

Appendix L

MANUFACTURING YOUTH APPRENTICESHIP

CASTING, CONDITIONING, FILLING, FINISHING, FORMING, JOINING/COMBINING, MOLDING, AND/OR SEPARATING (UNIT 5)

Unit 5: Production Pathways

Casting, Conditioning, Filling, Finishing, Forming, Joining/Combining, Molding, and/or Separating a piece/ product

Competency

1. Identify set up

Performance Standard Condition

Competence will be demonstrated

- at the worksite

Performance Standard Criteria

- Learner locates and reviews applicable technical drawings, work orders, and/or procedures for production processing
- Learner plans sequencing, tools, and equipment needed for procedure
- Learner identifies set up needed
- Learner consults 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 Pathways

Casting, Conditioning, Filling, Finishing, Forming, Joining/Combining, Molding, and/or Separating a piece/ product

Competency

2. Select tools and materials

Performance Standard Condition

Competence will be demonstrated

- at the worksite

Performance Standard Criteria

- Learner selects tools and production equipment to be used
- Learner selects appropriate work holding devices for work piece and equipment
- Learner checks raw materials needed against work order
- Learner verifies raw material(s) meet specifications
- Learner gathers all resources needed at the workstation
- Learner notifies 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 Pathways

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Competency

3. Check safety parameters

Performance Standard Condition

Competence will be demonstrated

- at the worksite

Performance Standard Criteria

- Learner reviews production procedure to be used
- Learner reviews safety requirements of procedure
- Learner verifies safety equipment and any Personal Protective Equipment (PPE) needed for production process
- Learner inspects tools and work area for safety considerations
- Learner examines 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:

Unit 5: Production Pathways

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Competency

4. Perform set up

Performance Standard Condition

Competence will be demonstrated

- at the worksite

Performance Standard Criteria

- Learner assembles and adjust tools and production equipment as required
- Learner verifies production equipment is available for use and in working order
- Learner verifies production equipment is current for preventative maintenance and/or calibration
- Learner calculates any control settings needed
- Learner checks equipment fluid, air, pressure levels as required
- Learner sets production equipment parameters as required for the procedure
- Learner installs work holding devices so they are secure
- Learner stages 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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Competency

5. Verify set up

Performance Standard Condition

Competence will be demonstrated

- at the worksite

Performance Standard Criteria

- Learner verifies set up meets process requirements and product specifications
- Learner examines first piece/product or production run for visual and/or dimensional specification
- Learner makes adjustments to ensure piece/product meets specification if needed
- Learner verifies repeatability of set up if applicable
- Learner documents set up procedure for repeatability if applicable
- Learner documents set up procedure if required

Learning Objectives

- Define repeatability
- Describe the importance of repeatability in manufacturing

Comments:

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Competency

6. Perform start up

Performance Standard Condition

Competence will be demonstrated

- at the worksite

Performance Standard Criteria

- Learner verifies correct set up of equipment adjustments
- Learner inspects piece/product
- Learner documents 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 Pathways

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Competency

7. Operate equipment

Performance Standard Condition

Competence will be demonstrated

- at the worksite

Performance Standard Criteria

- Learner wears the required Personal Protective Equipment (PPE) at all times as required for the operation of the equipment
- Learner cycles equipment
- Learner operates equipment safely in the manner required for the job task
- Learner operates equipment according to machine requirements
- Learner monitors equipment for safe 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

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Competency

8. Monitor product and process

Performance Standard Condition

Competence will be demonstrated

- at the worksite

Performance Standard Criteria

- Learner monitors piece/product produced for specification
- Learner monitors the process and equipment for performance
- Learner adjusts the process for quality and/or productivity as needed
- Learner takes corrective actions to resolve problems as they occur
- Learner replenishes processing materials as needed
- Learner tests piece/product for function
- Learner labels pieces/products for compliance or non-compliance
- Learner documents 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

9. Process documentation

Performance Standard Condition

Competence will be demonstrated

- at the worksite

Performance Standard Criteria

- Learner documents processing data on items such as labor, quality, quantity, and time
- Learner documentation is legible
- Learner documentation is accurate

Learning Objectives

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

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Competency

10. Shutdown process

Performance Standard Condition

Competence will be demonstrated

- at the worksite

Performance Standard Criteria

- Learner reviews procedure to be used
- Learner stops production process
- Learner verifies all equipment is shut down safely as required
- Learner identifies any process or equipment maintenance concerns with the production run
- Learner takes 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

11. Clean up

Performance Standard Condition

Competence will be demonstrated

- at the worksite

Performance Standard Criteria

- Learner selects appropriate cleaning tools and equipment
- Learner cleans production tools/equipment as required
- Learner cleans work area as required
- Learner stores tools safely in proper location
- Learner stores materials in safe manner
- Learner identifies unsafe conditions and reports them promptly
- Learner takes corrective action to correct unsafe conditions
- Learner ensures that workstation is clean and clear of safety hazards
- Learner ensures workstation is organized for efficiency
- Learner disposes of waste appropriately as required by the facility

Learning Objectives

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

Comments:

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12. 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 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

Unit 5: Production Pathways

Casting, Conditioning, Filling, Finishing, Forming, Joining/Combining, Molding, and/or Separating- Maintenance & Repair

Competency

1. Monitor equipment for correct operation

Performance Standard Condition

Competence will be demonstrated

- at the worksite

Performance Standard Criteria

- Learner reviews equipment quality measures for trends and problems as required
- Learner compares current equipment performance to optimal equipment operations on a regular basis
- Learner reports any noted deviations from expected performance
- Learner assists worksite professional to investigate abnormal equipment conditions in a timely manner
- Learner assists worksite professional to follow up on repaired equipment to ensure that that corrective action solved the problem
- Learner documents all monitoring activities
- Learner assures that repair history is complete, current and accurate

Learning Objectives

- Identify basic approaches to maintenance
- 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 how monitoring and diagnostic device are used to find out which equipment is operating correctly

Comments:

Unit 5: Production Pathways

Casting, Conditioning, Filling, Finishing, Forming, Joining/Combining, Molding, and/or Separating- Maintenance & Repair

Competency

2. Assist with the identification and diagnosis of equipment problems

Performance Standard Condition

Competence will be demonstrated

- at the worksite
- while assisting worksite professional

Performance Standard Criteria

- Learner ensures that equipment is properly labeled and pulled from production use
- Learner locates and interprets technical drawings for the equipment and process that is under investigation
- Learner locates the equipment reference materials and manuals
- Learner reviews previous preventative maintenance and repair history records on the equipment under investigation
- Learner assists worksite professional to identify the components to be checked for proper operation
- Learner ensures that appropriate safety devices and personal protective equipment are in place prior to diagnosis
- Learner ensures that all labeling and Lock Out/Tag Out procedures are in place prior to diagnosis
- Learner follows all safety requirements and wears appropriate Personal Protective Equipment (PPE) as required
- Learner assists the worksite professional to take appropriate readings using meters and testing equipment
- Learner assists the worksite professional in locating and determining the cause of the problems reported
- Learner assists worksite professional to match suggested remedies with problems for the inoperative systems
- Learner documents testing and evaluation
- Learner ensures that equipment is properly labeled and pulled from production use until repair

Learning Objectives

- Describe the most common causes of tool/equipment failure in your facility
- Explain the meaning of common alarms on equipment at your facility
- Compare what equipment and equipment material are recyclable and what is not at your facility
- Describe the purpose, function, and components of diagnostic testing equipment used in your facility
- Describe electrical systems reliability issues including power supply connections, operations, series & parallel circuit function, circuit breaker function, electric motor control, and power overload
- Describe 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 hydraulic system reliability issues including seals, gaskets, packing, and hydraulic fluids
- Describe 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
- Describe proper function of bearings and couplings and their reliability issues including functioning of transmission equipment, and bearings, shafts, & couplings functions
- Explain how to match bearing number nomenclature to bearing type
- Describe proper functioning of belts and chains and their reliability issues including belt drive, chain drive and roller chain drive functions

Comments:

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Competency

3. Perform routine preventative maintenance

Performance Standard Condition

Competence will be demonstrated

- at the worksite

Performance Standard Criteria

- Learner performs preventative maintenance (PM) according to facility schedule
- Learner communicates PM to production
- Learner assures that alternative equipment is available if needed by production
- Learner gathers supplies to perform PM
- Learner ensures that equipment is properly labeled and pulled from production use
- Learner follows appropriate Lock Out/Tag Out procedures prior to performing PM
- Learner follows all safety requirements and wears appropriate Personal Protective Equipment (PPE) as required
- Learner performs all required housekeeping tasks to maintain production schedule
- Learner assists worksite professional to follow PM schedule to calibrate and maintain equipment, tools and workstations
- Learner lubricates machine tools
- Learner checks machine guards
- Learner re-qualifies equipment for operation
- Learner documents preventative actions taken

Learning Objectives

- Describe the different types of lubricants, their uses, storage, and disposal requirements
- Discuss how to use a viscosimeter and grease gun
- Describe how diagrams schematics, equipment manuals, and equipment specifications to determine the schedule and process for PM
- Explain how to analyze bearings as to type and application
- Discuss the need to prevent contamination of fluids and bearings

Comments:

Unit 5: Production Pathways

Casting, Conditioning, Filling, Finishing, Forming, Joining/Combining, Molding, and/or Separating- Maintenance & Repair

Competency

4. Assist with routine repair maintenance

Performance Standard Condition

Competence will be demonstrated

- at the worksite
- while assisting worksite professional

Performance Standard Criteria

- Learner identifies equipment problems through malfunction or production or quality indicators
- Learner communicates repair needs to applicable parties
- Learner assures that alternative equipment is available if needed by production
- Learner consults worksite professionals, maintenance manuals, and equipment history to diagnose possible equipment problems
- Learner gathers supplies to perform repair
- Learner ensures that equipment is properly labeled and pulled from production use
- Learner follows appropriate Lock Out/Tag Out procedures prior to performing repair
- Learner follows all safety requirements and wears appropriate Personal Protective Equipment (PPE) as required
- Learner assists worksite professional to isolate system and component failure and to repair equipment problems
- Learner assists worksite professional to identify root cause of problem and develop corrective action plan
- Learner replaces bearings and/or couplings as needed
- Learner replaces belts and/or chains as needed
- Learner assists worksite professional to re-qualify equipment for operation
- Learner documents repairs completed
- Learner evaluates repair work through follow up

Learning Objectives

- Describe how diagrams schematics, equipment manuals, and equipment specifications to determine repair
- Discuss the need to prevent contamination of fluids and bearings

Comments:

Unit 5: Production Pathways

Casting, Conditioning, Filling, Finishing, Forming, Joining/Combining, Molding, and/or Separating- Maintenance & Repair

Competency

5. Assist with maintenance communication

Performance Standard Condition

Competence will be demonstrated

- at the worksite
- while assisting worksite professional

Performance Standard Criteria

- Learner verifies all internal and external communication with appropriate parties in a timely manner
- Learner communicates maintenance and repair needs clearly
- Learner uses the correct reporting formats for communication
- Learner documents maintenance and repair activities accurately
- Learner reports back and documents any maintenance and repair issues in a timely manner
- Investigations are complete, timely, and include indication of root cause
- Maintenance communication is timely and accurate
- Maintenance communication is documented

Learning Objectives

- 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: