



## PROGRAM OUTLINE

Automotive Service Technician – Foundation

Implementation date: September 1, 2024

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# **AUTOMOTIVE SERVICE TECHNICIAN FOUNDATION PROGRAM OUTLINE**

**APPROVED BY INDUSTRY  
FEBRUARY 2024**

**IMPLEMENTATION DATE  
SEPTEMBER 1, 2024**

**THIS BC PROGRAM HAS BEEN HARMONIZED AND IS BASED ON RSOS 2023**

**Developed by  
SkilledTradesBC  
Province of British Columbia**

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# **Section 1**

## **INTRODUCTION**

### **Automotive Service Technician - Foundation**

## Foreword

This revised Automotive Service Technician Foundation Program Outline is intended as a guide for instructors, apprentices, and employers of apprentices as well as for the use of industry organizations, regulatory bodies, and provincial and federal governments. It reflects updated standards based on the 2023 Red Seal Occupational Standard (RSOS) and the Automotive Service Technician Occupational Analysis (2024) and British Columbia industry and instructor subject matter experts.

Practical instruction by demonstration and student participation should be integrated with classroom sessions. Safe working practices, even though not always specified in each operation or topic, are an implied part of the program and should be stressed throughout the apprenticeship.

This Foundation Program Outline includes a list of recommended reference textbooks that are available to support the learning objectives and the minimum shop requirements needed to support instruction.

The Foundation Program Outline was prepared with the advice and assistance of the Automotive Service Technician Review Committee and will form the basis for further updating of the British Columbia Automotive Service Technician Program by SkilledTradesBC.

Competencies are to be evaluated through written exams and practical assessments. A passing grade is achieved by getting an overall mark of 70%. See the Assessment Guidelines in the Appendix for more details. The types of questions used on these exams must reflect the cognitive level indicated by the learning objectives and the learning tasks listed in the related competencies.

Achievement Criteria are included for competencies that require a practical assessment. The intent of including Achievement Criteria in the Foundation Program Outline is to ensure consistency in training across the many training institutions in British Columbia. Their purpose is to reinforce the theory and to provide a mechanism for evaluation of the learner's ability to apply the theory to practice. It is important that these performances be observable and measurable and that they reflect the skills spelled out in the competency as those required of a competent journey person. The conditions under which these performances will be observed and measured must be clear to the learner as well as the criteria by which the learner will be evaluated. The learner must also be given the evaluation criteria.

The performance spelled out in the Achievement Criteria is a suggested performance and is not meant to stifle flexibility of delivery. Training providers are welcome to substitute other practical performances that measure similar skills and attainment of the competency. Multiple performances may also be used to replace individual performances where appropriate.

### **SAFETY ADVISORY**

Be advised that references to the WorkSafeBC safety regulations contained within these materials do not/may not reflect the most recent Occupational Health and Safety Regulation the current Standards and Regulation in BC can be obtained on the following website: <http://www.worksafebc.com>. Please note that it is always the responsibility of any person using these materials to inform him/herself about the Occupational Health and Safety Regulation pertaining to his/her work.

## Acknowledgements

Industry and Instructor Subject Matter Experts retained to assist in the development and review of the 2024 Automotive Service Technician Program Outline from which this Foundation Program Outline is derived:

- Patrick Jones                      Instructor, Camosun College
  - Dale Baumel                      Instructor, Vancouver Island University
  - Adrian FitzPatrick              Automotive Service Technician
  - Matthew Wilkie                  Automotive Service Technician
  - Russ Hunter                      Instructor, BC Institute of Technology
- 

## Previous Contributors

Industry and Instructor Subject Matter Experts retained to assist in the development and review of the 2016 Program Outline:

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- Jeff Hoff                          Automotive Service Technician
- Loi Truong                        Automotive Service Technician
- Nic Nelson                        Automotive Service Technician
- Robert Kunka                    Instructor, Vancouver Community College
- Russ Hunter                      Instructor, BC Insititute of Technology

SkilledTradesBC would like to acknowledge the dedication and hard work of all the industry and training provider representatives appointed to identify the training requirements of the Automotive Service Technician occupation.

## How to Use this Document

This Foundation Program Outline has been developed for the use of individuals from several different audiences. The table below describes how each section can be used by each intended audience.

Section	Training Providers	Employers/ Sponsors	Apprentices	Challengers
<b>Program Credentialing Model</b>	Communicate program length and structure, and all pathways to completion	Understand the length and structure of the program	Understand the length and structure of the program, and pathway to completion	Understand challenger pathway to Certificate of Qualification
<b>OAC</b>	Communicate the competencies that industry has defined as representing the scope of the occupation	Understand the competencies that an apprentice is expected to demonstrate in order to achieve certification	View the competencies they will achieve as a result of program completion	Understand the competencies they must demonstrate in order to challenge the program
<b>Training Topics and Suggested Time Allocation</b>	Shows proportionate representation of general areas of competency (GACs) at each program level, the suggested proportion of time spent on each GAC, and percentage of time spent on theory versus practical application	Understand the scope of competencies covered in the technical training, the suggested proportion of time spent on each GAC, and the percentage of that time spent on theory versus practical application	Understand the scope of competencies covered in the technical training, the suggested proportion of time spent on each GAC, and the percentage of that time spent on theory versus practical application	Understand the relative weightings of various competencies of the occupation on which assessment is based
<b>Program Content</b>	Defines the objectives, learning tasks, high level content that must be covered for each competency, as well as defining observable, measurable achievement criteria for objectives with a practical component	Identifies detailed program content and performance expectations for competencies with a practical component; may be used as a checklist prior to signing a recommendation for certification (RFC) for an apprentice	Provides detailed information on program content and performance expectations for demonstrating competency	Allows individual to check program content areas against their own knowledge and performance expectations against their own skill levels
<b>Training Provider Standards</b>	Defines the facility requirements, tools and equipment, reference materials (if any) and instructor requirements for the program	Identifies the tools and equipment an apprentice is expected to have access to; which are supplied by the training provider and which the student is expected to own	Provides information on the training facility, tools and equipment provided by the school and the student, reference materials they may be expected to acquire, and minimum qualification levels of program instructors	Identifies the tools and equipment a tradesperson is expected to be competent in using or operating; which may be used or provided in a practical assessment



Section	Training Providers	Employers/ Sponsors	Apprentices	Challengers
<b>Appendix – Optional Training Topics</b>	This content was taken from the Foundation Program Outline (2016), <i>Optional Training Topics</i> . Use of this content is at the discretion of the training provider.			
<b>Appendix – Glossary</b>			Defines program specific terminology and acronyms	

**Note:** Automotive Service Technician Foundation Programs must cover the outcomes of the Level 1 program that is in effect. Content that exceeds the Level 1 outcomes is added at the discretion of the training provider. Please see ***Appendix A*** for sample optional content.

# **Section 2**

## **PROGRAM OVERVIEW**

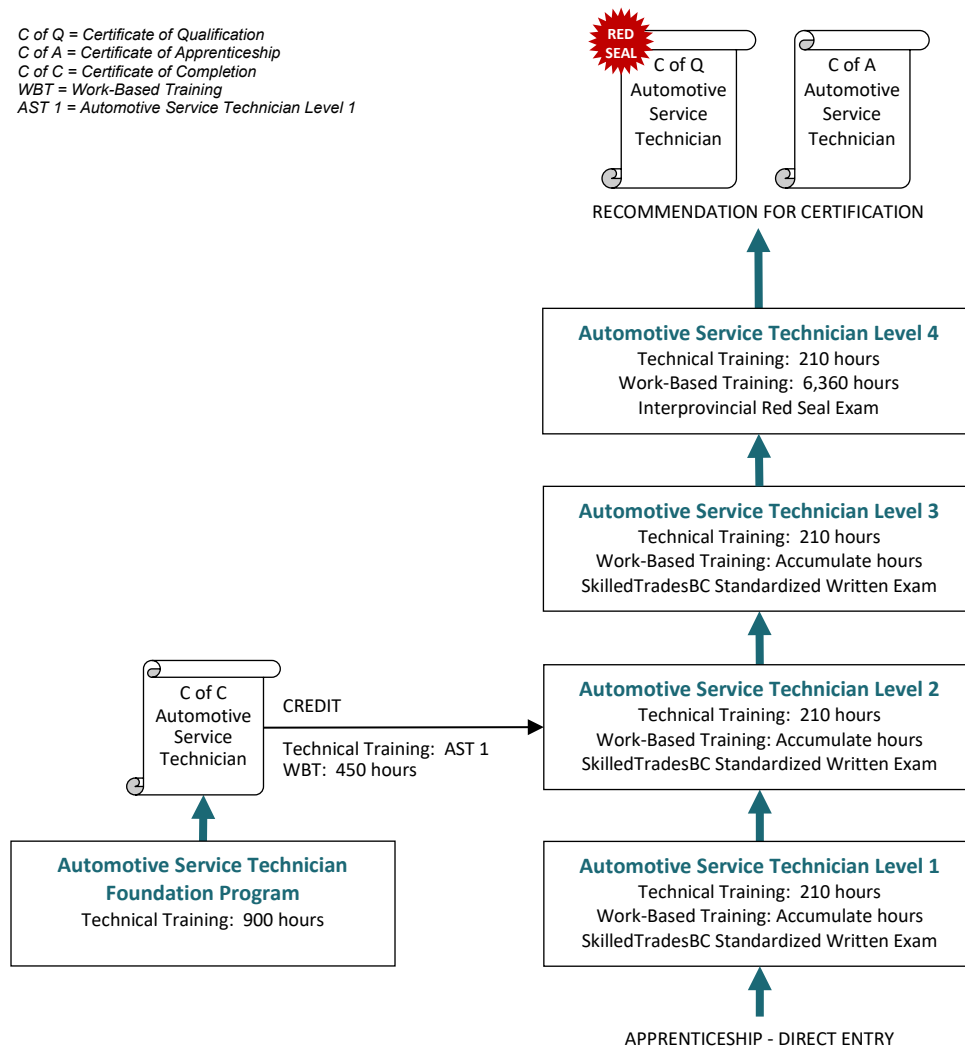
### **Automotive Service Technician**

## Program Credentialing Model

### Apprenticeship Pathway

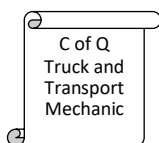
This graphic provides an overview of the Automotive Service Technician apprenticeship pathway.

*C of Q = Certificate of Qualification  
C of A = Certificate of Apprenticeship  
C of C = Certificate of Completion  
WBT = Work-Based Training  
AST 1 = Automotive Service Technician Level 1*



#### CROSS-PROGRAM CREDITS

*Individuals who hold the credentials listed below are entitled to receive partial credit toward the completion requirements of these programs:*



Technical Training: None  
Work-Based Training: 1,590 hours\*



Technical Training: None  
Work-Based Training: 1,590 hours\*

*\*Individuals who are holders of both certificates will only be awarded credit for 1,590 WBT hours total*

## Occupational Analysis Chart

# AUTOMOTIVE SERVICE TECHNICIAN

**Occupation Description:** “Automotive Service Technicians” possess the full range of knowledge and abilities required to perform preventative maintenance, diagnose faults, and repair automotive vehicles, light trucks, and hybrid and electric vehicle systems. These systems include engines, vehicle management, steering, braking, tires, wheels, drivetrains, suspension, electrical, advanced driver assistance systems (ADAS), electronics, heating, ventilation, and air conditioning (HVAC), restraints, trim, and accessories.

<b>PERFORM SAFETY-RELATED FUNCTIONS</b>	Maintain a safe work environment	Use personal protective equipment (PPE) and safety equipment
A	A1	A2
1	F	F

<b>USE TOOLS, EQUIPMENT, AND DOCUMENTATION</b>	Use tools and equipment	Use fasteners, tubing, hoses, and fittings	Use hoisting and lifting equipment	Use technical information
B	B1	B2	B3	B4
1	F	F	F	F

<b>USE COMMUNICATION AND MENTORING TECHNIQUES</b>	Use communication techniques	Use mentoring techniques
C	C1	C2
1	F	4

<b>DIAGNOSE AND REPAIR ENGINE SYSTEMS</b>	Diagnose and repair cooling systems	Diagnose and repair lubricating systems	Diagnose and repair engine assembly	Diagnose and repair accessory drive systems
D	D1	D2	D3	D4
2		2		2

<b>DIAGNOSE AND REPAIR GASOLINE ENGINE SUPPORT SYSTEMS</b>	Diagnose and repair advanced wiring and electronics	Diagnose and repair gasoline fuel delivery and injection systems	Diagnose and repair gasoline ignition systems	Diagnose and repair engine management systems	Diagnose and repair gasoline intake and exhaust systems	Diagnose and repair gasoline emissions control systems
E	E1	E2	E3	E4	E5	E6
3		3	3	3	3	3

## Section 2 Program Overview

<b>DIAGNOSE AND REPAIR DIESEL ENGINE SUPPORT SYSTEMS</b> F	Diagnose and repair diesel fuel delivery and injection systems F1 4	Diagnose and repair diesel intake and exhaust systems F2 4	Diagnose and repair diesel emission control systems F3 4			
<b>DIAGNOSE AND REPAIR VEHICLE NETWORKING SYSTEMS</b> G	Describe networking systems G1 3	Diagnose and repair networking systems G2 4				
<b>DIAGNOSE AND REPAIR DRIVELINE SYSTEMS</b> H	Diagnose and repair drive shafts and axles H1 1 F	Diagnose and repair manual transmissions and transaxles H2 2	Diagnose and repair automatic transmissions and transaxles H3 4	Diagnose and repair clutches H4 2	Diagnose and repair all-wheel drive (AWD) systems H5 4	Diagnose and repair final drive assemblies H6 2
<b>DIAGNOSE AND REPAIR ELECTRICAL SYSTEMS AND COMPONENTS</b> I	Diagnose and repair basic wiring and electrical systems I1 1 F	Diagnose and repair 12-volt batteries, starting, and charging systems I2 1 2 F	Diagnose and repair lighting and wiper systems I3 2	Diagnose and repair electrical options and accessories I4 3	Diagnose and repair instrumentation, entertainment systems, and displays I5 4	
<b>DIAGNOSE AND REPAIR HEATING, VENTILATION AND AIR CONDITIONING (HVAC) AND COMFORT CONTROL SYSTEMS</b> J	Diagnose and repair air flow control and heating systems J1 4	Diagnose and repair refrigerant systems J2 4				
<b>DIAGNOSE AND REPAIR STEERING AND SUSPENSION, BRAKING, CONTROL SYSTEMS, TIRES, WHEELS, HUBS, AND WHEEL BEARINGS</b> K	Diagnose and repair tires, wheels, hubs, and wheel bearings K1 1 F	Diagnose and repair suspension and control systems K2 1 2 F	Diagnose and repair steering and control systems K3 1 2 F	Diagnose and repair braking and control systems K4 1 2 F	Diagnose and repair advanced driver assistance systems (ADAS) K5 3	

Section 2  
Program Overview

<b>DIAGNOSE AND REPAIR RESTRAINT SYSTEMS, BODY COMPONENTS, ACCESSORIES AND TRIM</b> L	Diagnose and repair restraint systems L1	Diagnose and repair wind noises, rattles, and water leaks L2	Diagnose and repair interior and exterior components, accessories, and trim L3	Diagnose and repair latches, locks and movable glass L4
	1 4 F	1 F	1 F	1 F
<b>DIAGNOSE AND REPAIR HYBRID AND ELECTRIC VEHICLES (EV)</b> M	Implement specific safety protocols for hybrid and electric vehicles (EV) M1	Diagnose and repair hybrid and electric vehicle (EV) systems M2	Diagnose and repair hybrid and electric vehicle (EV) temperature management systems M3	
	1 F	4	4	

## Training Topics and Suggested Time Allocation: Foundation

### AUTOMOTIVE SERVICE TECHNICIAN –FOUNDATION

		% of Time	% of Time Allocated to:		
			Theory	Practical	Total
Line A	PERFORM SAFETY-RELATED FUNCTIONS	4%	70%	30%	100%
A1	Maintain a safe work environment		✓		
A2	Use personal protective equipment (PPE) and safety equipment		✓	✓	
Line B	USE TOOLS, EQUIPMENT, AND DOCUMENTATION	14%	40%	60%	100%
B1	Use tools and equipment		✓	✓	
B2	Use fasteners, tubing, hoses, and fittings		✓		
B3	Use hoisting and lifting equipment		✓	✓	
B4	Use technical information		✓		
Line C	USE COMMUNICATION AND MENTORING TECHNIQUES	1%	100%	0%	100%
C1	Use communication techniques		✓		
Line H	DIAGNOSE AND REPAIR DRIVELINE SYSTEMS	4%	50%	50%	100%
H1	Diagnose and repair drive shafts and axles		✓	✓	
Line I	DIAGNOSE AND REPAIR ELECTRICAL SYSTEMS AND COMPONENTS	23%	50%	50%	100%
I1	Diagnose and repair basic wiring and electrical systems		✓	✓	
I2	Diagnose and repair 12-volt batteries, starting, and charging systems		✓	✓	
Line K	DIAGNOSE AND REPAIR STEERING AND SUSPENSION, BRAKING, CONTROL SYSTEMS, TIRES, WHEELS, HUBS, AND WHEEL BEARINGS	50%	50%	50%	100%
K1	Diagnose and repair tires, wheels, hubs and wheel bearings		✓	✓	
K2	Diagnose and repair suspension and control systems		✓	✓	
K3	Diagnose and repair steering and control systems		✓	✓	
K4	Diagnose and repair braking and control systems		✓	✓	
Line L	DIAGNOSE AND REPAIR RESTRAINT SYSTEMS, BODY COMPONENTS, ACCESSORIES, AND TRIM	2%	80%	20%	100%
L2	Diagnose and repair wind noises, rattles, and water leaks		✓		
L3	Diagnose and repair interior and exterior components, accessories, and trim		✓	✓	
L4	Diagnose and repair latches, locks, and movable glass		✓		
Line M	DIAGNOSE AND REPAIR HYBRID AND ELECTRIC VEHICLES (EV)	2%	100%	0%	100%
M1	Implement specific safety protocols for hybrid and electric vehicles (EV)		✓		
Total Percentage for Automotive Service Technician Foundation		100%			

# **Section 3**

## **PROGRAM CONTENT**

### **Automotive Service Technician**



# **Foundation Automotive Service Technician**

<b>Line (GAC):</b>	<b>A</b>	<b>PERFORM SAFETY-RELATED FUNCTIONS</b>
<b>Competency:</b>	<b>A1</b>	<b>Maintain a safe work environment</b>

### Objectives

To be competent in this area, the individual must be able to:

- Apply safe work practices.

### LEARNING TASKS

1. Describe WorkSafeBC and OHS regulations

2. Describe safe work practices

3. Describe fire safety procedures

### CONTENT

- Rights and responsibilities
  - Right to refuse work
  - Reporting accidents
  - Investigations
- Personal Protective Equipment (PPE)
- Safe vehicle operation
  - Speed limit
  - Parking on a hoist
  - Road test
- Clean and organized work area
- Correct use of tools and equipment
  - Maintenance
  - Function
  - Operation
- Lockout procedures
- Flammable, explosion, and electrical hazards
- Using compressed air
- Component and causes of fire
  - Fuel
  - Heat
  - Oxygen
- Flammability
  - Flash points
- Types of fires
  - Class A, B, C and D fires
- Use of fire extinguishers
- Fire prevention equipment
  - Emergency fire blanket
- Precautions when working with flammable substances
- Storage of flammable materials
  - Gasoline
  - Oily rags

**LEARNING TASKS**

**CONTENT**

- |  |   |
|--|---|
| <p>4. Use Workplace Hazardous Materials Information System (WHMIS)</p> | <ul style="list-style-type: none"> <li>• WHMIS               <ul style="list-style-type: none"> <li>○ Right to know</li> <li>○ Worker education</li> <li>○ Product identification</li> </ul> </li> <li>• Roles and responsibilities               <ul style="list-style-type: none"> <li>○ Employers</li> <li>○ Suppliers</li> <li>○ Workers</li> </ul> </li> <li>• Labelling               <ul style="list-style-type: none"> <li>○ Symbols</li> </ul> </li> <li>• SDS               <ul style="list-style-type: none"> <li>○ Hazards</li> <li>○ Handling</li> <li>○ Ingredients</li> </ul> </li> <li>• Storage</li> </ul> |
|--|---|

Line (GAC):	A	PERFORM SAFETY-RELATED FUNCTIONS
Competency:	A2	Use personal protective equipment (PPE) and safety equipment

## Objectives

To be competent in this area, the individual must be able to:

- Use personal protective equipment (PPE).
- Describe shop emergency equipment and procedures.

## LEARNING TASKS

1. Apply personal safety protocols
2. Describe shop emergency equipment and procedures

## CONTENT

- Personal apparel
- Personal protective equipment (PPE)
  - Safety glasses
  - Boots
  - Face shield
- Exhaust extraction
- Hazard awareness
- Ergonomic lifting
- Emergency shutoffs
- Fire control
- Eye-wash facilities
- Spill kit
- Emergency exits
- First aid facilities
- Muster point

### Achievement Criteria

Performance	The learner will wear PPE as needed for each task.
Conditions	The learner will be given <ul style="list-style-type: none"> <li>• Access to PPE</li> </ul>
Criteria	The learner will be evaluated on <ul style="list-style-type: none"> <li>• PPE selection</li> <li>• PPE fit</li> <li>• Consistency of usage</li> </ul>

**Line (GAC):           B    USE TOOLS, EQUIPMENT, AND DOCUMENTATION**  
**Competency:        B1    Use tools and equipment**

**Objectives**

To be competent in this area, the individual must be able to:

- Use tools and equipment.
- Demonstrate safe use of welding equipment.

**LEARNING TASKS**

**CONTENT**

- |                        |  |
|------------------------|--|
| 1. Use hand tools      | <ul style="list-style-type: none"> <li>• Types               <ul style="list-style-type: none"> <li>○ Wrenches</li> <li>○ Sockets</li> <li>○ Pliers</li> </ul> </li> <li>• Special application tools               <ul style="list-style-type: none"> <li>○ Chisels and punches</li> <li>○ Tap and die</li> </ul> </li> <li>• Safety</li> <li>• Storage</li> <li>• Cleaning and maintenance</li> </ul> |
| 2. Use measuring tools | <ul style="list-style-type: none"> <li>• Types               <ul style="list-style-type: none"> <li>○ Vernier calipers</li> <li>○ Micrometers</li> <li>○ Feeler gauges</li> </ul> </li> <li>• Safety</li> <li>• Storage</li> <li>• Cleaning and maintenance</li> </ul>   |
| 3. Use power tools     | <ul style="list-style-type: none"> <li>• Types               <ul style="list-style-type: none"> <li>○ Impact wrench</li> <li>○ Grinders</li> <li>○ Drills</li> <li>○ Pneumatic</li> <li>○ Electric</li> </ul> </li> <li>• Safety</li> <li>• Storage</li> <li>• Cleaning and maintenance</li> </ul>   |
| 4. Use shop equipment  | <ul style="list-style-type: none"> <li>• Types               <ul style="list-style-type: none"> <li>○ Presses and pullers</li> <li>○ Solvent tank</li> </ul> </li> <li>• Safety</li> </ul>   |

**LEARNING TASKS**

**CONTENT**

- |  |   |
|--|---|
| <p>5. Use scan tools</p> <p>6. Describe oxyacetylene components</p> <p>7. Demonstrate oxyacetylene procedures</p> <p>8. Describe MIG (GMAW) welding components and methods</p> <p>9. Demonstrate MIG (GMAW) welding procedures</p> | <ul style="list-style-type: none"> <li>• Storage</li> <li>• Cleaning and maintenance</li> <li>• Functional testing</li> <li>• Code retrieval</li> <li>• Relearning</li> <li>• Safety</li> <li>• Gases</li> <li>• Cylinders, regulators and hoses</li> <li>• Torches</li> <li>• Set up</li> <li>• Lighting</li> <li>• Heating and cutting</li> <li>• Shut down</li> <li>• Storage</li> <li>• Inspection and maintenance</li> <li>• Gas Metal Arc Welding (GMAW)</li> <li>• Safety</li> <li>• Gases</li> <li>• Cylinders, regulator and hose</li> <li>• Ground terminal</li> <li>• Set up</li> <li>• Welding</li> <li>• Shut down</li> <li>• Storage</li> <li>• Inspection and maintenance</li> </ul> |
|--|---|

**Achievement Criteria**

- |             |   |
|-------------|---|
| Performance | The learner will select and use tools as needed for each task.  |
| Conditions  | The learner will be given <ul style="list-style-type: none"> <li>• Access to tools</li> </ul>   |
| Criteria    | The learner will be evaluated on <ul style="list-style-type: none"> <li>• Safety</li> <li>• Tool selection</li> <li>• Tool usage</li> </ul> |

**Line (GAC):**        **B    USE TOOLS, EQUIPMENT, AND DOCUMENTATION**  
**Competency:**     **B2    Use fasteners, tubing, hoses, and fittings**

### Objectives

To be competent in this area, the individual must be able to:

- Use fasteners.
- Describe tubing, hoses, fluids, fittings, and belts.

### LEARNING TASKS

1. Describe fasteners

2. Use fasteners

3. Identify lubricants and fluids

4. Describe tubing, hoses and fittings

### CONTENT

- Types
  - Bolts
  - Studs
  - Nuts
  - Washers
  - Keys
  - Snap rings
- Selection
  - Imperial
  - Metric
- Torquing
  - Sequence
  - Torque to yield
- Repair
  - Extraction
  - Helicoils
- Types
  - Greases
  - Engine oil
  - Transmission fluids
  - Brake fluids
  - Anti-freeze
  - Shop fluids
- Cleaners/detergents
- Penetrating fluids
  - Selection
  - Recycling
  - Selection
  - Types
  - Materials
  - Bending, cutting, flaring

5. Describe accessory drive belts

- Types
  - Serpentine
  - Stretch
  - V-belt
- Inspection and maintenance
- Installation



**Line (GAC):            B    USE TOOLS, EQUIPMENT, AND DOCUMENTATION**  
**Competency:        B3    Use hoisting and lifting equipment**

**Objectives**

To be competent in this area, the individual must be able to:

- Describe hoisting and lifting safety.
- Use hoisting and lifting equipment.

**LEARNING TASKS**

1. Describe hoisting and lifting safety procedures
  
2. Use hoisting and lifting equipment

**CONTENT**

- Capacities
- Operation
- Lock out
- Types of jacks
  - Mechanical
  - Hydraulic
  - Pneumatic
- Types of hoists
  - 2-post
  - 4-post
- Stands
- Engine hoists
- Inspection
- Vehicle lifting points
- Required adapters and extensions

**Line (GAC):           B    USE TOOLS, EQUIPMENT, AND DOCUMENTATION**  
**Competency:        B4    Use documentation and technical information**

**Objectives**

To be competent in this area, the individual must be able to:

- Use technical information.
- Describe use of documentation.

**LEARNING TASKS**

1. Describe technical information
  
2. Use technical information
  
3. Describe use of documentation

**CONTENT**

- Types
  - Electronic
  - Print
  
- Navigation
- Manufacturer's specifications
- Manufacturer's recalls
- Repair procedures
  - Labour times
  - Technical service bulletins (TSBs)
  
- Safety concerns
- Description of operations and parts
- Diagrams
  
- Shop management software
- Digital vehicle inspections
- Service history

<b>Line (GAC):</b>	<b>C</b>	<b>USE COMMUNICATION AND MENTORING TECHNIQUES</b>
<b>Competency:</b>	<b>C1</b>	<b>Use communication techniques</b>

## Objectives

To be competent in this area, the individual must be able to:

- Use communication techniques.
- Describe shop personnel.

## LEARNING TASKS

1. Demonstrate two-way communication
2. Use active listening
3. Use digital communication technologies
4. Describe shop personnel

## CONTENT

- Verbal and written communication
  - Customer
  - Coworker
- Records
  - Service/work orders
  - Technical reports
  - Digital Vehicle Inspection (DVI)
    - Quality of language
    - Quality of images
  - Parts requisition
- Trade terminology
- Constructive feedback
- Attention
- Open-ended questions
- Checking for understanding
- Clarification
- Modes of communication
  - Emails
  - Instant messaging
  - Text messaging
- Service advisor
  - Customer service
  - Repair orders
- Service manager
  - Sales production
  - Advisor mentor
- Foreman
  - Shop production
  - Training advisor
- Parts person
  - Ordering
  - Shop supplies

**Line (GAC):** H **DIAGNOSE AND REPAIR DRIVELINE SYSTEMS**

**Competency:** H1 Diagnose and repair drive shafts and axles

## Objectives

To be competent in this area, the individual must be able to:

- Describe drive shafts and axle shafts.
- Diagnose drive shafts and axle shafts.
- Repair drive shafts.

## LEARNING TASKS

1. Describe drive shafts and axle shafts
2. Diagnose drive shafts and axle shafts
3. Repair drive shafts

## CONTENT

- **Types**
  - Front-wheel drive
  - Rear-wheel drive
- **Components**
  - Constant velocity (CV) axles
  - Universal joints
  - Mounts and supports
- **Operation**
- **Inspection and testing**
  - Sensory
  - Run out
  - Working angle
- **Safety**
- **Component service**
  - Phasing
  - Joint replacement

### Achievement Criteria

Performance	The learner will replace a universal joint.
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Conditions	The learner will be given
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- Tools and equipment
- Access to technical information

Criteria	The learner will be evaluated on
1. The learner will be able to identify the components of a system.	1. The learner will be able to identify the components of a system.
2. The learner will be able to describe the function of each component.	2. The learner will be able to describe the function of each component.
3. The learner will be able to explain the relationship between the components.	3. The learner will be able to explain the relationship between the components.
4. The learner will be able to analyze the system and its components.	4. The learner will be able to analyze the system and its components.
5. The learner will be able to synthesize the information and present it in a clear and concise manner.	5. The learner will be able to synthesize the information and present it in a clear and concise manner.

- Safety
- Tool usage
- Procedure
- Accuracy of results

<b>Line (GAC):</b>	<b>I</b>	<b>DIAGNOSE AND REPAIR ELECTRICAL SYSTEMS AND COMPONENTS</b>
<b>Competency:</b>	<b>II</b>	<b>Diagnose and repair basic wiring and electrical systems</b>

### Objectives

To be competent in this area, the individual must be able to:

- Describe the fundamentals of electrical circuits and components.
- Use electrical test equipment.
- Diagnose electrical faults.
- Repair electrical faults.

### LEARNING TASKS

1. Describe electrical fundamentals
  
2. Describe electrical circuits and components
  
3. Interpret wiring diagrams
  
4. Use electrical test equipment

### CONTENT

- Terminology
- Theories
  - Ohm's law
  - Magnetism
- Types of circuits
- Faults
  - Opens
  - Shorts
  - Grounds
- Components
  - Switches
  - Circuit protection
  - Relays
- Symbols
- Colours
- Identification numbers
- Power flows
- Types
  - Test lights
  - Power (logic) probes
  - Digital Volt Ohm meter (DVOM)
- Measuring values
  - Voltage
  - Amperage
  - Resistance
- Units of measurement
- Voltage drop

**LEARNING TASKS**

5. Use scan tools

6. Diagnose electrical faults

7. Repair electrical faults

**CONTENT**

- Types
  - Tools
  - Codes
- On-board diagnostics
- Basic operation
- Faults
  - Opens
  - Shorts
  - Grounds
- Components
  - Switches
  - Circuit protection
  - Relays
- Repair methods

**Achievement Criteria**

**Performance** The learner will perform various electrical measurements on circuits.

**Conditions** The learner will be given

- A circuit
- Multi-meter

**Criteria** The learner will be evaluated on

- Safety
- Tool usage
- Procedures
- Accuracy of results

<b>Line (GAC):</b>	<b>I</b>	<b>DIAGNOSE AND REPAIR ELECTRICAL SYSTEMS AND COMPONENTS</b>
<b>Competency:</b>	<b>I2</b>	<b>Diagnose and repair 12-volt batteries, starting, and charging systems</b>

### Objectives

To be competent in this area, the individual must be able to:

- Describe 12-volt batteries.
- Diagnose 12-volt batteries.
- Repair 12-volt batteries.

### LEARNING TASKS

1. Describe 12-volt batteries
  
2. Diagnose 12-volt batteries
  
3. Repair 12-volt batteries

### CONTENT

- Safety
- Construction
- Types
- Ratings
- Inspection
- Tests
  - Load
  - Conductance
  - Parasitic
- Test results
- Safety
- Cleaning
- Maintenance
- Installation
- Charging
  - Size
  - Type
  - Rate
- Recycling

### Achievement Criteria

Performance	The learner will test a 12-volt battery.
Conditions	The learner will be given <ul style="list-style-type: none"> <li>• A 12-volt battery</li> <li>• Test equipment</li> </ul>
Criteria	The learner will be evaluated on <ul style="list-style-type: none"> <li>• Safety</li> <li>• Tool usage</li> <li>• Procedure</li> <li>• Accuracy of results</li> </ul>

**Line (GAC):            K    DIAGNOSE AND REPAIR STEERING AND SUSPENSION, BRAKING, CONTROL SYSTEMS, TIRES, WHEELS, HUBS, AND WHEEL BEARINGS**

**Competency:           K1    Diagnose and repair tires, wheels, hubs, and wheel bearings**

### Objectives

To be competent in this area, the individual must be able to:

- Describe tires, wheels, hubs, and wheel bearings.
- Diagnose tires and wheels.
- Repair tires and wheels.
- Diagnose hubs and bearings.
- Repair hubs and bearings.
- Repair Tire Pressure Monitoring System (TPMS).

### LEARNING TASKS

1. Describe tires and wheels

2. Diagnose tires and wheels

3. Repair tires and wheels

4. Describe Tire Pressure Monitoring System (TPMS)

5. Repair Tire Pressure Monitoring System (TPMS)

### CONTENT

- Tires
  - Types
  - Ratings
  - Side wall markings
- Wheel
  - Types
  - Offset
  - Fasteners
- Inspection
  - Wear patterns
  - Damage
  - Pulls and vibration
- Run out
- Service
  - Rotation
  - Mounting and balancing
    - Flat repair
    - Road force
- Types
  - Direct
  - Indirect
- Codes and data
- Sensor replacement
- System service
  - Reset
  - Reprogram



**LEARNING TASKS**

6. Describe wheel bearings and hubs

7. Diagnose wheel bearings and hubs

8. Repair wheel bearings and hubs

**CONTENT**

- Wheel bearing types
  - Serviceable
    - Tapered
  - Non-serviceable
- Components
  - Hub
  - Seal
  - Spindle
- Loading principles
- Inspection
  - Sensory
  - Measurements
- Lubrication
- Removal and installation
- Adjustments

**Achievement Criteria**

Performance The learner will mount and balance a tire.

Conditions The learner will be given

- A vehicle
- Tire mounting and balancing equipment

Criteria The learner will be evaluated on

- Safety
- Equipment usage
- Procedure
- Accuracy of balance

**Line (GAC):** K DIAGNOSE AND REPAIR STEERING AND SUSPENSION, BRAKING, CONTROL SYSTEMS, TIRES, WHEELS, HUBS, AND WHEEL BEARINGS

**Competency:** K2 Diagnose and repair suspension and control systems

## Objectives

To be competent in this area, the individual must be able to:

- Describe suspension and frame systems.
- Diagnose suspension systems.
- Repair suspension systems.

## LEARNING TASKS

1. Describe frame designs
2. Describe suspension systems

## CONTENT

- Types
  - Unibody
  - Body-over-frame
- Accident crumple zones
- Construction
- Front
  - Solid
  - Independent
  - Strut
  - Short and long arm
  - Multi-link
- Rear
  - Rigid
  - Independent
- Strut
- Multi-link
- Semi-rigid
- Components
  - Springs Types
  - Shocks and struts
  - Ball joints
    - Loaded
    - Follower
  - Sway bar
  - Rubber bushings
  - Mounting points
- Dynamics
  - Forces
  - Body roll
- Faults

**LEARNING TASKS**

3. Diagnose suspension systems

**CONTENT**

- Inspection
  - Sensory
- Tests
  - Road test
  - Ride height
  - Measurements
- Safety
- Removal and replacement
- Measurements
- Alignment
- Faults

4. Repair suspension systems

**Achievement Criteria**

**Performance** The learner will identify and inspect suspension systems.

**Conditions** The learner will be given

- A vehicle
- Measuring equipment
- Access to technical information

**Criteria** The learner will be evaluated on

- Safety
- Testing procedure
- Accuracy of component identifications
- Accuracy of inspection

**Line (GAC):** K DIAGNOSE AND REPAIR STEERING AND SUSPENSION, BRAKING, CONTROL SYSTEMS, TIRES, WHEELS, HUBS, AND WHEEL BEARINGS

**Competency:** K3 Diagnose and repair steering and control systems

## Objectives

To be competent in this area, the individual must be able to:

- Describe occupant restraint system safety.
- Describe mechanical and hydraulic steering systems.
- Diagnose mechanical and hydraulic steering systems.
- Repair mechanical and hydraulic steering systems.
- Perform wheel alignment.

## LEARNING TASKS

1. Describe occupant restraints
2. Describe steering columns, steering linkage, and steering gears
3. Diagnose steering columns, steering linkage, and steering gears

## CONTENT

- Safety
- Types
  - Driver
  - Passenger
  - Seat belt pre-tensioner
- Air bag wiring
- Column types
  - Tilt
  - Telescoping
- Column components
  - Shafts
  - universal joints
  - coupling
  - splines
  - Clockspring
- Steering wheel lock
- Combination switch
- Linkage types
  - Parallelogram
  - Cross steer
  - Rack and pinion
- Linkage
- Tie rods
- Gear types
  - Rack and pinion
  - Steering box
- Inspection

**LEARNING TASKS**  
steering gears

**CONTENT**

- Sensory
    - Measurements
  - Steering column tests
    - Functional
    - Codes and data
  - Steering linkage and gear tests
    - Road test
    - Steering wheel free play
    - Dry park test
  - Collapsing function
  - Electrical connections
  - Leakage
  - Wear
  - Safety
    - Disarm
  - Precautions
    - Handling
    - Storage
  - Removal and replacement
    - Airbag
    - Column
    - Gear assemblies
    - Tie rods
    - Boots
    - Bushings
  - Fluids
  - Pump
  - Hoses
  - Valves
  - Fluid level and condition
    - Leaks
  - Belts
  - Inspection
    - Sensory
    - Pressure
    - Volume
  - Removal and replacement
    - Belts
    - Pump
    - Gear
  - Procedures
4. Repair steering columns, steering linkage, and steering gears
5. Describe power steering
6. Diagnose power steering
7. Repair power steering

LEARNING TASKS		CONTENT
8.	Describe wheel alignment	<ul style="list-style-type: none"> <li>○ Bleeding</li> <li>• Steering geometry               <ul style="list-style-type: none"> <li>○ Caster, camber, and toe</li> <li>○ Steering axis inclination</li> <li>○ Thrust angle</li> </ul> </li> <li>• Equipment</li> <li>• Adjustments</li> </ul>
9.	Diagnose wheel alignment	<ul style="list-style-type: none"> <li>• Pre-checks               <ul style="list-style-type: none"> <li>○ Inspection</li> <li>○ Road test</li> <li>○ Tire wear</li> </ul> </li> </ul>
10.	Perform wheel alignment	<ul style="list-style-type: none"> <li>• Alignment procedure               <ul style="list-style-type: none"> <li>○ Adjustments</li> </ul> </li> <li>• Steering wheel centre check</li> <li>• Steering sensor re-calibration</li> <li>• Repair verification</li> </ul>

#### **Achievement Criteria 1**

Performance	The learner will perform a steering inspection.
Conditions	The learner will be given <ul style="list-style-type: none"> <li>• A vehicle</li> <li>• Measuring equipment</li> <li>• Access to technical information</li> </ul>
Criteria	The learner will be evaluated on <ul style="list-style-type: none"> <li>• Safety</li> <li>• Testing procedure</li> <li>• Accuracy of results</li> </ul>

#### **Achievement Criteria 2**

Performance	The learner will perform a wheel alignment.
Conditions	The learner will be given <ul style="list-style-type: none"> <li>• A vehicle</li> <li>• Wheel alignment equipment</li> </ul>
Criteria	The learner will be evaluated on <ul style="list-style-type: none"> <li>• Safety</li> <li>• Procedure</li> <li>• Tool and equipment usage</li> <li>• Accuracy of adjustments</li> </ul>

**Achievement Criteria 3**

Performance	The learner will remove and reinstall an air bag.
Conditions	The learner will be given <ul style="list-style-type: none"> <li>• A vehicle</li> <li>• Tools</li> <li>• Access to technical information</li> </ul>
Criteria	The learner will be evaluated on <ul style="list-style-type: none"> <li>• Safety</li> <li>• Procedure</li> <li>• Tool usage</li> <li>• Completion of task</li> </ul>

**Line (GAC):**        **K    DIAGNOSE AND REPAIR STEERING AND SUSPENSION, BRAKING, CONTROL SYSTEMS, TIRES, WHEELS, HUBS, AND WHEEL BEARINGS**

**Competency:**      **K4    Diagnose and repair braking and control systems**

### Objectives

To be competent in this area, the individual must be able to:

- Describe hydraulic brake and power assist systems.
- Diagnose hydraulic brake systems.
- Repair hydraulic brake systems.
- Diagnose power assist systems.
- Repair power assist systems.

### LEARNING TASKS

1. Describe hydraulic brake systems

2. Diagnose hydraulic brake systems

3. Repair hydraulic brake systems

4. Describe power assist systems

### CONTENT

- Principles
  - Hydraulic
- Pascal's law
  - Friction
- Types
  - Disc
  - Drum
- Components
  - Cylinders
  - Calipers
  - Valves
- Machining
- Faults
- Inspection
  - Sensory
  - Leaks
- Tests
  - Road test
  - Measurements
- Adjustment
- Replacement
- Bleeding/exchange
- Faults
- Principles
- Types
  - Vacuum
  - Hydraulic



**LEARNING TASKS**

5. Diagnose power assist systems

6. Repair power assist systems

**CONTENT**

- Components
- Faults
- Fluids
- Belts and hoses
- Vacuum
- Tests
  - Functional
  - Pressure
  - Vacuum
- Replacement
- Adjustment
  - Brake pedal free play
- Faults

**Achievement Criteria**

Performance The learner will inspect front disc brakes.

Conditions The learner will be given

- A vehicle
- Measuring equipment
- Access to technical information

Criteria The learner will be evaluated on

- Safety
- Tool usage
- Accuracy of inspection
- Accuracy and interpretation of measurements

<b>Line (GAC):</b>	<b>L</b>	<b>DIAGNOSE AND REPAIR RESTRAINT SYSTEMS, BODY COMPONENTS, ACCESSORIES, AND TRIM</b>
<b>Competency:</b>	<b>L2</b>	<b>Diagnose and repair wind noises, rattles, and water leaks</b>

### **Objectives**

To be competent in this area, the individual must be able to:

- Describe wind noises, rattles, and water leaks.
- Describe diagnoses of wind noises, rattles, and water leaks.
- Describe repair of wind noises, rattles, and water leaks.

### **LEARNING TASKS**

### **CONTENT**

1. Describe wind noises, rattles, and water leaks	<ul style="list-style-type: none"> <li>• Common areas</li> <li>• Seals</li> <li>• Diagnostic tools               <ul style="list-style-type: none"> <li>○ Smoke machine</li> <li>○ Chassis ears</li> <li>○ Water hose</li> </ul> </li> </ul>
2. Describe diagnoses of wind noises, rattles, and water leaks	<ul style="list-style-type: none"> <li>• Inspection               <ul style="list-style-type: none"> <li>○ Sensory</li> </ul> </li> <li>• Test               <ul style="list-style-type: none"> <li>○ Smoke</li> <li>○ Sound</li> <li>○ Water</li> </ul> </li> </ul>
3. Describe repair of wind noises, rattles, and water leaks	<ul style="list-style-type: none"> <li>• Component replacement</li> <li>• Adjustments</li> <li>• Repair verification</li> </ul>

<b>Line (GAC):</b>	<b>L</b>	<b>DIAGNOSE AND REPAIR RESTRAINT SYSTEMS, BODY COMPONENTS, ACCESSORIES, AND TRIM</b>
<b>Competency:</b>	<b>L3</b>	<b>Diagnose and repair interior and exterior components, accessories, and trim</b>

### Objectives

To be competent in this area, the individual must be able to:

- Describe interior and exterior components and trim.
- Diagnose interior and exterior components and trim.
- Repair interior and exterior components and trim.

### LEARNING TASKS

### CONTENT

1. Describe interior and exterior body components and trim	<ul style="list-style-type: none"> <li>• Exterior components <ul style="list-style-type: none"> <li>○ Mirrors</li> <li>○ Roof rack</li> </ul> </li> <li>• Interior components <ul style="list-style-type: none"> <li>○ Seats</li> <li>○ Dashboard</li> </ul> </li> <li>• Accessories <ul style="list-style-type: none"> <li>○ Running boards</li> <li>○ Bug shield</li> </ul> </li> </ul>
2. Diagnose interior and exterior components and trim	<ul style="list-style-type: none"> <li>• Inspection <ul style="list-style-type: none"> <li>○ Sensory</li> </ul> </li> </ul>
3. Repair interior and exterior components and trim	<ul style="list-style-type: none"> <li>• Repair parts and materials <ul style="list-style-type: none"> <li>○ Adhesives</li> <li>○ Gaskets</li> <li>○ Sealants</li> <li>○ Fastening devices</li> </ul> </li> <li>• Tools <ul style="list-style-type: none"> <li>○ Trim tools</li> <li>○ Hand tools</li> </ul> </li> <li>• Removal and replacement</li> <li>• Adjustments</li> <li>• Repair verification</li> </ul>

<b>Line (GAC):</b>	<b>L</b>	<b>DIAGNOSE AND REPAIR RESTRAINT SYSTEMS, BODY COMPONENTS, ACCESSORIES, AND TRIM</b>
<b>Competency:</b>	<b>L4</b>	<b>Diagnose and repair latches, locks, and movable glass</b>

### Objectives

To be competent in this area, the individual must be able to:

- Describe latches, locks and movable glass.
- Describe diagnoses of latches, locks, and movable glass.
- Describe repair of latches, locks, and movable glass.

### LEARNING TASKS

### CONTENT

1. Describe latches, locks, and movable glass	<ul style="list-style-type: none"> <li>• Components <ul style="list-style-type: none"> <li>○ Lock</li> <li>○ Cable</li> <li>○ Regulator</li> <li>○ Sensor/switches</li> <li>○ Actuator</li> </ul> </li> </ul>
2. Describe diagnoses of latches, locks, and movable glass	<ul style="list-style-type: none"> <li>• Inspection <ul style="list-style-type: none"> <li>○ Sensory</li> </ul> </li> <li>• Tests <ul style="list-style-type: none"> <li>○ Functional</li> <li>○ Codes and data</li> </ul> </li> </ul>
3. Describe repair of latches, locks, and movable glass	<ul style="list-style-type: none"> <li>• Component replacement</li> </ul>

**Line (GAC): M   DIAGNOSE AND REPAIR HYBRID AND ELECTRIC VEHICLES (EV)**

**Competency:** M1 Implement specific safety protocols for hybrid and electric vehicles (EV)

## Objectives

To be competent in this area, the individual must be able to:

- Describe hybrid and electric vehicle safety.
- Use high voltage PPE.

## LEARNING TASKS

1. Identify high voltage components
2. Describe hybrid and electric vehicle safety precautions and protocols
3. Apply high voltage safety protocols

## CONTENT

- High voltage battery
- Inverter
- Motor/generator
- Wiring
- Safety
  - Personal protective equipment (PPE)
  - Shop set up
- Cones / stanchions
- Caution signs
  - Precautions
- Pushing/ towing
- Auto start
- High voltage disconnect procedures
  - High voltage contactor
  - Shut-down service plug
- Safety perimeter
  - Cones / stanchions
  - Caution signs
- Personal protective equipment (PPE)
  - Gloves
    - Testing

# **Section 4**

## **TRAINING PROVIDER STANDARDS**

## **Facility Requirements**

### **Classroom Area**

- Comfortable seating and tables suitable for training, teaching, lecturing
- Compliance with all local and national fire code and occupational safety requirements
- Lighting controls to allow easy visibility of projection screen allowing students to take notes
- Windows must have shades or blinds to adjust sunlight
- Heating/air conditioning for comfort all year round
- In-room temperature regulation and ventilation to ensure comfortable room temperature
- Acoustics in the room must allow the instructor to be heard
- White marking board with pens and eraser (optional: flipchart in similar size)
- Projection screen or projection area at front of classroom
- Overhead projector and/or multi-media projector

### **Shop Area**

- Compliance with all local and national fire code and occupational safety requirements
- Ventilation and vehicle exhaust extraction as per WorkSafeBC Standards
- Compliance with Municipal and Provincial bylaws
- Ceiling shall be a minimum height of 16' or as varied by good engineering practices and code
- Appropriate lifting devices (hoists) used in industry
- Adequate hoist to student ratio
- Suitable demonstration area
- Lighting appropriate for good vision in ambient light
- Refuse and recycling bins for used shop materials
- First-aid facilities
- Computer terminals

### **Lab Requirements**

- This section does not apply.

### **Student Facilities**

- Adequate lunch room as per WorkSafeBC requirements
- Adequate washroom facilities as per WorkSafeBC requirements
- Personal storage lockers

### **Instructor's Office Space**

- Desk and filing space
- Computer

### **Other**

- WiFi

## **Tools and Equipment: Common to All Levels**

### **Required Shop Tools and Equipment**

- Acetylene torches
- Air compressor – hoses – inline filter and water separators
- Air or electric drills/tools
- Air or electric hammer/chisel
- Air or electric ratchet
- Antifreeze tester
- Battery charger/boosting equipment
- Bench grinders
- Bench vises
- Blow gun
- Bolt extractor set (easy outs)
- Brake pedal depressor
- Centre punch
- Chisels, punches
- Computer stations or terminals
- Creeper/fender covers
- Crowfoot wrenches (flare and std, SAE and metric)
- Die grinder
- Drill and bits
- Drill gauge
- Drill press
- Feeler gauges – SAE and metric
- Files – bastard cut/half round/mill cut/square and thread file
- Filter wrenches
- Flare nut wrenches – SAE and metric
- Flash lights
- Floor jack
- Grease gun and fluid suction pump
- Hacksaw
- Hammers – ball peen/dead blow/rubber
- Heat gun
- Hex keys – SAE and metric
- High voltage safety gloves (certified class 0 rated 1000v)
- High voltage warning signs
- Hydraulic press
- Impact driver and bits
- Impact wrench and impact socket set – SAE and metric
- Infrared thermometer
- Inspection mirror
- Jack stands and supports
- Jumper lead
- Logic (power) probe
- Magnetic pick up tool
- Mallet/soft face
- Mechanic's pick set
- Multimeter DVOM
- Oil drain barrels and disposal system
- Parts washers
- Pliers – slip joint, needle nose, adjustable, wheel weight, side cutter, snap ring, locking, hog ring and battery types
- Pry bar
- Ratchet and sockets – 1/4, 3/8 and 1/2 drive – SAE and metric, swivel, spark plug, extensions and adapters
- Scan tools (up-to-date with factory functions)
- Scraper (gasket and carbon)
- Screwdriver set
- Seal drivers and extractors
- Soldering tools
- Spring compressors – coil spring and strut
- Standard test leads and probes
- Steel rule
- Stethoscope
- Straight edge
- Stud extractor
- Tamper-proof torx set
- Tap and die set – SAE and metric
- Tap extractor
- Tape and ruler



- Terminal remover tools
- Test lamp – electronics safe (powered and non-powered)
- Thread files
- Thread pitch gauge
- Tin snips – centre, left and right cut
- Tire pressure gauge
- Tool box
- Torque angle meter/indicator
- Torque wrenches – 3/8 and ½
- Torx bits
- Vacuum pump/gauge
- Vehicle lifts (safety certified)
- Vehicle service information system
- Vernier caliper – SAE and metric
- Vise grips
- Water hose
- Welding equipment – GMAW welder and oxy fuelled
- Wire brush
- Wire stripper/crimping tool
- Work benches
- Wrench set – SAE and metric/various designs

**Student Tools and Equipment**

During attendance and completion of the technical training sessions, apprentices may be responsible for having specific equipment and tools. If equipment and tools are required, a list will be given to each apprentice at the beginning of the technical training session.

## **Tools and Equipment: Foundation**

### **Required Shop Tools and Equipment**

- Alignment lift and equipment- 4 wheel
- Angle grinder
- Axle boot clamp tool
- Ball joint press and adapters
- Battery post service and reshape tool
- Battery tester
- Belt tension release tool
- Brake bleeder wrenches
- Brake drum gauge (for brake shoe adjusting)
- Brake drum micrometer
- Brake fluid moisture tester
- Brake rotor gauge/micrometer
- Brake service tools (adjusters, spring removal, installation and caliper tools)
- Brake system bleeder
- Caliper tools for rear-wheel disc
- Dial indicator set
- Door trim tools
- Flaring tool (SAE, metric, and ISO)
- Tread depth gauge (for tires and brakes)
- Tube bending tool
- Tube cutters
- Universal joint press
- Vacuum gauge
- Wheel stud installer
- Heli-coil kits
- Hub service kit
- Leak detection tank (tires)
- Pickle-fork tool set
- Pitman arm pullers
- Pullers – gear, pulley and steering wheel
- Rivet gun
- Slide hammer
- Spreaders (tire
- Steering wheel holder
- Steering wheel puller set
- Stretch belt removal and installation tool
- Tie-rod end puller
- Tie-rod sleeve tools
- Tire balancer equipment (road-force type recommended)
- Tire changing machine (preferred run-flat capable
- Tire repair equipmen
- TPMS system service tools

## Reference Materials

### Recommended Reference Materials

#### Level One / Foundation

- CDX, *Fundamentals of Automotive Technology*.
- Erjavec, J., *Automotive technology: A systems approach*.
- Halderman, J. D., *Advanced Automotive Electrical and Electronics*.
- Trade Secrets Alberta, *Individual Learning Modules* (first period).

### Suggested Reference Material

- CDX, *Light Duty, Hybrid, and Electric Vehicles*.
- CDX, *Light Vehicle Diesel Engines*.
- Halderman, J. D., *Automotive Technology: Principles, Diagnosis, and Service*.

# Appendices

## Appendix A Optional Training Topics

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<b>Line 1</b>	<b>EMPLOYABILITY SKILLS</b>
1.1	Demonstrate employment readiness skills
<b>Line 2</b>	<b>TOOLS AND EQUIPMENT</b>
2.1	Use diagnostic equipment
<b>Line 3</b>	<b>GENERAL AUTOMOTIVE MAINTENANCE</b>
3.1	Perform general automotive maintenance
3.2	Perform exhaust system maintenance
<b>Line 4</b>	<b>GENERAL AUTOMOTIVE PRINCIPLES</b>
4.1	Describe fuel delivery systems
4.2	Describe internal combustion engines
4.3	Describe ignition and engine management systems
4.4	Describe hybrid and electric vehicles (EV)

**Line: 1 EMPLOYABILITY SKILLS**  
**Competency: 1.1 Demonstrate employment readiness skills**

**Objectives**

- Demonstrate the skills required to obtain employment

**LEARNING TASKS**

1. Prepare a resume

2. Prepare a cover letter

3. Identify job search resources

4. Prepare for an interview

**CONTENT**

- Gathering information
  - Goals
  - Skills
  - Education
  - Experience
  - Activities
  - References
- Types of resumes
- Not to exceed one page
- Highlight important accomplishments in same order as they appear in the job posting
- Internet
  - Industry networking
  - Industry publications
  - Direct approach
  - Organization research
  - Job qualification review
  - Prepare for broad personal questions
  - Resume review
  - Interview practice
  - Arriving ahead of time
  - Appropriate dress

**Achievement Criteria:**

Given a written and/or a practical assessment on employment readiness skills the learner will be able to demonstrate knowledge of the trade by achieving 70% or better based on a summative total of instructor assessment.

**Line: 2 TOOLS AND EQUIPMENT**

**Competency: 2.1 Use diagnostic equipment**

**Objectives**

- Use diagnostic equipment

**LEARNING TASKS**

1. Use mechanical diagnostic equipment

**CONTENT**

- Gauges
  - Compression
  - Vacuum
  - Fuel pressure
  - Oil pressure
  - Coolant tester
  - Tire pressure
  - Temperature
- Digital volt ohm meter (DVOM)
  - Units of measurement
  - Measure electrical signals
- Test light
- Power probe
- Scan tools
  - Describe generic and OEM scan tools
  - Types of codes
  - On board diagnostics
  - Data stream information
  - Code retrieval
  - Clearing fault codes

2. Use electrical diagnostic equipment

3. Use scan tools

**Achievement Criteria**

Given a written and/or a practical assessment on diagnostic equipment, the learner will be able to demonstrate knowledge of the trade by achieving 70% or better based on a summative total of instructor assessment.

**Line: 3 GENERAL AUTOMOTIVE MAINTENANCE**

**Competency: 3.1 Perform general automotive maintenance**

**Objectives**

- Describe general automotive maintenance
- Perform general automotive maintenance

**LEARNING TASKS**

**CONTENT**

1. Describe engine and driveline fluids	<ul style="list-style-type: none"> <li>• Types <ul style="list-style-type: none"> <li>○ Engine oils</li> <li>○ Coolants</li> <li>○ Transfer case oils</li> <li>○ Transmission oils</li> <li>○ Gear oils</li> </ul> </li> <li>• Additives</li> <li>• Gaskets and seals</li> <li>• Service intervals</li> </ul>
2. Perform engine and driveline fluid service	<ul style="list-style-type: none"> <li>• Drain and refill</li> <li>• Flush equipment</li> <li>• Filters</li> </ul>
3. Describe air filters, cabin filters, and wiper blades	<ul style="list-style-type: none"> <li>• Types</li> <li>• Inspection</li> <li>• Service intervals</li> </ul>
4. Perform air filter, cabin filter, and wiper blade service	<ul style="list-style-type: none"> <li>• Removal and replacement</li> </ul>
5. Describe vehicle inspection and maintenance resets	<ul style="list-style-type: none"> <li>• Inspection reports</li> <li>• Procedures <ul style="list-style-type: none"> <li>— Maintenance reset</li> </ul> </li> </ul>
6. Perform vehicle inspection and maintenance resets	<ul style="list-style-type: none"> <li>• Inspection reports</li> <li>• Procedures <ul style="list-style-type: none"> <li>— Maintenance reset</li> </ul> </li> </ul>

**Achievement Criteria:**

Given a written and/or a practical assessment on cooling system maintenance, the learner will be able to demonstrate knowledge of the trade by achieving 70% or better based on a summative total of instructor assessment.



**Line:           3   GENERAL AUTOMOTIVE MAINTENANCE**

**Competency:** 3.2 Perform exhaust system maintenance

## Objectives

- Describe exhaust system
- Service exhaust system

## LEARNING TASKS

1. Describe exhaust system
2. Service exhaust systems

## CONTENT

- Manifold and headers
- Catalytic converter
- Muffler and resonator
- Pipes
- Hangers
- Inspection
  - Sensory
- Thread repair
- Component removal
- Cutting procedures
- Component installation

### Achievement Criteria:

Given a written and/or a practical assessment on exhaust system maintenance, the learner will be able to demonstrate knowledge of the trade by achieving 70% or better based on a summative total of instructor assessment.

**Line: 4 GENERAL AUTOMOTIVE PRACTICES**

**Competency: 4.1 Describe fuel delivery systems**

**Objectives**

- Describe fuel delivery systems

**LEARNING TASKS**

1. Describe fuel delivery systems

**CONTENT**

- Systems
- Components
  - Filter
  - Fuel tank
  - Fuel lines
  - Pump
  - Fuel injectors

**Achievement Criteria:**

Given a written and/or a practical assessment on fuel delivery systems, the learner will be able to demonstrate knowledge of the trade by achieving 70% or better based on a summative total of instructor assessment.

**Line: 4 GENERAL AUTOMOTIVE PRACTICES**

**Competency: 4.2 Describe internal combustion engines**

**Objectives**

- Describe internal combustion engines

**LEARNING TASKS**

1. Describe internal combustion engines

**CONTENT**

- Types
  - Diesel
  - Gasoline
- Components
  - Short block assembly
  - Cylinder head assembly
  - Associated parts and fasteners
- Lubrication
- Cooling
- Gaskets and seals
- Construction design and materials
- Engine configurations
- Variable valve timing
- Emissions

**Achievement Criteria:**

Given a written and/or a practical assessment on internal combustion engines, the learner will be able to demonstrate knowledge of the trade by achieving 70% or better based on a summative total of instructor assessment.

**Line:** 4 **GENERAL AUTOMOTIVE PRINCIPLES**  
**Competency:** 4.3 **Describe ignition and engine management systems**

## Objectives

- Describe ignition systems
- Describe engine management systems

## LEARNING TASKS

1. Describe ignition systems
  
2. Describe engine management systems

## CONTENT

- Purpose
- Components
  - Spark plugs
  - Coils
- Maintenance
- Purpose
  - Performance
  - Fuel economy
  - Emissions
- Components
  - Modules and wiring
  - Sensors
  - Actuators
- Onboard diagnostic systems

## Achievement Criteria:

Given a written and/or a practical assessment on ignition and engine management systems, the learner will be able to demonstrate knowledge of the trade by achieving 70% or better based on a summative total of instructor assessment.

**Line: 4 GENERAL AUTOMOTIVE PRINCIPLES**

**Competency: 4.4 Describe hybrid and electric vehicles (EV)**

**Objectives**

- Describe hybrid and electric vehicles (EV)

**LEARNING TASKS**

1. Describe hybrid vehicles

**CONTENT**

- Types
  - Hybrid
  - Plug-in
- Fundamentals of operation
- Components
  - Internal combustion engine (ICE)
  - High voltage battery pack
- Modes of operation
  - Ready mode
- Driveline systems
- Fundamentals of operation
- Components
  - Electric vehicle supply equipment (EVSE)
  - Charging indicator
  - Drive motor
  - High voltage battery pack
- Modes of operation
  - Ready mode
  - Regenerative braking
- Driveline systems

2. Describe electric vehicles (EV)

**Achievement Criteria:**

Given a written and/or a practical assessment on hybrid and electric vehicles (EV), the learner will be able to demonstrate knowledge of the trade by achieving 70% or better based on a summative total of instructor assessment.

## **Appendix B Glossary**

<b>Accessories</b>	Features that are not originally equipped by the manufacturer
<b>Adjustment</b>	A minor change so that something works better, such as changing park position of a wiper.
<b>CAN</b>	Controller area network; a protocol for communication between electronic/computer modules.
<b>Describe</b>	To explain or give an account of an item or concept. This means an introduction to a topic area that will include terminology, safety as it pertains to the topic, types and uses of the item. For example, describing steering columns will include types, such as tilt and telescoping, steering wheel locks and combination switches.
<b>DVOM</b>	Digital voltage ohmmeter; meter for measuring voltage, amperage, resistance (ohms) and is digital in its operation.
<b>Identify</b>	Establish or indicate what something is. This is the most basic level of learning and typically precedes all others, including describing. In the case of a lengthy learning period (such as an apprenticeship), it is often adequate to identify a tool or procedure well in advance of actually describing and using the tool.
<b>Interpret</b>	To explain or understand the meaning of something. This primarily refers to using wiring diagrams and data.
<b>Maintain</b>	To keep a tool in good condition by performing regular maintenance such as lubrication or cleaning, as well as making repairs and correcting problems.
<b>Micrometer</b>	A precision measuring device for small distances.
<b>OBD</b>	On board diagnostics; part of a vehicle's engine management software used to monitor system performance.
<b>Ohm's law</b>	The relationship between current, resistance and voltage in any electrical circuit.
<b>Options</b>	Features that are originally equipped at time of manufacture.
<b>Pascal's law</b>	Fluid pressure exerted in a sealed vessel is equal and undiminished in all directions.
<b>Pneumatic</b>	Operated by compressed air.
<b>Sensory inspection</b>	Using one or more of the five senses to perform an inspection.
<b>Systems</b>	A set of components working together as parts of a mechanism or an interconnecting network.
<b>Use</b>	The act of using something. This typically involves the safe and proper operation of a tool or system.

## Appendix C

### Summary of Achievement Criteria

Achievement Criteria are included for competencies that require a practical assessment. The intent of including Achievement Criteria in the Foundation Program Outline is to ensure consistency in training across the many training institutions in British Columbia. Their purpose is to reinforce the theory and to provide a mechanism for evaluation of the learner's ability to apply the theory to practice. It is important that these performances be observable and measurable and that they reflect the skills spelled out in the competency. The conditions under which these performances will be observed and measured must be clear to the learner as well as the criteria by which the learner will be evaluated. The learner must also be given the evaluation criteria.

The performance spelled out in the Achievement Criteria is a suggested performance and is not meant to stifle flexibility of delivery. Training providers are welcome to substitute other practical performances that measure similar skills and attainment of the competency. Multiple performances may also be used to replace individual performances where appropriate.

The following tables summarize the practical assessments for each level. **For details, please refer to the Achievement Criteria following the competency in the Program Content section.**

AUTOMOTIVE SERVICE TECHNICIAN – FOUNDATION SUMMARY OF ACHIEVEMENT CRITERIA	
SUBJECT COMPETENCY	ACHIEVEMENT CRITERIA TASK
<b>A2</b> Use personal protective equipment (PPE) and safety equipment	The learner will wear PPE as needed for each task.
<b>B1</b> Use tools and equipment	The learner will select and use tools as needed for each task.
<b>H1</b> Diagnose and repair drive shafts and axles	The learner will replace a universal joint.
<b>I1</b> Diagnose and repair basic wiring and electrical systems	The learner will perform various electrical measurements on circuits.
<b>I2</b> Diagnose and repair 12-volt batteries, starting, and charging systems	The learner will test a 12-volt battery.
<b>K1</b> Diagnose and repair tires, wheels, hubs, and wheel bearings	The learner will mount and balance a tire.
<b>K2</b> Diagnose and repair suspension and control systems	The learner will identify and inspect suspension systems.
<b>K3</b> Diagnose and repair steering and control systems	1. The learner will perform a steering inspection. 2. The learner will perform a wheel alignment. 3. The learner will remove and reinstall an air bag.
<b>K4</b> Diagnose and repair braking and control systems	The learner will inspect front disc brakes.

AUTOMOTIVE SERVICE TECHNICIAN – FOUNDATION OPTIONAL TRAINING TOPICS SUMMARY OF ACHIEVEMENT CRITERIA	
SUBJECT COMPETENCY	ACHIEVEMENT CRITERIA TASK
<b>1.1</b> Demonstrate employment readiness skills	Given a written and/or a practical assessment on employment readiness skills, the learner will be able to demonstrate knowledge of the trade by achieving 70% or better based on a summative total of instructor assessment.
<b>2.1</b> Use diagnostic equipment	Given a written and/or a practical assessment on diagnostic equipment, the Learner will be able to demonstrate knowledge of the trade by achieving 70% or better based on a summative total of instructor assessment.
<b>3.1</b> Perform general automotive maintenance	Given a written and/or a practical assessment on cooling system maintenance, the learner will be able to demonstrate knowledge of the trade by achieving 70% or better based on a summative total of instructor assessment.
<b>3.2</b> Perform exhaust system maintenance	Given a written and/or a practical assessment on exhaust system maintenance, the Learner will be able to demonstrate knowledge of the trade by achieving 70% or better based on a summative total of instructor assessment.
<b>4.1</b> Describe fuel delivery systems	Given a written and/or a practical assessment on fuel delivery systems, the learner will be able to demonstrate knowledge of the trade by achieving 70% or better based on a summative total of instructor assessment.
<b>4.2</b> Describe internal combustion engines	Given a written and/or a practical assessment on internal combustion engines, the learner will be able to demonstrate knowledge of the trade by achieving 70% or better based on a summative total of instructor assessment.
<b>4.3</b> Describe ignition and engine management systems	Given a written and/or a practical assessment on ignition and engine management systems, the learner will be able to demonstrate knowledge of the trade by achieving 70% or better based on a summative total of instructor assessment.
<b>4.4</b> Describe hybrid and electric vehicles (EV)	Given a written and/or a practical assessment on hybrid and electric vehicles (EV), the learner will be able to demonstrate knowledge of the trade by achieving 70% or better based on a summative total of instructor assessment.