National Occupational Standard
Power Protection and Control Technician

Electricity Human Resources Canada is a non-profit organization supporting the human resources needs of the Canadian electricity sector.

Our Vision

Keeping the lights on in Canada by preparing and empowering a world-class workforce for the entire electricity industry.

Our Mission

Working to strengthen the ability of the Canadian electricity industry in meeting current and future needs for their workforce—one that is safety-focused, highly skilled, diverse and productive.

Our Values

We are a values-driven organization, committed to the improvement of our sector, the growth of Canada's economy, and the stability of our power grid. Our core values are:

Collaboration
Working with all stakeholders in Canada's electricity sector for our mutual benefit.

Trust
Forging relationships and products built on unwavering integrity.

Innovation
Leading the industry to be future-ready.

National Occupational Standards (NOS)

NOS are voluntary guidelines that have been developed to provide businesses, educators, trainers, and job seekers with practical guidance.

How are NOS used?

Employers, employees, and educational institutions can put NOS to a wide variety of uses supporting effective workforce planning:

- Support personnel certification or accreditation programs.
- Inform curricula for colleges and apprenticeships.
- Assist recruitment by informing job descriptions and providing a benchmark for employee appraisals.
- Identify career paths in order to promote employee retention.
- Help employers evaluate and determined the competencies of potential employees, including Internationally Trained Workers (ITWs).

Electricity Human Resources Canada has developed National Occupational Standards for a range of in-demand occupations.

Visit **electricityhr.ca** for more information.

Key Terms within the National Occupational Standard:

Major Category	**A general functional area within the industry**
Competency Area	**A specific area of responsibility within a Major Category**
Competency Unit	**A specific task that contains a description of the knowledge and performance components that are needed for successful, safe and effective completion**

Each Competency within the National Occupational Standard is made up of (some or all of) the following elements:

- **Purpose:** A statement that describes what the competency is, and why it is important.
- **Performance:** What a job incumbent must be able to do to perform the competency.
- **Knowledge:** What a job incumbent must know to perform the competency.
- **Glossary:** Definitions for key terms used in the competency.
- **Range of Context:** Specific variables or situations that may impact the way that the competency is performed.
- **Level of Practice:** The level of job incumbent that typically performs the competency.
- **Adapted Bloom's Taxonomy:** The level of cognitive performance required for the competency (of particular interest to trainers/educators).
- **RWATEM:** The Requisite Work Aids, Tools, Equipment and Materials used by job incumbents to perform the competency.

Chart of Competency:
Power Protection and Control Technician

This Chart outlines the competencies (also known as skills and knowledge) that are performed by Power Protection and Control Technicians.

KEY: Tasks included in trade national occupational analyses (i.e. Industrial and Construction Electricians) that are also performed by Power Protection and Control Technicians.

Occupational Definition:

Power Protection and Control Technicians install, commission, maintain, troubleshoot and repair the critical system equipment used for detecting and responding to power system faults, controlling system devices, metering schemes and telecom throughout a region or area. They may also perform design functions under the supervision of Professional Engineers. They are employed by electric power utilities and private electrical contractors. Their range of duties and responsibilities is dependent upon the type of operation for which they are employed.

Major Category	Competency Area	Competency Unit					
Construction and Installation	Monitor Installation of Electrical Equipment	Monitor installation of electrical equipment					
	Install Control Systems	Install discrete input/output (I/O) devices	Install analog input/output (I/O) devices	Install automated control systems	Program automated control systems		
	Complete Installation Process	Troubleshoot installation issues	Install operation and identification tags				
	Conduct Tests for Commissioning	Conduct electrical tests for commissioning	Conduct relay protection and metering tests	Conduct control system tests	Conduct communication system tests for commissioning		
	Commission Equipment and Systems	Verify equipment/system functionality	Document equipment/system performance				
Asset Maintenance	Prepare to Maintain Equipment and Systems	Organize materials and equipment for maintenance	Coordinate maintenance activities with others				
	Conduct Tests for Maintenance	Conduct electrical tests for maintenance					
	Maintain Generating, Distribution and Service Equipment	Maintain overcurrent protection devices	Maintain ground fault, arc fault and surge protection devices	Maintain under and over voltage protection devices			
	Maintain Control Systems	Maintain discrete input/output (I/O) devices	Maintain analog input/output (I/O) devices	Maintain automated control systems			
	Maintain Signaling and Communication Systems	Maintain communication systems					
	Repair Electrical, Hydraulic and Mechanical Equipment and Systems	Diagnose electrical, hydraulic and mechanical equipment and system issues	Repair issues with electrical, hydraulic and mechanical equipment and systems	Troubleshoot digital logic circuits			
Engineering	Provide Support for Engineers	Conduct investigative tasks under direction of engineer					
Safety	Maintain a Safe Working Environment	Follow safe work practices	Use personal protective equipment (PPE)	Participate in safety meetings and emergency drills	Isolate component, equipment or system	Perform lock-out, tag-out procedures	Handle, transport and store hazardous materials	Work in confined spaces
		Use fall arrest equipment	Minimize radiation exposure				
	Follow Sustainable Work Practices	Follow sustainable work practices					
	Respond to Emergencies	Participate in incident and accident investigations					
Security	Follow Security Practices	Follow security practices for physical work environment	Follow cybersecurity procedures				
Organizational Policies and Procedures	Follow Organizational Policies and Procedures	Follow organizational policies and procedures					
Information/Record Management	Complete Information/ Record Management Tasks	Maintain technical information and data	Use information/record management system for generation, transmission and distribution operations				
Information and Communication Technology Foundations	Use Digital Technology	Use communication applications	Use common software applications	Use navigation and mapping applications	Use digital mobile radios		
	Use Organization's ICT System	Use organization's ICT system					
Leadership	Facilitate Change	Implement change					
Foundational Trades Skills	Perform Routine Trade Tasks	Use hand and power tools	Use electrical measuring and testing equipment	Operate vehicles and motorized equipment			
Personal Competencies	Demonstrate Professionalism	Work as a member of a team	Develop professionally	Demonstrate professional and ethical conduct	Mentor/coach others	Manage stress	Manage time
	Communicate Effectively	Use active listening skills	Use speaking skills	Use writing skills	Negotiate with internal and external stakeholders	Conduct meetings and presentations	Exchange information with internal and external stakeholders

Major Category	**Construction and Installation**
Competency Area	**Monitor Installation of Electrical Equipment**
Competency Unit	**Monitor installation of electrical equipment**

Purpose

Monitoring the installation of electrical equipment regularly during the install process is critical to the execution of a successful project. Identifying potential issues before they are insurmountable problems helps to ensure that tasks are completed according to schedule and on budget. When done correctly, this task can help to identify when change is needed, what it entails, and how to implement the change so that there is minimum impact on the installation project's progress.

Performance/Abilities

P1 Communicate with stakeholders, including:
- receive instructions from project manager
- ask what can be done to better support work being completed
- identify concerns and issues
- address concerns and issues as they appear, e.g. communicate with project manager
- provide status updates, as required

P2 Conduct site visits and inspections, as required:
- wear appropriate PPE for work site
- assess progress towards installation schedule/milestones
- review project documentation while onsite, e.g. site drawings
- compare drawings and specifications to onsite construction and installation
- take corrective action, as necessary
- update or oversee update of project documentation (e.g. as-built prints), as necessary

P3 Ensure procedures are being followed, including safety and environmental protection

P4 Communicate plan adjustments to relevant stakeholders, as necessary:
- explain reasons for changes
- monitor implementation of adjustments

P5 Create project documentation, as necessary, e.g. status report, deficiency list

P6 Circulate project documentation to appropriate stakeholders, as required, e.g. director, service provider:
- file according to organizational/project protocol

Knowledge

K1 Organization policies, procedures and plans, e.g. safety, environmental protection, security

K2 Organization/project goals, vision and status

K3 Organizational information/record management system

K4 Organizational communication protocols

K5 Installation project schedule

K6 Relevant details of contracts

K7 Relevant regulations, e.g. industrial, construction

Contextual Variables

Range of Context

- Types of equipment being installed (e.g.transformers, breakers, relaying equipment, metering equipment, rotating machines, capacitor banks) and the number of pieces of equipment being installed varies, and this will affect the complexity of this competency and the timelines to complete this competency.
- Number of stakeholders to be included in communication will vary by installation project.

Level of Practice

- ☒ Frontline
- ☐ Supervisor
- ☐ Manager/Executive

Adapted Bloom's Taxonomy

- ☐ Recall, Remember
- ☐ Understand
- ☐ Apply
- ☐ Analyze
- ☒ Evaluate
- ☐ Create/Transform

RWATEM (Requisite Work Aids, Tools, Equipment or Materials)

- Manufacturer's specifications
- Project documentation, e.g. drawings, specifications, schedules, contract

Major Category	Construction and Installation
Competency Area	**Install Control Systems**
Competency Unit	**Install discrete input/output (I/O) devices**

Refer to the following task within the **Red Seal Occupational Standard (RSOS) for Industrial Electrician** for more details on how to perform this Competency:

Industrial Electrician

Block F: INSTALLS AND MAINTAINS PROCESS CONTROL SYSTEMS
Task 29: Installs and maintains input/output (I/O) devices
Skill 1: Installs discrete input/output (I/O) devices

Major Category	Construction and Installation
Competency Area	**Install Control Systems**
Competency Unit	**Install analog input/output (I/O) devices**

Refer to the following task within the **Red Seal Occupational Standard (RSOS) for Industrial Electrician** for more details on how to perform this Competency:

Industrial Electrician

Block F: INSTALLS AND MAINTAINS PROCESS CONTROL SYSTEMS
Task 29: Installs and maintains input/output (I/O) devices
Skill 3: Installs analog input/output (I/O) devices

Major Category	Construction and Installation
Competency Area	**Install Control Systems**
Competency Unit	**Install automated control systems**

Refer to the following task within the **Red Seal Occupational Standard (RSOS) for Industrial Electrician** and **Red Seal Occupational Standard (RSOS) for Construction Electrician** for more details on how to perform this Competency:

Industrial Electrician

Block F: INSTALLS AND MAINTAINS PROCESS CONTROL SYSTEMS
Task 30: Installs, programs and maintains automated control systems
Skill 1: Installs automated control systems

Construction Electrician

Block D: INSTALLS, SERVICES AND MAINTAINS MOTORS AND CONTROL SYSTEMS
Task 25: Installs, programs, services and maintains automated control systems
Skill 1: Installs automated control systems

Major Category	Construction and Installation
Competency Area	**Install Control Systems**
Competency Unit	**Program automated control systems**

Refer to the following task within the **Red Seal Occupational Standard (RSOS) for Industrial Electrician** and **Red Seal Occupational Standard (RSOS) for Construction Electrician** for more details on how to perform this Competency:

Industrial Electrician

Block F: INSTALLS AND MAINTAINS PROCESS CONTROL SYSTEMS
Task 30: Installs, programs and maintains automated control systems
Skill 3: Programs automated control systems

Construction Electrician

Block D: INSTALLS, SERVICES AND MAINTAINS MOTORS AND CONTROL SYSTEMS
Task 25: Installs, programs, services and maintains automated control systems
Skill 3: Programs and configures automated control systems

electricity
HUMAN RESOURCES CANADA

Major Category	Construction and Installation
Competency Area	Complete Installation Process
Competency Unit	Troubleshoot installation issues

Purpose

Construction and installation issues can vary in scope, from a piece of equipment not working correctly to structural changes that impact original installation plans. It is important to be able to address these issues, either immediately or to present options that can still meet the original plan's goals, or to provide options based on professional expertise and industry best practices. Consideration must be given to additional resource requirements, e.g. time, cost, personnel.

Performance/Abilities

P1 Determine cause of installation issue, (e.g. equipment operation, structural changes), for example:
  - review manufacturer's installation instructions/manual
  - review as-builts to original drawings installation was based on
  - review requirements for installation, e.g. building and electrical code
  - contact technical support, if necessary

P2 Inspect installation to identify any potential errors:
  - wear appropriate PPE
  - make corrections to equipment, if able, using industry best practices

P3 Consult other professionals, as necessary, e.g. co-worker, supervisor, engineer

P4 Determine potential adjustment options, for example:
  - replacement of equipment
  - relocation of installation
  - re-orientation of equipment
  - different type or size of equipment

P5 Determine viability of options, e.g. availability of other equipment, required regulatory approvals

P6 Present potential options, including:
  - impact on project, e.g. changes to functionality, extra cost, personnel
  - impact on further work, e.g. other trades
  - impact on schedule, e.g. delays to order new equipment, additional time for change installation location
  - make recommendations

P7 Obtain approval to make adjustments, if required:
  - ensure approval is documented, if required

P8 Document troubleshooting solution:
  - ensure changes are in as-builts

Knowledge

K1 Organization's policies and procedures, e.g. record management system

K2 Relevant CSA Standards, e.g. Canadian Electrical Code (CE code)

K3 Jurisdictional requirements, including installation requirements and codes

K4 Different types of equipment systems, components, characteristics and operation

K5 Industry best practices for installation

K6 Safety hazards

K7 Equipment suppliers

K8 Order of operations

K9 Project overview, including overall design

K10 Foundational electrical knowledge, as required for type of installation

K11 Foundational hydronic knowledge, as required for type of installation

K12 Foundational hydraulic knowledge, as required for type of installation

K13 Foundational mechanical knowledge, as required for type of installation

K14 Foundational construction knowledge, as required for type of installation

K15 Foundational GeoExchange knowledge, as required for type of installation

K16 Foundational process control knowledge, as required for type of installation

Glossary

- **Industry best practices:** methods that meet or exceed jurisdictional requirements, e.g. Canadian Electrical Code (CE code), bylaws.

Contextual Variables

Level of Practice

- ☒ Frontline
- ☒ Supervisor
- ☐ Manager/Executive

Adapted Bloom's Taxonomy

- ☐ Recall, Remember
- ☐ Understand
- ☐ Apply
- ☐ Analyze
- ☒ Evaluate
- ☐ Create/Transform

RWATEM (Requisite Work Aids, Tools, Equipment or Materials)

- Drawings and prints, including as-builts
- Manufacturer's manuals, specifications
- PPE
- Testing equipment, e.g. voltmeter, pressure gauge
- Hand and power tools, e.g. drills, screwdrivers, pliers

Major Category	Construction and Installation
Competency Area	Complete Installation Process
Competency Unit	Install operation and identification tags

Level of Practice

- ☒ Frontline
- ☐ Supervisor
- ☐ Manager/Executive

Adapted Bloom's Taxonomy

- ☐ Recall, Remember
- ☐ Understand
- ☒ Apply
- ☐ Analyze
- ☐ Evaluate
- ☐ Create/Transform

RWATEM (Requisite Work Aids, Tools, Equipment or Materials)

- PPE
- Label maker
- Labels and tags
- Schematic drawings/prints
- Permanent marker

Purpose

Tagging and labelling system equipment and components helps to foster the client's understanding of the system and its operation. It provides a common language when discussing the system and makes it easier for technicians when called in for repairs or maintenance. Incomplete or incorrect tags and labels can lead to miscommunication about issues, unnecessary repair or maintenance costs, and potentially dangerous conditions.

Performance/Abilities

P1 Wear appropriate PPE

P2 Determine components that require labelling, e.g. inverters, controls, supply and return pipes, grounding equipment, valves:
- review CSA/Canadian Electrical Code (CE code) requirements
- review prints, drawings and manufacturer's specifications

P3 Use industry-accepted markings for equipment tags and labels

P4 Install tags and labels:
- ensure printing is legible and permanent
- ensure tags and labels are visible
- ensure tags and labels are secure
- ensure tags and labels are oriented correctly, i.e. arrows in correct direction
- sign off on tags and labels, if required

P5 Identify markings on any drawings or instructions provided to clients, as required

Knowledge

K1 Organization's policies and procedures, e.g. PPE, client documentation

K2 CSA/ Canadian Electrical Code (CE code) requirements for tags and labels

K3 Jurisdictional requirement for tags and labels

K4 System, components, and operation

Glossary

- **Industry best practices:** methods that meet or exceed jurisdictional requirements, e.g. Canadian Electrical Code (CE code), bylaws.

Contextual Variables

Range of Context

- Proprietary equipment may have specific terminology that may differ from industry terminology.

Major Category	**Construction and Installation**
Competency Area	**Conduct Tests for Commissioning**
Competency Unit	**Conduct electrical tests for commissioning**

Purpose

It is important to ensure that an electrical installation is safe to operate. Tests are conducted before an installation becomes fully operational to ensure that the electrical system has been installed correctly and that all the components operate as they are designed and are safe. Failure to conduct these tests and to ensure that all the deficiencies are addressed could result in damage to equipment and have fatal consequences for co-workers, stakeholders and the public.

Performance/Abilities

P1 Plan tests:
- review prints
- determine testing requirements, e.g. process and tools

P2 Determine order of tests:
- no power (dead) tests first
- energized (live) tests last

P3 Determine availability of testing equipment and power sources:
- testing equipment is charged
- secondary or auxiliary source of current, e.g. generator
- ensure all motor rotation is correct in both grid-tied power and generator
- check power factor for motors and generators

P4 Ensure required portable testing equipment (e.g. multimeters, scopes, recorders) are in good working order:
- calibrated to manufacturer's specifications
- safety features are in place, e.g. sheathed probe tips

P5 Prepare to conduct tests:
- review test equipment manuals
- use required portable testing equipment
- wear appropriate PPE, e.g. boots, eye protection, gloves, arc flash protection
- mark off work area
- cover equipment with material, if required
- post permit tags
- connect voltage and current leads with correct gauge of leads, as required
- connect sensing input/outputs

P6 Conduct wire continuity tests:
- disconnect all equipment/appliances and open all switches
- apply specified current to circuit with testing equipment, e.g. multimeter

P7 Conduct insulation resistance tests:
- disconnect all equipment/appliances and open all switches or close/turn off wired-in equipment/appliances
- apply specified current with testing equipment, (e.g. Megger, dielectric or hipot test equipment) to circuit

P8 Conduct polarity (DC)/phase (AC) tests:
- check circuit continuity results for line and neutral, incorrect connections would indicate a fault (phase)

- inspect connections to equipment/appliances to ensure that the line and neutral connections are correct and the same throughout the installation (phase)
- take voltage readings with testing equipment, between specified lines (polarity)

P9 Conduct ground tests:
- apply specified current to ground conductor and ground electrodes with testing equipment

P10 Conduct ground resistance tests:
- apply current of testing equipment to ground or neutral lines

P11 Conduct bonding tests:
- inspect metal piping or other electrically conductive materials for connections to each other and/or to a ground conductor

P12 Conduct external loop impedance tests:
- disconnect main power and ground
- connect line and ground to testing device
- make calculation to determine an estimate of prospective fault current, if necessary

P13 Reconnect any lines disconnected for testing, e.g. ground line

P14 Test functionality of equipment/appliances, e.g. GFCI receptacles:
- verify installation meets specifications on equipment/appliances
- use testing equipment, if applicable
- turn equipment on
- run test
- compare operating parameters to manufacturer's specifications

P15 Conduct any specific tests requested by the project manager or client, e.g. rapid shut down system

P16 Analyze test results for issues or deficiencies:
- compare to standards or manufacturer's specifications
- consult with other stakeholders, if required, e.g. control center, metering group
- initiate corrective action, as required, e.g. repair, replace

P17 Verify issues and deficiencies have been addressed:
- re-run test
- verify acceptable parameters of readings or operation

P18 Document test results and any action taken in accordance with information/record management system

Knowledge

K1 Organization policies, procedures and plans, e.g. working with live equipment, information/record management system, safety

K2 Relevant CSA Standards, e.g. Canadian Electrical Code (CE code)

K3 Jurisdictional requirements, including permit requirements

K4 Industry best practices for conducting electrical tests

K5 Principles of electricity, e.g. Ohm's law, ratios, polarity, logic theory

K6 Types of electrical tests, their purpose and procedure

K7 Types of electrical testing equipment, their purpose and operation

Glossary

- **Bond testing:** related to ground continuity tests, bond testing ensures that metal structures and pipes coming in and out of a structure, which could build up an electrical charge are connected to each other and/or grounded.
- **External loop impedance testing:** a test that determines the perspective fault current and the capability of the ground of the external systems from the transformer to the installation, typically excluding the internal circuits of the installation.

- **Ground continuity test:** determines the continuity of the ground line to carry current.
- **Ground Fault Circuit Interrupter (GFCI):** a type of safety wall plug receptacle or circuit breaker that will shut down a circuit when there are specific abnormalities in current. Typically used in locations near water, e.g. bathroom sinks.
- **Ground resistance test:** test of the capability of the earth to ground or absorb current or resist current from an electrical system or equipment through the use of the ground or neutral circuit.
- **Industry best practices:** methods that meet or exceed jurisdictional requirements, e.g. Canadian Electrical Code (CE code), bylaws.

Contextual Variables

Range of Context

- Based on the size, scope, and complexity of the installation, testing of equipment may be carried out at different phases of the project as part of an overall commissioning plan.

Level of Practice

- ☒ Frontline
- ☐ Supervisor
- ☐ Manager/Executive

Adapted Bloom's Taxonomy

- ☐ Recall, Remember
- ☐ Understand
- ☐ Apply
- ☒ Analyze
- ☐ Evaluate
- ☐ Create/Transform

RWATEM (Requisite Work Aids, Tools, Equipment or Materials)

- Construction and installation prints and as-builts
- PPE
- Manufacturer's equipment/appliance manuals and specifications
- Testing equipment
- Safety barriers, e.g. pylons
- Covers
- Work permits, if required
- Hand tools
- Lock-out tags

Major Category	Construction and Installation
Competency Area	Conduct Tests for Commissioning
Competency Unit	Conduct relay protection and metering tests

Purpose

The correct installation of protection control equipment is critical to ensure the safe supply of electrical power to consumers. Relays and metering monitor and provide data to inform suppliers and consumers about power consumption and provide protection by preventing dangerous situations from occurring. Failure to test relay protection and metering equipment could cause faulty data and a lack of protection that could result in damaged equipment, power outages, injury and/or death to co-workers, stakeholders and the general public.

Performance/Abilities

P1 Plan tests:
- review prints
- determine order of tests
- determine testing requirements
- determine availability of testing equipment and power sources:
  - testing equipment is charged or has new batteries
  - secondary or auxiliary source of current, e.g. generator

P2 Prepare to conduct test according to industry best practices:
- review test equipment manuals
- use required portable testing equipment, (e.g. digital multi-meters, scopes, recorders), ensuring they:
  - are in good working order
  - are calibrated to manufacturer's specifications
  - have safety features in place, e.g. sheathed probe tips
- wear appropriate PPE, e.g. hard hat, safety glasses, safety boots
- mark off work area with appropriate barriers
- cover up materials for hazard protection, if required
- post clearance -to-work permit, if required
- connect test equipment as per instructions, including:
  - connect voltage and current leads with correct gauge of leads, as required
  - connect sensing input/outputs
- interface microprocessor relays and meters to computer as required, for example:
  - use specified communication protocols, e.g. RS232, Thernet, MODBUS, DNP
  - use relay specific software
  - configure computer communication ports, e.g. modem, network protocols
- inject signals to test operational settings

P3 Wire check protection schemes and metering circuits, for example:
- point to point check of wiring connections

P4 Test potential transformers (PTs) and current transformers (CTs) and associated cabling:
- verify PTs and CTs meet specifications:
  - compare to manufacturer's drawings and design specifications
- conduct required tests on transformers, e.g. polarity, saturation, insulation
- conduct tests on associated cables, e.g. insulation, DC resistance
- verify grounding

P5 Test protection schemes, metering circuits and relay functionality:
- apply provided settings
- conduct required tests, e.g. voltage, frequency, timing, current
- verify test results against industry-accepted standards
- verify operation under different system conditions, e.g. trip breaker, alarm contact, open switches

P6 Perform protection and metering load readings:
  - measure energized circuits with single or three phase power measuring equipment
- communication scheme, over-current, differential system fault:
  - check metering configuration, e.g. three phase, two wire, three wire
- verify readings with control center or metering group

P7 Analyze test results for issues or deficiencies:
- retrieve fault records from devices, e.g. SERs, DFRs, IEDs, portable recording devices
- compare fault records with proper operations of relay setting and protection scheme for type of fault
- compare to standards
- consult with other stakeholders, if required, e.g. control center, metering group
- initiate corrective action, as required, e.g. repair, replace

P8 Document test results and any action taken in accordance with information/record management system

Knowledge

K1 Organization policies, procedures and plans, e.g. working with live equipment, information/record management system, electrical safety

K2 Relevant CSA Standards, e.g. Canadian Electrical Code (CE code)

K3 Types of isolation equipment (i.e. CT links and Flexi Test switches)

K4 Specific CT hazards, e.g. open CT circuits, shorting of CT links

K5 Jurisdictional requirements, including permit requirements

K6 Industry best practices for testing power protection control equipment and systems

K7 Principles of electricity, e.g. Ohm's law, ratios, polarity, logic theory

K8 Operation of bulk electrical power system

K9 Types of electrical tests, their purpose and procedures

K10 Types of communications protocols and applicable software

K11 Types of relay software and their applications

K12 Types of relay and metering equipment, (e.g. relays, meters, transformers) their characteristics, (e.g. markings, classifications) and applications

Glossary

- **Communication protocols:** methods used to transmit data between electronic devices over serial lines. Common communication protocols include RS232, Ethernet, MODBUS, and DNP.
- **Current transformers:** a device used to step a primary current level to a lower secondary current level to be used for protection or metering devices.
- **Industry best practices:** methods that meet or exceed jurisdictional requirements, e.g. Canadian Electrical Code (CE code), bylaws.
- **Isolation equipment:** devices built into switch boards and transformers that allows for temporary isolation of a device or section of a circuit, e.g. test switch.
- **Potential transformer:** a device used to step a primary voltage level to a lower secondary voltage level to be used for protection or metering devices.
- **Relay specific software:** programming for relays that allows the setting of operational parameters.

Contextual Variables

Range of Context

- Based on the size, scope, and complexity of the installation, testing of relay protection and meters may be carried out at different phases of the project as part of an overall commissioning plan.
- Different types and manufacturers of equipment and testing equipment may impact the way this competency is carried out.

Level of Practice

- ☒ Frontline
- ☐ Supervisor
- ☐ Manager/Executive

Adapted Bloom's Taxonomy

- ☐ Recall, Remember
- ☐ Understand
- ☐ Apply
- ☒ Analyze
- ☐ Evaluate
- ☐ Create/Transform

RWATEM (Requisite Work Aids, Tools, Equipment or Materials)

- PPE
- Documentation
- Testing equipment
- Safety barriers, e.g. pylons
- Work permits, if required
- Power source, if required

Major Category	Construction and Installation
Competency Area	Conduct Tests for Commissioning
Competency Unit	Conduct control system tests

Purpose

The correct installation of control system equipment is critical to the safe operation of the electrical power system. It provides a means to respond to the data being monitored and to make changes to operations to address situations outside the normal operating parameters. Failure to test control system equipment and ensure it is functioning correctly could result in damaged equipment, power outages, and potentially, injuries or fatalities of co-workers, stakeholders and the general public.

Performance/Abilities

P1 Plan tests:
- review prints
- determine order of tests
- determine testing requirements
- determine availability of testing equipment and power sources:
  - testing equipment is charged or has new batteries

P2 Prepare to conduct tests:
- review test equipment manuals
- use required portable testing equipment, (e.g. digital multi-meters, scopes, recorders), ensure:
  - in good working order
  - calibrated to manufacturer's specifications
  - safety features in place, e.g. sheathed probe tips
- wear appropriate PPE, e.g. hard hat, safety glasses, safety boots
- mark off work area with flags
- connect voltage and current leads with correct gauge of leads, as required

P3 Isolate equipment from energy source, as required for testing

P4 Wire check protection schemes and metering circuits, for example:
- point to point check of wiring connections

P5 Test Human Machine Interface (HMI):
- verify device operates as designed:
  - configure device based on system requirements
  - verify program is operating
- verify data/signals are being sent and received
- follow security protocols to lock out HMI

P6 Set-up auto synchronizers:
- apply settings to auto synchronizers:
  - follow manufacturer's instructions
  - test/check inputs and outputs

P7 Check functionality of controls with Supervisory Control and Data Acquisition (SCADA), if applicable:
- verify points and data telemetry with SCADA technician, if required:
  - actuate control devices to ensure remote indications
- modify SCADA functionality to incorporate new control system installation, e.g. program control points, alarm points, telemetry point, status points

P8 Test Remote Terminal Units (RTUs):
- verify each specified control, alarm and telemetry point is providing input into RTU:
  - trace data from point devices to RTU
  - ensure data is accurate for each point
  - modify RTU as needed
- verify RTU output data accepted by central SCADA system:
  - compare input data is the same as output data for each specified point device
  - ensure data is from specified point device

P9 Analyze test results for issues or deficiencies:
- compare to standards or manufacturer's specifications
- consult with other stakeholders, if required, e.g. control center, metering group, commissioning group
- initiate corrective action, as required, e.g. repair, replace

P10 Document test results and any action taken in accordance with information/record management system

Knowledge

K1 Organization policies, procedures and plans, e.g. data security protocols, information/record management system, safety

K2 Relevant CSA Standards, e.g. Canadian Electrical Code (CE code)

K3 Jurisdictional requirements, including permit requirements

K4 Industry best practices for conducting electrical tests and control system tests

K5 Principles of electricity, e.g. Ohm's law, ratios, polarity, logic theory

K6 Operation of bulk electrical power system

K7 Control system components, their purpose and characteristics

K8 Advantages and disadvantages of different types of testing equipment

K9 Data gathering infrastructure, e.g. SCADA, HMI, RTUs

Glossary

- **Auto synchronizer:** a device that is part of the control system for multiple generators or motors, which ensures that the power output of the generator or motor is synchronized with the system that the power is being provided to, e.g. same voltage, phase angle, frequency.
- **Control System:** a system of interconnected devices that provide outputs and respond to inputs, which allows for the system being monitored to be controlled.
- **Human Machine Interface (HMI):** a computer interface that allows an operator to monitor the system, track inputs and outputs, and see a visual display of data of operating equipment or system.
- **Industry best practices:** methods that meet or exceed jurisdictional requirements, e.g. Canadian Electrical Code (CE code), bylaws.
- **Remote Terminal Units:** computerized devices in the field that control and gather data from the various mechanical and electrical components of the control system, (e.g. control points, alarm points, telemetry points) and sends it to the SCADA system.
- **Supervisory Control and Data Acquisition (SCADA):** a computer application that collects, monitors and may respond to data from components of industrial systems, which can be used to base business and operational decisions.

Contextual Variables

Range of Context

- Based on the size, scope, and complexity of the installation, testing of the control system may be carried out at different phases of the project as part of an overall commissioning plan.

Level of Practice

☒ Frontline
☐ Supervisor
☐ Manager/Executive

Adapted Bloom's Taxonomy

☐ Recall, Remember
☐ Understand
☐ Apply

☒ Analyze
☐ Evaluate
☐ Create/Transform

RWATEM (Requisite Work Aids, Tools, Equipment or Materials)

- Testing equipment
- Manufacturer's manuals and specifications for control system equipment and testing equipment
- PPE
- Computer
- Communications software
- Installation prints
- Safety barriers, e.g. pylons, equipment covers
- Work permits, if required

Major Category	Construction and Installation
Competency Area	Conduct Tests for Commissioning
Competency Unit	Conduct communication system tests for commissioning

Purpose

The communication system is vital to the ability of an organization and its automated protection system to monitor and control the power system. The data provided through the communication system is the basis for operational decisions. If the communication system is incorrectly installed and not tested prior to commissioning, it could result in damage to not only the communications system, but also power system equipment. This damage is potentially dangerous for personnel and may result in power outages for consumers.

Performance/Abilities

P1 Determine purpose for testing, e.g. variations in performance, unusual data

P2 Determine test(s) required for equipment and desired information, e.g. Signal to Noise Ratio Test

P3 Plan tests:
- review prints
- determine testing requirements
- determine order of tests
- determine availability of testing equipment and power sources:
  - testing equipment is charged or has new batteries

P4 Prepare to conduct test:
- review test equipment manufacturer's manuals
- use required portable testing equipment, (e.g. digital multi-meters, frequency selective meters, power level meters, optical time-domain reflectometer), ensuring they:
  - are in good working order
  - are calibrated to manufacturer's specifications
- wear appropriate PPE, e.g. hard hat, safety glasses, safety boots
- mark off work area with flags, barrier tape or other industry best practice
- cover materials, if required
- connect leads as required. e.g. current injection, input/output simulation or verification (dependent on equipment used for testing)
- troubleshoot testing equipment using industry-accepted methods

P5 Test wiring of communication system:
- test wire continuity of control system circuits and components e.g. resistance
- test insulation resistance of control system circuits and components e.g. Megger
- test polarity of control system circuits and components

P6 Test communication equipment functionality:
- use appropriate testing equipment, e.g. frequency selective meters, multimeters, noise measuring sets
- test various communication frequencies using industry best practices

P7 Connect computer/digital device to test communication system:
- determine protocols and software, e.g. RS232
- determine required communication system software, e.g. network management software, HP, Motorola
- configure computer communication ports

P8 Test data circuits:
- measure noise:
  - use noise test set, e.g. Autotims, Bit Error rate (BER)

P9 Test power line carrier equipment, e.g. operating frequencies specified for particular Programmable Logic Controller (PLC)
- test for power levels of communication circuits

P10 Test microwave equipment:
- test power levels of communication circuits
- measure bit error for each type of circuit

P11 Test fibre-optic cable and equipment:
- test continuity, power level, bit error and cable impedance
- compare to standard for reference cable and specific circuit types
- use computer and software to interact with test equipment

P12 Test neutralizing/isolating transformer:
- use testing equipment for high voltages

P13 Test multiplexer (MUX) systems:
- ensure digital equipment is functioning correctly
- monitor signal using Synchronous Optical Networking (SONET) over fibre-optic cable
- check signal speeds through Jungle Multiplexer (JMUX) and Inverse Multiplexer (IMUX) devices

P14 Analyze test results for issues or deficiencies:
- analyze readings:
  - compare to standards or manufacturer's specifications:
  - compare noise levels/transmission impairment and bit errors to accepted levels
- initiate corrective action, as required, e.g. repair, replace

P15 Verify issues and deficiencies have been addressed:
- re-run test, if required
- verify acceptable parameters of readings or operation

P16 Document electrical test results according to information/record management system requirements

Knowledge

K1 Organization policies, procedures and plans, e.g. safety protocols

K2 Organizational information/record management system

K3 Relevant CSA Standards, e.g. Canadian Electrical Code (CE code)

K4 Jurisdictional requirements, including codes

K5 Communication system structure and system components, purpose, characteristics and functions

K6 Communication software and telecommunication protocols

K7 Manufacturer's equipment and specifications for system being installed

K8 Industry best practices for conducting communication system tests

K9 Standard electrical tests for commissioning, e.g. wire continuity, insulation resistance, ground continuity

K10 Standard electrical tests for communication systems, e.g. bit error, power level, signal to noise ratio

K11 Electrical testing procedures and protocols for both high voltage and low voltage

Glossary

- **Bit error rate:** is a measure of the number of bit errors over a standardized number of bit transmissions. Used as a measure of interference to transmissions.
- **Industry best practices:** methods that meet or exceed jurisdictional requirements, e.g. Canadian Electrical Code (CE code), bylaws.
- **Inverse Multiplexer (IMUX):** a device that can take a combined multiplexer signal and slow the signal and break it down to its original signals

- **Neutralizing/Isolating Transformers:** transformers that protect communication lines by either creating a counter electromagnetic force or isolating communication signals to allow for accurate measurement.
- **Noise:** the interference caused by electromagnetic and other environmental forces that can interfere with communication signals.
- **Optical time-domain reflectometer:** a testing device for fibre-optic cable that measures the level of impedance (resistance) in the cable.
- **Power line carrier:** the use of power lines as a means of communications transmission. Generally used to transmit communication, and protection and monitoring data of the power system.
- **Synchronous Optical Networking (SONET):** a data transmission protocol designed for fibre-optic cable.
- **Wire continuity test:** test of wiring in circuits to ensure there are no breaks in the wiring that would impede the electrical current.

Contextual Variables

Range of Context

- The size, complexity and scope of a construction and installation could affect how long it could take to complete this competency.

Level of Practice

- ☒ Frontline
- ☐ Supervisor
- ☐ Manager/Executive

Adapted Bloom's Taxonomy

- ☐ Recall, Remember
- ☐ Understand
- ☐ Apply
- ☒ Analyze
- ☐ Evaluate
- ☐ Create/Transform

RWATEM (Requisite Work Aids, Tools, Equipment or Materials)

- PPE
- Testing equipment
- Manufacturer's manuals and specifications for communication system equipment and testing equipment
- Computer
- Communications software
- Installation prints
- Safety barriers, e.g. pylons
- Covers
- Work permits, if required

electricity
HUMAN RESOURCES CANADA

Major Category	Asset Maintenance
Competency Area	Prepare to Maintain Equipment and Systems
Competency Unit	Organize materials and equipment for maintenance

Purpose

Organizing materials and equipment in advance allows practitioners to complete maintenance activities as planned thereby avoiding wasting time and money and causing unnecessary delays.

Performance/Abilities

P1 Obtain required documentation, e.g. drawings, manufacturers' specifications, maintenance plan, safety standards

P2 Review maintenance plans and job requirements, for example:
- maintenance and repair activities
- sequence of activities
- location(s)
- time allocation
- workplace hazards and risk mitigation strategies
- environmental considerations, e.g. protecting water supplies, securing areas
- roles and responsibilities of self and other crew members

P3 Arrange for materials and equipment required for job, for example:
- identify materials and equipment required, e.g. safety equipment, hand and power tools, supplies, testing equipment
- book equipment in advance, if required
- ensure components are available:
  - ensure any missing components are ordered
  - confirm delivery date
- store materials in secured area when not in use, as required

P4 Collect materials and equipment for assignment

P5 Verify equipment and tools function properly

Knowledge

K1 Organization's policies and procedures, e.g. material handling, booking equipment, containing spills

K2 Applicable regulations, e.g. WHMIS, CSA standards, transportation of dangerous goods (TDG)

K3 Organization's information/record management system

K4 System being maintained, e.g. electrical, hydraulic, mechanical

K5 Tools and equipment required for maintenance of assets

K6 Types of access equipment (e.g. ladders, scaffolding, aerial work platform), their components and procedures for use

K7 Safe work planning process, e.g. tailboard meeting, set up

K8 Safety hazards associated with equipment and tools

K9 Types of safety hazards on sites

K10 PPE required for different maintenance activities and site hazards

K11 Electrical measuring and testing equipment and procedures for use

K12 Calibration procedures for electrical measuring and testing equipment

K13 Historical information (e.g. past incidents) related to assigned task

Contextual Variables

Range of Context

- The complexity of the maintenance activities, the availability of equipment and materials, the environmental conditions, the assigned level of responsibility, and the role of the practitioner will impact the performance of this competency.

Level of Practice

- ☒ Frontline
- ☒ Supervisor
- ☐ Manager/Executive

Adapted Bloom's Taxonomy

- ☐ Recall, Remember
- ☐ Understand
- ☒ Apply
- ☐ Analyze
- ☐ Evaluate
- ☐ Create/Transform

RWATEM (Requisite Work Aids, Tools, Equipment or Materials)

- Documentation, e.g. work order, maintenance plan, drawings, manufacturers' specifications, safety standards
- Communication tools, e.g. mobile phone

Major Category	Asset Maintenance
Competency Area	Prepare to Maintain Equipment and Systems
Competency Unit	Coordinate maintenance activities with others

Purpose

Maintenance activities are coordinated with others to ensure they are completed safely, properly and efficiently.

Performance/Abilities

P1 Confirm participation of other co-workers and trades as defined in maintenance plan:
- confirm scheduling
- confirm sequence of activities, if necessary

P2 Ensure required equipment and tools are available

P3 Confirm planned outages with control center personnel, if required

P4 Notify supervisor and other relevant parties of unexpected situations:
- revise schedule, as directed
- inform other affected departments and trades of required changes
- confirm changes with affected departments and trades
- re-book equipment and tools, if required

Knowledge

K1 Organization's policies and procedures, e.g. standard operating procedures (SOPs), safe work plan (SWP)

K2 Job requirements as specified in documentation, e.g. drawings, manufacturers' specifications, maintenance plans, safety plans

K3 Organization's information/record management system

K4 Roles and responsibilities of others involved

K5 System being maintained, e.g. electrical, hydraulic, mechanical

Contextual Variables

Range of Context

- The complexity of the maintenance activities, the availability of equipment and materials, the environmental conditions, the assigned level of responsibility, and the role of the practitioner will impact the performance of this competency.

Level of Practice

- ☒ Frontline
- ☐ Supervisor
- ☐ Manager/Executive

Adapted Bloom's Taxonomy

- ☐ Recall, Remember
- ☐ Understand
- ☒ Apply
- ☐ Analyze
- ☐ Evaluate
- ☐ Create/Transform

RWATEM (Requisite Work Aids, Tools, Equipment or Materials)

- Documents, e.g. maintenance records
- Communication tools, e.g. mobile phone

Purpose

Electrical tests are conducted to assess the condition of electrical equipment and systems. Testing provides data on the current condition of equipment that may indicate potential issues. Testing may also be conducted to meet regulatory or warranty requirements, to diagnose a problem, or to confirm effectiveness of a repair.

Performance/Abilities

P1 Determine purpose for testing, e.g. variations in performance, unusual data

P2 Determine electrical test(s) required for equipment and desired information, e.g. trip test, insulation test, gas test, gas relay test, functional checks

P3 Plan tests:
- review prints
- determine testing requirements, e.g. process and tools, testing parameters, testing order
- determine availability of testing equipment and power sources:
  - testing equipment is charged or has new batteries
  - secondary or auxiliary source of current, e.g. generator
  - ensure all motor rotation is correct in both grid-tied power and generator
  - check power factor for motors and generators

P4 Prepare to conduct tests:
- review test equipment manuals
- use required portable testing equipment, (e.g. protective relay test set, multimeter, hi-pot tester), ensure:
  - in good working order
  - calibrated to manufacturer's specifications
  - safety features in place, e.g. sheathed probe tips
  - Category Safety Rating (CAT)
- wear appropriate PPE, e.g. boots, eye protection, gloves, arc flash protection
- mark off safe work area
- cover equipment with material, if required

P5 Isolate electrical equipment and circuits e.g. disconnect linkages, open breakers, open disconnect switch

P6 Apply lock-out tags, if required

P7 Conduct test according to testing protocols, including:
- connect sensing input/outputs, as required

P8 Analyze test results:
- compare readings to variables and past results

P9 Document test results

P10 Determine if corrective action or further testing is required

P11 Remove lock-out tags

P12 Re-energize equipment

P13 Update asset maintenance log in information/record management system

electricity
HUMAN RESOURCES CANADA

Knowledge

K1 Organization's policies and procedures, e.g. safety, testing standards

K2 Jurisdictional requirements, e.g. electrical code

K3 Applicable regulations, e.g. Canadian Electrical Code (CE code), North American Electric Reliability Corporation (NERC), Worker Protection Code

K4 Organizational information/record management system

K5 Principles of electricity, circuits, voltage

K6 Principles of electrical engineering, e.g. theory (AC and DC), Program Logic Controllers (PLC), breakers and fuses, fiber optics and CANBUS communication, meters and meggers, transformers, generators, motors

K7 Types of electrical tests, their purpose, parameters and procedures, e.g. contact resistance, insulation resistance, continuity and ground grid test, polarity

K8 Types of isolation equipment, e.g. CT Links and Flexi Test switches

K9 Electrical testing equipment characteristics and limitations, e.g. range and capacity

K10 Structures, electrical pathways, and functions specific to equipment and system, e.g. transformers and regulators, breakers and contactors, cables and busways, switchgear, switchboards, motor control centers, switching devices, fuses, protective relays and metering

K11 Transmission and distribution systems, e.g. underground (radial, loop, network), overhead and underwater (radial, loop)

K12 Testing result implications for equipment and/or system

K13 Factors that could influence testing results, e.g. site conditions, power output, weather conditions

K14 Software related to equipment and required settings

Glossary

- **Category Safety Rating (CAT):** when selecting voltage testing instruments, an assessment must be performed to determine the proper category (CAT) rating required, based on the hazard exposure:
  - CAT I: safety rating typically covering electronic equipment
  - CAT II: safety rating typically covering single-phase receptacle connected loads (residential)
  - CAT III: safety rating typically covering three-phase distribution, including single phase commercial lighting
  - CAT IV: safety rating typically covering three-phase at utility connection, any outdoor conductors or primary supply

- **Electrical failure:** unit that does not meet electrical specifications defined for the device.

- **Gas test:** to check gas quality in SF6 breakers (high voltage), purity and water content in parts per million (PPM).

- **Gas relay test:** check for dissolved gas in transformers, indicator of internal issues with transformer.

Contextual Variables

Range of Context

- The increasing complexity of electrical installation locations may impact the performance of this competency.
- Equipment produced by different manufacturers may vary the performance of this competency.

Level of Practice

- ☒ Frontline
- ☐ Supervisor
- ☐ Manager/Executive

Adapted Bloom's Taxonomy

- ☐ Recall, Remember
- ☐ Understand
- ☐ Apply
- ☒ Analyze
- ☐ Evaluate
- ☐ Create/Transform

RWATEM (Requisite Work Aids, Tools, Equipment or Materials)

- Diagnostics and electrical test equipment, e.g. continuity testers, current leakage meters, digital recording ammeters, digital recording voltmeters, energized insulator testers, fault indicators, hi-pot testers, meggers, multi-meter, ohmmeters, phasing sticks, potential indicators, phase rotation meters, time domain reflectometers TDR, turns test ratio TTR, very low frequency VLF testers, electronic relay meters, single or three phase power measuring devices

- PPE, e.g. safety glasses, face shields, hard hats, safety shoes, insulating rubber gloves with leather protectors, insulating sleeves, flame resistant clothing

- Documentation, e.g. electrical schematics and diagrams, manufacturers specifications and recommendations, maintenance strategy and maintenance plan of equipment

Major Category	Asset Maintenance
Competency Area	Maintain Generating, Distribution and Service Equipment
Competency Unit	Maintain overcurrent protection devices

Refer to the following task within the **Red Seal Occupational Standard (RSOS) for Industrial Electrician** and **Red Seal Occupational Standard (RSOS) for Construction Electrician** for more details on how to perform this Competency:

Industrial Electrician:

Block B: INSTALLS, SERVICES AND MAINTAINS GENERATING, DISTRIBUTION AND SERVICE SYSTEMS
Task 8: Installs and maintains protection devices
Skill 2: Maintains overcurrent protection devices

Construction Electrician:

Block B: INSTALLS, SERVICES AND MAINTAINS GENERATING, DISTRIBUTION AND SERVICE SYSTEMS
Task 8: Installs, services and maintains protection devices
Skill 1: Install overcurrent protection devices

Major Category	Asset Maintenance
Competency Area	Maintain Generating, Distribution and Service Equipment
Competency Unit	Maintain ground fault, arc fault and surge protection devices

Refer to the following task within the **Red Seal Occupational Standard (RSOS) for Industrial Electrician** and **Red Seal Occupational Standard (RSOS) for Construction Electrician** for more details on how to perform this Competency:

Industrial Electrician:

Block B: INSTALLS, SERVICES AND MAINTAINS GENERATING, DISTRIBUTION AND SERVICE SYSTEMS
Task 8: Installs and maintains protection devices
Skill 4: Maintains ground fault, arc fault and surge protection devices

Construction Electrician:

Block B: INSTALLS, SERVICES AND MAINTAINS GENERATING, DISTRIBUTION AND SERVICE SYSTEMS
Task 8: Installs, services and maintains protection devices
Skill 3: Performs servicing and maintenance of protection devices

Major Category	Asset Maintenance
Competency Area	Maintain Generating, Distribution and Service Equipment
Competency Unit	Maintain under and over voltage protection devices

Refer to the following task within the **Red Seal Occupational Standard (RSOS) for Industrial Electrician** and **Red Seal Occupational Standard (RSOS) for Construction Electrician** for more details on how to perform this Competency:

Industrial Electrician:

Block B: INSTALLS, SERVICES AND MAINTAINS GENERATING, DISTRIBUTION AND SERVICE SYSTEMS
Task 8: Installs and maintains protection devices
Skill 6: Maintains under and over voltage protection devices

Construction Electrician:

Block B: INSTALLS, SERVICES AND MAINTAINS GENERATING, DISTRIBUTION AND SERVICE SYSTEMS
Task 8: Installs, services and maintains protection devices
Skill 3: Performs servicing and maintenance of protection devices

Major Category	Asset Maintenance
Competency Area	Maintain Control Systems
Competency Unit	Maintain discrete input/output (I/O) devices

Refer to the following task within the *Red Seal Occupational Standard (RSOS) for Industrial Electrician* for more details on how to perform this Competency:

Block F: INSTALLS AND MAINTAINS PROCESS CONTROL SYSTEMS

Task 29: Installs and maintains input/output (I/O) devices

Skill 2: Maintains discrete input/output (I/O) devices

Major Category	Asset Maintenance
Competency Area	Maintain Control Systems
Competency Unit	Maintain analog input/output (I/O) devices

Refer to the following task within the *Red Seal Occupational Standard (RSOS) for Industrial Electrician* for more details on how to perform this Competency:

Block F: INSTALLS AND MAINTAINS PROCESS CONTROL SYSTEMS

Task 29: Installs and maintains input/output (I/O) devices

Skill 4: Maintains analog input/output (I/O) devices

Major Category	Asset Maintenance
Competency Area	Maintain Control Systems
Competency Unit	Maintain automated control systems

Refer to the following task within the *Red Seal Occupational Standard (RSOS) for Industrial Electrician* for more details on how to perform this Competency:

Block F: INSTALLS AND MAINTAINS PROCESS CONTROL SYSTEMS

Task 30: Installs, programs and maintains automated control systems

Skill 2: Maintains automated control systems

Major Category	Asset Maintenance
Competency Area	Maintain Signaling and Communication Systems
Competency Unit	Maintain communication systems

Refer to the following task within the *Red Seal Occupational Standard (RSOS) for Industrial Electrician* and the *Red Seal Occupational Standard (RSOS) for Construction Electrician* for more details on how to perform this Competency:

Industrial Electrician:

Block E: INSTALLS AND MAINTAINS SIGNALLING AND COMMUNICATION SYSTEMS

Task 27: Installs and maintains communication systems

Skill 2: Maintains communication systems

Construction Electrician:

Block E: INSTALLS, SERVICES AND MAINTAINS SIGNALLING AND COMMUNICATION SYSTEMS

Task 27: Installs, services and maintains communication systems

Skill 4: Performs servicing and maintenance of communication systems

Major Category	Asset Maintenance
Competency Area	Repair Electrical, Hydraulic and Mechanical Equipment and Systems
Competency Unit	Diagnose electrical, hydraulic and mechanical equipment and system issues

Purpose

Electrical, hydraulic and mechanical equipment and system issues are diagnosed to determine a course of action.

Performance/Abilities

P1 Review information on nature and possible cause of issue:
- obtain description of problem and symptoms, for example:
  - review documentation of problem
  - discuss with person who reported problem
- review fault data and historical trends from control system, e.g. error response logs, programmable logic Controllers (PLCs), Supervisory Control and Data Acquisition (SCADA), remote terminal units (RTUs)
- review past maintenance logs
- review information about equipment/system, e.g. prints, schematic drawings, specifications, manufacturer's manuals, troubleshooting flow chart

P2 Use appropriate PPE, e.g. safety glasses, hard hat, safety boots, gloves

P3 Test operation of equipment or system to determine what is working correctly and what is not

P4 Follow manufacturer's troubleshooting recommendations

P5 Isolate electrical equipment or system, when required

P6 Conduct tests to identify cause:
- perform sensory inspection to detect abnormalities, for example:
  - listening for excessive noise
  - smelling for burned components
  - feeling for excessive vibration and heat
  - looking for indicators of abnormalities, e.g. leaks, missing and loose parts, damaged components, excessive wear, corrosion
- perform diagnostics testing, e.g. voltage, current, pressure, resistance, vibration

P7 Compare test results with expected values

P8 Determine potential course(s) of action to resolve issue

Knowledge

K1 Organization's policies and procedures, e.g. safe working practices, emergency response

K2 Applicable regulations and standards, e.g. Canadian Standards Association (CSA) standards, OSHA, confined space, safety standards, NERC standards

K3 Organizational information/record management system

K4 System being maintained, e.g. electrical, hydraulic, mechanical

K5 Principles of electricity, hydraulics or mechanics

K6 Information and controls systems

K7 Equipment and system characteristics and functions

K8 Mathematical operations and graphical functions e.g. OHMs Law, graphs, phasor representation

Glossary

- **Diagnostics:** examination of symptoms to determine nature of faults or failures.
- **Fault:** component or assembly not functioning properly which could result in failure.

CONTEXTUAL VARIABLES

Range of Context

- Complexity of systems, currency of equipment, and the level of integrated automation may affect performance of this competency.
- The order of the performance steps of this competency may vary depending on the type of equipment, the system, the nature of the issue and the situation.

Level of Practice

- ☒ Frontline
- ☐ Supervisor
- ☐ Manager/Executive

Adapted Bloom's Taxonomy

- ☐ Recall, Remember
- ☐ Understand
- ☐ Apply
- ☒ Analyze
- ☐ Evaluate
- ☐ Create/Transform

RWATEM (Requisite Work Aids, Tools, Equipment or Materials)

- Diagnostics and testing equipment e.g., multimeter, megger, capacitor tester, oscilloscope, high voltage tester, vibration sensor
- Documentation, e.g. equipment history, maintenance plans, manufacturers specifications, schematics and diagrams
- Information and control systems, if applicable, e.g. supervisory control and data acquisition (SCADA)

Major Category	Asset Maintenance
Competency Area	Repair Electrical, Hydraulic and Mechanical Equipment and Systems
Competency Unit	Repair issues with electrical, hydraulic, and mechanical equipment and systems

Purpose

Repairs or corrective maintenance must be made in a timely manner to ensure equipment and systems are restored to proper functioning as quickly and as safely as possible.

Performance/Abilities

P1 Diagnose equipment and system issues

P2 Obtain approval of recommended action, if required, e.g. if it will impact original system design or assessments, cost considerations

P3 Establish job plan for approved action:
- determine job steps
- determine who needs to be involved
- obtain required tools and equipment
- conduct tailboard conference

P4 Use appropriate PPE for work, e.g. safety glasses, safety boots, hard hat

P5 Establish safe working area, e.g. barriers around hazards and work area

P6 Isolate equipment or system

P7 Complete required course of action, for example:
- repair malfunctioning components
- replace components
- modify digital logic program
- tag equipment, if unable to repair

P8 Verify issue has been resolved, e.g. conduct appropriate test, ensure correct operation

P9 Update asset maintenance log in information/record management system

P10 Update prints, if applicable

Knowledge

K1 Organization's policies and procedures, e.g. electrical safety, arc-flash policies, lock-out tag-out procedures

K2 Applicable regulations, e.g. OHS regulations (see conduct tests for maintenance), Canadian Electrical Code

K3 Organizational information/record management system

K4 Principles of electricity, hydraulics or mechanics

K5 Information and control systems, e.g. outage management systems OMS, dashboard/PSE outage map, SAP Customer Information Systems, Supervisory Control and Data Acquisition SCADA, gas loading modeling

K6 System characteristics and functions

K7 Mathematical operations and graphical functions e.g. OHMs Law, graphs, phasor representation

Glossary

- **Phasor representation/diagram:** a graphical way of representing magnitude and directional relationship between two or more alternating quantities e.g. current, voltage.

CONTEXTUAL VARIABLES

Range of Context

- Complexity of systems, currency of equipment, and the level of integrated automation may affect performance of this competency.

Level of Practice

- ☒ Frontline
- ☐ Supervisor
- ☐ Manager/Executive

Adapted Bloom's Taxonomy

- ☐ Recall, Remember
- ☐ Understand
- ☐ Apply
- ☒ Analyze
- ☐ Evaluate
- ☐ Create/Transform

RWATEM (Requisite Work Aids, Tools, Equipment or Materials)

- Hand and portable power tools, e.g., splicing equipment, specialized locating equipment, soldering tools, micro-welding equipment, calipers, torque wrenches
- Diagnostic tools, e.g. thermography equipment, high potential testers, ultrasonic testers, circuit breaker analyzers, micrometers
- Materials, e.g. cleaning solutions, air hoses, rivets, bolts
- Safety equipment, e.g. safety glasses, hard hat, safety boots
- Documentation, e.g. schematics and diagrams, past maintenance logs, SCADA data, manufacturers specifications and recommendations, maintenance plan of equipment

Major Category	Asset Maintenance
Competency Area	Repair Electrical Equipment and Systems
Competency Unit	Troubleshoot digital logic circuits

Purpose

Issues with digital logic circuits need to be resolved in order to restore the power system to normal conditions securely and rapidly. This results in minimized losses and restoration time, and diminished adverse impacts. Resetting the digital logic circuits is typically required after an outage or some form of system fault.

Performance/Abilities

P1 Troubleshoot digital logic circuits issues, for example:
- review information on nature and possible cause:
  - obtain technical feedback
  - interpret SCADA findings
  - review schematic drawings, diagrams, blueprints, specifications
  - review past asset maintenance logs
- determine if issue is computer-based (i.e. dry air system, relay) or electric circuit- or equipment-based

P2 Interface with control systems, e.g. SCADA, Programmable Logic Controllers (PLCs), Remote Transmitting Unit(s) (RTU), Digital Analog Controllers (DACs), Automatic Circuit Reclosers (ACR) controllers

P3 Follow program flow and logic to determine problem

P4 Recommend program modification or consult with appropriate personnel, e.g. protection and control, design, engineering

P5 Obtain approval for modification

P6 Modify program:
- save copy of new program version

P7 Document issue and action taken in information/record management system

Knowledge

K1 Organization's policies and procedures, e.g. safe work practices,

K2 Organizational information/record management system

K3 Computer-based systems, e.g. dry air systems, relay systems

K4 Control systems, e.g. SCADA, PLCs, remote transmitting unit (RTU), digital analog controllers (CAD), ACR controls

K5 Digital circuits and information processing, e.g. logic functions, logic families

K6 Operational procedures, block diagrams, circuit theory of operation, diagnostic troubleshooting flowcharts, circuitry operation, ladder logic

K7 Electrical power systems

K8 Principles of electrical theory

K9 Principles of digital logic, e.g. discrete values, logic levels, conversions, logic gate symbols

K10 Digital signal processing, e.g. analog to digital conversion, signal to noise ratio, signals transformation, magnitude

K11 Applicable regulations, e.g. NERC

K12 Canadian Electrical Code

K13 Principles of networking, microprocessor systems, instrumentation, telecommunications, and other related technologies

K14 Manufacturer's software for equipment

Glossary

- **Digital logic family:** a group of electronic gates.
- **Digital logic circuit:** electronic circuits that have logic signals as in-puts and outputs.
- **Ladder logic:** programming language that creates/represents programs through ladder diagrams that are based on circuit diagrams.

CONTEXTUAL VARIABLES

Range of Context

- Complexity of systems may affect level of analysis required.
- Varying ages of equipment and software (software versions), and the level of integrated automation, may affect performance of this competency.

Level of Practice

- ☒ Frontline
- ☐ Supervisor
- ☐ Manager/Executive

Adapted Bloom's Taxonomy

- ☐ Recall, Remember
- ☐ Understand
- ☐ Apply
- ☒ Analyze
- ☐ Evaluate
- ☐ Create/Transform

RWATEM (Requisite Work Aids, Tools, Equipment or Materials)

- Computer diagnostic and configuration software and hardware to interface to the control system

Major Category	Engineering
Competency Area	Provide Support for Engineers
Competency Unit	Conduct investigative tasks under direction of engineer

Purpose

Assisting engineers with investigative projects are opportunities to develop expertise and to develop professionally.

Performance/Abilities

P1 Conduct investigation for engineers, for example:
- conduct tests
- collect data
- review current and historical data
- monitor equipment in the field
- diagnose electrical equipment and system issues

P2 Follow appropriate procedures and protocols to maintain a safe work environment, for example:
- follow safe work practices
- use personal protective equipment
- participate in safety meetings and emergency drills
- perform lock-out tag-out procedures
- handle and store hazardous materials
- work in confined spaces
- use fall arrest equipment
- minimize radiation exposure

P3 Analyze results of investigations, for example:
- trends
- repeating issues
- integration issues

P4 Make recommendations based on investigative purpose

P5 Document methodology, results and recommendations

P6 Make presentation to investigative team, if required

Knowledge

K1 Organization's policies and procedures, e.g. safe work practices,

K2 Organizational information/record management system

K3 Different types of electrical systems and equipment, their characteristics and purpose

K4 Types of data collected by system and its purpose

K5 Applicable regulations, e.g. CSA, NERC, OH&S

K6 Perform mathematical calculations and graphical functions

K7 Principles of electricity

K8 Types of electrical tests, their purpose and procedure

K9 Types of electrical testing equipment their purpose and operation

CONTEXTUAL VARIABLES

Range of Context

- Engineers are involved in creating solutions to a wide variety of problems. Assisting engineers in these endeavours could involve a wide range of tasks and would affect the way this competency is completed.

Level of Practice

- ☒ Frontline
- ☐ Supervisor
- ☐ Manager/Executive

Adapted Bloom's Taxonomy

- ☐ Recall, Remember
- ☐ Understand
- ☐ Apply
- ☒ Analyze
- ☐ Evaluate
- ☐ Create/Transform

RWATEM (Requisite Work Aids, Tools, Equipment or Materials)

- PPE, e.g. safety glasses, hard hat, safety boots

Major Category	Safety
Competency Area	Maintain a Safe Working Environment
Competency Unit	Follow safe work practices

Purpose

Following safe work practices is critical to protect employees, contractors, customers and the general public against injury or death, and to protect the organization and its assets from loss and liability.

Performance/Abilities

P1   Participate in safety orientations and training

P2   Complete safety certifications, as required, e.g. confined space

P3   Identify locations of:
- first aid kit
- emergency equipment
- emergency access routes

P4   Participate in daily safety meeting/tail-board meetings

P5   Follow safety policies and procedures on site, e.g. limits of approach

P6   Respect physical limitations of self and others

P7   Use protection systems, as required, e.g. lock-out tag-out, card system

P8   Inspect safety systems, as required, e.g. guards, emergency stops

P9   Perform tests, as required, e.g. test voltage level

P10 Establish exclusion zones, when required, e.g. around open trench or working heavy equipment:
- place barriers and/or signage

P11 Identify hazards on site, e.g. personal safety, work site, environmental:
- monitor weather conditions, as necessary

P12 Minimize or remove hazards, as necessary, for example:
- protect self from weather-related conditions, e.g. wear sunscreen and sunglasses, keep hydrated, wear warm clothing

P13 Use equipment only as intended/classified:
- ensure equipment is appropriate for work site conditions

P14 Maintain clean, orderly work area

P15 Dispose of waste materials, as required:
- dispose of hazardous materials (e.g. chemicals, batteries) according to legislation and organizational policies

P16 Store materials and equipment in designated areas

P17 Communicate issues to relevant personnel, e.g. co-workers, project manager:
- document work safety issues, as required

Knowledge

K1   Relevant legislation, including Occupational Health and Safety (OH&S)

K2   Safety Management Plan

K3   Organizational safety policies and procedures, including OH&S

K4   Workplace Hazardous Materials Information System (WHMIS)

K5   Required training and certifications for specific work, e.g. confined space

K6   Required personal protective equipment (PPE)

K7   Types of safety hazards on site

K8   Available emergency response services and their contact information

K9   Available equipment on worksite/in vehicles, e.g. first aid, containment equipment

K10 Procedures for safe excavation, if required

K11 Safety reporting procedures

CONTEXTUAL VARIABLES

Range of Context

- Quantity and type of safety hazards varies with type of work and work location.

Level of Practice

- ☒ Frontline
- ☒ Supervisor
- ☒ Manager/Executive

Adapted Bloom's Taxonomy

- ☐ Recall, Remember
- ☐ Understand
- ☒ Apply
- ☐ Analyze
- ☐ Evaluate
- ☐ Create/Transform

RWATEM (Requisite Work Aids, Tools, Equipment or Materials)

- First aid kits
- Safety equipment, e.g. spill kit, fire extinguisher
- Safety features on equipment
- Personal protective equipment (PPE)
- Rated tools, e.g. screwdriver rated for particular voltage

Major Category	Safety	Major Category	Safety
Competency Area	**Maintain a Safe Working Environment**	**Competency Area**	**Maintain a Safe Working Environment**
Competency Unit	**Use personal protective equipment (PPE)**	**Competency Unit**	**Participate in safety meetings and emergency drills**

Purpose

Using PPE correctly protects employees against injury or death, and protects the organization and its assets from loss and liability.

Performance/Abilities

P1 Ensure required training is up to date, e.g. fall arrest equipment training

P2 Select equipment appropriate to task and work environment

P3 Inspect/test PPE before use:
- check expiry dates, if applicable
- document condition

P4 Ensure PPE is properly fitted and adjusted

P5 Use PPE only for intended purpose

P6 Communicate issues with PPE to relevant personnel, e.g. co-workers, supervisor

P7 Tag defective equipment:
- turn in to relevant personnel or department

P8 Clean PPE after use:
- store in designated location

Knowledge

K1 Relevant legislation, including Occupational Health and Safety (OH&S)

K2 Organizational safety policies and procedures, including OH&S

K3 Potential safety hazards on site

K4 PPE required for specific tasks, equipment and environments

CONTEXTUAL VARIABLES

Range of Context

- Quantity and type of PPE varies with type of work and work location.

Level of Practice

- ☒ Frontline
- ☒ Supervisor
- ☒ Manager/Executive

Adapted Bloom's Taxonomy

- ☐ Recall, Remember
- ☐ Understand
- ☒ Apply
- ☐ Analyze
- ☐ Evaluate
- ☐ Create/Transform

RWATEM (Requisite Work Aids, Tools, Equipment or Materials)

- PPE, e.g. hard hats, safety glasses, safety boots, rubber gloves, fall arrest and restraint equipment, fire-retardant clothing, shock hazard PPE, arc flash hazard PPE, hearing protection, respiratory protection equipment

Purpose

Participating in safety meetings and emergency drills is important to ensure employees, contractors and customers work in a safe manner and are prepared for unexpected events. This also protects the organization and its assets against loss and liability.

Performance/Abilities

P1 Attend meetings and drills at scheduled times

P2 Identify role of self and team members in meetings and drills

P3 Share knowledge and skills with co-workers

P4 Communicate work issues to the group

P5 Participate in emergency drills, e.g. evacuation, fire, environmental, sabotage/terrorist/bomb threat, electrical restoration

P6 Debrief drills and exercises:
- provide feedback

P7 Take notes, if applicable

Knowledge

K1 Relevant legislation

K2 Organizational safety policies and procedures, including communication protocols

K3 Own and others' roles and responsibilities during emergencies

K4 Contact information for emergency services

K5 Types of safety hazards on site

CONTEXTUAL VARIABLES

Range of Context

- Types of meetings and emergency drills will vary with organization, type of work and work location.

Level of Practice

- ☒ Frontline
- ☒ Supervisor
- ☐ Manager/Executive

Adapted Bloom's Taxonomy

- ☐ Recall, Remember
- ☐ Understand
- ☒ Apply
- ☐ Analyze
- ☐ Evaluate
- ☐ Create/Transform

electricity
HUMAN RESOURCES CANADA

Major Category	Safety
Competency Area	Maintain a Safe Working Environment
Competency Unit	Isolate component, equipment or system

Purpose

Isolation procedures must be performed correctly to protect self and others (e.g. other employees, contractors, customers and the public) in preparation for work on powered components, equipment or systems. Performing this task incorrectly can lead to serious injury or death. This task also protects the organization and its assets against loss and liability.

Performance/Abilities

P1 Identify all sources of hazardous energy that may be encountered when performing work on component, equipment or system

P2 Disconnect each hazardous energy source in component, equipment or system, e.g. disconnect linkages, open breakers, open disconnect switch

P3 De-energize component, equipment or system, if required:
- release stored or residual energy, for example:
  - ground electrical devices, e.g. capacitors, batteries/UPS, accumulators
  - release hydraulic liquid
  - vent air pressure
  - brake mechanical movement

P4 Perform lock-out tag-out procedures

P5 Verify isolation using one of following methods:
- activate controls to ensure no response:
  - complete visual inspection, ensure electrical connections are open
- test component, equipment or system to ensure zero potential energy, for example:
  - test circuitry
  - check pressure gauges to ensure energy removed
  - check temperature gauges to ensure thermal energy discharged

P6 Document, as required

P7 Return component, equipment or system to normal configuration

P8 Ensure component, equipment or system can be safely re-energized, e.g. phase testing, Megger testing

P9 Re-energize component, equipment or system, if no other locks on equipment or system:
- coordinate re-energization with controlling authority

P10 Test component, equipment or system to ensure operating properly

P11 Document, as required

Knowledge

K1 Relevant regulations, e.g. work protection, grounding and bonding code

K2 Organization's policies and procedures, e.g. electrical safety, arc-flash policies, hazard assessment, lock-out tag-out procedures

K3 Type and rating of PPE required for isolation

K4 Testing procedures

K5 Electrical and mechanical principles, e.g. AC and DC, pressure

K6 Primary energy sources (i.e. electrical, mechanical, hydraulic, chemical, thermal and gravitational) in components, equipment and systems

K7 Safety tests to ensure zero energy state

K8 Electrical and mechanical control systems and components, e.g. SCADA, program logic controllers (PLC), breakers, fuses, disconnects

Glossary

- **De-energize (aka depressurize):** a process used to remove residual or stored energy from isolated component, equipment or system to eliminate the chance that residual or stored energy could accidentally harm workers.
- **Isolate:** a process used to disconnect component, equipment or system from a primary source of energy to eliminate the chance that the primary source of energy in component, equipment or system could accidentally harm workers.
- **Lock-out tag-out (LOTO):** a safety procedure used to ensure that components, equipment or systems are locked off and not able to be started up again prior to the completion of maintenance or repair work. It requires that hazardous energy sources be isolated and rendered inoperative before work is started on the component, equipment or system in question.
- **Tag-out:** a labelling process that is always used when lock-out is required; the process involves attaching or using an information tag or indicator (typically a standardized label) that includes tag #, name of component, equipment or system that has been isolated or re-configured, why lockout is required, the time of application, and the name of the authorized person who attached lock and tag.

Contextual Variables

Range of Context

- A multi-point isolation procedure requires more than one lock and may need more than one worker to execute.

Level of Practice	Adapted Bloom's Taxonomy	
☒ Frontline	☐ Recall, Remember	☒ Analyze
☒ Supervisor	☐ Understand	☐ Evaluate
☒ Manager/Executive	☐ Apply	☐ Create/Transform

RWATEM (Requisite Work Aids, Tools, Equipment or Materials)

- PPE, e.g. arc flash protection equipment, safety glasses, steel-toed boots, hard hats
- Lock-out tag-out devices, e.g. breaker lock, multi-lock, lock box, tag, hold cards
- Energy testing equipment, e.g. voltmeters, pressure gauges
- Energy removal devices, e.g. ground straps
- Locking devices, e.g. rotor pins

Major Category	Safety
Competency Area	Maintain a Safe Working Environment
Competency Unit	Perform lock-out tag-out procedures

Purpose

Lock-out tag-out procedures are performed for self-protection and as part of work protection procedures. These safety procedures eliminate the chance that equipment or systems could harm people through the unintended release of energy or the unintended start-up or motion of equipment or components. Not following proper lock-out tag-out procedures can lead to serious injury or death. These procedures also protect the organization and its assets against loss and liability.

Performance/Abilities

P1 Ensure required training is up to date

P2 Plan lock-out tag-out with relevant personnel:
- clarify scope of work to be done
- identify potential energy sources that must be controlled
- identify equipment and/or system to be locked-out tagged-out:
  - refer to panel schedules, drawings, single-line diagrams, cable and equipment tags
- confirm details:
  - when lock-out tag-out will begin
  - how long it will continue
  - authorized person responsible for applying locks and tags
  - affected persons to inform of lock-out tag-out

P3 Inform affected persons of lock-out tag-out

P4 Select appropriate PPE

P5 Isolate component, equipment or system:
- de-energize component, equipment or system, if required
- coordinate with controlling authority, if required

P6 Apply locking mechanisms or approved devices (e.g. locking pins, rotor locks), on component, equipment or system, as required

P7 Apply approved tag with required information, including:
- tag number
- name of component, equipment or system that is locked out
- why lock-out is required
- time component, equipment or system was locked out
- name of authorized person who attached tag and lock

P8 Verify component, equipment or system is locked out and tagged out properly:
- conduct visual inspection, e.g. tag filled out correctly

P9 Remove lock-out devices and tags when maintenance or repair activities are completed

Knowledge

K1 Organizational safety policies and procedures, including lock-out tag-out procedures

K2 Relevant legislation

K3 Training renewal requirements for lock-out tag-out

K4 Hazards associated with lock-out tag-out

K5 Energy potential in components, equipment and systems

K6 Procedures for potential energy testing

K7 Safety checks to ensure zero energy state

K8 Types of lock-out procedures, e.g. individual, group, and complex

K9 Types of locking devices and their applications

K10 Types of tags and their applications

Glossary

- **De-energize (aka depressurize):** a process used to remove residual or stored energy from isolated component, equipment or system to eliminate the chance that residual or stored energy could accidentally harm workers.
- **Isolate:** a process used to disconnect component, equipment or system from a primary source of energy to eliminate the chance that the primary source of energy in component, equipment or system could accidentally harm workers.
- **Lock-out tag-out (LOTO):** a safety procedure used to ensure that components, equipment or systems are locked off and not able to be started up again prior to the completion of maintenance or repair work. It requires that hazardous energy sources be isolated and rendered inoperative before work is started on the component, equipment or system in question.
- **Tag-out:** a labelling process that is always used when lock-out is required; the process involves attaching or using an information tag or indicator (typically a standardized label) that includes tag #, name of component, equipment or system that has been isolated or re-configured, why lock-out is required, the time of application, and the name of the authorized person who attached lock and tag.

CONTEXTUAL VARIABLES

Range of Context

- Types of systems that may be locked out vary, e.g. electrical, mechanical, hydraulic, pneumatic.
- Approved devices used to lock-out equipment/systems vary depending on the types of energy involved.
- Types of approved devices and voltage-rated equipment used to perform this task vary.
- A multi-point isolation procedure requires more than one lock and may need more than one worker to execute.
- The procedures for lock-out and tag-out may vary when provided as part of work protection.

Level of Practice

- ☒ Frontline
- ☒ Supervisor
- ☒ Manager/Executive

Adapted Bloom's Taxonomy

- ☐ Recall, Remember
- ☐ Understand
- ☐ Apply
- ☒ Analyze
- ☐ Evaluate
- ☐ Create/Transform

RWATEM (Requisite Work Aids, Tools, Equipment or Materials)

- Locking mechanisms or devices, e.g. locking pins, rotor locks, bars, cribbing, chains
- Tag devices, e.g. test and operate cards, hold cards
- Approved safety devices, e.g. arc flash protection equipment, energy removal devices, PPE
- Potential energy testing equipment, e.g. voltmeters, pressure gauges

Major Category	Safety
Competency Area	**Maintain a Safe Working Environment**
Competency Unit	**Handle, transport and store hazardous materials**

Level of Practice

☒ Frontline
☒ Supervisor
☐ Manager/Executive

Adapted Bloom's Taxonomy

☐ Recall, Remember
☐ Understand
☒ Apply

☐ Analyze
☐ Evaluate
☐ Create/Transform

RWATEM (Requisite Work Aids, Tools, Equipment or Materials)

- Safety Data Sheets (SDS)
- Approved containers for chemicals/hazardous materials
- Safety equipment, e.g. chemical aprons, goggles, spill containment

Purpose

Handling, transporting and storing hazardous materials must be performed correctly to ensure the safety of employees, contractors, customers the public, and the environment. Performing this task incorrectly can lead to serious injury or death. This task also protects the organization and its assets against loss and liability.

Performance/Abilities

P1   Ensure WHMIS training is up to date
P2   Ensure transportation of dangerous goods (TDG) training is up to date, if applicable
P3   Review information provided on Safety Data Sheets (SDS) for each material to be handled
P4   Review manufacturer's instructions for each material to be handled, if applicable
P5   Follow handling and disposal guidelines for hazardous materials, for example:
   - do not combine chemical products, as some combinations can be hazardous
   - use designated containers when transferring chemical products
   - label all chemical products/hazardous materials

P6   Store chemicals in designated, ventilated area away from danger, e.g. heat source
P7   Transport hazardous materials according to guidelines and legislation
P8   Document activities, as required

Knowledge

K1   Relevant legislation
K2   WHMIS, including hazard symbols, Safety Data Sheets (SDS)
K3   Organizational safety policies and procedures
K4   Location of first aid stations and procedures
K5   Location of safety equipment, e.g. eye-wash stations, spill containment

Glossary

- **Workplace Hazardous Material Information System (WHMIS):** a federal government mandated program that provides information on the safe use, storage, handling, and disposal of hazardous materials that may be in the workplace.

CONTEXTUAL VARIABLES

Range of Context

- Types of hazardous materials stored and handled varies depending upon type of work and work location.

Major Category	Safety
Competency Area	Maintain a Safe Working Environment
Competency Unit	Work in confined spaces

Purpose

Working in confined spaces must be performed correctly to ensure the safety of employees and contractors. Performing this task incorrectly can lead to serious injury or death. This task also protects the organization against loss and liability.

Performance/Abilities

P1 Ensure confined space training is up to date

P2 Preplan entry:
- identify hazards, e.g. gases, multiple power sources
- discuss with team members
- review rescue procedures

P3 Select appropriate personal protective equipment (PPE)

P4 Erect barriers and warning signs, as necessary

P5 Gather tools and equipment before entering space

P6 Use confined space equipment according to manufacturer's instructions

P7 Verify entry permit

P8 Monitor and document atmospheric conditions:
- evacuate space, as necessary

P9 Maintain constant communication with team members outside of confined space

P10 Secure confined space during inactivity

Knowledge

K1 Relevant legislation, including Occupational Health & Safety (OH&S)

K2 Organizational safety policies and procedures

K3 Manufacturer's instructions and recommendations

K4 Location of first aid stations and procedures

K5 Definition of confined space, e.g. locations that require care and monitoring

K6 Types of confined space monitoring equipment and their operation

K7 Hazards associated with confined spaces

K8 Types of gasses and their properties

K9 Rescue procedures for confined spaces

Level of Practice

- ☒ Frontline
- ☒ Supervisor
- ☐ Manager/Executive

Adapted Bloom's Taxonomy

- ☐ Recall, Remember
- ☐ Understand
- ☐ Apply
- ☒ Analyze
- ☐ Evaluate
- ☐ Create/Transform

RWATEM (Requisite Work Aids, Tools, Equipment or Materials)

- Equipment for communication, e.g. two-way radios, air horns, closed circuit video
- Equipment for securing confined spaces, e.g. signage, tape, barricades, barriers, locks, hole covers
- Personal protective equipment, e.g. safety harness, respirator
- Space conditioning equipment, e.g. fans, inert gas, pressurized air, sump pump
- Monitoring equipment
- Rescue equipment

CONTEXTUAL VARIABLES

Range of Context

- Types of confined spaces vary, e.g. trenches, tanks, stacks.
- Types of hazards vary, e.g. lack of ventilation, inert gas, oxygen deficiency, exceeding explosive limits.
- Types of gasses encountered in confined spaces vary, e.g. chlorine, carbon monoxide.

Major Category	Safety
Competency Area	Maintain a Safe Working Environment
Competency Unit	Use fall arrest equipment

RWATEM (Requisite Work Aids, Tools, Equipment or Materials)

- Fall arrest equipment, e.g. harness, lanyard
- Anchors

Purpose

Fall arrest equipment must be used correctly to ensure the safety of employees and contractors. Performing this task incorrectly can lead to serious injury or death. This task also protects the organization against loss and liability.

Performance/Abilities

P1 Ensure fall arrest training is up to date

P2 Use fall arrest equipment only for intended purpose

P3 Ensure ladders, scaffolding and lift equipment are appropriate for task

P4 Select appropriate personal protective equipment (PPE)

P5 Inspect fall arrest equipment before use:
- check expiry dates, if applicable
- document condition
- tag and remove defective equipment from service

P6 Ensure fall arrest equipment is properly fitted and adjusted

P7 Ensure safety harnesses are attached to rated anchor points

P8 Communicate issues to relevant personnel, e.g. co-workers, supervisor

P9 Clean fall arrest equipment after use:
- store in designated location

Knowledge

K1 Relevant legislation, including Occupational Health and Safety (OH&S)

K2 Organizational safety policies and procedures, including OH&S

K3 Manufacturer's specifications and recommendations for use and care

K4 Types of safety hazards on site that impact fall arrest

K5 PPE required for specific environments

K6 Use of anchor points

CONTEXTUAL VARIABLES

Range of Context

- Types of fall arrest equipment and anchors may vary depending on job and environment.

Level of Practice

- ☒ Frontline
- ☒ Supervisor
- ☐ Manager/Executive

Adapted Bloom's Taxonomy

- ☐ Recall, Remember
- ☐ Understand
- ☒ Apply
- ☐ Analyze
- ☐ Evaluate
- ☐ Create/Transform

Major Category	Safety
Competency Area	Maintain a Safe Working Environment
Competency Unit	Minimize radiation exposure

Purpose

Minimizing exposure to radiation is critical to mitigate risks that threaten personal safety, environment and production in nuclear power generating facilities and other generating stations that use radioactive substances.

Performance/Abilities

P1 Use radiation monitoring systems, e.g. handheld gamma/beta meters
- verify operation of meters on a daily basis

P2 Conduct radiation surveys, as required:
- in vicinity of radiation source
- for surface contamination
- for airborne radio activity

P3 Follow radiation exposure permits, for example:
- wear appropriate Electronic Personal Dosimetry (EPD) for radiation levels
- wear appropriate PPE
- limit exposure time

P4 Consult records as needed, e.g. system history and trends, entries in information/record management and asset management system

P5 Identify abnormalities, e.g. alarms:
- resolve issues when possible, e.g. mitigate tritium leaks, dispose of contaminated materials

P6 Respond to unplanned events, e.g. primary heat transport leaks

P7 Initiate or assist with maintenance, as appropriate

P8 Document test results overages and operational changes:
- communicate/file information, as required

Knowledge

K1 Applicable regulations as developed and overseen by the Canadian Nuclear Safety Commission, e.g. safety, environmental, record keeping, operator certification

K2 Manufacturer's specifications and recommendations

K3 Operating policies and procedures, e.g. taking samples, conducting tests

K4 Information/record management system

K5 Digital documentation, e.g. mechanical and electrical schematics and diagrams

K6 Interrelatedness of equipment and systems and impact on operations

K7 Characteristics of radiation

K8 Devices used to monitor radiation, e.g. radiation monitor units, meters

K9 Radiation containing systems, e.g. filtering system, vacuum system, negative pressure containment system

Glossary

- **Abnormalities:** information gathered from monitoring and inspections of equipment and systems that indicate existing or potential problems; equipment and systems that are operating outside of desired parameters.

- **Distributed control system (DCS):** a control system that regulates a process from a series of strategic positions in the processing plant, as opposed to from a single, centralize control unit.
- **Inspect:** to observe the condition of equipment and systems using human senses, e.g. sight, hearing, touch, smell. Inspections may be routine or conducted as part of the troubleshooting process when issues arise to determine the cause of unplanned events.
- **Monitor:** to observe the condition of equipment and systems using data that is displayed on equipment or computer monitors.
- **Operate:** to monitor (e.g. SCADA, data, alarms, video), inspect (e.g., touch, sight, smell, sound) and control when necessary (e.g., start/stop and adjust) generating station equipment and auxiliaries.
- **Radiation:** energy that is transmitted in the form of waves or streams of particles. In a nuclear reaction, radiation is emitted through fission; the heat created by the fission process is used to power steam turbines in nuclear power stations.
- **Radiation levels:** measurement of the amount of ionizing radiation released by a material that is expressed as radioactivity.
- **Radioactivity:** the property possessed by some elements (such as uranium) of spontaneously emitting energy in the form of radiation as a result of the decay of an unstable atom. Radioactivity is also the term used to describe the rate at which radioactive material emits radiation.
- **Supervisory control and data acquisition (SCADA) system:** a process automation system consisting of software and programmable logic controllers (PLCs) that collects data from instruments and sensors in remote locations (e.g. substations) and transmits it to a control centre for monitoring or controlling purposes.

CONTEXTUAL VARIABLES

Range of Context

- Power generating stations may use nuclear equipment for monitoring, e.g. coal storage bunkers.

Level of Practice

- ☒ Frontline
- ☐ Supervisor
- ☐ Manager/Executive

Adapted Bloom's Taxonomy

- ☐ Recall, Remember
- ☐ Understand
- ☒ Apply
- ☐ Analyze
- ☐ Evaluate
- ☐ Create/Transform

RWATEM (Requisite Work Aids, Tools, Equipment or Materials)

- Radiation monitors, e.g. fixed area gamma meters, Electronic Personal Dosimetry (EPD)
- Appropriate PPE
- Monitoring and control applications, e.g. SCADA, DCS
- Required documents, e.g. manufacturer's specifications, standard operating procedures, checklists

Purpose

Following sustainable work practices is critical to protect the environment and to protect employees, contractors and the general public against personal injury. It creates a positive public impression of the organization and its commitment to social responsibility, and protects the organization from loss and liability.

Performance/Abilities

P1 Ensure required training is up to date, e.g. WHMIS

P2 Identify potential environmental hazards, including:

- contaminants of water, air and soil
- hazardous materials

P3 Identify locations of:

- first aid kit
- spill kits
- emergency access routes and personnel
- Safety Data Sheets (SDS)

P4 Monitor weather conditions, as necessary, e.g. consider direction of chemical drift

P5 Follow waste management practices:

- sort waste by type
- place waste in correct disposal container or area

P6 Use recycled products and materials when possible

P7 Store hazardous materials and equipment in designated areas

P8 Dispose of hazardous materials (e.g. chemicals, batteries) according to legislation and organizational policies

P9 Communicate issues to relevant personnel, e.g. co-workers, supervisor:

- document issues, as required

Knowledge

K1 Relevant legislation, including Occupational Health and Safety (OH&S)

K2 Organizational safety policies and procedures, including OH&S

K3 Sustainability plan and practices, e.g. energy and water conservation, commitment to low-carbon energy

K4 Importance of sustainable practices, e.g. controlled use of ozone depleting substances

K5 Safety Management Plan

K6 Workplace Hazardous Materials Information System (WHMIS)

K7 Types of hazardous materials associated with specific work activities

K8 Available emergency response services and their contact information

K9 Available equipment on site or in vehicles, e.g. first aid, containment equipment

K10 Procedures for safe evacuation, if required

K11 Procedures for containment, if required

K12 Safety reporting procedures

CONTEXTUAL VARIABLES

Range of Context

- Quantity and type of hazards vary with type of work and work location.

Level of Practice

- ☒ Frontline
- ☒ Supervisor
- ☒ Manager/Executive

Adapted Bloom's Taxonomy

- ☐ Recall, Remember
- ☐ Understand
- ☒ Apply
- ☐ Analyze
- ☐ Evaluate
- ☐ Create/Transform

RWATEM (Requisite Work Aids, Tools, Equipment or Materials)

- First aid kits
- Spill kit
- Personal protective equipment
- Safety Data Sheets (SDS)

Major Category	Safety
Competency Area	Respond to Emergencies
Competency Unit	Participate in incident and accident investigations

Purpose

Participating in the investigation of an incident or accident will help to determine what happened, why it occurred, and how to prevent similar events from occurring in the future.

Performance/Abilities

P1 Survey scene, as required:
- make the scene safe
- secure the scene, as necessary
- tag relevant equipment or materials
- photograph environment, as necessary

P2 Gather information, as required, for example:
- people directly and indirectly involved
- relevant equipment or material
- site
- process, i.e. work procedures, instructions, training, safety records

P3 Participate in interviews with relevant parties, e.g. emergency authority, Worker's Compensation Board (WCB), supervisor:
- describe events in own words

P4 Document events, as necessary, e.g. write witness report

P5 Participate in root-cause analysis, as required

Knowledge

K1 Relevant legislation

K2 Safe work procedures

K3 Incident investigation and reporting requirements

K4 Types of safety hazards on site

Glossary

- **Accident:** an accident is an unplanned, unwanted event that disrupts the orderly flow of the work process. It involves the motion of people, objects or substances.
- **Incident:** an accident or other occurrence which resulted in or had the potential to cause injury or occupational disease. The term incident includes "close-call" or "near-miss" events.
- **Worker's Compensation Board (WCB):** WCB is an insurance program that covers injuries in the workplace. It covers wage replacement for injured workers, healthcare costs and rehabilitation costs. It is paid for by employers and is no fault.

CONTEXTUAL VARIABLES

Range of Context

- Complexity of investigation and required reports will depend upon the accident/incident, type of work and work location.

Level of Practice

- ☒ Frontline
- ☒ Supervisor
- ☒ Manager/Executive

Adapted Bloom's Taxonomy

- ☐ Recall, Remember
- ☐ Understand
- ☐ Apply
- ☒ Analyze
- ☐ Evaluate
- ☐ Create/Transform

RWATEM (Requisite Work Aids, Tools, Equipment or Materials)

- Camera
- Notebook
- Computer software
- Legal forms related to incident/accident reporting
- Personal protective equipment (PPE)

electricity
HUMAN RESOURCES CANADA

Major Category	Security	Major Category	Security
Competency Area	**Follow Security Practices**	**Competency Area**	**Follow Security Practices**
Competency Unit	**Follow security practices for physical work environment**	**Competency Unit**	**Follow cybersecurity procedures**

Purpose

Following practices to protect the physical work environment is critical to protect project/organizational assets, employees, contractors, customers and the general public.

Performance/Abilities

P1 Adhere to security procedures, including:
- participate in NERC training, as required
- use tools and equipment, e.g. access cards
- identify situations that may cause security issues, e.g. door propped open, gate access point unmanned

P2 Update procedures/tools on regular basis, as required, e.g. use new codes

P3 Report unsafe or suspicious activity, e.g. unauthorized visitors, equipment being removed from site unexpectedly

P4 Document work security issues

Knowledge

K1 Relevant legislation

K2 NERC Standards

K3 Organizational/project security policies and procedures

K4 Types of security hazards on site

K5 Authorized access systems and their use

CONTEXTUAL VARIABLES

Range of Context

- Quantity and type of security hazards varies with type of work and work location.

Level of Practice

- ☒ Frontline
- ☒ Supervisor
- ☒ Manager/Executive

Adapted Bloom's Taxonomy

- ☐ Recall, Remember
- ☐ Understand
- ☐ Apply
- ☒ Analyze
- ☐ Evaluate
- ☐ Create/Transform

RWATEM (Requisite Work Aids, Tools, Equipment or Materials)

- Access tools and equipment, e.g. key cards, identification cards

Purpose

Along with Information and Communication Technology (ICT) security functions that are built into an organization's computer system, it is essential for users to follow cybersecurity protocols to prevent intentional damage to an organization through cyberattacks. Users following security protocols are another layer of protection from external threats.

Performance/Abilities

P1 Follow system log-in/out protocols:
- log out of system when work is completed

P2 Participate in organization's cybersecurity training

P3 Use passwords:
- change passwords when requested or required by organization's ICT procedures
- do not share passwords with others
- do not write passwords down in a visible place
- use a mix of characters, letters and numbers for passwords

P4 Operate organization's computer system in a secure manner, for example:
- use computers and smart mobile devices approved by organization
- do not leave computer equipment unattended, e.g. computer, smart phone, tablet, flash drives, hard drives
- do not plug unauthorized flash drives or smart phones into computer
- use organization's sites and applications for field devices
- comply with assigned permissions and access limits
- upload security updates as directed, and use newest versions of application software

P5 Carry out work on organization's computer system securely, for example:
- use approved web browsers and search engines
- check all URLs for indications of a phishing site, e.g. spelling errors, complete "https://" on secure sites
- avoid using links, when possible, even on secure websites
- do not download from unknown websites
- do not work using unsecured internet connections or public computers

P6 Use communication applications in a secure manner:
- do not accept or open mail or attachments from unknown senders
- use approved communication channels and protocols, especially when communicating with other organizations
- do not provide confidential work information to an unknown email source/caller:

P7 Do not upload personal applications or access personal websites on organization's devices

P8 Do not post unauthorized work information on social networks

P9 Back up files to specified drives and at specified times, as directed

P10 Contact ICT immediately when:
- computer device is unresponsive or is operating in odd manner
- windows or communications open with unusual messages, demands, or instructions, especially when system will not respond
- there are frequent information or data disruptions, misconfigurations, and gaps or unexplained changes

Knowledge

K1   Organization's cybersecurity protocols
K2   Approved applications
K3   Personal password for access to system
K4   Access permissions and restrictions
K5   Indicators of data corruption
K6   Potential risks to system, e.g. viruses, malware, ransomware
K7   Normal application operations
K8   Indicators of unsecured or fraudulent websites

Glossary

- **Cybersecurity:** the practice of protecting systems, networks, and programs from digital attacks that interrupt normal business operations. Digital or cyberattacks try to:
  - access confidential and/or sensitive information to use for illegal purposes, e.g. identity theft;
  - destroy or change confidential and/or sensitive information to disrupt business operations; or,
  - extort money from users by holding their systems hostage until some form of payment is received.
- **Malware:** software that is specifically designed to access and/or damage a computer without owner of the computer being aware of what is happening, e.g. viruses, worms, spyware.
- **Ransomware:** software that prevents users from accessing their own data until the user pays a ransom.
- **Phishing:** a scam to obtain personal information to commit fraud, often involving social engineering, e.g. email or phone calls from distant relative requesting money, phony websites with sign up forms, message from bank requiring confirmation of account information.
- **Social engineering:** attempts to obtain personal or confidential information or to get the user to perform certain tasks by what appears to be a legitimate source or person; a component of phishing.

CONTEXTUAL VARIABLES

Range of Context

- While many cybersecurity safeguards are built into the design of the system software, users working from home, working remotely in the field, or on personal devices, e.g. smart phones, may change the performance of this skill.

Level of Practice

- ☒ Frontline
- ☒ Supervisor
- ☒ Manager/Executive

Adapted Bloom's Taxonomy

- ☐ Recall, Remember
- ☐ Understand
- ☒ Apply
- ☐ Analyze
- ☐ Evaluate
- ☐ Create/Transform

RWATEM (Requisite Work Aids, Tools, Equipment or Materials)

- Passwords
- Computers, mobile devices
- Cybersecurity software
- Key fob, e.g. RSA SecurID token

Major Category	Organizational Policies and Procedures
Competency Area	**Follow Organizational Policies and Procedures**
Competency Unit	**Follow organizational policies and procedures**

Purpose

Following policies and procedures is important to create a consistent work environment for employees and to provide consistent service delivery to internal/external customers.

Performance/Abilities

P1   Review organizational policies and procedures
P2   Participate in orientation and on-the-job training
P3   Complete all work-related tasks according to organizational policies and procedures
P4   Identify opportunities for improvement to policies and procedures:
  - communicate to team members and supervisors, as appropriate

P5   Keep up to date with changes to policies and procedures, e.g. access online library for updates

Knowledge

K1   Organization policies, procedures and plans, e.g. occupational health and safety, workplace health and wellness
K2   Organization/project goals, vision and status
K3   Organizational document management system, e.g. where to find latest policies and communication documents

CONTEXTUAL VARIABLES

Range of Context

- Number of policies and procedures to be followed will vary.

Level of Practice

- ☒ Frontline
- ☒ Supervisor
- ☒ Manager/Executive

Adapted Bloom's Taxonomy

- ☐ Recall, Remember
- ☐ Understand
- ☒ Apply
- ☐ Analyze
- ☐ Evaluate
- ☐ Create/Transform

RWATEM (Requisite Work Aids, Tools, Equipment or Materials)

- Organizational policies and procedures manual
- Documents associated with organizational policies and procedures, including forms, checklists

Major Category	Information/Record Management
Competency Area	Complete Information/Record Management Tasks
Competency Unit	Maintain technical information and data

RWATEM (Requisite Work Aids, Tools, Equipment or Materials)

- CAD software
- Mobile workforce technology

Purpose

Maintaining technical information and data is important so that critical and up to date information is available. This data is the basis for setting goals and objectives for the short-, medium- and long-term. It also ensures that legislative requirements are met.

Performance/Abilities

P1 Identify types of information/records that are required, for example:
- operations and maintenance manual
- bill of material parts
- asset related information, e.g. type of equipment, location
- event and call logs
- drawings
- test results

P2 Provide information as required, e.g. fill out online or paper forms:
- ensure information is provided/records are completed within required timelines, e.g. daily, weekly, monthly

P3 Ensure information recorded is accurate and complete

P4 Complete field mark-ups, as required

P5 Verify that drawing revisions match field wiring, as required

P6 Update drawings or ensure drawings are sent for update, as required

P7 File revised drawings according to information/record management protocols

Knowledge

K1 Legislation, e.g. NERC Standards

K2 Organization policies, procedures and plans

K3 Organization/project goals, vision and status

K4 Organizational document management system

K5 Use of relevant software, e.g. CAD, GIS

CONTEXTUAL VARIABLES

Range of Context

- Work environment can make this skill challenging to perform, e.g. outdoors.

Level of Practice

- ☒ Frontline
- ☐ Supervisor
- ☐ Manager/Executive

Adapted Bloom's Taxonomy

- ☐ Recall, Remember
- ☐ Understand
- ☐ Apply
- ☒ Analyze
- ☐ Evaluate
- ☐ Create/Transform

electricity
HUMAN RESOURCES CANADA

Major Category	Information/Record Management
Competency Area	Complete Information/Record Management Tasks
Competency Unit	Use information/record management system for generation, transmission and distribution operations

Purpose

Using the information/record management system keeps oneself and others up to date on the condition of equipment, systems and auxiliaries. The information/record management system provides information for operating decisions, compliance requirements, and allows for smooth shift changes. It also serves as an organizational record of information and instructions for managing protection, energy storage, generation, transmission, distribution and dispatch. In addition, the reporting system provides a history of operating events for post-fault analysis and reflects the long-term efficiency of power generation, transmission and distribution systems.

Performance/Abilities

P1 Review information recorded during previous shift(s):
- analyze information relevant to shift tasks, e.g. outstanding authorizations, unresolved faults, generation status, abnormal circuit or plant configurations, imposed load constraints, shift-transfer sheets, customer outage information
- determine action required, e.g. how to resolve faults depending on type and frequency, follow-up with engineering groups

P2 Record information during shift in required format and timeframe:
- record status of systems including abnormalities and corrections made
- record information immediately upon receipt
- note information source, e.g. other operators, SCADA, contractors, members of public, operating forms, industry codes
- use abbreviations and terminology according to industry and organizational practice
- use 24-hour clock when recording times
- consider time zones for reporting energy transactions, if required
- keep operating log up to date throughout shift
- sign or initial log entries at beginning and end of shift
- ensure regulatory logging requirements are met

P3 Keep uncompleted actions in view for supervision:
- communicate status updates and other important information (verbally and/or in documents) to co-workers at shift change

Knowledge

K1 Applicable regulations, e.g. reporting requirements, privacy, security

K2 Reliability criteria and standards of local, regional and continental bodies, e.g. North American Electric Reliability Corporation (NERC)

K3 Reporting system procedures, e.g. access, use, filing, distribution, turnover, information security

K4 Types of information documented in information/record management, for example:
- operating events
- relevant non-operating events, e.g. lightning, bird strikes, accidents, unauthorized entries into restricted areas
- changes in status and abnormal conditions
- corrective actions

- exact time of sending or receiving operational instructions and messages
- energy storage, generation, transmission, distribution and dispatch
- asset management activities
- switching instructions
- operation of circuit breakers and disconnectors
- auto-reclose operations
- work orders
- relay flaggings
- protection limitations
- incidents reported to the control centre
- switching schedules, shift handover information, operational constraints

K5 Shift change procedures, e.g. report abnormal situations, complete shift change report

K6 Types of reporting documents and their purpose, e.g. fault logs, status reports, shift change reports, asset management

K7 Industry terminology and abbreviations

K8 24-hour clock

K9 Time zones

Glossary

- **Information/record management system:** collection of manual or electronic logs, sheets, completed authorization forms and other records, which together form a complete record of operating events in a station or operating area.

CONTEXTUAL VARIABLES

Level of Practice
- ☒ Frontline
- ☐ Supervisor
- ☐ Manager/Executive

Adapted Bloom's Taxonomy
- ☐ Recall, Remember
- ☐ Understand
- ☒ Apply
- ☐ Analyze
- ☐ Evaluate
- ☐ Create/Transform

RWATEM (Requisite Work Aids, Tools, Equipment or Materials)

- Required documents, e.g. fault logs, status reports, shift change reports
- Shift reporting software and applications
- Electronic job order system
- Voice logs

Major Category	Information and Communication Technology Foundations
Competency Area	Use Digital Technology
Competency Unit	Use communication applications

Purpose

Communication applications allow efficiencies when sending and receiving messages. This includes combinations of visual and audio communication and document sharing over distance which in turn allow for virtual meetings, educational webinars, and other communication formats that can save time and money.

Performance/Abilities

P1 Open desired communication application on system, online, or on cell phone e.g. email, text messaging

P2 Verify message before sending

P3 Select communication recipients:
- verify who will receive message, e.g. only include relevant parties

P4 Use email:
- follow email etiquette, e.g. do not use all uppercase, keep message professional in tone
- include purpose of message in subject line
- create concise and clear message
- add attachments following email application protocols, e.g. drop and click, select file using paperclip icon:
  - follow application instructions to make attachment smaller or use alternative document sharing applications if attachment is too large
- close message with appropriate salutation and sign-off, e.g. organization logo and contact information
- proofread message before sending
- manage mailboxes:
  - use settings to designate type of mail, if appropriate, e.g. check junk mail regularly, check auto rules to ensure up to date and correct
  - delete messages in trash and junk mail periodically

P5 Use text messaging:
- keep messages brief
- do not use texting abbreviations, e.g. lol, btw
- do not use emojis and animated images, e.g. GIFs

P6 Use conferencing applications authorized by organization:
- ensure appropriate documents are open and screen background is appropriate when screen sharing
- ensure quiet environment when using audio
- mute microphone when not speaking
- consider lag time when speaking and sharing documents
- announce name when entering conference and before speaking, if appropriate

Knowledge

K1 Organization's policies and procedures, e.g. cybersecurity, logging into applications

K2 Application functions and icons, e.g. trash can, flags, reply

K3 Purpose of communication

K4 Audience

K5 Writing protocols for email and text messages

K6 Communication considerations, e.g. background noise, time lag, pitch of voice

Glossary

- **Cybersecurity:** the practice of protecting systems, networks, and programs from digital attacks that interrupt normal business operations. Digital or cyberattacks try to:
  - access confidential and/or sensitive information to use for illegal purposes, e.g. identity theft;
  - destroy or change confidential and/or sensitive information to disrupt business operations; or,
  - extort money from users by holding their systems hostage until some form of payment is received.

- **Emoji:** a small digital icon used to express a feeling or idea.
- **GIF:** series of images encoded to automatically replay back as an animated sequence.

CONTEXTUAL VARIABLES

Range of Context

- Communication applications on mobile devices may differ from desktop system and clarity of communication may vary.
- Communication applications differ depending on system and device being used.

Level of Practice

- ☒ Frontline
- ☒ Supervisor
- ☒ Manager/Executive

Adapted Bloom's Taxonomy

- ☐ Recall, Remember
- ☐ Understand
- ☒ Apply
- ☐ Analyze
- ☐ Evaluate
- ☐ Create/Transform

RWATEM (Requisite Work Aids, Tools, Equipment or Materials)

- Computer
- Tablet
- Cell phone
- Communication software applications
- Headsets

electricity
HUMAN RESOURCES CANADA

Major Category	Information and Communication Technology Foundations	Major Category	Information and Communication Technology Foundations
Competency Area	Use Digital Technology	Competency Area	Use Digital Technology
Competency Unit	Use common software applications	Competency Unit	Use navigation and mapping applications

Purpose

Common computer software applications for word processing, data spreadsheets, and presentations help to increase the productivity and efficiency of the organization.

Performance/Abilities

P1 Select appropriate application for task, e.g. word processing, presentation, spreadsheets

P2 Use application's tools to create, enhance or customize content

P3 Save document to appropriate folder and drive

Knowledge

K1 Organizational policies and procedures, e.g. file naming, file sharing, cybersecurity

K2 Purpose and features of common applications

K3 Links between applications, e.g. cell phone camera photos are saved automatically in photo application

Glossary

- **Cybersecurity:** the practice of protecting systems, networks, and programs from digital attacks that interrupt normal business operations. Digital or cyberattacks try to:
  - access confidential and/or sensitive information to use for illegal purposes, e.g. identity theft;
  - destroy or change confidential and/or sensitive information to disrupt business operations; or,
  - extort money from users by holding their systems hostage until some form of payment is received.

CONTEXTUAL VARIABLES

Range of Context

- Applications will differ depending on device and operating systems.

Level of Practice

- ☒ Frontline
- ☒ Supervisor
- ☒ Manager/Executive

Adapted Bloom's Taxonomy

- ☐ Recall, Remember
- ☐ Understand
- ☒ Apply
- ☐ Analyze
- ☐ Evaluate
- ☐ Create/Transform

RWATEM (Requisite Work Aids, Tools, Equipment or Materials)

- Computer
- Tablet
- Cell phone
- Common software applications

Purpose

Navigation and mapping applications are used to ensure accurate identification and documentation of asset and work locations, as well as ensure the safety of personnel in the field and the efficient use of resources.

Performance/Abilities

P1 Use global positioning system (GPS) and geographical information system (GIS) device required for tasks e.g. GPS receiver, truck tracker, cell phone

P2 Follow manufacturer's instructions

P3 Ensure correct types of maps of field work area are uploaded or correct views selected, for example:
- street maps
- topographical maps
- satellite view

P4 Comply with GPS features in vehicles and personal tracking fob requirements when working in field

Knowledge

K1 Manufacturer's instructions

K2 Organization's policies and procedures, e.g. safety

K3 Capabilities and limitations of different types of devices and applications

K4 Types of maps

K5 Geographical coordinates

K6 Functions of navigation and mapping applications

Glossary

- **Geographic information system (GIS):** a computer application that captures, stores, checks and displays data related to positions on Earth's surface; may include cartographic data, photographic data, digital data, or data in spreadsheets.
- **Geographic coordinates:** a grid system consisting of lines of latitude (north-south) and lines of longitude (east-west) that allow users to define a precise location on the earth's surface. Expressed in degrees and minutes.
- **Global Positioning System (GPS):** a computer program that uses triangulation to determine a user's location on the earth by feedback received from at least three satellites orbiting the earth.
- **Waypoint:** is the marking of a location by obtaining the geographic coordinates with a GPS unit.

CONTEXTUAL VARIABLES

Range of Context

- Locating assets may require both GIS and GPS.
- There is generally no cellular or wireless service in remote destinations which may impact the type of GPS device that can be used.

Level of Practice

☒ Frontline
☒ Supervisor
☐ Manager/Executive

Adapted Bloom's Taxonomy

☐ Recall, Remember
☐ Understand
☒ Apply

☐ Analyze
☐ Evaluate
☐ Create/Transform

RWATEM (Requisite Work Aids, Tools, Equipment or Materials)

• GPS receiver
• Cell phone
• Computer

Major Category	Information and Communication Technology Foundations
Competency Area	Use Digital Technology
Competency Unit	Use digital mobile radios

Purpose

Digital mobile radios (DMRs) are used for internal communications between departments and work groups for the purposes of primary and emergency backup communication.

Performance/Abilities

P1 Use digital mobile radios as required, for example:
  • from field to office
  • between work groups
  • within own work group
  • for emergency communications

P2 Follow manufacturer's instructions
P3 Comply with organization's policies and guidelines
P4 Comply with Industry Canada's radio communication regulations, e.g. licensing requirements

Knowledge

K1 Applicable legislation, e.g. Industry Canada's radio communication regulations
K2 Manufacturer's instructions and recommendations
K3 Organization's policies and procedures, e.g. safety, communication protocols
K4 Capabilities and limitations of different types of devices

Contextual Variables

Level of Practice

☒ Frontline
☐ Supervisor
☐ Manager/Executive

Adapted Bloom's Taxonomy

☐ Recall, Remember
☐ Understand
☒ Apply

☐ Analyze
☐ Evaluate
☐ Create/Transform

RWATEM (Requisite Work Aids, Tools, Equipment or Materials)

• Digital mobile radio

Major Category	Information and Communication Technology Foundations
Competency Area	Use Organization's ICT System
Competency Unit	Use organization's ICT system

Purpose

Following the organization's protocols to enter and retrieve information in the computer system is essential to ensure the organized, accurate, and secure documentation of an organization's activities across various types of computerized equipment.

Performance/Abilities

P1 Follow organization's policies and procedures, e.g. data entry, cybersecurity

P2 Retrieve required information from saved files or databases, for example:
- access information from saved files or databases as permitted from:
  - computer hard drive
  - organization's shared drive(s)
- use appropriate search terms to find required information, e.g. file name, subject matter, customer name

P3 Enter/update information, for example:
- complete all data fields accurately
- check accuracy of manual data entry
- do not enter same data more than once
- do not edit or change data without appropriate permissions

P4 Upload information, e.g. files, photograph, prints, data:
- ensure information sources are secure

P5 Save work:
- use file naming protocol
- save in appropriate drive(s) and folder

Knowledge

K1 Organization's protocols, for example:
- cybersecurity
- access permissions
- file naming
- organization of shared drives
- printing
- file sharing

K2 Applications purposes and functions

K3 Consequences of inaccurate or incomplete data

K4 Different uses of data

K5 Allowable data requests

K6 Organization of shared drive(s)

K7 Uploading and downloading of documents, files, drawings and photos

Glossary

- **Computer Aided Design (CAD):** a computer application that is used to produce 2- and 3-dimensional drawings of an engineered design that details the physical components and layout.
- **Cybersecurity:** the practice of protecting systems, networks, and programs from digital attacks that interrupt normal business operations. Digital or cyberattacks try to:
  - access confidential and/or sensitive information to use for illegal purposes, e.g. identity theft;
  - destroy or change confidential and/or sensitive information to disrupt business operations; or,
  - extort money from users by holding their systems hostage until some form of payment is received.
- **Geographic Information Systems (GIS):** a computer application that manages geographic information, which can be manipulated to display aspects of geographical information in a map format.

CONTEXTUAL VARIABLES

Range of Context

- Organizations will have different levels of permissions and access to different applications and shared drives based on occupational requirements and responsibilities.
- Organizations may use proprietary closed computer systems and networks.
- Access to system and applications may differ if using a mobile device.
- Cybersecurity protocols may differ in levels of automation and auto-surveillance, e.g. audit trails.
- Organizations may use different purchased applications.

Level of Practice

- ☒ Frontline
- ☒ Supervisor
- ☒ Manager/Executive

Adapted Bloom's Taxonomy

- ☐ Recall, Remember
- ☐ Understand
- ☒ Apply
- ☐ Analyze
- ☐ Evaluate
- ☐ Create/Transform

RWATEM (Requisite Work Aids, Tools, Equipment or Materials)

- Computer or mobile device
- Software programs

Major Category	Leadership
Competency Area	Facilitate Change
Competency Unit	Implement change

Level of Practice

☒ Frontline
☒ Supervisor
☒ Manager/Executive

Adapted Bloom's Taxonomy

☐ Recall, Remember ☒ Analyze
☐ Understand ☐ Evaluate
☐ Apply ☐ Create/Transform

RWATEM (Requisite Work Aids, Tools, Equipment or Materials)

- Organizational policies and procedures manual
- Collective agreement, if applicable

Purpose

Implementing change is important to ensure that the project/organization keeps up to date with, and even anticipates, changes in the sector. This helps to ensure the project/organization remains efficient and successful.

Performance/Abilities

P1 Communicate changes to all employees:
- define new expectations
- explain the rationale and benefits
- promote open dialogue

P2 Identify potential barriers to change, e.g. employee resistance, current logistical structures:
- develop strategies to mitigate challenges, e.g. collaborate with other departments or vendors

P3 Monitor implementation of change:
- measure change progress
- foster organizational persistence and patience while change is being implemented
- recognize success, e.g. reward staff

P4 Identify changes that are not being successfully implemented:
- take action to resolve issues

Knowledge

K1 Organization policies, procedures and plans
K2 Organization/project goals, vision and status
K3 Reason for, and benefits of, change being implemented
K4 Roles and responsibilities of team members
K5 Methods of measuring change
K6 Challenges that may impede implementation of change, e.g. employee resistance
K7 Collective agreement

CONTEXTUAL VARIABLES

Range of Context

- Collective agreements in union work environments may change how this skill is performed.
- Authority to implement change, and to adjust/revise changes and their methods of implementation varies across organizations.
- Management support and organizational policy may make this task challenging to complete.

electricity
HUMAN RESOURCES CANADA

Major Category	Foundational Trades Skills
Competency Area	Perform Routine Trade Tasks
Competency Unit	Use hand and power tools

RWATEM (Requisite Work Aids, Tools, Equipment or Materials)

- Personal protective equipment, e.g. safety glasses, gloves, safety boots, hearing protection
- Hand and power tools, e.g. standard hand tools, drill press, pneumatic wrenches

Purpose

Correctly using hand and power tools protects employees against injury or death and protects the organization from loss and liability.

Performance/Abilities

P1 Follow organization's policies and procedures, e.g. ensure required training is completed

P2 Follow manufacturer's instructions, e.g. inspection, preparation, cleaning

P3 Wear appropriate PPE, e.g. safety glasses

P4 Inspect hand and power tools before use

P5 Ensure hand or power tool is appropriate and rated for task

P6 Use tools for intended purpose only

P7 Communicate issues with tools to relevant personnel, e.g. co-workers, supervisor

P8 Tag defective tools:
- turn in to relevant personnel or department

P9 Clean tools after use:
- store in designated location

Knowledge

K1 Relevant legislation, e.g. Occupational Health and Safety (OH&S)

K2 Organizational safety policies and procedures, e.g. OH&S

K3 Types of safety hazards on site and mitigation methods, e.g. limits of approach, barriers

K4 Types of safety hazards associated with hand and power tools

K5 PPE required for specific tasks

K6 Types of hand and power tools, their components and procedures for use

K7 Manufacturer's instructions and recommendations, including ratings

CONTEXTUAL VARIABLES

Range of Context

- Types of hand and power tools vary with type of work and work location.

Level of Practice

- ☒ Frontline
- ☒ Supervisor
- ☐ Manager/Executive

Adapted Bloom's Taxonomy

- ☐ Recall, Remember
- ☐ Understand
- ☐ Apply
- ☒ Analyze
- ☐ Evaluate
- ☐ Create/Transform

electricity
HUMAN RESOURCES CANADA

Major Category	Foundational Trades Skills
Competency Area	Perform Routine Trade Tasks
Competency Unit	Use electrical measuring and testing equipment

RWATEM (Requisite Work Aids, Tools, Equipment or Materials)

- Personal protective equipment, e.g. gloves, safety glasses
- Electrical measuring and testing equipment, e.g. multi-meters, power level meters, frequency selective meters, hi-pot tester, non-contact tester, diagnostic test equipment

Purpose

Correctly using electrical measuring and testing equipment protects employees and contractors against injury or death and protects the organization from loss and liability. It also helps to ensure that data being analyzed is accurate.

Performance/Abilities

P1 Follow relevant legislation, e.g. Occupational Health & Safety

P2 Follow organization's policies and procedures, e.g. ensure required training is completed

P3 Follow manufacturer's instructions, e.g. inspection, preparation, calibration, grounding

P4 Wear appropriate personal protective equipment (PPE), e.g. safety glasses, gloves

P5 Inspect equipment before use

P6 Ensure equipment is appropriate and rated for task

P7 Use equipment for intended purpose only

P8 Communicate issues with equipment to relevant personnel, e.g. co-workers, supervisor

P9 Tag defective equipment:
- turn in to relevant personnel or department

P10 Clean equipment after use:
- store in designated location

Knowledge

K1 Relevant legislation, including Occupational Health and Safety (OH&S)

K2 Organizational safety policies and procedures, e.g. OH&S and training requirements

K3 Types of safety hazards on site and mitigation methods, e.g. limits of approach, barriers

K4 Types of safety hazards associated with electrical measuring and testing equipment

K5 PPE required for specific tasks

K6 Types of electrical measuring and testing equipment, their components and procedures for use

K7 Inspection procedures for electrical measuring and testing equipment

K8 Calibration procedures for electrical measuring and testing equipment

CONTEXTUAL VARIABLES

Range of Context

- Types of equipment will vary with type of work and work location.

Level of Practice

- ☒ Frontline
- ☒ Supervisor
- ☐ Manager/Executive

Adapted Bloom's Taxonomy

- ☐ Recall, Remember
- ☐ Understand
- ☐ Apply
- ☒ Analyze
- ☐ Evaluate
- ☐ Create/Transform

electricity
HUMAN RESOURCES CANADA

Major Category	Foundational Trades Skills
Competency Area	Perform Routine Trade Tasks
Competency Unit	Operate vehicles and motorized equipment

RWATEM (Requisite Work Aids, Tools, Equipment or Materials)

- Personal protective equipment, e.g. personal flotation device, helmet
- Vehicles and motorized equipment, e.g. trucks, quads, side-by-sides, boats, snowmobiles, bucket trucks

Purpose

Correctly operating vehicles and motorized equipment protects employees, contractors and members of the public against injury or death, and protects the organization from loss and liability.

Performance/Abilities

P1 Obtain correct training and licenses for vehicles and motorized equipment, as required

P2 Identify traffic areas and potential site hazards

P3 Select vehicles and motorized equipment according to site and task requirements

P4 Inspect vehicles and motorized equipment before use:
- ensure fluid levels are acceptable
- adjust controls and safety features, as required
- document condition of equipment, as required

P5 Operate vehicles and motorized equipment according to legal requirements and organizational policies and procedures

P6 Communicate issues with vehicles and motorized equipment to relevant personnel, e.g. co-workers, supervisor

P7 Inform relevant personnel or department if vehicles and motorized equipment are defective or require maintenance

P8 Store vehicles and motorized equipment in designated location

Knowledge

K1 Relevant legislation, e.g. regulations for off-road equipment, highway traffic act

K2 Organizational safety policies and procedures, including Occupational Health & Safety

K3 Types of safety hazards on site

K4 Types of safety hazards associated with vehicles and motorized equipment

K5 Types of vehicles and motorized equipment, their components and procedures for use

K6 Inspection procedures for vehicles and motorized equipment

CONTEXTUAL VARIABLES

Range of Context

- Types of vehicles and motorized equipment will vary with type of work and work location.

Level of Practice

- ☒ Frontline
- ☒ Supervisor
- ☐ Manager/Executive

Adapted Bloom's Taxonomy

- ☐ Recall, Remember
- ☐ Understand
- ☒ Apply
- ☐ Analyze
- ☐ Evaluate
- ☐ Create/Transform

Major Category	Personal Competencies
Competency Area	Demonstrate Professionalism
Competency Unit	Work as a member of a team

Purpose

Working as a member of a team helps to ensure that operations run smoothly, and allows project managers, supervisors, employees and contractors to be proactive before small issues become large problems.

Performance/Abilities

P1 Demonstrate respect and empathy towards others:
- respect diversity
- respect differing perspectives
- promote an inclusive work environment
- recognize changes in team members' behaviours, e.g. mental health strain

P2 Be accountable:
- report unexpected conditions
- be punctual
- comply with schedule
- take action when issues arise

P3 Initiate contact with other team members on regular basis:
- ask questions

P4 Share knowledge and skills

P5 Recognize others' contributions and success

P6 Accept and provide constructive feedback

P7 Ask for help, when needed

P8 Offer help to team members

P9 Respond to requests in a timely manner

P10 Be open to change

P11 Participate actively in team meetings

Knowledge

K1 Organization policies, procedures and plans

K2 Organization/project goals, vision and status

K3 Roles and responsibilities of team members, including own role

K4 Team members' contact information

K5 Sector and project terminology and common abbreviations

K6 Symptoms of psychological strain, e.g. decreased quality of work, withdrawal

CONTEXTUAL VARIABLES

Range of Context

- Team members will vary, for instance, there may be a range of small, temporary working groups and more permanent, long-term working groups.

- Physically locations may change the way this skill is performed, e.g. communication may have to occur via distance means.

Level of Practice

- ☒ Frontline
- ☒ Supervisor
- ☒ Manager/Executive

Adapted Bloom's Taxonomy

- ☐ Recall, Remember
- ☐ Understand
- ☒ Apply
- ☐ Analyze
- ☐ Evaluate
- ☐ Create/Transform

RWATEM (Requisite Work Aids, Tools, Equipment or Materials)

- Software, e.g. video chat, virtual meeting
- Communication tools, e.g. email, telephone

Major Category	Personal Competencies
Competency Area	Demonstrate Professionalism
Competency Unit	Develop professionally

Level of Practice

☒ Frontline
☒ Supervisor
☒ Manager/Executive

Adapted Bloom's Taxonomy

☐ Recall, Remember ☒ Analyze
☐ Understand ☐ Evaluate
☐ Apply ☐ Create/Transform

RWATEM (Requisite Work Aids, Tools, Equipment or Materials)

- Computer access
- Mentoring/coaching program
- Education grant program, if available
- Collective agreement

Purpose

Developing professionally is important to keep current with sector trends, products and services. It improves an individual's attitude, knowledge, self-confidence and skills.

Performance/Abilities

P1 Maintain qualifications and certifications, as required, e.g. trade license, professional designation, First Aid, CPR

P2 Assess own skills, knowledge and abilities:
- reflect on feedback from peers and supervisor
- identify areas for improvement

P3 Identify areas of interest where new skill and knowledge development might be useful, e.g. new methods/products used in the sector

P4 Upgrade skills and knowledge, for example:
- attend courses offered by equipment manufacturers
- read sector-specific publications
- conduct research
- enroll in educational and professional development courses and programs
- participate in mentorship programs
- ask for assistance or instruction

P5 Participate in local trade and business organizations, as applicable

P6 Network with professional peers, e.g. attend conferences or trade shows

P7 Join and participate in associations, as applicable

P8 Ensure professional development is documented in organization's record management system, as required

Knowledge

K1 Organization policies, procedures and plans

K2 Organization/project goals, vision and status

K3 Own skills, knowledge and abilities

K4 Roles and responsibilities of team members, including own role

K5 Where to find up-to-date and accurate information on the sector

K6 Relevant training providers and their offerings

CONTEXTUAL VARIABLES

Range of Context

- Access to resources may affect the way this skill is performed, e.g. organization's professional development budget, individuals may only attend provided professional development sessions during work time.
- Physical location may change the way this skill is performed, e.g. all professional development may have to be pursued via distance means.

Major Category	Personal Competencies
Competency Area	Demonstrate Professionalism
Competency Unit	Demonstrate professional and ethical conduct

Purpose

Demonstrating professional and ethical conduct is important to build trust and respect in relationships with others. It also helps to promote a positive image of the organization and the sector.

Performance/Abilities

P1 Participate in relevant training, e.g. conflict of interest, code of conduct, ethics

P2 Support high standards and practices that protect public and bring credibility to organization, sector, and community, for example:
- follow professional code of ethics/code of conduct, as applicable
- implement responsible policies
- avoid degrading or malicious discussion
- recognize potential conflict of interest

P3 Demonstrate professional attributes, including:
- approachability, e.g. be available to coworkers and clients
- composure, e.g. remain calm in emergency
- empathy, e.g. show concern for others' problems
- emotional intelligence, e.g. awareness of own and others' emotional states
- fairness, e.g. treat all equally
- flexibility, e.g. be open to new situations and approaches
- being proactive, e.g. address issues before they become large problems
- initiative
- QA/QC principles in relation to work, e.g. catching potential errors prior to issues
- trustworthiness, e.g. honour commitments
- social responsibility, e.g. report injured wildlife to appropriate authorities

P4 Ensure appearance is professional, e.g. wear uniform or organizational id/tag, ensure attire is in good repair

P5 Comply with legal requirements, e.g. high visibility clothing, NERC requirements, conflict of interest

P6 Maintain confidentiality of information, as required

P7 Maintain accurate records

P8 Show respect for organization's assets, e.g. take proper care of tools and equipment

Knowledge

K1 Relevant legislation, e.g. Freedom of Information and Protection of Privacy (FOIP), NERC Standards

K2 Organization policies, procedures and plans

K3 Organization/project goals, vision and status

K4 Code of conduct/Code of ethics

K5 Own skills, knowledge and abilities

K6 Roles and responsibilities of team members, including own role

K7 Where to find up-to-date and accurate information on standards and practices

CONTEXTUAL VARIABLES

Range of Context

- Formal codes of ethics may exist in some subsectors and not others.

Level of Practice

- ☒ Frontline
- ☒ Supervisor
- ☒ Manager/Executive

Adapted Bloom's Taxonomy

- ☐ Recall, Remember
- ☐ Understand
- ☒ Apply
- ☐ Analyze
- ☐ Evaluate
- ☐ Create/Transform

Major Category	Personal Competencies
Competency Area	Demonstrate Professionalism
Competency Unit	Mentor/coach others

Level of Practice

- ☒ Frontline
- ☒ Supervisor
- ☒ Manager/Executive

Adapted Bloom's Taxonomy

- ☐ Recall, Remember
- ☐ Understand
- ☐ Apply
- ☒ Analyze
- ☐ Evaluate
- ☐ Create/Transform

RWATEM (Requisite Work Aids, Tools, Equipment or Materials)

- Software, e.g. video chat, virtual meeting
- Communication tools, e.g. email, telephone

Purpose

Mentoring/coaching others is important to help create an environment of continuous learning within the organization. It helps to ensure consistency in the work being completed, and assists with building positive workplace relationships. It contributes to an improvement of both individual and team performance.

Performance/Abilities

P1 Initiate contact with other team members/learners on regular basis:
- ask questions

P2 Use positive approach to help team members/learners solve problems:
- ask questions to help focus on problem
- guide resolution/performance
- demonstrate patience

P3 Demonstrate tasks for others, as required:
- explain importance of and reasons for process/tasks
- link learning to other tasks and overall job

P4 Set up environment for learner to practice skills, as required:
- ensure safety of learning environment

P5 Recognize success, e.g. praise team member/learner

P6 Assess learners' progress, as appropriate

P7 Provide supportive and corrective feedback

P8 Ask for feedback on own performance as coach/mentor

Knowledge

K1 Organization policies, procedures and plans

K2 Organization/project goals, vision and status

K3 Roles and responsibilities of team members/learners, including own role

K4 Role of workplace mentor/coach

K5 Sector and project terminology and common abbreviations

K6 Different ways of learning/learning needs and strategies to address them, e.g. language proficiency, learning preference

K7 How to adjust to different learning styles

K8 Importance of, and techniques for, providing effective feedback

CONTEXTUAL VARIABLES

Range of Context

- Mentoring/coaching may be a formalized or informal process, which will affect how this skill is performed.

Major Category	Personal Competencies
Competency Area	Demonstrate Professionalism
Competency Unit	Manage stress

Level of Practice

☒ Frontline
☒ Supervisor
☒ Manager/Executive

Adapted Bloom's Taxonomy

☐ Recall, Remember   ☒ Analyze
☐ Understand   ☐ Evaluate
☐ Apply   ☐ Create/Transform

RWATEM (Requisite Work Aids, Tools, Equipment or Materials)

• Psychological health and wellness program

Purpose

Managing stress is important to improve one's own ability to balance personal and professional demands, perform one's job competently, and contribute to a harmonious workplace.

Performance/Abilities

P1 Attend to own physical, emotional, spiritual, family and financial needs:
  • ask for help, if needed

P2 Recognize own limitations and those of others, e.g. know when to say no

P3 Recognize how your stress affects others

P4 Manage time effectively:
  • prioritize tasks to be done
  • ensure schedule is realistic
  • negotiate or discuss with team members/supervisor, as required

P5 Delegate responsibilities, when appropriate

P6 Adapt to shift work, as required, for example:
  • prepare self for shifts
  • ensure proper rest/sleep
  • ensure proper nutrition

P7 Maintain open communication with others

P8 Identify coping strategies, e.g. maintain a sense of humour

Knowledge

K1 Organization policies, procedures and plans

K2 Organization/project goals, vision and status

K3 Organization's wellness program, e.g. available gym memberships, counselling programs

K4 Own skills, knowledge and abilities

K5 Roles and responsibilities of team members, including own role

K6 Symptoms of psychological strain, e.g. fatigue, irritability, difficulty concentrating, isolation

CONTEXTUAL VARIABLES

Range of Context

• Availability of an organization wellness program, and its associated offerings, may alter the way this skill is performed.

Major Category	Personal Competencies
Competency Area	Demonstrate Professionalism
Competency Unit	Manage time

Purpose

Managing time is important to support efficiency and productivity by allowing the required time to be spent on the areas/tasks of most importance, and ensures that all tasks can be completed according to schedule.

Performance/Abilities

P1 Set goals:
- ensure goals are realistic and relevant
- outline objectives to be achieved for each goal

P2 Identify tasks that need to be achieved for each objective:
- prioritize based on importance and urgency

P3 Determine amount of time each task will take, considering:
- previous experience
- available resources
- competing priorities
- possible delays

P4 Use time management system, e.g. electronic calendar, daytimer:
- record appointments, meetings and critical dates

P5 Create action plan:
- identify timelines and critical dates

P6 Schedule tasks:
- delegate tasks, as required

P7 Monitor progress of tasks and action plan:
- review/update timelines regularly

P8 Identify incomplete tasks:
- develop plan for completion

P9 Review goals and objectives periodically:
- review time management system
- evaluate own tasks
- evaluate progress toward goals
- make adjustments, as required

Knowledge

K1 Organization policies, procedures and plans
K2 Organization/project goals, vision and status
K3 Own skills, knowledge and abilities
K4 Roles and responsibilities of team members, including own role

CONTEXTUAL VARIABLES

Range of Context

- Complexity of time management will vary with job role and current tasks.
- Goals, objectives and action plans may be provided, depending upon job role and organization.
- Unplanned situations, including emergencies, can make it difficult to perform this skill.
- Collaboration may or may not be required, e.g. some activities need to be coordinated with others/other work teams.

Level of Practice

- ☒ Frontline
- ☒ Supervisor
- ☒ Manager/Executive

Adapted Bloom's Taxonomy

- ☐ Recall, Remember
- ☐ Understand
- ☐ Apply
- ☒ Analyze
- ☐ Evaluate
- ☐ Create/Transform

RWATEM (Requisite Work Aids, Tools, Equipment or Materials)

- Time management sytems, e.g. electronic calendar, daytimer
- Software, e.g. project management software

Major Category	Personal Competencies
Competency Area	Communicate Effectively
Competency Unit	Use active listening skills

RWATEM (Requisite Work Aids, Tools, Equipment or Materials)

- Software, e.g. video chat, virtual meeting
- Communication tools, e.g. telephone

Purpose

Using active listening skills helps to ensure that all parties understand each other. This promotes effective teamwork, improves productivity and reduces stress.

Performance/Abilities

P1 Choose appropriate time and place to listen, if possible:
- remove distractions, as required

P2 Listen carefully to message:
- be open-minded
- use attentive body language, e.g. face speaker
- listen until message is complete, i.e. do not interrupt
- give speaker undivided attention

P3 Watch for nonverbal indicators that reinforce or contradict message, e.g. nod, rolling eyes

P4 Respond to message, for example:
- use nonverbal indicators, e.g. nod, smile
- offer comments
- use questions to seek additional information or clarify details
- paraphrase to confirm understanding

Knowledge

K1 Relevant legislation, e.g. Freedom of Information and Protection of Privacy

K2 Organization policies, procedures and plans

K3 Organization/project goals, vision and status

K4 Effective communication practices, e.g. verbal versus non-verbal, characteristics of respectful communication

K5 Sector, trade and project terminology and common abbreviations

K6 Question types, e.g. open-ended, closed, probing, mirror

K7 Communication that constitutes harassment and discrimination

CONTEXTUAL VARIABLES

Range of Context

- Physical location may change the way this skill is performed, e.g. all listening may have to occur via distance means.

Level of Practice

- ☒ Frontline
- ☒ Supervisor
- ☒ Manager/Executive

Adapted Bloom's Taxonomy

- ☐ Recall, Remember
- ☐ Understand
- ☐ Apply
- ☒ Analyze
- ☐ Evaluate
- ☐ Create/Transform

Major Category	Personal Competencies
Competency Area	Communicate Effectively
Competency Unit	Use speaking skills

Purpose

Using speaking skills helps to ensure that all parties understand each other, and reduces errors due to misinterpretation. This promotes effective teamwork, improves productivity and reduces stress.

Performance/Abilities

P1 Identify purpose of message

P2 Consider needs and limitations of listeners

P3 Organize ideas before speaking

P4 Determine appropriate time and place to deliver message

P5 Determine appropriate format, e.g. formal/informal, group/individual

P6 Make final revisions to message

P7 Communicate message:
- be concise
- speak clearly
- use proper grammar
- vary tone, volume, inflection and rate of speech
- make eye contact
- use positive language whenever possible
- ensure that verbal and non-verbal communication convey same message

P8 Adjust message to listener, if appropriate, for example:
- simplify technical information
- use different question types to determine listener's needs
- avoid using slang, jargon, profanity or sarcasm
- consider impact of message on listener, e.g. time restrictions, emotional impact

P9 Confirm understanding:
- ask for questions and feedback
- review what was explained

P10 Encourage additional questions at later date, if appropriate

P11 Answer questions or know where to find answer:
- follow up with listener who asked question

Knowledge

K1 Relevant legislation, e.g. Freedom of Information and Protection of Privacy

K2 Organization policies, procedures and plans

K3 Organization/project goals, vision and status

K4 Organizational communication protocols, e.g. who needs what information, speaking to media

K5 Effective communication practices, e.g. verbal versus non-verbal, characteristics of respectful communication

K6 Sector, trade and project terminology and common abbreviations

K7 Question types, e.g. open-ended, closed, probing, mirror

K8 Communication that constitutes harassment and discrimination

Range of Context

- Physical location may change the way this skill is performed, e.g. speaking may have to occur via distance means.

Level of Practice

- ☒ Frontline
- ☒ Supervisor
- ☒ Manager/Executive

Adapted Bloom's Taxonomy

- ☐ Recall, Remember
- ☐ Understand
- ☐ Apply
- ☒ Analyze
- ☐ Evaluate
- ☐ Create/Transform

RWATEM (Requisite Work Aids, Tools, Equipment or Materials)

- Software, e.g. video chat, virtual meeting
- Communication tools, e.g. telephone

Major Category	Personal Competencies
Competency Area	Communicate Effectively
Competency Unit	Use writing skills

Level of Practice

☒ Frontline
☒ Supervisor
☒ Manager/Executive

Adapted Bloom's Taxonomy

☐ Recall, Remember
☐ Understand
☐ Apply

☒ Analyze
☐ Evaluate
☐ Create/Transform

Purpose

Using writing skills helps to ensure that all parties understand each other, and reduces errors due to misinterpretation. This promotes effective teamwork, improves productivity and reduces stress.

RWATEM (Requisite Work Aids, Tools, Equipment or Materials)

- Software, e.g. Microsoft Word
- Communication tools, e.g. email

Performance/Abilities

P1 Determine purpose of message

P2 Identify target audience

P3 Provide accurate, complete and concise information

P4 Use format, tone, and style suited to purpose, e.g. email, business letter, report

P5 Consider reader's:
- perceptions
- reading ability
- needs
- technical understanding

P6 Write first draft, if required:
- arrange ideas logically
- be clear and concise

P7 Proofread message:
- correct errors

P8 Produce final copy:
- send to reader(s)/recipient(s)

P9 File copy according to organizational/project protocol

P10 Follow up, as required, e.g. ensure message was received

Knowledge

K1 Relevant legislation, e.g. Freedom of Information and Protection of Privacy

K2 Organization policies, procedures and plans

K3 Organization/project goals, vision and status

K4 Organizational document management system

K5 Organizational communication protocols, e.g. who needs what information

K6 Basic spelling and grammar

K7 Sector, trade and project terminology and common abbreviations

K8 Communication that constitutes harassment and discrimination

CONTEXTUAL VARIABLES

Range of Context

- Depending upon the message and audience, process may be formal or informal.

Major Category	Personal Competencies
Competency Area	Communicate Effectively
Competency Unit	Negotiate with internal and external stakeholders

Purpose

Negotiating effectively with internal and external stakeholders helps to ensure all parties are satisfied with the resulting outcomes.

Performance/Abilities

P1 Determine who needs to be involved in negotiation

P2 Determine own position:
- represent project/organization's position, as required

P3 Identify what is flexible and what is not

P4 Present offer to other party

P5 Acknowledge position or offer of other party

P6 Discuss possible outcomes with other party:
- remain open, honest and flexible
- focus on positive outcomes
- clarify position, as required, e.g. provide supporting information, discuss ramifications
- focus on issue at hand
- suggest alternatives

P7 Analyze impacts of possible outcomes, e.g. schedule, resources/cost

P8 Facilitate agreement

P9 Confirm agreement in writing:
- File agreement according to project/organizational protocol

Knowledge

K1 Relevant legislation, e.g. Freedom of Information and Protection of Privacy

K2 Organization policies, procedures and plans

K3 Organization/project goals, vision and status

K4 Organizational document management system

K5 Effective communication practices, e.g. verbal versus non-verbal, characteristics of respectful communication

K6 Project stakeholders and their contact information

K7 Relevant government agencies and their contact information

K8 Sector and project terminology and common abbreviations

K9 Negotiation techniques and strategies

Glossary

- **Stakeholders:** individuals and groups who are impacted by the activities or decisions of others; the individuals and groups could be within (internal) or outside (external) of the organization or project, e.g. co-workers, supervisors, contractors, customers, the public, government, union, shareholders.

CONTEXTUAL VARIABLES

Range of Context

- Stakeholders involved in interactions will vary, e.g. tradespeople, team members, managers, agency representatives, and this may affect the tone of the communication, i.e. formal or informal.
- Physical location may change the way this skill is performed, e.g. all communication may have to occur via distance means.

Level of Practice

- ☒ Frontline
- ☒ Supervisor
- ☒ Manager/Executive

Adapted Bloom's Taxonomy

- ☐ Recall, Remember
- ☐ Understand
- ☐ Apply
- ☐ Analyze
- ☒ Evaluate
- ☐ Create/Transform

RWATEM (Requisite Work Aids, Tools, Equipment or Materials)

- Software, e.g. video chat, virtual meeting, Microsoft Word, project management software
- Communication tools, e.g. email, telephone

Major Category	Personal Competencies
Competency Area	Communicate Effectively
Competency Unit	Conduct meetings and presentations

Purpose

Conducting meetings and presentations effectively allows the sharing of information and ideas, which results in positive and solution-focused working relationships and working environments.

Performance/Abilities

P1 Determine if meeting or presentation is required:
- identify what message needs to be conveyed and within what timeframe
- identify best type of meeting/presentation for the purpose

P2 Determine who needs to be:
- participant at meeting
- in audience at presentation

P3 Prepare for meeting/presentation:
- confirm availability of key persons
- prepare outline or agenda
- make room arrangements, as required
- determine resources or materials required

P4 Inform participants/audience of location, start time and duration

P5 Conduct meeting/presentation:
- stay on topic
- allow time for questions and feedback

P6 Adjourn according to schedule

P7 Document event, as necessary:
- distribute documentation, as necessary
- file according to organizational/project protocol

P8 Complete any follow-up required, e.g. find answer to question asked during session

Knowledge

K1 Relevant legislation, e.g. Freedom of Information and Protection of Privacy

K2 Organization policies, procedures and plans

K3 Organization/project goals, vision and status

K4 Organizational document management system

K5 Effective communication practices, e.g. verbal versus non-verbal, characteristics of respectful communication

K6 Sector and project terminology and common abbreviations

K7 Software applications for building visual presentations

CONTEXTUAL VARIABLES

Range of Context

- Stakeholders involved in meetings and presentations will vary, e.g. tradespeople, team members, managers, agency representatives, and this may affect the tone of the communication, i.e. formal or informal.
- Physical location may change the way this skill is performed, e.g. all communication may have to occur via distance means.

Level of Practice

- ☒ Frontline
- ☒ Supervisor
- ☒ Manager/Executive

Adapted Bloom's Taxonomy

- ☐ Recall, Remember
- ☐ Understand
- ☐ Apply
- ☒ Analyze
- ☐ Evaluate
- ☐ Create/Transform

RWATEM (Requisite Work Aids, Tools, Equipment or Materials)

- Software, e.g. Powerpoint, project management software, video chat, virtual meeting
- Communication tools, e.g. email, telephone, projectors, flip charts

Major Category	Personal Competencies
Competency Area	Communicate Effectively
Competency Unit	Exchange information with internal and external stakeholders

Purpose

Interacting effectively and appropriately with internal and external stakeholders helps to ensure that operations run smoothly and allows managers, supervisors, co-workers, customers and other stakeholders to be proactive before small issues become large problems. Exchanging relevant and accurate information in a timely manner is essential for good performance and relations between individuals and stakeholder groups.

Performance/Abilities

P1 Determine what information needs to be shared and within what timeframe:
- respect confidentiality of sensitive information
- tailor message to audience
- collect information from stakeholders to make decisions or take action, e.g. communicate with host of co-generation station to meet their needs

P2 Determine who needs information, e.g. department head, team members, customers, government agency

P3 Determine best method for communicating information, e.g. conduct meeting, hold conference call, send email, share data analysis via SCADA

P4 Share information through best method, including:
- conduct or participate in face-to-face meetings
- communicate over distance, e.g. call department of environment about a log jam in dam, share video or photos of equipment and systems with maintenance team
- email information and updates to have permanent record of exchanges
- use specialized communication/reporting software, e.g. OASIS, Reliability Coordinator information System
- use three-way communication to confirm understanding and ensure safety

P5 Monitor own communication devices frequently, e.g. smartphone, email

P6 Document communication, as necessary:
- file according to organization's information/record management system

Knowledge

K1 Relevant legislation, e.g. NERC Standards of Conduct, Freedom of Information and Protection of Privacy

K2 Organization policies, procedures and plans

K3 Organizational goals, vision and status

K4 Organizational information/record management system

K5 Effective communication practices, e.g. verbal versus non-verbal, characteristics of respectful communication, three-way communication

K6 Relevant stakeholders, e.g. team members, other departments, contractors, customers, government agencies,

K7 Information needs of stakeholders

K8 Industry terminology and common abbreviations

K9 Basics of how overall electricity system works and how components impact each other, e.g. how distribution and transmission affect generation

Glossary

- **Stakeholders:** individuals and groups who are impacted by the activities or decisions of others; the individuals and groups could be within (internal) or outside (external) of the organization or project, e.g. co-workers, supervisors, contractors, customers, the public, government, union, shareholders.
- **Three-way communication:** sharing a message in three steps: 1. sender states message, 2. receiver repeats message, 3. sender cofirms that receiver has repeated message correctly or corrects any misunderstandings.

CONTEXTUAL VARIABLES

Range of Context

- Stakeholders involved in interactions will vary, e.g. tradespeople, team members, managers, agency representatives, and this may affect the tone of the communication, i.e. formal or informal.
- Physical location may change the way this skill is performed, e.g. all communication may have to occur via distance means.
- Continuous training for proper communication, and monitoring of practice, is commonplace for many occupations within the industry.

Level of Practice

- ☒ Frontline
- ☒ Supervisor
- ☒ Manager/Executive

Adapted Bloom's Taxonomy

- ☐ Recall, Remember
- ☐ Understand
- ☐ Apply
- ☒ Analyze
- ☐ Evaluate
- ☐ Create/Transform

RWATEM (Requisite Work Aids, Tools, Equipment or Materials)

- Software, e.g. video chat, virtual meeting, OASIS, RCIS
- Communication devices, e.g. email, telephone

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