



**ONTARIO COLLEGE OF TRADES**  
**ORDRE DES MÉTIERS DE L'ONTARIO**

Apprenticeship  
Curriculum Standard

Recreational Vehicle  
Technician

Level 1

Trade Code: 690H

Development Date: 2003



**Please Note:**

Apprenticeship Training and Curriculum Standards were developed by the Ministry of Training, Colleges and Universities (MTCU). As of April 8<sup>th</sup>, 2013, the Ontario College of Trades (College) has become responsible for the development and maintenance of these standards. The College is carrying over existing standards without any changes.

However, because the Apprenticeship Training and Curriculum Standards documents were developed under either the *Trades Qualification and Apprenticeship Act* (TQAA) or the *Apprenticeship and Certification Act, 1998* (ACA), the definitions contained in these documents may no longer be accurate and may not be reflective of the *Ontario College of Trades and Apprenticeship Act, 2009* (OCTAA) as the new trades legislation in the province. The College will update these definitions in the future.

Meanwhile, please refer to the College's website ([www.collegeoftrades.ca](http://www.collegeoftrades.ca)) for the most accurate and up-to-date information about the College. For information on OCTAA and its regulations, please visit: [www.collegeoftrades.ca/about/legislation-and-regulations](http://www.collegeoftrades.ca/about/legislation-and-regulations).

## Table of Contents

### Introduction

Summary of Total Program In-School Training Hours Level .....	1
1. Shop Practices.....	2
1.1 Trade Calculations.....	3
1.2 Hand/Power Tools and Trade Equipment .....	5
1.3 Precision Measuring Tools and Diagnostic Equipment .....	13
1.4 Lifting and Blocking Systems.....	18
1.5 Fastening and Mounting Devices.....	21
1.6 Workplace Charts and Diagrams I.....	24
1.7 Workplace Communications I.....	27
1.8 Applied Computer Skills .....	30
2. LPG Systems 1a .....	33
2.1 Plumbing and Gas Systems .....	34
3. Electrical and Electronic Systems.....	38
3.1 Electrical and Electronic Systems.....	39
3.2 D/C Electrical and Electronic Systems I.....	43
3.3 A/C Electrical and Electronic Systems I .....	47
4. RV Construction and Appearance 1 .....	52
4.1 Vehicle Detailing- Interior and Exterior .....	53
4.2 Tires, Wheels and Rims (Towed).....	58
5. Plumbing and Gas Systems 1b .....	63
5.1 Plumbing I.....	64
6. Welding Practices 1.....	69
6.1 Oxy Fuel Heating and Cutting.....	70
Reference Material .....	75

## INTRODUCTION

This new 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

---

**Suggested Minimum Equipment List For Training Delivery Agencies**
**ONTARIO RV TECHNICIAN APPRENTICESHIP PROGRAM**

<b>Power Sources and Equipment</b>	<b>Number of Apprentices For Each Tool</b>
------------------------------------	--

Oxy-Fuel-Gas Manual Cutting equipment	1
---------------------------------------	---

<b>Basic Hand Tools and Equipment</b>	<b>Number of Apprentices For Each Tool</b>
---------------------------------------	--

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.

## Summary of Total Program In-School Training Hours

<b>Reportable Subjects</b>	<b>Total</b>	<b>Theory</b>	<b>Practical</b>
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
Total	240	109	131

***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.***

---

Number:	1		
Title:	Shop Practices		
Duration:	67 Total Hours	Theory:28 hours	Practical: 39 hours
Prerequisites:	None		
Co-requisites:	None		

---

1.1	Trade Calculations	6 Total Hours	Theory: 3 hours	Practical: 3 hours
1.2	Hand/Power Tools and Trade Equipment	12 Total Hours	Theory: 4 hours	Practical: 8 hours
1.3	Precision Measuring Tools and Diagnostic Equipment	9 Total Hours	Theory: 3 hours	Practical: 6 hours
1.4	Lifting and Blocking Systems	6 Total Hours	Theory: 4 hours	Practical: 2 hours
1.5	Fastening and Mounting Devices	6 Total Hours	Theory: 4 hours	Practical: 2 hours
1.6	Workplace Charts and Diagrams I	12 Total Hours	Theory: 6 hours	Practical: 6 hours
1.7	Workplace Communications I	6 Total Hours	Theory: 4 hours	Practical: 2 hours
1.8	Applied Computer Skills	10 Total Hours	Theory: 0 hour	Practical: 10 hours

## 1.1 – Trade Calculations

### Cross-Reference to Training Standards:

6066, 6071, 6075, 6080

Duration:      Total Hours: 6      Theory: 3 Hours      Practical: 3 Hours

### General Learning Outcome:

Upon successful completion of the reportable subject, the apprentice is able to demonstrate a working knowledge of basic arithmetic, applied calculation, formula calculations, and systems of measurement.

### Learning Outcomes:

Upon successful completion, the apprentice is able to:

- 1.1.1 Explain and perform the fundamentals of basic arithmetic.
- 1.1.2 Explain and perform applied calculations.
- 1.1.3 Explain and perform formula calculations.
- 1.1.4 Explain and perform Metric and Imperial calculations.

Learning Content:

1.1.1 Explain and perform the fundamentals of basic arithmetic.  
[.5/.5]

- whole number operations (add, subtract, multiply, divide)
- use of calculators

1.1.2 Explain and perform applied calculations.  
[.5/.5]

- percents
- fractions
- decimals
- percent/fraction/decimal conversion
- apply calculations to complete:
  - work orders
  - estimates
  - invoices

1.1.3 Explain and perform formula calculations.  
[1/1]

- exponents
- square roots
- formulas for:
  - perimeter
  - circumference
  - area
  - volume
  - mass
  - pressure

1.1.4 Explain and perform Metric and Imperial calculations.  
[1/1]

- Metric measurement units
- Imperial measurement units
- Metric/Imperial conversion (charts/tables)

## 1.2 – Hand/Power Tools and Trade Equipment

### Cross-Reference to Training Standards:

6068-6074, 6076-6079

Duration:      Total Hours: 12      Theory: 4 Hours      Practical: 8 Hours

### General Learning Outcome:

Upon successful completion of the reportable subject, the apprentice is able to demonstrate a working knowledge of the types, construction, principles of operation, maintenance, and safe workplace usage of hand and power tools.

### Learning Outcomes:

Upon successful completion, the apprentice is able to:

- 1.2.1 Define the conditions of a safe workplace.
- 1.2.2 Describe OHS (Occupational Health and Safety Act).
- 1.2.3 Describe workplace hazards.
- 1.2.4 Describe the construction, type and application of safety devices and equipment used in the workplace.
- 1.2.5 Describe the construction, type and application of hand/power tools used in the workplace.
- 1.2.6 Explain and demonstrate the principles of operation for safety devices and equipment.
- 1.2.7 Explain and demonstrate the principles of operation for hand/power tools.
- 1.2.8 Maintain workplace tools and equipment.

Learning Content:

1.2.1 Define the conditions of a safe workplace.  
[0.5/0]

- clean and orderly work area
- removal of fire hazards
- clean up grease, oil spills, fluids
- remove obstructions from work area
- first aid equipment
- fire suppression equipment
- safe use and storage of tools and equipment
- adequate ventilation and lighting
- safe from electrical shock
  - good ground connection
  - cable connection
  - no water/conductive elements
- rules of safe conduct
  - no horseplay
  - caution against use of reaction-impairing drugs
  - designated smoking areas only
  - report unsafe working conditions

1.2.2 Describe OHSA (Occupational Health and Safety Act).  
[0.5/0]

- legislation
- obligation of employer and employee

1.2.3 Describe workplace hazards.  
[0.5/0]

- glass
- primers
- epoxy
- urethane
- dust fumes
- exhaust
- explosive
- fumes
- equipment
  - ladders
  - scaffolding



- gas and alternate fuels
- lighting
- sound levels
- electrical hazards
- mechanical hazards
  - damaged/faulty air lines
  - high pressure hydraulic systems
  - lift systems
- inadequate ventilation

1.2.4 Describe the construction, type and application of safety devices and equipment used in the workplace.  
[0.5/0]

- safety harness
- safety cages
- personal protection
  - hearing protection
  - safety glasses
  - protective head gear
  - goggles
  - hand protection
  - safety boots
  - protective clothing
  - respirators and breathing apparatus

1.2.5 Describe the construction, type and application of hand/power tools used in the workplace.  
[1/0]

- hand tools
  - hammer
  - wire brush
  - side cutters
  - chipping hammer
  - cold chisel/chisels
  - pliers
  - vise grips
  - vise
  - hack saw/saws
  - screwdrivers
  - scalers
  - wheel grinders

- disc grinders
- pipe cutters (copper/plastic)
- flaring tool
- tube bender
- wrenches
- torque wrench
- sockets
- clamps
- files
- augers
- punches
- ratchets
- plane
- rivet gun
- cotter pin puller
- allen keys – wrench set
- tin snips
- nut drivers
- shears/nibblers
- hole saw kit
- power tools
  - wheel grinders
  - disc grinders
  - bench grinders
  - abrasive cut-off saws
  - die grinders
  - drills
  - air tools
  - air compressor
  - rivet guns
  - nibblers
  - drill presses
  - electric saws (skill, table, radial, miter, and band)
  - electric impact wrenches
  - electric pipe cutters
  - threading machines
  - sanders
  - routers
  - planes
  - chisels
  - augers
  - battery charger

- speciality tools
  - crimping tools
  - pop rivet kit
  - wheel seal puller
  - awning spring wind tool
  - awning rail straightener tool
  - pressure relief valve tool
  - gas valve tool
  - antenna tool
  - butane soldering equipment
  - Venturi cleaning brush (flue-baffle)
  - ring seater tool (Atwood hot water tanks)
- related equipment
  - extension cords
  - testing devices
  - power sources
  - hydraulic equipment and fluid levels
  - hoists and jacks
  - mechanical stands

1.2.6 Explain and demonstrate the principles of operation for safety devices and equipment.

[0.5/1]

- safety harness
- safety cages
- personal protection
  - hearing protection
  - safety glasses
  - protective head gear
  - goggles
  - hand protection
  - safety boots
  - protective clothing
  - respirators and breathing apparatus
- set up and proper usage of ladders and scaffolds

1.2.7 Explain and safely demonstrate the principles of operation for hand/power tools.  
[0.5/6]

- safe operating procedures
  - holding techniques for hand tools
  - angles and appropriate pressure application
  - extension cords of proper length
  - floor protection against exposed wires
  - grounding wires
  - spark-proof tools in hazardous areas
  - grounding and bonding of flammable liquids
  - safe sheet metal handling
- hand tools
  - hammer
  - wire brush
  - side cutters
  - chipping hammer
  - cold chisel/chisels
  - pliers
  - vise grips
  - vise
  - hack saw/saws
  - screwdrivers
  - scalers
  - wheel grinders
  - disc grinders
  - pipe cutters (copper/plastic)
  - flaring tool
  - tube bender
  - wrenches
  - torque wrench
  - sockets
  - clamps
  - files
  - augers
  - punches
  - ratchets
  - plane
  - rivet gun
  - cotter pin puller
  - allen keys – wrench set
  - tin snips
  - nut drivers
  - shears/nibblers
  - hole saw kit

- power tools
  - wheel grinders
  - disc grinders
  - bench grinders
  - abrasive cut-off saws
  - die grinders
  - drills
  - air tools
  - air compressor
  - rivet guns
  - nibblers
  - drill presses
  - electric saws (skill, table, radial, miter, and band)
  - electric impact wrenches
  - electric pipe cutters
  - threading machines
  - sanders
  - routers
  - planes
  - chisels
  - augers
  - battery charger
- specialty tools
  - crimping tools
  - pop rivet kit
  - wheel seal puller
  - awning spring wind tool
  - awning rail straightener tool
  - pressure relief valve tool
  - gas valve tool
  - antenna tool
  - butane soldering equipment
  - Venturi cleaning brush (flue-baffle)
  - ring seater tool (Atwood hot water tanks)
- related equipment
  - extension cords
  - testing devices
  - power sources
  - hydraulic equipment and fluid levels
  - hoists and jacks
  - mechanical stands

1.2.8 Maintain workplace tools and equipment.  
[0/1]

- basic tool maintenance procedures
  - cleaning
  - storage
  - lubrication
  - methods of restoring critical surfaces
  - store gas cylinders upright
  - sharpening
  - design and proper use of guards
  - warning signs and tag systems
  - machine lockout procedure
  - inspect for defective/damaged equipment

### 1.3 – Precision Measuring Tools and Diagnostic Equipment

#### Cross-Reference to Training Standards:

6067-6080

Duration:      Total Hours: 9      Theory: 3 Hours      Practical: 6 Hours

#### 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, and maintenance of precision measuring tools and diagnostic equipment.

#### Learning Outcomes:

Upon successful completion, the apprentice is able to:

- 1.3.1 Define the purpose and fundamentals of precision tools and diagnostic equipment.
- 1.3.2 Describe the construction, types and application of precision measuring tools and diagnostic equipment.
- 1.3.3 Explain and demonstrate the principles of operation of precision measuring tools and diagnostic equipment.
- 1.3.4 Perform maintenance and calibration procedures of precision measuring tools and diagnostic equipment.

Learning Content:

## 1.3.1 Define the purpose and fundamentals of precision tools and diagnostic equipment.

[1/0]

- measurement systems – Metric/Imperial
- measurement terms
  - datum line
  - centreline
  - symmetrical
  - asymmetrical
  - length
  - width
  - height
  - diagonal
- diagnostic testing - areas of diagnosis
  - plumbing
  - heating, ventilation and air conditioning
  - bodywork
  - LPG
  - electrical systems
  - tires
  - welding
  - slide-out systems
  - chassis and undercarriage
  - supplemental braking systems
  - accessories
- testing:
  - pressure
  - leaks
  - temperature
  - venting
  - CO
  - flow
  - wear
  - voltage
  - amperage
  - cracks/fractures



1.3.2 Describe the construction, types and application of precision measuring tools and diagnostic equipment. [1/0]

- tools
  - micrometers (inside, outside, depth)
  - calipers
  - vernier
  - straight edges
  - dial indicators
  - torque wrenches
  - measuring tape
  - ruler
  - level
  - multimeter
  - CO detector
  - monometer
  - hydrometer
  - load tester
- gauges
  - universal
  - pressure
  - gas pressure (low pressure test set)
  - HWH high pressure fluid gauge
  - vacuum
- leak-detectors
  - electronic
  - bubble solution
  - combustionable gas detector
  - handheld gas leak detector
- temperature
  - glass thermometers
  - digital pocket thermometers
  - electronic thermometers (thermocouple and thermistor sensors)
  - non-contact infra-red thermometers
- specialty tools and devices
  - industry supplied diagnostic tools
    - Dometic PAL RV appliance diagnostic kit
    - Fenwal Gas Ignition field tester
    - Kwik test (electric step tester)
- test lights (12-volt)
- A/C D/C amp clamps
- Tekonsha brake control tester
- Tekonsha circuit testers

1.3.3 Explain and demonstrate the principles of operation of precision measuring tools and diagnostic equipment. [1/5]

- tools
  - micrometers (inside, outside, depth)
  - calipers
  - vernier
  - straight edges
  - dial indicators
  - torque wrenches
  - measuring tape
  - ruler
  - level
  - multimeter
  - CO detector
  - monometer
  - hydrometer
  - load tester
- gauges
  - universal
  - pressure
  - gas pressure (low pressure test set)
  - HWH high pressure fluid gauge
  - vacuum
- leak-detectors
  - electronic
  - bubble solution
  - combustionable gas detector
  - handheld gas leak detector
- temperature
  - glass thermometers
  - digital pocket thermometers
  - electronic thermometers (thermocouple and thermistor sensors)
  - non-contact infra-red thermometers
- specialty tools and devices
  - industry supplied diagnostic tools
    - Dometic PAL
    - PAL RV appliance diagnostic kit
    - Fenwal Gas Ignition field tester
    - Kwik test (electric step tester)
- test lights (12-volt)
- A/C D/C amp clamps
- Tekonsha brake control tester
- Tekonsha circuit testers

1.3.4 Perform maintenance and calibration procedures of precision measuring tools and diagnostic equipment.

[0/1]

- tool maintenance procedures
  - storage
  - lubrication
  - methods of restoring critical surfaces
  - adjustments, calibration
  - micrometer calibrating kit
- diagnostic equipment maintenance and storage

## 1.4 – Lifting and Blocking Systems

### Cross-Reference to Training Standards:

6065, 6073, 6074, 6075, 6078

Duration:      Total Hours: 6      Theory: 4 Hours      Practical: 2 Hours

### General Learning Outcome:

Upon successful completion of the reportable subject, the apprentice is able to demonstrate a working knowledge of the purpose, construction, and safe operating principles of lifting and blocking systems.

### Learning Outcomes:

Upon successful completion, the apprentice is able to:

- 1.4.1 Define the purpose and fundamentals of lifting and blocking systems.
- 1.4.2 Describe the construction, types, styles and application of lifting and blocking procedures.
- 1.4.3 Explain the safe operating principles of lifting and blocking systems.
- 1.4.4 Perform lifting and blocking procedures according to manufacturers' specifications and industry-accepted standards.

Learning Content:

1.4.1 Define the purpose and fundamentals of lifting and blocking systems.  
[0.5/0]

- safety issues
  - lift devices
  - blocking
- background
  - development of lifting and blocking systems

1.4.2 Describe the construction, types, styles and application of lifting and blocking procedures.  
[1/0]

- lift systems
  - hydraulic
  - electric
  - floor
  - pneumatic
- blocking devices
  - wheel chocks
  - jack stands
  - safety issues
- rollers/skids
  - wood
  - steel
  - skids with lubricant
  - skid plates with lubricant

1.4.3 Explain the safe operating principles of lifting and blocking systems.  
[2.5/0]

- lift systems
  - weight ratings
  - hydraulic
  - electric
  - floor
  - pneumatic
- blocking devices
  - wheel chocks
  - jack stands
  - safety issues

- rollers/skids
  - wood
  - steel
  - skids with lubricant
  - skid plates with lubricant

1.4.4 Perform lifting and blocking procedures according to manufacturers' specifications and industry-accepted standards.

[0/2]

- demonstrate blocking procedures
- demonstrate use of rollers/skids
  - wood
  - steel
  - skids with lubricant
  - skid plates with lubricant
- demonstrate lift systems
  - weight ratings

## 1.5 – Fastening and Mounting Devices

### Cross-Reference to Training Standards:

6068-6079

Duration:      Total Hours: 6      Theory: 4 Hours      Practical: 2 Hours

### General Learning Outcome:

Upon successful completion of the reportable subject, the apprentice is able to demonstrate a working knowledge of the purpose, construction, and principles of fastening and mounting devices.

### Learning Outcomes:

Upon successful completion, the apprentice is able to:

- 1.5.1 Define the purpose and fundamentals of fastening and mounting devices.
- 1.5.2 Describe the construction, types, styles and application of fastening and mounting devices.
- 1.5.3 Explain the principles of operation of fastening and mounting devices.
- 1.5.4 Perform installation and removal procedures for fastening and mounting devices.

Learning Content:

1.5.1 Define the purpose and fundamentals of fastening and mounting devices. [1/0]

- vibration
- thread terminology
- fastener grades/application
- Society of Automotive Engineers (SAE)
- Systems International (SI)
- tensile strength
- shear strength
- yield strength
- grade, pitch, threads per inch
- diameter, length, head size, yield point and fatigue
- loctite grades
- anti-seize
- factors that affect torque
  - thread condition
  - lubrication
  - temperature
  - fastener composition
- oxy-fuel and welding

1.5.2 Describe the construction, types, styles and application of fastening and mounting devices. [1.5/0]

- bolts/nuts
- screws
- studs
- locking devices
- pins
- rivets
- keys
- washers
- retaining rings
- helicoils
- thread sealants and adhesives
- welds
- castellated nuts
- cotter pins
- d-washers
- nutserts



1.5.3 Explain the principles of operation of fastening and mounting devices.  
[1.5/0]

- torque effects of wet, dry and clean threads
- locking devices
- helicoil thread repair principles
- temperature
- compatibility
- clamping force

1.5.4 Perform installation and removal procedures for fastening and mounting devices.  
[0/2]

- verify thread strengths and torque requirements for wet and dry
- thread repair
  - freeing seized threads, removal of broken studs/cap screws
  - installation of helicoils, locking devices
- metal working practices
  - drilling
  - tapping
  - hack sawing
  - filing
  - grinding
- sealant selection, removal and installation practices
- loctite and anti-seize applications

## 1.6 – Workplace Charts and Diagrams I

### Cross-Reference to Training Standards:

6088

Duration:      Total Hours: 12      Theory: 6 Hours      Practical: 6 Hours

### 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 workplace charts and diagrams.

### Learning Outcomes:

Upon successful completion, the apprentice is able to:

- 1.6.1 Define the purpose and fundamentals of workplace charts and diagrams.
- 1.6.2 Describe the types, styles and application of workplace charts and diagrams.
- 1.6.3 Explain the principles of operation of workplace charts and diagrams.
- 1.6.4 Read and interpret workplace charts and diagrams.

Learning Content:

1.6.1 Define the purpose and fundamentals of workplace charts and diagrams.  
[1/0]

- purpose of a drawing
- location of devices
- routing of wire
- vents
- plumbing
- system notes
  - dimensions
  - materials
  - specification
- follow repair procedures
- accuracy of installation/repair/removal
- safety

1.6.2 Describe the types, styles and application of workplace charts and diagrams.  
[1.5/0]

- components of drawing
  - lines
  - views
  - symbols
  - title block
  - list of materials
  - notes and specifications
- working drawings
  - flow charts
  - ladder diagrams
  - repair diagrams
  - schematics

1.6.3 Explain the principles of operation of workplace charts and diagrams.  
[3.5/0]

- common lines
  - object lines
  - hidden lines
  - centre lines
  - dimension and extension lines
  - leader lines
  - break lines
  - cutting plane lines
  - hatch lines
- common symbols
  - electrical
  - electronic
  - mechanical
  - hydraulic
- repair sequences
- repair diagrams
- flowcharts
- diagnostic/troubleshooting charts

1.6.4 Read and interpret workplace charts and diagrams.  
[0/6]

- convert schematics to ladder diagrams
- identify location of devices, dimensions, materials and specifications
- identify type and model of vehicle, parts, components and assemblies
- interpret proper flowchart sequence

## 1.7 – Workplace Communications I

### Cross-Reference to Training Standards:

6066

Duration:      Total Hours: 6      Theory: 4 Hours      Practical: 2 Hours

### 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:

- 1.7.1 Define the purpose of effective communication with co-workers and with clients.
- 1.7.2 Describe different types of communication.
- 1.7.3 Describe listening and verbal communication techniques.
- 1.7.4 Perform applications of effective communication as to client and company standards.

## Learning Content

1.7.1 Define the purpose of effective communication with co-workers and with clients.  
[1/0]

- co-workers
  - safety
  - accuracy
  - efficiency
  - trust
  - improved workplace environment
  - improved morale
- clients
  - customer service
  - repeat business
  - word-of-mouth referrals
  - accuracy
  - efficiency
  - trust

1.7.2 Describe different types of communication.  
[1/0]

- communication methods
  - verbal
  - written
  - body language
- communication media
  - face-to-face
  - telephone
  - e-mail
  - video
  - mail
- levels of communication
  - collegial (peers and co-workers)
  - professional (clients from all knowledge levels)

1.7.3 Describe listening and verbal communication techniques.  
[2/0]

- listening skills
  - active
  - passive
  - critical
  - body language
  - listener response
- verbal skills
  - asking questions
  - paraphrasing communications
  - type of language (trade, plain, jargon)
  - attitude (positive, condescending, encouraging, negative)
  - type of communication (brief, efficient, lengthy, technical)

1.7.4 Perform applications of effective communication as to client and company standards.  
[0/2]

- identify personal communication styles
- identify attitudes (positive, respect for others)
- verbal communication
- use computers where relevant
- enact appropriate classroom client-technician scenarios

## 1.8 – Applied Computer Skills

### Cross-Reference to Training Standards:

6080

Duration:      Total Hours: 10      Theory: 0 Hours      Practical: 10 Hours

### General Learning Outcome:

Upon successful completion of the reportable subject, the apprentice is able to demonstrate a working knowledge of the purpose, functions, and usage of a personal computer (PC).

### Learning Outcomes:

Upon successful completion, the apprentice is able to:

- 1.8.1 Define the purpose, function and applications of computers.
- 1.8.2 Perform fundamental operating tasks for a PC.



Learning Content:

## 1.8.1 Define the purpose, function and applications of computers.

[1/1]

- introduction to computing
- hardware components
  - floppy disk drive
  - hard drive
  - CD-ROM
  - Mouse
  - Keyboard
  - modem
  - CPU
  - RAM
  - Printers
  - Cables and connectors
- software
  - operating system (o/s)
  - word-processing
  - spreadsheet
  - database
  - e-mail
  - web browsers

## 1.8.2 Perform fundamental operating tasks for a PC.

[0/4]

- boot-up and shut down procedures
- operating procedures
  - mouse
  - return/enter key
  - navigation arrows
- accessing and opening software
  - Start Menu
  - Desktop Icons
  - Windows Explorer
- saving files
  - floppy drive
  - hard drive
  - CD-rom
- software menus
- cut/copy/paste

- creating/opening files
- dealing with common errors
  - ctrl/alt/del
- use common software
  - word-processing
  - spreadsheet
  - database
  - e-mail
  - browser
- use specialized software
  - entering customer information
  - repair estimate

**EVALUATION:**

Theory Testing	40%
Practical Application Exercises	35%
Research Project	15%
Notebook and Organizational Skills	10%

Number: 2

Title: LPG Systems 1a

Duration: 18 Total Hours      Theory: 18 hours      Practical: 0 hours

Prerequisites: None

Co-requisites: Level 1: Unit 1

---

2.1 Plumbing and Gas Systems

18 Total Hours      Theory: 18 hours      Practical: 0 hours

## 2.1 – Plumbing and Gas Systems

### Cross-Reference to Training Standards:

6068, 6070

Duration:      Total Hours    18      Theory: 18 Hours      Practical: 0 Hours

### 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 plumbing and gas systems.

### Learning Outcomes:

Upon successful completion, the apprentice is able to:

- 2.1.1 Define the purpose and trade-relevant applications of plumbing and gas systems.
- 2.1.2 Describe the scientific principles fundamental to plumbing and gas systems.
- 2.1.3 Describe the construction, types, styles, and application common to plumbing and gas systems.
- 2.1.4 Explain the safe operating principles of components common to plumbing and gas systems.
- 2.1.5 Define the purpose and fundamentals of LPG.
- 2.1.6 Identify and describe the construction, types, styles, and application of LPG components.
- 2.1.7 Explain the safe operating principles of LPG.

Learning Content:

2.1.1 Define the purpose and trade-relevant applications of plumbing and gas systems.  
[0.5/0]

- history and background
- plumbing
- hydraulics
- LPG
- welding
- accessories

2.1.2 Describe the scientific principles fundamental to plumbing and gas systems.  
[5.5/0]

- pressure
- energy
  - kinetic
- Charles' Law, Boyle's Law
- Pascal's Law and application to static fluids
- Bernoulli's Principle
- siphons
- trap seals
- properties of water
  - gravity
  - states
  - volume through temperature change
  - chemical composition
  - weights and measures
  - viscosity
  - cohesion
- properties of gases
  - chemical composition
  - volume, temperature, pressure

2.1.3 Describe the construction, types, styles, and components common to plumbing and gas systems.  
[5/0]

- valves
- regulators
- lines
- pipes and piping

- fittings
  - composites
  - LP fittings
  - water fittings
- hoses
  - shielded gas
  - composites
- manifolds
- seals
- gaskets
- tanks
- cylinders

2.1.4 Explain the safe operating principles of components common to plumbing and gas systems. [7/0]

- valves
- regulators
- lines
- pipes and piping
- fittings
  - composites
  - LP fittings
  - water fittings
- hoses
  - shielded gas
  - composites
- manifolds
- seals
- gaskets
- tanks
- cylinders

2.1.5 Define the purpose and fundamentals of LPG. [1/0]

- compliance with TSSA (Technical Standards and Safety Authority)
- certification process
- RV applications
  - gas appliances (high and low pressure)
  - generators
- history and background
- properties of liquid and vapour

2.1.6 Identify and describe the construction, types, styles, and application of LPG components. [3/0]

- 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

2.1.7 Explain the safe operating principles of LPG. [2/0]

- safe storage
  - fenced compound
  - valves
  - tank and cylinder expiry identification
- safe usage of valves and all other equipment
  - open valve slowly
  - do not tamper with relief valves
  - contact with skin, first aid

**EVALUATION:**

Theory Testing	80%
Practical Application Exercises	-
Research Project	10%
Notebook and Organizational Skills	10%

Number:	3		
Title:	Electrical and Electronic Systems		
Duration:	66 Total Hours	Theory:34 hours	Practical:32 hours
Prerequisites:	None		
Co-requisites:	Level 1: Unit 1		

---

3.1 Electrical and Electronic Systems

15 Total Hours      Theory: 15 hours      Practical: 0 hours

3.2 D/C Electrical and Electronic Systems I

30 Total Hours      Theory: 12 hours      Practical: 18 hours

3.3 A/C Electrical and Electronic Systems I

21 Total Hours      Theory: 7 hours      Practical: 14 hours



### 3.1 – Electrical and Electronic Systems

#### Cross-Reference to Training Standards:

6065, 6069

Duration:      Total Hours: 15      Theory: 15 Hours      Practical: 0 Hours

#### 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 electrical and electronic systems.

#### Learning Outcomes:

Upon successful completion, the apprentice is able to:

- 3.1.1 Define the purpose and trade-relevant applications of electrical and electronic systems.
- 3.1.2 Describe the scientific principles fundamental to electrical and electronic systems.
- 3.1.3 Describe the construction, types, styles, and application of trade-relevant electrical and electronic components.
- 3.1.4 Explain the safe operating principles of trade-relevant electrical and electronic components.

Learning Content:

3.1.1 Define the purpose and trade-relevant applications of electrical and electronic systems.

[2/0]

- history
- A/C
- D/C
- generators
- converters/invertors
- batteries
- solar power
- charging systems
- RV applications

3.1.2 Describe the scientific principles fundamental to electrical and electronic systems.

[4/0]

- atomic structure
- conductors and insulators
- magnetism
  - laws of magnetism
  - magnetic field
  - flux density
  - permeability
  - reluctance
- electromagnetism
- electron and conventional theories
- sources of electricity
  - heat
  - pressure
  - static
  - chemical
  - light
  - magnetism
- Ohm's Law, Kirchoff's Law, Watt's Law
- current flow, heat and resistance
- Metric/Imperial system

- units of measurement
  - ohms
  - volts
  - coulombs
  - amps
  - amp hours
  - watts
  - kilo-watt hour
- voltage
- amperage
- resistance
- wattage
- electrical circuit
  - series
  - parallel
  - series parallel
- opens, shorts, grounds

3.1.3 Describe the construction, types, styles, and application of trade-relevant electrical and electronic components. [5/0]

- motors
- solenoids
- batteries
  - automotive
  - deep cycle
  - gel
- fuses
- circuit breakers
- switches
- relays
- circuit protection devices
- sensors
- modules
- wiring harnesses
- diagnostic lights
- connectors
- circuit boards
- display panels
- inverter and converter systems
- solar panels
- generators

3.1.4 Explain the safe operating principles of trade-relevant electrical and electronic components.

[4/0]

- OHSA
- safe workplace
- unintentional grounding of watches/rings
- eye and hand protection
- static electricity interference
- motors
- solenoids
- batteries
- fuses
- circuit breakers
- switches
- relays
- circuit protection devices
- sensors
- modules
- wiring harnesses
- diagnostic lights
- connectors
- circuit boards
- display panels
- inverter and converter systems
- solar panels
- generators

### 3.2 – D/C Electrical and Electronic Systems I

#### Cross-Reference to Training Standards:

6069

Duration:      Total Hours: 30      Theory: 12 Hours      Practical: 18 Hours

#### General Learning Outcome:

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

#### Learning Outcomes:

Upon successful completion, the apprentice is able to:

- 3.2.1 Define the purpose and fundamentals of D/C electrical and electronic systems.
- 3.2.2 Identify and describe the construction, types, styles, and application of D/C electrical and electronic systems components.
- 3.2.3 Explain the operating principles of D/C electrical and electronic systems.
- 3.2.4 Perform inspection and testing procedures on D/C electrical and electronic systems following manufacturers' recommendations.
- 3.2.5 Perform diagnostics and troubleshooting on D/C electrical and electronics 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 D/C electrical and electronic systems.  
[2/0]

- history and development
- difference between A/C current and D/C current
- batteries
  - hot cranking amps (HCA)
  - amp-hour rating (AH)
  - cranking amps (CA)
  - reserve capacity (RC)
  - cold cranking amps (CCA)
  - chemical action during charging and discharging
  - temperature effects
  - internal resistance factors
  - safe usage and storage
  - deep cycle batteries
  - gel batteries
  - automotive battery
- electrical circuits
  - series
  - parallel
  - combination
  - voltage, resistance and current
- CSA code standards (z240) as relevant

3.2.2 Identify and describe the construction, types, styles, and application of D/C electrical and electronic systems components.  
[4/0]

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

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

- safe handling precautions
- 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

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

[0/6]

- 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
- state of charge
- surface discharge
- load test
- testing converter and inverter systems

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

[0/6]

- use inspection/testing techniques
- check inputs, outputs, grounds
- 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.

[0/6]

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



### 3.3 – A/C Electrical and Electronic Systems I

#### Cross-Reference to Training Standards:

6069

Duration:      Total Hours: 21      Theory: 7 Hours      Practical: 14 Hours

#### General Learning Outcome:

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

#### Learning Outcomes:

Upon successful completion, the apprentice is able to:

- 3.3.1 Define the purpose and fundamentals of A/C electrical and electronic systems.
- 3.3.2 Identify and describe the construction, types, styles, and application of A/C electrical and electronic systems components.
- 3.3.3 Explain the operating principles of A/C electrical and electronic systems.
- 3.3.4 Perform inspection and testing procedures on A/C electrical and electronic systems following manufacturers' recommendations.
- 3.3.5 Perform diagnostics and troubleshooting on A/C electrical and electronic 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 A/C electrical and electronic systems.  
[1.5/0]

- history and background
- difference between A/C current and D/C current
- magnetism
- inductance
- impedance
- capacitance
- dielectric strength
- capacitive resistance
- apparent power
- power factor
- three phase voltages

3.3.2 Identify and describe the construction, types, styles, and application of A/C electrical and electronic systems components.  
[2/0]

- capacitors
- panel box
- receptacles
- power cords
  - 15 amp
  - 30 amp
  - 50 amp
- ground fault interrupters
- surge protection devices

- 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
  -

3.3.3 Explain the operating principles of A/C electrical and electronic systems.  
[3.5/0]

- safe operations
- 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 amp
  - 30 amp
  - 50 amp
- ground fault interrupters
- surge protection devices

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

[0/4]

- 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

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

[0/4]

- use inspection/testing techniques
- check voltage, polarity, ground
- 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.

[0/6]

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

**EVALUATION:**

Theory Testing	55%
Practical Application Exercises	25%
Research Project	15%
Notebook and Organizational Skills	10%

Number: 4

Title: RV Construction and Appearance 1

Duration 29 Total Hours Theory: 11 hours Practical 18 hours

Prerequisites: Level 1: Unit 1

Co-requisites: None

---

4.1 Vehicle Detailing- Interior and Exterior

9 Total Hours Theory: 3 hours Practical: 6 hours

4.2 Tires, Wheels and Rims (Towed)

20 Total Hours Theory: 8 hours Practical: 12 hours

#### 4.1 – Vehicle Detailing – Interior and Exterior

##### Cross-Reference to Training Standards:

6065, 6077

Duration:      Total Hours: 9 Theory: 3 Hours      Practical: 6 Hours

##### 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 detailing RVs.

##### Learning Outcomes:

Upon successful completion, the apprentice is able to:

- 4.1.1 Define the purpose and fundamentals of vehicle detailing.
- 4.1.2 Identify and describe the construction, types, styles, and application of detailing equipment.
- 4.1.3 Identify and describe the construction, types, styles, and application of component units that require detailing on RVs.
- 4.1.4 Explain the basic operating principles of detailing.
- 4.1.5 Perform inspection, testing, and diagnostic procedures on RV components following manufacturers' recommendations.
- 4.1.6 Perform detailing operations for the following as to manufacturers' recommendations.
- 4.1.7 Verify detailing operations for the following as to industry standards.

Learning Content:

4.1.1 Define the purpose and fundamentals of vehicle detailing.  
[0.5/0]

- appearance
- protection

4.1.2 Identify and describe the construction, types, styles, and application of detailing equipment.  
[0.5/0]

- soap and water
- wipes
- lights
- vacuum
- shampoo
- stain remover
- deodorizer
- polish
- cleaning supplies (sponge, chamois, cleaning agents)
- paint
- lubricants
- power buffer

4.1.3 Identify and describe the construction, types, styles, and application of component units that require detailing on RVs.  
[0.5/0]

- windows
- walls
- floor coverings
- ceiling coverings
- upholstery
- appliances
- water and waste water systems
- kitchen
- bathroom furnishings and fittings
- doors
- vents
- cabinets
- hardware



- lighting fixtures
- wheels
- stripes, decals
- trim
- mouldings
- glass
- paint finish
- awnings
- accessories
- underbody
- storage and engine compartments
- fastening, mounting and mechanical devices

4.1.4 Explain the basic operating principles of detailing. [1.5/0]

- cleaning procedures for the following:
  - light scratches
  - dirt in paint, paint imperfections
  - water stains
  - bacteria and mould
  - interior stains (gum, urine, grease)
  - exterior stains (tar, road film)
  - vinyl maintenance
  - soiled carpet
  - paint overspray
  - discolouration
  - oxidization
  - dirt and debris
  - odours
  - undercoating
  - cracks, fractures
  - worn, loose, missing, damaged, defective parts
- detailing methods
  - washing
  - compounding
  - polishing
  - wiping with solvent
  - vacuuming
  - shampooing
  - treating
  - painting
  - deodorizing
  - removing mould and bacteria

- safety
  - eye and hand protection
  - skin protection (barrier creams)
  - breathing apparatus

4.1.5 Perform inspection, testing, and diagnostic procedures on RV components following manufacturers' recommendations.  
[0/1.5]

- visual and physical inspection
  - lights
  - wipes
  - locate and record all interior and exterior contaminants
- determine cleaning sequence
- inspecting and testing for:
  - appearance
  - performance
  - function
- consult appropriate resource materials (workplace drawings, manuals)
- use computer for research where relevant

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

- use test area first
- wash with soap and water
- chamois
- compound light scratches and overspray
- polish
- remove stains with solvent
- clean glass
- clean tires and wheels
- vacuum interior
- clean interior furnishings
- shampoo
- deodorize
- remove bacteria, mould
- touch-up painting
- lubricate where necessary
- aligning

4.1.7 Verify detailing operations for the following as to industry standards.  
[0/0.5]

- thorough visual inspection
- detailing checklist

**EVALUATION:**

Theory Testing	20%
Practical Application Exercises	65%
Research Project	10%
Notebook and Organizational Skills	10%

## 4.2 – Tires, Wheels and Rims (Towed)

### Cross-Reference to Training Standards:

6073

Duration:            Total Hours: 20      Theory: 8 Hours      Practical: 12 Hours

### 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 tires, wheels, and rims.

### Learning Outcomes:

Upon successful completion, the apprentice is able to:

- 4.2.1 Define the purpose and fundamentals of tires, wheels, and rims.
- 4.2.2 Identify and describe the functions, construction, composition, types, styles and applications of tires, wheels and rims.
- 4.2.3 Explain the principles of operation of tires, wheels and rims.
- 4.2.4 Perform inspection and testing procedures on tires, wheels and rims following manufacturers' recommendations.
- 4.2.5 Perform diagnostics and troubleshooting on tires, wheels and rims according to manufacturers' specifications.
- 4.2.6 Perform repairs, replacement, and installation according to manufacturers' recommendations.

Learning Content:

4.2.1 Define the purpose and fundamentals of tires, wheels, and rims.  
[0.5/0]

- history and development
  - split rims
  - safety cages
- torquing wheel nuts
- effects of water (hydroplaning)
- sliding and rolling friction
- tire sizes, load rating
- static and dynamic balance
- tread wear depth minimum
- tire and rim matching
- tire materials

4.2.2 Identify and describe the functions, construction, composition, types, styles and applications of tires, wheels and rims.  
[1/0]

- tires, wheel and hubs for towed vehicles
- tire materials
- tire tread designs
- bias tire
- run-flat tires
- balancing
- air pressure
- tread design and traction
- valves
- valve extensions
- caps
- wheel discs
- wheel liners
- spacers
- balance weights
- sensors and related components
- fastening and mounting devices

4.2.3 Explain the principles of operation of tires, wheels and rims.  
[2.5/0]

- tire static and dynamic balance
- tire action under various operating conditions
- bias ply applications
- radial applications
- tires, wheel and hubs for towed vehicles
- tire materials
- tire tread designs
- run-flat tires
- balancing
- air pressure
- tread design and traction
- valves
- valve extensions
- caps
- wheel discs
- wheel liners
- spacers
- balance weights
- sensors and related components
- fastening and mounting devices

4.2.4 Perform inspection, testing and diagnostic procedures on tire and rim assemblies following manufacturers' recommendations  
[0/0.5]

- tire type mixing
- tire ratings and size
- perform tire, wheel, and rim safety inspection
- visual inspection
  - radial and lateral run-out
  - tire matching for dual application
  - tire condition
  - wear
  - defects
  - corrosion

- physical inspection
  - overheated components
  - loose, missing, damaged parts
  - contamination
  - tire pressure and leaks
  - vibration
  - noise
  - cracks and fractures
  - tire matching
  - measure radial and lateral wheel and tire run-out
- air pressure precautions
- vehicle lift and support precautions
- torque wrench
- tire gauge

4.2.5 Perform diagnostics and troubleshooting on tires, wheels and rims according to manufacturers' specifications.

[0/0.5]

- determine factors that affect tire wear
- determine factors that cause cord separation
- use inspection/testing techniques
- use diagnostic equipment
- consult appropriate resource materials (workplace drawings, manuals)
- use computer for research where relevant

4.2.6 Perform repairs, replacement, and installation according to manufacturers' recommendations.

[0/1]

- observe static and dynamic wheel assembly balance
  - mechanical
  - computer-assisted
- removal and installation of tire on rim
- observe recommended tire repair procedures
- tire type mixing and rotation
- wheel bearing pre-load and end-play
- verify integrity of repairs and operations

**EVALUATION:**

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



Number: 5

Title: Plumbing and Gas Systems 1b

Duration: 24 Total Hours      Theory: 12 hours      Practical: 12 hours

Prerequisites: Level 1: Unit 1, 2

Co-requisites: None

---

5.1 Plumbing I

24 Total Hours      Theory: 12 hours      Practical: 12 hours

## 5.1 – Plumbing I

### Cross-Reference to Training Standards:

6068

Duration:      Total Hours    24      Theory: 12 Hours      Practical: 12 Hours

### 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 plumbing systems.

### Learning Outcomes:

Upon successful completion, the apprentice is able to:

- 5.1.1 Define the purpose and fundamentals of plumbing systems.
- 5.1.2 Identify and describe the construction, types, styles, and application of plumbing system components.
- 5.1.3 Explain the operating principles of plumbing systems.
- 5.1.4 Perform inspection and testing procedures on plumbing systems following manufacturers' recommendations.
- 5.1.5 Perform diagnostics and troubleshooting on plumbing 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 plumbing systems. [2/0]

- history
- industry changes
- water systems
  - fresh (potable, city) water
  - black (waste) water
  - grey water
- chemicals used in waste systems
  - changes
  - environmental

5.1.2 Identify and describe the construction, types, styles, and application of plumbing system components. [3/0]

- 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

- REVIEW AS NECESSARY:
  - regulators
  - lines
  - hoses
  - manifolds
  - seals
  - gaskets
  - tanks

5.1.3 Explain the operating principles of plumbing systems.  
[7/0]

- cold water and hot water (as relevant)
- 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
- freeze protection devices and fluids
- 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
- REVIEW AS NECESSARY:
  - regulators
  - lines
  - hoses
  - manifolds
  - seals
  - gaskets
  - tanks

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

[0/4]

- 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

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

[0/3]

- use inspection/testing techniques
- 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.

[0/5]

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

Number: 6

Title: Welding Practices 1

Duration: 48 Total Hours      Theory: 18 hours      Practical: 30 hours

Prerequisites: Level 1: Unit 1, 2

Co-requisites: None

---

6.1 Oxy-Fuel Heating and Cutting

48 Total Hours      Theory: 18 hours      Practical: 30 hours

## 6.1 – Oxy-Fuel Heating and Cutting

### Cross-Reference to Training Standards:

6065, 6071, 6074

Duration:      Total Hours: 48      Theory: 18 Hours      Practical: 30 Hours

### 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 oxy-fuel equipment for heating and cutting.

### Learning Outcomes:

Upon successful completion, the apprentice is able to:

- 6.1.1 Define the purpose and fundamentals of heating and cutting practices.
- 6.1.2 Describe the functions, construction, types, styles, and application of oxy-fuel welding equipment.
- 6.1.3 Describe the functions, construction, types, styles, and application of structures and devices that require welding on RVs.
- 6.1.4 Explain the safe operating principles of oxy-fuel welding equipment.
- 6.1.5 Perform inspection and testing procedures on unit parts following manufacturers' recommendations.
- 6.1.6 Perform diagnostics and troubleshooting on oxy-fuel welding equipment and unit parts 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 heating and cutting practices.  
[2/0]

- fuel
  - acetylene
  - propane
- history
- basic metallurgy
  - frames and chassis
- flames
  - primary
  - secondary
  - oxidizing
  - neutral
  - carbonizing
- oxy-fuel
- plasma cutters
- fundamental safety issues

6.1.2 Describe the functions, construction, types, styles, and application of oxy-fuel welding equipment.  
[4/0]

- tanks
- identification features
- fittings
- pressure regulators
- tips
- oxyacetylene valves
- manual valves
- gauges
- heating and cutting
- hoses
- wire brushes
- descalers
- abrasives
- fire retardant shielding

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

[4/0]

- 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

6.1.4 Explain the safe operating principles of oxy-fuel welding equipment.

[8/0]

- storage
- pressure settings
- fire extinguisher availability
- safety protection (eye, face, hand, foot, clothing)
- setup sequence
- ignition sequence
- shutdown sequence
- cylinder handling
- fire prevention
- flammable container precautions
- tanks
- identification features
- fittings
- pressure regulators
- tips
- oxyacetylene valves
- manual valves
- gauges
- heating and cutting
- hoses
- wire brushes
- descalers
- abrasives
- fire retardant shielding

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

[0/3]

- 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
- use appropriate gauges

6.1.6 Perform diagnostics and troubleshooting on oxy-fuel welding equipment and unit parts according to manufacturers' specifications.

[0/3]

- use inspection/testing techniques
- 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.

[0/24]

- install/remove
- heating/cutting seized nuts and bolts
- heating frame assemblies
- attaching/removing hitches
- cutting operations
- fabricating
- checking for distortion, damage to surrounding area
- recommend service
  - sub-trade referral (decision)
- verify integrity of operations

**EVALUATION:**

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

6<sup>th</sup> 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**

3<sup>rd</sup> Edition, Hogg. ISBN 0-07-548869-8

**Practical Heating Technology**

Johnson. ISBN 0-8273-4881-9

**Impact: A Guide to Business Communications**

3<sup>rd</sup> Edition, Northey. ISBN 0-13-452541-8

**CSA 240 RV Standard Code Book** – can be ordered on-line at [www.csa.com](http://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