SKILLEDTRADESBC

PROGRAM OUTLINE

Motorcycle Technician

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MOTORCYCLE TECHNICIAN
PROGRAM OUTLINE

APPROVED BY INDUSTRY

MARCH 2021

BASED ON

RSOS 2020

Developed by
SkilledTradesBC
Province of British Columbia

TABLE OF CONTENTS

Section 1

INTRODUCTION

Motorcycle Technician

Foreword

This revised 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 2020 Red Seal Occupational Standard (RSOS). It was developed by 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.

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 Section 4 for more details.

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 measurable and that they reflect the skills spelled out in the competency. The conditions under which these performances will be observed and measured must be clear to the learner as well as the criteria by which the learner will be evaluated. The learner must also be given the evaluation criteria.

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

SAFETY ADVISORY

Be advised that references to the WorkSafe BC 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

The Program Outline was prepared with the advice and direction of the following industry and instructor Subject Matter Experts:

- Steve Coates, Kelowna Honda Powerhouse
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- Mike Gardell, BCIT
- Rory Lambie, Ducati Canada

SkilledTradesBC would like to acknowledge the dedication and hard work of all the industry and instructor representatives appointed to identify the training requirements of the Motorcycle Technician 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	Communicates program length and structure, and all pathways to completion	Illustrates the length and structure of the program	Illustrates the length and structure of the program, and pathway to completion	Illustrates the challenger pathway to Certificate of Qualification
OAC	Communicates the competencies that industry has defined as representing the scope of the occupation	Displays the competencies that an apprentice is expected to demonstrate in order to achieve certification	Displays the competencies apprentices will achieve as a result of program completion	Displays the competencies challengers 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	Shows 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	Shows 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	Shows 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 – Glossary and Acronyms			Defines program specific terms and acronyms	

Section 2

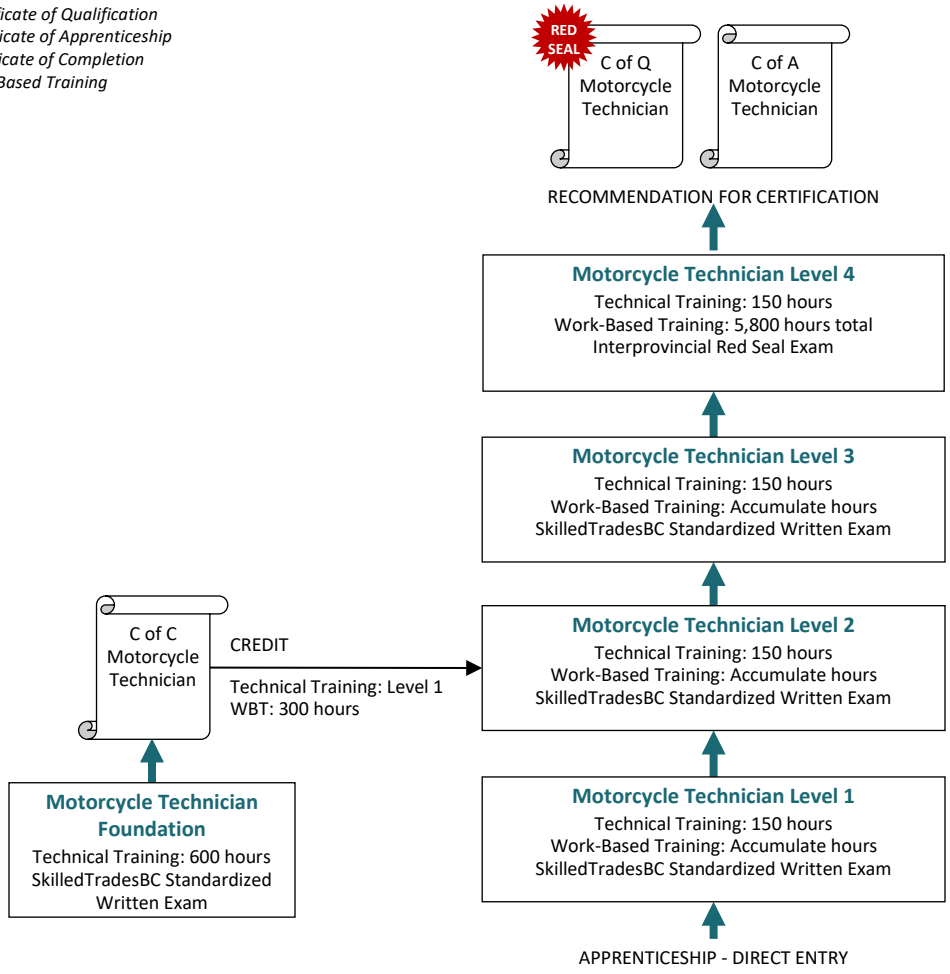
PROGRAM OVERVIEW

Motorcycle Technician

Program Credentialing Model

Motorcycle Technician

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 this program

Technical Training: None
Work-Based Training: 3,360 hours

Occupational Analysis Chart

MOTORCYCLE TECHNICIAN

Occupation Description: Motorcycle technicians work primarily on 2 and 3-wheeled motorcycles and other units such as motor scooters. They inspect, clean, test, assemble, diagnose, maintain and repair engines, transmissions, drive systems, steering assemblies, braking systems, chassis and suspension, electrical systems, vehicle management systems, fuel systems and exhaust systems. They may specialize in repairing, rebuilding, customizing or servicing these systems or assemblies.

Motorcycle technicians work with hand, power, pneumatic, measuring, diagnostic and testing tools, and shop equipment. Reference material, documentation, computers and software are also necessary tools in this trade. With additional training, Motorcycle technicians can transfer their skills and knowledge to related units and equipment such as, but not limited to, all-terrain vehicles, snowmobiles, watercraft and outdoor power equipment.

PERFORM SAFETY-RELATED FUNCTIONS **A**	Maintain safe work environment A1	1					Use personal protective equipment (PPE) and safety equipment A2	1																
PERFORM ROUTINE WORK PRACTICES **B**	Use trade-related consumables B1	1					Perform periodic maintenance of lubrication systems B2	1					Perform periodic maintenance of cooling systems B3	1					Perform periodic maintenance of bearings B4	1					Perform storage procedures B5	1					Prepare new motorcycles B6	1				
	Conduct safety inspections B7				4																			
USE TOOLS, EQUIPMENT AND DOCUMENTATION **C**	Use diagnostic tools and equipment C1	1	2	3			Use precision measuring instruments C2	1					Use hand tools C3	1					Use heating/cutting tools and equipment C4	1					Use pneumatic and electric power tools and equipment C5	1					Use shop equipment C6	1				

	Use documentation C7				
	1				

USE COMMUNICATION AND MENTORING TECHNIQUES D	Use communication techniques D1				
	1				
	Use mentoring techniques D2				
				4	

MAINTAIN CHASSIS AND COMPONENTS E	Maintain frames E1				
		2	3		
	Maintain steering heads E2				
		2			
	Maintain steering systems for multi-wheeled motorcycles E3				
		2	3		
	Maintain chassis standard and accessory components E4				
		2	3		

MAINTAIN SUSPENSION SYSTEMS F	Maintain front suspension components F1				
		2	3		
	Maintain front suspension components for multi-wheeled motorcycles F2				
		2	3		
	Maintain rear suspension components F3				
		2	3		

MAINTAIN WHEELS AND TIRES G	Maintain tires G1				
	1				
	Maintain spoked wheels G2				
			3		
	Maintain cast wheels G3				
	1				

MAINTAIN BRAKING SYSTEMS H	Maintain hydraulic braking systems H1				
	1				
	Maintain mechanical braking systems H2				
	1				
	Maintain braking control systems H3				
				4	

MAINTAIN TWO-STROKE AND FOUR-STROKE ENGINES I	Apply principles of engines and engine construction I1	Maintain cylinder heads I2	Maintain valve systems on two-stroke engines I3	Maintain valve trains on four-stroke engines I4	Maintain cylinders and pistons I5	Maintain crankshaft assemblies I6
	2 3	3 4	2 3	3 4	2 3 4	3 4
	Maintain counterbalance assemblies I7	Maintain engine cases I8	Maintain lubrication systems I9	Maintain cooling systems I10		
	3 4	3 4	2 3 4	2 3		
MAINTAIN CLUTCHES AND PRIMARY DRIVES J	Maintain primary drives and driven gears J1	Maintain primary drive chains and sprockets J2	Maintain primary drive belts and pulleys (sprockets) J3	Maintain manual clutches J4	Maintain automatic clutches J5	Maintain manual starting systems J6
	2	2	2	2	2	2
MAINTAIN TRANSMISSIONS K	Maintain constant mesh transmissions K1	Maintain continuously variable transmissions (CVT) K2				
	3 4	2				
MAINTAIN FINAL DRIVE SYSTEMS L	Maintain final drive chains and sprockets L1	Maintain final drive shafts and gears L2	Maintain final drive belts and pulleys (sprockets) L3			
	1	3	1			
MAINTAIN ELECTRICAL SYSTEMS M	Apply electrical and electronic principles M1	Maintain batteries M2	Maintain electrical standard and accessory components M3	Maintain wiring harness systems M4	Maintain ignition systems M5	Maintain electric starting systems M6
	1 3	1	1 2 3	2 3	3	2

	Maintain charging systems M7				
		2			
MAINTAIN VEHICLE MANAGEMENT SYSTEMS N	Read diagnostic trouble codes (DTC) N1	Use specialized equipment N2	Interpret diagnostic trouble codes (DTC) results N3	Maintain system circuitry and components N4	Update software N5
	1	4	4	4	4
MAINTAIN FUEL AND EXHAUST SYSTEMS O	Maintain fuel tanks and fuel delivery components O1	Maintain air delivery systems O2	Maintain carburetor systems O3	Maintain exhaust systems O4	Maintain fuel injection systems O5
	2 3	2 3	2 3	2 3	4
MAINTAIN ELECTRIC MOTORCYCLES P	Implement specific safety protocols for electric motorcycles P1	Maintain electric motorcycles P2			
	4	4			

Training Topics and Suggested Time Allocation

MOTORCYCLE TECHNICIAN– LEVEL 1

			% of Time Allocated to:		
		% of Time	Theory	Practical	Total
Line A	**PERFORM SAFETY-RELATED FUNCTIONS**	**6%**	**100%**	**0%**	**100%**
A1	Maintain safe work environment		✓		
A2	Use personal protective equipment (PPE) and safety equipment		✓		
Line B	**PERFORM ROUTINE WORK PRACTICES**	**18%**	**60%**	**40%**	**100%**
B1	Use trade-related consumables		✓		
B2	Perform periodic maintenance of lubrication systems		✓	✓	
B3	Perform periodic maintenance of cooling systems		✓	✓	
B4	Perform periodic maintenance of bearings		✓	✓	
B5	Perform storage procedures		✓		
B6	Prepare new motorcycles		✓		
Line C	**USE TOOLS, EQUIPMENT AND DOCUMENTATION**	**11%**	**30%**	**70%**	**100%**
C1	Use diagnostic tools and equipment		✓	✓	
C2	Use precision measuring instruments		✓	✓	
C3	Use hand tools		✓	✓	
C4	Use heating/cutting tools and equipment		✓	✓	
C5	Use pneumatic and electric power tools and equipment		✓	✓	
C6	Use shop equipment		✓		
C7	Use documentation		✓		
Line D	**USE COMMUNICATION AND MENTORING TECHNIQUES**	**3%**	**100%**	**0%**	**100%**
D1	Use communication techniques		✓		
Line G	**MAINTAIN WHEELS AND TIRES**	**16%**	**40%**	**60%**	**100%**
G1	Maintain tires		✓	✓	
G3	Maintain cast wheels		✓	✓	
Line H	**MAINTAIN BRAKING SYSTEMS**	**18%**	**50%**	**50%**	**100%**
H1	Maintain hydraulic braking systems		✓	✓	
H2	Maintain mechanical braking systems		✓	✓	
Line L	**MAINTAIN FINAL DRIVE SYSTEMS**	**13%**	**40%**	**60%**	**100%**
L1	Maintain final drive chains and sprockets		✓	✓	
L3	Maintain final drive belts and pulleys (sprockets)		✓	✓	
Line M	**MAINTAIN ELECTRICAL SYSTEMS**	**12%**	**60%**	**40%**	**100%**
M1	Apply electrical and electronic principles		✓		
M2	Maintain batteries		✓	✓	
M3	Maintain electrical standard and accessory components		✓		
Line N	**MAINTAIN VEHICLE MANAGEMENT SYSTEMS**	**3%**	**50%**	**50%**	**100%**

			% of Time Allocated to:		
		% of Time	Theory	Practical	Total
N1	Read diagnostic trouble codes (DTC)		✓	✓	
	Total Percentage for Motorcycle Technician Level 1	**100%**			

Training Topics and Suggested Time Allocation

MOTORCYCLE TECHNICIAN– LEVEL 2

			% of Time Allocated to:		
		% of Time	Theory	Practical	Total
Line C	**USE TOOLS, EQUIPMENT AND DOCUMENTATION**	**6%**	**40%**	**60%**	**100%**
C1	Use diagnostic tools and equipment		✓	✓	
Line E	**MAINTAIN CHASSIS AND COMPONENTS**	**17%**	**40%**	**60%**	**100%**
E1	Maintain frames		✓		
E2	Maintain steering heads		✓	✓	
E3	Maintain steering systems for multi-wheeled motorcycles		✓		
E4	Maintain chassis standard and accessory components		✓	✓	
Line F	**MAINTAIN SUSPENSION SYSTEMS**	**14%**	**40%**	**60%**	**100%**
F1	Maintain front suspension components		✓		
F2	Maintain front suspension components for multi-wheeled motorcycles		✓	✓	
F3	Maintain rear suspension components		✓	✓	
Line I	**MAINTAIN TWO-STROKE AND FOUR-STROKE ENGINES**	**13%**	**60%**	**40%**	**100%**
I1	Apply principles of engines and engine construction		✓		
I3	Maintain valve systems on two-stroke engines		✓		
I5	Maintain cylinders and pistons		✓		
I9	Maintain lubrication systems		✓	✓	
I10	Maintain cooling systems		✓	✓	
Line J	**MAINTAIN CLUTCHES AND PRIMARY DRIVES**	**15%**	**40%**	**60%**	**100%**
J1	Maintain primary drives and driven gears		✓	✓	
J2	Maintain primary drive chains and sprockets		✓	✓	
J3	Maintain primary drive belts and pulleys (sprockets)		✓		
J4	Maintain manual clutches		✓	✓	
J5	Maintain automatic clutches		✓	✓	
J6	Maintain manual starting systems		✓	✓	
Line K	**MAINTAIN TRANSMISSIONS**	**8%**	**50%**	**50%**	**100%**
K2	Maintain continuously variable transmissions (CVT)		✓	✓	
Line M	**MAINTAIN ELECTRICAL SYSTEMS**	**17%**	**60%**	**40%**	**100%**
M3	Maintain electrical standard and accessory components		✓	✓	
M4	Maintain wiring harness systems		✓	✓	
M6	Maintain electric starting systems		✓	✓	
M7	Maintain charging systems		✓	✓	
Line O	**MAINTAIN FUEL AND EXHAUST SYSTEMS**	**10%**	**35%**	**65%**	**100%**

			% of Time Allocated to:		
		% of Time	Theory	Practical	Total
O1	Maintain fuel tanks and fuel delivery components		✓		
O2	Maintain air delivery systems		✓	✓	
O3	Maintain carburetor systems		✓	✓	
O4	Maintain exhaust systems		✓	✓	
	Total Percentage for Motorcycle Technician Level 2	**100%**			

Training Topics and Suggested Time Allocation

MOTORCYCLE TECHNICIAN– LEVEL 3

			% of Time Allocated to:		
		% of Time	Theory	Practical	Total
Line C	**USE TOOLS, EQUIPMENT AND DOCUMENTATION**	**3%**	**100%**	**0%**	**100%**
C1	Use diagnostic tools and equipment		✓		
Line E	**MAINTAIN CHASSIS AND COMPONENTS**	**12%**	**40%**	**60%**	**100%**
E1	Maintain frames		✓	✓	
E3	Maintain steering systems for multi-wheeled motorcycles		✓	✓	
E4	Maintain chassis standard and accessory components		✓	✓	
Line F	**MAINTAIN SUSPENSION SYSTEMS**	**15%**	**50%**	**50%**	**100%**
F1	Maintain front suspension components		✓	✓	
F2	Maintain front suspension components for multi-wheeled motorcycles		✓	✓	
F3	Maintain rear suspension components		✓	✓	
Line G	**MAINTAIN WHEELS AND TIRES**	**8%**	**20%**	**80%**	**100%**
G2	Maintain spoked wheels		✓	✓	
Line I	**MAINTAIN TWO-STROKE AND FOUR-STROKE ENGINES**	**22%**	**30%**	**70%**	**100%**
I1	Apply principles of engines and engine construction		✓		
I2	Maintain cylinder heads		✓	✓	
I3	Maintain valve systems on two-stroke engines		✓	✓	
I4	Maintain valve trains on four-stroke engines		✓	✓	
I5	Maintain cylinders and pistons		✓	✓	
I6	Maintain crankshaft assemblies		✓	✓	
I7	Maintain counterbalance assemblies		✓	✓	
I8	Maintain engine cases		✓	✓	
I9	Maintain lubrication systems		✓	✓	
I10	Maintain cooling systems		✓	✓	
Line K	**MAINTAIN TRANSMISSIONS**	**12%**	**30%**	**70%**	**100%**
K1	Maintain constant mesh transmissions		✓	✓	
Line L	**MAINTAIN FINAL DRIVE SYSTEMS**	**6%**	**30%**	**70%**	**100%**
L2	Maintain final drive shafts and gears		✓	✓	
Line M	**MAINTAIN ELECTRICAL SYSTEMS**	**11%**	**60%**	**40%**	**100%**
M1	Apply electrical and electronic principles		✓		
M3	Maintain electrical standard and accessory components		✓		
M4	Maintain wiring harness systems		✓	✓	
M5	Maintain ignition systems		✓	✓	
Line O	**MAINTAIN FUEL AND EXHAUST SYSTEMS**	**11%**	**40%**	**60%**	**100%**
O1	Maintain fuel tanks and fuel delivery components		✓	✓	

			% of Time Allocated to:		
		% of Time	Theory	Practical	Total
O2	Maintain air delivery systems		✓	✓	
O3	Maintain carburetor systems		✓	✓	
O4	Maintain exhaust systems		✓	✓	
	Total Percentage for Motorcycle Technician Level 3	**100%**			

Training Topics and Suggested Time Allocation

MOTORCYCLE TECHNICIAN– LEVEL 4

			% of Time Allocated to:		
		% of Time	Theory	Practical	Total
Line B	**PERFORM ROUTINE WORK PRACTICES**	**6%**	**100%**	**0%**	**100%**
B7	Conduct safety inspections		✓		
Line D	**USE COMMUNICATION AND MENTORING TECHNIQUES**	**5%**	**100%**	**0%**	**100%**
D2	Use mentoring techniques		✓		
Line H	**MAINTAIN BRAKING SYSTEMS**	**10%**	**50%**	**50%**	**100%**
H3	Maintain braking control systems		✓	✓	
Line I	**MAINTAIN TWO-STROKE AND FOUR-STROKE ENGINES**	**25%**	**30%**	**70%**	**100%**
I2	Maintain cylinder heads		✓	✓	
I4	Maintain valve trains on four-stroke engines		✓	✓	
I5	Maintain cylinders and pistons		✓	✓	
I6	Maintain crankshaft assemblies		✓	✓	
I7	Maintain counterbalance assemblies		✓	✓	
I8	Maintain engine cases		✓	✓	
I9	Maintain lubrication systems		✓	✓	
Line K	**MAINTAIN TRANSMISSIONS**	**15%**	**40%**	**60%**	**100%**
K1	Maintain constant mesh transmissions		✓	✓	
Line N	**MAINTAIN VEHICLE MANAGEMENT SYSTEMS**	**25%**	**50%**	**50%**	**100%**
N2	Use specialized equipment		✓	✓	
N3	Interpret diagnostic trouble codes (DTC) results		✓	✓	
N4	Maintain system circuitry and components		✓	✓	
N5	Update software		✓	✓	
Line O	**MAINTAIN FUEL AND EXHAUST SYSTEMS**	**11%**	**50%**	**50%**	**100%**
O5	Maintain fuel injection systems		✓	✓	
Line P	**MAINTAIN ELECTRIC MOTORCYCLES**	**3%**	**100%**	**0%**	**100%**
P1	Implement specific safety protocols for electric motorcycles		✓		
P2	Maintain electric motorcycles		✓		
	Total Percentage for Motorcycle Technician Level 4	**100%**			

Section 3

PROGRAM CONTENT

Motorcycle Technician

Level 1

Motorcycle 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:

- Describe maintaining safe work environment, including
  - WorkSafeBC and regulations
  - Workplace Hazardous Materials Information System (WHMIS)
  - Fire safety
  - Policies, procedures and practices

LEARNING TASKS	CONTENT

1. Describe WorkSafeBC	• Regulations
	  ○ Workers' Compensation Act
	  ○ Occupational Health and Saftey (OHS)
	• Rights and responsibilities
	  ○ Workers
	  ○ Employers
	  ○ WorkSafeBC

2. Describe WHMIS	• Purpose
	• Regulations
	• Responsible agencies
	• Types of hazardous materials
	  ○ Solvents
	  ○ Fuels
	  ○ Oils and filters
	  ○ Asbestos
	  ○ Acids
	  ○ Refrigerant
	  ○ Brake fluid
	  ○ Batteries
	• PPE requirements
	• Handling, storage and disposal of hazardous materials
	• Safety Data Sheets (SDS)
	  ○ Information provided
	  ○ Updating SDS
	  ○ Locations in shop
	• Labels and symbols
	• WHMIS-exempt materials

LEARNING TASKS	CONTENT

3. Describe fire safety	• Fire prevention
	  ○ Handling and storage of compustible materials
	  ○ Electrical equipment and circuits
	  ○ Fire safety plan
	• Classes of fires
	• Extinguisher types and uses
	• Fire response plans

4. Describe maintaining a safe work environment	• Workplace policies
	• Company and personal liabilities
	• Behaviour and attitude
	• Identification of hazards
	• Communication
	• Ventilation
	  ○ Exhaust gas extraction system
	• Lighting
	• Safety procedures
	  ○ Working on and around vehicles
	  ○ Test rides
	• Housekeeping practices
	  ○ Cleanliness
	  ○ Organization of space, tools, and materials

5. Describe stabilizing motorcycles	• Equipment
	  ○ Wheel clamps
	  ○ Stands
	  ○ Tie-downs
	• Preventing tipping and falling

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:

- Describe selecting, wearing and maintaining PPE.
- Describe safety equipment and its maintenance.

LEARNING TASKS	CONTENT

1. Describe selecting and wearing PPE	• Regulations and workplace policies
	• Personal rights and responsibilities
	• Applications, limitations and procedures for use
	• Types
	  ○ Eye protection
	  ○ Hearing protection
	  ○ Masks
	  ○ Respirators
	  ○ Coveralls
	  ○ Gloves
	  ○ Work boots
	  ○ Approved helmet

2. Describe safety equipment	• Regulations and workplace policies
	• Personal rights and responsibilities
	• Applications, limitations and procedures for use
	• Locations
	• Types
	  ○ Eye wash stations
	  ○ Workplace mats
	  ○ First aid kits

3. Describe maintaining PPE and safety equipment	• Inspections • Replacement • Disposal • Storage

Line (GAC): B PERFORM ROUTINE WORK PRACTICES

Competency: B1 Use trade-related consumables

Objectives

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

- Describe trade-related consumables.

LEARNING TASKS	CONTENT

1. Describe trade-related consumables	• Manufacturers' specifications and procedures
	• Regulations
	• Applications
	• Procedures for use
	• Storage
	• Disposal
	• Environmental considerations
	• Types
	  ○ Glues
	  ○ Sealants
	  ○ Paints
	  ○ Fasteners
	  ○ Lubricants
	  ○ Electrical supplies
	  ○ Bonding and locking agents
	  ○ Solvents
	  ○ Cleaners

Line (GAC): B PERFORM ROUTINE WORK PRACTICES

Competency: B2 Perform periodic maintenance of lubrication systems

Objectives

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

- Describe lubrication theory, types and classification systems.
- Describe lubricating two-stroke and four-stroke engines.
- Describe maintenance of lubrication systems.
- Service engine oil and filters.

LEARNING TASKS	CONTENT
1. Describe lubrication theory	• Friction • Petroleum-based oils • Synthetic oils • Semi-synthetics or blends • Environmentally-safe oils ○ Vegetable-based oil • Hydrodynamic lubrication

2. Describe types of lubricants	• Oils
	  ○ Types
	  – Two-stroke
	  – Four-stroke
	  – Gear
	  – Hydraulic
	  – Vegetable-based
	  ○ Properties
	  ○ Additives
	  – Teflon
	  – Moly blend
	  ○ Uses
	• Greases
	  ○ Types
	  – Soap-based
	  – Clay-based
	  ○ Properties
	  ○ Additives
	  ○ Uses
	• Environmental considerations

3. Describe lubricant classification systems	• Society of Automotive Engineering (SAE)

LEARNING TASKS	CONTENT
	○ Oil functions ○ Viscosity ○ Single and multi grades ○ Detergent/non detergent • American Petroleum Institute (API) • Japanese Automotive Standards Organization (JASO) • National Lubricating Grease Institute (NLGI) • Ratings and labelling • Two-stroke ○ Two-cycle (TC) ○ Two-cycle water cooled (TC-W) ○ Formulations (TC-W2, TC-W3) • Four-stroke ○ JASO MA (for wet-clutch) ○ JASO MB (for automatic)
4. Describe lubricating two- and four- stroke engine systems	• Two-stroke ○ Mix ratios ○ Injected ○ Pre-mixed • Four-stroke ○ Crankcase (wet sump) ○ Dry sump
5. Describe maintenance of lubrication systems	• Scheduling ○ Monthly ○ Distance ○ Hourly ○ Condition (moisture) • Filter change ○ Environment conditions – Normal – Severe – Extreme • Filters ○ Oil ○ Positive Crankcase Ventilation (PCV) • Materials ○ Foam

LEARNING TASKS	CONTENT
	○ Metal mesh ○ Paper ○ Canister ○ Oiled
6. Describe servicing lubrication systems	• Manufacturers' specifications and procedures • Precautions ○ Spillage ○ Hot/cold drain ○ Over/under filling ○ Turbo priming ○ Post-change leak inspection ○ Correct fluids • Procedures ○ Hot/cold drain ○ Stepped procedures ○ Priming ○ Filling ○ Test ride • Fluid service ○ Engine oil ○ Transmission ○ Differentials ○ Final drives (shaft drives) ○ Hydraulics ○ Brake ○ Clutch ○ Gearboxes
7. Perform periodic maintenance of lubrication systems	• Servicing ○ Engine oil ○ Filters

Achievement Criteria

Performance	The learner will service engine oil and filters.
Conditions	The learner will be given • Manufacturers' specifications and procedures • Motorcycle • Tools and equipment
Criteria	The learner will be evaluated on • Safety • Adherence to manufacturers' specifications and procedures • Quality of service

Line (GAC): B PERFORM ROUTINE WORK PRACTICES

Competency: B3 Perform periodic maintenance of cooling systems

Objectives

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

- Service cooling systems, including air and liquid cooled systems.

LEARNING TASKS	CONTENT

1. Describe engine cooling theory	• Air cooling
	  ○ Oil cooling
	  ○ Surface area
	  ○ Cooling fins
	  ○ Air flow
	• Liquid cooling
	  ○ Coolant flow
	  ○ Pressurized systems
	  ○ Radiant heat dissipation
	  ○ Types of coolants
	  – Ethylene glycol
	  – Long-life
	  – Environmentally safe

2. Perform maintenance of liquid-cooled systems	• Manufacturers' specifications and procedures
	• Coolant testing
	  ○ pH
	  ○ Concentration
	  ○ Hydrometer
	  ○ Electrolysis (with volt meter)
	• Coolant changing
	• Thermostat testing
	• Pressure testing
	• Thermostatic switches
	• Fans

3. Perform maintenance of air-cooled systems	• Manufacturers' specifications and procedures • Oil cooler inspections • Cooling fin maintenance • Air ducting (shrouds) • Fans • Cleaning procedures

Achievement Criteria

Performance	The learner will service cooling systems.
Conditions	The learner will be given • Manufacturers' specifications and procedures • Motorcycle • Tools and equipment
Criteria	The learner will be evaluated on • Safety • Adherence to manufacturers' specifications and procedures • Quality of service

Line (GAC): B PERFORM ROUTINE WORK PRACTICES

Competency: B4 Perform periodic maintenance of bearings

Objectives

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

- Describe bearing types and their maintenance.
- Service wheel bearings.

LEARNING TASKS	CONTENT

1. Describe bearing systems	• Rolling
	  ○ Design
	  ○ Components
	  ○ Load application
	  ○ Uses
	  – Rotating shafts
	  – Rotating axles
	  ○ Types
	  – Single ball
	  – Double ball
	  – Needle
	  – Taper roller
	• Plain
	  ○ Uses
	  – Journals
	  – Shafts
	  ○ Types
	  – Shell
	  – Bushing
	  – Oil-lite

2. Describe bearing maintenance	• Cleaning
	  ○ Solvent bath
	  ○ Rubber precautions
	• Inspection
	  ○ Spalling
	  ○ Overheating
	  ○ Electrical pitting
	  ○ Denting and brinelling
	  ○ Water damage
	  ○ Coolant damage
	• Lubrication
	  ○ Oiling

LEARNING TASKS	CONTENT
3. Perform simple bearing maintenance	○ Packing • Pre-loading • Basic diagnosis of bearings • Replacement of wheel bearings

Achievement Criteria

Performance — The learner will service wheel bearings.

Conditions — The learner will be given

- Manufacturers' specifications and procedures
- Motorcycle
- Tools and Equipment

Criteria — The learner will be evaluated on

- Safety
- Adherence to manufacturers' specifications and procedures
- Quality of service

Line (GAC): B PERFORM ROUTINE WORK PRACTICES

Competency: B5 Perform storage procedures

Objectives

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

- Describe storage procedures.

LEARNING TASKS

1. Describe storage procedures

CONTENT

- Manufacturers' specifications and procedures
- Short-term (seasonal)
- Long-term
  - Returning motorcycle to service
- Lubing cylinders
- Precautions
  - Storage oils
  - Cycling engine
- Draining carburetors
- Topping up tanks
- Adding stabilizers
- Protective coatings
- Disconnecting batteries
  - Full charge
- Setting tire pressure
- Fitted covers

Line (GAC): B PERFORM ROUTINE WORK PRACTICES

Competency: B6 Prepare new motorcycles

Objectives

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

- Describe preparing new motorcycles for sale.

LEARNING TASKS	CONTENT
1. Describe assembly procedures	• Manufacturers' specifications and procedures • Inspecting and reporting for damage from shipping • Uncrating • Assembly • Preparation for showroom • Pre-delivery inspection (PDI)

2. Describe accessory (upgrades) components	• Electrical/electronic accessories
	  ○ Heated grips
	  ○ GPS
	  ○ Fog lamps
	• Hard accessories
	  ○ Luggage
	  ○ Windscreens
	  ○ Engine/frame guards

3. Describe preparing motorcycle for showroom	• Detailing
	  ○ Selecting products for task/component
	• Pressure washing precautions
	  ○ Electrical components and instrumentation
	  ○ Intake
	  ○ Paint and finishes
	  ○ Chain o-rings
	  ○ Labels and decals

Line (GAC): C USE TOOLS, EQUIPMENT AND DOCUMENTATION

Competency: C1 Use diagnostic tools and equipment

Objectives

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

- Describe diagnostic tools and equipment and their maintenance.
- Perform basic electrical measurements using a DMM.

LEARNING TASKS	CONTENT
1. Describe diagnostic tools and equipment	• Manufacturers' specifications and procedures • Digital Multi-meter (DMM) • Leak-down tester • Compression gauges • Vacuum gauges • Computer diagnostic software • Exhaust gas analyzers • Battery testers
2. Describe diagnostic tools and equipment maintenance	• Manufacturers' specifications and procedures • Storage • Inspection • Maintenance • Calibration • Operation
3. Perform basic electrical measurements in series and parallel circuits using a DMM	• Voltage • Current • Resistance

Achievement Criteria

Performance	The learner will perform basic electrical measurements using a DMM.
Conditions	The learner will be given • Manufacturers' specifications and procedures • Motorcycle or component • Tools and equipment
Criteria	The learner will be evaluated on • Safety • Adherence to manufacturers' specifications and procedures • Accuracy of measurements

Line (GAC): C USE TOOLS, EQUIPMENT AND DOCUMENTATION

Competency: C2 Use precision measuring instruments

Objectives

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

- Describe precision measuring instruments and their use.
- Perform basic measurements using precision measuring instruments.

LEARNING TASKS	CONTENT

1. Describe precision measuring instruments	• Manufacturers' specifications and procedures
	• Steel rules
	• Tapes
	• Calipers and dividers
	  ○ Inside
	  ○ Outside
	  ○ Dividers
	  ○ Vernier
	• Micrometers
	  ○ Inside
	  ○ Outside
	  ○ Depth
	• Gauges
	  ○ Telescoping
	  ○ Internal bore
	  ○ Plasti
	  ○ Ball
	  ○ Feeler
	  ○ Angle
	• Dial indicators
	• Torque wrenches

2. Describe using precision measuring instruments	• Manufacturers' specifications and procedures
	• Selection
	• Storage
	• Measurements
	  ○ Inside
	  ○ Outside
	  ○ Depth
	  ○ Radial
	  ○ Linear

LEARNING TASKS	CONTENT
	○ Circumference ○ Diameter ○ Stroke ○ Torque ○ Run-out ○ Taper • Maintenance • Calibration/Zeroing
3. Perform basic measurements using precision measuring instruments	• Tire pressure guages • Torque wrenches • Digital (vernier) calipers • Dial indicators

Achievement Criteria

Performance — The learner will perform basic measurements using precision measuring instruments.

Conditions — The learner will be given
- Manufacturers' specifications and procedures
- Motorcycle or component
- Tools and equipment

Criteria — The learner will be evaluated on
- Safety
- Adherence to manufacturers' specifications and procedures
- Accuracy of measurement

Line (GAC): C USE TOOLS, EQUIPMENT AND DOCUMENTATION

Competency: C3 Use hand tools

Objectives

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

- Describe hand tools and their use.
- Describe fastening devices and threading systems.
- Perform thread repair.

LEARNING TASKS	CONTENT

1. Describe hand tools	• Manufacturers' specifications and procedures
	• Wrenches
	  ○ US standard/metric
	  – Types
	  – Applications
	  ○ Torque
	  – Types
	  – Applications
	• Pullers
	  ○ Internal
	  ○ External
	  ○ Specialty
	• Socket sets
	• Pliers
	• Screwdrivers
	• Hammers
	• Punches and chisels
	• Impact drivers
	• Files and hacksaws
	• Vises

2. Describe using hand tools	• Manufacturers' specifications and procedures • Safety • Uses • Identification and selection • Inspection • Operation • Cleaning and maintenance • Storage

LEARNING TASKS	CONTENT
3. Describe fastening devices	• Washers • Keys • Pins • Circlips • Retaining clips

4. Describe threading systems	• Screw thread systems
	  ○ Terminology
	  ○ Metric and imperial
	  ○ Size and pitch
	• Thread fastener designs
	  ○ Tensile strength
	• Thread lubricants
	• Thread locking agents
	• Taps and tap wrenches
	• Dies and die stocks
	• Thread inserts
	• Common tapping problems
	• Thread repair
	• Broken stud removal

5. Perform thread repair	• Drilling
	  ○ Identification of metals and hardness
	  ○ Selection of drill bits
	• Threading and thread repairs
	• Measuring thread pitches and sizes
	• Fastener torquing as per manufacturers' specifications and procedures

Achievement Criteria

Performance The learner will perform thread repair.

Conditions The learner will be given

- Manufacturers' specifications and procedures
- Component
- Tools and equipment

Criteria The learner will be evaluated on

- Safety
- Adherence to manufacturers' specifications and procedures
- Quality of repair

Line (GAC): C USE TOOLS, EQUIPMENT AND DOCUMENTATION

Competency: C4 Use heating/cutting tools and equipment

Objectives

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

- Use heating/cutting tools and equipment.

LEARNING TASKS	CONTENT

1. Describe heating/cutting tools and equipment	• Types
	• Components
	  ○ Cylinders
	  ○ Valves
	  ○ Regulators
	  ○ Torches
	  ○ Devices
	• Gases
	  ○ Oxygen
	  ○ Acetylene
	  ○ Propane

2. Describe safety considerations for using heating/cutting tools and equipment	• OHS regulations
	• Shop procedures and best practices
	• Work clothes and PPE
	• Safety equipment
	• Personal behaviours
	  ○ Awareness of hazards
	  ○ Daily clean up
	• Emergency procedures
	  ○ Firefighting equipment
	  ○ First aid

3. Use heating/cutting tools and equipment	• Oxyacetylene set up and shut down
	  ○ Assembly
	  ○ Lighting and adjusting torch
	  ○ Shutting down
	  ○ Disassembly
	• Using torches for heating
	  ○ Lighting techniques
	  ○ Heating techniques
	• Using torches for cutting
	  ○ Lighting techniques
	  ○ Cutting techniques

LEARNING TASKS

CONTENT

- Maintenance and storage of equipment and gases

Achievement Criteria

Performance	The learner will use heating/cutting tools and equipment.
Conditions	The learner will be given • Tools and equipment • Suitable material
Criteria	The learner will be evaluated on • Safety • Quality of work • Torch-use techniques

Line (GAC): C USE TOOLS, EQUIPMENT AND DOCUMENTATION

Competency: C5 Use pneumatic and electric power tools and equipment

Objectives

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

- Use pneumatic and electric power tools and equipment.

LEARNING TASKS	CONTENT
1. Describe pneumatic and electric power tools and equipment	• Compressors • Impact gun (wrenches) • Ratchets • Air blowers • Inflators • Drills • Rotary grinders

2. Use pneumatic and electric power tools and equipment	• Manufacturers' specifications and procedures
	• Selection
	• Storage
	• Inspection
	• Maintenance
	  ○ Sharpening
	  ○ Cleaning
	  ○ Lubrication
	  ○ Charging

Achievement Criteria

Performance	The learner will use power tools and equipment.
Conditions	The learner will be given • Tools and equipment • Suitable material
Criteria	The learner will be evaluated on • Safety • Quality of work • Tool-use techniques

Line (GAC): C USE TOOLS, EQUIPMENT AND DOCUMENTATION

Competency: C6 Use shop equipment

Objectives

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

- Describe using shop equipment, including drill press, bench grinder, lifting equipment and welding equipment.

LEARNING TASKS	CONTENT

1. Describe shop equipment	• Parts washer
	• Drill press
	• Hydraulic press
	• Bench grinder
	• Lifting equipment
	  ○ Motorcycle hoists
	  ○ Hydraulic jacks
	  ○ Overhead cranes
	  ○ Mechanical lifts
	  ○ Hydraulic lifts
	  ○ Winch lifts
	  ○ Slings
	  ○ Securing devices
	  – Blocking
	  – Supporting
	  – Quick stands
	  – Tie-down devises

2. Describe using shop equipment	• Manufacturers' specifications and procedures
	• OHS regulations
	• Applications
	• Inspection
	• Maintenance
	  ○ Oiling
	  ○ Cleaning
	  – Solvents/parts washer
	  – Glass bead machine
	  – Pressure washer
	• Storage
	• Calibration

3. Describe welding equipment and its operation	• Manufacturers' specifications and procedures

LEARNING TASKS

CONTENT

- Gas Metal Arc Welding (GMAW)/ Metal Inert Gas (MIG)
- Unit power source
- Electrical principals
- Types of wire electrodes
- Wire feed assemblies
- Gas flow pressures and volumes
- Operation
    - Principles
    - Applications
    - Safety

Line (GAC): C USE TOOLS, EQUIPMENT AND DOCUMENTATION

Competency: C7 Use documentation

Objectives

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

- Describe documentation, including service information, inventory control systems, and record keeping.

LEARNING TASKS	CONTENT

1. Describe service information	• Manufacturers' specifications and procedures
	• Locating resources and information
	• Technical Service Bulletins (TSB)
	• Forms
	  ○ Hard copy
	  ○ Electronic
	• Safety recalls

2. Describe inventory control systems	• Work orders • Purchase orders • Parts department • Shop supplies

3. Describe record keeping	• Work orders
	  ○ Internal
	  ○ External
	  – Model
	  – Vehicle Identification Number (VIN)
	  – Year
	• Purchase requisitions
	• Purchase orders
	• PDI forms
	• Insurance or warranty claim forms
	• Time cards
	• Service history records
	• Service check lists
	• Maintenance schedule lists

Line (GAC): D USE COMMUNICATION AND MENTORING TECHNIQUES

Competency: D1 Use communication techniques

Objectives

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

- Describe communication skills.

LEARNING TASKS	CONTENT

1. Describe essential skills	• Background
	  ○ Employment and Social Development Canada
	  ○ Identified by employers as the skills required to perform on the job
	• Reading
	• Document use
	• Numeracy
	• Writing
	• Oral communication
	• Working with others
	• Thinking
	• Computer use
	• Continuous learning

2. Describe shop organization and control structure	• People and groups in the workplace
	• Service department structure
	  ○ Service manager
	  ○ Service writer
	  ○ Journeyperson
	  ○ Apprentice
	• Parts department
	• Sales department
	• Types of pay

3. Describe resource and time management	• Productivity/efficiency • Planning work tasks • Avoiding waste
4. Describe teamwork	• Importance of teamwork to the business • Personal responsibility and attitudes • Working cooperatively

LEARNING TASKS	CONTENT
	• Working independently • Interpersonal relationships • Keeping workplace free of harassment and discrimination • Staff meetings
5. Describe communication skills	• Interpersonal skills • Active listening • Problem solving • Interpreting meaning • Cultural contexts • Tone of voice • Body language • Personal appearance • Telephone skills • Giving and following instructions

Line (GAC): G MAINTAIN WHEELS AND TIRES

Competency: G1 Maintain tires

Objectives

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

- Inspect tires.
- Service tires.

LEARNING TASKS	CONTENT

1. Describe tire construction	• Types
	  ○ Tube and tubeless
	  ○ Bias ply
	  ○ Radial
	• Materials
	  ○ Rubber compounds
	  ○ Nylon
	  ○ Aramids
	  ○ Foam
	  ○ Plastic
	• Components
	  ○ Valve Stems
	  ○ Tubes
	  ○ Rim bands
	  ○ Rim locks
	  ○ Tire Pressure Monitoring Systems (TPMS)

2. Describe tire coding	• Imperial and metric sizing • Size coding variations • Aspect ratios • Speed ratings • Load index • Ply ratings • Maximum inflation pressure • Directional arrows • Date coding
3. Inspect tires	• Manufacturers' specifications and procedures • Checks and measurements • Tire conditions and defects ○ Wear

LEARNING TASKS	CONTENT
	○ Rubber deterioration
4. Remove and reinstall/replace tires	• Manufacturers' specifications and procedures • Surface protection ○ Masking ○ Covers • Component removal and replacement (Re & Re) to access tires ○ Fenders ○ Shocks ○ Exhaust ○ Seats ○ Luggage ○ Final drives ○ Brakes • Tire deflating and removal ○ Tire machine • Tire inflation ○ Bead sealing ○ Maximum pressure
5. Perform tire repair	• Provincial Motor Vehicle Act • Manufacturers' specifications and procedures • Determining replacement vs. repair • Types of repair ○ Tube patching ○ Tire patching ○ Temporary plug ○ Sealing liquids
6. Perform tire balancing	• Static ○ Truing stand • Dynamic ○ Computerized balancing machine

Note: see G3 Maintain cast wheels for Achievement Criteria

Line (GAC): G MAINTAIN WHEELS AND TIRES

Competency: G3 Maintain cast wheels

Objectives

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

- Inspect and service cast wheels.

LEARNING TASKS	CONTENT
1. Describe wheel rim design	• Rim contours • Rim width and tire-size range • Rim locks

2. Describe cast wheels	• Types/materials
	  ○ Drop-center
	  ○ Steel
	  ○ Drop-forged aluminum
	  ○ Plastic
	  ○ Carbon fibre
	  ○ Billet
	  ○ Stamped
	• Components
	  ○ Bearings
	  ○ Spacers
	  ○ Speedometer drive
	  ○ Cush drive
	  ○ ABS reluctors
	  ○ ABS sensors
	  ○ TPMS Sensors
	  ○ Balancing weights
	  ○ Valve
	  ○ Seals
	  ○ Hubs
	  ○ Axles

3. Inspect wheels	• Wheel condition
	  ○ Runout
	  ○ Cracking
	  ○ Lug wear
	  ○ Bends
	  ○ Warps
	  ○ Bearing damage
	• Component condition

LEARNING TASKS	CONTENT

4. Perform wheel service	• Manufacturers' specifications and procedures
	• Handling precautions
	  ○ Styles
	  ○ Taping
	  ○ Scratches
	  ○ Chips
	  ○ Sharp objects
	• Sublet repairs
	• Bead cleaning and preparation
	• Component removal, replacement and service

Achievement Criteria

Note: This achievement criteria covers both G1 Maintain tires and G3 Maintain cast wheels.

Performance	The learner will Re & Re a tire and wheel and perform tire balancing.
Conditions	The learner will be given • Manufacturers' specifications and procedures • Motorcycle or motorcycle wheel • Tools and equipment
Criteria	The learner will be evaluated on • Safety • Adherence to manufacturer's specifications and procedures • Quality of work

Line (GAC): H MAINTAIN BRAKING SYSTEMS

Competency: H1 Maintain hydraulic braking systems

Objectives

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

- Diagnose and service hydraulic braking systems.

LEARNING TASKS	CONTENT
1. Describe theory of hydraulic braking systems	• Pascal's law • Characteristics of fluid • Hydraulic movement • Pressure multiplication

2. Describe brake fluids	• Manufacturers' specifications and procedures
	• Classifications
	  ○ US Department of Transportation (DOT)
	  ○ DOT 3, 4, 5, 5.1
	• Handling and storage

3. Describe hydraulic brake components	• Master cylinders • Single- and double- acting piston calipers • Disc or rotors • Drums and shoes • Pads • Wheel cylinders (All-terrain Vehicle (ATVs)) • Anti-lock Braking System (ABS) modules

4. Diagnose hydraulic braking systems	• Conditions
	  ○ Sponginess
	  ○ Fading
	  ○ Lockup
	  ○ Dragging
	  ○ Binding
	  ○ Seizing
	• Checks and measurements
	• Causes of failure
	• Determining servicing procedures

5. Service hydraulic braking systems	• Manufacturers' specifications and procedures • Component replacement

LEARNING TASKS	CONTENT

	• Bleeding
	• Adjustments
	• Fluid inspection
	  ○ Level
	  ○ Moisture content
	  ○ Fluid replacement

6. Rebuild components	• Disassembly and assembly
	  ○ Master cylinders
	  ○ Calipers

Line (GAC): H MAINTAIN BRAKING SYSTEMS

Competency: H2 Maintain mechanical braking systems

Objectives

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

- Diagnose and service mechanical braking systems.

LEARNING TASKS	CONTENT

1. Describe mechanical braking systems	• Types
	  ○ Disc
	  ○ Drum
	  ○ Parking brake
	• Components
	  ○ Single leading shoe
	  ○ Double leading shoe
	  ○ Discs
	  ○ Cables
	  ○ Linkages
	• Operation

2. Diagnose mechanical braking systems	• Manufacturers' specifications and procedures
	• Conditions
	  ○ Squealing
	  ○ Sponginess
	  ○ Pulsation
	  ○ Fading
	  ○ Lockup
	  ○ Dragging
	  ○ Binding
	  ○ Seizing
	• Checks and measurements
	• Causes of failure
	• Determining servicing procedures

3. Service mechanical braking systems	• Manufacturers' specifications and procedures • Adjustments • Component removal and replacement • Cleaning procedures and precautions (asbestosis)

Achievement Criteria

Performance	The learner will service mechanical brakes, including • Inspection • Replacement • Adjustment
Conditions	The learner will be given • Manufacturers' specifications and procedures • Motorcycle • Tools and equipment
Criteria	The learner will be evaluated on • Safety • Adherence to manufacturers' specifications and procedures • Quality of service

Line (GAC): L MAINTAIN FINAL DRIVE SYSTEMS

Competency: L1 Maintain final drive chains and sprockets

Objectives

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

- Clean, lubricate, and adjust final chain drive systems.

LEARNING TASKS	CONTENT

1. Describe final drive chains and sprockets	• Chain drives
	  ○ Cushioned
	  ○ Uncushioned
	• Chains
	  ○ O-rings
	  ○ Non-O-rings
	  ○ Hyvo chains (silent)
	  ○ Rollers
	  ○ Master links (detachable)
	• Sprockets
	  ○ Aluminum
	  ○ Steel
	  ○ Cushioned
	  ○ Non-cushioned

2. Describe diagnosis of final drive chains and sprockets	• Inspection • Determining defects and wear • Causes of failure • Determining servicing procedures
3. Service final drive chains and sprockets	• Manufacturers' specifications and procedures • Cleaning • Sizing • Matching chains and sprockets • Removing and replacing • Lubrication • Inspecting and adjusting

Achievement Criteria

Performance	The learner will clean, lubricate, and adjust chain drive systems.
Conditions	The learner will be given • Manufacturers' specifications and procedures • Motorcycle • Tools and equipment
Criteria	The learner will be evaluated on • Safety • Adherence to manufacturers' specifications and procedures • Quality of service

Line (GAC): L MAINTAIN FINAL DRIVE SYSTEMS

Competency: L3 Maintain final drive belts and pulleys (sprockets)

Objectives

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

- Inspect, clean, and adjust final drive belt and pulleys (sprockets).

LEARNING TASKS	CONTENT

1. Describe final drive belts and pulleys (sprockets)	• Belts
	  ○ Multiple
	  – Cogged
	  – Tracks
	  ○ Ribbed
	  ○ Timed
	• Drive mechanisms
	  ○ Front (drive) pulley
	  ○ Rear (driven) pulley

2. Describe diagnosing final drive belts and pulleys (sprockets)	• Inspection
	• Tension gauges
	• Alignment methods
	• Defects
	  ○ Cracks
	  ○ Holes
	  ○ Stretch
	  ○ Splits
	  ○ Wear
	  ○ Alignment
	  ○ Tension
	• Noise
	• Causes of failure
	• Determinig servicing procedures

3. Service final drive belt and pulleys (sprockets)	• Manufacturers' specifications and procedures
	• Precautions
	  ○ Contamination (oils and greases)
	  ○ Tight bends
	  ○ Adjustments
	• Removal and replacement
	• Matching

LEARNING TASKS

CONTENT

- Length/width
- Cog size
- Application
- Power
- Taper
- Turn radius

- Routing
- Cleaning
- Tensioning
- Alignment

Achievement Criteria

Performance	The learner will inspect, clean, and adjust final drive belt and pulleys (sprockets).
Conditions	The learner will be given • Manufacturers' specifications and procedures • Motorcycle • Tools and equipment
Criteria	The learner will be evaluated on • Safety • Adherence to manufacturers' specifications and procedures • Quality of service

Line (GAC): M MAINTAIN ELECTRICAL SYSTEMS

Competency: M1 Apply electrical and electronic principles

Objectives

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

- Describe electrical principles, circuits, diagrams, and schematics.

LEARNING TASKS	CONTENT

1. Describe electrical principles	• Atomic structure
	• Electrical charges
	• Electron flow
	• Conductors and insulators
	• Voltage, current and resistance
	• Sources of electricity
	  ○ Chemical
	  ○ Magnetic

2. Describe electrical circuits	• Components
	  ○ Power supply
	  ○ Conductors
	  ○ Loads
	  ○ Connectors
	  ○ Switches
	  ○ Fuses
	  – Inline
	  – Main
	  – Fusible links
	• Ohm's Law
	  ○ Current
	  ○ Voltage
	  ○ Resistance
	  ○ Calculations
	  ○ Wattage
	• Types
	  ○ Series
	  ○ Parallel
	  ○ Series-parallel

3. Describe diagrams and schematics	• Types
	  ○ Wiring
	  ○ System-specific
	  ○ Component-specific

Line (GAC): M MAINTAIN ELECTRICAL SYSTEMS

Competency: M2 Maintain batteries

Objectives

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

- Maintain batteries.

LEARNING TASKS	CONTENT

1. Describe batteries	• Types
	  ○ Lead-acid
	  ○ Gel-type
	  ○ Lithium-ion
	• Construction
	• Electrolytes
	• Operating cycles
	• Dry-charged
	• Maintenance-free
	• Capacity ratings

2. Diagnose battery condition	• Manufacturers' specifications and procedures
	• Testing
	  ○ Load
	  ○ Standing voltage
	  ○ Open circuit
	  ○ Capacity
	  ○ Conductivity
	  ○ Parasitic draw
	  ○ Surface draw
	• Faults
	  ○ Causes of failure
	• Determining servicing procedures

3. Service batteries	• Manufacturers' specifications and procedures • Safety precautions • Replacing • Cleaning posts • Filling electrolytes • Charging batteries • Initializing/activating

Achievement Criteria

Performance	The learner will test and/or initialize a battery.
Conditions	The learner will be given • Manufacturers' specifications and procedures • A battery • Tools and equipment
Criteria	The learner will be evaluated on • Safety • Adherence to manufacturers' specifications and procedures • Quality of service

Line (GAC): M MAINTAIN ELECTRICAL SYSTEMS

Competency: M3 Maintain electrical standard and accessory components

Objectives

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

- Describe standard electrical components.

LEARNING TASKS	CONTENT

1. Describe standard electrical components	• Standard vs. accessory components
	• Types of standard components
	  ○ Lights
	  ○ Horns
	  ○ Signal systems

Line (GAC): N MAINTAIN VEHICLE MANAGEMENT SYSTEMS

Competency: N1 Read diagnostic trouble codes (DTC)

Objectives

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

- Read and record DTCs.

LEARNING TASKS	CONTENT

1. Describe vehicle management systems	• Types
	  ○ Engine management
	  ○ Braking
	  ○ Traction control
	  ○ Displays
	  ○ Suspension
	• Components
	  ○ Malfunction indicator light (MIL)
	  ○ Sensors
	  ○ Modules
	  ○ Controller Area Network (CAN bus)

2. Read DTCs	• Manufacturers' specifications and procedures • Using diagnostic equipment • Checking for fault codes • Determining meaning • Recording fault codes

Achievement Criteria

Performance	The learner will read and record DTCs.
Conditions	The learner will be given • Manufacturers' specifications and procedures • Motorcycle • Diagnostic equipment
Criteria	The learner will be evaluated on • Safety • Adherence to manufacturers' specifications and procedures • Accuracy of data gathered

Level 2

Motorcycle Technician

Line (GAC): C USE TOOLS, EQUIPMENT AND DOCUMENTATION

Competency: C1 Use diagnostic tools and equipment

Objectives

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

- Perform tests using diagnostic tools and equipment.

LEARNING TASKS	CONTENT
1. Describe diagnostic tools and equipment	• Leak-down testers • Compression gauges • Vacuum gauges • Computers • Diagnostic software • DMM/multimeters

2. Perform tests using diagnostic tools and equipment	• Manufacturers' specifications and procedures
	• Using mechanical diagnotic tools
	  ○ Compression test
	  ○ Leak-down test
	• Using DMM
	  ○ Voltage drop test
	• Using diagnostic software
	  ○ Inspecting for fault codes
	  ○ Monitoring data

Achievement Criteria

Performance	The learner will perform tests using diagnostic tools and equipment.
Conditions	The learner will be given • Manufacturers' specifications and procedures • Motorcycle • Diagnostic tools and equipment
Criteria	The learner will be evaluated on • Safety • Adherence to manufacturers' specifications and procedures • Accuracy of results gathered

Line (GAC): E MAINTAIN CHASSIS AND COMPONENTS

Competency: E1 Maintain frames

Objectives

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

- Describe frames.
- Describe performing a visual inspection of a frame.

LEARNING TASKS	CONTENT

1. Describe frames	• Types
	  ○ Full-cradle
	  ○ Single-cradle
	  ○ Double-cradle
	  ○ Perimeter (Delta)
	  ○ Backbone
	  ○ Stamped
	  ○ Modular
	  ○ Trellis
	• Components
	• Handling
	  ○ Wheelbase
	  ○ Rake and trail
	  ○ Offset
	• Materials
	  ○ Steel
	  ○ Aluminum
	  ○ Composites

2. Describe performing a visual inspection of a frame	• Manufacturers' specifications and procedures • Safety • Bolt alignment • Modifications • Record and report findings

Line (GAC): E MAINTAIN CHASSIS AND COMPONENTS

Competency: E2 Maintain steering heads

Objectives

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

- Service steering heads for 2-wheeled motorcycles.

LEARNING TASKS	CONTENT
1. Describe steering heads for 2-wheeled motorcycles	• Steering stems • Upper and lower triple clamps • Bearings • Steering dampers • Front axle components • Linkages • Pivot shafts

2. Diagnose steering heads for 2-wheeled motorcycles	• Manufacturers' specifications and procedures
	• Inspection
	  ○ Smoothness of operation
	  ○ Excessive play
	  ○ Wear
	  ○ Notchy feel
	• Measurements

3. Service steering heads for 2-wheeled motorcycles	• Manufacturers' specifications and procedures • Head tightening • Bearing adjustment • Lubing • Bearing and race removal and replacement

Achievement Criteria

Performance	The learner will service steering heads for 2-wheeled motorcycles.
Conditions	The learner will be given • Manufacturers' specifications and procedures • Motorcycle • Tools and equipment
Criteria	The learner will be evaluated on • Safety • Adherence to manufacturers' specifications and procedures • Quality of service

Line (GAC): E MAINTAIN CHASSIS AND COMPONENTS

Competency: E3 Maintain steering systems for multi-wheeled motorcycles

Objectives

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

- Describe diagnosing steering systems for multi-wheeled motorcycles.

LEARNING TASKS	CONTENT

1. Describe steering systems for multi-wheeled motorcycles	• Types
	  ○ 3-wheeled
	  – Non-leaning
	  – Leaning
	  ○ 4-wheeled (ATV)
	  – Rack and Pinion
	  – Electronic Power Steering (EPS)
	• Components
	  ○ Steering stems
	  ○ Upper and lower triple clamps
	  ○ Bearings
	  ○ Steering dampers
	  ○ Front axle components
	  ○ Linkages and tie rods
	  ○ Pivot shafts
	  ○ Bell cranks

2. Describe diagnosing steering systems for multi-wheeled motorcycles	• Manufacturers' specifications and procedures • Inspection • Conditions • Causes of failure • Testing and measurements

Line (GAC): E MAINTAIN CHASSIS AND COMPONENTS

Competency: E4 Maintain chassis standard and accessory components

Objectives

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

- Install chassis accessory components.

LEARNING TASKS	CONTENT

1. Describe chassis components	• Standard
	  ○ Wheels
	  ○ Fenders
	  ○ Forks
	  ○ Fairings
	  ○ Shocks
	• Accessories
	  ○ Engine guards
	  ○ Hand guards
	  ○ Centre/side stands
	  ○ Luggage and mounts
	  ○ Windshields
	  ○ Back rests

2. Install chassis accessory components	• Manufacturers' specifications • Installation procedures • Tool use • Verification of operation of component and motorcycle

Achievement Criteria

Performance	The learner will remove and install an accessory chassis component.
Conditions	The learner will be given • Manufacturers' specifications and/or procedures • Motorcycle • Tools and equipment
Criteria	The learner will be evaluated on • Safety • Adherence to manufacturers' specifications and/or procedures • Quality of installation

Line (GAC): F MAINTAIN SUSPENSION SYSTEMS

Competency: F1 Maintain front suspension components

Objectives

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

- Describe diagnosing and servicing front-suspension components.

LEARNING TASKS	CONTENT

1. Describe front-suspension systems	• Principles of suspension
	  ○ Sprung weight
	  ○ Un-sprung weight
	• Types
	  ○ Forks
	  – Conventional
	  – Inverted
	  – Springer
	  – Tele-lever
	  ○ Links
	  – Leading
	  – Trailing

2. Describe front-suspension components	• Forks
	  ○ Stanchions
	  ○ Seals
	  ○ Springs
	  ○ Bushings
	  ○ Valving
	• Shock absorbers/dampers
	  ○ Adjustable
	  ○ Non-adjustable
	  ○ Air
	• Linkages
	  ○ Bushings
	  ○ Arms
	  ○ Pivots
	• Springs
	  ○ Single-rate
	  ○ Progressive
	  ○ Air

3. Describe diagnosis of front-suspension components	• Manufacturers' specifications and procedures

LEARNING TASKS	CONTENT

	• Inspections
	  ○ Springs
	  – Broken
	  – Sagging
	  ○ Leaks
	  – Fluid
	  – Air
	  ○ Noises

4. Describe servicing front-suspension components	• Manufacturers' specifications and procedures
	• Safety precautions
	• Specialized tools
	• Lubrication
	• Removal and replacement
	• Adjustments
	• Fork oil change
	• Fork disassembly and assembly
	• Seal replacement
	• Filling bladders
	• Bleeding air
	• Pressure
	  ○ Air
	  ○ Dampening
	• Adjustments
	  ○ Ride tension (spring)
	  ○ Ride height (air)

Line (GAC): F MAINTAIN SUSPENSION SYSTEMS

Competency: F2 Maintain front suspension components for multi-wheeled motorcycles

Objectives

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

- Describe diagnosing front suspension components for multi-wheeled motorcycles.
- Service ATV front suspension components.

LEARNING TASKS	CONTENT
1. Describe front suspension systems for multi-wheeled motorcycles	• Leaning multi-wheeled (LMW) • Parrellogram link-arm structure • Leaning • A-arm suspension

2. Describe front suspension components for multi-wheeled motorcycles	• Ball joints
	• Linkages
	• Tie rods
	• Bushings
	• Control arms
	• Springs
	• Damping
	  ○ Shocks
	  ○ Forks

3. Describe diagnosing front suspension components for multi-wheeled motorcycles	• Manufacturers' specifications and procedures • Inspections • Measurements • Play or movement • Road handling • Tire and component wear

4. Service ATV front suspension components	• Manufacturers' specifications and procedures
	• Safety
	• Lifting and securing
	• Adjustments
	  ○ Wheel alignment
	  ○ Damping
	  ○ Spring pre-load
	• Lubrication

LEARNING TASKS	CONTENT
	• Measurements • Component replacement • Verifying operation

Achievement Criteria

Performance	The learner will service ATV front suspension components.
Conditions	The learner will be given • Manufacturers' specifications and procedures • ATV • Tools and equipment
Criteria	The learner will be evaluated on • Safety • Adherence to manufacturers' specifications and procedures • Quality of service

Line (GAC): F MAINTAIN SUSPENSION SYSTEMS

Competency: F3 Maintain rear suspension components

Objectives

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

- Perform adjustments on rear suspension components.

LEARNING TASKS	CONTENT

1. Describe rear suspension systems	• Types and designs
	  ○ Single
	  ○ Dual-shock
	  ○ Air
	  ○ Rising rate (progressive) linked
	  ○ Linkless shock mounting
	  ○ A-arm
	  ○ Swing arm
	  ○ Pivotless
	  ○ Hidden (soft tail)

2. Describe rear suspension components	• Spring technology
	  ○ Spring rate
	  ○ Progressive springs
	  ○ Preload
	• Shock absorber technology
	  ○ Emulsion
	  ○ Nitrogen gas
	• Linkage bearings and bushings
	• Swing arms
	  ○ Pivotless
	  ○ Single-sided
	  ○ Dual-sided
	  ○ Hidden (soft tail)

3. Service rear suspension components	• Manufacturers' specifications and procedures
	• Lubrication
	• Adjustments
	  ○ Sag (spring pre-load)
	  ○ Rebound and compression
	  ○ Wheel alignment

Achievement Criteria

Performance	The learner will adjust rear suspension.
Conditions	The learner will be given • Manufacturers' specifications and procedures • Motorcycle • Tools and equipment
Criteria	The learner will be evaluated on • Safety • Adherence to manufacturers' specifications and procedures • Quality of service

Line (GAC): I MAINTAIN TWO-STROKE AND FOUR-STROKE ENGINES

Competency: I1 Apply principles of engines and engine construction

Objectives

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

- Describe two-stroke and four- stroke engines.

LEARNING TASKS	CONTENT

1. Describe engine construction	• Two-stroke
	• Four-stroke
	• Designs
	  ○ Single cylinder
	  ○ Multi-cylinder
	  – V
	  – Inline
	  – Horizontally-opposed
	• Components
	• Classifications
	  ○ Stroke cycle
	  ○ Valve location
	  ○ Cylinder configuration

2. Describe two-stroke engines	• Construction
	  ○ Piston port
	  ○ Reed valve
	  ○ Rotary valve
	  ○ Direct injection
	  ○ Variable exhaust port mechanisms
	  ○ Crankcase sealing
	  ○ Crankshafts
	  ○ Air-cooled
	  ○ Liquid-cooled
	• Operation
	  ○ Stroke cycle
	  ○ Cross-scavenging
	  ○ Loop-scavenging
	  ○ Lubrication
	  – Pre-mix
	  – Injected

3. Describe four-stroke engines	• Construction

LEARNING TASKS	CONTENT
	○ Push rod Overhead Valve (OHV) ○ Single Overhead Cam (SOHC) ○ Dual Overhead Cam (DOHC) ○ Combustion chamber design ○ Multi-valve heads ○ Air-cooled ○ Liquid-cooled • Operation ○ Stroke cycle ○ Lubrication – Wet sump – Dry sump

Line (GAC): I MAINTAIN TWO-STROKE AND FOUR-STROKE ENGINES

Competency: I3 Maintain valve systems on two-stroke engines

Objectives

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

- Describe servicing valve systems on two-stroke engines.

LEARNING TASKS	CONTENT

1. Describe valve systems on two-stroke engines	• Types
	  ○ Reed valve
	  ○ Rotary valve
	  ○ Piston port
	  ○ Variable exhaust port
	• Components
	  ○ Mechanisms and controls
	  ○ Reed blocks (petals)
	  ○ Ports
	  – Transfer
	  – Intake
	  – Exhaust

2. Describe servicing valve systems on two-stroke engines	• Manufacturer's specifications and procedures • Inspections • Cleaning and de-carboning • Adjustments

Line (GAC): I MAINTAIN TWO-STROKE AND FOUR-STROKE ENGINES

Competency: I5 Maintain cylinders and pistons

Objectives

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

- Describe construction of cylinders and pistons on two-stroke engines.

LEARNING TASKS	CONTENT

1. Describe piston construction on two-stroke engines	• Shape and heat expansion
	  ○ Cam ground
	  ○ Skirt length
	• Piston pin offset
	• Piston pin clips
	• Material types
	  ○ Cast
	  ○ Forged
	• Rings
	  ○ Locating pins
	  ○ Straight rail
	  ○ Keystone
	  ○ Dykes
	  ○ Markings
	  ○ Ring material types
	• Piston windows (port openings)

2. Describe cylinder construction on two-stroke engines	• Types
	  ○ Single
	  ○ Twin
	  ○ Multi
	• Materials
	  ○ Cast iron
	  ○ Aluminum
	• Cylinder bores
	  ○ Plated
	  ○ Sleeved
	• Ports
	  ○ Intake
	  ○ Exhaust
	  ○ Transfer

Line (GAC): I MAINTAIN TWO-STROKE AND FOUR-STROKE ENGINES

Competency: I9 Maintain lubrication systems

Objectives

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

- Describe diagnosing lubrication systems on two-stroke engines.
- Service lubrication systems on two-stroke engines.

LEARNING TASKS	CONTENT

1. Describe lubrication systems on two-stroke engines	• Types
	  ○ Automatic oil injection
	  ○ Pre-mix
	• Components
	  ○ Level sensors
	  ○ Pumps
	  ○ Lines
	  ○ Reservoirs
	  ○ Strainers and filters
	  ○ Check valves

2. Describe diagnosing lubrication systems on two-stroke engines	• Inspection • Tests and measurements • Causes of failure • Determining servicing procedures • Mix ratios
3. Service lubrication systems on two-stroke engines	• Manufacturers' specifications and procedures • Bleeding • Removal and replacement of components • Adjustments (cable action oil pump) • Leak detection • Repairs

Achievement Criteria

Performance	The learner will service lubrication systems on two-stroke engines.
Conditions	The learner will be given • Manufacturers' specifications and procedures • Motorcycle • Tools and equipment
Criteria	The learner will be evaluated on • Safety • Adherence to manufacturers' specifications and procedures • Quality of service

Line (GAC): I MAINTAIN TWO-STROKE AND FOUR-STROKE ENGINES

Competency: I10 Maintain cooling systems

Objectives

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

- Describe diagnosing and servicing cooling systems on two-stroke and four-stroke engines.
- Diagnose and service cooling systems on liquid-cooled engines.

LEARNING TASKS	CONTENT

1. Describe cooling systems on two-stroke and four-stroke engines	• Types
	  ○ Air-cooled
	  ○ Liquid-cooled
	  ○ Air-over-oil cooled
	• Components for air-cooled systems
	  ○ Fins
	  ○ Fans
	  ○ Shrouds
	• Components for liquid-cooled systems
	  ○ Thermostats
	  ○ Sensors
	  ○ Pumps
	  – Gear drives
	  – Chain drives
	  ○ Radiators and heat exchangers
	  ○ Pressure caps
	  ○ Lines
	  ○ Jackets
	  ○ Fans
	  ○ Reservoirs
	  ○ Gaskets and seals
	  ○ Shrouds
	• Components for air-over-oil cooled systems
	  ○ Fins
	  ○ Fans
	  ○ Shrouds
	  ○ Oil coolers
	  ○ Lines

2. Diagnose cooling systems on two-stroke and four-stroke engines	• Manufacturers' specifications and procedures • Test equipment procedures ○ Pressure pumps

LEARNING TASKS	CONTENT
	○ Hydrometers • Inspection ○ Liquid-cooled – Electric fan operation – Leak detection ○ Air-cooled – Fin condition – Shrouds – Debris ○ Air-over-oil – Fin condition – Shrouds – Debris – Leak detection
3. Service cooling systems on two-stroke and four-stroke engines	• Manufacturers' specifications and procedures • Flushing (vacuum bleeding) • Component Re & Re • Sealing

Achievement Criteria

Performance	The learner will diagnose and service cooling systems on liquid-cooled engines.
Conditions	The learner will be given • Manufacturers' specifications and procedures • Motorcycle • Tools and equipment
Criteria	The learner will be evaluated on • Safety • Adherence to manufacturers' specifications and/or procedures • Quality of service

Line (GAC): J MAINTAIN CLUTCHES AND PRIMARY DRIVES

Competency: J1 Maintain primary drives and driven gears

Objectives

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

- Diagnose primary drives and driven gears.

LEARNING TASKS	CONTENT

1. Describe primary drive systems	• Types
	  ○ Gear drive
	  ○ Chain drive
	  ○ Belt drive
	• Components
	  ○ Roller and HY-VO ® chain
	  ○ Belt and tensioners
	  ○ Gears

2. Describe primary drives and driven gears	• Gear types
	  ○ Straight-cut
	  ○ Helical
	  ○ Cush (damper) drives
	  ○ Scissor
	• Attachments
	  ○ Key way
	  ○ Taper
	  ○ Spline

3. Diagnose primary drives and driven gears	• Manufacturers' specifications and procedures
	• Inspection
	  ○ Abnormal noises
	  ○ Wear
	  – Backlash
	  ○ Fluid
	  – Level
	  – Leaks
	  – Contamination
	  ○ Vibration

4. Describe servicing primary drives and driven gears	• Manufacturers' specifications and procedures • Component replacement

Line (GAC): J MAINTAIN CLUTCHES AND PRIMARY DRIVES

Competency: J2 Maintain primary drive chains and sprockets

Objectives

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

- Maintain and adjust primary drive chains.

LEARNING TASKS	CONTENT

1. Describe primary drive chains and sprockets	• Types
	  ○ Roller
	  ○ Hyvo/multi-link

2. Diagnose drive chains and sprockets	• Manufacturers' specifications and procedures
	• Inspection
	  ○ Abnormal noises
	  ○ Wear
	  – Chain
	  – Sprockets
	  – Guide
	  – Covers
	  – Tensioners
	  ○ Fluid
	  – Level
	  – Leaks
	  – Contamination
	  ○ Vibration
	  ○

3. Service primary drive chains and sprockets	• Manufacturers' specifications and procedures • Component maintenance • Component adjustment

Achievement Criteria

Performance	The learner will maintain and adjust primary drive chains.
Conditions	The learner will be given • Manufacturers' specifications and procedures • Motorcycle • Tools and equipment
Criteria	The learner will be evaluated on • Safety • Adherence to manufacturers' specifications and procedures • Quality of service

Line (GAC): J MAINTAIN CLUTCHES AND PRIMARY DRIVES

Competency: J3 Maintain primary drive belts and pulleys (sprockets)

Objectives

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

- Describe primary drive belts and pulleys (sprockets).

LEARNING TASKS	CONTENT

1. Describe primary drive belts and pulleys (sprockets)	• Types
	  ○ Motorcycle
	  ▪ Cogged (after market)
	  ○ ATV and scooters
	  ▪ V-belt (CVT)
	• Composition
	  ○ Rubber
	  ○ Cloth sheath
	  ○ Rating

Line (GAC): J MAINTAIN CLUTCHES AND PRIMARY DRIVES

Competency: J4 Maintain manual clutches

Objectives

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

- Diagnose and service manual clutches.

LEARNING TASKS	CONTENT

1. Describe manual clutches	• Types
	  ○ Wet
	  ○ Dry
	  ○ Single-plate
	  ○ Multi-plate
	  ○ Back torque
	  ○ Torque assist
	• Components
	  ○ Clutch plates
	  – Friction (driving)
	  – Metal (driven)
	  ○ Pressure plates
	  – Diaphragm spring
	  – Coil springs
	  – Cushion springs
	  – Aftermarket types
	  ○ Release bearings
	  ○ Release mechanisms
	  – Cable
	  – Linkage
	  – Hydraulic

2. Diagnose manual clutches	• Manufacturers' specifications and procedures
	• Inspection
	  ○ Slippage
	  ○ Dragging
	  ○ Chatter
	• Measurements
	  ○ Plate thickness
	  ○ Spring free length
	  ○ Warpage
	  ○ Free play

LEARNING TASKS	CONTENT

3. Service manual clutches	• Manufacturers' specifications and procedures
	• Fluid selections
	• Adjustments
	  ○ Mechanical
	  ○ Hydraulic
	• Component replacement
	• Measurements
	• Safety switches

Achievement Criteria

Performance	The learner will service manual clutches.
Conditions	The learner will be given • Manufacturers' specifications and procedures • Motorcycle • Tools and equipment
Criteria	The learner will be evaluated on • Safety • Adherence to manufacturers' specifications and procedures • Quality of service

Line (GAC): J MAINTAIN CLUTCHES AND PRIMARY DRIVES

Competency: J5 Maintain automatic clutches

Objectives

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

- Diagnose centrifugal force (automatic) clutches.
- Describe servicing centrifugal force (automatic) clutches.

LEARNING TASKS	CONTENT

1. Describe centrifugal force (automatic) clutches	• Types
	  ○ Automatic (CVT)
	  ○ Electronically-controlled
	• Components
	  ○ Clutch baskets
	  ○ Hub and shoes
	  ○ Pressure plates
	  ○ Centrifugal rollers
	  ○ Springs
	  ○ Primary and secondary drive sheaves
	  ○ Drive and driven plates
	  ○ Drive belts

2. Diagnose centrifugal force (automatic) clutches	• Manufacturers' specifications and procedures
	• Inspection
	  ○ Abnormal noises
	  ○ Wear
	  ○ Belt wear limit
	  ○ Contamination
	  ○ Vibration
	  ○ Fluids (for wet type clutches)
	• Test ride

3. Describe servicing centrifugal force (automatic) clutches	• Manufacturers' specifications and procedures • Inspection and measurements • Cleaning • Component replacement • Adjustments

Line (GAC): J MAINTAIN CLUTCHES AND PRIMARY DRIVES

Competency: J6 Maintain manual starting systems

Objectives

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

- Maintain manual starting systems.

LEARNING TASKS	CONTENT

1. Describe manual starting systems	• Types of starting systems
	  ○ Recoil (pull)
	  ○ Kick
	  – Primary
	  – Transmission
	• Components for recoil start systems
	  ○ Springs and mechanisms
	  ○ Handles and ropes
	  ○ Sprag clutch/one way
	• Components for kick start systems
	  ○ Pedals (kick lever)
	  ○ Ratchets
	  ○ Return springs
	  ○ Shafts
	  ○ Idler gears

2. Diagnose manual starting systems	• Manufacturers' specifications and procedures
	• Inspection
	  ○ Abnormal noises
	  ○ Smoothness of operation
	  ○ Wear

3. Service manual starting systems	• Manufacturers' specifications and procedures • Re & Re components • Cleaning • Lubrication

Achievement Criteria

Performance	The learner will remove, service and replace components for a recoil starting system.
Conditions	The learner will be given • Manufacturers' specifications and procedures • Motorcycle or ATV with applicable starter systems • Tools and equipment
Criteria	The learner will be evaluated on • Safety • Adherence to manufacturers' specifications and procedures • Quality of service

Line (GAC): K MAINTAIN TRANSMISSIONS

Competency: K2 Maintain continuously variable transmissions (CVT)

Objectives

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

- Describe CVT, centrifugal clutch and belt drives, and hydrostatic drives.
- Describe maintaining hydrostatic drives.
- Maintain centrifugal clutch and belt drives.

LEARNING TASKS	CONTENT

1. Describe CVT	• Types
	  ○ Semi-automatic (e.g. scooters)
	  ○ CVT
	  – Centrifugal clutch and belt drive
	  – Hydraulic (hydrostatic)
	• Functions
	  ○ Shift
	  ○ Range select
	  ○ Engagement

2. Describe centrifugal clutch and belt drives	• Components
	  ○ Sheaves (pulleys)
	  ○ V-belts
	  ○ Weights (rollers)
	  ○ Sprags (over-running clutches)
	  ○ Springs
	  ○ Sensors
	  ○ Shafts
	  – Primary
	  – Secondary

3. Describe hydrostatic drives	• Components
	  ○ Pumps
	  ○ Motors
	  ○ Control valves
	  ○ Piston and cylinder assemblies
	  ○ Swash plates
	  ○ Shafts
	  ○ Bearings
	  ○ Springs
	  ○ Housings and oil passages

LEARNING TASKS	CONTENT
	○ Seals
4. Diagnose centrifugal clutch and belt drives	• Manufacturers' specifications and procedures • Inspections ○ Component wear ○ Smoothness of operation ○ Contamination • Measurements ○ Belt tension and width ○ Alignment (offset)
5. Describe diagnosing hydrostatic drives	• Manufacturers' specifications and procedures • Inspections ○ Fluid level and condition – Cavitation – Aeration – Contamination ○ Component wear • Measurements ○ Linkages – Free play – Travel ○ Adjustments
6. Service centrifugal clutch and belt drives	• Manufacturers' specifications and procedures • Cleaning • Inspection • Lubrication • Replacement of components • Adjustments
7. Describe servicing hydrostatic drives	• Manufacturers' specifications and procedures • Fluid replacement • Adjustments ○ Linkages ○ Controls

Achievement Criteria

Performance	The learner will service centrifugal clutch and belt drives.
Conditions	The learner will be given • Manufacturers' specifications and procedures • Motorcycle • Tools and equipment
Criteria	The learner will be evaluated on • Safety • Adherence to manufacturers' specifications and procedures • Quality of service

Line (GAC): M MAINTAIN ELECTRICAL SYSTEMS

Competency: M3 Maintain electrical standard and accessory components

Objectives

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

- Install electrical accessory components.

LEARNING TASKS	CONTENT

1. Describe electrical accessory components (upgrades)	• Rider assistance systems
	  ○ Cruise control
	  ○ Slide/traction control
	  ○ Quick shifters
	• Cameras
	• Audio systems
	• Security systems
	• Lights
	  ○ Fog
	  ○ Driving
	• Powered windshields
	• Global Positioning System (GPS)
	  ○ Lap timers
	  ○ Navigation

2. Install electrical accessory components	• Manufacturers' specifications and procedures
	  ○ Aftermarket manufacturers
	  ○ Original Equipment Manufacturers
	• Verifying operation

Achievement Criteria (Optional depending on availability of components)

Performance	The learner will install electrical accessory components.
Conditions	The learner will be given • Manufacturers' specifications and procedures • Motorcycle and component • Tools and equipment
Criteria	The learner will be evaluated on • Safety • Adherence to manufacturers' specifications and procedures • Quality of installation

Line (GAC): M MAINTAIN ELECTRICAL SYSTEMS

Competency: M4 Maintain wiring harness systems

Objectives

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

- Interpret wiring diagrams.
- Repair connections on wiring harness systems.

LEARNING TASKS	CONTENT

1. Describe wiring harness systems	• Type
	  ○ Standard
	  ○ CAN bus
	• Components
	  ○ Connectors
	  ○ Protection and insulation
	  ○ Routing
	  ○ Diodes
	  ○ Resistors
	  ○ Switches
	  ○ Sensors
	  ○ Wire
	  ▪ Gauge
	  ▪ Materials
	  ▪ Colour coding
	  ▪ Shielding

2. Interpret wiring diagrams	• Manufacturers' specifications and procedures
	• Symbols and legends
	  ○ Sensors
	  ○ Connections
	  ○ Grounds
	  ○ Diodes
	  ○ Resistors
	  ○ Relays
	  ○ Fuses
	  ○ Colour abbreviations
	  ○ Wire gauges
	• Using diagrams for troubleshooting

3. Repair connections on wiring harness systems	• Manufacturers' specifications and procedures • Soldering

LEARNING TASKS	CONTENT
	• Crimping • Insulating • Cleaning terminals • Verifying connection

Achievement Criteria

Performance	The learner will repair connections on wiring.
Conditions	The learner will be given • Manufacturers' specifications and procedures • Wiring and connectors • Tools and equipment
Criteria	The learner will be evaluated on • Safety • Adherence to manufacturers' specifications and procedures • Quality of repair

Line (GAC): M MAINTAIN ELECTRICAL SYSTEMS

Competency: M6 Maintain electric starting systems

Objectives

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

- Diagnose and service electric starting systems.

LEARNING TASKS	CONTENT

1. Describe electric starting systems	• Engagement types
	  ○ Solenoid-driven
	  ○ Sprag
	• Components
	  ○ Solenoids
	  ○ Relays
	  ○ Switches
	  ○ Starter drives
	  – Gear reduction
	  – Direct
	  ○ Starter motors
	  – Field windings
	  – Brushes
	  – Armature
	  – Commutator
	  ○ Wiring
	  – Primary
	  – Secondary

2. Diagnose electric starting systems	• Manufacturers' specifications and procedures
	• Inspections
	  ○ Corrosion
	  ○ Connections
	  ○ Operation
	• Tests and measurements
	  ○ Battery
	  ○ Solenoid / relay
	  ○ Starter draw
	  ○ Voltage drop
	  ○ Bench test
	• Causes of failure

LEARNING TASKS	CONTENT

3. Service electric starting systems	• Manufacturers' specifications and procedures
	• Starter Re & Re
	• Disassembly, cleaning, inspection and replacement
	  ○ Contacts
	  ○ Commutators
	  ○ Terminals
	  ○ Brushes
	  ○ Armatures
	  ○ Seals
	  ○ O-rings
	  ○ Bearings and bushings

Achievement Criteria

Performance	The learner will diagnose and service electric starting systems.
Conditions	The learner will be given • Manufacturers' specifications and procedures • Motorcycle and appropriate components • Tools and equipment
Criteria	The learner will be evaluated on • Safety • Adherence to manufacturers' specifications and procedures • Quality of service

Line (GAC): M MAINTAIN ELECTRICAL SYSTEMS

Competency: M7 Maintain charging systems

Objectives

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

- Diagnose and service charging systems.

LEARNING TASKS	CONTENT

1. Describe charging systems	• Types
	  ○ Generators / alternators
	  ○ Excited field
	  ○ Alternate Current (AC) magneto
	• Components
	  ○ Armatures
	  ○ Commutators
	  ○ Brushes
	  ○ End frames
	  ○ Rotors and flywheels
	  ○ Magnets
	  ○ Field windings
	  ○ Stators
	  ○ Regulators / rectifiers
	  ○ Slip rings
	  ○ Connectors

2. Diagnose charging systems	• Manufacturers' specifications and procedures
	• Visual inspections
	• Tests and measurements
	  ○ Output performance
	  – DC voltage
	  – Amperage
	  ○ Stator (AC magneto)
	  – AC voltage output
	  – Resistance
	  – Short to ground
	  ○ Regulator rectifiers
	  – Diodes
	  – Shorts
	  – High resistance
	  – Opens
	  ○ Alternators

LEARNING TASKS	CONTENT
	– Field coil – Resistance – Opens – Shorts • Interpretation of results
3. Service charging systems	• Manufacturers' specifications and procedures • Removal and replacement • Disassembly and reassembly

Achievement Criteria

Performance — The learner will test and diagnose charging systems.

Conditions — The learner will be given
- Manufacturers' specifications and procedures
- Motorcycle
- Tools and equipment

Criteria — The learner will be evaluated on
- Safety
- Adherence to manufacturers' specifications and procedures
- Accuracy of measurements
- Interpretation of results

Line (GAC): O MAINTAIN FUEL AND EXHAUST SYSTEMS

Competency: O1 Maintain fuel tanks and fuel delivery components

Objectives

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

- Describe diagnosing and servicing fuel tanks and delivery components.

LEARNING TASKS	CONTENT

1. Describe fuel tanks and fuel delivery components	• Components
	  ○ Fuel tanks
	  ○ Evaporative systems
	  ○ Fuel lines
	  ○ Petcocks (valve)
	  – Electrical
	  – Mechanical
	  – Vacuum
	  ○ Fuel pumps
	  – Internal
	  – External
	  – Regulators
	  ○ Fuel caps
	  – Vented
	  – Non-vented
	  ○ Fuel filters
	  ○ Fuel level indicators

2. Describe diagnosing fuel tanks and fuel delivery components	• Manufacturers' specifications and procedures
	• Symptoms
	  ○ Rough idle
	  ○ Stalling
	  ○ Flooding
	  ○ Hesitation
	  ○ Lack of power
	• Visual inspections
	  ○ Fuel condition and contamination
	  ○ Vent lines
	  ○ Fittings and hoses
	• Tests and measurements
	  ○ Fuel pressure and volume
	• Interpretation of results

LEARNING TASKS	CONTENT
3. Describe servicing fuel tanks and fuel delivery components	• Manufacturers' specifications and procedures • Safety procedures • Replacement • Cleaning

Line (GAC): O MAINTAIN FUEL AND EXHAUST SYSTEMS

Competency: O2 Maintain air delivery systems

Objectives

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

- Diagnose and service air delivery systems.

LEARNING TASKS	CONTENT

1. Describe air delivery systems	• Types
	  ○ Forced air induction
	  ○ Naturally-aspirated
	• Components
	  ○ Air boxes
	  ○ Air filters
	  ○ Throttle bodies
	  ○ Boots and bellows
	  ○ Intake manifolds
	  ○ Gaskets
	  ○ Idle controls
	• Power enhancement equipment
	  ○ Super chargers
	  ○ Turbo chargers
	  ○ Ram air
	  ○ Secondary fuel management boxes

2. Diagnose air delivery systems	• Manufacturers' specifications and procedures • Visual inspections
3. Service air delivery systems	• Manufacturers' specifications and procedures • Servicing and/or replacing air filters • Cleaning throttle bodies

Achievement Criteria

Performance	The learner will test and diagnose air delivery systems.
Conditions	The learner will be given • Manufacturers' specifications and procedures • Motorcycle • Tools and equipment
Criteria	The learner will be evaluated on • Safety • Adherence to manufacturers' specifications and procedures • Accuracy of measurements • Interpretation of results

Line (GAC): O MAINTAIN FUEL AND EXHAUST SYSTEMS

Competency: O3 Maintain carburetor systems

Objectives

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

- Diagnose carburetor systems.
- Service carburetor systems (on single-cylinder engine).

LEARNING TASKS	CONTENT

1. Describe carburetors	• Types
	  ○ Mechanical slides
	  ○ Constant Velocity (CV)
	• Principles
	  ○ Carburation
	  ○ Atomization
	  ○ Vaporization
	  ○ Venturi principle
	  ○ Air-fuel ratios
	• Components
	  ○ Jets
	  ○ Floats and float valves
	  ○ Float bowls
	  ○ Needles
	  ○ Butterflies
	  ○ Cables
	  ○ Gaskets and O-rings
	• Circuits
	  ○ Float
	  ○ Cold start
	  ○ Low speed / idle
	  ○ High speed
	  ○ Acceleration
	  ○ Power

2. Diagnose carburetor systems	• Manufacturers' specifications and procedures • Visual inspections
3. Service carburetor systems (on single-cylinder engine)	• Manufacturers' specifications and procedures • Disassembly • Cleaning

LEARNING TASKS	CONTENT

	• Adjustments
	  ○ Idle Revolutions per minute (RPM)
	  ○ Mixture

Achievement Criteria

Performance	The learner will service carburetor systems (on single-cylinder engine).
Conditions	The learner will be given • Manufacturers' specifications and procedures • Motorcycle • Tools and equipment
Criteria	The learner will be evaluated on • Safety • Adherence to manufacturers' specifications and procedures • Quality of service

Line (GAC): O MAINTAIN FUEL AND EXHAUST SYSTEMS

Competency: O4 Maintain exhaust systems

Objectives

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

- Service exhaust systems.

LEARNING TASKS	CONTENT

1. Describe exhaust systems	• Types
	  ○ Four-cycle engines
	  – Wave travel and acoustic tuning
	  ○ Two-cycle engines
	  – Wave travel and expansion chamber design
	• Components
	  ○ Headers
	  ○ Catalytic convertors
	  ○ Gaskets
	  ○ Variable valves
	  ○ Spark arresters
	  ○ Mufflers
	  – Expansion chambers
	  – Packing
	  – Slip-ons (aftermarket)

2. Service exhaust systems	• Manufacturers' specifications and procedures • Component Re & Re • System cleaning • Sealing

Achievement Criteria

Performance	The learner will service exhaust systems.
Conditions	The learner will be given • Manufacturers' specifications and procedures • Motorcycle • Tools and equipment
Criteria	The learner will be evaluated on • Safety • Adherence to manufacturers' specifications and procedures • Quality of service

Level 3

Motorcycle Technician

Line (GAC): C USE TOOLS, EQUIPMENT AND DOCUMENTATION

Competency: C1 Use diagnostic tools and equipment

Objectives

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

- Describe advanced use of diagnostic measuring tools and equipment.
- Describe maintenance of diagnostic tools and equipment.

LEARNING TASKS	CONTENT

1. Describe advanced use of diagnostic measuring tools and equipment	• Types
	  ○ Leak down tester
	  ○ Fuel pressure gauge
	  ○ Oil pressure gauge
	  ○ Compression gauge
	  ○ Vacuum gauge
	  ○ Manometer
	  ○ Inspection camera (borescope)
	  ○ Exhaust gas analyzers (EGA)
	  ○ Stethoscope
	  – Electronic
	  – Mechanical
	• Advanced tests
	  ○ Full sweep leak down (of bore)
	  ○ Running compression
	  ○ Sonic
	  – Vacuum leaks
	  – Belt tension
	  ○ Multi-channel labsope
	  – Pattern analysis

2. Describe maintenance of diagnostic tools and equipment	• Manufacturers' specifications and procedures • Calibration • Cleaning • Lubrication

Line (GAC): E MAINTAIN CHASSIS AND COMPONENTS

Competency: E1 Maintain frames

Objectives

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

- Diagnose frames.
- Describe replacing frames.

LEARNING TASKS	CONTENT

1. Diagnose frames	• Manufacturers' specifications and procedures
	• Visual inspections for cracks
	  ○ Welds
	  ○ Steering heads
	  ○ Paints
	• Point to point measurements

2. Describe replacing frames	• Manufacturers' specifications and procedures
	• Regulations
	• VIN assignment
	• Jurisdictions having authority (JHA)
	• Re & Re
	  ○ Wire harness routing
	  ○ Cable routing
	  ○ Engine mounting
	  ○ Bearings
	• Adjustments

Line (GAC): E MAINTAIN CHASSIS AND COMPONENTS

Competency: E3 Maintain steering systems for multi-wheeled motorcycles

Objectives

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

- Diagnose and service steering systems for multi-wheeled motorcycles.
- Describe LMW technology.

LEARNING TASKS	CONTENT
1. Diagnose steering systems for multi-wheeled motorcycles	• Manufacturers' specifications and procedures • Inspection • Conditions • Causes of failure • Testing and measurements

2. Service steering systems for multi-wheeled motorcycles	• Manufacturers' specifications and procedures
	• Component Re & Re
	  ○ Ball joints
	  ○ Steering knuckles
	  ○ Bearings and bushings
	  ○ Steering dampers
	  ○ Linkages and tie rods
	  ○ Pivot shafts
	  ○ Bell cranks
	  ○ Brackets
	• Adjustments
	• Verification of operation

3. Describe LMW technology	• Manufacturers' specifications and procedures • Principles of operation • Diagnosis • Servicing

Achievement Criteria

Performance	The learner will Re & Re components, make adjustments, and perform wheel alignment on a multi-wheeled motorcycle or ATV.
Conditions	The learner will be given • Manufacturers' specifications and procedures • Multi-wheeled motorcycle or ATV • Tools and equipment
Criteria	The learner will be evaluated on • Safety • Adherence to manufacturers' specifications and procedures • Quality of service

Line (GAC): E MAINTAIN CHASSIS AND COMPONENTS

Competency: E4 Maintain chassis standard and accessory components

Objectives

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

- Diagnose and service chassis accessory components.

LEARNING TASKS	CONTENT
1. Describe chassis accessory components	• Engine guards • Hand guards • Centre/side stands • Luggage and mounts • Windshields • Back rests
2. Diagnose chassis accessory components	• Manufacturers' specifications and procedures • Inspection • Conditions • Causes of failure • Testing and measurements
3. Service chassis accessory components	• Manufacturers' specifications and procedures • Re & Re • Adjustments • Verification of operation

Line (GAC): F MAINTAIN SUSPENSION SYSTEMS

Competency: F1 Maintain front suspension components

Objectives

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

- Diagnose and service front-suspension components.

LEARNING TASKS	CONTENT

1. Diagnose front-suspension components	• Manufacturers' specifications and procedures
	• Inspections
	  ○ Test ride
	  ○ Visual
	• Conditions
	  ○ Damaged components
	  – Wear
	  – Excessive free play
	  – Bends
	  ○ Sagging
	  ○ Pre-load
	  ○ Damping
	  ○ Leaks
	  – Fluid
	  – Air
	  ○ Noises
	  ○ Stiction

2. Service front-suspension components	• Manufacturers' specifications and procedures
	• Safety precautions
	  ○ Gas or air pressure
	  ○ Pressure on springs
	• Specialized tools
	• Lubrication
	• Re & Re
	• Adjustments
	  ○ Spring pre-load
	  ○ Damping
	• Fork oil change
	• Fork disassembly and assembly
	• Seal replacement
	• Charge with gas or air
	• Verification of operation

Achievement Criteria

Performance	The learner will service front-suspension components.
Conditions	The learner will be given • Manufacturers' specifications and procedures • Motorcycle • Tools and equipment
Criteria	The learner will be evaluated on • Safety • Adherence to manufacturers' specifications and procedures • Quality of service

Line (GAC): F MAINTAIN SUSPENSION SYSTEMS

Competency: F2 Maintain front suspension components for multi-wheeled motorcycles

Objectives

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

- Diagnose and service front suspension components for multi-wheeled motorcycles.

LEARNING TASKS	CONTENT
1. Diagnose front suspension components for multi-wheeled motorcycles	• Manufacturers' specifications and procedures • Inspections • Measurements • Play or movement • Road handling • Tire and component wear

2. Service front suspension components for multi-wheeled motorcycles	• Manufacturers' specifications and procedures
	• Lubrication
	• Adjustments
	  ○ Wheel alignment
	  ○ Damping
	  ○ Spring pre-load

Achievement Criteria

Performance	The learner will service front suspension components for multi-wheeled motorcycles.
Conditions	The learner will be given • Manufacturers' specifications and procedures • Multi-wheeled motorcycle or ATV • Tools and equipment
Criteria	The learner will be evaluated on • Safety • Adherence to manufacturers' specifications and procedures • Quality of service

Line (GAC): F MAINTAIN SUSPENSION SYSTEMS

Competency: F3 Maintain rear suspension components

Objectives

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

- Diagnose and service rear suspension components.

LEARNING TASKS	CONTENT

1. Diagnose rear suspension components	• Manufacturers' specifications and procedures
	• Inspections
	  ○ Leaks
	  ○ Stiction
	  ○ Noises
	  ○ Excessive free play and wear
	  ○ Damping
	• Measurements
	  ○ Alignment
	  ○ Spring pre-load

2. Service rear suspension components	• Manufacturers' specifications and procedures • Linkage service • Damper unit rebuilding • Nitrogen charging and recharging • Removal and replacement • Wheel alignment

Achievement Criteria

Performance	The learner will service rear suspension components.
Conditions	The learner will be given • Manufacturers' specifications and procedures • Motorcycle • Tools and equipment
Criteria	The learner will be evaluated on • Safety • Adherence to manufacturers' specifications and procedures • Quality of service

Line (GAC): G MAINTAIN WHEELS AND TIRES

Competency: G2 Maintain spoked wheels

Objectives

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

- Diagnose and service spoked wheels.

LEARNING TASKS	CONTENT

1. Describe spoked wheels	• Types
	  ○ Tubed
	  ○ Tubeless
	  ○ Alloy
	  ○ Steel
	• Components
	  ○ Rims
	  ○ Spokes and nipples
	  ○ Hubs, axles and bearings
	  ○ Rim bands
	  ○ Rim locks
	  ○ Pressure sensors
	  ○ Reluctors
	  ○ Speedometer drives
	  ○ Cush drives
	  ○ Balancing weights
	  ○ Tubes and valves

2. Diagnose spoked wheels	• Manufacturers' specifications and procedures
	• Inspection
	  ○ Visual
	  – Bearings
	  – Spoke holes
	  – Cracks
	  – Corrosion
	  ○ Measure run out
	  – Axial/lateral
	  – Radial
	  ○ Spoke torque
	  ○ Balance
	• Causes of failure
	  ○ Maintenance issues
	  ○ Collision

LEARNING TASKS	CONTENT
	○ Corrosion ○ Stress
3. Service spoked wheels	• Manufacturers' specifications and procedures • Relacing • Truing • Balancing

Achievement Criteria

Performance	The learner will replace and true a spoked motorcycle wheel.
Conditions	The learner will be given • Manufacturers' specifications and procedures • Motorcycle or spoked wheel • Tools and equipment
Criteria	The learner will be evaluated on • Safety • Adherence to manufacturers' specifications and procedures • Quality of service

Line (GAC): I MAINTAIN TWO-STROKE AND FOUR-STROKE ENGINES

Competency: I1 Apply principles of engines and engine construction

Objectives

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

- Describe engine principles.

LEARNING TASKS	CONTENT

1. Describe engine principles	• Combustion
	  ○ Normal combustion
	  ○ Pre-ignition
	  ○ Detonation
	• Measurements
	  ○ Displacement
	  ○ Compression ratio
	  ○ Horsepower
	  ○ Torque
	  ○ Efficiency

Line (GAC): I MAINTAIN TWO-STROKE AND FOUR-STROKE ENGINES

Competency: I2 Maintain cylinder heads

Objectives

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

- Describe diagnosing cylinder heads on two-stroke engines.
- Service cylinder heads on two-stroke engines.

LEARNING TASKS	CONTENT

1. Describe cylinder heads	• Designs (2-stroke engines)
	  ○ Air-cooled
	  ○ Liquid-cooled
	• Designs (4-stroke engines)
	  ○ OHV
	  ○ OHC
	  ○ DOHC
	  ○ Air-cooled
	  ○ Liquid-cooled
	• Components
	  ○ Decompressors
	  ○ Spark plugs
	  ○ Sensors
	  ○ Seals
	  ○ Cooling fins

2. Describe diagnosing cylinder heads on two-stroke engines	• Manufacturers' specifications and procedures
	• Inspection
	  ○ Warpage
	  ○ Heat effects
	  ○ Cooling fin condition
	  ○ Cooling jacket condition
	  ○ Combustion area condition
	  ○ Sparkplug thread condition
	  ○ Cracks
	  ○ Sealing surface condition
	• Measurements

3. Service cylinder heads on two-stroke engines	• Manufacturers' specifications and procedures • De-carboning • Clearing cooling fins

LEARNING TASKS	CONTENT
	• Gasket Re & Re • Sealing • Planing

Achievement Criteria

Performance	The learner will service cylinder heads on two-stroke engines.
Conditions	The learner will be given • Manufacturers' specifications and procedures • Motorcycle or motorcycle engine • Tools and equipment
Criteria	The learner will be evaluated on • Safety • Adherence to manufacturers' specifications and procedures • Quality of service

Line (GAC): I MAINTAIN TWO-STROKE AND FOUR-STROKE ENGINES

Competency: I3 Maintain valve systems on two-stroke engines

Objectives

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

- Diagnose and service valve systems on two-stroke engines.

LEARNING TASKS	CONTENT

1. Diagnose valve systems on two-stroke engines	• Manufacturers' specifications and procedures
	• Inspections
	  ○ Visual
	  ○ Operational verification
	  – Valve / linkage

2. Service valve systems on two-stroke engines	• Manufacturers' specifications and procedures • Sealing • Cleaning / decarbonizing • Adjustments • Component replacement

Achievement Criteria

Performance	The learner will service valve systems on two-stroke engines.
Conditions	The learner will be given • Manufacturers' specifications and procedures • Motorcycle or motorcycle engine • Tools and equipment
Criteria	The learner will be evaluated on • Safety • Adherence to manufacturers' specifications and procedures • Quality of service

Line (GAC): I MAINTAIN TWO-STROKE AND FOUR-STROKE ENGINES

Competency: I4 Maintain valve trains on four-stroke engines

Objectives

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

- Describe diagnosing valve trains on four-stroke engines.
- Service valve trains on four-stroke engines.

LEARNING TASKS	CONTENT

1. Describe valve trains on four-stroke engines	• Types
	  ○ OHV
	  ○ OHC
	  ○ DOHC
	• Components
	  ○ Seals
	  ○ Rocker arms
	  ○ Rocker shafts
	  ○ Camshafts
	  ○ Push rods
	  ○ Adjusters
	  ○ Shims and buckets
	  ○ Lifters (tappets) and followers
	  – Hydraulic
	  – Solid

2. Describe poppet valve assemblies	• Components
	  ○ Valves
	  ○ Springs, keepers, retainers
	  ○ Spring seats
	  ○ Seals

3. Describe camshaft design	• Design
	  ○ Lift and duration
	  ○ Cam to crankshaft timing
	  ○ Decompressors
	  ○ Variable valve actuation
	  ○ Desmodromic
	• Components
	  ○ Drives
	  – Chain
	  – Belt
	  – Gear

LEARNING TASKS	CONTENT
	○ Tensioners – Automatic – Semi-automatic – Manual
4. Describe diagnosing valve trains on four-stroke engines	• Manufacturers' specifications and procedures • Inspections • Causes of failure • Measurements
5. Service valve trains on four-stroke engines	• Manufacturers' specifications and procedures • Re & Re components • Decarbonization • Valve clearance adjustments ○ Rocker arm/cam follower tappet screw ○ Eccentric rocker shaft ○ Adjustable push rod ○ Hydraulic tappet • Cam chain/belt adjustment • Sealing

Achievement Criteria

Performance: The learner will service valve trains on four-stroke engines.

Conditions: The learner will be given
- Manufacturers' specifications and procedures
- Motorcycle or motorcycle engine
- Tools and equipment

Criteria: The learner will be evaluated on
- Safety
- Adherence to manufacturers' specifications and procedures
- Quality of service

Line (GAC): I MAINTAIN TWO-STROKE AND FOUR-STROKE ENGINES

Competency: I5 Maintain cylinders and pistons

Objectives

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

- Service cylinders and pistons on two-stroke engines.

LEARNING TASKS	CONTENT

1. Diagnose cylinders and pistons on two-stroke engines	• Manufacturers' specifications and procedures
	• Inspections and tests
	  ○ Visual
	  ○ Compression
	  ○ Pressure
	• Causes of failure
	• Measurements

2. Service cylinders on two-stroke engines	• Manufacturers' specifications and procedures • Cleaning • Chamfering • Gasket replacement • Honing • Deglazing

3. Service pistons on two-stroke engines	• Manufacturers' specifications and procedures
	• Component replacement
	  ○ Complete piston and rings
	  ○ Rings only
	  ○ Wrist pin
	• Cleaning
	• Decarbonizing
	• Installation precautions
	  ○ Ring gaps
	  ○ Piston to wall clearance
	  ○ Orientation

Achievement Criteria

Performance	The learner will service cylinders and pistons on two-stroke engines.
Conditions	The learner will be given • Manufacturers' specifications and procedures • Motorcycle or motorcycle engine • Tools and equipment
Criteria	The learner will be evaluated on • Safety • Adherence to manufacturers' specifications and procedures • Quality of service

Line (GAC): I MAINTAIN TWO-STROKE AND FOUR-STROKE ENGINES

Competency: I6 Maintain crankshaft assemblies

Objectives

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

- Describe diagnosing crankshaft assemblies.
- Service one-piece crankshaft assemblies.

LEARNING TASKS	CONTENT

1. Describe crankshaft assemblies	• Design
	  ○ Cross-drilled
	  ○ Forged
	  ○ Steel
	  ○ Cast
	  ○ One-piece
	  ○ Multi-piece
	  ○ Single throws
	  ○ Multi throws
	  ○ Offset throws (splayed)
	• Components
	  ○ Roller bearings
	  ○ Plain bearings
	  ○ Journals
	  ○ Connecting rods
	  – Bearings
	  ▪ Big end
	  ▪ Small end
	  – Bushings
	  ○ Flywheels
	  ○ Thrust washers
	  ○ Harmonic balancers
	  ○ Labyrinth (mechanical seals)
	  ○ Seals
	  ○ Crank stuffers

2. Describe diagnosing crankshaft assemblies	• Manufacturers' specifications and procedures
	• Inspections
	  ○ Truing (balancing)
	  ○ Keyways and threads
	  ○ Oil passages
	• Measurements and checks

LEARNING TASKS	CONTENT
	○ Journals
3. Service one-piece crankshaft assemblies	• Manufacturers' specifications and procedures • Removal • Reinstall • Seals

Achievement Criteria

Performance	The learner will remove and reinstall a one-piece crankshaft assembly.
Conditions	The learner will be given • Manufacturers' specifications and procedures • Motorcycle or motorcycle engine • Tools and equipment
Criteria	The learner will be evaluated on • Safety • Adherence to manufacturers' specifications and procedures • Quality of service

Line (GAC): I MAINTAIN TWO-STROKE AND FOUR-STROKE ENGINES

Competency: I7 Maintain counterbalance assemblies

Objectives

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

- Diagnose and service counterbalance assemblies.

LEARNING TASKS	CONTENT

1. Describe counterbalance assemblies	• Drives
	  ○ Chain
	  ○ gear
	• Tensioners
	  ○ Automatic
	  ○ Semi-automatic
	  ○ Manual
	• Journals
	• Counter-weights
	  ○ Single
	  ○ Multi
	• Seals
	• Operation
	  ○ Counter force
	  ○ Timing
	  ○ Timing marks

2. Diagnose counterbalance assemblies	• Manufacturers' specifications and procedures
	• Inpection
	  ○ Timing
	  ○ Straightness
	  ○ Bearing condition
	• Measurements and checks
	  ○ Journals
	  ○ Bearings
	  ○ Oil clearance

3. Service counterbalance assemblies	• Manufacturers' specifications and procedures • Removal • Installation • Adjustments ○ Chain slack

LEARNING TASKS	CONTENT
	○ Belt tension ○ Timing • Sealing • Verification of operation

Achievement Criteria

Performance	The learner will remove and install counterbalance assemblies.
Conditions	The learner will be given • Manufacturers' specifications and procedures • Motorcycle or motorcycle engine • Tools and equipment
Criteria	The learner will be evaluated on • Safety • Adherence to manufacturers' specifications and procedures • Quality of service

Line (GAC): I MAINTAIN TWO-STROKE AND FOUR-STROKE ENGINES

Competency: I8 Maintain engine cases

Objectives

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

- Diagnose and service engine cases.

LEARNING TASKS	CONTENT

1. Describe engine cases	• Design
	  ○ Vertical split
	  ○ Horizontal split
	  ○ Cylinder integration
	• Components
	  ○ Bearing bosses
	  ○ Inspection ports and covers
	  ○ Seals/sealants
	  ○ Sealing surfaces
	  ○ Gaskets

2. Diagnose engine cases	• Manufacturers' specifications and procedures
	• Inspection
	  ○ Visual
	  ○ Threads and fasteners
	  ○ Check-valves and galleries
	  ○ Straightness of mating surfaces
	  ○ Stress cracks
	  ○ Bearing bosses
	• Causes of failure
	• Measurements

3. Service engine cases	• Manufacturers' specifications and procedures • Removal and replacement of components • Sealing • Thread repair

Achievement Criteria

Performance	The learner will remove and replace engine cases.
Conditions	The learner will be given • Manufacturers' specifications and procedures • Motorcycle or motorcycle engine • Tools and equipment
Criteria	The learner will be evaluated on • Safety • Adherence to manufacturers' specifications and procedures • Quality of service

Line (GAC): I MAINTAIN TWO-STROKE AND FOUR-STROKE ENGINES

Competency: I9 Maintain lubrication systems

Objectives

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

- Describe diagnosing lubrication systems on four-stroke engines
- Service lubrication systems on four-stroke engines.

LEARNING TASKS	CONTENT

1. Describe lubrication systems on four-stroke engines	• Lubrication systems
	  ○ Splash
	  ○ Pressurized
	  ○ Wet and dry sumps
	• Crankcase ventilation systems
	• Components
	  ○ Oil pumps
	  ○ Oil filters
	  ○ Lubrication galleries (passages) and valves
	  ○ Check valves
	  ○ Pressure warning indicator systems
	  ○ Coolers

2. Describe diagnosing lubrication systems on four-stroke engines	• Manufacturers' specifications and procedures
	• Inspections and tests
	  ○ Visual
	  ○ Leaks
	  ○ Pressure
	  ○ Oil flow

3. Service lubrication systems on four-stroke engines	• Manufacturers' specifications and procedures • Component replacement • Cleaning oil passages and screens • Sealing

Achievement Criteria

Performance	The learner will service lubrication systems on four-stroke engines.
Conditions	The learner will be given • Manufacturers' specifications and procedures • Motorcycle • Tools and equipment
Criteria	The learner will be evaluated on • Safety • Adherence to manufacturers' specifications and procedures • Quality of service

Line (GAC): I MAINTAIN TWO-STROKE AND FOUR-STROKE ENGINES

Competency: I10 Maintain cooling systems

Objectives

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

- Diagnose cooling systems on two-stroke and four-stroke engines.

LEARNING TASKS	CONTENT

1. Diagnose cooling systems on two-stroke and four-stroke engines	• Manufacturers' specifications and procedures
	• Test equipment procedures
	  ○ Dyes
	  ○ Infrared
	  ○ Carbon dioxide (CO_2) detectors (gas analyzers)
	• Inspection

Achievement Criteria

Performance	The learner will perform test procedures on a liquid cooling system.
Conditions	The learner will be given • Manufacturers' specifications and procedures • Motorcycle • Tools and equipment
Criteria	The learner will be evaluated on • Safety • Adherence to manufacturers' specifications and procedures • Accuracy of results

Line (GAC): K MAINTAIN TRANSMISSIONS

Competency: K1 Maintain constant mesh transmissions

Objectives

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

- Describe diagnosing constant mesh transmissions.
- Service constant mesh transmissions.

LEARNING TASKS	CONTENT

1. Describe constant mesh transmissions	• Types
	  ○ Direct (main shaft)
	  ○ Indirect (lay/counter shaft)
	  ○ Constant mesh sliding gears
	  ○ Dual-clutch transmissions (DCT)
	• Design variations
	  ○ 3-speed
	  ○ 4-speed
	  ○ 5-speed
	  ○ 6-speed
	  ○ Overdrive
	• Components
	  ○ Gear types
	  – Spur
	  – Helical
	  – Bevel
	  ○ Shift forks
	  ○ Shift drum
	  ○ Linkages
	  – Shift shaft
	  – Ratchet mechanisms
	  – Neutral indicators
	  – Gear indicators
	• Power flow and ratios

2. Describe diagnosing constant mesh transmissions	• Manufacturers' specifications and procedures
	• Inspections and measurements
	  ○ Visual
	  ○ Test ride
	  ○ Component wear and damage

LEARNING TASKS	CONTENT
	○ Shaft end play ○ Backlash ○ Bearings ○ Seals
3. Service constant mesh transmissions	• Manufacturers' specifications and procedures • Disassembly and reassembly ○ Pre-lube ○ Bearing pre-load ○ Sealant/gaskets ○ Shift fork alignment ○ Torque values ○ Fluid levels ○ Shaft end play ○ Gasket thickness ○ Circlip orientation • Component replacement • Verify operations

Achievement Criteria

Performance	The learner will service constant mesh transmissions.
Conditions	The learner will be given • Manufacturers' specifications and procedures • Motorcycle or motorcycle engine • Tools and equipment
Criteria	The learner will be evaluated on • Safety • Adherence to manufacturers' specifications and procedures • Quality of service

Line (GAC): L MAINTAIN FINAL DRIVE SYSTEMS

Competency: L2 Maintain final drive shafts and gears

Objectives

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

- Diagnose and service final drive shafts and gears.

LEARNING TASKS	CONTENT

1. Describe final drive shafts and gears	• Types
	  ○ Splined
	  ○ Cardan (universal joint)
	  ○ Slip yoke
	  ○ Constant velocity
	  ○ Four wheel-drive (4WD)
	• Components
	  ○ Differentials
	  ○ Drive shafts
	  ○ Universal joints
	  ○ Splines
	  ○ Seals and gaskets
	  ○ Bellows and boots
	  ○ Bearings
	  ○ Gears
	  ○ Shims

2. Diagnose final drive shafts and gears	• Manufacturers' specifications and procedures
	• Inspection
	  ○ Noise
	  ○ Vibration
	  ○ Fluid leak
	  ○ Component

3. Service final drive shafts and gears	• Manufacturers' specifications and procedures
	• Shafts
	  ○ Lubrication
	  ○ Wear inspection
	  ○ Removal and replacement
	• Gears
	  ○ Lubrication
	  ○ Removal and inspection
	  ○ Measurement and assessment

LEARNING TASKS	CONTENT
	○ Shimming ○ Replace and adjust components • Bearings and seals

Achievement Criteria

Performance	The learner will disassemble, service and reassemble a final drive gear unit.
Conditions	The learner will be given • Manufacturers' specifications and procedures • Motorcycle, ATV or separate final drive gear unit • Tools and equipment
Criteria	The learner will be evaluated on • Safety • Adherence to manufacturers' specifications and procedures • Quality of service

Line (GAC): M MAINTAIN ELECTRICAL SYSTEMS

Competency: M1 Apply electrical and electronic principles

Objectives

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

- Describe electrical and electronic components.
- Interpret electrical diagrams.
- Describe electrical troubleshooting.

LEARNING TASKS	CONTENT
1. Describe electrical principles	• Left hand rule (coils) • Positive switching • Negative switching • Induction and amplification

2. Describe electrical components	• Power sources
	  ○ Battery
	  ○ Capacitors
	• Connectors
	• Relays
	• Solenoids
	• Coils
	• Fuses and circuit protection

3. Describe electronic components	• Capacitors/ condensers/ suppressors
	• Light-emitting Diodes (LEDs)
	• Transistors
	  ○ Negative-Positive-Negative (NPN)
	  ○ Positive-Negative-Positive (PNP)
	• Pulse generators
	• Diodes
	• Resistors
	  ○ Fixed
	  ○ Variable
	• Zener diodes

4. Interpret electrical diagrams	• Types
	  ○ Pictorial
	  ○ Block

LEARNING TASKS	CONTENT
	○ Schematic • Symbols • Circuit tracing
5. Describe electrical troubleshooting	• Faults ○ Grounds ○ High resistance ○ Shorts ○ Opens • Component failure

Line (GAC): M MAINTAIN ELECTRICAL SYSTEMS

Competency: M3 Maintain electrical standard and accessory components

Objectives

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

- Describe diagnosing electrical accessory components.

LEARNING TASKS	CONTENT

1. Describe diagnosing electrical accessory components	• Manufacturers' specifications and procedures
	  ○ Aftermarket manufacturer
	  ○ Original Equipment Manufacturer (OEM)
	• Inspections
	  ○ Wiring and connections
	  ○ Component operation
	• Diagnostic tools and equipment

Line (GAC): M MAINTAIN ELECTRICAL SYSTEMS

Competency: M4 Maintain wiring harness systems

Objectives

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

- Diagnose wiring harness systems.

LEARNING TASKS	CONTENT

1. Diagnose wiring harness systems	• Manufacturers' specifications and procedures
	• Inspections
	  ○ Visual
	  ○ Routing
	  ○ Chafing
	  ○ Insulation
	• Tests
	  ○ Connections
	  ○ Breaks
	  ○ Continuity
	  ○ Resistance
	  ○ Shorts

Line (GAC): M MAINTAIN ELECTRICAL SYSTEMS

Competency: M5 Maintain ignition systems

Objectives

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

- Diagnose and service ignition systems.

LEARNING TASKS	CONTENT

1. Describe ignition systems	• Types
	  ○ Battery
	  – Point
	  – Transistorized
	  – Capacitor Discharged Ignition (CDI)
	  ○ AC magneto
	  – Point
	  – CDI
	  – Transistorized
	  ○ Computerized
	• Components
	  ○ Spark plugs
	  ○ High tension coils
	  – Dual lead coils
	  – Coil over plug
	  – Single lead coils
	  ○ Pulse/ pick up coils
	  ○ Charge/ excitor/ source coils
	  ○ Sensors
	  ○ Primary and secondary circuits
	  ○ Mechanical timing mechanisms
	  – Centrifugal
	  – Vacuum

2. Diagnose ignition systems	• Manufacturers' specifications and procedures
	• Visual inspection
	• Dynamic testing
	  ○ Kilovolts (KV)
	  ○ Peak voltage
	  ○ Oscilloscope
	  – Interpret patterns
	  ○ Timing

LEARNING TASKS	CONTENT
	○ Dwell • Static testing ○ Resistance ○ Coils ○ Wiring – Primary – Secondary ▪ Insulation – Connectors ○ Trigger devices ○ Modules ○ Advance mechanisms ○ Spark plugs
3. Service ignition systems	• Manufacturers' specifications and procedures • Component replacement • Air gap adjustments

Achievement Criteria

Performance	The learner will diagnose and service ignition systems.
Conditions	The learner will be given • Manufacturers' specifications and procedures • Motorcycle • Tools and equipment
Criteria	The learner will be evaluated on • Safety • Adherence to manufacturers' specifications and procedures • Accuracy of test results • Quality of service

Line (GAC): O MAINTAIN FUEL AND EXHAUST SYSTEMS

Competency: O1 Maintain fuel tanks and fuel delivery components

Objectives

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

- Diagnose and service fuel tanks and fuel delivery components.

LEARNING TASKS	CONTENT

1. Diagnose fuel tanks and fuel delivery components	• Manufacturers' specifications and procedures
	• Symptoms
	  ○ Rough idle
	  ○ Stalling
	  ○ Flooding
	  ○ Hesitation
	  ○ Lack of power
	• Visual inspections
	  ○ Fuel condition and contamination
	  ○ Vent lines
	  ○ Fittings and hoses
	  ○ Evaporative emission control (EVAP)
	• Tests and measurements
	  ○ Fuel pressure and volume
	• Interpretation of results

2. Service fuel tanks and fuel delivery components	• Manufacturers' specifications and procedures • Safety procedures • Component repair and replacement • Cleaning

Achievement Criteria

Performance	The learner will diagnose and service fuel tanks and fuel delivery components.
Conditions	The learner will be given • Manufacturers' specifications and procedures • Motorcycle • Tools and equipment
Criteria	The learner will be evaluated on • Safety • Adherence to manufacturers' specifications and procedures • Accuracy of test results • Quality of service

Line (GAC): O MAINTAIN FUEL AND EXHAUST SYSTEMS

Competency: O2 Maintain air delivery systems

Objectives

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

- Diagnose and service air delivery systems.

LEARNING TASKS	CONTENT
1. Diagnose air delivery systems	• Manufacturers' specifications and procedures • Visual inspections • Tests and measurements ○ Vacuum leaks

2. Service air delivery systems	• Manufacturers' specifications and procedures
	• Throttle bodies and carburetors
	  ○ Synchronizing
	  ○ Adjustments
	  ○ Cleaning

Achievement Criteria

Performance	The learner will synchronize throttle bodies and/or carburetors.
Conditions	The learner will be given • Manufacturers' specifications and procedures • Motorcycle • Tools and equipment
Criteria	The learner will be evaluated on • Safety • Adherence to manufacturers' specifications and procedures • Quality of service

Line (GAC): O MAINTAIN FUEL AND EXHAUST SYSTEMS

Competency: O3 Maintain carburetor systems

Objectives

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

- Diagnose and service carburetor systems.

LEARNING TASKS	CONTENT
1. Diagnose carburetor systems	• Manufacturers' specifications and procedures • Idle and cruise tests • Performance problem troubleshooting • Fuel and vacuum leaks • Exhaust gas analysis (EGA) ○ Interpret CO, HC, O_2 and CO_2 readings

2. Service carburetor systems	• Manufacturers' specifications and procedures
	• Cleaning
	  ○ Ultra-sonic
	  ○ Chemical
	• Adjustments
	  ○ Synchronization
	  ○ Mixture
	  ○ Float level
	  ○ Idle speed
	• Component replacement

Achievement Criteria

Performance	The learner will set up and adjust carburetors.
Conditions	The learner will be given • Manufacturers' specifications and procedures • Motorcycle • Tools and equipment
Criteria	The learner will be evaluated on • Safety • Adherence to manufacturers' specifications and procedures • Quality of service

Line (GAC): O MAINTAIN FUEL AND EXHAUST SYSTEMS

Competency: O4 Maintain exhaust systems

Objectives

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

- Diagnose and service exhaust systems.

LEARNING TASKS	CONTENT
1. Diagnose exhaust systems	• Manufacturers' specifications and procedures • Visual inspections • Noises • Leaks • Exhaust valve control systems
2. Service exhaust systems	• Manufacturers' specifications and procedures • Muffler re-packing • Exhaust valve cleaning and adjustments • Installation of spark arrestors (after-market)

Level 4

Motorcycle Technician

Line (GAC): B PERFORM ROUTINE WORK PRACTICES

Competency: B7 Conduct safety inspections

Objectives

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

- Describe conducting safety inspections.

LEARNING TASKS	CONTENT

1. Describe conducting safety inspections	• Regulations
	• Inspections
	  ○ Post-accident
	  ○ Custom-builds
	  ○ Notice of orders
	• Designated inspection facility
	• Inspectors
	  ○ Training
	  ○ Endorsement

Line (GAC): D USE COMMUNICATION AND MENTORING TECHNIQUES

Competency: D2 Use mentoring techniques

Objectives

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

- Describe mentoring.
- Describe maintaining a healthy workplace environment.

LEARNING TASKS	CONTENT

1. Describe mentoring	• Responsibilites
	  ○ Reporting work-based hours
	  ○ Sign off on certification
	  ○ Passing on knowledge to next generation
	• Coaching
	• Sharing techniques and best practices
	• Learning/teaching strategies
	  ○ Identifying learning needs
	  ○ Demonstrating skills
	  ○ Assessing skills
	  ○ Providing feedback
	• Modelling leadership
	• Communication
	• Professionalism
	  ○ Authenticity
	  ○ Honesty
	  ○ Respect

2. Describe maintaining a healthy workplace environment	• Role of employer and employees
	• Safety
	• Policies
	  ○ Recruiting
	  ○ Hiring
	  ○ Employee handbooks
	  ○ Harrassment and discrimination
	• Training
	• Workplace culture

Line (GAC): H MAINTAIN BRAKING SYSTEMS

Competency: H3 Maintain braking control systems

Objectives

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

- Diagnose and service braking control systems.

LEARNING TASKS	CONTENT

1. Describe braking control systems	• Types
	  ○ ABS
	  ○ Linked
	• Components
	  ○ Pumps
	  ○ Electronic control unit (ECU)
	  ○ Sensors
	  ○ Valves
	  ○ Hoses, lines and fittings
	  ○ Reluctors
	  ○ Wiring

2. Diagnose braking control systems	• Manufacturers' specifications and procedures
	• Inspection
	  ○ Fluid leak
	  ○ Performance
	  ○ Hygroscopic
	• Tests and measurements
	  ○ Dynamic pump test
	  ○ Fault codes
	  ○ Air gap check
	  ○ Electrical
	• Causes of failure
	  ○ Maintenance issues
	  ○ Moisture contamination
	  ○ Corrosion
	  ○ Wear
	  ○ Component damage

3. Service braking control systems	• Manufacturers' specifications and procedures • Fluid replacement • Component replacement

Achievement Criteria

Performance	The learner will perform braking control systems diagnostic tests and measurements.
Conditions	The learner will be given • Manufacturers' specifications and procedures • ABS-equipped motorcycle • Tools and equipment
Criteria	The learner will be evaluated on • Safety • Adherence to manufacturers' specifications and procedures • Accuracy of diagnosis

Line (GAC): I MAINTAIN TWO-STROKE AND FOUR-STROKE ENGINES

Competency: I2 Maintain cylinder heads

Objectives

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

- Diagnose and service cylinder heads on 4-stroke engines.

LEARNING TASKS	CONTENT

1. Describe cylinder heads on 4-stroke engines	• Components
	  ○ Valve seats
	  ○ Guides
	  ○ Cam shaft bearing saddles
	  ○ Threads and fasteners

2. Diagnose cylinder heads on 4-stroke engines	• Manufacturers' specifications and procedures
	• Inspection
	  ○ Warpage
	  ○ Cooling fin condition
	  ○ Cooling jacket condition
	  ○ Combustion area condition
	  ○ Thread and fastener condition
	  ○ Cracks
	  ○ Sealing surface condition
	• Measurements and tests
	  ○ Valve seat
	  ○ Valve sealing test
	  ○ Valve guide wear

3. Service cylinder heads on 4-stroke engines	• Manufacturers' specifications and procedures • De-carboning • Clearing cooling fins • Gasket Re&Re • Sealing • Planing • Valve seat re-conditioning (repair vs. sublet)

Achievement Criteria

Performance	The learner will disassemble, diagnose and record findings for cylinder heads on 4-stroke engines.
Conditions	The learner will be given • Manufacturers' specifications and procedures • Motorcycle, motorcycle engine or cylinder head • Tools and equipment
Criteria	The learner will be evaluated on • Safety • Adherence to manufacturers' specifications and procedures • Accuracy of findings

Line (GAC): I MAINTAIN TWO-STROKE AND FOUR-STROKE ENGINES

Competency: I4 Maintain valve trains on four-stroke engines

Objectives

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

- Diagnose and service valve trains on four-stroke engines.

LEARNING TASKS	CONTENT

1. Diagnose valve trains on four-stroke engines	• Manufacturers' specifications and procedures
	• Inspections
	  ○ Noises
	  – Valve clearance
	  – Cam chain tension
	  ○ Wear
	• Causes of failure
	• Camshaft measurements
	  ○ Timing
	  ○ Chain wear
	  ○ Lobe wear
	  ○ Journal wear
	• Valve measurements
	  ○ Face wear
	  ○ Spring free length
	  ○ Spring squareness
	  ○ Bucket/lifter/tappet wear
	  ○ Shim calculations

2. Service valve trains on four-stroke engines	• Manufacturers' specifications and procedures • Shim/cam follower • Shim over and under bucket adjustments

Achievement Criteria

Performance	The learner will diagnose and service valve trains on four-stroke engines, including • Diagnose and record findings • Shim/bucket-type valve adjustment
Conditions	The learner will be given • Manufacturers' specifications and procedures • Motorcycle or motorcycle engine • Tools and equipment
Criteria	The learner will be evaluated on • Safety • Adherence to manufacturers' specifications and procedures • Accuracy of findings and adjustments

Line (GAC): I MAINTAIN TWO-STROKE AND FOUR-STROKE ENGINES

Competency: I5 Maintain cylinders and pistons

Objectives

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

- Diagnose and service cylinders and pistons on four-stroke engines.

LEARNING TASKS	CONTENT

1. Diagnose cylinders and pistons on four-stroke engines	• Manufacturers' specifications and procedures
	• Inspections and tests
	  ○ Visual
	  ○ Compression
	  ○ Leak down
	  ○ Wear
	• Causes of failure
	• Measurements
	  ○ Cylinder bore
	  – Taper
	  – Out-of-round
	  ○ Piston clearance
	  ○ Ring end gap

2. Service cylinders on four-stroke engines	• Manufacturers' specifications and procedures • Cleaning • Gasket replacement • Boring (sublet vs. in-shop) • Honing • Deglazing

3. Service pistons on four-stroke engines	• Manufacturers' specifications and procedures
	• Component replacement
	  ○ Complete piston and rings
	  ○ Rings only
	  ○ Wrist pin
	• Cleaning
	• Decarbonizing
	• Installation precautions
	  ○ Ring gaps
	  ○ Piston to wall clearance
	  ○ Orientation

Achievement Criteria

Performance	The learner will diagnose and Re & Re cylinders and pistons on four-stroke engines.
Conditions	The learner will be given • Manufacturers' specifications and procedures • Motorcycle or motorcycle engine • Tools and equipment
Criteria	The learner will be evaluated on • Safety • Adherence to manufacturers' specifications and procedures • Accuracy of measurements • Quality of service

Line (GAC): I MAINTAIN TWO-STROKE AND FOUR-STROKE ENGINES

Competency: I6 Maintain crankshaft assemblies

Objectives

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

- Diagnose crankshaft assemblies.
- Describe servicing multi-piece (built-up) crankshaft assemblies.

LEARNING TASKS	CONTENT

1. Diagnose crankshaft assemblies	• Manufacturers' specifications and procedures
	• Inspections
	  ○ Run out
	  ○ Truing (balancing)
	  ○ Keyways and threads
	  ○ Oil passages
	  ○ Bearings
	• Measurements and checks
	  ○ Run out
	  ○ Journals
	  ○ Plain bearing selection
	  ○ Oil clearance (plastigage)

2. Describe servicing multi-piece (built-up) crankshaft assemblies	• Manufacturers' specifications and procedures • Tool and equipment selection • Removal • Disassembly • Assessments • Reassembly • Truing and balancing • Installation • Seals and bearings

Achievement Criteria

Performance	The learner will measure run out and inspect bearings on a crankshaft assembly.
Conditions	The learner will be given • Manufacturers' specifications and procedures • Motorcycle, motorcycle engine or crankshaft assembly • Tools and equipment
Criteria	The learner will be evaluated on • Safety • Adherence to manufacturers' specifications and procedures • Accuracy of measurements

Line (GAC): I MAINTAIN TWO-STROKE AND FOUR-STROKE ENGINES

Competency: I7 Maintain counterbalance assemblies

Objectives

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

- Verify repair of counterbalance assemblies.
- Describe specialized designs of counterbalance assemblies.

LEARNING TASKS	CONTENT
1. Verify repair of counterbalance assemblies	• Manufacturers' specifications and procedures • Engine vibration • Test ride • Timing • Chain adjustments
2. Describe specialized designs of counterbalance assemblies	• Offset crankshaft design requitements • Coupling force balancing shafts • Harmonic vibration equalizer assemblies

Line (GAC): I MAINTAIN TWO-STROKE AND FOUR-STROKE ENGINES

Competency: I8 Maintain engine cases

Objectives

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

- Assess engine cases.

LEARNING TASKS

1. Assess engine cases

CONTENT

- Manufacturers' specifications and procedures
- Inspection
  - Visual
  - Threads and fasteners
  - Check-valves and galleries
  - Straightness of mating surfaces
  - Stress cracks
  - Bearing bosses
- Causes of failure
  - Leaks
    - Warpage
    - Cracks
- Test equipment
  - Smoke machine
  - Pressure
  - Dye testing
- Measurements
  - Bearing bosses
  - Straightness

Achievement Criteria

Performance	The learner will perform diagnostic tests and measurements on engine cases.
Conditions	The learner will be given • Manufacturers' specifications and procedures • Motorcycle or motorcycle engine • Tools and equipment
Criteria	The learner will be evaluated on • Safety • Adherence to manufacturers' specifications and procedures • Accuracy of test results and measurements

Line (GAC): I MAINTAIN TWO-STROKE AND FOUR-STROKE ENGINES

Competency: I9 Maintain lubrication systems

Objectives

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

- Diagnose lubrication systems on four-stroke engines.
- Describe lubrication systems accessories.

LEARNING TASKS	CONTENT

1. Diagnose lubrication systems on four-stroke engines	• Manufacturers' specifications and procedures
	• Inspections and tests
	  ○ Visual
	  ○ Leaks
	  ○ Pressure
	  ○ Oil flow
	  ○ Oil cooling
	• Identifying causes of failure
	  ○ Filter examination
	  ○ Contamination
	  – Fuel
	  – Water

2. Describe lubrication systems accessories	• After market or optional add ons
	• Types
	  ○ Coolers
	  ○ Filtration systems
	  ○ Oil temperature gauge kits
	• Installation process

Achievement Criteria

Performance	The learner will perform oil pressure testing.
Conditions	The learner will be given • Manufacturers' specifications and procedures • Motorcycle • Tools and equipment
Criteria	The learner will be evaluated on • Safety • Adherence to manufacturers' specifications and procedures • Accuracy of test results and measurements

Line (GAC): K MAINTAIN TRANSMISSIONS

Competency: K1 Maintain constant mesh transmissions

Objectives

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

- Diagnose constant mesh transmissions.

LEARNING TASKS

1. Diagnose constant mesh transmissions

CONTENT

- Manufacturers' specifications and procedures
- Inspections and measurements
  - Visual
  - Test ride
  - Component wear and damage
  - Shaft end play
  - Backlash
  - Bearings
  - Seals
  - Fluid
    - Contamination
    - Metal debris
- Identifying causes of failure
  - Lack of lubrication
  - Overheating
  - Improper operation

Line (GAC): N MAINTAIN VEHICLE MANAGEMENT SYSTEMS

Competency: N2 Use specialized equipment

Objectives

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

- Use interface systems.
- Use specialized equipment.

LEARNING TASKS	CONTENT

1. Describe specialized equipment	• Scanners
	• Interface systems (laptop)
	• Diagnostic software
	  ○ OEM
	  ○ Aftermarket
	• Manometer
	• Exhaust analyzers
	• Dynometer
	• Graphing multimeter
	• Lab scopes and signals
	  ○ Wave form (analog)
	  ○ Square form (digital)
	• Peak voltage adaptors

2. Use interface systems	• Manufacturers' specifications and procedures
	• Retrieving codes and data
	• Freeze frame data (failure records)
	• Data logging
	• Active (bi-directional) tests
	  ○ Static
	  ○ Dynamic
	• Adjustments
	  ○ Idle speed
	  ○ CO/ fuel mixture

3. Use specialized equipment	• Manufacturers' specifications and procedures
	• Peak voltage adaptors
	• Sensor testing
	  ○ Reference voltage
	  ○ Voltage generating sensors
	  ○ Variable resistance sensors

LEARNING TASKS

CONTENT

- Oxygen sensors
- Hall-effect sensors
- Adjusting sensors
  - Throttle position
- Qualifying sensor operation

Achievement Criteria

Performance	The learner will use specialized equipment.
Conditions	The learner will be given • Manufacturers' specifications and procedures • Motorcycle • Tools and equipment
Criteria	The learner will be evaluated on • Safety • Adherence to manufacturers' specifications and procedures • Quality of interpretation of test results and measurements

Line (GAC): N MAINTAIN VEHICLE MANAGEMENT SYSTEMS

Competency: N3 Interpret diagnostic trouble codes (DTC) results

Objectives

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

- Describe system DTCs and retrieval methods.
- Interpret DTC results.

LEARNING TASKS	CONTENT

1. Describe system DTCs	• System types
	  ○ Engine management
	  ○ Braking
	  ○ Traction control
	  ○ Displays
	  ○ Suspension
	• Components
	  ○ MIL
	  ○ Sensors
	  ○ Modules
	  ○ CAN bus

2. Describe DTC retrieval methods	• Methods of retrieval
	  ○ Scan tools
	  ○ Interface systems
	  ○ Indicator display
	• Types of DTCs
	  ○ Flashing
	  ○ Instrument panel display
	  ○ ISO
	  ○ Stored and current
	  ○ “P” codes
	  ○ Alphanumerical codes
	  ○ Numerical codes

3. Interpret DTC results	• Manufacturers' specifications and procedures • Determining which DTCs to investigate first • Utilizing troubleshooting charts to identify areas of concern • Determining corrective action

Achievement Criteria

Performance	The learner will interpret DTC results and determine corrective action.
Conditions	The learner will be given • Manufacturers' specifications and procedures • Motorcycle • Tools and equipment
Criteria	The learner will be evaluated on • Safety • Adherence to manufacturers' specifications and procedures • Accuracy of interpretation and corrective action selected.

Line (GAC): N MAINTAIN VEHICLE MANAGEMENT SYSTEMS

Competency: N4 Maintain system circuitry and components

Objectives

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

- Interpret computer wiring diagrams.
- Test engine management input sensors and output actuators.
- Service computer control systems.

LEARNING TASKS	CONTENT

1. Describe computer control systems	• Computer modules
	  ○ Location
	  ○ Identification
	  ○ Precautions
	  ○ Memory
	• Inputs/sensors
	• Outputs/actuators

2. Interpret computer wiring diagrams	• Interpret symbols
	  ○ Fuel injectors
	  ○ Speed sensors
	  ○ Pressure sensors
	  ○ Relays
	  ○ Electronic Control Module (ECM)
	  ○ Fall detection switches
	  ○ Test couplers
	  ○ Safety switches
	  ○ Low-oil switches

3. Test engine management input sensors	• Rev limiter
	• Inputs/sensors
	  ○ Intake air temperature
	  ○ Intake pressure
	  ○ Throttle sensor
	  ○ Intake flow meters
	  ○ O_2 sensor
	  ○ Crankshaft sensor
	  ○ Camshaft sensor
	  ○ Coolant temperature sensor
	  ○ Fall detection sensor
	  ○ Barometric sensor

LEARNING TASKS	CONTENT

4. Test engine management output actuators	• Actuators
	  ○ Coils
	  ○ Injectors
	  ○ Idle control
	  ○ Fuel pump
	  ○ Cold start systems
	  ○ Malfunction indicator lamp
	  ○ Throttle stepper motors
	  ○ MIL

5. Service computer control systems	• Manufacturers' specifications and procedures • Locating components and connectors • Self-diagnostic modes • Resetting and relearning adaptives • Adjusting sensors • Health checks • Data streaming • Replacing components • Verifying repair

Achievement Criteria

Performance	The learner will test and service computer control systems.
Conditions	The learner will be given • Manufacturers' specifications and procedures • Motorcycle • Tools and equipment
Criteria	The learner will be evaluated on • Safety • Adherence to manufacturers' specifications and procedures • Accuracy of test results • Quality of service

Line (GAC): N MAINTAIN VEHICLE MANAGEMENT SYSTEMS

Competency: N5 Update software

Objectives

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

- Verify most recent version of software.
- Describe updating program software.

LEARNING TASKS	CONTENT
1. Identify scan tool applicable to vehicle data port	• Manufacturers' specifications and procedures • Connectors • Cables • Adaptors

2. Verify most recent version of software	• Types
	  ○ TSB
	  ○ Warranty updates
	  ○ In field corrections
	• Accessing version information
	  ○ Vehicle
	  ○ Scan tool
	• Comparison to most recent specifications available

3. Describe updating program software	• Manufacturers' specifications and procedures • Downloading and uploading procedures of software updates • OEM vs. aftermarket • Programming and configuring individual modules • Verification of operation of updated modules • Verification of operation of updated component or vehicle

Achievement Criteria

Performance	The learner will identify scan tool and most recent version of software.
Conditions	The learner will be given • Manufacturers' specifications and procedures • Motorcycle • Tools and equipment
Criteria	The learner will be evaluated on • Safety • Adherence to manufacturers' specifications and procedures • Accuracy of procedure and results

Line (GAC): O MAINTAIN FUEL AND EXHAUST SYSTEMS

Competency: O5 Maintain fuel injection systems

Objectives

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

- Diagnose and service fuel injection systems.

LEARNING TASKS	CONTENT

1. Describe fuel injection systems	• Types
	  ○ Sequential
	  ○ Direct
	  ○ Dual (twin) injection
	  ○ Return and returnless
	• Components
	  ○ Filters/strainers
	  ○ Injectors
	  – Primary
	  – Secondary (shower)
	  ○ Lines
	  ○ Pressure regulator
	  ○ Throttle body

2. Diagnose fuel injection systems	• Manufacturers' specifications and procedures
	• Inspection
	  ○ Visual
	  – Leak (internal, external)
	  – Wiring and connectors
	  ○ Operation
	• Tests and measurements
	  ○ Injector (electrical)
	  ○ Injector flow (spray pattern, volume)
	  ○ Exhaust gas analysis
	• Causes of failure
	  ○ Contaminants
	  ○ Component failure
	  – Electrical
	  – Mechanical

3. Service fuel injection systems	• Manufacturers' specifications and procedures

LEARNING TASKS	CONTENT
	• Cleaning • Component replacement

Achievement Criteria

Performance	The learner will perform fuel injection tests and measurements for diagnostic purposes.
Conditions	The learner will be given • Manufacturers' specifications and procedures • Motorcycle • Tools and equipment
Criteria	The learner will be evaluated on • Safety • Adherence to manufacturers' specifications and procedures • Accuracy of diagnosis

Line (GAC): P MAINTAIN ELECTRIC MOTORCYCLES

Competency: P1 Implement specific safety protocols for electric motorcycles

Objectives

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

- Describe electric motorcycle safety.

LEARNING TASKS	CONTENT

1. Describe electric motorcycle safety	• Manufacturers' specifications and procedures
	• Safety
	  ○ Jurisdictional regulations
	  ○ Shop guidelines
	  ○ Precautions
	  – Pushing
	  – Towing
	• PPE
	  ○ Gloves
	• High voltage disconnect procedures
	• Disposal procedures

Line (GAC): P MAINTAIN ELECTRIC MOTORCYCLES

Competency: P2 Maintain electric motorcycles

Objectives

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

- Describe diagnosing and servicing electric motorcycles.

LEARNING TASKS	CONTENT

1. Describe electric motorcycles	• Types
	  ○ Single-motor
	  ○ Dual-motor
	  ○ Regenerative
	  ○ Voltage levels
	• Fundamentals of operation
	• Components
	  ○ Motor generators
	  – AC
	  – Direct Current (DC)
	  ○ Inverters and converters
	  ○ Wiring and control
	  ○ Driveline systems
	  ○ Lubrication systems
	  ○ Cooling systems
	• Modes of operation

2. Describe diagnosing electric motorcycles	• Manufacturers' specifications and procedures
	• Inspections
	• Tests and measurements
	  ○ Equipment selection
	  ○ Electrical
	  ○ Data
	  ○ Functional tests

3. Describe servicing electric motorcycles	• Manufacturers' specifications and procedures
	• Test equipment certification
	  ○ Protection levels
	  – Category II
	  – Category III
	• Component replacement
	• Maintenance

LEARNING TASKS	CONTENT
	○ Lubricants ○ Cooling system ○ Battery charging ○ Driveline

Section 4

ASSESSEMENT GUIDELINES

Assessment Guidelines – Level 1

Level 1 Grading Sheet: Subject Competency and Weightings

PROGRAM: IN-SCHOOL TRAINING:	MOTORCYCLE TECHNICIAN LEVEL 1		
LINE	**SUBJECT COMPETENCIES**	**THEORY WEIGHTING**	**PRACTICAL WEIGHTING**
A	PERFORM SAFETY-RELATED FUNCTIONS	6%	0%
B	PERFORM ROUTINE WORK PRACTICES	18%	21%
C	USE TOOLS, EQUIPMENT AND DOCUMENTATION	11%	11%
D	USE COMMUNICATION AND MENTORING TECHNIQUES	3%	0%
G	MAINTAIN WHEELS AND TIRES	16%	19%
H	MAINTAIN BRAKING SYSTEMS	18%	21%
L	MAINTAIN FINAL DRIVE SYSTEMS	13%	13%
M	MAINTAIN ELECTRICAL SYSTEMS	12%	12%
N	MAINTAIN VEHICLE MANAGEMENT SYSTEMS	3%	3%
	Total	100%	100%
In-school theory / practical subject competency weighting		70%	30%
Final in-school mark		IN-SCHOOL %	

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

Assessment Guidelines – Level 2

Level 2 Grading Sheet: Subject Competency and Weightings

PROGRAM: IN-SCHOOL TRAINING:	MOTORCYCLE TECHNICIAN LEVEL 2		
LINE	**SUBJECT COMPETENCIES**	**THEORY WEIGHTING**	**PRACTICAL WEIGHTING**
C	USE TOOLS, EQUIPMENT AND DOCUMENTATION	6%	6%
E	MAINTAIN CHASSIS AND COMPONENTS	17%	17%
F	MAINTAIN SUSPENSION SYSTEMS	14%	14%
I	MAINTAIN TWO-STROKE AND FOUR-STROKE ENGINES	13%	13%
J	MAINTAIN CLUTCHES AND PRIMARY DRIVES	15%	15%
K	MAINTAIN TRANSMISSIONS	8%	8%
M	MAINTAIN ELECTRICAL SYSTEMS	17%	17%
O	MAINTAIN FUEL AND EXHAUST SYSTEMS	10%	10%
	Total	100%	100%
In-school theory / practical subject competency weighting		70%	30%
Final in-school mark		IN-SCHOOL %	

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

Assessment Guidelines – Level 3

Level 3 Grading Sheet: Subject Competency and Weightings

PROGRAM: IN-SCHOOL TRAINING:	MOTORCYCLE TECHNICIAN LEVEL 3		
LINE	**SUBJECT COMPETENCIES**	**THEORY WEIGHTING**	**PRACTICAL WEIGHTING**
C	USE TOOLS, EQUIPMENT AND DOCUMENTATION	3%	0%
E	MAINTAIN CHASSIS AND COMPONENTS	12%	12%
F	MAINTAIN SUSPENSION SYSTEMS	15%	16%
G	MAINTAIN WHEELS AND TIRES	8%	8%
I	MAINTAIN TWO-STROKE AND FOUR-STROKE ENGINES	22%	23%
K	MAINTAIN TRANSMISSIONS	12%	12%
L	MAINTAIN FINAL DRIVE SYSTEMS	6%	6%
M	MAINTAIN ELECTRICAL SYSTEMS	11%	12%
O	MAINTAIN FUEL AND EXHAUST SYSTEMS	11%	11%
	Total	100%	100%
In-school theory / practical subject competency weighting		65%	35%
Final in-school mark		IN-SCHOOL %	

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

Assessment Guidelines – Level 4

Level 4 Grading Sheet: Subject Competency and Weightings

PROGRAM: IN-SCHOOL TRAINING:	MOTORCYCLE TECHNICIAN LEVEL 4		
LINE	**SUBJECT COMPETENCIES**	**THEORY WEIGHTING**	**PRACTICAL WEIGHTING**
B	PERFORM ROUTINE WORK PRACTICES	6%	0%
D	USE COMMUNICATION AND MENTORING TECHNIQUES	5%	0%
H	MAINTAIN BRAKING SYSTEMS	10%	15%
I	MAINTAIN TWO-STROKE AND FOUR-STROKE ENGINES	25%	35%
K	MAINTAIN TRANSMISSIONS	15%	0%
N	MAINTAIN VEHICLE MANAGEMENT SYSTEMS	25%	35%
O	MAINTAIN FUEL AND EXHAUST SYSTEMS	11%	15%
P	MAINTAIN ELECTRIC MOTORCYCLES	3%	0%
	Total	100%	100%
In-school theory / practical subject competency weighting		60%	40%
Final in-school mark Apprentices must achieve a minimum 70% for the final in-school mark to be eligible to write the Motorcycle Technician Interprovincial Red Seal exam.		IN-SCHOOL %	

All apprentices who complete Level 4 of the Motorcycle Technician program with a FINAL level mark of 70% or greater will write the Interprovincial Red Seal examination as their final assessment.

SkilledTradesBC will enter the apprentices' Motorcycle Technician Interprovincial Red Seal examination percentage score into SkilledTradesBC Portal.

A minimum percentage score of 70% on the examination is required for a pass.

Section 5

TRAINING PROVIDER STANDARDS

Facility Requirements

Classroom Area

- Compliance with all local and national fire code and occupational safety requirements
- Compliance with municipal and provincial bylaws and regulations, including WorkSafeBC requirements
- Comfortable seating and tables suitable for learning
- Overhead and multimedia projectors with a projection screen
- Whiteboard with marking pens and erasers
- Lighting controls to allow easy visibility of the projection screen while allowing students to take notes
- Windows must have shades or blinds to adjust sunlight
- In-room temperature control to ensure comfortable room temperature
- Acoustics in the room must allow audibility of the instructor
- Access to the internet for students and instructors using suitable devices
- Access to a library complete with reference material for student and instructor use

Shop Area

- Compliance with all local and national fire code and occupational safety requirements
- Compliance with municipal and provincial bylaws and regulations, including WorkSafeBC requirements
- Minimum square feet and ceiling height to safely accommodate all required equipment and tools associated with practical training components as identified in this Program Outline
- 2,400 square feet per 16 students with 16-foot ceilings is recommended
- Adequate outdoors area, fenced
- Adequate climate control and lighting
- Ventilation as per WorkSafeBC standards
- Storage area for tools, equipment and materials
- Refuse and recycling bins for used materials
- First Aid facilities
- Posted signage for fire exits, first aid facilities, safety equipment, hazardous materials

Lab Requirements

- N/A

Student Facilities

- Adequate lunchroom as per WorkSafeBC requirements
- Adequate washroom facilities as per WorkSafeBC requirements
- Personal storage lockers

Instructor's Office Space

- Desk and filing space
- Computer

Other

- N/A

Tools and Equipment

Shop Equipment

Required

- Allen wrenches (Metric and SAE)
- Ball hone
- Ball peen hammer
- Bearing and seal driver set
- Bearing puller set
- Brass mallet
- Circlip plier set
- Combination wrench set (Metric and SAE)
- Crimping tool
- Dead-blow hammer
- Drill press
- File set
- Gasket scraper
- Hand drill
- Impact driver
- Lock wrench
- Pick set
- Pin/hook wrench
- Pliers set
- Punch set
- Riveting tool
- Rubber mallet
- Screwdriver set
- Seal driver set
- Slide hammer
- Snap ring pliers
- Socket set (Metric and SAE)
- Spoke torque wrench
- Spoke wrench
- Thread repair kit
- Tire irons
- Torque wrenches in/lb, ft/lb Nm
- Vacuum pump
- Wire brush
- Wire cutting tool
- Wire stripping tool
- Wire wheel

Recommended

- Cylinder hone
- Reamers
- Torque plates
- Valve resurfacing tool
- Valve seat cutter

Shop (Facility) Tools

Standard Tools

- Alignment bars
- Battery charger
- Bench grinder
- Bench Vice
- Bleeding equipment
- Brake cylinder hone
- Cable lubricating tool
- Carbon scraper
- Chain breaker
- Crankcase separator
- Crankshaft puller/installer
- Damper rod holder
- Hand Grinder
- Headlight aiming equipment
- Piston pin puller
- Nitrogen recharging unit
- Ring compressor
- Seal remover
- Tire balancing equipment
- Tire mounting equipment
- Wheel balancing equipment
- Wheel truing jig

Cutting/Heating Tools and Equipment

- Cutting equipment
- Electric arc welding equipment
- Heat gun
- Oxyacetylene welding
- Propane torch
- Soldering equipment

Pneumatic and Electric Power Tools

- Bonding equipment
- Compressed blower
- Grinder
- Hydraulic jack
- Hydraulic press
- Impact wrench
- Media blaster
- Riveting equipment
- Rotary tool
- Suspension Spring compressor
- Ultrasonic cleaner
- Valve spring compressor

Measuring Devices

- Alignment tool
- Carburetor float level gauge
- Coolant testing devices
- Cylinder bore gauge
- Degree wheel
- Dial indicator
- Engine tachometer
- Feeler gauge
- Graduated cylinder
- Height gauge
- Hydrometer
- Inside micrometer
- Inside/outside calipers
- Micrometer
- Oil pressure gauge
- Plasti-gage
- Small hole gauge set
- Steel rule
- Straightedge
- Tape measure
- Telescoping gauges set
- Tension gauge
- Tire pressure gauge
- Tread depth gauge
- Vernier caliper

Diagnostic and Testing Tools

- Alignment tool
- Battery tester
- Borescope
- Compression tester
- Computer diagnostic equipment
- Crankcase pressure test equipment
- Fuel pressure tester
- Hydrometer/refractometer
- Leak-down tester
- Multimeter
- Spark tester
- Stethoscope
- Test light
- Timing light
- Vacuum gauge

Reference Materials

Required Reference Materials

• Modern Motorcycle Technology; Abdo	ISBN 978 1 305497 450
• Motorcycle Electrical Systems: How to Troubleshoot; Martin	ISBN 978 0 760345 368
• Trades Common Core Line J Oxyacetylene Cut and Weld (MN1727), BC Govt.	7960002610
• AST Custom package, Alberta Govt. Trades Learning Guides	7850000433

Recommended Resources

• Two Stroke Engines; Senn	ISBN 9781631268625

Suggested Texts

- N/A

Instructor Requirements

Occupation Qualification

The instructor must possess one of the following:

- Motorcycle Technician Certificate of Qualification with an Interprovincial Red Seal Endorsement
- Motorcycle Mechanic Certificate of Qualification with an Interprovincial Red Seal Endorsement

Work Experience

The instructor must possess

- A minimum of 5 years' experience working in the industry as a journeyperson.
- 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:

- An Instructor Diploma or equivalent
- A Bachelor's Degree in Education
- A Master's Degree in Education

Appendices

Appendix A:
Glossary of Acronyms

4WD	Four Wheel-Drive
ABS	Anti-lock braking System
AC	Alternate Current
API	American Petroleum Institute
ATV	All-terrain Vehicle
C of A	Certificate of Apprenticeship
C of C	Certificate of Completion
C of Q	Certificate of Qualification
CAN	Controller Area Network
CDI	Capacitor Discharged Ignition
CV	Constant Velocity
CVT	Continuously Variable Transmissions
DC	Direct Current
DCT	Dual-clutch Transmissions
DMM	Digital Multi-meter
DOHC	Dual Overhead Cam
DOT	Department of Transportation
DTC	Diagnostic Trouble Codes
ECM	Electronic Control Module
ECU	Electronic Control Unit
EGA	Exhaust Gas Analyzers
EGA	Exhaust Gas Analysis
EPS	Electronic Power Steering
EVAP	Evaporative Emission control
GAC	General Areas of Competencies
GMAW	Gas Metal Arc Welding
GPS	Global Positioning System
JASO	Japanese Automotive Standards Organization
JHA	Jurisdictions Having Authority
KV	Kilovolts
LED	Light-Emitting Diode
LMW	Leaning Multi-wheeled
MIG	Metal Inert Gas
MIL	Malfunction Indicator Light
NLGI	National Lubricating Grease Institute
NPN	Negative-Positive-Negative
OAC	Occupational Analysis Chart
OEM	Original Equipment Manufacture
OHS	Occupational Health & Safety
OHV	Overhead Valve
PCV	Positive Crankcase Ventilation
PDI	Pre-delivery Inspection

PNP	Positive-Negative-Positive
PPE	Personal Protective Equipment
Re & Re	Removal and Replacement
RFC	Recommendation for Certification
RPM	Revolutions per minute
RSOS	Red Seal Occupational Standards
SAE	Society of Automotive Engineering
SDS	Safety Data Sheets
SOHC	Single Overhead Cam
TC	Two-cycle
TC-W	Two-cycle water cooled
TPMS	Tire Pressure Monitoring System
TSB	Technical Service Bulletins
TV	Television
VIN	Vehicle Identification Number
WBT	Work-Based Training
WHMIS	Workplace Hazardous Materials Information System

Appendix B:
Summary of Achievement Criteria

Achievement Criteria are included for 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 measurable and that they reflect the skills spelled out in the competency. The conditions under which these performances will be observed and measured must be clear to the learner as well as the criteria by which the learner will be evaluated. The learner must also be given the evaluation criteria.

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

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

MOTORCYCLE TECHNICIAN – LEVEL 1 SUMMARY OF ACHIEVEMENT CRITERIA	
SUBJECT COMPETENCY	**ACHIEVEMENT CRITERIA TASK**
B2 Perform periodic maintenance of lubrication systems	The learner will service engine oil and filters.
B3 Perform periodic maintenance of cooling systems	The learner will service cooling systems.
B4 Perform periodic maintenance of bearings	The learner will service wheel bearings.
C1 Use diagnostic tools and equipment	The learner will perform basic electrical measurements using a DMM.
C2 Use precision measuring instruments	The learner will perform basic measurements using precision measuring instruments.
C3 Use hand tools	The learner will perform thread repair.
C4 Use heating/cutting tools and equipment	The learner will use heating/cutting tools and equipment.
C5 Use pneumatic and electric power tools and equipment	The learner will use power tools and equipment.
G1 Maintain tires	The learner will Re & Re a tire and wheel and perform tire balancing. *Note: This achievement criteria covers both G1 Maintain tires and G3 Maintain cast wheels.*
G3 Maintain cast wheels	
H2 Maintain mechanical braking systems	The learner will service mechanical brakes, including • Inspection • Replacement • Adjustment
L1 Maintain final drive chains and sprockets	The learner will clean, lubricate, and adjust chain drive systems.
L3 Maintain final drive belts and pulleys (sprockets)	The learner will inspect, clean, and adjust final drive belt and pulleys (sprockets).
M2 Maintain batteries	The learner will test and/or initialize a battery.
N1 Read diagnostic trouble codes (DTC)	The learner will read and record DTCs.

MOTORCYCLE TECHNICIAN – LEVEL 2 SUMMARY OF ACHIEVEMENT CRITERIA	
SUBJECT COMPETENCY	**ACHIEVEMENT CRITERIA TASK**
C1 Use diagnostic tools and equipment	The learner will perform tests using diagnostic tools and equipment.
E2 Maintain steering heads	The learner will service steering heads for 2-wheeled motorcycles.
E4 Maintain chassis standard and accessory components	The learner will remove and install an accessory chassis component.
F2 Maintain front suspension components for multi-wheeled motorcycles	The learner will service ATV front suspension components.
F3 Maintain rear suspension components	The learner will adjust rear suspension.
I9 Maintain lubrication systems	The learner will service lubrication systems on two-stroke engines.
I10 Maintain cooling systems	The learner will diagnose and service cooling systems on liquid-cooled engines.
J2 Maintain primary drive chains and sprockets	The learner will maintain and adjust primary drive chains.
J4 Maintain manual clutches	The learner will service manual clutches.
J6 Maintain manual starting systems	The learner will remove, service and replace components for a recoil starting system.
K2 Maintain continuously variable transmissions (CVT)	The learner will service centrifugal clutch and belt drives.
M3 Maintain electrical standard and accessory components	*(Optional depending on availability of components)* The learner will install electrical accessory components.
M4 Maintain wiring harness systems	The learner will repair connections on wiring.
M6 Maintain electric starting systems	The learner will diagnose and service electric starting systems.
M7 Maintain charging systems	The learner will test and diagnose charging systems.
O2 Maintain air delivery systems	The learner will test and diagnose air delivery systems.
O3 Maintain carburetor systems	The learner will service carburetor systems (on single-cylinder engine).
O4 Maintain exhaust systems	The learner will service exhaust systems.

MOTORCYCLE TECHNICIAN – LEVEL 3 SUMMARY OF ACHIEVEMENT CRITERIA	
SUBJECT COMPETENCY	**ACHIEVEMENT CRITERIA TASK**
E3 Maintain steering systems for multi-wheeled motorcycles	The learner will Re & Re components, make adjustments, and perform wheel alignment on a multi-wheeled motorcycle or ATV.
F1 Maintain front suspension components	The learner will service front-suspension components.
F2 Maintain front suspension components for multi-wheeled motorcycles	The learner will service front suspension components for multi-wheeled motorcycles.
F3 Maintain rear suspension components	The learner will service rear suspension components.
G2 Maintain spoked wheels	The learner will replace and true a spoked motorcycle wheel.
I2 Maintain cylinder heads	The learner will service cylinder heads on two-stroke engines.
I3 Maintain valve systems on two-stroke engines	The learner will service valve systems on two-stroke engines.
I4 Maintain valve trains on four-stroke engines	The learner will service valve trains on four-stroke engines.
I5 Maintain cylinders and pistons	The learner will service cylinders and pistons on two-stroke engines.
I6 Maintain crankshaft assemblies	The learner will remove and reinstall a one-piece crankshaft assembly.
I7 Maintain counterbalance assemblies	The learner will remove and install counterbalance assemblies.
I8 Maintain engine cases	The learner will remove and replace engine cases.
I9 Maintain lubrication systems	The learner will service lubrication systems on four-stroke engines.
I10 Maintain cooling systems	The learner will perform test procedures on a liquid cooling system.
K1 Maintain constant mesh transmissions	The learner will service constant mesh transmissions.
L2 Maintain final drive shafts and gears	The learner will disassemble, service and reassemble a final drive gear unit.
M5 Maintain ignition systems	The learner will diagnose and service ignition systems.
O1 Maintain fuel tanks and fuel delivery components	The learner will diagnose and service fuel tanks and fuel delivery components.
O2 Maintain air delivery systems	The learner will synchronize throttle bodies and/or carburetors.
O3 Maintain carburetor systems	The learner will set up and adjust carburetors.

MOTORCYCLE TECHNICIAN – LEVEL 4 SUMMARY OF ACHIEVEMENT CRITERIA	
SUBJECT COMPETENCY	**ACHIEVEMENT CRITERIA TASK**
H3 Maintain braking control systems	The learner will perform braking control systems diagnostic tests and measurements.
I2 Maintain cylinder heads	The learner will disassemble, diagnose and record findings for cylinder heads on 4-stroke engines.
I4 Maintain valve trains on four-stroke engines	The learner will diagnose and service valve trains on four-stroke engines, including • Diagnose and record findings • Shim/bucket-type valve adjustment
I5 Maintain cylinders and pistons	The learner will diagnose and Re & Re cylinders and pistons on four-stroke engines.
I6 Maintain crankshaft assemblies	The learner will measure run out and inspect bearings on a crankshaft assembly.
I8 Maintain engine cases	The learner will perform diagnostic tests and measurements on engine cases.
I9 Maintain lubrication systems	The learner will perform oil pressure testing.
N2 Use specialized equipment	The learner will use specialized equipment.
N3 Interpret diagnostic trouble codes (DTC) results	The learner will interpret DTC results and determine corrective action.
N4 Maintain system circuitry and components	The learner will test and service computer control systems.
N5 Update software	The learner will identify scan tool and most recent version of software.
O5 Maintain fuel injection systems	The learner will perform fuel injection tests and measurements for diagnostic purposes.

Appendix C:
Previous Contributors

The Motorcycle & Power Equipment Technician Program Outline (2011) was prepared with the advice and direction of an industry steering committee convened initially by the Automotive Training Standards Organization. Members included:

- Curtis Mackie — Western Power Sports, Service Manager
- Brad Hartwig (M.Ed.) — BCIT Instructor
- Dale Popp — School District #23 Central Okanagan Instructor
- Danny Kelly — Power Source Canada, Business Manager
- Edward Sweet — Essential Motorcycle Services, Owner
- Gary Harrison — Surfwood Supply, Owner/Manager
- Gordon Hill — Fraser Valley Yamaha, Owner/Manager/technician
- J.P. Beaudreault — G.A. Check Point Yamaha, Technician
- Jeff Mica — BCIT Instructor
- Kevin Connor — Yamaha Motor Canada Ltd, Technical Trainer
- Kimberly Reid — Trev Deeley Harley Davidson, Service Manager
- Larry Ling — Hole Shot Honda, Service Manager
- Marcie Ladubec — Orca Bay Suzuki, Technician
- Mike Charbula — BCIT Instructor
- Orlando Banman — Power Source Canada, Technical Advisor
- Patty Davin — The Repair Man, Owner/Manager
- Rome Saratan — Celtic Distributors Ltd., Manager
- Sarah vanderGracht — Essential Motorcycle Services, Service Advisor
- Sean Thompson — Honda Canada, Regional Manager
- Simon Ellock — Suzuki Canada Inc., Instructor/trainer
- Steve Cazalet — Magneto Sales, Regional Manager
- Steve Wesea — Honda Canada, Instructor/trainer
- Terry Robbins — Fraser Valley Equipment Ltd., Owner/manager
- Travis Baker — Denco Cycle, Owner/technician

Industry Subject Matter Experts retained to assist in the development of the 2011 Program Outline content:

- Curtis Mackie — Western Power Sports, Service Manager
- Edward Sweet — Essential Motorcycle Services, Owner/technician
- Gary Harrison — Surfwood Supply, Owner/Manager
- Gordon Hill — Fraser Valley Yamaha, Owner/Manager/technician
- Jeff Mica — BCIT Instructor
- Kimberly Reid — Trev Deeley Harley Davidson, Service Manager
- Larry Ling — Hole Shot Honda, Service Manager
- Marcie Ladubec — Orca Bay Suzuki, Technician
- Orlando Banman — Power Source Canada, Technical Advisor
- Sarah vanderGracht — Essential Motorcycle Services, Service Advisor
- Sean Thompson — Honda Canada, Regional Manager
- Terry Robbins — Fraser Valley Equipment Ltd., Owner/manager

Industry Subject Matter Experts retained as outline reviewers:

- Jeff Mica — BCIT Instructor
- Marcie Ladubec — Orca Bay Suzuki Technician
- Orlando Banman — Power Source Canada, Technical Advisor