

SKILLED**TRADES**^{BC}

PROGRAM OUTLINE

Automotive Service Technician (AST) - Foundation

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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)
Foundation

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

Industry and Instructor Subject Matter Experts retained to assist in the development of the Program Outline for AST 1,2,3 and 4, on which this FDN outline is based:

- 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
- Chris Wylie Searles Auto Repair

The 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, measurable achievement criteria for objectives with a practical component	Identifies detailed program content and performance expectations for competencies with a practical component; may be used as a checklist prior to signing a recommendation for certification (RFC) for an apprentice	Provides detailed information on program content and performance expectations for demonstrating competency	Allows individual to check program content areas against their own knowledge and performance expectations against their own skill levels
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 – Optional Training Topics	This content was taken from the Foundation Program Outline (2009), <i>Optional Topics</i> . Use of this content is at the discretion of the training provider.			
Appendix – Glossary	Defines program specific terminology and acronyms			

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

Section 2

PROGRAM OVERVIEW

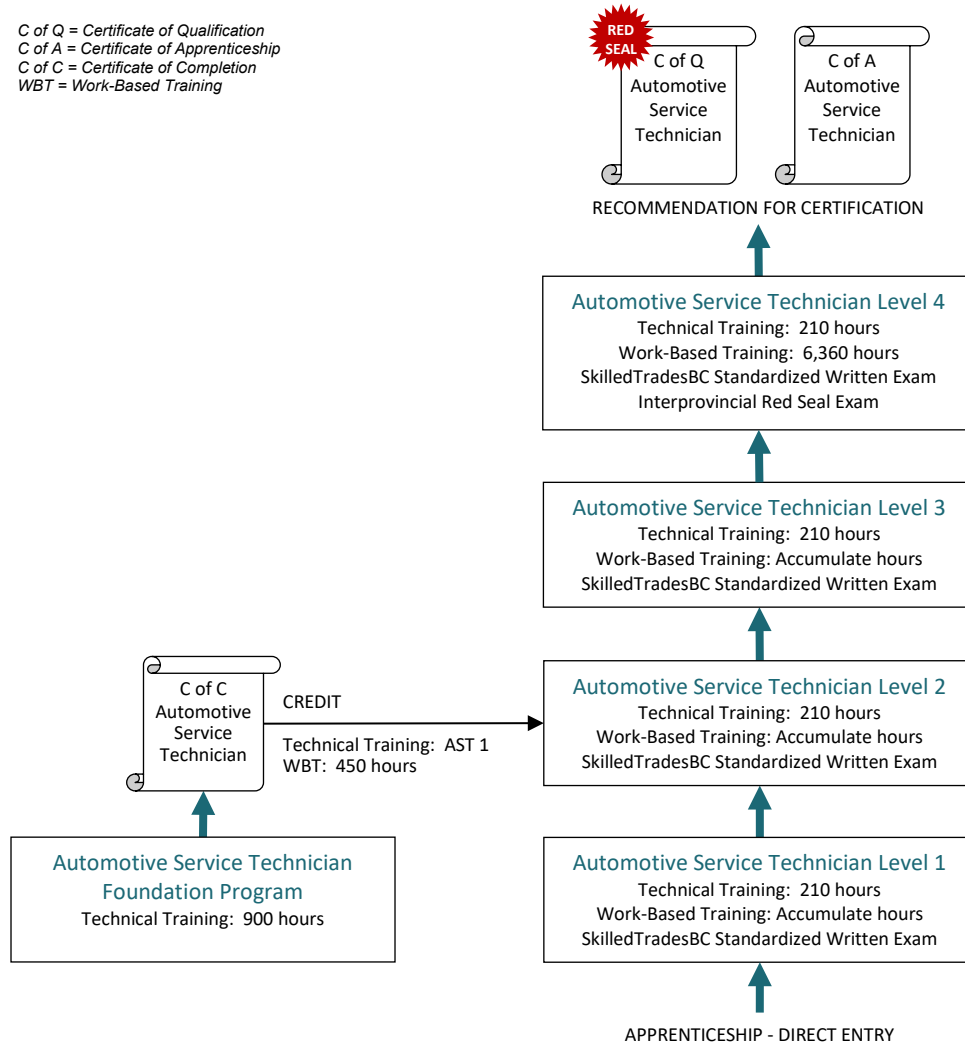
Automotive Service Technician (AST)

Program Credentialing Model

Apprenticeship Pathway

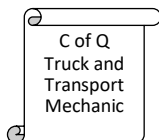
This graphic provides an overview of the Automotive Service Technician apprenticeship pathway.

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	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	1	1	1
USE COMMUNICATION AND MENTORING TECHNIQUES C	Use communication techniques C1	Use mentoring techniques C2		
	1	4		
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	2	2	2

**HARMONIZED PROGRAM
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
	<input type="checkbox"/> <input type="checkbox"/> 3 <input type="checkbox"/> <input type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/> 3 <input type="checkbox"/> <input type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/> 3 <input type="checkbox"/> <input type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/> 3 <input type="checkbox"/> <input type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/> 3 <input type="checkbox"/> <input type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/> 3 <input type="checkbox"/> <input type="checkbox"/>
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			
	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> 4 <input type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> 4 <input type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> 4 <input type="checkbox"/>			
DIAGNOSE AND REPAIR VEHICLE NETWORKING SYSTEMS G	Identify type of networking system G1	Diagnose and repair networking systems G2				
	<input type="checkbox"/> <input type="checkbox"/> 3 <input type="checkbox"/> <input type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/> 3 <input type="checkbox"/> <input type="checkbox"/>				
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
	1 <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	<input type="checkbox"/> 2 <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> 4 <input type="checkbox"/>	<input type="checkbox"/> 2 <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/> 3 <input type="checkbox"/> <input type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> 4 <input type="checkbox"/>
	Diagnose and repair final drive assemblies H7					
	<input type="checkbox"/> 2 <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>					
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	
	1 <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	1 2 <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	<input type="checkbox"/> 2 <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/> 3 <input type="checkbox"/> <input type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> 4 <input type="checkbox"/>	

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

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

Section 3
PROGRAM CONTENT
Automotive Service Technician

Level 1

Automotive Service Technician

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): 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

1. Use hand tools

CONTENT

- Types
 - Wrenches
 - Sockets
 - Pliers
- Special application tools
 - Chisels and punches
 - Tap and die
- Safety
- Storage
- Cleaning and maintenance

2. Use measuring tools

- Types
 - Vernier calipers
 - Micrometers
 - Feeler gauges
- Safety
- Storage
- Cleaning and maintenance

3. Use power tools

- Types
 - Impact wrench
 - Grinders
 - Drills
 - Pneumatic
 - Electric
- Safety
- Storage
- Cleaning and maintenance

4. Use shop equipment

- Types
 - Presses and pullers
 - Solvent tank
- Safety

LEARNING TASKS

CONTENT

5. Describe oxyacetylene components

- Storage
- Cleaning and maintenance
- Safety
- Gases
- Cylinders, regulators and hoses
- Torches

6. Demonstrate oxyacetylene procedures

- Set up
- Lighting
- Heating and cutting
- Shut down
- Storage
- Inspection and maintenance

7. Describe MIG (GMAW) welding components and methods

- Gas Metal Arc Welding (GMAW)
- Safety
- Gases
- Cylinders, regulator and hose
- Ground terminal

8. Demonstrate MIG (GMAW) welding procedures

- 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

- Access to tools

Criteria The learner will be evaluated on

- 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

CONTENT

1. Describe drive shafts

2. Service drive shafts

- 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 <ul style="list-style-type: none"> • Vehicle • Tools and 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: 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

CONTENT

- | | |
|--|---|
| <ol style="list-style-type: none"> 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 | <ul style="list-style-type: none"> • Terminology • Theories <ul style="list-style-type: none"> ○ Ohm's law ○ Magnetism ○ Watt's law • Types of circuits • Faults <ul style="list-style-type: none"> ○ Opens ○ Shorts ○ Grounds • Components <ul style="list-style-type: none"> ○ Switches ○ Circuit protection ○ Relays • Symbols • Colours • Identification numbers • Power flows • Types of wires • Repair methods • Types <ul style="list-style-type: none"> ○ Test lights ○ Power (logic) probes ○ Digital Volt Ohm meter (DVOM) • Measuring values <ul style="list-style-type: none"> ○ 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

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

CONTENT

- | | |
|---|--|
| <p>1. Describe steering columns</p> | <ul style="list-style-type: none"> • Types <ul style="list-style-type: none"> ○ Tilt ○ Telescoping • Steering wheel lock • Combination switch |
| <p>2. Inspect steering columns</p> | <ul style="list-style-type: none"> • Shafts, universal joints, coupling, splines • Collapsing function • Electrical connections |
| <p>3. Describe occupant restraints</p> | <ul style="list-style-type: none"> • Safety • Types <ul style="list-style-type: none"> ○ Driver ○ Passenger ○ Seat belt pre-tensioner • Air bag wiring |
| <p>4. Remove and replace steering wheel air bag inflator module</p> | <ul style="list-style-type: none"> • Safety <ul style="list-style-type: none"> ○ Disarm • Precautions <ul style="list-style-type: none"> ○ Handling ○ Storage |
| <p>5. Describe steering linkage</p> | <ul style="list-style-type: none"> • Types <ul style="list-style-type: none"> ○ 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

2. Describe suspension systems

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

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
- Safety
- Visual inspection
- Road test
- Removal and replacement
- Measurements
- Alignment
- Faults

4. Inspect and service suspension systems

Achievement Criteria

Performance The learner will identify and inspect suspension systems.

Conditions The learner will be given

- A vehicle
- Measuring equipment
- Access to technical information

Criteria The learner will be evaluated on

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

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

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

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 (and Foundation)

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

Reference Materials

Required 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://tradesecrets.alberta.ca/ILMOrder/order.asp>.

Suggested Reference Material

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

Appendices

APPENDIX A

Optional Content

Appendix A: Optional Training Topics

		Old Competency
Line 1	EMPLOYABILITY SKILLS	Line B
1.1	Demonstrate employment readiness skills	B3
Line 2	TOOLS AND EQUIPMENT	Line C
2.1	Use diagnostic equipment	C7
Line 3	GENERAL AUTOMOTIVE MAINTENANCE	Line D
3.1	Perform cooling system maintenance	D2
3.2	Perform exhaust system maintenance	D3
3.3	Perform transmission maintenance	D4
Line 4	GENERAL AUTOMOTIVE PRACTICES	Line E
4.1	Assess leaks	E1
4.2	Service Gaskets and Seals	E2
4.3	Describe fuel delivery systems	E4
4.4	Describe internal combustion engine principles	E5
4.5	Describe vehicle emissions	E6
Line 5	STEERING SYSTEMS	Line G
5.1	Describe four wheel steering systems	G7
Line 6	BASIC ELECTRICAL SYSTEMS	Line I
6.1	Describe engine management systems	I5
6.2	Describe ignition systems	I6

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

Objectives

The learner will be able to demonstrate the skills required to obtain and retain employment

LEARNING TASKS

1. Describe the responsibilities of employees and expectations employers have of employees

CONTENT

- Communication
 - Use of trade language
 - Reading and comprehending
 - Writing
- Thinking
 - Problem solving and decision making
 - Use of mathematics
 - Use of current technology
 - Ability to research
- Desire to continue learning
- Positive attitude
 - Self esteem
 - Confidence
 - Honesty and integrity
 - Initiative
 - Energy
 - Persistence
 - Cooperative
- Responsibility
 - Dependability
 - Goal and priority setting
 - Time management
 - Money management
 - Punctuality

- Adaptability
 - Positive attitude towards change
 - Respect for other diversity and differences
 - Creativity
 - Flexible
 - Team skills
 - Work with others
 - Group planning
 - Respect for others thoughts and opinions
 - Leadership when appropriate
 - Ability to handle conflict
 - Self control
 - Care for quality
 - Personal care
 - Clean
 - Neat
 - Dress appropriately
 - Rested
 - No substance abuse
 - Following safety regulations

- 2. Describe responsibilities of employers and expectations employees have of employers
 - Respect
 - Trust
 - Fairness
 - Care
 - Concern
 - Feelings
 - Safe work site
 - Timely payment

- 3. Describe responsibilities employees have to customers
 - Vehicle protection precautions
 - Smoking
 - Fender covers
 - Road testing
 - Privacy

- | | | |
|----|----------------------------------|---|
| 4. | Prepare a resume | <ul style="list-style-type: none"> • Gathering information <ul style="list-style-type: none"> ○ Goals ○ Skills ○ Education <ul style="list-style-type: none"> – Dates ○ Experience <ul style="list-style-type: none"> – Dates – Relationships and responsibilities ○ Activities ○ References • Statements of accomplishment <ul style="list-style-type: none"> ○ Challenge ○ Action <ul style="list-style-type: none"> – Skills applied ○ Results • Types of resumes <ul style="list-style-type: none"> ○ Chronological ○ Functional ○ Generic ○ Specific |
| 5. | Prepare a letter of introduction | <ul style="list-style-type: none"> • Not to exceed one page • Highlight important accomplishments in same order as they appear in the job posting |
| 6. | Identify job search resources | <ul style="list-style-type: none"> • Newspapers • Internet • Networking • Industry publications • Direct approach |
| 7. | Prepare for an interview | <ul style="list-style-type: none"> • Research of the organization • Review of job qualifications • Prepare for broad personal questions • Review of resume • Interview practice • Arriving ahead of time • Appropriate dress |

Achievement Criteria:

Given a written and/or a practical assessment on Employment Readiness Skills the Learner will be able to demonstrate knowledge of the trade by achieving 70% or better based on a summative total of Instructor assessment.

Line: 2 TOOLS AND EQUIPMENT
Competency: 2.1 Use diagnostic equipment

Objectives

- The learner will be able to demonstrate the use of diagnostic equipment
- The learner will be able to interpret diagnostic information

LEARNING TASKS

1. Use mechanical diagnostic equipment

2. Use electrical diagnostic equipment

3. Use scan tools

CONTENT

- Gauges
 - Compression
 - Vacuum
 - Fuel pressure
 - Oil pressure
 - Leak down tester
 - Coolant tester
 - Tire pressure
 - Temperature
- Hydrometer
- Digital volt ohm meter (DVOM)
 - Units of measurement
 - Measure electrical signals
- Test light
- Logic probe
- High impedance test light
- Analog / digital
- Oscilloscope
- Breakout box
- AVR (charging systems)
- Timing light
- Scan tools
 - Describe generic and OEM scan tools
 - Types of codes
 - On board diagnostics
 - Data stream information
 - Code retrieval
 - Clearing fault codes

Achievement Criteria

Given a written and/or a practical assessment on Diagnostic Equipment, the Learner will be able to demonstrate knowledge of the trade by achieving 70% or better based on a summative total of Instructor assessment.

Line: 3 GENERAL AUTOMOTIVE MAINTENANCE

Competency: 3.1 Perform cooling system maintenance

Objectives

- The learner will be able to describe cooling system components and fluids
- The learner will be able to inspect cooling system condition and perform routine cooling system maintenance

LEARNING TASKS

CONTENT

1. Describe engine coolants	<ul style="list-style-type: none"> • Ethylene glycol-based antifreeze • Propylene glycol-based antifreeze • Phosphate-free ethylene-glycol based antifreeze • Organic acid technology (OAT) • Hybrid organic acid technology (HOAT) • Chemical treatments and additives • Antifreeze / water proportions • Recycling
2. Describe basic cooling system operation	<ul style="list-style-type: none"> • Air cooled • Liquid cooled open-system • Liquid cooled closed system
3. Describe and identify cooling system components	<ul style="list-style-type: none"> • Radiator • Hoses • Clamps • Water pump • Thermostat • Heater core • Pressure cap • Expansion tank • Engine coolant passages • Cooling fans • Temperature sensors and indicators
4. Test engine coolant	<ul style="list-style-type: none"> • Hydrometer • Refractometer • pH strips • Electrolysis inspection • Combustion gases

5. Maintain cooling systems

- Leak inspection and diagnosis
- Drain and refill cooling system
- Bleed cooling system
- Flush cooling system
- Test thermostat
- Replace thermostat

Achievement Criteria:

Given a written and/or a practical assessment on Cooling System Maintenance, the Learner will be able to demonstrate knowledge of the trade by achieving 70% or better based on a summative total of Instructor assessment.

Line: 3 GENERAL AUTOMOTIVE MAINTENANCE
Competency: 3.2 Perform exhaust system maintenance

Objectives

- The learner will be able to identify exhaust system components
- The learner will be able to diagnose exhaust systems
- The learner will be able to perform exhaust system maintenance

LEARNING TASKS

CONTENT

1. Identify exhaust system components	<ul style="list-style-type: none"> • Manifold and headers • Catalytic converter • Muffler and resonator • Piping and hardware
2. Describe the design and operation of exhaust systems	<ul style="list-style-type: none"> • Manifold and headers • Catalytic converter • Muffler and resonator • Piping and hardware
3. Inspect and repair exhaust systems	<ul style="list-style-type: none"> • Inspection <ul style="list-style-type: none"> ○ Visual ○ Audible ○ Smoke machine • Thread repair • Component removal • Cutting procedures • Component installation

Achievement Criteria:

Given a written and/or a practical assessment on Exhaust System Maintenance, the Learner will be able to demonstrate knowledge of the trade by achieving 70% or better based on a summative total of Instructor assessment.

Line: 3 GENERAL AUTOMOTIVE MAINTENANCE

Competency: 3.3 Perform transmission maintenance

Objectives

- The learner will be able to perform maintenance operations on manual transmissions and transaxles
- The learner will be able to perform maintenance operations on automatic transmissions and transaxles

LEARNING TASKS

CONTENT

1. Describe and identify transmission fluids	<ul style="list-style-type: none"> • Gear oil • Engine oil • Manufacturer’s specific manual transmission fluids • Manufacturer’s specific automatic transmission fluids
2. Maintain manual transmissions and transaxles	<ul style="list-style-type: none"> • Fluid level inspection • Fluid selection • Leak diagnosis • Drain and refill • Linkage adjustment
3. Maintain automatic transmissions and transaxles	<ul style="list-style-type: none"> • Fluid level inspection • Fluid selection • Leak diagnosis • Drain and refill • Replace pan gasket and filter • Flush transmission fluid • Inspect shift linkage • Inspect throttle valve cable or linkage • Extract diagnostic codes using a scan tool

Achievement Criteria:

Given a written and/or a practical assessment on Transmission Maintenance, the Learner will be able to demonstrate knowledge of the trade by achieving 70% or better based on a summative total of Instructor assessment.

Line: 4 GENERAL AUTOMOTIVE PRACTICES
Competency: 4.1 Assess leaks

Objectives

- The learner will be able to locate leaks and determine causes and solutions

LEARNING TASKS

CONTENT

1. Describe leak detection methods	<ul style="list-style-type: none"> • Visual • Audible • Black light • Fluid analysis • Pressurization / vacuum • Smoke generator
2. Assess leak relevance	<ul style="list-style-type: none"> • Cost of repair • Potential damage

Achievement Criteria:

Given a written and/or a practical assessment on Assessing Leaks, the Learner will be able to demonstrate knowledge of the trade by achieving 70% or better based on a summative total of Instructor assessment.

Line: 4 GENERAL AUTOMOTIVE PRACTICES
Competency: 4.2 Service gaskets and seals

Objectives

- The learner will be able to identify causes of gasket and seal failure
- The learner will be able to select gaskets and seals
- The learner will be able to remove and replace gaskets and seals

LEARNING TASKS

CONTENT

1.	Describe gasket and seal construction	<ul style="list-style-type: none"> • Gasket <ul style="list-style-type: none"> ○ Cylinder head gaskets ○ Other gaskets <ul style="list-style-type: none"> – Rubber – Non-rubber – Reusable – Forms in place • Sealers <ul style="list-style-type: none"> ○ Aerobic ○ Anaerobic ○ Sensor safe • Seals <ul style="list-style-type: none"> ○ O-rings ○ Lip seals • Sealing washers
2.	Diagnose cause of failure	<ul style="list-style-type: none"> • Incorrect assembly • Excessive heat • Over pressurization • Lack of lubrication • Seal deterioration • Mating surface damage
3.	Service gaskets and seals	<ul style="list-style-type: none"> • Removal techniques • Surface preparation • Installation techniques • Torque sequence

Achievement Criteria:

Given a written and/or a practical assessment on Gasket and Seal Service, the Learner will be able to demonstrate knowledge of the trade by achieving 70% or better based on a summative total of Instructor assessment.

Line: 4 GENERAL AUTOMOTIVE PRACTICES
Competency: 4.3 Describe fuel delivery systems

Objectives

- The learner will be able to identify fuel delivery system components
- The learner will be able to describe the design and operation of fuel delivery systems

LEARNING TASKS

CONTENT

1. Identify components of fuel delivery systems	<ul style="list-style-type: none"> • Fuel tank • Filler neck and cap • Roll-over valves • Fuel pumps and regulators • Filters and strainers • Fuel heaters • Water separators • Vapour recovery • Sensors and gauges • Gaskets and seals • Associated lines and fittings
2. Describe the design and operation of fuel delivery systems	<ul style="list-style-type: none"> • Fuel tank • Filler neck and cap • Roll-over valves • Fuel pumps and regulators • Filters and strainers • Fuel heaters • Water separators • Vapour recovery • Sensors and gauges • Construction materials • Associated lines and fittings

Achievement Criteria:

Given a written and/or a practical assessment on Fuel Delivery Systems, the Learner will be able to demonstrate knowledge of the trade by achieving 70% or better based on a summative total of Instructor assessment.

Line: 4 GENERAL AUTOMOTIVE PRACTICES
Competency: 4.4 Describe internal combustion engine principles

Objectives

- The learner will be able to identify internal combustion engine components
- The learner will be able to describe the design and operation of internal combustion engines

LEARNING TASKS

CONTENT

<p>1. Describe internal combustion engine components</p> <p>2. Describe the design and operation of internal combustion engines</p>	<ul style="list-style-type: none"> • Short block assembly • Cylinder head assembly • Associated parts and fasteners • Fuel types • Two and four stroke cycle • Construction design and materials • Engine configurations • Cooling medium • Lubrication • Design variations <ul style="list-style-type: none"> ○ Miller cycle ○ Wankel ○ Variable valve timing
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Achievement Criteria:

Given a written and/or a practical assessment on Internal Engine Combustion Principles, the Learner will be able to demonstrate knowledge of the trade by achieving 70% or better based on a summative total of Instructor assessment.

Line: 4 GENERAL AUTOMOTIVE PRACTICES
Competency: 4.5 Describe vehicle emissions

Objectives

- The learner will be able to describe the principles of combustion
- The learner will be able to describe the byproducts of combustion
- The learner will be able to describe effects of byproducts of combustion on the environment

LEARNING TASKS

CONTENT

1. Describe the combustion process	<ul style="list-style-type: none"> • Products of complete combustion • Products of incomplete combustion
2. Describe causes of harmful vehicle emissions	<ul style="list-style-type: none"> • Oxides of nitrogen • Hydrocarbons • Carbon monoxide • Carbon dioxide • Oxides of sulphur • Particulates
3. Describe the effects of products of combustion on the environment	<ul style="list-style-type: none"> • Oxides of nitrogen • Hydrocarbons • Carbon monoxide • Carbon dioxide • Oxides of sulphur • Particulates

Achievement Criteria:

Given a written and/or a practical assessment on Vehicle Emissions, the Learner will be able to demonstrate knowledge of the trade by achieving 70% or better based on a summative total of Instructor assessment.

Line: 5 **STEERING SYSTEMS**
Competency: 5.1 **Describe four wheel steering systems**

Objectives

- The learner will be able to identify four-wheel steering system components
- The learner will be able to describe the operation of four-wheel steering systems

LEARNING TASKS

1. Describe the design and operation of four-wheel steering systems

CONTENT

- Overview
 - Electrical systems
 - Mechanical systems

Achievement Criteria:

Given a written and/or a practical assessment on Four Wheel Steering Systems, the Learner will be able to demonstrate knowledge of the trade by achieving 70% or better based on a summative total of Instructor assessment.

Line: 6 BASIC ELECTRICAL SYSTEMS
Competency: 6.1 Describe engine management systems

Objectives

- The learner will be able to describe the function of engine management systems
- The learner will be able to identify the components of engine management systems

LEARNING TASKS

CONTENT

1.	Describe the purpose of engine management systems	<ul style="list-style-type: none"> • Monitoring and controlling <ul style="list-style-type: none"> ○ Emissions ○ Fuel economy ○ Driveability ○ Warranty date collection ○ Troubleshooting
2.	Identify onboard diagnostic systems	<ul style="list-style-type: none"> • OBD • OBD II
3.	Identify the components of engine management systems	<ul style="list-style-type: none"> • Microprocessor • Software • Inputs • Outputs • Wiring and connectors • Diagnostic connections

Achievement Criteria:

Given a written and/or a practical assessment on Engine Management Systems, the Learner will be able to demonstrate knowledge of the trade by achieving 70% or better based on a summative total of Instructor assessment.

Line: 6 BASIC ELECTRICAL SYSTEMS

Competency: 6.2 Describe ignition systems

Objectives

- The learner will be able to identify ignition system components
- The learner will be able to describe the design and operation of electronic ignition systems

LEARNING TASKS

CONTENT

<p>1. Identify the components of electronic ignition systems</p>	<ul style="list-style-type: none"> • Battery • Ignition switch and wiring • Trigger device(s) • Sensors • Computer • Distributor type <ul style="list-style-type: none"> ○ Rotor ○ Cap ○ Advance / retard mechanisms • Ignition coil(s) • High tension wires • Spark plugs
<p>2. Describe the design and operation of electronic ignition systems</p>	<ul style="list-style-type: none"> • Purpose of ignition system • Primary and secondary circuit • Waste spark • Variable / fixed dwell systems • Timing • Ignition switch and wiring • Trigger device(s) • Sensors • Computer • Distributor type • Distributor-less (direct) • Ignition coil(s) • High tension wires • Spark plugs

Achievement Criteria:

Given a written and/or a practical assessment on Ignition Systems, the Learner will be able to demonstrate knowledge of the trade by achieving 70% or better based on a summative total of Instructor assessment.

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:

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