

Level Four

IE Code	IE Competency Title	Credit	OAC Ref.
IE119-4WC	Design and draw electrical and electronic drawings including schematics, maintain documentation and produce as-built drawings	4	F5
IE155-4WC	Install and maintain motor control and power distribution centres	5	J5
IE157-4WC	Install and maintain HVAC equipment	3	I6
IE162-4WC	Install and maintain power generation controls	9	P7
IE163-4WC	Install and maintain power generator protective relays	9	P8
IE172-4WC	Install and maintain process control hardware	3	Q3
IE179-4WC	Install and maintain variable frequency drives (VFD)	7	J6
IE183-4WC	Install and maintain a UPS system	4	O3
IE184-4WC	Install and maintain batteries	3	O4
IE185-4WC	Demonstrate knowledge of detection and alarm systems	3	Q4
IE186-4WC	Install and maintain detection and alarm systems	9	Q4

Assessment

With training and guidance you will acquire the skills and knowledge to enable you to competently demonstrate completion of these tasks to your assessor. You must keep a record, on the diary pages included, of the details of the work done when completing the tasks to help the assessor see the experience you have gained prior to the assessment decision being made.

Evidence

Assessment of this standard requires the following types of evidence be gathered by you and presented by you to your assessor:

- Completed apprentice work diary for each task – add more pages if you need to
- Observation by the assessor of you completing the relevant tasks
- Task verification – another person who has observed you completing the tasks to the appropriate standard
- Copies of work records, where applicable, or reference to work records to show when the tasks were completed.

The specific evidence requirements you must present are listed on the following pages.

SPECIFICATION

People credited with this standard are able to:

- **Demonstrate and apply knowledge of design and drawing practice, symbols and conventions for electricians, maintenance of those drawings and create as-built drawings**

<p>Credit 4</p> <p>Prerequisite</p> <p>Competency standard IE117-1TC, Demonstrate knowledge of electrical and electronic drawings; and Competency standard IE118-1TC, Demonstrate knowledge of manuals and manufacturer specifications.</p> <p>Assessment</p> <p>For assessment purposes, all explanations, descriptions, and activities must comply with current legislation, including the Canadian Electrical Code, WorkSafeBC or other applicable regulations, and industry practice.</p> <p>Quality Assurance</p> <p>Any assessor assessing against this competency standard must be a qualified electrician.</p> <p>References</p> <p>The Canadian Electrical Code, Part I, Canadian Standards Association, most current edition (CEC).</p> <p>Definitions</p> <p><i>IEEE</i> – Institute of Electrical and Electronic Engineers <i>ULC</i> – Underwriters Laboratories of Canada <i>ISO</i> – International standards organization <i>As-built status</i> – any difference between planned wiring and installation and as it was actually built.</p>
<p>Task 1: Plan a new electrical installation or a revision to an existing installation.</p> <p>Task 2: Design electrical circuits and installation layouts.</p> <p>Task 3: Interpret existing, and create new documents and drawing specifications according to organizational technical data management practice.</p> <p>Task 4: Update drawings to ‘as-built’ status using common symbol sets and numbering standards; and file correctly to comply with organizational technical data management practice.</p>

This unit relates to the following competency number and topic in the provincial OAC and Program Outline:
F5 Design and draw electrical and electronic drawings

Task 1: Plan a new electrical installation or a revision to an existing installation.

Apprentice Diary

(1.1)

Date/s	Description of work done over a period of time. Include details of installation and maintenance events and dates where drawings were required.

Identify installation requirements and design constraints of the installations/ maintenance work, for example: safety considerations, access, cable runs and exposure, panel layout.

(1.2)

Describe the solutions that you envisage using to solve the constraints of the design, for example why is the panel laid out the way that it is? What are the details of the cable runs? What solutions to any access constraints have you used? How will you address safety issues? What type of progressive numbering system will be used?

The solutions should address the principles of efficient circuit design and equipment layout. (1.3)

Explain relevant regulatory codes/rules that may apply to circuit design – for example CEC, ULC, IEEE, ISO.

(1.3)

Assessor Checklist

I verify the apprentice is able to perform the following task(s) to the standard outlined and attest to his/her competence.

- Described principles of efficient circuit design and equipment layout and how these will be addressed in the design: (1.1)
Specify which principles were identified.

Assessor/ verifier name: _____ Signature: _____ Date: _____

- Identified installation requirements and design constraints for circuits and equipment. (1.2)
Assessor/ verifier name: _____ Signature: _____ Date: _____

- Explained regulatory requirements that must be addressed in the design. (1.3)
Assessor/ verifier name: _____ Signature: _____ Date: _____

- All apprentice’s explanations, descriptions, and activities complied with current legislation, including the Canadian Electrical Code, WorkSafeBC or other applicable regulations, and industry practice.
Assessor/ verifier name: _____ Signature: _____ Date: _____

Note: if simulation was used for any of the tasks, attach a brief description of the exercise to this competency.

Task 2: Design electrical circuits and installation layouts

Note: the level of detail desired for competence is, as an example, a design for a basic motor control circuit. This design piece could be simulated in the workplace using a commonly occurring industry design need.

Apprentice Diary

(2.1)

Date/s	<p>Log the process of design below that carries on from determining the needs in the previous section – provide info and preferably examples evidence of:</p> <ul style="list-style-type: none"> • Sketch design • Identification of components • Methods of attachment and support. <p>Design must incorporate ease of assembly and disassembly in components, fastenings and restraint, explain how this has been achieved.</p>

Components

(2.2)

List the components of the design in the table below and identify why they are appropriate choices, for example compliance with standards, ability to be easily replaced (interoperability), interchangeability, reliability, cost etc.

Note: Interoperability means the ability to source electrical components from different manufacturers and fit them into circuits where other manufacturer components are specified – providing all operational specifications are met.

Component	Reason why it is chosen/appropriate

Regulations and rules

Which regulations/rules apply to the above described design?

(2.3)

Assessor Checklist

I verify the apprentice is able to perform the following task(s) to the standard outlined and attest to his/her competence.

- Design incorporated principles of ease of assembly and disassembly in types of components, fastenings and restraints. (2.1)

Note: the level of detail desired for competence is, as an example, a design for a basic motor control circuit. This design piece could be simulated in the workplace using a commonly occurring industry design need.

Assessor/ verifier name: _____ Signature: _____ Date: _____

- Selected components as appropriate to meet design specifications. (2.2)
 - selected components allowed flexibility between proprietary standards
 - selected components were suitable for interoperation/interchanging with alternative manufacturer parts (where appropriate) and still met operational specifications
 - selected components met parts catalogue standards
 - cost was considered.

Note: Interoperability means the ability to source electrical components from different manufacturers and fit them into circuits where other manufacturer components are specified – providing all operational specifications are met.

Assessor/ verifier name: _____ Signature: _____ Date: _____

- Design met regulatory requirements. (2.3)

Assessor/ verifier name: _____ Signature: _____ Date: _____

- All apprentice’s explanations, descriptions, and activities complied with current legislation, including the Canadian Electrical Code, WorkSafeBC or other applicable regulations, and industry practice.

Assessor/ verifier name: _____ Signature: _____ Date: _____

Note: if simulation was used for any of the tasks, attach a brief description of the exercise to this competency.

Task 3: Interpret existing, and create new documents and drawing specifications according to organizational technical data management practice.

Apprentice Diary

(3.1)

Date/s	Identify below, existing drawings that you have interpreted and applied information from. Include dates of the work and type of information obtained from the drawings.

New drawing

Attach a copy of a drawing that you have created which is clear and able to be interpreted successfully. (3.2)

Note: complexity of drawing and document management systems vary, assessment should reference best practice but assess workplace procedures.



Include the following on your drawing:

- title blocks
- scales when performing design work
- projection
- legend
- schedules
- drawing and document filing specifications
- symbol conventions
- IEEE conventions
- revision key
- detail breakouts.

You may also include index page and title page.

Specification documentation

Attach or provide reference details of typical specification documentation that accompanies a design drawing such as your new drawing example – in accordance with technical data management standards.

(3.3)

Assessor Checklist

I verify the apprentice is able to perform the following task(s) to the standard outlined and attest to his/her competence.

- Interpretation of existing document and drawing specifications was demonstrated - in accordance with organizational technical data management practice (3.1)

Assessor/ verifier name: _____ Signature: _____ Date: _____

- New drawings were created with drawn components, which were able to be interpreted in accordance with industry practice. (3.2)
 - title block was included
 - scales were identified (when appropriate to the design work – not for schematics)
 - projection was identified
 - legends were used appropriately
 - schedules of components were developed
 - drawing met document filing specifications
 - symbol conventions were used appropriately
 - IEEE conventions were used appropriately
 - revision details were included to appropriate convention
 - detail breakouts were included appropriately.

Note: complexity of drawing and document management systems vary, assessment will reference best practice but assess workplace procedures

Assessor/ verifier name: _____ Signature: _____ Date: _____

- New specifications were developed in accordance with organizational technical data management standards. (3.3)

Assessor/ verifier name: _____ Signature: _____ Date: _____

- All apprentice's explanations, descriptions, and activities complied with current legislation, including the Canadian Electrical Code, WorkSafeBC or other applicable regulations, and industry practice.

Assessor/ verifier name: _____ Signature: _____ Date: _____

Note: if simulation was used for any of the tasks, attach a brief description of the exercise to this competency.

Task 4: Update drawings to ‘as-built’ status using common symbol sets and numbering standards, and file correctly to comply with organizational technical data management practice.

Updating drawings to as-built

Attach a sample of updated drawings showing wiring and installation changes or provide reference and details of updated drawings and jobs.



(4.1)

Update documentation

Provide details of field modification documentation to accompany the as-built changes and cross-referenced tracking system for drawings in accordance with technical data management practice.

***Note:** document tracking systems include software tools such as Autoview, contained in the PLC, or may be exclusively paper based as a drawing tracking/cross referenced system. Assessment will take differing tracking systems into account.*

(4.1)

Field numbering system

Provide overview details of field numbering system used to document as-built status to operations organizational needs.

(4.2)

Computer aided drafting

(4.3 – 4.6)

Provide details of the drawing and technology used to create the CAD drawn electro-technology drawing – attach the drawing if possible. Include details of:

- file creation
- file saving and storage
- CAD tools
- CAD symbol libraries
- CAD application/s.

(4.3, 4.6)

What conventions were used? Include:

- layout
- content symbols
- labelling.

(4.4)

Outline the drafting practice used including:

- drawing content
- scaling
- labelling
- reference points.

(4.5)

Assessor Checklist

I verify the apprentice is able to perform the following task(s) to the standard outlined and attest to his/her competence.

- Wiring and installation changes were noted on existing documents to common standards. (4.1)
- documentation was modified according to the context and as-built installation
 - cross referencing system for tracking drawings was used.

Note: document tracking systems include software tools such as Autoview, contained in the PLC, or may be exclusively paper based as a drawing tracking/cross referenced system. Assessment should take differing tracking systems into account.

Assessor/ verifier name: _____ Signature: _____ Date: _____

- Field numbering systems were used to document as-builts in accordance with organizational technical data management practice. (4.2)

Assessor/ verifier name: _____ Signature: _____ Date: _____

- All apprentice’s explanations, descriptions, and activities complied with current legislation, including the Canadian Electrical Code, WorkSafeBC or other applicable regulations, and industry practice.

Assessor/ verifier name: _____ Signature: _____ Date: _____

Computer Aided Drafting

- Appropriate CAD technology was used in the drafting process and outcomes, including: (4.3)
- file creation
 - file saving and storage
 - CAD tools
 - CAD symbol libraries
 - CAD applications.

Assessor/ verifier name: _____ Signature: _____ Date: _____

- Computer generated electro-technology drawings included relevant conventions including: (4.4)
- layout
 - content
 - symbols
 - labelling.

Assessor/ verifier name: _____ Signature: _____ Date: _____

- Established drafting practices were used to prepare the drawing including: (4.5)
- drawing content
 - scaling
 - labelling
 - reference points.

Assessor/ verifier name: _____ Signature: _____ Date: _____

- Drawings conformed with organizational technical data management standards including: (4.6)
- content
 - drawing entities and symbols
 - drawing attributes.

Assessor/ verifier name: _____ Signature: _____ Date: _____

- All apprentice's explanations, descriptions, and activities complied with current legislation, including the Canadian Electrical Code, WorkSafeBC or other applicable regulations, and industry practice.

Assessor/ verifier name: _____ Signature: _____ Date: _____

Note: if simulation was used for any of the tasks, attach a brief description of the exercise to this competency.

Additional Supporting Evidence

(To be completed by the apprentice and signed by the assessor)

Describe what workplace records are available to verify you performed this work.

Describe where a moderator can locate these records to verify your work when doing a quality check.

Name and describe the CEC rules required when you performed these tasks.

Name applicable manufacturer guidelines that were followed when doing these tasks.

Apprentice Signature: _____ *Date:* _____

Assessor Signature: _____ *Date:* _____

Additional Questions

Attach written notes of any additional questions asked of the apprentice and answers given. Ensure they are signed and dated by both the apprentice and assessor.

SPECIFICATION

People credited with this standard are able to:

- **Install and maintain motor control centres, voltage control and power distribution centres to appropriate standards.**

Credit 5**Prerequisite**

Competency standard IE152-4TC, Demonstrate knowledge of the installation and maintenance of high voltage circuits; and

Competency standard IE141-2TC, Demonstrate knowledge of the installation and maintenance of low voltage circuits; and

Competency standard IE150-3TC, Demonstrate knowledge of AC motors.

Assessment

For assessment purposes, all explanations, descriptions, and activities must comply with current legislation, including the Canadian Electrical Code, WorkSafeBC or other applicable regulations, and industry practice.

Quality Assurance

Any assessor assessing against this competency standard must be a qualified electrician.

References

The Canadian Electrical Code, Part I, Canadian Standards Association, most current edition (CEC)

WorkSafeBC Occupational Health and Safety (OHS) regulations.

Definitions

Properly – to CEC rules and in a manner that complies with WorkSafeBC regulations.

MCC – Motor Control Centres (typically 208 to 600v)

VCC – Voltage Control Centres (high voltage MCC)

PDC – Power Distribution Centre.

Task 1: Install and maintain motor control centres (MCC) to CEC rules and manufacturer specifications.

Task 2: Install and maintain voltage control centres (VCC) to CEC rules.

Task 3: Install and maintain power distribution centres (PDC) to CEC rules.

This unit relates to the following competency number and topic in the provincial OAC and Program Outline:

J5 Install and maintain motor control, voltage control and power distribution centers

Task 1: Install and maintain motor control centres (MCC) to CEC rules and manufacturer specifications.

Apprentice Diary – MCC installation

(1.1)

Note: re-installing may be used for this assessment, as long as all required installation aspects are demonstrated.

Date/s	Description of MCC installation and dates. Describe a motor control centre installation that you have completed, include: <ul style="list-style-type: none"> • manufacturer specifications • installation specifications • location and optimization • seismic considerations • safety standards • CEC • ULC Explain any choices you have made.

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Apprentice Diary – MCC maintenance

(1.2)

Note: preventative maintenance and standards of cleanliness vary between applications, assessment is to company standards.

Date/s	Description of MCC maintenance and dates. Include details of: <ul style="list-style-type: none"> • design specifications • manufacturer specifications • troubleshooting techniques • magnetic contactors • ground fault relays and motor protection relays • check terminations • fuses • insulation test • cleaning and blueprint reading (identify cable and wires) • check contacts • overload protection • grounding and bonding. • cubicle safety procedures • explain any choices you have made.

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Assessor Checklist

I verify the apprentice is able to perform the following task(s) to the standard outlined and attest to his/her competence.

- A motor control centre was installed properly: (1.1)
- manufacturer specifications were observed
 - installation specifications were followed correctly
 - location and optimization
 - seismic considerations
 - safety standards were followed correctly
 - CEC rules were complied with
 - ULC code was complied with.

Note: re-installing may be used to assess competency on installing as long as all installation considerations are demonstrated.

Assessor/ verifier name: _____ Signature: _____ Date: _____

- A motor control centre was maintained to CEC and company standards: (1.2)
- system design specifications were followed
 - manufacturer specifications were followed
 - troubleshooting techniques were used
 - magnetic contactors checked
 - ground fault relays and motor protection relays checked
 - terminations checked
 - fuses checked
 - insulation test/s performed accordingly
 - cleaning carried out correctly
 - blueprints interpreted correctly for cable and wires
 - contacts checked
 - overload protection was checked
 - grounding and protection was checked
 - cubicle safety procedures were followed.

Note: Other maintenance parts may include: vacuum contactors, SF6 contactors.

Note: preventative maintenance and standards of cleanliness vary between applications; assessment should be in accordance with company standards.

Assessor/ verifier name: _____ Signature: _____ Date: _____

- All apprentice's explanations, descriptions, and activities complied with current legislation, including the Canadian Electrical Code, WorkSafeBC or other applicable regulations, and industry practice.

Assessor/ verifier name: _____ Signature: _____ Date: _____

Note: if simulation was used for any of the tasks, attach a brief description of the exercise to this competency.

Task 2: Install and maintain voltage control centres (PDC) to CEC rules.

Note: re-installing may be used to assess competency on installing as long as all required installation aspects are demonstrated.

Apprentice Diary – PDC installation

(2.1, 2.2)

Date/s	Describe PDC installations and dates. Include reference to: <ul style="list-style-type: none"> • adjustments to specification required • identification signs and labels • drawings and blueprints used and any modifications required • tools used to perform the installation – must include hot sticks, contact closure testers and standard test equipment • CEC rules 2300v standards • CEC rules 600v standards • trip circuits • electrical ground hazards • explain any choices you have made.

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Apprentice Diary – PDC maintenance

(2.3)

Date/s	Description of PDC maintenance and dates – include aspects as listed in the assessor observation (below) and explain any choices you have made.

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Assessor Checklist

I verify the apprentice is able to perform the following task(s) to the standard outlined and attest to his/her competence.

- PDC were installed in accordance with CEC rules. (2.1)
 - adjustments to specifications were made
 - signs and labels were correctly identified
 - drawings and blueprints were interpreted correctly
 - modifications to drawings and blueprints were made correctly
 - CEC rules 2300v standards were followed
 - CEC rules 600v standards were followed
 - trip circuits
 - electrical ground hazards.

Note: re-installing may be used to assess competency on installing as long as all installation considerations are demonstrated.

Assessor/ verifier name: _____ Signature: _____ Date: _____

- Appropriate tools were used: (2.2)
 - hot sticks were used
 - contact closure testers were used
 - standard test equipment was used.

Assessor/ verifier name: _____ Signature: _____ Date: _____

- PDC was maintained in accordance with CEC rules (2.3)
 - isolation points were identified and labelled correctly
 - common test equipment was used on PDC
 - external trip device location
 - prints and schematics were interpreted correctly
 - any deviations from operating specifications were identified and corrected(overheating, noise)
 - load current was checked
 - voltage balance was checked
 - preventative maintenance procedures required were carried out.

Assessor/ verifier name: _____ Signature: _____ Date: _____

- All apprentice's explanations, descriptions, and activities complied with current legislation, including the Canadian Electrical Code, WorkSafeBC or other applicable regulations, and industry practice.

Assessor/ verifier name: _____ Signature: _____ Date: _____

Note: if simulation was used for any of the tasks, attach a brief description of the exercise to this competency.

Task 3: Select, install and maintain protective relays on power distribution equipment, to all applicable safety standards and manufacturer guidelines.

Apprentice Diary – Protective relay installation

(3.1)

Date/s	Provide details of protective relay installation/s and dates. Include details of: <ul style="list-style-type: none"> • reading and modification of prints and schematics • access and interpretation of manuals and specifications • overcurrent/undercurrent states • safety procedures • explain any choices you have made.

Apprentice Diary – Protective relay maintenance

(4.2)

Date/s	Provide details of protective relay maintenance and dates. Include details of: <ul style="list-style-type: none"> • access and interpret trip logs • safe working procedures • May include • ground fault • phase loss • dead bus • explain any choices you have made.

Assessor Checklist

I verify the apprentice is able to perform the following task(s) to the standard outlined and attest to his/her competence.

- Protective relays were installed: (4.1)
- prints and schematics were read and modified as necessary
 - manuals and specifications were accessed
 - over current/undercurrent states were identified.
 - safety procedures were followed.

Assessor/ verifier name: _____ Signature: _____ Date: _____

- Protective relays were maintained: (4.2)
- trip logs were accessed and interpreted
 - safe working procedures were followed.

Assessor/ verifier name: _____ Signature: _____ Date: _____

- All apprentice's explanations, descriptions, and activities complied with current legislation, including the Canadian Electrical Code, WorkSafeBC or other applicable regulations, and industry practice.

Assessor/ verifier name: _____ Signature: _____ Date: _____

Note: if simulation was used for any of the tasks, attach a brief description of the exercise to this competency.

Additional Supporting Evidence

(To be completed by the apprentice and signed by the assessor)

Describe what workplace records are available to verify you performed this work.

Describe where a moderator can locate these records to verify your work when doing a quality check.

Name and describe the CEC rules required when you performed these tasks.

Name applicable manufacturer guidelines that were followed when doing these tasks.

Apprentice Signature: _____ *Date:* _____

Assessor Signature: _____ *Date:* _____

Additional Questions

Attach written notes of any additional questions asked of the apprentice and answers given. Ensure they are signed and dated by both the apprentice and assessor.

SPECIFICATION

People credited with this standard are able to:

- **Install and maintain Heating, Ventilation and Air Conditioning equipment**

<p>Credit 3</p> <p>Prerequisite Competency Standard IE156-4TC, Demonstrate knowledge of installing and maintaining HVAC equipment.</p> <p>Assessment For assessment purposes, all explanations, descriptions, and activities must comply with current legislation, including the Canadian Electrical Code, WorkSafeBC or other applicable regulations, and industry practice.</p> <p>Quality Assurance Any assessor assessing against this competency standard must be a qualified electrician.</p> <p>References The Canadian Electrical Code, Part I, Canadian Standards Association, most current edition (CEC) WorkSafeBC Occupational Health and Safety (OHS) regulations Environmental Management Act regulations – BCreg 387/99 Ozone Depleting Substances And Other Halocarbons Regulation (CFC recovery regulations).</p> <p>Definitions <i>CFC</i> – Chlorofluorocarbons <i>HVAC</i> – Heating, Ventilation and Air Conditioning</p>
<p>Task 1: Install heating and cooling equipment in HVAC and production processes to meet CEC rules and manufacturer specifications.</p> <p>Task 2: Maintain heating and cooling equipment in HVAC and production processes to meet CEC rules and manufacturer specifications.</p>

This unit relates to the following competency number and topic in the provincial OAC and Program Outline:

I6 *Install and maintain HVAC equipment*

Task 1: Install heating and cooling equipment in HVAC and production processes to meet CEC rules and manufacturer specifications.

Apprentice Diary – HVAC Installation

(1.1, 1.2)

Date/s	<p>Describe HVAC installation/s completed including dates and details of equipment</p> <p>Evidence is required for the following components:</p> <ul style="list-style-type: none"> • fans and air movement • compressors • heat exchange circuits • control circuits and relays • dampers • thermostats • solenoids <p>Include reference and dates in the diary to other more detailed documentation and records about the installation such as job sheets/specifications/invoices/plans/component manufacturer specifications and explain any choices you have made.</p>

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Assessor Checklist

I verify the apprentice is able to perform the following task(s) to the standard outlined and attest to his/her competence.

- Install heating and cooling equipment (all in accordance with CEC): (1.1)
 - fans and air movement equipment was installed
 - compressors were installed
 - heat exchange units were installed
 - control circuits and relays were installed
 - dampers were installed
 - thermostats were installed
 - solenoids were installed.

- The installation was documented in accordance with company standards. (1.2)

- All apprentice's explanations, descriptions, and activities complied with current legislation, including the Canadian Electrical Code, WorkSafeBC or other applicable regulations, and industry practice.

Assessor/ verifier name: _____ Signature: _____ Date: _____

Note: if simulation was used for any of the tasks, attach a brief description of the exercise to this competency.

Task 2: Maintain heating and cooling equipment in HVAC and production processes to meet CEC rules and manufacturer specifications.

Apprentice Diary – HVAC maintenance

(2.1, 2.2)

Date/s	<p>Describe HVAC maintenance completed, including dates and details of equipment</p> <p>Evidence is required for the following elements that must be included in the maintenance process:</p> <ul style="list-style-type: none"> • safety principles • common faults encountered and troubleshooting techniques used • diagnostic measuring tools used to determine condition of equipment • reference to specification and construction prints <p>cleaning of equipment</p> <p>Include reference and dates in the diary to other more detailed documentation and records about the installation such as job sheets/specifications/invoices/plans/ component manufacturer specifications and explain any choices you have made.</p> <p><i>Note: certification is required to breach the coolant circuit – CFC recovery regulations apply.</i></p>

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Assessor Checklist

I verify the apprentice is able to perform the following task(s) to the standard outlined and attest to his/her competence.

- Maintained heating and cooling equipment: (2.1)
 - safety principles were followed
 - common faults were detected and troubleshooting techniques used
 - diagnostic tools were used
 - specification manuals and construction prints were followed
 - equipment was cleaned during maintenance.

Note: certification is required to breach the coolant circuit – CFC recovery regulations apply.

- The maintenance was documented in accordance with company standards. (2.2)
- All apprentice's explanations, descriptions, and activities complied with current legislation, including the Canadian Electrical Code, WorkSafeBC or other applicable regulations, and industry practice.

Assessor/ verifier name: _____ Signature: _____ Date: _____

Note: if simulation was used for any of the tasks, attach a brief description of the exercise to this competency.

Additional Supporting Evidence

(To be completed by the apprentice and signed by the assessor)

Describe what workplace records are available to verify you performed this work.

Describe where a moderator can locate these records to verify your work when doing a quality check.

Name and describe the CEC rules required when you performed these tasks.

Name applicable manufacturer guidelines that were followed when doing these tasks.

Apprentice Signature: _____ *Date:* _____

Assessor Signature: _____ *Date:* _____

Additional Questions

Attach written notes of any additional questions asked of the apprentice and answers given. Ensure they are signed and dated by both the apprentice and assessor.

SPECIFICATION

People credited with this standard are able to:

- **Install and maintain power generation controls to CEC rules, and power authority and manufacturer specifications and installation guidelines.**

Credit 9**Prerequisite**

Competency Standard IE160-4TC, Demonstrate knowledge of power generation equipment.

Assessment

For assessment purposes, all explanations, descriptions, and activities must comply with current legislation, including the Canadian Electrical Code, WorkSafeBC or other applicable regulations, and industry practice.

Quality Assurance

Any assessor assessing against this competency standard must be a qualified electrician.

References

The Canadian Electrical Code, Part I, Canadian Standards Association, most current edition (CEC)
WorkSafeBC Occupational Health and Safety (OHS) regulations.

Task 1: Install power generation controls matched to duty expectations and in accordance with CEC rules, manufacturer specifications and power authority requirements.

Task 2: Maintain power generation controls matched to duty expectations and in accordance with CEC rules, manufacturer specifications and power authority requirements.

This unit relates to the following competency number and topic in the provincial OAC and Program Outline:
P7 Install and maintain power generation controls

Task 1: Install power generation controls matched to duty expectations and in accordance with CEC rules, manufacturer specifications and power authority requirements.

Installing power generation controls

Outline the main details about a power generation control system that you have installed. Include: (1.1)

- the relevant CEC rules
- system manufacturer, type and specification
- manuals (specification and operation) references used
- safety codes and procedures.

Apprentice Diary – Installation (1.2)

Date/s	Provide details of work done installing power generation controls. Explain any choice you have made. Installation details may include: <ul style="list-style-type: none"> • power loading characteristics and capacities • control parameters • wire, shield and ground controls • emergency shutdown procedures.

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What documentation did you prepare to back up the installation in accordance with company practice? (1.3)

Assessor Checklist

I verify the apprentice is able to perform the following task(s) to the standard outlined and attest to his/her competence.

- Prepared for installation of power generation controls: (1.1)
 - safety codes and procedures were followed
 - specification manuals were accessed and interpreted correctly.

Assessor/ verifier name: _____ Signature: _____ Date: _____

- Power generation controls were installed in accordance with industry practice. (1.2)

Assessor/ verifier name: _____ Signature: _____ Date: _____

- Installation was documented in accordance with company standards (1.3)

Assessor/ verifier name: _____ Signature: _____ Date: _____

- All apprentice's explanations, descriptions, and activities complied with current legislation, including the Canadian Electrical Code, WorkSafeBC or other applicable regulations, and industry practice.

Assessor/ verifier name: _____ Signature: _____ Date: _____

Note: if simulation was used for any of the tasks, attach a brief description of the exercise to this competency.

Task 2: Maintain power generation controls matched to duty expectations and in accordance with CEC rules, manufacturer specifications and power authority requirements.

Apprentice Diary – Maintenance

(2.1)

Date/s	Description of maintenance work done over a period of time including dates. Explain any choices you have made. Examples of maintenance types include: <ul style="list-style-type: none"> • error codes and messages • software interrogation • test procedures • live bus safety precautions • time delay adjustments • coordination with plant/process controllers, indicator lights and alarms • cabinet maintenance.

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What documentation backed up the maintenance?

(2.2)

Assessor Checklist

I verify the apprentice is able to perform the following task(s) to the standard outlined and attest to his/her competence.

- Power generation controls were maintained in accordance with industry practice. (2.1)

Assessor/ verifier name: _____ Signature: _____ Date: _____

- Maintenance was documented in accordance with company standards. (2.2)

Assessor/ verifier name: _____ Signature: _____ Date: _____

- All apprentice's explanations, descriptions, and activities complied with current legislation, including the Canadian Electrical Code, WorkSafeBC or other applicable regulations, and industry practice.

Assessor/ verifier name: _____ Signature: _____ Date: _____

Note: if simulation was used for any of the tasks, attach a brief description of the exercise to this competency.

Additional Supporting Evidence

(To be completed by the apprentice and signed by the assessor)

Describe what workplace records are available to verify you performed this work.

Describe where a moderator can locate these records to verify your work when doing a quality check.

Name and describe the CEC rules required when you performed these tasks.

Name applicable manufacturer guidelines that were followed when doing these tasks.

Apprentice Signature: _____ *Date:* _____

Assessor Signature: _____ *Date:* _____

Additional Questions

Attach written notes of any additional questions asked of the apprentice and answers given. Ensure they are signed and dated by both the apprentice and assessor.

SPECIFICATION

People credited with this standard are able to:

- **Select, install and maintain power generator protective relays to applicable code and manufacturer guidelines.**

Credit 9

Prerequisite

Competency Standard IE160-4TC, Demonstrate knowledge of power generation equipment.

Assessment

For assessment purposes, all explanations, descriptions, and activities must comply with current legislation, including the Canadian Electrical Code, WorkSafeBC or other applicable regulations, and industry practice.

Quality Assurance

Any assessor assessing against this competency standard must be a qualified electrician.

References

The Canadian Electrical Code, Part I, Canadian Standards Association, most current edition (CEC)
WorkSafeBC Occupational Health and Safety (OHS) regulations.

Task 1: Select appropriate protective relays and install to CEC rules and manufacturer specifications in accordance with industry practice.

Task 2: Maintain protective relays to CEC rules and manufacturer specifications.

This unit relates to the following competency number and topic in the provincial OAC and Program Outline:

P8 *Install and maintain power generator protective relays*

Task 1: Select appropriate protective relays and install to CEC rules and manufacturer specifications in accordance with industry practice.

Protective relay installation

Outline the main details about a power generation control system that you have installed. Include: (1.1)

- the relevant CEC rules
- system manufacturer, type and specification
- manuals (specification and operation) references used
- safety codes and procedures.

Apprentice Diary – Selection and Installation (1.2)

Date/s	<p>Description of selection and installation of protective relays: This may be for example a protective relay for a diesel powered generator. Include details of job and installations dates, reference to equipment specifications and explain any choices you have made.</p> <p>Installation may include:</p> <ul style="list-style-type: none"> • set up electronic load sharing controls • set up speed controls • voltage regulator static set up • program equipment parameters • reverse power relay settings.

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Provide details of documentation developed to support the installation (in accordance with company standards) (1.3)

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Assessor Checklist

I verify the apprentice is able to perform the following task(s) to the standard outlined and attest to his/her competence.

- Selected equipment and prepared for the installation of protective relays for primary power supplies. (1.1)
Assessor/ verifier name: _____ *Signature:* _____ *Date:* _____
- Installed protective relays for primary power supplies in accordance with industry practice. (1.2)
Assessor/ verifier name: _____ *Signature:* _____ *Date:* _____
- Documented the installation in accordance with company standards. (1.3)
Assessor/ verifier name: _____ *Signature:* _____ *Date:* _____
- All apprentice's explanations, descriptions, and activities complied with current legislation, including the Canadian Electrical Code, WorkSafeBC or other applicable regulations, and industry practice.
Assessor/ verifier name: _____ *Signature:* _____ *Date:* _____

Note: if simulation was used for any of the tasks, attach a brief description of the exercise to this competency.

Task 2: Maintain protective relays to CEC rules and manufacturer specifications.

Apprentice Diary – Maintenance

(2.1)

Date/s	Provide details of maintenance completed and applicable dates and specifications. Explain any choices you have made. Maintenance must include: <ul style="list-style-type: none"> • error codes and messages • bench test synchronizers • synchronizer dynamic adjustments • voltage regulator adjustment • ramp time • current transformer phasing • load gain adjustment.

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Provide details of documentation completed to record maintenance: (2.2)

Assessor Checklist

I verify the apprentice is able to perform the following task(s) to the standard outlined and attest to his/her competence.

- Maintained protective relays in accordance with industry practice: (2.1)
 - error codes and messages were interpreted
 - synchronizers were bench tested
 - synchronizer dynamic adjustments were carried out
 - voltage regulator was adjusted
 - ramp time OK
 - current transformer phasing OK
 - load gain adjustment OK.

Assessor/ verifier name: _____ Signature: _____ Date: _____

- Documented maintenance in accordance with company standards. (2.2)

Assessor/ verifier name: _____ Signature: _____ Date: _____

- All apprentice's explanations, descriptions, and activities complied with current legislation, including the Canadian Electrical Code, WorkSafeBC or other applicable regulations, and industry practice.

Assessor/ verifier name: _____ Signature: _____ Date: _____

Note: if simulation was used for any of the tasks, attach a brief description of the exercise to this competency.

Additional Supporting Evidence

(To be completed by the apprentice and signed by the assessor)

Describe what workplace records are available to verify you performed this work.

Describe where a moderator can locate these records to verify your work when doing a quality check.

Name and describe the CEC rules required when you performed these tasks.

Name applicable manufacturer guidelines that were followed when doing these tasks.

Apprentice Signature: _____ *Date:* _____

Assessor Signature: _____ *Date:* _____

Additional Questions

Attach written notes of any additional questions asked of the apprentice and answers given. Ensure they are signed and dated by both the apprentice and assessor.

SPECIFICATION

People credited with this standard are able to:

- **Install and maintain process control hardware in accordance with CEC rules and manufacturer specifications.**

Credit 3**Prerequisite**

Competency Standard IE168-4TC, Demonstrate knowledge of control systems.

Assessment

For assessment purposes, all explanations, descriptions, and activities must comply with current legislation, including the Canadian Electrical Code, WorkSafeBC or other applicable regulations, and industry practice.

Quality Assurance

Any assessor assessing against this competency standard must be a qualified electrician.

References

The Canadian Electrical Code, Part I, Canadian Standards Association, most current edition (CEC), WorkSafeBC Occupational Health and Safety (OHS) regulations.

Definitions

PLC – programmable logic controller

Process control hardware – equipment used to regulate and control electronic systems such as input devices (sensors etc), processing devices (PLCs) and associated power supplies and related hardware.

Task 1: Install process control sensors, hardware and controllers to CEC rules and equipment manufacturer specifications.

Task 2: Maintain process control sensors, hardware and controllers to equipment manufacturer specifications and company standards.

This unit relates to the following competency number and topic in the provincial OAC and Program Outline:

Q3 *Install and maintain process control hardware*

Task 1: Install process control sensors, hardware and controllers to CEC rules and equipment manufacturer specifications

Outline the specification of the control hardware to be installed.

Include details (or reference to details) of:

(1.1)

- electronics power supplies
- voltage and current calibration
- controller tuning parameters, such as proportional band, gain, reset, derivative etc
- quarter decay
- installation specifications.

Apprentice Diary - Installation

May include:

- install and maintain process control hardware and software on a pressurized pneumatic plywood machine
- adjust for best function and document a preventative maintenance schedule for the controllers.

Note: re-installing may be used to assess competency on installing as long as all required installation aspects are demonstrated.

(1.2)

Date/s	Description of sensor and controller installation work done. Include reference to dates and the following points, and explain any choices you have made: <ul style="list-style-type: none"> • sensor types • location • control logic • PLC routines • load change during tuning • optimum control/minimum oscillation • testing

What documentation was prepared to record the installation – according to standard practice in your workplace? (1.3)

Assessor Checklist

I verify the apprentice is able to perform the following task(s) to the standard outlined and attest to his/her competence.

- Apprentice prepared for installation of process controllers including observing the following installation factors: (1.1)
 - electronics power supplies
 - voltage and current calibration
 - controller tuning parameters, such as proportional band, gain, reset, derivative etc.
 - installation specifications.

Assessor/ verifier name: _____ Signature: _____ Date: _____

- Apprentice installed process control sensors and controllers in accordance with industry practice including observing the following factors: (1.2)
 - sensor types
 - location
 - control logic
 - PLC routines
 - load change during tuning
 - optimum control/minimum oscillation
 - testing.

Note: re-installing may be used to assess competency on installing as long as all required installation aspects are demonstrated.

Assessor/ verifier name: _____ Signature: _____ Date: _____

- Installation was documented in accordance with company standards. (1.3)

Assessor/ verifier name: _____ Signature: _____ Date: _____

- All apprentice's explanations, descriptions, and activities complied with current legislation, including the Canadian Electrical Code, WorkSafeBC or other applicable regulations, and industry practice.

Assessor/ verifier name: _____ Signature: _____ Date: _____

Note: if simulation was used for any of the tasks, attach a brief description of the exercise to this competency.

Apprentice Diary – Maintenance

(2.1)

Date/s	Description of maintenance work done. Include reference to dates and the following points, and explain any choices you have made: <ul style="list-style-type: none"> • analyze faults using software • adjust control parameters • logic tests • access manufacturer specifications and service manuals • maintenance schedules.

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What documentation was prepared to support the installation? (2.2)

Assessor Checklist

I verify the apprentice is able to perform the following task(s) to the standard outlined and attest to his/her competence.

- Apprentice maintained process controls including observing the following factors: (2.1)
 - analyze faults using software
 - adjust control parameters
 - logic tests
 - access manufacturer specifications and service manuals
 - maintenance schedules.

Assessor/ verifier name: _____ Signature: _____ Date: _____

- Maintenance was documented in accordance with company standards. (2.2)

Assessor/ verifier name: _____ Signature: _____ Date: _____

- All apprentice's explanations, descriptions, and activities complied with current legislation, including the Canadian Electrical Code, WorkSafeBC or other applicable regulations, and industry practice.

Assessor/ verifier name: _____ Signature: _____ Date: _____

Note: if simulation was used for any of the tasks, attach a brief description of the exercise to this competency.

Additional Supporting Evidence

(To be completed by the apprentice and signed by the assessor)

Describe what workplace records are available to verify you performed this work.

Describe where a moderator can locate these records to verify your work when doing a quality check.

Name and describe the CEC rules required when you performed these tasks.

Name applicable manufacturer guidelines that were followed when doing these tasks.

Apprentice Signature: _____ *Date:* _____

Assessor Signature: _____ *Date:* _____

Additional Questions

Attach written notes of any additional questions asked of the apprentice and answers given. Ensure they are signed and dated by both the apprentice and assessor.

SPECIFICATION

People credited with this standard are able to:

- **Install and maintain variable frequency drives (VFD) to appropriate CEC codes, guidelines and standards.**

Credit 7**Prerequisite**

Competency Standard IE178-4TC, Demonstrate knowledge of variable speed drives (VSD) and starting systems.

Assessment

For assessment purposes, all explanations, descriptions, and activities must comply with current legislation, including the Canadian Electrical Code, WorkSafeBC or other applicable regulations, and industry practice.

Quality Assurance

Any assessor assessing against this competency standard must be a qualified electrician.

References

The Canadian Electrical Code, Part I, Canadian Standards Association, most current edition (CEC), WorkSafeBC Occupational Health and Safety (OHS) regulations.

Definitions

Properly – to CEC rules and in a manner that complies with WorkSafeBC regulations.

Task 1: Install VFD drive systems and related controls to CEC rules and manufacturer specifications.

Task 2: Maintain VFD drive systems and related controls to CEC rules and manufacturer specifications.

This unit relates to the following competency number and topic in the provincial OAC and Program Outline:

J6 Install and maintain variable frequency drives (VFD)

Task 1: Install VFD drive systems and related controls to CEC rules and manufacturer specifications.

Provide details of the drive and specifications/installation manuals used for installation, include: (1.1, 1.2)

- control parameters
- frequency and motor speed
- ramping speed vs. time
- soft start
- VFD self tune
- controller/PC interface
- explain any choices you have made.

Note: re-installing may be used to assess competency on installing as long as all installation considerations are demonstrated.

Apprentice Diary – Drive system installation **(1.2)**

Date/s	Diary of drive system installation. Include dates and details of installation and explain any choices you have made.

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Documentation of installation

What documentation was prepared to record the installation – according to standard practice in your workplace? (1.3)

Assessor Checklist

I verify the apprentice is able to perform the following task(s) to the standard outlined and attest to his/her competence.

Install VFD drive systems and related controls to CEC rules and manufacturer specifications.

- Prepared for installation of drive systems: (1.1)
 - located and checked specification and technical installation information.
- Installed and set up drive systems: (1.2)
 - control parameters were determined
 - frequency and motor speed were checked
 - ramping speed vs. time was checked/determined
 - soft start was checked/set up
 - VFD self tune performed correctly
 - interface between controller and pc operated correctly.

Note: re-installing may be used to assess competency on installing as long as all installation considerations are demonstrated.

- Installation was documented in accordance with company procedures. (1.3)
- All apprentice’s explanations, descriptions, and activities complied with current legislation, including the Canadian Electrical Code, WorkSafeBC or other applicable regulations, and industry practice.

Assessor/ verifier name: _____ Signature: _____ Date: _____

Note: if simulation was used for any of the tasks, attach a brief description of the exercise to this competency.

Task 2: Maintain VFD drive systems and related controls to CEC rules and manufacturer specifications.

Apprentice Diary

(2.1)

Date/s	Diary of drive system maintenance. Include dates and details of maintenance and explain any choices you have made. <i>(the assessor observation section of this assessment includes the range of maintenance aspects that should be covered)</i>

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Documentation of maintenance

- What documentation was prepared to record the maintenance – according to standard practice in your workplace (2.2)

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Assessor Checklist

I verify the apprentice is able to perform the following task(s) to the standard outlined and attest to his/her competence.

- Drive systems were properly maintained: (2.1)
- diagnostic tools were used
 - PC interface and analysis established condition of VFD
 - operation and specification information was accessed/interpreted.

Assessor/ verifier name: _____ Signature: _____ Date: _____

- Maintenance was documented correctly – according to standard company practice. (2.2)

Assessor/ verifier name: _____ Signature: _____ Date: _____

- All apprentice's explanations, descriptions, and activities complied with current legislation, including the Canadian Electrical Code, WorkSafeBC or other applicable regulations, and industry practice.

Assessor/ verifier name: _____ Signature: _____ Date: _____

Note: if simulation was used for any of the tasks, attach a brief description of the exercise to this competency.

Additional Supporting Evidence

(To be completed by the apprentice and signed by the assessor)

Describe what workplace records are available to verify you performed this work.

Describe where a moderator can locate these records to verify your work when doing a quality check.

Name and describe the CEC rules required when you performed these tasks.

Name applicable manufacturer guidelines that were followed when doing these tasks.

Apprentice Signature: _____ *Date:* _____

Assessor Signature: _____ *Date:* _____

Additional Questions

Attach written notes of any additional questions asked of the apprentice and answers given. Ensure they are signed and dated by both the apprentice and assessor.

SPECIFICATION

People credited with this standard are able to:

- **Install and maintain a UPS system in a common application. The UPS must be wired in accordance with CEC rules and equipment manufacturer specifications.**

Credit 4**Prerequisite**

Competency Standard IE181-4TC, Demonstrate knowledge of back up power equipment, UPS, battery banks and battery charging systems.

Assessment

For assessment purposes, all explanations, descriptions, and activities must comply with current legislation, including the Canadian Electrical Code, WorkSafeBC or other applicable regulations, and industry practice.

Quality Assurance

Any assessor assessing against this competency standard must be a qualified electrician.

References

The Canadian Electrical Code, Part I, Canadian Standards Association, most current edition (CEC)
WorkSafeBC Occupational Health and Safety (OHS) regulations

Definitions

UPS – uninterruptible power supply.

Task 1: Install a UPS system in a common application wired to CEC rules in accordance with equipment manufacturer specifications.

Task 2: Maintain a UPS system in a common application wired to CEC rules in accordance with equipment manufacturer specifications.

This unit relates to the following competency number and topic in the provincial OAC and Program Outline:

O3 *Install and maintain a UPS system*

Task 1: Install a UPS system in a common application wired to CEC rules in accordance with equipment manufacturer specifications.

Outline the following details about the planned installation: (1.1)

- equipment manufacturer specifications
- applicable CEC rules
- range of reference drawings and schematics
- system design details including installation and security

Apprentice Diary – UPS installation (1.2)

Date/s	Description of installation work done. Explain any choices you have made and include: <ul style="list-style-type: none"> • security of connection of UPS • wiring, bonding and shielding details • setting of transfer switch • setting of alarms • setting of operating parameters with reference to distribution circuit standards • drawings and schematics interpreted for the information • electronic components.

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What documentation has been prepared to support the installation of the UPS? (1.3)

Assessor Checklist

I verify the apprentice is able to perform the following task(s) to the standard outlined and attest to his/her competence.

- Prepared to install a UPS system: (1.1)
 - security of installation determined
 - drawings and schematics were interpreted to plan the installation
 - manufacturer specifications were interpreted to plan installation.

Assessor/ verifier name: _____ Signature: _____ Date: _____

- UPS was installed in accordance with industry practice: (1.2)
 - installation was secure
 - wiring, bonding and shielding was done to spec and rules
 - transfer switch was set correctly to spec
 - alarms were set to spec
 - operating parameters were set with reference to distribution circuit standards.

Assessor/ verifier name: _____ Signature: _____ Date: _____

- Installation was documented in accordance with company standards: (1.3)
 - drawings and schematics were updated to “as built”

Assessor/ verifier name: _____ Signature: _____ Date: _____

- All apprentice’s explanations, descriptions, and activities complied with current legislation, including the Canadian Electrical Code, WorkSafeBC or other applicable regulations, and industry practice.

Assessor/ verifier name: _____ Signature: _____ Date: _____

Note: if simulation was used for any of the tasks, attach a brief description of the exercise to this competency.

Task 2: Maintain a UPS system in a common application wired to CEC rules in accordance with equipment manufacturer specifications.

Apprentice Diary – UPS maintenance

(2.1)

Date/s	Provide details of UPS maintenance, explain any choices you have made and include reference to the following aspects: <ul style="list-style-type: none"> • security check • wiring, bonding and shielding check • check/test transfer switch • check alarms • check operating parameters with reference to distribution circuit standards • electronic components.

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Provide details of documentation completed to support the maintenance (2.2)

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Assessor Checklist

I verify the apprentice is able to perform the following task(s) to the standard outlined and attest to his/her competence.

- Apprentice maintained a UPS system in accordance with industry practice: (2.1)
 - security of UPS was checked
 - wiring bonding and shielding was checked
 - transfer switch was checked
 - alarms were checked
 - operating parameters were checked with reference to distribution circuit standards
 - electronic components of UPS were checked in accordance with manufacturer specs.

Assessor/ verifier name: _____ Signature: _____ Date: _____

- UPS maintenance was documented in accordance with company standards. (2.2)

Assessor/ verifier name: _____ Signature: _____ Date: _____

- All apprentice's explanations, descriptions, and activities complied with current legislation, including the Canadian Electrical Code, WorkSafeBC or other applicable regulations, and industry practice.

Assessor/ verifier name: _____ Signature: _____ Date: _____

Note: if simulation was used for any of the tasks, attach a brief description of the exercise to this competency.

Additional Supporting Evidence

(To be completed by the apprentice and signed by the assessor)

Describe what workplace records are available to verify you performed this work.

Describe where a moderator can locate these records to verify your work when doing a quality check.

Name and describe the CEC rules required when you performed these tasks.

Name applicable manufacturer guidelines that were followed when doing these tasks.

Apprentice Signature: _____ *Date:* _____

Assessor Signature: _____ *Date:* _____

Additional Questions

Attach written notes of any additional questions asked of the apprentice and answers given. Ensure they are signed and dated by both the apprentice and assessor.

SPECIFICATION

People credited with this standard are able to:

- **Select, install and maintain batteries that supply emergency or operating power.**

Credit 3**Prerequisite**

Competency Standard IE181-4TC, Demonstrate knowledge of back-up power equipment, UPS, battery banks and battery charging systems.

Assessment

For assessment purposes, all explanations, descriptions, and activities must comply with current legislation, including the Canadian Electrical Code, WorkSafeBC or other applicable regulations, and industry practice.

Quality Assurance

Any assessor assessing against this competency standard must be a qualified electrician.

References

The Canadian Electrical Code, Part I, Canadian Standards Association, most current edition (CEC)
WorkSafeBC Occupational Health and Safety (OHS) regulations.

Task 1: Select and install batteries in accordance with CEC rules and manufacturer specifications.

Task 2: Maintain batteries in accordance with CEC rules and manufacturer specifications.

This unit relates to the following competency number and topic in the provincial OAC and Program Outline:

O4 Install and maintain batteries

Task 1: Select and install batteries in accordance with CEC rules and manufacturer specifications.

Provide background details about the battery installation and selection of batteries that you are using for your assessment event (include relevant CEC rules etc). (1.1)

Apprentice Diary – Battery Installation (1.1)

Date/s	Provide details and dates of activities carried out when installing batteries. Explain any choices you have made and include the following: <ul style="list-style-type: none"> • off gassing hazards • charge holding characteristics • load and recharge rate • wiring and grounding • CEC rules for mounting and connection of batteries • program charge regime.

What documentation, in accordance with company standards, has been prepared to support the installation? (1.2)

Battery maintenance plan – for installation above: Outline the maintenance requirements of the installation including: (1.3)

- monitoring intervals
- electrolyte and specific gravity testing
- voltage testing.

Assessor Checklist

I verify the apprentice is able to perform the following task(s) to the standard outlined and attest to his/her competence.

- Batteries are selected and installed in accordance with industry practice: (1.1)
- off gassing hazards are accounted for
 - charge holding characteristics are accounted for
 - load and recharge rate are calculated and appropriate to the installation
 - wiring and grounding is carried out to industry standards and CEC rules
 - CEC rules for mounting and connection of batteries are followed
 - program charge regime.

Assessor/ verifier name: _____ Signature: _____ Date: _____

- Installation is documented in accordance with company standards. (1.2)

Assessor/ verifier name: _____ Signature: _____ Date: _____

- Battery maintenance plan for above installation is developed: (1.3)
- electrolyte and specific gravity testing is included in plan
 - voltage testing is included in plan.

Assessor/ verifier name: _____ Signature: _____ Date: _____

- All apprentice’s explanations, descriptions, and activities complied with current legislation, including the Canadian Electrical Code, WorkSafeBC or other applicable regulations, and industry practice.

Assessor/ verifier name: _____ Signature: _____ Date: _____

Note: if simulation was used for any of the tasks, attach a brief description of the exercise to this competency.

Task 2: Maintain batteries in accordance with CEC rules and manufacturer specifications.

Apprentice Diary – Battery maintenance

(2.1)

Date/s	<p>Provide details and dates of maintenance activities. Explain any choices you have made and include:</p> <ul style="list-style-type: none"> • electrolyte and specific gravity testing • equalization • float charging • testing voltages and characteristics of battery types • replace batteries and cells • maintenance schedule details.

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What documentation, in accordance with company standards, has been prepared to support the maintenance? (2.2)

Assessor Checklist

I verify the apprentice is able to perform the following task(s) to the standard outlined and attest to his/her competence.

- Batteries were maintained in accordance with industry practice: (2.1)
 - level and specific gravity of electrolyte was tested
 - equalization of batteries was carried out
 - float charging was done to maintain full charge
 - battery voltage tested to determine information about battery condition
 - batteries/cells replaced
 - maintenance was carried out in accordance with maintenance schedule.

Assessor/ verifier name: _____ Signature: _____ Date: _____

- Maintenance was documented in accordance with company standards. (2.2)

Assessor/ verifier name: _____ Signature: _____ Date: _____

- All apprentice's explanations, descriptions, and activities complied with current legislation, including the Canadian Electrical Code, WorkSafeBC or other applicable regulations, and industry practice.

Assessor/ verifier name: _____ Signature: _____ Date: _____

Note: if simulation was used for any of the tasks, attach a brief description of the exercise to this competency.

Additional Supporting Evidence

(To be completed by the apprentice and signed by the assessor)

Describe what workplace records are available to verify you performed this work.

Describe where a moderator can locate these records to verify your work when doing a quality check.

Name and describe the CEC rules required when you performed these tasks.

Name applicable manufacturer guidelines that were followed when doing these tasks.

Apprentice Signature: _____ *Date:* _____

Assessor Signature: _____ *Date:* _____

Additional Questions

Attach written notes of any additional questions asked of the apprentice and answers given. Ensure they are signed and dated by both the apprentice and assessor.

SPECIFICATION

People credited with this standard are able to:

- **Demonstrate knowledge of the theory of detection and alarm, fire, security systems and video monitoring systems.**

Credit 3**Assessment**

For assessment purposes, all explanations, descriptions, and activities must comply with current legislation, including the Canadian Electrical Code, WorkSafeBC or other applicable regulations, and industry practice.

Quality Assurance

Any assessor assessing against this competency standard must be a qualified electrician.

References

The Canadian Electrical Code, Part I, Canadian Standards Association, most current edition (CEC)
WorkSafeBC Occupational Health and Safety (OHS) regulations.

Definitions

CRT – Cathode ray tube

LCD – Liquid crystal display

Task 1: Describe the installation of alarm systems

This unit relates to the following competency number and topic in the provincial OAC and Program Outline:

Q4 Install and maintain signal, communication and alarm systems

Task 1: Describe the installation of alarm systems

Apprentice Diary – Types and characteristics of detection and alarm circuits

(1.1)

Date/s	Record dates, types and characteristics of detection and alarm circuits that you have worked on.

Describe types and characteristics of detection and alarm circuits. Must include: (1.1)

- Fire
- Smoke
- Heat
- Motion
- Intrusion
- Oil
- Vibration
- Air and water quality

Apprentice Diary – Installation of alarm systems

(1.1)

Date/s	<p>Describe alarm system installation and related CEC rules.</p> <p>Must include:.</p> <ul style="list-style-type: none"> • alarm circuitry characteristics • alarm history and data storage • supervisory currents • horns • strobes • printers • dialers and lights • end of line resistors • fail safe logic • calibration and verification techniques for correct detection target • correct placement of sensors/monitors • test alarm points through to final annunciation • ambient temperature and humidity

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Assessor Checklist

I verify the apprentice is able to perform the following task(s) to the standard outlined and attest to his/her competence.

- Describe types and characteristics of detection and alarm circuits. Must include: (1.1)
 - Smoke
 - Heat
 - Motion
 - Intrusion
 - Oil
 - Vibration
 - Air and water quality

Assessor/ verifier name: _____ Signature: _____ Date: _____

- Describe alarm system installation and related CEC rules. Must include: 1.2)
 - alarm circuitry characteristics
 - alarm history and data storage
 - supervisory currents
 - horns
 - strobes
 - printers
 - dialers and lights
 - end of line resistors
 - fail safe logic
 - calibration and verification techniques for correct detection target
 - correct placement of sensors/monitors
 - test alarm points through to final annunciation
 - ambient temperature and humidity

Assessor/ verifier name: _____ Signature: _____ Date: _____

- All apprentice's explanations, descriptions, and activities complied with current legislation, including the Canadian Electrical Code, WorkSafeBC or other applicable regulations, and industry practice.

Assessor/ verifier name: _____ Signature: _____ Date: _____

Note: if simulation was used for any of the tasks, attach a brief description of the exercise to this competency.

Additional Supporting Evidence

(To be completed by the apprentice and signed by the assessor)

Describe what workplace records are available to verify you performed this work.

Describe where a moderator can locate these records to verify your work when doing a quality check.

Name and describe the CEC rules required when you performed these tasks.

Name applicable manufacturer guidelines that were followed when doing these tasks.

Apprentice Signature: _____ *Date:* _____

Assessor Signature: _____ *Date:* _____

Additional Questions

Attach written notes of any additional questions asked of the apprentice and answers given. Ensure they are signed and dated by both the apprentice and assessor.

SPECIFICATION

People credited with this standard are able to:

- **Install and maintain detection and alarm systems in accordance with CEC rules, application requirements and manufacturer specifications.**

Credit 9**Prerequisite**

Competency Standard IE185-4TC, Demonstrate knowledge of safety and security systems.

Assessment

For assessment purposes, all explanations, descriptions, and activities must comply with current legislation, including the Canadian Electrical Code, WorkSafeBC or other applicable regulations, and industry practice.

Quality Assurance

Any assessor assessing against this competency standard must be a qualified electrician.

References

The Canadian Electrical Code, Part I, Canadian Standards Association, most current edition (CEC)
WorkSafeBC Occupational Health and Safety (OHS) regulations.

Task 1: Install an alarm system in accordance with industry practice and CEC rules.

Task 2: Maintain detection and alarm circuits in accordance with industry practice.

This unit relates to the following competency number and topic in the provincial OAC and Program Outline:

Q4 Install and maintain signal, communication and alarm systems

Task 1: Install an alarm system in accordance with industry practice and CEC rules.

Identify the planned system design/specification – include relevant CEC rules, and documentation/ drawings that you will be using for reference:

- may include details about
- alarm circuitry characteristics
- supervisory currents
- horns
- strobes
- printers
- diallers and lights
- end of line resistors
- fail safe logic.

(1.1)

Apprentice Diary – Alarm installation

(1.1)

Date/s	Provide details and dates of installation. Explain any choices you have made.

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Describe the alarm programming process.

(1.2)

Describe the testing and verification process.

(1.3)

Identify/describe the documentation prepared to support the installation.

(1.4)

Assessor Checklist

I verify the apprentice is able to perform the following task(s) to the standard outlined and attest to his/her competence.

- Apprentice installed detection and alarm circuits. (1.1)
Assessor/ verifier name: _____ *Signature:* _____ *Date:* _____
- Alarm parameters programmed to perform to specification. (1.2)
Assessor/ verifier name: _____ *Signature:* _____ *Date:* _____
- Alarm installation tested and verified to CEC rules and specs. (1.3)
Assessor/ verifier name: _____ *Signature:* _____ *Date:* _____
- Installation was documented to company standards. (1.4)
- All apprentice's explanations, descriptions, and activities complied with current legislation, including the Canadian Electrical Code, WorkSafeBC or other applicable regulations, and industry practice. (1.4)
Assessor/ verifier name: _____ *Signature:* _____ *Date:* _____

Note: if simulation was used for any of the tasks, attach a brief description of the exercise to this competency.

Task 2: Maintain detection and alarm circuits in accordance with industry practice.

Describe a maintenance regime for an alarm circuit and sensors that you have established.

Outline the details of (or attach) a maintenance regime that you have developed (you may prepare a suitable maintenance regime for the installation done in task):

(2.1)

Apprentice Diary – Maintenance

(2.2)

Date/s	<p>Provide details and dates of maintenance carried out. Explain any choices you have made. Some of the maintained components may include the following:</p> <ul style="list-style-type: none"> • alarm circuitry characteristics • supervisory currents • horns • strobes • printers • diallers and lights • end of line resistors • fail safe logic • calibration and verification techniques for correct detection target • correct placement of sensors/ monitors • test alarm points through to final annunciation • maintenance schedules.

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What documentation has been prepared to support the maintenance? (2.3)

Assessor Checklist

I verify the apprentice is able to perform the following task(s) to the standard outlined and attest to his/her competence.

- A preventative maintenance regime developed for the alarm circuit and sensors. (2.1)
Assessor/ verifier name: _____ *Signature:* _____ *Date:* _____
- Detection and alarm circuits maintained to meet CEC rules and industry practice. (2.2)
Assessor/ verifier name: _____ *Signature:* _____ *Date:* _____
- Maintenance was documented in accordance with company standards. (2.3)
Assessor/ verifier name: _____ *Signature:* _____ *Date:* _____
- All apprentice's explanations, descriptions, and activities complied with current legislation, including the Canadian Electrical Code, WorkSafeBC or other applicable regulations, and industry practice.
Assessor/ verifier name: _____ *Signature:* _____ *Date:* _____

Note: if simulation was used for any of the tasks, attach a brief description of the exercise to this competency.

Additional Supporting Evidence

(To be completed by the apprentice and signed by the assessor)

Describe what workplace records are available to verify you performed this work.

Describe where a moderator can locate these records to verify your work when doing a quality check.

Name and describe the CEC rules required when you performed these tasks.

Name applicable manufacturer guidelines that were followed when doing these tasks.

Apprentice Signature: _____ *Date:* _____

Assessor Signature: _____ *Date:* _____

Additional Questions

Attach written notes of any additional questions asked of the apprentice and answers given. Ensure they are signed and dated by both the apprentice and assessor.