Industrial Electricians NOC 7242

Introduction

Industrial electricians install, maintain, test, troubleshoot and repair industrial electrical equipment and associated electrical and electronic controls. They are employed by electrical contractors and maintenance departments of factories, plants, mines, shipyards and other industrial establishments.

The three most important essential skills are:

1. Reading
2. Document Use
3. Thinking (Critical Thinking)

Note: Each Essential Skills task is followed by a number in brackets, e.g., (2). This number reflects the estimated complexity rating for that task. The actual complexity rating may vary in some workplaces.

A. Reading	
Typical: 1 to 4	Most Complex: 4
Examples	
• Read instructions and warnings written on signs, labels and packaging, e.g., read signs to learn about noise and electrical shock hazards. (1) • Read short text entries on technical drawings and forms, e.g., read entries on job hazard assessment forms to learn about unsafe conditions. (1) • Read instructions, e.g., read detailed instructions listed on work orders to learn about tasks to be completed. (2) • Read notices posted on bulletin boards covering topics such as health and safety policy updates and upcoming events. (2) • Read email messages, e.g., read email messages from supervisors that provide detailed information about malfunctions that require troubleshooting. (2) • Read safety-related information, e.g., read Material Safety Data Sheets (MSDS) to learn how to safely use controlled products such as adhesives and lubricants. (2) • Read magazine and website articles to learn about new products and stay informed about industry practices. (3) • Read technical service bulletins, e.g., read technical service bulletins issued by equipment manufacturers to learn about faulty wiring harnesses. (3) • Read a wide variety of operating, repair, maintenance, testing and quality control manuals, e.g., read manuals to learn how to install, maintain and repair equipment. (3) • Read and interpret electrical codes, standards and regulations, e.g., read codes issued by regulatory committees, associations, safety code councils, and municipal and provincial governments to learn required practices for electrical installations and repairs. (4)	
Reading 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	
Typical: 1 to 4	Most Complex: 4
Examples	

- Read labels, e.g., read labels on product packaging, equipment, drawings and panels to locate safety and certification information, operating specifications and identification numbers. (1)
- Read meters and digital readouts to locate data such as energy readings, settings, error codes and the number of hours equipment has been operating. (1)
- Take information from pre-maintenance work orders to determine the location and the type of work to be done. (2)
- Complete a variety of safety-related forms, e.g., complete equipment lockout forms prior to repairing equipment. (2)
- Study shift, operating and maintenance schedules to locate the dates and times of upcoming repair and maintenance tasks. (2)
- Complete a variety of forms, e.g., enter data, such as dates, identification numbers, times, specifications and costs to complete work orders and permits. (3)
- Locate data such as specifications, classifications, material coefficients and identification numbers in complex tables, e.g., scan tables in the Canadian Electrical Code for specifications, such as the size of wire needed in relation to the length of run and size of motor. (3)
- Use scale drawings, e.g., use elevation drawings and floor plans to locate measurements and the position of equipment and support structures. (3)
- Use a variety of assembly drawings, e.g., use assembly and exploded view diagrams of complex equipment components to plan installations and troubleshoot faults. (3)
- Interpret a variety of schematic drawings, e.g., study wiring schematics to locate electrical system components such as circuits and to troubleshoot equipment faults. (4)

Document Use Summary	
√	Read signs, labels or lists.
√	Complete forms by marking check boxes, recording numerical information or entering words, phrases, sentences or text of a paragraph or more.
√	Read completed forms containing check boxes, numerical entries, phrases, addresses, sentences or text of a paragraph or more.

√	Read tables, schedules or other table-like text (e.g., read production schedules).
√	Enter information on tables, schedules or other table-like text.
√	Recognize common angles such as 15, 30, 45 and 90 degrees.
√	Draw, sketch or form common shapes such as circles, triangles, spheres, rectangles, squares, etc.
√	Interpret scale drawings (e.g., floorplans or maps).
√	Take measurements from scale drawings.
√	Make sketches.
√	Obtain information from sketches, pictures or icons (e.g., computer toolbars).

C. Writing

Typical: 1 to 2	Most Complex: 3

Examples

- Write short comments in log books, e.g., write short comments in log books to inform co-workers about progress being made on installations. (1)
- May write email messages, e.g., write email messages to supervisors and managers to provide details of the work to be undertaken during the next scheduled shut-down. (2)
- May write reports to describe events leading up to workplace accidents, e.g., write about injuries and events when completing reports for workers' compensation boards. (2)
- May write detailed service reports that include descriptions of problems and their solutions. (3)

Writing Summary

Length	**Purpose for Writing**						
	To organize or remember	To keep a record or document	To inform or request information	To persuade or justify a request	To present an analysis or comparison	To present an evaluation or critique	To entertain
Text requiring less than one paragraph of new text	☐	☐	☐	☐			
Text rarely requiring more than one paragraph	☐	☐	☐	☐			
Longer text		☐	☐				

D. Numeracy

Typical: 1 to 3	Most Complex: 3

Examples

Money Math

- Not a requirement for this occupation.

Scheduling, Budgeting and Accounting Math

- May total and report the cost of small projects and repairs. (2)
- May schedule the completion of concurrent installation and repair tasks by considering project tasks, lead times and the availability of labour and parts. (2)

Measurement and Calculation Math

- Take a variety of measurements using basic tools, e.g., measure length of cables and the dimensions of equipment using tape measures. (1)
- Calculate electrical requirements, e.g., calculate current flows, resistances and voltages, and troubleshoot electrical faults. (2)
- Calculate summary measures, e.g., calculate the average amount of power used by large installations. (2)
- Calculate requirements using formulae, e.g., use formulae to calculate the parameters for conduit fills and three-phase electrical circuits. (3)

Data Analysis Math

- Compare measurements of energy, dimension, speed, temperature and torque to specifications, e.g., compare the numeric values from gauges and digital displays to standard or required specifications found in operating and installation manuals. (1)
- Calculate summary measures to monitor the progression of faults, e.g., average multiple energy readings to determine the condition of electrical components. (2)
- Analyze multiple energy readings to evaluate electrical system functions and troubleshoot faults, e.g., compare electrical resistance measurements to calculated or predicted values at various points in a circuit to identify the location of a ground fault. (3)

Numerical Estimation

- May estimate times and costs for equipment repairs and installations. (1)
- Estimate the register or range of values that will correspond to the correct reading on the sensing or control instrument when installing and calibrating programmable logic controller systems. (2)
- Estimate the useful life remaining for equipment components such as motors. (2)

Math Skills Summary

a. Mathematical Foundations Used

Whole Numbers	Read and write, count, round off, add or subtract, multiply or divide whole numbers, e.g., read voltage ratings on equipment; count wires; round amperage loads to the nearest 10 amps; total individual loads to find maximum load; divide voltage by resistance to find amperage.
Integers	Read and write, add or subtract, multiply or divide integers, e.g., measure electrical potential in positive and negative voltages.

Fractions	Read and write, add or subtract fractions, multiply or divide by a fraction, multiply or divide fractions, e.g., determine the diameter of bolt needed to install a starter motor.
Decimals	Read and write, round off, add or subtract decimals, multiply or divide by a decimal, multiply or divide decimals, e.g., read the starting current for motors to thousandths of amp.
Percent	Read and write percents, calculate the percent one number is of another, calculate a percent of a number, e.g., express the current drawn by a motor under load as a percentage of the current drawn when the motor is not loaded.
Equivalent Rational Numbers	Convert between fractions and decimals or percentage, e.g., express bearing, journal and fitting sizes in fractions of an inch or a decimal equivalent as the task demands.
Equations and Formulae	Use formulae by inserting quantities for variables and solving, e.g., use a formula from the electrical codebook to determine amps when watts and volts are known.
Use of Rate, Ratio and Proportion	Use rates, ratios and proportions, e.g., use ratios and proportions to calculate energy flows from transformers.
Measurement Conversions	Perform measurement conversions, e.g., convert between Imperial and SI measures when installing American-manufactured equipment and the construction drawing dimensions are given in metres.
Areas, Perimeters, Volumes	Calculate area, perimeters and volumes, e.g., calculate perimeters and areas when installing wiring layouts, cathodic protection and public address systems.
Geometry	Use geometry, e.g., use geometry to place an electrical conduit so that it is straight and true, and to calculate offsets from straight runs.

b. Measurement Instruments Used

Examples

- Time using clocks and calendars.
- Distance or dimension using measuring tapes and scales.
- Temperature using digital thermometers and infra-red temperature guns.
- Electrical potential (volts) using a volt meters and multimeters.
- Electrical resistance using ohmmeters, wheatstone bridges and multimeters.
- Amperage or current using ammeters and multimeters.
- Flow using transmitters and regulators.
- Pressure using pressure gauges.
- Rotational force using torque wrenches.
- Angles using protractors and dial indicators.
- Use the SI (metric) measurement system.
- Use the imperial measurement system.

E. Oral Communication	
Typical: 1 to 3	Most Complex: 3
Examples	

- Speak with suppliers to learn about products, prices and delivery schedules. (1)
- Exchange information with co-workers, e.g., speak with other tradespeople such as millwrights to coordinate activities and schedules. (2)
- Exchange information during meetings, e.g., discuss safety issues and procedures during meetings with co-workers. (2)
- Talk to operators about equipment and machinery breakdowns, e.g., ask operators detailed questions to troubleshoot faults and provide complex instructions to avoid similar breakdowns. (3)
- Exchange technical repair and troubleshooting information, e.g., discuss unusual electronic control module faults with co-workers and help desk technicians. (3)
- May provide detailed explanations, e.g., provide detailed instructions to apprentices about electrical troubleshooting techniques and safe work practices. (3)

Oral Communication Summary

Type	Purpose for Oral Communication (Part I)					
	To greet	To take messages	To provide or receive information, explanation, direction	To seek, obtain information	To co-ordinate work with that of others	To reassure, comfort
Listening (little or no interaction)			☐	☐		
Speaking (little or no interaction)			☐	☐	☐	
Interact with co-workers			☐	☐	☐	
Interact with those you supervise or direct			☐	☐	☐	
Interact with supervisor/manager			☐	☐	☐	
Interact with peers and colleagues from other organization			☐	☐	☐	
Interact with customers/clients/ public			☐	☐	☐	
Interact with suppliers, servicers			☐	☐	☐	
Participate in group discussion			☐	☐	☐	
Present information to a small group						

Present information to a large group						

Type	Purpose for Oral Communication (Part II)					
	To discuss (exchange information, opinions)	To persuade	To facilitate, animate	To instruct, instill understanding, knowledge	To negotiate, resolve conflict	To entertain
Listening (little or no interaction)						
Speaking (little or no interaction)						
Interact with co-workers	?					
Interact with those you supervise or direct	?					
Interact with supervisor/manager	?	?		?		
Interact with peers and colleagues from other organization	?			?		
Interact with customers/clients/ public	?	?		?	?	
Interact with suppliers, servicers	?				?	
Participate in group discussion	?	?		?	?	
Present information to a small group						
Present information to a large group						

F. Thinking	
Typical: 1 to 3	Most Complex: 3
a. Problem Solving	
Examples	

- Are unable to install or repair equipment because specifications and instructions are unavailable. They consult manufacturers, co-workers, suppliers and colleagues for advice and research websites to locate useable information. (2)
- Face disruptions of work schedules, timelines and budgets when project designs are found to be faulty and when specifications are changed after projects have already started. They assist in the development of new designs and perform other work until projects are restarted. (3)
- Encounter intermittent faults in equipment. They run diagnostic procedures and test the telephones during peak usage periods. They call customers for more information and scan

service bulletins from manufacturers to see if any of them refer to intermittent service. (3)

b. Decision Making

Examples

- Decide order of tasks and their priorities, e.g., decide when to begin a time-consuming job based on the probability of being interrupted. (2)
- Decide that a piece of equipment should be repaired rather than replaced. They consider capital, material and labour costs. (2)
- Decide to shut down a machine because of a pending malfunction. They consider the costs associated with the unexpected shutdown, the potential for damage and the risk of injury to workers if the machine is not serviced. (3)
- May select materials and suppliers, e.g., decide which brands and types of materials to use by considering specifications, warranties, costs and ease of use. (3)
- Decide how to deal with emergency situations, e.g., decide how to contend with serious equipment malfunctions that have the potential to injure workers and cause significant property and environmental damage. (3)

c. Critical Thinking

Examples

- May evaluate the performance of apprentices. They consider apprentices' abilities to complete electrical installations, and diagnose and troubleshoot faults. (2)
- Evaluate the safety of work sites. They observe elements such as overhead wiring, lockouts, confined spaces and fall hazards. They take note of potential hazards such as iced walkways and improperly stored tools. (2)
- Evaluate the severity of equipment faults. They consider criteria such as readings, specifications and the risks to safety, property and the environment. (3)
- Assess the quality and neatness of installations before leaving work sites. They check the equipment for proper labelling, confirm that cables are properly anchored and connections are tight, and review test results. They compare completed installations to drawings and other project documents to ensure equipment has been installed as planned. (3)

d. Job Task Planning and Organizing

Industrial electricians coordinate their work with other trades and production staff, each having different needs and priorities. (2)

Own Job Planning and Organizing

They organize the most effective use of their time within the framework of assigned tasks. Routine tasks are generally assigned by supervisors or dictated by a procedure established by the employer. Much of their other work is in response to broken or malfunctioning electrical installations and cannot be scheduled. They often have to re-prioritize tasks several times a day. (2)

e. Significant Use of Memory

Examples

- Remember a system's basic parameters and operating tolerances.
- Remember the faults associated with error and trouble codes for various types of

equipment.
f. Finding Information
Examples
• Find motor specifications by looking on tags and identification plates, and by referring to manuals and technical drawings. (1) • Find requirements for non-routine installations by consulting with co-workers and electrical engineers, and by reading electrical codes. (2) • Learn how to troubleshoot and repair difficult faults by reading operation manuals, conducting Internet research, seeking information on Web forums and blogs and by speaking with other tradespeople, electrical engineers and manufacturers. (3)

G. Working with Others	
Industrial electricians work as part of a team that includes other tradespeople and professionals to install, repair and maintain industrial electrical systems and equipment. They usually work independently, co-ordinating their work with others. For large jobs, they work with a partner or crew.	
Participation in Supervisory or Leadership Activities	
√	Monitor the work performance of others.
√	Inform other workers or demonstrate to them how tasks are performed.
√	Orient new employees.
x	Make hiring recommendations.
√	Assign routine tasks to other workers.
x	Assign new or unusual tasks to other workers.
√	Identify training that is required by, or would be useful for, other workers.
x	Deal with other workers' grievances or complaints.

H. Digital Technology	
Typical: 1 to 2	Most Complex: 3
Examples	
Word Processing • May write letters to customers, police and insurance brokers to present the results of mechanical inspections. (2) **Spreadsheet Software** • May use spreadsheet software to tally costs for job estimates and invoices. (2) **Bookkeeping, Billing and Accounting Software**	

- Not a requirement for this occupation.

Communication Software

- Use communication software to exchange email with suppliers and help desk technicians. (2)

Data Bases

- Use databases to enter repair information and retrieve equipment maintenance histories. (2)
- May use databases to retrieve and print scale and assembly diagrams. (2)

Presentation Software

- Not a requirement for this occupation.

Graphics Software

- Use graphics software, e.g., use graphics software incorporated in scanning tools to access data displays such as signal values. (2)

Internet

- Use the Internet to access training courses and seminars offered by training institutions, unions, suppliers and employers. (2)
- Use Internet browsers and search engines to access technical service bulletins, electrical codes, specifications and troubleshooting guides. (2)
- Use Internet browsers to access and share information on Web forums and blogs. (2)
- Search through Internet websites and navigate several menus to locate technical data such as pin assignments on integrated circuit chips. (2)

Programming and System Design

- May install and service Ethernet, peer-to-peer and wireless networks. (3)
- May install and service process control systems, such as distributed control systems (DCSs) and programmable logic controllers (PLCs), to control the speed and output of machinery. (3)

Project Management Software

- May use project management software for complex equipment installations to schedule lead times and the completion of project milestones. (3)

Other Digital Technology

- May use personal digital assistant (PDA) devices to access regulatory codes and complete numeracy-related tasks, such as calculating material requirements. (1)
- Use hand-held electronic devices to access equipment error codes and operational data such as electrical readings. (1)

I. Continuous Learning

Industrial electricians often receive in-house safety training to update their certifications, such as Workplace Hazardous Materials Information System (WHMIS), Transportation of Dangerous Goods (TDG), first aid and cardio-pulmonary resuscitation (CPR). They also receive training to safely operate equipment, such as forklifts. They learn about new equipment on-the-job by reading manuals and through hands-on experience. They obtain computer training by taking courses off-site.

How Learning Occurs

Learning may be acquired:

√	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 • with costs paid by the worker.

J. Other Information

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

Physical Aspects

Industrial electricians stand, bend, kneel and crouch while performing tasks. They walk from one area to another or they sit while driving. They use their sense of hearing, sight, smell and touch to determine the operating condition of parts and detect faults. Colour vision is essential for work on colour coded wiring.

Attitudes

The industrial electricians interviewed felt that industrial electricians should be patient and work well under pressure, be confident in their ability and knowledge, and be interested in the science of electricity. They also need to get along well with other people and take pride in their work.

Your comments:

What changes are needed, e.g., should other tasks be added? Please specify.

_____
_____
_____
_____
_____

Are there skills related to this section that have not been mentioned?

_____
_____
_____
_____