Skilled Trades Ontario | Métiers spécialisés Ontario

Apprenticeship Curriculum Standard

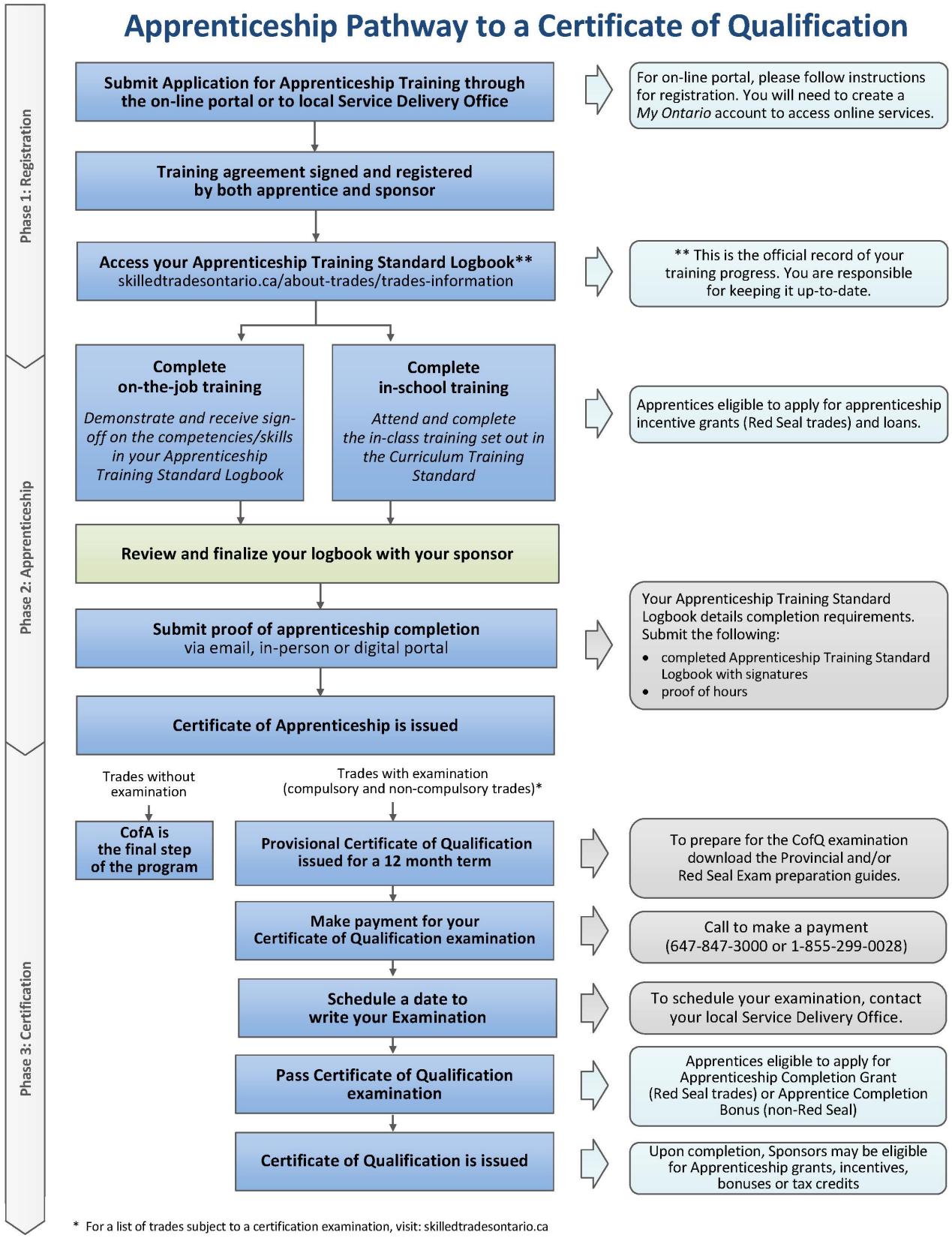
Recreational Vehicle Technician

Level 2

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 2

Summary of Total Program In-School Training Hours

Number	Reportable Subjects	Hours Total	Hours Theory	Hours Practical
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**

Number:	1		
Title:	**Electrical/Electronic Systems 2**		
Duration:	Total Hours: 30	Theory: 15	Practical: 15
Prerequisites:	Level 1		
Co-requisites:	None		

1.1 D/C Electrical/Electronic Systems II

21 Total Hours Theory: 9 hours Practical: 12 hours

1.2 A/C Electrical/Electronic Systems II

9 Total Hours Theory: 6 hours Practical: 3 hours

Number:	1.1		
Title:	**D/C Electrical and Electronic Systems II**		
Duration:	Total Hours: 21	Theory: 9	Practical: 12
Cross Reference to Training Standard: 6068			

General Learning Outcome:

Upon successful completion of the reportable subject, the apprentice is able to demonstrate a working knowledge of the types, operating principles, inspection, diagnosis, and repair of D/C electrical and electronic systems.

Learning Outcomes:

Upon successful completion, the apprentice is able to:

1.1.1 Identify and describe the construction, types, styles, and application of D/C electrical and electronic systems components.

1.1.2 Explain the operating principles of D/C electrical and electronic systems.

1.1.3 Perform inspection and testing procedures on D/C electrical and electronic systems following manufacturers' recommendations.

1.1.4 Perform diagnostics and troubleshooting on D/C electrical and electronics systems according to manufacturers' specifications.

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

Learning Content:

1.1.1 Identify and describe the construction, types, styles, and application of D/C electrical and electronic systems components.
[3/0]

- isolators
  - B.I.R.D. systems (bi-directional relay device)
- proximity and auditory alarms
- solar power systems
- electrical accessories
- charging systems (motorhomes)

- REVIEW AS NECESSARY:
  - electrical circuits
  - conductors
  - manual and automatic switches
  - load devices
  - over-load devices
  - batteries
  - lead acid
  - low maintenance
  - maintenance-free batteries
  - gelled cell batteries
  - deep cycle batteries
  - fusible links
  - cables
  - lighting
  - motors
  - solenoids
  - fuses
  - circuit breakers
  - switches
  - relays
  - circuit protection devices
  - sensors
  - modules
  - wiring harnesses
  - diagnostic lights
  - connectors
  - circuit boards
  - display panels
  - inverter and converter systems
  - generators

1.1.2 Explain the operating principles of D/C electrical and electronic systems. [6/0]

- isolators
  - B.I.R.D. system
- proximity and auditory alarms
- solar power systems
- electrical accessories
- generators
- charging systems (motorhome)

- REVIEW AS NECESSARY:
  - batteries
  - motors
  - solenoids
  - fuses
  - inverter and converter systems
  - fusible links
  - cables
  - lighting
  - circuit breakers
  - switches
  - relays
  - circuit protection devices
  - sensors
  - modules
  - wiring harnesses
  - diagnostic lights
  - connectors
  - circuit boards
  - display panels

1.1.3 Perform inspection and testing procedures on D/C electrical and electronic systems following manufacturers' recommendations.
[0/4]

- visual and physical inspection
  - corrosion
  - worn, loose, damaged, missing, defective parts
  - temperature
  - odour
  - vibration
  - noise
- testing with meters
  - voltage and voltage drop
  - amperage
  - specific draws
- re-programming
  - energy management systems
  - inverter interfacing
- testing converter and inverter systems

1.1.4 Perform diagnostics and troubleshooting on D/C electrical and electronic systems according to manufacturers' specifications.
[0/3]

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

1.1.5 Perform assigned operations for the following as to manufacturers' recommendations
[0/5]

- install, replace, repair batteries, D/C components
- verify
  - inputs, outputs, grounds
  - operations
- maintenance
  - safe cleaning
  - storage
- charging procedures
- activation

Number:	1.2		
Title:	**A/C Electrical and Electronic Systems II**		
Duration:	Total Hours: 9	Theory: 6	Practical: 3
Cross Reference to Training Standard: 6069			

General Learning Outcome:

Upon successful completion of the reportable subject, the apprentice is able to demonstrate a working knowledge of the types, operating principles, inspection, diagnosis and repair of A/C electrical and electronic systems.

Learning Outcomes:

Upon successful completion, the apprentice is able to:

1.2.1 Identify and describe the construction, types, styles, and application of A/C electrical and electronic systems components.

1.2.2 Explain the operating principles of A/C electrical and electronic systems.

1.2.3 Perform inspection and testing procedures on A/C electrical and electronic systems following manufacturers' recommendations.

1.2.4 Perform diagnostics and troubleshooting on A/C electrical and electronic systems according to manufacturers' specifications.

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

Learning Content:

1.2.1 Identify and describe the construction, types, styles, and application of A/C electrical and electronic systems components.
[1.5/0]

- generators
  - ATS (Automatic Transfer Switch)
- auditory alarms
- electrical accessories

- REVIEW AS NECESSARY:
  - capacitors
  - panel box
  - receptacles
  - power cords (15, 30, 50 amp)
  - ground fault interrupters
  - surge protection devices
  - motors
  - fuses
  - circuit breakers
  - switches
  - relays
  - sensors
  - modules
  - wiring harnesses
  - diagnostic lights
  - connectors
  - circuit boards
  - display panels
  - inverter and converter systems
  - energy management systems

1.2.2 Explain the operating principles of A/C electrical and electronic systems. [4.5/0]

- generators
  - ATS (Automatic Transfer Switch)
- auditory alarms
- electrical accessories
- REVIEW AS NECESSARY:
  - motors
  - fuses
  - circuit breakers
  - switches
  - relays
  - sensors
  - modules
  - wiring harnesses
  - diagnostic lights
  - connectors
  - circuit boards
  - display panels
  - inverter and converter systems
  - energy management systems
  - capacitors
  - panel box

  - receptacles
  - power cords (15, 30, 50 amp)
  - ground fault interrupters
  - surge protection devices

1.2.3 Perform inspection and testing procedures on A/C electrical and electronic systems following manufacturers' recommendations.
[0/0.5]

- visual and physical inspection
  - corrosion
  - worn, loose, damaged, missing, defective parts
  - connections
  - temperature
  - odour
  - vibration
  - noise
- testing with meters
  - voltage and voltage drop
  - amperage
- specific draws
- grounding
- polarity

1.2.4 Perform diagnostics and troubleshooting on A/C electrical and electronic systems according to manufacturers' specifications.
[0/1]

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

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

- install, replace, repair A/C operations in RVs
- verify
  - voltage, polarity and ground
  - frequency of generators
  - operations
- maintain
- adjust

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

Number:	2		
Title:	**Shop Practices 2**		
Duration:	Total Hours: 12	Theory: 7	Practical: 5
Prerequisites:	Level 1		
Co-requisites:	None		

2.1 Workplace Communications II

6 Total Hours Theory: 4 hours Practical: 2 hours

2.2 Workplace Charts and Diagrams II

6 Total Hours Theory: 3 hours Practical: 3 hours

Number:	2.1		
Title:	**Workplace Communications II**		
Duration:	Total Hours: 6	Theory: 4	Practical: 2
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 Describe written and other related communication techniques.

2.1.2 Explain principles of effective communication.

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

Learning Content:

2.1.1 Describe written and other related communication techniques. [0.5/0]

- written skills
  - legible writing
  - accuracy of entering forms, providing details
- assessment skills
  - knowledge level of customer
  - point-of-view of customer/co-worker
- REVIEW AS NECESSARY:
  - listening skills
  - verbal skills

2.1.2 Explain principles of effective communication.
[2.5/0]

- listening
  - attentive
  - paraphrasing ideas and statements
  - assessing knowledge level of customer
  - assessing objectives of customer
  - positive attitude
  - patience
- verbal communication
  - attentive
  - ask clear and direct questions
  - use plain language
  - clear and concise explanations
  - positive attitude
  - answer any questions
  - confirm client’s needs
- written communication
  - legible
  - plain language
  - provide accurate details
  - punctuation/spelling/grammar
  - complete all required sections on documents
  - clear and concise explanations

2.1.3 Perform applications of effective communication as to client and company standards.
[1/2]

- listening and assessment skills
- verbal communication
- use computers where relevant
- complete documents and forms
- enact classroom client-technician scenarios

Number:	2.2		
Title:	**Workplace Charts and Diagrams II**		
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 types, principles of operation, and interpretation of various prints, drawings and sketches.

Learning Outcomes:

Upon successful completion, the apprentice is able to:

2.2.1 Describe the types, styles and application of prints, drawings and sketches.

2.2.2 Explain the principles of operation of prints, drawings and sketches.

2.2.3 Read and interpret prints, drawings and sketches.

Learning Content:

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

- assembly prints
- sub-assembly prints
- blueprints
- shop or working drawings
- sketches

2.2.2 Explain the principles of operation of prints, drawings and sketches.
[2.5/0]

- common views and presentations
  - orthographic projection
  - front, back, top, and side views
  - revolved views
  - full and sectional views
  - selecting the appropriate “front”
  - isometric drawing
  - three-dimensional sketching
  - oblique and perspective views
  - pictorial drawing
  - true perspective
  - vanishing point
  - not to be scaled
  - section views
  - full and partial sections
  - revolved section
  - half section
- scale

2.2.3 Read and interpret prints, drawings and sketches.
[0/3]

- identify location of devices, dimensions, materials and specifications
- identify type and model of vehicle, parts, components and assemblies
- identify scale
- interpret blueprints

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

Number:	3		
Title:	**Plumbing and Gas Systems 2**		
Duration:	Total Hours: 21	Theory: 6	Practical: 15
Prerequisites:	Level 1; TSSA Certification (RV-2)		
Co-requisites:	None		

3.1 Plumbing II

12 Total Hours Theory: 3 hours Practical: 9 hours

3.2 Liquid Petroleum Gas (LPG) II

9 Total Hours Theory: 3 hours Practical: 6 hours

Number:	3.1		
Title:	**Plumbing II**		
Duration:	Total Hours: 12	Theory: 3	Practical: 9
Cross Reference to Training Standard: 6067			

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, diagnosis and repair of plumbing systems.

Learning Outcomes:

Upon successful completion, the apprentice is able to:

3.1.1 Identify and describe the construction, types, styles, and application of plumbing system components.

3.1.2 Explain the operating principles of plumbing systems.

3.1.3 Perform inspection and testing procedures on plumbing systems following manufacturers' recommendations.

3.1.4 Perform diagnostics and troubleshooting on plumbing systems according to manufacturers' specifications.

3.1.5 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 plumbing system components.
[1/0]

- plumbing fixtures
- monitor panels
- pump assemblies
- filters
  - installed systems
  - auxiliary systems

- accumulators
- actuators
- valves
  - macerator
- solenoids
- REVIEW AS NECESSARY:
  - regulators
  - lines
  - hoses
  - manifolds
  - seals
  - gaskets
  - tanks
  - toilets
  - sinks
  - showers, tubs
  - drains
  - flushing systems
    - vacuum
    - gravity
  - pipes
    - copper
    - plastic
    - PVC (ABS)
    - tubing
  - vents
  - caps
  - fittings
  - clamps
  - insulation systems
    - tank heating
    - heat tape
  - valves
    - gate
    - globe
    - ball
    - angle
  - freeze protection devices and fluids

3.1.2 Explain the operating principles of plumbing systems.
[2/0]

- plumbing fixtures
- monitor panels
- pump assemblies
- filters
  - installed systems
  - auxiliary systems
- accumulators
- actuators
- valves
  - macerator
  - solenoids
- REVIEW AS NECESSARY:
  - regulators
  - lines
  - hoses
  - manifolds
  - seals
  - gaskets
  - tanks
  - drain waste
  - drain venting
    - wet
    - dry
  - city water connections
  - holding tank waste and vents
  - holding tanks
  - freshwater tanks
  - float valves
  - gravity tanks
  - vacuum waste system
  - p-traps
  - toilets
  - sinks
  - showers, tubs
  - drains
  - flushing systems
    - vacuum
    - gravity
  - pipes
    - copper
    - plastic
    - PVC (ABS)
    - tubing

  - vents
  - caps
  - fittings
  - clamps
  - insulation systems
    - tank heating
    - heat tape
  - valves
    - gate
    - globe
    - ball
    - angle
  - freeze protection devices and fluids

3.1.3 Perform inspection and testing procedures on plumbing systems following manufacturers' recommendations.
[0/1.5]

- visual and physical inspection
  - temperature
  - pressure
  - worn, loose, missing, damaged, defective parts
  - leaks
  - levels
  - flows
  - venting
  - corrosion
  - vibration
  - noise
  - misalignment
  - odours
  - colour
- use appropriate gauges

3.1.4 Perform diagnostics and troubleshooting on plumbing systems according to manufacturers' specifications.
[0/1.5]

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

3.1.5 Perform assigned operations for the following as to manufacturers' recommendations.
[0/6]

- maintain, repair, replace, install common RV plumbing operations
  - replace toilet valves
- flow direction
- winterization processes/bypass operation
  - refrigerators, washing machines, appliances
- verify operations

Number:	3.2		
Title:	**Liquid Petroleum Gas (LPG) II**		
Duration:	Total Hours: 9	Theory: 3	Practical: 6
Cross Reference to Training Standard: 6070			

General Learning Outcome:

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

Learning Outcomes:

Upon successful completion, the apprentice is able to:

3.2.1 Explain the operating principles of LPG.

3.2.2 Perform inspection and testing procedures on LPG systems following manufacturers' recommendations.

3.2.3 Perform diagnostics and troubleshooting on LPG systems according to manufacturers' specifications.

3.2.4 Perform assigned operations for the following as to manufacturers' recommendations and T.S.S.A. requirements.

Learning Content:

3.2.1 Explain the operating principles of LPG.
[3/0]

- pilot lights
- high and low pressure connections
- liquid and vapour connections
- tanks/cylinders
  - horizontal
  - vertical
- couplers
- sensors
- mechanical and electronic controls
- warning devices
- switches

- manifold
- fittings
  - flared
  - forged
  - compression
  - quick-connect
- REVIEW AS NECESSARY:
  - regulators
  - lines
  - hoses
  - valves
  - seals
  - piping

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

- TSSA requirements
- visual and physical inspection
  - leaks
  - tags
  - misalignment
  - colour
  - worn, loose, missing, damaged, defective parts
  - opens/shorts/grounds
  - routing of wires
  - lines
  - hoses
  - odour
  - temperature
  - distortion
  - corrosion
  - contamination
- check diagnostic codes
- gas detection devices
- pressure test
- use diagnostic equipment
  - monometer (pressure)
  - pressure gauge (mechanical and electronic)
  - CO detector
  - propane detector

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

- use inspection/testing techniques
- use diagnostic equipment
  - monometer (pressure)
  - pressure gauge (mechanical and electronic)
  - CO detector
  - propane detector
- consult appropriate resource materials (workplace drawings, manuals)
- use computer for research where relevant

3.2.4 Perform assigned operations for the following as to manufacturers' recommendations and T.S.S.A. requirements.
[0/3]

- maintenance of LPG equipment
- installation/repair/replacement of systems involving LP gas
- recommend service where necessary
- verify system integrity; verify operations

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

Number:	4		
Title:	**Heating, Refrigeration and Air Conditioning Systems 1**		
Duration:	Total Hours: 24	Theory: 18	Practical: 6
Prerequisites:	Level 1		
Co-requisites:	None		

4.1 Heating, Refrigeration and Air Conditioning Systems

24 Total Hours Theory: 18 hours Practical: 6 hours

Number:	4.1		
Title:	**Heating, Refrigeration, and Air Conditioning Systems**		
Duration:	Total Hours: 24	Theory: 18	Practical: 6
Cross Reference to Training Standard: 6065.04, 6065.06, 6071, 6072, 6073, 6076, 6086			

General Learning Outcome:

Upon successful completion of the reportable subject, the apprentice is able to demonstrate a working knowledge of the purpose, applications, scientific principles, and equipment used in heating, refrigeration, and air conditioning systems.

Learning Outcomes:

Upon successful completion, the apprentice is able to:

4.1.1 Define the purpose and trade-relevant applications of heating, refrigeration, and air conditioning systems.

4.1.2 Describe the scientific principles fundamental to heating, refrigeration, and air conditioning systems.

4.1.3 Describe the construction, types, styles, and application of components common to heating, refrigeration, and air conditioning components.

4.1.4 Define the safety and legislative considerations involved in working with heating, refrigeration, and air conditioning systems.

4.1.5 Explain the safe operating principles of components common to heating, refrigeration, and air conditioning systems.

Learning Content:

4.1.1 Define the purpose and trade-relevant applications of heating, refrigeration, and air conditioning systems.
[1/0]

- history and background
- water heaters
- refrigerators and freezers
  - ice makers
- ranges and ovens
- air conditioning
- heat pump
- auxiliary heating

4.1.2 Describe the scientific principles fundamental to heating, refrigeration, and air conditioning systems.
[6/0]

- elements
  - atoms
  - molecules
  - compounds
- movement of molecules
- molecular cohesion
- measurements of matter
  - volume
  - destiny
- effects of heat on matter
  - expansion
  - linear and cubical
  - coefficients of expansion
- classifications of energy
  - kinetic
  - potential
  - heat energy
- definition of heat
- energy sources
  - mechanical
  - electrical
  - chemical
  - heat

- expenditure of energy
  - work and horsepower
  - units of work
  - work equivalents
  - energy efficiency
- pressure
  - atmospheric pressure
  - units of pressure and vacuum measurement
  - pressure-temperature relationships
  - saturation tables
- heat transfer
  - direction of flow
  - conduction
  - convection
  - radiation
  - factors that affect rate of heat flow
- states of matter
- heat intensity
- heat quantity
- heat energy and change of state
  - latent heat of vaporization
  - latent heat of fusion
  - saturated and superheated vapour
  - subcooled liquid
- overview of gas laws
  - Charles' Law
  - Boyle's Law
  - Lussac's Law
  - general gas law

4.1.3 Describe the construction, types, styles, and application of components common to heating, refrigeration, and air conditioning systems. [5/0]

- electrodes
- piezo lighter
- pilot assemblies
- burners
- elements
- shrouds
- fans
- thermostat
- pumps
- ducts

- vents
- valves
- cooling
- housings
- covers
- flues

4.1.4 Define the safety and legislative considerations involved in working with heating, refrigeration, and air conditioning systems.
[6/0]

- OHSA
- treatment of hazardous materials
- WHMIS
  - relevant MSDS (Material Safety Data Sheet)
- EPA

4.1.5 Explain the safe operating principles common to heating, refrigeration, and air conditioning systems.
[0/6]

- heating and ventilation
  - air flow characteristics
  - inside and outside ventilation
- blower motors
- plenum chambers and ducts
- air doors and controls
- heater cores
  - chassis heating/air conditioning systems
- filter systems
- electrodes
- piezo lighter
- pilot assemblies
- burners
- elements
- shrouds
- fans
- thermostat
- pumps
- ducts
- vents

- valves
- cooling
- housings
- covers
- flues

Evaluation Structure			
Theory Testing	Practical Application Exercises	Research Project	Notebook and Organizational Skills
70%	10%	10%	10%

Number:	5		
Title:	**Welding Practices 2**		
Duration:	Total Hours: 51	Theory: 15	Practical: 36
Prerequisites:	Level 1		
Co-requisites:	None		

5.1 MIG Welding

27 Total Hours Theory: 9 hours Practical: 18 hours

5.2 Shielded Metal Arc Welding

24 Total Hours Theory: 6 hours Practical: 18 hours

Number:	5.1		
Title:	**MIG Welding**		
Duration:	Total Hours: 27	Theory: 9	Practical: 18
Cross Reference to Training Standard: 6065, 6075, 6081			

General Learning Outcome:

Upon successful completion of the reportable subject, the apprentice is able to demonstrate a working knowledge of the purpose, construction, safe operating principles, inspection, and usage of MIG welding equipment.

Learning Outcomes:

Upon successful completion, the apprentice is able to:

5.1.1 Define the purpose and fundamentals of MIG welding.

5.1.2 Describe the functions, construction, types, styles, and application of MIG welding equipment.

5.1.3 Describe the functions, construction, types, styles, and application of structures and devices that require MIG welding on RVs.

5.1.4 Explain the safe operating principles of MIG welding.

5.1.5 Set-up equipment for a variety of MIG welding applications.

5.1.6 Perform inspection and testing procedures on unit parts following manufacturers' recommendations.

5.1.7 Perform diagnostics and troubleshooting on welding equipment and unit parts according to manufacturers' specifications.

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

5.1.9 Verify integrity of assigned operations according to manufacturers' recommendations and industry approved repair procedures.

Learning Content:

5.1.1 Define the purpose and fundamentals of MIG welding.
[1/0]

- modes of metal transfer
  - short-circuiting
  - spray arc
  - globular
  - pulsed
- gas shielding
  - purpose
  - Argon/Helium
  - CO_2
  - mixed gases
  - triple mix gas
- safety review

5.1.2 Describe the functions, construction, types, styles, and application of MIG welding equipment.
[2.5/0]

- constant voltage power source
  - self-correcting arc gap
- application of constant current power sources
- wire feeders
  - spool guns
  - push type
  - push pull type
- drive rolls
- liners
  - metallic
  - non-metallic
- gas diffusers
- contact tips/tubes
- nozzles
- water cooled guns
- tanks
- fittings
- regulators
- electrical connectors
- cables

- ground clamps
- drive assemblies and cooling fans
- guns
- flow meters
- shielded gas hoses
- consumables
  - optimal wire type and size
  - low alloy
  - steels
  - stainless steels
  - aluminum
  - purpose of copper plating
- wire brushes
- descalers
- abrasives
- personal protective equipment
- fire-retardant shielding

5.1.3 Describe the functions, construction, types, styles, and application of structures and devices that require MIG welding on RVs.
[2.5/0]

- full and space frame structures
- sheet metal parts
- fastening and mounting devices
- galvanized and conventional metals
- high strength steel
- aluminum
- heavy gauge steel frames and assemblies

5.1.4 Explain the safe operating principles of MIG welding.
[3/0]

- UV radiation
- appropriate helmet and filter plate
- spatter and proper safety clothing
- storage and handling of high pressure cylinders
- flow meters
- fumes and gases
- oxygen depletion

- primary variables
  - current type and polarity
  - amperage
  - wire feed speed
  - wire diameter
  - voltage
  - preheat
- secondary variables (conducted during welding)
  - travel speed
  - nozzle to work distance
  - work angle
  - gun angle to work
  - techniques:
    - stringer
    - multi-passes
    - weaving
    - forehand
    - backhand
- fillet welds
  - lap joint
  - tee joint
  - corner joint
  - flat position (1F)
  - horizontal position (2F)
  - material:
  - plate and sheet
  - structural shapes
  - structural shapes to plate
- groove welds
  - single bevel
  - double bevel
  - single vee-groove
  - flat position (1G)
  - horizontal position (2G)
  - material:
    - plate
    - structural shapes
- seam welding
- silicon bronze welding
- all position welding

5.1.5 Set-up equipment for a variety of MIG welding applications.
[0/1]

- consumables
- welding parameters
  - voltage
  - wire feed speed
  - gas flow rate
- work lead connection
- maintenance of equipment
- mechanical feeders
  - drive rolls
  - spool axle tension
  - contact tip
  - gun nozzle
  - gun liner (wear, restriction, loops, circulator)
- changing shielding gas cylinders
  - leaks

5.1.6 Perform inspection and testing procedures on unit parts following manufacturers' recommendations.
[0/1]

- visual and physical inspection
  - pressure
  - cracks
  - leaks
  - foreign matter
  - wear
  - proper setting
  - connections
  - obstructions
  - burns
  - loose and missing parts
  - distortion
  - bends
  - misalignment
  - dents
  - seized parts
  - fan operation
  - broken spot welds
- use appropriate gauges

5.1.7 Perform diagnostics and troubleshooting on welding equipment and unit parts according to manufacturers' specifications.
[0/1]

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

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

- fillet welds
- groove welds
- seam welding
- cleaning and grinding all welds

5.1.9 Verify integrity of assigned operations according to manufacturers' recommendations and industry approved repair procedures.
[0/3]

- clean and finish welds to specifications
- correct penetration
- visible cracks
- undercuts
- melt-through
- porosity
- craters
- excessive spatter
- edge defects
- pinholes
- plug welds
- damage to surrounding area
- inspection of welds
  - non-destructive test methods
  - destructive test methods

Number:	5.2		
Title:	**Shielded Metal Arc Welding**		
Duration:	Total Hours: 24	Theory: 6	Practical: 18
Cross Reference to Training Standard: 6065, 6075, 6082			

General Learning Outcome:

Upon successful completion of the reportable subject, the apprentice is able to demonstrate a working knowledge of the purpose, construction, safe operating principles, inspection and usage of Shielded Metal Arc Welding (SMAW) equipment.

Learning Outcomes:

Upon successful completion, the apprentice is able to:

5.2.1 Define the purpose and fundamentals of SMAW.

5.2.2 Describe the functions, construction, types, styles, and application of SMAW equipment.

5.2.3 Describe the functions, construction, types, styles, and application of structures and devices that require SMAW on RVs.

5.2.4 Explain the safe operating principles of SMAW.

5.2.5 Set-up equipment for a variety of SMAW welding applications.

5.2.6 Perform inspection and testing procedures on unit parts following manufacturers' recommendations.

5.2.7 Perform diagnostics and troubleshooting on welding equipment and unit parts according to manufacturers' specifications.

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

5.2.9 Verify integrity of assigned operations according to manufacturers' recommendations and industry approved repair procedures.

Learning Content:

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

- development of metal arc welding
- method of melting and freezing
- fusion
- arc characteristics
  - arc length (effect on voltage)
  - penetration
  - travel speed

5.2.2 Describe the functions, construction, types, styles, and application of SMAW equipment.
[2/0]

- power sources
  - transformers
  - rectifiers
  - inverters
  - generators
  - engine-driven
- power source controls
  - amperage
  - duty cycle
  - voltage
  - current type
  - polarity
  - arc force
- electrical connectors
- cables
- ground clamps
- cooling fans
- electrode holders
  - clamp
  - jaw types
- electrodes
  - basic construction
  - flux coating
  - classification (CSA, AWS)
  - low hydrogen
  - cellulose
  - rutile
  - iron powder

  - mild steel
  - low alloy
  - stainless steel
  - storage and handling
- wire brushes
- descalers
- abrasives
- personal protective equipment
- fire retardant shielding

5.2.3 Describe the functions, construction, types, styles, and application of structures and devices that require SMAW on RVs.
[0.5/0]

- heavy gauge equipment
- galvanized, conventional metals
- heavy gauge steel and frames

5.2.4 Explain the safe operating principles of SMAW.
[2.5/0]

- UV radiation
- appropriate helmet and filter plate
- spatter and proper safety clothing
- storage and handling of high pressure cylinders
- flow meters
- fumes and gases
- oxygen depletion
- primary variables
  - current type and polarity
  - amperage
  - pre-heat
  - electrode size
- secondary variables (conducted during welding)
  - travel speed
  - arc length
  - work angle
  - electrode angle
  - techniques:
    - stringer
    - multi-passes
    - weaving
    - whipping
    - drag

- fillet welds
  - striking the arc
  - running beads
  - stops and restarts
  - filling crater
  - lap joint
  - tee joint
  - corner joint
  - flat position (1F)
  - horizontal position (2F)
  - vertical position (3F)
  - material:
    - plate
    - structural shapes
    - structural shapes to plate
- groove welds
  - single bevel
  - single vee-groove
  - flat position (1G)
  - horizontal position (2G)
  - material
    - plate
    - structural shapes
- seam welding
- silicon bronze welding
- all position welding

5.2.5 Set-up equipment for a variety of SMAW welding applications. [0/1]

- electrode selection
- power sources
  - transformers
  - rectifiers
  - inverters
  - generators
- power source controls
  - amperage
  - voltage
  - current type
  - polarity
- power source ignition
- electrical connectors

- cables
  - size and condition
  - relationship to required amperage
- electrode holders
- work lead
  - completion of welding circuit
  - clamps in good repair
  - work lead locations
  - safety concerns

5.2.6 Perform inspection and testing procedures on unit parts following manufacturers' recommendations.
[0/1]

- visual and physical inspection
  - cracks
  - wear
  - proper setting
  - connections
  - loose and missing parts
  - fan operation
  - tears
  - seams
- use appropriate gauges

5.2.7 Perform diagnostics and troubleshooting on welding equipment and unit parts according to manufacturers' specifications.
[0/1]

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

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

- fillet welds
- groove welds
- seam welding
- cleaning and grinding all welds

5.2.9 Verify integrity of assigned operations according to manufacturers' recommendations and industry approved repair procedures. [0/1]

- clean and finish welds to specifications
- slag inclusion
- overlap
- correct penetration
- visible cracks
- undercuts
- melt-through
- porosity
- craters
- excessive spatter
- edge defects
- pinholes
- plug welds
- damage to surrounding area
- inspection of welds
  - non-destructive test methods
  - destructive test methods

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

Number:	6		
Title:	**Towed Unit Systems 2**		
Duration:	Total Hours: 24	Theory: 9	Practical: 15
Prerequisites:	Level 1; Level 2: Unit 1		
Co-requisites:	None		

6.1 Supplemental Braking Systems (Towed)

18 Total Hours Theory: 6 hours Practical: 12 hours

6.2 Hitching Systems I

6 Total Hours Theory: 3 hours Practical: 3 hours

Number:	6.1		
Title:	**Supplemental Braking Systems (Towed)**		
Duration:	Total Hours: 18	Theory: 6	Practical: 12
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 purpose, construction, operating principles, inspection, diagnosis, and repair of supplementary braking systems.

Learning Outcomes:

Upon successful completion, the apprentice is able to:

6.1.1 Define the purpose and fundamentals of braking system assemblies.

6.1.2 Define the purpose and fundamentals of supplementary braking systems.

6.1.3 Describe the construction, types, styles, and application of supplementary braking systems.

6.1.4 Explain the operating principles of supplementary braking systems.

6.1.5 Perform inspection and testing procedures on supplementary braking systems following manufacturers' recommendations.

6.1.6 Perform diagnostics and troubleshooting on supplementary braking systems according to manufacturers' specifications.

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

Learning Content:

6.1.1 Define the purpose and fundamentals of braking system assemblies.
[1/0]

- Pascal's Law
- laws of levers, mechanical advantage
- friction
- velocity and acceleration
- torque multiplication
- displacement
- environmental concerns
  - brake dust

6.1.2 Define the purpose and fundamentals of supplementary braking systems.
[1/0]

- gross combined weight rating
- inertia
- safety and legislation
- hydraulic
- vacuum-assist
- air brake
- electric
- mechanical

6.1.3 Describe the construction, types, styles, and application of supplementary braking systems.
[1.5/0]

- surge brake
- air assist brake
- mechanical
- inertia
- hydraulic
- electric
- vacuum assist
- breakaway device

- components
  - cable
  - receiver
  - replacement shank
  - motors
  - solenoids
  - relays
  - batteries
  - isolators
  - fuses
  - circuit board and breakers
  - connectors
  - sensors
  - modules
  - diodes
  - magnets
  - brake controls (proportional, digital)

6.1.4 Explain the operating principles of supplementary braking systems. [2.5/0]

- surge brake
  - proportional braking
- air-assist brake
  - used in diesel pushers with air brake systems
  - proportional braking
  - air actuated
  - braking device
  - air hose
- hydraulic braking
- vacuum-assist brake
  - non-proportional
  - gas engine
- electronic magnetic braking systems
- dashboard warning lights
- breakaway device
  - switches
- effect of SBS on antilock system
- safety
  - brake dust

- components
  - cable
  - receiver
  - replacement shank
  - motors
  - solenoids
  - relays
  - batteries
  - isolators
  - fuses
  - circuit board and breakers
  - connectors
  - sensors
  - modules
  - diodes
  - magnets
  - brake controls (proportional, digital)

6.1.5 Perform inspection and testing procedures on supplementary braking systems following manufacturers' recommendations.
[0/2]

- visual and physical inspection
  - air hose
  - cables
  - electronics
  - magnets
  - bearings
  - performance of brakes
  - seals
  - leaks
  - wear
  - defects
  - loose, missing, damaged parts
  - corrosion

6.1.6 Perform diagnostics and troubleshooting on supplementary braking 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

6.1.7 Perform assigned operations for the following as to manufacturers' recommendations.
[0/7]

- repair, replace, install, adjust supplemental braking systems and component parts
- maintain, clean supplemental braking systems and component parts
- recognize limits of repair, recommend for service
- verify integrity of operations

Number:	6.2		
Title:	**Hitching Systems I**		
Duration:	Total Hours: 6	Theory: 3	Practical: 3
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 purpose, construction, operating principles, inspection, diagnosis, and installation of hitching systems.

Learning Outcomes:

Upon successful completion, the apprentice is able to:

6.2.1 Define the purpose and fundamentals of hitching systems.

6.2.2 Identify and describe the construction, types, styles, and application of hitching systems.

6.2.3 Explain the safe operating principles of hitching systems.

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

6.2.5 Perform diagnostics and troubleshooting on hitching systems 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 hitching systems.
[0.5/0]

- weight distribution
- gross combined weight rating
- receivers
- hitches
- inertia

6.2.2 Identify and describe the construction, types, styles, and application of hitching systems.
[1/0]

- Class I, II, III, IV, V receivers
- 5th wheel hitches
  - gooseneck
- mounting rails
- equalizers
- anti-sway devices
- balls
- ball mounts
- lubricants
- hitch pins
- clips
- safety chains
- clevis
  - pintle mounts
- shackles
- quick links
- s-hooks
- locking mechanisms
- cables and connectors
- lights

6.2.3 Explain the safe operating principles of hitching systems.
[1.5/0]

- securing the hitch
- hitch and receiver connections
- safety precautions
- safety chains
- breakaway switches
- brake lights
- Class I, II, III, IV, V receivers
- 5th wheel hitches
  - gooseneck
- mounting rails
- equalizers
- anti-sway devices
- balls
- ball mounts

- lubricants
- hitch pins
- clips
- safety chains
- clevis
  - pintle mounts
- shackles
- quick links
- s-hooks
- locking mechanisms
- cables and connectors
- lights

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

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

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

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

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

- electrical and electronic connections
- maintain hitching system
  - lubrication
  - clean

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

Number:	7		
Title:	**Accessories I**		
Duration:	Total Hours: 27	Theory: 14	Practical: 13
Prerequisites:	Level 1; Level 2: Unit 1		
Co-requisites:	None		

7.1 Room Extension Systems

24 Total Hours Theory: 12 hours Practical: 12 hours

7.2 Storage Systems

3 Total Hours Theory: 2 hours Practical: 1 hours

Number:	7.1		
Title:	**Room Extension Systems**		
Duration:	Total Hours: 24	Theory: 12	Practical: 12
Cross Reference to Training Standard: None			

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 room extension systems.

Learning Outcomes:

Upon successful completion, the apprentice is able to:

7.1.1 Define the purpose and fundamentals of room extension systems.

7.1.2 Describe the construction, types, styles, and application of room extension systems.

7.1.3 Explain the operating principles of room extension systems.

7.1.4 Perform inspection and testing procedures on room extension systems following manufacturers' recommendations.

7.1.5 Perform diagnostics and troubleshooting on room extension 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 room extension systems. [1.5/0]

- expansion of RV living space
- history and overview
- pulley systems
- mechanical advantage

7.1.2 Describe the construction, types, styles, and application of room extension systems.
[2.5/0]

- slide-outs
  - flush floor
  - raised floor
- tip-outs
- park model fixed extensions
- electric-hydraulic
- electric rack and pinion
- gear driven
- manual slide-out
- tent camper lift systems
- hybrid lift systems
- components
  - cable
  - motors
  - solenoid valves
  - relays
  - batteries
  - fuses
  - circuit board and breakers
  - connectors
  - sensors
  - switches
  - actuators
  - modules
  - pulleys
  - gears
  - hydraulics, hydraulic pumps
  - manual winch
  - travel locks and locking mechanisms
  - guide rails
  - gaskets
  - seals

7.1.3 Explain the operating principles of room extension systems. [8/0]

- slide-outs
  - flush floor
  - raised floor
- tip-outs
- park model fixed extensions
- electric-hydraulic
- electric rack and pinion
- gear driven
- manual slide-out
- tent camper lift systems
- hybrid lift systems
- components
  - cable
  - motors
  - solenoid valves
  - relays
  - batteries
  - fuses
  - circuit board and breakers
  - connectors
  - sensors
  - switches
  - actuators
  - modules
  - pulleys
  - gears
  - hydraulics, hydraulic pumps
  - manual winch
  - travel locks and locking mechanisms
  - guide rails
  - gaskets
  - seals

7.1.4 Perform inspection and testing procedures on room extension systems following manufacturers' recommendations.
[0/2]

- visual and physical inspection
  - worn, loose, missing, damaged, defective parts
  - corrosion
  - misalignment
  - fractures
  - vibration
  - noise
  - leaks
  - pressure
  - colour

7.1.5 Perform diagnostics and troubleshooting on room extension 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

7.1.6 Perform assigned operations for the following as to manufacturers' recommendations.
[0/7]

- repair, replace
  - damaged/defective components
- maintain, clean, lubricate
  - slide-out systems
  - lift systems
- adjustments
- alignment
- verify repairs and integrity of operations

Number:	7.2		
Title:	**Storage Systems**		
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 repair of storage systems.

Learning Outcomes:

Upon successful completion, the apprentice is able to:

7.2.1 Identify and describe the construction, types, styles, and application of storage systems.

7.2.2 Explain the operating principles of storage systems.

7.2.3 Perform inspection, testing, and diagnostic procedures on storage systems following manufacturers' recommendations.

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

Learning Content:

7.2.1 Identify and describe the construction, types, styles, and application of storage systems.
[0.5/0]

- storage pods
  - fixed
  - portable
- racking and carrying systems
  - ladders and roof racks

7.2.2 Explain the operating principles of storage systems.
[1.5/0]

- storage pods
  - fixed
  - portable
- racking and carrying systems
  - ladders and roof racks

7.2.3 Perform inspection, testing, and diagnostic procedures on storage systems following manufacturers' recommendations.
[0/0.5]

- check hinges, locks, catches, rollers, door seals
- corrosion
- worn, loose, missing, damaged, defective components
- secure mounting
- consult appropriate resource materials (workplace drawings, manuals)
- use computer for research where relevant

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

- install, repair, replace storage units and component parts
- verify mounting integrity
- clean, maintain, lubricate locks, hinges, catches, rollers, door seals

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

Number:	8		
Title:	**RV Construction and Appearance 2**		
Duration:	Total Hours: 51	Theory: 15	Practical: 36
Prerequisites:	Level 1		
Co-requisites:	None		

8.1 Autobody – Interior I

27 Total Hours Theory: 9 hours Practical: 18 hours

8.2 Autobody – Exterior I

24 Total Hours Theory: 6 hours Practical: 18 hours

Number:	8.1		
Title:	**Autobody – Interior I**		
Duration:	Total Hours: 27	Theory: 9	Practical: 18
Cross Reference to Training Standard: 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 Define the purpose and fundamentals of interior bodywork.

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

8.1.3 Explain the operating principles of interior RV components.

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

8.1.5 Explain the safe operating principles of interior bodywork.

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

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

Learning Content:

8.1.1 Define the purpose and fundamentals of interior bodywork.
[1/0]

- structural and material difference
  - wood
  - aluminum
  - steel
  - vacuum-bonded walls
  - composite devices
- fastening devices and methods
- safety knowledge (electrical-power sources)
- OHSA

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

- wall panels
- moulding
- glass
- vents
- floor
- floor coverings
- furniture
- upholstery
- doors
- seals
- window treatments
- screens
- lighting fixtures
- mirrors

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

- wall panels
- moulding
- glass
- vents
- floor
- floor coverings
- furniture

- upholstery
- doors
- seals
- window treatments
- screens
- lighting fixtures
- mirrors

8.1.4 Describe the types, styles, and applications of interior bodywork operations. [3/0]

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

8.1.5 Explain the safe operating principles of interior bodywork. [3/0]

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

8.1.6 Perform inspection, testing, and diagnostic procedures on interior components following manufacturers' recommendations.
[0/2]

- 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

8.1.7 Perform assigned operations for the following as to manufacturers' recommendations.
[0/16]

- maintain interior components
- repair/replace
  - wall panels
  - glass
  - floor
  - interior components
- sealing/caulking
- install units, floor coverings
- adjust hinges, latches, shelves, rails, tracks, doors
- recommend service
- verify repairs and integrity of operations

Number:	8.2		
Title:	**Autobody – Exterior I**		
Duration:	Total Hours: 24	Theory: 6	Practical: 18
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 Define the purpose and fundamentals of exterior bodywork.

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

8.2.3 Explain the safe 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 Define the purpose and fundamentals of exterior bodywork.
[1/0]

- history and background of wall structures
  - wood (stick and tin structures)
  - fibreglass
  - aluminum
  - bonded walls
  - composites

- types of body damage
  - scratches
  - dents
  - fractures
  - collision
  - corrosion
  - oxidization
  - discolouration
- properties and characteristics of:
  - metal
  - aluminum
  - fibreglass
  - rubber
  - composites
  - bonded wall
  - glass

8.2.2 Identify and describe the construction, types, styles, and application of exterior components on RVs that are subject to bodywork.
[2/0]

- roof finishes
  - rubber
  - metal
  - fibreglass
  - vinyl
- roof structures
  - vacuum-bonded
  - wood frame
  - metal frame
- floor
  - plywood
  - Oriented Strand Board (OSB)
  - vacuum-bonded floors
  - moulded composite
- underbelly
  - vapour barriers (metal, plastic)
  - Urethane spray
- rock guards
- fastening and mounting devices

8.2.3 Explain the safe operating principles of exterior bodywork.
[3/0]

- personal protection (eye, hand, breathing)
- roughing out
- roof patching
- grinding
- filing
- filling
- sanding
- sealing
- riveting
- undercoating
- preparation
- priming
- painting

8.2.4 Perform inspection, testing, and diagnostic procedures on exterior components following manufacturers' recommendations.
[0/3]

- visual and physical inspection
  - damage
  - fit
  - distortion
  - scratches
  - dents and fractures
  - cosmetic damage
  - structural integrity
  - corrosion
  - leaks
    - 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.
[0/15]

- repair/replace roof, floor, underbelly components
- finishing
  - grinding
  - filing
  - filling
  - sanding
  - painting
- verify integrity of bodywork
- verify structural integrity of the unit
- recommend for service

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