions a maintenance mechanical should consider when working in an industrial environment. The instruction introduces the worker to various aspects of workplace safety, including hand and power tools safety, rigging and lifting safety, as well as mechanical and electrical safety.

### Learning Outcomes and Content

1. Describe the safe use and care of hand and power tools.
2. Describe best practices to avoid falls in the workplace.
3. Describe OSHA regulations covering safe practices with walking and working surfaces and how following those regulations will positively impact daily operations in the workplace.
4. Describe how to avoid OSHA violations and how to handle a load without tipping the vehicle.
5. Describe the proper steps necessary to safely lift and transport materials within the work environment.
6. Describe best practices for grinding safety.
7. Describe best practices for welding safety.
8. Describe best practices for mechanical safety.
9. Describe best practices for electrical safety.



## The Manufacturers Association

### TRAINING PLAN – Maintenance Mechanic (YEAR 2)

#### Learning Modules

Module	Hrs. of Instruction	Provider
<b><u>Hand and Power Tool Safety</u></b> – This learning module provides guidelines for the safe use of common hand and power tools. Employees should never remove any safety guards from a tool’s point of operation unless authorized. Tools must be regularly cleaned and maintained, and all blades must be kept sharp.	1.5	ToolingU-SME
<b><u>Walking and Working Surfaces</u></b> - This learning module inform workers of the ways they can decrease the risks of injury and death regarding walking and working surfaces by following the guidelines as provided by OSHA. This module also covers the standards of fall protection practices, equipment and procedures.	1.5	ToolingU-SME
<b><u>Powered Industrial Truck Safety</u></b> - This learning module provides an overview of safety topics related to forklifts and other PITs. OSHA has many standards surrounding the use of PITs in the workplace for operators, non-operators, attended vehicles, and unattended vehicles.	1.5	ToolingU-SME
<b><u>Rigging Inspection and Safety</u></b> - This learning module covers basic inspection and safety procedures for rigging equipment and lifting devices.	1.5	ToolingU-SME
<b><u>Safety for Lifting Devices</u></b> - This learning module covers the different pieces of lifting equipment that may be used in the workplace and the safest ways to work with those pieces of equipment. Overhead cranes and hoists are used for lifting heavy loads.	1.5	ToolingU-SME
<b><u>Grinding Safety</u></b> – This learning module provides an overview of safety concerns and precautions for grinding operations. Grinding machines, wheels, and fluids pose several safety hazards, so operators must take proper preventative measures. Wheel guards can protect grinding operators from flying shards in the event of wheel breakage.	1.5	ToolingU-SME
<b><u>Welding Safety Essentials</u></b> – This learning module provides a broad overview of safety topics for various welding processes. The course describes general safety practices, such as electrical, fire, cylinder, and fume safety, that welders must follow.	1.5	ToolingU-SME
<b><u>Hydraulics and Pneumatics Safety</u></b> – This learning module provides a complete overview of the best safety and injury prevention practices for fluid power systems.	1.5	ToolingU-SME
<b><u>Safety for Mechanical Work</u></b> - This learning module provides a comprehensive overview of the safety hazards associated with working on any mechanical system, including the possibility for falls, fires, electrocution, or crushing injuries when entering a machine.	1.5	ToolingU-SME



## The Manufacturers Association

### TRAINING PLAN – Maintenance Mechanic (YEAR 2)

<p><b>Safety for Electrical Work</b> - This learning module Work provides an overview of the risks of working with electricity, as well as safety precautions Electricity can cause shock, burns, and fires. Electric shock occurs when current passes through a person's body.</p>	1.5	ToolingU-SME
<p><b>Arc Flash Safety</b> This learning module teaches a worker about the risk of electrical hazards and the need to understand the electrical hazards present in their work environment. This instruction includes facility specific electrical hazards, the classification of those hazards, and the techniques and procedures for safe work practices.</p>	4	Facility

### Unit 2-3: Lifting and Moving Equipment

The learning unit introduces the worker to the safe lifting and moving of machines and other industrial equipment. Instruction includes and introduction to common equipment used to move loads, such as cable, chains, slings and hoists, as well as the safety practices required in the shop. Additional classes focus on load calculations and proper inspection of rigging equipment.

#### Learning Outcomes and Content

1. Identify common rigging equipment
2. Explain how to calculate a load.
3. Describe how to inspect equipment
4. Describe the different types of rigging equipment.
5. Identify different types of lifting and moving equipment
6. Describe the rigging inspection process.
7. Demonstrate the ability to safely move loads from one location to another using the proper equipment and procedures for the job.

#### Learning Module

Module	Hrs. of Instruction	Provider
<p><b>Intro to Machine Rigging</b> – This learning module covers basic rigging equipment, calculating loads, inspecting equipment, and following safety precautions.</p>	1.5	ToolingU-SME
<p><b>Rigging Equipment</b> – This learning module covers the different kinds of equipment used in rigging, the properties of rope and chains, basic knots, hitches, and sling configurations, and fittings and end attachments.</p>	1.5	ToolingU-SME
<p><b>Lifting and Moving Equipment</b> – This learning module covers the different kinds of lifting devices, moving equipment, and scaffolds used in rigging.</p>	1.5	ToolingU-SME



**The Manufacturers Association**

**TRAINING PLAN – Maintenance Mechanic (YEAR 2)**

<p><b>Rigging Mechanics</b> – This learning module covers the mechanical laws involved in rigging, as well as essential practices for calculating the weight of a load and determining its center of gravity.</p>	1.5	ToolingU-SME
<p><b>Load Transfers</b> – This learning module will teach a worker how to safely move loads from one location to another using the proper equipment and procedures for the job. Instruction will include the demonstration and practice of several different rigging techniques, including the sling technique, come-a-long technique, blocking technique, and chaining technique. Instruction will also teach a worker how to use a dolly, manual pry bars, and hydraulic jacks, to safely move loads.</p>	8	Facility

**Unit 2-4: Production Equipment and Machine Overview**

The learning unit teaches the worker about the safety, components, quality, operation, faults/issues, and corrective actions commonly found on production equipment and machines.

Learning Outcomes and Content

1. Describe the work order process at your facility.
2. Identify the vital information on a work order.
3. Describe safety precautions to consider for each production machine at your facility.
4. Identify and describe the purpose the major components on each production machine.
5. Demonstrate the ability to start, stop, and emergency stop the production equipment.
6. Identify and recognize the product quality issues that may be a result of machine malfunction or failure.
7. Describe the most common faults or issues that occur on each production machine.
8. Describe the corrective actions that should be considered when diagnosing a machine malfunction or failure.

Learning Modules

Module	Hrs. of Instruction	Provider
<p><b>Work Order System</b> – This learning module introduces a worker to the facility specific work order submission, receiving, and acknowledgment process. This instruction also includes the identification of critical information on a work order.</p>	4	Facility
<p><b>Machine Safety</b> - This learning module identifies the specific safety precautions and concerns associated with each facility machine. Safety devices, policies, and procedures are reviewed, including machine guarding, pinch point awareness, required PPE and environmental conditions.</p>	8	Facility
<p><b>Machine Components</b> – This learning module identifies the operational sections and various working components of each facility specific machine. These areas could include loading, conveyors, presses, printers, cutters, drying, and offloading. Further exploration of components includes such machine specific elements as drive belts, sensors, switches, bearings, and servos.</p>	8	Facility



## The Manufacturers Association

### TRAINING PLAN – Maintenance Mechanic (YEAR 2)

<b>Machine Operation</b> – This learning module teaches a worker the fundamentals of machine operation. This includes start up, shut down, and emergency shut down procedures for each facility specific machine.	16	Facility
<b>Machine and Product Quality</b> -This learning module introduces worker to the most common product quality issues that can occur because of specific machine malfunction or component failure.	8	Facility
<b>Faults and Issues</b> – This learning module explores the various machine specific faults or malfunctions that can occur. This includes the identification of faults on the machine HMI, as well as a discussion and recognition of abnormal operating conditions	8	Facility
<b>Corrective Actions</b> – This learning module follows up on the previous module by addressing the most common forms of corrective actions that can be taken as part of the troubleshooting and machine diagnostic process. Instruction includes the discussion of multiple repair or replacement solutions for any given fault or issue	8	Facility

### Unit 2-5: Machine Shop: Cutting and Drilling

The learning unit introduces a worker to various cutting and drilling operations. Instruction covers basic cutting theory, metal cutting fluids, workholding devices, clamping basics, and tool selection.

#### Learning Outcomes and Content

1. Identify the most common cutting processes, as well as the machines used to perform them.
2. Identify the types of machine tools used in metal cutting operations and describe their function.
3. Describe chip formation and how it affects surface finish, part quality, and tool life.
4. Identify optimal band sawing variables and conditions.
5. Identify the common types of cutting fluids and describe their optimal use.
6. Describe how the tool material dictates the material removal rate, surface finish and tolerance, and expense to the manufacturer in the form of reduced scrap, extended tool life, production rates, and part quality.
7. Identify the different carbide grades and select the proper grade for a particular cutting operation.
8. Identify clamping components and describe their relative advantages.
9. Identify common types of tool wear and strategies to reduce or prevent them from occurring.
10. Describe how optimizing cutting conditions leads to better products, higher output, and reduced manufacturing costs.
11. Demonstrate the ability to safely setup and operate machine tools to perform routine sawing operations.
12. Demonstrate the ability to safely setup and operate machine tools to perform routine drilling operations.

#### Learning Modules

Module	Hrs. of Instruction	Provider
<b>Cutting Processes</b> – This learning module provides an introductory overview of the common metal cutting operations	1.5	ToolingU-SME



## The Manufacturers Association

### TRAINING PLAN – Maintenance Mechanic (YEAR 2)

<b>Overview of Machine Tools</b> – This learning module provides an overview of the basic machine tools used in metal cutting operations.	1.5	ToolingU-SME
<b>Basic Cutting Theory</b> – This learning module provides an introductory overview of metal cutting theory and chip formation.	1.5	ToolingU-SME
<b>Band Saw Operation</b> – This learning module gives an in-depth description of the considerations required for band sawing operations.	1.5	ToolingU-SME
<b>Introduction to Metal Cutting Fluids</b> – This learning module provides an overview of the use of cutting fluids in machining operations, including basic fluid safety and maintenance.	1.5	ToolingU-SME
<b>Introduction to Workholding</b> - This class introduces the role of a workholding device during the manufacturing process and identifies common groups of these devices.	1.5	ToolingU-SME
<b>Supporting and Locating Principles</b> - This class describes the fundamental theory to properly supporting, locating, and clamping a workpiece.	1.5	ToolingU-SME
<b>Locating Devices</b> - This class identifies the most common types of locating components used in custom workholding devices and fixtures.	1.5	ToolingU-SME
<b>Cutting Tool Materials</b> -This learning module provides an in-depth discussion of various cutting tool materials and their properties.	1.5	ToolingU-SME
<b>Carbide Grade Selection</b> -This learning module describes the different carbide tool grades and explains how to select the proper grade for a cutting operation	1.5	ToolingU-SME
<b>Clamping Basics</b> - This class covers the most common types of clamping components and explains their relative advantages and applications.	1.5	ToolingU-SME
<b>ANSI Insert Selection</b> – This learning module provides information on how to identify the qualities and properties of a carbide cutting insert based on its ANSI insert number	1.5	ToolingU-SME
<b>Advanced Tool Materials</b> – This learning module describes advanced metal-cutting tool materials: how they are made and how they are used.	1.5	ToolingU-SME
<b>Drill Tool Geometry</b> – This learning module provides an overview of each tool angle for a drill, including point angle and helix angle, and details the impact that each angle has on a cutting operation	1.5	ToolingU-SME



**The Manufacturers Association**

**TRAINING PLAN – Maintenance Mechanic (YEAR 2)**

<p><b>Optimizing Tool Life and Process</b> – This learning module provides a detailed overview of the various considerations necessary for prolonging cutting tool life.</p>	1.5	ToolingU-SME
<p><b>Impact of Workpiece Materials</b> - This learning module gives a detailed overview of the various types of workpiece materials, how they can be processed, and the challenges posed by each</p>	1.5	ToolingU-SME
<p><b>Sawing Practical</b> - This learning module will teach a worker how to plan for a sawing project and develop the skills required to use sawing equipment. Safe working procedures and standard work will be emphasized when setting up and operating the sawing equipment. The session will also discuss routine maintenance responsibilities required on sawing equipment.</p>	6	Facility
<p><b>Drilling Practical</b> - This learning module will teach a worker how to plan for a drilling project and develop the skills required to use drilling equipment. Safe working procedures and standard work will be emphasized when setting up and operating the drill. The session will also discuss routine maintenance responsibilities required on drilling equipment.</p>	6	Facility