

National Occupational Standard

PV Installer

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 determine 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: PV Installer

This Chart outlines the competencies (also known as skills and knowledge) that are performed by PV Installers.

Key: Tasks included in trade national occupational analyses (i.e. Industrial and Construction Electricians) that are also performed or sub-contracted by PV Installers for safe installation

Occupational Definition:

PV Installers assemble and install photovoltaic (PV) systems on roofs or other structures in compliance with site assessment and schematics. May include measuring, cutting, assembling, and bolting structural framing and solar modules. Utility-scale installation requires a wider skill set related to high voltage interconnection and substation knowledge.

Major Category	Competency Area	Competency Unit						
Construction and Installation	Plan Installation	Organize materials and equipment for installation	Coordinate installation activities with others	Examine site conditions				
	Perform Foundational Electrical Installation Tasks	Fabricate support structures	Install brackets, hangers and fasteners	Install grounding systems	Install bonding systems	Install ground fault detection systems	Install conductors and cables	
		Install conduit, tubing and fittings	Install raceways	Install boxes and enclosures	Install wiring devices	Install lightning protection	Install under and over voltage protection	
	Install PV System	Install module support structures	Install modules	Install solar charge controller	Install battery bank	Install inverter	Install energy monitoring and control systems	Program PV equipment
	Install Generating, Distribution and Service Equipment	Install single-phase consumer/ supply services and metering equipment	Install three-phase consumer/ supply services and metering equipment	Install overcurrent protection devices	Install ground fault, arc fault and surge protection devices	Install low voltage distribution equipment	Install extra-low voltage transformers	Install low voltage single-phase transformers
		Install low voltage three-phase transformers	Install high voltage transformers					
	Install Generating, Distribution and Service Systems	Install AC generating systems	Install DC generating systems	Install high voltage systems				
	Install Wiring Systems	Install high voltage cables						
	Complete Installation Process	Troubleshoot installation issues	Install operation and identification tags					
	Conduct Tests for Commissioning	Conduct electrical tests for commissioning						
Commission Equipment and Systems	Verify equipment/system operation and functionality	Document equipment/ system performance	Perform site cleanup	Demonstrate system to client/end-user				
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	Use fall arrest equipment
		Work in confined spaces						
	Maintain a Sustainable Environment	Follow sustainable work practices						
Respond to Emergencies	Respond to chemical spills and leaks	Respond to non-electrical emergencies	Participate in high-angle rescue	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						
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						
Foundational Trades Skills	Perform Routine Trade Tasks	Use hand and power tools	Use electrical measuring and testing equipment	Use access equipment and work platforms	Operate vehicles and motorized equipment	Lubricate equipment and components	Assist with rigging, hoisting/ lifting and moving tasks	
Personal Competencies	Demonstrate Professionalism	Work as 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 hand signals	Use writing skills	Negotiate with internal and external stakeholders	Exchange information with internal and external stakeholders	

Major Category

Construction and Installation

Competency Area

Plan Installation

Competency Unit

Organize materials and equipment for installation

Purpose

Organizing material and equipment for an installation is important to ensure everything is ready to begin the installation. This helps to ensure that the installation is completed efficiently and safely.

Performance/Abilities

- P1** Determine materials and equipment needed, for example:
- analyze technical drawings and specifications
 - reference job plan
 - size equipment and components
 - access material lists of suppliers and pricing based on system specifications
- P2** Ensure availability of materials and equipment for installation:
- use inventory/procurement system, i.e. ordering and purchasing procedures
 - schedule delivery, as required
- P3** Coordinate delivery of materials and equipment on site, as required:
- verify delivery matches order, e.g. type, quantity
 - document delivery
 - inspect materials and equipment for damage
 - contact purchasing department or suppliers for replacements, as required
- P4** Stage materials and equipment on site:
- coordinate with other tradespeople
 - secure materials and equipment
- P5** Stock vehicle(s)/equipment, as required:
- ensure standard stocking levels are met, if required
 - ensure required site-specific materials and equipment are in vehicle(s)/equipment
 - organize materials and equipment within vehicle(s)/equipment
- P6** Communicate issues with obtaining materials and equipment to appropriate personnel, e.g. project manager, general contractor, client, supplier

Knowledge

- K1** Organization policies, procedures and plans, e.g. purchasing procedures, emergency plan
- K2** Relevant CSA Standards, e.g. Canadian Electrical Code (CE code)
- K3** Jurisdictional requirements, including permit requirements, e.g. OH&S
- K4** Manufacturer's specifications for equipment and system being installed
- K5** Other documents relevant to the installation, e.g. technical drawings, client requirements
- K6** Organizational document management system
- K7** Inspection procedures for materials and equipment, including common issues with materials and equipment
- K8** Site/installation requirements
- K9** Sensitive areas/areas to be avoided on-site, e.g. first nations, archeological

Contextual Variables

Range of Context

- Number and types of materials and equipment will vary with size/scope of the project. For example, commercial installation has more complexity, different types of material used, and more individuals to coordinate with. The scope of commercial work is larger, and often more complex, than residential.
- Job specifications and on-site conditions can vary the way this skill is performed.

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
- Technical drawings, specifications and equipment lists
- Software, e.g. identification and documentation of equipment on site
- Clipboard/paper
- Digital camera
- Computer/tablet/smartphone

Purpose

Coordinating installation activities is important to ensure that all involved with the installation are aware of their roles and responsibilities. This helps to ensure that the installation is completed efficiently and safely.

Performance/Abilities

- P1** Review installation plan with sub-trades, customers, contractors, and suppliers, as required:
- provide own qualifications, as required
 - reference technical drawings and specifications, as required
 - reference job plan, as required
- P2** Modify installation plan based on discussions, as required
- P3** Coordinate activities with co-workers
- P4** Coordinate activities with General Contractor (GC) and sub-trades, as required:
- follow established communication protocols
 - attend and complete site safety orientation meeting (and test) and display valid hard hat decal
 - attend regular tailgate meetings as required by GC
- P5** Coordinate activities with suppliers:
- consider logistics and timing requirements of goods and services
 - confirm arrival of goods and services
- P6** Coordinate activities with homeowner/building operator, as required:
- consider impact of installation on surrounding environment and properties
- P7** Interact with inspectors, as required
- P8** Complete documentation, for example:
- make notes on paper or app
 - modify plan
 - obtain email confirmation
 - record changes to calendar
 - maintain digital photograph history of installation milestones

Knowledge

- K1** Organization policies, procedures and plans, e.g. communication protocols
- K2** Organization/project goals, vision and status
- K3** Relevant CSA Standards, e.g. Canadian Electrical Code (CE code)
- K4** Relevant qualifications/certifications for the installation
- K5** Jurisdictional requirements, including permit requirements
- K6** Manufacturer's specifications for system being installed
- K7** Organizational document management system
- K8** Documents relevant to the installation, e.g. technical drawings, client requirements, scope of work

K9 Roles and responsibilities of all involved in installation, for example:

- client
- sub-trades
- contractors
- suppliers
- co-workers
- inspectors

K10 Applicable regulatory agencies responsible for inspections

K11 Inspection stages of installation

Contextual Variables

Range of Context

- Types of individuals and number of individuals involved with an installation will vary with the size and complexity of the work.
- More coordination may be required for large projects or for installations that encounter unusual conditions.
- Commercial installation has more complexity, different types of material used, and more individuals to coordinate with. The scope of work is larger than residential.

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)

- Communication tools, e.g. email, telephone
- Cell phone apps
- Calendars
- Computer/tablet/smartphone
- Digital camera

Purpose

Examining site conditions is important to ensure the installation proceeds safely and efficiently. If this is not performed correctly, it can cause considerable project delays.

Performance/Abilities

- P1** Wear appropriate PPE for site, e.g. steel-toed boots, hard hat, safety glasses, high-visibility vest
- P2** Verify that appropriate permits have been obtained for the installation, e.g. building
- P3** Verify location of utilities, as required:
- contact appropriate utilities and jurisdictional authorities to obtain locates or clearance number
 - lay out location of utilities on site map
- P4** Confirm existence of other buried services with client, if required, e.g. septic field, communication lines, cistern
- P5** Verify property lines, easements and boundaries, if required:
- refer to legal maps
- P6** Verify other relevant approvals have been obtained, as required, e.g. homeowners' association, right of way
- P7** Verify location(s) of existing equipment and services, as required, e.g. refrigeration lines, hydronic lines, cable runs, electrical service interface, water/wastewater piping
- P8** Discuss installation with client/representative to confirm installation plan
- P9** Coordinate installation activities with others, e.g. location of equipment
- P10** Inspect site environmental conditions, e.g. dampness, temperature, ice, wind, snow:
- analyze against plans and specifications
 - ensure situation is safe to proceed
- P11** Communicate changes to designer, as required:
- modify design documents and submit for approval, as required
 - justify need for modifications, e.g. provide data
- P12** Ensure work is ready to begin on installation, including:
- potential hazards identified
 - traffic areas identified
 - required materials and equipment on site
 - barricades and signage around work zone
 - traffic control in place, as required
 - access control on work site and storage areas, e.g. locked gate, as required
 - sufficient lighting and ventilation, as required
- P13** Document site conditions, as required:
- note deficiencies

Knowledge

- K1** Organization policies, procedures and plans, e.g. safety protocols
- K2** Relevant CSA Standards, e.g. Canadian Electrical Code (CE code)

- K3** Jurisdictional requirements, including permit requirements
- K4** Manufacturer's specifications for equipment and system being installed
- K5** Other documents relevant to the installation, e.g. technical drawings, client requirements, scope of work
- K6** Industry best practices for specific installation
- K7** Organizational document management system
- K8** Roles and responsibilities of all involved in installation, for example:
- client
 - sub-trades
 - contractors
 - suppliers
 - co-workers
 - inspectors
- K9** Potential safety hazards and mitigation strategies

Glossary

- **Locates:** ground markings identifying the position of utility lines based on records or electronic locating equipment.

Contextual Variables

Range of Context

- This competency may be simple or complex depending upon the type and size of installation, and specific installation site.

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
- Site maps
- Technical drawings

Purpose

Fabricating support structures is important to protect and support equipment and components. Properly fabricated support structures reduce damage to equipment and structures, as well as injury to persons.

Performance/Abilities

- P1** Wear appropriate PPE, e.g. safety glasses, hard hat, fall arrest equipment
- P2** Select appropriate tools according to task, manufacturers' specifications, engineered drawings, and site
- P3** Identify support structure requirements and materials according to task, manufacturers' specifications, engineered drawings, and site conditions
- P4** Confirm capacity of equipment to ensure it meets requirements of support structure size, strength and weight
- P5** Verify plans for support structure
- P6** Confirm presence of required materials for support structure and their appropriateness by comparing to:
- job specifications and plans
 - environment
 - strength and durability ratings
- P7** Review installation location:
- review installation plan
 - measure installation site
 - plan how to avoid obstructions
- P8** Prepare material for support structure, for example:
- cut to size
 - drill holes
- P9** Assemble material to create structure:
- ensure structure is straight and free of sharp edges
- P10** Install support structure according to industry best practices, ensuring they are:
- level
 - square
 - following building lines
- P11** Inspect finished support structure to ensure it meets requirements
- P12** Communicate issues to relevant personnel, e.g. co-workers, project manager
- P13** Clean tools after use, as required
- P14** Store tools and supplies in designated location

Knowledge

- K1** Organization's policies, procedures and plans, e.g. safety protocols
- K2** Relevant standards and regulations, e.g. Canadian Standards Association standards, Underwriters Laboratories of Canada standards, Canadian Electrical Code (CE code), building code
- K3** Required permits

- K4** Manufacturer's specifications for equipment and system being installed
- K5** Other documents relevant to installation, e.g. technical drawings, client requirements
- K6** Industry best practices for fabricating support structures
- K7** Organization's information/record management system
- K8** Types of safety hazards on site
- K9** Types of safety hazards associated with fabricating support structures, for example:
- grinding
 - cutting
 - power tools
 - solvents
 - ballasts
- K10** PPE required for specific tasks
- K11** Types of material, e.g. wood, steel, aluminum
- K12** Types of brackets, hangers and fasteners, e.g. their characteristics and applications
- K13** Characteristics of different materials, e.g. weight, hardness, conductivity
- K14** Types of shop equipment and tools and their applications, e.g. grinders, power metal saws, drills
- K15** Terminology related to shop equipment and tools
- K16** Measurement and layout techniques
- K17** Procedures used to fabricate support structures
- K18** Hoisting and lifting techniques
- K19** Different types of roof configurations and materials and their impact on safety and installation procedures
- K20** Torqueing and tensioning techniques, e.g. pneumatics, mechanical means

Glossary

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

Contextual Variables

Range of Context

- This competency may be simple or complex depending upon the type and size of installation, and specific installation site.

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, fall arrest equipment
- Shop equipment, tools and attachments, e.g. hand saws, drills, chop saws, grinders, screw drivers, wrenches
- Materials for support structure, e.g. wood, steel aluminum, brackets, hangers
- Fasteners, e.g. anchors, nuts, bolts, screws
- Sealants, e.g. tar products, silicone
- Hoisting and lifting equipment

Purpose

Installing brackets, hangers and fasteners correctly is important to protect and support equipment and components. This reduces hazards including the risk of damage to equipment and structures, as well as the risk of injury to persons.

Performance/Abilities

- P1** Wear appropriate PPE, e.g. safety glasses, hard hat, fall arrest equipment
- P2** Select appropriate tools to install or remove fastening and retaining devices
- P3** Select brackets, hangers and fasteners according to task, manufacturer's specifications, engineered drawings, and site conditions
- P4** Review installation location:
 - review installation plan
 - measure installation site
 - plan how to avoid obstructions
- P5** Secure brackets, hangers and fasteners to structure according to industry best practices, ensuring they are:
 - level
 - square
 - following building lines
- P6** Communicate issues to relevant personnel, e.g. co-workers, project manager
- P7** Clean tools after use, as required
- P8** Store tools and supplies in designated location

Knowledge

- K1** Organization policies, procedures and plans, e.g. safety protocols
- K2** Relevant standards and regulations, e.g. Canadian Standards Association standards, Underwriters Laboratories of Canada standards, Canadian Electrical Code (CE code), building code
- K3** Required permits
- K4** Manufacturer's specifications for system being installed
- K5** Other documents relevant to installation, e.g. technical drawings, client requirements
- K6** Industry best practices for installing brackets, hangers and fasteners
- K7** Organizational document management system
- K8** Types of safety hazards on site
- K9** Types of safety hazards associated with brackets, hangers and fasteners
- K10** Types of brackets, hangers and fasteners, their characteristics and applications
- K11** Measurement and layout techniques
- K12** Consequences of using incorrect brackets, hangers and fasteners, or installing them incorrectly
- K13** PPE required for specific tasks
- K14** Terminology related to brackets, hangers and fasteners
- K15** Hoisting and lifting techniques

K16 Different types of roof configurations and materials and their impact on safety and installation procedures

K17 Torquing and tensioning techniques, e.g. pneumatics, mechanical means

Glossary

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

Contextual Variables

Range of Context

- Weather and site conditions can affect the way this skill is performed.
- Brackets can be installed with support structures or conductors and cables.

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, fall arrest equipment
- Site plans and drawings
- Hangers, e.g. trapezes, pipe clamps, beam clamps
- Brackets, e.g. angle brackets, T-brackets, L-brackets, floor brackets, ceiling brackets
- Fasteners, e.g. spring nuts, bolts, screws, concrete anchors
- Hand and power tools, e.g. measuring tape, screwdriver, power drill, wrenches
- Hoisting and lifting equipment

Purpose

Installing grounding systems correctly is important to protect persons and equipment from transient and fault current.

Performance/Abilities

- P1** Adhere to Canadian Electrical Code (CE code)
- P2** Wear appropriate PPE, e.g. safety glasses, hard hat, fall arrest equipment
- P3** Select appropriate tools for grounding systems
- P4** Select correct type of grounding electrodes for task, considering:
- site-specific conditions
 - engineering conditions
- P5** Select ground conductor size
- P6** Determine installation location, considering:
- routing
 - point of termination at source of supply and service equipment
- P7** Install grounding system components (e.g. electrodes, conductors, connectors, plumbing) according to industry best practices, specific layout and site conditions:
- adhere to building code
- P8** Terminate grounding system components according to industry best practices:
- interconnect, as required
 - ensure grounding connector is securely terminated at source of supply
- P9** Perform ground resistance test, if required:
- document results
- P10** Communicate issues to relevant personnel, e.g. co-workers, project manager
- P11** Clean tools after use, as required
- P12** Store tools and supplies in designated location

Knowledge

- K1** Organization policies, procedures and plans, e.g. safety protocols
- K2** Relevant standards and regulations, e.g. Canadian Standards Association standards, Underwriters Laboratories of Canada standards, Canadian Electrical Code (CE code), building code
- K3** Required permits
- K4** Manufacturer's specifications for system being installed
- K5** Other documents relevant to the installation, e.g. technical drawings, client requirements
- K6** Tasks that require trades certification
- K7** Industry best practices for grounding
- K8** Organization's information/record management system

K9 Types of safety hazards on site

K10 Types of grounding components, their characteristics and applications

K11 Consequences of incorrect grounding

K12 PPE required for specific tasks

K13 Terminology related to grounding

Glossary

- **Grounding:** a permanent and continuous path to the earth with sufficient ampacity to carry any fault current liable to be imposed on it, and of a sufficiently low impedance to limit the voltage rise above ground and to facilitate the operation of the protective devices in the circuit.
- **Industry best practices:** methods that meet or exceed jurisdictional requirements, e.g. Canadian Electrical Code (CE code), bylaws.

Contextual Variables

Range of Context

- Weather and site conditions can affect the way this skill is performed.
- The scope and requirements of residential, commercial and utility scale projects differ significantly in complexity.

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, fall arrest equipment
- Grounding system components, e.g. grounding electrodes, grounding conductors, grounding connectors
- Ground testing equipment, e.g. ground loop impedance tester, ground megohmmeter

Purpose

Installing bonding systems correctly is important to protect persons and equipment from transient and fault current.

Performance/Abilities

- P1** Adhere to Canadian Electrical Code (CE code)
- P2** Wear appropriate PPE, e.g. safety glasses, hard hat, fall arrest equipment
- P3** Select appropriate tools for bonding systems
- P4** Select bonding method based on:
 - environment
 - amperage
 - voltage
 - mechanical protection
 - conductor material and size
- P5** Select bonding conductor size based on engineering specifications
- P6** Determine installation location according to industry best practices
- P7** Install bonding components according to industry best practices:
 - consider layout, site conditions, jurisdictional requirements
 - ensure continuity between non-current carrying components or apparatus of electrical systems and other metallic components
 - ensure components facilitate function of overcurrent devices (fault current)
- P8** Terminate bonding system components according to industry best practices:
 - interconnect, as required
- P9** Perform continuity and resistance tests:
 - document results, if required
- P10** Communicate issues to relevant personnel, e.g. co-workers, project manager
- P11** Clean tools after use, as required
- P12** Store tools and supplies in designated location

Knowledge

- K1** Organization policies, procedures and plans, e.g. safety protocols
- K2** Relevant standards and regulations, e.g. Canadian Standards Association standards, Underwriters Laboratories of Canada standards, Canadian Electrical Code (CE code), building code
- K3** Required permits
- K4** Manufacturer's specifications for system being installed
- K5** Other documents relevant to the installation, e.g. technical drawings, client requirements
- K6** Tasks that require trades certification
- K7** Industry best practices for bonding

- K8** Organization's information/record management system
- K9** Types of safety hazards on site
- K10** Types of bonding components, their characteristics and applications
- K11** Consequences of incorrectly bonding
- K12** PPE required for specific tasks
- K13** Terminology related to bonding

Glossary

- **Bonding:** a low impedance path obtained by permanently joining all non-current-carrying metal parts to ensure electrical continuity and having the capacity to safely conduct any current likely to be imposed on it.
- **Industry best practices:** methods that meet or exceed jurisdictional requirements, e.g. Canadian Electrical Code (CE code), bylaws.

Contextual Variables

Range of Context

- Weather and site conditions can affect the way this competency is performed.
- Installers must be aware that this competency applies to the installation of any exposed metal surfaces.

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, fall arrest equipment
- Bonding components, e.g. metallic raceways, cables, copper or aluminum conductors, connectors, locknuts, terminations
- Tools, e.g. screwdriver, drill, wrenches

Purpose

Installing ground fault detection systems correctly is important to protect persons and equipment from risk of electrical shock.

Performance/Abilities

- P1** Analyze need for ground fault detection system, as required by Canadian Electrical Code (CE code)
- P2** Refer to client requirements, drawings and specifications
- P3** Wear appropriate PPE, e.g. safety glasses, hard hat, fall arrest equipment
- P4** Select appropriate tools for installing ground fault detection systems
- P5** Select correct type of ground fault detection system for task, considering:
- Canadian Electrical Code (CE code) requirements
 - site-specific conditions
 - jurisdictional requirements
 - drawings and specifications
 - manufacturers' specifications
- P6** Determine installation layout and location, as required, considering:
- manufacturers' specifications
 - CE code requirements
 - site-specific conditions
 - jurisdictional requirements
 - drawings and specifications
 - organization and client requirements
- P7** Install ground fault detection system components (e.g. resistors, relays, annunciators) according to industry best practices, specific layout, site conditions and CE code requirements:
- use fasteners designed for material used in support structure
- P8** Set parameters for ground fault detection system according to industry best practices
- P9** Test operation of system according to manufacturer's specifications:
- document results, if required
- P10** Update documentation, as required, e.g. create as-builts
- P11** Communicate issues to relevant personnel, e.g. co-workers, project manager
- P12** Clean tools after use, as required
- P13** Store tools and supplies in designated location

Knowledge

- K1** Organization's policies, procedures and plans, e.g. safety protocols
- K2** Relevant standards and regulations, e.g. Canadian Standards Association standards, Underwriters Laboratories of Canada standards, Canadian Electrical Code (CE code), building code
- K3** Required permits

- K4** Manufacturer's specifications for system being installed
- K5** Other documents relevant to installation, e.g. technical drawings, client requirements
- K6** Tasks that require trades certification
- K7** Industry best practices for installing ground fault detection systems
- K8** Organization's information/record management system
- K9** Types of safety hazards on site
- K10** Types of ground fault detection system components, their characteristics and applications
- K11** Installation procedures for ground fault detection systems
- K12** Consequences of incorrectly installing ground fault detection system
- K13** PPE as required for specific tasks, e.g. safety glasses, hard hat, fall arrest equipment, arc flash clothing
- K14** Terminology related to ground fault detection systems

Glossary

- Ground fault:** an unintentional electrical path between a part (operating normally at some potential to ground) and the ground.
- Industry best practices:** methods that meet or exceed jurisdictional requirements, e.g. Canadian Electrical Code (CE code), bylaws.

Contextual Variables

Range of Context

- Weather and site conditions can affect the way this skill is performed.
- Type of ground fault detection system will vary, e.g. solidly grounded system, impedance-grounded system, ungrounded systems.
- In some jurisdictions, some of the tasks in this competency may require certification in the electrical trade in order to be 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, e.g. safety glasses, hard hat, fall arrest equipment, arc flash clothing
- Ground fault system components, e.g. resistors, relays, annunciators (horns, panels), indicators (pilot lights) reset buttons, breakers, interconnecting wiring, ground fault sensors (direct, residual or zero sequence)
- Fasteners, e.g. screws, bolts, straps, inserts, anchors, wedge clamps, seismic restraints, insulators
- Tools, e.g. screw drivers, wrenches, multimeter
- Documentation, e.g. schematics, panel schedules, log sheets, shop drawings, terminal identification, warning labels

Purpose

Installing conductors and cables correctly is important to ensure proper operation and safety of equipment.

Performance/Abilities

- P1** Wear appropriate PPE, for example:
- safety glasses
 - hard hat
 - fall arrest equipment
 - arc flash clothing
 - rubber gloves
- P2** Select appropriate tools for installing conductors and cables
- P3** Select correct size, type and number of conductors and cables for task, considering:
- Canadian Electrical Code (CE code) requirements
 - site-specific conditions
 - jurisdictional requirements
 - drawings and technical specifications
 - organization and client requirements
- P4** Install conductors, cables and associated components (e.g. fittings, supports, plates) according to industry best practices, site conditions and CE code
- P5** Prepare conductors and cables for termination:
- clean, as required
- P6** Terminate conductors and cables according to industry best practices
- P7** Update documentation, as required, e.g. as-builts, warning labels, fire plan
- P8** Remove existing conductors, cables and associated components, as required:
- dispose of components according to organization's policy
- P9** Label conductors, cables and associated components and all parts integral to system
- P10** Communicate issues to relevant personnel, e.g. co-workers, project manager
- P11** Clean tools after use, as required
- P12** Store tools and supplies in designated location
- P13** Types of conductors, cables and associated components, their characteristics and applications

Knowledge

- K1** Organization policies, procedures and plans, e.g. safety protocols
- K2** Relevant standards and regulations, e.g. Canadian Standards Association standards, Underwriters Laboratories of Canada standards, Canadian Electrical Code (CE code), building code
- K3** Required permits
- K4** Manufacturers' specifications for equipment and system being installed
- K5** Other documents relevant to the installation, e.g. technical drawings, client requirements

- K6** Tasks that require trades certification
- K7** Industry best practices for installing conductors and cables
- K8** Organization's information/record management system
- K9** Types of safety hazards on site
- K10** Color-coding used to identify conductors and cables
- K11** Installation procedures for conductors and cables
- K12** Consequences of incorrectly installing conductors and cables
- K13** PPE required for specific tasks
- K14** Terminology related to conductors and cables

Glossary

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

Contextual Variables

Range of Context

- Weather, site and installation conditions (e.g. hazardous, wet, underground) can affect the way this competency is performed.
- **In some jurisdictions, performance of some tasks in this competency may require certification in the electrical trade.**

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, fall arrest equipment, arc flash clothing, rubber gloves
- Conductors and cables
- Components for conductor and cable installation, e.g. mechanical fittings, compression fittings, supports, straps, connectors, hangers, heat shrink, anti-oxidant compounds, non-ferrous and/or non-conductive plates and connectors
- Tools, e.g. drills, pipe bender, hammer drill
- Documentation, e.g. schematics, panel schedules, log sheets, shop drawings, terminal identification, warning labels, as-builts

Purpose

Installing conduit, tubings and fittings correctly is important to protect wiring and to prevent damage to property, personal injury, or death.

Performance/Abilities

- P1** Wear appropriate PPE, e.g. gloves, eye protection, hard hat, high visibility vest
- P2** Select appropriate tools for installing conduit and tubing
- P3** Select correct size and type of conduit, tubing and fittings for task, considering:
 - Canadian Electrical Code (CE code) requirements
 - site-specific conditions
 - jurisdictional requirements
 - drawings and technical specifications
 - organization and client requirements
- P4** Determine routing of conduit and tubing, considering:
 - suitability for application
 - other tradesperson's activities
- P5** Measure conduit and tubing according to industry best practices:
 - size for installation, as required e.g. cut, thread, bend conduit or tubing
- P6** Assemble conduit, tubing and fittings according to industry best practices
- P7** Install conduit, tubing and fittings according to industry best practices and site conditions:
 - position conduit and tubing
 - mount conduit and tubing, e.g. ensure support is provided
- P8** Update documentation, as required, e.g. as-builts
- P9** Remove existing conduit and tubing, as required:
 - dispose of according to organizational policy
- P10** Communicate issues to relevant personnel, e.g. co-workers, project manager
- P11** Clean tools after use, as required
- P12** Store tools and supplies in designated location

Knowledge

- K1** Organization policies, procedures and plans, e.g. safety protocols
- K2** Relevant CSA Standards, e.g. Canadian Electrical Code (CE code)
- K3** Jurisdictional requirements, including permit requirements
- K4** Manufacturer's specifications for equipment and system being installed
- K5** Client requirements
- K6** Industry best practices for installing conduit and tubing
- K7** Organizational information/record management system

- K8** Types of safety hazards on site
- K9** Types of conduit and tubing, their characteristics and applications
- K10** Installation procedures for conduit and tubing
- K11** Consequences of incorrectly installing conduit and tubing
- K12** PPE required for specific tasks
- K13** Terminology related to conduit and tubing

Glossary

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

Contextual Variables

Range of Context

- Weather, site and installation conditions (e.g. hazardous, wet, underground, indoor) can affect the way this competency is performed.
- Types of conduit and tubing vary (e.g. rigid metal, rigid Poly Vinyl Chloride (PVC), electrical metallic tubing (EMT), coated rigid, non-metallic flex) and this affects the performance of this competency, i.e. procedures for sizing.
- **In some jurisdictions, performance of some tasks in this competency may require certification in the electrical trade.**

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. gloves, eye protection, hard hat, high visibility vest, as site requires
- Required conduit and tubing
- Fittings
- Tools, e.g. drills, hand tools, explosive-actuated tools
- Documentation, e.g. schematics, technical drawings, prints, manufacturer's specifications

Purpose

Installing raceways correctly is important to protect wiring and to prevent damage to property and personal injury or death.

Performance/Abilities

- P1** Wear appropriate PPE, e.g. gloves, hard hat, eye protection
- P2** Select appropriate tools for installing raceways
- P3** Select correct size and type of raceway for task, considering:
 - Canadian Electrical Code (CE code) requirements
 - site-specific conditions
 - jurisdictional requirements
 - drawings and technical specifications
 - organization and client requirements
- P4** Determine routing of raceways, considering:
 - suitability for application
 - other tradesperson's activities
- P5** Measure raceways according to industry best practices:
 - size for installation, as required e.g. cut or form raceway
- P6** Assemble raceways according to industry best practices
- P7** Install raceways according to industry best practices and site conditions:
 - position raceways
 - mount raceways, e.g. ensure support is provided
- P8** Update documentation, as required, e.g. as-builts
- P9** Remove existing raceways, as required:
 - dispose of according to organizational policy
- P10** Communicate issues to relevant personnel, e.g. co-workers, project manager
- P11** Clean tools after use, as required
- P12** Store tools and supplies in designated location

Knowledge

- K1** Organization policies, procedures and plans, e.g. safety protocols
- K2** Relevant CSA Standards, e.g. Canadian Electrical Code (CE code)
- K3** Jurisdictional requirements, including permit requirements
- K4** Manufacturer's specifications for equipment and system being installed
- K5** Client requirements
- K6** Industry best practices for installing raceways
- K7** Organizational information/record management system

- K8** Types of safety hazards on site
- K9** Types of raceways, their characteristics and applications
- K10** Installation procedures for raceways
- K11** Consequences of incorrectly installing raceways
- K12** PPE required for specific tasks
- K13** Terminology related to raceways

Glossary

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

Contextual Variables

Range of Context

- Weather, site and installation conditions (e.g. hazardous, wet, underground, indoor) can affect the way this competency is performed.
- Types of raceways vary (e.g. cable-tray wireways, underfloor raceways, busways, cellular raceways, surface raceways), which affects the performance of this competency, i.e. procedures for sizing.
- **In some jurisdictions, performance of some tasks in this competency may require certification in the electrical trade.**

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. gloves, hard hat, eye protection, as site requires
- Required raceways
- Raceway components, e.g. fittings, supports
- Tools, e.g. drills, hand tools
- Documentation, e.g. schematics, as-builts, technical drawings, manufacturer's specifications

Purpose

Installing boxes and enclosures correctly is important to protect wiring, connections and controls. Properly installed boxes and enclosures can prevent damage to property and personal injury or death.

Performance/Abilities

- P1** Wear appropriate PPE, e.g. hard hats, eye protection, gloves
- P2** Select appropriate tools for installing boxes and enclosures
- P3** Select correct size and type of box/enclosure for task, considering:
 - Canadian Electrical Code (CE code) requirements
 - site-specific conditions
 - jurisdictional requirements
 - drawings and technical specifications
 - organization and client requirements
- P4** Determine installation location of boxes and enclosures, considering:
 - suitability for application
 - other tradesperson's activities
- P5** Assemble boxes and enclosures according to industry best practices
- P6** Install boxes and enclosures according to industry best practices and site conditions:
 - position boxes and enclosures
 - mount boxes and enclosures, e.g. ensure support is provided
- P7** Update documentation, as required e.g. as-builts
- P8** Remove existing boxes and enclosures, as required:
 - dispose of according to organizational policy
- P9** Communicate issues to relevant personnel, e.g. co-workers, project manager
- P10** Clean tools after use, as required
- P11** Store tools and supplies in designated location

Knowledge

- K1** Organization policies, procedures and plans, e.g. safety protocols
- K2** Relevant CSA Standards, e.g. Canadian Electrical Code (CE code)
- K3** Jurisdictional requirements, including permit requirements
- K4** Manufacturer's specifications for equipment and system being installed
- K5** Client requirements
- K6** Industry best practices and procedures for installing boxes and enclosures
- K7** Organizational information/record management system
- K8** Types of safety hazards on site
- K9** Types of boxes and enclosures, their characteristics and applications

K10 Consequences of incorrectly installing boxes and enclosures

K11 PPE required for specific tasks

K12 Terminology related to boxes and enclosures

Glossary

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

Contextual Variables

Range of Context

- Weather, site and installation conditions (e.g. hazardous, wet, underground, indoor) can affect the way this competency is performed.
- **In some jurisdictions, performance of some tasks in this competency may require certification in the electrical trade.**

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, eye protection, gloves
- Required boxes and enclosures
- Fittings/supports for boxes and enclosures
- Tools, e.g. drills, hand tools, explosive-actuated tools
- Documentation, e.g. schematics, technical drawings, manufacturer's specifications

Purpose

Installing wiring devices correctly is important to ensure the device operates safely and efficiently, protects and prevents property damage, and prevents personal injury and death.

Performance/Abilities

- P1** Wear appropriate PPE, e.g. gloves, eye protection, hard hat, steel-toe boots
- P2** Select appropriate tools for installing wiring devices
- P3** Select correct size and type of wiring device for task, considering:
- Canadian Electrical Code (CE code) requirements
 - site-specific conditions
 - jurisdictional requirements
 - drawings and technical specifications
 - organization and client requirements
- P4** Determine installation location of wiring device using industry best practices
- P5** Select branch circuit wiring for task, considering:
- CE code requirements
 - site-specific conditions
 - jurisdictional requirements
 - drawings
 - organization and client specifications
- P6** Install branch circuit wiring according to industry best practices and site conditions
- P7** Install wiring devices according to industry best practices and site conditions
- P8** Terminate conductors according to industry best practices, ensuring no excessive bare conductors or loose strands
- P9** Test operation:
- ensure circuit has specified voltage and phasing, as required
- P10** Install faceplate according to industry best practices, as required
- P11** Update documentation, as required e.g. as-builts
- P12** Remove existing wiring devices, as required:
- dispose of according to organizational policy
- P13** Communicate issues to relevant personnel, e.g. co-workers, project manager
- P14** Clean tools after use, as required
- P15** Store tools and supplies in designated location

Knowledge

- K1** Organization policies, procedures and plans, e.g. safety protocols
- K2** Relevant CSA Standards, e.g. Canadian Electrical Code (CE code)
- K3** Jurisdictional requirements, including permit requirements

- K4** Manufacturer's specifications for equipment and system being installed
- K5** Client requirements
- K6** Industry best practices and procedures for installing wiring devices
- K7** Organizational information/record management system
- K8** Types of safety hazards on site
- K9** Types of wiring devices, their characteristics and applications
- K10** Colour-coding used to identify conductors
- K11** Consequences of incorrectly installing wiring devices
- K12** PPE required for specific tasks
- K13** Terminology related to wiring devices

Glossary

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

Contextual Variables

Range of Context

- Weather, site and installation conditions (e.g. hazardous, wet, outdoors, indoors) can affect the way this competency is performed.
- In some jurisdictions, performance of some tasks in this competency may require certification in the electrical trade.**

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. gloves, eye protection, hard hat, steel-toe boots
- Specified wiring devices, e.g. lamp holders, switches, timers, sensors, relays, controllers, safety switches, power outlets, receptacles
- Tools, e.g. hand tools
- Documentation, e.g. schematics, technical drawings, manufacturer's specifications

Purpose

Installing lightning protection correctly is important to direct any lightning energy to ground. This protects equipment and structures from damage and persons from injury.

Performance/Abilities

- P1** Wear appropriate PPE, e.g. rubber gloves, hard hat, steel-toe boots, eye protection
- P2** Select appropriate tools for installing lightning protection
- P3** Select correct type of lightning protection for task, considering:
 - Canadian Electrical Code (CE code) requirements
 - site-specific conditions
 - jurisdictional requirements
 - drawings and technical specifications
 - organization and client requirements
- P4** Determine installation location and layout of lightning protection using industry best practices:
 - ensure lightning energy is directed to ground
- P5** Install lightning protection system components (e.g. lightning rod, intercepting conductors, ground electrodes) according to industry best practices, specific layout, and site conditions:
 - use fasteners designed for the attachment to material of support structure
- P6** Terminate lightning protection system components according to industry best practices:
 - interconnect components to be protected, as required
- P7** Verify installation:
 - visually inspect to ensure interconnection requirements are met
- P8** Update documentation as required, e.g. as-builts
- P9** Remove existing lightning protection, as required:
 - dispose of according to organizational policy
- P10** Communicate issues to relevant personnel, e.g. co-workers, project manager
- P11** Clean tools after use, as required
- P12** Store tools and supplies in designated location

Knowledge

- K1** Organization policies, procedures and plans, e.g. safety protocols
- K2** Relevant CSA Standards, e.g. Canadian Electrical Code (CE code)
- K3** Jurisdictional requirements, including permit requirements
- K4** Manufacturer's specifications for equipment and system being installed
- K5** Client requirements
- K6** Industry best practices and procedures for installing lightning protection
- K7** Organizational information/record management system

- K8** Types of safety hazards on site
- K9** Types of lightning protection systems, their characteristics and applications
- K10** Consequences of incorrectly installing lightning protection
- K11** PPE required for specific tasks
- K12** Terminology related to lightning protection

Glossary

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

Contextual Variables

Range of Context

- The type of lightning protection system used will affect how this competency is performed.

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. rubber gloves, hard hat, steel-toe boots, eye protection, fall arrest equipment
- Lightning protection components, e.g. lightning rod (air terminal), intercepting conductors, down conductors, ground electrodes (ground rods), supports, lightning arresters
- Tools, e.g. hand tools, lifts/aerial platforms, climbing gear
- Documentation, e.g. schematics, technical drawings, prints, manufacturer's specifications

Purpose

Installing under and over voltage protection devices correctly is important to protect equipment, and to prevent circuit damage, property damage and personal injury.

Performance/Abilities

- P1** Wear appropriate PPE, e.g. rubber gloves, hard hat, eye protection, steel-toe boots
- P2** Select appropriate tools for installing under and over voltage protection devices
- P3** Select correct type of under and over voltage protection devices for task, considering:
- Canadian Electric Code (CE code) requirements
 - site-specific conditions
 - jurisdictional requirements
 - drawings and technical specifications
 - organization and client requirements
- P4** Install under and over voltage protection devices (e.g. protective relays, sensors) according to industry best practices, specific layout and site conditions:
- mount using hardware designed for the equipment
- P5** Connect under and over voltage protection devices to circuit according to industry best practices
- P6** Set parameters for under and over voltage protection devices according to industry best practices
- P7** Test operation of devices according to manufacturer's specifications
- P8** Update documentation, as required, e.g. as-builts, schematics, panel schedule, log sheet
- P9** Communicate issues to relevant personnel, e.g. co-workers, project manager
- P10** Clean tools after use, as required
- P11** Store tools and supplies in designated location

Knowledge

- K1** Organization policies, procedures and plans, e.g. safety protocols
- K2** Relevant CSA Standards, e.g. Canadian Electrical Code (CE code)
- K3** Jurisdictional requirements, including permit requirements
- K4** Manufacturer's specifications for equipment and system being installed
- K5** Client requirements
- K6** Industry best practices and procedures for installing under and over voltage protection devices
- K7** Organizational information/record management system
- K8** Importance of updating documentation
- K9** Types of safety hazards on site
- K10** Types of under and over voltage protection devices, their characteristics and applications
- K11** Consequences of incorrectly installing under and over voltage protection devices
- K12** PPE required for specific tasks
- K13** Terminology related to under and over voltage protection devices

Glossary

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

Contextual Variables

Range of Context

- Weather and site conditions can affect the way this competency is performed.

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. rubber gloves, hard hat, eye protection, steel-toe boots
- Specified under and over voltage protection devices, e.g. under voltage device, protective relay, sensor
- Hardware, e.g. bolts, screws, brackets, stand-offs, cabling, transition pieces, boxes, enclosures
- Documentation, e.g., schematics, as-builts
- Tools, e.g. hand tools, testing equipment

Purpose

Installing module support structures correctly is important to ensure the safety of persons, equipment and structures. Incorrect installation can cause damage to equipment and structures and injury to persons.

Performance/Abilities

- P1** Wear appropriate PPE, e.g. steel-toe boots, fall arrest equipment, eye protection, hearing protection
- P2** Determine placement of modules according to site install plan
- P3** Install anchor/mechanical connection points according to industry best practices, as required, for example:
- use roofing procedures for specific roof type, e.g. shingles
 - ensure installation area is free of debris, e.g. nails, screws
 - install flashing
 - install lag bolts
 - install mounting brackets
 - drive piles
 - install ground anchors
 - install counterweights/ballasted system/guy wires
- P4** Verify anchor/mechanical connection
- P5** Ensure roof penetrations are waterproof/sealed
- P6** Install rails according to industry best practices, as required:
- attach to anchor/mechanical connection points
 - ensure rails are aligned
 - join rails, i.e. connect rails together
 - torque nuts to manufacturer's specifications
 - align rails, as required
- P7** Communicate installation issues to appropriate personnel, e.g. project manager, client

Knowledge

- K1** Organization policies, procedures and plans, e.g. communication protocols
- K2** Organizational document management system
- K3** Jurisdictional requirements, including permit requirements
- K4** Manufacturer's specifications for module support system being installed
- K5** Other documents relevant to the installation, e.g. technical drawings, client requirements
- K6** Industry best practices for installing the module support structures
- K7** PV module support system types (e.g. ground-mount, flat roof mount, pitched roof mount) and their specific characteristics and applications
- K8** Roof types and how they impact installation
- K9** Wind and snow loads
- K10** Environmental impacts of module support system placement
- K11** Location of underground utilities, as required

K12 Terminology related to photovoltaic module support structures e.g. fixed, tilt, Balance of System (BOS) terms

Glossary

- **Balance of system (BOS):** all components of a PV system other than the modules. In addition to inverters and racking, this includes the cables/wires, switches, enclosures, fuses, ground fault detectors, and more.
- **Industry best practices:** methods that meet or exceed jurisdictional requirements, e.g. Canadian Electrical Code (CE code), bylaws.

Contextual Variables

Range of Context

- Buildings/structures may have rafters/supports that are not straight, which will affect the performance of this competency.
- Job specifications and on-site conditions can vary the way this competency is performed.
- Complexity of this competency will vary with type and size of system being installed and on-site conditions.
- If joining the rails requires bonding according to manufacturer's specifications, electricians are required for this task.

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
- PPE, e.g. steel-toe boots, hard hat, fall arrest, eye protection, hearing protection
- Measuring tools, e.g. tape measure, string line, laser level
- Hand and power tools, e.g. drill, saw, torque wrench
- Module support structure assembly, e.g. lag bolts, flashing, rails, brackets

Purpose

Installing modules correctly is important to ensure the safety of persons, equipment and structures. Incorrect installation of modules can cause damage to equipment and structures and injury to persons.

Performance/Abilities

- P1** Wear appropriate PPE, e.g. steel-toe boots, fall arrest
- P2** Install wire combiner boxes according to industry best practices, if needed
- P3** Install rapid shutdown equipment, if required by Canadian Electrical Code (CE code)
- P4** Inspect modules before installation, i.e. check for damage:
- conduct OCV (open circuit voltage) test
- P5** Bond railing system to ground according to industry best practices:
- torque nuts to manufacturer's specifications
- P6** Install module level power electronics (MLPE) according to industry best practices
- P7** Install system conductors according to industry best practices
- P8** Interconnect components and conductors to point of common coupling according to industry best practices, as required
- P9** Install modules according to industry best practices:
- ensure installation area is free of debris, e.g. nails, screws
 - attach to mounts/railings
 - ensure panels are aligned
 - connect wiring between modules
 - bond modules, as required
 - torque nuts to manufacturer's specifications
- P10** Install mechanical protection, if required, e.g. rodent protection
- P11** Communicate installation issues to appropriate personnel, e.g. project manager, client

Knowledge

- K1** Organization policies, procedures and plans, e.g. communication protocols
- K2** Organizational document management system
- K3** Relevant CSA Standards, e.g. Canadian Electrical Code (CE code)
- K4** Jurisdictional requirements, including permit requirements
- K5** Manufacturer's specifications for equipment and system being installed
- K6** Other documents relevant to the installation, e.g. technical drawings, client requirements
- K7** Industry best practices for installing PV systems
- K8** Fundamentals of solar radiation
- K9** Physical principles that affect PV technologies
- K10** PV system types (e.g. integrated, hybrid, grid-tied) and their specific characteristics and applications
- K11** Equipment used for grid-tie and off-grid systems, including certifications required and how it is used, e.g. micro

inverter, string inverter, hybrid

- K12** Components used in PV installations and their functions
- K13** Roof types and how they impact installation
- K14** Wire management methods and materials
- K15** Wind and snow loads
- K16** Shade analysis and optimization
- K17** Fundamental knowledge of electricity, e.g. trade certification
- K18** Terminology related to photovoltaics, e.g. Active Solar Energy, kinetic storage, fixed tilt array, Balance of System (BOS) terms

Glossary

- Balance of system (BOS):** all components of a PV system other than the modules. In addition to inverters and racking, this includes the cables/wires, switches, enclosures, fuses, ground fault detectors, and more.
- Industry best practices:** methods that meet or exceed jurisdictional requirements, e.g. Canadian Electrical Code (CE code), bylaws.
- Module level power electronics (MLPE):** devices that can be incorporated into a solar PV system to improve its performance in certain conditions. Includes microinverters, DC power optimizers.
- Open circuit voltage (OCV) test:** an open-circuit voltage test checks battery voltage by connecting an accurate digital voltmeter to the battery posts after disconnecting the battery ground cable.

Contextual Variables

Range of Context

- Job specifications and on-site conditions can vary the way this competency is performed.
- Complexity of this competency will vary with type and size of system being installed and on-site conditions.
- System being installed may vary this competency, for instance, rapid shutdown equipment may be integral to MLPE.
- System may be grid-tied or stand-alone which will change the complexity of this competency, as well as the danger of the install.
- This competency must be performed by a competent qualified electrician.**

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
- PPE, e.g. steel-toe boots, hard hat, fall arrest, hearing protection, eye protection
- Measuring tools, e.g. tape measure, level
- Camera, e.g. to photograph installation
- Calculator, e.g. to confirm conversions
- Proprietary Apps
- Hand and power tools, e.g. drill, multimeter, torque wrench
- Modules

Purpose

Installing solar charge controller(s) is important to ensure the system can correctly regulate the flow of electricity from the generation source to the battery and the load. A system may have multiple solar charge controllers, and they must be compliant for use with one another. The controller keeps the battery fully charged without over-charging it. Incorrect installation, such as reverse polarity, can cause equipment damage and/or electric shock.

Performance/Abilities

- P1** Wear appropriate PPE, e.g. rubber gloves, face shield, hearing protection, eye protection, hard hat
- P2** Mount solar charge controller(s) according to industry best practices:
- ensure controller is not installed in sealed component with batteries due to possibility of corrosion and explosion
- P3** Configure solar charge controller(s) according to industry best practices:
- select relevant battery type
- P4** Install grounding/bonding according to industry best practices
- P5** Interconnect wiring according to industry best practices:
- install and terminate DC load, if required
 - interconnect multiple solar charge controllers and network cables, as required
- P6** Communicate installation issues to appropriate personnel, e.g. project manager, client

Knowledge

- K1** Organization policies, procedures and plans, e.g. communication protocols
- K2** Organizational document management system
- K3** Relevant CSA Standards, e.g. Canadian Electrical Code (CE code)
- K4** Jurisdictional requirements, including permit requirements
- K5** Manufacturer's specifications for equipment and system being installed
- K6** Other documents relevant to the installation, e.g. technical drawings, client requirements
- K7** Industry best practices for installing the controller
- K8** Fundamentals of solar radiation, e.g. temperature considerations
- K9** Physical principles that affect PV technologies
- K10** PV system types (e.g. integrated, hybrid, grid-tied) and their specific characteristics and applications
- K11** Equipment used for grid-tied and off-grid systems, including certifications required and how it is used
- K12** Components used in PV installations and their functions
- K13** Importance of balancing PV installation in a circuit
- K14** Terminology related to photovoltaics, e.g. Active Solar Energy, kinetic storage, fixed tilt array, Balance of System (BOS) terms

Glossary

- Balance of system (BOS):** all components of a PV system other than the modules. In addition to inverters and racking, this includes the cables/wires, switches, enclosures, fuses, ground fault detectors, and more.
- Industry best practices:** methods that meet or exceed jurisdictional requirements, e.g. Canadian Electrical Code (CE code), bylaws.

Contextual Variables

Range of Context

- Job specifications and on-site conditions can vary the way this competency is performed.
- Complexity of this competency will vary with type and size of system being installed and on-site conditions.
- At certain voltages, this competency must be performed by a competent qualified electrician.**

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. rubber gloves, face shield, hearing protection, eye protection, hard hat
- Manufacturer's specifications
- Hand and power tools, e.g. drill, pipe bender, wire crimpers
- Solar control charger

Purpose

Installing the battery bank is important to ensure the system can store energy from the modules and use it during times of need, e.g. night, cloudy day. Incorrect installation of the system can cause serious injury or death.

Performance/Abilities

- P1** Wear appropriate PPE, e.g. rubber gloves, face shield, rubber smock, breathing protection
- P2** Balance all batteries:
- connect in parallel
 - allow to rest for time required
- P3** Charge batteries
- P4** Visually check to ensure electrolyte levels are correct:
- top up with distilled water, as required
- P5** Install rack/support structures according to industry best practices, as required:
- use safe lifting techniques
 - install in location that can support battery weight
 - ensure safe location for batteries, e.g. away from sources of corrosion and explosion
 - ensure location is accessible for maintenance
 - bond, as required
- P6** Install batteries according to industry best practices:
- ensure correct conductors are used, e.g. size, colour, type, rating
 - clean and prepare battery terminals
 - ensure appropriate physical enclosures are used, e.g. weatherproof
 - ensure proper passive and active ventilation, if required
 - confirm polarity and voltage before interconnecting to load
 - install Battery Temperature Sensors (BTS), as required
 - install disconnect and overcurrent protection devices
 - install emergency disconnect means, as required
 - install warning labels
- P7** Interconnect wiring according to industry best practices
- P8** Communicate installation issues to appropriate personnel, e.g. project manager, client

Knowledge

- K1** Organization policies, procedures and plans, e.g. communication protocols
- K2** Organizational document management system
- K3** Relevant CSA Standards, e.g. Canadian Electrical Code (CE code)
- K4** Jurisdictional requirements, including permit requirements
- K5** Manufacturer's specifications for equipment and system being installed
- K6** Other documents relevant to the installation, e.g. technical drawings, client requirements
- K7** Industry best practices for installing batteries

- K8** Wire management methods and materials
- K9** Fundamentals of solar radiation
- K10** Physical principles that affect PV technologies
- K11** PV system types (e.g. integrated, hybrid, grid-tied) and their specific characteristics and applications
- K12** Types of batteries used in PV systems and their applications, e.g. lithium, lead-acid
- K13** Equipment used for grid-tied and off-grid systems, including certifications required and how it is used
- K14** Components used in PV installations and their functions
- K15** Safety hazards when installing batteries, e.g. caustic electrolyte, high short-circuit currents, arc flash hazards, hydrogen and oxygen gas, injury due to battery mass
- K16** WHMIS, e.g. neutralizing agents and their applications
- K17** Proper conductor installation, routing, identification, size, colour, type and rating
- K18** Importance of balancing PV installation in a circuit
- K19** Terminology related to photovoltaics, e.g. Active Solar Energy, kinetic storage, fixed tilt array, Balance of System (BOS) terms
- K20** Warning labels that are required to be installed in accordance with Canadian Electrical Code (CE code)

Glossary

- Balance of system (BOS):** all components of a PV system other than the modules. In addition to inverters and racking, this includes the cables/wires, switches, enclosures, fuses, ground fault detectors, and more.
- Industry best practices:** methods that meet or exceed jurisdictional requirements, e.g. Canadian Electrical Code (CE code), bylaws.

Contextual Variables

Range of Context

- Job specifications and on-site conditions can vary the way this competency is performed.
- Complexity of this competency will vary with type and size of system being installed and on-site conditions.
- Voltage of battery bank will vary. This will dictate if a competent Qualified Electrician is required for the installation.**

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
- Hand and power tools, e.g. stainless steel wire brush, wrenches, torque wrench
- Voltmeter
- Multi-meter
- PPE, e.g. rubber gloves, face shield, rubber smock, breathing protection
- Distilled water
- Baking soda or soda ash
- Anti-corrosion compound
- Racking/supports for batteries
- Batteries, e.g. lithium, lead-acid

Major Category	Construction and Installation
Competency Area	Install PV System
Competency Unit	Install inverter

Purpose

Installing the inverter is important to ensure the system operates correctly when activated, and correctly inverts electrical power from direct current (DC) to alternating current (AC). If this is done incorrectly there can be system faults/error code indications and it can cause irreversible internal component failure.

Performance/Abilities

- P1** Wear appropriate PPE, e.g. hearing protection, eye protection, steel-toe boots
- P2** Ensure inverter components are sized correctly for installation, i.e. matches voltage, phase, frequency and sine wave profile of electricity produced
- P3** Install components according to industry best practices:
 - use correct fasteners for installation conditions, e.g. material of support structure
- P4** Terminate components and conductors according to industry best practices:
 - install rapid shutdown, if required
- P5** Interconnect components and conductors according to industry best practices, e.g. transformer, trough, side of meter
- P6** Analyze system output
- P7** Communicate installation issues to appropriate personnel, e.g. project manager, client

Knowledge

- K1** Organization policies, procedures and plans, e.g. communication protocols
- K2** Organizational document management system
- K3** Relevant CSA Standards, e.g. Canadian Electrical Code (CE code)
- K4** Jurisdictional requirements, including permit requirements
- K5** Manufacturer's equipment and specifications for system being installed
- K6** Other documents relevant to the installation, e.g. technical drawings, client requirements
- K7** Industry best practices for installing the power conditioning equipment
- K8** Wire management methods and materials
- K9** Fundamentals of solar radiation
- K10** Physical principles that affect PV technologies
- K11** PV system types (e.g. integrated, hybrid, grid-tied) and their specific characteristics and applications
- K12** Equipment used for grid-tied and off-grid systems, including certifications required and how it is used
- K13** Components used in PV installations and their functions
- K14** Safety hazards associated with installation of inverters
- K15** Order of initiation and order of disconnect for inverters
- K16** Importance of balancing PV installation in a circuit
- K17** Terminology related to photovoltaics, e.g. Active Solar Energy, kinetic storage, fixed tilt array, Balance of System (BOS) terms

Glossary

- **Balance of system (BOS):** all components of a PV system other than the modules. In addition to inverters and racking, this includes the cables/wires, switches, enclosures, fuses, ground fault detectors, and more.
- **Industry best practices:** methods that meet or exceed jurisdictional requirements, e.g. Canadian Electrical Code (CE code), bylaws.

Contextual Variables

Range of Context

- Job specifications and on-site conditions can vary the way this competency is performed.
- Complexity of this competency will vary with type and size of system being installed and on-site conditions.
- **This competency should be performed by a competent qualified electrician.**

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
- Hand and power tools, e.g. drill, level, screwdriver
- PPE, e.g. hearing protection, eye protection, steel-toe boots
- Multimeter

Purpose

Installing the energy monitoring and control system is important to ensure that the system functions properly. Incorrect installation can cause incorrect data (or lack of data) about the export of energy, as well as client dissatisfaction.

Performance/Abilities

- P1** Wear appropriate PPE, e.g. hearing protection, eye protection, steel-toe boots
- P2** Mount monitoring and control system according to industry best practices:
 - place in correct location according to drawings and client/job requirements
 - ensure system is level and secure
- P3** Terminate conductors
- P4** Bond system to ground, if required
- P5** Connect monitoring and control system to equipment to be monitored
- P6** Interconnect wiring according to industry best practices
- P7** Contact system administrator for online access, if required
- P8** Connect monitoring device to communication system, e.g. internet, SCADA
- P9** Communicate installation issues to appropriate personnel, e.g. project manager, system administrator

Knowledge

- K1** Organization policies, procedures and plans, e.g. communication protocols
- K2** Organizational document management system
- K3** Relevant CSA Standards, e.g. Canadian Electrical Code (CE code)
- K4** Jurisdictional requirements, including permit requirements
- K5** Manufacturer's specifications for equipment and system being installed
- K6** Other documents relevant to the installation, e.g. technical drawings, client requirements
- K7** Industry best practices for installing energy monitoring and control system
- K8** Wire management methods and materials
- K9** Fundamentals of solar radiation
- K10** Physical principles that affect PV technologies
- K11** PV system types (e.g. integrated, hybrid, grid-tied) and their specific characteristics and applications
- K12** Equipment used for grid-tied and off-grid systems, including certifications required and how it is used
- K13** Components of control and monitoring systems and their function
- K14** Types of data communication hardware
- K15** Automated control system data highway system characteristics, applications and function
- K16** Terminology related to photovoltaics, e.g. Active Solar Energy, kinetic storage, fixed tilt array, Balance of System (BOS) terms

Glossary

- **Balance of system (BOS):** all components of a PV system other than the modules. In addition to inverters and racking, this includes the cables/wires, switches, enclosures, fuses, ground fault detectors, and more.
- **Industry best practices:** methods that meet or exceed jurisdictional requirements, e.g. Canadian Electrical Code (CE code), bylaws.
- **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

- Job specifications and on-site conditions can vary the way this competency is performed.
- Complexity of this competency will vary with type and size of system being installed and on-site conditions.
- This competency is very system-specific.
- **This competency should be performed by a competent qualified electrician.**

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
- PPE, e.g. hearing protection, eye protection, steel-toe boots
- Computer
- Cell phone apps
- Hand and power tools, e.g. drill, screwdriver
- Multimeter

Purpose

Programming the PV equipment (e.g. inverter, solar charge controller, battery monitoring equipment, automatic generator start equipment (AGS)) is important to ensure that the system operates within the correct parameters. Incorrect installation of the system can cause damage to appliances and other electrical devices.

Performance/Abilities

- P1** Wear appropriate PPE, e.g. hearing protection, eye protection, steel-toe boots
- P2** Program electrical equipment parameters according to manufacturer's instructions and site conditions:
 - adjust system to intended function, as required
- P3** Test system after installation:
 - compare to expected results from manufacturer, organization and client specifications
 - further adjust programming of system, as required
 - troubleshoot, as required
- P4** Communicate issues to appropriate personnel, e.g. project manager, manufacturer technical support

Knowledge

- K1** Organization policies, procedures and plans, e.g. communication protocols
- K2** Organizational document management system
- K3** Relevant CSA Standards, e.g. Canadian Electrical Code (CE code)
- K4** Jurisdictional requirements, including permit requirements
- K5** Manufacturer's specifications for equipment and system being installed
- K6** Other documents relevant to the installation, e.g. technical drawings, client requirements
- K7** Industry best practices for setting parameters on equipment
- K8** Fundamentals of solar radiation
- K9** Physical principles that affect PV technologies
- K10** PV system types (e.g. integrated, hybrid, grid-tied) and their specific characteristics and applications
- K11** Equipment used for grid-tied and off-grid systems, including certifications required and how it is used
- K12** Control circuit logic
- K13** Automated control system data highway system characteristics, applications and function
- K14** Terminology related to photovoltaics, e.g. Active Solar Energy, kinetic storage, fixed tilt array, Balance of System (BOS) terms

Glossary

- **Balance of system (BOS):** all components of a PV system other than the modules. In addition to inverters and racking, this includes the cables/wires, switches, enclosures, fuses, ground fault detectors, and more.
- **Industry best practices:** methods that meet or exceed jurisdictional requirements, e.g. Canadian Electrical Code (CE code), bylaws.

- **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

- Job specifications and on-site conditions can vary the way this competency is performed.
- Complexity of this competency will vary with type and size of system being installed and on-site conditions.
- Interconnection requirements may vary the way this competency is performed.

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
- PPE, e.g. hearing protection, eye protection, steel-toe boots
- Hand and power tools, e.g. drill, screwdrivers
- Multimeters
- Computer
- Cell phone apps

Major Category	Construction and Installation
Competency Area	Install Generating, Distribution and Service Equipment
Competency Unit	Install single-phase consumer/supply services and metering equipment

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 and maintains generating, distribution and service systems
- Task 7:** Installs and maintains consumer/supply services and metering equipment
- Skill 1:** Installs single-phase consumer/supply services and metering equipment

Construction Electrician

- Block B:** Installs and maintains generating, distribution and service systems
- Task 7:** Installs and maintains consumer/supply services and metering equipment
- Skill 1:** Installs single-phase consumer/supply services and metering equipment

Major Category	Construction and Installation
Competency Area	Install Generating, Distribution and Service Equipment
Competency Unit	Install 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 and maintains generating, distribution and service systems
- Task 8:** Installs and maintains protection devices
- Skill 2:** Installs overcurrent protection devices

Construction Electrician

- Block B:** Installs and maintains generating, distribution and service systems
- Task 8:** Installs, services and maintain protection devices
- Skill 1:** Installs overcurrent protection devices

Major Category	Construction and Installation
Competency Area	Install Generating, Distribution and Service Equipment
Competency Unit	Install three-phase consumer/supply services and metering equipment

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 and maintains generating, distribution and service systems
- Task 7:** Installs and maintains consumer/supply services and metering equipment
- Skill 2:** Installs three-phase consumer/supply services and metering equipment

Construction Electrician

- Block B:** Installs, services and maintains generating, distribution and service systems
- Task 7:** Installs, services and maintains consumer/supply services and metering equipment
- Skill 2:** Installs three-phase consumer/supply services and metering equipment

Major Category	Construction and Installation
Competency Area	Install Generating, Distribution and Service Equipment
Competency Unit	Install ground arc, 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 and maintains generating, distribution and service systems
- Task 8:** Installs and maintains protection devices
- Skill 3:** Installs 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 2:** Installs ground fault, arc fault and surge protection devices

Major Category	Construction and Installation
Competency Area	Install Generating, Distribution and Service Equipment
Competency Unit	Install low voltage distribution equipment

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 B:** Installs and maintains generating, distribution and service systems
- Task 9:** Installs and maintains low voltage distribution systems
- Skill 1:** Installs low voltage distribution systems

Major Category	Construction and Installation
Competency Area	Install Generating, Distribution and Service Equipment
Competency Unit	Install low voltage single-phase transformers

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 and maintains generating, distribution and service systems
- Task 15:** Installs and maintains transformers
- Skill 3:** Installs low voltage single-phase transformers

Construction Electrician

- Block B:** Installs and maintains generating, distribution and service systems
- Task 15:** Installs, services and maintains transformers
- Skill 2:** Installs low-voltage single-phase transformers

Major Category	Construction and Installation
Competency Area	Install Generating, Distribution and Service Equipment
Competency Unit	Install extra-low voltage transformers

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 and maintains generating, distribution and service systems
- Task 15:** Installs and maintains transformers
- Skill 1:** Installs extra-low voltage transformers

Construction Electrician

- Block B:** Installs, services and maintains generating, distribution and service systems
- Task 15:** Installs, services and maintains transformers
- Skill 1:** Installs extra-low voltage transformers

Major Category	Construction and Installation
Competency Area	Install Generating, Distribution and Service Equipment
Competency Unit	Install low voltage three-phase transformers

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 and maintains generating, distribution and service systems
- Task 15:** Installs and maintains transformers
- Skill 5:** Installs low voltage three-phase transformers

Construction Electrician

- Block B:** Installs, services and maintains generating, distribution and service systems
- Task 15:** Installs, services and maintains transformers
- Skill 3:** Installs low-voltage three-phase transformers

Major Category	Construction and Installation
Competency Area	Install Generating, Distribution and Service Equipment
Competency Unit	Install high voltage transformers

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 and maintains generating, distribution and service systems

Task 15: Installs and maintains transformers

Skill 7: Installs high voltage transformers

Construction Electrician

Block B: Installs and maintains generating, distribution and service systems

Task 15: Installs, services and maintains transformers

Skill 4: Installs high voltage transformers

Major Category	Construction and Installation
Competency Area	Install Generating, Distribution and Service Systems
Competency Unit	Install DC generating 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 B: Installs and maintains generating, distribution and service systems

Task 12: Installs and maintains power generating systems

Skill 3: Installs direct current (DC) generating systems

Construction Electrician

Block B: Installs, services and maintains generating, distribution and service systems

Task 12: Installs, services and maintains power generating systems

Skill 3: Installs DC (direct current) generating systems

Major Category	Construction and Installation
Competency Area	Install Generating, Distribution and Service Systems
Competency Unit	Install AC generating 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 B: Installs and maintains generating, distribution and service systems

Task 12: Installs and maintains power generating systems

Skill 1: Installs alternating current (AC) generating systems

Construction Electrician

Block B: Installs, services and maintains generating, distribution and service systems

Task 12: Installs, services and maintains power generating systems

Skill 1: Installs AC (alternating current) generating systems

Major Category	Construction and Installation
Competency Area	Install Generating, Distribution and Service Systems
Competency Unit	Install high voltage 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 B: Installs and maintains generating, distribution and service systems

Task 14: Installs and maintains high voltage systems

Skill 1: Installs high voltage systems

Construction Electrician

Block B: Installs, services and maintains generating, distribution and service systems

Task 14: Installs, services and maintains high voltage systems

Skill 1: Installs high voltage equipment

Major Category	Construction and Installation	Major Category	Construction and Installation
Competency Area	Install Wiring Systems	Competency Area	Complete Installation Process
Competency Unit	Install high voltage cables	Competency Unit	Troubleshoot installation issues

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

Construction Electrician

Block B: Installs, services and maintains generating, distribution and service systems

Task 14: Installs, services and maintains high voltage systems

Skill 2: Installs high voltage cables

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

Range of Context

- Job specifications and on-site conditions can vary the way this competency is performed.
- Complexity of this competency will vary with type and size of system being installed and on-site conditions.
- Interconnection requirements may vary the way this competency is performed.

Level of Practice

- Frontline
- Supervisor
- Manager/Executive

Adapted Bloom's Taxonomy

- | | |
|---|--|
| <input type="checkbox"/> Recall, Remember | <input type="checkbox"/> Analyze |
| <input type="checkbox"/> Understand | <input checked="" type="checkbox"/> Evaluate |
| <input type="checkbox"/> Apply | <input type="checkbox"/> 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

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

Contextual Variables

Range of Context

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

Level of Practice

- Frontline
- Supervisor
- Manager/Executive

Adapted Bloom's Taxonomy

- | | |
|---|---|
| <input type="checkbox"/> Recall, Remember | <input type="checkbox"/> Analyze |
| <input type="checkbox"/> Understand | <input type="checkbox"/> Evaluate |
| <input checked="" type="checkbox"/> Apply | <input type="checkbox"/> Create/Transform |

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

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

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

Purpose

As part of the commissioning process it is important that all equipment, systems and other infrastructure are inspected, test results reviewed, deficiencies addressed, and functionality of the entire system tested before making the system operational. This ensures that clients can be confident of the system's capabilities when they take over its operation. Failure to verify the system's functionality could result in extraneous costs, damage to equipment and injury to personnel.

Performance/Abilities

- P1** Wear appropriate PPE, e.g. steel-toe boots, safety glasses, gloves
- P2** Review installation prints, as-builts, test results
- P3** Inspect installed components for deficiencies:
- in workmanship, e.g. leaks, lines are straight, control wiring is correctly installed
 - in materials, e.g. required number of units, free of visual defects
- P4** Troubleshoot deficiencies, according to industry best practices:
- correct issue, e.g. repair, replace
 - document actions
- P5** Inspect installed mechanical components, e.g. ensure fasteners are properly secured to system
- P6** Inspect installed electrical components:
- review electrical test results
 - verify deficiencies have been addressed
 - conduct spot checks
- P7** Inspect system plumbing, if applicable:
- compare to schematics
 - check for visible leaks or issues
- P8** Document inspection results
- P9** Verify system operation:
- make note of operating conditions, e.g. weather conditions, instrument readings
 - energize system or notify appropriate personnel to energize system, if required
 - observe system operation
 - use controls to check operation and performance
 - determine if there are issues or deficiencies
 - shut down system
- P10** Troubleshoot deficiencies:
- correct issue, e.g. repair, service
 - document actions
- P11** Update prints:
- create or ensure as-builts are accurate, e.g. verify drawing revisions match field wiring
- P12** Complete equipment database, if applicable:
- list equipment by type (e.g. relays, meters), including serial numbers, make, model

- document equipment settings, e.g. dates, controller set points, volumes, pressures
- document test results

Knowledge

- K1** Organization policies, procedures and plans, e.g. testing and commissioning protocols, safety
- K2** Organizational information/record management system
- K3** Relevant standards and regulations, e.g. Canadian Standards Association standards, Underwriters Laboratories of Canada standards, Canadian Electrical Code (CE Code), building code
- K4** Required permits
- K5** Principles of electricity
- K6** Principles of fluid flow, if applicable
- K7** Principles of protection and control
- K8** Principles of Process Control (PID Control) if applicable
- K9** Scope and limitations of electrical testing
- K10** Tasks that require trades certification
- K11** Industry best practices for inspecting system for commissioning
- K12** Manufacturer's equipment, specifications, characteristics, and operation
- K13** Safety hazards associated with commissioning

Glossary

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

Contextual Variables

Range of Context

- Scope, size, complexity and type of installation may affect what has to be inspected and how long it takes to perform this competency.
- **In some jurisdictions, some of the tasks in this competency may require certification in the electrical, HVAC, or plumbing trades in order to be 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)

- Manufacturer's manuals and specifications for installed equipment
- Installation prints and as-builts
- PPE, e.g. hard hat, safety glasses
- Hand tools, e.g. pressure and temperature gauge, multimeter, flow meters

Purpose

The commissioning report represents the due diligence taken through the construction and installation of a project. This applies to every aspect of a project, including all the components of the electrical system. Failure to provide required information could lead to potential liability for damage and injury.

Performance/Abilities

- P1** Compile testing results, including:
- results and methods of control testing, if applicable
 - results and methods of function testing
 - results of protection testing, e.g. relay and meter test results
- P2** Complete equipment database, if applicable:
- list equipment by type, e.g. relays, meters
 - document serial numbers, make, model style
 - document equipment settings, e.g. dates, controller set points, volumes, pressures
 - document test results
- P3** Write equipment evaluation reports, if applicable:
- review equipment test results
 - analyze results, considering manufacturer's specifications, industry standards
 - provide maintenance requirements based on manufacturer's and designer's recommendations
- P4** Prepare training materials:
- develop training materials e.g. based on manufacturer's equipment manuals, blueprints, bench testing experience
 - present training, if required
- P5** Write fault analysis report, if applicable:
- review relay test results e.g. determine targets, identify fault records
 - check Supervisory Control and Data Acquisition (SCADA) alarm records
 - obtain Sequence of Events Recorder (SER) documentation
 - develop report based on pre-operational testing
- P6** Submit documentation and database for commissioning report to appropriate personnel

Knowledge

- K1** Organization policies, procedures and plans, e.g. testing and commissioning protocols, safety
- K2** Organizational information/record management system
- K3** Relevant standards and regulations, e.g. Canadian Standards Association standards, Underwriters Laboratories of Canada standards, Canadian Electrical Code (CE code), building code
- K4** Required permits
- K5** Principles of electricity
- K6** Principles of fluid flow, if applicable
- K7** Principles of protection and control

- K8** Scope and limitations of electrical testing
- K9** Interpretation of test results
- K10** Industry best practices for inspecting systems for commissioning
- K11** Manufacturer's equipment, specifications, characteristics, and operation
- K12** Safety hazards associated with commissioning

Glossary

- **Industry best practices:** methods that meet or exceed jurisdictional requirements, e.g. Canadian Electrical Code (CE code), bylaws.
- **Sequence of Events Recorder (SER):** as a system, it records events and time stamps them as they happen. As an application, the software gathers and stores this data for analysis; often used for root-cause analysis.
- **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

- The scope, size and complexity of the project could impact the scope and the level of detail required for the commissioning report.

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 manuals and specifications
- Equipment test results, e.g. relay, metering, control system, communication system
- Record keeping device or document, e.g. tablet, computer, Toughbook, applicable testing results form

Major Category

Construction and Installation

Competency Area

Commission Equipment and Systems

Competency Unit

Perform site cleanup

Purpose

When preparing to hand off a new system to a client, it is important restore the site to as close as possible to what it was before the work was done or to what was agreed upon with the client. It presents a professional image of the personnel doing the work and the organization they represent.

Performance/Abilities

P1 Wear appropriate PPE

P2 Remove work debris:

- clean up refuse from installation, e.g. packaging, leftover hardware
- dispose of unwanted materials in waste bin for appropriate disposal
- dispose of hazardous material as required, e.g. follow WHMIS guidelines, use specified disposal site

P3 Ensure sub-trades perform site cleanup after their work

P4 Verify site is in acceptable condition:

- meet terms as agreed upon with client
- use before and after photographs, if available or work order description, if applicable

P5 Have client sign-off on acceptable site condition, if required

Knowledge

K1 Organization policies, procedures and plans, e.g. client handover procedures, safety, information/record management system

K2 Relevant standards and regulations, e.g. Canadian Standards Association standards, Underwriters Laboratories of Canada standards, Canadian Electrical Code (CE code), building code

K3 Required permits

K4 Workplace Hazardous Material Information System (WHMIS) and Safety Data Sheets (SDS) guidelines for appropriate hazardous material handling and disposal

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.
- **Safety Data Sheets (SDS):** part of WHMIS program, these sheets contain comprehensive information on sixteen aspects of a hazardous material, including handling and storage, disposal consideration, and transport information.

Contextual Variables

Range of Context

- The size and scope of the project could impact the amount of debris to be removed to bring the site to an acceptable condition.

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)

- Garbage bags or bins
- Vehicle to haul debris to disposal sites
- Hazardous material storage containers, if required
- Required PPE, e.g. hard hat, safety boots, safety glasses
- Client agreement, or pre-construction photos, if applicable

Purpose

A responsible demonstration of the installation to the client and/or end-user is the final step in commissioning. Providing clients and end-users with thorough instructions on how to operate and maintain their new system results in less call-backs and greater client satisfaction. Failure to provide a demonstration to clients may result in unintentional damage to system by client or end-user.

Performance/Abilities

- P1** Wear appropriate PPE, e.g. safety boots, safety glasses, hard hat, fall arrest protection
- P2** Prepare for demonstration and handover:
 - gather relevant documentation, e.g. equipment manuals and specifications, permit and inspection reports
- P3** Demonstrate start up and shut down procedures
- P4** Demonstrate functionality and performance, according to industry best practices, including:
 - normal operation
 - emergency shut down procedures
 - by-pass mode
 - expected operating parameters
 - reset procedure
- P5** Demonstrate simple, routine maintenance procedures
- P6** Demonstrate basic diagnostic procedures
- P7** Indicate markings and labels for all components
- P8** Provide safety information
- P9** Activate system, according to industry best practices
- P10** Review system equipment warranties and requirements
- P11** Provide relevant documentation to client or end-user
- P12** Obtain client's sign-off on project

Knowledge

- K1** Organization policies, procedures and plans, e.g. commissioning protocols, safety
- K2** Organizational information/record management system
- K3** Relevant standards and regulations, e.g. Canadian Standards Association standards, Underwriters Laboratories of Canada standards, Canadian Electrical Code (CE code), building code
- K4** Required permits
- K5** Principles of electricity
- K6** Principles of fluid flow, if applicable
- K7** Principles of protection and control
- K8** Industry terminology
- K9** Manufacturer's equipment, specifications, characteristics, and operation
- K10** Industry best practices for demonstration and client handover

- K11** Documents to be handed over to client/end-user, e.g. as-builts, system design, warranties, commissioning documents, operation manuals, maintenance documents

Glossary

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

Contextual Variables

Range of Context

- Scope, size, complexity and type of installation may affect the level of detail required and the time it takes 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, e.g. gloves, safety glasses, hard hat
- Documentation, e.g. manufacturer's manuals and specifications, inspection reports
- Online monitoring platform, e.g. log in credentials, review functions

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. lockout/tagout, 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 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

Glossary

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

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
- PPE
- Rated tools, e.g. screwdriver rated for particular voltage

Major Category	Safety
Competency Area	Maintain a Safe Working Environment
Competency Unit	Use personal protective equipment (PPE)

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

Glossary

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

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

Major Category	Safety
Competency Area	Maintain a Safe Working Environment
Competency Unit	Participate in safety meetings and emergency drills

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

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

- Frontline
- Supervisor
- Manager/Executive

Adapted Bloom's Taxonomy

- | | |
|---|---|
| <input type="checkbox"/> Recall, Remember | <input checked="" type="checkbox"/> Analyze |
| <input type="checkbox"/> Understand | <input type="checkbox"/> Evaluate |
| <input type="checkbox"/> Apply | <input type="checkbox"/> 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 lockout 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

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.

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

Major Category

Safety

Competency Area

Maintain a Safe Working Environment

Competency Unit

Use fall arrest equipment

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

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

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

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

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.

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
- PPE, e.g. safety harness, respirator
- Space conditioning equipment, e.g. fans, inert gas, pressurized air, sump pump
- Monitoring equipment
- Rescue equipment

Major Category

Safety

Competency Area

Maintain a Sustainable Environment

Competency Unit

Follow sustainable work practices

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

- | | |
|---|---|
| <input type="checkbox"/> Recall, Remember | <input type="checkbox"/> Analyze |
| <input type="checkbox"/> Understand | <input type="checkbox"/> Evaluate |
| <input checked="" type="checkbox"/> Apply | <input type="checkbox"/> Create/Transform |

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

- First aid kits
- Spill kit
- PPE
- Safety Data Sheet (SDS)

Major Category

Safety

Competency Area

Respond to Emergencies

Competency Unit

Respond to chemical spills and leaks

Purpose

Responding quickly and correctly to chemical spills and leaks reduces the chance of injury to employees, contractors, customers and the public, and protects the environment.

Performance/Abilities

- P1** Initiate Emergency Response Plan, if required, e.g. notify internal and external authorities
- P2** Assess level of hazard, e.g. potential for fire or explosion:
 - do not touch spilled materials
 - identify chemical, if possible
 - remove or extinguish ignition sources, if possible
- P3** Contain spills and leaks, if possible:
 - use tools and equipment appropriate to chemical, e.g. corrosion-resistant
 - prevent chemicals from reaching sewers, drains and confined spaces
 - increase ventilation to spill area, if possible
 - contain with earth, sand or absorbent material that does not react with spilled material
 - soak up spilled liquid with absorbent material
 - scoop/shovel spilled material into suitable, covered, labeled containers
- P4** Perform clean-up, as required:
 - wear personal protective equipment (PPE) appropriate to the chemicals being handled
 - flush spill area with water, if safe
 - contain runoff for disposal
 - handle contaminated absorbent material same as hazardous materials
 - ensure clothing, equipment and tools are decontaminated
- P5** Communicate spills and leaks to appropriate personnel, e.g. co-workers, supervisor:
 - document issues, as required, e.g. note in logbook
 - estimate quantity of unrecovered chemicals

Knowledge

- K1** Relevant legislation
- K2** Emergency Response Plan
- K3** Organizational safety policies and procedures, including Occupational Health & Safety (OH&S)
- K4** Workplace Hazardous Materials Information System (WHMIS)
- K5** Transportation of Dangerous Goods (TDG)
- K6** Types of chemicals that may be encountered
- K7** Importance of handling chemical spills and leaks correctly and in timely manner
- K8** Available emergency response services and their contact information
- K9** Procedures for safe evacuation, if required
- K10** Safety reporting procedures

Contextual Variables

Range of Context

- Type of chemicals encountered will vary, e.g. chlorine, oil.
- Size of spill/amount of chemicals spilled may vary the approach to handling the spill/leak.

Level of Practice

- Frontline
- Supervisor
- Manager/Executive

Adapted Bloom's Taxonomy

- | | |
|---|---|
| <input type="checkbox"/> Recall, Remember | <input checked="" type="checkbox"/> Analyze |
| <input type="checkbox"/> Understand | <input type="checkbox"/> Evaluate |
| <input type="checkbox"/> Apply | <input type="checkbox"/> Create/Transform |

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

- PPE, e.g. gloves, masks, eye protection
- Materials for containment, e.g. sand, earth
- Tools for containment, e.g. corrosion resistant shovel, disposal container
- Legal forms related to chemical spills and leaks

Major Category

Safety

Competency Area

Respond to Emergencies

Competency Unit

Respond to non-electrical emergencies

Purpose

Responding quickly and correctly to non-electrical emergencies reduces the chance of injury or death to employees, contractors, customers and the public as well as minimizes damage to the environment. It also protects the organization and its assets against loss and liability.

Performance/Abilities

- P1** Remain calm
- P2** Initiate Emergency Response Plan for type of risk, if required, for example:
 - notify internal and external authorities
 - evacuate
 - follow direction of emergency authority
 - assist emergency authorities
 - secure area
- P3** Assess level of hazard:
 - determine what is exposed to risk, e.g. unit, station, site, field operations
- P4** Record details of emergency, for example:
 - date and time
 - nature of emergency
 - time authorities were contacted
 - time authorities arrived
 - action taken
 - names and contact information for witnesses
- P5** Follow up, as required, for example:
 - take action to prevent recurrence

Knowledge

- K1** Relevant legislation
- K2** Emergency Response Plan
- K3** Organizational safety policies and procedures, including Occupational Health & Safety (OH&S)
- K4** Workplace Hazardous Materials Information System (WHMIS)
- K5** Available emergency response services and their contact information
- K6** Procedures for safe evacuation, if required
- K7** Emergency reporting procedures

Contextual Variables

Range of Context

- Type of emergencies encountered will vary, e.g. bomb threat, sabotage threat, natural disaster.
- Severity of emergency situation will vary.

Level of Practice

- Frontline
- Supervisor
- Manager/Executive

Adapted Bloom's Taxonomy

- | | |
|---|---|
| <input type="checkbox"/> Recall, Remember | <input checked="" type="checkbox"/> Analyze |
| <input type="checkbox"/> Understand | <input type="checkbox"/> Evaluate |
| <input type="checkbox"/> Apply | <input type="checkbox"/> Create/Transform |

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

- Communication equipment
- Emergency response equipment, e.g. first aid kits, fire extinguishers
- Notebook

Major Category

Safety

Competency Area

Respond to Emergencies

Competency Unit

Participate in high-angle rescue

Purpose

Responding quickly and correctly to a situation in which individual(s) are in danger at height reduces the chance of injury and death to employees, contractors, customers and the public. It also protects the organization and its assets against loss and liability.

Performance/Abilities

- P1** Maintain certification for high-angle rescue
- P2** Participate in high-angle rescue training exercises
- P3** Prepare for potential rescue:
 - inspect equipment on regular basis
 - replace equipment, as necessary
 - store rescue kit in designated location
- P4** Assess level of hazard
- P5** Initiate Emergency Response Plan, if required, for example:
 - notify internal and external authorities
 - secure area
- P6** Follow legislated procedures for high-angle rescue
- P7** Communicate issues to appropriate personnel, e.g. co-workers, supervisor:
 - document actions, as required

Knowledge

- K1** Relevant legislation
- K2** Emergency Response Plan
- K3** Organizational safety policies and procedures, including Occupational Health & Safety (OH&S)
- K4** Certification/training needed for high-angle rescue
- K5** Inspection requirements for equipment
- K6** Available emergency response services and their contact information
- K7** First aid training
- K8** Procedures for safe evacuation, if required
- K9** Emergency reporting procedures

Contextual Variables

Range of Context

- Environmental conditions will vary, e.g. wind direction/speed.

Level of Practice

- Frontline
- Supervisor
- Manager/Executive

Adapted Bloom's Taxonomy

- | | |
|---|---|
| <input type="checkbox"/> Recall, Remember | <input type="checkbox"/> Analyze |
| <input type="checkbox"/> Understand | <input type="checkbox"/> Evaluate |
| <input checked="" type="checkbox"/> Apply | <input type="checkbox"/> Create/Transform |

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

- High-angle rescue kit
- High-angle rescue equipment, e.g. elevated work platform, ladder
- First aid kit

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
- PPE

Major Category

Security

Competency Area

Follow Security Practices

Competency Unit

Follow security practices for physical work environment

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

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

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)

- CAD software
- Mobile workforce technology

Major Category

Information and Communication Technology (ICT) 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

- | | |
|---|---|
| <input type="checkbox"/> Recall, Remember | <input type="checkbox"/> Analyze |
| <input type="checkbox"/> Understand | <input type="checkbox"/> Evaluate |
| <input checked="" type="checkbox"/> Apply | <input type="checkbox"/> Create/Transform |

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

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

Major Category

Information and Communication Technology (ICT) Foundations

Competency Area

Use Digital Technology

Competency Unit

Use common software 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

- | | |
|---|---|
| <input type="checkbox"/> Recall, Remember | <input type="checkbox"/> Analyze |
| <input type="checkbox"/> Understand | <input type="checkbox"/> Evaluate |
| <input checked="" type="checkbox"/> Apply | <input type="checkbox"/> Create/Transform |

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

- Computer
- Tablet
- Cell phone
- Common software applications

Major Category

Information and Communication Technology (ICT) Foundations

Competency Area

Use Digital Technology

Competency Unit

Use navigation and mapping 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 (ICT) Foundations
Competency Area	Use Digital Technology
Competency Unit	Use digital mobile radios

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

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

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

Foundational Trades Skills

Competency Area

Perform Routine Trade Tasks

Competency Unit

Use hand and power tools

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

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

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

Major Category

Foundational Trades Skills

Competency Area

Perform Routine Trade Tasks

Competency Unit

Use electrical measuring and testing 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

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

- PPE, 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

Major Category

Foundational Trades Skills

Competency Area

Perform Routine Trade Tasks

Competency Unit

Use access equipment and work platforms

Purpose

Correctly using access equipment and work platforms 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 up to date
- P2** Wear appropriate personal protective equipment (PPE), e.g. fall arrest
- P3** Identify traffic areas and potential site hazards
- P4** Select access equipment according to site and task requirements
- P5** Inspect access equipment and installation location as per manufacturer's guidelines
- P6** Use equipment only for intended purpose
- P7** Secure access equipment, as required
- P8** Use confined space monitoring equipment, as required
- P9** Communicate issues with equipment to relevant personnel, e.g. co-workers, supervisor
- P10** Tag defective equipment:
 - turn in to relevant personnel or department
- P11** 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

Glossary

- **Access equipment:** any equipment that is specially designed to help user to work safe in locations not readily accessible, e.g. above ground, below ground, confined space, at height.

Contextual Variables

Range of Context

- Types of access equipment used varies according to 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. fall arrest equipment, hard hat, shepherd hooks
- Occupational Health & Safety documents, e.g. safe work procedures
- Access equipment and work platforms, e.g. portable and permanent ladders, diving boards, scissor-lifts, scaffolding, articulating boom

Major Category

Foundational Trades Skills

Competency Area

Perform Routine Trade Tasks

Competency Unit

Operate vehicles and motorized equipment

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

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

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

Major Category

Foundational Trades Skills

Competency Area

Perform Routine Trade Tasks

Competency Unit

Lubricate equipment and components

Purpose

Lubricating equipment and components protects assets against damage and extends the lifespan of equipment and components. Completing this task effectively protects the environment and may also protect employees and contractors against injury.

Performance/Abilities

- P1** Wear appropriate personal protective equipment (PPE), e.g. safety glasses, gloves, masks
- P2** Determine lubricant requirements:
 - refer to manufacturer's specifications for lubricant and equipment
 - comply with applicable regulations
- P3** Select appropriate lubricant, e.g. oil, grease, dry solid, water
- P4** Select appropriate application tools and equipment, e.g. grease gun, hand tool
- P5** Identify points requiring lubricants according to manufacturer's specifications and engineered drawings
- P6** Maintain lubricant levels, as required
- P7** Remove lubricants, as required:
 - follow procedures for recycling or disposal
 - replace lubricants, as required
- P8** Respond to spills and leaks, as required:
 - report spills to supervisor
- P9** Communicate issues to relevant personnel, e.g. co-workers, supervisor
- P10** Clean tools after use, as required
- P11** Store tools and remaining lubricants in designated approved location

Knowledge

- K1** Relevant legislation and documents, e.g. WHMIS
- K2** Manufacturer's specifications and engineered drawings of equipment
- K3** Organizational safety policies and procedures, including Occupational Health & Safety
- K4** Manufacturer's safety data sheets (SDS) and other lubricant specifications, e.g. PPE, first aid measures, characteristics
- K5** Types of safety hazards on site and associated with lubrication, e.g. pinch points
- K6** PPE required for specific tasks
- K7** Consequences of using incorrect lubricant or not following application instructions

Contextual Variables

Range of Context

- Types of lubricants vary with types of equipment and components, nature of the work and work location.
- Tools used to lubricate equipment and components will vary with the type of lubricant, equipment and components.

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, goggles, masks, gloves
- Hand tools, e.g. grease guns
- Lubricants, e.g. oil, grease, dry solid, water

Major Category

Foundational Trades Skills

Competency Area

Perform Routine Trade Tasks

Competency Unit

Assist with rigging, hoisting/lifting and moving tasks

Purpose

Assisting with rigging, hoisting/lifting and moving equipment and materials protects employees, contractors and members of the general public against injury or death, and equipment from damage. It also protects the organization against loss and liability.

Performance/Abilities

- P1** Wear appropriate personal protective equipment (PPE), e.g. high visibility equipment, hard hat, gloves, safety boots, safety glasses
- P2** Determine equipment needs based on:
 - characteristics of rigging, hoisting/lifting or moving task, e.g. headroom, environment, stability
 - process to be used for rigging, hoisting/lifting or moving
 - number of items being lifted/moved at one time
 - weight of load
 - location of taglines
- P3** Identify load ratings for sling arrangements, as required
- P4** Inspect equipment for damage and wear
- P5** Secure area, as required:
 - assess site, ground, environmental conditions
 - assist with route planning
 - remove hazards, obstructions and other anomalies
 - secure area of lift radius
 - confirm location of personnel
- P6** Determine scheduling of activities based on environmental conditions, e.g. weather
- P7** Communicate issues to relevant personnel, e.g. co-workers, supervisor
- P8** Communicate clearly before, during and after hoist/lift/move:
 - ensure direct communication between operator and signal person, i.e. direct line of sight or radio communication
 - use hand signals and verbal communication

Knowledge

- K1** Relevant legislated requirements, e.g. Occupational Health & Safety (OH&S)
- K2** Organizational safety policies and procedures, e.g. OH&S
- K3** Types of safety hazards on site
- K4** Types of safety hazards associated with rigging, hoisting/lifting and moving
- K5** Terminology, hand signals and flagging associated with rigging, hoisting/lifting and moving
- K6** PPE required for specific tasks
- K7** Types of hoisting and lifting equipment, their components, accessories, applications, ratings, limitations and procedures for use, including:
 - sling angles for hoisting/lifting

- K8** Types of moving equipment and their applications, e.g. crane, boom or forklift
- K9** Procedures to ensure work area is safe for lifting

Major Category

Personal Competencies

Competency Area

Demonstrate Professionalism

Competency Unit

Work as member of a team

Contextual Variables

Range of Context

- Types of equipment and tools vary with type of work and work location.
- Environment and weather conditions can alter the way this task is performed.

Level of Practice

- Frontline
- Supervisor
- Manager/Executive

Adapted Bloom's Taxonomy

- | | |
|---|--|
| <input type="checkbox"/> Recall, Remember | <input type="checkbox"/> Analyze |
| <input type="checkbox"/> Understand | <input checked="" type="checkbox"/> Evaluate |
| <input type="checkbox"/> Apply | <input type="checkbox"/> Create/Transform |

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

- PPE, e.g. high visibility clothing, hard hat, gloves, safety glasses, safety footwear
- Rigging, hoisting/lifting and moving equipment and tools, e.g. chain hoists, rope blocks, cable winches, web hoists, levers, slings, ropes, cables, taglines, crane, forklift

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

- | | |
|---|---|
| <input type="checkbox"/> Recall, Remember | <input type="checkbox"/> Analyze |
| <input type="checkbox"/> Understand | <input type="checkbox"/> Evaluate |
| <input checked="" type="checkbox"/> Apply | <input type="checkbox"/> 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

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.

Level of Practice

- Frontline
- Supervisor
- Manager/Executive

Adapted Bloom's Taxonomy

- | | |
|---|---|
| <input type="checkbox"/> Recall, Remember | <input checked="" type="checkbox"/> Analyze |
| <input type="checkbox"/> Understand | <input type="checkbox"/> Evaluate |
| <input type="checkbox"/> Apply | <input type="checkbox"/> Create/Transform |

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

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

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

- | | |
|---|---|
| <input type="checkbox"/> Recall, Remember | <input type="checkbox"/> Analyze |
| <input type="checkbox"/> Understand | <input type="checkbox"/> Evaluate |
| <input checked="" type="checkbox"/> Apply | <input type="checkbox"/> Create/Transform |

Major Category

Personal Competencies

Competency Area

Demonstrate Professionalism

Competency Unit

Mentor/coach others

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.

Level of Practice

- Frontline
- Supervisor
- Manager/Executive

Adapted Bloom's Taxonomy

- | | |
|---|---|
| <input type="checkbox"/> Recall, Remember | <input checked="" type="checkbox"/> Analyze |
| <input type="checkbox"/> Understand | <input type="checkbox"/> Evaluate |
| <input type="checkbox"/> Apply | <input type="checkbox"/> 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

Manage stress

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.

Level of Practice

- Frontline
- Supervisor
- Manager/Executive

Adapted Bloom's Taxonomy

- | | |
|---|---|
| <input type="checkbox"/> Recall, Remember | <input checked="" type="checkbox"/> Analyze |
| <input type="checkbox"/> Understand | <input type="checkbox"/> Evaluate |
| <input type="checkbox"/> Apply | <input type="checkbox"/> Create/Transform |

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

- Psychological health and wellness program

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 systems, 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

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

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 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

Major Category	Personal Competencies
Competency Area	Communicate Effectively
Competency Unit	Use hand signals

Contextual Variables

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

Purpose

Using hand signals helps to ensure that all parties understand each other, and reduces errors due to misinterpretation, especially in noisy environments or situations in which verbal communication is difficult. Using hand signals helps to reduce the risk of accidents and injury.

Performance/Abilities

- P1** Communicate with team members prior to activity requiring hand signals, when possible:
 - confirm signals with team members prior to beginning the activity
 - identify procedures to be followed
 - identify roles of each individual, including self
 - discuss any potential hazards
- P2** Ensure own visibility to operator/team members, e.g. wear high visibility vest:
 - maintain eye contact, if possible
 - never position self in a compromised location, e.g. behind moving vehicle or equipment, in a drop zone
 - maintain situational awareness
- P3** Use appropriate hand signals, e.g. emergency stop, distance to stopping point
- P4** Finish task with planned stop signal

Knowledge

- K1** Relevant legislation, e.g. Occupational Health and Safety
- K2** Organization policies, procedures and plans
- K3** Hand signals for different actions, e.g. proceed slowly, distance to stopping point, stop, turn

Contextual Variables

Range of Context

- Environmental conditions may alter the way this skill is performed.

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 signal cards

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.

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.

Level of Practice

- Frontline
- Supervisor
- Manager/Executive

Adapted Bloom's Taxonomy

- | | |
|---|---|
| <input type="checkbox"/> Recall, Remember | <input checked="" type="checkbox"/> Analyze |
| <input type="checkbox"/> Understand | <input type="checkbox"/> Evaluate |
| <input type="checkbox"/> Apply | <input type="checkbox"/> Create/Transform |

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

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

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

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 confirms 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

Notes

Notes

Electricity Human Resources Canada would like to acknowledge all of the industry subject matter experts from across Canada who were involved in drafting, reviewing and validating this National Occupational Standard.