



**ONTARIO COLLEGE OF TRADES**  

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**ORDRE DES MÉTIERS DE L'ONTARIO**

Apprenticeship  
Curriculum Standard

Auto Body and Collision  
Damage Repairer

Levels 1, 2 and 3

310B

2006



**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).

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## INTRODUCTION

This new curriculum standard for the **Autobody and Collision Damage Repairer** trade is designed down from the learning outcomes, which were in turn developed from the industry-approved training standard.

The curriculum is organized into **three levels** of training, each includes 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 centres 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 performance objectives in the Apprenticeship Training Standards for **Autobody and Collision Damage Repairer**. 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 2006

Summary of Total Program In-School Training Hours

<b>Reportable Subjects</b>	<b>Total</b>	<b>Theory</b>	<b>Practical</b>
1. Applied Work Practices	39	28	11
2. Welding	36	20	16
3. Body Frame and Structure	93	46	47
4. Refinishing	39	26	13
5. Applied Mechanical	33	26	7
<b>Total</b>	<b>240</b>	<b>146</b>	<b>94</b>

Number: 1

Title: **Applied Work Practices**

Duration: 39 Total Hours

Theory: 28 Hours      Practical: 11 Hours

Prerequisites: None

Co-requisites: None

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**1.1 Shop Safety**

12 Total Hours      Theory: 12 Hours      Practical: 0 Hours

**1.2 Hand Tools**

6 Total Hours      Theory: 5 Hours      Practical: 1 Hours

**1.3 Shop Equipment**

9 Total Hours      Theory: 5 Hours      Practical: 4 Hours

**1.4 Trim/ Hardware**

12 Total Hours      Theory: 6 Hours      Practical: 6 Hours

## 1.1- Shop Safety

### Cross-Reference to Learning Outcomes:

6040.01, 6040.02, 6040.03, 6040.04, 6040.06, 6040.07

Duration: 12 Total Hours Theory: 12 hours Practical: 0 hours

### General Learning Outcome:

To describe the pertinent information relating to safe work practices, *Workplace Hazardous Materials Information Safety (WHMIS)*, *Occupational Health and Safety Act (OHSA)*, *Repair and Storage Insurance Board (RSIB)* and the *Workplace Safety Insurance Board (WSIB)*.

### Learning Outcomes:

Upon successful completion, the apprentice is able to:

- 1.1.1 Define the purpose and fundamentals of safe work practices.
- 1.1.2 Describe *Workplace Hazardous Materials Information Safety (WHMIS)*.
- 1.1.3 Describe *Occupational Health and Safety Act (OHSA)*.
- 1.1.4 Describe the *Repair and Storage Liens Act (RSLA)*.
- 1.1.5 Describe the *Workplace Safety Insurance Board (WSIB)*.

Learning Content:

1.1.1 Define the purpose and fundamentals of safe work practices.

- [410]
- personal attire
  - glasses
  - shields
  - guards breathing
  - filters ventilation
  - masks
  - gloves
  - clothing
  - footwear
  - rings and other jewelery
  - fire extinguishers
    - types of fires
    - application of specific types of extinguishers
  - physical activities
    - lifting techniques
    - handling of tools and equipment
    - working conditions and organization of work area
    - application of force on wrenches and levers
  - facilities
    - housekeeping / cleanliness
    - ventilation / exhausting
    - shop layout
    - test tanks
    - lighting
    - emergency responses
    - loose clothing
    - compressed air
    - tools and equipment

1.1.2 Describe *Workplace Hazardous Materials Information Safety (WHMIS)*.

- [310] -
- right to know
  - legislation
  - safe handling of products
  - hazardous materials
  - Material Safety Data Sheets (MSDS)

1.1.3 Describe *Occupational Health and Safety Act (OHSA)*.

- [2/0] - legislation
- obligation of employer and worker

1.1.4 Describe the *Repair and Storage Liens Act (RSLA)*.

- [2/0]
- payment for repairs or storage lien
  - search for
    - Personal Property Security Registration (RPSR)
    - registration by vehicle identification number (VIN)
    - registration by individual's names
    - registration by business name
  - dispute over lien

1.1.5 Describe the *Workplace Safety Insurance Board (WSIB)*.

- [1/0]
- reporting accidents to company
  - reporting accidents to WSIB
  - required records
  - training requirements
  - accident prevention
  - safety precautions
  - personal protection equipment
  - housekeeping

## 1.2 -Hand Tools

### Cross-Reference to Learning Outcomes:

6041,6042,6043,6044,6045,6046,6047,6048,6049,6050,6051,6052,6053,  
6054,6055,6056,6057,6058

Duration: 6 Total Hours                      Theory: 5 hours                      Practical: 1 hour

### General Learning Outcome:

To demonstrate a working knowledge of the purpose, function, operating principles and maintenance for using hand tools.

### Learning Outcomes:

Upon successful completion, the apprentice is able to:

- 1.2.1 Define the purpose, fundamentals, types, styles and application of hand tools.
- 1.2.2 Describe the functions, construction, features and types of basic hand tools.
- 1.2.3 Explain the operating principles of hand tools.
- 1.2.4 Perform the manufacturer's maintenance and recommended operating procedures for hand tools and perform the assigned operations.

Learning Content:

1.2.1 Define the purpose, fundamentals, types, styles and application of hand tools.

- [1/0] features that determine quality
- durability
  - metal alloys
  - coatings
- factors that determine application
- weight
  - metal thickness
  - angles
  - gripping features
  - imperial and metric

1.2.2 Describe the functions, construction, features and types of basic hand tools.

- [3/0] wrenches
- torque wrenches
  - open end, box end, combination
  - flare nut (line)
  - adjustables
- socket sets
- drives - ¼", 3/8", ½", ¾", 1"
  - ratchets
  - flex handles
- pliers
- diagonal cutters
  - slip joint, channel lock, needle nose
  - vise grip
  - screwdrivers flat
- blade and slotted  
Phillips  
Torx  
Robertson
- cutting tools
    - hacksaw
    - chisel
    - files
    - twist drills
    - reamers
    - taps and dies
  - dollies

- spoons
- picks (pry bars)
- driving tools
  - hammers
- ball-peen, bell-faced, soft-faced punches
- centre, pin, starting, aligning cleaning tools
  - scrapers
  - wire brushes
  - power-driven rotary wire brushes
  - solvent brushes

1.2.3 Explain the operating principles of hand tools.

- [1/0] - wrenches  
sockets  
pliers  
screwdrivers  
cutting tools  
driving tools  
cleaning tools

1.2.4 Perform the manufacturer's maintenance and recommended operating procedures for hand tools and perform the assigned operations.

- [0/1] - maintenance
- lubrication
  - cleaning
  - storage
- demonstrate and perform the applied operating techniques
- holding techniques
  - pulling and tightening techniques
  - gripping techniques

### **1.3 - Shop Equipment**

#### Cross-Reference to Learning Outcomes:

6041,6042,6043,6044,6045,6046,6047,6048,6049,6050,6051,6052,6053,  
6054,6055,6056,6057,6058

Duration:      9 Total Hours                  Theory: 5 hours                  Practical: 4 hours

#### General Learning Outcome:

To demonstrate a working knowledge of the purpose, function, operating principles and maintenance for using shop equipment.

#### Learning Outcomes:

Upon successful completion, the apprentice is able to:

- 1.3.1 Define the purpose and fundamentals of shop equipment.
- 1.3.2 Explain the construction features of shop equipment.
- 1.3.3 Explain the principles of operation of power tools and equipment.
- 1.3.4 Demonstrate the ability to operate shop equipment and power tools according to the manufacturers' recommended safe operating procedures.
- 1.3.5 Perform the manufacturers' recommended maintenance procedures for shop equipment.

Learning Content:

1.3.1 Define the purpose and fundamentals of shop equipment.

- [1 /0] - definitions  
shop layout  
shop equipment installation

1.3.2 Explain the construction features of shop equipment. [2/0]

- grinders
- bench grinders
  - portable grinders
- drills
- drill press
  - portable drills
- vise
- solid and swivel
  - soft and hard jaw
- lift equipment
- hoists
  - hydraulic jacks
  - pneumatic jacks
  - blocking equipment (safety stands)
- cleaning equipment
- power spray

1.3.3 Explain the principles of operation of power tools and equipment.

- [2/0] - power tools
- impact wrenches
  - portable drills
  - sanders
  - air hammer
  - polishers
  - grinders
  - washers and degreasers
- equipment
- hydraulic, pneumatic and electric
  - mechanical and hydraulic jacks
  - safety blocking devices

1.3.4 Demonstrate the ability to operate shop equipment and power tools according to the manufacturers' recommended safe operating procedures.

- [0/3]            lifting and jacking equipment
- lifting techniques single person / two person
  - hydraulic hoists
  - jacking
    - mechanical
    - hydraulic
  - safety blocking
    - power tools
  - impact wrenches
  - portable drills
  - grinders
    - bench portable
    - cleaning of equipment
  - power spray
  - degreasing / cleaning agents

1.3.5 Perform the manufacturers' recommended maintenance procedures for shop equipment.

- [0/1]            maintenance
- electrical cords and connections
  - air lines and connections
  - hydraulic lines and connections
  - moisture contamination
- identify and perform the recommended and adjustments to shop equipment

## **1.4 - Trim/ Hardware**

### Cross-Reference to Learning Outcomes:

6043.01' 6043.02, 6043.03, 6043.04

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

### General Learning Outcome:

To demonstrate a working knowledge of the purpose, removal, replacement and repair procedures for trim / hardware.

### Learning Outcomes:

Upon successful completion, the apprentice is able to:

- 1.4.1 Define the purpose and fundamentals of trim / hardware.
- 1.4.2 Explain the removal, replacement and repair procedures for automotive trim hardware.
- 1.4.3 Perform manufacturers' recommended removal, replacement and repair procedures for automotive trim hardware.
- 1.4.4 Describe the fundamentals of adhesives, fasteners and retainers used for mouldings, emblems, exterior trim, decals, and stripes.
- 1.4.5 Describe the removal, replacement and repair procedures for mouldings, emblems and exterior trim decals, graphics and stripes.
- 1.4.6 Perform manufacturers' removal, replacement and repair procedures for moldings, emblems, exterior trim, decals, graphics and stripes.

Learning Content:

1.4.1 Define the purpose and fundamentals of trim / hardware.

- [2/0]
- trim adhesives
    - spray
    - tube
    - anaerobic
    - activated
  - fasteners and retainers
  - standard and metric
    - classification of bolts and nuts
    - grade of material
    - tensile strength
    - sizes and threads per inch
    - locking devices
    - torque specifications
    - drill and tap drill sizes
  - clips and fastening methods
  - cladding
  - trim panels floor
  - coverings
  - headliners
  - vinyl tops
  - convertible tops
  - weather stripping

1.4.2 Explain the removal, replacement and repair procedures for automotive trim hardware.

- [2/0]
- latches
  - lock cylinders
  - handles
  - roof racks
  - hinges
  - antennae
  - grills
  - seats
    - frames
    - tracks
  - headliners
  - trim panels
  - cladding
  - weather stripping
  - seating anchoring

1.4.3 Perform manufacturers' recommended removal, replacement and repair procedures for automotive trim hardware and materials.

- [0/3] - door, trunk, hood locks and latches
- Lock cylinders
  - latches
  - door handles
  - hinges
  - roof racks
  - grills
  - seats
  - tracks
  - trim panels
  - cladding
  - headliners
  - weather stripping
  - floor coverings

1.4.4 Describe the fundamentals of adhesives, fasteners and retainers used for mouldings, emblems, exterior trim, decals, and stripes.

- [1/0] - purpose, types, styles, applications
- trim adhesives (spray-tube type)
  - clips, retainers, fasteners
  - decals, graphics, pinstripes

1.4.5 Describe the removal, replacement and repair procedures for mouldings, emblems and exterior trim decals, graphics and stripes.

- [1/0] - identify tools for removal of mouldings  
 replacement of damages clips  
 decal stripe removal using heat, scraper, chemical and eraser wheel  
 replacement procedures for body side, windshield, wheel opening, mouldings  
 graphic and decal replacement
- dry method
  - water method
  - soap and water method
- wood grain transfers

1.4.6 Perform manufacturers' removal, replacement and repair procedures for mouldings, emblems, exterior trim, decals, graphics and stripes.

[0/3]

using test unit

- remove mouldings
- replace clips as necessary
- remove emblems
- replace adhesive as needed for reinstallation
- remove decals, graphics
- solvents
- heat and scraper
- chemical spray
- eraser wheel
- replace decals, stripes and graphics
- water
- soap and water
- dry

Number: 2

Title: **Welding**

Duration: 36 Total Hours

Theory: 20 hours      Practical: 16 hours

Prerequisites: Unit 1

Co-requisites: Unit 3, 4, 5

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**2.1- Oxyacetylene Welding, Heating and Cutting**

6 Total Hours      Theory: 4 Hours      Practical: 2 Hours

**2.2- Gas Metal Arc Welding (GMAW) Fundamentals**

24 Total Hours      Theory: 12 Hours      Practical: 0 Hours

**2.3- Plasma Arc Cutting**

6 Total Hours      Theory: 4 Hours      Practical: 2 Hours

## **2.1 - Oxyacetylene Welding, Heating and Cutting**

### Cross-Reference to Learning Outcomes:

6048.01, 6048.02, 6048.03, 6048.04, 6048.05

Duration: 6 Total Hours                      Theory: 4 hours                      Practical: 3 hours

### General Learning Outcome:

To demonstrate a working knowledge of the purpose, function, safe operating principles and maintenance procedures for oxyacetylene welding / heating / cutting equipment.

### Learning Outcomes:

Upon successful completion, the apprentice is able to:

- 2.1.1 Identify the purpose and fundamentals of safe oxy-acetylene welding, heating and cutting practices.
- 2.1.2 Describe the functions, construction, types and application of oxyacetylene welding equipment.
- 2.1.3 Explain the safe principles of operation of oxyacetylene welding equipment.
- 2.1.4 Describe the manufacturers' system maintenance procedure of oxyacetylene welding equipment.
- 2.1.5 Perform basic welding, heating, and cutting procedures.

Learning Content:

2.1.1 Identify the purpose and fundamentals of safe oxy-acetylene welding, heating and cutting practices.

[1/0]

- oxy-fuel gases
- eye, hand, face, clothing protection
- set up, ignition and shutdown sequenc
- cylinder handling
- fire prevention
- butane lighters
- flammable container welding precautions

2.1.2 Describe the functions, construction, types and application of oxyacetylene welding equipment.

[1/0]

- tanks
- identification features
- pressure regulators
- manual valves
- manifold systems
- gauges and hose
- tips
- cutting
- welding

2.1.3 Explain the safe principles of operation of oxyacetylene welding equipment.

[1/0]

- tanks
- pressure regulators
- manual valves
- manifold
- systems
- gauges and hoses
- tips
- cutting
- welding

2.1.4 Describe the manufacturers' system maintenance procedure of oxyacetylene welding equipment.

[1/0]

- tanks
- manual valves, gauges, and hose
- pressure regulators
- tips

2.1.5 Perform basic welding, heating, and cutting procedures.

[0/2]

- set up and shutdown sequence
- correct oxygen and acetylene pressures
- ignition procedures
- select correct heating and cutting tips
- observance of tip angle, temperature of metals
- awareness of potential heat or cutting damage to surrounding materials
- adjust pressure settings
- adjust flames types
  - carbonizing
  - neutral
  - oxidizing
- perform welding on:
  - butt
  - lap
  - corner
  - edge
  - tee

## **2.2 -Gas Metal Arc Welding (GMAW) Fundamentals**

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

### Cross-Reference to Learning Outcomes:

6045.01, 6045.02, 6()45.03, 6045.04, 6045.05

### General Learning Outcome:

To demonstrate a working knowledge of the purpose, construction, safe operating principles and maintenance procedures for Gas Metal Arc Welding (GMAW). Be able to perform welding procedures and diagnose defects in weld.

### Learning Outcomes:

Upon successful completion, the apprentice is able to:

- 2.2.1 Define the purpose and fundamentals of the Gas Metal Arc Welding (GMAW) process.
- 2.2.2 Describe the construction, types and application of Gas Metal Arc Welding (GMAW) equipment and consumables.
- 2.2.3 Explain the principles of operation of Gas Metal Arc Welding (GMAW) equipment and procedures.
- 2.2.4 Perform Gas Metal Arc Welding (GMAW) set up procedures for welding on thin gauge mild steel.
- 2.2.5 Diagnose defects for Gas Metal Arc Welding (GMAW).
- 2.2.6 Describe manufacturers' maintenance procedures for Gas Metal Arc Welding (GMAW) equipment.

Learning Content:

2.2.1 Define the purpose and fundamentals of the Gas Metal Arc Welding (GMAW) process.

[3/0]

- electrical fundamentals
- electrical polarity
- power sources
- wire feeders
- gas shielding

2.2.2 Describe the construction, types and application of Gas Metal Arc Welding (GMAW) equipment and consumables.

[3/0]

- power sources
  - rectifier
  - generator
  - inverter
- consumables
  - wire types
  - wire specifications
  - wire sizes
  - shielding gases
  - contact tips

2.2.3 Explain the principles of operation of Gas Metal Arc Welding (GMAW) equipment and procedures.

[3/0]

- equipment settings and trial beads
- arc initiation
- short circuit and spray methods
- gun angle and travel speeds wire drive speeds
- gas flow rate
- electrode protrusion
- power source characteristics

2.2.4 Perform Gas Metal Arc Welding (GMAW) set up procedures for welding on thin gauge mild steel.

[0/9]

- inspect welder
- set up welder
- identify safety precautions
  - set up safety equipment
  - make welder adjustments
  - gas flow
  - amperage / wire feed
  - voltage
  - perform test weld
  - GMAW weld joints
  - Butt
  - Lap
  - GMAW weld joints in the flat position using mild steel
  - 20/22 gauge
  - mig weld joints using various techniques
    - continuous
    - plug / stitch / tack

2.2.5 Diagnose defects for Gas Metal Arc Welding (GMAW).

[0/3]

- visually inspect weld for
  - porosity
  - Cracks
  - excessive spatter
  - undercut
  - overlap
  - penetration
  - destructively test weld by
    - shear testing
    - peel testing - spot / plug (hammer / chisel)

2.2.6 Describe manufacturers' maintenance procedures for Gas Metal Arc Welding (GMAW) equipment.

[3/0]

- drive roll pressure
- cable conduit cleanliness
- contact tip condition
- gas nozzle condition
- constant voltage power source
- wire drive systems
- gas shielding systems
- gun and cable assemblies
- special safety equipment
- approved welding areas or both
- ventilating equipment

### 2.3 - Plasma Arc Cutting

#### Cross-Reference to Learning Outcomes:

6049.01, 6049.02, 6049.03, 6049.04, 6049.05

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

#### General Learning Outcome:

To demonstrate a working knowledge of the purpose, function, safe operating principles and maintenance procedures for Plasma Arc Cutting (PAC) equipment. Be able to perform Plasma Arc Cutting (PAC).

#### Learning Outcomes:

Upon successful completion, the apprentice is able to:

- 2.3.1 Define the purpose and fundamentals of plasma arc cutting.
- 2.3.2 Describe the function, construction, types and application of plasma arc cutting equipment and consumables.
- 2.3.3 Explain the principles of operation of plasma arc cutting.
- 2.3.4 Perform plasma arc cutting operations.

Learning Content:

2.3.1 Define the purpose and fundamentals of plasma arc cutting.

- [1/0] - electrical fundamentals
- electrical polarity
  - structural integrity issues
  - distortion and un-distortion

2.3.2 Describe the function, construction, types and application of plasma arc cutting equipment and consumables.

- [1/0] power sources
- ground clamp and holder
  - electrical connectors
  - electrodes
  - hoses
  - regulators
  - lines and fittings
  - tips and nozzles

2.3.3 Explain the principles of operation of plasma arc cutting.

- [2/0] equipment settings  
cutting variables
- speed
  - distance
  - thickness
  - air supply
- personal safety precautions route  
planning for cutting path vehicle  
safety precautions

2.3.4 Perform plasma arc cutting operations.

- [0/2] - set up personal protection
- protect vehicle
  - clean and prepare cutting route
  - adjust plasma arc machine
  - connect air supply and attach clamps
  - test plasma arc cut
  - plasma arc cut vehicle sections

Number: 3

Title: **Body Frame and Structure**

Duration: 93 Total Hours

Theory: 46 hours      Practical: 47 hours

Prerequisites: Unit 1, 2

Co-requisites: Unit 4, 5

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**3.1 - Vehicle Construction and Design**

15 Total Hours      Theory: 12 hours      Practical: 3 hours

**3.2- Non-Structural Panel Repair Fundamentals**

15 Total Hours      Theory: 15 hours      Practical: 0 hours

**3.3- Metal Finishing**

27 Total Hours      Theory: 12 hours      Practical: 15 hours

**3.4- Bumpers**

9 Total Hours      Theory: 3 hours      Practical: 6 hours

**3.5- Abrasive and Fillers**

12 Total Hours      Theory: 4 hours      Practical: 8 hours

### 3.1 -Vehicle Construction and Design

#### Cross-Reference to Learning Outcomes:

6050.01, 6050.02, 6050.03, 6050.04, 6054.01, 6054.02, 6054.03, 6054.04

Duration: 15 Total Hours Theory: 12 hours Practical: 3 hours

#### General Learning Outcome:

To demonstrate a working knowledge of the purpose, construction and design of body panels and assemblies.

#### Learning Outcomes:

Upon successful completion, the apprentice is able to:

- 3.1.1 Define the purpose and variations of body and panels designs.
- 3.1.2 Perform an inspection to determine vehicle construction and design.

Learning Content:

3.1.1 Define the purpose and variations of body and panels designs.

- [12/0] -
- vehicle design
    - compact
    - intermediate
    - full size
    - sedan
    - hardtop
    - convertible
    - station wagon
    - van pickup
  - body panel
    - construction
    - design
      - front
      - centre
      - rear
      - assemblies
    - unibody design
    - body over frame
    - frame types
      - full frame
      - perimeter frame
      - ladder frame
      - partial frame
      - sub-frame
      - torque boxes
  - space frames apron
  - assemblies radiator
  - supports cross
  - members pillars
    - A pillars
    - B pillars
    - C pillars
  - shock towers
  - rocker panels
  - quarters
  - roofs
  - floor pans
  - structural reinforcements (impact beams)
  - high strength steel (HSS)
  - stress and stress concentrators

3.1.2 Perform an inspection to determine vehicle construction and design.

- [0/3] - locate vehicle parts and components
- identify vehicle type
- identify vehicle design and construction
- identify crush zones
- identify manufactures cautions

### **3.2 - Non-Structural Panel Repair Fundamentals**

Cross-Reference to Learning Outcomes:

6050.01, 6050.02, 6050.03, 6050.04

Duration: 30 Total Hours Theory: 15 hours Practical: 15 hours

General Learning Outcome:

To demonstrate a working knowledge of the fundamentals of body panel damage patterns and repair procedures.

Learning Outcomes:

Upon successful completion, the apprentice is able to:

- 3.2.1 Define the purpose and fundamentals of body panel repairs.
- 3.2.2 Explain the principles of damage patterns for collision repairs.
- 3.2.3 Perform recommended repair techniques and procedures on panel with minor damage.

Learning Content:

3.2.1 Define the purpose and fundamentals of body panel repairs. [9/0]

body panel

- construction
- design
  - crown
  - combination crown
  - double crown
- composition
- repair ability

characteristics of sheet metal

- cold rolled
- hot rolled
- low carbon (mild steel)
- deformation
- tensile strength
- yield strength
- ultimate strength
- compressive strength
- shear strength
- torsional strength
- yield point
- elastic deformation
- spring back
- plastic deformation

characteristics of aluminum

- melting temperature
- work hardening
- ductile characteristics
- oxide film
- hammering
- filing
- grinding
- shrinking
- heating

3.2.2 Explain the principles of damage patterns for collision repairs.

- [6/0]
- identification of damage patterns
    - direct or primary
    - indirect or secondary
    - related damage
    - direction of damage force
    - properties and characteristics of sheet metal
    - maintaining corrosion protection
  - types of damaged:
    - dents
    - folds
    - stretching
    - work hardening
  - buckles
    - single hinge
    - double hinge
    - collapsed hinge
    - rolled back

3.2.3 Perform recommended repair techniques and procedures on panel with minor damage.

- [0/15] -
- proper surface preparation (inside and out)
    - rough out and align using:
      - hammer on dolly
      - hammer off dolly
      - spring hammering
      - bumping
      - kinking
      - prying
      - welding
      - patching
      - stretching
      - pulling
      - shrinking
        - gas torch
        - unispotter
        - cold (with shrinking hammer)

### **3.3 - Metal Finishing**

Cross-Reference to Learning Outcomes:

6050.01, 6050.02, 6050.03, 6050.04

Duration:      27 Total Hours      Theory: 12 hours      Practical: 15 hours

General Learning Outcome:

To demonstrate a working knowledge of the fundamentals of metal finishing repairs.

Learning Outcomes:

Upon successful completion, the apprentice is able to:

- 3.3.1 Define the purpose and fundamentals of metal finishing.
- 3.3.2 Explain the repair procedures for metal finishing.
- 3.3.3 Perform metal finishing repairs using prescribed tools and equipment.

Learning Content:

3.3.1 Define the purpose and fundamentals of metal finishing.

- [6/0] - identify damage
- repair-ability
  - sight and feel
- tool selection  
repair techniques and sequences

3.3.2 Explain the repair procedures for metal finishing.

- [6/0] identify damage  
determine repair sequence  
hammer and dolly techniques  
filling techniques  
grinding  
buffing  
sanding

3.3.3 Perform metal finishing repairs using prescribed tools and equipment.

- [0/15] - identify damage
- repair-ability
  - sight and feel
- tool selection  
repair techniques and sequences  
hammering off / on dolly  
picking / prying  
filing
- locate high and low spots
  - direction
  - pressure
  - cross filling
  - scratch patterns
- grinding  
buffing  
sanding

### **3.4 - Bumpers**

Cross-Reference to Learning Outcomes:

6050.01, 6050.02, 6050.03, 6050.04

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

General Learning Outcome:

To demonstrate a working knowledge of the fundamentals, removal and replacement procedures for bumper assemblies.

Learning Outcomes:

Upon successful completion, the apprentice is able to:

- 3.4.1 Define the purpose and fundamentals of bumper assemblies and components.
- 3.4.2 Perform removal and replacement procedures for bumper assemblies with the prescribed service tools and equipment.
- 3.4.3 Perform manufacturers' recommended repair and testing procedures for bumper systems and components.

Learning Content:

3.4.1 Define the purpose and fundamentals of bumper assemblies and components.

- [310] - materials
- steel
  - aluminium
  - plastic
- impact absorbers / systems  
face bars / covers
- steel
  - aluminium (steel-aluminium corrosion)
  - composite material
  - reinforcement repair
  - impact bars
  - impact absorbers
  - impact strips

3.4.2 Perform removal and replacement procedures for bumper assemblies with the prescribed service tools and equipment.

- [0/3] - dismantling and cleaning of components  
- inspection for damage  
- overhauling system

3.4.3 Perform manufacturers' recommended repair and testing procedures for bumper systems and components.

- [0/3] - alignment of bumper face bar  
- inspection of impact absorbers /systems  
- testing of impact absorber / systems

### 3.5 - Abrasives and Fillers

#### Cross-Reference to Learning Outcomes:

6050.01, 6050.02, 6050.03, 6050.04, 6051.01, 6051.02, 6051.03, 6051.04

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

#### General Learning Outcome:

To demonstrate a working knowledge of the fundamentals of abrasives and fillers, their applications and surface preparation.

#### Learning Outcomes:

Upon successful completion, the apprentice is able to:

- 3.5.1 Define the purpose and fundamentals of abrasives and fillers.
- 3.5.2 Explain the techniques and procedures for the use of abrasives and fillers.
- 3.5.3 Perform the application of fillers and finish surfaces by sanding.

Learning Content:

3.5.1 Define the purpose and fundamentals of abrasives and fillers.

- [2/0]
- abrasives
    - grading and grit
    - open coat
    - closed coat
    - types
    - applications and options
  - fillers
    - type
    - composition
    - mixing procedures
    - applications

3.5.2 Explain the techniques and procedures for the use of abrasives and fillers.

- [2/0]
- repair assessment and sequence
  - abrasive selection
  - tool selection
    - applicators
    - grinders
    - sanders
    - sanding blocks / files
  - filler application methods and techniques
  - sanding
    - roughing / leveling
    - finishing
    - techniques

3.5.3 Perform the application of fillers and finish surfaces by sanding.

- [0/8]
- clean and assess repairs
  - prepare surfaces for fillers using abrasives apply fillers
  - rough and level fillers
    - finish filler surface

Number: 4

Title: **Refinishing**

Duration: 39 Total Hours

Theory: 26 hours      Practical: 13 hours

Prerequisites: Unit 1

Co-requisites: Unit 2, 3, 5

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**4.1 - Surface Preparation**

9 Total Hours      Theory: 6 hours      Practical: 3 hours

**4.2- Preparation- Undercoats**

9 Total Hours      Theory: 6 hours      Practical: 3 hours

**4.3- Paint Identification and Application**

9 Total Hours      Theory: 6 hours      Practical: 3 hours

**4.4- Spray Guns**

6 Total Hours      Theory: 4 hours      Practical: 2 hours

**4.5 - Spray Booths**

3 Total Hours      Theory: 2 hours      Practical: 1 hours

**4.6 - Compressed Air Delivery**

3 Total Hours      Theory: 2 hours      Practical: 1 hour

#### **4.1 - Surface Preparation**

##### Cross-Reference to Learning Outcomes:

6042.01, 6042.02, 6042.03, 6042.04, 6057.01, 6057.02, 6057.03, 6057.04

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

##### General Learning Outcome:

To demonstrate a working knowledge of surface preparation prior to refinishing.

##### Learning Outcomes:

Upon successful completion, the apprentice is able to:

- 4.1.1 Describe the introductory information and fundamentals of preparation products.
- 4.1.2 Describe the sanding procedures for surface preparation.
- 4.1.3 Perform sanding procedures for surface preparation.

Learning Content:

4.1.1 Describe the introductory information and fundamentals of preparation products.

- [3/0]            cleaning agents / sequence
- degreaser
  - final wash
  - metal conditioner
- masking materials
- masking tapes
  - masking papers
  - spray mask
  - plastic wrap
- paint strippers
- mechanical
  - chemical
- vehicle protection

4.1.2 Describe the sanding procedures for surface preparation.

- [3/0]            surface evaluation / assessment
- pre-existing damage
  - industrial fallout
  - acid rain
  - UV damage
  - hail damage
- sandpaper / sanding techniques
- grades
  - types
  - hand sanding
  - fresh paint
- sanding equipment
- block
  - oscillating (dual action)
  - vibrating
  - sandblasting

4.1.3 Perform sanding procedures for surface preparation.

- [0/3]
- assess / evaluate surface
  - select sanding option types
  - of sanding required remove
  - imperfections feather edges
  - hand sanding
    - wet
    - dry
  - machine sanding
    - wet
    - dry
  - block
    - oscillating (dual action)
    - vibrating
    - rotating (single action)
  - grit selection
    - variables / issues
    - performance
    - guidelines
  - specialty metal

## 4.2 - Preparation - Undercoats

### Cross-Reference to Learning Outcomes:

6041.01,6041.02,6041.03, 6041.04

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

### General Learning Outcome:

To demonstrate a working knowledge of the application of undercoats, protective coatings, putties and fillers.

### Learning Outcomes:

Upon successful completion, the apprentice is able to:

- 4.2.1 Define the introductory information and fundamentals, application and types of undercoats and protective coatings.
- 4.2.2 Explain the application procedures for undercoats and protective coatings.
- 4.2.3 Describe and perform recommended procedures for applying glazing putties and fillers.
- 4.2.4 Perform manufacturers' application for undercoats and protective coatings.

Learning Content:

4.2.1 Define the introductory information and fundamentals, application and types of undercoats and protective coatings.

- [2/0]            composition  
                   reduction  
                   sanding
- undercoats
  - primer-sealers
  - putties
  - fillers

4.2.2 Explain the application procedures for undercoats and protective coatings.

- [2/0]            flash times  
                   drying times  
                   application  
                   clean-up of equipment

4.2.3 Describe and perform recommended procedures for applying glazing putties and fillers.

- [2/0]    -        glazing putties
- polyester
  - epoxy resin-based
  - lacquer (solvent based)
- spray fillers
- primer surfacer

4.2.4 Perform manufacturers' application for undercoats and protective coatings.

- [0/3]            mix materials
- drying times
  - equipment cleanup
- paint strippers
- mechanical
  - chemical
- primers
- etching
  - filler / epoxy / sealer

### **4.3 - Paint Identification and Application**

#### Cross-Reference to Learning Outcomes:

6042.03, 04, 6057.01, 6057.02, 6057.03, 6057.04

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

#### General Learning Outcome:

To demonstrate a working knowledge of paint composition, identification, handling procedures and application.

#### Learning Outcomes:

Upon successful completion, the apprentice is able to:

- 4.3.1 Define the purpose and fundamentals of paint composition.
- 4.3.2 Identify VOC (Volatile Organic Compound) handling procedures.
- 4.3.3 Describe and perform vehicle and paint manufacturers' procedures for locating paint codes.
- 4.3.4 Identify types of previous paint coatings.
- 4.3.5 Explain the differences of preparation requirements and consequences for each type of refinish system.
- 4.3.6 Perform manufacturers' refinishing procedures for topcoat application.

Learning Content:

4.3.1 Define the purpose and fundamentals of paint composition.

- [2/0]
- paint content
    - pigments
    - binders
    - solvents
    - driers
    - performance additives
  - topcoats
    - enamel
    - lacquer
    - acrylic enamel
    - polyurethane
    - acrylic urethane enamel
    - acrylic lacquer
    - basecoat clearcoat
    - single stage and multi-stage
    - water base

4.3.2 Identify VOC (Volatile Organic Compound) handling procedures.

- (1/0)
- background / history
  - tracking of VOC
    - inventory
    - mixing
  - computerized equipment
    - mixing
    - record keeping

4.3.3 Describe and perform vehicle and paint manufacturers' procedures for locating paint codes.

- [1/0]
- locate and record vehicle manufacturers'
    - paint codes
    - trim codes
    - VIN breakdown
  - locate paint manufacturers' colour chips
    - reference vehicle codes to colour chips
    - reference colour chips to colour formula
    - confirm colour formula / variables

4.3.4 Identify types of previous paint coatings.

[1/0]            visual inspection sanding  
                         compounding  
                         solvent application  
                         heat application

4.3.5 Explain the differences of preparation requirements and consequences for each type of refinish system.

[1/0]            primer  
                         • selection  
                         • applications  
                         sandpaper options  
                         • type  
                         • grit contour  
                         mapping die back  
                         gloss retention

4.3.6 Perform manufacturers' refinishing procedures for topcoat application.

[0/3]            determine topcoat mixing ratio  
                         mix paint materials perform  
                         spray techniques  
                         • wetness of application  
                         • methods and patterns of application  
                         • flash and tack times  
                         routing

#### **4.4 - Spray Guns**

Cross-Reference to Learning Outcomes:

6057.03, 6057.04

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

General Learning Outcome:

To demonstrate a working knowledge of the purpose, construction and maintenance procedures for spray guns.

Learning Outcomes:

Upon successful completion, the apprentice is able to:

- 4.4.1 Define the purpose and fundamentals of spray guns.
- 4.4.2 Describe the function and construction of the major components of spray guns.
- 4.4.3 Perform manufacturers' maintenance procedures for spray guns of various types.

Learning Content:

4.4.1 Define the purpose and fundamentals of spray guns. [210] -

- suction (siphon) feed
- pressure feed
- gravity feed
- touch-up gun air
- brush
- reasons for development of H.V.L.P.
- H.V.L.P. (high volume low pressure)
- L.V.L.P. (low volume low pressure) Plural
- component
- internal mix
- external mix
- related V.O.C. issues T.E.
- (transfer efficiency) air
- lines / hoses
- diameter / size variables
- connections

4.4.2 Describe the function and construction of the major components of spray guns.

- [2/0]
- air caps
- fluid tips
- fluid needles
- air volume control valve
- baffles
- spreader valve
- gun body
- seals, gaskets and packings

4.4.3 Perform manufacturers' maintenance procedures for spray guns of various types.

- [0/2] -
- back flushing
- exterior cleaning
- interior cleaning (manual and machine)
- polishing as required
- lubrication
- troubleshooting storage
- fluid hoses
- test spray equipment
- adjust spray equipment

#### **4.5 - Spray Booths**

Cross-Reference to Learning Outcomes:

6057.03

Duration:      3 Total Hours              Theory: 2 hours              Practical: 1 hour

General Learning Outcome:

To demonstrate a working knowledge of the purpose, principles of operation and maintenance procedures for spray booths.

Learning Outcomes:

Upon successful completion, the apprentice is able to:

- 4.5.1 Define the purpose and fundamentals of spray booths.
- 4.5.2 Explain the principles of operation of various types of booths.
- 4.5.3 Perform manufacturers' maintenance and cleaning of spray booths, prep stations and mixing room.

Learning Content:

4.5.1 Define the purpose and fundamentals of spray booths.

[1/0] walls  
 intake filters  
 arrestor filters  
 seals  
 temperature controls  
 manometers  
 bake unit  
 lights

4.5.2 Explain the principles of operation of various types of booths. [1/0]

cross flow  
 semi-downdraft  
 downdraft solid  
 back drive  
 through prep  
 stations mixing  
 rooms

4.5.3 Perform manufacturers' maintenance and cleaning of spray booths, prep stations and mixing room.

[0/1] wall cleaning  
 floors cleaning  
 intake filter replacement and / or cleaning  
 exhaust filter cleaning and / or replacement (dry)  
 exhaust filter cleaning and water recycling and replacement  
 air line cleaning and inspection  
 air regulator draining and inspection of contaminants  
 inspection of seals  
 inspection of flaps

#### **4.6 - Compressed Air Delivery**

Cross-Reference to Learning Outcomes:

6042.03, 6057.03

Duration:      3 Total Hours              Theory: 2 hours              Practical: 1 hours

General Learning Outcome:

To demonstrate a working knowledge of the fundamentals of compressed air systems and required maintenance procedures.

Learning Outcomes:

Upon successful completion, the apprentice is able to:

- 4.6.1 Define the purpose and fundamentals of compressed air systems.
- 4.6.2 Perform maintenance procedures and troubleshooting for compressed air systems.

Learning Content:

4.6.1 Define the purpose and fundamentals of compressed air systems. [2/0]

- applications of compressors and components
  - pump- single-stage, multi-stage, rotary screw and turbine
  - horsepower (HP)
  - cubic feet per minute
  - tank
  - pressure switch
  - safety valve
  - foot valve
  - centrifugal pressure release
  - heat switch
  - regulators
  - hoses / airlines
  - belts, pulleys
  - overload protection
  - airline layout

4.6.2 Perform maintenance procedures and troubleshooting for compressed air systems.

- [0/1] -
- maintenance
    - cleaning
    - oil changing
    - component testing
    - waterdraining, manual/ automatic air intake
    - filtering
    - contamination
    - location of supply
  - troubleshooting
    - overheating
    - knocking
    - run-on (excessive run time)
    - pumping oil
    - air leakage
    - hard startup
  - distribution systems
    - air transformer
    - separator / regulators
    - condensers, after coolers / air dryers
    - lubricators

Number: 5

Title: **Applied Mechanical**

Duration: 33 Total Hours

Theory: 25 hours      Practical: 8 hours

Prerequisites: . Unit 1

Co-requisites: Unit 2, 3, 4

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**5.1 - Personal Computer Skills**

6 Total Hours      Theory: 4 hours      Practical: 2 hours

**5.2- Electrical Fundamentals**

9 Total Hours      Theory: 6 hours      Practical: 3 hours

**5.3 - Battery Fundamentals**

3 Total Hours      Theory: 3 hours      Practical: 0 hours

**5.4- Air Conditioning Awareness**

3 Total Hours      Theory: 3 hours      Practical: 0 hours

**5.5- Tires and Rims**

6 Total Hours      Theory: 3 hours      Practical: 3 hours

**5.6- Circuit Repair and Protection Devices**

6 Total Hours      Theory: 4 hours      Practical: 2 hours

## **5.1 - Personal Computer Skills**

### Cross-Reference to Learning Outcomes:

6058.01, 6058.02, 6058.03

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

### General Learning Outcome:

To demonstrate a working knowledge of the fundamentals and use of a personal computer (PC).

### Learning Outcomes:

Upon successful completion, the apprentice is able to:

5.1.1 Define the purpose, functions and applications of the computer operating systems.

5.1.2 Perform the following computer functions.

Learning Content:

5.1.1 Define the purpose, functions and applications of the computer operating systems.

- [4/0]
- introduction to the computer
    - components
    - device names and designations
    - hard / floppy disk data retention
    - CD- ROM
    - DVD
  - operating systems
    - DOS
    - Windows
    - pc/mac
  - software management
    - format
    - directory
    - file naming
    - copy
    - delete
    - rename

5.1.2 Perform the following computer functions.

- [0/2] -
- accessing menu structures
  - naming / saving files / folders
  - copy / move
  - file / browse
  - search / replace
  - access resources
    - drives including CD
    - internet, intranets
    - print resource sheet

## 5.2 - Electrical Fundamentals

### Cross-Reference to Learning Outcomes:

6052.01, 6052.02, 6052.03, 6052.04

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

### General Learning Outcome:

To demonstrate a working knowledge of the fundamentals of electricity and electrical test equipment.

### Learning Outcomes:

Upon successful completion, the apprentice is able to:

- 5.2.1 Define the fundamentals of electricity.
- 5.2.2 Define the purpose and fundamentals of electrical test equipment.
- 5.2.3 Perform test procedures using various pieces of test equipment following manufacturers' recommendations.

Learning Content:

5.2.1 Define the fundamentals of electricity.

- [3/0]            current / voltage / resistance  
                   conductors  
                   series circuits  
                   parallel circuits  
                   series / parallel circuits  
                   open circuits  
                   closed circuits  
                   short circuits
- dead short
  - intermittent short
  - cross circuit short
  - high resistance short

5.2.2 Define the purpose and fundamentals of electrical test equipment. [310]

- electrical meters (analog and digital)  
                   high and low impedance multi-meters  
                   ammeter / voltmeter / ohmmeter  
                   continuity tester  
                   current probe  
                   induction pickup  
                   test light / test light (self powered)

5.2.3 Perform test procedures using various pieces of test equipment following manufacturers' recommendations.

- [0/3]            voltage / amperage / resistance  
                   voltage drop  
                   parasitic load  
                   open circuits  
                   closed circuits  
                   short circuits
- dead short
  - intermittent short
  - cross circuit short
  - high resistance short

### **5.3 - Battery Fundamentals**

Cross-Reference to Learning Outcomes:

6051.01, 6051.02, 6051.03, 6051.04

Duration:      3 Total Hours              Theory: 3 hours              Practical: 0 hours

General Learning Outcome:

To demonstrate a working knowledge of the fundamentals, construction, inspection and testing of a battery.

Learning Outcomes:

Upon successful completion the apprentice is able to:

- 5.3.1 Describe the purpose and fundamentals of a battery.
- 5.3.2 Describe the construction, types and principles of operation of batteries.
- 5.3.3 Perform inspection and testing procedure following manufacturers recommendations.

Learning Content:

5.3.1 Describe the purpose and fundamentals of a battery.

[1/0] - installation and removal  
connecting and disconnecting  
types of terminals  
jump starting  
leaks

5.3.2 Describe the construction, types and principles of operation of batteries.

[1/0] - lead acid  
maintenance free  
gelled cell

5.3.3 Perform inspection and testing procedure following manufacturers recommendations.

[1/0] - visual inspection  
state of charge  
surface charge  
hot cranking amps (HCA) cold  
cranking amps (CCA) cranking  
amps (CA)  
amp-hour rating (AH)  
reserve capacity (RC)  
specific gravity  
temperature effects  
maintenance  
state of charge  
activation  
charging procedures  
cleaning per cautions slow  
charge / fast charge

#### **5.4 - Air Conditioning Awareness**

Cross-Reference to Learning Outcomes:

6053.01, 6051.02, 6051.03, 6051.04

Duration:      3 Total Hours              Theory: 3 hours              Practical: 0 hours

General Learning Outcome:

To demonstrate a working knowledge of health and safety issues, component identification and operating principles of mobile air conditioning systems.

Learning Outcomes:

Upon successful completion, the apprentice is able to:

- 5.4.1 Identify the health and safety issues concerning the handling of ozone depleting substances.
- 5.4.2 Identify the major components and operating principles used in mobile air conditioning systems.

Learning Content:

5.4.1 Identify the health and safety issues concerning the handling of ozone depleting substances.

- [1/0] identify personal safety equipment used when handling CFC/HFC/HCFC
- eye, hand and face protection
  - identify dangers related to the handling of CFC/HFC/HCFC
  - toxicity
  - flammability
  - handling precautions
  - Inhalation
  - skin and eye contact
  - cylinder temperature / pressures

5.4.2 Identify the major components and operating principles used in mobile air conditioning systems.

- [2/0] identify major components of automotive air conditioning systems
- condenser
  - receiver dehydration
  - accumulator-dryer
  - evaporator
  - compressor
  - hoses, lines and fittings
- outline major components of air conditioning control systems
- low and high-pressure cutout
  - low charge protection
  - evaporator temperature control
  - cycling clutch control
  - orifice tubes
  - expansion valves
- fan controls

## 5.5 - Tires and Rims

### Cross-Reference to Learning Outcomes:

6055.01, 6055.02, 6055.03, 6055.04

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

### General Learning Outcome:

To demonstrate a working knowledge of the fundamentals, construction and application of tires and rims.

### Learning Outcomes:

Upon successful completion, the apprentice is able to:

- 5.5.1 Define the fundamentals of tires and rims.
- 5.5.2 Identify the construction, types, styles and application of tires and rims.
- 5.5.3 Perform inspection, testing and diagnosis of tire and rim assemblies with the prescribed tools and equipment
- 5.5.4 Perform assigned operations on tires and rims.

Learning Content:

5.5.1 Define the fundamentals of tires and rims.

- [1/0] fastener torque  
effects of water (hydra planning)  
sliding and rolling friction  
tire sizes, load ratings  
static and dynamic balance

5.5.2 Identify the construction, types, styles and application of tires and rims.

- [2/0] tire materials  
tire tread designs  
tire construction
- bias ply
  - belted bias ply
- radial ply  
run flat tires

5.5.3 Perform inspection, testing and diagnosis of tire and rim assemblies with the prescribed tools and equipment.

- [0/1] tire and rim safety inspection  
identifying and measure radial and lateral wheel and  
tire run out  
identifying factors that affect tire wear  
identifying factors that cause cord separation

5.5.4 Perform assigned operations on tires and rims.

- [0/2] observe static and dynamic balance of wheel assemblies
- mechanical
  - computer-assisted
- observe recommended wheel assembly removal and  
installation procedures

## 5.6 - Circuit Repair And Protection Devices

### Cross-Reference to Learning Outcomes:

6051.01, 6051.02, 6051.03, 6051.04

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

### General Learning Outcome:

To demonstrate a working knowledge of the purpose, construction, principles of operation of circuit protection devices and their inspection and testing.

### Learning Outcomes:

Upon successful completion, the apprentice is able to:

- 5.6.1 Define the purpose and fundamentals of circuit repair and protection devices.
- 5.6.2 Describe the construction, types and application of circuit repair and protection devices.
- 5.6.3 Explain the principles of operation of circuit protection devices.
- 5.6.4 Perform inspection and testing procedures on circuit repair and protection devices with the prescribed service tools and equipment following manufacturers' recommendations.

Learning Content:

5.6.1 Define the purpose and fundamentals of circuit repair and protection devices.

[1/0] opens  
 shorts  
 grounds  
 unintentional grounds  
 high resistance connections  
 safety when repairing electrical circuits

5.6.2 Describe the construction, types and application of circuit repair and protection devices.

[2/0] wiring and terminals

- wire size
- identification
- composition - copper / aluminum
- terminal connectors
- soldering

circuit protection devices

- fuses
- circuit breakers
- fusible links

5.6.3 Explain the principles of operation of circuit protection devices. [1/0]

circuit protection devices  
 fuses  
 circuit breakers  
 fusible links

5.6.4 Perform inspection and testing procedures on circuit repair and protection devices with the prescribed service tools and equipment following manufacturers' recommendations.

- [0/2]
- wiring and connectors
    - wire size twisted
    - pair shielded
  - temperature effects
  - weather proofing
  - circuit protection
    - fuses
    - circuit breakers
    - fusible links
  - wiring repair- copper / aluminum
    - cleaning
    - splicing
    - crimping
    - soldering
    - corrosion protection
    - weather proofing
  - circuit analysis to identify
    - shorts
    - opens
    - grounds
    - unintentional grounds
    - high resistance
  - dynamic circuit testing and voltage drops

Evaluation Structure:

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

Reference Material:

**Complete Automotive Painting**

By Robert Scharff and Richard J. Paquette.

Published by Delmar Publishers Inc.

ISBN# 0-8273-3582-2

**1-Car Professional Automotive**

Collision Repair 2<sup>nd</sup> Edition

By James E. Duffy

Published by Delmar Publishers Inc.

ISBN# 0-7608-1398-3

**Motor Auto Body Repair, 3<sup>rd</sup> Edition** By

Robert Scharff and James E. Duffy Published

by Delmar Publishers Inc.

ISBN # 0-8273-6858-5

**The Principles of Auto Body Repairing and Repainting, 5<sup>th</sup> Edition**

By A.G. Deroche

Published by Prentice Hall

ISBN 0-13-678053-9

Summary of Total Program In-School Training Hours

Reportable Subjects	Total	Theory	Practical
1. Welding	33	13	20
2. Refinishing	33	16	17
3. Plastic Repair	30	21	9
4. Body and Structure	54	40	14
5. Non-Structural Repairs	57	21	36
6. Applied Mechanical	33	25	8
Total	240	135	105

Number: 1

Title: **Welding**

Duration: 33 Total Hours

Theory: 13 hours      Practical: 20 hours

Prerequisites: Level1

Co-requisites: Unit 2,3,4, 5 and 6

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**1.1 - Shielded Metal Arc Welding (SMAW)**

6 Total Hours      Theory: 4 hours      Practical: 2 hours

**1.2- Gas Metal Arc Welding (GMAW)**

21 Total Hours      Theory: 5 hours      Practical: 16 hours

**1.3 - Resistance Spot Welding (RSW) Compression**

6 Total Hours      Theory: 4 hours      Practical: 2 hours

### **1.1- Shielded Metal Arc Welding (SMAW)**

Cross-Reference to Learning Outcomes:

6047.01, 6047.02, 6047.03, 6047.04

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

General Learning Outcome:

To demonstrate a working knowledge of performing Shielded Metal Arc Welding (SMAW), including use and maintenance of equipment.

Learning Outcomes:

Upon successful completion, the apprentice is able to:

- 1.1.1 Define the purpose and fundamentals of the Shielded Metal Arc Welding (SMAW) process.
- 1.1.2 Describe the functions, construction and applications of Shielded Metal Arc Welding (SMAW) equipment and consumables.
- 1.1.3 Perform Shielded Metal Arc Welding (SMAW) procedures with A.C. and D.C. welding equipment.
- 1.1.4 Describe manufacturers' maintenance procedures for Shielded Metal Arc Welding (SMAW) equipment.

Learning Content:

1.1.1 Define the purpose and fundamentals of the Shielded Metal Arc Welding (SMAW) process.

[1/0]            arc emissions electrical  
                     polarity electrical  
                     fundamentals

1.1.2 Describe the functions, construction and applications of Shielded Metal Arc Welding (SMAW) equipment and consumables.

[1/0]            transformers  
                     rectifiers  
                     controls  
                     electrode holders  
                     electrode specification

- codes
- current type and polarity
- position
- penetration
- base metal material
- material condition

1.1.3 Perform Shielded Metal Arc Welding (SMAW) procedures with A.C. and D.C. welding equipment.

[1/2]            machine adjustments  
                     single and multiple pass butt and fillet welds in flat position show  
                     examples of defective welds  
                     trial beads

1.1.4 Describe manufacturers' maintenance procedures for Shielded Metal Arc Welding (SMAW) equipment.

[1/0] -            identify, inspect, service and explain the requirements of the  
                     electrode cables, holding devices, power sources and protective  
                     equipment  
                     welding cables holding  
                     devices power sources  
                     protective equipment

## **1.2- Gas Metal Arc Welding (GMAW)**

### Cross-Reference to Learning Outcomes:

6045.01, 6045,02, 6045,03, 6045.04, 6045, 05

Duration: 21 Total Hours Theory: 5 hours Practical: 16 hours

### General Learning Outcome:

To demonstrate a working knowledge of performing Gas Metal Arc Welding (GMAW), including use and maintenance of equipment. Also diagnose welds for defects to maintain manufacturers' structural requirements.

### Learning Outcomes:

Upon successful completion, the apprentice is able to:

- 1.2.1 Describe and perform Gas Metal Arc Welding (GMAW) on various types of gauges of metal.
- 1.2.2 Describe and diagnose Gas Metal Arc Welding (GMAW) welds for defects to maintain manufacturers' structural requirements.
- 1.2.3 Describe and diagnose Gas Metal Arc Welding (GMAW) welds for defects to maintain manufacturers' structural requirements.

Learning Content:

1.2.1 Explain the principles of operation of Gas Metal Arc Welding (GMAW) equipment and procedures.

- [3/0] - equipment settings and trial beads arc initiation  
 short circuit and spray methods  
 gun angle and travel speeds wire drive speeds  
 gas flow rate electrode protrusion  
 power source characteristics

1.2.2 Perform Gas Metal Arc Welding (GMAW) on various types of gauges of metal.

- [0/13] - set up mig welder  
 make adjustments
- gas flow
  - amperage / wire feed
  - voltage
- perform test weld  
 prepare weld zone  
 tack weld joint  
 weld joints
- butt
  - lap
  - tee
- weld joints in positions
- flat / horizontal / vertical / overhead
- weld joints in different positions using
- thin gauge mild steel
  - high-strength steel
  - galvanized
- weld joints using various techniques
- continuous
  - plug
  - stitch
  - spot
  - lap spot
  - tack

1.2.3 Describe and diagnose Gas Metal Arc Welding (GMAW) welds for defects to maintain manufacturers' structural requirements.

- [2/3] - visual inspection for
- porosity
  - cracks
  - excessive spatter
  - undercut
  - overlap
  - penetration
- destructive testing
- shear testing
  - peel testing (hammer / chisel)

### **1.3 - Resistance Spot Welding (RSW) Compression**

Cross-Reference to Learning Outcomes:

6046.01

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

General Learning Outcome:

To demonstrate a working knowledge of performing Resistance Spot Welding (RSW), including use and maintenance of equipment. Also diagnose welds for defects to maintain manufacturers' structural requirements

Learning Outcomes:

Upon successful completion, the apprentice is able to:

- 1.3.1 Describe the function, construction and types of Resistance Spot Welding (RSW) equipment and components.
- 1.3.2 Explain the principles of operation of Resistance Spot Welding (RSW) equipment.
- 1.3.3 Demonstrate and perform Resistance Spot Welding (RSW) procedures.
- 1.3.4 Diagnose Squeeze Type Resistant Spot Welding (STRSW) welds for defects to maintain manufacturers' structural requirements.

Learning Content:

1.3.1 Describe the function, construction and types of Resistance Spot Welding (RSW) equipment and components.

- [2/0] - equipment
- transformer
  - pressure handle adjustment
  - current flow adjustment
  - arms, design and styles
  - tips, diameter and styles
- compression spot welding
- metal preparation
  - joint
  - tip pressure
  - current flow and temperature
  - apply time

1.3.2 Explain the principles of operation of Resistance Spot Welding (RSW) equipment

- [2/0] - clearance between welding surfaces  
surface to be welded  
anti-corrosion agents  
application of equipment  
number of welds  
weld pitch position  
of welds

1.3.3 Demonstrate and perform Resistance Spot Welding (RSW) procedures.

- [0/1] - perform adjustments  
current flow  
time  
pressure

1.3.4 Diagnose Resistant Spot Welding (RSW) welds for defects to maintain manufacturers' structural requirements.

[0/1] - appearance testing  
spot position number  
of spots pitch  
dents  
pinholes  
spatter  
destructive testing  
non-destructive testing

Number: 2

Title: **Refinishing**

Duration: 39 Total Hours

Theory: 19 hours      Practical: 20 hours

Prerequisites: Level 1

Co-requisites: Unit 1, 3, 4, 5, and 6

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**2.1 - Plastic Refinish**

15 Total Hours      Theory: 7 hours      Practical: 8 hours

**2.2 - Top Coat Application- Complete**

18 Total Hours      Theory: 9 hours      Practical: 8 hours

**2.3 - Vehicle Detailing**

6 Total Hours      Theory: 3 hours      Practical: 3 hours

## 2.1 - Plastic Refinish

### Cross-Reference to Learning Outcomes:

6051.01, 6051.02, 6051.03, 6051.04

Duration: 15 Total Hours      Theory: 7 hours      Practical: 8 hours

### General Learning Outcome:

To demonstrate a working knowledge of performing spot and complete refinishing for rigid and flexible plastics.

### Learning Outcomes:

Upon successful completion, the apprentice is able to:

- 2.1.1 Define the purpose and fundamentals of refinishing automotive plastics.
- 2.1.2 Explain the repair procedures for spot and complete panel refinishing on rigid and flexible automotive plastics.
- 2.1.3 Perform automotive plastic refinish procedures.
- 2.1.4 Perform manufacturers' refinishing procedures for rigid and flexible plastics.
- 2.1.5 Demonstrate and perform manufacturers' refinishing procedures for interior parts.

Learning Content:

2.1.1 Define the purpose and fundamentals of refinishing automotive plastics.

- [3/0]
- plastic usage and identification
    - thermoset
    - thermoplastic
    - fiberglass
    - SMC (sheet moulded compound)
    - R.R.I.M. (Reinforced Reaction Injection Moulding)
  - plastics' reaction to solvents and heat
    - absorption
    - softening
    - destruction
  - primer and paint compatibility
  - specialty products and effects
    - primers
    - flex agents
    - adhesion promoter
    - matt agents
    - iexiuring agents
  - identifying types
    - manufacturers' guides
    - heat
    - solvents
    - density

2.1.2 Explain the repair procedures for spot and complete panel refinishing on rigid and flexible automotive plastics.

- [3/0]
- minor repairs
    - feathering
    - fillers
    - sanding procedures
    - adhesion promoters
    - flex agents
    - primers
  - complete panel refinishing
  - spot or partial panel refinishing
  - drying times

2.1.3 Perform automotive plastic refinish procedures.

- [0/2]            identify personal protection equipment  
                  minor repairs of scratches and gouges  
                  cleaning  
                  block sanding  
                  adhesion promoters  
                  primer  
                  refinish  
                  flex additives

2.1.4 Perform manufacturers' refinishing procedures for rigid and flexible plastics.

- [0/4]            pre-clean and tack  
                  spraying  
                  flexible finish (Elastomeric)  
                  control drying time  
                  clean up equipment

2.1.5 Demonstrate and perform manufacturers' refinishing procedures for interior parts.

- [1/2] -            identification
- part / substrate
  - colour
  - gloss levels

## **2.2- Top Coat Application- Complete**

### Cross-Reference to Learning Outcomes:

6057.01. 6057.02. 6057.03. 6057.04

Duration: 18 Total Hours Theory: 9 hours Practical: 9 hours

### General Learning Outcome:

To demonstrate a working knowledge of performing complete vehicle refinishing and final inspection.

### Learning Outcomes:

Upon successful completion, the apprentice is able to:

- 2.2.1 Define the introductory information and fundamentals of spraying techniques.
- 2.2.2 Explain the preparation procedures for complete vehicle refinish of various topcoats.
- 2.2.3 Describe and perform manufacturers' refinish procedures for complete vehicle refinishing.
- 2.2.4 Inspect the vehicle finish for coverage.

Learning Content:

2.2.1 Define the introductory information and fundamentals of spraying techniques.

- [3/0] -       gun adjustments  
                  gun motion  
                  routing (spray plan)
- single-stage
  - multi-stage

2.2.2 Explain the preparation procedures for complete vehicle refinish of various topcoats.

- [3/0] -       cleaning sanding  
                  masking  
                  undercoat application
- wiping
  - spraying
- flash times  
                  coats of application

2.2.3 Describe and perform manufacturers' refinish procedures for complete vehicle refinishing.

- [3/8] -       blow off  
                  preclean and tack vehicle  
                  prepare spray booth  
                  mask vehicle  
                  prepare paint  
                  spray test equipment  
                  control drying time  
                  clean up equipment

2.2.4 Inspect the vehicle finish for coverage.

- [0/1] -       insufficient film thickness  
                  transparent colours  
                  bleeding through

### **2.3 - Vehicle Detailing**

Cross-Reference to Learning Outcomes:

6041.01, 6041.02, 6041.03, 6041.04

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

General Learning Outcome:

To demonstrate a working knowledge of interior and exterior vehicle detailing.

Learning Outcomes:

Upon successful completion, the apprentice is able to:

- 2.3.1 Define the purpose and fundamentals of vehicle detailing.
- 2.3.2 Explain the procedures for removal of common contaminants from interiors and exteriors.
- 2.3.3 Identify various types of contaminants on and in vehicles.
- 2.3.4 Perform detailing procedures on both the interior and exterior.

Learning Content:

2.3.1 Define the purpose and fundamentals of vehicle detailing.

- [1/0] - identify cleaning procedures for the following conditions:
- light scratches
  - dirt in paint
  - water stains
  - tar
  - road film
  - stains on interior (gum, blood, urine, grease)
  - stains on exterior (tar, road film)
  - vinyl top maintenance
  - soiled carpet
  - paint over spray

2.3.2 Explain the procedures for removal of common contaminants from interiors and exteriors.

- [1/0] - washing compounding
- mil thickness / precautions
  - investigation / verification
- polishing  
wiping with solvents  
waxing  
vacuuming  
shampooing  
treating

2.3.3 Identify various types of contaminants on and in vehicles.

- [1/0] - using test unit, wash exterior with soap and water  
locate and record all contaminants on interior and exterior

2.3.4 Perform detailing procedures on both the interior and exterior.

[0/3]            remove grease or tar with solvent  
                  wash with soap and water  
                  chamois  
                  compound light scratches and over spray  
                  polish as required (to remove road film)  
                  clean glass  
                  vacuum interior  
                  wipe down interior  
                  final inspection

Number: 3

Title: **Plastic Repair**

Duration: 30 Total Hours

Theory: 21 hours      Practical: 9 hours

Prerequisites: Level 1

Co-requisites: Unit 1, 2, 4, 5, and 6

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**3.1 - Non-Reinforced Plastics**

12 Total Hours      Theory: 8 hours      Practical: 4 hours

**3.2- Reinforced Plastic**

9 Total Hours      Theory: 6 hours      Practical: 3 hours

**3.3- Plastic Welding**

9 Total Hours      Theory: 7 hours      Practical: 2 hours

### **3.1 - Non-reinforced Plastics**

Cross-Reference to Learning Outcomes:

6051.01, 6051.02, 6051.03, 6051.04

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

#### General Learning Outcome:

To demonstrate a working knowledge of repairing non-reinforced plastics.

#### Learning Outcomes:

Upon successful completion, the apprentice is able to:

- 3.1.1 Define the purpose and fundamentals of non-reinforced plastic.
- 3.1.2 Explain the repair procedures for non-reinforced plastics.
- 3.1.3 Demonstrate and perform recommended manufacturers' repair procedures for plastic components.

Learning Content:

3.1.1 Define the purpose and fundamentals of non-reinforced plastic.

- [3/0]            purpose, types and application of:
- plastics
    - thermoset, thermoplastic
    - identification
  - possible toxic effects
- usage and location  
repair material  
two part epoxy and adhesives

3.1.2 Explain the repair procedures for non-reinforced plastics.

- [3/0] -            gouges and scratches
- tears
  - punctures
  - complete panel replacement
  - partial panel replacement

3.1.3 Demonstrate and perform recommended manufacturers' repair procedures for plastic components.

- [2/4]            identification of type for repair process
- removal of panel if necessary
  - precleaning and removal of parting agent featheredging,
  - sanding and beveling damaged areas
  - reinforcing inside as needed
  - application of repair material
  - sanding repair material

### **3.2- Reinforced Plastic**

Cross-Reference to Learning Outcomes:

6051.01, 6051.02, 6051.03, 6051.04

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

General Learning Outcome:

To demonstrate a working knowledge of repairing reinforced plastics.

Learning Outcomes:

Upon successful completion, the apprentice is able to:

- 3.2.1 Define the purpose and fundamentals of reinforced plastics.
- 3.2.2 Explain the repair procedures for reinforced rigid plastics.
- 3.2.3 Demonstrate and perform manufacturers' recommended repair procedures for reinforced rigid plastic panels.

Learning Content:

3.2.1 Define the purpose and fundamentals of reinforced plastics.

- [2/0] - S.M.C. (sheet moulded compound)  
 R.R.I.M. (reinforced reaction injected moulded)  
 resins
- epoxy
  - polyester
  - catalyst
  - fibreglass
  - cloth
  - matting
  - chopped
  - ground
  - screening

3.2.2 Explain the repair procedures for reinforced rigid plastics.

- [3/0] - direct damage  
 indirect damage  
 stress cracking  
 bonding strip  
 conventional  
 bonding factory seams

3.2.3 Demonstrate and perform manufacturers' recommended repair procedures for reinforced rigid plastic panels.

- [1/3] - repair of cracks or gouges by:
- precleaning panel
  - grinding and feather damage
  - mixing epoxy materials
  - applying epoxy materials
  - sanding epoxy materials
  - priming and painting panel

### **3.3 - Plastic Welding**

#### Cross-Reference to Learning Outcomes:

6051.01, 6051.02, 6051.03, 6051.04

Duration: 9 Total Hours          Theory: 7 hours          Practical: 2 hours

#### General Learning Outcome:

To demonstrate a working knowledge of plastic repair by performing welding.

#### Learning Outcomes:

Upon successful completion, the apprentice is able to:

- 3.3.1 Define the purpose and fundamentals of plastic welding.
- 3.3.2 Explain the construction of plastic welding system components.
- 3.3.3 Explain the principles of operation of the plastic welding system processes.
- 3.3.4 Explain the repair procedures for welding plastic vehicle components.
- 3.3.5 Demonstrate and perform the recommended procedures for plastic welding of vehicle components.

Learning Content:

3.3.1 Define the purpose and fundamentals of plastic welding. [2/0]

- types of plastics
  - thermoplastics
  - thermosetting plastics
- methods used to verify the type of plastics used
  - manufacturer ID locations
  - sanding / grinding test

3.3.2 Explain the construction of plastic welding system components.

- [1/0] -
- hot air welding
    - electronically heated torches
    - gas heated torches
  - airless welding
    - welding rods
    - temperature
  - gas and power control units
    - argon
    - nitrogen

3.3.3 Explain the principles of operation of the plastic welding system processes.

- [1/0] -
- hot air and airless welding process
    - welding rod materials
    - temperature control
    - pressure control
    - angle between rod and base material

3.3.4 Explain the repair procedures for welding plastic vehicle components.

- [2/0]
- material cleaning and preparation
  - weld joint types
  - gouge repairs tear
  - repairs puncture
  - repairs tack welds
  - clamping and holding

3.3.5 Demonstrate and perform the recommended procedures for plastic welding of vehicle components.

- [1 /2] - clean and prepare weld zone joint
  - tack joint pieces to be welded
  - perform weld
  - finish weld for inspection
  - test and inspect weld

Number: 4

Title: **Body and Structure**

Duration: 54 Total Hours

Theory: 40 hours      Practical: 14 hours

Prerequisites: Level 1

Co-requisites: Unit 1, 2, 3, 5, and 6

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**4.1- Corrosion Protection**

12 Total Hours      Theory: 10 hours      Practical: 2 hours

**4.2- Measuring System**

18 Total Hours      Theory: 14 hours      Practical: 4 hours

**4.3- Automotive Glass**

12 Total Hours      Theory: 7 hours      Practical: 5 hours

**4.4- Safety Devises**

12 Total Hours      Theory: 9 hours      Practical: 3 hours

#### **4.1 - Corrosion Protection**

Cross-Reference to Learning Outcomes:

6050.01, 6050.02, 6050.03, 6050.04, 6054.01, 6054.02, 6054.03, 6054.04

Duration: 12 Total Hours Theory: 10 hours Practical: 2 hours

General Learning Outcome:

To demonstrate a working knowledge of the protection for the modern vehicle against corrosion.

Learning Outcomes:

Upon successful completion, the apprentice is able to:

- 4.1.1 Define the main cause of corrosion.
- 4.1.2 Define the basic types of corrosion protection used on modern vehicles.
- 4.1.3 Define the environmental and atmospheric conditions that influence the rate of corrosion.
- 4.1.4 Define the different corrosion protection products used during repair procedures.
- 4.1.5 Define the applications and fundamentals of body sealers and corrosion protection materials.
- 4.1.6 Inspect body panels assemblies with the prescribed service tools and equipment.
- 4.1.7 Perform manufacturers' application procedures for body sealers and corrosion protection materials.

Learning Outcome:

4.1.1 Define the main cause of corrosion.

[2/0]            exposed metal  
                       moisture (electrolyte)  
                       oxygen acid rain  
                       industrial fallout  
                       corrosive materials (acids)  
                       collision repairs (welding etc.)  
                       moisture seepage  
                       drain holes  
                       insufficient protection  
                       welding damage

4.1.2 Define the basic types of corrosion protection used on modern vehicles.

[2/0]            plating  
                       • galvanizing  
                       • zinc coating  
                       paint  
                       anti-corrosion compounds  
                       • petroleum-based compounds  
                       • wax-base

4.1.3 Define the environmental and atmospheric conditions that influence the rate of corrosion.

[2/0]            moisture  
                       relative humidity  
                       temperature  
                       air pollution

4.1.4 Define the different corrosion protection products used during repair procedures.

[1/0]            protective  
                       coatings  
                       primers  
                       anti-corrosion compounds  
                       body sealers  
                       seam sealers  
                       weld-through primers  
                       anti-rust agents  
                       rust converters

4.1.5 Define the applications and fundamentals of body sealers and corrosion protection materials.

- [2/0]
- sealers
    - brushable
    - medium body
    - heavy body
  - corrosion protection materials
    - spraying
    - wiping
    - brushing

4.1.6 Inspect body panels assemblies with the prescribed service tools and equipment.

- [1/0]
- inspection and testing for:
    - corrosion damage

4.1.7 Perform manufacturers' application procedures for body sealers and corrosion protection materials.

- [0/2]
- application of body sealers and corrosion protection hoods
  - fenders
  - doors
  - rockers
  - quarters
  - pillars deck
  - lids floor
  - pans

## 4.2 - Measuring Systems

### Cross-Reference to Learning Outcomes:

6050.01, 6050.02, 6050.03, 6050.04, 6054.01, 6054.02, 6054.03, 6054.04,  
6058.01, 6058.02, 6058.03

Duration: 18 Total Hours Theory: 14 hours Practical: 4 hours

### General Learning Outcome:

To demonstrate a working knowledge of measuring frame and unibody requirements when performing structural repairs.

### Learning Outcomes:

Upon successful completion, the apprentice is able to:

- 4.2.1 Define the purpose and fundamentals of measuring terms and definitions.
- 4.2.2 Define the purpose and fundamentals of reference manuals and resources.
- 4.2.3 Explain the procedures for locating frame and structure repair specification information.
- 4.2.4 Demonstrate and perform equipment manufacturers' recommended procedures for measuring of frame and unibody vehicles.

Learning Content:

4.2.1 Define the purpose and fundamentals of measuring terms and definitions. [410]

terms

- datum
- centreline
- symmetrical
- asymmetrical
- measuring devices / systems

4.2.2 Define the purpose and fundamentals of reference manuals and resources.

[4/0]

resource materials

- interpret materials
  - distinguish between major and minor indexes
- consult equipment manufacturer manuals  
access software / resources

4.2.3 Explain the procedures for locating frame and structure repair specification information.

[4/0]

datum

centreline  
lower ball joint control arm measurements  
strut tower  
upper body  
referencing upper body to under body  
measuring system mounting locations  
repair tolerances

4.2.4 Demonstrate and perform equipment manufacturers' recommended procedures for measuring of frame and unibody vehicles.

[2/4]

set up vehicle

set up measuring system determine  
centreline and datum measure  
complete vehicle  
check for accuracy to blueprint  
dismantle equipment  
clean, lubricate and store equipment

### **4.3 - Automotive Glass**

Cross-Reference to Learning Outcomes:

6056.01, 6056.02, 6056.03, 6056.04

Duration:      12 Total Hours      Theory: 7 hours      Practical: 5 hours

General Learning Outcome:

To demonstrate a working knowledge of removal and replace of automotive glass.

Learning Outcomes:

Upon successful completion, the apprentice is able to:

- 4.3.1 Define the purpose and fundamentals of automotive glass.
- 4.3.2 Explain the removal, replacement and repair procedures for automotive glass.
- 4.3.3 Perform the removal and replacement of moveable glass with the prescribed service tools and equipment
- 4.3.4 Demonstrate the recommended removal and replacement procedures for stationary glass.
- 4.3.5 Perform the recommended testing procedures for automotive glass leaks.

Learning Content:

4.3.1 Define the purpose and fundamentals of automotive glass.

- [2/0]            glass
- laminated
  - temperea
  - encapsulated
  - flush mount
- sealant kit
- aahe1ves
  - butyl
  - gaskets

4.3.2 Explain the removal, replacement and repair procedures for automotive glass.

- [2/0]            removal tools procedures  
for:
- pinchweld preparation
  - urethane
  - butyl
  - encapsulated
  - rubber gasket
  - moveable glass / adjustments

4.3.3 Perform the removal and replacement of moveable glass with the prescribed service tools and equipment.

- [0/3]            removal of trim panel disconnection  
of regulator removal of glass  
replacement of glass  
adjustments

4.3.4 Demonstrate the recommended removal and replacement procedures for stationary glass.

[3/0]            remove trim  
                  protect interior and exterior surfaces  
                  remove glass / clean up  
                  test fit  
                  prepare aperture  
                  install sealant replace  
                  glass / trim test for  
                  leaks

4.3.5 Perform the recommended testing procedures for automotive glass leaks.

[0/2]            fit and operation  
                  wind noise and water leaks  
                  • chalk dust method  
                  • test drive and stethoscope method  
                  • hose on low pressure  
                  sonic leak

#### 4.4 - Safety Devices

##### Cross-Reference to Learning Outcomes:

6044.01, 6044.02, 6044.03, 6044.04, 6052.01, 6052.02, 6052.03, 6052.04,  
6055.01, 6055.05, 6055.06, 6055.07

Duration: 12 Total Hours Theory: 9 hours Practical: 3 hours

##### General Learning Outcome:

To demonstrate a working knowledge of identifying, inspecting and testing vehicle safety devices.

##### Learning Outcomes:

Upon successful completion, the apprentice is able to:

- 4.4.1 Describe and identify systems and components that require testing or inspection after collision repairs.
- 4.4.2 Demonstrate seat belt condition and operation checks.
- 4.4.3 Demonstrate brake pedal holding checks and vehicle fluid level inspection.
- 4.4.4 Identify supplemental restraint system (air bag) components and safety precautions for:
- 4.4.5 Explain the procedures for component testing and road testing.
- 4.4.6 Perform recommended manufacturers' procedures for testing safety-related systems and components.

Learning Content:

4.4.1 Describe and identify systems and components that require testing or inspection after collision repairs.

- [2/0]           brakes
- seat belts
  - unusual noises, e.g. Squeaks and rattles
  - head lamp focusing
  - head lamp aiming equipment setup and operation
  - vehicle lighting checks
  - S.I.R. - air bag activation
  - horns
  - indicator lamps
  - radio and clock set
  - set mirrors
  - tail lamps
  - battery connection
  - tire pressure
  - wheel lugs

4.4.2 Demonstrate seat belt condition and operation checks.

- [1/0]           seat belt condition and operation
- belt damage
  - retraction action
  - hold down bolts
  - action of belt couplers

4.4.3 Demonstrate brake pedal holding checks and vehicle fluid level inspection.

- [1/0]           static brake pedal holding ability
- engine off
  - apply pressure to pedal
  - hold for 30 seconds
  - pedal should stay firm
- bleeding brakes (manufactures recommendations and cautions)
- demonstration of vehicle fluid level inspection
- brake fluid
  - engine oil
  - transmission fluid
  - coolant
  - power steering
  - washer fluid

4.4.4 Identify supplemental restraint system (air bag) components and safety precautions for:

[1/1] SIR- air bag activation seat  
belts indicator  
lights

4.4.5 Explain the procedures for component testing and road testing.

[4/0] test driving to check

- brakes
- seat belts
- unusual noises, e.g. squeaks and rattles
- head lamp focusing
- S.I.R.- air bag activation
- horns
- indicator lamps
- radio and clock set
- set mirrors
- taillamps

4.4.6 Perform recommended manufacturers' procedures for testing safety-related systems and components.

[0/2] inspect

- seat belt
- head lamp focusing
- windshield wipers and washers
- tail lamps
- turn indicators
- S.I.R. - air bag activation
- brakes
- horn
- mirrors
- radio and clock reset

Number: 5

Title: **Non-Structural Repairs**

Duration: 57 Total Hours

Theory: 21 hours      Practical: 36 hours

Prerequisites: Level 1

Co-requisites: Unit 1, 2, 3, 4 and 6

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**5.1 - Non-Structural Panel Repair**

27 Total Hours      Theory: 9 hours      Practical: 18 hours

**5.2 - Non-Structural Panel Replacement Fundamentals**

12 Total Hours      Theory: 12 hours      Practical: 0 hours

**5.3 - Non-Structural Panel Replacement**

18 Total Hours      Theory: 0 hours      Practical: 18 hours

### **5.1 - Non-Structural Panel Repair**

#### Cross-Reference to Learning Outcomes:

6050.01, 6050.02, 605.03, 6050.04

Duration: 27 Total Hours      Theory: 9 hours      Practical: 18 hours

#### General Learning Outcome:

To demonstrate a working knowledge of non-structural panel repair using a logical repair sequence.

#### Learning Outcomes:

Upon successful completion, the apprentice is able to:

- 5.1.1 Describe the inspection to determine logical and sequential repair techniques and procedures.
- 5.1.2 Perform major body panel repairs using a logical repair plan.

Learning Content:

5.1.1 Describe the inspection to determine logical and sequential repair techniques and procedures.

- [9/0] -        remove necessary parts to determine damage  
                  identify damage patterns  
                  identify damage direction  
                  determine tools required  
                  determine metal techniques  
                  determine equipment needed  
                  identify corrosion protection used

5.1.2 Perform major body panel repairs using a logical repair plan.

- [0/18] -        rough out and align using:
- body jacks
  - hammer and dolly
  - pulling equipment
  - prying
  - welding
  - patching
  - shrinking
  - stretching

## **5.2- Non-Structural Panel Replacement Fundamentals**

### Cross-Reference to Learning Outcomes:

6050.01, 6050.02, 6050.03

Duration: 12 Total Hours      Theory: 12 hours      Practical: 0 hours

### General Learning Outcome:

To demonstrate a working knowledge of theory of non-structural panel replacement

### Learning Outcomes:

Upon successful completion, the apprentice is able to:

- 5.2.1 Define the purpose and fundamentals of non-structural panel removal replacement and alignment
- 5.2.2 Explain the removal, replacement and alignment procedures for non-structural body panels.

Learning Content:

5.2.1 Define the purpose and fundamentals of non-structural panel removal replacement and alignment.

- [6/0] - part identification for removal and alignment  
fastening methods and techniques
- mechanical
  - welded
  - adhesives
- component protection

5.2.2 Explain the removal, replacement and alignment procedures for non-structural body panels.

- [6/0] - remove necessary parts to expose damaged panel  
removal and storage of fasteners  
inspection of replacement panel  
installation of replacement panel  
alignment and adjustment techniques  
inspecting and testing

### **5.3 - Non-Structural Panel Replacement**

Cross-Reference to Learning Outcomes:

6050.03, 6050.04

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

General Learning Outcome:

To demonstrate a working knowledge of practice of non-structural panel replacement.

Learning Outcomes:

Upon successful completion, the apprentice is able to:

5.3.1 Perform non-structural body panel replacement.

Learning Content:

5.3.1 Perform non-structural body panel replacement.

- [0/18] -
  - remove any necessary sub-parts and / or trim
  - remove and store all fasteners
  - remove damaged panel
  - inspect replacement panel
  - prep as required for corrosion protection
  - corrosion protection
  - obtain proper hardware
  - install replacement panel
  - align and adjust as necessary
  - inspect and final fit
  - maintain manufacturers' integrity

Number: 6

Title: **Applied Mechanical**

Duration: 33 Total Hours

Theory: 25 hours      Practical: 8 hours

Prerequisites: Level1

Co-requisites: Units 1, 2, 3, 4, 5

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**6.1 - Heating, Ventilation and Cooling Systems**

9 Total Hours      Theory: 7 hours      Practical: 2 hours

**6.2 - Basic Electrical/ Vacuum Systems**

9 Total Hours      Theory: 6 hours      Practical: 3 hours

**6.3 - Vehicle Dash**

6 Total Hours      Theory: 5 hours      Practical: 1 hour

**6.4 - Fuel and Exhaust Systems**

9 Total Hours      Theory: 7 hours      Practical: 2 hours

## **6.1 - Heating, Ventilation and Cooling Systems**

### Cross-Reference to Learning Outcomes:

6053.01, 6053.02, 6053.03, 6053.04

Duration:      9 Total Hours              Theory: 7 hours              Practical: 2 hours

### General Learning Outcome:

To demonstrate a working knowledge of the principles of operation for heating, ventilation and cooling systems, to determine required testing and repair operations.

### Learning Outcomes:

Upon successful completion, the apprentice is able to:

- 6.1.1 Define the purpose and fundamentals of engine heating and ventilation and cooling systems.
- 6.1.2 Describe the construction features and application of engine heating, ventilation and cooling systems.
- 6.1.3 Explain the principles of operation of engine heating and cooling systems.
- 6.1.4 Inspection and testing of heating, ventilation and cooling systems and perform the assigned questions.
- 6.1.5 Recommend reconditioning or repairs following manufacturers' procedures and perform assigned operations.

Learning Content:

6.1.1 Define the purpose and fundamentals of engine heating and ventilation and cooling systems.

- [2/0] - fundamentals of coolant  
 means of heat transfer. including convection,  
 conduction and radiation  
 temperature effects on expansion and contraction heat  
 measurements  
 the effects of pressure on boiling points / ratio  
 anti-freeze characteristics  
 engine coolant circulation

6.1.2 Describe the construction features and application of engine heating, ventilation and cooling systems.

- [3/0] liquid-cooled systems
- thermostats
  - radiators and heater cores (pressurized sealed systems)
  - pressure caps (related pressure / temperature relationship)
  - water pumps
  - fans controls
    - electrical, viscous, mechanical
- shrouds and deflectors  
 heater cores  
 heater and ventilation controls
- vacuum operated
  - manual controls
  - air vent doors

6.1.3 Explain the principles of operation of engine heating and cooling systems.

- [2/0] - coolant circulation and heat transfer air  
 flow characteristics  
 heating and ventilation controls

6.1.4 Inspection and testing of heating, ventilation and cooling systems and perform the assigned questions.

- [0/1] perform demonstration of:
- visual inspection
  - freeze point testing
  - internal and external leakage testing
  - pressure tester
  - temperature control operation
  - testing coolant and air flow

6.1.5 Recommend reconditioning or repairs following manufacturers' procedures and perform assigned operations.

- [0/1] perform a demonstration of:
- heater and ventilation control operating functions

## **6.2 - Basic Electrical Vacuum Systems**

### Cross-Reference to Learning Outcomes:

6052.01, 6052.02, 6052.03, 6053.01, 6053.02, 6053.03, 6053.04

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

### General Learning Outcome:

To demonstrate a working knowledge of the operation of electrical / vacuum systems to determine required testing and repair operations.

### Learning Outcomes:

Upon successful completion, the apprentice is able to:

- 6.2.1 Describe the functions, construction features and operation of electrical and vacuum systems.
- 6.2.2 Explain the application and operation of analog and digital electrical test meters.
- 6.2.3 Inspection and testing of electrical and vacuum systems and perform assigned operations.

Learning Content:

6.2.1 Describe the functions, construction features and operation of electrical and vacuum systems.

- [4/0] - electrical test meters
- ammeters - tests electric flow
    - very low resistance
    - positive and negative polarity
    - connect with a load-in series
- voltmeters
- analog
  - digital high impedance
- ohmmeter
- application precautions
  - circuit continuity checks
- relays
- electromagnetic switch and mechanical action
- vacuum controlled system
- vacuum supply
  - vacuum motor
  - vacuum lines
  - vacuum switch

6.2.2 Explain the application and operation of analog and digital electrical test meters.

- [2/0] analog meters
- digital meters (high impedance meter)
- test lights (high impedance)
- perform a demonstration and performance of meter diagnostic procedures for:
- loose connections and leads
  - defective batteries
  - adjusting of meter gauge
  - polarity of leads
  - continuity of leads and clips
  - defective fuses, circuit breakers

6.2.3 Inspection and testing of electrical and vacuum systems and perform assigned operations.

[0/3]

perform a demonstration of:

- electrical systems tests
  - circuit voltage, amperage and resistance
  - motors
  - solenoids
  - relays
  - coils
  - lighting systems
- perform a demonstration of:
  - vacuum tests:
    - vacuum leak testing
    - vacuum motor operations and adjustments
    - vacuum control function tests

### **6.3- Vehicle Dash**

Cross-Reference to Learning Outcomes:

6043.01, 6043.02, 6043.03, 6043.04, 6057.01, 6057.02, 6057.03, 6057.04

Duration:      6 Total Hours              Theory: 5 hours              Practical: 1 hours

General Learning Outcome:

To demonstrate a working knowledge of vehicle dash operation and service procedures.

Learning Outcomes:

Upon successful completion, the apprentice is able to:

- 6.3.1    Define the introductory information and fundamentals of a vehicle dash.
  
- 6.3.2    Describe the manufacturers' service procedures for vehicle dash assemblies.

Learning Content:

6.3.1 Define the introductory information and fundamentals of a vehicle dash removal, replacement and repairs.

- [3/0]
- main types of vehicle dash units
    - one piece padded dashboards
    - multi-piece padded dash
  - electrical connectors and wire harness routing
  - repairs
    - vinyl scuffs and abrasions
    - vinyl cuts
    - vinyl bubbles
    - vinyl wrinkles
  - vinyl looseness
  - chemical adhesives / adhesion promoter
  - two-part adhesive
  - flexible part repair

6.3.2 Describe the manufacturers' service procedures for vehicle dash assemblies.

- [2/1] -
- demonstration and perform assign operations of recommended procedures for removal and replacement of:
    - dashboard panels
    - steering wheels and columns (collapsible)
    - wiring harness and instrument panel connection
    - protecting vehicle dash and trim from damage

## **6.4 - Fuel and Exhaust Systems**

### Cross-Reference to Learning Outcomes:

6040.01, 6040.02

Duration: 9 Total Hours                      Theory: 7 hours                      Practical: 2 hours

### General Learning Outcome:

To demonstrate a working knowledge of the fundamentals of operation and service procedures for fuel and exhaust systems.

### Learning Outcomes:

Upon successful completion, the apprentice is able to:

- 6.4.1 Define the introductory information and fundamentals fuel and exhaust systems.
- 6.4.2 Identify the basic construction features of fuel and exhaust system components.
- 6.4.3 Describe the recommended procedure to drain, remove, inspect and replace vehicle fuel tanks and related components.
- 6.4.4 Outline the safety requirements and precautions for vehicles equipped with alternate fuel systems.
- 6.4. Inspect and test fuel and exhaust systems and perform the assigned operations.

Learning Content:

6.4.1 Define the introductory information and fundamentals fuel and exhaust systems.

- [2/0] - fuel vapour control  
 rollover protection valves  
 tank and line fastening methods  
 exhaust clearances  
 residual line pressures for electric in-take fuel pumps  
 storage and handling procedures for volatile liquids thermal expansion and contraction  
 nature and transmission of sound

6.4.2 Identify the basic construction features of fuel and exhaust system components.

- [2/0] - gasoline fuel tanks
- baffles
  - materials
  - attachment methods
- lines
- materials
- safety devices
- vent control
  - rollover valves
- over full protection
- exhaust manifolds
- cast iron
  - steel alloy
  - dual and single
- exhaust pipes
- single wall
  - double resonators
- and mufflers
- baffles
  - inlet and outlet features
- catalytic converters
- heats shields
  - outer shell stainless materials
- operating temperatures

6.4.3 Describe the recommended procedure to drain, remove, inspect and replace vehicle fuel tanks and related components.

- [2/0]            Perform a demonstration of:  
                     the recommended procedure to utilize C.S.A  
                     approved fuel drainage and storage equipment  
                     the recommended steps to remove test and replace:
- fuel tanks
  - lines
  - safety devices

6.4.4 Outline the safety requirements and precautions for vehicles equipped with alternate fuel systems.

- [1/0] -            liquid petroleum gas (L.P.G.)
- recommended inside parking practices for vehicles  
                     with full tanks  
                     with partially empty tanks  
                     near welding area  
                     inside a paint or prep booth
- recommended procedures for:
- checking potential leaks
  - turning off valves

6.4.5 Inspect and test fuel and exhaust systems and perform the assigned operations.

- [0/2]            perform a demonstration of:
- visual inspection for leaks, dents, recommended  
                     clearances and support mechanisms
  - exhaust back pressure tests for restrictions
  - catalytic converter testing procedures

Evaluation Structure:

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

Reference Material:

**Complete Automotive Painting**

By Robert Scharff and Richard J. Paquette.

Published by Delmar Publishers Inc.

ISBN# 0-8273-3582-2

**I-Car Professional Automotive**

Collision Repair 2nd Edition

By James E. Duffy

Published by Delmar Publishers Inc.

ISBN# 0-7608-1398-3

**Motor Auto Body Repair, 3<sup>rd</sup> Edition**

By Robert Scharff and James E. Duffy

Published by Delmar Publishers Inc.

ISBN # 0-8273-6858-5

**The Principles of Auto Body Repairing and Repainting, 5<sup>th</sup> Edition**

By A.G. Deroche

Published by Prentice Hall

ISBN 0-13-678053-9

Summary of Total Program In-School Training Hours

<b>Reportable Subjects</b>	<b>Total</b>	<b>Theory</b>	<b>Practical</b>
1. Damage Analysis and Estimating	36	23	13
2. Body, Frame and Structure	60	28	32
3. Structural Panel Replacement	60	23	37
4. Alignment	18	12	6
5. Refinishing	33	16	17
6. Applied Mechanical	33	24	9
<b>Total</b>	<b>240</b>	<b>126</b>	<b>114</b>

Number: 1

**Title: Damage Analysis and Estimating**

Duration: 36 Total Hours

Theory: 23 hours      Practical: 13 hours

Prerequisites: Level 1, 2

Co-requisites: NA

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**1.1 - Damage Analysis**

12 Total Hours      Theory: 6 hours      Practical: 6 hours

**1.2- Damage Patterns**

12 Total Hours      Theory: 11 hours      Practical: 1 hour

**1.3- Damage Estimating**

15 Total Hours      Theory: 9 hours      Practical: 6 hours

## **1.1 - Damage Analysis**

### Cross-Reference to Learning Outcomes:

6054.01, 6064.02, 6058.01, 6059.02

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

### General Learning Outcome:

To demonstrate a working knowledge of vehicle damage analysis.

### Learning Outcomes:

Upon successful completion, the apprentice is able to:

- 1.1.1 Define the purpose and fundamentals of damage analysis.
- 1.1.2 Explain the procedures for diagnosing frame and unibody structures.
- 1.1.3 Analyze damaged unibody and framed vehicles.

Learning Content:

1.1.1 Define the purpose and fundamentals of damage analysis.

- [3/0] - vehicle inspection procedures
- detection of signs of damage
  - uses of diagnosing concepts
    - primary
    - seconaary
    - mechanical
    - interior
    - exterior trim

1.1.2 Explain the procedures for diagnosing frame and unibody structures.

- [3/0] - signs of damage
- pulled welds
  - split sealers
  - cracked paint
  - buckles
  - panel mis-alignment
- measuring concepts
- length
  - width
  - height
  - upper body
  - tolerances

1.1.3 Analyze damaged unibody and framed vehicles.

- [0/6] - visually analyze damage  
anchor vehicle  
set up measuring system  
determine extent of damage  
produce a repair plan

## **1.2 - Damage Patterns**

### Cross-Reference to Learning Outcomes:

6054.01, 6054.02, 6055.02, 6055.05, 6058.01, 6058.02

Duration: 12 Total Hours Theory: 11 hours Practical: 1 hours

### General Learning Outcome:

To demonstrate a working knowledge of determining vehicle damage patterns

### Learning Outcomes:

Upon successful completion, the apprentice is able to:

- 1.2.1 Define the purpose and fundamentals of damage patterns.
- 1.2.2 Explain the types of structural and frame damage.
- 1.2.3 Perform steering and suspension inspection to identify damage.

Learning Content:

1.2.1 Define the purpose and fundamentals of damage. patterns.

- [5/0] - direction of damaging forces  
primary (direct)  
secondary (indirect)  
related (inertia)

1.2.2 Explain the types of structural and frame damage.

- [5/0] - damage sequences
- side sway
  - sag
  - mash
  - diamond
  - twist

1.2.3 Perform steering and suspension inspection to identify damage.

- [0/2] - jounce / rebound check  
steering lock-to-lock  
strut rotation  
wheel position

### **1.3 - Damage Estimating**

#### Cross-Reference to Learning Outcomes:

6058.01, 6058.02, 6058.03

Duration: 15 Total Hours      Theory: 9 hours      Practical: 6 hours

#### General Learning Outcome:

To demonstrate a working knowledge of completing a vehicle damage estimating.

#### Learning Outcomes:

Upon successful completion, the apprentice is able to:

- 1.3.1 Define the purpose and fundamentals of vehicle damage estimating.
- 1.3.2 Identify and explain the use of estimating resources.
- 1.3.3 Identify and explain how to cost.
- 1.3.4 Complete accurate damage appraisal reports utilizing a range of damaged vehicles.

Learning Content:

1.3.1 Define the purpose and fundamentals of vehicle damage estimating.

- [3/0] - terms, definitions and concepts  
types of estimates  
purpose, application, information and general layout  
essential legal requirements of a repair order

1.3.2 Identify and explain the use of estimating resources.

- [2/0] - estimating guides  
manuals microfiche  
related software

1.3.3 Identify and explain how to cost.

- [1/0] - parts  
materials  
labour  
sublet items

1.3.4 Complete accurate damage appraisal reports utilizing a range of damaged vehicles.

- [0/6] - manual/ electronically  
light  
medium  
heavy

Number: 2

Title: **Body, Frame and Structure**

Duration: 60 Total Hours

Theory: 28 hours      Practical: 32 hours

Prerequisites: Level 1, 2 and Unit 1

Co-requisites: Unit 4, 5 and 6

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**2.1- Aluminium Repair**

18 Total Hours      Theory: 9 hours      Practical: 9 hours

**2.2 - Anchoring Systems**

15 Total Hours      Theory: 10 hours      Practical: 5 hours

**2.3 - Vehicle Structure and Frame Re-alignment**

27 Total Hours      Theory: 9 hours      Practical: 18 hours

## **2.1 - Aluminium Repair**

Cross-Reference to Learning Outcomes:

6045.03, 6045.04, 6045.05, 6050.01, 6050.02, 6050.03, 6050.04

Duration: 18 Total Hours Theory: 9 hours Practical: 9 hours

### General Learning Outcome:

To demonstrate a working knowledge of repairing aluminium components.

### Learning Outcomes:

Upon successful completion, the apprentice is able to:

- 2.1.1 Define the purpose and fundamentals of aluminium panel repair.
- 2.1.2 Explain the repair procedures for aluminium panels.
- 2.1.3 Demonstrate and perform recommended manufacturers' repair procedures to aluminium panels.
- 2.1.4 Explain the procedures for welding aluminium.
- 2.1.5 Demonstrate and perform welding procedure on aluminium panels to recommended industry standards.

Learning Content:

2.1.1 Define the purpose and fundamentals of aluminium panel repair.

[2/0] - manufacturer's usage  
various types  
identification

2.1.2 Explain the repair procedures for aluminium panels.

[4/0] - annealing process  
hammer and dolly  
shrinking  
stretching  
filling  
filing  
use of fillers  
grinding precautions temperature  
sensitive crayons

2.1.3 Demonstrate and perform recommended manufacturers' repair procedures to aluminium panels.

[0/6] - identification of material type  
precleaning of damaged area  
removal of necessary finish  
annealing metal  
hammering and dollying  
grinder  
application of filler material  
filling and / or sanding contour  
feather edging  
priming

2.1.4 Explain the procedures for welding aluminium.

[0/30] - identify welding equipment / processes for aluminium

- Gas Metal Arc Welding (GMAW)
- Gas Tungsten Arc Welding (GTAW)
- oxy-acetylene

set up welding equipment  
identify types of joints  
prepare joint and preheat  
use recommended techniques  
dressing joint techniques

2.1.5 Demonstrate and perform welding procedure on aluminium panels to recommended industry standards.

- [0/3] -      Gas Metal Arc Welding (GMAW)  
                 Gas Tungsten Arc Welding (GTAW)  
                 set up welder  
                 make adjustment  
                 perform test weld  
                 prepare weid joint
- lap joint
  - butt joint with insert
  - plug weld
- dress the joint  
                 destructive testing

## 2.2 - Anchoring Systems

### Cross-Reference to Learning Outcomes:

6054.02, 6054.03, 6054.04

Duration: 15 Total Hours      Theory: 10 hours      Practical: 5 hours

### General Learning Outcome:

To demonstrate a working knowledge of anchoring procedures for vehicle structural and frame repairs.

### Learning Outcomes:

Upon successful completion, the apprentice is able to:

- 2.2.1 Define the purpose and fundamentals of anchoring systems.
- 2.2.2 Explain the clamping and anchoring procedures for vehicle structures and frames.
- 2.2.3 Perform anchoring of vehicle structures and frames.

Learning Content:

2.2.1 Define the purpose and fundamentals of anchoring systems.

- [6/0] - types of anchoring systems
- dedicated
  - universal
  - portable
  - stationary
- purpose of anchoring  
anchoring locations
- manufacturers' recommendations
  - structures and frames

2.2.2 Explain the clamping and anchoring procedures for vehicle structures and frames.

- [4/0] - location of clamping and anchoring points  
removal components  
protection of components  
attachment and removal procedures  
corrosion protection replacement

2.2.3 Perform anchoring of vehicle structures and frames.

- [0/5] - inspect vehicle  
determine anchoring points  
remove and / or protect components  
anchor vehicle  
remove attachments  
replace corrosion protection

### **2.3 - Vehicle Structure and Frame Re-alignment**

Cross-Reference to Learning Outcomes:

None

Duration:      27 Total Hours              Theory: 9 hours              Practical: 18 hours

General Learning Outcome:

To demonstrate a working knowledge of vehicle structure and frame re- alignment.

Learning Outcomes:

Upon successful completion, the apprentice is able to:

- 2.1.1 Define the purpose and fundamentals of vehicle structure and frame re-alignment.
- 2.1.2 Explain the re-alignment procedures for structures and frames.
- 2.1.3 Perform structure and frame re-alignment.

Learning Content:

2.3.1 Define the purpose and fundamentals of vehicle structure and frame re-alignment.

- [3/0] - purpose, function and applications of alignment equipment
- portapowers
  - pumps / gauges
  - chains
  - clamps
  - safety cables

2.3.2 Explain the re-alignment procedures for structures and frames.

- [6/0] - types of pulls
- vector pulls
  - down pulls
  - up pulls
  - tower pulls
  - cowl pulls
  - pillar pulls
- pulling strategies
- angle of pull
  - forces applied
  - number of pulls
  - stress relieving
  - kink vs. bend

2.3.3 Perform structure and frame re-alignment.

- [0/18] - inspect equipment  
 attach pulling fixtures / clamps  
 install safety equipment engage  
 power equipment  
 realign by pulling and stress relieving to  
 manufacturers' specifications  
 remove and store equipment

Number: 3

Title: **Structural Panel Replacement**

Duration: 60 Total Hours

Theory: 23 hours      Practical: 37 hours

Prerequisites: Level 1, 2 Unit 1, 2

Co-requisites: Unit 4, 5 and 6

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**3.1 - Structural Panel Fundamentals**

9 Total Hours      Theory: 9 hours      Practical: 0 hours

**3.2 - Structural Panel Replacement**

21 Total Hours      Theory: 3 hours      Practical: 18 hours

**3.3 - Structural Panel Sectioning Fundamentals**

9 Total Hours      Theory: 9 hours      Practical: 0 hours

**3.4 - Structural Panel Sectioning**

21 Total Hours      Theory: 2 hours      Practical: 19 hours

### **3.1 - Structural Panel Fundamentals**

Cross-Reference to Learning Outcomes:

6050.01, 6050.02, 6050.03

Duration: 9 Total Hours      Theory: 9 hours      Practical: 0 hours

General Learning Outcome:

To demonstrate a working knowledge of theory associated with structural panel replacement.

Learning Outcomes:

Upon successful completion, the apprentice is able to:

- 3.1.1 Define the purpose and fundamentals of removal and replacement of structural panels.
- 3.1.2 Explain the repair procedures for the removal and replacement of structural panel.

Learning Content:

3.1.1 Define the purpose and fundamentals of removal and replacement of structural panels.

- [5/0] - purpose, function, styles and application of:
- apron assemblies
  - radiator supports
  - cross members
  - pillars
  - shock towers
  - rocker panels
  - floor pans
- replacement vs. repairability / liability  
maintaining vehicle structural integrity  
identify high strength steel (HSS)

3.1.2 Explain the repair procedures for the removal and replacement of structural panel.

- [4/0] - removal and replacement techniques
- spot weld location
  - spot weld removal
  - replacement panel preparation
  - seam and or weld joint preparation
  - weld through primer application
  - test fitting of replacement panels
  - welding procedures

### **3.2 - Structural Panel Replacement**

Cross-Reference to Learning Outcomes:

6046.04, 6046.05, 6050.01, 6050.03, 6050.04, 6054.03, 6054.04

Duration: 21 Total Hours Theory: 3 hours Practical: 18 hours

#### General Learning Outcome:

To demonstrate a working knowledge of the removal and replacement of structural panels.

#### Learning Outcomes:

Upon successful completion, the apprentice is able to:

- 3.2.1 Demonstrate and perform structural panel removal and replacement procedures using prescribed service tools and equipment.
- 3.2.2 Demonstrate and perform inspection and testing procedures on welds to maintain manufacturers' structural requirements.

Learning Content:

3.2.1 Demonstrate and perform structural panel removal and replacement procedures using prescribed service tools and equipment.

- [2/16] -       locate proper body seams  
                  locate spot welds  
                  spot weld removal  
                  replacement panel preparation  
                  seam and or weld joint preparation  
                  apply weld through primers  
                  test fit panel  
                  install panel
- spotweld
  - plug weld
  - compression weld
- maintain required fit and clearances

3.2.2 Demonstrate and perform inspection and testing procedures on welds to maintain manufacturers' structural requirements.

- [1 /2] -       final fit and alignment  
                  destructive testing  
                  non-destructive testing

### **3.3 - Structural Panel Sectioning Fundamentals**

Cross-Reference to Learning Outcomes:

6050.01, 6054.01

Duration: 9 Total Hours      Theory: 9 hours      Practical: 0 hours

General Learning Outcome:

To demonstrate a working knowledge of the theory associated with structural panel sectioning.

Learning Outcomes:

Upon successful completion, the apprentice is able to:

- 3.3.1 Define the purpose and fundamentals of structural sectioning.
- 3.3.2 Explain the procedures for structural sectioning.

Learning Content:

3.3.1 Define the purpose and fundamentals of structural sectioning. [5/0] -

maintaining manufacturers' structural strength

types of sectioning

reasons for sectioning

sectioning locations

types of joints

- lap joint
- offset butt joint
- butt joint with insert

caution areas

- existing body holes
- inner reinforcements
- double layers
- anchor points

suspension

seat belts

shoulder belts

3.3.2 Explain the procedures for structural sectioning.

[4/0] - a pillars

b pillars c

pillars

rocker panels

floor panels

truck floors

frame rails

- closed section
- open hat section

full body sections

- cowl cut front
- rear body clip
- complete side section

### **3.4 - Structural Panel Sectioning**

Cross-Reference to Learning Outcomes:

6046.01, 6046.02, 6046.03, 6046.04, 6050.01, 6050.02, 6050.03, 6050.04,  
6054.01, 6054.03, 6054.04

Duration:      21 Total Hours              Theory: 2 hours              Practical: 19 hours

General Learning Outcome:

To demonstrate a working knowledge of performing structural panel sectioning.

Learning Outcomes:

Upon successful completion, the apprentice is able to:

- 3.4.1 Demonstrate and perform sectioning repair using prescribed service tools and equipment.
- 3.4.2 Perform inspection and testing procedure on welds and joints to maintain manufacturers' structural requirements.

Learning Content:

3.4.1 Demonstrate and perform sectioning repair using prescribed service tools and equipment.

[2/16] -        setup simulated joint  
                  test the joint fit  
                  apply weld through primer  
                  align panel  
                  perform weld  
                  dress down weld  
                  nondestructive test  
                  destructive test  
                  evaluation

3.4.2 Perform inspection and testing procedure on welds and joints to maintain manufacturers' structural requirements.

[0/3] -        visually inspect vehicle for location of sectioning  
                  remove coatings where necessary determine  
                  type of sectioning  
                  develop logical repair sequence  
                  spot weld removal  
                  removal of damaged section  
                  prepare seams and joints  
                  prepare replacement section  
                  replace section

Number: 4

Title: **Alignment**

Duration: 18 Total Hours

Theory: 12 hours      Practical: 6 hours

Prerequisites: Level 1, 2 Unit 1 and 2

Co-requisites: Unit 3, 4, 5 and 6

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**4.1 - Alignment Fundamentals**

9 Total Hours      Theory: 9 hours      Practical: 0 hours

**4.2 - Alignment Adjustment and Service**

9 Total Hours      Theory: 3 hours      Practical: 6 hours

#### **4.1 - Alignment Fundamentals**

Cross-Reference to Learning Outcomes:

6055.01, 6055.02

Duration: 9 Total Hours      Theory: 9 hours      Practical: 0 hours

General Learning Outcome:

To demonstrate a working knowledge of alignment fundamentals.

Learning Outcomes:

Upon successful completion, the apprentice is able to:

- 4.1.1 Define the purpose and fundamentals of vehicle alignment.
- 4.1.2 Describe the construction, types, styles and application of vehicle suspension system alignment and adjustment points.
- 4.1.3 Define alignment angles and measurements
- 4.1.4 Explain the wheel alignment adjustments and calculations.

Learning Content:

4.1.1 Define the purpose and fundamentals of vehicle alignment.

- [2/0] - Ackerman's Principles
- parallelograms
  - center of gravity
  - mechanical advantage
  - decimals, fractions, negative fractions
  - metric
  - centrifugal force
  - vehicle thrust angles

4.1.2 Describe the construction, types, styles and application of vehicle suspension system alignment and adjustment points.

- [3/0] - types of alignment systems
- two-wheel geometric center line alignment
  - four-wheel thrust alignment
- eccentrics  
shims  
slots  
strut rods  
component identification

4.1.3 Define alignment angles and measurements

- [3/0] - caster  
camber  
toe-in / toe-out  
steering axis inclination  
turning radius  
trim height  
thrust line / tracking  
center line

4.1.4 Explain the wheel alignment adjustments and calculations.

- [1/0] - shim adjustments  
eccentric adjustments  
strut rod adjustments  
elongated holes (slots)

## **4.2 - Alignment Adjustment and Service**

### Cross-Reference to Learning Outcomes:

6055.01, 6055.03, 6055.04

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

### General Learning Outcome:

To demonstrate a working knowledge of perform vehicle alignments.

### Learning Outcomes:

Upon successful completion, the apprentice is able to:

- 4.2.1 Explain the principles of operation of vehicle alignment equipment.
- 4.2.2 Describe and perform inspection, testing and diagnostic procedures on suspension systems and alignment angles.
- 4.2.3 Describe and perform adjusting, following manufacturers' procedures, specifications and readings for two-wheel and four-wheel alignment.

Learning Content:

4.2.1 Explain the principles of operation of vehicle alignment equipment.

[1/0] - operating procedures of alignment equipment

4.2.2 Describe and perform inspection, testing and diagnostic procedures on suspension systems and alignment angles.

[1/3] - perform suspension component checks

- visual
- trim height
- angles

perform vehicle alignment checks

- observation of ride control devices

4.2.3 Describe and perform adjusting, following manufacturers' procedures, specifications and readings for two-wheel and four-wheel alignment.

[1/3] - describe vehicle alignment procedures

observe the:

- equipment set-up
- alignment readings
- specifications comparison
- adjustment changes

adjustment and correct vehicle alignment for:

- rear wheels, camber and toe settings
- front wheels, camber, caster, toe, steering axis inclination and turning angles
- chassis trim height
- thrust line to geometric centre line correction

identify the factors responsible for improper vehicle tracking and / or stability

Number: 5

Title: **Refinishing**

Duration: 33 Total Hours

Theory: 16 hours      Practical: 17 hours

Prerequisites: Level 1, 2 Unit 1 and 2

Co-requisites: Unit 2, 3, 4 and 6

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**5.1 - Colour Matching**

12 Total Hours                      Theory: 7 hours      Practical: 5 hours

**5.2- Top Coat Application, Spot and Panel Repair**

15 Total Hours                      Theory: 6 hours      Practical: 9 hours

**5.3 - Masking Material and Over-Spray Removal**

6 Total Hours                      Theory: 3 hours      Practical: 3 hours

## 5.1 - Colour Matching

### Cross-Reference to Learning Outcomes:

6057.01, 6057.02, 6057.03, 6057.04

Duration: 12 Total Hours Theory: 7 hours Practical: 5 hours

### General Learning Outcome:

To demonstrate a working knowledge of colour matching various vehicle finishes.

### Learning Outcomes:

Upon successful completion, the apprentice is able to:

- 5.1.1 Define the introductory information and fundamentals of colour matching, formulae, tinters, and reasons for colour mismatch.
- 5.1.2 Describe and perform the procedures for mixing and tinting paint.
- 5.1.3 Mix and adjusts paints to achieve a blendable finish with the prescribed service tools and equipment.
- 5.1.4 Describe and perform the paint manufacturers' procedures for testing colours through the use of spray out cards.

Learning Content:

5.1.1 Define the introductory information and fundamentals of colour matching, formulae, tinters, and reasons for colour mismatch.

- [3/0] -        how light produces colour  
                   light source
- metamerism
  - daylight, incandescent, fluorescent
- primary colours  
 various manufacturers' characteristics
- colour harmony
  - colour blindness
- Muncel colour theory
- Value, hue, chroma

5.1.2 Describe the procedures for mixing and tinting paint.

- [3/0] -        formulation of paint colours and mixing procedures
- ratings
    - standard O.E.M. colour
    - approximate
    - low hiding
    - tinters involved to achieve a colour
- variation of colour
- how to darken
  - how to lighten
- application variables
- gun distance
  - air pressure
  - gun setup
  - mixing equipment
  - solvent change
- kill colour cast  
 saturation  
 desaturation

5.1.3 Mix and adjusts paints to achieve a blendable finish with the prescribed service tools and equipment.

[0/3] - mix colour according to formula  
spray out test card / let down panel  
compare to standard  
spectra photometer  
evaluate colour adjust  
colour  
spray out test card  
compare to standard  
record adjustments

5.1.4 Describe and perform the paint manufacturers' procedures for testing colours through the use of spray out cards.

[1/2] - apply correct ground coat if necessary  
spray out test card  
clear test card  
compare card to standard  
adjust colour  
compare to standard  
vehicle spot or complete refinish

## 5.2 - Top Coat Application, Spot and Panel Repair

### Cross-Reference to Learning Outcomes:

7003.04, 7003.05, 7003.06, 7004.01, 7004.02, 7004.03

Duration: 15 Total Hours Theory: 6 hours Practical: 9 hours

### General Learning Outcome:

To demonstrate a working knowledge of vehicle top coat application involving spot repairs.

### Learning Outcomes:

Upon successful completion, the apprentice is able to:

- 5.2.1 Explain the procedures for blending spot repairs.
- 5.2.2 Describe procedure for necessary repairs.
- 5.2.3 Perform the product manufacturers' procedures for blending spot repairs.
- 5.2.4 Inspect an automotive finish to determine types of problems within the paint and recommend the correct repair procedures.

Learning Content:

5.2.1 Explain the procedures for blending spot repairs.

- [3/0] - sanding procedures and products wet or dry
  - hand or mechanical
  - primer application and types used for colour match
  - primer sanding
  - vehicle masking
  - blending techniques
  - spraying stages
  - flash and drying times
  - compounding

5.2.2 Describe procedure for necessary repairs.

- [3/0] - reapply the coat
  - sand out, resurface and top coat
  - remove surface material to primer
  - remove to bare metal
  - rub out with rubbing compound
  - ultra-fine sand papers
  - glazes
  - polishing

5.2.3 Perform the product manufacturers' procedures for blending spot repairs.

- [0/6] - mix paint
  - prepare unit for blending
  - cleaning
  - sanding
  - priming
  - masking
  - spraying
  - cleanup
  - detailing

5.2.4 Inspect an automotive finish to determine types of problems within the paint and recommend the correct repair procedures.

[0/3] - acid spotting  
blotches  
contour mapping  
dry spray  
feather edge splitting  
fish eyes  
lifting  
mottling  
pin holing  
rust under finish  
sand scratch swelling  
solvent popping  
wrinkles  
blistering  
blushing  
dirt  
low gloss  
filler bleed-through  
full finish  
microchecking  
orange peel  
runs, sags  
shrinking  
water spots  
final inspection  
film thickness  
coverage  
clear application  
solvent blends dry  
edge  
runs

### **5.3 - Masking Material and Over-Spray Removal**

Cross-Reference to Learning Outcomes:

7003.08, 7006.01, 7006.02, 7006.07

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

General Learning Outcome:

To demonstrate a working knowledge of the removal of masking material and overspray.

Learning Outcomes:

Upon successful completion, the apprentice is able to:

5.3.1 Describe the recommended methods of removing masking materials and over spray.

5.3.2 Final vehicle clean up.

Learning Content:

5.3.1 Describe the recommended methods of removing masking material and over spray.

[3/0] -       masking tape removal  
                  time  
                  temperature  
                  direction of pull  
                  liquid masking / wash off  
                  test over spray removal method  
                  solvents  
                  compounds  
                  fine steel wool  
                  clay

5.3.2 Final vehicle clean up.

[0/3] -       wash  
                  vacuum  
                  clean windows  
                  clean tires  
                  clean heating ducts  
                  reset clocks / radio  
                  check lights  
                  paint care instructions  
                  blackout wheel wells  
                  check over spray / residue on door trims  
                  wipe down interior  
                  clean wiper blades

Number: 6

Title: **Applied Mechanical**

Duration: 33 Total Hours

Theory: 24 hours      Practical: 9 hours

Prerequisites: Level 1, 2 Unit 1

Co-requisites: Unit 2, 3, 4, and 5

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**6.1- Computer Fundamentals**

6 Total Hours      Theory: 6 hours      Practical: 0 hours

**6.2- Electronic Fundamentals**

6 Total Hours      Theory: 4 hours      Practical: 2 hours

**6.3- Servicing Electrical and Electronic Systems**

9 Total Hours      Theory: 6 hours      Practical: 3 hours

**6.4 - Applied Electrical Schematics and Component Location**

6 Total Hours      Theory: 2 hours      Practical: 4 hours

**6.5 - Air Conditioning Fundamentals**

3 Total Hours      Theory: 3 hours      Practical: 0 hours

**6.6 - Power Train**

3 Total Hours      Theory: 3 hours      Practical: 0 hours

## **6.1 - Computer Fundamentals**

### Cross-Reference to Learning Outcomes:

6040.05, 6058.01, 6058.02

Duration: 6 Total Hours      Theory: 6 hours      Practical: 0 hours

### General Learning Outcome:

To demonstrate a working knowledge of operation of onboard computers.

### Learning Outcomes:

Upon successful completion, the apprentice is able to:

6.1.1 Define the purpose and fundamentals of onboard computers

6.1.2 Describe the function and construction features of onboard computers.

Learning Content:

6.1.1 Define the purpose and fundamentals of onboard computers.

- [3/0] - computer / microprocessor  
 inputs / sensors  
 processing / logic  
 storage / memory
- ROM (Read Only Memory)
  - PROM (Programmable Read Only Memory)
  - RAM (Random Access Memory)
  - KAM (Keep Alive Memory)
- outputs / actuators communication  
 signals
- analog
  - digital
  - binary code
  - sine wave / square wave
- multiplexing  
 fibre optics

6.1.2 Describe the function and construction features of onboard computers.

- [3/0] - computer / microprocessor  
 inputs / sensors  
 processing / logic  
 storage / memory
- ROM (Read Only Memory)
  - PROM (Programmable Read Only Memory)
  - RAM (Random Access Memory)
  - KAM (Keep Alive Memory)
- outputs / actuators communication  
 signals
- analog
  - digital
  - binary code
  - sine wave / square wave
- multiplexing  
 fibre optics

## **6.2 - Electronic Fundamentals**

### Cross-Reference to Learning Outcomes:

6052.01, 6052.02, 6052.03, 6052.04

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

### General Learning Outcome:

To demonstrate a working knowledge of the fundamentals of basic electronic components.

### Learning Outcomes:

Upon successful completion, the apprentice is able to:

- 6.2.1 Define purpose and fundamentals of basic electronic components.
- 6.2.2 Describe the construction features of electronic components.
- 6.2.3 Describe the operation of electronic components.
- 6.2.4 Inspect and test electronic components according to manufacturers recommendations.

Learning Content:

6.2.1 Define purpose and fundamentals of basic electronics.

[1/0] -        semiconductors  
                  diodes  
                  transistors / capacitors  
                  sensors  
                  variable resistor  
                  optical devices

6.2.2 Describe the construction features of electronic components.

[1/0]            semiconductors  
                  diodes  
                  transistors / capacitors  
                  sensors  
                  variable resistor  
                  optical devices

6.2.3 Describe the operation of electronic components

[2/0] -        semiconductors  
                  diodes  
                  transistors / capacitors  
                  sensors  
                  variable resistor  
                  optical devices

6.2.4 Inspect and test electronic components according to manufacturers ' recommendations.

[2/0] -        semiconductors  
                  diodes  
                  transistors / capacitors  
                  sensors  
                  variable resistor  
                  optical devices

### **6.3 - Servicing Electrical and Electronic Systems**

Cross-Reference to Learning Outcomes:

6052.01, 6052.02, 6052.03, 6052.04

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

General Learning Outcome:

To demonstrate a working knowledge of servicing electrical/ electronic systems effected by body damaged.

Learning Outcomes:

Upon successful completion, the apprentice is able to:

- 6.3.1 Describe vehicle electric / electronic system that may need servicing after repairing vehicle damage.
- 6.3.2 Describe ways of protecting these systems during vehicle repairs.
- 6.3.3 Explain the principles of performing diagnostics to these systems.
- 6.3.4 Perform assigned operation for testing electrical/ electronic systems.

Learning Content:

6.3.1 Describe vehicle electric / electronic system that may need servicing after repairing vehicle damage.

- [2/0] -        restraint systems
- active / passive
- electronic steering  
 electronic suspension (load leveling)  
 antilock brakes  
 inertia switches

6.3.2 Describe ways of protecting these systems during vehicle repairs.

- [2/0] -        battery disconnect  
                   erased memory / stored memory  
                   static electricity  
                   routing of wiring  
                   location of welding cables  
                   computer removal computer  
                   storage  
                   connector- disconnect / reconnect

6.3.3 Explain the principles of performing diagnostics to these systems.

- [2/0] -        visual inspection  
                   self diagnostics
- warning lights
  - flash codes
  - scan tools
- erase trouble codes  
 reset system

6.3.4 Perform assigned operation for testing electrical/ electronic systems.

- [0/3] -        visual  
                   self diagnostics
- warning lights
  - flash codes
  - scan tools
- erase trouble codes  
 reset system

#### **6.4 - Applied Electrical Schematics and Component Location**

Cross-Reference to Learning Outcomes:

6042.01, ' 6042.02, 6056.01, 6056.02

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

General Learning Outcome:

To demonstrate a working knowledge of purpose and application of electrical schematics and component location information.

Learning Outcomes:

Upon successful completion, the apprentice is able to:

- 6.4.1 Define the purpose and fundamentals of electrical wiring schematics.
- 6.4.2 Describe the construction features and application of manufacturers' wiring diagrams.
- 6.4.3 Perform assigned operations using various wiring schematics.
- 6.4.4 Perform assigned operations to locate various electrical/ electronic components.

Learning Content:

6.4.1 Define the purpose and fundamentals of electrical wiring schematics.

[1/0] - electrical symbols  
circuit identification methods  
colour codes  
numbers codes  
abbreviations

6.4.2 Describe the construction features and application of manufacturers' wiring diagrams.

[1 /0] - electrical symbols  
circuit identification methods  
colour codes  
numbers codes  
abbreviations

6.4.3 Perform assigned operations using various wiring schematics.

[0/2] - various layouts  
interpretation  
hard copy  
electronic sources

6.4.4 Perform assigned operations to locate various electrical / electronic components.

[0/2] - various components  
hard copy  
electronic sources

## **6.5 - Air Conditioning Fundamentals**

### Cross-Reference to Learning Outcomes:

6053.01, 6053.05, 6053.06, 6053.07

Duration: 3 Total Hours Theory: 3 hours Practical: 0 hours

### General Learning Outcome:

To demonstrate a working knowledge of fundamental operation of air conditioning systems.

### Learning Outcomes:

Upon successful completion, the apprentice is able to:

- 6.5.1 Define the purpose and fundamentals of air conditioning systems.
- 6.5.2 Describe the functions and construction features of air conditioning systems components.
- 6.5.3 Explain the principles of operation of air conditioning systems.

Learning Content:

6.5.1 Define the purpose and fundamentals of air conditioning systems.

- [1/0] - refrigerant characteristics  
 temperature and humidity relationship  
 properties of R12 and R134A  
 gas laws, temperature, pressure and volume
- heat absorotion
  - liquid and gas states
  - temperature effects
- thermal expansion and contraction

6.5.2 Describe the functions and construction features of air conditioning systems components.

- [1/0] - R12 dichlorodifluoromethane
- boiling point, toxicity, flammability, etc.
- R134A tetrafluoroethane
- boiling point, toxicity, flammability, etc.
- lubricants for R12 and R134A  
 control valves  
 evaporator temperature controls  
 condensers  
 receiver dryer  
 evaporator  
 compressor  
 hoses and tires

6.5.3 Explain the principles of operation of air conditioning systems.

- [1/0] - cycling clutch system orifice  
 tube system  
 thermostatic expansion valve system

## 6.6 - Power Train

### Cross-Reference to Learning Outcomes:

6055.01, 6055.02, 6055.03, 6055.04, 6055.05, 6055.06, 6055.07

Duration: 3 Total Hours      Theory: 3 hours      Practical: 0 hours

### General Learning Outcome:

To demonstrate a working knowledge of removal and replacement of power train components.

### Learning Outcomes:

Upon successful completion, the apprentice is able to:

6.6.1 Outline the power train assembly removal and replacement procedures.

Learning Content:

6.6.1 Outline the power train assembly removal and replacement procedures.

- [3/0] - fluid draining and storing requirements  
vehicle supporting and lifting requirements  
power train assembly lifting and supporting  
procedures
- engine lift points
  - transmission jack placement
  - final component alignment
- manufacturers' recommended steps to remove and  
replace
- engines assemblies
  - transmission assemblies
  - differential assemblies
- final component alignment  
suspension alignment  
bolt torque / axle torque

Evaluation Structure:

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

Reference Material:

**Complete Automotive Painting**

By Robert Scharff and Richard J. Paquette.

Published by Delmar Publishers Inc.

ISBN# 0-8273-3582-2

**I-Car Professional Automotive**

Collision Repair 2nd Edition

By James E. Duffy

Published by Delmar Publishers Inc.

ISBN# 0-7608-1398-3

**Motor Auto Body Repair, 3<sup>rd</sup> Edition**

By Robert Scharff and James E. Duffy

Published by Delmar Publishers Inc.

ISBN # 0-8273-6858-5

**The Principles of Auto Body Repairing and Repainting, 5<sup>th</sup> Edition**

By A.G. Deroche

Published by Prentice Hall

ISBN 0-13 678053-9

