Skilled Trades Ontario | Métiers spécialisés Ontario

Apprenticeship Curriculum Standard

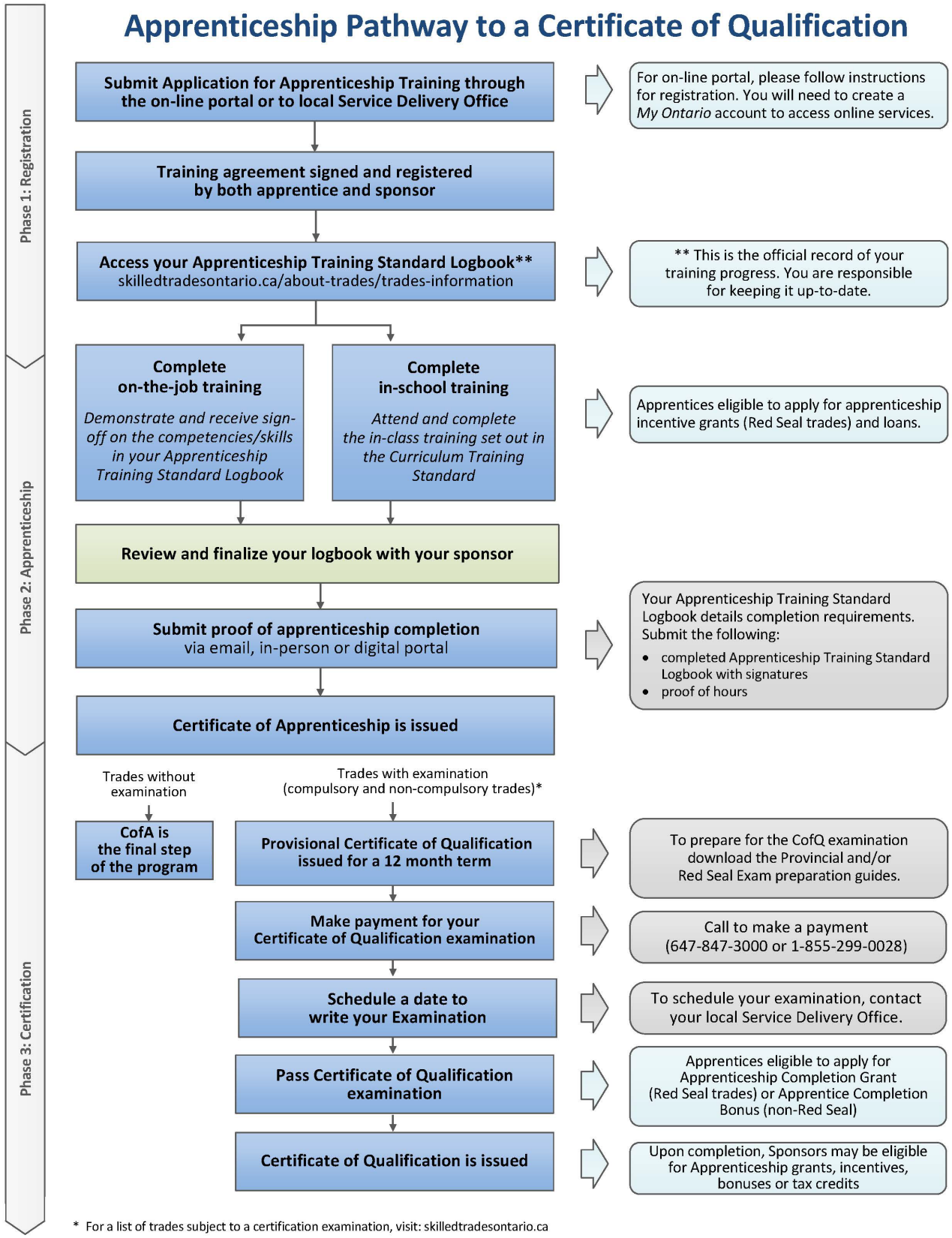
Recreational Vehicle Technician

Level 3

690H

2003

Apprenticeship Pathway to a Certificate of Qualification



* For a list of trades subject to a certification examination, visit: skilledtradesontario.ca

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Please Note: This Standard has been revised to reflect the visual identity of Skilled Trades Ontario (STO) which replaced the Ontario College of Trades on January 1, 2022. The content of this Standard may refer to the former organization; however, all trade specific information or content remains relevant and accurate based on the original date of publishing.

Please refer to STO's website: **skilledtradesontario.ca** for the most accurate and up to date information. For information about BOSTA and its regulations, please visit ***Building Opportunities in the Skilled Trades Act, 2021* (BOSTA).**

Any updates to this publication are available on-line; to download this document in PDF format, please follow the link: Skilled Trades Ontario.ca.

Maintained with transfer to Skilled Trades Ontario 2003 (V100)

Preface

This curriculum standard for the Recreational Vehicle Technician trade program is based upon the on-the-job performance objectives, located in the industry-approved training standard.

The curriculum is organized into 3 levels of training. The Reportable Subjects Summary chart (located on page 3) summarizes the training hours for each reportable subject.

The curriculum identifies the learning that takes place in-school. The in-school program focuses primarily on the theoretical knowledge and the essential skills required to support the performance objectives of the Apprenticeship Training Standards.

Employers/Sponsors are expected to extend the apprentice's knowledge and skills through practical training on a work site. Regular evaluations of the apprentice's knowledge and skills are conducted throughout training to verify that all apprentices have achieved the learning outcomes identified in the curriculum standard.

It is not the intent of the in-school curriculum to perfect on-the-job skills. The practical portion of the in-school program is used to reinforce theoretical knowledge. Skill training is provided on the job.

Please refer to Skilled Trades Ontario website (www.skilledtradesontario.ca) for the most accurate and up-to-date information about Skilled Trades Ontario. For information on *Building Opportunities in the Skilled Trades Act, 2021 (BOSTA)*) and its regulations, please visit Building Opportunities in the Skilled Trades Act, 2021, S.O. 2021, c. 28 - Bill 288 (ontario.ca)

Pre-requisites

In order to advance to Level 2 of the apprenticeship program, an individual must have completed all of the units outlined in Level 1. Similarly, in order to advance to Level 3 of the program, an individual must have completed all of the units outlined in Level 1 and 2.

Hours Disclaimer (if applicable)

It is agreed that Training Delivery Agents (TDAs) may need to make slight adjustments (with cause) according to particular apprentice needs and may deviate from the unit sequencing and the prescribed practical and theoretical hours shown within the standard. However, all TDAs will comply with the hours at the reportable subject level.

Suggested Equipment for Training Delivery Agencies

The listing of tools on pages 75–78 does not list minimum quantities based on the understanding that the delivering TDA is in the best position to determine the need based on its delivery methodology.

Personal and Safety Equipment: Personal protective equipment is at the discretion of the TDA who must conform to Ontario Provincial Health and Safety Regulations.

Introduction

This curriculum standard for the Recreational Vehicle (RV) Technician trade is designed down from the learning outcomes, which were in turn developed from the industry-approved training standard.

The curriculum is organized into 3 levels of training, each including reportable subjects containing like or similar learning outcomes to reflect the units of the training standard. The hours charts indicates how the curriculum can be delivered in the current block release format and summarizes the hours of training for each reportable by level. Since the reportable subjects are all divisible by three they can be adapted to accommodate a more flexible training delivery other than block release.

The reportable subjects are cross-referenced to the training standard for ease of comparison.

Each reportable subject and learning outcome identifies a recommended number of training hours. This hour allotment is broken into hours for instruction in theory and practical application. The division of the curriculum into reportable subjects that follow a natural progression of learning through the levels and branches of training will allow training centers and apprentices' flexibility in program delivery while still observing the importance of sequencing learning in a logical progression.

The curriculum is framed by and includes specific references to terminal performance objectives in the Apprenticeship Training Standards for the Recreational Vehicle (RV) Technician. However, it identifies only the learning that takes place off the job, in a training centre. The in-school program focuses primarily on the theoretical knowledge required to master the performance objectives of the Training Standards. Employers are expected to extend the apprentice's knowledge and skills through appropriate practical training on the work site. Regular evaluations of the apprentice's knowledge and skills is conducted throughout training to assure that all apprentices have achieved the learning outcomes identified in the curriculum standard. The balance between theoretical and practical evaluation is identified for each unit of learning outcomes.

Implementation date:
September 2005

Summary of Total Program In-School Training Hours

Number	Reportable Subjects	Hours Total	Hours Theory	Hours Practical
Level 1				
1	Shop Practices	67	28	39
2	Plumbing and Gas Systems 1a	18	18	0
3	Electrical/Electronic Systems	66	34	32
4	RV Construction and Appearance 1	29	11	18
5	Plumbing and Gas Systems 1b	24	12	12
6	Welding Practices 1	48	18	30
	Level 1 Totals	**240**	**109**	**131**
Level 2				
1	Electrical/Electronic Systems 2	30	15	15
2	Shop Practices 2	12	7	5
3	Plumbing and Gas Systems 2	21	6	15
4	Heating, Refrigeration and A/C Systems 1	24	18	6
5	Welding Practices 2	51	15	36
6	Towed Unit Systems 2	24	9	15
7	Accessories 1	27	14	13
8	RV Construction and Appearance 2	51	15	36
	Level 2 Totals	**240**	**99**	**141**
Level 3				
1	Towed Unit Systems 3a	6	2	4
2	Shop Practices 3a	12	6	6
3	Accessories 2	36	17	19
4	Towed Unit Systems 3b	27	9	19
5	Electrical/Electronic Systems 3	18	10	8
6	Heating, Refrigeration and A/C Systems 2	42	25	17
7	Towed Unit Systems 3c	21	9	12
8	RV Construction and Appearance 3	54	12	42
9	Shop Practices 3b	24	12	12
	Level 3 Totals	**240**	**102**	**138**
	Totals	**720**	**310**	**410**

Please note:

RV Technician apprentices must complete their RV-2 LPG certification with T.S.S.A. prior to beginning Level 2 of instruction.

RV Technician apprentices must complete their RV-1 LPG certification with T.S.S.A. prior to beginning Level 3 of instruction.

Level 3

Summary of Total Program In-School Training Hours

Number	Reportable Subjects	Hours Total	Hours Theory	Hours Practical
1	Towed Unit Systems 3a	6	2	4
2	Shop Practices 3a	12	6	6
3	Accessories 2	36	17	19
4	Towed Unit Systems 3b	27	9	19
5	Electrical/Electronic Systems 3	18	10	8
6	Heating, Refrigeration and A/C Systems 2	42	25	17
7	Towed Unit Systems 3c	21	9	12
8	RV Construction and Appearance 3	54	12	42
9	Shop Practices 3b	24	12	12
	Level 3 Totals	**240**	**102**	**138**

Number:	1		
Title:	**Towed Unit Systems 3a**		
Duration:	Total Hours: 6	Theory: 2	Practical: 4
Prerequisites:	Level 2		
Co-requisites:	None		

1.1 Hitching Systems II

6 Total Hours Theory: 2 hours Practical: 4 hours

Number:	1.1		
Title:	**Hitching Systems II**		
Duration:	Total Hours: 6	Theory: 2	Practical: 4
Cross Reference to Training Standard: 6075			

General Learning Outcome:

Upon successful completion of the reportable subject the, apprentice is able to demonstrate a working knowledge of the inspection, diagnosis, and installation of hitching systems.

Learning Outcomes:

Upon successful completion, the apprentice is able to:

1.1.1 Perform inspection and testing procedures on hitching systems following manufacturers' recommendations.

1.1.2 Perform diagnostics and troubleshooting on hitching systems according to manufacturers' specifications.

1.1.3 Perform assigned operations for the following as to manufacturers' recommendations.

Learning Content:

1.1.1 Perform inspection and testing procedures on hitching systems following manufacturers' recommendations.
[1/0]

- visual and physical inspection
  - brake lights
  - corrosion
  - wear
  - defects
  - loose, missing, damaged components
  - connections
  - cracks
- blocking system

1.1.2 Perform diagnostics and troubleshooting on hitching systems according to manufacturers' specifications.
[1/0]

- use inspection/testing techniques
- consult appropriate resource materials (workplace drawings, manuals)
- use computer for research where relevant

1.1.3 Perform assigned operations for the following as to manufacturers' recommendations.
[0/4]

- installing, repairing, removing hitches and components
  - heating/cutting
  - oxy-fuel, MIG, SMAW
- selecting proper hitching system based on weight ratings
- electrical and electronic connections
- welding sway bar mount or tab
- set up of weight distribution

Evaluation:

The following evaluation structure is only a suggested format. Specific evaluation of theory and practical components of training varies due to the resource material and training aides utilized.

Evaluation Structure			
Theory Testing	Practical Application Exercises	Research Project	Notebook and Organizational Skills
20%	60%	10%	10%

Number:	2		
Title:	**Shop Practices 3a**		
Duration:	Total Hours: 12	Theory: 6	Practical: 6
Prerequisites:	Level 2		
Co-requisites:	None		

2.1 Workplace Communications III

6 Total Hours Theory: 3 hours Practical: 3 hours

2.2 Workplace Charts and Diagrams III

6 Total Hours Theory: 3 hours Practical: 3 hours

Number:	2.1		
Title:	**Workplace Communications III**		
Duration:	Total Hours: 6	Theory: 3	Practical: 3
Cross Reference to Training Standard: 6080			

General Learning Outcome:

Upon successful completion of the reportable subject, the apprentice is able to demonstrate a working knowledge of the purpose, principles, and applications of effective workplace communication.

Learning Outcomes:

Upon successful completion, the apprentice is able to:

2.1.1 Explain principles of small business operations.

2.1.2 Explain principles of conflict resolution.

2.1.3 Perform applications of effective communication as to client and company standards.

Learning Content:

2.1.1 Explain principles of small business operations.
[1.5/0]

- costs associated with running a business
- communicating explanation of service costs to clients

2.1.2 Explain principles of conflict resolution.
[1.5/0]

- listening
- assess escalating situation
- positive attitude
- calm demeanour
- seek to understand client’s point-of-view
- ask clear questions
- restating/paraphrasing concerns

- negotiations for resolution
  - 4-step process
- offer different solutions
- report conflicts to management

2.1.3 Perform applications of effective communication as to client and company standards.
[0/3]

- prepare and write service reports
- complete documents and forms
- listening and assessment skills
- verbal communication
- use computers where relevant
- justify service costs to clients
- enact classroom client-technician scenarios

Number:	2.2		
Title:	**Workplace Charts and Diagrams III**		
Duration:	Total Hours: 6	Theory: 3	Practical: 3
Cross Reference to Training Standard: 6088			

General Learning Outcome:

Upon successful completion of the reportable subject, the apprentice is able to demonstrate a working knowledge of the purpose, types, principles of operation, and interpretation of advanced workplace drawings.

Learning Outcomes:

Upon successful completion, the apprentice is able to:

2.2.1 Describe the types, styles and application of advanced workplace drawings.

2.2.2 Explain the principles of operation of advanced workplace drawings.

2.2.3 Read and interpret advanced workplace drawings.

Learning Content:

2.2.1 Describe the types, styles and application of advanced workplace drawings. [0.5/0]

- working drawings
  - engineering drawings
  - architectural drawings
  - CAD drawings

2.2.2 Explain the principles of operation of advanced workplace drawings. [2.5/0]

- working drawings
  - engineering drawings
  - architectural drawings
  - CAD drawings

2.2.3 Read and interpret advanced workplace drawings.
[0/3]

- overlay blueprints to produce 3D picture
- identify location of devices, dimensions, materials and specifications
- identify type and model of vehicle, parts, components and assemblies

Evaluation:

The following evaluation structure is only a suggested format. Specific evaluation of theory and practical components of training varies due to the resource material and training aides utilized.

Evaluation Structure			
Theory Testing	Practical Application Exercises	Research Project	Notebook and Organizational Skills
40%	30%	20%	10%

Number:	3		
Title:	**Accessories 2**		
Duration:	Total Hours: 36	Theory: 17	Practical: 19
Prerequisites:	Level 2		
Co-requisites:	None		

3.1 Appliances

3 Total Hours Theory: 2 hours Practical: 1 hours

3.2 Comfort Control Systems

18 Total Hours Theory: 6 hours Practical: 12 hours

3.3 Communication Systems

15 Total Hours Theory: 9 hours Practical: 6 hours

Number:	3.1		
Title:	**Appliances**		
Duration:	Total Hours: 3	Theory: 2	Practical: 1
Cross Reference to Training Standard: 6085			

General Learning Outcome:

Upon successful completion of the reportable subject, the apprentice is able to demonstrate a working knowledge of the construction, principles of operation, inspection, and installation of common RV appliances

Learning Outcomes:

Upon successful completion, the apprentice is able to:

3.1.1 Identify and describe the construction, types, styles, and application of common RV appliances.

3.1.2 Explain the operating principles of common RV appliances.

3.1.3 Perform inspection and testing procedures on common RV appliances following manufacturers' recommendations.

3.1.4 Perform assigned operations for the following as to manufacturers' recommendations.

Learning Content:

3.1.1 Identify and describe the construction, types, styles, and application of common RV appliances.
[0.5/0]

- appliances
  - toaster
  - microwave/convection oven
  - coffee machine
  - washer/dryer (vented and ventless)
  - blender
  - central vacuum
  - dishwasher

3.1.2 Explain the operating principles of common RV appliances.
[1.5/0]

- washer/dryer (vented and ventless)
  - evaporator
  - condenser
  - effective draining
  - moisture control systems

3.1.3 Perform inspection and testing procedures on common RV appliances following manufacturers' recommendations.
[0/0.5]

- visual inspection
- filter and venting

3.1.4 Perform assigned operations for the following as to manufacturers' recommendations.
[0/0.5]

- install and replace most appliances
- diagnose/troubleshoot washer/dryer
- repair, install, replace washer/dryer
- verify against manufacturers' specifications
- maintain and clean
  - washer/dryer
  - filters
- fastening and securing
- recommend service

Number:	3.2		
Title:	**Comfort Control Systems**		
Duration:	Total Hours: 18	Theory: 6	Practical: 12
Cross Reference to Training Standard: 6085			

General Learning Outcome:

Upon successful completion of the reportable subject, the apprentice is able to demonstrate a working knowledge of the purpose, construction, principles of operation, inspection, diagnosis and repair of comfort control systems.

Learning Outcomes:

Upon successful completion, the apprentice is able to:

3.2.1 Define the purpose and fundamentals of comfort control systems.

3.2.2 Identify and describe the construction, types, styles, and application of comfort control systems.

3.2.3 Explain the operating principles of comfort control systems.

3.2.4 Perform inspection and testing procedures on comfort control systems following manufacturers' recommendations.

3.2.5 Perform diagnostics and troubleshooting on comfort control systems according to manufacturers' specifications.

3.2.6 Perform assigned operations for the following as to manufacturers' recommendations.

Learning Content:

3.2.1 Define the purpose and fundamentals of comfort control systems. [1/0]

- humidity control
- history and background
- use of knots to secure certain systems

3.2.2 Identify and describe the construction, types, styles, and application of comfort control systems.
[1/0]

- auxiliary venting and cooling systems
  - power vents
  - window shading devices
- awnings, covers and skirting
  - bag awnings
  - box awnings
  - spring roll-up awnings
  - window awnings
  - topper awnings
  - weather closing devices
  - electric motor controlled awnings
  - associated hardware
  - centre rafters
  - ground supports
  - support carriers
  - construction materials
- add-a-rooms
  - softwall
  - hardwall
  - rigid roof type

3.2.3 Explain the operating principles of comfort control systems.
[4/0]

- auxiliary venting and cooling systems
  - power vents (thermostats and rain sensors)
  - window shading devices
- awnings, covers and skirting
  - bag awnings
  - box awnings
  - spring roll-up awnings
  - window awnings
  - topper awnings
  - weather closing devices
  - electric motor controlled awnings
  - associated hardware
  - centre rafters
  - ground supports
  - support carriers
  - 12-volt, manual
  - self-supporting
  - auto-retract
  - tension controls (springs, ratchets, etc.)

- properties of ropes and knots
  - knots, bends and hitches
- add-a-rooms
  - softwall
  - hardwall
  - rigid roof type

3.2.4 Perform inspection and testing procedures on comfort control systems following manufacturers' recommendations.
[0/1]

- visual and physical inspection
  - leaks
  - misalignment
  - corrosion
  - wear
  - colour
  - defects
  - loose, missing, damaged parts
  - connections
  - venting
  - flow
  - temperature
  - vibration
  - noise
  - wear
  - fractures
  - odour
  - colour

3.2.5 Perform diagnostics and troubleshooting on comfort control systems according to manufacturers' specifications.
[0/3]

- use inspection/testing techniques
- use diagnostic equipment
- consult appropriate resource materials (workplace drawings, manuals)
- use computer for research where relevant

3.2.6 Perform assigned operations for the following as to manufacturers' recommendations.
[0/8]

- demonstrate knots, bends and hitches
- repair, replace, align, install comfort control systems and component parts
- clean, lubricate and align mounting hardware
- align awning to manufacturers' specifications
- checking seals
- verify integrity of operations

Number:	3.3		
Title:	**Communications Systems**		
Duration:	Total Hours: 15	Theory: 9	Practical: 6
Cross Reference to Training Standard: 6085			

General Learning Outcome:

Upon successful completion of the reportable subject, the apprentice is able to demonstrate a working knowledge of the purpose, construction, principles of operation, inspection, diagnosis and installation of communications systems.

Learning Outcomes:

Upon successful completion, the apprentice is able to:

3.3.1 Define the purpose and fundamentals of communications systems.

3.3.2 Identify and describe the construction, types, styles, and application of communications systems.

3.3.3 Explain the operating principles of communications systems.

3.3.4 Perform inspection and testing procedures on communications systems following manufacturers' recommendations.

3.3.5 Perform diagnostics and troubleshooting on communications systems according to manufacturers' specifications.

3.3.6 Perform assigned operations for the following as to manufacturers' recommendations.

Learning Content:

3.3.1 Define the purpose and fundamentals of communications systems. [1/0]

- history and background
- analog and digital

3.3.2 Identify and describe the construction, types, styles, and application of communications systems.
[2/0]

- audio, visual, entertainment systems
  - TV
  - VCR
  - DVD
  - MP3
  - back-up cameras
  - stereos
  - speakers
  - amps
  - A/V control centres
- satellite
  - manual and automatic
- GPS positioning
  - hand-held
  - installed
  - satellite phone
- antenna and communication systems
  - CB radio
  - manual
  - automatic
- security systems
  - installed
  - portable
- hardware
  - RF filters
  - fibre optics
  - connections
  - cables
  - sensors
  - multiplex

3.3.3 Explain the operating principles of communications systems.
[6/0]

- audio, visual, entertainment systems
  - TV
  - VCR
  - DVD
  - MP3
  - back-up cameras

  - stereos
  - speakers
  - amps
  - A/V control centres
- satellite
  - manual and automatic
- GPS positioning
  - hand-held
  - installed
  - satellite phone
- antenna and communication systems
  - CB radio
  - manual
  - automatic
- security systems
  - installed
  - portable

3.3.4 Perform inspection and testing procedures on communications systems following manufacturers' recommendations.
[0/1]

- visual and physical inspection:
  - corrosion
  - wires (continuity)
  - breakers
  - connections (in/out)
  - worn, loose, missing, damaged, defective components
  - leaks
  - misalignment
  - temperature
  - vibration
  - noise
- volt/ohm meter
- coaxial connections

3.3.5 Perform diagnostics and troubleshooting on communications systems according to manufacturers' specifications.
[0/2]

- use inspection/testing techniques
- use diagnostic equipment
- consult appropriate resource materials (workplace drawings, manuals)
- use computer for research where relevant

3.3.6 Perform assigned operations for the following as to manufacturers' recommendations.
[0/3]

- set up and install units
- check connections
- recommend service

Evaluation:

The following evaluation structure is only a suggested format. Specific evaluation of theory and practical components of training varies due to the resource material and training aides utilized.

Evaluation Structure			
Theory Testing	Practical Application Exercises	Research Project	Notebook and Organizational Skills
30%	40%	20%	10%

Number:	4		
Title:	**Towed Unit Systems 3b**		
Duration:	Total Hours: 27	Theory: 9	Practical: 18
Prerequisites:	Level 2; Level 3: Unit 1		
Co-requisites:	None		

4.1 Chassis and Undercarriage Systems (Towed)

27 Total Hours Theory: 9 hours Practical: 18 hours

Number:	4.1		
Title:	**Chassis and Undercarriage Systems (Towed)**		
Duration:	Total Hours: 27	Theory: 9	Practical: 18
Cross Reference to Training Standard: 6084			

General Learning Outcome:

Upon successful completion of the reportable subject, the apprentice is able to demonstrate a working knowledge of the purpose, construction, operating principles, inspection, diagnosis, and repair of chassis and undercarriage systems.

Learning Outcomes:

Upon successful completion, the apprentice is able to:

4.1.1 Define the purpose and fundamentals of chassis and undercarriage systems.

4.1.2 Identify and describe the construction, types, styles, and application of chassis and undercarriage systems.

4.1.3 Explain the safe operating principles of chassis and undercarriage systems.

4.1.4 Perform inspection and testing procedures on chassis and undercarriage systems following manufacturers' recommendations.

4.1.5 Perform diagnostics and troubleshooting on chassis and undercarriage systems according to manufacturers' specifications.

4.1.6 Perform assigned operations for the following as to manufacturers' recommendations.

Learning Content:

4.1.1 Define the purpose and fundamentals of chassis and undercarriage systems. [1/0]

- suspension
- protection of vehicle components
- load distribution

4.1.2 Identify and describe the construction, types, styles, and application of chassis and undercarriage systems.
[4/0]

- suspension
  - rubber
  - leaf-spring
  - torsion
  - independent systems
  - I-beam
  - frames
  - axles
  - levelling and stabilizing systems
  - air spring
  - air bag
  - shock absorbers
  - bushings
- bumpers
- tire carriers
- tongue jacks
- ball couplers
- locking devices
- safety chains
- steps
- skid plates, rollers
- king pin and box
- landing gear
- motors
- cylinders
- gears
- hangers, shackles, equalizers
- saddles, spindles, bearings, races
- d-washers, castellated nuts, cotter pins
- brake assemblies
  - magnets
- lines, fittings
- gauges
- valves
- pumps
- tanks
  - fuel
  - water

- electronics
- lubricants, fluids
- paint
- undercoating materials

4.1.3 Explain the safe operating principles of chassis and undercarriage systems. [4/0]

- blocking
- proper use of jacks, hoists, stands
- suspension
- protection of vehicle components
- load distribution
- suspension
  - rubber
  - leaf-spring
  - torsion
  - independent systems
  - I-beam
  - frames
  - axles
  - levelling and stabilizing systems
  - air spring
  - shock absorbers
  - bushings
- bumpers
- tire carriers
- tongue jacks
- ball couplers
- locking devices
- safety chains
- steps
- skid plates, rollers
- king pin and box
- landing gear
- motors
- cylinders
- gears
- hangers, shackles, equalizers
- saddles, spindles, bearings, races
- d-washers, castellated nuts, cotter pins
- brake assemblies
  - magnets

- lines, fittings
- gauges
- valves
- pumps
- tanks
  - fuel
  - water
- electronics
- lubricants, fluids
- paint
- undercoating materials

4.1.4 Perform inspection and testing procedures on chassis and undercarriage systems following manufacturers' recommendations.
[0/3]

- alignment
- stability
- ride height
- load distribution
- levelling systems
- ride control systems
- physical inspection for:
  - vibration
  - noise
  - corrosion
  - fractures
  - leaks
  - pressure
  - colour
  - wear
  - defects
  - loose, missing, damaged parts

4.1.5 Perform diagnostics and troubleshooting on chassis and undercarriage systems according to manufacturers' specifications.
[0/3]

- use inspection/testing techniques
- use diagnostic equipment
- consult appropriate resource materials (workplace drawings, manuals)
- use computer for research where relevant

4.1.6 Perform assigned operations for the following as to manufacturers' recommendations.
[0/12]

- repair, replace, install
  - kingpin and box, skid plates
  - component parts
- maintain
  - valves, pumps, tanks
- clean and lubricate
  - bearings
  - gears
  - jacks
  - bushings
  - stabilizer jacks
- verify repairs and integrity of operations

Evaluation:

The following evaluation structure is only a suggested format. Specific evaluation of theory and practical components of training varies due to the resource material and training aides utilized.

Evaluation Structure			
Theory Testing	Practical Application Exercises	Research Project	Notebook and Organizational Skills
30%	50%	10%	10%

Number:	5		
Title:	**Electrical/Electronic Systems 3**		
Duration:	Total Hours: 18	Theory: 10	Practical: 8
Prerequisites:	Level 2		
Co-requisites:	None		

5.1 Solar Power Systems

6 Total Hours Theory: 4 hours Practical: 2 hours

5.2 Generator Systems

12 Total Hours Theory: 6 hours Practical: 6 hours

Number:	5.1		
Title:	**Solar Power Systems**		
Duration:	Total Hours: 6	Theory: 4	Practical: 2
Cross Reference to Training Standard: 6068, 6085			

General Learning Outcome:

Upon successful completion of the reportable subject, the apprentice is able to demonstrate a working knowledge of the purpose, construction, principles of operation, inspection, diagnosis, and repair of solar power systems.

Learning Outcomes:

Upon successful completion, the apprentice is able to:

5.1.1 Define the purpose and fundamentals of solar power systems.

5.1.2 Identify and describe the construction, types, styles, and application of solar power systems.

5.1.3 Explain the operating principles of solar power systems.

5.1.4 Perform inspection and testing procedures on solar power systems following manufacturers' recommendations.

5.1.5 Perform diagnostics and troubleshooting on solar power systems according to manufacturers' specifications.

5.1.6 Perform assigned operations for the following as to manufacturers' recommendations.

Learning Content:

5.1.1 Define the purpose and fundamentals of solar power systems.
[0.5/0]

- history and background
- conversion of solar power to electricity

5.1.2 Identify and describe the construction, types, styles, and application of solar power systems.
[1/0]

- solar power systems
  - portable
  - fixed
  - charge controllers
  - battery banks
  - monitor panel
  - modules
  - inverter
  - solar panels

5.1.3 Explain the operating principles of solar power systems.
[2.5/0]

- solar power systems
  - portable
  - fixed
  - charge controllers
  - battery banks
  - monitor panel
  - modules
  - inverter
  - solar panels (function and outputs)

5.1.4 Perform inspection and testing procedures on solar power systems following manufacturers' recommendations.
[0/0.5]

- visual and physical inspection
  - leaks
  - corrosion
  - pressure
  - venting
  - flow
  - temperature
  - vibration
  - noise
  - connections
  - worn, loose, missing, damaged, defective components
- load test
- input/output test
- automatic transfer test

5.1.5 Perform diagnostics and troubleshooting on solar power systems according to manufacturers' specifications.
[0/0.5]

- use inspection/testing techniques
- use diagnostic equipment
- consult appropriate resource materials (workplace drawings, manuals)
- use computer for research where relevant

5.1.6 Perform assigned operations for the following as to manufacturers' recommendations.
[0/1]

- install panels, unit, controllers, batteries
- repair/replace
  - damaged solar panels, batteries
- recommend service
- maintain/clean/lubricate
- verify integrity of operations

Number:	5.2		
Title:	**Generator Systems**		
Duration:	Total Hours: 12	Theory: 6	Practical: 6
Cross Reference to Training Standard: 6069, 6085			

General Learning Outcome:

Upon successful completion of the reportable subject, the apprentice is able to demonstrate a working knowledge of the purpose, construction, principles of operation, inspection, diagnosis and installation of generator systems.

Learning Outcomes:

Upon successful completion, the apprentice is able to:

5.2.1 Define the purpose and fundamentals of generator systems.

5.2.2 Identify and describe the construction, types, styles, and application of generator systems.

5.2.3 Explain the operating principles of generator systems.

5.2.4 Perform inspection and testing procedures on generator systems following manufacturers' recommendations.

5.2.5 Perform diagnostics and troubleshooting on generator systems according to manufacturers' specifications.

5.2.6 Perform assigned operations for the following as to manufacturers' recommendations.

Learning Content:

5.2.1 Define the purpose and fundamentals of generator systems.
[1/0]

- history and background
- remote camping power sources

5.2.2 Identify and describe the construction, types, styles, and application of generator systems.
[2/0]

- LPG/diesel/gasoline
- portable
- built-in
- ATS (automatic transfer systems)
- exhaust systems/noise suppressors
- safety
- hardware:
  - cables
  - fuse boxes
  - fuses
  - circuit breakers

5.2.3 Explain the operating principles of generator systems.
[3/0]

- functions and outputs
- fuel supply
- cooling requirements
- LPG/diesel/gasoline
- portable
- built-in
- ATS (automatic transfer systems)
- exhaust systems/noise suppressors
- vibration control
- safety
- hardware:
  - cables
  - fuse boxes
  - fuses
  - circuit breakers

5.2.4 Perform inspection and testing procedures on generator systems following manufacturers' recommendations.
[0/2]

- visual and physical inspection
  - leaks
  - corrosion
  - pressure
  - venting
  - flow
  - temperature
  - vibration
  - noise
  - connections
  - worn, loose, missing, damaged, defective components
- load test
- input/output test
- automatic transfer test

5.2.5 Perform diagnostics and troubleshooting on generator systems according to manufacturers' specifications.
[0/1]

- use inspection/testing techniques
- use diagnostic equipment
- consult appropriate resource materials (workplace drawings, manuals)
- use computer for research where relevant

5.2.6 Perform assigned operations for the following as to manufacturers' recommendations.
[0/3]

- install generator systems
- repair/replace
  - plugs, filter, oil
  - general service
- maintain, clean, lubricate
- recommend service
- verify integrity of operations

Evaluation:

The following evaluation structure is only a suggested format. Specific evaluation of theory and practical components of training varies due to the resource material and training aides utilized.

Evaluation Structure			
Theory Testing	Practical Application Exercises	Research Project	Notebook and Organizational Skills
40%	30%	20%	10%

Number:	6		
Title:	**Heating, Refrigeration and Air Conditioning Systems 2**		
Duration:	Total Hours: 42	Theory: 25	Practical: 17
Prerequisites:	Level 2		
Co-requisites:	None		

6.1 Water Heaters

6 Total Hours Theory: 3 hours Practical: 3 hours

6.2 Ranges and Ovens

6 Total Hours Theory: 3 hours Practical: 3 hours

6.3 Refrigeration Systems

9 Total Hours Theory: 4 hours Practical: 5 hours

6.4 Air Conditioning and Heat Pump Systems

12 Total Hours Theory: 9 hours Practical: 3 hours

6.5 Furnaces and Heating Systems for Coaches/Trailers

9 Total Hours Theory: 6 hours Practical: 3 hours

Number:	6.1		
Title:	**Water Heaters**		
Duration:	Total Hours: 6	Theory: 3	Practical: 3
Cross Reference to Training Standard: 6071			

General Learning Outcome:

Upon successful completion of the reportable subject, the apprentice is able to demonstrate a working knowledge of the purpose, construction, operating principles, inspection, diagnosis, and repair of water heaters.

Learning Outcomes:

Upon successful completion, the apprentice is able to:

6.1.1 Define the purpose and fundamentals of water heaters.

6.1.2 Identify and describe the construction, types, styles, and application of water heater components.

6.1.3 Explain the operating principles of water heaters.

6.1.4 Perform inspection and testing procedures on water heaters following manufacturers' recommendations.

6.1.5 Perform diagnostics and troubleshooting on water heaters according to manufacturers' specifications.

6.1.6 Perform assigned operations for the following as to manufacturers' recommendations.

Learning Content:

6.1.1 Define the purpose and fundamentals of water heaters.
[0.5/0]

- history and development
- types of water heaters
  - propane
  - propane and electric
  - propane, electric and motor-aid
  - diesel

6.1.2 Identify and describe the construction, types, styles, and application of water heater components.
[1/0]

- tanks
  - lined
  - unlined
- insulation
  - types and insulating values
  - vapour barrier
- hoses
- fittings
- gaskets
- seals
- sensors
- anodes
- drain plugs
- doors
- hinges
- springs
- switches
- relays
- modules
- safety devices
- burners
- gas valves/gas controllers
- REVIEW AS NECESSARY:
  - electrodes
  - piezo lighter
  - pilot assemblies
  - burners
  - elements
  - thermostat
  - ducts
  - vents
  - valves
  - housings

6.1.3 Explain the operating principles of water heaters.
[1.5/0]

- LPG
- diesel
- electric
- motor-aid
- thermostats
- regulators
- insulation
- pilot assemblies
- burners
- piezo lighter
- anodes
- elements
- drain plugs
- safety devices
- heat exchanges
- gas valves/gas controllers
- REVIEW AS NECESSARY:
  - electrodes
  - piezo lighter
  - pilot assemblies
  - burners
  - elements
  - thermostat
  - ducts
  - vents
  - valves
  - housings

6.1.4 Perform inspection and testing procedures on water heaters following manufacturers' recommendations.
[0/1]

- visual and physical inspection
  - corrosion
  - odour
  - colour
  - leaks
  - pressure
  - venting
  - flow

  - temperature
  - vibration
  - noise
  - wear
  - misalignment
  - fractures
- inspection of pilot and main burner flame

6.1.5 Perform diagnostics and troubleshooting on water heaters according to manufacturers' specifications.
[0/0.5]

- use inspection/testing techniques
- consult appropriate resource materials (workplace drawings, manuals)
- use computer for research where relevant

6.1.6 Perform assigned operations for the following as to manufacturers' recommendations.
[0/1.5]

- install, replace, repair water heaters and components
- clean, maintain and adjust water heaters and components
- inspect and replace tank liner
- verify integrity of operations

Number:	6.2		
Title:	**Ranges and Ovens**		
Duration:	Total Hours: 6	Theory: 3	Practical: 3
Cross Reference to Training Standard: 6073			

General Learning Outcome:

Upon successful completion of the reportable subject, the apprentice is able to demonstrate a working knowledge of the purpose, construction, operating principles, inspection, diagnosis, and repair of ranges and ovens.

Learning Outcomes:

Upon successful completion, the apprentice is able to:

6.2.1 Define the purpose and fundamentals of ranges and ovens.

6.2.2 Identify and describe the construction, types, styles, and application for components of ranges and ovens.

6.2.3 Explain the operating principles of ranges and ovens.

6.2.4 Perform inspection and testing procedures on ranges and ovens following manufacturers' recommendations.

6.2.5 Perform diagnostics and troubleshooting on ranges and ovens according to manufacturers' specifications.

6.2.6 Perform assigned operations for the following as to manufacturers' recommendations.

Learning Content:

6.2.1 Define the purpose and fundamentals of ranges and ovens.
[0.5/0]

- history and development
- LP gas and electric
- heat transfer (review)

6.2.2 Identify and describe the construction, types, styles, and application for components of ranges and ovens.
[1/0]

- lines
- hoses
- fittings
- gaskets
- seals
- sensors
- grates
- racks
- doors
- hinges
- springs
- switches
- relays
- modules
- clocks
- lights
- safety devices
- safety valves
- valves
- regulators
- REVIEW AS NECESSARY:
  - electrodes
  - piezo lighter
  - pilot assemblies
  - burners
  - elements
  - thermostats
  - ducts
  - vents
  - housings
  - covers

6.2.3 Explain the operating principles of ranges and ovens.
[1.5/0]

- LPG
- thermostats
- regulators
- insulation
- pilot assemblies
- burners
- piezo lighter
- valves
- filters
- vents
- ducts
- heat exchanger
- safety devices
- safety valves
- REVIEW AS NECESSARY:
  - elements
  - housings
  - covers

6.2.4 Perform inspection and testing procedures on ranges and ovens following manufacturers' recommendations.
[0/0.5]

- visual and physical inspection
  - corrosion
  - odour
  - colour
  - leaks
  - pressure
  - venting
  - flow
  - temperature
  - vibration
  - noise
  - wear
  - misalignment
  - fractures
  - worn, loose, missing, damaged, defective parts
- filters
- vents
- pilot assemblies
- inspection of pilot and main burner flame

6.2.5 Perform diagnostics and troubleshooting on ranges and ovens according to manufacturers' specifications.
[0/1]

- use inspection/testing techniques
- consult appropriate resource materials (workplace drawings, manuals)
- use computer for research where relevant

6.2.6 Perform assigned operations for the following as to manufacturers' recommendations.
[0/1.5]

- install, replace, repair ranges and ovens and component parts
- maintain, and adjust ranges and ovens and component parts
- verify integrity of operations

Number:	6.3		
Title:	**Refrigeration Systems**		
Duration:	Total Hours: 9	Theory: 4	Practical: 5
Cross Reference to Training Standard: 6072			

General Learning Outcome:

Upon successful completion of the reportable subject, the apprentice is able to demonstrate a working knowledge of the purpose, construction, operating principles, inspection, diagnosis, and repair of refrigeration systems.

Learning Outcomes:

Upon successful completion, the apprentice is able to:

6.3.1 Define the purpose and fundamentals of refrigeration systems.

6.3.2 Identify and describe the construction, types, styles, and application of refrigeration system components.

6.3.3 Explain the operating principles of refrigeration systems.

6.3.4 Perform inspection and testing procedures on refrigeration systems following manufacturers' recommendations.

6.3.5 Perform diagnostics and troubleshooting on refrigeration systems according to manufacturers' specifications.

6.3.6 Perform the replacement of a cooling unit according to industry standards and manufacturers' recommendations.

6.3.7 Perform assigned operations for the following as to manufacturers' recommendations.

Learning Content:

6.3.1 Define the purpose and fundamentals of refrigeration systems.
[1/0]

- history and development
- refrigeration theory
  - absorption
  - compression
- heat transfer (review)
- properties of refrigerants
  - absorption (hydrogen, ammonia, water; chromium sulphate)
- disposal of refrigerant waste
  - laws
  - Montreal Protocol

6.3.2 Identify and describe the construction, types, styles, and application of refrigeration system components.
[1.5/0]

- cooling units
  - evaporator
  - compressor
  - condenser
- ice maker
- insulation
- lines
- hoses
- fittings
- gaskets
- seals
- sensors
- baffles
- fans
- racks
- crispers
- catch basin
- caps
- doors
- latches
- hinges
- springs
- switches

- relays
- modules
- lights
- REVIEW AS NECESSARY:
  - electrodes
  - piezo lighter
  - pilot assemblies
  - burners
  - elements
  - thermostats
  - manifolds
  - valves
  - flues
  - vents
  - housings
  - covers

6.3.3 Explain the operating principles of refrigeration systems. [1.5/0]

- absorption cycle
- LPG
- 12 volt D/C
- 110 volt AC
- cooling unit
- thermostats
- regulators
- insulation
- pilot assemblies
- burners
- piezo lighter
- valves
- vents
- ice maker
- insulation
- lines
- hoses
- fittings
- gaskets
- seals
- sensors
- flues
- baffles

- fans
- racks
- crispers
- catch basin
- caps
- doors
- latches
- hinges
- springs
- switches
- relays
- modules
- lights
- REVIEW AS NECESSARY:
  - electrodes
  - elements
  - thermostats
  - valves
  - housings
  - covers

6.3.4 Perform inspection and testing procedures on refrigeration systems following manufacturers' recommendations.
[0/0.5]

- visual and physical inspection
  - corrosion
  - odour
  - colour
  - leaks
  - pressure
  - venting
  - flow
  - temperature
  - noise
  - misalignment
  - fractures
  - worn, loose, missing, damaged, defective parts
- cooling unit test
- flues
- vents
- pilot assemblies
- inspection of pilot and main burner flame

6.3.5 Perform diagnostics and troubleshooting on refrigeration systems according to manufacturers' specifications.
[0/1]

- use inspection/testing techniques
- consult appropriate resource materials (workplace drawings, manuals)
- use computer for research where relevant

6.3.6 Perform the replacement of a cooling unit according to industry standards and manufacturers' recommendations.
[0/3]

- replacement of cooling unit

6.3.7 Perform assigned operations for the following as to manufacturers' recommendations.
[0/0.5]

- maintain, adjust refrigeration systems and components
- verify integrity of operations

Number:	6.4		
Title:	**Air Conditioning and Heat Pump Systems**		
Duration:	Total Hours: 12	Theory: 9	Practical: 3
Cross Reference to Training Standard: 6065.02, 6065.04, 6076			

General Learning Outcome:

Upon successful completion of the reportable subject, the apprentice is able to demonstrate a working knowledge of the purpose, construction, operating principles, inspection, diagnosis, and repair of air conditioning and heat pump systems.

Learning Outcomes:

Upon successful completion, the apprentice is able to:

6.4.1 Define the purpose and fundamentals of air conditioning and heat pump systems.

6.4.2 Identify and describe the construction, types, styles, and application for components of air conditioning and heat pump systems.

6.4.3 Explain the operating principles of air conditioning and heat pump systems.

6.4.4 Perform inspection and testing procedures on air conditioning and heat pump systems following manufacturers' recommendations.

6.4.5 Perform diagnostics and troubleshooting on air conditioning and heat pump systems according to manufacturers' specifications.

6.4.6 Perform assigned operations for the following as to manufacturers' recommendations.

Learning Content:

6.4.1 Define the purpose and fundamentals of air conditioning and heat pump systems.
[1/0]

- history and development
- refrigeration theory
  - basic compression refrigeration cycle model
  - heat transfer

- disposal of refrigerant waste
  - laws
  - Montreal Protocol
  - EPA
  - recover, reuse, recycle, reclaim

6.4.2 Identify and describe the construction, types, styles, and application for components of air conditioning and heat pump systems.
[2/0]

- cooling units
  - evaporator
  - compressor
  - condenser
  - receiver
  - metering device
- compressor
  - reciprocating
  - rotary
  - screw
  - scroll
  - centrifugal
- accumulator-dryer
- heat exchanger
- lines
- hoses
- fittings
- seals
- trays
- cooling fans
- motors
- actuators
- air distribution systems
- sensors
- switches
- relays
- modules
- refrigerants
  - CFC, HCFC, HFC, non-carbon
  - ammonia
  - R12
  - R134a
- lubricants

- thermostats
  - comfort control centres
  - co-ordination with furnace and/or a/c & heat pumps
- REVIEW AS NECESSARY:
  - shrouds
  - fans
  - valves
  - housings

6.4.3 Explain the operating principles of air conditioning and heat pump systems. [6/0]

- mechanical cooling cycle
  - compressor
  - condenser
  - receiver
  - metering device
  - evaporator
  - high pressure and low pressure side
- condensing units
- operating temperatures and pressures for refrigeration cycles:

  compressor
  - condition of refrigerant vapour
  - discharge temperature and pressure
  - calculated superheat

  condenser
  - condition of refrigerant vapour entering
  - saturated condensing temperature and pressure
  - calculated sub cooling

  receiver
  - pressure losses in condenser and piping
  - saturation pressure and temperature
  - loss of sub cooling

  metering device
  - condition of entering refrigerant
  - pressure and temperature of entering refrigerant
  - importance of sub cooling
  - pressure reduction
  - flash gas
  - temperature reduction

  evaporator
  - condition of entering refrigerant
  - saturated suction temperature and pressure
  - requirement for evaporator superheat
  - determining operator evaporator superheat
  - determining suction line superheat

- system lubrication
- control valves
  - low and high pressure cutout
  - evaporator temperature control
  - cycling clutch control
  - orifice tubes
  - low temperature lockout
- thermostats
  - comfort control centres
  - co-ordination with furnace and/or a/cs & heat pumps
- regulators
- valves
- vents
- ducts
- heat exchanger
- lines
- hoses
- fittings
- seals
- trays
- cooling fans
- motors
- actuators
- air distribution systems
- sensors
- switches
- relays
- modules
- refrigerants
  - CFC, HCFC, HFC, non-carbon
  - ammonia
  - R12
  - R134a
- lubricants
- REVIEW AS NECESSARY:
  - shrouds
  - fans
  - valves
  - housings

6.4.4 Perform inspection and testing procedures on air conditioning and heat pump systems following manufacturers' recommendations.
[0/0.5]

- visual and physical inspection
  - corrosion
  - odour
  - colour
  - leaks
  - pressure
  - venting
  - flow
  - temperature
  - vibration
  - noise
  - misalignment
  - fractures
  - worn, loose, missing, damaged, defective parts
- check lubricants

6.4.5 Perform diagnostics and troubleshooting on air conditioning and heat pump systems according to manufacturers' specifications.
[0/1]

- use inspection/testing techniques
- using diagnostic tools
- consult appropriate resource materials (workplace drawings, manuals)
- use computer for research where relevant

6.4.6 Perform assigned operations for the following as to manufacturers' recommendations.
[0/1.5]

- install, replace, repair air conditioners, heat pumps, and component parts
- recognize limits of repair and recommend service
- maintain air conditioners, heat pumps, and component parts
- verify integrity of operations

Number:	6.5		
Title:	**Furnaces and Heating Systems for Coaches/Trailers**		
Duration:	Total Hours: 9	Theory: 6	Practical: 3
Cross Reference to Training Standard: 6086			

General Learning Outcome:

Upon successful completion of the reportable subject, the apprentice is able to demonstrate a working knowledge of the purpose, construction, operating principles, inspection, diagnosis, and repair of furnaces and heating systems for coaches/trailers.

Learning Outcomes:

Upon successful completion, the apprentice is able to:

6.5.1 Define the purpose and fundamentals of furnaces and heating systems for coaches/trailers.

6.5.2 Identify and describe the construction, types, styles, and application for components of furnaces and heating systems for coaches/trailers.

6.5.3 Explain the operating principles of furnaces and heating systems for coaches/trailers.

6.5.4 Perform inspection and testing procedures on furnaces and heating systems for coaches/trailers following manufacturers' recommendations.

6.5.5 Perform diagnostics and troubleshooting on furnaces and heating systems for coaches/trailers according to manufacturers' specifications.

6.5.6 Perform assigned operations for the following as to manufacturers' recommendations.

Learning Content:

6.5.1 Define the purpose and fundamentals of furnaces and heating systems for coaches/trailers.
[1/0]

- history and development
- heat transfer (review)
- types of heating systems
  - forced air
  - direct vent
  - gravity
  - catalytic
  - auxiliary (glycol, engine-aid)

6.5.2 Identify and describe the construction, types, styles, and application for components of furnaces and heating systems for coaches/trailers.
[1.5/0]

- heat exchangers
- heater blower assemblies
- actuators
- motors
- engine-aid systems
- lines
- hoses
- fittings
- gaskets
- seals
- pumps
- thermostats
  - comfort control centres
  - co-ordination with a/c & heat pump
- sensors
- switches
- relays
- modules
- flues
- cables
- glycol-based antifreeze

- REVIEW AS NECESSARY:
  - electrodes
  - pilot assemblies
  - piezo lighter
  - burners
  - shrouds
  - fans
  - ducts
  - vents
  - valves
  - housings

6.5.3 Explain the operating principles of furnaces and heating systems for coaches/trailers.
[3.5/0]

- LPG
- thermostats
  - comfort control centres
  - co-ordination with a/c & heat pump
- pilot assemblies
- engine-aid systems
- burners
- piezo lighter
- valves
- filters
- vents
- flues
- ducts
- fans
- shrouds
- heat exchangers
- heater blower assemblies
- actuators
- motors
- lines
- hoses
- fittings
- gaskets
- seals
- pumps

- sensors
- switches
- relays
- modules
- cables
- glycol-based antifreeze

6.5.4 Perform inspection and testing procedures on furnaces and heating systems for coaches/trailers following manufacturers' recommendations.
[0/1]

- visual and physical inspection
  - corrosion
  - odour
  - colour
  - types and levels of fluids
  - leaks
  - pressure
  - venting
  - flow
  - temperature
  - vibration
  - noise
  - wear
  - misalignment
  - fractures
  - wires
  - worn, loose, missing, damaged, defective parts
- CO test
- inspection of pilot and main burner flame

6.5.5 Perform diagnostics and troubleshooting on furnaces and heating systems for coaches/trailers according to manufacturers' specifications.
[0/1]

- use inspection/testing techniques
- using diagnostic equipment
- consult appropriate resource materials (workplace drawings, manuals)
- use computer for research where relevant

6.5.6 Perform assigned operations for the following as to manufacturers' recommendations.
[0/1]

- install, replace, repair furnaces, heating systems and component parts
- clean, maintain, adjust furnaces, heating systems and component parts
- verify integrity of operations

Evaluation:

The following evaluation structure is only a suggested format. Specific evaluation of theory and practical components of training varies due to the resource material and training aides utilized.

Evaluation Structure			
Theory Testing	Practical Application Exercises	Research Project	Notebook and Organizational Skills
40%	30%	20%	10%

Number:	7		
Title:	**Towed Unit Systems 3c**		
Duration:	Total Hours: 21	Theory: 9	Practical: 12
Prerequisites:	Level 2; Level 3: Unit 1, 4		
Co-requisites:	None		

7.1 Suspension and Handling Enhancement Systems

12 Total Hours Theory: 6 hours Practical: 6 hours

7.2 Vehicle Towing Accessories

9 Total Hours Theory: 3 hours Practical: 6 hours

Number:	7.1		
Title:	**Suspension and Handling Enhancement Systems**		
Duration:	Total Hours: 12	Theory: 6	Practical: 6
Cross Reference to Training Standard: 6084, 6085			

General Learning Outcome:

Upon successful completion of the reportable subject, the apprentice is able to demonstrate a working knowledge of the purpose, construction, principles of operation, inspection, diagnosis and repair of suspension and handling enhancement systems.

Learning Outcomes:

Upon successful completion, the apprentice is able to:

7.1.1 Define the purpose and fundamentals of suspension and handling enhancement systems.

7.1.2 Identify and describe the construction, types, styles, and application of suspension and handling enhancement systems.

7.1.3 Explain the operating principles of suspension and handling enhancement systems.

7.1.4 Perform inspection and testing procedures on suspension and handling enhancement systems following manufacturers' recommendations.

7.1.5 Perform diagnostics and troubleshooting on suspension and handling enhancement systems according to manufacturers' specifications.

7.1.6 Perform assigned operations for the following as to manufacturers' recommendations.

Learning Content:

7.1.1 Define the purpose and fundamentals of suspension and handling enhancement systems.
[1/0]

- air ride systems
- handling and steering systems
  - improve handling, ride of coach
  - safety

7.1.2 Identify and describe the construction, types, styles, and application of suspension and handling enhancement systems.
[1/0]

- air ride systems
  - automatic levelling
  - compressors
  - valves
  - lines
  - solenoid switches
  - fittings
  - controls (park/level auxiliary systems)
- handling and steering systems
  - bell cranks
  - steering dampeners
  - sway controls (front and rear)
  - shocks (dual-action)
  - hardware
  - bushings
  - fasteners

7.1.3 Explain the operating principles of suspension and handling enhancement systems.
[4/0]

- air ride systems
  - automatic levelling
  - compressors
  - valves
  - lines
  - solenoid switches
  - fittings
  - controls (park/level auxiliary systems)
- handling and steering systems
  - bell cranks
  - steering dampeners
  - sway controls (front and rear)
  - shocks (dual-action)
  - hardware
  - bushings
  - fasteners

7.1.4 Perform inspection and testing procedures on suspension and handling enhancement systems following manufacturers' recommendations.
[0/1]

- visual and physical inspection
  - leaks
  - misalignment
  - corrosion
  - colour
  - pressure
  - temperature
  - vibration
  - noise
  - connections
  - worn, loose, missing, damaged, defective components

7.1.5 Perform diagnostics and troubleshooting on suspension and handling enhancement systems according to manufacturers' specifications.
[0/1]

- use inspection/testing techniques
- use diagnostic equipment
- consult appropriate resource materials (workplace drawings, manuals)
- use computer for research where relevant

7.1.6 Perform assigned operations for the following as to manufacturers' recommendations.
[0/4]

- install air ride, steering and handling
- repair/replace/adjust
  - bags, lines, bushings, valves, controls
- maintain, clean, lubricate
- recommend service
- verify integrity of repairs/operations

Number:	7.2		
Title:	**Vehicle Towing Accessories**		
Duration:	Total Hours: 9	Theory: 3	Practical: 6
Cross Reference to Training Standard: 6075, 6085			

General Learning Outcome:

Upon successful completion of the reportable subject, the apprentice is able to demonstrate a working knowledge of the purpose, construction, principles of operation, inspection, diagnosis, and installation of vehicle towing accessories.

Learning Outcomes:

Upon successful completion, the apprentice is able to:

7.2.1 Define the purpose and fundamentals of vehicle towing accessories.

7.2.2 Identify and describe the construction, types, styles, and application of vehicle towing accessories.

7.2.3 Explain the operating principles of vehicle towing accessories.

7.2.4 Perform inspection and testing procedures on vehicle towing accessories following manufacturers' recommendations.

7.2.5 Perform diagnostics and troubleshooting on vehicle towing accessories according to manufacturers' specifications.

7.2.6 Perform assigned operations for the following as to manufacturers' recommendations.

Learning Content:

7.2.1 Define the purpose and fundamentals of vehicle towing accessories. [0.5/0]

- history and background
- tow bars
- tow dollies

7.2.2 Identify and describe the construction, types, styles, and application of vehicle towing accessories.
[1/0]

- tow bars
  - vehicle mount
  - motorhome mount
  - removable
  - fixed
  - safety cables
  - clearance lighting
  - wire harnesses
- tow dollies
  - table turn
  - auto steer
  - braking systems
  - safety cables
  - clearance lighting
  - wiring harnesses

7.2.3 Explain the operating principles of vehicle towing accessories.
[1.5/0]

- tow bars
  - safety
  - gross combined weight rating
  - vehicle mount
  - motorhome mount
  - removable
  - fixed
  - safety cables
  - clearance lighting
  - wire harnesses
  - verify strength and proper installation of hitch
- tow dollies
  - safety
  - gross combined weight rating
  - table turn
  - auto steer
  - braking systems
  - safety cables
  - clearance lighting
  - wire harnesses
  - verify strength and proper installation of hitch

7.2.4 Perform inspection and testing procedures on vehicle towing accessories following manufacturers' recommendations.
[0/1]

- visual and physical inspection
  - leaks
  - corrosion
  - colour
  - tire pressure
  - temperature
  - wheel balance
  - vibration
  - noise
  - connections
  - worn, loose, missing, damaged, defective components
  - misalignment
  - safety harnesses and chains

7.2.5 Perform diagnostics and troubleshooting on vehicle towing accessories according to manufacturers' specifications.
[0/2]

- use inspection/testing techniques
- use diagnostic equipment
- consult appropriate resource materials (workplace drawings, manuals)
- use computer for research where relevant

7.2.6 Perform assigned operations for the following as to manufacturers' recommendations.
[0/3]

- install tow bars
- set up tow dollies
- verify weight ratings
- verify hitch security
- repair/replace worn, loose, missing, damaged, defective parts
- maintain, clean, lubricate
- adjust alignment
- recommend service
- verify integrity of operations

Evaluation:

The following evaluation structure is only a suggested format. Specific evaluation of theory and practical components of training varies due to the resource material and training aides utilized.

Evaluation Structure			
Theory Testing	Practical Application Exercises	Research Project	Notebook and Organizational Skills
30%	40%	20%	10%

Number:	8		
Title:	**RV Construction and Appearance 3**		
Duration:	Total Hours: 54	Theory: 12	Practical: 42
Prerequisites:	Level 2		
Co-requisites:	None		

8.1 Autobody – Interior II

24 Total Hours Theory: 6 hours Practical: 18 hours

8.2 Autobody – Exterior II

30 Total Hours Theory: 6 hours Practical: 24 hours

Number:	8.1		
Title:	**Autobody – Interior II**		
Duration:	Total Hours: 24	Theory: 6	Practical: 18
Cross Reference to Training Standard: 6065.03, 6077			

General Learning Outcome:

Upon successful completion of the reportable subject, the apprentice is able to demonstrate a working knowledge of the purpose, components, operating principles, inspection and performance of interior bodywork on RVs.

Learning Outcomes:

Upon successful completion, the apprentice is able to:

8.1.1 Identify and describe the construction, types, styles, and application of interior components on RVs that are subject to bodywork.

8.1.2 Explain the operating principles of interior RV components.

8.1.3 Describe the types, styles, and applications of interior bodywork operations.

8.1.4 Explain the safe operating principles of interior bodywork.

8.1.5 Perform inspection, testing, and diagnostic procedures on interior components following manufacturers' recommendations.

8.1.6 Perform assigned operations for the following as to manufacturers' recommendations.

Learning Content:

8.1.1 Identify and describe the construction, types, styles, and application of interior components on RVs that are subject to bodywork.
[1/0]

- ceiling panels
- ceiling coverings
- cabinetry
- countertops
- shelving

8.1.2 Explain the operating principles of interior RV components.
[1/0]

- ceiling panels
- ceiling coverings
- cabinetry
- countertops
- shelving

8.1.3 Describe the types, styles, and applications of interior bodywork operations.
[2/0]

- sanding
- priming
- painting
- replace/repair defective components
- caulking
- bonding
- insulating
- trimming
- fastening and securing

8.1.4 Explain the safe operating principles of interior bodywork.
[2/0]

- sanding
- priming
- painting
- replace/repair defective components
- caulking
- bonding
- insulating
- trimming
- fastening and securing
- safely removing ceiling panels
  - plumbing
  - electrical
- repairing cracks, scratches, damage
- personal protection (eyes, hand, breathing)

8.1.5 Perform inspection, testing, and diagnostic procedures on interior components following manufacturers' recommendations.
[0/4]

- visual and physical inspection
  - discolouration
  - worn, loose, missing, damaged, defective components
  - fit, misalignment
  - scratches, dents, fractures
  - cosmetic damage
  - structural integrity
  - corrosion
  - leaks
  - burns
  - vibrations
  - water damage
  - odour
- consult appropriate resource materials (workplace drawings, manuals)
- use computer for research where relevant

8.1.6 Perform assigned operations for the following as to manufacturers' recommendations.
[0/14]

- maintain interior components
- repair/replace
  - ceiling panels
  - cabinetry
  - countertops
  - shelving
- sealing/caulking
- install units, dinettes, cabinetry, ceiling coverings
- adjust hinges, latches, shelves, rails, tracks, doors
- recommend service
- verify integrity of repairs and operations

Number:	8.2		
Title:	**Autobody – Exterior II**		
Duration:	Total Hours: 30	Theory: 6	Practical: 24
Cross Reference to Training Standard: 6078			

General Learning Outcome:

Upon successful completion of the reportable subject, the apprentice is able to demonstrate a working knowledge of the purpose, components, operating principles, inspection and performance of exterior bodywork on RVs.

Learning Outcomes:

Upon successful completion, the apprentice is able to:

8.2.1 Identify and describe the construction, types, styles, and application of exterior components on RVs that are subject to bodywork.

8.2.2 Identify and describe damage patterns of body panels and assemblies.

8.2.3 Explain the operating principles of exterior bodywork.

8.2.4 Perform inspection, testing, and diagnostic procedures on exterior components following manufacturers' recommendations.

8.2.5 Perform assigned operations for the following as to manufacturers' recommendations.

Learning Content:

8.2.1 Identify and describe the construction, types, styles, and application of exterior components on RVs that are subject to bodywork.
[1/0]

- body panels
  - metal
  - fibreglass
  - aluminum
  - composite
  - bonded wall
  - construction
  - design
  - composition
  - repairability

- assemblies
  - unibody design
  - body on frame
  - sub-frames and outriggers
- glass components
  - laminated
  - tempered
  - encapsulated

8.2.2 Identify and describe damage patterns of body panels and assemblies. [1/0]

- primary
- secondary
- related
- direction of damaging force
- delamination

8.2.3 Explain the safe operating principles of exterior bodywork. [4/0]

- personal protection (eye, hand, breathing)
- roughing out
- shaping of metal
  - pulling equipment
  - prying
  - patching
- shrinking
- stretching
- roof patching
- grinding
- filing
- filling
- sanding
- cutting
- welding
- sealing
- riveting
- undercoating
- preparation
- priming
- painting

- removal of glass
  - urethane
  - butyl
  - encapsulated
  - rubber gasket
  - moveable glass/adjustments

8.2.4 Perform inspection, testing, and diagnostic procedures on exterior components following manufacturers' recommendations.
[0/6]

- visual and physical inspection
  - damage
  - fit
  - distortion
  - delamination
  - scratches
  - dents and fractures
  - cosmetic damage
  - structural integrity
  - corrosion
  - leaks
  - water leaks in glass
  - hose on low pressure
  - sonic leak detector
  - pressurized leak tests
  - burns
  - stains
  - vibration
  - discolouration
  - worn, loose, missing, damaged, defective components
  - wind noise
  - sealants
  - hidden damage
- consult appropriate resource materials (workplace drawings, manuals)
- use computer for research where relevant

8.2.5 Perform assigned operations for the following as to manufacturers' recommendations.
[0/18]

- remove and repair/replace glass
- panels and assemblies
  - rough and align to shape
  - using body jacks and pulling equipment
  - prying
  - welding
  - patching
  - shrinking
  - stretching
- finishing
  - grinding
  - filing
  - filling
  - sanding
  - painting
- verify integrity of bodywork
- verify structural integrity of the unit
- recommend for service

Evaluation:

The following evaluation structure is only a suggested format. Specific evaluation of theory and practical components of training varies due to the resource material and training aides utilized.

Evaluation Structure			
Theory Testing	Practical Application Exercises	Research Project	Notebook and Organizational Skills
20%	60%	10%	10%

Number:	9		
Title:	**Shop Practices 3b**		
Duration:	Total Hours: 24	Theory: 12	Practical: 12
Prerequisites:	Level 2; Level 3: Units 1-8		
Co-requisites:	None		

9.1 Pre-Delivery Inspections (PDI)

12 Total Hours Theory: 6 hours Practical: 6 hours

9.2 Cost Estimates

12 Total Hours Theory: 6 hours Practical: 6 hours

Number:	9.1		
Title:	**Pre-Delivery Inspections (PDI)**		
Duration:	Total Hours: 12	Theory: 6	Practical: 6
Cross Reference to Training Standard: 6066			

General Learning Outcome:

Upon successful completion of the reportable subject, the apprentice is able to demonstrate a working knowledge of the purpose, components, and operating principles of Pre-Delivery Inspections.

Learning Outcomes:

Upon successful completion, the apprentice is able to:

9.1.1 Define the purpose and fundamentals of PDIs.

9.1.2 Identify and describe the construction, types, styles, and application of equipment used to conduct PDIs.

9.1.3 Explain the operating procedures used in PDIs.

9.1.4 Perform inspection and testing procedures in accordance with PDI standards.

Learning Content:

9.1.1 Define the purpose and fundamentals of PDIs.
[1/0]

- LP system integrity and appliance operation
- PDI check-list
  - manufacturer
  - dealer
- fit, form and function

9.1.2 Identify and describe the construction, types, styles, and application of equipment used to conduct PDIs.
[2/0]

- tools
  - straight edges
  - torque wrenches
  - measuring tape
  - level
- gauges
  - manometer
  - pressure
  - multimeter
- leak-detectors
  - electronic
  - bubble solution
- temperature
  - glass thermometers
  - digital pocket thermometers
  - infra-red thermometers
- CO detector

9.1.3 Explain the operating procedures used in PDIs.
[3/0]

- visual inspection
- physical inspection
- PDI check lists
- recording of results

9.1.4 Perform inspection and testing procedures in accordance with PDI standards.
[0/6]

- visual and physical inspection of all components and systems
  - structural integrity
  - cleanliness
  - cracks
  - distortion
  - corrosion
  - leaks
  - worn, loose, missing, damaged, defective parts
  - dirt
  - pressure
  - venting
  - flow

    - temperature
    - vibration
    - noise
    - misalignment
    - fractures
    - odour
    - colour
- LP system test
- TSSA compliance
- using PDI checklist
- record results
- consult appropriate resource materials (workplace drawings, manuals)
- use computer for research where relevant
- verify accuracy of report
    - visual and physical inspection
    - report filled in correctly

Number:	9.2		
Title:	**Cost Estimates**		
Duration:	Total Hours: 12	Theory: 6	Practical: 6
Cross Reference to Training Standard: 6065.04, 6087			

General Learning Outcome:

Upon successful completion of the reportable subject, the apprentice is able to demonstrate a working knowledge of the fundamentals, components, and procedures used in the production of cost estimates.

Learning Outcomes:

Upon successful completion, the apprentice is able to:

9.2.1 Define the purpose and fundamentals of cost estimates.

9.2.2 Identify and describe the construction, types, styles, and application of equipment used to conduct cost estimates.

9.2.3 Explain the operating procedures used in conducting damage repair estimates.

9.2.4 Explain the operating procedures used in conducting service repair estimates.

9.2.5 Perform inspection, testing, and diagnostic procedures to determine cost estimates following system specifications and manufacturers' recommendations.

9.2.6 Perform cost estimates for the following as to industry and government standards.

Learning Content:

9.2.1 Define the purpose and fundamentals of cost estimates.
[1/0]

- Motor Vehicle Repair Act
  - obligations
  - importance of accurate estimating
- math fundamentals
  - whole number operations
  - percentages
- computer fundamentals

9.2.2 Identify and describe the construction, types, styles, and application of equipment used to conduct cost estimates.
[1/0]

- service reports
- camera
- repair estimating manuals
- flat rate
- calculator
- computer
- parts and materials price lists
- specification charts
- tape measure
- templates and patterns

9.2.3 Explain the operating procedures used in conducting damage repair estimates.
[2/0]

- inspect and record damage
- photograph all damaged body parts
- record damage on service report
- record customer insurance and unit data
- record estimator’s name and date
- calculate costs using:
  - service report
  - repair estimating manuals
  - price lists
  - flat rate/time
- enter information in computer

9.2.4 Explain the operating procedures used in conducting service repair estimates.
[2/0]

- inspect and diagnose
- photograph and record service required
- calculate costs using:
  - service report
  - repair estimating manuals
  - price lists
  - flat rate/time
- enter information on computer

9.2.5 Perform inspection, testing, and diagnostic procedures to determine cost estimates following system specifications and manufacturers' recommendations.
[0/2]

- visual and physical inspection
  - structural integrity
  - visible and hidden damage
  - poor fit, distortion, misalignment
  - corrosion
  - leaks
  - fractures
  - metal and paint damage
  - worn, loose, missing, damaged, defective parts
- photograph damage
- record results on service report
- verify results
- consult appropriate resource materials (workplace drawings, manuals)
- use computer for research where relevant

9.2.6 Perform cost estimates for the following as to industry and government standards.
[0/4]

- record information
  - damage
  - service
  - customer information
  - estimator information

- calculate costs
  - sub-lets
  - towing
  - storing
  - freight
  - rentals
  - set-up
  - disposal fees
  - taxes
  - labour
  - parts
  - repairs
- use specification charts, templates, flat rate/time, price lists, estimating manuals
- MVRA standards
- verify estimate
  - validate specifications
  - perform calculations
  - verify correct customer information (insurance, unit data)

Evaluation:

The following evaluation structure is only a suggested format. Specific evaluation of theory and practical components of training varies due to the resource material and training aides utilized.

Evaluation Structure			
Theory Testing	Practical Application Exercises	Research Project	Notebook and Organizational Skills
30%	40%	20%	10%

Reference Material

The following reference materials as listed are suggestions for resource materials. This is not a definitive list, nor is it mandatory. Additional reference material may be employed, particularly manufacturer-specific resource materials, including pamphlets and videos.

Trailer Life's Repair and Maintenance Manual
Livingston, ISBN 0-934798-70-2

Automotive Mechanics
Tenth Edition, Crouse and Anglin. ISBN 0-02-800943-6

Basic Blueprint Reading and Sketching
6th Edition, Olivio. ISBN 0-8273-5740-0

Basic Wiring for Canada
Creative Homeowner Press, ISBN 1-58011-018-5

Modern Plumbing
Blankenbaker, ISBN 0-87006-939-X

Auto Body Repair and Refinishing
3rd Edition, Hogg. ISBN 0-07-548869-8

Practical Heating Technology
Johnson. ISBN 0-8273-4881-9

Impact: A Guide to Business Communications
3rd Edition, Northey. ISBN 0-13-452541-8

CSA 240 RV Standard Code Book – can be ordered on-line at www.csa.com.
Product ID number: 2411671

Ontario Propane Code Books – distributed through CSA
Natural Gas and Propane Installation Code (B149.1-00)
Propane Storage and Handling Code

RVIA Technical Series
printed and distributed through Okanagan University College in B.C.

Getting Started in Electronics
Radio Shack book, Mims, catalogue #: 276-5003a

Suggested Minimum Equipment List for Training Delivery Agencies

Ontario RV Technician Apprenticeship Program

Power Sources and Equipment	Number of Apprentices for Each Tool
Oxy-Fuel-Gas Manual Cutting equipment	1

Basic Hand Tools and Equipment	Number of Apprentices for Each Tool
Hammer	1
Side Cutters	1
Chipping Hammer	1
Vise Grips	1
Screwdrivers (set)	1
Wrenches (set)	1
Ratchets	1
Sockets (set)	1
Wire Brush	2
Hacksaw/Saws	2
Punches (set)	2
Pliers (set)	3
Pipe Cutters (copper/plastic)	3
Plane	3
Cold Chisel/Chisels (set)	4
Vise	4
Scalers	4
Disc Grinders	4
Flaring Tool	4
Tube Bender	4
Clamps (set)	4
Files (set)	4
Augers (set)	4
Rivet Gun	4
Nut Drivers (set)	4
Allen Keys – Wrench Set	4
Wheel Grinders	5
Hole Saw Kit	5
Cotter Pin Puller	5
Tin Snips (set)	5

Optional Hand Tools

Shears/Nibblers

Power Tools	Number of Apprentices for Each Tool
Wheel Grinders	3
Disc Grinders	3
Drills (Battery & 110v)	3
Bench Grinders	4
Rivet Guns	4
Sanders	4
Abrasive Cut-Off Saws	5
Die Grinders	5
Air Tools (assorted)	5
Drill Presses	5
Electric Impact Wrenches	5
Routers	5
Nibblers (Handheld)	10
Planes	10
Battery Charger	10
Chisels	20
Electric Saws (skill, table, radial, mitre, and band)	20

Optional/As Required Power Tools

Air Compressor
Electric Pipe Cutters
Threading Machines
Augers

Specialty Tools	Number of Apprentices for Each Tool
Crimping Tools	2
Pop Rivet Kit	4
Wheel Seal Puller	5
Butane Soldering Equipment	5
Venturi Cleaning Brush (flue-baffle)	5
Pressure Relief Valve Tool	10
Gas Valve Tool	10
Awning Spring Wind Tool	20
Awning Rail Straightener Tool	20
Antenna Tool	20
Ring Seater Tool (Atwood Hot Water Tanks)	20

Related Equipment, as required

Extension Cords
Testing Devices
Hydraulic Equipment and Fluid Levels
Hoists and Jacks
Mechanical Stands
Ladders
Scaffolds
Fastening and Mounting Devices

Precision Measuring Tools & Diagnostic Equipment	**Number of Apprentices for Each Tool**
Measuring Tape	1
Ruler	1
Multimeter	1
Micrometers (Inside, Outside, Depth)	2
Vernier Caliper	2
Test Lights (12-volt)	2
Torque Wrench	3
Calipers	4
Dial Indicators	4
Level	4
Pressure Gauge	4
Bubble Solution (Leak Detector)	4
A/C D/C amp clamps	4
Straight Edges	5
CO detector	5
Digital Pocket Thermometer	5
Monometer	10
Hydrometer	10
Load Tester	10
Universal Gauge (set)	10
Gas Pressure Gauge (Low Pressure Test Set)	10
HWH High Pressure Fluid gauge	10
Vacuum Gauge	10
Electronic Leak Detector	10
Glass Thermometer	10
Electronic Thermometer (thermocouple and thermistor sensors)	10
Non-Contact Infra-Red Thermometers	10
Dometic PAL RV Appliance Diagnostic Kit	10

Fenwal Gas Ignition Field Tester	10
Tekonsha Circuit Testers	10
Combustionable Gas Detector	20
Handheld Gas Leak Detector	20
Kwik Test (Electric Step Tester)	20
Tekonsha Brake Control Tester	20

Safety Equipment	**Number of Apprentices for Each Tool**
Goggles	1
Earplugs (sound suppression devices)	1
Masks	1
Gloves	1
Safety Glasses	1
Face Shields	3
Respirators	4
Safety Harness	4
Fire Blankets	5
Fire Extinguisher	5
Safety Cage (optional)	

Resource Materials, as required

Codebooks
Engineering Specifications
Manufacturer’s Specifications, manuals and charts
Safety Manuals

Additional Equipment	**Number of Apprentices for Each Tool**
Computer Workstation	1

Personal and Safety Equipment

Personal protective equipment is at the discretion of the TDA who must conform to Ontario Provincial Health and Safety Regulations.

RV Technician apprentices may supply their own work clothing, boots, coveralls, and prescription safety glasses.

Items such as hard hats, eye and hearing protection, and all other tools are frequently the responsibility of the employer.

Resource materials, charts, regulations, specifications, service bulletins, manufacturers’ manuals, and logbooks are supplied by the employer or equipment owner.

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Recreation Vehicle Service Technician