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Ministry of Training, Colleges and Universities
Colleges Branch, Program Quality Unit
9th floor, Mowat Block
900 Bay Street
Toronto, Ontario
M7A 1L2

Telephone: (416) 325-1934
Fax: (416) 327-1853
E-mail: colleges.branch@edu.gov.on.ca

Inquiries regarding specific Motive Power Technician programs offered by colleges of applied arts and technology in Ontario should be directed to the relevant college.

Inquiries regarding this program standard should be directed to the address noted above.

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I. Introduction

This document is the Program Standard for all Motive Power Technician programs of instruction leading to an Ontario College Diploma delivered by Ontario colleges of applied arts and technology (MTCU funding code 56405).

Development of System-Wide Program Standards

In 1993, the Government of Ontario initiated program standards development with the objectives of bringing a greater degree of consistency to college programming offered across the province, broadening the focus of college programs to ensure graduates have the skills to be flexible and to continue to learn and adapt, and providing public accountability for the quality and relevance of college programs.

The Colleges Branch of the Ministry of Training, Colleges and Universities has responsibility for the development, review, and approval of system-wide standards for programs of instruction at Ontario colleges of applied arts and technology.

Program Standards

Program standards apply to all similar programs of instruction offered by colleges across the province. Each program standard for a postsecondary program includes the following elements:

- **Vocational standard** (the vocationally specific learning outcomes which apply to the program of instruction in question),

- **Generic employability skills standard** (the generic skills learning outcomes which apply to all programs of instruction offering similar credentials), and

- **General education standard** (the requirement for general education in postsecondary programs of instruction).

Collectively, these elements outline the essential skills and knowledge that a student must reliably demonstrate in order to graduate from the program.

Individual colleges of applied arts and technology offering the program of instruction determine the specific program structure, delivery methods, and other curriculum matters to be used in assisting students to achieve the outcomes articulated in the standard. Individual colleges also determine whether additional local learning outcomes will be required to reflect specific local needs and/or interests.
The Expression of Program Standards as Learning Outcomes

Learning outcomes represent culminating demonstrations of learning and achievement. They are not simply a listing of discrete skills, nor broad statements of knowledge and comprehension. In addition, learning outcomes are interrelated and cannot be viewed in isolation of one another. As such, they should be viewed as a comprehensive whole. They describe performances that demonstrate that significant integrated learning by graduates of the program has been achieved and verified.

Expressing standards as learning outcomes ensures consistency in the outcomes for program graduates, while leaving to the discretion of individual colleges curriculum matters such as the specific program structure and delivery methods.

The Presentation of the Learning Outcomes

The learning outcome statement sets out the culminating demonstration of learning and achievement that the student must reliably demonstrate before graduation.

The elements of the performance for each outcome define and clarify the level and quality of performance necessary to meet the requirements of the learning outcome. However, it is the performance of the learning outcome itself on which students are evaluated. The elements are indicators of the means by which the student may proceed to satisfactory performance of the learning outcome. The elements do not stand alone but rather in reference to the learning outcome of which they form a part.

The Development of a Program Standard

In establishing the standards development initiative, the Government determined that all postsecondary programs of instruction should include vocational skills coupled with a broader set of essential skills. This combination is considered critical to ensuring that college graduates have the skills required to be successful both upon graduation from the college program and throughout their working and personal lives.

A program standard is developed through a broad consultation process involving a range of stakeholders with a direct interest in the program area, including employers, professional associations, universities, secondary schools, and program graduates working in the field, in addition to students, faculty, and administrators at the colleges themselves. It represents a consensus of participating stakeholders on the essential learning that all program graduates should have achieved.
Updating the Program Standard

The Ministry of Training, Colleges and Universities will undertake regular reviews of the vocational learning outcomes for this program to ensure that the Motive Power Technician Program Standard remains appropriate and relevant to the needs of students and employers across the Province of Ontario. To confirm that this document is the most up-to-date release, contact the Ministry of Training, Colleges and Universities at the address or telephone number noted on the inside cover page.
II. Vocational Standard

All graduates of Motive Power Technician programs of instruction must have achieved the sixteen vocational learning outcomes listed in the following pages, in addition to achieving the generic employability skills learning outcomes and meeting the general education standard.

Preamble

The motive power field encompasses a variety of vehicle transportation. Graduates of the Motive Power Technician Program have demonstrated achievement of vocational learning outcomes that include the essential skills, knowledge, and attitudes for entry-level positions in a cross-section of motive power environments.

Achievement of the vocational learning outcomes will prepare the graduates of the four-semester Motive Power Technician Program to analyse and solve motive power system problems, to diagnose* and repair mechanical, electronic, and electrical motive power components and systems, and to use a variety of troubleshooting techniques and test equipment to support vehicle transportation. In addition, graduates will have developed safe working practices in the use of machinery, tools, and equipment. Finally, graduates will be able to assist in project management, quality control, and quality assurance; to perform customer service functions; and to apply communication, documentation, information technology, and computer skills to support a motive power environment.

Graduates of Motive Power Technician Programs work in a broad range of employment settings in businesses and industries in both large and small organizations, such as dealerships, manufacturers, service and repair shops, retail stores, and insurance companies. Their activities may include repairs, service writing, sales, customer relations coordination, parts counter service, warranty claim processing, supervising, and insurance appraisal.

While certain positions may require discrete knowledge or a higher level of a particular skill, it is clear that the skills, knowledge, and attitudes essential to all entry-level positions in the motive power field have been identified in the Motive Power Technician Program Standard. Individual college programs may build on this standard by offering an area of specialization. Graduates' learning would be significantly enhanced by opportunities for as much practical experience as is feasible during their time in the program.

*diagnose: to use a variety of procedures such as inspection, analysis, and testing to identify the nature of a problem affecting a motive power component, system, or subsystem.
There may be opportunities for graduates to pursue further educational or occupational qualifications; through apprenticeship or through articulation agreements between the colleges, universities, or professional organizations, graduates may be granted credits towards a degree or other certification. Students should contact individual colleges for further details of a college's articulation agreements with other institutions or professional associations.
Synopsis of the Vocational Learning Outcomes
Motive Power Technician Programs

The graduate has reliably demonstrated the ability to

1. analyse, diagnose*, and solve various motive power system problems by using problem-solving and critical thinking skills and strategies and by applying fundamental knowledge of motor vehicle operation, components, and their interrelationships.

2. diagnose* and repair climate control systems in compliance with manufacturers’ recommendations.

3. diagnose* and repair engine systems in compliance with manufacturers’ recommendations.

4. diagnose* and repair electrical, electronic, personal safety, and emission components and systems in compliance with manufacturers’ recommendations.

5. diagnose* and repair drive train components and systems in compliance with manufacturers’ recommendations.

6. diagnose* and repair suspension, steering, and brake components and systems in compliance with manufacturers’ recommendations.

7. disassemble and assemble components to required specifications by applying workshop skills and knowledge of basic shop practices.

8. select and use a variety of troubleshooting techniques and test equipment to assess electronic circuits, vehicle systems, and subsystems.

9. apply knowledge of hydraulics and pneumatics to the testing and analysis of motive power systems and subsystems.

10. communicate information effectively, credibly, and accurately by producing supporting documentation to appropriate standards.

11. use information technology and computer skills to support work in a motive power environment.

*diagnose: to use a variety of procedures such as inspection, analysis, and testing to identify the nature of a problem affecting a motive power component, system, or subsystem.
12. prepare, support, maintain, and communicate data from log, record, and documentation systems.

13. apply business practices, project management skills, and communication skills to improve customer service.

14. assist in quality-control and quality-assurance programs and procedures.

15. develop and use personal and professional strategies and plans to improve professional growth, job performance, and work relationships.

16. complete all assigned work in compliance with occupational, health, safety, and environmental law; established policies and procedures; codes and regulations; and in accordance with ethical principles.

Note: The learning outcomes have been numbered as a point of reference; numbering does not imply prioritization, sequencing, nor weighting of significance.
The Vocational Learning Outcomes

1. The graduate has reliably demonstrated the ability to

   analyse, diagnose*, and solve various motive power system problems by using problem-solving and critical thinking skills and strategies and by applying fundamental knowledge of motor vehicle operation, components, and their interrelationships.

Elements of the Performance

- identify the technical criteria necessary to resolve motive power system problems
- apply knowledge of climate control systems, engines, drive lines, fuel delivery, ignition, vehicle suspension, steering, and brakes to analyse and resolve technical problems
- inspect, test, and make adjustments to motive power systems according to established procedures
- use appropriate testing and measurement equipment to assist in troubleshooting
- use a variety of resources (e.g., technical manuals, Internet, CD-ROM, suppliers, coworkers) to acquire relevant technical information
- apply mathematical and scientific analysis for troubleshooting, maintaining, and testing components, equipment, and systems
- use a systematic approach to problem solving and decision making
- recognize limitations in problem solving
- calculate and convert Imperial and SI measurement units using a variety of methods
- verify solutions by using diverse problem-solving techniques
- build a repertoire of problem-solving skills through experience and other learning opportunities
- connect and operate diagnostic test equipment in compliance with manufacturers’ recommendations

*diagnose: to use a variety of procedures such as inspection, analysis, and testing to identify the nature of a problem affecting a motive power component, system, or subsystem.
2. *The graduate has reliably demonstrated the ability to*

*diagnose* and repair climate control systems in compliance with manufacturers’ recommendations.

**Elements of the Performance**

- performance test ventilation and heating systems
- performance test air conditioning systems
- inspect, test, and repair climate control systems
- inspect and test body and trim components for problems affecting climate control such as water leaks
- recognize the importance of ODP (ozone depletion potential)
- recognize the necessity to obtain certification required for the manipulation of gases and fluids used in air conditioning systems

*diagnose*: to use a variety of procedures such as inspection, analysis, and testing to identify the nature of a problem affecting a motive power component, system, or subsystem.
3. The graduate has reliably demonstrated the ability to diagnose* and repair engine systems in compliance with manufacturers’ recommendations.

Elements of the Performance

- inspect and measure bearings and seals
- select and apply sealants
- disassemble, measure, and assemble engines and their components
- inspect and test engine cooling systems
- inspect and test belts and pulleys
- inspect and test lubrication systems
- identify different engine types and sizes
- take into account engine removal concerns such as lifting and hoisting
- perform and follow maintenance procedures (e.g., lubrication, oil change, filter change)
- inspect and test cylinder blocks and components
- apply measuring procedures to engine crankshaft and bearings
- inspect and test camshafts and valve train drive mechanisms
- service engine cylinder heads
- apply measuring procedures to engine valve guides, valves, seats, and valve springs
- determine cause of engine component failure
- apply diagnostic procedures to turbochargers and superchargers
- identify and perform machining processes for cylinders, heads, valves, etc.
- perform nondestructive component testing

*diagnose: to use a variety of procedures such as inspection, analysis, and testing to identify the nature of a problem affecting a motive power component, system, or subsystem.
4. The graduate has reliably demonstrated the ability to

diagnose* and repair electrical, electronic, personal safety, and emission components and systems in compliance with manufacturers’ recommendations.

Elements of the Performance

- inspect and test batteries, and charging and starting systems
- use manufacturers’ wiring diagrams to locate electrical components and circuits
- inspect, test, and repair circuits and circuit protection devices
- inspect intake and exhaust systems
- inspect and test fuel systems
- replace filters
- input and output test fuel injection, exhaust gas recirculation (EGR), secondary air injection (AIR) pumps, and emission components
- remove and replace fuel system components
- identify and inspect emission components
- inspect and test electronic devices such as diodes, transistors, and sensors
- inspect and test electronic ignition system devices
- apply diagnostic procedures to A/C generators and voltage regulators
- maintain electronic fuel injection systems
- inspect and test primary fuel circuit on diesels
- apply diagnostic procedures to cranking motor circuits and drives
- inspect and test restraint and automatic seat belt systems
- recognize the operation of inflatable and non-inflatable restraint systems
- inspect and test distributorless ignition systems
- apply diagnostic procedures to internally regulated, externally regulated, and computer-controlled charging systems
- inspect and test power accessories and electrical options

*diagnose: to use a variety of procedures such as inspection, analysis, and testing to identify the nature of a problem affecting a motive power component, system, or subsystem.
5. The graduate has reliably demonstrated the ability to diagnose* and repair drive train components and systems in compliance with manufacturers’ recommendations.

Elements of the Performance

- apply diagnostic procedures to push-type clutches and flywheel assemblies
- adjust and/or replace clutch assemblies
- apply diagnostic procedures to manual transmissions/transaxles
- dismantle, inspect, and test driveline components of rear wheel drive vehicles and front wheel drive vehicles
- apply diagnostic procedures to transfer case assemblies
- apply diagnostic procedures to service automatic transmissions/transaxles
- apply diagnostic procedures to lockup torque converters, sensors, and controls

*diagnose: to use a variety of procedures such as inspection, analysis, and testing to identify the nature of a problem affecting a motive power component, system, or subsystem.
6. The graduate has reliably demonstrated the ability to diagnose* and repair suspension, steering, and brake components and systems in compliance with manufacturers’ recommendations.

Elements of the Performance

• inspect and test suspension system components and subassemblies
• apply diagnostic procedures to tire and rim assemblies
• identify, inspect, and replace brake lines
• replace or adjust hand and parking brake assemblies
• inspect and service disc and drum brake assemblies
• perform four wheel alignment
• identify and inspect brake system components and subassemblies
• inspect, test, and lubricate steering systems
• replace shock absorbers, MacPherson struts, wheel bearing assemblies and other related components
• inspect and test power steering pumps and integral power steering units
• apply diagnostic procedures to power-assisted brake assemblies
• inspect and test anti-lock and traction control brake assemblies
• replace and test wheel sensors
• apply inspection and testing techniques to vehicle pre-alignment checks
• apply diagnostic procedures to vehicle steering problems
• make required adjustments to align vehicles (e.g., four wheel alignment)

*diagnose: to use a variety of procedures such as inspection, analysis, and testing to identify the nature of a problem affecting a motive power component, system, or subsystem.
7. The graduate has reliably demonstrated the ability to

disassemble and assemble components to required specifications by applying
workshop skills and knowledge of basic shop practices.

Elements of the Performance

• assess the performance characteristics, limitations, potential, and safety of
  machinery, tools, and other equipment
• repair or correct component faults
• use appropriate tools, equipment, and processes to remove, replace, and assemble
  components
• install and remove fasteners
• use oxyacetylene welding and Metal inert gas (MIG) welding equipment as
  required
• use repair techniques such as drilling, tapping, and welding
• select and use hand tools properly
• use measuring devices such as micrometers
8. *The graduate has reliably demonstrated the ability to*

select and use a variety of troubleshooting techniques and test equipment to assess electronic circuits, vehicle systems, and subsystems.

**Elements of the Performance**

- troubleshoot equipment and systems such as engines, drive trains, transmission, clutches, steering and suspension systems, brakes, air conditioning and ventilation systems, fuel systems, exhaust systems, emission devices, and electronic components
- use a variety of references to complete troubleshooting
- troubleshoot in accordance with established principles, practices, procedures, and policies
- use the correct testing equipment and setup for the accurate assessment of equipment performance
- analyse problems of an electrical/electronics nature and apply established practice to arrive at practical solutions
- repair equipment when appropriate
- follow established service schedules
- determine whether a fault is electrical, electronic, or mechanical in nature
- recommend appropriate repair process and initiate repair
- apply inspection and testing procedures using diagnostic equipment such as pressure gauges, vacuum gauges, and digital tachometers in compliance with manufacturers’ recommendation
- apply knowledge of instrumental theory to the performance of analyses
- recognize abnormal results according to guidelines and respond accordingly
- select and use standard equipment and materials, such as scopes, emission testers, tire balancers, and scan tools
- interpret and report results of analysis using required format
- use testing equipment and their associated data systems
- perform physical testing on motive power components, electronic devices, assemblies, and systems
- check the calibration of a variety of trade tools and equipment such as scan tools and wheel balancers
- maintain precision and non-precision measuring tools such as micrometers, verniers, and calipers
9. *The graduate has reliably demonstrated the ability to*

apply knowledge of hydraulics and pneumatics to the testing and analysis of motive power systems and subsystems.

**Elements of the Performance**

- apply knowledge of hydraulics to troubleshoot transmissions
- analyse the operation of fluid systems
- install, repair, and maintain vehicle braking systems using knowledge of hydraulics and pneumatics
- analyse the design features and operation of fluid conditioners, pumps, valves, and actuators
10. *The graduate has reliably demonstrated the ability to*

communicate information effectively, credibly, and accurately by producing supporting documentation to appropriate standards.

**Elements of the Performance**

- interpret and prepare work-related documents
- write and prepare reports, business letters, and memos
- organize, interpret, write, and produce technical reports
- use correct automotive terminology suited to the situation and the persons involved
- communicate well with others in oral and written formats
- use electronic media appropriately
- plan, organize, and deliver oral presentations using appropriate technology
- compile, organize, and present data in accordance with established procedures and to recognized standards
11. The graduate has reliably demonstrated the ability to

use information technology and computer skills to support work in a motive power environment.

Elements of the Performance

• use computer systems and application software to resolve technical problems
• use computer hardware and applications to access, exchange, store, retrieve, process, organize, and present information and produce technical documents within a transportation environment
• use computers to set up and monitor vehicle systems
• use computer hardware and software to measure components to required specifications
• apply electronic processing to customer information databases
• access information from a variety of electronic sources (e.g., the Internet)
12. *The graduate has reliably demonstrated the ability to*

prepare, support, maintain, and communicate data from log, record, and
documentation systems.

**Elements of the Performance**

- prepare, evaluate, and modify technical documentation such as operator,
maintenance, repair, and installation procedures
- use and maintain paper-based and electronic systems to store and retrieve
  information
- interpret and use information from technical manuals
- maintain current, clear, and accurate project-related documents in accordance with
  established organizational practices
- use records to prepare reports and plan activities
- prepare and maintain parts inventory and installation records
- prepare and maintain maintenance and service logs
- document clearly work processes such as problem-solving methodologies and
  troubleshooting procedures
- apply fundamental stockroom control skills
- document the testing, modification, and application of equipment and systems
- keep logs of work completed
13. The graduate has reliably demonstrated the ability to apply business practices, project management skills, and communication skills to improve customer service.

Elements of the Performance

• apply principles of customer service when dealing with customers
• participate in meetings in a variety of work-related roles
• analyse work activities through the appropriate use of data sampling and recording methods and the presentation of charts, diagrams, models, and reports
• use time, equipment, and materials in a cost-effective manner
• apply basic knowledge of sales and marketing within materials and operations management
• take into account the importance of design and maintenance of the physical plant, facilities, and equipment
• participate in the development of strategies to support operations and customer service requirements
• perform the work of customer service support positions such as parts/counter personnel and service writer
• contribute to parts, service, and equipment sales
• help find solutions to customers’ problems
• recognize the importance of appropriate behaviour when dealing with customers of various cultures
• use negotiation strategies to achieve mutually beneficial results
14. The graduate has reliably demonstrated the ability to

assist in quality-control and quality-assurance programs and procedures.

Elements of the Performance

- follow maintenance schedules
- apply preventive and predictive maintenance techniques
- record and report compliance with appropriate quality assurance procedures and specifications
- participate in quality-assurance testing
- assist in preparing reports concerning statistical data
- make adjustments or changes to vehicle operation as required by the results of quality-assurance testing
- inspect components using appropriate measuring instruments as required
- recognize the importance of various relevant quality-control/quality-assurance programs
- use quality-control charts as required
- use relevant software to assist in monitoring quality assurance and quality control
- apply functional specifications, procedures, and relevant standards applicable to the motive power environments
15. *The graduate has reliably demonstrated the ability to*

*develop and use personal and professional strategies and plans to improve professional growth, job performance, and work relationships.*

**Elements of the Performance**

- apply a systematic approach to decision making
- keep abreast of changes in the motive power field
- use appropriate self-management techniques (e.g., time management, stress management)
- recognize the importance of ongoing professional development
- apply team work and interpersonal knowledge and skills to improve work relationships
- act reliably, flexibly, and tactfully, and use good judgement in all interpersonal situations
- listen effectively and respond appropriately to feedback
- recognize the importance of professional associations and the value of obtaining professional designations and certification
16. *The graduate has reliably demonstrated the ability to*

complete all assigned work in compliance with occupational, health, safety, and environmental law; established policies and procedures; codes and regulations; and in accordance with ethical principles.

**Elements of the Performance**

- comply with environmental, health, and safety legislation and their related codes and regulations such as the Workplace Hazardous Materials Information System (WHMIS), and the Occupational Health and Safety Act (OHSA)
- perform all work in accordance with the established workplace safety protocols
- consider the significance of legal and ethical issues such as human rights, health and safety, employment standards, and privacy within business operations
- apply appropriate material handling procedures to vehicle subsystems and assemblies
- support the provision of a healthy and safe workplace environment
- comply with work specifications and other technical documents
- adhere to applicable laws, regulations, codes, standards, requirements, and policies relating to transportation (e.g., vehicle safety laws, Highway Traffic Act)
III. Generic Employability Skills Standard

All graduates of Motive Power Technician programs of instruction must have achieved the thirteen generic employability skills learning outcomes listed on the following pages, in addition to achieving the vocational learning outcomes and meeting the general education standard. In the generic employability skills learning outcomes, an explanation of the outcome is also provided to help ensure clarity.
Synopsis of the Generic Employability Skills Learning Outcomes
Motive Power Technician Programs

*The graduate has reliably demonstrated the ability to*

1. communicate clearly, concisely, and correctly in the written, spoken, and visual form that fulfills the purpose and meets the needs of the audiences.

2. reframe information, ideas, and concepts using the narrative, visual, numerical, and symbolic representations which demonstrate understanding.

3. apply a wide variety of mathematical techniques with the degree of accuracy required to solve problems and make decisions.

4. use a variety of computer hardware and software and other technological tools appropriate and necessary to the performance of tasks.

5. interact with others in groups or teams in ways that contribute to effective working relationships and the achievement of goals.

6. evaluate her or his own thinking throughout the steps and processes used in problem solving and decision making.

7. collect, analyze, and organize relevant and necessary information from a variety of sources.

8. evaluate the validity of arguments based on qualitative and quantitative information in order to accept or challenge the findings of others.

9. create innovative strategies and/or products that meet identified needs.

10. manage the use of time and other resources to attain personal and/or project-related goals.

11. take responsibility for her or his own actions and decisions.

12. adapt to new situations and demands by applying and/or updating her or his knowledge and skills.

13. represent her or his skills, knowledge, and experience realistically for personal and employment purposes.
The Generic Employability Skills Learning Outcomes

1.  The graduate has reliably demonstrated the ability to communicate clearly, concisely, and correctly in the written, spoken, and visual form that fulfills the purpose and meets the needs of the audiences.

Explanation

Communicating in a clear, concise, and correct manner requires producing the written, spoken, or visual material that best suits the situation. Graduates will have developed their ability to analyze their audiences to identify what is required and to match those needs with the means that is most appropriate. They will have produced material according to the style and conventions required, and they will have checked their products for accuracy and clarity. Finally, graduates will have used the tools available to them to create and correct their written, spoken, and visual messages.

Elements of the Performance

- Plan and organize communications according to the purpose and the audiences
- Choose the format (e.g., memo, illustration, video, multimedia presentation, diagram) appropriate to the purpose
- Incorporate content that is meaningful and necessary
- Produce material that conforms to the conventions of the chosen format
- Use language and style suitable to the audience and purpose
- Ensure that the material is free from mechanical errors
- Use the computer technology that will enhance the production of materials
- Evaluate communications and adjust for any errors in content, structure, style, and mechanics
2. *The graduate has reliably demonstrated the ability to*

*reframe information, ideas, and concepts using the narrative, visual, numerical, and symbolic representations which demonstrate understanding.*

**Explanation**

Responding to messages from many sources requires the ability to receive and to comprehend what has been received. One way to demonstrate that comprehension is to reframe, or restate in other forms, the original message. This requires graduates to have developed the skills to read, listen to, and observe messages contained within narrative and visual form. It also requires the ability to construct unique narrative and visual representations that are consistent with the original messages.

**Elements of the Performance**

- Develop and use strategies to read, listen, and observe effectively
- Clarify what has been read, heard, and observed
- Reproduce original information in other formats (e.g., written and spoken summaries; tables, figures, charts, diagrams, maps, drawings, photographs, and computer-generated graphics; terms represented by numbers; and values represented by letters or signs)
- Use technology, where appropriate, to aid in reframing
- Evaluate the representation for consistency of meaning with the original
- Acknowledge the use of material from other sources according to the conventions of the medium used
3. *The graduate has reliably demonstrated the ability to*

apply a wide variety of mathematical techniques with the degree of accuracy
required to solve problems and make decisions.

**Explanation**

Using mathematics effectively in everyday situations requires the ability to apply a wide
variety of mathematical skills accurately. Graduates will have demonstrated their ability
to apply the concepts of number and space to situations which include quantities,
magnitudes, measurements, and ratios. They will have developed their ability to identify
the need for mathematics, to apply mathematical techniques (concepts, conventions,
strategies, and operations) and to check the results of their applications. This will require
graduates to be flexible and creative and to be confident in their mathematical skills and
abilities.

**Elements of the Performance**

- Recognize situations that require mathematics
- Assess potential mathematical strategies (including models, geometric
  representations or formulas, elementary algebraic equations, descriptive statistical
  methods, and mathematical reasoning) for suitability and effectiveness
- Decide on the degree of accuracy required for answers
- Estimate probable answers
- Execute mathematical operations necessary to implement selected strategies
- Use calculators or appropriate technological tools to perform mathematical
  operations accurately
- Check for errors in numerical answers and the appropriate fit between problems
  and answers
- Express answers clearly
- Transfer the use of mathematical strategies from one situation to another
4. **The graduate has reliably demonstrated the ability to**

use a variety of computer hardware and software and other technological tools appropriate and necessary to the performance of tasks.

**Explanation**

Using computers and other technologies as tools to increase productivity and to enhance tasks requires graduates to have the confidence and ability to use the tools well. Graduates will have demonstrated the ability to recognize when computers and other technologies contribute to completing tasks, solving problems, performing research, and creating products. They will use the technological tool most appropriate to the task and use it accurately. Finally, they will have gained confidence in continuing to learn about and cope with new technologies in the future.

**Elements of the Performance**

- Use basic operating system functions competently (e.g., load software, store and retrieve data)
- Determine which tasks can best be handled by computers and other technology
- Select suitable software, equipment, and tools for the task
- Use the software, equipment, and tools effectively, correctly, and ethically
- Deal with equipment and software problems and errors in a logical and systematic manner
- Transfer concepts, knowledge, and skills from one technology to another
- Evaluate one’s own use of hardware, software, and technological tools
5. The graduate has reliably demonstrated the ability to interact with others in groups or teams in ways that contribute to effective working relationships and the achievement of goals.

Explanation

Working in teams or groups in either a work or personal context requires the ability to assume responsibility for collective duties and decisions. It also requires interacting effectively with the members of the group. Therefore, in achieving this outcome, graduates will have demonstrated their ability to understand and complete the various tasks required of them as group members. They will also have demonstrated their ability to understand and respond to others.

Elements of the Performance

- Identify the tasks to be completed
- Establish strategies to accomplish the tasks
- Identify roles for members of the team/group
- Clarify one’s own roles and fulfill them in a timely fashion
- Treat other members of the group equitably and fairly
- Contribute one’s own ideas, opinions, and information while demonstrating respect for those of others
- Employ techniques intended to bring about the resolution of any conflicts
- Regularly assess the group’s progress and interactions and make adjustments when necessary
6. The graduate has reliably demonstrated the ability to evaluate her or his own thinking throughout the steps and processes used in problem solving and decision making.

Explanation

Solving a range of complex problems and dealing with a variety of tasks require the thinking skills and strategies that will allow graduates to identify what has to be done and to select and implement the most suitable approach. In applying thinking skills and strategies, graduates will have understood the limits as well as the potential of their own thought processes. As well, in attempting various strategies, they will have explored styles of thinking that may be new to them. This will allow graduates to understand the way they think and how they approach decisions and problems.

Elements of the Performance

- Clarify the nature and extent of problems or required directions
- Explore various thinking skills and strategies that could be used
- Identify limits as well as the potential of one’s own thought processes
- Choose and apply thinking skills and strategies (e.g., inductive and deductive thinking; creative and intuitive thinking; inquiry; critical thinking; and reflection)
- Evaluate results of the thinking skills and strategies used in problem solving and decision making
- Appreciate the benefits of the use of alternative types of thinking
7. *The graduate has reliably demonstrated the ability to*

*collect, analyze, and organize relevant and necessary information from a variety of sources.*

**Explanation**

Making decisions and completing tasks often requires information that can be used as support. Graduates, therefore, must be able to access current, relevant, and useful information and to organize that information in understandable ways. In achieving this outcome, graduates will have developed and used strategies to locate and gather a wide range of information, most particularly through technological means. They will have learned how to select pertinent information and to sort it so that it can be displayed in useful formats like databases and spreadsheets. This information can then be used to support decisions and to assist in the completion of tasks.

**Elements of the Performance**

- Identify the nature of information required
- Investigate sources of information (including people, text, databases, and the Internet)
- Gather information from the most appropriate sources using various data collection techniques, including technology
- Examine the information and select what is relevant, important, and useful
- Employ a variety of techniques to organize the information (e.g., spreadsheets, databases, graphs, charts)
- Draw conclusions about how the information can be used
- Evaluate the processes used
- Cite sources according to the conventions of the medium used
8. *The graduate has reliably demonstrated the ability to*

*evaluate the validity of arguments based on qualitative and quantitative information in order to accept or challenge the findings of others.*

**Explanation**

With the wealth of numerical and non-numerical information available, graduates must be able to interpret, understand, and draw conclusions about what others have produced. Graduates will have used their mathematical abilities to question the validity of statistics and other numerical claims. Graduates also will have used their language and critical thinking skills to analyze the assumptions and evidence that others use to support more qualitative arguments and conclusions. As a result, graduates will have developed the ability to question and make decisions about what they read, hear, and observe.

**Elements of the Performance**

- Identify conclusions and claims made by others
- Detect any fallacies, biases, misrepresentations, and assumptions and judge their relevance to supporting arguments
- Check for accuracy and credibility of claims or arguments
- Be prepared to defend acceptance or rejection of claims or arguments
9. *The graduate has reliably demonstrated the ability to*

create innovative strategies and/or products that meet identified needs.

**Explanation**

Creating strategies and products that are original and innovative will require graduates to develop their creative thinking skills to find alternative ways to address situations. Graduates will have developed the confidence to use old information in new ways; to see unique relationships; and to practice the lateral, divergent, and intuitive thinking that will yield new approaches.

**Elements of the Performance**

- Analyze needs
- Generate creative ideas for strategies and products that will meet needs
- Choose alternatives to pursue based on needs and criteria of projects/plans
- Create strategies/products
- Evaluate strategies/products according to meeting needs
10. *The graduate has reliably demonstrated the ability to*

manage the use of time and other resources to attain personal and/or project-related goals.

**Explanation**

Achieving task-related goals in their personal and professional lives requires graduates to use their time, money, space, and other, often limited, resources as efficiently as possible. Graduates will have developed their ability to plan and predict ways of achieving goals. They will have developed and used tools intended to assist in the process. Finally, they will have attempted to follow their plans and use the tools, assessing regularly how realistic the goals, plans, and processes are and adapting when it is necessary.

**Elements of the Performance**

- Define reasonable and realistic goals
- Use planning tools (e.g., budgets, schedules) to achieve goals
- Monitor the process and goals and respond to changes
- Use resources (e.g., money, space, time) efficiently to accomplish tasks
- Re-evaluate goals and the use of resources and make appropriate adjustments
11. _The graduate has reliably demonstrated the ability to take responsibility for her or his own actions and decisions._

**Explanation**

Making decisions, taking positions, and completing tasks require graduates to be accountable for actions taken and to defend their convictions. Graduates will have demonstrated their ability to evaluate what they do and why they do it. They will have taken into consideration their individual values, beliefs, and opinions and the effects these have on their actions. Not only will graduates be able to justify their decisions, they will be able to advocate positively on behalf of themselves.

**Elements of the Performance**

- Review the results of one’s actions and decisions
- Reflect on the processes and practices used
- Identify any errors and make corrections
- Identify successes for adaptation to other situations
- Account for how one’s own values and beliefs affect actions and decisions
- Evaluate and act upon constructive feedback
- Be prepared to defend decisions made and actions taken
12. The graduate has reliably demonstrated the ability to adapt to new situations and demands by applying and/or updating her or his knowledge and skills.

**Explanation**

Transferring skills from one context to another enables graduates to be lifelong learners. Graduates will have developed the confidence to know that their current skills are applicable to a range of changing, novel, and unexpected situations. They will have demonstrated their ability to reflect on what they can do, match those skills to the new demands, and apply previous skills or develop the additional ones that will make them as effective in the new situations.

**Elements of the Performance**

- Assess current skills, knowledge, and learning styles
- Identify skills and knowledge required for new situations
- Adapt current skills and knowledge to new situations
- Identify new skills and knowledge required
- Choose the most appropriate learning and working styles to acquire new skills and knowledge
- Evaluate success of the processes and actual adaptations
13. *The graduate has reliably demonstrated the ability to*

represent her or his skills, knowledge, and experience realistically for personal and employment purposes.

**Explanation**

Preparing for changes in their personal and professional lives requires graduates to assess and present their accomplishments and abilities. In achieving this outcome, graduates will have developed their ability to reflect on what they have done and learned. They will also have summarized their abilities in ways that are attractive and useful to potential recipients. These ways may include portfolios and resumes. Finally, graduates will have developed the skills to present themselves and their accomplishments personally and with confidence.

**Elements of the Performance**

- Summarize one’s own skills, knowledge, and experience realistically
- Choose formats (e.g., resume, portfolio, interview) which best display skills, knowledge, and experiences according to the situations
- Evaluate responses to the representations and make any adjustments
IV. General Education Standard

All graduates of Motive Power Technician programs of instruction must have met the general education requirement described on the following pages, in addition to achieving the vocational and generic employability skills learning outcomes.

The General Education Requirement for Ontario College Diploma and Ontario College Advanced Diploma Programs

Graduates will have been engaged in learning that exposes them to at least one discipline outside their main field of study and increases their awareness of the society and culture in which they live and work. This will typically involve students taking three to five courses (or the equivalent) designed discretely from vocational learning opportunities. This learning would normally be delivered using a combination of required and elective processes.

The general education requirement is an integral component of the Motive Power Technician Program Standard, along with the vocational and generic employability skills learning outcomes.

The general education requirement is to be met consistent with the following guiding principles:

1. General education in the colleges is to identify and deal with issues of societal concern in a manner relevant to the lives of students. General education courses are to be structured in such a way as to guide students through the historical context of such issues, their theoretical bases, and application to contemporary life.

2. All general education courses offered in the colleges are to be designed to benefit one or more of three aims: learners’ personal growth and enrichment, informed citizenship, and working life.

3. An essential component of the mission of Ontario’s colleges is the encouragement and support of continuous learning. This commitment to lifelong learning is to be reflected in each of the general education courses offered in the colleges.
General education appropriate for Ontario colleges is defined as those postsecondary learning experiences that enable learners to meet more effectively the societal challenges that they face in their community, family, and working life. General education in the colleges provides learners with insight into the enduring nature of the issues being addressed and into their particular relevance to today and the future. This education is intended to encourage and support continuous learning and is designed to address one or more of the goals and associated broad objectives established for general education.

Goals and Broad Objectives of General Education

1. **Aesthetic Appreciation**

   *understand beauty, form, taste, and the role of the arts in society*

   **Broad Objectives**

   - develop critical awareness of the arts in society
   - perceive and evaluate the role of the arts in society
   - heighten critical appreciation through development and application of personal and formal judgement factors

2. **Civic Life**

   *understand the meaning of freedoms, rights, and participation in community and public life*

   **Broad Objectives**

   - develop knowledge of the structure and function of governments in Canada: legislative, judicial, and administrative arms; roles of elected officials and public servants; and a personal awareness of citizen responsibility
   - develop historical understanding of major issues affecting Canadian politics and a critical awareness of related public policy
   - develop awareness of international issues and their effects, and the place of Canada in international communities
   - develop awareness of the history, significance, and organization of the voluntary sector in community life
3. **Cultural Understanding**

*understand the cultural, social, ethnic, and linguistic diversity of Canada and the world*

**Broad Objectives**

- develop an understanding of cultural identity by linking personal history to broader cultural study
- develop an understanding of the diversity of cultures and subcultures represented in Canadian society and of their interactions within the Canadian society
- develop intercultural understanding through reasoned reflection on various cultures’ responses to universal human issues

4. **Personal Development**

*gain greater self-awareness, intellectual growth, well-being, and understanding of others*

**Broad Objectives**

- consider one’s expectations and values and analyze their impact on personal goals
- apply an understanding of the individual and human development to personal life and relationships
- integrate the concept of well-being into one’s lifestyle
- understand oneself as a learner and articulate one’s own learning style

5. **Social Understanding**

*understand relationships among individuals and society*

**Broad Objectives**

- develop informed understanding of social organization and institutions and of ongoing issues in relationships between individuals, groups, and societies
- develop informed understanding of social trends, social change, and social problems and of implications for social and personal response
- develop informed understanding of contemporary social problems and issues
6. **Understanding Science**

*appreciate the contribution of science to the development of civilization, human understanding, and potential*

**Broad Objectives**

- develop an understanding of the history, philosophy, contributions, perspectives, and limitations of the sciences
- develop an understanding of the scientific method and its uses in measuring quantifiable entities and confirming laws of nature

7. **Understanding Technology**

*understand the interrelationship between the development and use of technology and society and the ecosystem*

**Broad Objectives**

- relate implications of current transformations in technological knowledge and development to our physical and biological world
- develop awareness of ethical positions on enduring issues regarding the place of the human species in the physical and biological world

8. **Work and the Economy**

*understand the meaning, history, and organization of work; and of working life challenges to the individual and society*

**Broad Objectives**

- set personal expectations for efficiency, effectiveness, ethics, and rewards and reconcile them with the changing work environment
- apply knowledge of the organization and structure of work, its institutions, and history; and of social and cultural attitudes to work
- develop an understanding of the changing nature of work and the economy