

COMPETENCY-BASED OCCUPATIONAL FRAMEWORK FOR REGISTERED APPRENTICESHIP

Robotics Technician

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The nonprofit Urban Institute is dedicated to elevating the debate on social and economic policy. For nearly five decades, Urban scholars have conducted research and offered evidence-based solutions that improve lives and strengthen communities across a rapidly urbanizing world. Their objective research helps expand opportunities for all, reduce hardship among the most vulnerable, and strengthen the effectiveness of the public sector.

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Competency-Based Occupational Frameworks

The Urban Institute, under contract with the US Department of Labor, has worked with employers, subject matter experts, labor unions, trade associations, credentialing organizations, and academics to develop Competency-Based Occupational Frameworks (CBOFs) for Registered Apprenticeship programs. These frameworks define the **purpose** of an occupation, the **job functions** that are carried out to fulfill that purpose, the **competencies** that enable the apprentice to execute those job functions well, and the **performance criteria** that define the specific knowledge, skills, and personal attributes associated with high performance in the workplace. This organizational hierarchy—job purpose, job functions, competencies, performance criteria—is designed to illustrate that performing work well requires more than just acquiring discrete knowledge elements or developing a series of manual skills. To perform a job well, the employee must be able to assimilate knowledge and skills learned in various settings, recall and apply that information to the present situation, and carry out work activities using sound professional judgment, demonstrating an appropriate attitude or disposition and achieving a level of speed and accuracy necessary to meet the employer’s business need.

The table below compares the terminology of Functional Analysis with that of traditional Occupational Task Analysis to illustrate the important similarities and differences. While both identify the key technical elements of an occupation, functional analysis includes the identification of behaviors, attributes, and characteristics of workers necessary to meet an employer’s expectations.

Framework Terminology	Traditional Task Analysis Terminology
Job Function: the work activities that are carried out to fulfill the job purpose	Job Duties: roles and responsibilities associated with an occupation
Competency: the actions an individual takes and the attitudes he/she displays to complete those activities	Task: a unit of work or set of activities needed to produce some result
Performance Criteria: the specific knowledge, skills, dispositions, attributes, speed, and accuracy associated with meeting the employer’s expectations	Subtask: the independent actions taken to perform a unit of work or activity

Although designed for use in competency-based apprenticeship, these Competency-Based Occupational Frameworks also support time-based apprenticeship by defining more clearly and precisely what an apprentice is expected to learn and do during the allocated time period.

CBOFs are comprehensive to encompass the full range of jobs that may be performed by individuals in the same occupation. As employers or sponsors develop their individual apprenticeship programs, they can extract from or add to the framework to meet their unique organizational needs.

Components of the Competency-Based Occupational Framework

Occupational Overview: This section of the framework provides a description of the occupation including its purpose, the setting in which the job is performed, and unique features of the occupation.

Work Process Schedule: This section includes the job functions and competencies that would likely be included in an apprenticeship sponsor's application for registration. These frameworks provide a point of reference that has already been vetted by industry leaders so sponsors can develop new programs knowing that they will meet or exceed the consensus expectations of peers. Sponsors maintain the ability to customize their programs to meet their unique needs, but omission of a significant number of job functions or competencies should raise questions about whether or not the program has correctly identified the occupation of interest.

Cross-Cutting Competencies: These competencies are common among all workers and focus on the underlying knowledge, attitudes, personal attributes, and interpersonal skills that are important regardless of the occupation. That said, while these competencies are important to all occupations, the relative importance of some versus others may change from one occupation to the next. These relative differences are illustrated in this part of the CBOF and can be used to design pre-apprenticeship programs or design effective screening tools when recruiting apprentices to the program.

Detailed Job Function Analysis: This portion of the framework includes considerable detail and is designed to support curriculum designers and trainers in developing and administering the program. The detail in this section may be confusing to those seeking a more succinct, higher-level view of the program. For this reason, we recommend that the Work Process Schedule be the focus of program planning activities, leaving the detailed job function analysis sections to instructional designers as they engage in their development work.

- a. **Related Technical Instruction:** Under each job function appears a list of foundational knowledge, skills, tools, and technologies that would likely be taught in the classroom to enable the apprentice's on-the-job training safety and success.
- b. **Performance Criteria:** Under each competency, we provide recommended performance criteria that could be used to differentiate between minimally, moderately, and highly competent apprentices. These performance criteria are generally skills based rather than knowledge based, but may also include dispositional and behavioral competencies.

Using the Competency-Based Occupational Framework to Develop a Registered Apprenticeship Program

When developing a registered apprenticeship program, the Work Process Schedule included in this CBOF provides an overview of the job functions and competencies an expert peer group deemed to be important to this occupation. The Work Process Schedule in this document can be used directly, or modified and used to describe your program content and design as part of your registration application.

When designing the curriculum to support the apprenticeship program—including on-the-job training and related technical instruction—the information the Detailed Job Functions section could be helpful. These more detailed job function documents include recommendations for the key knowledge and skills that might be included in the classroom instruction designed to support a given job function, and the performance criteria provided under each competency could be helpful to trainers and mentors in evaluating apprentice performance and insuring inter-rater reliability when multiple mentors are involved.

Robotics Technician Occupational Overview

Occupational Purpose and Context

Robotics technicians safely build, install, operate, test, monitor, maintain, calibrate, and repair unmanned, automated, servo-mechanical, or electromechanical equipment. Workers in this occupation repair robots or peripheral equipment and troubleshoot robotic systems. They program and operate programmable logic controllers (PLCs), end-of-arm tools, robots and automated machinery, and conveyors, and they are able to troubleshoot these components. They perform preventative or corrective maintenance on robotics systems, assemble components, and properly and safely use necessary tools. Robotics technicians evaluate the efficiency and reliability of industrial robotic systems, test performance, document procedures and results, and develop robotic path motions.

Potential Job Titles

Electro-Mechanic or Electro-Mechanical Technician (E/M Technician), Electronic Technician, Engineering Technician, Laboratory Technician (Lab Technician), Maintenance Technician, Mechanical Technician, Product Test Specialist, Test Technician, Tester, Automation Technician, Electrical and Instrumentation Technician (E&I Technician), Field Service Technician, Instrument and Automation Technician, Instrument Specialist, Instrument Technician, Instrumentation and Controls Technician, Instrumentation and Process Controls Technician, Process Control Technician, Programmable Logic Controllers Technician

Attitudes and Behaviors

Robotics technicians should have well-developed critical thinking skills, use a systems approach to troubleshoot, and use logic and reasoning to identify solutions and repair machines and systems using the needed tools. Robotics technicians must demonstrate proficiency interacting with computers, equipment, and people, as well as interpersonal skills such as strong communication and organization, which are crucial to coordinating team activities to accomplish goals. Robotics technicians must display high attention to detail, dependability, and adaptability to changes in the workplace. Finally, robotics technicians must be willing to face challenges and overcome obstacles in a time-sensitive environment.

Apprenticeship Prerequisites

Most robotics technicians have at least an associate's degree, but this may not be a prerequisite for an apprenticeship program. Robotics technicians may have to be physically capable of performing the registered apprenticeship program's essential functions, with or without a reasonable accommodation and without posing a direct threat to the health and safety of themselves or others. Drug screenings may also be a prerequisite to employment. Some employers may also implement an aptitude screening before employment.

Occupational Pathways

n/a

Certifications, Licensure, and Other Credential Requirements

Credential	Offered by	Before, During, or After Apprenticeship
n/a		

Job Functions

Job Functions	Core or Optional
1. Ensure appropriate safety procedures are followed to protect self and others from accidents and injuries	Core
2. Install, program, and operate the robot and/or automated machinery	Core
3. Safely and efficiently use tools	Core
4. Safely perform maintenance and calibration for robots and/or automated machinery to properly function	Core
5. Troubleshoot errors in programming, robot, or system components	Core
6. Communicate with team, supervisor, and customers	Core

Stackable Programs

This occupational framework is designed to link to the following additional framework(s) as part of a career laddering pathway.

Stackable Programs	Base or Higher Level	Stacks on Top of
n/a		

Options and Specializations

The following options and specializations have been identified for this occupation. The Work Process Schedule and individual job function outlines indicate which job functions and competencies were deemed by industry advisors to be optional. Work Process Schedules for specializations are included at the end of this document.

Options and Specializations	Option	Specialization
n/a		

Levels

Industry advisors have indicated that individuals in this occupation may function at different levels, based on the nature of their work, the amount of time spent in an apprenticeship, the level of skills or knowledge mastery, and the degree of independence in performing the job or supervisory/management responsibilities.

Level	Distinguishing Features	Added Competencies	Added Time Requirements
n/a			

Work Process Schedule

WORK PROCESS SCHEDULE

O*NET-SOC Code: 17-3024.01

RAPIDS Code: 3002CB

Robotics Technician

Job Title: Robotics Technician

Level:

Specialization:

Stackable Program: __Yes __No

Base Occupation Name:

Company Contact:

Address:

Phone:

Email:

Apprenticeship Type:

Competency-based

Time-based

Hybrid

Prerequisites:

Job Function 1: Ensure appropriate safety procedures are followed to protect self and others from accidents and injuries

Competencies	Core or Optional	RTI	OJT
A. Keep self, others, and robots and/or automated machinery safe	Core		
B. Properly use safety features and components to conduct safety procedures	Core		
C. Report unsafe work conditions	Core		
D. Practice good housekeeping	Core		
E. Follow lock-out/tag-out procedures	Core		
F. Respond to emergency situations safely and efficiently	Core		
G. Adhere to company and legal safety standards	Core		

Job Function 2: Install, program, and operate the robot and/or automated machinery

Competencies	Core or Optional	RTI	OJT
A. Set-up the robot and/or automated machinery for use	Core		
B. Program the robot and/or automated machinery to carry out intended tasks	Core		
C. Use programmable logic controller (PLC) or other industrial communication protocols to operate the robot and/or automated machinery	Core		
D. Operate the robot and/or automated machinery	Core		
E. Build or assemble robotic devices/systems and/or automated machinery	Optional		

F. Use a production program to modify a position value (position register)	Core		
G. Record, interpret, and convert measurements to accurately install and configure robots and/or automated machinery	Core		
H. Adjust or repair robot and/or automated machinery components to ensure efficient operation	Core		
I. Interpret process control documentation to ensure safe and efficient operation of the robot and/or automated machinery	Core		

Job Function 3: Safely and efficiently use tools

Competencies	Core or Optional	RTI	OJT
A. Select proper tools for a given situation	Core		
B. Use tools safely	Core		
C. Use non power tools to install and repair components	Core		
D. Use power tools to install and repair components	Core		
E. Use proper tools to install and repair wiring	Core		
F. Repair or replace pneumatic components and hydraulic fittings using appropriate hand tools and metering devices	Core		
G. Perform calculations to identify specifications for use of tools (e.g., for cutting)	Optional		

Job Function 4: Safely perform maintenance and calibration for robots and/or automated machinery to properly function

Competencies	Core or Optional	RTI	OJT
A. Clean the robot, controller(s), and/or other automation machinery safely	Core		
B. Perform hardware maintenance	Core		
C. Calibrate the robot and/or automated machinery	Core		
D. Test components	Core		
E. Sort and ensure materials and equipment are in designated areas after use	Core		

Job Function 5: Troubleshoot errors in programming, robot, or system components

Competencies	Core or Optional	RTI	OJT
A. Review the equipment and product information	Core		
B. Perform tests on programs, wiring, and solder joints	Core		
C. Interpret test results using root-cause analysis to identify the problem	Core		
D. Properly use tools and repair techniques to resolve the problem	Core		
E. Make a recommendation to address the identified issue	Core		

F. Accurately report or document how problems were addressed	Core		
G. Understand and use computer networks	Core		
H. Use industrial communication protocols to troubleshoot errors	Core		
I. Use blueprints or schematics to troubleshoot	Core		
Job Function 6: Communicate with team, supervisor, and customers			
Competencies	Core or Optional	RTI	OJT
A. Read, interpret, and markup schematics and technical documents	Core		
B. Communicate with coworkers	Core		
C. Communicate with supervisor	Core		
D. Train customers and/or coworkers to safely use and maintain robots and/or automation machinery	Core		
E. Complete required documentation	Core		

Cross-Cutting Competencies

COMPETENCY**		0	1	2	3	4	5	6	7	8
Personal Effectiveness	Interpersonal Skills									
	Integrity									
	Professionalism									
	Initiative									
	Dependability and Reliability									
	Adaptability and Flexibility									
	Lifelong Learning									
Academic	Reading									
	Writing									
	Mathematics									
	Science and Technology									
	Communication									
	Critical and Analytical Thinking									
	Basic Computer Skills									
Workplace	Teamwork									
	Customer Focus									
	Planning and Organization									
	Creative Thinking									
	Problem Solving and Decision Making									
	Working with Tools and Technology									
	Checking, Examining, and Recording									
	Business Fundamentals									
	Sustainable									
	Health and Safety									

** The names of the cross-cutting competencies come from the US Department of Labor’s Competency Model Clearinghouse, and definitions for each can be viewed at “Building Blocks Model,” Competency Model Clearinghouse, accessed June 19, 2020,

<https://www.careeronestop.org/CompetencyModel/competency-models/building-blocks-model.aspx>.

Cross-cutting competencies identify transferable skills—sometimes called “soft skills” or “employability skills”—that are important for workplace success, regardless of a person’s occupation. Still, the relative importance of specific cross-cutting competencies differs from occupation to occupation. The cross-cutting competencies table, above, provides information about which of these competencies is most important to be successful in a particular occupation. This information can be useful to employers or intermediaries in screening and selecting candidates for apprenticeship programs, or to pre-apprenticeship providers who seek to prepare individuals for successful entry into an apprenticeship program.

The scoring system utilized to evaluate competency levels required in each cross-cutting skill aligns with the recommendations of the Lumina Foundation’s Connecting Credentials Framework. The framework can be found at “Connecting Credentials: A Beta Credentials Framework,” Lumina Foundation, April 29, 2015, <http://connectingcredentials.org/wp-content/uploads/2015/05/ConnectingCredentials-4-29-30.pdf>.

Detailed Job Functions

Job Function 1: Ensure appropriate safety procedures are followed to protect self and others from accidents and injuries

Related Technical Instruction		
KNOWLEDGE	SKILLS	TOOLS & TECHNOLOGIES
<ul style="list-style-type: none"> • Safe operation of electrical systems and equipment • OSHA safety standards • Emergency procedures • Lock-out/tag-out (LOTO) procedures • Safety data sheets • Government, industry, and company standards • Causes of arc flashes 	<ul style="list-style-type: none"> • Maintain safe work area • Safely use hand and power tools 	<ul style="list-style-type: none"> • Personal protective equipment (PPE) • Electric controls and power lock-out (ECPL) signage • Emergency stops pushbuttons • Gate interlocks • Floor markings • Area scanners • Light curtains • Vision sensors • Pressure mats • Warning/indicator lights • Safety data sheets

Competency A: Keep self, others, and robots and/or automated machinery safe	Core or Optional
PERFORMANCE CRITERIA	
1. Practice environmental awareness; understand where moving components present safety risks	Core
2. Wear personal protective equipment (PPE), including eye, ear, hand, respiratory, body, and foot protection; ensure correct fit and that optimum protection is provided to the wearer for the specific task, in accordance with applicable OSHA regulations	Core
3. Prevent back injuries by adhering to proper work practices when lifting objects	Core
4. Perform first aid and CPR	Core

Competency B: Properly use safety features and components to conduct safety procedures	Core or Optional
PERFORMANCE CRITERIA	
1. Safely enter a work cell and perform proper electric controls and power lock-out (ECPL) procedures	Core
2. Build, test, maintain, and operate safety circuits and guarding systems	Core

3. Conduct ECPL control gravity procedure as it relates to the robotic manipulator before performing any inspection or maintenance work	Core
4. Identify the robot work envelope and explain why it is important for safely working within the robot cell	Core
5. Use the following safety components as applicable: ECPL signage, all emergency stops pushbuttons, gate interlocks, floor markings, area scanners, light curtains, vision sensors, pressure mats, and warning/indicator lights	Core
6. Locate and interpret material safety data sheets (SDS)	Core
7. Recognize all protective tags and lock-out devices used to isolate equipment and components from hazardous energy sources per OSHA regulations	Core

Competency C: Report unsafe work conditions	Core or Optional
PERFORMANCE CRITERIA	
1. Follow protocol for reporting observed unsafe conditions or actions	Core
2. Report injuries to a supervisor or safety personnel promptly	Core
3. Ensure the injured person is attended to	Core
4. Accurately describe how the incident occurred to help prevent future recurrence of similar accidents	Core

Competency D: Practice good housekeeping	Core or Optional
PERFORMANCE CRITERIA	
1. Ensure the workplace is clean and free of spills or fire hazards	Core
2. Ensure the workplace is organized and free of obstructions	Core

Competency E: Follow lock-out/tag-out procedures	Core or Optional
PERFORMANCE CRITERIA	
1. Safely power down robot	Core
2. Properly use lock-out/tag-out to secure electrical equipment and machinery	Core

Competency F: Respond to emergency situations safely and efficiently	Core or Optional
PERFORMANCE CRITERIA	
1. Respond to arc flashes and/or fires appropriately	Core
2. Demonstrate the proper procedure should an employee be trapped by a manipulator arm	Core
3. Use the emergency stop activation and the emergency stop reset procedures when needed	Core
4. Use the emergency robot arm brake release	Core
5. Properly deploy emergency and standard shutdown of all required equipment	Core

Competency G: Adhere to company and legal safety standards		Core or Optional
PERFORMANCE CRITERIA		
1. Attend company safety orientation and demonstrate competency with company safety standards		Core
2. Read and adhere to legal standards including OSHA and other relevant federal or state regulations		Core

Job Function 2: Install, program, and operate the robot and/or automated machinery

Related Technical Instruction		
KNOWLEDGE	SKILLS	TOOLS & TECHNOLOGIES
<ul style="list-style-type: none"> • Production program and teach pendant use • Programming • Motion, servo motor location, and axis of typical 6-axis robot • How to use multiple robots cooperatively, including collision avoidance and any necessary peripheral components • Lean and six sigma statistics • Electrical and fluid systems 	<ul style="list-style-type: none"> • Use PLCs to operate the robot and/or automated machinery • Programming • Install parts • Perform maintenance • Build, use, and troubleshoot electrical and fluid systems 	<ul style="list-style-type: none"> • Teach pendant • Joint and Cartesian coordinate systems • End effector • Fixtures • Controller(s) • HMIs (Human Machine Interfaces)

Competency A: Set up the robot and/or automated machinery for use	Core or Optional
PERFORMANCE CRITERIA	
1. Conduct prestart check and power up and shutdown sequences for typical robot cell, understanding when to use short-term versus long-term shutdown sequences	Core
2. Set up the world frame, tool frame, user, and object frame	Core
3. Setup and test tool center points (TCPs) for the following as available: gripper, adhesive/sealer application, welder, paint, nutrunner, hemmer, and vision	Core

Competency B: Program the robot and/or automated machinery to carry out intended tasks	Core or Optional
PERFORMANCE CRITERIA	
1. Program collision avoidance and detection	Core
2. Use macros and subroutines in programming	Core
3. Backup and restore program files, system parameters, and control software images	Core
4. Create looping and branching statements to repeat a portion of the robot decisionmaking program	Core

Competency C: Use PLC or other industrial communication protocols to operate the robot and/or automated machinery	Core or Optional
PERFORMANCE CRITERIA	

1. Use PLC or other device to efficiently transfer data	Core
2. Use EtherNet/IP, profinet, and other necessary industrial communication protocols to communicate to the robot and/or automated machinery	Core

Competency D: Operate the robot and/or automated machinery	Core or Optional
PERFORMANCE CRITERIA	
1. Use a PLC to control and communicate with the robot	Core
2. Operate the world, tool, user, and object frames	Core
3. Access and modify I/O signals	Core
4. Use the teach pendant controls to jog the robot around all available axes	Core
5. Use both Joint and Cartesian coordinate systems	Core
6. Use end-of-arm tooling	Core
7. Use the densifier and dress-out pack	Core
8. Use robot transfer unit, including necessary peripheral components like fixtures and controllers	Core
9. Demonstrate placing robot into auto mode for running production	Core

Competency E: Build or assemble robotic devices/systems and/or automated machinery	Core or Optional
PERFORMANCE CRITERIA	
1. Install control components, photo eyes, proximity sensors, servo drives, tachs, and encoders	Optional
2. Install new robotic systems in stationary positions or on tracks	Optional
3. Install and connect hydraulic components in a basic functional circuit given a schematic	Optional
4. Mount and align a pneumatic cylinder or motor	Optional
5. Identify, install, and align flexible, flange, grid, and chain couplings	Optional
6. Assemble parts using threaded fasteners, washers, and nuts	Optional
7. Assemble parts using keys, clips, snap rings, and tie wraps	Optional
8. Safely complete assembly and/or connections of motors, sensors, relays, circuit breakers, or PLC's	Optional

Competency F: Use a production program to modify a position value (position register)	Core or Optional
PERFORMANCE CRITERIA	
1. Load production programs from the teach pendant	Core
2. Run programs that adjust speed and force, and run in step, cycle, and continuous modes	Core

Competency G: Record, interpret, and convert measurements to accurately install and configure robots and/or automated machinery	Core or Optional
PERFORMANCE CRITERIA	
1. Accurately measure components	Core
2. Record measurements	Core
3. Convert units	Core
4. Interpret measurements from blueprints and schematics	Core

Competency H: Adjust or repair robot and/or automated machinery components to ensure efficient operation	Core or Optional
PERFORMANCE CRITERIA	
1. Identify inefficiencies such as uneven wear	Core
2. Repair or replace robot component and/or automated machinery to remedy inefficiency and/or enhance efficiency	Core

Competency I: Interpret process control documentation to ensure safe and efficient operation of the robot and/or automated machinery	Core or Optional
PERFORMANCE CRITERIA	
1. Read and interpret process control documentation	Core
2. Apply company process control standards to the safe and efficient operation of the robot and/or automated machinery	Core

Job Function 3: Safely and efficiently use tools

Related Technical Instruction		
KNOWLEDGE	SKILLS	TOOLS & TECHNOLOGIES
<ul style="list-style-type: none"> • Safe operation of power tools • Wiring systems • Hydraulic systems 	<ul style="list-style-type: none"> • Precision work with power and nonpower tools • Manipulate wiring • Manipulate hydraulic systems 	<ul style="list-style-type: none"> • Safety features on power tools • Wrenches • Power tools • Soldering iron • Metering devices

Competency A: Select proper tools for a given situation	Core or Optional
PERFORMANCE CRITERIA	
1. Accurately assess need	Core
2. Identify the most appropriate tools for the need	Core

Competency B: Use tools safely	Core or Optional
PERFORMANCE CRITERIA	
1. Check equipment to verify it is ready for operation in accordance with a safety checklist	Core
2. Maintain awareness of work environment to ensure safety for self and others	Core

Competency C: Use nonpower tools to install and repair components	Core or Optional
PERFORMANCE CRITERIA	
1. Use fixed and allen/hex key wrenches to assemble or repair robot components	Core
2. Use ratchet wrenches to assemble or repair robot components	Core
3. Use click-type torque wrench to assemble or repair robot components	Core

Competency D: Use power tools to install and repair components	Core or Optional
PERFORMANCE CRITERIA	
1. Safely turn on and off electric-powered hand tools	Core
2. Safely use electric-powered hand tools, following schematics and measurements accurately, to build and repair robot components	Core

Competency E: Use proper tools to install and repair wiring	Core or Optional
PERFORMANCE CRITERIA	
1. Strip a wire	Core
2. Attach wire to terminals	Core
3. Perform a continuity test on wiring connected via soldering	Core
4. Prepare a wire for soldering	Core
5. Solder a wire to terminals	Core

Competency F: Repair or replace pneumatic components and hydraulic fittings using appropriate hand tools and metering devices	Core or Optional
PERFORMANCE CRITERIA	
1. Connect hydraulic components in a basic functional circuit	Core
2. Identify pump classifications and calculate flow rates	Core
3. Use appropriate hand tools and metering devices to repair or replace hydraulic components	Core
4. Determine correct oils and fluids to use	Core

Competency G: Perform calculations to identify specifications for use of tools (e.g., for cutting)	Core or Optional
PERFORMANCE CRITERIA	
1. Solve missing measurements of right angles	Optional
2. Calculate the area of a circle	Optional
3. Calculate cutting tool positions	Optional

Job Function 4: Safely perform maintenance and calibration for robots and/or automated machinery to properly function

Related Technical Instruction		
KNOWLEDGE	SKILLS	TOOLS & TECHNOLOGIES
<ul style="list-style-type: none"> Necessary maintenance to ensure proper function of robot components Understand how to prevent electrostatic discharge (ESD) 	<ul style="list-style-type: none"> Clean and maintain robot components System checks Problem solving Calibration Lubricate components 	<ul style="list-style-type: none"> Electrostatic discharge Human machine interface (HMI) Pressure gauges Flow meters Temperature gauges Hoist

Competency A: Clean the robot, controller(s), and/or other automation machinery safely	Core or Optional
PERFORMANCE CRITERIA	
1. Ensure the workplace is clean, organized, and free of obstructions, spills, or fire hazards	Core
2. Clean and sort materials and equipment into designated areas after use	Core
3. Inspect leaks, dirt, and loose connections during equipment operations	Core
4. Clean up and, if necessary, repair the cause of leaks, dirt, and loose connections	Core

Competency B: Perform hardware maintenance	Core or Optional
PERFORMANCE CRITERIA	
1. Inspect and replace basic components including lubrication, battery pack, controller filter, and robot axis motor	Core
2. Maintain various types of end-of-arm tooling (e.g., material handling, welder, nutrunner, etc.)	Core
3. Conduct system checks for typical robot system	Core
4. Account for parts and inventory	Core
5. Replace equipment as scheduled	Core
6. Maintain action/work log	Core
7. Lubricate bearings using Zerk fittings	Core
8. Inspect a hoist to determine if it is safe for use	Core

Competency C: Calibrate the robot and/or automated machinery	Core or Optional
PERFORMANCE CRITERIA	
1. Conduct calibration procedures including calibration alignment witness marks (zero degree) and updating the servo motor revolution (pulse) counter procedure	Core
2. Read and interpret pressure gauges, flow meters, fluid levels, temperature gauges, voltages, and current	Core
3. Demonstrate the ability to use human machine interface (HMI) equipment to monitor machine performance	Core

Competency D: Test components	Core or Optional
PERFORMANCE CRITERIA	
1. Test and inspect a solder joint for integrity	Core
2. Use software such as spreadsheets, databases, and word processors to test components	Core

Competency E: Sort and ensure materials and equipment are in designated areas after use	Core or Optional
PERFORMANCE CRITERIA	
1. Keep accurate inventories of materials	Core
2. Ensure equipment is put away in its proper place after use	Core

Job Function 5: Troubleshoot errors in programming, robot, or system components

Related Technical Instruction		
KNOWLEDGE	SKILLS	TOOLS & TECHNOLOGIES
<ul style="list-style-type: none"> • Common causes of errors • Electronic fault and electrical system • PLC-generated fault or message • Pneumatic system fault • Manipulator mechanical problem on a multi-axis robot unit • End-of-arm tooling (EOAT) mechanical problem • Electronic fault and electrical system 	<ul style="list-style-type: none"> • Problem solving • Restart procedure • Interpret and respond to error messages 	<ul style="list-style-type: none"> • Simulation software • Diagnostic tests

Competency A: Review the equipment and product information	Core or Optional
PERFORMANCE CRITERIA	
1. Compare measurements with those in the relevant service manual	Core
2. Use service manuals to determine appropriate values, levels, and other information	Core
3. Correctly identify component symbols on schematics	Core

Competency B: Perform tests on programs, wiring, and solder joints	Core or Optional
PERFORMANCE CRITERIA	
1. Use simulation software to develop offline and test (debug) programs	Core
2. Perform diagnostic tests on hardware and software systems	Core

Competency C: Interpret test results using root-cause analysis to identify the problem	Core or Optional
PERFORMANCE CRITERIA	
1. Identify machine malfunctions through observations of control panels or other notifications	Core
2. Monitor (both electrically and physically) systems and use feedback to identify and correct root causes	Core

3. Interpret and respond to event messages, error codes, fault messages, alarm messages, warning messages, and so on using the teach pendant	Core
4. Interpret diagnostic results	Core

Competency D: Properly use tools and repair techniques to resolve the problem	Core or Optional
PERFORMANCE CRITERIA	
1. Test solutions	Core
2. Implement solutions	Core
3. Monitor solutions	Core
4. Document the corrections made (if needed)	Core
5. Restart the operating system using the proper restart procedure called for in the situation	Core

Competency E: Make a recommendation to address the identified issue	Core or Optional
PERFORMANCE CRITERIA	
1. Make recommendations to solve the immediate problem and root cause	Core
2. Troubleshoot robotic systems using knowledge of microprocessors, programmable controllers, electronics, circuit analysis, mechanics, sensor or feedback systems, hydraulics, and pneumatics	Core

Competency F: Accurately report or document how problems were addressed	Core or Optional
PERFORMANCE CRITERIA	
1. Correctly read and notate technical data from sensors when identifying if a replacement or repair is necessary	Core
2. Document any sensor readings, error codes, malfunctions, and repair or replacement work completed per company guidelines	Core

Competency G: Understand and use computer networks	Core or Optional
PERFORMANCE CRITERIA	
1. Use company computer system to communicate or update information in a network	Core

Competency H: Use industrial communication protocols to troubleshoot errors		Core or Optional
PERFORMANCE CRITERIA		
1. Use PLC or other device to interpret, troubleshoot, and resolve errors		Core
2. Use EtherNet/IP, propinet, and other necessary industrial communication protocols to interpret, troubleshoot, and resolve errors		Core

Competency I: Use blueprints or schematics to troubleshoot		Core or Optional
PERFORMANCE CRITERIA		
1. Apply interpretation of electrical, pneumatics, hydraulic, and other blueprints and schematics to the problem		Core
2. Accurately markup blueprints and schematics to demonstrate changes made		Core

Job Function 6: Communicate with team, supervisor, and customers

Related Technical Instruction		
KNOWLEDGE	SKILLS	TOOLS & TECHNOLOGIES
<ul style="list-style-type: none"> Central processing unit (CPU) Computer Monitor 	<ul style="list-style-type: none"> Communicate effectively with others Interpret and apply documentation Write clearly and effectively Manage files Complete forms Use appropriate language 	<ul style="list-style-type: none"> Word processing Spreadsheets Presentations Databases

Competency A: Read, interpret, and markup schematics and technical documents	Core or Optional
PERFORMANCE CRITERIA	
1. Demonstrate the ability to apply what is learned from written material to work situations	Core
2. Demonstrate the ability to navigate computer systems and perform file management tasks	Core
3. Demonstrate the ability to identify inconsistent or missing information	Core
4. Demonstrate the ability to read and interpret process control system documentation, including identifying components on a P&ID diagram, instrument tag, and instrument index	Core
5. Read and comprehend work-related instructions and policies, memos, bulletins, notices, letters, and policy manuals; demonstrate compliance with governmental regulations	Core

Competency B: Communicate with coworkers	Core or Optional
PERFORMANCE CRITERIA	
1. Make clear and concise reports	Core
2. Demonstrate the ability to send and retrieve electronic mail	Core
3. Promptly communicate issues as they arise to team members	Core
4. Communicate effectively with the original designer of the system as needed	Core

Competency C: Communicate with supervisor	Core or Optional
PERFORMANCE CRITERIA	
1. Coordinate travel plans	Core

2. Prioritize workload based on information from managers and supervisors	Core
3. Participate in meetings	Core
4. Suggest process and product improvements	Core
5. Prepare written reports and make presentations	Core
6. Maintain files and records, including timekeeping	Core

Competency D: Train customers and/or coworkers to safely use and maintain robots and/or automated machinery	Core or Optional
PERFORMANCE CRITERIA	
1. Train customers to operate robots	Core
2. Teach customers safety procedures	Core
3. Teach customers basic routine maintenance	Core

Competency E: Complete required documentation	Core or Optional
PERFORMANCE CRITERIA	
1. Document test procedures	Core
2. Document test results	Core
3. Understand and use safety, procedural, and testing documentation	Core
4. Maintain inventories	Core

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