Power Protection and Control Technicians and Technologists

Profile Outline

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About the Electricity Sector Council

Approximately 100,000 Canadians are involved in the generation, transmission and distribution of one of our country's essential utilities: electricity. Their work powers homes and businesses across the country, fuelling everything from light bulbs, cell phones and refrigerators to water treatment plants and road vehicle assembly lines.

The Electricity Sector Council provides support to this dedicated team by working with industry employers and other stakeholders to research and resolve human resource and workplace development issues.

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Disclaimer: Please note that some of the tasks detailed in this document will require the services of a registered tradesperson depending upon the province of work. Provincial regulations change from time to time, employers and employees should consult your provincial appropriate licensing authority for clarification regarding which tasks may be affected. It is the responsibility of the individual employer/employee to ensure they act within the regulation for their jurisdiction.

Introduction

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

The most important Essential Skills for Power Protection and Control Technicians and Technologists are:

- Numeracy
- Thinking Skills – Problem Solving
- Computer Use

A. Reading Text

Reading Text refers to reading material that is in the form of sentences or paragraphs. *Reading Text* generally involves reading notes, letters, memos, manuals, specifications, regulations, books, reports or journals. *Reading Text* includes:

- forms and labels if they contain at least one paragraph;
- print and non-print media such as computer screen and microfiche text; and
- paragraph-length text within charts, tables and graphs.

The Reading Text Complexity Rating Scale ranges from Level 1 (least complex) to Level 5 (most complex). The typical text reading tasks of Power protection and control technicians and technologists are at Complexity Levels 1 to 3. Their most complex text reading tasks are at Complexity Level 3.

Examples

Power Protection and Control Technicians and Technologists:

- read lists. For example, Power Protection and Control Technicians and Technologists read lists of routine tests to complete when installing meters or relays. (1)

- read notes and memos. For example, power protection and control technicians and technologists may read notes and memos from their supervisors or training departments that outline upcoming training sessions and programs. (1)

- read e-mail messages on a variety of topics. For example, power protection and control technicians and technologists read messages from supervisors, co-workers and engineers that describe project progress, request information and notify them of changes to work orders. (2)

- read policies and procedures in manuals and handbooks. For example, power protection and control technicians and technologists read maintenance, functional and commissioning procedures to learn the steps required to complete tasks. (2)

- read technical reference books. For example, power protection and control technicians and technologists refer to training and reference books to determine how to correctly apply a particular protection philosophy to the work to be performed. (2)

- read reports. For example, Power Protection and Control Technicians and Technologists may read daily outage reports that provide a brief description of equipment taken out of service, as well as reports provided by various sources, such as IEEE, NERC, and the North American Power Council, that propose recommendations related to power protection and control work. (3)

- read manufacturers' manuals for various equipment, including relays and meters. For example, Power Protection and Control Technicians and Technologists read technical manuals when commissioning and troubleshooting relays and meters to ensure that they follow the correct steps when completing the work. (3)

Reading Text Summary

Type of Text	Purpose for Reading			
	To scan for specific information/ To locate information	To skim for overall meaning, to get the 'gist'.	To read the full text to understand or to learn.	To read the full text to critique or to evaluate.
Forms	✓	✓		
Labels	✓	✓		
Notes, Letters, Memos	✓	✓	✓	
Manuals, Specifications, Regulations	✓	✓	✓	
Reports, Books, Journals	✓	✓	✓	

B. Document Use

Document Use refers to tasks that involve a variety of information displays in which words, numbers, icons and other visual characteristics (e.g., line, colour, shape) are given meaning by their spatial arrangement. Workplace examples of documents include graphs, lists, tables, blueprints, schematics, drawings, signs and labels.

If a document includes a paragraph of text, as may be the case on a label or a completed form, it is also included in ***Reading Text***. Documents requiring the entry of words, phrases, sentences and paragraphs are also included in ***Writing***.

The Document Use Complexity Rating Scale ranges from Level 1 (least complex) to Level 5 (most complex). The typical document reading tasks of Power protection and control technicians and technologists are at Complexity Levels 1 to 4. Their most complex document reading tasks are at Complexity Level 4.

Examples

Power Protection and Control Technicians and Technologists:

- locate data on labels and tags. For example, power protection and control technicians and technologists review work permit tags on electrical equipment to verify when equipment had been isolated and by whom. They review labels on equipment to obtain operational and safety data. (1)

- locate data in signs. For example, power protection and control technicians and technologists refer to warning signs which describe mandatory personal protective equipment or alert of potential hazards. (1)

- locate data in sketches, pictures and icons. For example, power protection and control technicians and technologists interpret icons and data in supervisory control and data acquisition systems (SCADA) and remote terminal units (RTUs) to identify system disturbances on the display screens. (2)

- enter data into forms. For example, power protection and control technicians and technologists complete commissioning forms for work completed, adding quantitative data such as test readings, and briefly describing the work completed and any problems that were encountered. (2)

- locate data in completed forms. For example, they review tailboard conference forms when they arrive on-site to locate information about the work to be completed, the hazards identified, and the issues considered prior to beginning the work. (2)

- locate data in tables and schedules. For example, power protection and control technicians and technologists review equipment outage schedules within maintenance program systems to determine when particular pieces of equipment will be maintained. (2)

- interpret schematic drawings. For example, power protection and control technicians and technologists interpret manufacturers' drawings related to a particular system or piece of equipment to commission, troubleshoot or change a circuit. (2)

- interpret drawings of electrical systems to understand their operation. For example, power protection and control technicians and technologists interpret drawings of control circuits to determine where power is flowing, where voltage and currents are located, and how an action creates a particular reaction to determine the overall operation of the protection relaying system. (3)

- complete field marks on prints. For example, power protection and control technicians and technologists make field marks on existing prints to be reviewed by the drafting department to reflect changes resulting from new installations and upgrades. (3)

- draw common shapes on phaser diagrams. For example, power protection and control technicians and technologists illustrate phase circuits on phaser diagrams by drawing shapes, including circles and squares, to represent elements within the electrical system. (3)

- recognize common angles on diagrams and drawings. For example, they recognize and interpret angles on phaser diagrams to review setting angles in preparation for conducting fault analyses or installing PTs and phase shifting transformers. (3)

- locate data and trends in graphs. For example, power protection and control technicians and technologists interpret the waveforms of voltages and currents on graphs to identify operating capacities and potential malfunctions of relays and other equipment. (4)

Examples of Creating Documents

Power Protection and Control Technicians and Technologists:

- create relay test sheets using macros and formulas to evaluate the functionality of the relay.

- create graphs that plot voltages over a period of time to use as a comparison to manufacturer's standards for acceptable performance of a relay.

- may create cable schedules to identify the types and sizes of wire and cables that need to be run to terminal ends and equipment.

- create tables and charts to gather, organize and analyze equipment test data for various parameters.

- may create schematic drawings for feeder protections, control schemes and telemetry installations.

Document Use Summary

Power Protection and Control Technicians and Technologists:

- Read signs, labels or lists.
- Complete forms by marking check boxes, recording numerical information or entering words, phrases, sentences or texts of a paragraph or more.
- Read completed forms containing check boxes, numerical entries, phrases, addresses, sentences or texts of a paragraph or more.
- Read tables, schedules or other table-like text.
- Create tables, schedules or other table-like text.
- Enter information on tables, schedules or other table-like text.
- Plot information on graphs (e.g., line, pie, and bar).
- Obtain specific information from graphs or charts.
- Interpret information on graphs or charts.
- Construct or draw graphs or charts.
- Recognize common angles such as 15º, 30º, 45º, and 90º.
- Draw, sketch or form common shapes such as circles, triangles, spheres, rectangles, squares, etc.
- Interpret scale drawings (e.g., blueprints or maps).
- Read assembly drawings (e.g., those found in service and parts manuals.
- Read schematic drawings (e.g., electrical schematics).
- Create schematic drawings.
- Make sketches.
- Obtain information from sketches, pictures or icons.

C. Writing

Writing includes:

- ***text writing and writing in documents such as filling in forms; and***
- ***non-***paper-based writing such as typing on a computer.

The Writing Complexity Rating Scale ranges from Level 1 (least complex) to Level 5 (most complex). The typical writing tasks of Power protection and control technicians and technologists are at Complexity Level 1 to 4. Their most complex writing tasks are at Complexity Level 4.

Examples

Power Protection and Control Technicians and Technologists:

- write job steps. For example, they outline and document the key steps required to complete a job to be referenced in the future by those completing the assigned task. (1)

- write e-mail messages to co-workers, colleagues and supervisors to request information or assistance, coordinate activities, describe problems encountered in the field, and respond to inquiries. (2)

- may write near-miss or incident reports. For example, they may describe in detail the events that led up to the near-miss or incident and what should be done in the future to prevent the incident from recurring. (2)

- complete entries in log books. For example, power protection and control technicians and technologists may write short descriptions of the work that they completed and what problems were encountered during their shifts. (2)

- write reports. For example, Power Protection and Control Technicians and Technologists write outage reports that describe the cause of the outage and recommendations for follow-up; commissioning reports that document how the job proceeded and areas for future improvement; and recommendation reports that put forth recommendations for the purchase of new equipment based on test results. These reports may be used to inform future decisions. (3)

- may write letters of justification for test equipment. For example, power protection and control technicians and technologists may write letters of approval for equipment over a certain dollar value to be sent to supervisors as justification. (3)

- may write procedures that describe to other workers exactly how complex job tasks should be performed. For example, Power Protection and Control Technicians and Technologists may write procedures for how to change the settings on a new piece of equipment by condensing the complex information presented in the manual into a 6-10 page document. (4)

- may write training materials. For example, power protection and control technicians and technologists may prepare course materials for procedures and processes to be delivered to new trainees. The training materials must present technical information in a way that can be easily understood by the learner. (4)

Writing Summary

Length	Purpose for Writing						
	To organize/to remember	To keep a record/to document	To inform/to request information	To persuade/to justify a request	To present an analysis or comparison	To present an evaluation or critique	To entertain
Texts requiring less than one paragraph of new text.	✓	✓					
Texts rarely requiring more than one paragraph		✓	✓				
Longer texts		✓	✓		✓	✓	

D. Numeracy Task

Numeracy refers to the use of numbers by workers and their requirement to think in quantitative terms in order to complete tasks.

Numerical Calculation is rated within four different application settings as specific knowledge of concepts or procedures are exclusive to each setting:

- ***Money Math*** - financial transactions, such as handling cash, preparing bills or making payments;
- ***Scheduling or Budgeting and Accounting Math*** - managing time and money as resources, planning and monitoring their use, assessing best value, reducing waste;
- ***Measurement and Calculation Math*** - measuring and describing the physical world; and,
- ***Data Analysis Math*** - analysis of numerical data such as extrapolation of information and determination of trends or statistically significant effects.

Numerical Calculation

The Numerical Calculation Rating Scale ranges from Level 1 (least complex) to Level 5 (most complex). The numerical calculation tasks of Power protection and control technicians and technologists involve:

- Money Math at Complexity Level 2.
- Scheduling or Budgeting and Accounting Math at Complexity Level 2.
- Measurement & Calculation Math at Complexity Levels 1 to 3.
- Data Analysis at Complexity Levels 2 to 3.

Examples

Power Protection and Control Technicians and Technologists:

- calculate amounts for expense account reimbursements. They calculate amounts for travel in personal vehicles using per kilometre rates. They may add amounts for per diem allowances and meals. (Money Math) (2)

- may prepare schedules. For example, they may work with their supervisors, foremen and managers to schedule the work activities of their departments. (Scheduling or Budgeting and Accounting Math) (2)

- measure physical properties using test equipment and gauges. For example, they may measure temperatures and pressures using gauges on equipment. (Measurement and Calculation Math) (1)

- calculate the percentage of error between “as found” and expected values. For example, they measure the “as found” readings for equipment, subtract the “as found” reading from the expected value, divide by the expected value, and multiply by 100 to determine the percentage of error. (Measurement and Calculation Math) (2)

- calculate amperages, voltages and resistances using Ohm's law. (Measurement and Calculation Math) (3)

- compare measurements and equipment readings to specifications. For example, power protection and control technicians and technologists test and record equipment pressures, temperatures and voltage levels on a variety of equipment and compare the data to standards and norms. They determine if the equipment is operating within an acceptable range and use their analyses to identify the need for recalibration, repair or replacement of the equipment. (Data Analysis Math) (2)

- analyze trends in quantitative data. For example, power protection and control technicians and technologists analyze temperature point data over a period of time as recorded by the SCADA system. They may analyze the data by creating graphs to identify anomalies and trends and to compare readings to standards. (Data Analysis Math) (3)

Math Skills Summary

a) Mathematical Foundations Used

Number Concepts	
Whole Numbers	Read and write; add or subtract; multiply or divide whole numbers. For example, reading values off of gauges; calculating distances travelled for expense claims.
Integers	Read and write; add or subtract; multiply or divide integers. For example, reading and writing temperatures; monitoring direction of power flow.
Rational Numbers – Fractions	Read and write; add or subtract fractions. For example, reading and writing sizes of parts in fractions of inches.
Rational Numbers - Decimals	Use decimals mainly to refer to dollars and cents. For example, interpreting readings expressed as decimals; preparing expense claim forms.
Rational Numbers - Percent	Read and write percents; calculate the percent one number is of another; calculate a percent of a number. For example, determining percentage of error on equipment during maintenance tests; reading percentage impedance, saturation and percent loading for transformers.
Equivalent Rational Numbers	Convert between decimals and percentages. For example, converting between percentages and decimals when reading pressure data on gauges.
Other Real Numbers	Use powers and roots; scientific notation; significant digits. For example, using significant digits when determining large generation outputs, such as megawatts; using complex numbers when conducting fault analyses.

Patterns and Relations	
Equations and Formulae	Solve problems by constructing and solving equations with one unknown. Use formulae by inserting quantities for variables and solving. Write, simplify and solve two variable algebraic problems. Write, simplify and solve quadratic equations. For example, inserting quantities into Ohm's Law formulae to calculate current, voltage and resistance; calculating kilowatt hours.
Use of Rate, Ratio and Proportion	Use a rate showing comparison between two quantities with different units. Use a ratio showing comparison

	between two quantities with the same units. For example, using ratios to express relative primary and secondary current values in amps (e.g., 400:5); using ratios to express MVA to voltage.
See Document Use for information on using scale drawings	

Shape and Spatial Sense	
Measurement Conversions	Perform measurement conversions. For example, converting pressure measurements in pounds per square inch to kilopascals.
Areas, Perimeters, Volumes	Calculate areas. Calculate perimeters. Calculate volumes. For example, calculating areas of relay room; calculating perimeters of stations; calculating volumes of chlorine and oil holding tanks.
Geometry	Use geometry. For example, calculating slopes for relays using the formula y= mx + b.
Trigonometry	Use trigonometry. For example, applying trigonometric equations when conducting power analyses and when calculating load readings and phase angles.
See Document Use for information on recognizing common angles and drawing, sketching and forming common forms and figures	

Statistics and Probability	
Summary Calculations	Calculate averages. Calculate rates other than percentages. Calculate proportions or ratios. For example, calculating average power and voltage readings over periods of time; calculating flow rates in kilowatt hours; calculating transformer ratio (e.g., primary turns to secondary turns)
Statistics and Probabilities	Use descriptive statistics (e.g., collecting, classifying, analyzing and interpreting data). For example, collecting and analyzing test data to determine operational trends.
See Document Use for information on using tables, schedules or other table-like text, using graphical presentations	

b) How Calculations Are Performed

- In their heads
- Using a pen and paper
- Using a calculator
- Using a computer

c) Measurement Instruments Used

- **Time** – For example, using clocks and watches.
- **Weight or mass** – For example, using scales.
- **Distance or dimension** – For example, using measuring wheels and tapes.
- **Liquid volume** – For example, using ultrasonic liquid level sensors.
- **Temperature** – For example, using thermometers and gauges
- **Pressure** – For example, using gauges.
- **Electrical Potential (Volt)** – For example, using voltmeters, polymeters and multimeters.
- **Wattage** – For example, using kilowatt meters.
- **Angles** – For example, using phase angle meters and polymeters
- **Amperage** – For example, using ammeters.
- **Insulation** – For example, using meggers.

They use the:

- System International (Metric) measuring system, and
- Imperial measuring system

E. Oral Communication

> ***Oral Communication*** pertains primarily to the use of speech to give and exchange thoughts and information.

The Oral Communication Complexity Rating Scale ranges from Level 1 (least complex) to Level 4 (most complex). The typical oral communication tasks of Power protection and control technicians and technologists are at Complexity Levels 1 to 3. Their most complex oral communication tasks are at Complexity Level 3.

Examples

Power Protection and Control Technicians and Technologists:

- discuss product malfunctions or technical questions with suppliers and manufacturers' representatives. (1)
- discuss ongoing work with co-workers. They communicate daily with their fellow technicians to provide updates on work to be completed, to gain advice and assistance when troubleshooting faults and to coordinate job tasks. (2)
- receive guidance and work orders from their supervisors and managers. They provide them with updates on job progress and discuss issues or problems that they are encountering with their work. (2)
- talk to customers and the public. For example, they may communicate with representatives from utilities to whom they are supplying power. They may also speak with telecommunications providers who lease their lines to discuss bonding and protection issues. (2)
- discuss potential hazards, barriers and special considerations to ensure safety on the job site during daily tailboard conference meetings with co-workers and colleagues prior to commencing work. (2)
- may facilitate training sessions. They may prepare and deliver training information to a group of technologists and trainees related to a new product or relay that will be put into use. (3)
- discuss matters such as the current status of projects, policy and procedure changes, health and safety hazards, and issues encountered with co-workers and supervisors at general project and safety meetings. They may be asked to present pertinent information as these meetings and to provide their insight and knowledge in solving problems and issues. (3)

- discuss technical aspects of work assignments with colleagues. For example, they may consult with system control personnel, electrical engineers, draftsmen, industrial electricians, telecommunications technicians, and power line technicians to discuss processes, procedures and standards and to coordinate work tasks. (3)

Modes of Communication Used

- **In person** – For example, discussing unexpected faults in equipment with fellow co-workers when troubleshooting.
- **Using a telephone** – For example, speaking with supervisors in another location by telephone to obtain information.
- **Using a two-way radio** – For example, speaking with co-workers in the field with two-way radios and walkie-talkies.
- **Using specialized communication signals** – For example, using hand signals in the field or in noisy environments.

Environmental Factors Affecting Communication

Some Power Protection and Control Technicians and Technologists are required to work in environments that require the use of ear protection which can limit their ability to hear their two-way radios and walkie-talkies.

Oral Communication Summary

Type	Purposes of Oral Communication (Part 1)					
	To greet	To take messages	To provide/ receive information, explanation, direction	To seek, obtain information	To co-ordinate work with that of others	To reassure, comfort
Interact with co-workers			✓	✓	✓	
Interact with supervisor/ manager			✓	✓	✓	
Interact with peers and colleagues from other organizations			✓	✓	✓	
Interact with customers/clients /public			✓		✓	
Interact with suppliers, servicers			✓			
Participate in group discussion			✓	✓	✓	
Present information to a small group			✓			

Type	Purposes of Oral Communication (Part 2)					
	To discuss (exchange information, opinions)	To persuade	To facilitate, animate	To instruct, instil under-standing, knowledge	To negotiate, resolve conflict	To entertain
Interact with co-workers	✓					
Interact with supervisor/ manager	✓					
Interact with peers and colleagues from other organizations	✓					
Interact with customers/clients/public	✓					
Interact with suppliers, servicers	✓					
Participate in group discussion	✓					
Present information to a small group	✓			✓		

F. Thinking Skills

Thinking Skills differentiate among five different types of cognitive functions. However, these functions are interconnected and include:

1. ***Problem Solving***
2. ***Decision Making***
3. ***Critical Thinking***
4. ***Job Task Planning and Organizing***
5. ***Significant Use of Memory***
6. ***Finding Information***

1. Problem Solving

> ***Problem solving*** involves problems that require solutions. For example, a mechanic solves problems, e.g., the car shakes when driven over 80 km./hr., by eliminating probable causes until the correct one is identified and remedied. Most problems concern mechanical challenges, people or situations.

The Problem Solving Complexity Rating Scale ranges from Level 1 (least complex) to Level 4 (most complex). The typical problem solving tasks of Power protection and control technicians and technologists are at Complexity Levels 2 to 3. Their most complex problem solving tasks are at Complexity Level 3.

Examples

Power Protection and Control Technicians and Technologists:

- may encounter issues with leased lines. For example, they are notified by an operator that communication has been lost on a line leased to a telecommunications company. They complete an end-to-end test of the line to verify the circuitry and to determine the source of the problem. If the problem lies within the jurisdiction of the telecommunications company, they will assist the company employees to troubleshoot the issue and restore communication across the lines. (2)

- detect design-related problems or inefficiencies. For example, when reviewing completed work, they may detect that a setting is incorrect for the application. They contact the engineering department to inform them of what the setting should be and gain approval to make the change. The changes made must be reflected on the “as-built” drawings. (2)

- encounter problems when commissioning equipment. For example, they may find that they are not obtaining the correct readings when commissioning a new relay. They review their procedures and refer to the manufacturers’ manuals to verify their processes. They may also discuss the issue with the engineering group and complete an internal inspection of the relay components to determine the cause of the problem, which could range from an inaccurate setting to an anomalous defect. (3)

- encounter equipment malfunctions that they are required to troubleshoot. For example, they receive calls that breakers or disconnects are not opening properly. They rely on their past experience to consider what could be causing the malfunction prior to arriving on site. Once on site, they communicate with the general control center to discuss the alarms shown and the sequence of events to determine which aspect of the circuitry to troubleshoot. They check the fuses, wiring and equipment components point-by-point to eliminate areas that are operational in an attempt to locate the source of the fault. (3)

2. Decision Making

> ***Decision making*** refers to making a choice among options.
>
> ***Decision making*** occurs during problem solving, but not all decision making is part of problem solving. It is, therefore, presented as a separate thinking skill. For example, buyers for retail outlets regularly make decisions about which suppliers to buy from, i.e., they select from the options for particular types of merchandise. This is not problem solving.

The Decision Making Complexity Rating Scale ranges from Level 1 (least complex) to Level 4 (most complex). The typical decision making tasks of Power protection and control technicians and technologists are at Complexity Levels 2 to 3. Their most complex decision making tasks are at Complexity Level 3.

Examples

Power Protection and Control Technicians and Technologists:

- decide in what sequence to complete commissioning procedures for a large system. They consider the work being completed by other working groups to determine what they can complete now and what tasks have to be deferred to a later time. (2)

- decide whether to repair a piece of faulty equipment or order a replacement part. They consider their knowledge of the piece of equipment, the availability of tools and equipment to repair the defect, and the time and costs associated with a repair versus a replacement. (2)

- decide to change work procedures. For example, they decide to revise or change the format or sequence of a work procedure that they feel is not formatted in a chronological order or logical sequence. They make these changes to improve worker efficiency and productivity without compromising worker safety. (2)

- may decide to recommend adjustments or changes to systems and equipment during the commissioning phase. For example, power protection and control technicians and technologists may decide to modify a system from the design drawing to ensure that the system operates at optimal efficiency. They must base their decisions on their knowledge and experience and ensure that the integrity of the system and the safety of others is not compromised. (3)

3. Critical Thinking

Critical Thinking is the process of evaluating ideas or information, using a rational, logical thought process, and referring to objective criteria, to reach a rational judgement about value, or to identify strengths and weaknesses.

Critical Thinking may be an element in other thinking skills. For example, judgement is sometimes required to evaluate the choices offered during the course of ***Decision Making*** and to evaluate solutions proposed as a result of ***Problem Solving***. In other cases, Critical Thinking is an independent job task.

The Critical Complexity Rating Scale ranges from Level 1 (least complex) to Level 4 (most complex). The typical critical thinking tasks of Power protection and control technicians and technologists are at Complexity Levels 2 to 3. Their most complex critical thinking tasks are at Complexity Level 3.

Examples

Power Protection and Control Technicians and Technologists:

- assess the efficacy of a system in the commissioning process. They check the design drawings, verify the placement of the equipment, and review the quantitative test data to determine if the system will perform as expected. (2)

- evaluate the appropriateness of a piece of equipment for an installation. They review the product specifications and compare them to the design requirements to determine if the product will in fact produce the desired outcome or perform the correct function for the application. (2)

- judge the quality and veracity of equipment readings. To confirm that data is sufficient and accurate, they may conduct equipment tests and diagnostics, compare test results to data from previous tests, ask co-workers for opinions and read manuals and specifications. (3)

- may assess the completeness and quality of installation, commissioning or repair of systems or equipment by their fellow co-workers or other work crews. For example, they may review work orders to verify that appropriate maintenance tasks have been performed. They may test equipment after work has been completed to verify functionality and visually inspect work areas to ensure the installation, commissioning or repair is complete. (3)

4. Job Task Planning and Organizing

There are two aspects to ***Planning and Organizing: Job Task Planning and Organizing*** and ***Organizational Planning***.

Job Task Planning and Organizing refers to the extent to which the workers plan and organize their own tasks.

Organizational Planning refers to the job incumbent's involvement in the organization's broader planning and organizing tasks (i.e., planning and organizing the work of others, operational planning, strategic planning).

The Job Task Planning and Organizing Rating Scale ranges from Level 1 (least complex) to Level 4 (most complex). Power Protection and Control Technicians and Technologists plan and organize their job tasks at Complexity Level 3.

Own Job Planning and Organizing

Power Protection and Control Technicians and Technologists are required to complete routine maintenance and testing, in addition to troubleshooting, installing and commissioning systems and equipment. They are typically assigned tasks by their supervisors or follow prescribed schedules as outlined by their company departments. They are able to prioritize their tasks by responding to immediate demands while also completing scheduled tasks. Their work may be interrupted by unexpected and unpredictable factors, including trouble calls, equipment malfunctions or weather disturbances. They must be able to coordinate and integrate their work with others to complete their work as efficiently as possible. (3)

Planning and Organizing for Others

Power Protection and Control Technicians and Technologists may delegate and direct the tasks of trainees or other trades people, such as industrial electricians.

5. Significant Use of Memory

Significant Use of Memory includes any significant or unusual use of memory for workers in the occupational group. It does not include normal memory use that is a requirement for every occupation.

Examples

Power Protection and Control Technicians and Technologists:

- remember resolutions to problems or challenges from past experience to apply this knowledge to problems currently being encountered.
- remember mathematical formulae to complete common calculations.

6. Finding Information

Finding Information involves using any of a variety of sources including text, people, computerized databases or information systems.

Finding Information is highlighted in this section as an essential job skill. However, workers' use of various information sources may be referred to in other sections such as *A. Reading Text, B. Use of Documents, E. Oral Communication* and *H. Computer Use*.

The Finding Information Complexity Rating Scale ranges from Level 1 (least complex) to Level 4 (most complex). Power Protection and Control Technicians and Technologists, tasks that involve finding information are at Complexity Level 2.

Examples

Power Protection and Control Technicians and Technologists:

- may find information about company and corporate policies and procedures on an intranet or internal computer network. (2)
- may find information about standard test practices in relay field notes. (2)
- find information about devices in training materials and on the internet. (2)

G. Working with Others

The Essential Skill of ***Working with Others*** examines the extent to which employees work with others to carry out their tasks. Do they have to work co-operatively with others? Do they have to have the self-discipline to meet work targets while working alone?

The Working with Others Complexity Rating Scale ranges from Level 1 (least complex) to Level 4 (most complex). Power Protection and Control Technicians and Technologists, work with others at Complexity Level 3.

Descriptive Paragraph

Power Protection and Control Technicians and Technologists work as members of teams comprised of technicians and technologists, as well as engineers, draftsman and other skilled workers, including electricians and power line technicians. They work with their teams to install, test, commission and troubleshoot electrical systems and components. They communicate regularly to co-ordinate their work activities with other electrical and mechanical personnel to complete their job tasks. Power protection and control technicians and technologists typically work independently to test and commission equipment. They may work with a partner or a helper when troubleshooting a system or commissioning a complex system. (3)

Participation in Supervisory or Leadership Activities

- participate in formal discussions about work processes or product improvement.
- have opportunities to make suggestions on improving work processes.
- monitor the work performance of others.
- inform other workers or demonstrate to them how tasks are to be performed.
- orient new employees.
- make hiring recommendations.
- assign routine tasks to other workers.
- identify training that is required by, or would be useful for, other workers.

H. Computer Use

Computer Use indicates the variety and complexity of computer use within the occupational group

The Computer Use Rating Scale ranges from Level 1 (least complex) to Level 5 (most complex). The Computer Use tasks of Power Protection and Control Technicians and Technologists, are at Complexity Levels 2 and 3.

Examples

Power Protection and Control Technicians and Technologists:

- use word processing software. For example, they use basic desktop publishing features of Word to write, edit and format reports, procedures, and other documents. (2)
- use database software. For example, power protection and control technicians and technologists access equipment databases to view, enter or retrieve data that describes equipment inventory, and documents maintenance and repairs. (2)
- use spreadsheet software. For example, power protection and control technicians and technologists enter quantitative test data into spreadsheets to monitor the response of equipment; to enter dates and times into spreadsheets; to create maintenance schedules; and to create test plans using formula calculations and macros. (3)
- use computer-assisted design software to view design drawings and to make design modifications. (2)
- use communications software. For example, they use communications software to send and receive e-mail messages and retrieve attachments from supervisors, managers and co-workers. (3)
- use the Internet. For example, Power Protection and Control Technicians and Technologists access user manuals and product information on manufacturers' websites. They may use company intranets to access company policies and procedures, schedules and forms. (2)
- use other computer and software applications. For example, they may use supervisory control and data acquisition systems and remote terminal units to monitor the operation of equipment. They use specific software applications for their test equipment and relays, such as RTS, Power System Communicate, and SEL. (3)

I. Continuous Learning

Continuous Learning examines the requirement for workers in an occupational group to participate in an ongoing process of acquiring skills and knowledge.

Continuous Learning tests the hypothesis that more and more jobs require continuous upgrading, and that all workers must continue learning in order to keep or to grow with their jobs. If this is true then the following will become Essential Skills:

- knowing how to learn;
- understanding one's own learning style; and
- knowing how to gain access to a variety of materials, resources and learning opportunities.

The Continuous Learning Complexity Rating Scale ranges from Level 1 (least complex) to Level 4 (most complex). Power Protection and Control Technicians and Technologists perform Continuous Learning tasks at Complexity Level 3.

Description

Power Protection and Control Technicians and Technologists are required to continually update their skills and knowledge to keep up with changes in technology related to their jobs. They learn informally on a daily basis through talking with co-workers and reading information contained in manufacturers' manuals, websites, reports and e-mails. They may be required to develop a learning plan with their supervisors to identify areas and methods for which they require training. They are required to complete and maintain mandatory safety training and certifications, including CPR, first aid, fall arrest, and WHMIS. They also take part in training sessions pertaining to new equipment or methodologies related to their work. Training for Power Protection and Control Technicians and Technologists is typically provided by the company. Training opportunities can range from computer-based modules provided in-house to 1-2 week training sessions conducted by product representatives or hired training consultants. (3)

How Learning Occurs

- as part of regular work activity.
- from co-workers.
- through training offered in the workplace.
- through reading or other forms of self-study:
  - at work,
  - on worker's own time,
  - using materials available through work,
  - using materials obtained through a professional association or union,
  - using materials obtained on worker's own initiative,
- through off-site training:
  - during working hours at no cost to the worker,
  - partially subsidized,
  - with costs paid by the worker,

J. Other Information

Other Information summarizes additional information collected during interviews with job incumbents and focus groups with occupational experts.

In addition to collecting information for this Essential Skills Profile, our interviews with job incumbents also asked about the following topics.

1. Physical Aspects

Power Protection and Control Technicians and Technologists spend time sitting at a desk when planning and completing design work and standing when completing fieldwork. They use upper limb coordination, manual dexterity and hand-eye coordination to manipulate computer hardware and test equipment. They may be required to work in awkward positions, noisy environments, extreme temperatures and in confined spaces, depending upon the location and nature of their fieldwork. Some power protection and control technicians and technologists may be required to exert strength to lift test equipment that can range in weight from 60 to 100 pounds. They must have unaffected color vision as color-coding of electrical circuitry is essential for the job.

2. Attitudes

Power Protection and Control Technicians and Technologists must be alert, cooperative and confident to make decisions and solve problems related to their work. They must be self-motivated individuals who can work effectively as members of a team. They must be thorough and cautious and be willing to continuously learn as they work in a highly detailed and evolving field.

3. Future Trends Affecting Essential Skills

In the future, technological advancements and computerized equipment will change the way in which Power Protection and Control Technicians and Technologists complete their work. As relays, test equipment and computers become more technologically advanced, Power Protection and Control Technicians and Technologists will be required to complete specialized training and learn new processes and methodologies in a short amount of time. As a result of this anticipated rise in the use of advanced technologies and computer programs and applications, Power Protection and Control Technicians and Technologists will have to be increasingly computer literate to be efficient and capable practitioners.

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