



The Manufacturers Association

TRAINING PLAN – FOUNDATIONAL (YEAR 1)

Total Related Training Instruction (RTI) Hours: 144

Learning Unit	Hrs. of Instruction
Unit 1: Industrial Safety <ul style="list-style-type: none"> ➤ PPE ➤ Hazardous Materials ➤ OSHA ➤ First Aid ➤ Proper Lifting Techniques ➤ 5S 	26.5
Unit 2: Blueprint Reading and Drawings <ul style="list-style-type: none"> ➤ Blueprint Reading and Mechanical Drawing ➤ GD&T ➤ Fundamentals of CAD 	10.5
Unit 3: Mathematics <ul style="list-style-type: none"> ➤ Intermediate Algebra ➤ Geometry ➤ Trigonometry ➤ Units of Measurement 	12
Unit 4: Industrial and Labor Relations <ul style="list-style-type: none"> ➤ History and Background ➤ Labor Laws ➤ Union Structures ➤ Grievance Procedures ➤ Collective Bargaining 	10.5
Unit 5: Trade Theory and Science <ul style="list-style-type: none"> ➤ Practical Metallurgy ➤ Manufacturing Processes ➤ Dimensional Metrology 	44.5
Unit 6: Workplace Skills <ul style="list-style-type: none"> ➤ Sexual Harassment Prevention ➤ Written and Oral Communications ➤ Active Listening ➤ Teamwork ➤ Problem Solving ➤ Computer Skills and Literacy ➤ Time Management ➤ Customer Focus 	40



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Unit 1: Industrial Safety

The learning unit instructs the worker in safety and loss prevention in the workplace. This includes modules involving safety concepts, hazard controls and compliance with safety and health programs mandated from federal and state regulations, including OSHA. In addition to this core safety training, organizations may have additional required safety training that will need to be added to the educational pathway below.

Learning Outcomes and Content

1. Identify regulations as applicable to the Occupational Health and Safety Act (OHSA) and Globally Harmonized System (GHS).
2. Describe safe procedures and practices required when setting up and using machines, equipment, tools, coolants/lubricants, and cleaning agents.
3. Demonstrate use of all required protective clothing and gear.

Learning Modules

Module	Hrs. of Instruction	Provider
Personal Protective Equipment (PPE) - This learning module will introduce the purpose and use of personal protective equipment (PPE), in accordance with the Occupational Safety and Health Administration (OSHA).	1.5	
SDS and Hazard Communications – This learning module will discuss communication methods about hazardous workplace substances and how they increase employee awareness and safety.	2	
Flammable and Combustible Liquids – This learning module will the procedures required to safely handle, store, and dispose of dangerous liquids.	1.5	
Metal Cutting Fluid Safety – This learning module will introduce the safety concerns related to working with metal cutting fluids.	1.5	
Introduction to OSHA – This learning modules will provide an introduction to the purpose of OSHA and how its standards and guidelines affect employers and employees.	1.5	
Hearing Conservation – This learning module will introduce the effects of sound and noise on the body and how to protect themselves from related injuries.	1.5	
Respiratory Equipment – This learning module will introduce the types and uses of breathing equipment for various airborne hazards.	1.5	
Machine Guarding – This learning module will introduce basic machine guarding practices and devices and includes information on hazardous machine components, motions, and actions.	1.5	
Confined Spaces – This learning module will introduce OSHA regulations and the best practices for performing work safely in a confined space.	1.5	



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Fire Safety and Prevention – This learning module will introduce OSHA regulations regarding fire safety and how they impact day-to-day operations in the workplace.	1.5	
Ergonomics Awareness – This learning module will introduce the science of ergonomics and its application in the workplace.	1.5	
Back Injury Prevention – This learning module will discuss important information concerning back safety and its prevention.	1.5	
Lockout/Tagout Overview – This learning module will introduce OSHA requirements and best practices for preventing accidental startup during maintenance and repair.	1.5	
5S Overview – This learning module will introduce the purpose and process of 5S to promote organization, efficiency, and team work through several sequential steps.	1.5	

Unit 2: Blueprint Reading and Drawings

The learning unit instructs the worker in the basic requirements communicated graphically by engineering drawings (blueprints) for a product or assembly. An understanding of how to read a blueprint is critical to manufacture and inspect parts to accurate specifications. Accurate blueprint creation helps to ensure that finished parts will function in a way that meets the original intent. After completing this unit, associates should be able to read a basic blueprint and determine the critical features on a part that need to be measured.

Learning Outcomes and Content

1. Identify types and formats of engineering drawings/CAD data.
2. Identify graphic language and symbols of engineering drawings/CAD data.
3. Describe dimensional terminology and practices.
4. Describe the principle views of orthographic projection to identify component features.
5. Demonstrate the ability to interpret information found on a blueprint and call out critical information regarding the drawing.
6. Demonstrate the ability to perform fundamental tasks within CAD/CAM software tools.

Learning Module

Module	Hrs. of Instruction	Provider
Print Reading and Symbols - This learning module will teach a thorough understanding of blueprints and how to read them. Blueprints are documents that contain three major elements: the drawing, dimensions, and notes. The drawing illustrates the views of the part necessary to show its features. Together, the extension and dimension lines on the drawing indicate dimensions and specific tolerance information of each feature. The notes contain administrative and global information about the part. A blueprint contains all instructions and requirements necessary to manufacture and inspect a part.	1.5	
Basics of Tolerance – This learning module will discuss the different types of tolerances and the relationship between tolerances and part dimensions.	1.5	
Print Reading – Fluid Systems – This learning module will discuss the basic layout of hydraulic and pneumatic prints and addresses the most common symbols used to identify components.	1.5	



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Print Reading – Electrical – This learning module will discuss common electrical prints and symbols.	1.5	
GD&T – Introduction - This learning module will discuss the symbols and vocabulary of geometric dimensioning and tolerancing, or GD&T.	1.5	
GD&T – Major Rules – This learning module will discuss the rules and concepts of geometric dimensioning and tolerancing, or GD&T, including Rule #1, Rule #2, bonus tolerance, the 3-2-1 Rule, and virtual and resultant conditions, as well as the datum reference frame (DRF).	1.5	
CAD/CAM Overview – This learning module will discuss CAD design methods, including the different types of part drawings and modeling, and the CAM data conversion process, including how toolpaths and movements are plotted based on design data.	1.5	

Unit 3: Mathematics

The learning unit instructs the worker in the application of trade mathematics to design and interpret engineering prints and to meet customer specifications.

Learning Outcomes and Content

1. Apply mathematical principles to trade-specific applications.
2. Apply calculations to convert between fractions, decimals, mixed numbers and improper fractions.
3. Perform conversions between units of measurement.

Learning Modules

Module	Hrs. of Instruction	Provider
Basic Arithmetic - This learning module will teach a worker basic arithmetic operations, including addition, subtraction, multiplication, and division. Additionally, it introduces the concept of negative numbers and integers. The class concludes with an overview of the order of operations and grouping symbols.	1.5	
Working with Numbers - This learning module will teach a worker how to perform basic mathematical operations using fractions, decimals, and percentages. The class covers addition, subtraction, multiplication, and division with fractions and decimals. It also discusses conversions between fractions, decimals, mixed numbers, and improper fractions.	1.5	
Shop Algebra - This learning module will discuss the basic principles of algebra and demonstrates how to solve equations containing multiple operations.	1.5	
Shop Geometry I – This learning module will discuss the relationships between the various angles formed when lines intersect can be used to solve geometry problems and interpret blueprints.	1.5	



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Shop Geometry II - This learning module will discuss how to categorize triangles by their sides and angles, calculate missing angles based on the measurements of other angles, and determine the area of a triangle.	1.5	
Shop Geometry III – This learning module will discuss the calculations and uses of circles and polygons when working with prints in any number of manufacturing capacities.	1.5	
Shop Trigonometry – This learning module will discuss the Pythagorean theorem and how it is used to solve various math problems involving and using right triangles for unknown dimensions on blueprints.	1.5	
Units and Conversions - This learning module will provide a worker with a thorough explanation of the English and Metric systems and how conversion between them occurs. Units of measurement are used every day in a production environment. Converting between units is often required, especially for businesses dealing internationally.	1.5	

Unit 4: Industrial and Labor Relations

The learning unit instructs the worker in labor relations can help apprentices manage and strengthen employment relationships, provide good representation for workers and design an effective organizational structure. This is a brief overview of what the average worker will learn during their apprenticeship journey.

Learning Outcomes and Content

1. Recall the history of the Union, Labor History background and current laws and practices.
2. Understand the structure and roles within a unionized work environment.
3. Recognize the process for filing grievance procedures in unionized and non-unionized workplaces.

Learning Modules

Module	Hrs. of Instruction	Provider
Labor and Employment Relations Introduction - This learning module covers how the labor market and human resource issues are impacted by factors such as race, gender and class. The viewpoints of the employer, the employee and employee group representatives will be discussed.	1.5	
Labor Relations Movement Development - This learning module covers a historical and philosophical overview of the labor relations movement and the social, economic and political impact it's had in America. Students will also look at the activities and structure of labor unions and other employee representative type organizations.	1.5	
Current Issues and Labor Relations - This learning module looks at current political, social and economic issues that are impacting the labor relations movement. Effective strategies to deal with these contemporary issues will also be discussed.	1.5	



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<p>Law and Labor Relations – This learning module will discuss the legal guidelines that currently govern labor relations in America will be covered in this course. Students learn how current guidelines were developed by examining federal and state laws, statutes and relevant court cases.</p>	1.5	
<p>Conflict and Conflict Resolution in the Workplace - How people resolve work-related grievances will be covered in this course. Students learn about grievance procedures and how to solve them as well as looking at union and non-union workplaces.</p>	1.5	
<p>Leadership Within Unions - This learning module will teach students about the role of being a union leader. Responsibilities will be discussed in addition to what it's like to make important decisions, how to communicate properly and other important attributes of a well-respected union leader.</p>	1.5	
<p>Collective Bargaining - This learning module will focus on what goes into contract negotiations. Contract language will be emphasized in addition to how to resolve contract disputes to benefit workers and employers alike.</p>	1.5	

Unit 5: Trade Theory and Science

The learning unit instructs the worker in the foundational knowledge required by the trade to include an understanding of the science of metallurgy, general manufacturing processes and the common gaging and variable inspection tools and methods, such as calipers and micrometers. In addition, the learning unit will discuss common manufacturing process and terminology that will be part of the apprentice's everyday work.

Learning Outcomes and Content

1. Describe characteristics of metals.
2. Describe the manufacturing processes to produce steel and cast iron.
3. Describe the physical and mechanical properties of steels and cast iron.
4. Describe identification systems for steels and cast iron.
5. Describe ferrous metal heat-treating processes.
6. Describe the properties and characteristics of non-metallic materials.
7. Identify the primary standards of length.
8. Recall terms and features used in measurement techniques.
9. Recognize measuring, checking, and gauging equipment.
10. Recognize direct reading linear measuring instruments.
11. Recognize indirect reading (transfer type) linear measuring equipment.
12. Recall the company's Quality Management System (QMS).
13. Recognize the Quality Assurance team and their responsibilities.
14. Understand ISO 9000 Standards and how they apply to individuals.
15. Recognize the purpose of Standard Operating Procedures (SOPs).
16. Identify common defects found in the company's manufacturing process.
17. Understand the type of quality documents a worker is responsible to complete on a daily basis.
18. Recall the elements of a Continuous Improvement Program.
19. Recall the importance of following a preventative maintenance schedule.



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Learning Modules

Module	Hrs. of Instruction	Provider
<u>Manufacturing Materials – Physical Properties</u> - This learning module will discuss manufacturing materials and their physical properties, including thermal, electrical, and magnetic properties.	1.5	
<u>Manufacturing Materials – Mechanical Properties</u> - This learning module will discuss hardness, ductility, and strength, what materials exhibit these characteristics, and common methods a facility might use to test these qualities.	1.5	
<u>Introduction to Metals</u> – This learning module will discuss how various metals function in different environments, making them better equipped to select materials and tooling.	1.5	
<u>Classification of Steel</u> – This learning module will discuss the major types of steel classifications and describe the nomenclature used to identify various grades of steel.	1.5	
<u>Ferrous Metals</u> – This learning module will discuss how to evaluate materials and anticipate how ferrous metals will function in different environments.	1.5	
<u>Nonferrous Metals</u> – This learning module will discuss various nonferrous metals, their characteristics, and their uses.	1.5	
<u>Heat Treating Metals</u> - This learning module will discuss steel heat treatment methods (annealing, quenching, normalizing, and tempering) and how heat and carbon content impact a steel's microstructure.	1.5	
<u>Non-Metals – Plastics</u> – This learning module will discuss an overview of plastic and its properties. This course introduces users to thermoplastics and thermosets, physical and mechanical properties, polymer structure and arrangement, manufacturing methods, and common additives.	1.5	
<u>Non-Metals - Thermoplastics</u> – This learning module will discuss the properties and applications of thermoplastics, including an overview of the amorphous and semicrystalline molecular regions found in thermoplastics.	1.5	
<u>Non-Metals – Thermosets</u> – This learning module will discuss the key characteristics and types of thermosets as well as common processing methods.	1.5	
<u>Non-Metals – Ceramics</u> – This learning module will discuss the major categories, properties, and uses of ceramics.	1.5	
<u>Non-Metals – Composites</u> – This learning module will discuss the basic methods for processing composites, as well as some of the materials used for these processes.	1.5	



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<p><u>Introduction to ISO 9000 Standards</u> – This learning module will discuss the role of a Quality Management System (QMS), ISO 9001:2015's ten sections, and ISO 9001:2015's connection to other standards.</p>	1.5	
<p><u>Following Standard Work</u> – This learning module emphasizes the importance of following company developed standard work and how standard operating procedures impact the quality program, customer satisfaction and the overall success of the business.</p>	1.5	
<p><u>Continuous Process Improvement</u> – This learning module will introduce principles of continuous process improvement and the tools used to implement it at a facility.</p>	1.5	
<p><u>Nonconforming Product Awareness</u> – This learning module will introduce the common defects found in the manufacturing environment and the most likely causes for each defect.</p>	1.5	
<p><u>Maintaining Equipment Performance</u> – This learning module will introduce the worker to the common manufacturing maintenance strategies (reactive, corrective, predictive, preventive, reliability-centered, and total productive maintenance) and understand their responsibilities in upholding maintenance tasks, as part of the program.</p>	1.5	
<p><u>Common Measuring Tools</u> - This learning module will teach an associate a common gaging and variable inspection tools and methods. Variable inspection takes a specific measurement using common devices such as calipers and micrometers. The sensitivity of the instrument must be greater than the measurement being taken. Both calipers and micrometers are read by finding the alignments in lines on the devices. Gages, such as gage blocks, plug gages, ring gages, and thread gages, reveal whether a dimension is acceptable or unacceptable without a specific quantity.</p>	1.5	
<p><u>Applied Measurement</u> - This learning module will teach an associate how to select gauges according to the feature or characteristic to be measured, the applicable tolerance and the accuracy, and the resolution and capability of the test instrument. The worker will determine whether the type of measurement should be direct, differential, or transfer and use the tool to read measurements.</p>	16	
<p><u>Tool Calibration</u> - This learning module will teach an associate details the calibration of measuring instruments and its necessary documentation. Calibration should occur at regular intervals. Companies should have a written document that defines their calibration procedures. Calibration records and reports ensure that traceability is intact. This documentation proves that measurements are accurate.</p>	1.5	



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Unit 6: Workplace Skills

The learning unit instructs the worker in the key types of communication and common roadblocks to communication, as well as how to use effective communication as a tool to help build teamwork and manage conflict in a diverse workplace. In addition, this unit will instruct in critical workplace skills, such as computer skills, time management and problem solving.

Learning Outcomes and Content

- Enhance teamwork with co-workers by applying strong communications and listening techniques.
- Understand the importance of effective communication and the various forms and mediums of communication used in the workplace.
- Demonstrate the ability to apply steps to manage conflict within the workplace.
- Understand the methods to prevent harassment and discrimination in a diverse workplace.
- Demonstrate a computer aptitude to perform daily word processing tasks, accessing and saving data to a file, and performing basic tasks such as printing and performing communications through email.

Learning Modules

Module	Hrs. of Instruction	Provider
Harassment and Discrimination – This learning module will discuss how to identify and prevent harassment and discrimination in a diverse workplace, as well as some basic Federal laws that protect workers from harassment and discrimination.	3	
Effective Communications - This learning module will discuss the key types of communication and common roadblocks to communication, as well as how to use effective communication as a tool to help build teamwork and manage conflict.	1.5	
21st Century Communication Techniques – This learning module will discuss the importance of effective communication and the various forms and mediums of communication in the workplace.	1.5	
Conflict Resolution Principles – This learning module will introduce the basic steps to take to resolve conflicts in the workplace and help ensure that the same conflicts do not return.	1.5	
Working in Teams – This learning module will teach the principles in readily sharing information, knowledge and personal strengths in seeking to understand and building on differing perspectives of others to enhance team efficiency and quality outcomes.	1.5	
Reading Comprehension – This learning modules will review sentence structures and techniques for the comprehension of facts in paragraphs.	1.5	
Computer Basics – This learning module will teach processes to perform daily computer processing tasks, accessing and saving data to a file, and performing basic tasks such as printing and performing communications through email.	6	
Cybersecurity – This learning module will teach standard computer and web browsing techniques and conventions for the safeguarding privacy and security for the organization.	1.5	



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<p><u>Critical Thinking for Effective Decision-Making</u> – This learning module provide a foundation and set of tools and techniques for Critical Thinking in a variety of situations.</p>	1.5	
<p><u>Troubleshooting Tool & Techniques</u> - This learning module will discuss the various methods and tools used to troubleshoot problems, to include Root Cause Analysis (RCA), the use of Pareto charts, and the importance of documentation.</p>	1.5	
<p><u>Critical and Creative Thinking</u> – 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.</p>	16	
<p><u>Practical Time and Workload Management</u> – This learning module will introduce techniques to organize time effectively and utilize self-management habits that lead to increased productivity on the job.</p>	1.5	
<p><u>Customer Focus First</u> – This learning module will teach the critical elements of customer service that will bring customers back to experience service that outdoes the competition.</p>	1.5	