Appendix L

MANUFACTURING
YOUTH APPRENTICESHIP

PRODUCTION PATHWAY
MANUFACTURING PROCESSES (UNIT 5)

Unit 5: Production Pathway
Manufacturing Processes

Competency

1. Read technical drawings and work orders

Performance Standard Condition

Competence will be demonstrated

at the worksite

Performance Standard Criteria

Performance will be successful when learners:

Review technical drawing
Gather reference materials as needed
Determine type of print and views used
Determine material specifications
Determine critical dimensions and tolerances
Analyze supplementary data
Determine product or job instructions and specifications
Interpret symbols and procedures

Learning Objectives

Explain the need for technical drawings, also known as blueprints, schematics, part prints, or engineering drawings
Explain how technical drawings detail work piece design parameters, lay out and specifications
Explain how product design and production are related
Discuss different types of technical drawings
Identify terminology related to technical drawings
Describe how to interpret views, projections and elements from a technical drawing
Identify common terms, components, revisions, symbols, assembly sequence, dimensions, tolerances, scale, and list of materials from technical drawings or work orders

Comments:

Unit 5: Production Pathway
Manufacturing Processes

Competency

2. Interpret symbols and procedures

Performance Standard Condition

Competence will be demonstrated

at the worksite

Performance Standard Criteria

Performance will be successful when learners:

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

Learning Objectives

Define and explain the use of lines, views, symbols, dimensions, scale, and tolerances on technical drawings
Identify different lines by name, type, order of usage, and application such as object, hidden, center, section, dimension, extension, cutting plane, short break, long break, phantom
Demonstrate standard view placement practices
Compare pictorial format, orthographic projection, sectional views, and detail schedules
Discuss the standards for production document lines
Describe the standard usage of metric (SI) linear units in drafting
Identify and interpret 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
Determine procedure number cross-references to technical drawings

Comments:

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Manufacturing Processes

Competency

3. Identify set up

Performance Standard Condition

Competence will be demonstrated

at the worksite

Performance Standard Criteria

Performance will be successful when learners:

Locate and review applicable technical drawings, work orders, and/or procedures for production processing

Plan sequencing, tools, and equipment needed for procedure

Identify set up needed

Consult with worksite professional to verify production schedule, deadlines, and timeframes

Learning Objectives

Describe how a processing plan is developed from a technical drawing for process, equipment, tools, and holders

Explain how product design and production are related

Identify terminology related to production

List characteristics of major types of production systems

Compare and contrast conventional production processes with automated production processes to produce a piece

Comments:

Unit 5: Production Pathway
Manufacturing Processes

Competency

4. Select tools and materials

Performance Standard Condition

Competence will be demonstrated

at the worksite

Performance Standard Criteria

Performance will be successful when learners:

Select tools and production equipment to be used
Select appropriate work holding devices for work piece and equipment
Check raw materials needed against work order
Verify raw material(s) meet specifications
Gather all resources needed at the workstation
Notify worksite professional of any discrepancies

Learning Objectives

List the various tools and equipment used in production at your worksite
Outline applications of each tool and equipment
Describe and demonstrate the safety requirements and safeguards for each tool and equipment
Explain the importance of materials meeting specifications prior to processing
Identify, name, and explain the function of each specific control on equipment you operate
List typical work holding devices for each equipment type you use
Compare and contrast the different methods used in your process. For example, the different methods of casting

Comments:

Unit 5: Production Pathway
Manufacturing Processes

Competency

5. Perform safety checks

Performance Standard Condition

Competence will be demonstrated

at the worksite

Performance Standard Criteria

Performance will be successful when learners:

Review production procedure to be used

Review safety requirements of procedure

Verify safety equipment and any Personal Protective Equipment (PPE) needed for production process

Inspect tools and work area for safety considerations

Examine equipment labeling and safeguarding

Learning Objectives

List the types of labeling used on tools and equipment at your facility to indicate whether a tool or piece of equipment is functional and safe to use

List the situations which require you to obtain help to resolve problems with equipment or production

List the safety rule for the equipment you will be operating

Comments:

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Manufacturing Processes

Competency

6. Assist to perform set up

Performance Standard Condition

Competence will be demonstrated

at the worksite
while assisting a worksite professional

Performance Standard Criteria

Performance will be successful when learners:

Assemble and adjust tools and production equipment as required
Verify production equipment is available for use and in working order
Verify production equipment is current for preventative maintenance and/or calibration
Calculate any control settings needed
Check equipment fluid, air, pressure levels as required
Set production equipment parameters as required for the procedure
Install work holding devices so they are secure
Stage pieces and raw materials for production

Learning Objectives

List the types of labeling used on tools and equipment at your facility to indicate whether a tool or piece of equipment is functional and safe to use
Explain the purpose and importance of preventative maintenance and calibration
List the situations which require you to obtain help to resolve problems with equipment or production
Identify the major components of equipment used in your production process and their functions
Identify variables that impact equipment settings

Comments:

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Manufacturing Processes

Competency

7. Verify set up

Performance Standard Condition

Competence will be demonstrated

at the worksite

Performance Standard Criteria

Performance will be successful when learners:

Verify set up meets process requirements and product specifications
Examine first piece/product or production run for visual and/or dimensional specification
Make adjustments to ensure piece/product meets specification if needed
Verify repeatability of set up if applicable
Document set up procedure for repeatability if applicable
Document set up procedure if required

Learning Objectives

Define repeatability
Describe the importance of repeatability in manufacturing

Comments:

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Manufacturing Processes

Competency

8. Perform start up

Performance Standard Condition

Competence will be demonstrated

at the worksite

Performance Standard Criteria

Performance will be successful when learners:

Verify correct set up of equipment adjustments
Inspect piece/product
Document start up procedure

Learning Objectives

Describe the production process procedure to be completed
List the situations which require you to obtain help to resolve problems with equipment or production

Comments:

Unit 5: Production Pathway
Manufacturing Processes

Competency

9. Operate equipment

Performance Standard Condition

Competence will be demonstrated

at the worksite

Performance Standard Criteria

Performance will be successful when learners:

Wear the required Personal Protective Equipment (PPE) at all times as required for the operation of the equipment
Cycle equipment
Operate equipment safely in the manner required for the job task
Operate equipment according to machine requirements
Monitor equipment for correct operation while operating

Learning Objectives

Describe advantages and limitations of automated production
List the safety rules associated with automated production systems
List the situations which require you to obtain help to resolve problems with equipment or production
Identify how your production process is used to make pieces and products
Describe the techniques required to produce the piece to specified tolerance

Comments:

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Competency

10. Monitor product and process specifications

Performance Standard Condition

Competence will be demonstrated

at the worksite

Performance Standard Criteria

Performance will be successful when learners:

Monitor piece/product produced for specification
Monitor the process and equipment for performance
Adjust the process for quality and/or productivity as needed
Take corrective actions to resolve problems as they occur
Replenish processing materials as needed
Test piece/product for function
Label pieces/products for compliance or non-compliance
Document quality control checks
Pieces are produced to specification

Learning Objectives

List the quality checks performed as part of the production process
Explain why products are tested for quality and function
List the situations which require you to obtain help to resolve problems with equipment or production
Explain why labeling and documentation are part of the quality check

Comments:

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Competency

11. Process production documents

Performance Standard Condition

Competence will be demonstrated

at the worksite

Performance Standard Criteria

Performance will be successful when learners:

Document processing data on items such as labor, quality, quantity, and time
Verify fabrication and production documentation is completed
Documentation is legible
Documentation is complete
Documentation is in appropriate format
Documentation is stored or forwarded as required
Pieces are correctly stored or staged

Learning Objectives

Describe the uses of production data
Describe the importance of documenting the production process

Comments:

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Competency

12. Shutdown process

Performance Standard Condition

Competence will be demonstrated

at the worksite

Performance Standard Criteria

Performance will be successful when learners:

Review procedure to be used
Stop production process
Verify all equipment is shut down safely as required
Identify any process or equipment maintenance concerns with the production run
Take corrective action to report and correct maintenance concerns

Learning Objectives

Describe the shutdown procedures used for the specific production equipment you operate

Comments:

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Competency
13. Clean up

Performance Standard Condition

Competence will be demonstrated

at the worksite

Performance Standard Criteria

Performance will be successful when learners:

Select appropriate cleaning tools and equipment
Clean production tools/equipment as required
Clean work area as required
Store tools safely in proper location
Store materials in safe manner
Identify unsafe conditions and reports them promptly
Take corrective action to correct unsafe conditions
Ensure that workstation is clean and clear of safety hazards
Ensure workstation is organized for efficiency
Dispose of waste appropriately as required

Learning Objectives

Describe the cleaning procedures and materials used for the specific processes you perform

Comments:

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Competency
14. Monitor equipment for correct operation

Performance Standard Condition

Competence will be demonstrated

at the worksite

Performance Standard Criteria

Performance will be successful when learners:

Review equipment quality measures for trends and problems as required
Compare current equipment performance to optimal equipment operations on a regular basis
Report any noted deviations from expected performance
Ensure that equipment is properly labeled and pulled from production use if inoperative
Assist worksite professional to investigate abnormal equipment conditions in a timely manner
Assist worksite professional to follow up on repaired equipment to ensure that corrective action solved the problem
Document all monitoring activities

Learning Objectives

Explain the meaning of common alarms on equipment at your facility
Explain how to read and review repair history records
Describe how trends for malfunctioning equipment might appear in production records
List the tools and equipment at your facility that must be monitored and maintained
Define Total Productive Maintenance (TPM)
Describe common electrical systems reliability issues including power supply connections, operations, series and parallel circuit function, circuit breaker function, electric motor control, and power overload
Describe common pneumatic system reliability issues including pressure gage readings, conductors, connectors, seals, gaskets, packing, quick-connect fittings, pneumatic cylinder and motor operations, air muffler operations, actuator power output, and pressure regulator operations
Describe common hydraulic system reliability issues including seals, gaskets, packing, and hydraulic fluids
Describe common automated machine reliability issues including computerized control processes, logic control circuits, solenoid-operated fluid power valves, electromechanical limit switches, time delay devices, manual controls, and interlock circuits

Comments:

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Competency

15. Document equipment use and/or operational problems

Performance Standard Condition

Competence will be demonstrated

at the worksite

Performance Standard Criteria

Performance will be successful when learners:

Verify all internal and external communication with appropriate parties in a timely manner
Communicate maintenance and repair needs clearly
Use the correct reporting formats for communication
Document use, maintenance, and repair activities accurately
Report back and document any maintenance and repair issues in a timely manner
Maintenance communication is timely and accurate
Maintenance communication is documented

Learning Objectives

Explain the uses of equipment data
Discuss how to schedule repair and maintenance functions with respect to production requirements and production levels
Explain how communication for repair and maintenance issues demonstrates a knowledge of customer and business needs
List the parties that need to be involved of repair and maintenance issues
Describe the importance of documenting communications

Comments:

ADDITIONAL Learning Objectives for Specific Production Processes

Casting

Describe the casting process
Compare the functions, advantages, disadvantages, and amorphous materials used for various mold components
Differentiate between sand, metal, and plaster/ceramic mold casting processes
Identify the function of the casting components
Identify common terminology used in casting
Interpret casting specifications on technical drawings
Compare hot and cold chamber processes
Determine the function of a die cast trim die
Identify standard mold bases and brushing sets
Identify runners, gates, and water lines that cool the mold

Conditioning

Compare the functions, advantages, disadvantages, and materials used for different conditioning processes such as hardening, tempering, and annealing
Explain the procedure for hardness testing
Describe characteristics, advantages and limitations of furnaces and hardness testing equipment
Identify common terminology used in conditioning
Interpret conditioning specifications on technical drawings

Filling

Compare the functions, advantages, disadvantages, and materials used for different filling processes

Finishing

Compare different finishing (coating) techniques such as spraying, powder, roll, electro-coating, and dipping, and their applications
Interpret finishing specifications on technical drawings
Explain how finishes are used to improve the look and performance of engineering materials

Forming

Compare the functions, components, advantages, disadvantages, and materials used with different metal forming and die sets
Identify pierce, form, draw, and progressive dies
Compare shears, brake presses, and roll formers
Calculate clearance and tonnage parameters
Describe various stripping methods
Distinguish between open die forging and closed die forging
Describe die construction
Compare casting and forging processes
Identify common terminology used in forming and forging
Interpret forming specifications on technical drawings

Joining/Combining

Compare different joining methods such as sewing, gluing, nailing and welding
Compare characteristics, advantages and limitations of welding, brazing, and soldering
Compare functions, advantages, disadvantages, and materials used for different welding types
Define how variables of such as current, voltage, polarity, arc length, speed, flux, flow rates, material, piece thickness, etc affect a weld
Compare the functions, advantages, disadvantages, and materials used for different brazing/soldering types
Interpret joining specifications on technical drawings

Molding

Compare the functions, advantages, disadvantages, and materials used for various mold components
Compare different molding techniques such as blown, injected, rotated, and vacuum-formed
Consult mold setup information that accompanies installed mold
Describe how set temperatures, pressures, position and timers affect the mold
Identify common terminology used in molding
Evaluate the characteristics, advantages and limitations of different types of thermo-plastics
Interpret molding specifications on technical drawings
Explain the importance of a parting line
Define the functions of cavities and cores
Describe the runner system
Identify how a part is released from a mold
Identify potential problems during the molding process

Separating

Compare the functions, advantages, disadvantages, and materials used for different separating processes
Interpret separating specifications on technical drawings