

SKILLED**TRADES**^{BC}

PROGRAM OUTLINE

Automotive Service Technician (AST)

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AUTOMOTIVE SERVICE TECHNICIAN (AST) HARMONIZED PROGRAM OUTLINE

**APPROVED BY INDUSTRY
DECEMBER 2016**

**BASED ON
RSOS 2016**

**Developed by
SkilledTradesBC
Province of British Columbia**

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Section 1

INTRODUCTION

Automotive Service Technician (AST)

Foreword

This revised Automotive Service Technician 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 2016 Red Seal Occupational Standard (RSOS) and the Automotive Service Technician Occupational Analysis (2016) 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 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 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 those competencies that require a practical assessment. The intent of including Achievement Criteria in the 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 measureable and that they reflect the skills spelled out in the competency as those required of a competent journeyman. 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 of the Occupational Analysis Chart and the Program Profile:

- Jamie Bloomfield Okanagan College
- Dean Cadieux Vancouver Island University
- Jeff Hoff Napa AutoPro
- Russ Hunter BC Insititute of Technology
- Robert Kunka Vancouver Community College
- Nic Nelson Foreman's Integra Tire Auto Centre
- Loi Truong Mercedes-Benz
- Matt Wilkie Cloverdale Auto Repair

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- Robert Kunka Vancouver Community College
- Nic Nelson Foreman's Integra Tire Auto Centre
- Loi Truong Mercedes-Benz
- Chris Wylie Searles Auto Repair

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 (AST) occupation.

How to Use this Document

This 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
Program Credentialing Model	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
OAC	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
Training Topics and Suggested Time Allocation	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
Program Content	Defines the objectives, learning tasks, high level content that must be covered for each competency, as well as defining observable, measureable 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
Training Provider Standards	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
Appendix – Glossary			Defines program specific terminology and acronyms	

Section 2

PROGRAM OVERVIEW

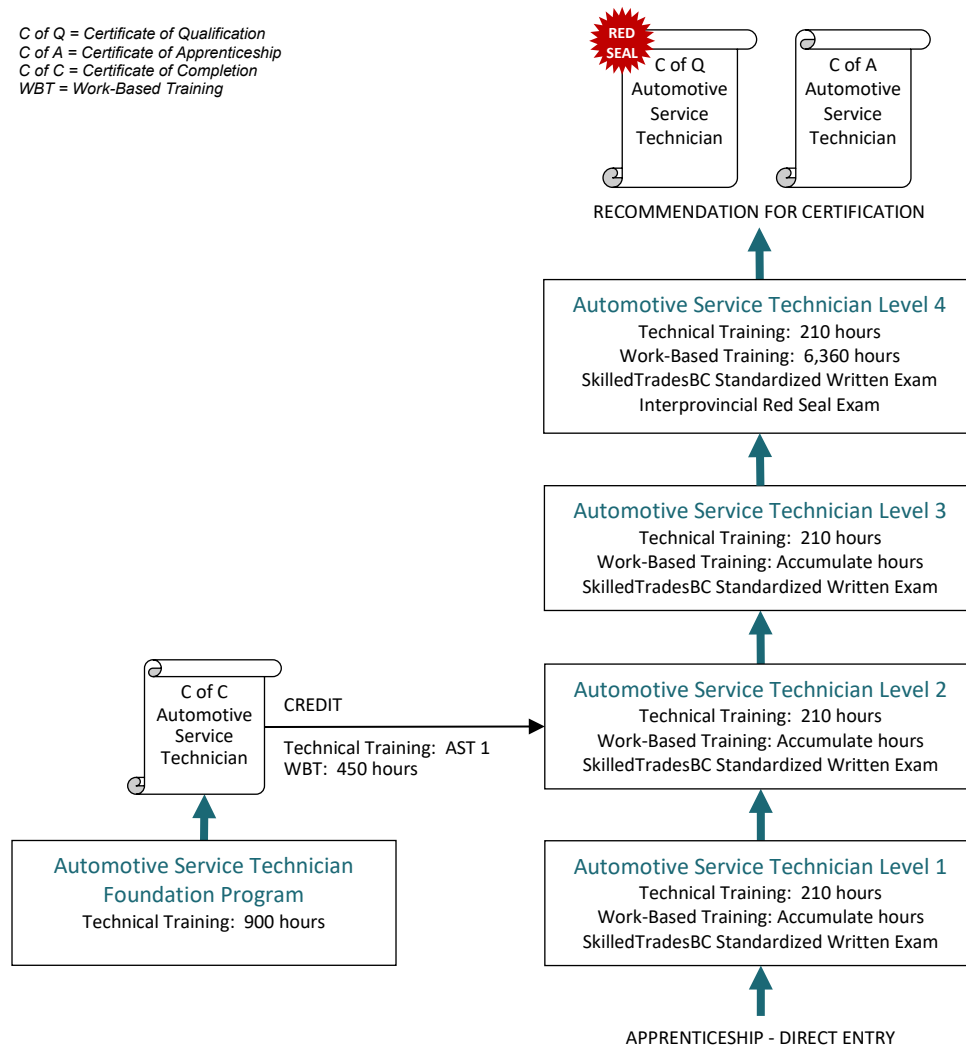
Automotive Service Technician (AST)

Program Credentialing Model

Apprenticeship Pathway

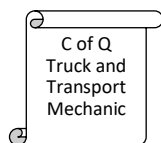
This graphic provides an overview of the Automotive Service Technician apprenticeship pathway.

C of Q = Certificate of Qualification
C of A = Certificate of Apprenticeship
C of C = Certificate of Completion
WBT = Work-Based Training



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 problems and repair vehicle systems including engines, vehicle management, hybrids, steering, braking, tires, wheels, drivetrains, suspension, electrical, electronics, heating, ventilation and air conditioning (HVAC), restraints, trim and accessories of automotive vehicles and light trucks with a gross vehicle weight less than 5,500 kg.

PERFORM SAFETY-RELATED FUNCTIONS A	Maintain safe work environment A1	Use personal protective equipment (PPE) and safety equipment A2		
	1			
USE TOOLS, EQUIPMENT AND DOCUMENTATION B	Use tools and equipment B1	Use fasteners, tubing, hoses and fittings B2	Use hoisting and lifting equipment B3	Use technical information B4
	1			
USE COMMUNICATION AND MENTORING TECHNIQUES C	Use communication techniques C1	Use mentoring techniques C2		
	1			
DIAGNOSE AND REPAIR ENGINE SYSTEMS D	Diagnose and repair cooling systems D1	Diagnose and repair lubricating systems D2	Diagnose and repair engine assembly D3	Diagnose and repair accessory drive systems D4
	2			

HARMONIZED PROGRAM OUTLINE

Program Overview

DIAGNOSE AND REPAIR GASOLINE ENGINE SUPPORT SYSTEMS E	Diagnose and repair advanced wiring and electronics E1	Diagnose and repair gasoline fuel delivery and injection systems E2	Diagnose and repair gasoline ignition systems E3	Diagnose and repair engine management systems E4	Diagnose and repair gasoline intake and exhaust systems E5	Diagnose and repair gasoline emissions control systems E6
	<div><div></div><div></div><div>3</div><div></div><div></div></div>	<div><div></div><div></div><div>3</div><div></div><div></div></div>	<div><div></div><div></div><div>3</div><div></div><div></div></div>	<div><div></div><div></div><div>3</div><div></div><div></div></div>	<div><div></div><div></div><div>3</div><div></div><div></div></div>	<div><div></div><div></div><div>3</div><div></div><div></div></div>
DIAGNOSE AND REPAIR DIESEL ENGINE SUPPORT SYSTEMS F	Diagnose and repair diesel fuel delivery and injection systems F1	Diagnose and repair diesel intake and exhaust systems F2	Diagnose and repair diesel emission control systems F3			
	<div><div></div><div></div><div></div><div>4</div><div></div></div>	<div><div></div><div></div><div></div><div>4</div><div></div></div>	<div><div></div><div></div><div></div><div>4</div><div></div></div>			
DIAGNOSE AND REPAIR VEHICLE NETWORKING SYSTEMS G	Identify type of networking system G1	Diagnose and repair networking systems G2				
	<div><div></div><div></div><div>3</div><div></div><div></div></div>	<div><div></div><div></div><div>3</div><div></div><div></div></div>				
DIAGNOSE AND REPAIR DRIVELINE SYSTEMS H	Diagnose and repair drive shafts and axles H1	Diagnose and repair manual transmissions and transaxles H2	Diagnose and repair automatic transmissions and transaxles H3	Diagnose and repair clutches H4	Diagnose and repair mechanical transfer cases H5	Diagnose and repair all-wheel drive (AWD) systems H6
	<div>1<div><div></div><div></div><div></div><div></div><div></div></div></div>	<div>2<div><div></div><div></div><div></div><div></div><div></div></div></div>	<div><div></div><div></div><div></div><div>4</div><div></div></div>	<div>2<div><div></div><div></div><div></div><div></div><div></div></div></div>	<div><div></div><div></div><div>3</div><div></div><div></div></div>	<div><div></div><div></div><div></div><div>4</div><div></div></div>
	Diagnose and repair final drive assemblies H7					
	<div>2<div><div></div><div></div><div></div><div></div><div></div></div></div>					
DIAGNOSE AND REPAIR ELECTRICAL SYSTEMS AND COMPONENTS I	Diagnose and repair basic wiring and electrical systems I1	Diagnose and repair starting and charging systems and batteries I2	Diagnose and repair lighting and wiper systems I3	Diagnose and repair electrical options and accessories I4	Diagnose and repair instrumentation, entertainment systems and displays I5	
	<div>1<div><div></div><div></div><div></div><div></div><div></div></div></div>	<div>1<div>2<div><div></div><div></div><div></div><div></div><div></div></div></div></div>	<div>2<div><div></div><div></div><div></div><div></div><div></div></div></div>	<div><div></div><div></div><div>3</div><div></div><div></div></div>	<div><div></div><div></div><div></div><div>4</div><div></div></div>	

HARMONIZED PROGRAM OUTLINE

Program Overview

DIAGNOSE AND REPAIR HEATING, VENTILATION AND AIR CONDITIONING (HVAC) AND COMFORT CONTROL SYSTEMS J	Diagnose and repair air flow control and heating systems J1 <table><tr><td></td><td></td><td></td><td>4</td><td></td></tr></table>				4		Diagnose and repair refrigerant systems J2 <table><tr><td></td><td></td><td></td><td>4</td><td></td></tr></table>				4													
			4																					
			4																					
DIAGNOSE AND REPAIR STEERING AND SUSPENSION, BRAKING, CONTROL SYSTEMS, TIRES, WHEELS, HUBS AND WHEEL BEARINGS K	Diagnose and repair steering and control systems K1 <table><tr><td>1</td><td>2</td><td></td><td></td><td></td></tr></table>	1	2				Diagnose and repair suspension and control systems K2 <table><tr><td>1</td><td>2</td><td></td><td></td><td></td></tr></table>	1	2				Diagnose and repair braking and control systems K3 <table><tr><td>1</td><td>2</td><td></td><td></td><td></td></tr></table>	1	2				Diagnose and repair tires, wheels, hubs and wheel bearings K4 <table><tr><td>1</td><td></td><td></td><td></td><td></td></tr></table>	1				
1	2																							
1	2																							
1	2																							
1																								
DIAGNOSE AND REPAIR RESTRAINT SYSTEMS, BODY COMPONENTS, ACCESSORIES AND TRIM L	Diagnose and repair restraint systems L1 <table><tr><td></td><td></td><td></td><td>4</td><td></td></tr></table>				4		Diagnose and repair wind noises, rattles and water leaks L2 <table><tr><td>1</td><td></td><td></td><td></td><td></td></tr></table>	1					Diagnose and repair interior and exterior components, accessories and trim L3 <table><tr><td>1</td><td></td><td></td><td></td><td></td></tr></table>	1					Diagnose and repair latches, locks and movable glass L4 <table><tr><td>1</td><td></td><td></td><td></td><td></td></tr></table>	1				
			4																					
1																								
1																								
1																								
DIAGNOSE AND REPAIR HYBRID AND ELECTRIC VEHICLES (EV) M	Implement specific safety protocols for hybrid and electric vehicles (EV) M1 <table><tr><td>1</td><td></td><td></td><td></td><td></td></tr></table>	1					Diagnose and repair hybrid and electric vehicle (EV) systems M2 <table><tr><td></td><td></td><td></td><td>4</td><td></td></tr></table>				4													
1																								
			4																					

Training Topics and Suggested Time Allocation: Level 1

AUTOMOTIVE SERVICE TECHNICIAN – LEVEL 1

		% of Time Allocated to:			
		% of Time	Theory	Practical	Total
Line A	PERFORM SAFETY-RELATED FUNCTIONS	4%	70%	30%	100%
A1	Maintain 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	7%	40%	60%	100%
H1	Diagnose and repair drive shafts and axles		✓	✓	
Line I	DIAGNOSE AND REPAIR ELECTRICAL SYSTEMS AND COMPONENTS	20%	50%	50%	100%
I1	Diagnose and repair basic wiring and electrical systems		✓	✓	
I2	Diagnose and repair starting and charging systems and batteries		✓	✓	
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 steering and control systems		✓	✓	
K2	Diagnose and repair suspension and control systems		✓	✓	
K3	Diagnose and repair braking and control systems		✓	✓	
K4	Diagnose and repair tires, wheels, hubs and wheel bearings		✓	✓	
Line L	DIAGNOSE AND REPAIR RESTRAINT SYSTEMS, BODY COMPONENTS, ACCESSORIES AND TRIM	3%	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		✓		

		% of Time	% of Time Allocated to:		
			Theory	Practical	Total
Line M	DIAGNOSE AND REPAIR HYBRID AND ELECTRIC VEHICLES (EV)	1%	100%	0%	100%
M1	Implement specific safety protocols for hybrid and electric vehicles (EV)		✓		
Total Percentage for AST Level 1		100%			

Training Topics and Suggested Time Allocation: Level 2

AUTOMOTIVE SERVICE TECHNICIAN – LEVEL 2

		% of Time Allocated to:			
		% of Time	Theory	Practical	Total
Line D	DIAGNOSE AND REPAIR ENGINE SYSTEMS	38%	40%	60%	100%
D1	Diagnose and repair cooling systems		✓		
D2	Diagnose and repair lubricating systems		✓		
D3	Diagnose and repair engine assembly		✓	✓	
D4	Diagnose and repair accessory drive systems		✓		
Line H	DIAGNOSE AND REPAIR DRIVELINE SYSTEMS	31%	40%	60%	100%
H2	Diagnose and repair manual transmissions and transaxles		✓	✓	
H4	Diagnose and repair clutches		✓		
H7	Diagnose and repair final drive assemblies		✓	✓	
Line I	DIAGNOSE AND REPAIR ELECTRICAL SYSTEMS AND COMPONENTS	17%	40%	60%	100%
I2	Diagnose and repair starting and charging systems and batteries		✓	✓	
I3	Diagnose and repair lighting and wiper systems		✓		
Line K	DIAGNOSE AND REPAIR STEERING AND SUSPENSION, BRAKING, CONTROL SYSTEMS, TIRES, WHEELS, HUBS AND WHEEL BEARINGS	14%	60%	40%	100%
K1	Diagnose and repair steering and control systems		✓	✓	
K2	Diagnose and repair suspension and control systems		✓		
K3	Diagnose and repair braking and control systems		✓	✓	
Total Percentage for AST Level 2		100%			

Training Topics and Suggested Time Allocation: Level 3

AUTOMOTIVE SERVICE TECHNICIAN – LEVEL 3

		% of Time Allocated to:			
		% of Time	Theory	Practical	Total
Line E	DIAGNOSE AND REPAIR GASOLINE ENGINE SUPPORT SYSTEMS	80%	60%	40%	100%
E1	Diagnose and repair advanced wiring and electronics		✓	✓	
E2	Diagnose and repair gasoline fuel delivery and injection systems		✓	✓	
E3	Diagnose and repair gasoline ignition systems		✓	✓	
E4	Diagnose and repair engine management systems		✓	✓	
E5	Diagnose and repair gasoline intake and exhaust systems		✓		
E6	Diagnose and repair gasoline emissions control systems		✓	✓	
Line G	DIAGNOSE AND REPAIR VEHICLE NETWORKING SYSTEMS	10%	50%	50%	100%
G1	Identify type of networking system		✓		
G2	Diagnose and repair networking systems		✓	✓	
Line H	DIAGNOSE AND REPAIR DRIVELINE SYSTEMS	3%	100%	0%	100%
H5	Diagnose and repair mechanical transfer cases		✓		
Line I	DIAGNOSE AND REPAIR ELECTRICAL SYSTEMS AND COMPONENTS	7%	40%	60%	100%
I4	Diagnose and repair electrical options and accessories		✓	✓	
Total Percentage for AST Level 3		100%			

Training Topics and Suggested Time Allocation: Level 4

AUTOMOTIVE SERVICE TECHNICIAN – LEVEL 4

		% of Time Allocated to:			
		% of Time	Theory	Practical	Total
Line C	USE COMMUNICATION AND MENTORING TECHNIQUES	1%	100%	0%	100%
C2	Use mentoring techniques		✓		
Line F	DIAGNOSE AND REPAIR DIESEL ENGINE SUPPORT SYSTEMS	11%	50%	50%	100%
F1	Diagnose and repair diesel fuel delivery and injection systems		✓	✓	
F2	Diagnose and repair diesel intake and exhaust systems		✓		
F3	Diagnose and repair diesel emission control systems		✓		
Line H	DIAGNOSE AND REPAIR DRIVELINE SYSTEMS	54%	50%	50%	100%
H3	Diagnose and repair automatic transmissions and transaxles		✓	✓	
H6	Diagnose and repair all-wheel drive (AWD) systems		✓	✓	
Line I	DIAGNOSE AND REPAIR ELECTRICAL SYSTEMS AND COMPONENTS	2%	80%	20%	100%
I5	Diagnose and repair instrumentation, entertainment systems and displays		✓		
Line J	DIAGNOSE AND REPAIR HEATING, VENTILATION AND AIR CONDITIONING (HVAC) AND COMFORT CONTROL SYSTEMS	17%	50%	50%	100%
J1	Diagnose and repair air flow control and heating systems		✓		
J2	Diagnose and repair refrigerant systems		✓	✓	
Line L	DIAGNOSE AND REPAIR RESTRAINT SYSTEMS, BODY COMPONENTS, ACCESSORIES AND TRIM	5%	60%	40%	100%
L1	Diagnose and repair restraint systems		✓		
Line M	DIAGNOSE AND REPAIR HYBRID AND ELECTRIC VEHICLES (EV)	10%	80%	20%	100%
M2	Diagnose and repair hybrid and electric vehicle (EV) systems		✓	✓	
Total Percentage for AST Level 4		100%			

Section 3

PROGRAM CONTENT

Automotive Service Technician

Level 1

Automotive Service Technician

Line (GAC): A PERFORM SAFETY-RELATED FUNCTIONS
Competency: A1 Maintain safe work environment

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

4. Use Workplace Hazardous Materials Information System (WHMIS)

CONTENT

- WHMIS
 - Right to know
 - Worker education
 - Product identification
- Roles and responsibilities
 - Employers
 - Suppliers
 - Workers
- Labelling
 - Symbols
- MSDS
 - Hazards
 - Handling
 - Ingredients
- Storage

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:

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

LEARNING TASKS

1. Describe personal safety
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
- Outside meeting place

Achievement Criteria

Performance	The learner will wear PPE as needed for each task.
-------------	--

Conditions	The learner will be given
------------	---------------------------

- Access to PPE

Criteria	The learner will be evaluated on
----------	----------------------------------

- PPE selection
- PPE fit
- Consistency of usage

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

LEARNING TASKS

CONTENT

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

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"> • Access to tools |
| Criteria | The learner will be evaluated on <ul style="list-style-type: none"> • Safety • Tool selection • Tool usage |

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

CONTENT

- | | |
|--|--|
| 1. Describe fasteners | <ul style="list-style-type: none"> • Types <ul style="list-style-type: none"> ○ Bolts ○ Studs ○ Nuts ○ Washers ○ Keys ○ Snap rings |
| 2. Use fasteners | <ul style="list-style-type: none"> • Selection <ul style="list-style-type: none"> ○ Imperial ○ Metric • Torquing <ul style="list-style-type: none"> ○ Sequence ○ Torque to yield • Repair <ul style="list-style-type: none"> ○ Extraction ○ Helicoils |
| 3. Identify lubricants and fluids | <ul style="list-style-type: none"> • Types <ul style="list-style-type: none"> ○ Greases ○ Engine oil ○ Transmission fluids ○ Brake fluids ○ Anti-freeze ○ Shop fluids <ul style="list-style-type: none"> – Cleaners/detergents – Penetrating fluids • Selection • Recycling |
| 4. Describe tubing, hoses and fittings | <ul style="list-style-type: none"> • 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:

- 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 technical information

Objectives

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

- Use technical information.

LEARNING TASKS

1. Describe technical information

2. Use technical information

CONTENT

- Types
 - Electronic
 - Print

- Navigation
- Manufacturer's specifications
- Manufacturer's recalls
- Repair procedures
 - Estimates
 - Technical service bulletins (TSBs)

- Safety concerns
- Description of operations and parts
- Diagrams

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

Objectives

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

- Use communication techniques

LEARNING TASKS

1. Demonstrate two-way communication
2. Use active listening
3. Use digital communication technologies

CONTENT

- Verbal and written instructions
- Record keeping
 - Service/work orders
 - Technical reports
 - Parts requisition
- Attention
- Open-ended questions
- Clarification
- Hand-held devices

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:

- Service drive shafts and axle shafts.

LEARNING TASKS

1. Describe drive shafts

2. Service drive shafts

CONTENT

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

Achievement Criteria

Performance The learner will assess driveline angle.

Conditions The learner will be given

- Vehicle
- Tools and equipment
- Access to technical information

Criteria The learner will be evaluated on

- Safety
- Tool usage
- Procedure
- Accuracy of results

Line (GAC): I DIAGNOSE AND REPAIR ELECTRICAL SYSTEMS AND COMPONENTS

Competency: I1 Diagnose and repair basic wiring and electrical systems

Objectives

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

- Describe the fundamentals of electrical circuits and components.
- Service and repair wiring.
- Use electrical test equipment.

LEARNING TASKS

1. Describe electrical fundamentals

2. Describe electrical circuits and components

3. Read and interpret wiring diagrams

4. Service and repair wiring

5. Use electrical test equipment

CONTENT

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

LEARNING TASKS

6. Use scan tools

CONTENT

- Voltage drop
- Types
 - Tools
 - Codes
- On-board diagnostics
- Basic operation

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

Line (GAC): **I DIAGNOSE AND REPAIR ELECTRICAL SYSTEMS AND COMPONENTS**

Competency: **I2 Diagnose and repair starting and charging systems and batteries**

Objectives

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

- Service and test 12-volt batteries.

LEARNING TASKS

CONTENT

- | | |
|-------------------------------|---|
| 1. Describe 12-volt batteries | <ul style="list-style-type: none"> • Safety • Construction • Types • Ratings |
| 2. Service 12-volt batteries | <ul style="list-style-type: none"> • Inspection • Cleaning • Maintenance • Installation • Recycling |
| 3. Test 12-volt batteries | <ul style="list-style-type: none"> • Load • Conductance • Hydrometer • Parasitic • Interpret test data |
| 4. Charge 12-volt batteries | <ul style="list-style-type: none"> • Safety • Size, type, rate |

Achievement Criteria

Performance The learner will test a 12-volt battery.

Conditions The learner will be given

- A 12-volt battery
- Test equipment

Criteria The learner will be evaluated on

- Safety
- Tool usage
- Procedure
- Accuracy of results

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

Competency: **K1 Diagnose and repair steering and control systems**

Objectives

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

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

LEARNING TASKS

1. Describe steering columns

2. Inspect steering columns

3. Describe occupant restraints

4. Remove and replace steering wheel air bag inflator module

5. Describe steering linkage

CONTENT

- Types
 - Tilt
 - Telescoping
- Steering wheel lock
- Combination switch
- Shafts, universal joints, coupling, splines
- Collapsing function
- Electrical connections
- Safety
- Types
 - Driver
 - Passenger
 - Seat belt pre-tensioner
- Air bag wiring
- Safety
 - Disarm
- Precautions
 - Handling
 - Storage
- Types
 - Parallelogram
 - Cross steer
 - Rack and pinion
- Linkage
- Tie rods

- | | |
|--|--|
| 6. Inspect steering linkage | <ul style="list-style-type: none"> • Tests <ul style="list-style-type: none"> ○ Road test ○ Steering wheel free play ○ Dry park test ○ Visual inspection |
| 7. Describe conventional steering gears | <ul style="list-style-type: none"> • Recirculating ball steering box design <ul style="list-style-type: none"> ○ Ball nut assembly ○ Sector shaft ○ Thrust bearings ○ Seals ○ Lubrication |
| 8. Service conventional steering gears | <ul style="list-style-type: none"> • Seal leakage • Shaft wear • Adjustments <ul style="list-style-type: none"> ○ Gear tooth lash ○ Over centre adjustment |
| 9. Describe rack and pinion steering gears | <ul style="list-style-type: none"> • Housing and seals • Rack and pinion • Bearings • Tie rod ends • Bellows (dust boots) • Mounting |
| 10. Service rack and pinion steering gears | <ul style="list-style-type: none"> • Tie rod ends • Leaks • Mounting |
| 11. Describe power steering | <ul style="list-style-type: none"> • Fluids • Pump • Hoses • Valves |
| 12. Service power steering | <ul style="list-style-type: none"> • Fluid level and condition <ul style="list-style-type: none"> ○ Leaks • Belts • Tests <ul style="list-style-type: none"> ○ Road test ○ Visual inspection ○ Pressure and volume • Bleeding procedures |

13. Perform wheel alignment

- Steering geometry
 - Caster, camber, toe
 - Steering axis inclination
 - Thrust angle
- Pre-checks and road test
- Alignment procedure
 - Factory adjustments
- Steering wheel centre check
- Steering sensor re-calibration

Achievement Criteria 1

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

Achievement Criteria 2

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

Achievement Criteria 3

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

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:

- Inspect and service mechanical suspension systems.

LEARNING TASKS

1. Describe frame designs

CONTENT

- Unibody
 - Subframe
- Conventional types
 - Perimeter
 - Ladder
 - Torque boxes
- Accident crumple zones
- Construction
- Front
 - Rigid
 - Independent
 - McPherson strut
 - Short and long arm
 - Multi-link
 - Twin I-beam
- Rear
 - Rigid
 - Independent
 - Chapman strut
 - Short and long arm
 - Multi-link
 - Semi-rigid
- Dynamics
 - Forces
 - Body roll
- Faults

2. Describe suspension systems

3. Describe suspension components
 - Springs
 - Purpose
 - Types
 - Coil
 - Leaf
 - Torsion bar
 - Ride height
 - Performance
 - Shocks and struts
 - Purpose
 - Components
 - Types
 - Conventional
 - Gas
 - Applications
 - Towing
 - Off road
 - Performance
 - Ball joints
 - Loaded
 - Follower
 - Anti-sway bar
 - Rubber bushings
 - Mounting points
4. Inspect and service suspension systems
 - Safety
 - Visual inspection
 - Road test
 - Removal and replacement
 - Measurements
 - Alignment
 - Faults

Achievement Criteria

Performance	The learner will identify and inspect suspension systems.
Conditions	The learner will be given <ul style="list-style-type: none"> • A vehicle • Measuring equipment • Access to technical information
Criteria	The learner will be evaluated on <ul style="list-style-type: none"> • 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 braking and control systems**

Objectives

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

- Service and repair mechanical, hydraulic brake systems.
- Service power assist systems.

LEARNING TASKS

CONTENT

- | | |
|-------------------------------------|---|
| 1. Describe hydraulic brake systems | <ul style="list-style-type: none"> • Principles <ul style="list-style-type: none"> ○ Hydraulic <ul style="list-style-type: none"> – Pascal's law ○ Friction • Types <ul style="list-style-type: none"> ○ Disc ○ Drum • Components <ul style="list-style-type: none"> ○ Cylinders ○ Calipers ○ Valves • Faults |
| 2. Service hydraulic brake systems | <ul style="list-style-type: none"> • Road test • Inspection • Adjustment • Measurement • Machining • Replacement • Bleeding/exchange • Faults |
| 3. Service brake tubing | <ul style="list-style-type: none"> • Materials • Bending, cutting, flaring • Fittings |
| 4. Describe power assist systems | <ul style="list-style-type: none"> • Principles • Types <ul style="list-style-type: none"> ○ Vacuum ○ Hydraulic • Components • Faults |

LEARNING TASKS

5. Service power assist systems

CONTENT

- Fluids
- Belts and hoses
- Vacuum
- Replacement
- Adjustment
 - Brake pedal free play
- Tests
 - Function test
 - Pressure test
 - Vacuum test
- 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

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

Competency: **K4 Diagnose and repair tires, wheels, hubs and wheel bearings**

Objectives

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

- Service and repair tires and wheels.
- Service and repair hubs and bearings.

LEARNING TASKS

CONTENT

- | | |
|--|--|
| 1. Describe tire construction | <ul style="list-style-type: none"> • Side wall markings • Ratings • Tread design • Run flat design |
| 2. Service tires | <ul style="list-style-type: none"> • Inspection <ul style="list-style-type: none"> ○ Wear patterns ○ Damage • Rotation • Mounting and balancing • Repair |
| 3. Describe wheels | <ul style="list-style-type: none"> • Types • Offset • Sizing • Wheel fasteners |
| 4. Inspect wheels | <ul style="list-style-type: none"> • Curb damage • Run out |
| 5. Describe Tire Pressure Monitoring System (TPMS) | <ul style="list-style-type: none"> • Types <ul style="list-style-type: none"> ○ Direct ○ Indirect • Sensor replacement • System service <ul style="list-style-type: none"> ○ Reset ○ Reprogram ○ Calibrate |
| 6. Describe wheel bearings | <ul style="list-style-type: none"> • Types <ul style="list-style-type: none"> ○ Ball ○ Tapered roller ○ Sealed • Components |

LEARNING TASKS

CONTENT

7. Service wheel bearings

- Loading principles
- Removal and installation techniques
- Lubrication
- Axial and radial play
- Adjustment

8. Describe spindles and hubs

- Front-wheel drive
- Rear-wheel drive
- Bearing types

9. Service spindles and hubs

- Lubrication
- Inspection
 - Sensory
 - Measurements
- Bearing adjustment
- Removal and installation

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):	L	DIAGNOSE AND REPAIR RESTRAINT SYSTEMS, BODY COMPONENTS, ACCESSORIES AND TRIM
Competency:	L2	Diagnose and repair wind noises, rattles and water leaks

Objectives

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

- Identify common areas of concern for wind noise, rattles and water leaks.

LEARNING TASKS

1. Describe wind noise, rattles and water leaks

CONTENT

- Diagnostic tools
 - Smoke machine
 - Chassis ears
 - Water hose

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

Objectives

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

- 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"> • Exterior components <ul style="list-style-type: none"> ○ Mirrors ○ Roof rack • Interior components <ul style="list-style-type: none"> ○ Seats ○ Dashboard • Accessories <ul style="list-style-type: none"> ○ Running boards ○ Bug shield |
| 2. Repair interior and exterior components and trim | <ul style="list-style-type: none"> • Repair parts and materials <ul style="list-style-type: none"> ○ Adhesives ○ Gaskets ○ Sealants ○ Fastening devices • Tools <ul style="list-style-type: none"> ○ Trim tools ○ Hand tools • Remove, replace and adjust • Verify fit, function and performance |

Line (GAC): **L DIAGNOSE AND REPAIR RESTRAINT SYSTEMS, BODY COMPONENTS, ACCESSORIES AND TRIM**

Competency: **L4 Diagnose and repair latches, locks and movable glass**

Objectives

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

- Describe latches, locks and movable glass.

LEARNING TASKS

1. Describe latches, locks and movable glass.

CONTENT

- Components
 - Lock
 - Rod
 - Cable
 - Regulator
 - Sensor/switches

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.

LEARNING TASKS

1. Identify high voltage components
2. Describe hybrid and electric vehicle safety

CONTENT

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

Level 2

Automotive Service Technician

Line (GAC):	D	DIAGNOSE AND REPAIR ENGINE SYSTEMS
Competency:	D1	Diagnose and repair cooling systems

Objectives

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

- Service cooling systems.
- Diagnose cooling systems faults.

LEARNING TASKS

1. Describe cooling system
2. Service cooling systems

CONTENT

- Operation
- Coolant and additive properties
- Components
 - Radiator
 - Thermostat
 - Water pump
 - Sensors and switches
- Secondary or auxiliary cooling systems
- Safety
- Inspection
 - Sensory
- Depressurization
- Testing
 - Pressure
 - Air flow
 - Temperature
 - Coolant
 - Temperature
 - Additives
- Service
 - Fluid exchange
 - Bleeding
- Removal and installation techniques
- Faults

Line (GAC): **D DIAGNOSE AND REPAIR ENGINE SYSTEMS**
Competency: **D2 Diagnose and repair lubricating systems**

Objectives

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

- Service lubricating systems.
- Diagnose lubricating systems.

LEARNING TASKS

1. Describe lubrication systems

CONTENT

- Oil
 - Grades
 - Types
 - Synthetics
- Pumps
 - Gerotor
 - Vane
 - Gear
- Filters
- Sensors
- Oil galleries
- Crank case ventilation systems
- Sumps and strainers
- Coolers
- Associated plumbing and hardware
- Gauges
- Valvetrain controls
 - Variable valve timing
 - Cylinder deactivation
- Faults
- Inspection
 - Sensory
- Testing
 - Pressure testing
 - Leak detection
- Service
 - Filter
 - Seals and gaskets
 - Components
 - Maintenance
- Priming
- Faults

2. Service lubrication systems

Line (GAC):	D	DIAGNOSE AND REPAIR ENGINE SYSTEMS
Competency:	D3	Diagnose and repair engine assembly

Objectives

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

- Disassemble, inspect, and reassemble engine.
- Assess engine mechanical condition.

LEARNING TASKS

1. Describe gasoline internal combustion engines components

CONTENT

- Describe gasoline internal combustion engines components
 - Short block assembly
 - Crank shaft
 - Pistons
 - Connecting rods
 - Cylinder head assembly
 - Cam shaft
 - Valves
 - Valvetrain
 - Variable valve timing
 - Cam actuators
 - Sensors
- Describe gasoline internal combustion engines
 - Four stroke cycle
 - Construction design and materials
 - Engine configurations
 - Inline
 - V
 - Opposed
 - Engine dimensions
 - Stroke x bore
 - Engine measurements
 - Horse power
 - Torque
 - Volumetric efficiency
 - Cylinder deactivation systems
- Describe diesel engines
 - Compare component construction and operation to gasoline internal combustion engines
 - Compression ignition
 - Compression ratio

- | | |
|--|--|
| <p>4. Perform engine mechanical condition tests on gasoline and diesel engines</p> | <ul style="list-style-type: none"> • Sensory • Cylinder pressure testing <ul style="list-style-type: none"> ○ Spark ignition ○ Compression ignition • Cylinder leak down • Power balance • Leak detection <ul style="list-style-type: none"> ○ Dye/Black light |
| <p>5. Describe engine removal and installation</p> | <ul style="list-style-type: none"> • Safety <ul style="list-style-type: none"> ○ Jacking and hoisting ○ Weight distribution • Procedures <ul style="list-style-type: none"> ○ Removal ○ Installation |
| <p>6. Describe engine disassembly procedures</p> | <ul style="list-style-type: none"> • Disassembly procedures • Cleaning <ul style="list-style-type: none"> ○ Solvent ○ Chemical ○ Steam • Measuring and evaluating • Short block assembly <ul style="list-style-type: none"> ○ Boring and honing ○ Machining <ul style="list-style-type: none"> – Bearing surfaces – Mating surfaces ○ Piston fitting ○ Bearing installation • Cylinder head assembly <ul style="list-style-type: none"> ○ Machining ○ Crack detection and repair ○ Valve train assembly |

- 7. Perform engine disassembly and inspection
 - Disassembly and removal
 - Cylinder head
 - Pistons
 - Crankshaft
 - Camshaft
 - Bearings
 - Cleaning
 - Measuring and evaluating
 - Piston fitting
 - Bearing installation
 - Mating surfaces
 - Crankshaft
 - Camshaft
 - Valvetrain

- 8 Perform engine assembly procedures
 - Preassembly cleaning
 - Assemble short block
 - Fitting parts
 - Measuring and torquing
 - Lubrication
 - Install cylinder head
 - Assemble valvetrain
 - Sprockets
 - Belt
 - Chain
 - Tensioners
 - Balance shafts
 - Mechanical engine timing
 - Assemble associated parts and fasteners
 - Gaskets and sealants
 - Seal installation
 - Start up/break in procedures

Achievement Criteria 1

Performance	The learner will perform engine mechanical assessment.
Conditions	The learner will be given <ul style="list-style-type: none"> • Vehicle • Test equipment • Access to technical information
Criteria	The learner will be evaluated on <ul style="list-style-type: none"> • Safety • Procedure • Tool usage • Accuracy of results

Achievement Criteria 2

Performance	The learner will perform engine component measurements.
Conditions	The learner will be given <ul style="list-style-type: none"> • An engine or engine components • Measuring equipment • Access to technical information
Criteria	The learner will be evaluated on <ul style="list-style-type: none"> • Safety • Procedure • Tool usage • Accuracy of results

Line (GAC):	D	DIAGNOSE AND REPAIR ENGINE SYSTEMS
Competency:	D4	Diagnose and repair accessory drive systems

Objectives

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

- Service accessory drive systems.

LEARNING TASKS

1. Describe accessory drive components
2. Service accessory drive systems

CONTENT

- Components
 - Tensioners
 - Pulleys
- Inspection
 - Alignment
 - Tensioner
 - Belt
- Installation
- Faults

Line (GAC): **H DIAGNOSE AND REPAIR DRIVELINE SYSTEMS**
Competency: **H2 Diagnose and repair manual transmissions and transaxles**

Objectives

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

- Describe manual transmissions and transaxles.
- Service manual transmissions and transaxles.

LEARNING TASKS

CONTENT

- | | |
|--|---|
| 1 Describe manual transmission and transaxle components | <ul style="list-style-type: none"> • Gears and shafts • Synchronizers • Bearings and bushings • Linkage <ul style="list-style-type: none"> ○ Interlock and detents • Final drive • Switches, solenoids and sensors |
| 2 Describe manual transmissions and transaxles | <ul style="list-style-type: none"> • Power flow • Gear ratios <ul style="list-style-type: none"> ○ Torque multiplication and reduction ○ Simple and compound • Synchronization • Final drive • Lubricants and additives • System lubrication |
| 3 Remove and install transmissions and transaxles | <ul style="list-style-type: none"> • Safety <ul style="list-style-type: none"> ○ Jacking and hoisting ○ Weight distribution • Procedures |
| 4 Perform manual transmission and transaxle disassembly, inspection, and reassembly | <ul style="list-style-type: none"> • Inspection <ul style="list-style-type: none"> ○ Sensory ○ Internal component wear • Measurement <ul style="list-style-type: none"> ○ Synchronizer components ○ Shaft wear ○ Gear end play • Diagnose transmission and transaxle faults • Shifter mechanism • Adjustments |

Achievement Criteria 1

Performance	The learner will inspect manual transmission and transaxle components.
Conditions	The learner will be given <ul style="list-style-type: none">• Transmission components• Tools• Access to technical information
Criteria	The learner will be evaluated on <ul style="list-style-type: none">• Safety• Tool usage• Procedure• Accuracy of results

Achievement Criteria 2

Performance	The learner will calculate gear ratios.
Conditions	The learner will be given <ul style="list-style-type: none">• Transmission or transaxle
Criteria	The learner will be evaluated on <ul style="list-style-type: none">• Safety• Tool usage• Procedure• Accuracy of results

Line (GAC): **H DIAGNOSE AND REPAIR DRIVELINE SYSTEMS**
Competency: **H4 Diagnose and repair clutches**

Objectives

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

- Describe clutch systems.
- Service clutch systems.

LEARNING TASKS

1. Describe clutch components

CONTENT

- Types of clutch systems
 - Conventional
 - Dual clutch
 - Pull clutch
- Flywheel
 - Conventional
 - Dual mass
- Pressure plates
- Friction discs
- Bearings and bushings
- Safety switches
- Operating hardware
 - Clutch release
- Removal and replacement
- Inspection
 - Sensory
- Diagnose clutch faults
- Maintenance and adjustments
 - Bleeding

2. Service clutch components

Line (GAC):	H	DIAGNOSE AND REPAIR DRIVELINE SYSTEMS
Competency:	H7	Diagnose and repair final drive assemblies

Objectives

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

- Describe final drive (differentials) assemblies.
- Service final drive (differentials) assemblies.

LEARNING TASKS

1. Describe final drives (differentials)

CONTENT

- Housings and mounts
 - Integral
 - Removable
- Gears, shafts and bearings
- Axles
 - Full floating
 - Semi floating
- Limited slip and locking differentials
 - Torque bias
- Sensors
- Lubricants and additives
- Gaskets and seals
- Power flow
- Gear ratio
- Inspection and adjustments
 - Sensory
 - Gear tooth contact patterns
 - Pinion depth
 - Backlash
 - Bearing pre-load
- Procedures
 - Disassembly and reassembly
 - Gear set up

- ## 2. Service final drive assemblies (differentials)

Achievement Criteria

Performance	The learner will perform backlash measurement and adjustment.
Conditions	The learner will be given <ul style="list-style-type: none"> • Final drive assembly • Measuring tools • Access to technical information
Criteria	The learner will be evaluated on <ul style="list-style-type: none"> • Safety • Tool usage • Procedure • Accuracy of results

Line (GAC): **I DIAGNOSE AND REPAIR ELECTRICAL SYSTEMS AND COMPONENTS**

Competency: **I2 Diagnose and repair starting and charging systems and batteries**

Objectives

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

- Service starting systems.
- Service charging systems.

LEARNING TASKS

1. Describe starting systems

2. Service starting systems

CONTENT

- Theoretical principles
 - Magnetism
- Components
 - Starter
 - Permanent magnet
 - Electro magnet
 - Solenoids and relays
 - Ring gear
 - Ignition switch
 - Conventional
 - Push button start
- Operation
- Wiring and controls
 - Computer controlled
 - Idle start stop
- Faults
- Inspection and testing
 - Sensory
 - Electrical
 - Mechanical
 - Scan tool
 - Functional test
- Component removal and replacement
- Faults

- | | |
|------------------------------|--|
| 3. Describe charging systems | <ul style="list-style-type: none"> • Theoretical principles <ul style="list-style-type: none"> ○ Induction • Electronics <ul style="list-style-type: none"> ○ Diodes and transformers • Components <ul style="list-style-type: none"> ○ Alternators <ul style="list-style-type: none"> – Over-running pulleys ○ Regulators and controls ○ Gauges and indicators ○ Sensors • Operation • Wiring and controls <ul style="list-style-type: none"> ○ Computer controlled • Faults |
| 4. Service charging systems | <ul style="list-style-type: none"> • Inspection and testing <ul style="list-style-type: none"> ○ Sensory ○ Electrical ○ Mechanical ○ Scan tool <ul style="list-style-type: none"> – Data and functional test • Component removal and replacement • Faults |

Achievement Criteria 1

- | | |
|-------------|---|
| Performance | The learner will test a starting system. |
| Conditions | The learner will be given <ul style="list-style-type: none"> • A vehicle • Test equipment • Access to technical information |
| Criteria | The learner will be evaluated on <ul style="list-style-type: none"> • Safety • Tool usage • Procedure • Accuracy of results |

Achievement Criteria 2

Performance	The learner will test a charging system.
Conditions	The learner will be given <ul style="list-style-type: none"> • A vehicle • Test equipment • Access to technical information
Criteria	The learner will be evaluated on <ul style="list-style-type: none"> • Safety • Tool usage • Procedure • Accuracy of results

Line (GAC): I DIAGNOSE AND REPAIR ELECTRICAL SYSTEMS AND COMPONENTS

Competency: I3 Diagnose and repair lighting and wiper systems

Objectives

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

- Service lighting systems.
- Service wiper systems.

LEARNING TASKS

1. Describe lighting systems

2. Service lighting systems

3. Describe wiper systems

4. Service wiper systems

CONTENT

- Safety
- Types
 - Conventional
 - High intensity discharge (HID)
 - Light emitting diode (LED)
- Wiring and controls
- Sensors and switches
- Faults
- Inspection and testing
 - Sensory
 - Electrical
 - Scan tools
 - Data and functional test
- Wiring diagrams
- Adjustments
 - Aiming
- Faults
- Mechanical
 - Motors
 - Linkage/transmissions
- Wiring and controls
 - Computer control
- Sensors and switches
- Pump and washer systems
- Faults
- Inspection and testing
 - Sensory
 - Mechanical
 - Electrical
 - Scan tools
 - Data and functional test
- Wiring diagrams
- Adjustments
- Faults

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

Competency: **K1 Diagnose and repair steering and control systems**

Objectives

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

- Service electronic power steering.

LEARNING TASKS

1. Describe electronic steering systems

CONTENT

- Types
 - Column
 - Rack
- Sensors
 - Steering wheel
 - Torque
- Voltage level
 - Low
 - High
- Wiring and controls
- Computer-controlled
- Faults
- Inspection and testing
 - Sensory
 - Mechanical
 - Electrical
 - Scan tools
 - Data and functional test
- Wiring diagrams
- Service procedures
 - Replacement
 - Rack
 - Sensors
 - Alignment
 - Zeroing
 - Relearning
- Faults

2. Service electronic steering systems

Achievement Criteria

Performance	The learner will reset and relearn steering sensors.
Conditions	<p>The learner will be given</p> <ul style="list-style-type: none"> • A vehicle • Scan tool • Access to technical information
Criteria	<p>The learner will be evaluated on</p> <ul style="list-style-type: none"> • Safety • Tool usage • Procedure • Completion/accuracy of task

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 servicing of electronic suspension systems.

LEARNING TASKS

1. Describe electronic suspension systems
2. Describe servicing of electronic suspension systems

CONTENT

- Electrically controlled shocks
- Load levelling system
- Air springs/struts
- Electronic/computer controlled dynamic systems
- Sensors and actuators
- Wiring and controls
- Faults
- Safety
- Inspection and testing
 - Sensory
 - Mechanical
 - Air spring leak test
 - Electrical
 - Scan tools
 - Data and functional test
- Wiring diagrams
- Service procedures
 - Replacement
 - Relearning ride height
 - Alignment
- Faults

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

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

Objectives

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

- Describe anti-lock braking systems and related systems.
- Service anti-lock braking systems.

LEARNING TASKS

1. Describe anti-lock braking systems

CONTENT

- Two and four wheel
- Components
 - Wheel speed sensors
 - Hydraulic modulator
 - Control module
- Wiring and controls
- Operation
- Faults
- Related systems
 - Electronic brake force distribution
 - Traction control
 - Stability control

2. Service anti-lock braking systems

- Inspection and testing
 - Sensory
 - Mechanical
 - Electrical
 - Scan tools
 - Data and functional test
- Wiring diagrams
- Service procedures
 - Component replacement
 - Power bleeding
- Faults

Achievement Criteria

Performance The learner will test a wheel-speed sensor.

Conditions The learner will be given

- A vehicle
- Test equipment
- Access to technical information

Criteria The learner will be evaluated on

- Safety
- Tool usage
- Procedure
- Accuracy of results

Level 3

Automotive Service Technician

Line (GAC): E **DIAGNOSE AND REPAIR GASOLINE ENGINE SUPPORT SYSTEMS**

Competency: E1 Diagnose and repair advanced wiring and electronics

Objectives

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

- Apply advanced electrical and electronic principles.
- Use advanced wiring diagrams.
- Use advanced electrical test equipment.

LEARNING TASKS

1. Describe advanced electrical and electronic principles
2. Interpret advanced wiring diagrams
3. Use advanced electrical test equipment

CONTENT

- Components
 - Diodes
 - Transistors
 - Capacitors
 - Photonic semiconductors
- Operation
- Electrical signal types
 - Pulse width modulation
 - Duty cycle
- Symbols and components
 - Conventional
 - Computer controlled circuit
- Types
 - North American
 - European
- Types
 - Graphing multi-meter
 - Lab scope/Digital Storage Oscilloscope (DSO)
 - Scan tool
- Operation
 - Set up
 - Functionality

4. Describe computer control systems
- Computer fundamentals
 - Operation
 - Inputs
 - Process
 - Outputs
 - Memory
 - Look up tables
 - Adaptions
 - Software
 - Programming
 - Upgrading and reflashing
 - Faults

Achievement Criteria 1

- | | |
|-------------|---|
| Performance | The learner will use lab scope to test a component. |
| Conditions | The learner will be given <ul style="list-style-type: none"> • A vehicle or simulation board • Lab scope • Access to technical information |
| Criteria | The learner will be evaluated on <ul style="list-style-type: none"> • Safety • Tool usage • Procedure • Accuracy of results |

Achievement Criteria 2

- | | |
|-------------|---|
| Performance | The learner will use an advanced wiring diagram to diagnose a fault. |
| Conditions | The learner will be given <ul style="list-style-type: none"> • A system fault • Access to technical information |
| Criteria | The learner will be evaluated on <ul style="list-style-type: none"> • Procedure • Accuracy of results |

Line (GAC): E DIAGNOSE AND REPAIR GASOLINE ENGINE SUPPORT SYSTEMS

Competency: E2 Diagnose and repair gasoline fuel delivery and injection systems

Objectives

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

- Service fuel delivery and injection systems.
- Service gasoline direct injection (GDI) systems.

LEARNING TASKS

1. Identify fuel types

2. Describe fuel delivery systems

3. Describe fuel injection systems

CONTENT

- Safety
- Gasoline
 - Ethanol
- Characteristics
 - Ratings
 - Properties
 - Additives
- Alternate types
 - Liquid petroleum gas
 - Compressed natural gas
- Components
 - Fuel tank
 - Fuel pump assembly
 - Fuel pressure regulator
 - Associated lines and fittings
- Operation
- Wiring and control
 - Computer control
- Faults
- Safety
- Components
 - Fuel injectors
 - Rail and associated fittings
- Operation
- Wiring and controls
 - Computer control
 - Driver types
 - Sensors
- Faults

4. Service fuel delivery and injection systems
 - Safety
 - Inspection and testing
 - Sensory
 - Pressure
 - Volume
 - Electrical
 - Test equipment
 - Signals, data and functional test
 - Component replacement
 - Fuel system cleaning
 - Faults
5. Describe gasoline direct injection (GDI) systems
 - Safety
 - High pressure components
 - Pump
 - Regulator
 - Injectors
 - Type
 - Timing
 - Lines and fittings
 - Operation
 - Modes
 - Homogenous
 - Stratified
 - Faults
 - Wiring and controls
 - Computer controlled
 - Sensors
6. Service GDI systems
 - Safety
 - High pressure
 - Inspection and testing
 - Sensory
 - Pressure
 - Volume
 - Electrical
 - Test equipment
 - Signals, data and functional test
 - Component replacement
 - Fuel system cleaning
 - Faults

Achievement Criteria 1

Performance	The learner will perform a fuel pressure test.
Conditions	The learner will be given <ul style="list-style-type: none">• A vehicle• Test equipment• Access to technical information
Criteria	The learner will be evaluated on <ul style="list-style-type: none">• Safety• Tool usage• Procedure• Accuracy of results

Achievement Criteria 2

Performance	The learner will test a fuel injector.
Conditions	The learner will be given <ul style="list-style-type: none">• A vehicle• Test equipment• Access to technical information
Criteria	The learner will be evaluated on <ul style="list-style-type: none">• Safety• Tool usage• Procedure• Accuracy of results

Line (GAC): E DIAGNOSE AND REPAIR GASOLINE ENGINE SUPPORT SYSTEMS

Competency: E3 Diagnose and repair gasoline ignition systems

Objectives

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

- Service electronic ignition systems.

LEARNING TASKS

1. Describe electronic ignition systems

CONTENT

- Theoretical principles
 - Primary/secondary circuits
 - Timing
 - Advance
 - Retard
 - Induction
- Components
 - Ignition coils
 - Spark plugs
 - Electrode design
 - Temperature
 - Sensors
- Types
 - Waste spark
 - Coil on plug
- Operation
- Faults
- Wiring and controls
 - Computer control
 - Sensors
- Safety
- Inspection and testing
 - Sensory
 - Electrical
- Test equipment
 - Signals, data and functional test
- Component replacement
- Maintenance
- Faults

2. Service electronic ignition systems

Achievement Criteria 1

Performance	The learner will test an ignition coil.
Conditions	The learner will be given <ul style="list-style-type: none">• A vehicle• Test equipment• Access to technical information
Criteria	The learner will be evaluated on <ul style="list-style-type: none">• Safety• Tool usage• Procedure• Accuracy of results

Achievement Criteria 2

Performance	The learner will test a crank shaft position sensor.
Conditions	The learner will be given <ul style="list-style-type: none">• A vehicle• Test equipment• Access to technical information
Criteria	The learner will be evaluated on <ul style="list-style-type: none">• Safety• Tool usage• Procedure• Accuracy of results

Line (GAC): E DIAGNOSE AND REPAIR GASOLINE ENGINE SUPPORT SYSTEMS

Competency: E4 Diagnose and repair engine management systems

Objectives

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

- Service engine management systems.
- Access and interpret system data.

LEARNING TASKS

1. Describe engine management

2. Describe engine management inputs

3. Describe engine management outputs

4. Service engine management inputs and outputs

CONTENT

- Power train control module responsibilities
 - Ignition systems
 - Fuel systems
 - Air management (induction) systems
 - Emissions systems
- Principles
 - Speed density
 - Mass air flow
 - Feedback
- Types of sensors
 - Speed
 - Position
 - Temperature
 - Volume
 - Pressure
 - Oxygen
- Operation
- Faults
- Wiring and inputs from other systems
- Principles
 - Air management
- Types of actuators
 - Solenoids
 - Motors
- Operation
- Wiring and control
 - Computer controls
- Inspection and testing
 - Sensory

LEARNING TASKS

CONTENT

- Electrical
 - Mechanical
 - Vacuum
 - Test equipment
 - Signals, data and functional test
 - Component replacement
 - Maintenance
 - Throttle body cleaning
 - Adaptions
 - Reset
 - Re-learn
 - Fuel trim

- 5. Access and interpret on-board diagnostic (OBD) information
 - Factory interface
 - Data
 - Ignition
 - Fuel
 - Misfire
 - Software versions
 - OBD global interface
 - Codes
 - Freeze frame
 - Readiness monitors
 - Evaluation of data
 - Code definition and description
 - Failure parameters

Achievement Criteria

- | | |
|-------------|---|
| Performance | The learner will access and interpret data to diagnose a system fault. |
| Conditions | The learner will be given <ul style="list-style-type: none"> • A vehicle • Test equipment • Access to technical information |
| Criteria | The learner will be evaluated on <ul style="list-style-type: none"> • Safety • Tool usage • Procedure • Accuracy of results |

Line (GAC): E DIAGNOSE AND REPAIR GASOLINE ENGINE SUPPORT SYSTEMS

Competency: E5 Diagnose and repair gasoline intake and exhaust systems

Objectives

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

- Describe air induction, forced induction and exhaust systems.
- Describe servicing air induction and exhaust systems.

LEARNING TASKS

CONTENT

- | | |
|---|---|
| 1. Describe air induction and exhaust systems | <ul style="list-style-type: none"> • Air induction components <ul style="list-style-type: none"> ○ Air filtration ○ Throttle body ○ Intake manifold <ul style="list-style-type: none"> – Valves, linkages and motors • Exhaust systems <ul style="list-style-type: none"> ○ Manifolds and headers ○ Catalytic converters ○ Mufflers and resonators ○ Associated pipes and hardware • Faults |
| 2. Describe forced air induction | <ul style="list-style-type: none"> • Types <ul style="list-style-type: none"> ○ Superchargers ○ Turbochargers • Principles of operation <ul style="list-style-type: none"> ○ Boost ○ Measurements ○ Calculations ○ Effects • Intercoolers • Boost control |
| 3. Describe servicing air induction and exhaust systems | <ul style="list-style-type: none"> • Inspection and testing <ul style="list-style-type: none"> ○ Sensory ○ Electrical ○ Mechanical ○ Vacuum ○ Scan tool data and functional tests • Component replacement • Faults |

Line (GAC): E DIAGNOSE AND REPAIR GASOLINE ENGINE SUPPORT SYSTEMS

Competency: E6 Diagnose and repair gasoline emissions control systems

Objectives

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

- Service gasoline emission control systems.
- Service gasoline evaporative emission control systems.

LEARNING TASKS

CONTENT

1. Describe vehicle emissions

- Types
 - Hydrocarbons
 - Carbon Monoxide
 - Oxides of nitrogen (NOX)

2. Describe gasoline emission systems

- Impacts of emissions
- Regulations
- Pre-combustion systems
 - Positive crankcase ventilation (PCV)
 - Exhaust gas recirculation (EGR)
- Post-combustion systems
 - Secondary air injection
 - Catalytic convertors

3. Service gasoline emission systems

- Operation
- Faults
- Wiring and control
- Sensors and actuators
- Safety
- Inspection and testing
 - Sensory
 - Pressure
 - Mechanical
 - Electrical
 - Vacuum
- Test equipment
 - Signals, data and functional test
- Component replacement
- Faults

- | | |
|--|--|
| 4. Describe evaporative emission systems | <ul style="list-style-type: none"> • Types <ul style="list-style-type: none"> ○ Pressure ○ Vacuum • Components <ul style="list-style-type: none"> ○ Fuel tank ○ Canister ○ Solenoids/ valves ○ Sensors • Operation <ul style="list-style-type: none"> ○ System self test ○ Readiness monitor • Faults • Wiring and control |
| 5. Service evaporative emission systems | <ul style="list-style-type: none"> • Safety • Inspection and testing <ul style="list-style-type: none"> ○ Sensory ○ Pressure ○ Vacuum ○ Electrical • Test equipment <ul style="list-style-type: none"> ○ Signals, data and functional test • Component replacement • Faults |

Achievement Criteria 1

- | | |
|-------------|---|
| Performance | The learner will perform a catalyst efficiency test. |
| Conditions | The learner will be given <ul style="list-style-type: none"> • A vehicle • Test equipment • Access to technical information |
| Criteria | The learner will be evaluated on <ul style="list-style-type: none"> • Safety • Tool usage • Procedure • Accuracy of results |

Achievement Criteria 2

Performance The learner will perform evaporative emissions system leak test.

Conditions The learner will be given

- A vehicle
- Test equipment
- Access to technical information

Criteria The learner will be evaluated on

- Safety
- Tool usage
- Procedure
- Accuracy of results

Line (GAC): **G DIAGNOSE AND REPAIR VEHICLE NETWORKING SYSTEMS**
Competency: **G1 Identify type of networking system**

Objectives

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

- Describe network computer control systems.
- Describe multiplexing.

LEARNING TASKS

1. Describe network computer control systems

2. Describe multiplexing

CONTENT

- Network fundamentals
- Network configurations
 - Ring
 - Parallel
 - Bus
- Components
- Wiring and connectors
 - Single wire
 - Twisted pair
 - Fiber optic
- Network types
 - Controller Area Network (CAN)
 - Local Interconnect Network (LIN)
 - Flexray
 - Media Oriented Systems Transport (MOST)
- Operation
- Faults
- Multiplexing fundamentals
 - Switch inputs
 - Control Modules
 - Body Control Module (BCM)
 - Outputs
- Faults

Line (GAC):	G	DIAGNOSE AND REPAIR VEHICLE NETWORKING SYSTEMS
Competency:	G2	Diagnose and repair networking systems

Objectives

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

- Service networking systems.
- Service multiplexing systems.
- Service module software.

LEARNING TASKS

1. Service networking systems
2. Service multiplexing systems
3. Service module software

CONTENT

- Inspection and testing
- Test equipment
 - Signals, data and functional test
- Component replacement
- Repair
- Faults
- Inspection and testing
- Test equipment
 - Signals, data and functional test
- Component replacement
- Repair
- Faults
- Identify module software version
 - Technical Service Bulletin (TSB)
- Service equipment
- Procedure
 - Manufactures guidelines
 - Battery voltage
- Update
- Configuration

Achievement Criteria 1

Performance	The learner will perform a functional test on a multiplexing system.
Conditions	The learner will be given <ul style="list-style-type: none"> • Vehicle • Test equipment • Access to technical information
Criteria	The learner will be evaluated on <ul style="list-style-type: none"> • Safety • Tool usage • Procedure • Accuracy of results

Achievement Criteria 2

Performance	The learner will determine if there is an updated software version for a control module.
Conditions	The learner will be given <ul style="list-style-type: none"> • Vehicle • Test equipment • Access to technical information
Criteria	The learner will be evaluated on <ul style="list-style-type: none"> • Safety • Tool usage • Procedure • Accuracy of results

Line (GAC):	H	DIAGNOSE AND REPAIR DRIVELINE SYSTEMS
Competency:	H5	Diagnose and repair mechanical transfer cases

Objectives

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

- Describe mechanical transfer cases and power flow.

LEARNING TASKS

1. Describe mechanical transfer cases

CONTENT

- Types
 - Part-time
 - Full-time
- Configuration
 - Chain-drive
 - Gear-drive
- Components
- Lubricants
- Operation
- Types
 - Part-time
 - Full-time
- Engagement types
 - Mechanical
 - Motor
- Configuration
 - Chain-drive
 - Gear-drive
- Modes of operation
 - Two-high (2H)
 - Four-high (4H)
 - Four-low (4L)

2. Describe mechanical transfer case power flow

Line (GAC): I DIAGNOSE AND REPAIR ELECTRICAL SYSTEMS AND COMPONENTS

Competency: I4 Diagnose and repair electrical options and accessories

Objectives

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

- Service electrical options and accessories.

LEARNING TASKS

CONTENT

- | | |
|--|--|
| 1. Describe electrical options and accessories | <ul style="list-style-type: none"> • Factory options <ul style="list-style-type: none"> ○ Sunroof ○ Mirrors ○ Seats ○ Windows • Accessories <ul style="list-style-type: none"> ○ Remote starter ○ Theft deterrents • Operation • Faults • Wiring and controls |
| 2. Service electrical options and accessories | <ul style="list-style-type: none"> • Inspection and testing <ul style="list-style-type: none"> ○ Sensory ○ Electrical ○ Mechanical • Component replacement • Repair |
| 3. Service electrical accessories | <ul style="list-style-type: none"> • Power accessories <ul style="list-style-type: none"> ○ Continuity tests ○ Voltage drop ○ Identify circuit operation ○ Current flow • Diagnostic fault codes |

Achievement Criteria 1

Performance	The learner will perform electrical tests on a power window system.
Conditions	The learner will be given <ul style="list-style-type: none"> • Vehicle • Test equipment • Access to technical information
Criteria	The learner will be evaluated on <ul style="list-style-type: none"> • Safety • Tool usage • Procedure • Accuracy of results

Achievement Criteria 2

Performance	The learner will perform electrical tests on a power door lock system.
Conditions	The learner will be given <ul style="list-style-type: none"> • Vehicle • Test equipment • Access to technical information
Criteria	The learner will be evaluated on <ul style="list-style-type: none"> • Safety • Tool usage • Procedure • Accuracy of results

Level 4

Automotive Service Technician

Line (GAC): **C** **USE COMMUNICATION AND MENTORING TECHNIQUES**
Competency: **C2** **Use mentoring techniques**

Objectives

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

- Use mentoring techniques.

LEARNING TASKS

1. Describe mentoring

CONTENT

- Responsibilities
 - Sign off
 - Reporting work-based hours
- Modelling leadership
- Coaching
- Learning/teaching strategies
 - Identifying learning needs
 - Demonstrating skill
 - Assessing skills
 - Providing feedback
- Communication
- Professionalism

Line (GAC): **F DIAGNOSE AND REPAIR DIESEL ENGINE SUPPORT SYSTEMS**
Competency: **F1 Diagnose and repair diesel fuel delivery and injection systems**

Objectives

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

- Describe diesel fuel and fuel testing.
- Describe diesel high pressure electronic fuel injection systems.
- Service diesel fuel systems.

LEARNING TASKS

1. Describe diesel fuels

2. Describe diesel low pressure fuel delivery

CONTENT

- Safety
- Characteristics
 - Ratings
 - Properties
 - Additives
- Contamination and testing
- Alternate types
 - Bio diesel
- Components
 - Fuel tank
 - Fuel pump assembly
 - Associated lines and fittings
 - Filtration
 - Water
 - Sensor
- Operation
- Wiring and control
- Faults

- | | |
|---|--|
| <p>3. Describe diesel high pressure electronic fuel injection systems</p> | <ul style="list-style-type: none"> • Safety • High pressure components <ul style="list-style-type: none"> ○ Pump ○ Regulators ○ Injectors ○ Lines and fittings • Operation <ul style="list-style-type: none"> ○ Types <ul style="list-style-type: none"> – Common rail ○ Timing ○ Strategies • Faults • Wiring and controls • Sensors |
| <p>4. Service diesel fuel systems</p> | <ul style="list-style-type: none"> • Safety <ul style="list-style-type: none"> ○ High pressure • Inspection and testing <ul style="list-style-type: none"> ○ Sensory ○ Hydrometer ○ Pressure ○ Volume ○ Electrical • Test equipment <ul style="list-style-type: none"> ○ Scan tool <ul style="list-style-type: none"> – Data and functional • Component replacement • Maintenance • Repair • Faults |

Achievement Criteria 1

Performance	The learner will test diesel fuel.
Conditions	The learner will be given <ul style="list-style-type: none">• Fuel• Test equipment• Access to technical information
Criteria	The learner will be evaluated on <ul style="list-style-type: none">• Safety• Tool usage• Procedure• Accuracy of results

Achievement Criteria 2

Performance	The learner will test the low pressure fuel supply system.
Conditions	The learner will be given <ul style="list-style-type: none">• Vehicle• Test equipment• Access to technical information
Criteria	The learner will be evaluated on <ul style="list-style-type: none">• Safety• Tool usage• Procedure• Accuracy of results

Line (GAC): F DIAGNOSE AND REPAIR DIESEL ENGINE SUPPORT SYSTEMS
Competency: F2 Diagnose and repair diesel intake and exhaust systems

Objectives

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

- Describe diesel intake and exhaust systems.
- Describe servicing diesel intake and exhaust.

LEARNING TASKS

CONTENT

- | | |
|---|---|
| 1. Describe air induction and exhaust systems | <ul style="list-style-type: none"> • Air induction components <ul style="list-style-type: none"> ○ Air filtration ○ Intake manifold ○ Heaters and glow plugs • Exhaust systems <ul style="list-style-type: none"> ○ Emissions components ○ Manifolds ○ Mufflers ○ Tail pipe cooler • Faults |
| 2. Describe forced air induction | <ul style="list-style-type: none"> • Turbochargers <ul style="list-style-type: none"> ○ Types • Principles of operation <ul style="list-style-type: none"> ○ Boost ○ Measurements ○ Calculations ○ Effects • Charged air cooler (CAC) • Faults |
| 3. Describe servicing air induction and exhaust systems | <ul style="list-style-type: none"> • Inspection and testing <ul style="list-style-type: none"> ○ Sensory ○ Electrical ○ Mechanical ○ Scan tool data and functional tests • Component replacement • Faults |

Line (GAC):	F	DIAGNOSE AND REPAIR DIESEL ENGINE SUPPORT SYSTEMS
Competency:	F3	Diagnose and repair diesel emission control systems

Objectives

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

- Service diesel emission systems.

LEARNING TASKS

1. Describe diesel emissions
2. Describe diesel emission systems
3. Service diesel emission systems

CONTENT

- Types
 - Particulates
 - Oxides of nitrogen (NOX)
- Impacts of emissions
- Regulations
- Pre-combustion systems
 - Positive crankcase ventilation (PCV)
 - Exhaust gas recirculation (EGR)
- Post-combustion systems
 - Catalytic converters
 - Diesel particulate filter (DPF)
 - Selective catalyst reduction (SCR)
- Operation
- Faults
- Wiring and control
- Sensors and actuators
- Safety
- Inspection and testing
 - Sensory
 - Electrical
- Test equipment
 - Signals, data and functional test
- Diesel exhaust fluid (DEF)
 - Testing
- Component replacement
- Maintenance
 - Exhaust gas recirculation (EGR) de-carbonization
 - Diesel particulate filter (DPF)
- Faults

Line (GAC): **H DIAGNOSE AND REPAIR DRIVELINE SYSTEMS**
Competency: **H3 Diagnose and repair automatic transmissions and transaxles**

Objectives

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

- Service automatic transmissions and transaxles.
- Assess automatic transmissions and transaxles condition.

LEARNING TASKS	CONTENT
1. Describe automatic transmissions and transaxles components	<ul style="list-style-type: none"> • Torque convertors • Planetary gear train • Clutches and bands • Control valve body • Chains and sprockets • Coolers • Pumps • Fluid types • Sensors and actuators
2. Describe automatic transmissions and transaxles	<ul style="list-style-type: none"> • Types <ul style="list-style-type: none"> ○ Dual clutch transmission (DCT) ○ Constant velocity transmission (CVT) ○ Conventional planetary • Operation • Fundamentals <ul style="list-style-type: none"> ○ Gear ratios ○ Power flow ○ Hydraulics ○ Electronics • Faults <ul style="list-style-type: none"> ○ Mechanical ○ Electrical (Control-side)
3. Disassemble, inspect and re-assemble automatic transmissions and transaxles	<ul style="list-style-type: none"> • Procedures • Testing and inspection <ul style="list-style-type: none"> ○ Air check ○ Leak test • Wiring and controls • Hydraulics and electronics • Lubrication

- | | |
|--|---|
| <p>4. Service automatic transmissions and transaxles</p> | <ul style="list-style-type: none"> • Inspection and testing <ul style="list-style-type: none"> ○ Signals ○ Data ○ Functional test • Test equipment • Adjustments <ul style="list-style-type: none"> ○ Shift adaptations • Service procedures <ul style="list-style-type: none"> ○ Relearn ○ Software update • Maintenance <ul style="list-style-type: none"> ○ Filtration ○ Fluid exchange |
|--|---|

Achievement Criteria

Performance	The learner will perform an automatic transmission/transaxle assessment.
Conditions	The learner will be given <ul style="list-style-type: none"> • A vehicle or transmission • Test equipment • Access to technical information
Criteria	The learner will be evaluated on <ul style="list-style-type: none"> • Safety • Tool usage • Procedure • Accuracy of results

Line (GAC): **H DIAGNOSE AND REPAIR DRIVELINE SYSTEMS**
Competency: **H6 Diagnose and repair all-wheel (AWD) systems**

Objectives

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

- Service all-wheel (AWD) drive systems.
- Service four-wheel drive (4WD) systems.

LEARNING TASKS

1. Describe AWD systems

CONTENT

- Principles of operation
 - Power flow
 - Torque vectoring
- Components
 - Power transfer unit (PTU)
 - Couplings
 - Torque splitting device
- Sensors and actuators
- Related systems
 - Stability control
 - Traction control
- Lubrication and fluids
- Wiring and controls
- Faults

2. Describe 4WD systems

- Modes of operation
 - Selective
 - Automatic
- Components
 - Transfer cases
 - Axle disconnects
 - Hubs
 - Manual
 - Auto
- Sensors and actuators
- Related systems
 - Stability control
 - Traction control
- Lubrication and fluids
- Wiring and controls
- Faults

LEARNING TASKS

3. Service AWD and 4WD systems

CONTENT

- Disassembly, inspection, reassembly
- Inspection and testing
 - Mechanical
 - Electrical
 - Vacuum
 - Signals
 - Data
 - Functional test
- Test equipment
- Service procedures
 - Relearn
 - Software update
- Component replacement
- Maintenance
 - Fluid
- Faults

Achievement Criteria

Performance The learner will disassemble, inspect and reassemble a transfer case.

Conditions The learner will be given

- A transfer case
- Tools and equipment
- Access to technical information

Criteria The learner will be evaluated on

- Safety
- Tool usage
- Procedure
- Accuracy of results

Line (GAC):	I	DIAGNOSE AND REPAIR ELECTRICAL SYSTEMS AND COMPONENTS
Competency:	I5	Diagnose and repair instrumentation, entertainment systems and displays

Objectives

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

- Describe instrumentation, entertainment systems and displays.
- Describe servicing instrumentation, entertainment systems and displays.

LEARNING TASKS

CONTENT

- | | |
|---|---|
| 1. Describe instrumentation | <ul style="list-style-type: none"> • Types <ul style="list-style-type: none"> ○ Analogue ○ Digital • Gauges <ul style="list-style-type: none"> ○ Inputs <ul style="list-style-type: none"> – Sending units • Warning lights • Networking |
| 2. Describe entertainment systems | <ul style="list-style-type: none"> • Audio <ul style="list-style-type: none"> ○ Speakers ○ Networking • Video • Wiring and components • Wireless <ul style="list-style-type: none"> ○ Bluetooth ○ WiFi ○ Cellular • Faults |
| 3. Describe displays | <ul style="list-style-type: none"> • Information center <ul style="list-style-type: none"> ○ Navigation ○ Collision avoidance ○ Parking assist ○ Back up camera • Warning lights |
| 4. Describe servicing instrumentation, entertainment systems and displays | <ul style="list-style-type: none"> • Inspection and testing <ul style="list-style-type: none"> ○ Signals ○ Data ○ Functional tests • Replacement • Repair • Software updates • Personalization • Faults |

Line (GAC):	J	DIAGNOSE AND REPAIR HEATING, VENTILATION AND AIR CONDITIONING (HVAC) AND COMFORT CONTROL SYSTEMS
Competency:	J1	Diagnose and repair air flow control and heating systems

Objectives

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

- Service air flow systems.
- Service heating systems.

LEARNING TASKS

1. Describe air flow systems

CONTENT

- Components
 - Actuators
 - Sensors
 - Doors
 - Linkage
- Wiring and control
 - Computer controlled
- Operation
 - Modes
 - Blend
 - Defrost
 - Zones

2. Describe heating systems

- Faults
- Components
 - Cooling system
 - Heater cores
 - Secondary heater
 - Electric
- Wiring and control
 - Computer controlled
- Operation
 - Modes
 - Blend
 - Defrost
 - Zones
- Faults

- 3. Service air flow and heating systems
 - Inspection and testing
 - Sensory
 - Mechanical
 - Electrical
 - Test equipment
 - Signal
 - Data
 - Functional test
 - Component replacement
 - Repair
 - Maintenance
 - Filters
 - Relearn procedures

Line (GAC):	J	DIAGNOSE AND REPAIR HEATING, VENTILATION AND AIR CONDITIONING (HVAC) AND COMFORT CONTROL SYSTEMS
Competency:	J2	Diagnose and repair refrigerant systems

Objectives

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

- Service refrigerant systems.

LEARNING TASKS

CONTENT

- | | |
|---------------------------------|---|
| 1. Describe refrigerant systems | <ul style="list-style-type: none"> • Safety • Principles of operation <ul style="list-style-type: none"> ○ Fundamentals ○ Strategies • Types <ul style="list-style-type: none"> ○ Refrigerants ○ Lubricants ○ Systems • Components <ul style="list-style-type: none"> ○ Types of compressors <ul style="list-style-type: none"> – High voltage – Clutchless ○ Condensor ○ Evaporator core • Wiring and control <ul style="list-style-type: none"> ○ Computer controlled ○ Sensors and actuators • Faults |
| 2. Service refrigerant systems | <ul style="list-style-type: none"> • Safety • Inspection and testing <ul style="list-style-type: none"> ○ Sensory ○ Mechanical ○ Electrical ○ Temperature ○ Pressure ○ Leak detection • Test equipment <ul style="list-style-type: none"> ○ Signal ○ Data ○ Functional test • Component replacement • Procedures <ul style="list-style-type: none"> ○ Maintenance |

LEARNING TASKS

CONTENT

- Repair
- Evacuate
- Recharge
- Faults

Achievement Criteria 1

Performance	The learner will assess refrigerant operating pressures.
Conditions	The learner will be given <ul style="list-style-type: none"> • A vehicle • Test equipment • Access to technical information
Criteria	The learner will be evaluated on <ul style="list-style-type: none"> • Safety • Tool usage • Procedure • Accuracy of results

Achievement Criteria 2

Performance	The learner will perform a refrigerant system performance test.
Conditions	The learner will be given <ul style="list-style-type: none"> • A vehicle • Test equipment • Access to technical information
Criteria	The learner will be evaluated on <ul style="list-style-type: none"> • Safety • Tool usage • Procedure • Accuracy of results

Achievement Criteria 3

Performance	The learner will perform an evacuation and recharge of a refrigerant system.
Conditions	The learner will be given <ul style="list-style-type: none"> • A vehicle • Test equipment • Access to technical information
Criteria	The learner will be evaluated on <ul style="list-style-type: none"> • Safety • Tool usage • Procedure • Accuracy of results

Line (GAC): L **DIAGNOSE AND REPAIR RESTRAINT SYSTEMS, BODY COMPONENTS, ACCESSORIES AND TRIM**

Competency: L1 Diagnose and repair restraint systems

Objectives

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

- Describe restraint systems.
- Describe servicing restraint systems.

LEARNING TASKS

1. Describe restraint systems
2. Describe servicing restraint systems

CONTENT

- Principles of operation
 - Deployment strategies
- Types
- Components
 - Clock spring
 - Sensors
 - Impact
 - Occupancy detection
 - Modules
- Wiring and controls
- Safety
 - Handling
 - Disposal
- Inspection and testing
 - Sensory
 - Mechanical
 - Electrical
 - Data
 - Signals
- Component replacement
- Repair
- Programming/calibration

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

Competency: **M2 Diagnose and repair hybrid and electric vehicle (EV) systems**

Objectives

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

- Service hybrid and electric vehicles (EV).

LEARNING TASKS

1. Describe hybrid and electric vehicles (EV)

2. Service hybrid and electric vehicles (EV)

CONTENT

- Fundamentals of operation
 - Hybrid Electric Vehicle (HEV)
 - Series-parallel
 - Parallel
 - Plug in
 - Electric Vehicle (EV)
- Components
 - High voltage battery
 - Motor generators
 - Inverters and converters
- Modes of operation
 - Regenerative braking
 - Idle shut off
- Wiring and control
- Driveline systems
 - Lubricants
- Safety protocols
- Inspection and testing
 - Sensory
 - Electrical
 - Data
 - Functional tests
- Test equipment
 - Category III
- Component replacement
- Maintenance
 - Filtration
 - Lubricants
 - Cooling system
- Repair
- Battery charging

Achievement Criteria

Performance	The learner will perform a high voltage battery disconnect.
Conditions	<p>The learner will be given</p> <ul style="list-style-type: none"> • A hybrid vehicle or EV • Tools and equipment • Access to technical information
Criteria	<p>The learner will be evaluated on</p> <ul style="list-style-type: none"> • Safety • Tool and equipment usage • Procedure • Accuracy of results

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 Equipment

- Acetylene torches
- Air compressor – hoses – inline filter and water separators
- Battery charger/boosting equipment
- Bench grinders
- Bench vises
- Bottle jacks (2)
- Brake pedal depressor
- Computer stations or terminals
- Drill press
- Floor jack
- Grease gun and fluid suction pump
- Heat gun
- High voltage safety gloves (0 rated 1000v)
- Hydraulic press
- Infrared thermometer
- Jack stands and supports
- Oil drain barrels and disposal system
- Parts washers
- Seal drivers and extractors
- Spreaders (tire)
- Smoke machine
- Spring compressors – coil spring and strut
- Tire balancer equipment (road-force type recommended)
- Tire changing machine (preferred run-flat capable)
- Tire repair equipment
- TPMS system service tools
- Vehicle lifts
- Vehicle service information system
- Water hose
- Welding equipment – GMAW welder and oxy fuelled
- Work benches

Required Electronic Service Equipment

- Lab scope – 4-8 per class of 16 (2-channel, digital, curser function with time capture capability)
- Lab scope accessories (shielded cables and back probes)
- Logic (power) probe
- Low amp probe
- Scan tools (various factory and generic)

Required Shop (Facility) Tools

- Air drills/tools
- Air hammer/chisel
- Air ratchet
- Antifreeze tester
- Blow gun
- Bolt extractor set (easy outs)
- Centre punch
- Chisels, punches
- Creeper/fender covers
- Crowfoot wrenches (flare and std, SAE and metric)
- Drill and bits
- Drill gauge
- 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
- Hacksaw

- Hammers – ball peen/dead blow/rubber
- Hex keys – SAE and metric
- Impact driver and bits
- Impact wrench and impact socket set – SAE and metric
- Inspection mirror
- Jumper lead
- Magnetic pick up tool
- Mallet/soft face
- Mechanic's pick set
- 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
- Scraper (gasket and carbon)
- Screwdriver set
- Steel rule
- Stethoscope
- Straight edge
- Stud extractor
- Tap and die set – SAE and metric
- Tap extractor
- Tape and ruler
- Thread files
- Thread pitch gauge
- Tin snips – centre, left and right cut
- Tire pressure gauge
- Tool box
- Torque wrenches – 3/8 and 1/2
- Vise grips
- Wire brush
- Wire stripper/crimping tool
- 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: Level 1

Required Shop Equipment

- Air buffer
- Airbag removal tools
- Airbag simulators
- Alignment lift and equipment- 4 wheel
- Angle grinder
- Arbor press
- Axle boot clamp tool
- Ball joint press and adapters
- Battery hydrometer
- Battery tester (electronic)
- Battery tester/alternator and starter tester (AVR)
- Bearing remover
- Belt tension gauge
- Brake adjustment calipers
- Brake bleeder wrenches
- Brake cylinder hone
- Brake drum gauge (for brake shoe adjusting)
- Brake drum micrometer
- Brake fluid moisture tester
- Brake lathe
- Brake pressure tester
- Brake rotor gauge/micrometer
- Brake system bleeder
- Brake washer system (for 2 and 4 post hoists)
- Caliper tools for rear-wheel disc
- Chassis ears
- Dial indicator set (flare and std, SAE and metric)
- Door trim tools
- Electrical short detector
- Flaring tool (SAE, metric and ISO)
- Heli-coil kits
- Hub service kit
- Leak detection tank (tires)
- Pickle-fork tool set
- Pitman arm pullers
- Power-steering pressure tester
- Pullers – gear, pulley and steering wheel
- Rivet gun
- Slide hammer
- Smoke machine
- Steering wheel holder
- Steering wheel puller set
- Stretch belt removal and installation tool
- Tie-rod end puller
- Tie-rod sleeve tools
- Transmission fixtures
- Tube bending tool
- Tube cutters
- U-joint press
- Upholstery tools – trim panel tools
- Vacuum gauge
- Wheel stud installer

Required Shop (Facility) Tools

- Battery post service and reshape tool
- Belt tension release tool
- Brake bleeder wrenches
- Brake service tools (adjusters, spring removal, installation and caliper tools)
- Die grinder
- Multi-meter (DVOM)
- Nut driver set – SAE and metric
- Soldering tools
- Standard test leads and probes
- Tamper-proof torx set
- Terminal remover tools
- Test lamp – electronics safe (powered and non-powered)
- Torque angle meter/indicator
- Torx bits
- Tread depth gauge (for tires and brakes)
- Trouble light
- Utility knife
- Vacuum pump/gauge
- Vernier caliper – SAE and metric

Tools and Equipment: Level 2

Required Shop (Facility) Tools and Equipment

- Alternator pulley remover
- Antifreeze tester
- Black light
- Bore scope
- Chassis ears
- Compression tester
- Coolant drain barrels and disposal system
- Coolant vacuum filler
- Cooling system pressure tester
- Cylinder hones
- Cylinder leak down tester
- Dial bore gauge
- Engine lift
- Engine oil pressure test kit
- Engine supports
- Headlight aiming equipment
- Micrometers
- Oil drain barrels and disposal system
- Pyrometer
- Reamers
- Transmission fixtures

Tools and Equipment: Level 3

Required Shop (Facility) Tools and Equipment

- Fuel line disconnect set
- Fuel testing equipment
- Vacuum/pressure gauge
- Module reprogramming equipment

Tools and Equipment: Level 4

Required Shop (Facility) Tools and Equipment

- Air bag load tool
- Air conditioning recovery equipment
- Automatic transmission oil pressure test kit
- Diesel fuel hydrometer
- Fuel pressure gauges
- Leak detection equipment (refrigerants)

Reference Materials

Recommended Reference Materials

Level One

- Erjavec, J. (2014/2015). *Automotive technology: A systems approach*.
- Halderman, J. D. (2014/2017). *Automotive Electrical and Electronics*.
- Trade Secrets Alberta, *Individual Learning Modules* (first period). For a list of modules, see https://www.crownpub.bc.ca/Product/Details/7850000004_S#/?statesave=true

Level Two

- Erjavec, J. (2014/2015). *Automotive technology: A systems approach*.
- Halderman, J. D. (2014/2017). *Automotive Electrical and Electronics*.
- Trade Secrets Alberta, *Individual Learning Modules* (second period). For a list of modules, see https://www.crownpub.bc.ca/Product/Details/7850000005_S#/?statesave=true

Level Three

- Erjavec, J. (2014/2015). *Automotive technology: A systems approach*.
- Halderman, J. D. (2014/2017). *Automotive Electrical and Electronics*.
- Trade Secrets Alberta, *Individual Learning Modules* (third period). For a list of modules, see https://www.crownpub.bc.ca/Product/Details/7850000006_S#/?statesave=true

- Halderman, J. D. (2016). *Automotive Fuel and Emissions Control Systems*.

OR

- Halderman, J. D. (2016). *Advanced Engine Performance Diagnosis*.

Level Four

- Erjavec, J. (2014/2015). *Automotive technology: A systems approach*.
- Halderman, J. D. (2014/2017). *Automotive Electrical and Electronics*.
- Trade Secrets Alberta, *Individual Learning Modules* (fourth period). For a list of modules, see https://www.crownpub.bc.ca/Product/Details/7850000007_S#/?statesave=true
- Halderman, J. D. and T. Birch. (2016). *Automatic Transmissions and Transaxles*.

Suggested Reference Material

- Halderman, J. D. (2016). *Automotive Technology: Principles, Diagnosis, and Service*.
- Wright, G. (2013). *Automotive Diesel Technology*.

Instructor Requirements

Occupation Qualification

The instructor must possess:

- Automotive Service Technician with an Interprovincial “Red Seal” endorsement

Work Experience

- Must have a minimum of five years’ experience as a journeyperson
- Must have diverse industry experience covering all the competencies in this program

Instructional Experience and Education

It is preferred that the instructor also possesses one of the following:

- Instructor’s Certificate (minimum 30-hour course)
- Instructors must have or be registered in an Instructor’s Diploma Program, to be completed within a five year period
- Hold a Bachelor’s or Master’s Degree in Education

Appendices

APPENDIX A

Assessment Guidelines

Level 1 Grading Sheet: Subject Competency and Weightings

PROGRAM: IN-SCHOOL TRAINING:		AUTOMOTIVE SERVICE TECHNICIAN LEVEL 1	
LINE	SUBJECT COMPETENCIES	THEORY WEIGHTING	PRACTICAL WEIGHTING
A	PERFORM SAFETY-RELATED FUNCTIONS	7%	7%
B	USE TOOLS, EQUIPMENT AND DOCUMENTATION	10%	10%
C	USE COMMUNICATION AND MENTORING TECHNIQUES	1%	0%
H	DIAGNOSE AND REPAIR DRIVELINE SYSTEMS	3%	5%
I	DIAGNOSE AND REPAIR ELECTRICAL SYSTEMS AND COMPONENTS	25%	33%
K	DIAGNOSE AND REPAIR STEERING, SUSPENSION, BRAKING, CONTROL SYSTEMS, TIRES WHEELS, HUBS AND WHEEL BEARINGS	45%	45%
L	DIAGNOSE AND REPAIR RESTRAINT SYSTEMS, BODY COMPONENTS, ACCESSORIES AND TRIM	5%	0%
M	DIAGNOSE AND REPAIR HYBRID AND ELECTRIC VEHICLES (EV)	4%	0%
	Total	100%	100%
In-school theory / practical subject competency weighting		70%	30%
Final in-school percentage score		IN-SCHOOL%	
In-school Percentage Score Combined theory and practical subject competency multiplied by		80%	
Standardized Level Exam Percentage Score The exam score is multiplied by		20%	
Final Percentage Score		FINAL %	

Level 2 Grading Sheet: Subject Competency and Weightings

PROGRAM: IN-SCHOOL TRAINING:		AUTOMOTIVE SERVICE TECHNICIAN LEVEL 2	
LINE	SUBJECT COMPETENCIES	THEORY WEIGHTING	PRACTICAL WEIGHTING
D	DIAGNOSE AND REPAIR ENGINE SYSTEMS	30%	30%
H	DIAGNOSE AND REPAIR DRIVELINE SYSTEMS	30%	30%
I	DIAGNOSE AND REPAIR ELECTRICAL SYSTEMS AND COMPONENTS	20%	20%
K	DIAGNOSE AND REPAIR STEERING, SUSPENSION, BRAKING, CONTROL SYSTEMS, TIRES WHEELS, HUBS AND WHEEL BEARINGS	20%	20%
	Total	100%	100%
In-school theory & practical subject competency weighting		70%	30%
Final in-school percentage score		IN-SCHOOL%	

In-school Percentage Score Combined theory and practical subject competency multiplied by	80%
Standardized Level Exam Percentage Score The exam score is multiplied by	20%
Final Percentage Score	FINAL %

Level 3 Grading Sheet: Subject Competency and Weightings

PROGRAM: IN-SCHOOL TRAINING:		AUTOMOTIVE SERVICE TECHNICIAN LEVEL 3	
LINE	SUBJECT COMPETENCIES	THEORY WEIGHTING	PRACTICAL WEIGHTING
E	DIAGNOSE AND REPAIR GASOLINE ENGINE SUPPORT SYSTEMS	64%	65%
G	DIAGNOSE AND REPAIR VEHICLE NETWORKING SYSTEMS	15%	10%
H	DIAGNOSE AND REPAIR DRIVELINE SYSTEMS	2%	0%
I	DIAGNOSE AND REPAIR ELECTRICAL SYSTEMS AND COMPONENTS	19%	25%
	Total	100%	100%
In-school theory / practical subject competency weighting		70%	30%
Final in-school percentage score		IN-SCHOOL%	

In-school Percentage Score Combined theory and practical subject competency multiplied by	80%
Standardized Level Exam Percentage Score The exam score is multiplied by	20%
Final Percentage Score	FINAL %

Level 4 Grading Sheet: Subject Competency and Weightings

PROGRAM: IN-SCHOOL TRAINING:		AUTOMOTIVE SERVICE TECHNICIAN LEVEL 4	
LINE	SUBJECT COMPETENCIES	THEORY WEIGHTING	PRACTICAL WEIGHTING
C	USE COMMUNICATION AND MENTORING TECHNIQUES	1%	0%
F	DIAGNOSE AND REPAIR DIESEL ENGINE SUPPORT SYSTEMS	22%	20%
H	DIAGNOSE AND REPAIR DRIVELINE SYSTEMS	25%	40%
I	DIAGNOSE AND REPAIR ELECTRICAL SYSTEMS AND COMPONENTS	10%	0%
J	DIAGNOSE AND REPAIR HEATING, VENTILATION AND AIR CONDITIONING (HVAC) AND COMFORT CONTROL SYSTEMS	22%	30%
L	DIAGNOSE AND REPAIR RESTRAINT SYSTEMS, BODY COMPONENTS, ACCESSORIES AND TRIM	8%	0%
M	DIAGNOSE AND REPAIR HYBRID AND ELECTRIC VEHICLES (EV)	12%	10%
	Total	100%	100%
In-school theory / practical subject competency weighting		70%	30%
Final in-school percentage score		IN-SCHOOL%	

In-school Percentage Score Combined theory and practical subject competency multiplied by	80%
Standardized Level Exam Percentage Score The exam score is multiplied by	20%
Final Percentage Score Apprentices must achieve a minimum 70% for the final level percentage score to be eligible to write the Automotive Service Technician Interprovincial Red Seal exam.	FINAL %

SkilledTradesBC will enter the apprentices Automotive Service Technician Red Seal Interprovincial examination mark in SkilledTradesBC Portal. A minimum mark of 70% on the examination is required for a pass.

APPENDIX B

Glossary

Appendix B: Glossary

Accessories	Features that are not originally equipped by the manufacturer
Adjustment	A minor change so that something works better, such as changing park position of a wiper.
CAN	Controller area network; a protocol for communication between electronic/computer modules.
Describe	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.
DVOM	Digital voltage ohmmeter; meter for measuring voltage, amperage, resistance (ohms) and is digital in its operation.
Identify	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.
Interpret	To explain or understand the meaning of something. This primarily refers to using wiring diagrams and data.
Maintain	To keep a tool in good condition by performing regular maintenance such as lubrication or cleaning, as well as making repairs and correcting problems.
Micrometer	A precision measuring device for small distances.
OBD	On board diagnostics; part of a vehicle's engine management software used to monitor system performance.
Ohm's law	The relationship between current, resistance and voltage in any electrical circuit.
Options	Features that are originally equipped at time of manufacture.
Pascal's law	Fluid pressure exerted in a sealed vessel is equal and undiminished in all directions.
Pneumatic	Operated by compressed air.
Sensory inspection	Using one or more of the five senses to perform an inspection.
Systems	A set of components working together as parts of a mechanism or an interconnecting network.
Use	The act of using something. This typically involves the safe and proper operation of a tool or system.

APPENDIX C

Previous Contributors

Appendix C: Previous Contributors

The Program Outline was prepared with the advice and direction of an industry steering committee convened initially by the Automotive Training Standards Organization (ATSO). Members include:

- Jeff Summers Automotive Service Technician
- Loi Truong Automotive Service Technician
- Matthew Wilkie Automotive Service Technician

Subject Matter Experts retained to assist in the development of the Program Outline content:

- Corey Bransfield Instructor, Okanagan College
- Dean Cadieux Instructor, Vancouver Island University
- Jeff Hoff Manager, Napa Autopro, Prince George
- Russ Hunter Instructor, BC Institute of Technology
- Jeff Summers Automotive Service Technician
- Loi Truong Automotive Service Technician
- Matthew Wilkie Automotive Service Technician
- Brian Yanda Service Manager, Harris Mazda and Instructor, Malaspina College