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YOUR TICKET.

PROGRAM OUTLINE

Heavy Mechanical Foundation





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HEAVY MECHANICAL FOUNDATION PROGRAM OUTLINE

**APPROVED BY INDUSTRY
SEPTEMBER 2013**

**Developed by
Industry Training Authority
Province of British Columbia**



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Section 1

INTRODUCTION

Heavy Mechanical Foundation



Foreword

A Heavy Mechanical Foundation student upon successful completion of the Foundation Program will possess the full range of basic knowledge of the Heavy Duty, Truck and Transport, Diesel Engine, and Transport Trailer trades. Upon completion of the Foundation Program the student will have completed the technical in school training related to Level One apprenticeship in the particular trade. The student will possess the abilities and skills required to, safely, adjust, maintain, and operate the equipment or vehicles related to these trades at a Level One apprentice.

Heavy Mechanical Foundation student inspects and repairs heavy trucks, commercial trucks, buses, diesel engines, transport trailers, cranes, graders, drills, bulldozers and other heavy equipment for proper performance. They also inspect the vehicles and equipment to detect, and to determine the extent of the repair required. These technicians service engines and engine support systems, hydraulic systems, pneumatics, and drive trains and perform general maintenance and repairs. Other duties include adjusting equipment, welding and cutting, repairing or replacing defective parts, components or systems, using hand and power tools and test equipment.

Upon completion of the program, the Heavy Mechanical Foundation student enters into an apprenticeship where they work in the full range of environmental conditions; from comfortable shops to remote sites where inclement weather can be a factor. Shift work is common. Good physical condition is important because the work often requires considerable standing, bending, crawling, lifting, climbing, pulling and reaching.

Due to the size and complexity of the equipment, safety is of prime importance. The student must be conscious of the impact on people, equipment, work area and environment when performing their work.

Some important attributes of the Heavy Mechanical Foundation student are:

- Reliability
- Analytical skills
- Ability to read and understand service manuals
- Mathematical aptitude

They also demonstrate the ability to:

- Communicate effectively
- Work with little or no supervision
- Contribute to a team approach
- Plan and work sequentially
- Adapt to changing technology
- Problem solve

Key attributes for people entering this trade are mechanical aptitude, manual dexterity, hand-eye coordination, stamina and agility. Communication skills and patience are also important. Other assets are good vision, hearing and sense of smell to diagnose problems. This occupation may require a valid driver's license with air endorsement and/or a forklift operator's certificate.

SAFETY ADVISORY

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



Acknowledgements

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- K. Poisson, Coast Mountain Bus Company (Apprenticeship Coordinator)
- D. Vallely, Coast Mountain Bus Company (Manager of Mechanics)
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- B. Holcik- Finning (Instructor)
- L. Babcock- Thompson Rivers University (Chair)
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- G. Shorland (Facilitator and Director, Program Standards)
- R. Robertson (CEO transCDA)

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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	Learners
Program Credentialing Model	Communicate program length and structure, and all pathways to completion	Understand the length and structure of the program, and pathway to completion
OAC	Communicate the competencies that industry has defined as representing the scope of the occupation	View the competencies they will achieve as a result of program completion
Training Topics and Suggested Time Allocation	Shows proportionate representation of general areas of competency (GACs) at each program level, the suggested proportion of time spent on each GAC, and percentage of time spent on theory versus practical application	Understand the scope of competencies covered in the technical training, the suggested proportion of time spent on each GAC, and the percentage of that time spent on theory versus practical application
Program Content	Defines the objectives, learning tasks, high level content that must be covered for each competency, as well as defining observable, measureable achievement criteria for objectives with a practical component	Provides detailed information on program content and performance expectations for demonstrating competency
Training Provider Standards	Defines the facility requirements, tools and equipment, reference materials (if any) and instructor requirements for the program	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



Section 2

PROGRAM OVERVIEW

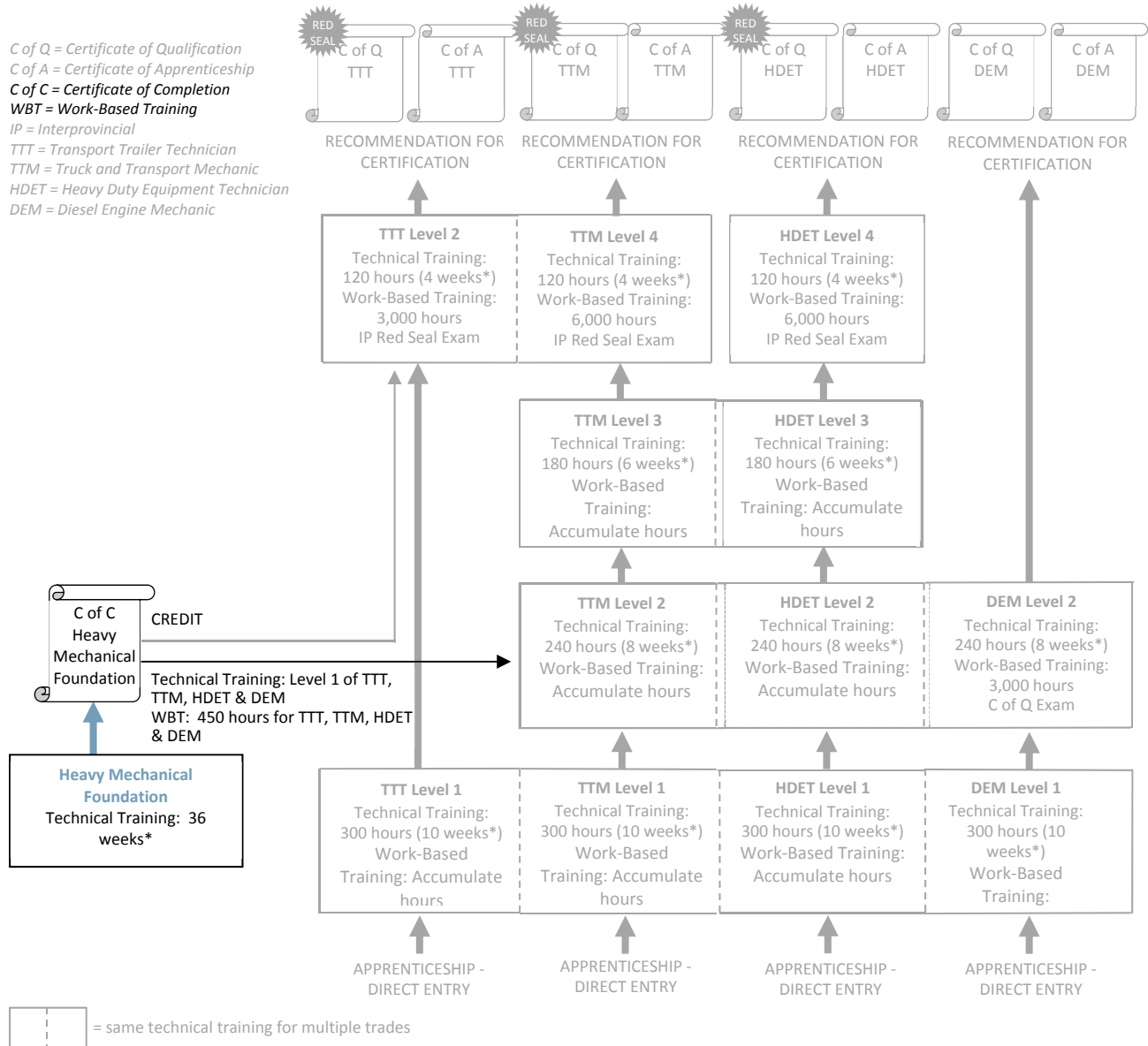
Heavy Mechanical Foundation



Program Overview

Program Credentialing Model

C of Q = Certificate of Qualification
 C of A = Certificate of Apprenticeship
 C of C = Certificate of Completion
 WBT = Work-Based Training
 IP = Interprovincial
 TTT = Transport Trailer Technician
 TTM = Truck and Transport Mechanic
 HDET = Heavy Duty Equipment Technician
 DEM = Diesel Engine Mechanic



*Suggested duration based on 30-hour week



Occupational Analysis Chart

HEAVY MECHANICAL FOUNDATION

Occupation Description: The Heavy Mechanical Foundation program covers the scope of four occupations:

- **Heavy Duty Equipment Technician:** “Heavy Duty Equipment Technician” means a person who maintains, manufactures, overhauls, reconditions and repairs equipment powered by internal combustion engines or electricity and without limiting the foregoing, including graders, loaders, shovels, tractors, trucks, forklifts, wheeled and tracked vehicles of all types used in construction, logging, sawmill, manufacturing, mining and other similar industry.
- **Truck & Transport Mechanic:** “Truck & Transport Mechanic” means a person who maintains, rebuilds, overhauls, reconditions does diagnostic troubleshooting of motorized commercial truck, bus, and road transport equipment.
- **Diesel Engine Mechanic:** “Diesel Engine Mechanic” means a person who installs, repairs, and maintains all internal combustion diesel engines and components used in transport, construction and marine.
- **Transport Trailer Technician:** “Transport Trailer Technician” means a person who maintains, rebuilds, overhauls, reconditions, and does diagnostic trouble shooting and repairs of commercial truck and trailers.

Occupational Skills A	Use Safe Work Practices A1	Apply Occupational Health and Safety A2	Use Environmental Practices A3	Use Hand Tools, Power Tools, and Shop Equipment A4	Use Fasteners and Fittings A5	Lift and Support Loads A6
	1 F	1 F	1 F	1 F	1 F	1 F
	Operate Equipment A7	Use Shop Resources and Record Keeping Practices A8	Service Winch Wire Rope A9	Identify Lubricants A10	Service Bearings and Seals A11	Apply Math and Science A12
1 F	1 F	1 F	1 F	1 F	F	
Use Electronic Media A13	Use Cutting and Welding Equipment A14	Prepare Job Action A15	Describe Diagnostic Procedures A16	Prepare for Employment A17		
1 F	1 F	F	1 F	F		



Brakes B	Service and Repair Hydraulic Brakes B1	Service and Repair Hydraulic Power Brakes B2	Service and Repair Air Brakes B3						
	1								F
Hydraulics C	Describe Hydraulic Systems C1	Service Hydraulic Components C2							
	1								F
Electrical D	Describe Electricity D1	Use Electrical Testing Instruments D2	Service and Diagnose Batteries D3	Service Charging Systems D4	Service Starting Systems D6	Service Electrical Circuits D8			
	1								F
Frames, Steering and Suspension E	Service and Diagnose Tires, Wheels, and Hubs E1	Service Steering Systems E2	Service, Diagnose and Repair Suspension Systems E4	Remove and Install Undercarriage E5	Diagnose and Repair Frames E6				
	1								F
Trailer F	Service Landing Gear and Trailer Accessories F1	Service and Repair Coupling Systems F2	Service, Diagnose and Repair Trailer Body Components F3	Service, Diagnose and Repair Heating and Refrigeration Systems F4					
	1								F
Heating, Ventilation & Air Conditioning G	Describe Heating and Air Conditioning Fundamentals G1	Diagnose and Repair Heating and Air Conditioning Systems G2							
	1								F



Engines and Supporting Systems H	Service Engine Support Systems H2	Service Diesel Fuel Supply Systems H4	Service Gasoline Fuel Systems H6	Remove and Install Diesel Engine H9	Service, Diagnose and Repair Electronic Ignition Systems H16	
	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Powertrain I	Service Clutches I2	Service Manual Transmissions I4	Service Torque Converters and Dividers I7	Service Powershift and Automatic Transmissions I8	Service Drivelines I11	Service Drive Axles I13
	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	Service Final Drives I15	Remove and Install Transmissions I20	Remove and Install Drivelines and Differentials I21	Remove and Install Final Drives I22		
	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
Structural Components & Accessories J	Identify Protective Structures J1	Service Cab Structures J2				
	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>			



Training Topics and Suggested Time Allocation

Heavy Mechanical Foundation

		% of Time Allocated to:			
		% of Time	Theory	Practical	Total
Line A	OCCUPATIONAL SKILLS	30%	70%	30%	100%
A1	Use Safe Work Practices		✓	✓	
A2	Apply Occupational Health and Safety		✓	✓	
A3	Use Environmental Practices		✓	✓	
A4	Use Hand Tools, Power Tools, and Shop Equipment		✓	✓	
A5	Use Fasteners and Fittings		✓	✓	
A6	Lift and Support Loads		✓	✓	
A7	Operate Equipment		✓	✓	
A8	Use Shop Resources and Record Keeping Practices		✓	✓	
A9	Service Winch Wire Rope		✓	✓	
A10	Identify Lubricants		✓	✓	
A11	Service Bearings and Seals		✓	✓	
A12	Apply Math and Science		✓		
A13	Use Electronic Media		✓	✓	
A14	Use Cutting and Welding Equipment		✓	✓	
A15	Prepare Job Action		✓		
A16	Describe Diagnostic Procedures		✓		
A17	Prepare for Employment		✓		
Line B	BRAKES	12%	47%	53%	100%
B1	Service and Repair Hydraulic Brakes		✓	✓	
B2	Service and Repair Hydraulic Power Brakes		✓	✓	
B3	Service and Repair Air Brakes		✓	✓	
Line C	HYDRAULICS	6%	71%	29%	100%
C1	Describe Hydraulic Systems		✓		
C2	Service Hydraulic Components		✓	✓	
Line D	ELECTRICAL	10%	45%	55%	100%
D1	Describe Electricity		✓		
D2	Use Electrical Testing Instruments		✓	✓	
D3	Service and Diagnose Batteries		✓	✓	
D4	Service Charging Systems		✓	✓	
D6	Service Starting Systems		✓	✓	
D8	Service Electrical Circuits		✓	✓	
Line E	FRAMES, STEERING AND SUSPENSION	15%	43%	57%	100%
E1	Service and Diagnose Tires, Wheels, and Hubs		✓	✓	
E2	Service Steering Systems		✓	✓	
E4	Service, Diagnose and Repair Suspension Systems		✓	✓	
E5	Remove and Install Undercarriage		✓	✓	
E6	Diagnose and Repair Frames		✓	✓	



% of Time Allocated to:

		% of Time	Theory	Practical	Total
Line F	TRAILER	6%	69%	31%	100%
F1	Service Landing Gear and Trailer Accessories		✓	✓	
F2	Service and Repair Coupling Systems		✓	✓	
F3	Service, Diagnose and Repair Trailer Body Components		✓	✓	
F4	Service, Diagnose and Repair Heating and Refrigeration Systems		✓	✓	
Line G	HEATING, VENTILATION AND AIR CONDITIONING	3%	50%	50%	100%
G1	Describe, Heating and Air Conditioning Fundamentals		✓		
G2	Diagnose and Repair Heating and Air Conditioning Systems		✓	✓	
Line H	ENGINES AND SUPPORTING SYSTEMS	9%	32%	68%	100%
H2	Service Engine Support Systems		✓		
H4	Service Diesel Fuel Supply Systems		✓	✓	
H6	Service Gasoline Fuel Systems		✓	✓	
H9	Remove and Install Diesel Engine		✓	✓	
H16	Service, Diagnose and Repair Electronic Ignition Systems		✓	✓	
Line I	POWERTRAINS	8%	36%	64%	100%
I2	Service Clutches		✓	✓	
I4	Service Manual Transmissions		✓	✓	
I7	Service Torque Converters and Dividers		✓	✓	
I8	Service Powershift and Automatic Transmissions		✓	✓	
I11	Service Drivelines		✓	✓	
I13	Service Drive Axles		✓	✓	
I15	Service Final Drives		✓	✓	
I20	Remove and Install Transmissions		✓	✓	
I21	Remove and Install Drivelines and Differentials		✓	✓	
I22	Remove and Install Final Drives		✓	✓	
Line J	STRUCTURAL COMPONENTS AND ACCESSORIES	1%	76%	24%	100%
J1	Identify Protective Structures		✓		
J2	Service Cab Structures		✓	✓	
Total Percentage for Heavy Mechanical Foundation		100%			



Section 3

PROGRAM CONTENT

Heavy Mechanical Foundation



LEARNING TASKS

3. Locate shop emergency equipment and procedures

4. Describe the conditions necessary to support a fire

5. Describe the classes of fires according to the materials being burned

6. Apply preventative fire safety precautions when working near, handling or storing flammable liquids or gases, combustible materials and electrical apparatus

7. Describe the considerations and steps to be taken prior to fighting a fire

8. Describe the procedure for using a fire extinguisher

CONTENT

- Emergency shutoffs
- Fire control systems
- Eye wash facilities
- Emergency exits
- First aid facilities
- Emergency contact/phone numbers
- Outside meeting place
- Disaster meeting place

- Air
- Fuel
- Heat

- Class A
- Class B
- Class C
- Class D
- Symbols and colours

- Fuels
- Diesel
- Gasoline
- Propane
- Natural Gas
- Ventilation
- Purging
- Lubricants
- Oily rags
- Combustible metals
- Aerosols

- Warning others and the Fire Department
- Evacuation of others
- Fire contained and not spreading
- Personal method of egress
- Training

- P.A.S.S.
 - Pull
 - Aim
 - Squeeze
 - Sweep



LEARNING TASKS

9. Describe fire suppression systems

CONTENT

- Types
- Construction
- Operation
- Disarming



Line (GAC): **A** **OCCUPATIONAL SKILLS**
Competency: **A3** **Use Environmental Practices**

Objectives

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

- Describe the purpose of the Workplace Hazardous Materials Information System (WHMIS) Regulations.
- Explain the contents of the Material Safety Data Sheets (MSDS).
- Explain the content of a WHMIS label.
- Apply WHMIS regulations.

LEARNING TASKS

1. State the legislation that requires suppliers of hazardous materials to provide MSDSs and label products as a condition of sale and importation

2. State the purpose of the Workplace Hazardous Materials Information System (WHMIS)

3. Describe the key elements of WHMIS

4. Describe the responsibilities of suppliers under WHMIS

5. Describe the responsibilities of employers under WHMIS

CONTENT

- Hazardous Product Act
- Controlled Products Regulations
- Ingredients Disclosure List
- Hazardous Materials Information Review Act
- Hazardous Materials Information Review Regulations

- Protection of Canadian workers from the adverse effects of hazardous materials through the provision of relevant information while minimizing the economic impact on industry and the disruption of trade
- Recognition of rights
 - Workers
 - Employers
 - Suppliers
 - Regulators
- Material safety data sheets (MSDSs)
- Labeling of containers of hazardous materials
- Worker education programs

- Provide
 - MSDSs
 - Labels

- Provide
 - MSDSs
 - Labeling
 - Worker education



LEARNING TASKS

6. Describe information to be disclosed on a MSDS

7. Identify symbols found on WHMIS labels and their meaning

8. Apply WHMIS regulations as they apply to hazardous materials used in the shop

9. Identify current environmental standards

CONTENT

- Hazardous ingredients
- Preparation information
- Product information
- Physical data
- Fire or explosion
- Reactivity data
- Toxicological properties
- Preventive measures
- First-aid measures

- Compressed gases
- Flammable and combustible materials
- Oxidizing materials
- Poisonous and infectious materials
 - Materials causing immediate and serious toxic effects
 - Materials causing other toxic effects
 - Bio-hazardous infectious materials
- Corrosive materials
- Dangerously reactive materials

- Use, storage and disposal of
 - Solvents
 - Caustic cleaners
 - Cleaning solutions
 - Alcohol used for cleaning
 - Gasoline
 - Diesel fuel
 - L.P.G.
 - C.N.G.
 - Asbestos
 - Battery acid
 - Refrigerants
 - Brake fluid
 - Antifreeze
 - Lubricants
 - Tracer dyes

- Environmental Protection Agency (EPA)
- Hazardous Materials (HAZMAT)
- Industry Standards



Line (GAC): **A** **OCCUPATIONAL SKILLS**
Competency: **A4** **Use Hand Tools, Power Tools and Shop Equipment**

Objectives

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

- Select, use and maintain tools and shop equipment.
- Select, use and maintain safety equipment.

LEARNING TASKS

1. Use protective equipment associated with the use of tools and shop equipment

2. Apply lock-out procedures to shop equipment

3. Select, use and maintain hand tools

CONTENT

- Personal Protective Equipment
 - Head
 - Hands
 - Lungs
 - Eyes
 - Ears
 - Feet
 - Clothing
- Screening
- Guarding
- Ventilation
- Clean up
- WorkSafeBC lock-out procedures
- Electrical isolation
- Tags
- Locks
- Hand tool safety
 - Safety practices
 - Work with a safe attitude
 - Tool selection
 - Organize work area
 - Correct usage of hand tools
 - Maintain hand tools
 - Safe tool handling
 - Safe tool storage
- Hazards
- Wrenches
- Screwdrivers
- Cutting tools
- Hammers
- Chisels/punches
- Pry bars
- Pliers



LEARNING TASKS

4. Select, use and maintain measuring instruments

5. Select, use and maintain power tools

6. Select, use and maintain drill bits

7. Select, use and maintain shop equipment

CONTENT

- Clamping tools
- Abrasives
- Pullers
- Torque wrenches and multipliers

- Layout tools
- Precision measuring
- Imperial
- Metric
- Micrometer
- Veriner
- Dial indicator
- Feeler/thickness gauges
- Bore gauges

- Pneumatic
- Electric
- Hydraulic

- Types
- Sharpening
- Cutting speeds

- Presses
- Parts cleaning equipment
 - Hot tank
 - Cold solution
 - Hot agitator
 - Solvent tank
 - Pressure washer
 - Steam cleaner
 - Chemical cleaners
- Drill press
- Glass beader
- Sand blaster
- Grinders
- Compressor
- Cut-off saws



Line (GAC): **A** **OCCUPATIONAL SKILLS**
Competency: **A5** **Use Fasteners and Fittings**

Objectives

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

- Select and use imperial and metric fasteners.
- Select and use pipe, tubing, hose and fittings.

LEARNING TASKS

1. Select and use imperial and metric fasteners

2. Cut and repair internal and external threads

3. Select use and repair tubing, pipe and fittings

CONTENT

- Thread systems
- Fastener types
 - Installation
- Washers
 - Types
 - Applications
- Locking devices
 - Types
 - Applications
- Taps
- Dies
- Thread repair
- Tubing
 - Types
 - Sizing
 - Applications
- Pipe
 - Types
 - Sizing
- Threads
 - Applications
- Fitting
 - Types
 - Sizing
 - Applications
- Assembly procedures
- Sealants
- Cutting, bending and flaring



LEARNING TASKS

4. Select and use hose and hose fittings

CONTENT

- Hose
 - Types
 - Sizing
 - Applications
- Assembly
- Hose fittings
 - Types



Line (GAC): A OCCUPATIONAL SKILLS

Competency: A6 Lift and Support Loads

Objectives

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

- Apply the WorkSafeBC Safety Regulations to lifting and blocking applications.
- Select, use and maintain lifting and blocking equipment.
- Lift and move loads.

LEARNING TASKS

1. Apply the Occupational Health and Safety Regulations
2. Determine load weight
3. Select, use and maintain jacks
4. Select, use and maintain stands and blocking
5. Select, use and maintain wire ropes, chains and lifting straps
6. Use fibre rope knots, bends and hitches
7. Use visual and sound signals
8. Select, use and maintain hoisting equipment
9. Lift, hoist and move loads

CONTENT

- Refer to Regulations
 - PPE
 - Clothing
 - Housekeeping
 - Safe lifting and carrying
 - Safe handling with cranes
- Manufacturer’s specification
- Estimation
- Types
- Capacities
- Manufacturer’s procedures
- Types
- Capacities
- Bridging
- Types
- Capacities
- Inspection
- Rating tags
- Rigging and lifting attachments
- Types
- Uses
- Care and maintenance
- WorkSafeBC Safety Regulations
 - Hand
 - Sound
- Types
- Capacities
- Operation
- Determine safe working load
- Lifting and rigging procedures
- Regulations and specifications



Line (GAC): **A** **OCCUPATIONAL SKILLS**
Competency: **A7** **Operate Equipment**

Objectives

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

- Perform pre-start and walk around inspections.
- Start, move, secure and stop equipment.
- Obtain forklift operation training.

LEARNING TASKS

1. Describe pre-start and walk around inspections

2. Describe starting aids

3. Describe start up procedures

4. Describe emergency shut down procedures

5. Start, operate and shut down selected equipment

6. Lock-out heavy duty equipment prior to service

7. Operate a forklift

CONTENT

- Checklist
- Operator's manuals
- Glow plug systems
- Intake preheater systems
- Starting fluids
- Block/circulating heaters
- Battery warmers
- Controls
- Cranking
- Monitoring
- Jump starting
- Cut-off
 - Fuel
 - Air
- Pre-start and walk around
- Use of starting aids
- Moving
- Securing and shutting down
- WorkSafeBC requirements
- Electrical isolation (Night switch)
- Tag
- Key in pocket
- Safe operation
- Forklift training (certification optional)
 - Occupational Health and Safety Regulations
 - Maintenance and records



Line (GAC): **A** **OCCUPATIONAL SKILLS**
Competency: **A9** **Service Winch Wire Rope**

Objectives

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

- Describe wire rope and its applications.
- Inspect and service wire rope used on winches.

LEARNING TASKS

1. Describe wire rope
2. Inspect wire rope
3. Service wire rope

CONTENT

- Types
 - Regular lay
 - Lang lay
- Construction
- Application
- Safe working load
- Frequency
- Wear
- Damage
- Inspection
- Remove
- Repair or replace
- Lubrication
- Scheduled maintenance



LEARNING TASKS

4. Handle lubricants

5. Perform fluid analysis

CONTENT

- Storage
- Disposal
- Personal protection

- Procedures
- Safety
- Reports
 - Contamination
 - Condition
 - Recommendations



LINE (GAC): A OCCUPATIONAL SKILLS

Competency: A12 Apply Math and Science

Objectives

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

- Use mathematics to solve problems involving whole numbers.
- Describe key terms and concepts for working with fractions.
- Solve problems involving common fractions.
- Describe key terms and concepts for working with decimals.
- Convert between common decimal fractions.
- Solve problems involving decimal fractions.
- Describe and convert between metric and imperial measurements.
- Describe key terms and concepts for working with ratio and proportion.
- Use ratio and proportion to solve problems.
- Describe and use key terms and concepts for equations and formulas.
- Solve problems using perimeters, areas and volume.
- Describe and use angles and geometric construction.

LEARNING TASKS

1. Identify words indicating mathematical operations

2. Solve word problems involving whole numbers

3. Describe key terms and concepts for working with fractions

4. Add and subtract fractions

5. Multiply and divide fractions

CONTENT

- Operations
 - Addition
 - Subtraction
 - Multiplication
 - Divisions

- Process

- Numerator
- Denominator
- Terms
- Proper fraction
- Improper fraction
- Mixed number
- Common fraction
- Reciprocal
- Lowest common denominator

- Unlike fractions
- Like fractions
- Mixed numbers

- Proper fractions
- Improper fractions
- Mixed numbers



LEARNING TASKS

6. Solve word problems involving fractions
7. Describe key terms and concepts for working with decimals
8. Convert between decimals and fractions
9. Add, subtract, multiply and divide decimals
10. Describe metric measurement
11. Convert between the metric and imperial system of measurement
12. Describe key terms and concepts for working with ratio and proportion
13. Solve word problems involving ratio and proportion
14. Describe key terms and concepts for equations and formulas
15. Solve problems involving formulas
16. Solve problems involving perimeters
17. Solve problems involving area

CONTENT

- Process
- Place value
- Significant digits
- Rounding
- Repeating decimal fractions
- Conversion
 - Decimal to fraction
 - Fraction to decimal
- Fraction with lowest terms
- Place value
- Word problems
- Units
- Prefixes
- Converting within the metric system
- Length
- Mass
- Volume
- Temperature
- Pressure
- Torque
- Ratio
 - Formulas
- Proportion
 - Cross multiplication
- Process
- Equation
- Formula
- Constant
- Solution
- Operational symbols
- Order of operations
- Word problems
- Calculations
- Formulas
- Calculations
- Formulas



Line (GAC): **A OCCUPATIONAL SKILLS**
Competency: **A14 Use Cutting and Welding Equipment**

Objectives

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

- Identify metals.
- Describe different welding procedures.
- Cut, weld and braze using oxy-acetylene.
- Perform shielded metal arc weld.
- Weld using wire feed processes.
- Solder tubing and sheet metal.

LEARNING TASKS

1. Identify regulations with respect to welding
2. Identify metals

3. Identify oxy-acetylene components

4. Use oxy-acetylene equipment

5. Cut mild steel with oxy-acetylene equipment

CONTENT

- WorkSafeBC Safety Regulations
- Metals and alloys
- Terminology
- Shapes
- Storage and handling
- Gases
- Valves and regulators
- Cylinders
- Hoses and fittings
- Cutting torches and tips
- Safety precautions
- Blow back
- Check valves
- Assembly procedures
- Operation procedures
- Lighting
- Pressures
- Adjusting
- Shut down procedures
- Leak testing
- Storage
- Set-up
- Freehand cuts
- Guided cuts
- Hole piercing



LEARNING TASKS

6. Weld mild steel with oxy-acetylene equipment

7. Braze lap joints with oxy-acetylene equipment

8. Solder tubing and sheet metal

9. Describe the shielded metal arc welding (SMAW) process

10. Identify shielded metal arc welding equipment

11. Identify mild steel electrodes for shielded metal arc welding

12. Weld mild steel with shielded metal arc

CONTENT

- Principles of fusion welding
- Filler metal
- Flux
- Welding tips
- Flame
- Technique
- Basic joints

- Brazing set-up
- Brazing techniques

- Process and procedures
- Solder types
 - 60/40
 - 40/60
 - Rosin core
 - Acid core

- Process
- Applications
- Safety requirements

- AC/DC machines
- Components
- Electrode holder
- Ground clamps
- Cables
- Connectors

- Types
- Operations
- Classifications
- Selection
- Storage and handling

- Procedures
- Weld ground placement
- Settings
- Positions
- Joints
- Types of welds



LEARNING TASKS

13. Weld mild steel using wire feed processes

14. Describe air-arc gouging

CONTENT

- Procedures
- Settings
- Safety
- Weld types and positions
- Wire type

- Purpose
- Procedure
- Safety



Line (GAC): **A OCCUPATIONAL SKILLS**
Competency: **A16 Describe Diagnostic Procedures**

Objectives

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

- Describe the importance of following a diagnostic procedure.
- Describe diagnostic procedures used for troubleshooting.

LEARNING TASKS

1. Describe the importance of following a diagnostic process

2. Describe general diagnostic procedures

3. Describe the importance of following manufacturer’s diagnostic procedures where available

4. Describe the importance of failure analysis

CONTENT

- Cost of improper diagnosis
- Unhappy customers
- Lost business
- Time management
- Efficiency
- Damage to components
- Understand system
- Understand complaint
- Communicate with operator
- Operational test
- Visual inspection
- Form all possible conclusions
- Test conclusions
- System component isolation
- Time saving
- Warranty requirement
- Diagnostic efficiency
- Repeat failure
- Extend life
- Cost
- Customer satisfaction



Line (GAC): A OCCUPATIONAL SKILLS

Competency: A17 Prepare for Employment

Objectives

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

- Describe the areas and types of vehicles and equipment maintained and repaired.
- Describe different business types.
- Describe relationships between business, labour, and government.
- Demonstrate positive employee attributes.
- Describe employer responsibilities.
- Prepare a resume and identify job search resources.
- Prepare for an interview.

LEARNING TASKS

1. Describe the areas and types of vehicles and equipment maintained and repaired

2. Describe the current heavy mechanics trade

3. Describe the range of working conditions

4. Describe types of businesses

5. Describe labour groups

CONTENT

- Types of equipment for heavy mechanical trades
 - Buses
 - Excavators
 - Trucks
 - Loaders
 - Tractors
 - Trailers
 - Dozers
- Current apprenticeship training
- Physical and mental requirements
- Job opportunities
 - Locations
 - Advancement
 - Specialization
- Types of employment opportunities
 - Dealerships
 - Fleets
 - Independents
- Pay scales
- Hours of work
- Working environments
- Quality control
- Independent
- Dealerships
- Fleets
- Union
- Non-union



LEARNING TASKS

11. Identify job search sources

12. Prepare for an interview

13. Follow up on an interview

CONTENT

- Closing Paragraph
- Newspapers
- Internet
- Networking
- Industry publications
- Direct approach
- Research of the organization
- Review of job qualifications
- Prepare for broad personal questions
- Review of resume
- Interview practice
- Personal appearance
- Arriving ahead of time
- Written
 - Letter of appreciation
- Verbal



LEARNING TASKS

4. Describe the hydraulics of a brake system

5. Select brake fluids

6. Describe parking brake systems

7. Diagnose hydraulic brake systems

8. Repair hydraulic brake systems

CONTENT

- Types
 - Disk
 - Drum
 - Multidisc
 - Others
- Components
 - Master cylinder
 - Metering valve
 - Proportioning valve
 - Switches
- Operation
- Requirements
- Types
 - DOT 3
 - DOT 4
 - DOT 5
 - Others
- Characteristics
 - Hygroscopic
 - Boiling point
 - Viscosity
- Identification
- Types
 - Integral
 - Driveline
 - Hydraulic
 - Mechanical
- Components
- Operation
- Diagnostic procedures
 - Operational checks
 - Fluid condition/level
- Inspection
- Components
 - Hydraulic
 - Mechanical
- Inspection
- Remove
- Repair or replace
- Install
- Flush/bleed



LEARNING TASKS

- 9. Service parking brake systems

- 10. Perform preventive maintenance

CONTENT

- Inspection
- Remove
- Repair or replace
- Install

- Inspection
- Operational tests
- Fluid level checks
- Adjustment
- Lubrication

Achievement Criteria

Performance B1 Service and Repair Hydraulic Brakes

Conditions The learner will require:

- Tools
- Test equipment
- Manufacturer's specifications
- A work place or training environment

Equipment with hydraulic disk and drum brakes

Criteria The learner will be competent once the performance criteria is met:

- Followed safe work practices throughout entire task including lock out procedures
- Conducted in a logical manner
- Conducted according to manufacturer's specifications
- Conducted according to work place requirements

Throughout the term of the apprenticeship, the learner must conduct the above performance a multiple of times and in a variety of contexts



Line (GAC): B BRAKES
Competency: B2 Service and Repair Hydraulic Power Brakes

Objectives

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

- Diagnose hydraulic assisted power brake systems.
- Repair hydraulic assisted power brake systems.
- Describe hydraulic anti-lock braking (ABS) systems.
- Diagnose and repair hydraulic anti-lock braking (ABS) systems.

LEARNING TASKS

1. Describe the power brake systems

2. Diagnose power brake systems

3. Repair power brake systems

4. Describe hydraulic anti-lock braking systems

CONTENT

- Types
 - Vacuum boosters
 - Hydro-boost
 - Hydro-max
 - Hydraulic
- Components
- Operation
- Diagnostic procedures
- Operational test
- Components
- Inspection
- Testing
- Inspection
- Remove
- Repair or replace
- Install
- Adjustments
- Verify system operation
- Types
 - Single channel
 - Two channel
 - Four channel
- Components
- Operation
- Precautions



LEARNING TASKS

5. Diagnose hydraulic anti-lock braking systems

6. Repair hydraulic anti-lock braking systems

CONTENT

- Manufacturer's diagnostic procedures
- Road test
- Diagnostic codes
- Components
- Inspection
- Testing

- Inspection
- Remove
- Repair or replace
- Install
- Adjustments
- Verify system operation
- Diagnostic codes

Achievement Criteria

Performance B2 Service and Repair Hydraulic Power Brakes

Conditions The learner will require:

- Tools
- Test equipment
- Manufacturer's specifications
- A work place or training environment

Equipment with hydraulic disk and drum brakes

Criteria The learner will be competent once the performance criteria is met:

- Followed safe work practices throughout entire task including lock out procedures
- Conducted in a logical manner
- Conducted according to manufacturer's specifications
- Conducted according to work place requirements

Throughout the term of the apprenticeship, the learner must conduct the above performance a multiple of times and in a variety of contexts



LEARNING TASKS

4. Describe the basics of air brake schedules
5. Repair foundation brake assembly
6. Service and inspect air brakes
7. Describe tractor trailer pre-trip brake inspection
8. Perform a tractor trailer pre-trip brake inspection

CONTENT

- 121
- S
- SX
- Operation and routine maintenance
- Inspection
- Disassembly
- Replacement
- Measurement
- Assembly
- Adjustment
- Tractor and trailer
- Components
 - Foundation brakes
 - Reservoirs
 - Lines
 - Disc/Drum
- Adjustment
- Scheduled maintenance
- As per motor vehicle standards
- As per motor vehicle standards

Achievement Criteria

Performance B3 Service and Repair Air Brakes

Conditions The learner will require:

- Tools
- Test equipment
- Manufacturer's specifications
- A work place or training environment

Equipment with hydraulic disk and drum brakes

Criteria The learner will be competent once the performance criteria is met:

- Followed safe work practices throughout entire task including lock out procedures
- Conducted in a logical manner
- Conducted according to manufacturer's specifications
- Conducted according to work place requirements

Throughout the term of the apprenticeship, the learner must conduct the above performance a multiple of times and in a variety of contexts



LEARNING TASKS

4. Interpret basic hydraulic diagrams

CONTENT

- Types
 - Pictorial
 - Schematic
- Basic symbols



Line (GAC): C **HYDRAULICS**
Competency: C2 **Service Hydraulic Components**

Objectives

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

- Describe selected hydraulic components.
- Select hydraulic fluids for applications.
- Select and assemble hydraulic hoses and fittings.
- Demonstrate safe work procedures for hydraulic systems service.
- Perform scheduled maintenance on hydraulic systems.

LEARNING TASKS

1. Describe hydraulic components

2. Select hydraulic fluids

3. Select hydraulic hoses and fittings

4. Assemble hydraulic hoses and fittings

CONTENT

- Seals
- Hoses/lines
- Fittings
- Filters

- Requirements
- SAE viscosity ratings
- ISO viscosity ratings
- API service ratings
- Manufacturer’s specifications
- Synthetic/Non-synthetic (mineral)
- Component/System compatibility

- Hose construction
- Working pressure
- Ratings
- Compatability
- Hose application
- Fitting types
 - National Pipe Thread (NPT)
 - Joint Industry Conference (JIC)
 - O-ring Boss (ORB)
 - O-ring Face (ORFS)
 - Split flange
 - Society of Automotive Engineers (SAE)
 - Reusable/Permanent

- Permanent
- Reusable



LEARNING TASKS

5. Demonstrate safe work procedures

6. Perform scheduled maintenance

CONTENT

- Safety blocking equipment and attachments
- Relieve pressure
- Reservoir venting
- Actuator neutralization
- Temperature hazards

- Visual inspection
- Leaks
- Hose rubs
- External damage
- Fluid level check
- Filter change, fluid change, fluid analysis
- Strainers
- Flushing system

Achievement Criteria

Performance C2 Service Hydraulic Components

Conditions The learner will require:

- Tools
- Test equipment
- Manufacturer's specifications
- A work place or training environment
- Equipment with mobile hydraulic systems

Criteria The learner will be competent once the performance criteria is met:

- Followed safe work practices throughout entire task including lock out procedures
- Conducted in a logical manner
- Conducted according to manufacturer's specifications
- Conducted according to work place requirements

Throughout the term of the apprenticeship, the learner must conduct the above performance a multiple of times and in a variety of contexts



LEARNING TASKS

3. Describe magnetic theory

4. Identify common electrical components

5. Describe the basic function of common electronic components

6. Interpret basic electrical wiring diagrams

CONTENT

- Load
- Complete path
- Electrical relationships
- Ohm's Law
- Watt's Law
- Series circuits
- Parallel circuits
- Series parallel circuits
- Properties of magnetic lines of force
- Terminology
- Relationship to electric current
- Electromagnetic induction
 - Types
 - Requirements
 - Factors affecting magnitude
- Lamps
- Switches
- Relays
- Solenoids
- Resistors
 - Fixed
 - Variable
- Capacitors
- Motors
- Alternators
- Fuses
- Diodes
- Transistors
- Types
- Wiring schematic and diagrams
- Symbols
- Conventions
- Abbreviations



Line (GAC): **D ELECTRICAL**
Competency: **D4 Service Charging Systems**

Objectives

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

- Describe the purpose of charging circuits.
- Perform routine maintenance on charging circuits.

LEARNING TASKS

1. Describe charging circuits

2. Maintain charging circuits

CONTENT

- Purpose
- Operation
- Connections

- Inspection
- Visual
- Audible
- Output voltage/amperage test
- Belt condition and tension
- Alternator removal and replacement

Achievement Criteria

Performance D4 Service Charging Systems

- Conditions The learner will require:
- Tools
 - Test equipment
 - Manufacturer's specifications
 - A work place or training environment
 - Equipment with functional charging circuit

- Criteria The learner will be competent once the performance criteria is met:
- Followed safe work practices throughout entire task including lock out procedures
 - Conducted in a logical manner
 - Conducted according to manufacturer's specifications
 - Conducted according to work place requirements

Throughout the term of the apprenticeship, the learner must conduct the above performance a multiple of times and in a variety of contexts

**Achievement Criteria**

Performance D6 Service Starting Systems

Conditions The learner will require:

- Tools
- Test equipment
- Manufacturer's specifications
- A work place or training environment
- Equipment with functional starter circuit

Criteria The learner will be competent once the performance criteria is met:

- Followed safe work practices throughout entire task including lock out procedures
- Conducted in a logical manner
- Conducted according to manufacturer's specifications
- Conducted according to work place requirements

Throughout the term of the apprenticeship, the learner must conduct the above performance a multiple of times and in a variety of context

**Achievement Criteria**

Performance D8 Service Electrical Circuits

Conditions The learner will require:

- Tools
- Test equipment
- Manufacturer's specifications
- A work place or training environment
- Equipment with electrical and electronic

Criteria The learner will be competent once the performance criteria is met:

- Followed safe work practices throughout entire task including lock out procedures
- Conducted in a logical manner
- Conducted according to manufacturer's specifications
- Conducted according to work place requirements

Throughout the term of the apprenticeship, the learner must conduct the above performance a multiple of times and in a variety of contexts

**Achievement Criteria**

Performance E2 Service Steering Systems

Conditions The learner will require:

- Tools
- Test equipment
- Manufacturer's specifications
- A work place or training environment
- Equipment with various steering systems

Criteria The learner will be competent once the performance criteria is met:

- Followed safe work practices throughout entire task including lock out procedures
- Conducted in a logical manner
- Conducted according to manufacturer's specifications
- Conducted according to work place requirements

Throughout the term of the apprenticeship, the learner must conduct the above performance a multiple of times and in a variety of contexts



LINE (GAC): **E FRAMES, STEERING AND SUSPENSION**
Competency: **E4 Service, Diagnose and Repair Suspension Systems**

Objectives

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

- Describe suspension systems.
- Diagnose and repair suspension systems.

LEARNING TASKS

1. Describe wheeled equipment suspension systems

2. Diagnose wheeled equipment suspension systems

3. Repair wheeled equipment suspension systems

4. Diagnose and repair auto-lube systems

5. Describe truck and trailer steering axle suspension systems

CONTENT

- Types
 - Hydro pneumatic
 - Rigid
- Components
- Operation

- Inspection
- Measuring

- Inspection
- Remove
- Repair or replace
- Install
- Adjustments
- Lubrication
- Scheduled maintenance

- Inspection
- Remove
- Repair or replace
- Install
- Adjustments
- Scheduled maintenance

- Types
 - Single
 - Tandem
- Components
 - Air bag
 - Shock absorbers
 - Spring construction
 - Hangers and attachments
- Operation



LEARNING TASKS

6. Repair truck and trailer steering axle suspension systems

7. Describe truck and trailer rear axle suspension systems

8. Repair truck and trailer rear axle suspension systems

CONTENT

- Inspection
- Replacement
- Repair
- Adjustments
- Lubrication

- Arrangements
 - Single axle
 - Tandem axle
 - Tri axle
 - Lift axle
 - Tag axle
- Types
 - Walking beams
 - Leaf springs
 - Air bag
 - Rubber block
- Components
 - Torque rods
 - Transverse rods
 - Frame attachments
 - Springs
 - Pins and bushings
- Operation

- Inspection
- Replacement
- Repair
- Lubrication
- Adjustments

Achievement Criteria

Performance E4 Service, Diagnose and Repair Suspension Systems

- Conditions The learner will require:
- Tools
 - Test equipment
 - Manufacturer's specifications
 - A work place or training environment
 - Equipment with various suspension systems

- Criteria The learner will be competent once the performance criteria is met:
- Followed safe work practices throughout entire task including lock out procedures
 - Conducted in a logical manner
 - Conducted according to manufacturer's specifications
 - Conducted according to work place requirements

Throughout the term of the apprenticeship, the learner must conduct the above performance a multiple of times and in a variety of contexts



Line (GAC): E FRAMES, STEERING AND SUSPENSION

Competency: E6 Diagnose and Repair Frames

Objectives

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

- Describe types of frames.
- Diagnose and repair frames.

LEARNING TASKS

1. Describe rail and frame types

2. Diagnose frames

CONTENT

- Types of rails
 - Materials
 - Mild steel
 - High tensile steel
 - Aluminum
 - Strength
 - Resisting bending moment (RBM)
 - Section modulus
 - Yield strength
- Types of frames
 - Channel
 - Rigid
 - Articulated
 - I beam
- Components
 - Cross members
 - Brackets
 - Mounts
 - Hardware
 - Fasteners
 - Grade
 - Type
- Components
- Inspection
- Alignment
 - Measuring
 - Projection
 - Laser
 - String



LEARNING TASKS

3. Repair frames

CONTENT

- Visual inspection
- Rail replacement
- Rail sectional replacement
 - Welding procedure
 - Brace support
- Repair
 - Crack
 - Bent
 - Twisted
- Adjustments
 - Alignment

Achievement Criteria

Performance E6 Diagnose and Repair Frames

Conditions The learner will require:

- Tools
- Test equipment
- Manufacturer's specifications
- A work place or training environment
- Equipment with various frame configurations

Criteria The learner will be competent once the performance criteria is met:

- Followed safe work practices throughout entire task including lock out procedures
- Conducted in a logical manner
- Conducted according to manufacturer's specifications
- Conducted according to work place requirements

Throughout the term of the apprenticeship, the learner must conduct the above performance a multiple of times and in a variety of contexts



Line (GAC): F TRAILER
Competency: F1 Service Landing Gear and Trailer Accessories

Objectives

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

- Describe the construction and operation of accessories.
- Service limited accessories.

LEARNING TASKS

1. Describe the construction and operation of accessories

CONTENT

- Types
- Lift gates
 - Hydraulic
- Landing gear
 - Speeds
 - Gears
 - Cross rods
 - Support
- Ladders
- Dump box
 - Transfer box
 - High lift gate
 - Pony
 - End dump
 - Side dump
 - Clam dump
- Log bunks
 - Stakes
 - Extensions
 - Bunk
 - Bolster
 - Live
 - Fixed
- Draw bar
 - Pintle eye
 - Bushing
 - Compensator
- Load winch
 - Ratchet
 - Locks
- Components
- Operation



LEARNING TASKS

2. Service and repair lift gates, landing gears and winches

CONTENT

- Inspect
 - Operation
 - Hydraulics
 - Pivots
 - Lubrication
- Remove
- Repair or replace
- Install
- Lubrication
- Adjust
- Scheduled maintenance

Achievement Criteria

Performance F1 Service Landing Gear and Trailer Accessories

Conditions The learner will require:

- Tools
- Test Equipment
- Manufacturer's specifications
- A work place or training environment
- Equipment – trailer accessories, landing gear, logging bunk, lift gate

Criteria The learner will be competent once the performance criteria is met:

- Followed safe work practices throughout entire task including lock out procedures
- Conducted in a logical manner
- Conducted according to manufacturer's specifications
- Conducted according to work place requirements

Throughout the term of the apprenticeship, the learner must conduct the above performance a multiple of times and in a variety of contexts



LEARNING TASKS

4. Describe bolster plates and king pins

5. Describe pintle hooks and eyes

6. Service and repair pintle hooks and eyes

CONTENT

- Bolster plates
- King pins
 - Size
 - Mounting
- Types
- Ratings
- Buffers
- Pneumatic
- Hydraulic
- Safety chains
- Compensators
- Inspection
 - Cracks
 - Wear
 - Evidence of welding
 - Bushings
- Replacement
- Lubrication
- Scheduled maintenance

Achievement Criteria

Performance F2 Service and Repair Coupling Systems

Conditions The learner will require:

- Tools
- Test equipment
- Manufacturer's specifications
- A work place or training environment
- Equipment - fifth wheel and pintle hitch assembly

Criteria The learner will be competent once the performance criteria is met:

- Followed safe work practices throughout entire task including lock out procedures
- Conducted in a logical manner
- Conducted according to manufacturer's specifications
- Conducted according to work place requirements

Throughout the term of the apprenticeship, the learner must conduct the above performance a multiple of times and in a variety of contexts



Line (GAC): F TRAILER

Competency: F3 Service, Diagnose and Repair Trailer Body Components

Objectives

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

- Describe the purpose and operation of trailer body components.
- Install and remove trailer body components.
- Diagnose and repair or replace trailer body components.

LEARNING TASKS

1. Describe the purpose and operation of trailer body components

2. Remove and install trailer body components

3. Diagnose trailer body components

4. Repair trailer body components

CONTENT

- Components
 - Frames
 - Doors
 - Hinged
 - Roll up
 - Bumpers
 - Tanks
 - Valves
 - Manifold piping
 - Gauges
 - Transfer pump
 - Reflective tape

- Safety
- Operation
- Procedures
- Support systems

- Operation
- Manufacturer’s specifications
- Inspection and testing procedures
- Diagnosis
- Damage and wear identification

- Procedures
- Manufacturer’s specifications
- Testing
- Replacement
- Doors
 - Sidewall panels
 - Cross members

**Achievement Criteria**

Performance F3 Service, Diagnose and Repair Trailer Body Components

Conditions The learner will require:

- Tools
- Test equipment
- Manufacturer's specifications
- A work place or training environment
- Equipment with a variety of trailer bodies

Criteria The learner will be competent once the performance criteria is met:

- Followed safe work practices throughout entire task including lock out procedures
- Conducted in a logical manner
- Conducted according to manufacturer's specifications
- Conducted according to work place requirements

Throughout the term of the apprenticeship, the learner must conduct the above performance a multiple of times and in a variety of contexts



Line (GAC): F TRAILER
Competency: F4 Service, Diagnose and Repair Heating and Refrigeration Systems

Objectives

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

- Identify heating and refrigeration components.
- Diagnose refrigeration units.
- Repair heating and refrigeration systems.

LEARNING TASKS

1. Describe types of heating and refrigeration

2. Service and repair heating and refrigeration systems

3. Describe hazards associated with refrigeration units

CONTENT

- Trailer mounted
 - Cooling unit
 - Heating unit
- Maintenance
- Inspections
 - Operational checks
 - Pressure checks
 - Temperature checks
- Lubricants
- Service intervals
- Belts
- Fall protection
- Refrigerant
- Enviromental considerations
 - Ozone depletion
 - Global warming
 - Release of refrigerant

**Achievement Criteria**

Performance F4 Service, Diagnose and Repair Heating and Refrigeration Systems

Conditions The learner will require:

- Tools
- Test equipment
- Manufacturer's specifications
- A work place or training environment
- Equipment with refrigeration units

Criteria The learner will be competent once the performance criteria is met:

- Followed safe work practices throughout entire task including lock out procedures
- Conducted in a logical manner
- Conducted according to manufacturer's specifications
- Conducted according to work place requirements

Throughout the term of the apprenticeship, the learner must conduct the above performance a multiple of times and in a variety of contexts



LEARNING TASKS

4. Describe the impact of CFCs on the environment
5. Identify legislation/agreements dealing with the use and handling of CFCs

CONTENT

- Lubricants
- Controls
- Sensors
- Ozone depletion
- Global warming
- International
- Montreal Protocol on Substances that Deplete the Ozone Layer
- Kyoto Protocol to the United Nations Framework Convention on Climate Change
- Canadian Environmental Protection Act
- Provincial regulations
- Ozone Depleting Substances and Other Halocarbons Regulation
- Waste Management Act
- Training requirements
- Environmental awareness training course on ozone depleting substance control
- Certification
- CFC Handling
- Conservation objectives



Line (GAC): **G HEATING, VENTILATION AND AIR CONDITIONING**
Competency: **G2 Diagnose and Repair Heating and Air Conditioning Systems**

Objectives

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

- Diagnose heating and air conditioning systems.
- Repair heating and air conditioning systems.
- Describe the impact of CFCs on the environment.
- Apply legislated procedures when dealing with systems containing CFCs.

LEARNING TASKS

CONTENT

- | | |
|--|--|
| <ol style="list-style-type: none"> 1. Diagnose heating and air conditioning systems | <ul style="list-style-type: none"> • Diagnostic procedures • Manufacturer's procedures • Performance test • Diagnostic codes • Components • Inspection • Sensory inspection • Visual • Audible • Smell • Touch • Testing • Vacuum • Electrical • Mechanical • Pressure • Leak detection methods |
| <ol style="list-style-type: none"> 2. Repair heating and air conditioning systems | <ul style="list-style-type: none"> • Recovering, evacuation and recharging • Pressure/leak testing • Environmental considerations • Removing and replacing components • Verify system operations |
| <ol style="list-style-type: none"> 3. Describe the impact of CFCs on the environment | <ul style="list-style-type: none"> • Ozone depletion • Global warming |
| <ol style="list-style-type: none"> 4. Identify legislation/agreements dealing with the use and handling of CFCs | <ul style="list-style-type: none"> • International • Montreal Protocol on Substances that Deplete the Ozone Layer • Kyoto Protocol to the United Nations Framework Convention on Climate Change |



LEARNING TASKS

CONTENT

- Canadian Environmental Protection Act
- Provincial regulations
- Ozone Depleting Substances and Other Halocarbons Regulation
- Waste Management Act
- Training requirements
- Environmental awareness training course on ozone depleting substance control
- Certification
- Conservation objectives

Achievement Criteria

Performance G2 Diagnose and Repair Heating and Air Conditioning Systems

Conditions The learner will require:

- Tools
- Test equipment
- Manufacturer's specifications
- A work place or training environment
- Equipment with air conditioning units

Criteria The learner will be competent once the performance criteria is met:

- Followed safe work practices throughout entire task including lock out procedures
- Conducted in a logical manner
- Conducted according to manufacturer's specifications
- Conducted according to work place requirements

Throughout the term of the apprenticeship, the learner must conduct the above performance a multiple of times and in a variety of contexts



Line (GAC): H **ENGINES AND SUPPORTING SYSTEMS**

Competency: H2 **Service Engine Support Systems**

Objectives

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

- Describe engine support systems.
- Service engine support systems.
- Describe combustion of two and four stroke.

LEARNING TASKS

1. Describe the operation of two and four stroke internal combustion engines

2. Identify cooling systems

3. Service and maintain cooling systems and their components

4. Identify lubrication systems

5. Service lubrication systems and components

CONTENT

- Intake
- Compression
- Power
- Exhaust
- Scavenging
- Types
 - Air
 - Liquid
- Coolants
 - Types
- Components
 - Coolant system
 - Radiator/pressure cap
 - Thermostat
 - Expansion/surge tank
 - Fan system
- Shutter system
- Inspection
- Adjustment
- Testing
- Scheduled maintenance
- Types
- Lubricants
- Components
- Filter and cooler circuits
- Inspection
- Lubrication
- Testing
- Scheduled maintenance
 - Oil/filter analysis
 - Filter service



LEARNING TASKS

- 6. Identify air induction systems

- 7. Service air induction systems and components

- 8. Identify exhaust systems

- 9. Service exhaust systems and their components

CONTENT

- Oil change
- Types
- Components
 - Naturally aspirated type
 - Boosted type
- Precautions
- Inspection
- Lubrication
- Scheduled maintenance
 - Filter service
- Types
- Components
 - Mufflers
 - Emission systems
- Inspection
- Scheduled maintenance



LINE (GAC): H ENGINES AND SUPPORTING SYSTEMS

Competency: H4 Service Diesel Fuel Supply Systems

Objectives

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

- Identify characteristics of diesel fuel.
- Identify diesel fuel supply circuits and their components.
- Perform limited service on diesel supply circuits.

LEARNING TASKS

1. Identify characteristics of diesel fuel

2. Identify diesel fuel supply circuits

3. Service diesel fuel supply circuits

CONTENT

- Grades
- Characteristics
- Viscosity
- Cetane
 - Rating
 - Number
- Flash point
- Sulfur content
- Storage
- Disposal
- Safety precautions
- Types
- Components
 - Tank
 - Lines
 - Primary/secondary filters
 - Low/high pressure pumps
- Operation
- Inspection
- Removal
- Replacement
- Priming
- Scheduled maintenance
- Safety precautions



LEARNING TASKS

CONTENT

- Remove
- Repair or replace
- Install
- Adjustments
- Testing
- Scheduled maintenance



Line (GAC): I **POWERTRAINS**
Competency: I7 **Service Torque Converters and Dividers**

Objectives

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

- Identify purpose of torque converters and dividers.
- Service torque converters and dividers.

LEARNING TASKS

1. Identify the purpose of torque converters and dividers

2. Service torque converters and dividers

CONTENT

- Types
- Components
- Fluids

- Check operation
- Visual inspections
 - Fluid levels
 - Leaks
 - Mounting of attachments
- Filter/screens
- Oil coolers
- Scheduled maintenance



Line (GAC): I **POWERTRAINS**
Competency: I8 **Service Powershift and Automatic Transmissions**

Objectives

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

- Identify the operation of powershift and automatic transmissions.
- Service powershift and automatic transmissions.

LEARNING TASKS

1. Identify the basic operation of powershift and automatic transmissions

2. Service powershift and automatic transmissions

CONTENT

- Types
 - Multi-shaft
 - Planetary
- Operation
- Inspection
 - Mounting
 - Leaks
- Adjustments
- Fluid level
- Operational testing
- Scheduled maintenance



Line (GAC): I **POWERTRAINS**
Competency: I20 **Remove and Install Transmissions**

Objectives

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

- Identify transmissions.
- Remove and install transmissions.

LEARNING TASKS

1. Identify transmissions

2. Remove transmissions

3. Install transmissions

CONTENT

- Types
 - Manual shift
 - Automatic
 - Powershift
- Components
- Related components
 - Clutch
 - Torque converter
 - Torque divider
- Shifting operation
 - Mechanical
 - Pneumatic
 - Electronic
- Lubrication
- Remove
 - Support and block vehicle/equipment
 - Drain system
 - Remove hoses/lines and wiring
 - Support or remove attachments
 - Select and use of rigging/lifting devices
 - Support transmission after removal
- Install
 - Select and use of rigging/lifting devices
 - Install attachments
 - Install hoses/lines and wiring
 - Refill systems
 - Verify crankshaft rotation and endplay
 - Adjustments
 - Verify operation and check for leaks



Line (GAC): I **POWERTRAINS**
Competency: I21 **Remove and Install Drivelines and Differentials**

Objectives

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

- Remove and install drivelines and differentials.

LEARNING TASKS

1. Remove drivelines and differentials

2. Install drivelines and differentials

CONTENT

- Remove
 - Support and block vehicle/equipment
 - Drain system
 - Remove hoses/lines and wiring
 - Support or remove attachments
 - Select and use of rigging/lifting devices
 - Support differential after removal
- Install
 - Select and use of rigging/lifting devices
 - Install attachments
 - Install hoses/lines and wiring
 - Refill systems
 - Adjustments
 - Verify operation and check for leaks



Line (GAC): I **POWERTRAINS**
Competency: I22 **Remove and Install Final Drives**

Objectives

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

- Identify final drives.
- Remove and install final drives.

LEARNING TASKS

1. Remove final drives

2. Install final drives

CONTENT

- Remove
 - Support and block vehicle/equipment
 - Drain system
 - Remove hoses/lines and wiring
 - Support or remove attachments
 - Select and use of rigging/lifting devices
 - Support final drive after removal
- Install
 - Select and use of rigging/lifting devices
 - Install attachments
 - Install hoses/lines and wiring
 - Refill systems
 - Adjustments
 - Verify operation and check for leaks



Line (GAC): J STRUCTURAL COMPONENTS AND ACCESSORIES

Competency: J1 Identify Protective Structures

Objectives

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

- Describe regulations related to protective structures.
- Perform service or inspection of protective structures.

LEARNING TASKS

1. Describe structural components
2. Describe inspection procedures
3. Identify operational regulations

CONTENT

- Roll over protective structure (ROPS)
- Falling objects protective structure (FOPS)
- Operator protective structure (OPS)
- Cracks
- Dents
- Fatigue
- Components
- Safety glass
- Screens
- Service/diagnose/repair



Section 4

TRAINING PROVIDER STANDARDS



Facility Requirements

Classroom Area

- Recommended 2.5 sq. meters per student
- Projection screen, multimedia projector, whiteboard or similar
- Seating and tables suitable for lecturing
- Compliance with all safety codes

Shop Area

- Recommended 25 sq. meters per student
- Meet all safety and fire, and environmental codes
- Good lighting
- Appropriate lifting cranes as required to move industry equipment
- Approved ventilation systems

Lab Requirements

- Recommended 10 sq. meters per student
- Computer labs on-site

Student Facilities

- One locker per student, study areas, computer labs, food facility, hand wash facility, washroom facility

Instructor's Office Space

- Recommended 3.5 sq. meters

Other

- Storage space for classroom and shop props
- Parking space for heavy equipment and trucks
- Outside machine/truck wash bay



Tools and Equipment

Shop Equipment

Required Safety Equipment

- Ear protection
- Emergency backup lighting
- Eye wash station
- Face shield
- Fall arrest equipment
- Fall prevention equipment
- Fire extinguisher
- Fireproof blanket
- First aid station
- Gas mask
- Gloves
- Goggles
- Ladder
- Leather gloves
- Leggings
- Manlift
- Respirator
- Safety boots
- Safety cage
- Safety glasses
- Safety hat
- Splash suit

Student Tools (supplied by school)

Required

- 1/4, 3/8, and 1/2 inch drive socket sets
- Adjustable wrench
- Bar (pry, aligning, heel)
- Battery post and clamp cleaner, battery
- Terminal nut
- Battery terminal puller
- Brass drift
- Center punch
- Chisel
- Wire cutter, plier cutters, shears
- Digital multimeter



- Feeler gauge set
- File
- Hacksaw and blade
- Hammer: impact, rubber, sledge, air, slide, soft blow
- Hex key set, metric and imperial
- Jumper wire
- Magnetic pick-up tool (telescopic, flex)
- Metric and imperial steel rule
- Micrometer
- Pick (o-ring, seal)
- Pin punch
- Pipe wrench
- Pliers: insulated, snap ring, torque, punch
- Scraper
- Screwdriver
- Tape measure
- Test light
- Tool chest
- Universal joint
- Utility knife
- Wire brush
- Wire crimper and stripper
- Wrench set, combination (metric & imperial)
- Wrench set, flare nut (metric & imperial)

Recommended

- Air pressure gauge
- Belt tension gauge
- Boost gauge
- Borescope
- Depth micrometer
- Dial gauge
- Digital multimeter
- Electric pressure gauge
- Flowmeter
- Fuel pressure gauge
- Holding gauge
- Hydraulic pressure testing gauge/fittings
- Hydrometer
- Inside micrometer
- Level
- Manifold gauge



- Mechanical pressure gauge
- Non-magnetic feeler gauge
- Oil temperature gauge
- Phototachometer
- Pressure gauge
- Pull-type scale
- Pyrometer
- Small hole gauge
- Spectroscope
- Spring scale
- Steel ruler
- Stethoscope
- Straight edge
- Tachometer
- Telescoping gauge
- Test light
- Thermometer
- Timing gauge
- Tire gauge
- Transmission gauge set
- Vacuum gauge

Student Equipment (supplied by school)

Required

- Air compressor
- Axle stand
- Battery charger
- Battery load/starting system tester
- Bearing heater
- Bleeding equipment
- Booster cable
- Bottle/axle jack
- Cable hoist
- Chain hoist
- Component heating or cooling equipment
- Computer, portable diagnostic computer
- Crack detecting equipment
- Cutting and welding torch set
- Cylinder cart and tank
- Diagnostic equipment
- Dolly



- Engine rotator
- Floor hoist
- Forklift
- Drill: bench, hand drivers, twist, air
- Fast charger
- Fuel recovery and storage system
- Grinder: bench, hand, valve
- Honing equipment
- Hydraulic floor jack
- Hydraulic hand jack
- Hydraulic transmission jack
- Leak detection equipment
- Nitrogen charging equipment
- Parts wash station
- Press: arbor, spring, hydraulic, bushing, shop, mechanical
- Pressure washer
- Printer
- Puller: bearing, gear, heavy duty, reamer
- Retrieval and storage equipment
- Scanning tool
- Shop crane
- Sling/cable/chain
- Spreader bar
- Support stand
- Tire guard
- Transmission jack
- Welding equipment
- Refrigerant recycling cart
- Safety equipment

Recommended

- Alignment tool
- Analyzer: gas, infrared, vibration meter
- Black light
- Coolant recycling unit
- Chemical agitator
- Mobile crane
- Oil recovery and storage tank



Specialty Tools

Required Safety Equipment for Student (supplied by student)

Required

- Coveralls
- Safety boots (CSA approved)
- Safety glasses (CSA approved)

Recommended

- High visabilty coveralls
- Mechanics gloves



Reference Materials

Recommended Resources

- Industry Training Authority (ITA) www.itabc.ca
- Transportation Career Development Association (TCDA) www.tcda.ca
- WorkSafeBC www.worksafebc.com

Foundation

- Heavy Mechanical Group Foundation Learning Resources, Queens Printer
 - FOS Hydraulics (Deere) ISBN 0-86691-239-0
- or
- Vickers Mobile Hydraulics, ISBN 0-9634162-5-1
 - FOS Electronic and Electrical Systems (Deere), ISBN 0-86691-240-1
 - Heavy Duty Truck Systems 5th Edition (Norman/Scharff/Cosinchock), ISBN 0-7668-1340-1
 - Inside Air Brake Valves and Devices (Allan C. Wright)
 - Alberta Trades Training Modules, Queens Printer
 - FOS Air Conditioning (Deere) ISBN 086691-221-5
 - Driving Commercial Vehicles Manual MV2677 – Insurance Corporation of BC (ICBC) www.icbc.com

NOTE:

This list of Reference Materials is for training providers. Apprentices should contact their preferred training provider for a list of recommended or required texts for this program.



Instructor Requirements

Occupation Qualification

The instructor must possess:

- Heavy Duty Equipment Technician – Certificate of Qualification with Interprovincial Red Seal endorsement; or
- Truck & Transport Mechanic – Certificate of Qualification with Interprovincial Red Seal endorsement
-

Work Experience

A minimum of 10 years experience working in the industry as a journeyperson.

Instructional Experience and Education

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

- Grade 12 or equivalent– not mandatory
- Instructors Diploma– not mandatory