

## Manufacturing Production Pathway Test Blueprint

### I. Safety

#### A. Recognition of hazards

##### 1. Recognize and mitigate personal safety hazards.

- a. Analyze situations for examples of slip, trip, and fall hazards (e.g., oil on the floor, water on the floor, cords, debris, ladders, scaffolding, etc.).
- b. Analyze situations for examples of line of fire conditions (e.g., kick-back, surface sparks, grinder fire, stand to the side of a gas regulator, etc.).
- c. Identify hazards and type of PPE to address potential hazards (e.g., ear plugs, flying chips, safety glasses, long hair, respiratory, etc.).

##### 2. Identify and mitigate electrical hazards.

- a. Identify potential electrical hazards (e.g., frayed cords, bad grounds, sporadic switches, electrical shock hazards, etc.).
- b. Recognize voltage dangers.

##### 3. Recognize and understand potential fire and explosion hazards.

- a. Identify parts of the fire triangle (e.g., oxygen, fuel, and heat).
- b. Analyze which extinguisher types are used for various fires (e.g., ABCD, electrical, chemical, oil, gas, etc.).
- c. Demonstrate correct procedure for use of fire extinguishers (i.e., PASS)
- d. Demonstrate compressed gas cylinder storage and handling safety.
- e. Analyze unsafe conditions with respect to fire and explosions (e.g., gas tanks, combustibles near welding, enclosed cylinders, etc.).

##### 4. Recognize and understand potential chemical hazards.

- a. Define material safety data sheets.
- b. Apply the use of hazard communications (HazCom) and material safety data sheets (MSDSs).

##### 5. Recognize and understand confined space work hazards.

- a. Identify potential confined space hazards.
- b. Identify what constitutes a confined space.

#### B. Recognize and demonstrate safe workplace practices.

##### 1. Apply good housekeeping and organization skills.

- a. Apply proper workplace organization procedures.
- b. Identify appropriate cleaning procedures (e.g., cleaning up tools, debris cleanup, etc.).
- c. Identify inappropriate location for tools.

##### 2. Understand appropriate workplace behavior.

- a. Compare and contrast appropriate and inappropriate workplace behavior

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	(e.g., no horse play, intentionally unsafe acts, running in workplace, etc.).
	b. Apply the proper use of safety guards and procedures.
	c. Demonstrate safe working practices (e.g., safe lifting procedures, avoiding repetitive motion, kinesthetics, etc.).
	d. Recognize appropriate use of workplace equipment and tools.
	<b>3. Identify and analyze lock out/tag out (LOTO) situations and procedures.</b>
	a. Identify situations in which lock out/tag out is required.
	b. Analyze various energy sources for which lock out/tag out is required (e.g., electrical, mechanical, fluid, etc.).
	c. Identify appropriate types and locations for lock out/tag out devices.
	d. Describe the correct procedures in the use of lock out/tag out devices.
	<b>C. Safety regulations</b>
	<b>1. Understand the roles of national regulatory agencies in creating safe work environments.</b>
	a. Define the role of OSHA in workplace safety.
	b. Define the role of the EPA in environmental safety.
	<b>2. Understand the application of environmental regulations in the workplace.</b>
	a. Identify proper storage of chemicals and gases according to established regulations.
	b. Demonstrate proper disposal of chemicals according to established regulations.
	<b>D. Emergency preparedness</b>
	<b>1. First response</b>
	a. Identify proper procedures for first response to an emergency (e.g., call 911, what to do/not to do when someone is getting electrocuted, chemical spill, bodily injury, etc.).
	<b>II. Basic Tools and Equipment</b>
	<b>A. Identify and understand use of basic tools.</b>
	<b>1. Properly identify and maintain basic tools.</b>
	a. Identify proper use of a variety of hand tools (e.g., wrench, hammer, files, etc.).
	b. Identify proper use of a variety of power tools (e.g., drill, grinder, etc.), including pneumatic and hydraulic tools (e.g., impact tools, jacks, etc.).
	c. Recognize proper maintenance of basic tools (e.g., sharpening bits, cleaning wrenches, etc.).
	<b>B. Identify and understand the use of basic workplace equipment.</b>
	<b>1. Properly identify and utilize basic workplace equipment.</b>

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a.	Identify proper use of stationary basic workplace equipment (e.g., sanders, drill presses, band saws, pedestal grinders, etc.).
b.	Recognize proper maintenance of basic workplace equipment (e.g., lubrication, belts, guards, etc.).
<b>III. Blueprints</b>	
<b>A. Comprehend blueprints.</b>	
1. Understand basic orthographic projections.	
a.	Identify line types on drawings (e.g., visible lines, hidden lines, cut lines, etc.).
b.	Identify various views of orthographic projections.
c.	Recognize section and detail views.
d.	Visualize a 3D object from a 2D drawing.
2. Understand basic dimensioning tolerancing and symbols.	
a.	Identify basic dimensioning and tolerancing symbols.
b.	Interpret tolerance limits from blueprint.
c.	Apply blueprint welding symbols.
3. Understand basic drawing layout.	
a.	Identify parts of a drawing (e.g., notes, title block, bill of material, schedule, tolerance block, scale, etc.).
b.	Identify types of common drawings (e.g., assembly, detail, bill of material, etc.).
<b>IV. Measurement and Quality Control</b>	
<b>A. Measuring tools and instruments</b>	
1. Recognize tools and instruments.	
a.	Identify types of measuring tools and instruments (e.g., calipers, fillet gauges, tape measure, steel rule, square, level, protractor, micrometer, etc.).
b.	Differentiate standard and metric systems of measurement.
c.	Evaluate the level of precision for a given instrument or tool.
2. Demonstrate use of tools and instruments.	
a.	Demonstrate proper care and storage of tools and instruments.
b.	Demonstrate proper tool and instrument usage.
<b>B. Quality control</b>	
1. Understand quality control.	
a.	Define the purpose of quality control.
2. List types of inspection.	

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- a. Identify examples of destructive testing (e.g., bend test, nick break test, tensile pull, etc.).
- b. Identify examples of nondestructive testing (e.g., visual inspection, measurement, dye penetrant, radiographic, ultrasonic, magnetic particle, etc.).
- c. Compare and contrast destructive and nondestructive testing.

### V. Manufacturing Processes

#### A. Define subtractive processes.

##### 1. Identify types of precision machining processes.

- a. Identify aspects of machining processes (e.g., turning, milling, drilling, cutting, engraving, abrasive removals, etc.).
- b. Compare and contrast equipment uses and types.

##### 2. Identify types of thermal and non-thermal processes.

- a. Identify aspects of thermal and non-thermal processes (e.g., sawing, shearing, cutting, gouging, plasma cutter, oxy-fuel, water jet, blades, abrasive, laser, etc.).
- b. Compare and contrast equipment uses and types.

#### B. Define additive/joining processes.

##### 1. Identify types of thermal processes.

- a. Identify aspects of thermal joining processes (e.g., welding, brazing, thermal adhesives, composite, etc.).
- b. Compare and contrast the thermal joining processes.

##### 2. Identify types of non-thermal processes.

- a. Identify aspects of non-thermal joining processes (e.g., non-thermal adhesives, mechanical fasteners, etc.).
- b. Compare and contrast non-thermal processes.

#### C. Define automated processes.

##### 1. Identify applications.

- a. Identify material handling (e.g., sorting, packaging, shipping, tracking, etc.).
- b. Identify assembly applications (i.e., non-thermal and thermal joining).
- c. Identify uses of automated production (e.g., CNC, PLC).

#### D. Identify additional manufacturing processes.

##### 1. Identify non-additive and non-subtractive.

- a. Identify types (e.g., casting, molding, forming, finishing, conditioning, etc.).

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### VI. Materials

#### A. Recognize material storage methods.

##### 1. Select storage methods and systems.

a. List the benefits of organizing materials (e.g., ease of finding materials, reduces chance of selecting wrong material, etc.).

b. Identify various storage methods.

c. Identify types of coding systems (e.g., color, UPC, scan, tag system, etc.).

#### B. Material types

##### 1. Differentiate among ferrous metals.

a. Identify different types of ferrous metals.

b. Analyze the benefits of selection.

##### 2. Differentiate non-ferrous metals.

a. Identify different types of non-ferrous metals.

b. Analyze the benefits of selection.

##### 3. Differentiate other material types.

a. Differentiate other material types.

b. List common uses of composites (e.g., prosthetics, lightweight high-strength applications, etc.).

c. List common types of wood (e.g., natural woods and wood composites).