

Certification Exam Handbook Mechanical Engineering Technology

Offered by:



CTTAM
Certified Technicians & Technologists
Association of Manitoba

ASTTBC TECHNOLOGY
PROFESSIONALS
QUALIFIED. REGISTERED. ACCOUNTABLE.

© COPYRIGHT THE ASSOCIATION OF SCIENCE AND ENGINEERING TECHNOLOGY
PROFESSIONALS OF ALBERTA, 2017

ASET holds full Copyright to the materials printed herein.
Any distribution, copying or sale of these materials is contrary to law.

Table of Contents

- Introduction3
- Examination Information3
 - Purpose of Examination.....3
 - Examination Development Process3
 - Examination Content3
 - Examination Registration.....4
 - Study Resources for Examination4
- Exam Accommodations for Candidate with Disabilities5
- Examination Administration6
 - Admissions to the Exam Centre6
 - Taking the Exam.....7
 - After the Examination7
- Examination Scoring and Reporting.....7
- Review and Appeal Process8
- Appendix A: Mechanical Technologist Professional Competencies.....8

Introduction

The Mechanical Technologist Certification Exam Handbook has been prepared for mechanical 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 Mechanical Technologist Certification Examination is to identify competent mechanical 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 Mechanical 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 mechanical 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 Mechanical 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 mechanical engineering knowledge, equipment, and tools to collect and analyze technical problems and provide recommendations that meet technical specifications.

Technical Design: This competency area deals with candidates' ability to apply engineering knowledge, equipment, and tools to designing mechanical components, systems, and processes.

Technical Evaluation: In this competency area candidates are expected to be able to evaluate mechanical components, systems, and processes to determine their compliance with technical specifications.

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

Table 1. Description of Examination by Competency Area

Competency Area	Percentage of Questions	Number of Questions
1. Technical Analysis	30%	30
2. Technical Design	20%	20
3. Technical Evaluation	35%	35
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	35%	35
Application	50%	50
Critical Thinking	15%	15
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 Mechanical 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**.

American Society of Heating, Refrigerating and Air-Conditioning Engineers. (2005). 2005 ASHRAE handbook: Fundamentals. Atlanta, GA: American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc.

Elonka, S., & Minich, Q. (1983). Standard refrigeration and air conditioning questions & answers (3rd ed.). New York, NY: McGraw-Hill.

Johnson, J. L. (2002). Introduction to fluid power (1st ed.). Clifton Park, NY: Delmar Cengage Learning.

Mott, R. L. (2006). Applied fluid mechanics (6th ed.). Upper Saddle River, NJ: Pearson.

Norvelle, F. D. (1994). Fluid power technology. Albany, NY: Delmar Publishing Company.

Smith, P. R. (2001). Facilities engineering and management handbook: Commercial, industrial, and institutional buildings. New York, NY: McGraw-Hill.

The American Society of Mechanical Engineers. (2013). Factory-Made Wrought Butt welding Fittings. Retrieved from http://www.metline-pipefittings.in/wp-content/uploads/2014/05/ASME_B16.9_-2012_Wrought_Steel_ButtWeld_Fittings.pdf

Walker, K. M. (2008). Applied mechanics for engineering technology (8th ed.). Upper Saddle River, NJ: Pearson Prentice Hall.

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

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.

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

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 or CTTAM may modify exam material or 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 Mechanical 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 Mechanical 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 engineering 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: Mechanical Technologist Professional Competencies

Role Description

Entry-level mechanical engineering technologists collect technical data for design, fabrication, machine optimization, cost estimates, and quality control. Working under supervision, they analyze data, perform design, and develop technical solutions for mechanical components, systems, and processes. In addition, they contribute to productivity improvement initiatives in organizations.

Competency Name:	
Technical Analysis (Mechanical Engineering Technologists)	
Competency Definition:	
Apply mechanical engineering knowledge, equipment, and tools to collect and analyze technical problems and provide recommendations that meet technical specifications.	
#	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	Verify the documentation obtained from stakeholders, such as: 1) Specifications; 2) Technical drawings; 3) Calibration materials; 4) Bills of material; 5) Operation and maintenance manuals; and 6) Site visits.
1.4	Adhere to site safety requirement when collecting data.
1.5	Describe the operation of mechanical systems: 1) Heating; 2) Cooling; 3) Fluid handling; 4) Hydraulic; and 5) Pneumatic.
1.6	Conduct technical tests.
1.7	Analyze information gathered from test equipment (e.g., process flow, electrical output and input, pressure, and temperatures).
1.8	Document the data as required for future analysis, quality control, or record keeping.
1.9	Assess information to identify constraints and potential solutions.
1.10	Compare current data to past data and the baseline to identify trends or ensure quality.
1.11	Perform basic calculations to establish the viability of technical solutions: 1) Flow; 2) Capacity; 3) Horsepower; 4) Volts and Amps; and 5) Thermal Expansion.
1.12	Analyze data results in relation to project requirements, industry standards, and local codes.
1.13	Assist in the assessment of performance characteristics, limitations, and potential safety aspects of machinery, tools, and equipment.
1.14	Develop technical solutions.
1.15	Identify solutions that meet requirements of stakeholders and industry standards.
1.16	Evaluate the merits of alternative solutions.
1.17	Prepare a technical report: 1) Observation report; 2) Equipment failures; 3) Changes in system conditions; and 4) As found report.

Competency Name:	
Technical Design (Mechanical Engineering Technologists)	
Competency Definition:	
Apply engineering knowledge, equipment, and tools to designing mechanical components, systems, and processes.	

#	Competency Indicators
2.1	Identify design aspects, industry standards, and local codes to be followed in setting technical specifications.
2.2	Prepare technical drawings with tolerances and material specifications.
2.3	Design basic mechanical components, systems, and processes under supervision, such as: 1) Machine components; 2) Manufacturing systems; 3) Building systems; and 4) Industrial piping systems.
2.4	Assist in creating specifications for installation, equipment operation, testing, commissioning, and end-of-life procedures.
2.5	Coordinate design with other engineering disciplines internally and/or externally.

Competency Name:	
Technical Evaluation (Mechanical Engineering Technologists)	
Competency Definition:	
Evaluate mechanical components, systems, and processes to determine their compliance with technical specifications.	
#	Competency Indicators
3.1	Assist in monitoring progress on fabrication projects to ensure that products meet technical specifications.
3.2	Participate in monitoring production process improvements (i.e., quality, reliability, and productivity).
3.3	Monitor the installation of mechanical components and systems for industrial and commercial projects under supervision.
3.4	Participate in a preventative maintenance program.
3.5	Review documents during fabrication and installation processes to ensure their acceptability.
3.6	Maintain records of observations.
3.7	Assist in identifying the non-conforming systems and processes.
3.9	Assist in identifying lessons learned.

Competency Name:	
Project Management (Mechanical Engineering Technologists)	
Competency Definition:	
Participate in the implementation of projects to ensure the quality of deliverables, customer satisfaction, and adherence to the schedules and budgets.	
#	Competency Indicators
4.1	Research equipment or component needs, sources, competitive prices, delivery times, or operational costs.
4.2	Assist in monitoring progress on projects.
4.3	Prioritize own work activities to ensure that project objectives are met on time.
4.4	Estimate own task duration and effort required to meet project objectives.
4.5	Explain the value of workplace safety legislation.
4.6	Comply with workplace safety legislation.