

Motor Vehicle Body Repairer (Metal and Paint) Level 3

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Unit: C1 Environmental Awareness

Level: Three

Duration: 7 hours

Theory: 7 hours

Practical: 0 hours

Overview:

This unit is designed to provide the apprentice with an overview of environmental awareness and related requirements. Topics will also include aspects of HVAC. **Note: No percentage-weightings for test purposes are prescribed for this unit's objectives. Instead, a 'Pass/Fail' grade will be recorded for the unit in its entirety.**

Objectives and Content:

**Percent of
Unit Mark (%)**

- | | |
|---|------------|
| <p>1. Describe the fundamentals, health/safety issues and procedures/requirements involved in the handling of Chlorofluorocarbons (CFCs), Hydrofluorocarbons (HFCs) and Hydrochlorofluorocarbons (HCFCs).</p> <p>a. CFC, HFC and HCFC fundamentals</p> <ul style="list-style-type: none">• Environmental damage potential of compounds<ul style="list-style-type: none">-CFC and the ozone layer-The Montreal protocol-CFC: refrigeration and manufacturing industries• Ozone Depletion Potential (ODP)<ul style="list-style-type: none">-Chemical makeup and stability-ODP factors for various refrigerants-Global warming• Control strategies for CFCs, HFCs and HCFCs<ul style="list-style-type: none">-Environment Canada's role-Code practice-Responsibilities of service personnel-Implementation dates of legislation <p>b. Health and safety issues: ozone depleting substances</p> <ul style="list-style-type: none">• Personnel safety equipment used when handling compounds• Eye, hand and face protection• Handling dangers: CFCs, HFCs and HCFCs• Toxicity• Flammability• Handling precautions• Inhalation• Skin and eye contact• Cylinder temperatures and pressures <p>c. Procedures and requirement: the handling and release of ozone depleting substances</p> | <p>n/a</p> |
|---|------------|

- The four “Rs” of emission reduction
 - Recovery
 - Reuse
 - Recycle
 - Reclaim
- Equipment used to cover refrigerants
- Refrigerant storage tank types: implications of use
- Provincial regulations: handling of recovered ozone depleting substances
- CFC code of practice
- Record keeping requirements
 - Recovered refrigerant
 - Vehicle tagging
 - Cylinder inventories
 - Refrigerant transfers
- Maintenance procedures: recovery and recharging equipment
- Safe operating procedures: recovery and recharging equipment
 - Safety wear
 - Overpressure, overfilling
- Identification and use of reclaim cylinders
- Identification bands
- Contents, recycled gas
- Types of quick disconnects and one-way check valves

2. Describe the major components and operating principles used in mobile air conditioning systems. n/a

- a. Laws of physics applicable to air conditioning system operation
- Heat absorption
 - Solid, liquid and gas states
 - Gas laws, temperature, pressure and volume
 - Temperature and humidity relationship
 - Thermal expansion and contraction
 - Methods of heat transfer
 - Air Conditioning (A/C) thermodynamics
 - Refrigerant compressors
 - System lubrication
 - Properties of refrigerants
 - Alternative refrigerants
 - Refrigerant waste law requirements
 - Major components of air conditioning systems
 - Condenser
 - Receiver dehydration
 - Accumulator-dryer
 - Evaporators
 - Compressors (axial recirculating; radial; variable displacement)
 - Hoses, lines and fittings
 - Low and high pressure cutout
 - Low charge protection
 - Evaporator temperature control
 - Cycling clutch control
 - Orifice tubes
 - Expansion valves
 - Fan controls
 - Role of lubricant used in A/C operation
 - Refrigeration oils (R12 and R134A systems)
 - Red Tec refrigerant
 - Refrigerant characteristics
 - R134A

- Tetrafluoroethane
- Boiling point, toxicity, flammability, etc.
- Lubricants for refrigerants
- Air conditioning thermodynamics
- Other refrigerants

3. Describe and perform the diagnosis, inspection, testing and repair of air conditioning and climate control systems.

n/a

a. Diagnosis, inspection and testing methods

- Testing methods
 - Dyes
 - Electronic leak detectors
 - Bubble producing solutions
 - Nitrogen testing
- Testing
- Refrigerant identification
- Testing for refrigerant leaks
 - Dyes
 - Electronic leak detectors
 - Bubble producing solutions
 - Nitrogen testing
 - Fittings
 - Lines
 - Deals
 - Compressors
 - Evaporator
 - Condenser
- Testing system operating pressures and control functions
- Observations during performance tests
- Observance of government regulations for testing
- System tests for low and high pressure using a manifold gauge set
- Testing overall system for leaks using recommended equipment and procedures

b. Repair air conditioning systems and components

- Removal and replacement
 - Compressors, evaporators, condensers and control devices
- Compressor drive belt adjustment procedures
- Discharging, evacuating recovery, recycle and recharging
- Line and leakage repairs
- Service procedures
- Refrigeration systems service
- Retrofitting

c. Inspection, testing and diagnostic procedures on climate and control systems

- System and component diagnosis with recommended repair
- Control system circuit operation (using appropriate test equipment)

Motor Vehicle Body Repairer (Metal and Paint)

Unit: C2 Tools and Equipment III

Level: Three

Duration: 7 hours

Theory: 3 hours

Practical: 4 hours

Overview:

This unit is designed to provide the apprentice with the knowledge and skills for using and maintaining tools and equipment with a focus on their uses and applications for technical training units in Level Three.

Objectives and Content:	<u>Percent of Unit Mark (%)</u>
1. Identify tools and equipment, and describe their applications.	10%
a. Testing and diagnostic	
b. Shop	
c. Welding	
d. Measuring	
e. Straightening	
f. Refinishing	
g. Glass removal tools	
2. Describe and demonstrate care and maintenance procedures related to tools and equipment.	20%
a. Testing and diagnostic	
b. Shop	
c. Welding	
d. Measuring	
e. Straightening	
f. Refinishing	
g. Glass removal tools	
3. Demonstrate the use of various types of tools and equipment.	70%
a. Testing and diagnostic	
b. Shop	
c. Welding	
d. Measuring	
e. Straightening	
f. Refinishing	
g. Glass removal tools	

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Unit: C3 Metal Inert Gas (MIG) Welding and Squeeze-Type Resistance Spot Welding (STRSW)

Level: Three

Duration: 35 hours

Theory: 7 Hours

Practical: 28 Hours

Overview:

This unit is designed to provide the apprentice with the knowledge and skills related to Metal Inert Gas (MIG) welding and squeeze-type resistance spot welding (STRSW). Previously-covered techniques on MIG welding will be reviewed, together with additional techniques and processes with STRSW equipment, as they apply to performing various types of welds and joints on steel coupons.

Objectives and Content:	<u>Percent of Unit Mark (%)</u>
1. Define terminology associated with metal inert gas (MIG) welding and squeeze-type spot resistance welding (STRSW).	5%
2. Identify hazards and describe safe work practices pertaining to MIG welding and STRSW.	5%
3. Describe MIG welding processes and its applications.	10%
a. Electrode wire	
• Steel	
• Silica bronze	
4. Describe STRSW and its applications.	5%
5. Describe use of MIG welding and STRSW equipment.	10%
a. Current output	
b. Voltage output	
c. Metal Inert Gas (MIG) welding / Squeeze-Type Spot Resistance Welding (STRSW)	
d. Reverse polarity	
e. Straight polarity	
f. Transfer process	
6. Review MIG welding techniques for welding automotive steels.	5%
a. Travel speed	
b. Welding gun angle	
c. Travel angle	
d. Work angle	

- e. Pull/push technique
- f. Welding position
- g. Proper joint fit-up

7. Review and perform various types of welds and joints on steel coupons. 10%

- a. Joint
 - Lap
 - Butt with backing
 - Open butt
- b. Welds
 - Plug
 - Tack
 - Stitch
- c. Positions
 - Flat
 - Vertical
 - Horizontal
 - Overhead

8. Review and perform destructive testing to determine weld quality on steel coupons. 20%

- a. Visual
 - Penetration
 - Defects
- b. Destructive
 - Penetration
 - Defects

9. Demonstrate and perform welds using STRSW equipment on steel coupons. 30%

- a. Setup
- b. Visual
 - Penetration
 - Defects
- c. Destructive
 - Penetration
 - Defects

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Unit: C4 Rivet Bonding

Level: Three

Duration: 7 hours

Theory: 4 hours

Practical: 3 hours

Overview:

This unit is designed to provide the apprentice with the knowledge and skills for rivet bonding. Topics include: safe work practices, rivets and adhesives, products and materials used for rivet bonding, and the procedures for removal and installation of rivet bonding.

Objectives and Content:	<u>Percent of Unit Mark (%)</u>
1. Define terminology associated with rivet bonding.	5%
2. Identify hazards and describe safe work practices when rivet bonding.	5%
3. Describe rivets and adhesives.	10%
a. Types	
b. Characteristics	
c. Applications	
• Usage	
• Location	
• Substrates (steel/aluminum)	
4. Describe products and materials used for rivet bonding.	10%
a. Rivets	
• Solid	
• Self-piercing	
• Blind	
• Punch	
b. Adhesives	
5. Describe the procedures and tools used for rivet bonding.	10%
a. Tools and equipment	
b. Methods	
c. Storage	
d. Ordering	
6. Demonstrate and perform removal and installation of rivets and adhesives.	25%

7. Demonstrate and perform rivet bonding procedures.

35%

- a. OEM repair recommendations
- b. Set-up procedures for rivet bonding
- c. Bonding (adhesive) materials
- d. Inspection

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Unit: C5 Mechanical Components I

Level: Three

Duration: 28 hours

Theory: 7 hours

Practical: 21 hours

Overview:

This unit is designed to provide the apprentice with an overview of mechanical systems and components. Topics include: describing mechanical components, safety considerations, describing regulations and documentation relating to servicing, tools and equipment, inspecting, removing, and re-installing mechanical components for collision repair, cleaning, repairing, and replacing mechanical components and performing operational checks.

Objectives and Content:	<u>Percent of Unit Mark (%)</u>
1. Define terminology associated with mechanical components.	5%
2. Identify hazards and describe safe work practices when removing and installing mechanical components. <ul style="list-style-type: none">a. Personalb. Shop/facilityc. Environmentd. Jurisdictional refrigerant handling training	5%
3. Identify and describe types of mechanical components and their function. <ul style="list-style-type: none">a. Drive trainb. Exhaust systemc. Fuel systemd. Heating and cooling systeme. Accessories	15%
4. Identify and describe regulations and documentation related to removal and replacement of mechanical components. <ul style="list-style-type: none">a. Jurisdictional regulationsb. Federal regulations	5%
5. Demonstrate and perform procedures to inspect and repair mechanical components. <ul style="list-style-type: none">a. Operational checkb. Damage analysis	20%

6. **Demonstrate and perform procedures to remove and replace damaged mechanical components.** 50%
- a. OEM repair recommendations
 - b. Tools and equipment

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Unit: C6 Electrical and Electronic Components I

Level: Three

Duration: 14 hours

Theory: 11 hours

Practical: 3 hours

Overview:

This unit is designed to provide the apprentice with an overview of electrical and electronic components. Topics include: describing electrical and electronic systems and accessories, tools and equipment, safety considerations, protecting electrical and electronic systems during repairs, electrical and electronic damage, using, repairing, and adjusting electrical and electronic systems and accessories, diagnosing, repairing and replacing electrical and electronic systems.

Objectives and Content:	<u>Percent of Unit Mark (%)</u>
1. Define terminology associated with electrical and electronic components.	5%
2. Identify hazards and describe safe work practices when removing and installing electrical and electronic components. a. Personal b. Vehicle	5%
3. Describe the properties of magnetism and identify electrical parts. a. Magnets and current flow b. Solenoids c. Relays d. Electrical motors e. Magnetic fields	10%
4. Identify and describe the types of electrical and electronic components, and their function. a. Vehicle management systems b. Electrical generation and distribution systems c. Lighting systems d. Personal comfort systems e. Electronic circuit parts • Semi-conductors and computer controlled parts	10%
5. Identify and describe the tools and equipment used when repairing and installing electrical and electronic components.	10%

6. **Demonstrate and perform procedures to inspect and repair electrical and electronic components.** 25%
- a. Operational check
 - b. Damage analysis
 - c. Isolate and protect
 - d. System diagnosis
 - e. Electrical circuit and component testing (continuity, resistance, voltage/amperage and grounds)
 - Continuity
 - Resistance
 - Voltage
 - Amperage
 - Grounds
 - f. Lighting circuit
7. **Demonstrate and perform procedures to remove and replace electrical and electronic components.** 35%
- a. OEM repair recommendations
 - b. Tools and equipment
 - c. System diagnosis
 - d. Electrical circuit and component testing
 - Continuity
 - Resistance
 - Voltage
 - Amperage
 - Grounds
 - e. Lighting circuit

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Unit: C7 Supplemental Restraint Systems

Level: Three

Duration: 7 hours

Theory: 5 hours

Practical: 2 hours

Overview:

This unit is designed to provide the apprentice with an overview of supplemental restraint systems (SRS). Topics include: describing the types and location of SRS and their components, using document related to servicing SRS, safety considerations, installing, inspecting, and removing seat belt restraint systems, installing and removing air bags and performing operational checks of SRS.

Objectives and Content:	Percent of Unit Mark (%)
1. Define terminology associated with supplemental restraint systems (SRS) and their components.	5%
2. Identify hazards and describe safe work practices when removing and installing SRS and their components. a. Handling b. Storage c. Disposal	5%
3. Identify and describe the types of SRS, and their function. a. Active b. Passive	10%
4. Identify and interpret documentation relating to servicing SRS and their components. a. Service manuals (airbag replacement manual) b. Original equipment manufacturer (OEM) recommendations	10%
5. Describe and demonstrate the procedures used to identify, locate, and inspect SRS and their components. a. Air bags b. Seat belts c. Occupant classification systems (OCS) d. Operational check of supplemental restraint systems (restraint codes)	20%
6. Demonstrate and perform the procedures used to remove, repair and replace SRS and their components. a. Air bags b. Seat belts	50%

- c. Occupant classification systems (OCS)
- d. Operational check of SRS (restraint codes)

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Unit: C8 Structural Components I (Prepares)

Level: Three

Duration: 35 hours

Theory: 7 hours

Practical: 28 hours

Overview:

This unit is designed to provide the apprentice with an overview of damage analysis of conventional frames and unitized bodies. Topics will include: describing energy management zones, tools and equipment, analyzing damage to unitized bodies and conventional frames.

Objectives and Content:	<u>Percent of Unit Mark (%)</u>
1. Define terminology associated with structural components.	5%
2. Identify hazards and describe safe work practices when working with structural components.	5%
3. Identify and describe the types of structural components and their locations.	5%
4. Identify and describe tools and equipment used to analyze damage to structural components, their applications and procedures for use.	10%
a. Unitized bodies	
b. Conventional frames	
5. Identify and locate energy management zones in conventional frames and unitized bodies.	10%
a. Crumple/crush zone	
b. Substrate materials	
c. OEM specifications	
6. Describe the procedures used to prepare estimate documentation.	15%
a. Sources of information	
• Vehicle information number (VIN)	
• Applicable databases	
• Other vehicle information	
b. Importance of effective communication	
• Customers	
• Co-workers	
• Appraisers	
• Insurance adjusters	

- | | |
|--|------------|
| 7. Describe and demonstrate the procedures for analyzing damage to structural components. | 15% |
| a. Unitized bodies | |
| b. Conventional frames | |
| 8. Perform damage analyses on structural components. | 15% |
| a. Unitized bodies | |
| b. Conventional frames | |
| 9. Prepare and present a complete repair estimate. | 20% |

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Unit: C9 Measuring and Gauging

Level: Three

Duration: 28 hours

Theory: 7 hours

Practical: 21 hours

Overview:

This unit is designed to provide the apprentice with an overview of measuring and gauging. Topics include: types and theories of measuring and gauging systems; sources of information related to measuring and gauging; types of damage conditions; procedures for making upperbody and underbody measurements on an entire vehicle; and procedures to compare measurements with collision damage against manufacturer's specifications.

Objectives and Content:	<u>Percent of Unit Mark (%)</u>
1. Define terminology associated with measuring and gauging.	5%
a. Three section principle	
b. Datum plane	
c. Vehicle centerline	
d. Zero plane	
e. Point-to-point measurements	
• Measure from different points and locations (control and reference points)	
• Check dimensional alignment to manufacturer's specifications	
2. Identify and describe the types and theories of measuring and gauging systems.	5%
a. Mechanical	
b. Computerized	
c. Fixture	
d. Laser	
e. Tram gauge	
f. Other	
3. Identify and describe sources of information related to measuring and gauging.	10%
a. Types of dimension specifications	
b. Underhood and upperbody dimensional manual measurements	
c. Reading and understanding dimension sheets	
d. Symmetrical and asymmetrical	
e. Icons	
f. Measuring to compensate for weight	
g. Measuring movable parts	
h. Tolerances	
i. Comparative measurements	

- j. Measurements from an undamaged vehicle
-
- 4. **Identify and describe types of damage conditions.** **10%**
 - a. Diamond
 - b. Twist
 - c. Sag
 - d. Mash
 - e. Sidesway

 - 5. **Describe and demonstrate the procedures used for making upperbody and underbody measurements on the entire vehicle.** **15%**
 - a. Point to point
 - b. Comparison
 - c. Length
 - d. Width
 - e. Height
 - f. Suspension
 - g. Three-dimensional

 - 6. **Demonstrate set-up procedures for anchoring and applying correct force.** **20%**

 - 7. **Perform upperbody and underbody measurements on the entire vehicle.** **20%**
 - a. Point to point
 - b. Comparison
 - c. Length
 - d. Width
 - e. Height
 - f. Suspension
 - g. Three-dimensional

 - 8. **Perform procedures to compare measurements with collision damage against manufacturer's specifications.** **15%**

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Unit: C10 Structural Components II (Removes, Repairs and Installs)

Level: Three

Duration: 42 hours

Theory: 8 hours

Practical: 34 hours

Overview:

This unit builds on Structural Components I and is designed to provide the apprentice with the knowledge and skills about structural components with a focus on performing and applying removal, repair and installation procedures and techniques on structural components.

Objectives and Content:	<u>Percent of Unit Mark (%)</u>
1. Review terminology associated with structural components.	5%
2. Review safety considerations when removing, repairing or installing structural components.	5%
3. Identify and describe tools and equipment used to remove, repair or install structural components.	5%
4. Describe and demonstrate the procedures used to protect electrical and electronic systems and components when removing, repairing or installing structural components.	10%
5. Describe and demonstrate the procedures and techniques used to remove, repair or install structural components.	25%
a. Original equipment manufacturer (OEM) recommendations	
b. Industry standards (tested procedures)	
6. Perform the following repair procedures on a structural component.	50%
a. Remove	
b. Repair	
c. Install	

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Unit: C11 Refinishing Materials IV

Level: Three

Duration: 28 hours

Theory: 7 hours

Practical: 21 hours

Overview:

This unit builds on Refinishing Materials III and is designed to provide the apprentice with the knowledge and skills about refinishing materials with a focus on these topics: mixing and applying refinishing materials; the procedures to blend top coats; defects that occur during the application of refinishing materials and how to prevent and correct them; and performing various refinishing application procedures on structural components.

Objectives and Content:	<u>Percent of Unit Mark (%)</u>
1. Define terminology associated with colour theory.	10%
2. Review hazards and safe work practices when mixing and applying refinishing materials.	5%
3. Describe and demonstrate the procedures used for colour matching.	10%
4. Describe and demonstrate the procedures and techniques for mixing and applying refinishing materials. a. Single stage finishes <ul style="list-style-type: none">• Spot• Panel• Complete b. Base coat (clear coat) finishes <ul style="list-style-type: none">• Spot• Panel• Complete c. Multi-stage finishes <ul style="list-style-type: none">• Spot• Panel• Complete	15%
5. Describe the procedures used to blend top coats. a. Single stage b. Base coat c. Multi-stage	20%

6. **Identify defects that occur during application of refinishing materials, and describe the procedures used to prevent and correct them.** 10%
7. **Perform the following refinishing application procedures on a structural component.** 30%
- a. Colour matching
 - b. Various blending techniques
 - c. Mixing and applying single stage, basecoat, clearcoat and multi-stage finishes
 - d. Correcting and preventing topcoat defects
 - e. Final inspections

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Unit: C12 Alternate Fuel Systems

Level: Three

Duration: 7 hours

Theory: 5 hours

Practical: 2 hours

Overview:

This unit is designed to provide the apprentice with the knowledge and skills about alternate fuel systems. Topics include: hazards and safe work practices when repairing vehicles with alternate fuel systems; types of alternate fuel systems; and procedures associated with repairing vehicles with alternate fuel systems.

Objectives and Content:	<u>Percent of Unit Mark (%)</u>
1. Define terminology associated with alternate fuel systems.	5%
2. Identify hazards and safe work practices when repairing vehicles with alternate fuel systems.	15%
a. Safety precautions for working on hybrid/electric vehicles (EVs)	
• Personal protective equipment	
• Properly tag out the vehicle	
• Fire hazards	
• Electrocutation hazards	
• Electrolyte hazards	
• Use of hybrid identification markers	
• Working environment	
3. Identify and describe the types of alternative fuel systems.	10%
a. Electricity	
b. Compressed Natural Gas (CNG)	
c. Liquefied petroleum gas (LPG) (propane)	
d. Other	
4. Describe and demonstrate the procedures when performing repairs on vehicles with alternate fuel systems.	30%
a. Tools and procedures for use	
• Personal protective equipment (High voltage gloves, testing high voltage gloves, safety glasses, Insulated steel-toed boots)	
• High voltage multimeters and leads (Cat III)	
• Warning pylons	
• Insulated tools	
• Engine crane for battery removal	

- Hook or gaff for electrocution
- b. Deactivation
- c. Reactivation

5. Perform the following procedures on a vehicle with an alternate fuel system. 40%

- a. Deactivation
- b. Reactivation
- c. Handling
- d. Storage
- e. Inspection
