

## ARIZONA CTE CAREER PREPARATION STANDARDS & MEASUREMENT CRITERIA

### AUTOMATION AND ROBOTICS, 48.0500.2

#### STANDARD 1.0 – PERFORM ELECTRICAL AND ELECTRONIC TASKS

1.1	Measure voltage, current, resistance, and power in AC and DC circuits
1.2	Calculate voltage, current, resistance, and power in AC and DC circuits
1.3	Test voltage, current, and power in AC and DC circuits using an oscilloscope
1.4	Troubleshoot voltage, current, and power in AC and DC circuits
1.5	Troubleshoot components and connections

#### STANDARD 2.0 – PERFORM HYDRAULIC AND PNEUMATIC TASKS

2.1	Install linear and rotary actuators
2.2	Replace linear and rotary actuators
2.3	Troubleshoot linear and rotary actuators

#### STANDARD 3.0 – PERFORM PROGRAMMABLE LOGIC CONTROLLER (PLC) TASKS

3.1	Develop and implement ladder logic and relay circuits
3.2	Install a logic program into a PLC
3.3	Select input/output modules (AC and DC)
3.4	Troubleshoot input/output modules (AC and DC)
3.5	Troubleshoot PLC system operations

#### STANDARD 4.0 – PERFORM INDUSTRIAL ELECTRICITY TASKS

4.1	Implement proper ground requirements for high voltage circuits
4.2	Construct common control circuits using switches and relays

#### STANDARD 5.0 – INTERFACE DIGITAL AND ANALOG ELECTRONIC DEVICES

5.1	Select A/D and D/A converters
5.2	Test A/D and D/A converters
5.3	Troubleshoot A/D and D/A converters

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<b>STANDARD 6.0 – PERFORM MECHANICAL LINKAGES SYSTEM TASKS</b>	
6.1	Install a belt or chain drive
6.2	Install a gear train
6.3	Compute mechanical advantage of a belt or chain drive
6.4	Compute mechanical advantage of a gear train
<b>STANDARD 7.0 – PERFORM DRAFTING TASKS</b>	
7.1	Make freehand sketches
7.2	Translate freehand sketches into CAD representations
7.3	Determine shapes and sizes of surfaces from alternative views
7.4	Make simple CAD drawings involving geometric construction techniques
7.5	Make dimensional CAD drawings
<b>STANDARD 8.0 – PERFORM MICROPROCESSOR TASKS</b>	
8.1	Use sensors and displays to interface to a microprocessor-based system
8.2	Use a microprocessor-based system to control actuators
8.3	Perform diagnostic tests on a microprocessor-based system
<b>STANDARD 9.0 – PERFORM INDUSTRIAL ROBOTIC TASKS</b>	
9.1	Measure robotic performance against specified criteria
9.2	Interface a robot to real or simulated external equipment
9.3	Specify safety considerations when working with robotic systems
9.4	Identify a robot's degrees of freedom
<b>STANDARD 10.0 – PERFORM CIM TASKS</b>	
10.1	Start up and shut down a real or simulated automated process
10.2	Operate a real or simulated production work cell
<b>STANDARD 11.0 – PERFORM CNC TASKS</b>	
11.1	Perform system diagnostic tests on CNC equipment

These technical knowledge and skill standards were validated by a Skill Standards Validation Committee on October 9, 2009, and used in the adaptation, adoption, and development of test items for first time testing in Spring 2010.

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11.2	Download CNC programs from personal computer to CNC system
11.3	Troubleshoot CNC equipment
11.4	Configure software on personal computer for CNC interfacing
<b>STANDARD 12.0 – PERFORM DATA COMMUNICATIONS TASKS</b>	
12.1	Select data communication protocols and associated connectors
12.2	Configure data communication protocols
12.3	Identify tradeoffs among wired and wireless data communication protocols
12.4	Identify tradeoffs among higher level data communication protocols, e.g., TCP/IP
12.5	Troubleshoot data communications equipment
<b>STANDARD 13.0 – PERFORM SENSOR AND CONTROL SYSTEMS TASKS</b>	
13.1	Select actuators and sensors for use in a feedback control loop
13.2	Construct and operate a system with a feedback control loop
13.3	Calibrate sensors and actuators
13.4	Gather and statistically analyze performance data on a control loop
<b>STANDARD 14.0 – DESIGN DIGITAL LOGIC</b>	
14.1	Implement Boolean logic expressions
14.2	Use Boolean logic to analyze a problem
14.3	Implement a logic circuit using gates
<b>STANDARD 15.0 – DEVELOP ROBOTICS SOFTWARE</b>	
15.1	Select a programming language for a robotics application
15.2	Develop or discover reusable software components
15.3	Use software components to develop a robotics application
15.4	Functionally decompose a problem, identifying reusable components
<b>STANDARD 16.0 – APPLY THE ENGINEERING DESIGN PROCESS TO ROBOTICS DEVELOPMENT</b>	
16.1	Analyze requirements for a robotics problem

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16.2	Design a solution for a robotics problem
16.3	Use simulation to develop and validate a design for a robotics problem
16.4	Use a test driven development approach
<b>STANDARD 17.0 – EXAMINE THE ETHICAL IMPACT OF ROBOTICS</b>	
17.1	Identify Isaac Asimov's three laws of robotics
17.2	Investigate the societal impact of automation and robotics

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