

Certification Exam Handbook Electrical Engineering Technology

Offered by:



CTTAM
Certified Technicians & Technologists
Association of Manitoba



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Introduction

The Electrical Technologist Certification Exam Handbook has been prepared for electrical engineering technologists who are required to pass a certification exam to achieve registration as a Certified Engineering Technologist or Applied Science Technologist. The handbook is designed to provide candidates with essential information regarding the certification examination.

Examination Information

Purpose of Examination

The purpose of the Electrical Technologist Certification Examination is to identify competent electrical engineering technologists who possess technical competencies in their discipline, as outlined in a discipline-specific competency profile (**see Appendix A**). The ultimate goal is to protect the public by granting designations only to those professionals who have the skill and knowledge necessary to perform their job in a safe and competent manner.

Examination Development Process

The Electrical Technologist Certification Examination consists of 100 multiple-choice questions, including questions with graphs, diagrams, and schematics and questions that require calculations. Each multiple-choice question has four answer options, only one of which is correct. Exam questions vary in the level of cognitive difficulty.

A rigorous exam development process was implemented to ensure that the resultant exam meets professional testing standards as specified in the Standards for Educational and Psychological Testing. Exam development involved numerous consultations with experienced electrical engineering technologists, as well as education providers and industry representatives. These individuals contributed their expertise to seven stages of exam development, including: 1) competency development; 2) exam blueprinting; 3) item writing; 4) group item review; 5) pilot testing; 6) standard setting; and 7) exam form assembly.

Examination Content

The Electrical Technologist Certification Examination tests candidates' competencies in four areas (**see Table 1 and Appendix A for detailed information on examination content**).

Technical Analysis: In this competency area, candidates are expected to be able to apply electrical knowledge, equipment, and tools to analyze technical problems and provide input into solutions that meet technical specifications, regulatory requirements, industry standards, local codes, and requirements of internal and external clients.

Technical Design: This competency area deals with candidates' ability to design and implement electrical systems that meet requirements of stakeholders.

Technical Evaluation: In this competency area candidates are expected to be able to review own design prior to approval submission and provide technical support regarding safety and technical specifications as required.

Project Management: This competency area deals with candidates' ability to assist in the implementation of projects to ensure the quality of deliverables, client satisfaction, and adherence to schedules and budgets.

Table 1. Description of Examination by Competency Area

Competency Area	Percentage of Questions	Number of Questions
1. Technical Analysis	45%	45
2. Technical Design	25%	25
3. Technical Evaluation	15%	15
4. Project Management	15%	15
Total	100%	100

Table 2 provides the breakdown of exam questions by cognitive level. “Knowledge” questions require that candidates recall information and provide its interpretation. “Application” questions require that candidates apply their knowledge to practical situations, while “Critical thinking” questions require that candidates analyze complex situations and provide solutions.

Table 2. Description of Examination by Cognitive Level of Questions

Cognitive Level	Percentage of Questions	Number of Questions
Knowledge	40%	40
Application	40%	40
Critical Thinking	20%	20
Total	100%	100

As can be seen in Table 3, 40% of exam questions have an image (e.g., a graphic, figure, table, or a schematic).

Table 3. Description of Examination by Images

Images	Percentage of Questions	Number of Questions
Questions with Images	40%	40
Questions without Images	60%	60
Total	100%	100

Examination Registration

Applicants who are required to complete the Electrical Technologist Certification Examination will register for the examination at the time of application. Please see the ASET, CTTAM, or ASTTBC websites for current information on examination dates, fees, and policies.

Study Resources for Examination

The following resources may be of use to candidates interested in refreshing their knowledge prior to writing the examination. **Candidates are not expected to study each of these resources.** Rather, candidates may wish to review particular content areas in which they feel

they would like to update their current knowledge. For detailed information on the content areas covered on the exam, candidates should refer to **Appendix A**.

Bosela, T. (2003). *Electrical systems design*. Upper Saddle River, NJ: Pearson Education.

Canadian Standards Association. (2012). *Canadian Electrical Code. Part I. Safety standard for electrical installations: CSA standard C22.1-12*. Mississauga, ON: Canadian Standards Association.
Subject area(s): Standards

Chapman, S. J. (2005). *Electric machinery fundamentals (4th ed.)*. New York, NY: McGraw-Hill Higher Education.

Fehr, R. (2002). *Industrial power distribution*. Upper Saddle River, NJ: Prentice Hall.

Gill, P. (1998). *Electrical power equipment maintenance and testing*. New York, NY: Marcel Dekker.

Herman, S. L. (2010). *Electric motor control*. Clifton Park, NY: Delmar Cengage Learning.

Hubert, C. (2003). *Operating, testing, and preventative maintenance of electrical power apparatus*. Upper Saddle River, NJ: Pearson Education.

Jackson, H. W. (2008). *Introduction to electric circuits (8th ed.)*. New York, NY: Oxford University Press.

Kiameh, P. (2003). *Electrical equipment handbook: Troubleshooting and maintenance*. Toronto, Canada: McGraw-Hill.

Kissel, T. (2002). *Motor control technology for industrial maintenance*. Upper Saddle Ridge, NJ: Prentice-Hall.

Richardson, D. V. (1982). *Rotating electrical machinery and transformer technology (2nd ed.)*

Robbins, A., & Miller, W. (2007). *Circuit analysis: Theory and practice (4th ed.)*. Clifton Park, NY: Thomson Delmar Learning.

Wildi, T. (2006). *Electrical machines, drives, and power systems (6th ed.)*. Upper Saddle River, NJ: Pearson Education Ltd. Publishers.

Exam Accommodations for Candidate with Disabilities

According to Canadian human rights legislation and test industry standards, exam developers are responsible for providing candidates with disabilities with exam accommodations where appropriate and feasible. Exam accommodations are designed to remove barriers related to individual characteristics of candidates that may prevent them from demonstrating their technical competencies on the exam. “An appropriate accommodation is one that that responds to specific individual characteristics but does so in a way that does not change the construct the test is measuring or the meaning of scores.”¹

¹ American Educational Research Association (2014). *Standards for Educational and Psychological Testing*. Washington, DC (p. 67).

Candidates with disabilities should request accommodations to write the certification exam at the time of application. To protect the integrity of the examination, documented evidence of the candidate's disability must be submitted to ASET, CTTAM, or ASTTBC along with the application form. Such evidence includes a formal detailed diagnosis of the specific disability from an appropriate professional (e.g., physician, psychologist, rehabilitation counsellor) and supporting documentation citing the need for exam accommodations and what accommodations the candidate received in the past.

ASET, CTTAM, or ASTTBC will review the candidate's written request for accommodation and determine if it can be supported. Depending on the candidate's individual needs, ASET, CTTAM, or ASTTBC may modify exam administration conditions, including exam setting, exam presentation, or the addition of individuals to the exam (e.g., readers, scribes). Each request will be reviewed on a case-by-case basis.

Below is a list of reasonable exam accommodations for candidates with a disability.

1. *Separate Room*

A separate room is provided to candidates who due to the nature of their disability require an exam environment that minimizes distractions resulting from noise or movement or process information by talking aloud.

2. *Additional Time*

Extending additional time to candidates is a frequently used exam accommodation that is used with a variety of disability-related conditions. Often candidates are offered time-and-one-half to complete the exam (e.g., a 3-hour exam is extended to 4.5 hours).

3. *Interpreter*

Candidates with hearing impairment may request an interpreter who has proficiency in sign language.

4. *Reader*

A reader is an individual who reads exam instructions and/or exam questions to a candidate. Candidates with visual impairment or those with a learning disability may benefit from services of a reader during the examination.

5. *Recorder*

A recorder is an individual who fills in the answers for a candidate who has difficulty writing independently.

Costs related to exam accommodations will be the responsibility of the candidate.

Examination Administration

The Electrical Technologist Certification Examination will be administered on a computer in one of Yardstick's exam centers in Alberta, Manitoba, or British Columbia. Generally, exam centers are located in colleges and universities. An experienced proctor will oversee the examination. Limited space is also available for virtual proctoring of examinations. Please contact ASET, CTTAM, or ASTTBC for more information.

Admissions to the Exam Centre

ASET, CTTAM, and ASTTBC provide Yardstick with a list of examination candidates for each exam sitting. When an exam appointment is made, candidates will receive a booking confirmation email from Yardstick. **It is important that candidates bring this email with them to an examination center on the day of the examination.**

Upon entering the examination center, candidates will be asked to register with the proctor. The following information will need to be provided to the proctor.

- Candidate's first and last name
- Valid government-issued photo ID
- Candidate's booking email as provided by Yardstick

After the initial verification of identity, candidates will be asked to sign a roster.

Candidates' personal belongings, such as bags and jackets, will be stored in a designated area. Electronic devices, including but not limited to cell phones, tablets, and reference books, may not under any circumstances be brought into the exam center. The only exception to this rule is personal calculators. The proctor is responsible for inspecting candidate's calculators prior to the exam.

Candidates may bring with them into the exam center water, juice, coffee or another drink in a spill proof container with no label and, only if approved by the proctor, a sweater without pockets, and disposable ear plugs.

The use of scratch paper is permitted. The proctor will provide scratch paper to the candidates before the exam and collect it after the exam.

Taking the Exam

At the beginning of the examination, candidates will hear verbal examination instructions from the proctor and read the Candidate's Statement of Understanding and/or Non-disclosure Agreement in the software. Failure to comply with the regulations outlined in these documents will result in the candidate's results being invalidated. Candidates will not be able to begin the examination without agreeing to the conditions outlined in the document.

Next, exam candidates will be given written exam instructions in the software. These exam instructions will emphasize the fact that some exam questions contain images and/or require calculations. If the images appear too small on the screen, candidates will be advised to hover their mouse over them to get an expanded view.

Following exam instructions, there will be a tutorial available to candidates before they proceed to the exam.

After the Examination

Upon submitting their exam responses, candidates will be offered an opportunity to provide feedback on exam material and exam administration conditions by completing a short online survey. Then, candidates will submit their scrap paper to the proctor, sign out from the candidate roster, and leave the examination center.

Examination Scoring and Reporting

Multiple-choice examination questions are scored dichotomously, using a score of “0” for an incorrect response and a score of “1” for a correct response. The Technologist Certification Examinations are criterion-referenced exams, which means that a candidate should obtain a score that is equal or higher than an exam pass mark to pass the examination.

Each Certification Examination has its own pass mark. The pass mark for the Electrical Technologist Certification Examination was determined by the Exam Committee, which took into account the difficulty of exam questions and the expected level of performance for a minimally competent technologist. A psychometrically acceptable standard-setting methodology was used to set examination pass marks.

The examinations are electronically scored. Candidates can expect to obtain their exam score and the associated pass/fail decision within four to six weeks after the date of exam administration. Unsuccessful candidates will also receive a performance report indicating a failure to pass, their score, and areas of strength and weakness in the four tested competency areas. The unsuccessful candidates will be able to retake the exam.

Review and Appeal Process

A candidate who fails the Technologist Certification Examination may request that their exam score be verified. Due to the automated scoring and extensive quality control procedures, errors in scoring are extremely unlikely. However, candidates may request that ASET, CTTAM, or ASTTBC manually rescore their exam to verify the original score. The candidate will be responsible for any expenses incurred during the review and appeals process.

Appendix A: Electrical Technologist Professional Competencies

Role Description

Entry-level electrical engineering technologists apply knowledge of electrical theory to analyze existing electrical systems in the context of current infrastructure, technical specifications, regulatory requirements, industry standards, and local codes, and to design and implement electrical systems that meet requirements of internal and external clients. In addition, they verify that electrical systems were designed and operate as intended.

Competency Name:	
Technical Analysis (Electrical Engineering Technologists)	
Competency Definition:	
Apply electrical knowledge, equipment, and tools to analyze technical problems and provide input into solutions that meet technical specifications, regulatory requirements, industry standards, local codes, and requirements of internal and external clients.	
#	Competency Indicators
1.1	Collect quantitative and qualitative information to better understand technical problems and develop solutions.
1.2	Identify the scope of work in consultation with one's supervisor.
1.3	Identify existing electrical system's constraints.
1.4	Assess electrical safety before gathering data.
1.5	Determine suitable technical equipment, tools, and procedures.
1.6	Analyze data in relation to industry standards, local codes, and requirements of internal and external clients.
1.7	Interpret single-line and schematic diagrams of circuits or systems to determine their operating principles.
1.8	Interpret electrical technical documents, such as customer load lists and manufacturer's specification sheets.
1.9	Refer to applicable industry standards and local codes (e.g., Canada Electrical Code).
1.10	Consider the limitations of data for conclusions drawn from test results.
1.11	Identify potential technical, health, and environmental risks associated with implementation of engineering solutions.
1.12	Analyze general power system configurations and voltage levels.
1.13	Analyze single- and three-phase circuits using basic electrical formulas.
1.14	Explain the principles and functioning of bonding as well as solid and impedance grounding.
1.15	Make recommendations for design, installation or maintenance of electrical systems.

Competency Name:	
Technical Design (Electrical Engineering Technologists)	
Competency Definition:	
Design and implement electrical systems that meet requirements of stakeholders.	
#	Competency Indicators
2.1	Perform fundamental electrical calculations on electrical systems, such as: 1) Voltage drop; 2) Cable sizing; 3) Transformer ratings; 4) Lighting; 5) Raceways

2.2	Create or modify a schematic diagram or a drawing of a simple circuit or system, such as: 1) Single-line; 2) Equipment layout; 3) Control/wiring schematic.
2.3	Identify design aspects and technical specifications for electrical systems in accordance with local codes and industry standards.
2.4	Collaborate with a multi-disciplinary team to solve technical problems.
2.5	Use the appropriate technology to create or modify schematic diagrams or drawings.
2.6	Describe electrical controls, such as PLCs, relays, VFDs, and UPSs.
2.7	Compile technical documents and supporting information.

Competency Name:	
Technical Evaluation (Electrical Engineering Technologists)	
Competency Definition:	
Review own design prior to approval submission and provide technical support regarding safety and technical specifications as required.	
#	Competency Indicators
3.1	Provide guidance for implementation, installation, or maintenance of electrical systems under supervision.
3.2	Review electrical engineering plans to ensure compliance with technical specifications, regulatory requirements, industry standards, and local codes.
3.3	Perform quality control on electrical circuits, equipment or systems to ensure that design operates as intended.
3.4	Perform design verification (e.g., performance of alternative calculations, review of design output documents, and review of construction against an intended design).
3.5	Review design documents for compliance with technical specifications, regulatory requirements, industry standards, and local codes.

Competency Name:	
Project Management (Electrical Engineering Technologists)	
Competency Definition:	
Assist in the implementation of projects to ensure the quality of deliverables, client satisfaction, and adherence to schedules and budgets.	
#	Competency Indicators
4.1	Prioritize own work activities to ensure that project objectives are met on time and on budget.
4.2	Research equipment or component needs, sources, competitive prices, delivery times, or operational costs.
4.3	Calculate cost, materials, quantities and resources required for projects.
4.4	Assist in the preparation of budget and schedules for deliverables.
4.5	Quantify one's work that is completed to-date.
4.6	Assist in managing expectations of internal and external clients.
4.7	Establish and maintain effective working relationships with internal and external clients.
4.8	Report changes in own scope of work to the appropriate authorities to assist with project management.
4.9	Explain the value of workplace safety legislation.
4.10	Comply with workplace safety legislation.