

# **Appendix J**

## **MANUFACTURING YOUTH APPRENTICESHIP**

### **REQUIRED SKILLS (UNITS 1-3)**

## Unit 1: Required Skills

### Core Skills

Competency

#### 1. **Apply math and science**

Performance Standard Condition

**Competence will be demonstrated**

- at the worksite and classroom

Performance Standard Criteria

**Performance will be successful when:**

- Learner uses applicable math and science skills appropriately as required for performance of job tasks.

Learning Objectives

- Add, subtract, multiply, and divide whole numbers, fractions, decimals and percents
- Calculate averages, ratios, proportions, and rates
- Convert decimals to fractions, fractions to percents and vice versa
- Measure and accurately report measurements of time, temperature, distance, length, width, height, width, perimeter, area, volume, weight, velocity and speed
- Use appropriate formulas
- Convert measurements correctly (e.g., English (standard) to metric)
- Interpret meaning from data
- Describe motion such as rate, linear, displacement, velocity, acceleration, trajectory motion, rotational
- Discuss how force and torque are used in machine operations
- Describe the impact of friction on machine operation and methods
- Discuss how machines use pulleys and gear drives
- Describe electricity generation
- Explain the use of circuits in machinery

**Comments:**

## **Unit 1: Required Skills**

### **Core Skills**

Competency

#### **2. Communicate effectively**

Performance Standard Condition

#### **Competence will be demonstrated**

- at the worksite and classroom

Performance Standard Criteria

#### **Performance will be successful when:**

- Learner uses effective oral communication skills
- Learner follows written instructions
- Learner applies standard rules of language structure, including grammar and spelling in written communication
- Learner listens actively to others
- Learner communicates in a bias-free manner

Learning Objectives

- Apply English language correctly (spelling, grammar, structure)
- Derive meaning from text through summarizing
- Discern meaning from written instructions
- Use acceptable language
- Write and speak so others can understand
- Write legibly
- Discuss effective and active listening skills
- Explain how empathy and bias can be communicated verbally & non-verbally
- Describe the impact of non-verbal communication

**Comments:**

## Unit 1: Required Skills

### Core Skills

Competency

#### 3. Cooperate with others in a team setting

Performance Standard Condition

##### **Competence will be demonstrated**

- at the worksite and classroom

Performance Standard Criteria

##### **Performance will be successful when:**

- Learner demonstrates respect in relating to people
- Learner contributes to a group with ideas, suggestions, and effort
- Learner listens and responds appropriately to team member contributions
- Learner appreciates perspectives of people outside his/her own background/culture
- Learner works collaboratively with people from other backgrounds/cultures
- Learner resolves differences for the benefit of the team
- Learner completes their share of tasks necessary to complete a project

Learning Objectives

- Compare teams and groups
- Identify roles found in teams such as leader, facilitator, recorder, etc.
- List effective meeting management skills
- Demonstrate techniques which show respect for others
- Explain how empathy and bias can be communicated verbally & non-verbally
- Describe how to effectively give and receive feedback
- Discuss effective and active listening skills
- Describe conflict resolution methods
- Discuss ways to foster group communication and productivity
- Discuss ways to participate within a team setting
- Explain how to interact appropriately with diverse ethnic, age, cultural, religious, and economic groups in different situations
- Describe how work teams coordinate work flow and help manage resources

**Comments:**

## Unit 1: Required Skills

### Core Skills

Competency

#### 4. Act professionally

Performance Standard Condition

#### **Competence will be demonstrated**

- at the worksite

Performance Standard Criteria

#### **Performance will be successful when:**

- Learner is pleasant, courteous, and professional with coworkers and internal and external customers
- Learner's appearance and dress are appropriate according to the requirements of the employer
- Learner takes personal responsibility for attendance
- Learner begins work promptly
- Learner follows directions
- Learner organizes and prioritizes tasks efficiently
- Learner exhibits positive attitude and commitment to task at hand
- Learner completes assigned tasks accurately and in a timely manner
- Learner turns in quality work according to facility requirements
- Learner recognizes lack of knowledge and seeks help from information sources
- Learner evaluates work goals periodically with worksite professional
- Learner accepts constructive criticism and applies suggestions
- Learner communicates safety, training, and job-specific needs
- Learner adheres to safety rules and regulations

Learning Objectives

- Review your facility's employee manual for policies on Appearance, Breaks, Time Off, Cell Phone Use, Weather, Personal Issues, etc.
- Describe how you can demonstrate enthusiasm and commitment at the worksite
- Define initiative
- Explain ways that you can show initiative at a worksite
- Explain methods to evaluate work assignments and prioritize them
- Describe how to effectively receive feedback
- Set life-long personal educational and career goals
- Describe the major functions and duties of the 6 career pathways within the Manufacturing career cluster
- Discuss educational and credentialing requirements for a selected manufacturing job
- Contrast "positive" and "less positive" aspects of a selected manufacturing job

**Comments:**

## Unit 1: Required Skills

### Core Skills

Competency

#### 5. Think critically

Performance Standard Condition

#### **Competence will be demonstrated**

- at the worksite and classroom

Performance Standard Criteria

#### **Performance will be successful when:**

- Learner recognizes the existence of a problem
- Learner applies problem-solving steps
- Learner differentiates between fact and opinion
- Learner considers other viewpoints and perspectives
- Learner applies the principles and strategies of organized thinking
- Learner evaluates information, ideas, and problems
- Learner collects information through probing questions and research
- Learner defines the problem
- Learner uses techniques such as brainstorming to acquire alternative solutions
- Learner demonstrates comparison skills
- Learner makes decisions based on analysis
- Learner presents ideas for critical evaluation
- Learner supports viewpoints with evidence

Learning Objectives

- Explain different techniques for problem solving such as the problem solving cycle or Deming's 14 step problem solving cycle
- Describe how to break a problem down in order to brainstorm, evaluate, and analyze possible solutions
- Discuss the difference between fact and opinion
- Apply logical reasoning to analyzing problems and solutions
- Practice different problem solving situations
- Describe how to present a solution with evidence
- Explain ways to reach a decision by consensus
- Develop and implement a problem-solving strategy

**Comments:**

## **Unit 1: Required Skills**

### **Core Skills**

Competency

#### **6. Exhibit legal and ethical responsibilities**

Performance Standard Condition

#### **Competence will be demonstrated**

- at the worksite

Performance Standard Criteria

#### **Performance will be successful when:**

- Learner follows all safety and worksite standards and regulations including those required by the Occupational Safety & Health Administration (OSHA) and the Environmental Protection Agency (EPA)
- Learner uses worksite resources wisely and legally
- Learner complies with legal requirements for documentation
- Learner maintains confidentiality of company, customer, and co-worker information
- Learner receives, handles, packages, and ships materials and product according to shipping laws and regulations if applicable
- Learner identifies situations that are reportable to regulatory agencies
- Learner reports reportable incidents to worksite professional immediately, if applicable

## Learning Objectives

- Explain how regulations and standards affect manufacturers
- List the different state and federal agencies that provide regulatory oversight at your facility
- Describe some primary legal requirements that must be met at your facility
- Discuss the regulatory purpose and responsibility of OSHA
- List your rights as a worker according to OSHA
- Describe your legal responsibilities, limitations, and implications for action in your professional job role
- Describe the certification/license requirements to operate specific equipment
- Describe some confidentiality concerns at your facility
- Compare and contrast behaviors and practices that could result in liability or negligence
- Explain what situations are reportable in your facility
- Describe ethical work values such as confidentiality, productivity during the day, following safety standards
- Understand your responsibility to a global environment
- Describe why wise use of resources at the worksite is important
- Give examples of wasteful uses of resources (unnecessary waste and duplication) at the worksite
- Identify the main functions of production documents
- Identify the guidelines for retaining documents

## Comments:

## Unit 1: Required Skills

### Core Skills

Competency

#### 7. Use technology

Performance Standard Condition

**Competence will be demonstrated**

- at the worksite and/or classroom

Performance Standard Criteria

**Performance will be successful when:**

- Learner uses communication technology (such as pagers, radios, phone, fax, email, Internet) to access and distribute data and other information within the scope of the job
- Learner follows rules for proper computer and communication technology usage
- Learner enters, edits, and stores data on computerized equipment according to worksite guidelines, if applicable
- Learner verifies data entry prior to data storage or equipment operation

Learning Objectives

- Identify the parts and functions of a computer system using correct terminology including the keyboard, monitor, mouse, printer
- Point out the storage device locations on the computer such as the Hard drive, Floppy drive, CD-ROM drive, and Portable File Storage drive, etc
- Show the appropriate connections and positioning of peripheral devices such as a mouse, keyboard, monitor, and printer
- Define the rules for email etiquette
- Explain appropriate and inappropriate uses of email and internet while at work
- Describe the safeguards in place in your worksite system that prevent entering or editing errors and security of access

**Comments:**

## **Unit 2: Required Skills**

### **Safety**

Competency

#### **1. Follow personal safety requirements**

Performance Standard Condition

**Competence will be demonstrated**

- at the worksite

Performance Standard Criteria

**Performance will be successful when:**

- Learner participates in all required safety training
- Learner follows all worksite guidelines for personal safety
- Learner adheres to equipment safety standards
- Learner operates only equipment that he/she is trained on
- Learner visually inspects equipment to ensure safety compliance and function before operation
- Learner wears the required Personal Protective Equipment (PPE) at all times as required by the worksite for specific tasks
- Learner applies principles of proper body mechanics when necessary
- Learner reports any exposures, injuries, or accidents, personal or to others, immediately, if applicable
- Learner locates and can find key information on Material Safety Data Sheets (MSDS)
- Learner handles and disposes of any hazardous materials appropriately, if applicable

## Learning Objectives

- Discuss the regulatory purpose and responsibility of the Occupational Safety and Health Administration (OSHA)
- List your rights as a worker according to OSHA
- Explain the procedure to follow in case of an exposure, injury, or accident to self or to another
- Explain ways your department/facility prevents accidents
- List engineering controls that are taken to protect workers from accidents
- Describe safe and unsafe work habits and their implications
- List mechanical, chemical, electrical, compressed air, and equipment safety hazards at your facility
- Explain how Lock Out/Tag Out procedures prevent accidents
- Explain potential hazards associated with blood borne pathogens
- Define the Personal Protective Equipment (PPE) required for specific tasks in your facility
- Explain the use of safety equipment such as eyeball washers and chemical safety showers and when you would use them
- Explain the ergonomic impact of work techniques
- Describe proper techniques for lifting loads
- Describe the Material Safety Data Sheet (MSDS) and its purpose
- Discuss the procedures of handling & disposing of hazardous material

## Comments:

## Unit 2: Required Skills

### Safety

Competency

#### 2. Maintain a safe work environment

Performance Standard Condition

#### **Competence will be demonstrated**

- at the worksite

Performance Standard Criteria

#### **Performance will be successful when:**

- Learner complies with posted safety warnings and symbols
- Learner safely identifies, handles, stores, and uses hazardous materials and pressurized vessels according to facility procedure, if applicable
- Learner identifies unsafe conditions and/or work habits and reports them to the worksite professional immediately, if applicable
- Learner helps maintain a clean and safe working environment free of debris and obstacles
- Learner cleans, organizes, puts away items in the work area
- Learner assists worksite professional to conduct health, safety, and/or environmental accident investigations

Learning Objectives

- List the major components of a facility safety program
- List the different state and federal agencies that provide regulatory oversight at your facility for personal safety, environmental safety, and equipment safety
- Describe posted safety warnings and symbols and what they mean
- Describe safe and unsafe work habits and their implications
- Discuss the importance of keeping the work area and tools/equipment clean
- List mechanical, chemical, electrical, compressed air, and equipment safety hazards at your facility
- Explain potential hazards associated with blood borne pathogens
- Discuss how to identify and report unsafe conditions in your facility
- Discuss safety procedures to prevent accidents
- Describe the requirements at your facility for safety training and auditing
- Assess need for good housekeeping practices

**Comments:**

## Unit 2: Required Skills

### Safety

Competency

#### 3. Demonstrate professional role in an emergency

Performance Standard Condition

##### **Competence will be demonstrated**

- at the worksite

Performance Standard Criteria

##### **Performance will be successful when:**

- Learner participates in emergency safety simulations and drills
- Learner outlines the facility's policy and procedure for worksite incidents, accidents, electrical, fire, tornado, and other emergency situations
- Learner identifies the closest fire alarms and emergency exits in the assigned worksite area
- Learner identifies the fire extinguishers in the assigned worksite area
- Learner contacts emergency personnel according to facility requirements in the event of an emergency
- Learner documents any emergency incidents according to facility requirements

Learning Objectives

- Describe the procedures in your facility to report an emergency
- Review your department/facility procedures for responding to exposures, injuries, accidents, spills, fire, tornado, etc.
- Demonstrate how to use the fire extinguisher
- Explain the evacuation plan for the worksite
- Indicate the demeanor necessary during an emergency
- Explain the role of the Hazardous Materials (HAZMAT) team
- Locate and explain use of first aid emergency care kits
- Locate and explain use of spill kits, if applicable to worksite
- Describe the safety procedures for spills, burns, cuts, and inhalation
- Explain who in your facility can give first aid care in the event of an emergency
- Explain the use of safety equipment such as eyeball washers and chemical safety showers and when you would use them

**Comments:**

## Unit 3: Required Skills

### Manufacturing Fundamentals

#### Competency

##### 1. Focus on customer needs

#### Performance Standard Condition

##### **Competence will be demonstrated**

- at the worksite

#### Performance Standard Criteria

##### **Performance will be successful when:**

- Learner identifies internal and external customers impacted by the production process
- Learner works to satisfy internal and external customer's expectations
- Learner collaborates with team to provide responses and solutions to meet the requirements, requests, and concerns of internal and external customers
- Learner assists worksite professional to keep internal and external customers informed of project progress and decisions that may affect them

#### Learning Objectives

- Explain how manufacturing affects our standard of living
- List the sub-industries within manufacturing
- Identify trends in manufacturing
- Describe potential impacts of current trends
- Describe how the global economy is impacting manufacturing
- Identify the internal and external customers in your facility
- Explain some of the global market trends your facility faces and the company's position in that market place
- Describe the role of sales and marketing operations in your facility
- Describe how production requirements are determined from the product specifications
- Detail customer goals and needs for one line of products in your facility
- Compare needs of internal and external customers
- Explain the importance of continual customer contact about product specifications
- Describe facility issues that may impact customer needs being met
- Explore why a consumer buys a product
- Evaluate how customer service affects purchases
- Explain why manufacturers need to be able to customize products

**Comments:**

## **Unit 3: Required Skills**

### **Manufacturing Fundamentals**

Competency

#### **2. Interpret technical drawings**

Performance Standard Condition

#### **Competence will be demonstrated**

- at the worksite

Performance Standard Criteria

#### **Performance will be successful when:**

- Learner interprets technical drawings accurately as needed for job task
- Learner uses appropriate terminology
- Learner identifies lines, views, symbols, and representations on the drawings as applicable
- Learner interprets dimensions, tolerances, and scale on the drawings as applicable
- Learner interprets threads, tapers, and shop notes on the drawings as applicable
- Develop a production process plan from a technical drawing which includes tools, equipment, speeds, feeds, fixtures & holders as applicable

## Learning Objectives

- Explain the need for technical drawings, also known as blueprints, schematics, part prints, or engineering drawings
- Define and explain the use of lines, views, symbols, dimensions, scale, and tolerances on technical drawings
- Illustrate lines that are used for specific feature identification
- Demonstrate standard view placement practices
- Compare pictorial format, orthographic projection, sectional views, auxiliary views, and dimensional views
- Interpret fundamental geometric dimensioning and tolerance specification classification to fit category, ranking, and expressions
- Calculate tolerance limits
- Calculate allowances and accuracy requirements
- Differentiate between joining and fastening symbols
- Distinguish between surface texture and coating representations
- Identify and interpret assembly drawings as to type, part name, part number, callouts, components, and part size dimensions
- Determine the relationship of one part to another from assembly drawings
- Describe how a processing plan is developed from a technical drawing for process, equipment, tools, and holders
- Explain the purpose, principle, and advantages of Computer-Aided Drawing (CAD)
- Compare cost, advantages, and disadvantages of CAD versus Manual drawing
- Compare drawing time between CAD and manual techniques
- Compare changes on CAD and manual drawings

## Comments:

## **Unit 3: Required Skills**

### **Manufacturing Fundamentals**

Competency

#### **3. Measure using various instruments**

Performance Standard Condition

#### **Competence will be demonstrated**

- at the worksite

Performance Standard Criteria

#### **Performance will be successful when:**

- Learner considers the degree of precision required by the part feature tolerance if applicable
- Learner chooses correct measuring instrument for task
- Learner verifies equipment is available for use and in working order
- Learner verifies equipment is current for preventative maintenance and/or calibration
- Learner inspects tools and work area for safety considerations
- Learner cleans and adjusts measuring instrument prior to use
- Learner measures correctly and accurately with gages, calipers, and micrometer instruments
- Learner measures with semi-precision and precision layout tools accurately
- Learner measures with digital gages accurately
- Learner confirms part or material conforms to given specification
- Learner records measurement correctly including unit of measurement
- Learner calibrates, cleans, and stores measuring instruments properly as required

Learning Objectives

- Add, subtract, multiply, and divide whole numbers, fractions, decimals and percents
- Calculate averages, ratios, proportions, and rates
- Convert decimals to fractions, fractions to percents and vice versa
- Compare accuracy and precision when using measuring equipment
- Identify various calipers, micrometer instruments, and layout tools and their applications
- Identify digital measuring gages and instruments and their applications
- Describe how to read and interpret gages
- Measure and accurately report measurements of time, temperature, distance, length, width, height, width, perimeter, area, volume, weight, velocity and speed
- Use appropriate formulas
- Convert measurements correctly (e.g., English (US standard) to metric)

**Comments:**

## **Unit 3: Required Skills**

### **Manufacturing Fundamentals**

Competency

#### **4. Operate tools and equipment safely**

Performance Standard Condition

**Competence will be demonstrated**

- at the worksite

Performance Standard Criteria

**Performance will be successful when:**

- Learner operates only equipment that he/she is trained on
- Learner chooses correct tool or equipment for the task
- Learner follows and completes any tool check list
- Learner verifies tool/equipment is available for use and in working order
- Learner verifies tool/equipment is current for preventative maintenance and/or calibration
- Learner verifies safety equipment and any Personal Protective Equipment (PPE) needed for tool/equipment use
- Learner inspects tool/equipment and work area for safety considerations
- Learner checks air and power supplies as applicable
- Learner sets up and prepares tool/equipment for safe operation including lubrication and fluid level checks
- Learner wears the required Personal Protective Equipment (PPE) at all times as required for the operation of the tool/equipment
- Learner operates tool/equipment safely with guarding devices if applicable in the manner required for the job task
- Learner checks accuracy of tool/equipment operation with first run
- Learner monitors tool/equipment for safe operation while operating
- Learner compares tool/equipment performance regularly to optimal equipment operations
- Learner follows facility procedures for clean up and shut down after use
- Learner performs any required preventative maintenance procedures
- Learner investigates and promptly reports abnormal tool/equipment conditions
- Learner properly shuts down and labels any tool/equipment that is not operating as expected, if applicable
- Learner follows Lock Out/Tag Out procedures as applicable
- Learner documents use and maintenance as required
- Learner monitors tool/equipment to ensure that that corrective action solved the problem

## Learning Objectives

- Distinguish between common hand tools including hammers, wrenches, pliers, punches, taps, and dies
- Distinguish between screw thread types and sizes
- List the various tools and equipment used at your worksite such as cutting and non-cutting hand tools, sawing machines, pedestal (bench) grinders, drill presses, vertical milling machines, CNC equipment, lathes, molding equipment, etc.
- Give examples of manufacturing processes that use fixtures
- Define jig or fixture
- Explain 2 classes of jigs or fixtures
- Give examples of open and closed jigs
- Outline applications of each tool and equipment
- Describe and demonstrate the safety requirements for each tool and equipment
- Discuss start up and shut down procedures for each tool/equipment you will operate
- Explain the purpose of preventative maintenance
- Describe emergency shutdown procedures for the tool/equipment you will operate
- Explain how to recognize and address malfunctions for the tool/equipment you will operate
- Describe how to recognize wear and tear on equipment components
- Describe how to select lubricants and coolants as applicable
- Compare costs, advantages, and disadvantages of Computer Numerical Control (CNC) tools versus Manually set tools and equipment
- List the OSHA and other regulatory requirements as they apply to the equipment that you operate
- Describe proper techniques for lifting loads
- List the safeguards that apply to the equipment used in your facility for tools, automated machines, material handling equipment, and lifts
- List which tools and equipment require safety certification
- Explain Lock Out/Tag Out indications and procedures in your facility

## Comments:

## **Unit 3: Required Skills**

### **Manufacturing Fundamentals**

Competency

#### **5. Ensure materials and products meet quality specification**

Performance Standard Condition

#### **Competence will be demonstrated**

- at the worksite

Performance Standard Criteria

- Learner inspects and tests materials/piece/product at all stages of production to determine quality or condition
- Learner monitors materials, processes, equipment, tools, and products throughout the production process for safety and quality specifications
- Learner inspects final product/piece to ensure it meets specifications
- Learner promptly identifies and segregates materials and/or product that do not meet specification
- Learner communicates with worksite professional if materials and/or product do not meet requirements
- Learner documents all quality checks

Learning Objectives

- Describe the roles and responsibilities for quality in your facility
- Explain the importance of producing quality products at the lowest possible cost
- List the major stages involved in producing products
- Identify resources needed for production
- Explain the procedures for rejecting sub-standard products
- Define examples of Quality terminology
- Explain quality systems such as SPC, Six Sigma, TQM, ISO9000
- Describe the impact of quality standards on manufacturing
- Describe the major components of the ISO 9000 standards
- Explain how a facility becomes ISO 9000 certified
- Describe the types of ISO9000 compliance documentation requirements
- Explain the purpose and use of Quality tools such as the flowchart and cause & effect diagram
- Describe how paradigms affect the ability to change
- Describe how materials are selected and tested for product requirements
- Compare and contrast properties of different materials at your work site to their use in a piece/product

**Comments:**