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Electrical Technician and Technologist
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

Electrical technicians and technologists may work independently or provide technical support and services in the design, development, testing, production and operation of electrical equipment and systems. They are employed by electrical utilities, industrial manufacturing industries, and small, medium and large municipalities.

Classified Elsewhere (by related NOC):
2241: *Electrical and Electronics Engineering Technicians and Technologists*

The most important Essential Skills for Electrical Technicians and Technologists are:

- Document Use
- Oral Communication
- Thinking Skills – Problem Solving

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 Electrical Technicians and Technologists are at Complexity Levels 1 to 3. Their most complex text reading tasks are at Complexity Level 3.

Examples

Electrical Technicians and Technologists:

- read notes, memos and bulletins. For example, they may read short job status bulletins or notes from team members to keep update on work progress. They may read memos from line staff requesting additional information or an opinion on a technical matter. (1)

- read and respond to e-mail messages. For example, they may receive messages from electrical technician crew members, internal and external stakeholders, supervisors, engineering staff, and suppliers to stay informed about work progress, products, and materials. (1)

- read safety and equipment manuals. For example, they may read safety procedure manuals for proper machinery and equipment operation. They may read computer- based SCADA system manuals and Equipment Electrical Apparatus Manuals that address all of a company's equipment, testing and background. (2)

- read industry publications. For example, they may read periodicals such as *Electrical News*, *Electrical Engineering*, or *Transmission and Distribution World* to keep current on developments in the industry such as technological changes in equipment or test or repair processes. (2)

- read project reports. For example, they may read detailed interruption reports on the overhauls and maintenance carried out on utilities so that activities can be added to the outage database. (3)

- read project contracts. For example, they may read contracts to ensure that all of the deliverables and deadlines have been identified and that all project inclusions, exclusions and budgetary information are accurate. (3)

- read regulations and specifications. For example, they may read regulatory information issued by safety authorities or specifications for lightning arresters and geographic management systems. (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 Electrical Technicians and Technologists are at Complexity Levels 1 to 3. Their most complex document reading tasks are at Complexity Level 3.

Examples

Electrical Technicians and Technologists:

- review the comments and information supplied on outage reports. They review comments to ensure they are up-to-date with work processes. (1)
- locate data on labels. For example, they may scan the WHMIS or MSDS labels on equipment to ensure that they are ESA, ASTM or CEA certified or standardized parts. They may review labels on equipment to obtain operational and safety data. (1)
- locate data in tables and schedules. For example, they locate KPA to PSI pressure equivalencies in metric-to-imperial conversion tables. (1)
- plot information and identify trends in graphs. For example, they may plot equipment response time and fault range information on a graph to determine relay curves. (2)
- obtain information from drawings, sketches and scale drawings such as blueprints. For example, they may examine a drawing of a relay coil to determine the location of the contacts. They may determine the geographic location for protection devices by using scale drawings of sites. (2)
- enter data into forms. For example, they may complete electricity stoppage or outage report forms by adding quantitative data such as times and dates and by entering concise descriptions of faults or circumstances. They may fill out and submit document transmittal forms to track prints through the engineering departments. (2)
- review wiring and single-line diagrams. For example, they review single-line diagrams to determine the components of projects. They may review wiring diagrams which are detailed outlines of wires from a given terminal block to a destination point. They review these diagrams to ensure that there are no mistakes or faults, or to troubleshoot an electrical system. (2)

- interpret graphs and diagrams presented in new equipment manuals. For example, they may refer to and interpret diagrams presented in a technical manual for Automatic Circuit Reclosers (ACR) to ensure proper assembly, use and functioning of the new technology. (3)

- interpret data in schematic drawings. For example, they interpret symbols and icons in schematic drawings of electrical systems, power systems and transmission networks which illustrate functions of various components, connections to other system parts and nominal system outputs. (3)

- Interpret scale drawings. For example, they refer to and interpret information on scale drawings in preparation for the commissioning of a new sub-station to determine the location and lay-out of equipment. (3)

- review infrared images. For example, they may review thermographic cameras' infrared scans of sites to identify 'hot spots' on major switches at substations. (3)

- develop and review charts. For example, they may review or develop Gantt charts that detail project phases, timelines, milestones and major deliverables. (3)

- draw common shapes. For example, they may illustrate phase circuits on phaser diagrams and meter locates 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. (3)

Examples of Creating Documents

Electrical Technicians and Technologists:

- may sketch electrical components and their connections to systems to provide visual explanations to co-workers, colleagues and customers.

- may develop single-line diagrams to lay out project components

- may develop test sheets to follow when testing new electronic control equipment.

- may develop graphs to chart information. For example, they may graph conductance information to give a visual representation of whether it is getting poor or if the centre of gravity is out of range.

- may create schematic drawings to illustrate the operations of an electrical system.

Document Use Summary

Electrical 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.
- 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).
- Take measurements from scale drawings.
- Draw to scale.
- Read assembly drawings (e.g., those found in service and parts manuals).
- Create assembly drawings.
- Read schematic drawings (e.g., electrical schematics).
- Create schematic drawings.
- Make sketches.
- Obtain information from sketches, pictures or icons.
- Interpret radiographs.

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 Electrical Technicians and Technologists are at Complexity Level 1 to 4. Their most complex writing tasks are at Complexity Level 4.

Examples

Electrical Technicians and Technologists:

- write brief reminders and notes to co-workers. For example, they may write notes about shift duties and inspection procedures so that they can remember these details when they eventually write reports. They may write notes to co-workers to remind them of scheduled equipment maintenance and repairs. (1)

- write e-mail messages to co-workers, colleagues and supervisors to request information, coordinate activities and respond to inquiries. (2)

- write comments and specifications on staff reports. For example, they may write short comments to request further development or detailing of a section of a report that is being forwarded to management. (2)

- write reports and project assessments. For example, they prepare hazard assessments, condition assessment reports, deficiency reports, interruption reports, and maintenance plans to identify and present specific data and information relevant to proposed and ongoing projects. In overview reports they include details of what happened, when it happened, the time of the last overhaul and details of the equipment maintenance. (3)

- write training manuals. For example, they may sit on training committees that write training modules for equipment operation. They write steps that outline how to operate and test equipment. (4)

- write detailed test procedures and specifications for new pieces of equipment which describe to other workers exactly how complex job tasks should be performed. They write procedures and specifications for equipment operation, testing, troubleshooting, diagnosis and repair. For example, they may write specifications for geographic information systems which describe the spatial relationship and the network mapping functions for workers unfamiliar with the equipment. (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. Two aspects of ***Numeracy*** have complexity ratings: *Numerical Calculation;* and, *Numerical Estimation*.

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 Estimation refers to tasks involving any estimation (i.e., an approximation based on judgement) that results in a number.

Numerical Calculation

The Numerical Calculation Rating Scale ranges from Level 1 (least complex) to Level 5 (most complex). The numerical calculation tasks of Electrical Technicians and Technologists involve:

- Money Math at Complexity Levels 2 to 3.
- Scheduling or Budgeting and Accounting Math at Complexity Levels 3 to 4.
- Measurement & Calculation Math at Complexity Levels 1 to 3.
- Data Analysis at Complexity Levels 2 to 3.

Examples

Electrical Technicians and Technologists:

- may calculate amounts for purchases and travel expense reimbursements. They calculate amounts for travel in personal vehicles using per kilometre rates. They may add amounts for per diem allowances and meals. They may reconcile amounts charged on personal corporate credit cards. (Money Math) (2)

- may calculate amounts for quotes and invoices. For example, they calculate amounts for designing, testing and operation electrical systems and supply finished costs to the customers. They calculate charges using labour rates, add amounts for materials and equipment and calculate sales taxes. (Money Math) (3)

- prepare and monitor budgets. For example, they prepare yearly and technical budgets for electricity projects. They monitor budgets to ensure payments to suppliers have been made and that funds budgeted for supplies are effectively used. (Scheduling or Budgeting and Accounting Math) (3)

- prepare schedules. For example, they prepare work and maintenance schedules for themselves and for work crews. They determine and implement timelines for work procedures to be carried out and for outages and service shut offs to be observed. They must ensure that all impacted parties are aware of these schedules and that timelines are adhered to as rigidly as possible. (Scheduling or Budgeting and Accounting Math) (4)

- may measure distance height and grading. For example, they may use hand levels and transit or survey equipment to grade and measure for land profiles. (Measurement and Calculation Math) (1)

- may calculate ratios. For example, they may calculate ratios of transformer banks or ratios of SF6 gas to mix with CF4 gas. (Measurement and Calculation Math) (2)

- may calculate feeder loading balances using Ohm's law. They may calculate phase angles and power factors using trigonometric formulae. They may also calculate conductor size and circuit loading to determine whether one station can take the load off another when paralleling two systems. (Measurement and Calculation Math) (3)

- analyze tests and relay curve information to determine how the relays fit within a certain percentage of the curve. (Data Analysis Math) (2)

- analyze data presented in project reports. For example, they analyze information in the interruption reports and data in the outage database to interpret outage trends and to determine how coordination might be reviewed. They may analyze and trend the data by plotting information on charts or developing illustrative graphs. (Data Analysis Math) (3)

Numerical Estimation

The Numerical Estimation Rating Scale ranges from Level 1 (least complex) to Level 4. The numerical estimation tasks of Electrical Technicians and Technologists are at Complexity Levels 2 and 3.

- estimate the numerical length of a run when putting in a new service. For example, they may estimate the distance between the generating station and the destination. It is important that these estimates are reasonable and accurate to ensure that calculations compensate for voltage drop that occurs over long distances. (2)

- estimate the cost and time required for various maintenance and repair tasks. For example, they may estimate the amount of time required to complete a task. They may refer to previous experience of completing similar tasks to assist with the estimate. (3)

Math Skills Summary

a) Mathematical Foundations Used

Number Concepts	
Whole Numbers	Read and write; count; round off; add or subtract; multiply or divide whole numbers. For example, taking readings for meter audits;
Integers	Read and write; add or subtract; multiply or divide integers. For example, reading and writing temperature change, grading and datum checks
Rational Numbers - Decimals	Read and write; round off; add or subtract decimals; multiply or divide by a decimal; multiply or divide decimals. For example, reading and recording time in milliseconds
Rational Numbers - Percent	Read and write percents; calculate the percent one number is of another; calculate a percent of a number. For example, calculate overall repair cost as a percentage of the total cost of a piece of equipment;
Equivalent Rational Numbers	Convert between decimals and percentages. For example, converting measurements on a breaker; converting project completion from decimals to percentage complete.
Other Real Numbers	Use powers and roots; scientific notation; significant digits. For example, using power formulae (single phase conversion) and three phase power formulae to calculate electricity and electric charge.

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 quadratic equations. For example, using Ohm's law; using power factors and formulas when transforming and switching feeders to calculate the loading situation; using quadratic equations to calculate compression of wood poles.
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. Use a proportion showing comparison between two ratios or rates in order to solve problems. For example,

	performing timing tests on breakers to determine opening velocity (distance/time); performing differential relay calculations; preparing ratios of SF6 gas to CF4 gas; comparing actual versus estimated values for progress reporting.
See Document Use for information on using scale drawings.	

Shape and Spatial Sense	
Measurement Conversions	Perform measurement conversions. For example, converting measurements on equipment controls from imperial to metric.
Areas, Perimeters, Volumes	Calculate areas. Calculate perimeters. Calculate volumes. For example, calculating volumes of gasses to be combined; calculating the areas and perimeters of work sites.
Geometry	Use geometry. For example, applying geometric principles when applying rotary transformers and when transforming arcs to linear movement.
Trigonometry	Use trigonometry. For example, measuring tolerances; understanding power formulas; calculating phase angles.
See Document Use for information on recognizing common angles, 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 costs of projects for annual budget; calculating labour rates; calculating ratios of SF6 gas to CF4 gas to mix.
Statistics and Probabilities	Use descriptive statistics (e.g., collecting, classifying, analyzing and interpreting data). Use inferential statistics (e.g. using mathematical theories of probability, making conclusions about a population or about how likely it is that some event will happen). For examples, interpreting fault recorder information; calculating response time; interpreting reliability statistics prepared by engineering department.
See Document Use for information on using tables, schedules or other table-like text and 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 a watch or clock
- **Weight or mass** – For example, using scales
- **Distance or dimension** – For example, using measuring wheels, tape measures, and surveying levelling instruments
- **Liquid volume** – For example, using a meter on a gas pump and graduated cylinders
- **Temperature** – For example, using a thermometer and temperature gauge
- **Pressure** – For example, using calibrated gauges and transducers
- **Electrical Potential (Volt)** - For example, using a voltmeter
- **Wattage** - For example, using a wattmeter
- **Angles** - For example, using transits, phase angle meters, and protractors
- **Density** - For example, using density meters, specific gravity meter for batteries, sonic density meter for pole testing
- **Amperage** – For example, using an ammeter

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 Electrical Technicians and Technologists are at Complexity Levels 1 to 3. Their most complex oral communication tasks are at Complexity Level 3.

Examples

Electrical Technicians and Technologists:

- may discuss matters such as products and prices as well as technical aspects of equipment with servicers, supplier representatives and purchasing and accounting personnel. (1)
- communicate with utilities, customers and the general public. For example, they may speak with customers to gather network information in response to the addition of generators. They may address stakeholders in townships they service to discuss planned outages and ongoing projects. (2)
- discuss ongoing work with co-workers. For example, they may confirm job tasks and safety procedures. They may discuss security clearance, safety issues, additional manpower requests and regulations surrounding equipment with their supervisors. (2)
- communicate with apprentices. For example, they may speak with trainees and apprentices to explain how work is carried out, to review safety regulations and to confirm their learning. They use these conversations to gage the capacity and performance of apprentices. (2)
- discuss technical aspects of work assignments and unusual job tasks with co-workers, colleagues and supervisors. For example, they may communicate with technicians in the central control system regarding electrical clearances and switching procedures. They may discuss resource and safety planning and contracts with their supervisors. (3)

Modes of Communication Used

- **In person** – For example, asking customers about regulations on controlled sites.
- **Using a telephone** – For example, speaking with technicians in off-site offices by telephone to troubleshoot equipment malfunctions.
- **Using a two-way radio** – For example, speaking with co-workers on a job site.
- **Using specialized communication signals** – For example, using hand signals for craning and rigging.

Environmental Factors Affecting Communication

Electrical Technologists and Technicians working in noisy locations, such as generator stations or in valve halls, may need to remove themselves from their work environments to ensure their instructions are understood and well received.

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 Electrical Technicians and Technologists are at Complexity Levels 2 to 3. Their most complex problem solving tasks are at Complexity Level 3.

Examples

Electrical Technicians and Technologists:

- encounter equipment malfunctions due to manufacturers' defects. For example, they may encounter electrical wiring malfunctions. They review the schematics and isolate the suspected location of the malfunction. They then check the wiring diagrams before proceeding with the repair. (2)

- discover that data and diagrams are incorrect or inaccurate. They assemble a team of technicians and technologists to discuss the inaccuracies and come to consensus about the solution. They may then adjust the diagrams to reflect the change. (2)

- discover that automatic circuit recloser (ACR) components will not operate correctly in cold weather. They remove the ACRs from service for testing. After testing confirms correct operation at room temperature, they conduct a cold test at minus 40 degrees Celsius to mimic the malfunction. After cold testing replicates the error, they determine that the wrong lubricant is the cause of the malfunctions. They lubricate the component with the correct lubricant and return the ACRs to service. (3)

- experience equipment malfunctions in the field that they are unable to diagnose or repair. They write an explanatory email to fellow electrical engineering technologists and technicians in the technical support group, photograph the equipment with a digital camera and forward the information in order to troubleshoot and resolve the malfunction. They must act fast when there are malfunctions or failures that result in events such as oil spills as there are negative environmental and budgetary implications. (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 Electrical Technicians and Technologists, are at Complexity Levels 2 to 4. Their most complex decision making tasks are at Complexity Level 4.

Examples

Electrical Technicians and Technologists:

- decide which piece of equipment to purchase from a variety of options. For example, they may decide to purchase a specific Geographic Information System (GIS) from a supplier. They base their decision on the cost of delivery, the purchase price, the cost over the life of the asset and the overall efficiency of the equipment. (2)

- decide to expand the work crew on a given project. They may ask workers to take on additional hours or bring in technical experts or external consultants to meet project requirements. (2)

- decide on the sequence and nature of tasks to be carried out for a given project. They choose procedures and specifications to apply when testing equipment. For example, when conducting acceptance testing on a breaker, they may carry out an initial visual inspection, gas it up, check monitors and then analyze it. They may also refer to past work experience to decide which procedures to follow. (3)

- decide to call their supervisors or bosses for their advice and approval on moving forward with a job. For example, they may encounter a piece of broken equipment and are unsure as to whether it could be returned to service that night. They may call their supervisors to get approval for keeping service shut down until the proper tools and crew expertise are available. (3)

- decide to take breaker out of service because of faults and malfunctions. For example, they encounter an air fill valve that is blowing coils and determine that it is a significant enough problem to shut down service. They consider the causes of malfunctions and review potential hazards to co-workers and the environment. They base their decisions on the severity of possible risks such as customer backlash, dangerous emissions or leaks and heavy penalties against their employers. (4)

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 Electrical Technicians and Technologists are at Complexity Levels 2 to 3. Their most complex critical thinking tasks are at Complexity Level 3.

Examples

Electrical Technicians and Technologists:

- assess the safety of workplaces and work processes. To assess potential risks, they review previous work orders, permits, work protections and associated reports to see if hazards have been reported. They may verify details with safety personnel and supervisors. (2)

- evaluate reports and procedures. For example, they may evaluate the completeness and effectiveness of restoration procedures by assembling a group of technicians and technologists to review the breakdown of steps. (2)

- assess whether a piece of equipment should be refurbished or replaced. They consider the cost of the original piece of equipment, the cost of replacement parts and labour, and calculate the overall repair cost as a percentage of the total cost of the equipment. If refurbishing the equipment will cost more than 60% of the cost of the original equipment, then they may not proceed with repairs. (3)

- evaluate all project components to develop an accurate and complete capital plan. They consider associated risks, develop a list of justification priorities that are based on cost point per dollar, cost avoidance and then carry out cost or accounting and safety analyses. They incorporate all data and considerations into the final plan. (3)

- evaluate equipment analyses to determine maintenance schedules and project timelines. For example, they may evaluate equipment analyses prepared by company data analysis groups to determine the presence of trending problems. Upon evaluation they incorporate the findings into their work by adjusting maintenance frequency or may contact suppliers and seek the support of manufacturers to devise a solution. (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). Electrical Technicians and Technologists plan and organize their job tasks at Complexity Level 3.

Own Job Planning and Organizing

Electrical Technicians and Technologists complete assigned work and prioritize work tasks within the assignments and timelines given to them. They typically work as part of a team to plan how the overall work will be carried out and to devise strategies for when they encounter problems. They often organize and coordinate the work activities of multiple teams on a given site. Their work may frequently be interrupted by unpredictable or high risk factors such as equipment breakdowns, budget changes, communication errors, shortages on crews, unplanned outages, storms, floods and other emergencies. They must be able to react quickly to situations as they arise and reschedule and reorganize job tasks. (3)

Planning and Organizing for Others

Electrical engineering technicians and technologists may plan routine work activities for others on the job sites.

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

Electrical Technicians and Technologists:

- remember procedures for operating, switching, work protections, testing equipment and for solving common problems.
- remember where informative resources are located.
- remember mathematical formulae to complete common calculations.
- remember safety rules, policies and procedures.
- remember regulation details, codes and ledger account numbers

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). Electrical Technicians and Technologists, tasks that involve finding information are at Complexity Level 2.

Examples

Electrical Technicians and Technologists:

- find information on the internet or intranet about equipment and testing. They may review, download and print manuals that are available online. (2)
- find information on operating and testing procedures in equipment and health and safety manuals. (2)
- find information in technical reference materials. (2)
- find information using other experienced personnel as resources. (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). Electrical Technicians and Technologists, work with others at Complexity Level 3.

Description

Electrical Technicians and Technologists work independently preparing reports and devising procedures but collaborate with co-workers and colleagues frequently during the planning phases of new projects and throughout the life of projects. They work as part of a team to develop acceptance testing procedures and establish goals and points that they verify with the technical support and engineering groups. They work alone when they are on-call to assess and solve problems. They seek consensus from their work teams before deciding to perform tests. They communicate with commissioning coordinators, field crews and line workers and assist them with technical support matters for equipment. They may collaborate with colleagues and work within union agreements for making hiring recommendations and decisions. They may work independently and with others to complete work tasks and to provide training. (3)

Participation in Supervisory or Leadership Activities

Electrical Technicians and Technologists:

- 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.
- make hiring decisions.
- select contractors and suppliers.
- assign routine tasks to other workers.
- assign new or unusual 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 Electrical Technicians and Technologists, are at Complexity Levels 2 and 3.

Examples

Electrical Technicians and Technologists:

- use word processing software. For example, they may use desktop publishing features of Word to write, edit and format reports, procedures and other documents. (2)
- use graphics software. For example, they may use the graphics functions of document management software, such as Documentum, to develop, edit and store electrical designs. (3)
- may use database software. For example, they may use databases to enter, view and retrieve customer or project data which describes maintenance and repair histories. They may enter and track details about equipment failure in an RMS database. They may use PeopleSoft software to track and manage human resources. (2)
- may use spreadsheet software. For example, they may use the spreadsheet functions of Excel to track equipment in and out and Lotus123 Spreadsheet software to generate financial work orders. (2)
- may use financial software. For example, they may use SAP Financial Management Software to input and track allocated budget amounts associated with project work plan milestones and deliverables. (3)
- may use communication software. For example, they may use communication software to create and maintain contact lists, send and receive e-mail messages and retrieve and save attachments such as digital photographs from electrical technicians and co-workers in the field. (3)
- may use the Internet or internal intranet. For example, they may enter keywords in Internet search engines to learn about new equipment and to research equipment suppliers and vendors. They may use an internal company intranet to access confidential company guidelines, test procedures and established policies. (2)
- may use Visual Basic to develop user-enter HMIs for spreadsheets and databases. (3)
- may use computer-assisted design, manufacturing and machining software such as AutoCAD and Cable CAD for designing and mapping projects. (3)

- use other computer and software applications. For example, they may use relay test software or breaker analyzing software and download test sheets, event data and history onto their computers from these programs. They may use specialized industry software programmed to perform guying, voltage draw and short circuit calculations and to determine pulling tensions. (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). Electrical Technicians and Technologists perform Continuous Learning tasks at Complexity Level 3.

Description

Electrical Technicians and Technologists may have an internal course schedule book that outlines their company's continuous learning plan or may be responsible for seeking and participating in continuous learning opportunities on an individual basis. They may be required to renew their trade licenses. They engage in various optional training programs that may include report writing seminars, conflict resolution techniques, computer program or software familiarization courses and communication workshops. Training for the operation of various machinery has to be refreshed and renewed every few years as do first aid, hearing tests, electrical awareness tests and defensive driving courses. Electrical Technologists and Technicians may also take specific technological enhancement courses such as a training course on breakers or CAPA analyzers. Depending on the province where they work, they may be required to hold provincial certification. Training is a very important part of the job and it may take place in the classroom as well as on the job site. (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

Electrical Technicians and Technologists work in offices as well as on-site in the field. Physical requirements for the job can be demanding as they may need to work in confined spaces such as inside transformers or in highly elevated man lifts, bucket trucks or on ladders. They may need to lift ground chains and equipment upwards of 50lbs, but have cranes available to them for craning and rigging when assembling transformers. They should have attuned manual dexterity and good hand-eye coordination for carrying out grounding work. They may use their sense of smell to determine when something is overheating or burning.

2. Attitudes

Electrical Technicians and Technologists should be positive, open minded and should accept constructive criticism. They should be good team workers and be self-motivated, inquisitive problem solvers. They should also have a good sense of humour and not be too sensitive.

3. Future Trends Affecting Essential Skills

The technical complexity of Electrical Technicians' and Technologists' jobs continues to increase and evolve, including relay and digital aspects, and these are increasing the importance of math and computer use skills. Reading and writing skills are also becoming increasingly important as industry regulations become more stringent.

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