# Industrial Instrumentation and Controls Technician
# Skill Standards

TEXAS WORKFORCE INVESTMENT COUNCIL

## INDUSTRIAL INSTRUMENTATION AND CONTROLS TECHNICIAN SKILL STANDARDS

| Critical Work Function | Key Activity | Key Activity | Key Activity | Key Activity | Key Activity |
|---|---|---|---|---|---|
| **1.** Install and commission new industrial control system equipment in a new application | 1.1 Install pneumatic, electronic and digital controllers, and remote telemetry units. | 1.2 Install pneumatic, electronic and digital control valves, and self operated pressure regulators. | 1.3 Install current to pneumatic (I/P), pneumatic to current (P/I), voltage to current (E/I), current to voltage (I/E), digital to analog, (D/A), and analog to digital (A/D) transducers | 1.4 Install pneumatic, electronic and digital transmitters and measuring devices. | 1.5 Install pneumatic, electronic and digital relays and alarm panels. |
| | 1.6 Install pH, conductivity, gas chromatograph, turbidity, infrared, combustible, ultraviolet, oxygen, lower explosive limit and other analyzers and sample systems. | 1.7 Install pneumatic, electronic and digital switches. | 1.8 Install electronic, digital and variable frequency drive (VFD) or variable speed drive (VSD) motor controllers. | 1.9 Install DCS, PLC and fieldbus process control networks. | 1.10 Install 600-volt or less motors and rotating equipment protection devices such as vibration monitoring and motor control relays. |
| **2.** Maintain, calibrate, lubricate, clean and tune industrial control system equipment | 2.1 Maintain pneumatic, electronic and digital controllers, and remote telemetry units. | 2.2 Maintain pneumatic, electronic and digital control valves, and self operated pressure regulators. | 2.3 Maintain current to pneumatic (I/P), pneumatic to current (P/I), voltage to current (E/I), current to voltage (I/E), digital to analog, (D/A), and analog to digital (A/D) transducers. | 2.4 Maintain pneumatic, electronic and digital transmitters and measuring devices. | 2.5 Maintain pneumatic, electronic and digital relays and alarm panels. |
| | 2.6 Maintain pH, conductivity, gas chromatograph, turbidity, infrared, combustible, ultraviolet, oxygen, lower explosive limit and other analyzers and sample systems. | 2.7 Maintain pneumatic, electronic and digital switches. | 2.8 Maintain electronic, digital and variable frequency drive (VFD) or variable speed drive (VSD) motor controllers. | 2.9 Maintain DCS, PLC and fieldbus process control networks. | 2.10 Maintain 600-volt or less motors and rotating equipment protection devices such as vibration monitoring and motor control relays. |
| **3.** Troubleshoot and diagnose malfunctions of industrial control system equipment | 3.1 Troubleshoot pneumatic, electronic and digital controllers, and remote telemetry units | 3.2 Troubleshoot pneumatic, electronic and digital control valves, and self operated pressure regulators. | 3.3 Troubleshoot current to pneumatic (I/P), pneumatic to current (P/I), voltage to current (E/I), current to voltage (I/E), digital to analog, (D/A), and analog to digital (A/D) transducers. | 3.4 Troubleshoot pneumatic, electronic and digital transmitters and measuring devices. | 3.5 Troubleshoot pneumatic, electronic and digital relays and alarm panels. |
| | 3.6 Troubleshoot pH, conductivity, gas chromatograph, turbidity, infrared, combustible, ultraviolet, oxygen, lower explosive limit and other analyzers and sample systems. | 3.7 Troubleshoot pneumatic, electronic and digital switches. | 3.8 Troubleshoot electronic, digital and variable frequency drive (VFD) or variable speed drive (VSD) motor controllers. | 3.9 Troubleshoot DCS, PLC and fieldbus process control networks. | 3.10 Troubleshoot 600-volt or less motors and rotating equipment protection devices such as vibration monitoring and motor control relays. |

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| **4.** Repair or replace malfunctioning industrial control system equipment | 4.1 Repair or replace pneumatic, electronic and digital controllers, and remote telemetry units. | 4.2 Repair or replace pneumatic, electronic and digital control valves, and self operated pressure regulators. | 4.3 Repair or replace current to pneumatic (I/P), pneumatic to current (P/I), voltage to current (E/I), current to voltage (I/E), digital to analog, (D/A), and analog to digital (A/D) transducers. | 4.4 Repair or replace pneumatic, electronic and digital transmitters and measuring devices. | 4.5 Repair or replace pneumatic, electronic and digital relays and alarm panels. |
| | 4.6 Repair or replace pH, conductivity, gas chromatograph, turbidity, infrared, combustible, ultraviolet, oxygen, lower explosive limit and other analyzers and sample systems. | 4.7 Repair or replace pneumatic, electronic and digital switches. | 4.8 Repair or replace electronic, digital and variable frequency drive (VFD) or variable speed drive (VSD) motor controllers. | 4.9 Repair or replace DCS, PLC and fieldbus process control networks. | 4.10 Repair or replace 600-volt or less motors and rotating equipment protection devices such as vibration monitoring and motor control relays. |
| **5.** Maintain, test, clean, verify, repair or replace auxiliary systems | 5.1 Maintain Heating Ventilation and Air Conditioning (HVAC) systems including the heater, condenser/evaporator, fans, filters and thermostats that control the temperature and/or humidity in a closed space. | 5.2 Maintain lighting systems including the indoor and outdoor lights, changing light bulbs, replacing fluorescent ballasts, checking breakers and switches. | 5.3 Maintain backup power generation systems limited to low voltage generators (less than 600 volts) powered by diesel, gasoline or natural gas powered engines. | 5.4 Maintain cranes and/or hoists including the electric motors, controls and breakers. | 5.5 Maintain instrument air compressors including the compressor drive, compressor, filters, dryers and associated controls. |
| | 5.6 Maintain plant communication systems such as Supervisory Control And Data Acquisition (SCADA) systems, handheld radios and transmitting or repeater stations, and intercom systems. | 5.7 Maintain Uninterruptible Power Supplies (UPS) and Inverters. | 5.8 Maintain cathodic protection systems. | 5.9 Maintain navigation aids including lights and switchgear associated with lighting systems required for navigation aids or warnings. | 5.10 Maintain high voltage equipment including equipment that is energized with 600 volts or more. |

| **Occupational Title: Industrial Instrumentation and Controls Technician** | | | |
|---|---|---|---|
| **Critical Work Function 1.** Install and commission new industrial control system equipment in a new application | | **Occupational Skills, Knowledge & Conditions** | |
| **Key Activity** | **Performance Criteria**<br>*How do we know when the key activity is performed well or performed successfully?* | **Occupational Skills & Knowledge**<br>*What should the technician know and what skills should the technician have in order to do the activity?* | **Conditions**<br>*What tools must the technician use in order to do the activity?* |
| 1.1 Install pneumatic, electronic and digital controllers, and remote telemetry units. | 1.1.1 Installation meets the requirements of company/manufacturer/Health, Safety and Environment work practices, area classifications and specific application.<br>1.1.2 Controller is configured according to the application.<br>1.1.3 Controller is calibrated to engineering specifications using certified standards when applicable.<br>1.1.4 Physical inspection meets company/manufacturer/industry standards.<br>1.1.5 Functional test meets company/manufacturer/industry standards<br>1.1.6 Known inputs result in expected outputs as specified by the manufacturer<br>1.1.7 Documentation is completed according to company guidelines. | Read and redline P&IDs<br>Read and use instrument loop sheets<br>Read and use specification sheets<br>Read and use ladder diagrams<br>Use of reference material<br>Use or conversion of measurements to the metric system<br>Knowledge of math (trigonometry)<br>Knowledge of basic electrical AC/DC theory<br>Ability to learn new technology<br>Knowledge of test equipment<br>Preparation of Job Safety Analysis<br>Knowledge of permits and area classifications<br>Proper tubing and wiring installation<br>Proper use of hand tools<br>Knowledge of controller schemes (e.g. PID, ratio, cascade, feedforward, etc.) | Personal Protective Equipment (PPE)<br>P&IDs<br>Loop sheets<br>Specification sheets<br>Ladder diagrams<br>Reference material<br>Site-specific safety procedures<br>Job Safety Analysis (JSA)<br>Material Safety Data Sheets (MSDS)<br>Permits and area classifications<br>Hand tools<br>Digital volt meter<br>Tubing and conduit benders |

# INDUSTRIAL INSTRUMENTATION AND CONTROLS TECHNICIAN SKILL STANDARDS

| **Occupational Title: Industrial Instrumentation and Controls Technician** | | | |
|---|---|---|---|
| **Critical Work Function 1.** Install and commission new industrial control system equipment in a new application | | **Occupational Skills, Knowledge & Conditions** | |
| **Key Activity** | **Performance Criteria**<br>*How do we know when the key activity is performed well or performed successfully?* | **Occupational Skills & Knowledge**<br>*What should the technician know and what skills should the technician have in order to do the activity?* | **Conditions**<br>*What tools must the technician use in order to do the activity?* |
| 1.2 Install pneumatic, electronic and digital control valves, and self operated pressure regulators. | 1.2.1 Installation meets the requirements of company/manufacturer/Health, Safety, and Environment work practices, area classifications, and specific application.<br>1.2.2 Control valve / positioner is configured according to the application.<br>1.2.3 Control valve / positioner is calibrated to engineering specifications using certified standards when applicable.<br>1.2.4 Physical inspection meets company/manufacturer/industry standards.<br>1.2.5 Functional test meets company/manufacturer/industry standards<br>1.2.6 Known inputs result in expected outputs as specified by the manufacturer<br>1.2.7 Documentation is completed according to company guidelines. | Read and redline P&IDs<br>Read and use instrument loop sheets<br>Read and use specification sheets Use of reference material<br>Knowledge of math<br>Knowledge of basic electrical AC/DC theory<br>Ability to learn new technology<br>Knowledge of computerized maintenance programs<br>Knowledge of test equipment<br>Preparation of Job Safety Analysis Knowledge of permits and area classifications<br>Proper use of hand tools<br>Tubing and wiring installation<br>Knowledge of controller schemes (e.g. PID, ratio, cascade, feedforward, etc.)<br>Knowledge of piping specifications<br>Basic rigging | Personal Protective Equipment (PPE)<br>P&IDs<br>Loop sheets<br>Specification sheets<br>Reference material<br>Site-specific safety procedures Computerized maintenance programs Job Safety Analysis (JSA) Material Safety Data Sheets (MSDS) Permits and area classifications<br>Data forms<br>Hand tools<br>Digital volt meter<br>Tubing and conduit benders<br>Protocol communicator<br>Signal simulator |

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| **Key Activity** | **Performance Criteria**<br>*How do we know when the key activity is performed well or performed successfully?* | **Occupational Skills & Knowledge**<br>*What should the technician know and what skills should the technician have in order to do the activity?* | **Conditions**<br>*What tools must the technician use in order to do the activity?* |
| 1.3 Install current to pneumatic (I/P), pneumatic to current (P/I), voltage to current (E/I), current to voltage (I/E), digital to analog, (D/A), and analog to digital (A/D) transducers | 1.3.1 Installation meets the requirements of company/manufacturer/Health, Safety, and Environment work practices, area classifications, and specific application.<br>1.3.2 Transducer is configured according to the application.<br>1.3.3 Transducer is calibrated to engineering specifications using certified standards when applicable.<br>1.3.4 Physical inspection meets company/manufacturer/industry standards.<br>1.3.5 Functional test meets company/manufacturer/industry standards<br>1.3.6 Known inputs result in expected outputs as specified by the manufacturer<br>1.3.7 Documentation is completed according to company guidelines. | Read and redline P&IDs<br>Read and use instrument loop sheets<br>Read and use specification sheets<br>Use of reference material<br>Knowledge of basic electrical AC/DC theory<br>Ability to learn new technology<br>Knowledge of computerized maintenance programs<br>Knowledge of test equipment<br>Preparation of Job Safety Analysis<br>Knowledge of permits and area classifications<br>Proper use of hand tools<br>Tubing and wiring installation | Personal Protective Equipment (PPE)<br>P&IDs<br>Loop sheets<br>Specification sheets<br>Reference material<br>Site-specific safety procedures<br>Computerized maintenance programs<br>Job Safety Analysis (JSA)<br>Material Safety Data Sheets (MSDS)<br>Permits and area classifications<br>Data forms<br>Hand tools<br>Digital volt meter<br>Portable pressure tester<br>Signal simulator |

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| 1.4 Install pneumatic, electronic and digital transmitters and measuring devices. | 1.4.1 Installation meets the requirements of company/manufacturer/Health, Safety, and Environment work practices, area classifications, and specific application.<br>1.4.2 Transmitter is configured according to the application.<br>1.4.3 Transmitter is calibrated to engineering specifications using certified standards when applicable.<br>1.4.4 Physical inspection meets company/manufacturer/industry standards.<br>1.4.5 Functional test meets company/manufacturer/industry standards<br>1.4.6 Known inputs result in expected outputs as specified by the manufacturer<br>1.4.7 Documentation is completed according to company guidelines. | Read and redline P&IDs<br>Read and use instrument loop sheets<br>Read and use specification sheets<br>Use of reference material<br>Knowledge of math<br>Knowledge of the controlled process<br>Knowledge of basic electrical AC/DC theory<br>Ability to learn new technology<br>Knowledge of computerized maintenance programs<br>Knowledge of test equipment<br>Preparation of Job Safety Analysis<br>Knowledge of permits and area classifications<br>Proper use of hand tools<br>Tubing and wiring installation<br>Knowledge of piping specifications Configuration and calibration knowledge | Personal Protective Equipment (PPE) P&IDs Loop sheets<br>Specification sheets<br>Reference material<br>Site-specific safety procedures Computerized maintenance programs Job Safety Analysis (JSA) Material Safety Data Sheets (MSDS)<br>Permits and area classifications<br>Data forms Hand tools<br>Test equipment<br>Tubing and conduit benders<br>Digital volt meter<br>Portable pressure tester<br>Protocol communicator<br>Signal simulator<br>Temperature calibration equipment |

# INDUSTRIAL INSTRUMENTATION AND CONTROLS TECHNICIAN SKILL STANDARDS

| **Occupational Title: Industrial Instrumentation and Controls Technician** | | | |
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| **Critical Work Function 1.** Install and commission new industrial control system equipment in a new application | | **Occupational Skills, Knowledge & Conditions** | |
| **Key Activity** | **Performance Criteria**<br>*How do we know when the key activity is performed well or performed successfully?* | **Occupational Skills & Knowledge**<br>*What should the technician know and what skills should the technician have in order to do the activity?* | **Conditions**<br>*What tools must the technician use in order to do the activity?* |
| 1.5 Install pneumatic, electronic and digital relays and alarm panels. | 1.5.1 Installation meets the requirements of company/manufacturer/Health, Safety, and Environment work practices, area classifications, and specific application.<br>1.5.2 Relay is configured according to the application.<br>1.5.3 Relay is calibrated to engineering specifications using certified standards when applicable.<br>1.5.4 Physical inspection meets company/manufacturer/industry standards.<br>1.5.5 Functional test meets company/manufacturer/industry standards<br>1.5.6 Known inputs result in expected outputs as specified by the manufacturer<br>1.5.7 Documentation is completed according to company guidelines. | Read and redline P&IDs<br>Read and use instrument loop sheets<br>Read and use specification sheets<br>Use of reference material<br>Knowledge of basic electrical<br>AC/DC theory<br>Ability to learn new technology<br>Knowledge of test equipment<br>Preparation of Job Safety Analysis<br>Knowledge of permits and area classifications<br>Proper use of hand tools<br>Tubing and wiring installation<br>Proper use of test equipment | Personal Protective Equipment (PPE)<br>P&IDs<br>Loop sheets<br>Specification sheets<br>Reference material<br>Site-specific safety procedures<br>Computerized maintenance programs<br>Job Safety Analysis (JSA)<br>Material Safety Data Sheets (MSDS)<br>Permits and area classifications<br>Data forms<br>Hand tools<br>Digital volt meter<br>Portable pressure tester |

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| **Critical Work Function 1.** Install and commission new industrial control system equipment in a new application | | **Occupational Skills, Knowledge & Conditions** | |
| **Key Activity** | **Performance Criteria**<br>*How do we know when the key activity is performed well or performed successfully?* | **Occupational Skills & Knowledge**<br>*What should the technician know and what skills should the technician have in order to do the activity?* | **Conditions**<br>*What tools must the technician use in order to do the activity?* |
| 1.6 Install pH, conductivity, gas chromatograph, turbidity, infrared, combustible, ultraviolet, oxygen, lower explosive limit and other analyzers and sample systems. | 1.6.1 Installation meets the requirements of company/manufacturer/Health, Safety, and Environment work practices, area classifications, and specific application.<br>1.6.2 Analyzer is configured according to the application.<br>1.6.3 Analyzer is calibrated to engineering specifications using certified standards when applicable.<br>1.6.4 Physical inspection meets company/manufacturer/industry standards.<br>1.6.5 Functional test meets company/manufacturer/industry standards<br>1.6.6 Known inputs result in expected outputs as specified by the manufacturer<br>1.6.7 Documentation is completed according to company guidelines. | Read and redline P&IDs<br>Read and use instrument loop sheets<br>Read and use specification sheets<br>Read and use computer control logic<br>Use of reference material<br>Use or conversion of measurements to the metric system<br>Knowledge of the controlled process<br>Knowledge of math (algebra and trig)<br>Knowledge of physics<br>Knowledge of basic electrical AC/DC theory<br>Ability to learn new technology<br>Knowledge of computerized maintenance programs<br>Preparation of Job Safety Analysis<br>Knowledge of permits and area classifications<br>Knowledge of analyzer specific calibration equipment<br>Knowledge of environmental, regulatory, service requirements and consequences of sample release<br>Ability to interpret calibration results Calibration and configuration knowledge<br>Knowledge of standards (i.e. gases, buffers, samples, color charts, etc.)<br>Proper use of hand tools<br>Tubing and wiring installation | Personal Protective Equipment (PPE) P&IDs<br>Loop sheets<br>Specification sheets<br>Control logic diagrams<br>Reference material<br>Site-specific safety procedures Computerized maintenance programs Job Safety Analysis (JSA)<br>Material Safety Data Sheets (MSDS) Permits and area classifications<br>Data forms<br>Hand tools<br>Tubing and conduit benders<br>Analyzer specific calibration standards Screens, filters, and bottles<br>Analyzer specific calibration equipment |

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| **Critical Work Function 1.** Install and commission new industrial control system equipment in a new application | | **Occupational Skills, Knowledge & Conditions** | |
| **Key Activity** | **Performance Criteria**<br>*How do we know when the key activity is performed well or performed successfully?* | **Occupational Skills & Knowledge**<br>*What should the technician know and what skills should the technician have in order to do the activity?* | **Conditions**<br>*What tools must the technician use in order to do the activity?* |
| 1.7 Install pneumatic, electronic and digital switches. | 1.7.1 Installation meets the requirements of company/manufacturer/Health, Safety, and Environment work practices, area classifications, and specific application.<br>1.7.2 Switch is configured according to the application.<br>1.7.3 Switch is calibrated to engineering specifications using certified standards when applicable.<br>1.7.4 Physical inspection meets company/manufacturer/industry standards.<br>1.7.5 Functional test meets company/manufacturer/industry standards<br>1.7.6 Known inputs result in expected outputs as specified by the manufacturer<br>1.7.7 Documentation is completed according to company guidelines. | Read and redline P&IDs<br>Read and use instrument loop sheets<br>Read and use specification sheets<br>Use of reference material<br>Knowledge of basic electrical AC/DC theory<br>Ability to learn new technology<br>Knowledge of test equipment<br>Preparation of Job Safety Analysis<br>Knowledge of permits and area classifications<br>Proper use of hand tools<br>Tubing and wiring installation<br>Proper use of test equipment | Personal Protective Equipment (PPE)<br>P&IDs<br>Loop sheets<br>Specification sheets<br>Reference material<br>Site-specific safety procedures<br>Computerized maintenance programs<br>Job Safety Analysis (JSA)<br>Material Safety Data Sheets (MSDS)<br>Permits and area classifications<br>Data forms<br>Hand tools<br>Digital volt meter<br>Portable pressure tester |

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| **Critical Work Function 1.** Install and commission new industrial control system equipment in a new application | | **Occupational Skills, Knowledge & Conditions** | |
| **Key Activity** | **Performance Criteria**<br>*How do we know when the key activity is performed well or performed successfully?* | **Occupational Skills & Knowledge**<br>*What should the technician know and what skills should the technician have in order to do the activity?* | **Conditions**<br>*What tools must the technician use in order to do the activity?* |
| 1.8 Install electronic, digital and variable frequency drive (VFD) or variable speed drive (VSD) motor controllers. | 1.8.1 Installation meets the requirements of company/manufacturer/Health, Safety, and Environment work practices, area classifications, and specific application.<br>1.8.2 Motor controller is configured according to the application.<br>1.8.3 Motor controller is calibrated to engineering specifications using certified standards when applicable.<br>1.8.4 Physical inspection meets company/manufacturer/industry standards.<br>1.8.5 Functional test meets company/manufacturer/industry standards<br>1.8.6 Known inputs result in expected outputs as specified by the manufacturer<br>1.8.7 Documentation is completed according to company guidelines. | Read and redline P&IDs<br>Read and redline electrical drawings<br>Read and use instrument loop sheets<br>Read and use specification sheets<br>Read and use control logic diagrams<br>Use of reference material<br>Knowledge of math<br>Electrical knowledge<br>Motor control circuit knowledge<br>Knowledge of gated power devices (SCR, triacs, etc.)<br>Ability to learn new technology<br>Knowledge of computerized maintenance programs<br>Preparation of Job Safety Analysis<br>Knowledge of permits and area classifications<br>Proper use of hand tools<br>Knowledge of electrical wiring<br>Knowledge of electrical test equipment<br>Knowledge of configuration requirements | Personal Protective Equipment (PPE)<br>P&IDs<br>Electrical drawings<br>Loop sheets<br>Specification sheets<br>Control logic diagrams<br>Reference material<br>Site-specific safety procedures<br>Computerized maintenance programs<br>Job Safety Analysis (JSA)<br>Material Safety Data Sheets (MSDS)<br>Permits and area classifications<br>Data forms<br>Hand tools<br>Volt-ohm meter<br>Hot sticks Digital volt meter Oscilloscope<br>Tubing and conduit benders<br>Hypot tester<br>Protocol communicator<br>Megohm meter<br>Amp probe<br>Phase comparison tester<br>Signal simulator<br>Non-contact voltage tester |

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| **Key Activity** | **Performance Criteria**<br>*How do we know when the key activity is performed well or performed successfully?* | **Occupational Skills & Knowledge**<br>*What should the technician know and what skills should the technician have in order to do the activity?* | **Conditions**<br>*What tools must the technician use in order to do the activity?* |
| 1.9 Install DCS, PLC and fieldbus process control networks. | 1.9.1 Installation meets the requirements of company/manufacturer/Health, Safety, and Environment work practices, area classifications, and specific application.<br>1.9.2 Process control network is configured according to the application.<br>1.9.3 Process control network is calibrated to engineering specifications using certified standards when applicable.<br>1.9.4 Physical inspection meets company/manufacturer/industry standards.<br>1.9.5 Functional test meets company/manufacturer/industry standards<br>1.9.6 Known inputs result in expected outputs as specified by the manufacturer<br>1.9.7 Documentation is completed according to company guidelines. | Read and redline P&IDs<br>Read and redline PC network drawings<br>Read and use specification sheets<br>Knowledge of basic electrical AC/DC theory<br>Ability to learn new technology<br>Knowledge of computerized maintenance programs<br>Knowledge of test equipment<br>Preparation of Job Safety Analysis<br>Knowledge of industrial communication protocols<br>Knowledge of cable connector requirements | Personal Protective Equipment (PPE)<br>P&IDs<br>Network drawings<br>Specification sheets<br>Reference material<br>Site-specific safety procedures<br>Computerized maintenance programs<br>Job Safety Analysis (JSA)<br>Data forms<br>Hand tools<br>Cable testers<br>Digital volt meter<br>Oscilloscope Protocol analyzer |

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| **Key Activity** | **Performance Criteria**<br>*How do we know when the key activity is performed well or performed successfully?* | **Occupational Skills & Knowledge**<br>*What should the technician know and what skills should the technician have in order to do the activity?* | **Conditions**<br>*What tools must the technician use in order to do the activity?* |
| 1.10 Install 600-volt or less motors and rotating equipment protection devices such as vibration monitoring and motor control relays. | 1.10.1 Installation meets the requirements of company/manufacturer/Health, Safety, and Environment work practices, area classifications, and specific application.<br>1.10.2 Motor is configured according to the application.<br>1.10.3 Physical inspection meets company/manufacturer/industry standards.<br>1.10.4 Functional test meets company/manufacturer/industry standards<br>1.10.5 Known inputs result in expected outputs as specified by the manufacturer<br>1.10.6 Documentation is completed according to company guidelines. | Read and redline electrical drawings<br>Read and use specification sheets<br>Read and use motor control logic diagrams Use of reference material<br>Use or conversion of electric circuit measurements<br>Knowledge of math (trigonometry)<br>Knowledge of physics (length and leverage)<br>Electrical knowledge<br>Motor control circuit knowledge<br>Ability to learn new technology<br>Knowledge of computerized maintenance programs<br>Preparation of Job Safety Analysis<br>Knowledge of national electric code<br>Knowledge of phasing and motor rotation<br>Read and use nameplate data<br>Calibrating vibration monitors<br>Basic rigging | Personal Protective Equipment (PPE)<br>Electrical drawings<br>Specification sheets<br>Motor control logic diagrams<br>Reference material<br>Site-specific safety procedures<br>Computerized maintenance programs<br>Job Safety Analysis (JSA)<br>Material Safety Data Sheets (MSDS)<br>Permits and area classifications<br>Data forms Hand tools<br>Volt-ohm meter<br>Digital volt meter<br>Oscilloscope<br>Tubing and conduit benders<br>Wobulator<br>Hypot tester<br>Megohm meter<br>Amp probe<br>Phase comparison tester<br>Non-contact voltage tester |

**Academic and Employability Knowledge and Skill Matrix for Critical Work Function 1**

*On a scale of 1 (lowest) to 5 (highest), identify the level of complexity required in each of these skills for the worker to perform the critical work function. Keep in mind that this scale is not for rating an individual's proficiency. It is intended only for rating the level of complexity required to do the work.*

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CWF 1 Install and commission new industrial control system equipment in a new application** | | | | | | | | | | | | | | | | |
| Listening | Speaking | Using Information and Communication Technology | Gathering and analyzing Information | Analyzing and Solving Problems | Making Decisions and Judgments | Organizing and Planning | Using Social Skills | Adaptability | Working in Teams | Leading Others | Building Consensus | Self and Career Development | Writing | Reading | Mathematics | Science |
| 4 | 3 | 4 | 4 | 3 | 3 | 2 | 3 | 4 | 4 | 1 | 1 | 3 | 2 | 5 | 3 | 3 |

**Statement of Assessment for Critical Work Function 1**

Tools: The assessment process should include the following:

Written tests that include:
1) True-false, multiple choice and essay questions that rely on extended responses to further clarify an understanding of the knowledge being assessed.
2) Graphic representations (e.g. P&IDs, loop drawings and one-line electrical drawings) that reveals an understanding of symbology and connections between processes and devices.
3) Preparation and justification of a reasonable solution to a problem scenario.

Hands-on demonstrations of knowledge, skills and attitudes that:
1) Represents a problematic or challenging situation in the context of a career-technical perspective.
2) Involves a real life scenario, problem or situation to solve.
3) Applies relevant knowledge or skills.
4) Focuses on the application of knowledge and skills learned in one situation as it connects to a new and different one.
5) Reveals an ability to plan, organize and create a product or an event.
6) Requires study to analyze or evaluate the problem or situation.
7) Illustrates by individual performance the attained levels of knowledge, skills and attitudes.
8) Includes observation of events, groups and individuals that focuses on the salient traits of the skill or attitude being observed.

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|---|---|---|---|
| **Critical Work Function 2. Maintain, calibrate, lubricate, clean and tune industrial control system equipment.** | | **Occupational Skills, Knowledge & Conditions** | |
| **Key Activity** | **Performance Criteria**<br>*How do we know when the key activity is performed well or performed successfully?* | **Occupational Skills & Knowledge**<br>*What should the technician know and what skills should the technician have in order to do the activity?* | **Conditions**<br>*What tools must the technician use in order to do the activity?* |
| 2.1 Maintain pneumatic, electronic and digital controllers, and remote telemetry units. | 2.1.1 Work is performed to meet the requirements of company/manufacturer/Health, Safety and Environment work practices, specific application and area classification.<br>2.1.2 Routine maintenance is performed according to job scope.<br>2.1.3 Physical inspection meets company/manufacturer/industry parameters.<br>2.1.4 Configuration is verified according to the application.<br>2.1.5 Calibration is verified according to engineering specifications and certified standards when applicable.<br>2.1.6 Functional test meets company/manufacturer/industry standards.<br>2.1.7 Known inputs result in expected outputs as specified by the manufacturer.<br>2.1.8 Documentation is completed according to company guidelines. | Read and redline P&IDs<br>Read and use instrument loop sheets<br>Read and use specification sheets<br>Read and use ladder logic diagrams<br>Use of reference material<br>Knowledge of math<br>Knowledge of basic electrical AC/DC theory<br>Ability to learn new technology<br>Knowledge of computerized maintenance programs<br>Knowledge of test equipment<br>Preparation of Job Safety Analysis<br>Knowledge of permits and area classifications<br>Proper use of hand tools<br>Tubing and wiring installation<br>Knowledge of controller schemes (e.g. PID, ratio, cascade, feedforward, etc.)<br>Understand consequences of changes<br>Knowledge of preventive maintenance schedules | Personal Protective Equipment (PPE)<br>P&IDs<br>Loop sheets<br>Specification sheets<br>Ladder logic diagrams<br>Reference material<br>Site-specific safety procedures<br>Computerized maintenance programs<br>Job Safety Analysis (JSA)<br>Material Safety Data Sheets (MSDS)<br>Permits and area classifications<br>Data forms<br>Hand tools<br>Digital volt meter<br>Protocol communicator<br>Signal simulator |

| **Occupational Title: Industrial Instrumentation and Controls Technician** | | | |
|---|---|---|---|
| **Critical Work Function 2. Maintain, calibrate, lubricate, clean and tune industrial control system equipment.** | | **Occupational Skills, Knowledge & Conditions** | |
| **Key Activity** | **Performance Criteria**<br>*How do we know when the key activity is performed well or performed successfully?* | **Occupational Skills & Knowledge**<br>*What should the technician know and what skills should the technician have in order to do the activity?* | **Conditions**<br>*What tools must the technician use in order to do the activity?* |
| 2.2 Maintain pneumatic, electronic and digital control valves, and self operated pressure regulators. | 2.2.1 Work is performed to meet the requirements of company/manufacturer/Health, Safety and Environment work practices, specific application and area classification.<br>2.2.2 Routine maintenance is performed according to job scope.<br>2.2.3 Physical inspection meets company/manufacturer/industry parameters.<br>2.2.4 Configuration is verified according to the application.<br>2.2.5 Calibration is verified according to engineering specifications and certified standards when applicable.<br>2.2.6 Functional test meets company/manufacturer/industry standards.<br>2.2.7 Known inputs result in expected outputs as specified by the manufacturer.<br>2.2.8 Documentation is completed according to company guidelines. | Read and redline P&IDs<br>Read and use instrument loop sheets<br>Read and use specification sheets<br>Use of reference material<br>Knowledge of basic electrical AC/DC theory<br>Ability to learn new technology<br>Knowledge of computerized maintenance programs<br>Knowledge of test equipment<br>Preparation of Job Safety Analysis<br>Knowledge of permits and area classifications<br>Proper use of hand tools<br>Tubing and wiring installation<br>Knowledge of controller schemes (e.g. PID, ratio, cascade, feedforward, etc.)<br>Understand consequences of changes<br>Knowledge of preventive maintenance schedules | Personal Protective Equipment (PPE)<br>P&IDs<br>Loop sheets<br>Specification sheets<br>Reference material<br>Site-specific safety procedures<br>Computerized maintenance programs<br>Job Safety Analysis (JSA)<br>Material Safety Data Sheets (MSDS)<br>Permits and area classifications<br>Data forms<br>Hand tools<br>Digital volt meter<br>Protocol communicator<br>Signal simulator |

| Occupational Title: Industrial Instrumentation and Controls Technician | | | |
|---|---|---|---|
| **Critical Work Function 2. Maintain, calibrate, lubricate, clean and tune industrial control system equipment.** | | **Occupational Skills, Knowledge & Conditions** | |
| **Key Activity** | **Performance Criteria**<br>*How do we know when the key activity is performed well or performed successfully?* | **Occupational Skills & Knowledge**<br>*What should the technician know and what skills should the technician have in order to do the activity?* | **Conditions**<br>*What tools must the technician use in order to do the activity?* |
| 2.3 Maintain current to pneumatic (I/P), pneumatic to current (P/I), voltage to current (E/I), current to voltage (I/E), digital to analog, (D/A), and analog to digital (A/D) transducers. | 2.3.1 Work is performed to meet the requirements of company/manufacturer/Health, Safety and Environment work practices, specific application and area classification.<br>2.3.2 Routine maintenance is performed according to job scope.<br>2.3.3 Physical inspection meets company/manufacturer/industry parameters.<br>2.3.4 Configuration is verified according to the application.<br>2.3.5 Calibration is verified according to engineering specifications and certified standards when applicable.<br>2.3.6 Functional test meets company/manufacturer/industry standards.<br>2.3.7 Known inputs result in expected outputs as specified by the manufacturer.<br>2.3.8 Documentation is completed according to company guidelines. | Read and redline P&IDs<br>Read and use instrument loop sheets<br>Read and use specification sheets<br>Use of reference material<br>Knowledge of basic electrical AC/DC theory<br>Ability to learn new technology<br>Knowledge of computerized maintenance programs<br>Knowledge of test equipment<br>Preparation of Job Safety Analysis<br>Knowledge of permits and area classifications<br>Proper use of hand tools<br>Tubing and wiring installation<br>Understand consequences of changes<br>Knowledge of preventive maintenance schedules | Personal Protective Equipment (PPE)<br>P&IDs<br>Loop sheets<br>Specification sheets<br>Reference material<br>Site-specific safety procedures<br>Computerized maintenance programs<br>Job Safety Analysis (JSA)<br>Material Safety Data Sheets (MSDS)<br>Permits and area classifications<br>Data forms<br>Hand tools<br>Digital volt meter<br>Portable pressure tester<br>Signal simulator |

| **Occupational Title: Industrial Instrumentation and Controls Technician** | | | |
|---|---|---|---|
| **Critical Work Function 2. Maintain, calibrate, lubricate, clean and tune industrial control system equipment.** | | **Occupational Skills, Knowledge & Conditions** | |
| **Key Activity** | **Performance Criteria**<br>*How do we know when the key activity is performed well or performed successfully?* | **Occupational Skills & Knowledge**<br>*What should the technician know and what skills should the technician have in order to do the activity?* | **Conditions**<br>*What tools must the technician use in order to do the activity?* |
| 2.4 Maintain pneumatic, electronic and digital transmitters and measuring devices. | 2.4.1 Work is performed to meet the requirements of company/manufacturer/Health, Safety and Environment work practices, specific application and area classification.<br>2.4.2 Routine maintenance is performed according to job scope.<br>2.4.3 Physical inspection meets company/manufacturer/industry parameters.<br>2.4.4 Configuration is verified according to the application.<br>2.4.5 Calibration is verified according to engineering specifications and certified standards when applicable.<br>2.4.6 Functional test meets company/manufacturer/industry standards.<br>2.4.7 Known inputs result in expected outputs as specified by the manufacturer.<br>2.4.8 Documentation is completed according to company guidelines. | Read and redline P&IDs<br>Read and use instrument loop sheets<br>Read and use specification sheets<br>Use of reference material<br>Knowledge of basic electrical AC/DC theory<br>Ability to learn new technology<br>Knowledge of computerized maintenance programs<br>Knowledge of test equipment<br>Preparation of Job Safety Analysis<br>Knowledge of permits and area classifications<br>Proper use of hand tools<br>Tubing and wiring installation<br>Understand consequences of changes<br>Knowledge of preventive maintenance schedules | Personal Protective Equipment (PPE)<br>P&IDs<br>Loop sheets<br>Specification sheets<br>Reference material<br>Site-specific safety procedures<br>Computerized maintenance programs<br>Job Safety Analysis (JSA)<br>Material Safety Data Sheets (MSDS)<br>Permits and area classifications<br>Data forms<br>Hand tools<br>Digital volt meter<br>Portable pressure tester<br>Signal simulator |

# INDUSTRIAL INSTRUMENTATION AND CONTROLS TECHNICIAN SKILL STANDARDS

| **Occupational Title: Industrial Instrumentation and Controls Technician** | | | |
|---|---|---|---|
| **Critical Work Function 2. Maintain, calibrate, lubricate, clean and tune industrial control system equipment.** | | **Occupational Skills, Knowledge & Conditions** | |
| **Key Activity** | **Performance Criteria**<br>*How do we know when the key activity is performed well or performed successfully?* | **Occupational Skills & Knowledge**<br>*What should the technician know and what skills should the technician have in order to do the activity?* | **Conditions**<br>*What tools must the technician use in order to do the activity?* |
| 2.5 Maintain pneumatic, electronic and digital relays and alarm panels. | 2.5.1 Work is performed to meet the requirements of company/manufacturer/Health, Safety and Environment work practices, specific application and area classification.<br>2.5.2 Routine maintenance is performed according to job scope.<br>2.5.3 Physical inspection meets company/manufacturer/industry parameters.<br>2.5.4 Configuration is verified according to the application.<br>2.5.5 Calibration is verified according to engineering specifications and certified standards when applicable.<br>2.5.6 Functional test meets company/manufacturer/industry standards.<br>2.5.7 Known inputs result in expected outputs as specified by the manufacturer.<br>2.5.8 Documentation is completed according to company guidelines. | Read and redline P&IDs<br>Read and use instrument loop sheets<br>Read and use specification sheets Use of reference material<br>Knowledge of the controlled process<br>Knowledge of math<br>Knowledge of basic electrical AC/DC theory<br>Ability to learn new technology<br>Knowledge of computerized maintenance programs<br>Knowledge of test equipment<br>Preparation of Job Safety Analysis<br>Knowledge of permits and area classifications<br>Proper use of hand tools<br>Tubing and wiring installation<br>Configuration and calibration knowledge<br>Understand consequences of changes<br>Knowledge of preventive maintenance schedules | Personal Protective Equipment (PPE)<br>P&IDs<br>Loop sheets<br>Specification sheets<br>Reference material<br>Site-specific safety procedures<br>Computerized maintenance programs<br>Job Safety Analysis (JSA)<br>Material Safety Data Sheets (MSDS)<br>Permits and area classifications<br>Data forms<br>Hand tools<br>Test equipment<br>Digital volt meter<br>Portable pressure tester<br>Protocol communicator<br>Signal simulator<br>Temperature calibration equipment |

| Occupational Title: Industrial Instrumentation and Controls Technician | | | |
|---|---|---|---|
| **Critical Work Function 2. Maintain, calibrate, lubricate, clean and tune industrial control system equipment.** | | **Occupational Skills, Knowledge & Conditions** | |
| **Key Activity** | **Performance Criteria**<br>*How do we know when the key activity is performed well or performed successfully?* | **Occupational Skills & Knowledge**<br>*What should the technician know and what skills should the technician have in order to do the activity?* | **Conditions**<br>*What tools must the technician use in order to do the activity?* |
| 2.6 Maintain pH, conductivity, gas chromatograph, turbidity, infrared, combustible, ultraviolet, oxygen, lower explosive limit and other analyzers and sample systems. | 2.6.1 Work is performed to meet the requirements of company/manufacturer/Health, Safety and Environment work practices, specific application and area classification.<br>2.6.2 Routine maintenance is performed according to job scope.<br>2.6.3 Physical inspection meets company/manufacturer/industry parameters.<br>2.6.4 Configuration is verified according to the application.<br>2.6.5 Calibration is verified according to engineering specifications and certified standards when applicable.<br>2.6.6 Functional test meets company/manufacturer/industry standards.<br>2.6.7 Known inputs result in expected outputs as specified by the manufacturer.<br>2.6.8 Documentation is completed according to company guidelines. | Read and redline P&IDs<br>Read and use instrument loop sheets<br>Read and use specification sheets Read and use control logic diagrams Use of reference material<br>Use or conversion of measurements to the metric system<br>Knowledge of math<br>Knowledge of chemistry<br>Knowledge of physics<br>Knowledge of basic electrical AC/DC theory<br>Ability to learn new technology Knowledge of computerized maintenance programs<br>Preparation of Job Safety Analysis<br>Knowledge of permits and area classifications<br>Proper use of hand tools<br>Knowledge of analyzer specific calibration equipment<br>Knowledge of environmental, regulatory, service requirements and consequences of sample release<br>Ability to interpret calibration results<br>Calibration and configuration knowledge<br>Knowledge of standards (i.e. gases, buffers, samples, color charts, etc.)<br>Proper use of hand tools<br>Tubing and wiring installation<br>Knowledge of legal requirements for in service reporting and custody transfer<br>Knowledge of system interactions (e.g. interlocks and trips)<br>Understand consequences of changes<br>Knowledge of preventive maintenance schedules | Personal Protective Equipment (PPE)<br>P&IDs Loop sheets<br>Specification sheets<br>Control logic diagrams<br>Reference material<br>Site-specific safety procedures Computerized maintenance programs Job Safety Analysis (JSA)<br>Material Safety Data Sheets (MSDS) Permits and area classifications<br>Data forms<br>Hand tools<br>Protocol communicator<br>Tubing and conduit benders<br>Analyzer specific calibration equipment<br>Analyzer specific calibration standards<br>Screens, filters, and bottles<br>Analyzer specific calibration equipment |

## INDUSTRIAL INSTRUMENTATION AND CONTROLS TECHNICIAN SKILL STANDARDS

| **Occupational Title: Industrial Instrumentation and Controls Technician** | | | |
|---|---|---|---|
| **Critical Work Function 2. Maintain, calibrate, lubricate, clean and tune industrial control system equipment.** | | **Occupational Skills, Knowledge & Conditions** | |
| **Key Activity** | **Performance Criteria**<br>*How do we know when the key activity is performed well or performed successfully?* | **Occupational Skills & Knowledge**<br>*What should the technician know and what skills should the technician have in order to do the activity?* | **Conditions**<br>*What tools must the technician use in order to do the activity?* |
| 2.7 Maintain pneumatic, electronic and digital switches. | 2.7.1 Work is performed to meet the requirements of company/manufacturer/Health, Safety and Environment work practices, specific application and area classification.<br>2.7.2 Routine maintenance is performed according to job scope.<br>2.7.3 Physical inspection meets company/manufacturer/industry parameters.<br>2.7.4 Configuration is verified according to the application.<br>2.7.5 Calibration is verified according to engineering specifications and certified standards when applicable.<br>2.7.6 Functional test meets company/manufacturer/industry standards.<br>2.7.7 Known inputs result in expected outputs as specified by the manufacturer.<br>2.7.8 Documentation is completed according to company guidelines. | Read and redline P&IDs<br>Read and use instrument loop sheets<br>Read and use specification sheets<br>Use of reference material<br>Knowledge of basic electrical AC/DC theory<br>Ability to learn new technology<br>Knowledge of computerized maintenance programs<br>Knowledge of test equipment<br>Preparation of Job Safety Analysis<br>Knowledge of permits and area classifications<br>Proper use of hand tools<br>Tubing and wiring installation<br>Understand consequences of changes<br>Knowledge of preventive maintenance schedules | Personal Protective Equipment (PPE)<br>P&IDs<br>Loop sheets<br>Specification sheets<br>Reference material<br>Site-specific safety procedures<br>Computerized maintenance programs<br>Job Safety Analysis (JSA)<br>Material Safety Data Sheets (MSDS)<br>Permits and area classifications<br>Data forms<br>Hand tools<br>Digital volt meter<br>Portable pressure tester |

| Occupational Title: Industrial Instrumentation and Controls Technician | | | |
|---|---|---|---|
| **Critical Work Function 2. Maintain, calibrate, lubricate, clean and tune industrial control system equipment.** | | **Occupational Skills, Knowledge & Conditions** | |
| **Key Activity** | **Performance Criteria**<br>*How do we know when the key activity is performed well or performed successfully?* | **Occupational Skills & Knowledge**<br>*What should the technician know and what skills should the technician have in order to do the activity?* | **Conditions**<br>*What tools must the technician use in order to do the activity?* |
| 2.8 Maintain electronic, digital and variable frequency drive (VFD) or variable speed drive (VSD) motor controllers. | 2.8.1 Work is performed to meet the requirements of company/manufacturer/Health, Safety and Environment work practices, specific application and area classification.<br>2.8.2 Routine maintenance is performed according to job scope.<br>2.8.3 Physical inspection meets company/manufacturer/industry parameters.<br>2.8.4 Configuration is verified according to the application.<br>2.8.5 Calibration is verified according to engineering specifications and certified standards when applicable.<br>2.8.6 Functional test meets company/manufacturer/industry standards.<br>2.8.7 Known inputs result in expected outputs as specified by the manufacturer.<br>2.8.8 Documentation is completed according to company guidelines. | Read and redline P&IDs<br>Read and use instrument loop sheets<br>Read and use electrical drawings<br>Read and use specification sheets<br>Read and use control logic diagrams<br>Use of reference material<br>Knowledge of math<br>Electrical knowledge<br>Ability to learn new technology<br>Knowledge of computerized maintenance programs<br>Preparation of Job Safety Analysis<br>Knowledge of permits and area classifications<br>Proper use of hand tools<br>Basic mechanical knowledge<br>Motor control circuit knowledge<br>Knowledge of gated power devices (SCR, triacs, etc.)<br>Knowledge of electrical wiring<br>Knowledge of electrical test equipment<br>Knowledge of configuration requirements<br>Understand consequences of changes<br>Knowledge of preventive maintenance schedules | Personal Protective Equipment (PPE)<br>P&IDs<br>Electrical drawings<br>Loop sheets<br>Specification sheets<br>Control logic diagrams<br>Reference material<br>Site-specific safety procedures<br>Computerized maintenance programs<br>Job Safety Analysis (JSA)<br>Material Safety Data Sheets (MSDS)<br>Permits and area classifications<br>Data forms Hand tools<br>Volt-ohm meters<br>Hot sticks<br>Digital volt meter<br>Oscilloscope Multi-amp tester<br>Protocol communicator<br>Amp probe<br>Infrared camera<br>Non-contact voltage tester |

| **Occupational Title: Industrial Instrumentation and Controls Technician** | | | |
|---|---|---|---|
| **Critical Work Function 2. Maintain, calibrate, lubricate, clean and tune industrial control system equipment.** | | **Occupational Skills, Knowledge & Conditions** | |
| **Key Activity** | **Performance Criteria**<br>*How do we know when the key activity is performed well or performed successfully?* | **Occupational Skills & Knowledge**<br>*What should the technician know and what skills should the technician have in order to do the activity?* | **Conditions**<br>*What tools must the technician use in order to do the activity?* |
| 2.9 Maintain DCS, PLC and fieldbus process control networks. | 2.9.1 Work is performed to meet the requirements of company/manufacturer/Health, Safety and Environment work practices, specific application and area classification.<br>2.9.2 Process control network is adjusted according to the application.<br>2.9.3 Process control network is calibrated to engineering specifications with certified standards when applicable.<br>2.9.4 Physical inspection meets company/manufacturer/industry parameters.<br>2.9.5 Functional test meets company/manufacturer/industry standards.<br>2.9.6 Known inputs result in expected outputs as specified by the manufacturer.<br>2.9.7 Documentation is completed according to company guidelines. | Read and use process control network drawings<br>Read and use specification sheets<br>Use of reference material<br>Ability to learn new technology<br>Knowledge of equipment diagnostic indicators<br>Understand consequences of changes<br>Knowledge of preventive maintenance schedules | Process control network drawings<br>Specification sheets<br>Reference material |

## INDUSTRIAL INSTRUMENTATION AND CONTROLS TECHNICIAN SKILL STANDARDS

| **Occupational Title: Industrial Instrumentation and Controls Technician** | | | |
|---|---|---|---|
| **Critical Work Function 2. Maintain, calibrate, lubricate, clean and tune industrial control system equipment.** | | **Occupational Skills, Knowledge & Conditions** | |
| **Key Activity** | **Performance Criteria**<br>*How do we know when the key activity is performed well or performed successfully?* | **Occupational Skills & Knowledge**<br>*What should the technician know and what skills should the technician have in order to do the activity?* | **Conditions**<br>*What tools must the technician use in order to do the activity?* |
| 2.10 Maintain 600-volt or less motors and rotating equipment protection devices such as vibration monitoring and motor control relays. | 2.10.1 Work is performed to meet the requirements of company/manufacturer/Health, Safety and Environment work practices, specific application and area classification.<br>2.10.2 Physical inspection meets company/manufacturer/industry parameters.<br>2.10.3 Functional test meets company/manufacturer/industry standards.<br>2.10.4 Known inputs result in expected outputs as specified by the manufacturer.<br>2.10.5 Documentation is completed according to company guidelines. | Read and redline electrical drawings<br>Read and use specification sheets<br>Read and use control logic diagrams<br>Use of reference material<br>Use or conversion of electrical measurements<br>Knowledge of math<br>Electrical knowledge<br>Ability to learn new technology<br>Knowledge of computerized maintenance programs<br>Preparation of Job Safety Analysis<br>Knowledge of permits and area classifications<br>Proper use of hand tools<br>Read and use nameplate data<br>Calibrating vibration monitors<br>Understand consequences of changes<br>Knowledge of preventive maintenance schedules | Personal Protective Equipment (PPE)<br>Electrical drawings<br>Control logic diagrams<br>Specification sheets<br>Reference material<br>Site-specific safety procedures<br>Computerized maintenance programs<br>Job Safety Analysis (JSA)<br>Material Safety Data Sheets (MSDS)<br>Permits and area classifications<br>Data forms<br>Hand tools<br>Volt-ohm meters<br>Digital volt meter<br>Oscilloscope<br>Wobulator<br>Amp probe |

**Academic and Employability Knowledge and Skill Matrix for Critical Work Function 2**

*On a scale of 1 (lowest) to 5 (highest), identify the level of complexity required in each of these skills for the worker to perform the critical work function. Keep in mind that this scale is not for rating an individual's proficiency. It is intended only for rating the level of complexity required to do the work.*

| **Occupational Title: Industrial Instrumentation and Controls Technician** | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CWF 2: Maintain, calibrate, lubricate, clean and tune industrial control system equipment.** | | | | | | | | | | | | | | | | |
| Listening | Speaking | Using Information and Communication Technology | Gathering and analyzing Information | Analyzing and Solving Problems | Making Decisions and Judgments | Organizing and Planning | Using Social Skills | Adaptability | Working in Teams | Leading Others | Building Consensus | Self and Career Development | Writing | Reading | Mathematics | Science |
| 4 | 3 | 5 | 4 | 4 | 3 | 4 | 3 | 4 | 4 | 1 | 4 | 3 | 3 | 5 | 4 | 4 |

**Statement of Assessment for Critical Work Function 2:**

Tools: The assessment process should include the following.
Written tests that include:
1) True-false, multiple choice and essay questions that rely on extended responses to further clarify an understanding of the knowledge being assessed.
2) Graphic representations (e.g. P&IDs, loop drawings and one-line electrical drawings) that reveals an understanding of symbology and connections between processes and devices.
3) Preparation and justification of a reasonable solution to a problem scenario.

Hands-on demonstrations of knowledge, skills and attitudes that:
1) Represents a problematic or challenging situation in the context of a career-technical perspective.
2) Involves a real life scenario, problem or situation to solve.
3) Applies relevant knowledge or skills.
4) Focuses on the application of knowledge and skills learned in one situation as it connects to a new and different one.
5) Reveals an ability to plan, organize and create a product or an event.
6) Requires study to analyze or evaluate the problem or situation.
7) Illustrates by individual performance the attained levels of knowledge, skills and attitudes.
8) Includes observation of events, groups and individuals that focuses on the salient traits of the skill or attitude being observed.
9) Documentation of the development process from initial steps to final preparation.

| **Occupational Title: Industrial Instrumentation and Controls Technician** | | | |
|---|---|---|---|
| **Critical Work Function 3. Troubleshoot and diagnose malfunctions of industrial control system equipment.** | | **Occupational Skills, Knowledge & Conditions** | |
| **Key Activity** | **Performance Criteria**<br>*How do we know when the key activity is performed well or performed successfully?* | **Occupational Skills & Knowledge**<br>*What should the technician know and what skills should the technician have in order to do the activity?* | **Conditions**<br>*What tools must the technician use in order to do the activity?* |
| 3.1 Troubleshoot pneumatic, electronic and digital controllers, and remote telemetry units | 3.1.1 Work is performed to meet the requirements of company/manufacturer/Health, Safety and Environment work practices, specific application and area classification.<br>3.1.2 The point of deviation is identified where the known inputs result in unexpected outputs.<br>3.1.3 Source of malfunction is isolated.<br>3.1.4 Documentation is completed according to company guidelines. | Read and redline P&IDs<br>Read and use instrument loop sheets<br>Read and use specification sheets<br>Read and use ladder diagrams<br>Use of reference material<br>Knowledge of the controlled process<br>Knowledge of math<br>Knowledge of physics<br>Knowledge of basic electrical AC/DC theory<br>Ability to learn new technology<br>Knowledge of computerized maintenance programs<br>Knowledge of test equipment<br>Preparation of Job Safety Analysis<br>Knowledge of permits and area classifications<br>Proper use of hand tools<br>Tubing and wiring installation<br>Knowledge of controller schemes (e.g. PID, ratio, cascade, feedforward, etc.) | Personal Protective Equipment (PPE)<br>P&IDs<br>Loop sheets<br>Specification sheets<br>Ladder diagrams<br>Reference material<br>Site-specific safety procedures<br>Computerized maintenance programs<br>Job Safety Analysis (JSA)<br>Material Safety Data Sheets (MSDS)<br>Permits and area classifications<br>Data forms<br>Hand tools<br>Protocol communicator<br>Digital volt meter<br>Signal simulator |

| Occupational Title: Industrial Instrumentation and Controls Technician | | | |
|---|---|---|---|
| **Critical Work Function 3. Troubleshoot and diagnose malfunctions of industrial control system equipment.** | | **Occupational Skills, Knowledge & Conditions** | |
| **Key Activity** | **Performance Criteria**<br>*How do we know when the key activity is performed well or performed successfully?* | **Occupational Skills & Knowledge**<br>*What should the technician know and what skills should the technician have in order to do the activity?* | **Conditions**<br>*What tools must the technician use in order to do the activity?* |
| 3.2 Troubleshoot pneumatic, electronic and digital control valves, and self operated pressure regulators. | 3.2.1 Work is performed to meet the requirements of company/manufacturer/Health, Safety and Environment work practices, specific application and area classification.<br>3.2.2 The point of deviation is identified where the known inputs result in unexpected outputs.<br>3.2.3 Source of malfunction is isolated.<br>3.2.4 Documentation is completed according to company guidelines. | Read and redline P&IDs<br>Read and use instrument loop sheets<br>Read and use specification sheets<br>Use of reference material<br>Knowledge of math<br>Knowledge of the controlled process<br>Knowledge of basic electrical AC/DC theory<br>Ability to learn new technology<br>Knowledge of computerized maintenance programs<br>Knowledge of test equipment<br>Preparation of Job Safety Analysis<br>Knowledge of permits and area classifications Proper use of hand tools<br>Tubing and wiring installation<br>Knowledge of controller schemes (e.g. PID, ratio, cascade, feedforward, etc.) | Personal Protective Equipment (PPE)<br>P&IDs<br>Loop sheets<br>Specification sheets<br>Reference material<br>Site-specific safety procedures<br>Computerized maintenance programs<br>Job Safety Analysis (JSA)<br>Material Safety Data Sheets (MSDS)<br>Permits and area classifications<br>Data forms<br>Hand tools<br>Digital volt meter<br>Tubing and conduit benders<br>Protocol communicator<br>Signal simulator |

## INDUSTRIAL INSTRUMENTATION AND CONTROLS TECHNICIAN SKILL STANDARDS

| Occupational Title: Industrial Instrumentation and Controls Technician | | | |
|---|---|---|---|
| **Critical Work Function 3. Troubleshoot and diagnose malfunctions of industrial control system equipment.** | | **Occupational Skills, Knowledge & Conditions** | |
| **Key Activity** | **Performance Criteria**<br>*How do we know when the key activity is performed well or performed successfully?* | **Occupational Skills & Knowledge**<br>*What should the technician know and what skills should the technician have in order to do the activity?* | **Conditions**<br>*What tools must the technician use in order to do the activity?* |
| 3.3 Troubleshoot current to pneumatic (I/P), pneumatic to current (P/I), voltage to current (E/I), current to voltage (I/E), digital to analog, (D/A), and analog to digital (A/D) transducers. | 3.3.1 Work is performed to meet the requirements of company/manufacturer/Health, Safety and Environment work practices, specific application and area classification.<br>3.3.2 The point of deviation is identified where the known inputs result in unexpected outputs.<br>3.3.3 Source of malfunction is isolated.<br>3.3.4 Documentation is completed according to company guidelines. | Read and redline P&IDs<br>Read and use instrument loop sheets<br>Read and use specification sheets<br>Use of reference material<br>Knowledge of the controlled process<br>Knowledge of basic electrical AC/DC theory<br>Ability to learn new technology<br>Knowledge of computerized maintenance programs<br>Knowledge of test equipment<br>Preparation of Job Safety Analysis<br>Knowledge of permits and area classifications Proper use of hand tools<br>Tubing and wiring installation | Personal Protective Equipment (PPE)<br>P&IDs<br>Loop sheets<br>Specification sheets<br>Reference material<br>Site-specific safety procedures<br>Computerized maintenance programs<br>Job Safety Analysis (JSA)<br>Material Safety Data Sheets (MSDS)<br>Permits and area classifications<br>Data forms<br>Hand tools<br>Digital volt meter<br>Portable pressure tester<br>Signal simulator |

| Occupational Title: Industrial Instrumentation and Controls Technician | | | |
|---|---|---|---|
| **Critical Work Function 3. Troubleshoot and diagnose malfunctions of industrial control system equipment.** | | **Occupational Skills, Knowledge & Conditions** | |
| **Key Activity** | **Performance Criteria**<br>*How do we know when the key activity is performed well or performed successfully?* | **Occupational Skills & Knowledge**<br>*What should the technician know and what skills should the technician have in order to do the activity?* | **Conditions**<br>*What tools must the technician use in order to do the activity?* |
| 3.4 Troubleshoot pneumatic, electronic and digital transmitters and measuring devices. | 3.4.1 Work is performed to meet the requirements of company/manufacturer/Health, Safety and Environment work practices, specific application and area classification.<br>3.4.2 The point of deviation is identified where the known inputs result in unexpected outputs.<br>3.4.3 Source of malfunction is isolated.<br>3.4.4 Documentation is completed according to company guidelines. | Read and redline P&IDs<br>Read and use instrument loop sheets<br>Read and use specification sheets<br>Use of reference material<br>Knowledge of the controlled process<br>Knowledge of math<br>Knowledge of physics<br>Knowledge of basic electrical AC/DC theory<br>Ability to learn new technology<br>Knowledge of computerized maintenance programs<br>Knowledge of test equipment<br>Preparation of Job Safety Analysis<br>Knowledge of permits and area classifications Proper use of hand tools<br>Tubing and wiring installation<br>Knowledge of piping specifications Configuration and calibration knowledge | Personal Protective Equipment (PPE)<br>P&IDs<br>Loop sheets<br>Specification sheets<br>Reference material<br>Site-specific safety procedures Computerized maintenance programs<br>Job Safety Analysis (JSA)<br>Material Safety Data Sheets (MSDS) Permits and area classifications<br>Data forms<br>Hand tools<br>Test equipment<br>Tubing and conduit benders<br>Digital volt meter<br>Portable pressure tester<br>Protocol communicator<br>Signal simulator<br>Temperature calibration equipment |

# INDUSTRIAL INSTRUMENTATION AND CONTROLS TECHNICIAN SKILL STANDARDS

| **Occupational Title: Industrial Instrumentation and Controls Technician** | | | |
|---|---|---|---|
| **Critical Work Function 3. Troubleshoot and diagnose malfunctions of industrial control system equipment.** | | **Occupational Skills, Knowledge & Conditions** | |
| **Key Activity** | **Performance Criteria**<br>*How do we know when the key activity is performed well or performed successfully?* | **Occupational Skills & Knowledge**<br>*What should the technician know and what skills should the technician have in order to do the activity?* | **Conditions**<br>*What tools must the technician use in order to do the activity?* |
| 3.5 Troubleshoot pneumatic, electronic and digital relays and alarm panels. | 3.5.1 Work is performed to meet the requirements of company/manufacturer/Health, Safety and Environment work practices, specific application and area classification.<br>3.5.2 The point of deviation is identified where the known inputs result in unexpected outputs.<br>3.5.3 Source of malfunction is isolated.<br>3.5.4 Documentation is completed according to company guidelines. | Read and redline P&IDs<br>Read and use instrument loop sheets<br>Read and use specification sheets<br>Use of reference material<br>Knowledge of the controlled process<br>Knowledge of basic electrical AC/DC theory Ability to learn new technology<br>Knowledge of computerized maintenance programs<br>Knowledge of test equipment<br>Preparation of Job Safety Analysis<br>Knowledge of permits and area classifications Proper use of hand tools<br>Tubing and wiring installation | Personal Protective Equipment (PPE)<br>P&IDs<br>Loop sheets<br>Specification sheets<br>Reference material<br>Site-specific safety procedures<br>Computerized maintenance programs<br>Job Safety Analysis (JSA)<br>Material Safety Data Sheets (MSDS)<br>Permits and area classifications<br>Data forms<br>Hand tools<br>Digital volt meter<br>Portable pressure tester |

| Occupational Title: Industrial Instrumentation and Controls Technician | | | |
|---|---|---|---|
| **Critical Work Function 3. Troubleshoot and diagnose malfunctions of industrial control system equipment.** | | **Occupational Skills, Knowledge & Conditions** | |
| **Key Activity** | **Performance Criteria**<br>*How do we know when the key activity is performed well or performed successfully?* | **Occupational Skills & Knowledge**<br>*What should the technician know and what skills should the technician have in order to do the activity?* | **Conditions**<br>*What tools must the technician use in order to do the activity?* |
| 3.6 Troubleshoot pH, conductivity, gas chromatograph, turbidity, infrared, combustible, ultraviolet, oxygen, lower explosive limit and other analyzers and sample systems. | 3.6.1 Work is performed to meet the requirements of company/manufacturer/Health, Safety and Environment work practices, specific application and area classification.<br>3.6.2 The point of deviation is identified where the known inputs result in unexpected outputs.<br>3.6.3 Source of malfunction is isolated.<br>3.6.4 Documentation is completed according to company guidelines. | Read and redline P&IDs<br>Read and use instrument loop sheets<br>Read and use specification sheets<br>Read and use control logic diagrams<br>Use of reference material<br>Use or conversion of measurements to the metric system<br>Knowledge of the controlled process<br>Knowledge of math<br>Knowledge of chemistry<br>Knowledge of physics<br>Knowledge of basic electrical AC/DC theory<br>Ability to learn new technology<br>Knowledge of computerized maintenance programs<br>Preparation of Job Safety Analysis<br>Knowledge of permits and area classifications<br>Proper use of hand tools<br>Knowledge of analyzer specific calibration equipment<br>Knowledge of environmental, regulatory, service requirements and consequences of sample release<br>Ability to interpret calibration results<br>Calibration and configuration knowledge<br>Knowledge of standards (I.e. gases, buffers, samples, color charts, etc.)<br>Tubing and wiring installation | Personal Protective Equipment (PPE)<br>P&IDs<br>Loop sheets<br>Specification sheets<br>Control logic diagrams<br>Reference material<br>Site-specific safety procedures<br>Computerized maintenance programs<br>Job Safety Analysis (JSA)<br>Material Safety Data Sheets (MSDS)<br>Permits and area classifications<br>Data forms<br>Hand tools<br>Tubing and conduit benders<br>Protocol communicator<br>Analyzer specific calibration standards<br>Screens, filters, and bottles<br>Analyzer specific calibration equipment |

| Occupational Title: Industrial Instrumentation and Controls Technician | | | |
|---|---|---|---|
| **Critical Work Function 3. Troubleshoot and diagnose malfunctions of industrial control system equipment.** | | **Occupational Skills, Knowledge & Conditions** | |
| **Key Activity** | **Performance Criteria**<br>*How do we know when the key activity is performed well or performed successfully?* | **Occupational Skills & Knowledge**<br>*What should the technician know and what skills should the technician have in order to do the activity?* | **Conditions**<br>*What tools must the technician use in order to do the activity?* |
| 3.7 Troubleshoot pneumatic, electronic and digital switches. | 3.7.1 Work is performed to meet the requirements of company/manufacturer/Health, Safety and Environment work practices, specific application and area classification.<br>3.7.2 The point of deviation is identified where the known inputs result in unexpected outputs.<br>3.7.3 Source of malfunction is isolated.<br>3.7.4 Documentation is completed according to company guidelines. | Read and redline P&IDs<br>Read and use instrument loop sheets<br>Read and use specification sheets<br>Use of reference material<br>Knowledge of the controlled process<br>Knowledge of basic electrical AC/DC theory<br>Ability to learn new technology<br>Knowledge of computerized maintenance programs<br>Knowledge of test equipment<br>Preparation of Job Safety Analysis<br>Knowledge of permits and area classifications<br>Proper use of hand tools<br>Tubing and wiring installation | Personal Protective Equipment (PPE)<br>P&IDs<br>Loop sheets<br>Specification sheets<br>Reference material<br>Site-specific safety procedures<br>Computerized maintenance programs<br>Job Safety Analysis (JSA)<br>Material Safety Data Sheets (MSDS)<br>Permits and area classifications<br>Data forms<br>Hand tools<br>Digital volt meter<br>Portable pressure tester |

| Occupational Title: Industrial Instrumentation and Controls Technician | | | |
|---|---|---|---|
| **Critical Work Function 3. Troubleshoot and diagnose malfunctions of industrial control system equipment.** | | **Occupational Skills, Knowledge & Conditions** | |
| **Key Activity** | **Performance Criteria**<br>*How do we know when the key activity is performed well or performed successfully?* | **Occupational Skills & Knowledge**<br>*What should the technician know and what skills should the technician have in order to do the activity?* | **Conditions**<br>*What tools must the technician use in order to do the activity?* |
| 3.8 Troubleshoot electronic, digital and variable frequency drive (VFD) or variable speed drive (VSD) motor controllers. | 3.8.1 Work is performed to meet the requirements of company/manufacturer/Health, Safety and Environment work practices, specific application and area classification.<br>3.8.2 The point of deviation is identified where the known inputs result in unexpected outputs.<br>3.8.3 Source of malfunction is isolated.<br>3.8.4 Documentation is completed according to company guidelines. | Read and redline P&IDs<br>Read and use electrical drawings<br>Read and use instrument loop sheets<br>Read and use specification sheets<br>Read and use control logic diagrams<br>Use of reference material<br>Knowledge of the controlled process<br>Knowledge of math<br>Electrical knowledge<br>Motor control circuit knowledge<br>Knowledge of gated power devices (SCR, triacs, etc.)<br>Ability to learn new technology<br>Knowledge of computerized maintenance programs<br>Preparation of Job Safety Analysis<br>Knowledge of permits and area classifications<br>Proper use of hand tools<br>Knowledge of electrical wiring<br>Knowledge of electrical test equipment<br>Knowledge of configuration requirements | Personal Protective Equipment (PPE)<br>P&IDs<br>Electrical drawings<br>Loop sheets<br>Specification sheets<br>Control logic diagrams<br>Reference material<br>Site-specific safety procedures<br>Computerized maintenance programs<br>Job Safety Analysis (JSA)<br>Material Safety Data Sheets (MSDS)<br>Permits and area classifications<br>Data forms<br>Hand tools<br>Volt-ohm meter<br>Hot sticks<br>Digital volt meter<br>Oscilloscope<br>Hypot tester<br>Multi-amp tester<br>Protocol communicator<br>Megohm meter<br>Amp probe<br>Infrared camera<br>Signal simulator<br>Non-contact voltage tester<br>Power quality monitor |

| Occupational Title: Industrial Instrumentation and Controls Technician | | | |
|---|---|---|---|
| **Critical Work Function 3. Troubleshoot and diagnose malfunctions of industrial control system equipment.** | | **Occupational Skills, Knowledge & Conditions** | |
| **Key Activity** | **Performance Criteria**<br>*How do we know when the key activity is performed well or performed successfully?* | **Occupational Skills & Knowledge**<br>*What should the technician know and what skills should the technician have in order to do the activity?* | **Conditions**<br>*What tools must the technician use in order to do the activity?* |
| 3.9 Troubleshoot DCS, PLC and fieldbus process control networks. | 3.9.1 Work is performed to meet the requirements of company/manufacturer/Health, Safety and Environment work practices, specific application and area classification.<br>3.9.2 The point of deviation is identified where the known inputs result in unexpected outputs.<br>3.9.3 Source of malfunction is isolated.<br>3.9.4 Documentation is completed according to company guidelines. | Read and use process control network drawings<br>Read and use specification sheets<br>Use of reference material<br>Knowledge of the controlled process<br>Knowledge of basic electrical AC/DC theory<br>Ability to learn new technology<br>Knowledge of computerized maintenance programs<br>Knowledge of test equipment<br>Preparation of Job Safety Analysis<br>Knowledge of permits and area classifications<br>Proper use of hand tools<br>Knowledge of industrial communication protocols<br>Knowledge of cable connector requirements<br>Knowledge of equipment diagnostic indicators | Personal Protective Equipment (PPE)<br>Process control network drawings<br>Specification sheets<br>Reference material<br>Site-specific safety procedures<br>Computerized maintenance programs<br>Job Safety Analysis (JSA)<br>Data forms<br>Hand tools<br>Digital volt meter<br>Oscilloscope<br>Protocol analyzer<br>Cable testers |

| Occupational Title: Industrial Instrumentation and Controls Technician | | | |
|---|---|---|---|
| **Critical Work Function 3. Troubleshoot and diagnose malfunctions of industrial control system equipment.** | | **Occupational Skills, Knowledge & Conditions** | |
| **Key Activity** | **Performance Criteria**<br>*How do we know when the key activity is performed well or performed successfully?* | **Occupational Skills & Knowledge**<br>*What should the technician know and what skills should the technician have in order to do the activity?* | **Conditions**<br>*What tools must the technician use in order to do the activity?* |
| 3.10 Troubleshoot 600-volt or less motors and rotating equipment protection devices such as vibration monitoring and motor control relays. | 3.10.1 Work is performed to meet the requirements of company/manufacturer/Health, Safety and Environment work practices, specific application and area classification.<br>3.10.2 The point of deviation is identified where the known inputs result in unexpected outputs.<br>3.10.3 Source of malfunction is isolated.<br>3.10.4 Documentation is completed according to company guidelines. | Read and redline electrical drawings<br>Read and use specification sheets<br>Read and use control logic diagrams<br>Use of reference material<br>Use or conversion of electrical measurements<br>Knowledge of the controlled process<br>Knowledge of math<br>Knowledge of physics (force and power)<br>Electrical knowledge<br>Motor control circuit knowledge<br>Ability to learn new technology<br>Knowledge of computerized maintenance programs<br>Preparation of Job Safety Analysis<br>Knowledge of national electric code<br>Knowledge of phasing and motor rotation<br>Read and use nameplate data<br>Calibrating vibration monitors<br>Knowledge of megger tests<br>Knowledge of bridge tests<br>knowledge of power quality | Personal Protective Equipment (PPE)<br>Electrical drawings<br>Specification sheets<br>Motor control logic diagrams<br>Reference material<br>Site-specific safety procedures<br>Computerized maintenance programs<br>Job Safety Analysis (JSA)<br>Material Safety Data Sheets (MSDS)<br>Permits and area classifications<br>Data forms<br>Hand tools<br>Volt-ohm meter<br>Digital volt meter<br>Oscilloscope<br>Wobulator<br>Hypot tester<br>Multi-amp tester<br>Megohm meter<br>Amp probe<br>Infrared camera<br>Non-contact voltage tester |

**Academic and Employability Knowledge and Skill Matrix for Critical Work Function 3**

*On a scale of 1 (lowest) to 5 (highest), identify the level of complexity required in each of these skills for the worker to perform the critical work function. Keep in mind that this scale is not for rating an individual's proficiency. It is intended only for rating the level of complexity required to do the work.*

| **Occupational Title: Industrial Instrumentation and Controls Technician** | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CWF 3 Troubleshoot and diagnose malfunctions of industrial control system equipment** | | | | | | | | | | | | | | | | |
| Listening | Speaking | Using Information and Communication Technology | Gathering and analyzing Information | Analyzing and Solving Problems | Making Decisions and Judgments | Organizing and Planning | Using Social Skills | Adaptability | Working in Teams | Leading Others | Building Consensus | Self and Career Development | Writing | Reading | Mathematics | Science |
| 4 | 4 | 4 | 5 | 5 | 4 | 5 | 4 | 4 | 5 | 1 | 5 | 3 | 3 | 5 | 4 | 5 |

**Statement of Assessment for Critical Work Function 3**

Tools: The assessment process should include the following.

Written tests that include:
1) True-false, multiple choice and essay questions that rely on extended responses to further clarify an understanding of the knowledge being assessed.
2) Graphic representations (e.g. P&IDs, loop drawings and one-line electrical drawings) that reveals an understanding of symbology and connections between processes and devices.
3) Preparation and justification of a reasonable solution to a problem scenario.

Hands-on demonstrations of knowledge, skills and attitudes that:
1) Represents a problematic or challenging situation in the context of a career-technical perspective.
2) Involves a real life scenario, problem or situation to solve.
3) Applies relevant knowledge or skills.
4) Focuses on the application of knowledge and skills learned in one situation as it connects to a new and different one.
5) Reveals an ability to plan, organize and create a product or an event.
6) Requires study to analyze or evaluate the problem or situation.
7) Illustrates by individual performance the attained levels of knowledge, skills and attitudes.
8) Includes observation of events, groups and individuals that focuses on the salient traits of the skill or attitude being observed.

| Occupational Title: Industrial Instrumentation and Controls Technician | | | |
|---|---|---|---|
| **Critical Work Function 4. Repair or replace malfunctioning industrial control system equipment.** | | **Occupational Skills, Knowledge & Conditions** | |
| **Key Activity** | **Performance Criteria**<br>*How do we know when the key activity is performed well or performed successfully?* | **Occupational Skills & Knowledge**<br>*What should the technician know and what skills should the technician have in order to do the activity?* | **Conditions**<br>*What tools must the technician use in order to do the activity?* |
| 4.1 Repair or replace pneumatic, electronic and digital controllers, and remote telemetry units. | 4.1.1 Corrective repairs are performed according to job scope, company/manufacturer/Health, Safety and Environment work practices, specific application and area classification.<br>4.1.2 Physical inspection meets company/manufacturer/industry parameters.<br>4.1.3 Configuration is verified according to the application.<br>4.1.4 Calibration is verified according to engineering specifications with certified standards when applicable.<br>4.1.5 Functional test meets company/manufacturer/industry standards.<br>4.1.6 Known inputs result in expected outputs as specified by the manufacturer.<br>4.1.7 Documentation is completed according to company guidelines. | Read and redline P&IDs<br>Read and use instrument loop sheets<br>Read and use specification sheets<br>Read and use ladder logic diagrams<br>Use of reference material<br>Knowledge of math<br>Knowledge of basic electrical AC/DC theory Ability to learn new technology<br>Knowledge of computerized maintenance programs<br>Knowledge of test equipment<br>Preparation of Job Safety Analysis<br>Knowledge of permits and area classifications<br>Proper use of hand tools<br>Tubing and wiring installation<br>Knowledge of controller schemes (e.g. PID, ratio, cascade, feedforward, etc.)<br>Knowledge of management of change process | Personal Protective Equipment (PPE)<br>P&IDs<br>Loop sheets<br>Specification sheets<br>Ladder logic diagrams<br>Reference material<br>Site-specific safety procedures<br>Computerized maintenance programs<br>Job Safety Analysis (JSA)<br>Material Safety Data Sheets (MSDS)<br>Permits and area classifications<br>Data forms<br>Hand tools<br>Digital volt meter<br>Tubing and conduit benders<br>Protocol communicator<br>Hand tools |

| Occupational Title: Industrial Instrumentation and Controls Technician | | | |
|---|---|---|---|
| **Critical Work Function 4. Repair or replace malfunctioning industrial control system equipment.** | | **Occupational Skills, Knowledge & Conditions** | |
| **Key Activity** | **Performance Criteria**<br>*How do we know when the key activity is performed well or performed successfully?* | **Occupational Skills & Knowledge**<br>*What should the technician know and what skills should the technician have in order to do the activity?* | **Conditions**<br>*What tools must the technician use in order to do the activity?* |
| 4.2 Repair or replace pneumatic, electronic and digital control valves, and self operated pressure regulators. | 4.2.1 Corrective repairs are performed according to job scope, company/manufacturer/Health, Safety and Environment work practices, specific application and area classification.<br>4.2.2 Physical inspection meets company/manufacturer/industry parameters.<br>4.2.3 Configuration is verified according to the application.<br>4.2.4 Calibration is verified according to engineering specifications with certified standards when applicable.<br>4.2.5 Functional test meets company/manufacturer/industry standards.<br>4.2.6 Known inputs result in expected outputs as specified by the manufacturer.<br>4.2.7 Documentation is completed according to company guidelines. | Read and redline P&IDs<br>Read and use instrument loop sheets<br>Read and use specification sheets<br>Use of reference material<br>Knowledge of math<br>Knowledge of chemistry<br>Knowledge of basic electrical AC/DC theory<br>Ability to learn new technology<br>Knowledge of computerized maintenance programs<br>Knowledge of test equipment<br>Preparation of Job Safety Analysis<br>Knowledge of permits and area classifications<br>Proper use of hand tools<br>Tubing and wiring installation<br>Knowledge of controller schemes (e.g. PID, ratio, cascade, feedforward, etc.)<br>Knowledge of management of change process<br>Knowledge of piping specifications | Personal Protective Equipment (PPE)<br>P&IDs<br>Loop sheets<br>Specification sheets<br>Reference material<br>Site-specific safety procedures<br>Computerized maintenance programs<br>Job Safety Analysis (JSA)<br>Material Safety Data Sheets (MSDS)<br>Permits and area classifications<br>Data forms<br>Hand tools<br>Digital volt meter<br>Tubing and conduit benders<br>Protocol communicator<br>Signal simulator |

| Occupational Title: Industrial Instrumentation and Controls Technician | | | |
|---|---|---|---|
| **Critical Work Function 4. Repair or replace malfunctioning industrial control system equipment.** | | **Occupational Skills, Knowledge & Conditions** | |
| **Key Activity** | **Performance Criteria**<br>*How do we know when the key activity is performed well or performed successfully?* | **Occupational Skills & Knowledge**<br>*What should the technician know and what skills should the technician have in order to do the activity?* | **Conditions**<br>*What tools must the technician use in order to do the activity?* |
| 4.3 Repair or replace current to pneumatic (I/P), pneumatic to current (P/I), voltage to current (E/I), current to voltage (I/E), digital to analog, (D/A), and analog to digital (A/D) transducers. | 4.3.1 Corrective repairs are performed according to job scope, company/manufacturer/Health, Safety and Environment work practices, specific application and area classification.<br>4.3.2 Physical inspection meets company/manufacturer/industry parameters.<br>4.3.3 Configuration is verified according to the application.<br>4.3.4 Calibration is verified according to engineering specifications with certified standards when applicable.<br>4.3.5 Functional test meets company/manufacturer/industry standards.<br>4.3.6 Known inputs result in expected outputs as specified by the manufacturer.<br>4.3.7 Documentation is completed according to company guidelines. | Read and redline P&IDs<br>Read and use instrument loop sheets<br>Read and use specification sheets<br>Use of reference material<br>Knowledge of basic electrical AC/DC theory<br>Ability to learn new technology<br>Knowledge of computerized maintenance programs<br>Knowledge of test equipment<br>Preparation of Job Safety Analysis<br>Knowledge of permits and area classifications<br>Proper use of hand tools<br>Tubing and wiring installation<br>Knowledge of management of change process | Personal Protective Equipment (PPE)<br>P&IDs Loop sheets<br>Specification sheets<br>Reference material<br>Site-specific safety procedures<br>Computerized maintenance programs<br>Job Safety Analysis (JSA)<br>Material Safety Data Sheets (MSDS)<br>Permits and area classifications<br>Data forms<br>Hand tools<br>Digital volt meter<br>Portable pressure tester signal simulator |

| Occupational Title: Industrial Instrumentation and Controls Technician | | | |
|---|---|---|---|
| **Critical Work Function 4. Repair or replace malfunctioning industrial control system equipment.** | | **Occupational Skills, Knowledge & Conditions** | |
| **Key Activity** | **Performance Criteria**<br>*How do we know when the key activity is performed well or performed successfully?* | **Occupational Skills & Knowledge**<br>*What should the technician know and what skills should the technician have in order to do the activity?* | **Conditions**<br>*What tools must the technician use in order to do the activity?* |
| 4.4 Repair or replace pneumatic, electronic and digital transmitters and measuring devices. | 4.4.1 Corrective repairs are performed according to job scope, company/manufacturer/Health, Safety and Environment work practices, specific application and area classification.<br>4.4.2 Physical inspection meets company/manufacturer/industry parameters.<br>4.4.3 Configuration is verified according to the application.<br>4.4.4 Calibration is verified according to engineering specifications with certified standards when applicable.<br>4.4.5 Functional test meets company/manufacturer/industry standards.<br>4.4.6 Known inputs result in expected outputs as specified by the manufacturer.<br>4.4.7 Documentation is completed according to company guidelines. | Read and redline P&IDs<br>Read and use instrument loop sheets<br>Read and use specification sheets<br>Use of reference material<br>Use or conversion of measurements to the metric system<br>Knowledge of math<br>Knowledge of physics<br>Knowledge of basic electrical AC/DC theory<br>Ability to learn new technology<br>Knowledge of computerized maintenance programs<br>Knowledge of test equipment<br>Preparation of Job Safety Analysis<br>Knowledge of permits and area classifications<br>Proper use of hand tools<br>Knowledge of management of change process<br>Tubing and wiring installation<br>Knowledge of piping specifications<br>Configuration and calibration knowledge | Personal Protective Equipment (PPE)<br>P&IDs<br>Loop sheets<br>Specification sheets<br>Reference material<br>Site-specific safety procedures<br>Computerized maintenance programs<br>Job Safety Analysis (JSA)<br>Material Safety Data Sheets (MSDS)<br>Permits and area classifications<br>Data forms<br>Hand tools<br>Test equipment<br>Tubing and conduit benders<br>Digital volt meter<br>Portable pressure tester<br>Protocol communicator<br>Signal simulator<br>Temperature calibration equipment |

| Occupational Title: Industrial Instrumentation and Controls Technician | | | |
|---|---|---|---|
| **Critical Work Function 4. Repair or replace malfunctioning industrial control system equipment.** | | **Occupational Skills, Knowledge & Conditions** | |
| **Key Activity** | **Performance Criteria**<br>*How do we know when the key activity is performed well or performed successfully?* | **Occupational Skills & Knowledge**<br>*What should the technician know and what skills should the technician have in order to do the activity?* | **Conditions**<br>*What tools must the technician use in order to do the activity?* |
| 4.5 Repair or replace pneumatic, electronic and digital relays and alarm panels. | 4.5.1 Corrective repairs are performed according to job scope, company/manufacturer/Health, Safety and Environment work practices, specific application and area classification.<br>4.5.2 Physical inspection meets company/manufacturer/industry parameters.<br>4.5.3 Configuration is verified according to the application.<br>4.5.4 Calibration is verified according to engineering specifications with certified standards when applicable.<br>4.5.5 Functional test meets company/manufacturer/industry standards.<br>4.5.6 Known inputs result in expected outputs as specified by the manufacturer.<br>4.5.7 Documentation is completed according to company guidelines. | Read and redline P&IDs<br>Read and use instrument loop sheets<br>Read and use specification sheets<br>Use of reference material<br>Knowledge of solid state electronics<br>Knowledge of basic electrical AC/DC theory<br>Ability to learn new technology<br>Knowledge of computerized maintenance programs<br>Knowledge of test equipment<br>Preparation of Job Safety Analysis<br>Knowledge of permits and area classifications<br>Proper use of hand tools<br>Tubing and wiring installation<br>Knowledge of management of change process | Personal Protective Equipment (PPE)<br>P&IDs<br>Loop sheets<br>Specification sheets<br>Reference material<br>Site-specific safety procedures<br>Computerized maintenance programs<br>Job Safety Analysis (JSA)<br>Material Safety Data Sheets (MSDS)<br>Permits and area classifications<br>Data forms<br>Hand tools<br>Digital volt meter<br>Portable pressure tester |

| Occupational Title: Industrial Instrumentation and Controls Technician | | | |
|---|---|---|---|
| **Critical Work Function 4. Repair or replace malfunctioning industrial control system equipment.** | | **Occupational Skills, Knowledge & Conditions** | |
| **Key Activity** | **Performance Criteria**<br>*How do we know when the key activity is performed well or performed successfully?* | **Occupational Skills & Knowledge**<br>*What should the technician know and what skills should the technician have in order to do the activity?* | **Conditions**<br>*What tools must the technician use in order to do the activity?* |
| 4.6 Repair or replace pH, conductivity, gas chromatograph, turbidity, infrared, combustible, ultraviolet, oxygen, lower explosive limit and other analyzers and sample systems. | 4.6.1 Corrective repairs are performed according to job scope, company/manufacturer/Health, Safety and Environment work practices, specific application and area classification.<br>4.6.2 Physical inspection meets company/manufacturer/industry parameters.<br>4.6.3 Configuration is verified according to the application.<br>4.6.4 Calibration is verified according to engineering specifications with certified standards when applicable.<br>4.6.5 Functional test meets company/manufacturer/industry standards.<br>4.6.6 Known inputs result in expected outputs as specified by the manufacturer.<br>4.6.7 Documentation is completed according to company guidelines. | Read and redline P&IDs<br>Read and use instrument loop sheets<br>Read and use specification sheets<br>Read and use control logic diagrams<br>Use of reference material<br>Use or conversion of measurements to the metric system<br>Knowledge of the controlled process<br>Knowledge of math<br>Knowledge of physics<br>Knowledge of basic electrical AC/DC theory<br>Ability to learn new technology<br>Knowledge of computerized maintenance programs<br>Knowledge of test equipment<br>Preparation of Job Safety Analysis<br>Knowledge of permits and area classifications<br>Proper use of hand tools<br>Knowledge of management of change process<br>Knowledge of analyzer specific calibration equipment<br>Knowledge of environmental, regulatory, service requirements and consequences of sample release<br>Ability to interpret calibration results<br>Calibration and configuration knowledge<br>Knowledge of standards (I.e. gases, buffers, samples, color charts, etc.)<br>Tubing and wiring installation | Personal Protective Equipment (PPE)<br>P&IDs<br>Loop sheets<br>Specification sheets<br>Control logic diagrams<br>Reference material<br>Site-specific safety procedures<br>Computerized maintenance programs<br>Job Safety Analysis (JSA)<br>Material Safety Data Sheets (MSDS)<br>Permits and area classifications<br>Data forms<br>Hand tools<br>Protocol communicator<br>Tubing and conduit benders<br>Analyzer specific calibration standards<br>Screens, filters, and bottles<br>Analyzer specific calibration equipment |

| Occupational Title: Industrial Instrumentation and Controls Technician | | | |
|---|---|---|---|
| **Critical Work Function 4. Repair or replace malfunctioning industrial control system equipment.** | | **Occupational Skills, Knowledge & Conditions** | |
| **Key Activity** | **Performance Criteria**<br>*How do we know when the key activity is performed well or performed successfully?* | **Occupational Skills & Knowledge**<br>*What should the technician know and what skills should the technician have in order to do the activity?* | **Conditions**<br>*What tools must the technician use in order to do the activity?* |
| 4.7 Repair or replace pneumatic, electronic and digital switches. | 4.7.1 Corrective repairs are performed according to job scope, company/manufacturer/Health, Safety and Environment work practices, specific application and area classification.<br>4.7.2 Physical inspection meets company/manufacturer/industry parameters.<br>4.7.3 Configuration is verified according to the application.<br>4.7.4 Calibration is verified according to engineering specifications with certified standards when applicable.<br>4.7.5 Functional test meets company/manufacturer/industry standards.<br>4.7.6 Known inputs result in expected outputs as specified by the manufacturer.<br>4.7.7 Documentation is completed according to company guidelines. | Read and redline P&IDs<br>Read and use instrument loop sheets<br>Read and use specification sheets<br>Use of reference material<br>Knowledge of solid state electronics<br>Knowledge of basic electrical AC/DC theory<br>Ability to learn new technology<br>Knowledge of computerized maintenance programs<br>Knowledge of test equipment<br>Preparation of Job Safety Analysis<br>Knowledge of permits and area classifications<br>Proper use of hand tools<br>Tubing and wiring installation<br>Knowledge of management of change process | Personal Protective Equipment (PPE)<br>P&IDs<br>Loop sheets<br>Specification sheets<br>Reference material<br>Site-specific safety procedures<br>Computerized maintenance programs<br>Job Safety Analysis (JSA)<br>Material Safety Data Sheets (MSDS)<br>Permits and area classifications<br>Data forms<br>Hand tools Digital volt meter<br>Portable pressure tester |

| Occupational Title: Industrial Instrumentation and Controls Technician | | | |
|---|---|---|---|
| **Critical Work Function 4. Repair or replace malfunctioning industrial control system equipment.** | | **Occupational Skills, Knowledge & Conditions** | |
| **Key Activity** | **Performance Criteria**<br>*How do we know when the key activity is performed well or performed successfully?* | **Occupational Skills & Knowledge**<br>*What should the technician know and what skills should the technician have in order to do the activity?* | **Conditions**<br>*What tools must the technician use in order to do the activity?* |
| 4.8 Repair or replace electronic, digital and variable frequency drive (VFD) or variable speed drive (VSD) motor controllers. | 4.8.1 Corrective repairs are performed according to job scope, company/manufacturer/Health, Safety and Environment work practices, specific application and area classification.<br>4.8.2 Physical inspection meets company/manufacturer/industry parameters.<br>4.8.3 Configuration is verified according to the application.<br>4.8.4 Calibration is verified according to engineering specifications with certified standards when applicable.<br>4.8.5 Functional test meets company/manufacturer/industry standards.<br>4.8.6 Known inputs result in expected outputs as specified by the manufacturer.<br>4.8.7 Documentation is completed according to company guidelines. | Read and redline P&IDs<br>Read and redline electrical drawings<br>Read and use instrument loop sheets<br>Read and use specification sheets<br>Read and use control logic diagrams<br>Use of reference material<br>Knowledge of math<br>Electrical knowledge<br>Motor control circuit knowledge<br>Knowledge of gated power devices (SCR, triacs, etc.)<br>Ability to learn new technology<br>Knowledge of computerized maintenance programs<br>Preparation of Job Safety Analysis<br>Knowledge of permits and area classifications<br>Proper use of hand tools<br>Knowledge of electrical wiring<br>Knowledge of electrical test equipment<br>Knowledge of configuration requirements<br>Knowledge of management of change process | Personal Protective Equipment (PPE)<br>P&IDs<br>Electrical drawings<br>Loop sheets<br>Specification sheets<br>Control logic diagrams<br>Reference material<br>Site-specific safety procedures<br>Computerized maintenance programs<br>Job Safety Analysis (JSA)<br>Material Safety Data Sheets (MSDS)<br>Permits and area classifications<br>Data forms<br>Hand tools<br>Volt-ohm meter<br>Hot sticks<br>Digital volt meter<br>Oscilloscope<br>Tubing and conduit benders<br>Hypot tester<br>Multi-amp tester<br>Protocol communicator<br>Megohm meter<br>Amp probe<br>Phase comparison tester<br>Signal simulator<br>Non-contact voltage tester |

| Occupational Title: Industrial Instrumentation and Controls Technician | | | |
|---|---|---|---|
| **Critical Work Function 4. Repair or replace malfunctioning industrial control system equipment.** | | **Occupational Skills, Knowledge & Conditions** | |
| **Key Activity** | **Performance Criteria**<br>*How do we know when the key activity is performed well or performed successfully?* | **Occupational Skills & Knowledge**<br>*What should the technician know and what skills should the technician have in order to do the activity?* | **Conditions**<br>*What tools must the technician use in order to do the activity?* |
| 4.9 Repair or replace DCS, PLC and fieldbus process control networks. | 4.9.1 Corrective repairs are performed according to job scope, company/manufacturer/Health, Safety and Environment work practices, specific application and area classification.<br>4.9.2 Physical inspection meets company/manufacturer/industry parameters.<br>4.9.3 Configuration is verified according to the application.<br>4.9.4 Calibration is verified according to engineering specifications with certified standards when applicable.<br>4.9.5 Functional test meets company/manufacturer/industry standards.<br>4.9.6 Known inputs result in expected outputs as specified by the manufacturer.<br>4.9.7 Documentation is completed according to company guidelines. | Read and redline P&IDs<br>Read and redline PC network drawings<br>Read and use specification sheets<br>Use of reference material<br>Knowledge of basic electrical AC/DC theory<br>Ability to learn new technology<br>Knowledge of computerized maintenance programs<br>Knowledge of test equipment<br>Preparation of Job Safety Analysis<br>Knowledge of industrial communication protocols<br>Knowledge of cable connector requirements<br>Knowledge of management of change process | Personal Protective Equipment (PPE)<br>P&IDs<br>PC network drawings<br>Specification sheets<br>Reference material<br>Site-specific safety procedures<br>Computerized maintenance programs<br>Job Safety Analysis (JSA)<br>Data forms<br>Hand tools<br>Digital volt meter<br>Oscilloscope<br>Protocol analyzer<br>Cable tester |

| Occupational Title: Industrial Instrumentation and Controls Technician | | | |
|---|---|---|---|
| **Critical Work Function 4. Repair or replace malfunctioning industrial control system equipment.** | | **Occupational Skills, Knowledge & Conditions** | |
| **Key Activity** | **Performance Criteria**<br>*How do we know when the key activity is performed well or performed successfully?* | **Occupational Skills & Knowledge**<br>*What should the technician know and what skills should the technician have in order to do the activity?* | **Conditions**<br>*What tools must the technician use in order to do the activity?* |
| 4.10 Repair or replace 600-volt or less motors and rotating equipment protection devices such as vibration monitoring and motor control relays. | 4.10.1 Corrective repairs are performed according to job scope, company/manufacturer/Health, Safety and Environment work practices, specific application and area classification.<br>4.10.2 Physical inspection meets company/manufacturer/industry parameters.<br>4.10.3 Functional test meets company/manufacturer/industry standards.<br>4.10.4 Known inputs result in expected outputs as specified by the manufacturer.<br>4.10.5 Documentation is completed according to company guidelines. | Read and redline electrical drawings<br>Read and use specification sheets<br>Read and use motor control logic diagrams<br>Use of reference material<br>Use or conversion of electric circuit measurements<br>Knowledge of math<br>Electrical knowledge<br>Motor control circuit knowledge<br>Ability to learn new technology<br>Knowledge of computerized maintenance programs<br>Preparation of Job Safety Analysis<br>Knowledge of national electric code<br>Knowledge of phasing and motor rotation<br>Knowledge of megger tests<br>Read and use nameplate data<br>Calibrating vibration monitors<br>Basic rigging<br>Knowledge of management of change process | Personal Protective Equipment (PPE)<br>Electrical drawings<br>Specification sheets<br>Motor control logic diagrams<br>Reference material<br>Site-specific safety procedures<br>Computerized maintenance programs<br>Job Safety Analysis (JSA)<br>Material Safety Data Sheets (MSDS)<br>Permits and area classifications<br>Data forms<br>Hand tools<br>Volt-ohm meter<br>Digital volt meter<br>Oscilloscope<br>Tubing and conduit benders<br>Wobulator<br>Hypot tester<br>Multi-amp tester<br>Megohm meter<br>Amp probe<br>Phase comparison tester<br>Non-contact voltage tester |

**Academic and Employability Knowledge and Skill Matrix for Critical Work Function 4:**

*On a scale of 1 (lowest) to 5 (highest), identify the level of complexity required in each of these skills for the worker to perform the critical work function. Keep in mind that this scale is not for rating an individual's proficiency. It is intended only for rating the level of complexity required to do the work.*

| **Occupational Title: Industrial Instrumentation and Controls Technician** | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CWF 4 Repair or replace malfunctioning industrial control system equipment** | | | | | | | | | | | | | | | | |
| Listening | Speaking | Using Information and Communication Technology | Gathering and analyzing Information | Analyzing and Solving Problems | Making Decisions and Judgments | Organizing and Planning | Using Social Skills | Adaptability | Working in Teams | Leading Others | Building Consensus | Self and Career Development | Writing | Reading | Mathematics | Science |
| 4 | 4 | 4 | 4 | 4 | 3 | 4 | 3 | 4 | 4 | 1 | 4 | 3 | 3 | 5 | 3 | 3 |

**Statement of Assessment for Critical Work Function 4:**

Tools: The assessment process should include the following.

Written tests that include:
1) True-false, multiple choice and essay questions that rely on extended responses to further clarify an understanding of the knowledge being assessed.
2) Graphic representations (e.g. P&IDs, loop drawings and one-line electrical drawings) that reveals an understanding of symbology and connections between processes and devices.
3) Preparation and justification of a reasonable solution to a problem scenario.

Hands-on demonstrations of knowledge, skills and attitudes that:
1) Represents a problematic or challenging situation in the context of a career-technical perspective.
2) Involves a real life scenario, problem or situation to solve.
3) Applies relevant knowledge or skills.
4) Focuses on the application of knowledge and skills learned in one situation as it connects to a new and different one.
5) Reveals an ability to plan, organize and create a product or an event.
6) Requires study to analyze or evaluate the problem or situation.
7) Illustrates by individual performance the attained levels of knowledge, skills and attitudes.
8) Includes observation of events, groups and individuals that focuses on the salient traits of the skill or attitude being observed.

| **Occupational Title: Industrial Instrumentation and Controls Technician** | | | |
|---|---|---|---|
| **Critical Work Function 5. Maintain, test, clean, verify, repair or replace auxiliary systems.** | | **Occupational Skills, Knowledge & Conditions** | |
| **Key Activity** | **Performance Criteria**<br>*How do we know when the key activity is performed well or performed successfully?* | **Occupational Skills & Knowledge**<br>*What should the technician know and what skills should the technician have in order to do the activity?* | **Conditions**<br>*What tools must the technician use in order to do the activity?* |
| 5.1 Maintain Heating Ventilation and Air Conditioning (HVAC) systems including the heater, condenser/evaporator, fans, filters and thermostats that control the temperature and/or humidity in a closed space. | 5.1.1 Work is performed to meet the requirements of company/manufacturer/Health, Safety and Environment work practices, specific application and area classification.<br>5.1.2 Routine maintenance is performed according to job scope.<br>5.1.3 Physical inspection meets company/manufacturer/industry parameters.<br>5.1.4 Functional test meets company/manufacturer/industry standards.<br>5.1.5 Documentation is completed according to company guidelines. | Read and use specification sheets<br>Read and use ladder logic diagrams<br>Use of reference material<br>Knowledge of math<br>Knowledge of physics<br>Knowledge of basic electrical AC/DC theory<br>Ability to learn new technology<br>Knowledge of computerized maintenance programs<br>Preparation of Job Safety Analysis<br>Proper use of hand tools<br>Basic mechanical knowledge<br>Knowledge of motor controls<br>Knowledge of refrigeration principles | Personal Protective Equipment (PPE)<br>Ladder logic diagrams<br>Specification sheets<br>Reference material<br>Site-specific safety procedures<br>Computerized maintenance programs<br>Job Safety Analysis (JSA)<br>Material Safety Data Sheets (MSDS)<br>Data forms<br>Hand tools<br>Volt-ohm meter<br>Digital volt meter<br>Megohm meter<br>Amp probe |
| 5.2 Maintain lighting systems including the indoor and outdoor lights, changing light bulbs, replacing fluorescent ballasts, checking breakers and switches. | 5.2.1 Work is performed to meet the requirements of company/manufacturer/Health, Safety and Environment work practices, specific application and area classification.<br>5.2.2 Routine maintenance is performed according to job scope.<br>5.2.3 Physical inspection meets company/manufacturer/industry parameters.<br>5.2.4 Functional test meets company/manufacturer/industry standards.<br>5.2.5 Documentation is completed according to company guidelines. | Read and redline electrical drawings<br>Read and use specification sheets<br>Use of reference material<br>Knowledge of basic electrical AC/DC theory<br>Ability to learn new technology<br>Knowledge of computerized maintenance programs<br>Preparation of Job Safety Analysis<br>Proper use of hand tools | Personal Protective Equipment (PPE)<br>Specification sheets<br>Reference material<br>Site-specific safety procedures<br>Computerized maintenance programs<br>Job Safety Analysis (JSA)<br>Material Safety Data Sheets (MSDS)<br>Data forms<br>Hand tools<br>Volt-ohm meter<br>Digital volt meter<br>Amp probe |

| Occupational Title: Industrial Instrumentation and Controls Technician | | | |
|---|---|---|---|
| **Critical Work Function 5. Maintain, test, clean, verify, repair or replace auxiliary systems.** | | **Occupational Skills, Knowledge & Conditions** | |
| **Key Activity** | **Performance Criteria**<br>*How do we know when the key activity is performed well or performed successfully?* | **Occupational Skills & Knowledge**<br>*What should the technician know and what skills should the technician have in order to do the activity?* | **Conditions**<br>*What tools must the technician use in order to do the activity?* |
| 5.3 Maintain backup power generation systems limited to low voltage generators (less than 600 volts) powered by diesel, gasoline or natural gas powered engines. | 5.3.1 Work is performed to meet the requirements of company/manufacturer/Health, Safety and Environment work practices, specific application and area classification.<br>5.3.2 Routine maintenance is performed according to job scope.<br>5.3.3 Physical inspection meets company/manufacturer/industry parameters.<br>5.3.4 Functional test meets company/manufacturer/industry standards.<br>5.3.5 Documentation is completed according to company guidelines. | Read and redline electrical drawings<br>Read and use specification sheets<br>Read and use motor control logic diagrams<br>Use of reference material<br>Use or conversion of electric circuit measurements<br>Knowledge of math<br>Knowledge of physics (length and leverage)<br>Electrical knowledge<br>Motor control circuit knowledge<br>Ability to learn new technology<br>Knowledge of computerized maintenance programs<br>Preparation of Job Safety Analysis<br>Proper use of hand tools<br>Knowledge of national electric code<br>Knowledge of phasing and motor rotation<br>Read and use nameplate data<br>Calibrating vibration monitors<br>Basic rigging | Personal Protective Equipment (PPE)<br>Electrical drawings<br>Specification sheets<br>Motor control logic diagrams<br>Reference material<br>Site-specific safety procedures<br>Computerized maintenance programs<br>Job Safety Analysis (JSA)<br>Material Safety Data Sheets (MSDS)<br>Permits and area classifications<br>Data forms<br>Hand tools<br>Volt-ohm meter<br>Digital volt meter<br>Megohm meter<br>Amp probe<br>Phase comparison tester<br>Non-contact voltage tester |

| Occupational Title: Industrial Instrumentation and Controls Technician | | | |
|---|---|---|---|
| **Critical Work Function 5. Maintain, test, clean, verify, repair or replace auxiliary systems.** | | **Occupational Skills, Knowledge & Conditions** | |
| **Key Activity** | **Performance Criteria**<br>*How do we know when the key activity is performed well or performed successfully?* | **Occupational Skills & Knowledge**<br>*What should the technician know and what skills should the technician have in order to do the activity?* | **Conditions**<br>*What tools must the technician use in order to do the activity?* |
| 5.4 Maintain cranes and/or hoists including the electric motors, controls and breakers. | 5.4.1 Work is performed to meet the requirements of company/manufacturer/Health, Safety and Environment work practices, specific application and area classification.<br>5.4.2 Routine maintenance is performed according to job scope.<br>5.4.3 Physical inspection meets company/manufacturer/industry parameters.<br>5.4.4 Functional test meets company/manufacturer/industry standards.<br>5.4.5 Documentation is completed according to company guidelines. | Read and redline electrical drawings<br>Read and use specification sheets<br>Read and use motor control logic diagrams<br>Use of reference material<br>Knowledge of math<br>Electrical knowledge<br>Motor control circuit knowledge<br>Ability to learn new technology<br>Knowledge of computerized maintenance programs<br>Preparation of Job Safety Analysis<br>Proper use of hand tools<br>Knowledge of national electric code<br>Knowledge of phasing and motor rotation<br>Read and use nameplate data<br>Calibrating vibration monitors<br>Basic rigging | Personal Protective Equipment (PPE)<br>Electrical drawings<br>Specification sheets<br>Motor control logic diagrams<br>Reference material<br>Site-specific safety procedures<br>Computerized maintenance programs<br>Job Safety Analysis (JSA)<br>Material Safety Data Sheets (MSDS)<br>Permits and area classifications<br>Data forms<br>Hand tools<br>Volt-ohm meter<br>Digital volt meter<br>Megohm meter<br>Amp probe<br>Phase comparison tester<br>Non-contact voltage tester |

| Occupational Title: Industrial Instrumentation and Controls Technician | | | |
|---|---|---|---|
| **Critical Work Function 5. Maintain, test, clean, verify, repair or replace auxiliary systems.** | | **Occupational Skills, Knowledge & Conditions** | |
| **Key Activity** | **Performance Criteria**<br>*How do we know when the key activity is performed well or performed successfully?* | **Occupational Skills & Knowledge**<br>*What should the technician know and what skills should the technician have in order to do the activity?* | **Conditions**<br>*What tools must the technician use in order to do the activity?* |
| 5.5 Maintain instrument air compressors including the compressor drive, compressor, filters, dryers and associated controls. | 5.5.1 Work is performed to meet the requirements of company/manufacturer/Health, Safety and Environment work practices, specific application and area classification.<br>5.5.2 Routine maintenance is performed according to job scope.<br>5.5.3 Physical inspection meets company/manufacturer/industry parameters.<br>5.5.4 Functional test meets company/manufacturer/industry standards.<br>5.5.5 Documentation is completed according to company guidelines. | Read and redline electrical drawings<br>Read and use instrument loop sheets<br>Read and use specification sheets<br>Read and use programmable logic diagrams<br>Use of reference material<br>Electrical knowledge<br>Ability to learn new technology<br>Knowledge of computerized maintenance programs<br>Preparation of Job Safety Analysis<br>Proper use of hand tools<br>Knowledge of national electric code<br>Knowledge of phasing and motor rotation<br>Read and use nameplate data<br>Calibrating vibration monitors<br>Basic rigging | Personal Protective Equipment (PPE)<br>Electrical drawings<br>Programmable logic diagrams<br>Loop sheets<br>Specification sheets<br>Reference material<br>Site-specific safety procedures<br>Computerized maintenance programs<br>Job Safety Analysis (JSA)<br>Material Safety Data Sheets (MSDS)<br>Permits and area classifications<br>Data forms<br>Hand tools<br>Volt-ohm meter<br>Digital volt meter<br>Megohm meter<br>Amp probe<br>Phase comparison tester<br>Non-contact voltage tester |

| Occupational Title: Industrial Instrumentation and Controls Technician | | | |
|---|---|---|---|
| **Critical Work Function 5. Maintain, test, clean, verify, repair or replace auxiliary systems.** | | **Occupational Skills, Knowledge & Conditions** | |
| **Key Activity** | **Performance Criteria**<br>*How do we know when the key activity is performed well or performed successfully?* | **Occupational Skills & Knowledge**<br>*What should the technician know and what skills should the technician have in order to do the activity?* | **Conditions**<br>*What tools must the technician use in order to do the activity?* |
| 5.6 Maintain plant communication systems such as Supervisory Control And Data Acquisition (SCADA) systems, handheld radios and transmitting or repeater stations, and intercom systems. | 5.6.1 Work is performed to meet the requirements of company/manufacturer/Health, Safety and Environment work practices, specific application and area classification.<br>5.6.2 Routine maintenance is performed according to job scope.<br>5.6.3 Physical inspection meets company/manufacturer/industry parameters.<br>5.6.4 Functional test meets company/manufacturer/industry standards.<br>5.6.5 Documentation is completed according to company guidelines. | Read and redline communication network drawings<br>Read and use specification sheets<br>Use of reference material<br>Knowledge of basic electrical AC/DC theory<br>Ability to learn new technology<br>Knowledge of computerized maintenance programs<br>Preparation of Job Safety Analysis<br>Proper use of hand tools<br>Knowledge of industrial communication protocols<br>Knowledge of cable connector requirements<br>Knowledge of radio frequency repeater technology<br>Knowledge of diagnostic indicators | Personal Protective Equipment (PPE)<br>Communication network drawings<br>Specification sheets<br>Reference material<br>Site-specific safety procedures<br>Computerized maintenance programs<br>Job Safety Analysis (JSA)<br>Data forms<br>Hand tools<br>Digital volt meter<br>Protocol communicator<br>Frequency analyzer |
| 5.7 Maintain Uninterruptible Power Supplies (UPS) and Inverters. | 5.7.1 Work is performed to meet the requirements of company/manufacturer/Health, Safety and Environment work practices, specific application and area classification.<br>5.7.2 Routine maintenance is performed according to job scope.<br>5.7.3 Physical inspection meets company/manufacturer/industry parameters.<br>5.7.4 Functional test meets company/manufacturer/industry standards.<br>5.7.5 Documentation is completed according to company guidelines. | Read and redline electrical drawings<br>Read and use specification sheets<br>Use of reference material<br>Knowledge of math<br>Knowledge of physics (specific gravity)<br>Electrical knowledge<br>Ability to learn new technology<br>Knowledge of computerized maintenance programs<br>Preparation of Job Safety Analysis<br>Knowledge of permits and area classifications<br>Proper use of hand tools<br>Knowledge of gated power devices (SCR, triacs, thyristors, etc.) | Personal Protective Equipment (PPE)<br>Electrical drawings<br>Specification sheets<br>Reference material<br>Site-specific safety procedures<br>Computerized maintenance programs<br>Job Safety Analysis (JSA)<br>Material Safety Data Sheets (MSDS)<br>Permits and area classifications<br>Data forms<br>Hand tools<br>Volt-ohm meter<br>Digital volt meter<br>Hydrometer |

| Occupational Title: Industrial Instrumentation and Controls Technician | | | |
|---|---|---|---|
| **Critical Work Function 5. Maintain, test, clean, verify, repair or replace auxiliary systems.** | | **Occupational Skills, Knowledge & Conditions** | |
| **Key Activity** | **Performance Criteria**<br>*How do we know when the key activity is performed well or performed successfully?* | **Occupational Skills & Knowledge**<br>*What should the technician know and what skills should the technician have in order to do the activity?* | **Conditions**<br>*What tools must the technician use in order to do the activity?* |
| 5.8 Maintain cathodic protection systems. | 5.8.1 Work is performed to meet the requirements of company/manufacturer/Health, Safety and Environment work practices, specific application and area classification.<br>5.8.2 Routine maintenance is performed according to job scope.<br>5.8.3 Physical inspection meets company/manufacturer/industry parameters.<br>5.8.4 Functional test meets company/manufacturer/industry standards.<br>5.8.5 Documentation is completed according to company guidelines. | Read and redline electrical drawings<br>Read and use specification sheets<br>Use of reference material<br>Knowledge of basic electrical AC/DC theory<br>Ability to learn new technology<br>Knowledge of computerized maintenance programs<br>Preparation of Job Safety Analysis<br>Proper use of hand tools<br>Knowledge of national electric code | Personal Protective Equipment (PPE)<br>Electrical drawings<br>Specification sheets<br>Reference material<br>Site-specific safety procedures<br>Computerized maintenance programs<br>Job Safety Analysis (JSA)<br>Data forms<br>Hand tools<br>Digital volt meter<br>Amp probe<br>Non-contact voltage tester |
| 5.9 Maintain navigation aids including lights and switchgear associated with lighting systems required for navigation aids or warnings. | 5.9.1 Work is performed to meet the requirements of company/manufacturer/Health, Safety and Environment work practices, specific application and area classification.<br>5.9.2 Routine maintenance is performed according to job scope.<br>5.9.3 Physical inspection meets company/manufacturer/industry parameters.<br>5.9.4 Functional test meets company/manufacturer/industry standards.<br>5.9.5 Documentation is completed according to company guidelines. | Read and redline electrical drawings<br>Read and use specification sheets<br>Use of reference material<br>Knowledge of basic electrical AC/DC theory<br>Ability to learn new technology<br>Knowledge of computerized maintenance programs<br>Preparation of Job Safety Analysis<br>Proper use of hand tools | Personal Protective Equipment (PPE)<br>Electrical drawings<br>Specification sheets<br>Reference material<br>Site-specific safety procedures<br>Computerized maintenance programs<br>Job Safety Analysis (JSA)<br>Data forms<br>Hand tools<br>Volt-ohm meter<br>Digital volt meter<br>Amp probe |

| Occupational Title: Industrial Instrumentation and Controls Technician | | | |
|---|---|---|---|
| **Critical Work Function 5. Maintain, test, clean, verify, repair or replace auxiliary systems.** | | **Occupational Skills, Knowledge & Conditions** | |
| **Key Activity** | **Performance Criteria**<br>*How do we know when the key activity is performed well or performed successfully?* | **Occupational Skills & Knowledge**<br>*What should the technician know and what skills should the technician have in order to do the activity?* | **Conditions**<br>*What tools must the technician use in order to do the activity?* |
| 5.10 Maintain high voltage equipment including equipment that is energized with 600 volts or more. | 5.9.1 Work is performed to meet the requirements of company/manufacturer/Health, Safety and Environment work practices, specific application and area classification.<br>5.9.2 Routine maintenance is performed according to job scope.<br>5.9.3 Physical inspection meets company/manufacturer/industry parameters.<br>5.9.4 Functional test meets company/manufacturer/industry standards.<br>5.9.5 Documentation is completed according to company guidelines. | Read and redline electrical drawings<br>Read and use specification sheets<br>Read and use motor control diagrams<br>Use of reference material<br>Use or conversion of electrical measurements<br>Knowledge of math<br>Knowledge of high-voltage electrical theory<br>Ability to learn new technology<br>Knowledge of computerized maintenance programs<br>Preparation of Job Safety Analysis<br>Knowledge of high-voltage tools and equipment<br>Knowledge of terminating medium and high-voltage wiring<br>Knowledge of national electric code<br>Knowledge of OSHA 1910.269 and 1910.331-335 | Personal Protective Equipment (PPE)<br>Electrical drawings<br>Specification sheets<br>Reference material<br>Site-specific safety procedures<br>Computerized maintenance programs<br>Job Safety Analysis (JSA)<br>Material Safety Data Sheets (MSDS)<br>Data forms<br>High-voltage tools and equipment<br>Volt-ohm meter<br>Hot sticks<br>Digital volt meter<br>Hypot tester<br>Multi-amp tester<br>Megohm meter<br>Amp probe<br>Phase comparison tester<br>Infrared camera<br>Non-contact high-voltage tester |

**Academic and Employability Knowledge and Skill Matrix for Critical Work Function 5**

*On a scale of 1 (lowest) to 5 (highest), identify the level of complexity required in each of these skills for the worker to perform the critical work function. Keep in mind that this scale is not for rating an individual's proficiency. It is intended only for rating the level of complexity required to do the work.*

| **Occupational Title: Industrial Instrumentation and Controls Technician** | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CWF 5 Maintain, test, clean, verify, repair or replace auxiliary systems.** | | | | | | | | | | | | | | | | |
| Listening | Speaking | Using Information and Communication Technology | Gathering and analyzing Information | Analyzing and Solving Problems | Making Decisions and Judgments | Organizing and Planning | Using Social Skills | Adaptability | Working in Teams | Leading Others | Building Consensus | Self and Career Development | Writing | Reading | Mathematics | Science |
| 4 | 3 | 4 | 4 | 4 | 3 | 4 | 3 | 4 | 4 | 1 | 4 | 3 | 3 | 5 | 4 | 4 |

**Statement of Assessment for Critical Work Function 5**

Tools: The assessment process should include the following.

Written tests that include:
1) True-false, multiple choice and essay questions that rely on extended responses to further clarify an understanding of the knowledge being assessed.
2) Graphic representations (e.g. P&IDs, loop drawings and one-line electrical drawings) that reveals an understanding of symbology and connections between processes and devices.
3) Preparation and justification of a reasonable solution to a problem scenario.

Hands-on demonstrations of knowledge, skills and attitudes that:
1) Represents a problematic or challenging situation in the context of a career-technical perspective.
2) Involves a real life scenario, problem or situation to solve.
3) Applies relevant knowledge or skills.
4) Focuses on the application of knowledge and skills learned in one situation as it connects to a new and different one.
5) Reveals an ability to plan, organize and create a product or an event.
6) Requires study to analyze or evaluate the problem or situation.
7) Illustrates by individual performance the attained levels of knowledge, skills and attitudes.
8) Includes observation of events, groups and individuals that focuses on the salient traits of the skill or attitude being observed.