Skilled Trades Ontario | Métiers spécialisés Ontario

Apprenticeship Curriculum Standard

310B Auto Body and Collision Damage Repairer Levels 1, 2 & 3

310Q Auto Body Repairer Levels 1 & 2

2016

The Ontario College of Trades Auto Body & Collision Damage Repairer Curriculum Working Group would like to acknowledge the following trade representatives for their contributions to the development of this publication:

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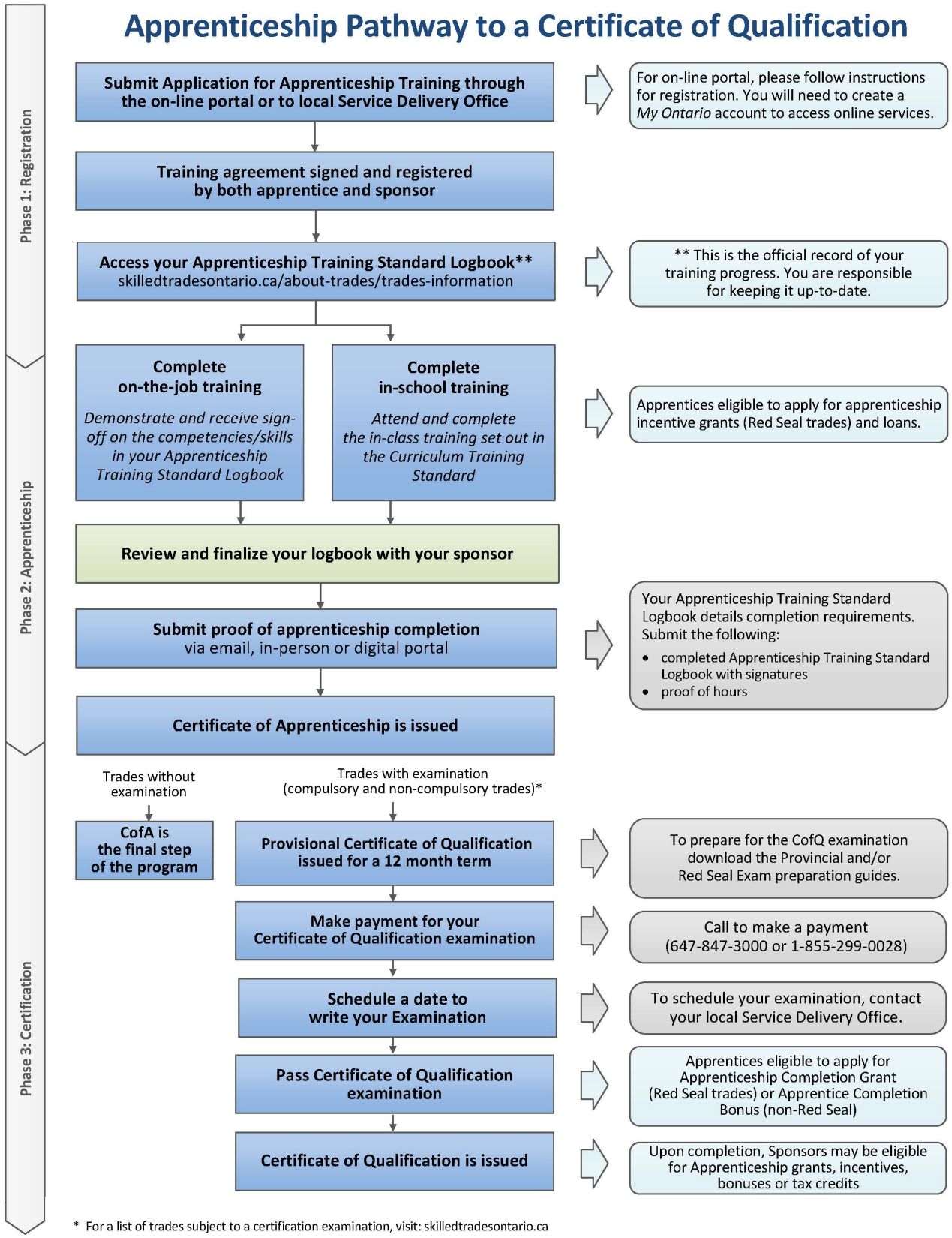
Please Note: This Standard has been revised to reflect the visual identity of Skilled Trades Ontario (STO) which replaced the Ontario College of Trades on January 1, 2022. The content of this Standard may refer to the former organization; however, all trade specific information or content remains relevant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

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

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

Maintained with transfer to Skilled Trades Ontario 2016 (V100)

Apprenticeship Pathway to a Certificate of Qualification



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

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Preface

This curriculum standard for the Auto Body and Collision Damage Repairer trade program is based upon the on-the-job performance objectives, located in the industry-approved training standard.

The curriculum is organized into 3 levels of training. The Reportable Subjects Summary chart (located on page 4) summarizes the training hours for each reportable subject.

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

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

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

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

Pre-requisites

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

Hours Disclaimer

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

Suggested Equipment for Training Delivery Agencies

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

Introduction

The Auto Body & Collision Damage Repairer curriculum standard is organized into three levels of training, each level includes reportable subjects containing like or similar learning outcomes to reflect the units of the training standard. The hours chart indicates how the curriculum can be delivered in the current block release format and summarizes the hours of training for each reportable subject by level. Since the reportable subjects are all divisible by three, they can be adapted to accommodate a more flexible training delivery model 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 Standard (ATS) for Auto Body & 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 ATS. Employers are expected to extend the apprentice's knowledge and skills through appropriate practical training on the work site. Regular evaluation 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.

Curriculum Breakdown

The curriculum is organized into three levels of training divided into 17 Reportable Subjects. The Reportable Subjects summary chart is on page 4.

The curriculum focuses on the theoretical knowledge and its application required in order to support the performance objectives within the ATS. Apprentices, therefore, are expected to complete the learning associated with these objectives by applying the prescribed in-school knowledge to the required practical experiences in the work setting.

The curriculum identifies the learning that takes place off-the-job. The in-school program focuses primarily on the theoretical knowledge and the essential skills required to support the performance objectives contained in the Apprenticeship Training Standards for Auto Body & Collision Damage Repairers.

Employers/Sponsors are expected to extend their apprentice's knowledge and skills through practical training on the work site. Regular evaluation of the apprentice's knowledge and skills are conducted throughout training to ensure that all Apprentices have achieved the learning outcomes identified in the curriculum standard. It is not the intent of the in-school curriculum to perfect on-the-job skills. The practical portion of the in-school program is used to reinforce theoretical knowledge.

To assure consistency in delivery, a time allocation has been included for each reportable subject, along with a theoretical and practical breakdown of the learning content. While setting out content requirements as prescribed in the Acts and Regulations for the trades, the curriculum standard has been designed to give the instructor every reasonable opportunity for flexibility and innovation in curriculum development, lesson planning and delivery.

In all practical learning activities, the Apprentices will abide by all applicable regulations and policies relating to practice and safety. Upon successful completion of all reportable subjects Apprentices will have achieved the elements of the Auto Body & Collision Damage Repairer Apprenticeship In-School Curriculum Standard.

Evaluation and Assessment
Within each level, percentages of the final grade for that particular subject have been assigned to theory testing and practical application exercises. These percentages have been based on the relative weighting of theoretical and practical learning that occurs within the reportable subject itself.

*Please Note: references to [x/y] within each learning outcome outlines the recommended split between theoretical and practical hours of in-school training.
Eg. [0/2] represents 0 hours of theory and 2 hours of practical.

Recommended Textbook
Collision Repair and Refinishing: A Foundation Course for Technicians
Second Edition
Alfred M. Thomas and Michael Jund
Published by Delmar
ISBN-13:978-1-133-60187-6
ISBN-10:1-133-60187-1

Reportable Subjects Summary

Number	Reportable Subjects	Hours Total	Hours Theory	Hours Practical
Level 1				
3160	Applied Work Practices	39	26	13
3161	Welding	36	17	19
3162	Body, Frame and Structure	90	40	50
3163	Refinishing	39	23	16
3164	Applied Mechanical	36	23	13
	TOTAL	**240**	**129**	**111**
Level 2				
3165	Welding	27	9	18
3166	Refinishing	39	18	21
3167	Plastic Repair	30	18	12
3168	Body and Structure	51	35	16
3169	Non-Structural Repair	57	21	36
3170	Applied Mechanical	36	27	9
	TOTAL	**240**	**128**	**112**
Level 3				
3171	Damage Analysis and Estimating	33	20	13
3172	Body, Frame and Structure	63	28	35
3173	Structural Panel Replacement	60	23	37
3174	Steering, Suspension and Alignment	21	14	7
3175	Refinishing	36	16	20
3176	Applied Mechanical	27	18	9
	TOTAL	**240**	**119**	**121**

Level 1

Reportable Subject Summary – Level 1

Number	Reportable Subjects	Hours Theory	Hours Practical	Hours Total
3160: Applied Work Practices				
3160.1	Shop Safety	10	2	12
3160.2	Hand Tools	5	1	6
3160.3	Shop Equipment	5	4	9
3160.4	Trim/Hardware	6	6	12
Sub Totals		**26**	**13**	**39**
3161: Welding				
3161.1	Oxyacetylene Welding, Heating and Cutting	4	2	6
3161.2	Gas Metal Arc Welding (GMAW) Fundamentals	9	15	24
3161.3	Plasma Arc Cutting	4	2	6
Sub Totals		**17**	**19**	**36**
3162: Body, Frame and Structure				
3162.1	Vehicle Construction and Design	11	4	15
3162.2	Non-structural Panel Repair Fundamentals	15	15	30
3162.3	Metal Finishing	7	14	21
3162.4	Bumpers	3	9	12
3162.5	Abrasive and Fillers	4	8	12
Sub Totals		**40**	**50**	**90**
3163: Refinishing				
3163.1	Surface Preparation	5	4	9
3163.2	Undercoats Preparation	3	3	6
3163.3	Paint Identification and Application	6	3	9
3163.4	Spray Guns	4	2	6
3163.5	Spray Booths	2	1	3
3163.6	Compressed Air Delivery	3	3	6
Sub Totals		**23**	**16**	**39**
3164: Applied Mechanical				
3164.1	Applied Computer Skills	2	1	3
3164.2	Electrical Fundamentals	8	4	12
3164.3	Battery Fundamentals	4	2	6
3164.4	Air Conditioning Awareness	2	1	3
3164.5	Tires and Rims	3	3	6
3164.6	Steering and Suspension Systems	4	2	6
Sub Totals		**23**	**13**	**36**
Level 1 Totals		**129**	**111**	**240**

Number:	S3160		
Title:	**Applied Work Practices**		
Duration:	Total Hours: 39	Theory: 26	Practical: 13

Number:	S3160.1		
Title:	**Shop Safety**		
Duration:	Total Hours: 12	Theory: 10	Practical: 2
Cross Reference to Training Standards: U9021			

General Learning Outcomes

Upon successful completion, the Apprentice is able to define the purpose and fundamentals of shop safety practices.

Learning Outcomes

Upon successful completion, the apprentice is able to:

3160.1.1 Define the purpose and fundamentals of safe work practices.

3160.1.2 Describe *Workplace Hazardous Materials Information Systems (WHMIS).*

3160.1.3 Describe *Occupational Health and Safety Act (OHSA)*.

3160.1.4 Describe the *Repair and Storage Liens Act (RSLA)*.

3160.1.5 Describe the *Workplace Safety Insurance Board (WSIB).*

Learning Content

3160.1.1 Define the purpose and fundamentals of safe work practices. [4/2]

Personal attire
Glasses
Shields
Guards
Breathing filters
Ventilation masks
Gloves
Clothing
Footwear
Rings and other jewelry

Fire safety
- fire extinguishers
- types of fires
- application of specific types of extinguishers
- cigarette lighters

Physical activities
- lifting techniques
- handling of tools and equipment
- working conditions and organization of work area
- application of force on wrenches and levers

First Aid procedures

Facilities
- housekeeping / cleanliness
- ventilation / exhausting
- shop layout
- test tanks
- lighting
- emergency responses
- loose clothing
- compressed air
- tools and equipment

3160.1.2 Describe *Workplace Hazardous Materials Information Systems (WHMIS)*. [3/0]

Right to know legislation
Safe handling of products
Hazardous materials
Material Safety Data Sheets (MSDS)

3160.1.3 Describe *Occupational Health and Safety Act (OHSA)*. [1/0]
Legislation
- obligation of employer and worker

3160.1.4 Describe the *Repair and Storage Liens Act (RSLA)*. [1/0]

Payment for repairs or storage lien
Search for

- Personal Property Security Registration (RPSR)
- Registration be vehicle identification number (VIN)
- Registration by individual's names
- Registration by business name dispute over lien

3160.1.5 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 Protective Equipment (PPE)
Housekeeping

Number:	S3160.2		
Title:	**Hand Tools**		
Duration:	Total Hours: 6	Theory: 5	Practical: 1
Cross Reference to Training Standards: U9021			

General Learning Outcomes

Upon successful completion, the Apprentice is able 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:

3160.2.1 Define the purpose, fundamentals, types, styles and application of hand tools.

3160.2.2 Describe the functions, construction, features and types of basic hand tools.

3160.2.3 Explain the operating principles of hand tools.

3160.2.4 Perform the manufacturer's maintenance and recommended operating procedures for hand tools.

Learning Content

3160.2.1 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

3160.2.2 Describe the functions, construction, features and types of basic hand tools. [3/0]

Wrenches
- torque wrenches
- open end, box end, combination and ratcheting
- flare nut (line)
- adjustable

Socket sets
- drives - ¼", 3/8", ½", ¾", 1"
- ratchets
- flex handles

Pliers
- diagonal cutters
- slip joint
- needle nose
- adjustable locking

Screwdrivers
- Flat
- Phillips
- Torx and tamper proof
- Robertson

Cutting tools
- hacksaw
- chisel
- files
- drills bits
- reamers
- taps and dies

Body Tools
- dollies
- spoons
- picks (pry bars)

Driving tools
- hammers
- punches

Cleaning tools
- scrapers
- wire brushes
- solvent brushes

3160.2.3 Explain the operating principles of hand tools. [1/0]

Wrenches
Sockets
Pliers
Screwdrivers
Cutting tools
Measuring tools
Driving tools
Cleaning tools

3160.2.4 Perform the manufacturer's maintenance and recommended operating procedures for hand tools. [0/1]

Maintenance and Operating Procedures
- lubrication
- cleaning
- storage
- dressing
- handling techniques

Number:	S3160.3		
Title:	**Shop Equipment**		
Duration:	Total Hours: 9	Theory: 5	Practical: 4
Cross Reference to Training Standards: U9021			

General Learning Outcomes

Upon successful completion, the Apprentice is able 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:

3160.3.1 Define the purpose and fundamentals of shop equipment.

3160.3.2 Identify the types and features of shop equipment.

3160.3.3 Explain the principles of operation of power tools and equipment.

3160.3.4 Demonstrate the ability to operate shop equipment and power tools according to the manufacturers' recommended operating procedures.

3160.3.5 Perform the manufacturers' recommended inspection and maintenance procedures for shop equipment.

Learning Content

3160.3.1 Define the purpose and fundamentals of shop equipment. [1/0]

Identify:
- equipment
- shop layout
- installation

3160.3.2 Identify the types and features of shop equipment. [2/0]

Grinders
- bench grinders
- portable grinder

Drills

Vise
- solid
- swivel

Lift equipment
- hoists
- hydraulic jacks
- pneumatic jacks
- safety stands

Cleaning equipment
- pressure washer
- gun cleaner

3160.3.3 Explain the principles of operation of power tools and equipment. [2/0]

Power tools
- pneumatic wrenches
- portable drills
- sanders
- air hammer
- polishers
- grinders
- cutting tools

Equipment
- hydraulic, pneumatic and electric

3160.3.4 Demonstrate the ability to operate shop equipment and power tools according to the manufacturers' recommended operating procedures. [0/3]

Grinders
- bench grinders
- portable grinder

Drills

Vise
- solid
- swivel

Lift equipment
- hoists
- hydraulic jacks
- pneumatic jacks
- safety stands

Cleaning equipment
- pressure washer
- gun cleaner

3160.3.5 Perform the manufacturers' recommended inspection and maintenance procedures for shop equipment. [0/1]

Electrical cords and connections
Air lines and connections
Hydraulic lines and connections

Number:	S3160.4		
Title:	**Trim/Hardware**		
Duration:	Total Hours: 12	Theory: 6	Practical: 6
Cross Reference to Training Standards: U9024			

General Learning Outcomes

Upon successful completion, the Apprentice is able 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:

3160.4.1 Define the purpose and fundamentals of trim/hardware.

3160.4.2 Explain the removal, replacement and repair procedures for automotive trim hardware.

3160.4.3 Perform manufacturers' recommended removal, replacement and repair procedures for trim/hardware and materials.

3160.4.4 Describe the fundamentals of adhesives, fasteners and retainers used for mouldings, emblems, exterior trim, decals, and stripes.

3160.4.5 Describe the removal, replacement and repair procedures for mouldings, emblems and exterior trim decals, graphics and stripes.

3160.4.6 Perform manufacturers' removal and installation procedures for mouldings,emblems, exterior trim, decals, graphics and stripes.

Learning Content

3160.4.1 Define the purpose and fundamentals of trim/hardware. [2/0]

Trim adhesives
- spray
- tube
- anaerobic
- activated

Fasteners and retainers

- classification of bolts and nuts (standard and metric)
- grade of material
- tensile strength
- sizes and thread pitch
- locking devices
- torque specifications
- one-time use

Clips and fastening methods
Interior and exterior body and trim components

3160.4.2 Explain the removal, replacement and repair procedures for trim/hardware. [2/0]

Latches
Lock cylinders
Handles
Roof racks
Hinges
Antennas
Grills
Seats
Headliners
Trim panels
Cladding
Weather stripping

3160.4.3 Perform manufacturers' recommended removal, replacement and repair procedures for 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
Vapour barrier

3160.4.4 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

3160.4.5 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 damaged and one-time use 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
- hot water with wax-free soap

3160.4.6 Perform manufacturers' removal and installation 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

Removing with the use of:
- solvents
- heat and scraper
- chemical spray
- eraser wheel

Installing with:
- water
- hot water with wax-free soap
- dry

Number:	S3161		
Title:	**Welding**		
Duration:	Total Hours: 36	Theory: 17	Practical: 19

Number:	S3161.1		
Title:	**Oxyacetylene Welding, Heating and Cutting**		
Duration:	Total Hours: 6	Theory: 4	Practical: 2
Cross Reference to Training Standards: U9029			

General Learning Outcomes

Upon successful completion, the Apprentice is able to demonstrate a working knowledge of the purpose, function, safe operating principles and maintenance procedures for oxyacetylene welding, heating and cutting equipment.

Learning Outcomes

Upon successful completion, the apprentice is able to:

3161.1.1 Identify the purpose and fundamentals of safe oxy-acetylene welding, heating and cutting practices.

3161.1.2 Describe the functions, construction, types and application of oxyacetylene welding equipment.

3161.1.3 Explain the safe principles of operation of oxyacetylene welding equipment.

3161.1.4 Describe the manufacturers' system maintenance procedure of oxyacetylene welding equipment.

3161.1.5 Perform basic welding, heating, and cutting procedures.

Learning Content

3161.1.1 Identify the purpose and fundamentals of safe oxyacetylene welding, heating and cutting practices. [1/0]

Purpose:
- fusion and braze welding
- heating
- cutting metal

Fundamentals:
- oxy-fuel gases
- eye, hand, face, clothing protection
- set up, ignition and shutdown sequence
- cylinder handling
- fire prevention
- hazards of butane lighters
- flammable container precautions

3161.1.2 Describe the functions, construction, types and application of oxyacetylene welding equipment. [1/0]

Equipment:
- tanks
- identification features
- pressure regulators
- manual valves
- manifold systems
- gauges and hoses
- welding and cutting tips

3161.1.3 Explain the safe principles of operation of oxyacetylene welding equipment. [1/0]

Equipment:
- tanks
- identification features
- pressure regulators
- manual valves
- manifold systems
- gauges and hoses
- welding and cutting tips

3161.1.4 Describe the manufacturers' system maintenance procedure of oxyacetylene welding equipment. [1/0]

Equipment:
- tanks
- identification features
- pressure regulators
- manual valves
- manifold systems
- gauges and hoses
- welding and cutting tips

3161.1.5 Perform basic welding, heating, and cutting procedures. [0/2]

Awareness of potential heat or cutting damage to surrounding materials:
- set up and shutdown sequence
- select heating and cutting tips
- adjust oxygen and acetylene pressures
- perform ignition procedures
- adjust flames types (carbonizing, neutral or oxidizing)
- observe tip angle and temperature of metals
- select filler rod

Perform the following welds:
- weld bead (with and without filler rod)
- butt
- lap
- corner
- edge
- tee

Number:	S3161.2		
Title:	**Gas Metal Arc Welding (GMAW) Fundamentals**		
Duration:	Total Hours: 24	Theory: 9	Practical: 15
Cross Reference to Training Standards: U9026			

General Learning Outcomes

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

Learning Outcomes

Upon successful completion, the apprentice is able to:

3161.2.1 Identify the purpose and fundamentals of the Gas Metal Arc Welding (GMAW) process.

3161.2.2 Describe the construction, types and application of Gas Metal Arc Welding (GMAW) equipment and consumables.

3161.2.3 Explain the principles of operation of Gas Metal Arc Welding (GMAW) equipment and procedures.

3161.2.4 Perform Gas Metal Arc Welding (GMAW) set up procedures for welding on thin gauge mild steel.

3161.2.5 Diagnose defects for Gas Metal Arc Welding (GMAW).

3161.2.6 Describe manufacturers' maintenance procedures for Gas Metal Arc Welding (GMAW) equipment.

Learning Content

3161.2.1 Identify the purpose and fundamentals of the Gas Metal Arc Welding (GMAW) process. [2/0]

Purpose:
- speed
- efficiency
- simplicity

Fundamentals:
- polarity
- power sources
- wire feeders
- gas shielding

3161.2.2 Describe the construction, types and application of Gas Metal Arc Welding (GMAW) equipment and consumables. [2/0]

Power sources:
- rectifier
- generator
- inverter

Consumables:
- wire types
- wire specifications
- wire sizes
- shielding gases
- contact tips

3161.2.3 Explain the principles of operation of Gas Metal Arc Welding (GMAW) equipment and procedures. [3/0]

Procedures:
- work set up
- equipment settings
- polarity
- trial beads
- arc initiation
- transfer methods
- travel speeds
- travel and work angle
- push or pull technique
- wire drive speeds
- gas flow rate
- electrode stick-out
- continuity/work clamp placement
- power source characteristics

3161.2.4 Perform Gas Metal Arc Welding (GMAW) set up procedures for welding on thin gauge mild steel. [0/12]

Inspect welder
Set up welder

Identify safety precautions:
- set up safety equipment
- make welder adjustments
- gas flow
- wire feed/amperage
- voltage
- perform test weld

Weld joints:
- butt (open or with backing plate)
- lap
- corner
- edge
- tee

Weld joints in the flat position using:
- mild steel
- 20/22 gauge

Weld joints using various techniques:
- Continuous/plug/stitch/tack

3161.2.5 Diagnose defects for Gas Metal Arc Welding (GMAW). [0/3]

Visually inspect weld for:
- porosity
- cracks
- excessive spatter
- undercut
- overlap
- penetration
- gaps
- excessive heat-affected zone
- burn-through
- excessive weld height

Destructively test weld by:
- shear testing
- peel testing
- twist testing

3161.2.6 Describe manufacturers' maintenance procedures for Gas Metal Arc Welding (GMAW) equipment. [2/0]

Procedures:
- 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
- designated welding areas
- ventilating
- duty cycle

Number:	S3161.3		
Title:	**Plasma Arc Cutting**		
Duration:	Total Hours: 6	Theory: 4	Practical: 2
Cross Reference to Training Standards: U9030			

General Learning Outcomes

Upon successful completion, the Apprentice is able to demonstrate a working knowledge of the purpose, function, safe operating principles and maintenance procedures for Plasma Arc Cutting (PAC) equipment including perform Plasma Arc Cutting (PAC).

Learning Outcomes

Upon successful completion, the apprentice is able to:

3161.3.1 Define the purpose and fundamentals of Plasma Arc Cutting.

3161.3.2 Describe the function, construction, types and application of Plasma Arc Cutting equipment, components and consumables.

3161.3.3 Explain the principles of operation of Plasma Arc Cutting.

3161.3.4 Perform Plasma Arc Cutting operations.

Learning Content

3161.3.1 Identify the purpose and fundamentals of Plasma Arc Cutting. [1/0]

Purpose:
- cutting metals
- safety
- smaller heat-affected zone
- speed

Fundamentals:
- polarity
- structural integrity issues
- distortion

3161.3.2 Describe the function, construction, types and application of Plasma Arc Cutting equipment, components and consumables. [1/0]

Power sources:
- work/continuity clamp
- electrical connectors
- hoses
- air supply
- regulators
- lines and fittings
- tips and nozzles

3161.3.3 Explain the principles of operation of Plasma Arc Cutting. [2/0]

Equipment settings

Cutting variables:
- speed
- distance
- thickness
- air supply
- type of metal

Personal safety precautions
Route planning for cutting path

Vehicle cutting considerations:
- glass
- upholstery
- sound deadening
- wiring
- air bags
- battery
- fuel lines

3161.3.4 Perform Plasma Arc Cutting operations. [0/2]

Operations:

- PPE
- work area set up
- protect vehicle
- clean and prepare cutting route
- connect air supply and attach clamps
- adjust plasma arc machine
- test plasma arc cut
- plasma arc cut vehicle sections

Number:	S3162		
Title:	**Body, Frame and Structure**		
Duration:	Total Hours: 90	Theory: 40	Practical: 50

Number:	S3162.1		
Title:	**Vehicle Construction and Design**		
Duration:	Total Hours: 15	Theory: 11	Practical: 4
Cross Reference to Training Standards: U9031			

General Learning Outcomes

Upon successful completion, the Apprentice is able 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:

3162.1.1 Define the purpose and variations of body and panel designs.

3162.1.2 Perform an inspection to determine vehicle construction and design.

3162.1.3 Demonstrate knowledge of vehicle construction and design.

Learning Content

3162.1.1 Define the purpose and variations of body and panel designs. [6/0]

Vehicle design:

- sub compact
- compact
- intermediate
- full size
- sedan
- hardtop
- convertible (soft and hard top)
- station wagon
- van
- pickup
- SUV/CUV
- hatchback

Drive types:
- FWD
- RWD
- AWD/4 wheel
- engine placement
- hybrids/electric

Body over frame:
- features
- body construction
- frame types:
- perimeter frame
- ladder frame
- stub frame
- X type

Unibody construction:
- features
- sections:
- front
- centre
- rear

Space frame
- features

3162.1.2 Explain the steps of an inspection to determine vehicle construction and design. [5/0]

Panels and components:
- exterior panels
- interior panels
- structural panels and components

Shapes and design:
- forming and stamping
- crowns (high and low)
- combination crown
- double crown
- work hardening
- ridges and flanges

Substrates:
- aluminum
- steels
- composites

Manufacturer's Joining Methods:
- STRSW
- weld bond
- GMAW
- laser welding
- mechanical fasteners
  - bolts/screws
  - rivets
- adhesives
- silicone bronze/brazing

3162.1.3 Demonstrate knowledge of vehicle construction and design. [0/4]

Locate vehicle parts and components
Identify substrates
Identify vehicle and drive types
Identify vehicle design and construction
Identify crush zones
Identify manufactures' labels

Number:	S3162.2		
Title:	**Non-Structural Panel Repair Fundamentals**		
Duration:	Total Hours: 30	Theory: 15	Practical: 15
Cross Reference to Training Standards: U9031			

General Learning Outcomes

Upon successful completion, the Apprentice is able to demonstrate a working knowledge of the fundamentals of non-structural panel damage patterns and repair procedures.

Learning Outcomes

Upon successful completion, the apprentice is able to:

3162.2.1 Define the purpose and fundamentals of body panel repairs.

3162.2.2 Explain the principles of damage patterns for collision repairs.

3162.2.3 Perform recommended repair techniques and procedures on panel with minor damage.

Learning Content

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

Characteristics of sheet metal:

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

Characteristics of aluminum:
- melting temperature
- heating
- work hardening
- ductile characteristics
- oxide film
- annealing
- hammering
- filing
- grinding
- shrinking
- dedicated tooling
- galvanic corrosion

3162.2.2 Explain the principles of damage patterns for collision repairs. [6/0]

Identification of damage patterns:
- direct or primary
- indirect or secondary
- related or unrelated
- direction of damage force

Types of damages:
- dents
- folds
- stretching
- work hardening
- corrosion
- buckles:
  - single hinge
  - double hinge
  - collapsed hinge
  - rolled back

3162.2.3 Perform recommended repair techniques and procedures on panel with minor damage. [0/15]

Proper surface preparation (inside and out)
- hot water with wax-free soap
- de-greaser

Rough out and align using:

- hammer on dolly
- hammer off dolly
- spring hammering
- bumping
- kinking
- prying
- welding
- patching
- stretching
- pulling
- shrinking:
  - oxyacetylene torch
  - electric shrinking (GMAW)
  - induction heating
  - stud gun heat shrinking tip (unispotter)
  - cold with shrinking hammer

Number:	S3162.3		
Title:	**Metal Finishing**		
Duration:	Total Hours: 21	Theory: 7	Practical: 14
Cross Reference to Training Standards: U9031			

General Learning Outcomes

Upon successful completion, the Apprentice is able to demonstrate a working knowledge of the fundamentals and repair procedures of metal finishing.

Learning Outcomes

Upon successful completion, the apprentice is able to:

3162.3.1 Define the purpose and fundamentals of metal finishing.

3162.3.2 Explain the repair procedures for metal finishing.

3162.3.3 Perform metal finishing repairs using tools and equipment.

Learning Content

3162.3.1 Define the purpose and fundamentals of metal finishing. [3/0]

Identify purpose
- repair damaged sheet metal without the use of fillers

Explain fundamentals

3162.3.2 Explain the repair procedures for metal finishing. [4/0]

Assess damage for reparability
- by visually inspecting
- by touch

Determine repair techniques and sequence
- hammer and dolly
- filing
- grinding
- buffing
- sanding

Select tools

3162.3.3 Perform metal finishing repairs using tools and equipment. [0/14]

Assess damage for reparability
- by visually inspecting
- by touch

Determine repair techniques and sequence
- hammer and dolly
- filing
- grinding
- buffing
- sanding

Select tools

Perform metal finish repairs by:
- Hammering off/on dolly
- Picking
- Prying
- Filing:
  - locating high and low spots (scratch patterns)
  - controlling pressure
  - cross filing
  - X filing
- grinding
- buffing
- sanding

Number:	S3162.4		
Title:	**Bumpers**		
Duration:	Total Hours: 12	Theory: 3	Practical: 9
Cross Reference to Training Standards: U9031			

General Learning Outcomes

Upon successful completion, the Apprentice is able 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:

3162.4.1 Define the purpose and fundamentals of bumper assemblies and components.

3162.4.2 Perform removal and replacement procedures for bumper assemblies with the service tools and equipment.

Learning Content

3162.4.1 Define the purpose and fundamentals of bumper assemblies and components. [3/0]

Purpose:
- to meet government safety regulations in reference to collision impact forces

Components:
- cover/fascia
- impact bars
- impact absorbers
- impact strips
- face bar
- rebar
- crush boxes
- mounting brackets
- mechanical absorbers
- collision avoidance and convenience components
- steel to aluminum insulators

Materials:
- steel
- aluminum
- composites

3162.4.2 Perform removal and replacement procedures for bumper assemblies with the service tools and equipment. [0/9]

Dismantling and cleaning of components
Inspecting for damage
Testing of impact absorber/systems
Reassembling components
Alignment of bumper assembly

Number:	S3162.5		
Title:	**Abrasives and Fillers**		
Duration:	Total Hours: 12	Theory: 4	Practical: 8
Cross Reference to Training Standards: U9023, U9031, U9033			

General Learning Outcomes

Upon successful completion, the Apprentice is able to demonstrate a working knowledge of the fundamentals of abrasives and fillers, applications and surface preparation.

Learning Outcomes

Upon successful completion, the apprentice is able to:

3162.5.1 Define the purpose and fundamentals of abrasives and fillers.

3162.5.2 Explain the techniques and procedures for the use of abrasives and fillers.

3162.5.3 Demonstrate the application of fillers and finish surfaces by sanding.

Learning Content

3162.5.1 Define the purpose and fundamentals of abrasives and fillers. [2/0]

Purpose of abrasives:
- leveling
- stripping paint
- refining/smoothing
- creating mechanical adhesion

Types and characteristics of abrasives:
- sandpaper:
  - grading and grit
  - open coat
  - closed coat
  - types
  - applications
- grinding discs
- abrasive pads
- polishing compounds/scuff paste
- abrasive wheel
- blasting media

Purpose of fillers:
- fill minor imperfections
- restore contour

Types and characteristics of fillers:
- body filler:
  - heavy weight
  - light weight
  - premium
- fiber-glass reinforce filler:
  - chopped
  - short strand
  - long strand
- specialty fillers:
  - aluminum
  - sprayable
  - epoxy
- finishing fillers:
  - 2K two component

3162.5.2 Explain the techniques and procedures for the use of abrasives and fillers. [2/0]

Considerations for abrasives:
- grit and composition selection
- tool selection
- sanding/Blocking techniques

Mixing procedures for fillers:
- hardener selection
- ratios
- mixing technique

Application for fillers:
- technique
- tolerances

Shaping and finishing of fillers:
- filing
- block sanding
- guide coat
- feather edging
- refining/final inspection

3162.5.3 Demonstrate the application of fillers and finish surfaces by sanding. [0/8]

Considerations for abrasives:
- grit and composition selection
- tool selection
- sanding/Blocking techniques

Mixing procedures for fillers:
- hardener selection
- ratios
- mixing technique

Application for fillers:
- technique
- tolerances

Shaping and finishing of fillers:
- filing
- block sanding
- guide coat
- feather edging
- refining/final inspection

Number:	S3163		
Title:	**Refinishing**		
Duration:	Total Hours: 39	Theory: 23	Practical: 16

Number:	S3163.1		
Title:	**Surface Preparation**		
Duration:	Total Hours: 9	Theory: 5	Practical: 4
Cross Reference to Training Standards: U9023			

General Learning Outcomes

Upon successful completion, the Apprentice is able to demonstrate a working knowledge of surface preparation prior to refinishing.

Learning Outcomes

Upon successful completion, the apprentice is able to:

3163.1.1 Describe the introductory information and fundamentals of preparation products.

3163.1.2 Describe the sanding procedures for surface preparation.

3163.1.3 Identify types and procedure of putties and fillers.

3163.1.4 Perform sanding and masking procedures.

Learning Content

3163.1.1 Describe the introductory information and fundamentals of preparation products. [2/0]

Cleaning agents / sequence:
- degreaser
- final wash
- metal conditioner

Masking materials:
- masking tapes
- masking papers
- spray mask
- plastic wrap

Paint strippers:
- mechanical
- chemical
- vehicle protection
- media blasting

3163.1.2 Describe the sanding procedures for surface preparation. [2/0]

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)

3163.1.3 Identify types and procedure of putties and fillers [1/0]
Types
- Putties:
  - polyester
  - epoxy resin-based
  - lacquer (solvent based)
- Spray fillers:
  - primer surface

Procedure
- Select application:
  - hand mixed and applied
  - by spray

Identify surface imperfections
Mixing according to manufacturers' recommendations
Apply polyester putty or spray filler
Apply guide coat
Level to contour by block sanding
Prepare surface for undercoats

3163.1.4 Perform sanding and masking procedures. [0/4]

A. Perform sanding and masking procedures.
    1. Assessing / evaluating surface
    2. Selecting sanding option:
        i. hand sanding:
            - wet
            - dry
        ii. machine sanding:
            - wet
            - dry
    3. Selecting grit:
        - variables/issues
        - performance
        - guidelines
        - substrate consideration
        - dry
    4. Removing imperfections
    5. Feather edging
    6. Leveling
    7. Blocking
    8. Abrading
    9. Masking

B. Perform filler application.
    1. Select application
        - hand mixed and applied
        - by spray
    2. Identify surface imperfections
    3. Mixing according to manufacturers' recommendations
    4. Apply polyester putty or spray filler
    5. Apply guide coat
    6. Level to contour by block sanding
    7. Prepare surface for undercoats

Number:	S3163.2		
Title:	**Undercoats Preparation**		
Duration:	Total Hours: 6	Theory: 3	Practical: 3
Cross Reference to Training Standards: U9023			

General Learning Outcomes

Upon successful completion, the Apprentice is able 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:

3163.2.1 Define the introductory information and fundamentals, application and types of undercoats and protective coatings.

3163.2.2 Explain the mixing and application procedures for undercoats and protective coatings.

3163.2.3 Perform manufacturers' application for undercoats and protective coatings.

Learning Content

3163.2.1 Define the introductory information and fundamentals, application and types of undercoats and protective coatings. [1/0]

Types:

- primers:
  - self-etch
  - epoxy
- high build primer-surfacers:
  - urethane
  - UV (ultra violet)
  - epoxy
- primer sealer:
  - urethane
  - epoxy
- Rubberized coating:
  - water-based
  - solvent-based

3163.2.2 Explain the mixing and application procedures for undercoats and protective coatings. [2/0]

Consult the manufacturers' technical data sheet for:

- PPE
- mixing ratios
- pot life
- tip size
- air pressure
- application
- flash times
- drying times
- drying methods
- clean-up of equipment

3163.2.3 Perform manufacturers' application for undercoats and protective coatings. [0/3]

Mix materials

- PPE
- mixing ratios
- pot life
- primer types:
  - etching
  - filler/epoxy/sealer
- tip size
- spray gun set up
- application
- flash times
- drying times
- clean-up of equipment

Number:	S3163.3		
Title:	**Paint identification and Application**		
Duration:	Total Hours: 9	Theory: 6	Practical: 3
Cross Reference to Training Standards: U9040			

General Learning Outcomes

Upon successful completion, the Apprentice is able to demonstrate a working knowledge of paint composition, identification, handling procedures and application.

Learning Outcomes

Upon successful completion, the apprentice is able to:

3163.3.1 Identify the fundamentals of topcoats.

3163.3.2 Identify VOC (Volatile Organic Compound) handling procedures.

3163.3.3 Describe and perform vehicle and paint manufacturers' procedures for locating paint codes.

3163.3.4 Identify methods to determine types of previous paint coatings.

3163.3.5 Explain the preparation considerations for types of refinishing system.

3163.3.6 Perform manufacturers' refinishing procedures for topcoat application.

Learning Content

3163.3.1 Identify the fundamentals of topcoats. [2/0]

Paint composition:
- pigments
- binders
- solvents

Additives:
- hardeners/activators
- reducers

Types:
- enamel
- lacquer
- acrylic enamel
- polyurethane

- acrylic urethane enamel
- acrylic lacquer
- urethane
- basecoat:
  - solvent
  - low VOC (Volatile Organic Compound) solvent
  - waterborne/waterbase
- clearcoat

3163.3.2 Identify VOC (Volatile Organic Compound) handling procedures. [1/0]

1. Tracking of VOC
   a. regulations
   b. inventory
   c. mixing
   d. consumption
2. Computerized equipment
   a. mixing
   b. record keeping

3163.3.3 Describe and perform vehicle and paint manufacturers' procedures for locating paint codes. [1/0]

Locate and record vehicle manufacturers':
- paint codes
- trim codes
- VIN

Locate paint manufacturers' colour chips
- reference vehicle codes to colour chips
- confirm colour formula / variant

3163.3.4 Identify methods to determine types of previous paint coatings. [1/0]

Visual inspection
Sanding test
Compounding test
Solvent test

3163.3.5 Explain the preparation considerations for types of refinishing systems. [1/0]

Primer selection
- selection
- applications

Sandpaper options
- type
- grit

Contour mapping
Die back

3163.3.6 Perform manufacturers' refinishing procedures for topcoat application. [0/3]

Determine topcoat mixing ratio
Mix paint materials
Set up refinish equipment

Perform spray techniques:
- wetness of application
- methods and patterns of application
  - speed, overlap, distance, angle (SODA)
- flash and tack times

Clean up refinish equipment

Number:	S3163.4		
Title:	**Spray Guns**		
Duration:	Total Hours: 6	Theory: 4	Practical: 2
Cross Reference to Training Standards: U9023 and U9040			

General Learning Outcomes

Upon successful completion, the Apprentice is able 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:

3163.4.1 Define the purpose, types and fundamentals of spray guns.

3163.4.2 Describe the function and construction of the major components of spray guns.

3163.4.3 Explain the principles of set up and operation of spray equipment.

3163.4.4 Perform manufacturers' maintenance procedures for spray guns of various types.

Learning Content

3163.4.1 Define the purpose, types and fundamentals of spray guns. [2/0]

Purpose:
- atomization
- spray patterns
- material transfer

Types and Fundamentals:
- suction (siphon) feed
- pressure feed
- gravity feed
  - conventional
  - H.V.L.P. (high volume low pressure)
  - R.P. (Reduced Pressure)
- touch-up gun
- air brush

3163.4.2 Describe the function and construction of the major components of spray guns. [1/0]

Air caps
Fluid tips
Fluid needles
Air volume control valve
Baffles
Spreader valve
Gun body
Cup
Seals, gaskets and packings

3163.4.3 Explain the principles of set up and operation of spray equipment. [1/0]

Set up:
- air pressure
- spray pattern
- fluid flow

Operation:
- two-stage trigger
- test pattern
- trouble shooting

3163.4.4 Perform manufacturers' maintenance procedures for spray guns of various types. [0/2]

Set up:
- air pressure
- spray pattern
- fluid flow

Operation:
- two-stage trigger
- test pattern
- trouble shooting

Maintenance:
- back flushing
- exterior cleaning
- interior cleaning (manual and machine)
- lubrication
- troubleshooting
- storage
- fluid hoses

Number:	S3163.5		
Title:	**Spray Booths**		
Duration:	Total Hours: 3	Theory: 2	Practical: 1
Cross Reference to Training Standards: U9040.03			

General Learning Outcomes

Upon successful completion, the Apprentice is able 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:

3163.5.1 Define the purpose and features of spray booths.

3163.5.2 Explain the principles of operation of various types of booths.

3163.5.3 Perform manufacturers' maintenance and cleaning of spray booths, prep stations and mixing room.

Learning Content

3163.5.1 Define the purpose and features of spray booths. [1/0]

Purpose:
- controlled refinishing environment

Features:
- walls
- filtration systems
- sprinkler systems
- seals
- air makeup unit
- temperature controls
- manometers
- bake unit
- lights

3163.5.2 Explain the principles of operation of various types of booths. [1/0]

Types:
- cross flow
- semi-downdraft
- downdraft
- solid back
- drive through
- above ground
- pit
- prep stations
- mixing rooms

3163.5.3 Perform manufacturers' maintenance and cleaning of spray booths, prep stations and mixing room. [0/1]

- Clean wall/glass
- Clean protective coating
- Clean light
- Clean floors
- Inspect/replace intake filter inspect
- Inspect/replace exhaust filter (dry or wet)
- Clean exhaust pit (dry or wet)
- Clean floor grate
- Clean/inspect air line
- Drain air regulator draining
- Inspect contaminants
- Inspect seals

Number:	S3163.6		
Title:	**Compressed Air Delivery**		
Duration:	Total Hours: 6	Theory: 3	Practical: 3
Cross Reference to Training Standards: U9021			

General Learning Outcomes

Upon successful completion, the Apprentice is able 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:

3163.6.1 Define the purpose types and fundamentals of compressed air systems.

Learning Content

3163.6.1 Define the purpose types and fundamentals of compressed air systems. [3/3]

Purpose: provide volume of pressurized clean useable air to equipment and pneumatic tools

Types:
- diaphragm
- piston
  - single stage
  - multi-stage
- rotary screw

Ratings:
- power requirements
- horsepower (HP)
- cubic feet per minute (CFM)
  - displacement
  - free air delivery
- pressure capabilities
- duty cycle
- tang size

Components:
- pumps
- motor
- tank
- pressure switch
- safety valve
- foot valve
- centrifugal pressure release
- heat switch
- regulators
- hoses / airlines
- belts, pulleys
- safety/belt guard
- overload protection
- airline layout

Maintenance:
- cleaning
- oil changing
- belt tension
- component testing
- water drain (manual/automatic)

Air intake:
- filtering
- contamination
- location of supply

Troubleshooting:
- overheating
- knocking
- run-on (excessive run time)
- pumping oil
- oil leaks
- air leakage
- hard startup

Distribution systems:
- air transformer
- separator / regulators
- condensers, after coolers / air dryers
- lubricators

Number:	S3164		
Title:	**Applied Mechanical**		
Duration:	Total Hours: 36	Theory: 23	Practical: 13

Number:	S3164.1		
Title:	**Applied Computer Skills**		
Duration:	Total Hours: 3	Theory: 2	Practical: 1
Cross Reference to Training Standards: U9021.06			

General Learning Outcomes

Upon successful completion, the Apprentice is able to perform necessary trade related computer functions and access trade and service information using a PC and the Internet according to on-the-job requirements.

Learning Outcomes

Upon successful completion, the apprentice is able to:

3164.1.1 Perform functions on a computer.

Learning Content

3164.1.1 Explain and perform the following functions on a computer. [2/1]

Access trade related information
Access internet:
- browsing
- file download

Access email:
- reading attachments
- send / receive

Number:	S3164.2		
Title:	**Electrical Fundamentals**		
Duration:	Total Hours: 12	Theory: 8	Practical: 4
Cross Reference to Training Standards: U9034			

General Learning Outcomes

Upon successful completion, the Apprentice is able to demonstrate a working knowledge of the fundamentals of electricity and electrical test equipment.

Learning Outcomes

Upon successful completion, the apprentice is able to:

3164.2.1 Define the fundamentals of electricity.

3164.2.2 Define the purpose and fundamentals of electrical test equipment.

3164.2.3 Perform test procedures using various pieces of test equipment following manufacturers' recommendations.

Learning Content

3164.2.1 Define the fundamentals of electricity. [4/0]

Current / voltage / resistance
Conductors
Circuit protection
Series circuits
Parallel circuits
Series / parallel circuits
Open circuits
Closed circuits
Short circuits:

- dead short
- intermittent short
- cross circuit short
- high resistance short

3164.2.2 Define the purpose and fundamentals of electrical test equipment. [4/0]

Purpose:
- Diagnose electrical circuits

Fundamentals:
- electrical meters
- high and low impedance multi-meters
- ammeter / voltmeter / ohmmeter
- continuity tester
- induction pickup
- test light / test light (self-powered)

3164.2.3 Perform test procedures using various pieces of test equipment following manufacturers' recommendations. [0/4]

Current / voltage / resistance
Conductors
Circuit protection
Series circuits
Parallel circuits
Series / parallel circuits
Open circuits
Closed circuits
Short circuits:
- dead short
- intermittent short
- cross circuit short
- high resistance short

Number:	S3164.3		
Title:	**Battery Fundamentals**		
Duration:	Total Hours: 6	Theory: 4	Practical: 2
Cross Reference to Training Standards: U9034			

General Learning Outcomes

Upon successful completion, the Apprentice is able to explain the purpose, construction, principles of operation of batteries and perform inspection and testing of batteries according to manufacturers' standards.

Learning Outcomes

Upon successful completion, the apprentice is able to:

3164.3.1 Explain the purpose and principles of operations of batteries.

3164.3.2 Explain the construction, types, styles and applications of batteries ratings.

3164.3.3 Describe precautions for servicing and charging.

3164.3.4 Identify fundamentals of hybrid/electric battery systems.

3164.3.5 Perform inspect and testing on batteries and assigned operations.

Learning Content

3164.3.1 Explain the purpose and principles of operations of batteries. [1/0]

Installation and removal
Connecting and disconnecting types of terminals
Jump starting
Leaks
Battery chemical action during charging and discharging
Temperature effect on charging and internal resistance ratings

3164.3.2 Explain the construction, types, styles and applications of batteries ratings. [1/0]

Construction:

- lead acid
- low maintenance
- absorbed glass mat (AGM)
- maintenance-free batteries

Ratings:
- hot cranking amps (HCA)
- amp-hour rating (AH)
- cranking amps (CA)
- reserve capacity (RC)
- cold cranking amps (CCA)

3164.3.3 Describe precautions for servicing and charging. [1/0]

Temperature adjustments
Conductance testing
Refractometer
Hydrometer

3164.3.4 Identify fundamentals of hybrid/electric battery systems. [1/0]

Battery types
Wire colouring
Service disconnect
Voltage precautions

3164.3.5 Perform inspection and test batteries. [0/2]

Visually inspect
Test state-of-charge
Perform surface discharge
Perform load/conductance test
Perform parasitic draw
Clean battery and terminals
Charge
Removal and replacement
Interpret battery sizing

Number:	S3164.4		
Title:	**Air Conditioning Awareness**		
Duration:	Total Hours: 3	Theory: 2	Practical: 1
Cross Reference to Training Standards: U9036			

General Learning Outcomes

Upon successful completion, the Apprentice is able 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:

3164.4.1 Identify the health and safety issues concerning the handling of refrigerants.

3164.4.2 Identify the major components and operating principles used in mobile air conditioning systems.

Learning Content

3164.4.1 Identify the health and safety issues concerning the handling of refrigerants. [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 (clorofluorocarbon) / HFC (hydroclorocarbon) / HFO (hydrofluoroolefin)
- handling precautions
- inhalation
- skin and eye contact
- cylinder temperature / pressures

Refrigerant waste law requirements

3164.4.2 Identify the major components and operating principles used in mobile air conditioning systems. [1/1]

Identify major components of automotive air conditioning systems
- condenser
- receiver dryer
- accumulator
- 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

Number:	S3164.5		
Title:	**Tires and Rims**		
Duration:	Total Hours: 6	Theory: 3	Practical: 3
Cross Reference to Training Standards: U9038			

General Learning Outcomes

Upon successful completion, the Apprentice is able 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:

3164.5.1 Define the fundamentals of tires and rims.

3164.5.2 Identify the construction, types, styles and application of tires and rims.

3164.5.3 Perform inspection, testing and diagnosis of tire and rim assemblies with tools and equipment.

3164.5.4 Perform assigned operations on tires and rims.

Learning Content

3164.5.1 Define the fundamentals of tires and rims. [1/0]

Fastener torque
Effects of water (hydroplaning)
Sliding and rolling friction
Sizes
Sidewall information
Static and dynamic balance
Reparability

3164.5.2 Identify the construction, types, styles and application of tires and rims. [2/0]

Tires
Materials
Tread designs
Construction:
- radial
- run flat tires

Pressure monitoring systems (TPMS)

Rims
- materials
- construction

3164.5.3 Perform inspection, testing and diagnosis of tire and rim assemblies with tools and equipment. [0/1]

Tire and rim safety inspection
Identify and measure radial and lateral wheel and tire run out
Identify factors that affect tire wear
Identify factors that cause cord separation

3164.5.4 Perform assigned operations on tires and rims. [0/2]

Static and dynamic balance of wheel assemblies
Wheel assembly removal and installation procedures
Tire repair
TPMS relearn

Number:	S3164.6		
Title:	**Steering and Suspension Systems**		
Duration:	Total Hours: 6	Theory: 4	Practical: 2
Cross Reference to Training Standards: U9038			

General Learning Outcomes

Upon successful completion, the Apprentice is able to explain the fundamental theories, characteristics and applications of steering and suspension systems according to principles of physics.

Learning Outcomes

Upon successful completion, the apprentice is able to:

3164.6.1 Identify various suspension and steering systems and components.

Learning Content

3164.6.1 Identify and demonstrate various suspension and steering systems and components. [4/2]

Non independent
Semi independent
Independent
Short- and long-control arms
McPherson strut
Modified strut
Wishbone
Multi-link
Spring types
Shock absorbers
Steering linkage types:

- parallelogram
- rack and pinion

Evaluation Structure	
Theory Testing	Practical Application Testing
50%	50%

Level 2

Reportable Subject Summary – Level 2

Number	Reportable Subjects	Hours Theory	Hours Practical	Hours Total
3165: Welding				
3165.1	Gas Metal Arc Welding (GMAW)	5	16	21
3165.2	Squeeze Type Resistance Spot Welding (STRSW)	4	2	6
Sub Totals		**9**	**18**	**27**
3166: Refinishing				
3166.1	Plastic Refinish	7	8	15
3166.2	Top Coat Application - Complete	9	9	17
3166.3	Vehicle Detailing	2	4	6
Sub Totals		**18**	**21**	**39**
3167: Plastic Repair				
3167.1	Plastics Fundamentals	3	0	3
3167.2	Non-Reinforced Plastics	10	8	18
3167.3	Rigid Reinforced Plastics	5	4	9
Sub Totals		**18**	**12**	**30**
3168: Body and Structure				
3168.1	Corrosion Protection	7	2	9
3168.2	Measuring Systems	12	6	18
3168.3	Automotive Glass	8	4	12
3168.4	Safety Devices	8	4	12
Sub Totals		**35**	**16**	**51**
3169: Non-Structural Repair				
3169.1	Non-Structural Panel Repair	9	18	27
3169.2	Non-Structural Panel Replacement Fundamentals	12	0	12
3169.3	Non-Structural Panel Replacement	0	18	18
Sub Totals		**21**	**36**	**57**
3170: Applied Mechanical				
3170.1	Heating, Ventilation and Cooling Systems	7	2	9
3170.2	Basic Electrical Systems	11	4	15
3170.3	Vehicle Dash	2	1	3
3170.4	Fuel and Exhaust Systems	7	2	9
Sub Totals		**27**	**9**	**36**
Level 2 Totals		**128**	**112**	**240**

Number:	3165		
Title:	**Welding**		
Duration:	Total Hours: 27	Theory: 9	Practical: 18

Number:	S3165.1		
Title:	**Gas Metal Arc Welding (GMAW)**		
Duration:	Total Hours: 21	Theory: 5	Practical: 16
Cross Reference to Training Standards: U9026			

General Learning Outcomes

Upon successful completion, the Apprentice is able to demonstrate a working knowledge of performing Gas Metal Arc Welding (GMAW), including use and maintenance of equipment and diagnose welds for defects to maintain manufacturers' structural requirements.

Learning Outcomes

Upon successful completion, the apprentice is able to:

3165.1.1 Explain the principles of operation of Gas Metal Arc Welding (GMAW) equipment and procedures for coated metals in the vertical, horizontal and overhead positions.

3165.1.2 Perform Gas Metal Arc Welding (GMAW) on various gauges of metal ranging from 20 to 22.

3165.1.3 Identify and diagnose Gas Metal Arc Welding (GMAW) welds for defects to maintain manufacturers' structural requirements.

Learning Content

3165.1.1 Explain the principles of operation of Gas Metal Arc Welding (GMAW) equipment and procedures for coated metals in the vertical, horizontal and overhead positions. [3/0]

Principles:

- PPE
- work set up
- equipment settings
- polarity
- trial beads
- arc initiation
- transfer methods

- travel speeds
- travel and work angle
- push or pull technique
- wire drive speeds
- gas flow rate
- electrode stick-out
- continuity/work clamp placement
- power source characteristics
- pulse MIG (Metal Inert Gas)

3165.1.2 Perform Gas Metal Arc Welding (GMAW) on various gauges of metal ranging from 20 to 22. [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:
- open butt
- butt with insert
- lap
- plug

Weld joints in positions:
- horizontal
- vertical
- overhead

Weld joints in different positions using coated mild steel:
- galvanized
- E-coated (electro deposition coating)
- Weld through primer

Weld joints using various techniques:
- continuous
- plug
- stitch
- spot
- tack

3165.1.3 Identify and diagnose Gas Metal Arc Welding (GMAW) welds for defects to maintain manufacturers' structural requirements. [2/3]

Visually inspect weld for:
- porosity
- cracks
- excessive spatter
- undercut
- overlap
- penetration
- gaps
- excessive heat-affected zone
- burn-through
- excessive weld height

Destructively test weld by:
- shear testing
- peel testing
- twist testing

Number:	S3165.2		
Title:	**Squeeze Type Resistance Spot Welding (STRSW)**		
Duration:	Total Hours: 6	Theory: 4	Practical: 2
Cross Reference to Training Standards: U9027			

General Learning Outcomes

Upon successful completion, the Apprentice is able to demonstrate a working knowledge of performing Resistance Spot Welding (RSW), including use and maintenance of equipment and diagnose welds for defects to maintain manufacturers' structural requirements

Learning Outcomes

Upon successful completion, the apprentice is able to:

3165.2.1 Describe the function, construction and types of Squeeze Type Resistance Spot Welding (STRSW) equipment and components.

3165.2.2 Explain the set-up of Squeeze Type Resistance Spot Welding (STRSW) equipment.

3165.2.3 Demonstrate and perform Squeeze Type Resistance Spot Welding (STRSW) procedures.

3165.2.4 Diagnose Squeeze Type Resistance Spot Welding (STRSW) welds for defects to maintain manufacturers' structural requirements.

Learning Content

3165.2.1 Describe the function, construction and types of Squeeze Type Resistance Spot Welding (STRSW) equipment and components. [2/0]

Function:
- duplicate OEM spot welds
- fusing metals together via current and pressure

Equipment/features:
- Air/liquid cooled
- Power source/voltage
- Duty cycle
- Software

Components:
- Transformer
- pressure adjustment
- current flow adjustment
- apply time
- arms, design and styles
- tips, diameter and styles
- cooling system
- lifting assist

3165.2.2 Explain the set-up of Squeeze Type Resistance Spot Welding (STRSW) equipment. [2/0]

Set up:
- vehicle and area preparation
- metal preparation
- joint:
  - clearance between welding surfaces
  - surface to be welded
  - anti-corrosion agents
  - application of equipment
  - number of welds
  - weld pitch
  - position of welds
  - weld bond
- tip pressure:
  - tip alignment and dressing
- weld time
- current

3165.2.3 Demonstrate and perform Squeeze Type Resistance Spot Welding (STRSW) procedures. [0/1]

Perform adjustments current flow time Set up/weld:
- vehicle and area preparation
- metal preparation

- joint:
  - clearance between welding surfaces
  - surface to be welded
  - anti-corrosion agents:
    - weld through primer
    - e-coat
  - application of equipment
  - number of welds
  - weld pitch
  - position of welds
  - weld bond
- current adjustment
- tip pressure adjustment:
  - tip alignment and dressing
- weld time

3165.2.4 Diagnose Squeeze Type Resistance Spot Welding (STRSW) welds for defects to maintain manufacturers' structural requirements. [0/1]

Appearance (non-destructive) testing:
- weld position
- flange distortion
- weld nugget size
- heat affect zone
- squeeze out (weld bond)
- number of spots
- pinholes
- blow throughs
- spatter

Destructive testing:
- shear testing
- peel testing
- twist testing

Number:	S3166		
Title:	**Refinishing**		
Duration:	Total Hours: 39	Theory: 18	Practical: 21

Number:	S3166.1		
Title:	**Plastic Refinish**		
Duration:	Total Hours: 15	Theory: 7	Practical: 8
Cross Reference to Training Standards: U9040			

General Learning Outcomes

Upon successful completion, the Apprentice is able 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:

3166.1.1 Define the purpose and fundamentals of refinishing automotive plastics.

3166.1.2 Explain the repair procedures for spot and complete panel refinishing on rigid and flexible automotive plastics.

3166.1.3 Explain and perform automotive plastic refinish procedures.

3166.1.4 Identify and apply manufacturers' refinishing procedures for interior parts.

Learning Content

3166.1.1 Define the purpose and fundamentals of refinishing automotive plastics. [3/0]

Purpose:
- restore the appearance and durability

Identification:
- thermoset
- thermoplastic
- rigid
- flexible
- reinforced
- non-reinforced
- ISO code

Primer and paint compatibility
Problems:
- solvent sensitive primer
- adhesion issues
- mold release agents
- reconditioned plastic components
- previous repairs
- static electricity
- wicking

Testing:
- solvent
- abrasion
- flexibility
- water beading/sheeting
- identification stamp (ISO – international standards organization)

Specialty products and effects:
- primers
- flex agents
- cleaning agent
- adhesion promoter
- matt agents
- texturing agents

3166.1.2 Explain the repair procedures for spot and complete panel refinishing on rigid and flexible automotive plastics. [2/4]

Rigid plastics:
- PPE
- hot water with wax-free soap
- anti-static wipe
- abrade the surface
- feather edge repair
- anti-static wipe
- use appropriate primer (epoxy/urethane)
- basecoat
- clear coat

Flexible plastics:
- PPE
- hot water with wax-free soap (inside out)
- solvent wash
- bake (raw)
- anti-static wipe (raw)
- abrade the surface
- anti-static wipe
- adhesion promoter (if required)
- primer/sealer flexed
- basecoat (with hardener if required)
- clear coat flexed

3166.1.3 Explain and perform automotive plastic refinish procedures. [1/2]

Procedures:
- PPE
- hot water with wax-free soap
- anti-static wipe
- minor repair
- feather edge repair
- anti-static wipe
- apply adhesion promoter (if required)
- use appropriate primer
- block sand and refine
- abrade panel
- basecoat (with hardener if required)
- clear coat (add flex agent if required)

Minor repairs:
- stone chips
- scratches
- gouges
- cracked/crazed coatings
- peeling paint
- mold defects
- pre-existing paint defects

3166.1.4 Identify and apply manufacturers' refinishing procedures for interior parts. [1/2]

Interior parts:
- dash panel
- interior trim panels
- centre console

Considerations:
- OEM recommendations
- substrate
- texture
- colour
- gloss levels
- film thickness

Procedures:
- follow paint manufacturer’s recommendations

Number:	S3166.2		
Title:	**Top Coat Application - Complete**		
Duration:	Total Hours: 18	Theory: 9	Practical: 9
Cross Reference to Training Standards: U9040			

General Learning Outcomes

Upon successful completion, the Apprentice is able to demonstrate a working knowledge of performing complete vehicle refinishing and final inspection.

Learning Outcomes

Upon successful completion, the apprentice is able to:

3166.2.1 Identify the techniques and considerations of spraying completes.

3166.2.2 Explain the preparation procedures for complete vehicle refinish of various topcoats.

3166.2.3 Describe and perform manufacturers' refinish procedures for complete vehicle refinishing.

3166.2.4 Inspect the vehicle finish for imperfections.

Learning Content

3166.2.1 Identify the techniques and considerations of spraying completes. [3/0]

Techniques and Considerations:

- Gun adjustments
- Gun motion
- Routing (spray plan)
  - single-stage
  - multi-stage (base clear)
- Spray booth settings
  - alternate fuel vehicle precautions
  - spraying temperature
  - ventilation
- Mil thickness
- Hiding/coverage
- Ground coat/sealer
- Paint texture
- Wet edge spraying
- Additive selection
- Vehicle protection

3166.2.2 Explain the preparation procedures for complete vehicle refinish of various topcoats. [3/0]

Preparation Procedure:
- PPE
- hot water with wax-free soap
- remove necessary trim
- blow off
- degrease
- carry out sanding operations
- blow off and mask
- degrease
- apply appropriate primer (epoxy/urethane)
- block sand and refine to recommended grit
- blow off and re-mask

3166.2.3 Describe and perform paint manufacturers' refinish procedures for complete vehicle refinishing. [3/8]

Procedure:
- PPE
- prepare spray booth
- blow off
- final degrease
- detail mask
- prepare paint
- blow off and tack
- test spray equipment
- apply top coats
- control drying time
- clean up equipment

3166.2.4 Inspect the vehicle finish for imperfections. [0/1]

Imperfections:
- runs
- excessive orange peel
- dirt
- bleeding through
- fisheye
- insufficient film thickness
- transparent colours
- mottling
- solvent pop
- die back

Number:	S3166.3		
Title:	**Vehicle Detailing**		
Duration:	Total Hours: 6	Theory: 2	Practical: 4
Cross Reference to Training Standards: U9022			

General Learning Outcomes

Upon successful completion, the Apprentice is able to demonstrate a working knowledge of interior and exterior vehicle detailing.

Learning Outcomes

Upon successful completion, the apprentice is able to:

3166.3.1 Identify the surface contaminants and defects that require cleaning, fine sanding and polishing for vehicle detailing.

3166.3.2 Explain the procedures for removing surface contaminants and defects from interiors and exteriors.

3166.3.3 Identify various types of surface contaminants and defects on interior and exterior of vehicles.

3166.3.4 Perform detailing procedures on interior and exterior as outlined.

Learning Content

3166.3.1 Identify the surface contaminants and defects that require cleaning, fine sanding and polishing for vehicle detailing. [1/0]

Cleaning:
- water stains
- tar
- road film
- stains on interior (gum, blood, urine, grease)
- soft top maintenance
- soiled carpet

Fine sanding and polishing:
- light scratches
- dirt in paint
- water stains
- stains on exterior (tar, road film, bird droppings, acid rain)
- industrial fallout (brake dust)
- paint over spray
- oxidized head lights

3166.3.2 Explain the procedures for removing surface contaminants and defects from interiors and exteriors. [1/0]

Procedures:
- washing
- wiping with solvents
- fine sanding
- compounding
- polishing
- waxing
- vacuuming
- shampooing
- treating
- freezing (gum)

Precautions:
- mil thickness / precautions
- uncured paint film
- compatibility of the cleaning agents
- equipment selection

3166.3.3 Identify various types of surface contaminants and defects on interior and exterior of vehicles. [0/2]

Using test unit
- wash exterior with wax-free soap and water
- rinse and chamois
- locate and record
  - contaminants
  - defects

3166.3.4 Perform detailing procedures on interior and exterior. [0/2]

Procedures:
- Wiping with solvents
- Fine sanding
- Compounding
  - light scratches
  - over spray
  - road film

- Polishing
- Waxing
- Vacuuming
- Shampooing
- Wipe down interior
- Treating
- Freezing (gum)
- Clean glass
- Final inspection

Number:	S3167		
Title:	**Plastic Repair**		
Duration:	Total Hours: 30	Theory: 18	Practical: 12

Number:	S3167.1		
Title:	**Plastics Fundamentals**		
Duration:	Total Hours: 3	Theory: 3	Practical: 0
Cross Reference to Training Standards: U9033			

General Learning Outcomes

Upon successful completion, the Apprentice is able to explain the purpose, fundamentals and types of plastics

Learning Outcomes

Upon successful completion, the apprentice is able to:

3167.1.1 Explain the purpose, fundamentals and types of plastics.

Learning Content

3167.1.1 Explain the purpose, fundamentals and types of plastics. [3/0]

Purpose and characteristics:
- weight reduction
- flexibility
- complex parts design
- dent resistance
- corrosion resistance

Types:
- thermoset
- thermoplastic
- rigid
- flexible
- reinforced
- non-reinforced

Identification methods:

- ISO code
- grind test
- float test
- burn test

Number:	S3167.2		
Title:	**Non-reinforced Plastics**		
Duration:	Total Hours: 18	Theory: 10	Practical: 8
Cross Reference to Training Standards: U9033			

General Learning Outcomes

Upon successful completion, the Apprentice is able to demonstrate a working knowledge of repairing non-reinforced plastics.

Learning Outcomes

Upon successful completion, the apprentice is able to:

3167.2.1 Define the purpose, fundamentals and types of plastics.

3167.2.2 Explain the considerations, types and methods of non-reinforced plastic repairs.

3167.2.3 Explain and perform the recommended manufacturers' adhesive-method repair procedures for non-reinforced plastic components.

3167.2.4 Explain and perform recommended manufacturers' welding-method repair procedures for non-reinforced plastic components.

Learning Content

3167.2.1 Define the purpose, fundamentals and types of plastics. [2/0]

Purpose and characteristics:
- weight reduction
- flexibility
- complex part designs
- dent resistance
- corrosion resistance

Types:
- thermoset
- thermoplastic
- rigid
- flexible
- reinforced
- non-reinforced

Identification methods:
- ISO code
- grind test
- float test
- burn test

3167.2.2 Explain the considerations, types and methods of non-reinforced plastic repairs. [2/0]

Repair considerations:
- type of plastic
- severity and extent of damage
- flexibility
- texture
- OEM vs. after-market construction materials
- location of damage
- OEM recommendations
- limitations:
  - SRS (trim covers and surrounds)
  - electronic safety and convenience components
  - impact absorbers
  - structural components

Types of damages:
- gouges
- cracks
- scratches
- tears
- distortion
- stress
- dents
- punctures

Repair methods:
- adhesive
- welding

3167.2.3 Explain and perform the recommended manufacturers' adhesive-method repair procedures for non-reinforced plastic components. [2/4]

PPE
Remove panel (if necessary)
Identify type for repair process
Clean
Reshape and remove stress
Bevel (if necessary)
Featheredge and abrade damaged areas
Reinforce backside (if necessary)
Apply adhesion promoter (if necessary)
Mix and apply repair material
Level to contour

3167.2.4 Explain and perform recommended manufacturers' welding-method repair procedures for non-reinforced plastic components. [4/4]

1. Explain the features and construction of plastic welding equipment and components.

Airless welding:
- temperature control
- tip selection
- variety of rods

Hot air welding:
- electronically heated torches
- gas heated torches
- welding rods
- temperature
- tips
- air flow

Gas and power control units:
- argon
- nitrogen

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

Hot air and airless welding process

- welding rod materials
- temperature control
- pressure control
- angle between rod and base material

3. Explain and perform the recommended procedures for welding of non-reinforced plastic components.

PPE
Remove panel (if necessary)
Identify type for repair process
Clean
Reshape and remove stress
Bevel
Featheredge and abrade damaged areas
Clamp and hold
Tack joint pieces to be welded
Weld from backside
Dress weld bead
Test and inspect weld

Number:	S3167.3		
Title:	**Rigid Reinforced Plastics**		
Duration:	Total Hours: 9	Theory: 5	Practical: 4
Cross Reference to Training Standards: U9033			

General Learning Outcomes

Upon successful completion, the Apprentice is able to demonstrate a working knowledge of repairing rigid reinforced plastics.

Learning Outcomes

Upon successful completion, the apprentice is able to:

3167.3.1 Explain the considerations, types and methods of reinforced plastic repairs.

3167.3.2 Explain and perform recommended manufacturers' adhesive bonding repair procedures for reinforced plastic components.

Learning Content

3167.3.1 Explain the considerations, types and methods of reinforced plastic repairs. [3/0]

Repair considerations:
- type of plastic
- severity and extent of damage
- flexibility and rigidity
- location of damage
- OEM recommendations
- limitations:
  - SRS electronic components
  - electronic safety and convenience components
  - structural components
  - attachment methods

Types of damages:
- Direct:
  - gouges
  - cracks
  - scratches
  - punctures

- Indirect:
  - stress cracks
  - distortion
  - mounting locations and brackets

Repair material selection:
- epoxy
- polyester
- catalyst
- fiberglass
- matting
- chopped
- ground

Repair method:
- adhesive bonding

3167.3.2 Explain and perform recommended manufacturers' adhesive bonding repair procedures for reinforced plastic components. [2/4]

PPE
Remove panel (if necessary)
Identify type for repair process
Clean
Reshape and remove stress
Bevel (if necessary)
Featheredge and abrade damaged areas
Reinforce backside (if necessary)
Apply adhesion promoter (if necessary)
Mix and apply repair material
Level to contour

Number:	S3168		
Title:	**Body and Structure**		
Duration:	Total Hours: 51	Theory: 35	Practical: 16

Number:	S3168.1		
Title:	**Corrosion Protection**		
Duration:	Total Hours: 9	Theory: 7	Practical: 2
Cross Reference to Training Standards: U9037			

General Learning Outcomes

Upon successful completion, the Apprentice is able to demonstrate a working knowledge of the protection for the modern vehicle against corrosion.

Learning Outcomes

Upon successful completion, the apprentice is able to:

3168.1.1 Define corrosion, types and contributing factors.

3168.1.2 Define the basic types of corrosion protection materials.

3168.1.3 Identify the different corrosion protection materials used during repair procedures.

3168.1.4 Identify body seam sealers and application methods.

3168.1.5 Inspect and perform manufacturers' application methods for body sealers and corrosion protection materials.

Learning Content

3168.1.1 Define corrosion, types and contributing factors. [1/0]

Definition:
- A result of a chemical reaction that occurs when exposed metal reacts to oxygen and an electrolyte.

Types of corrosion:
- galvanic corrosion
- rust
- oxidization

Contributing factors:
- exposed metal
- moisture (electrolyte)
- oxygen
- acid rain
- industrial fallout
- collision damage
- corrosive materials (acids, salts)
- collision repairs (welding etc.)
- moisture seepage
- drain holes
- insufficient protection
- welding damage
- dissimilar metals
- relative humidity
- temperature

3168.1.2 Define the basic types of corrosion protection materials. [2/0]

1. OEM

Plating:
- galvanizing
- zinc phosphate

Coating:
- electrodeposition coating (e-coat)
- primers
- anti-chip coating
- topcoats

Anti-corrosion compounds:
- petroleum-based
- wax-base

Body sealers:
- seam sealer
- under body spray
- anti-chip guard/film
- anti-chip overlay

2. Non-OEM

Coating:
- primers
- anti-chip coating
- topcoats

Anti-corrosion compounds:
- petroleum-based
- wax-base

Body sealers:
- seam sealer
- under body spray
- anti-chip guard/film
- anti-chip overlay

3168.1.3 Identify the different corrosion protection materials used during repair procedures. [1/0]

Protective coatings primers
Anti-corrosion compounds
Body sealers seam sealers
Weld-through primers
Anti-rust agents
Rust converters

3168.1.4 Identify body seam sealers and application methods. [2/0]

Body seam sealers:
- sprayable
- self-leveling
- air dry (1K)
- catalyst (2K)
- brushable
- medium body
- heavy body
- strip caulk
- direct to metal

Application methods:
- spraying
- wiping
- brushing
- caulking gun

3168.1.5 Inspect and perform manufacturers' application methods for body sealers and corrosion protection materials. [1/2]

Inspect to determine:
- application method
- materials used
- location where protection is required

Apply body seam sealers and corrosion protection materials to:
- hoods
- fenders
- doors
- rockers
- quarters
- pillars
- deck lids
- floor pans
- inner structure
- rear body panels

Number:	S3168.2		
Title:	**Measuring Systems**		
Duration:	Total Hours: 18	Theory: 12	Practical: 6
Cross Reference to Training Standards: U9037			

General Learning Outcomes

Upon successful completion, the Apprentice is able 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:

3168.2.1 Identify the purpose of measuring and related terms and definitions.

3168.2.2 Identify the purpose of reference manuals and resources.

3168.2.3 Explain the procedures for locating frame and structure repair specification information.

3168.2.4 Demonstrate and perform equipment manufacturers' recommended procedures for measuring of frame and unibody vehicles.

Learning Content

3168.2.1 Identify the purpose of measuring and related terms and definitions. [4/0]

Purpose:
- To determine the extent of structural misalignment.
- To restore vehicle to OEM specifications.

Terms and definitions:
- datum
- centreline
- zero plane/point
- symmetrical
- asymmetrical
- measuring devices / systems
- length
- repair tolerances
- point to point
- control points

3168.2.2 Identify the purpose of reference manuals and resources. [4/0]

Purpose:
- to determine OEM specifications of critical reference points.

Reference manuals and resources:
- OEM
- spec sheets
- dimension manual and charts
- blueprint
- online subscription (non-OEM)
- estimating software
- measuring software

3168.2.3 Explain the procedures for locating frame and structure repair specification information. [4/0]

To locate:
- legend information
- measuring points
- upper body measurements
- under body measurements
- measuring system mounting locations
- repair tolerances
- datum
- centreline
- zero plane/point
- length
- lower ball joint
- control arm measurements
- strut tower

3168.2.4 Demonstrate and perform equipment manufacturers' recommended procedures for measuring of frame and unibody vehicles. [0/6]

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

Number:	S3168.3		
Title:	**Automotive Glass**		
Duration:	Total Hours: 12	Theory: 8	Practical: 4
Cross Reference to Training Standards: U9039			

General Learning Outcomes

Upon successful completion, the Apprentice is able to demonstrate a working knowledge of removal and replacement of automotive glass.

Learning Outcomes

Upon successful completion, the apprentice is able to:

3168.3.1 Define the purpose and fundamentals of automotive glass.

3168.3.2 Explain the removal, repair and replacement procedures for stationary and removable automotive glass.

3168.3.3 Perform the removal and replacement of stationary and moveable glass with the service tools and equipment.

3168.3.4 Perform the recommended testing procedures for automotive glass leaks.

Learning Content

3168.3.1 Define the purpose and fundamentals of automotive glass. [2/0]

Glass:
- laminated
- tempered
- encapsulated
- flush mount
- optical rating

Sealant kit:
- adhesives
- butyl
- rubber gaskets

3168.3.2 Explain the removal, repair and replacement procedures for stationary and removable automotive glass. [3/0]

Removal tools
Removal, Repair and Replace procedures for:
- OEM recommendations
- Urethane:
  - pinch weld preparation
- butyl
- encapsulated
- rubber gasket
- moveable glass / adjustments

3168.3.3 Perform the removal and replacement of stationary and moveable glass with the service tools and equipment. [3/3]

Stationary:
- removal of interior trim
- disconnection of electrical connections
- removal of glass
- glass and pinch weld preparation
- installation
- reassembly

Moveable:
- removal of trim panel
- removal of glass
- remove and reinstall regulator
- replacement of glass
- adjustments
- reassembly

3168.3.4 Perform the recommended testing procedures for automotive glass leaks. [0/1]

Fit and operation
Leak test procedures:
- chalk dust
- test drive and stethoscope
- water hose on low pressure
- sonic

Number:	S3168.4		
Title:	**Safety Devices**		
Duration:	Total Hours: 12	Theory: 8	Practical: 4
Cross Reference to Training Standards: U9025, U9035 and U9038			

General Learning Outcomes

Upon successful completion, the Apprentice is able to demonstrate a working knowledge of identifying, inspecting and testing vehicle safety devices.

Learning Outcomes

Upon successful completion, the apprentice is able to:

3168.4.1 Describe and identify systems and components that require testing or inspection after collision repairs.

3168.4.2 Demonstrate seat belt condition and operation checks.

3168.4.3 Explain and demonstrate brake pedal holding checks and vehicle fluid level.

3168.4.4 Identify Supplemental Restraint System components and safety precautions.

3168.4.5 Explain the procedures for component testing and road testing.

3168.4.6 Perform recommended manufacturers' procedures for testing safety related systems and components.

Learning Content

3168.4.1 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 aiming equipment setup and operation
Vehicle lighting checks
Supplemental Restraint System (S.R.S.)
Horns
Indicator lamps
Radio and clock set
Set mirrors
Tail lamps
Battery connection
Tires and pressure (TPM-Tire Pressure Monitoring)
Wheel lugs Fluid levels
Hydraulic lock-up

3168.4.2 Demonstrate seat belt condition and operation checks. [1/0]

Seat belt condition and operation
- belt damage
- retraction action
- hold down bolts
- action of belt buckles

3168.4.3 Explain and demonstrate brake pedal holding checks and vehicle fluid level. [1/0]

Static brake pedal holding ability check:
- 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

3168.4.4 Identify Supplemental Restraint System (S.R.S.) components and safety precautions. [1/1]

Passive restraints
Active restraints
Seat belts
Indicator lights
Occupant Classification System (O.C.S.)

3168.4.5 Explain the procedures for component and road testing. [3/0]

Test driving to check:
- brake pedal height
- seat belts
- unusual noises, e.g. squeaks and rattles
- head lamp aiming
- S.R.S.
- horns

- indicator lamps
- radio and clock set
- windshield wipers and washers
- mirror set-up
- tail lamps and brake lamps

3168.4.6 Perform recommended manufacturers' procedures for testing safety related systems and components. [0/3]

Brake pedal height
Seat belts
Unusual noises, e.g. squeaks and rattles
Head lamp aiming
S.R.S.
Horns
Indicator lamps
Radio and clock set
Windshield wipers and washers
Mirror set-up
Tail lamps and brake lamps

Number:	S3169		
Title:	**Non-Structural Repair**		
Duration:	Total Hours: 57	Theory: 21	Practical: 36

Number:	S3169.1		
Title:	**Non-Structural Panel Repair**		
Duration:	Total Hours: 27	Theory: 9	Practical: 18
Cross Reference to Training Standards: U9031 and U9032			

General Learning Outcomes

Upon successful completion, the Apprentice is able to demonstrate a working knowledge of non- structural panel repair using a logical repair sequence and Paintless Dent Repair (PDR) procedures.

Learning Outcomes

Upon successful completion, the apprentice is able to:

3169.1.1 Describe the inspection procedures to determine logical and sequential repair techniques.

3169.1.2 Perform major body panel repairs using the repair plan.

3169.1.3 Explain and demonstrate of Paintless Dent Repair (PDR) procedure.

Learning Content

3169.1.1 Describe the inspection procedures to determine logical and sequential repair techniques. [8/0]

Remove necessary parts to determine damage
Identify direct and indirect damage
Identify damage patterns
Identify damage direction
Develop repair plan (tools and equipment, etc.)

3169.1.2 Perform major body panel repairs using the repair plan. [0/17]

Rough out and align using:
- hydraulic body jacks
- non-hydraulic pulling equipment
- hammer and dolly
- body picks
- stretching
- shrinking

3169.1.3 Explain and demonstrate of Paintless Dent Repair (PDR) procedure. [1/1]

Explain PDR equipment
Explain PDR process
Repair dent

Number:	S3169.2		
Title:	**Non-Structural Panel Replacement Fundamentals**		
Duration:	Total Hours: 12	Theory: 12	Practical: 0
Cross Reference to Training Standards: U9031			

General Learning Outcomes

Upon successful completion, the Apprentice is able to demonstrate a working knowledge of the theory of non-structural panel replacement.

Learning Outcomes

Upon successful completion, the apprentice is able to:

3169.2.1 Define the purpose and fundamentals of non-structural panel removal, replacement and alignment.

3169.2.2 Explain the removal, replacement and alignment procedures for non-structural body panels.

Learning Content

3169.2.1 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
- weld bond
- dissimilar metals consideration

3169.2.2 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

Number:	S3169.3		
Title:	**Non-Structural Panel Replacement**		
Duration:	Total Hours: 18	Theory: 0	Practical: 18
Cross Reference to Training Standards: U9031			

General Learning Outcomes

Upon successful completion, the Apprentice is able to perform non-structural panel replacement.

Learning Outcomes

Upon successful completion, the apprentice is able to:

3169.3.1 Perform non-structural body panel replacement.

Learning Content

3169.3.1 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

Install, align and adjust replacement panel:

Mechanical:
- torque fasteners

Welded:
- dress welds

Adhesives:
- dress adhesive cosmetically (if applicable)
- remove excess adhesive

Number:	S3170		
Title:	**Applied Mechanical**		
Duration:	Total Hours: 36	Theory: 27	Practical: 9

Number:	S3170.1		
Title:	**Heating, Ventilation and Cooling Systems**		
Duration:	Total Hours: 9	Theory: 7	Practical: 2
Cross Reference to Training Standards: U9036			

General Learning Outcomes

Upon successful completion, the Apprentice is able to demonstrate a working knowledge of the principles of operation for heating, ventilation and cooling systems and to determine required testing and repair operations.

Learning Outcomes

Upon successful completion, the apprentice is able to:

3170.1.1 Define the purpose and fundamentals of engine cooling systems.

3170.1.2 Describe the construction features and application of engine cooling systems.

3170.1.3 Explain the principles of operation of engine cooling systems.

3170.1.4 Inspection and testing of heating, ventilation and cooling systems and perform the assigned questions.

3170.1.5 Perform a demonstration of heater and ventilation control operating functions.

Learning Content

3170.1.1 Define the purpose and fundamentals of engine cooling systems. [2/0]

Purpose of coolant:
- maintain efficient operating temp
- heat on-demand in passenger compartment

Fundamentals of cooling:
- means of heat transfer:
  - convection
  - conduction
  - radiation
- temperature effects on expansion and contraction
- the effects of pressure on boiling points
- mixing ratios
- heat measurements
- anti-freeze characteristics
- engine coolant circulation
- system filling and bleeding

3170.1.2 Describe the construction features and application of engine cooling systems. [3/0]

Liquid-cooled systems and components:
- thermostats
- radiators
- oil coolers
- pressure caps (related pressure/temperature relationship)
- water pumps
- coolant level sensors
- surge tank/reservoir
- fans:
  - electrical
  - combination electric and hydraulic
  - viscous
  - mechanical
  - shrouds and deflectors
  - push/pull
- heater cores
- heater and ventilation controls
  - vacuum operated
  - manual controls
  - air vent doors

3170.1.3 Explain the principles of operation of engine cooling systems. [2/0]

Cooling circulation and heat transfer
Air flow characteristics
Heating and ventilation controls

3170.1.4 Perform inspection and testing of heating, ventilation and cooling systems. [0/1]

Visual inspection
Pressure testing
Freeze point testing
PH testing
Internal and external leakage testing
Testing fan operation
Testing coolant and air flow
System bleeding
Test engine temperature control operation

3170.1.5 Perform a demonstration of heater and ventilation control operating functions. [0/1]

Number:	S3170.2		
Title:	**Basic Electrical Systems**		
Duration:	Total Hours: 16	Theory: 11	Practical: 5
Cross Reference to Training Standards: U9034			

General Learning Outcomes

Upon successful completion, the Apprentice is able to demonstrate a working knowledge of the operation of electrical systems to determine required testing and repair operations.

Learning Outcomes

Upon successful completion, the apprentice is able to:

3170.2.1 Explain the concepts and laws of circuit function.

3170.2.2 Describe the purpose and devices to test electrical systems and components.

3170.2.3 Explain and demonstrate the application and operation of testing devices.

3170.2.4 Inspect and test electrical systems and perform assigned operations.

3170.2.5 Explain the principles of operation of circuit protection devices.

3170.2.6 Describe the construction, types and application of circuit repair and protection devices.

3170.2.7 Perform inspection and testing procedures on circuit protection devices and repair wiring according to manufacturers' recommendations.

Learning Content

3170.2.1 Explain the concepts and laws of circuit function. (2/0)

Circuit types:
- Series
- Parallel
- Series parallel

Laws of circuit function:
- Ohm’s law
- Kirchhoff’s law
- Watt’s law

3170.2.2 Describe the purpose and devices to test electrical systems and components. [4/0]

Testing of electrical systems for:
- voltage
- amperage
- resistance

Testing Devices:
- electrical test meters (DVOM – Digital Volt Ohm Meter)
  - ammeter
  - voltmeter
  - ohmmeter
- test light:
  - self-powered
  - circuit-powered
- jumper wires/test lead (fuse lead)

3170.2.3 Explain and demonstrate the application and operation of testing devices. [2/0]

Testing devices:
- digital meters (high impedance meter)
- test lights (high impedance)

Demonstrate meter diagnostic procedures for:
- loose connections and leads
- defective batteries
- adjusting of meter gauge
- polarity of leads
- continuity of leads and clips
- defective fuse
- circuit breakers

Demonstrate meter uses:

Ammeters:
- tests electric flow
- positive and negative polarity
- connect with a load in series
- inductive ammeter

Voltmeters:
- check source voltage
- voltage drop

Ohmmeter:
- circuit/device continuity

3170.2.4 Inspect and test electrical systems and perform assigned operations [0/2]

Inspect and test:
- fuses
- lighting systems
- cooling fans
- horns
- door systems
- relays
- bulbs

Check for:
- continuity
- circuit operation
- current flow
- voltage
- resistance
- open
- shorts
- grounds

3170.2.5 Explain the principles of operation of circuit protection devices. [1/0]

Circuit protection devices:
- fuses
- circuit breakers
- fusible links

3170.2.6 Describe the construction, types and application of circuit repair and protection devices. [2/0]

Wiring and terminals
- wire size
- identification
- composition
  - copper
  - aluminum

- terminal/butt connectors
- soldering (rosin core vs. acid core)
- corrosion protection
- shrink tubing

Circuit protection devices
- fuses
- circuit breakers
- fusible links

3170.2.7 Perform inspection and testing procedures on circuit protection devices and repair wiring according to manufacturers' recommendations. [0/2]

Inspect and test circuit protection devices:
- fuses
- circuit breakers
- fusible links

Repair wiring and connectors:
- wire size consideration
- copper / aluminum:
  - cleaning
  - splicing
  - crimping
  - soldering
  - weather proofing

Number:	S3170.3		
Title:	**Vehicle Dash**		
Duration:	Total Hours: 3	Theory: 2	Practical: 1

Cross Reference to Training Standards: U9024, U9025, U9034, U9035 and U9036

General Learning Outcomes

Upon successful completion, the Apprentice is able to demonstrate a working knowledge of vehicle dash operation and service procedures.

Learning Outcomes

Upon successful completion, the apprentice is able to:

3170.3.1 Identify and explain the procedures of a vehicle dash removal and replacement.

Learning Content

3170.3.1 Identify and explain the procedures of a vehicle dash removal and replacement. [2/1]

Main types of vehicle dash units:
- one piece padded dashboards
- multi-piece padded dash

Clusters
Steering wheels and columns (collapsible)
Trim and hardware
Electrical connectors
Wire harness routing
VIN plate awareness
Air bag precautions

Number:	S3170.4		
Title:	**Fuel and Exhaust Systems**		
Duration:	Total Hours: 9	Theory: 7	Practical: 2
Cross Reference to Training Standards: None			

General Learning Outcomes

Upon successful completion, the Apprentice is able 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:

3170.4.1 Define the purpose and fundamentals of fuel and exhaust systems.

3170.4.2 Identify the basic construction features of fuel and exhaust system components.

3170.4.3 Describe the procedure to drain, remove, inspect and replace vehicle fuel tanks and related components.

3170.4.4 Outline the safety requirements and precautions for vehicles equipped with alternate fuel systems.

3170.4.5 Inspect and test fuel and exhaust systems and perform the assigned operations.

Learning Content

3170.4.1 Define the purpose and fundamentals of fuel and exhaust systems. [2/0]

Purpose and fundamentals
Fuel:

- fuel vapour control
- rollover protection valves
- tank and line fastening methods
- residual line pressures for electric in-take fuel pumps
- storage and handling procedures for volatile liquids
- thermal expansion and contraction

Exhaust:

- mufflers and resonators
- gases and emissions
- exhaust clearances

3170.4.2 Identify the basic construction features of fuel and exhaust system components. [2/0]

Fuel tanks:
- baffles
- materials
- attachment methods
- pumps/sending units

Lines:
- materials

Safety devices:
- vent control
- rollover valves
- inertia switch
- battery disconnect

Gas cap and filler neck
Exhaust system:
- construction
- material
- dual and single
- resonators and mufflers
- inlet and outlet features
- catalytic converters
- heats shields
- hangers
- sensor precautions

3170.4.3 Describe the procedure to drain, remove, inspect and replace vehicle fuel tanks and related components. [2/0]

Explain manufacturer’s procedure for servicing:
- fuel tanks
- fuel pumps/sending units
- lines
- safety devices

Explain manufacturer’s procedures for storing:
- fuel
- tanks

3170.4.4 Outline the safety requirements and precautions for vehicles equipped with alternate fuel systems. [1/0]

Propane and natural gas
- checking potential leaks
- turning off valves
- baking precautions
- structural repair scenarios

Hybrid and Electric vehicles:
- PPE
- electrical service disconnect/discharge procedures
- high voltage lines
- baking precautions
- structural repair scenarios

3170.4.5 Perform inspection and testing of fuel and exhaust systems. [0/2]

Visual inspection for:
- leaks
- dents
- recommended clearances
- support mechanisms

Exhaust back pressure tests for:
- restrictions

Evaluation Structure	
Theory Testing	Practical Application Testing
50%	50%

Level 3

Reportable Subject Summary – Level 3

Number	Reportable Subjects	Hours Theory	Hours Practical	Hours Total
3171: Damage Analysis and Estimating				
3171.1	Damage Analysis	6	6	12
3171.2	Damage Patterns	8	1	9
3171.3	Damage Estimating	6	6	12
Sub Totals		**20**	**13**	**33**
3172: Body, Frame and Structure				
3172.1	Aluminum Repair	9	9	18
3172.2	Anchoring Systems	10	8	18
3172.3	Vehicle Structure and Frame Re-Alignment	9	18	27
Sub Totals		**28**	**35**	**63**
3173: Structural Panel Replacement				
3173.1	Structural Panel Fundamentals	9	0	9
3173.2	Structural Panel Replacement	3	18	21
3173.3	Structural Panel Sectioning Fundamentals	9	0	9
3173.4	Structural Panel Sectioning	2	19	21
Sub Totals		**23**	**37**	**60**
3174: Steering, Suspension And Alignment				
3174.1	Steering and Suspension	4	2	6
3174.2	Alignment Fundamentals	6	0	6
3174.3	Alignment Adjustments and Service	4	5	9
Sub Totals		**14**	**7**	**21**
3175: Refinishing				
3175.1	Colour Matching	7	5	12
3175.2	Top Coat Application, Spot and Panel Repair	6	12	18
3175.3	Masking Material and Over-Spray Removal	3	3	6
Sub Totals		**16**	**20**	**36**
3176: Applied Mechanical				
3176.1	Applied Electrical Schematics and Component Location	2	4	6
3176.2	Computer Fundamentals	3	0	3
3176.3	Service Electrical and Electronic Systems	6	3	9
3176.4	Air Conditioning Fundamentals	4	2	6
3176.5	Power Train	3	0	3
Sub Totals		**18**	**9**	**27**
Level 3 Totals		**119**	**121**	**240**

Number:	3171		
Title:	**Damage Analysis and Estimating**		
Duration:	Total Hours: 33	Theory: 20	Practical: 13

Number:	S3171.1		
Title:	**Damage Analysis**		
Duration:	Total Hours: 12	Theory: 6	Practical: 6
Cross Reference to Training Standards: U9037 and U9041			

General Learning Outcomes

Upon successful completion, the Apprentice is able to demonstrate a working knowledge of vehicle damage analysis.

Learning Outcomes

Upon successful completion, the apprentice is able to:

3171.1.1 Define the purpose and fundamentals of damage analysis.

3171.1.2 Explain the procedures for diagnosing frame and unibody structures.

3171.1.3 Perform an analysis of damaged unibody and full-framed vehicles.

Learning Content

3171.1.1 Define the purpose and fundamentals of damage analysis. [3/0]

Purpose:
- To provide a clear, concise itemized appraisal of vehicle damage.

Fundamentals:
- visual inspection of damage
- damage indicators
- measuring
- uses of diagnosing concepts
- primary
- secondary
- mechanical
- inertia
- interior
- exterior trim
- blueprinting

3171.1.2 Explain the procedures for diagnosing frame and unibody structures. [3/0]

Visually inspect for signs of damage:
- pulled welds
- split sealers
- cracked paint
- buckles
- panel misalignment

Measure vehicle for:
- length
- width
- height
- upper body misalignment
- tolerances

3171.1.3 Perform an analysis of damaged unibody and full-framed vehicles. [0/6]

Visually analyze damage
Set up and measure vehicle
Determine extent of damage
Produce a repair plan

Number:	S3171.2		
Title:	**Damage Patterns**		
Duration:	Total Hours: 9	Theory: 8	Practical: 1
Cross Reference to Training Standards: U9037 and U9041			

General Learning Outcomes

Upon successful completion, the Apprentice is able to demonstrate a working knowledge of vehicle damage patterns identification.

Learning Outcomes

Upon successful completion, the apprentice is able to:

3171.2.1 Define the principles of damage patterns.

3171.2.2 Explain the types of structural and frame damage.

3171.2.3 Perform steering and suspension inspection to identify damage.

Learning Content

3171.2.1 Define the principles of damage patterns. [4/0]

Direction of damaging forces
Primary (direct)
Secondary (indirect)
Related/unrelated
Inertia

3171.2.2 Explain the types of structural and frame damage. [4/0]

Types of damage:

- side sway
- sag
- mash
- diamond
- twist

3171.2.3 Perform steering and suspension inspection to identify damage. [0/1]

Tire pressure and size
Wheel assembly
Jounce / rebound check
Steering lock-to-lock
Strut rotation
Wheel position
Ride height
Road test

Number:	S3171.3		
Title:	**Damage Estimating**		
Duration:	Total Hours: 12	Theory: 6	Practical: 6
Cross Reference to Training Standards: U9041			

General Learning Outcomes

Upon successful completion, the Apprentice is able to demonstrate a working knowledge of vehicle damage estimating.

Learning Outcomes

Upon successful completion, the apprentice is able to:

3171.3.1 Define the purpose and fundamentals of vehicle damage estimating.

3171.3.2 Identify and explain the use of estimating resources.

3171.3.3 Identify and explain how to cost.

3171.3.4 Complete accurate damage appraisal reports utilizing a range of damaged vehicles.

Learning Content

3171.3.1 Define the purpose and fundamentals of vehicle damage estimating. [3/0]

Terms, definitions and concepts
Types of estimates
Application, information and general layout
Legal requirements of the repair estimate

3171.3.2 Identify and explain the use of estimating resources. [2/0]

Estimating guides
Estimating software

3171.3.3 Identify and explain how to cost. [1/0]

Parts:
- new, used or after market

Materials
Labour
Sublet items
Betterment
Appearance allowance

3171.3.4 Complete accurate damage appraisal reports utilizing a range of damaged vehicles. [0/6]

Electronically/hand written:

- light
- medium
- heavy

Number:	S3172		
Title:	**Body, Frame and Structure**		
Duration:	Total Hours: 63	Theory: 27	Practical: 35

Number:	S3172.1		
Title:	**Aluminum Repair**		
Duration:	Total Hours: 18	Theory: 9	Practical: 9
Cross Reference to Training Standards: U9026, U9031 and U9037			

General Learning Outcomes

Upon successful completion, the Apprentice is able to demonstrate a working knowledge of repairing aluminum components.

Learning Outcomes

Upon successful completion, the apprentice is able to:

3172.1.1 Define the principles of aluminum panel repair.

3172.1.2 Explain the repair procedures for aluminum panels.

3172.1.3 Demonstrate and perform manufacturers' repair procedures to aluminum panels.

3172.1.4 Explain the procedures for welding aluminum.

3172.1.5 Demonstrate and perform welding procedure on aluminum panels according to OEM recommendations.

Learning Content

3172.1.1 Define the principles of aluminum panel repair. [2/0]

Manufacturer's usage
Various types
Identification
Thickness
Behavioural characteristics

3172.1.2 Explain the repair procedures for aluminum panels. [4/0]

Annealing process
Temperature monitor
Cross contamination considerations
Hammer and dolly
Shrinking
Stretching
Filing
Use of fillers
Grinding precautions
Oxidization
Welding
Sanding
Ventilation

3172.1.3 Demonstrate and perform manufacturers' repair procedures to aluminum panels. [0/5]

PPE
Identification of material type
Pre-cleaning of damaged area
Removal of necessary finish
Annealing aluminum
Hammer and dolly techniques
Grinding/sanding
Application of filler material
Filling and / or sanding contour
Feather edging
Priming

3172.1.4 Explain the procedures for welding aluminum. [3/0]

Identify welding equipment and processes for aluminum:

- Gas Metal Arc Welding (GMAW):
  - Pulse welder
- Gas Tungsten Arc Welding (GTAW)
- Oxy-acetylene

Use PPE
Set up work area
Set up welding equipment
Identify types of joints
Prepare joint and preheat (tail in and tail out)
Use recommended techniques
Dressing joint techniques

3172.1.5 Demonstrate and perform welding procedures on body and frame gauge aluminum panels according to OEM recommendations. [0/4]

Gas Metal Arc Welding (GMAW)
Gas Tungsten Arc Welding (GTAW)
Set up welder
Make adjustment
Perform test weld
Prepare weld joint:

- lap joint
- butt joint with insert
- plug weld

Dress the joint
Destructive testing

Number:	S3172.2		
Title:	**Anchoring Systems**		
Duration:	Total Hours: 18	Theory: 10	Practical: 8
Cross Reference to Training Standards: U9037			

General Learning Outcomes

Upon successful completion, the Apprentice is able to demonstrate a working knowledge of anchoring procedures for vehicle structural and frame repairs.

Learning Outcomes

Upon successful completion, the apprentice is able to:

3172.2.1 Define the purpose and principles of anchoring systems.

3172.2.2 Explain the clamping and anchoring procedures for vehicle structures and frames.

3172.2.3 Perform anchoring of vehicle structures and frames.

Learning Content

3172.2.1 Define the purpose and principles of anchoring systems. [6/0]

Purpose of anchoring:
- to keep vehicle in a stationary position during collision repair

Types of anchoring systems:
- dedicated
- universal
- portable
- stationary
- floor

Anchoring locations:
- manufacturers' recommendations
- structures and frames

3172.2.2 Explain the clamping and anchoring procedures for vehicle structures and frames. [4/0]

Location of clamping and anchoring points
Removal of components
Protection of components
Attachment and removal procedures
Rocker panel pinch weld flange preparation
Blocking
Replace corrosion protection

3172.2.3 Perform anchoring of vehicle structures and frames. [0/8]

Inspect vehicle
Determine anchoring points
Remove and / or protect components
Anchor vehicle
Remove attachments
Prepare rocker panel pinch weld flange
Apply extra blocking
Replace corrosion protection

Number:	S3172.3		
Title:	**Vehicle Structure and Frame Re-Alignment**		
Duration:	Total Hours: 26	Theory: 8	Practical: 18
Cross Reference to Training Standards: U9037			

General Learning Outcomes

Upon successful completion, the Apprentice is able to demonstrate a working knowledge of vehicle structure and frame re-alignment.

Learning Outcomes

Upon successful completion, the apprentice is able to:

3172.3.1 Identify vehicle structure and frame re-alignment equipment.

3172.3.2 Explain the re-alignment procedures for structures and frames.

3172.3.3 Perform structure and frame re-alignment.

Learning Content

3172.3.1 Identify vehicle structure and frame re-alignment equipment. [3/0]

Equipment:
- frame racks
- hydraulic body jacks
- pneumatic over hydraulic pumps
- chains
- Attachments:
  - clamps
  - safety cables
  - hooks
  - turnbuckles
  - slings
  - pulleys
  - brackets

3172.3.2 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
- inner structure pulls
- rough pulls
- frame rail pulls

Pulling strategies:
- angle of pull
- chain alignment
- forces applied:
  - anchoring
  - pulling
  - blocking
- number of pulls
- cold stress relieving
- kink vs. bend
- considerations:
  - heat stress relieving
  - vehicle construction

3172.3.3 Perform structure and frame re-alignment. [0/18]

Inspect equipment
Measure
Attach pulling fixtures / clamps
Install safety equipment
Engage power equipment
Realign by pulling and stress relieving to manufacturers' specifications
Re-measure
Remove and store equipment

Number:	S3173		
Title:	**Structural Panel Replacement**		
Duration:	Total Hours: 62	Theory: 23	Practical: 39

Number:	S3173.1		
Title:	**Structural Panel Fundamentals**		
Duration:	Total Hours: 9	Theory: 9	Practical: 0
Cross Reference to Training Standards: U9037			

General Learning Outcomes

Upon successful completion, the Apprentice is able to demonstrate a working knowledge of the theory associated with structural panel replacement.

Learning Outcomes

Upon successful completion, the apprentice is able to:

3173.1.1 Identify the principles of structural panel removal and replacement.

3173.1.2 Explain the repair procedures for structural panel removal and replacement.

Learning Content

3173.1.1 Identify the principles of structural panel removal and replacement. [5/0]

Components:
- cowl
- apron assemblies
- radiator supports
- cross members
- pillars
- shock towers
- rocker panels
- floor pans
- unibody frame rails

- considerations:
  - OEM recommendations
  - replacement vs. reparability
  - liability
  - maintaining vehicle structural integrity
  - high strength steels
  - material identification
  - corrosion protection
  - heating
  - joining/attachment methods
  - customer expectations

3173.1.2 Explain the repair procedures for structural panel removal and replacement. [4/0]

Removal and replacement procedures:

- spot weld location/number
- spot weld removal
- replacement panel preparation
- seam/weld joint preparation
- corrosion protection
- test fitting of replacement panels
- final measure
- welding procedures
- considerations:
  - OEM considerations
  - attachment method

Number:	S3173.2		
Title:	**Structural Panel Replacement**		
Duration:	Total Hours: 23	Theory: 3	Practical: 18
Cross Reference to Training Standards: U9037			

General Learning Outcomes

Upon successful completion, the Apprentice is able to demonstrate a working knowledge of the removal and replacement of structural panels.

Learning Outcomes

Upon successful completion, the apprentice is able to:

3173.2.1 Demonstrate and perform structural panel removal and replacement procedures using service tools and equipment.

Learning Content

3173.2.1 Demonstrate and perform structural panel removal and replacement procedures using service tools and equipment. [3/18]

Locate proper body seams
Locate spot welds
Remove spot welds
Prepare replacement panel:
- welding
- weld bond
- mechanical

Prepare seam/weld joint
Apply corrosion protection
Measure/test fit panel
Test joining methods:
- destructive
- non-destructive

Install panel:
- Gas Metal Arc Welding (GMAW) techniques
  - Tradition MIG vs. pulse
- squeeze-type resistance spot welding (STRSW)
- weld bonding
- riveting and adhesive

Finish as required by installation method

Number:	S3173.3		
Title:	**Structural Panel Sectioning Fundamentals**		
Duration:	Total Hours: 9	Theory:9	Practical: 0
Cross Reference to Training Standards: U9026 and U9037			

General Learning Outcomes

Upon successful completion, the Apprentice is able to demonstrate a working knowledge of the theory associated with structural panel sectioning.

Learning Outcomes

Upon successful completion, the apprentice is able to:

3173.3.1 Identify the reasons for and principles of structural sectioning.

3173.3.2 Explain the procedures for structural sectioning.

Learning Content

3173.3.1 Identify the reasons for and principles of structural sectioning. [5/0]

Reasons for sectioning:
- time efficiency
- cost effectiveness
- less disruption of OEM corrosion protection

Types of sectioning joints:
- lap joint
- open butt joint
- butt joint with insert
- offset butt joint

Sectioning locations:
- OEM recommended
- industry guidelines

Caution areas:
- existing body holes
- inner reinforcements
- panel design
- multiple layers
- anchor points
- suspension/mechanical mounting locations
- seat belt assembly mounting locations

Considerations:
- OEM recommendations
- maintaining vehicle structural integrity
- customer expectations
- SRS mounting locations
- heating
- corrosion protection

3173.3.2 Explain the procedures for structural sectioning. [4/0]

Sectioning locations:
“A” pillars
“B” pillars
“C” pillars
“D” pillars
Rocker panels
Floor panels
- passenger
- trunk

Frame rails
- front
- rear
- open hat section

Closed section
Full body sections
- cowl cut
- rear body clip

Number:	S3173.4		
Title:	**Structural Panel Sectioning**		
Duration:	Total Hours: 21	Theory:2	Practical: 19
Cross Reference to Training Standards: U9026 and U9037			

General Learning Outcomes

Upon successful completion, the Apprentice is able to demonstrate a working knowledge of performing structural panel sectioning.

Learning Outcomes

Upon successful completion, the apprentice is able to:

3173.4.1 Perform inspection and testing procedure on welds and joints to maintain manufacturers' structural requirements.

3173.4.2 Demonstrate and perform sectioning repair using service tools and equipment.

Learning Content

3173.4.1 Perform inspection and testing procedure on welds and joints to maintain manufacturers' structural requirements. [0/3]

Test and inspect:
Setup simulated joint
Test the joint fit
Apply corrosion protection
Align panel
Perform weld
Dress down weld
Nondestructive test
Destructive test

3173.4.2 Demonstrate and perform sectioning repair using service tools and equipment. [2/16]

Procedure:
Check OEM sectioning recommendations
Develop logical repair sequence
Determine type of sectioning
Locate sectioning areas on vehicle
Remove coatings where necessary
Locate and remove spot weld
Remove damaged section
Prepare seams and joints
Prepare replacement section
Measure/test fit panel
Replace section
Finish as required by installation method

Number:	S3174		
Title:	**Steering, Suspension and Alignment**		
Duration:	Total Hours: 21	Theory:14	Practical: 7

Number:	S3174.1		
Title:	**Steering and Suspension**		
Duration:	Total Hours: 6	Theory:4	Practical: 2
Cross Reference to Training Standards: U9038			

General Learning Outcomes

Upon successful completion, the Apprentice is able to explain the operation, servicing and inspection of suspension and steering components and perform the removal and replacement procedures for suspension and steering components

Learning Outcomes

Upon successful completion, the apprentice is able to:

3174.1.1 Explain the operation, servicing and inspection of suspension and steering components.

3174.1.2 Perform manufacturer's recommended removal and replacement procedures for suspension and steering components.

Learning Outcomes

3174.1.1 Explain the operation, servicing and inspection of suspension and steering components. [4/0]

Steering and suspension components:

- wheel hubs
- wheel bearings
- steering knuckle
- steering linkage
- strut assemblies
- shock absorbers / dampeners
- control arms
- anti-roll bar
- ball joints
- springs

3174.1.2 Perform manufacturer's recommended removal and replacement procedures for suspension and steering components. [0/2]

Steering and suspension components:

- wheel hubs
- wheel bearings
- steering knuckle
- steering linkage
- strut assemblies
- shock absorbers / dampeners
- control arms
- anti-roll bar
- ball joints
- springs

Number:	S3174.2		
Title:	**Alignment Fundamentals**		
Duration:	Total Hours: 6	Theory:6	Practical: 0
Cross Reference to Training Standards: U9038			

General Learning Outcomes

Upon successful completion, the Apprentice is able to demonstrate a working knowledge of alignment fundamentals.

Learning Outcomes

Upon successful completion, the apprentice is able to:

3174.2.1 Define the purpose of alignment angles and measurements.

3174.2.2 Identify alignment types.

3174.2.3 Identify adjustment styles.

Learning Outcomes

3174.2.1 Define the purpose of alignment angles and measurements. [4/0]

Purpose:
- To return the vehicle to its optimum ride and handling characteristics.

Caster
Camber
Toe-in / toe-out
Steering axis inclination
Turning radius
Trim height
Thrust line
Thrust angle
Geometric centre line
Ackerman’s principles
Included angle
Set back
Scrub radius

3174.2.2 Identify alignment types. [1/0]

Types of alignment:
- two-wheel geometric center line alignment
- two-wheel thrust line alignment
- four-wheel alignment

3174.2.3 Identify adjustment styles. [1/0]

Eccentrics
Shims / contact shims
Slots
Strut rods
Wedges
Elongating holes

Number:	S3174.3		
Title:	**Alignment Adjustments and Service**		
Duration:	Total Hours: 9	Theory:4	Practical: 5
Cross Reference to Training Standards: U9038			

General Learning Outcomes

Upon successful completion, the Apprentice is able to demonstrate a working knowledge of alignment adjustments and service.

Learning Outcomes

Upon successful completion, the apprentice is able to:

3174.3.1 Explain the principles of operation of vehicle alignment equipment.

3174.3.2 Describe and perform inspection, testing and diagnostic procedures on suspension systems and alignment angles.

3174.3.3 Describe and perform adjusting, following manufacturers' procedures, specifications and readings for two-wheel and four-wheel alignment.

Learning Content

3174.3.1 Explain the principles of operation of vehicle alignment equipment. [2/0]

Operating procedures of alignment equipment as per equipment manufacturer’s recommendations:
- set up
- measure
- view measurements

3174.3.2 Describe and perform inspection, testing and diagnostic procedures on suspension systems and alignment angles. [1/2]

Perform suspension component checks:
- visual
- trim height
- angles

Perform vehicle alignment checks:
- observation of ride control devices

3174.3.3 Describe and perform adjusting, specifications and readings for two-wheel and four- wheel alignment according manufacturers' procedures. [1/3]

Describe vehicle alignment procedures:

- obtain required specifications
- record alignment readings
- identify the factors responsible for improper vehicle tracking and / or stability
- determine required adjustment
- adjustment and correct vehicle alignment for:
  - rear wheels, camber and toe settings
  - front wheels, camber, caster, toe, steering axis inclination and turning angles

Number:	S3175		
Title:	**Refinishing**		
Duration:	Total Hours: 36	Theory:16	Practical: 20

Number:	S3175.1		
Title:	**Colour Matching**		
Duration:	Total Hours: 12	Theory:7	Practical: 5
Cross Reference to Training Standards: U9040			

General Learning Outcomes

Upon successful completion, the Apprentice is able to demonstrate a working knowledge of colour matching on various vehicle finishes.

Learning Outcomes

Upon successful completion, the apprentice is able to:

3175.1.1 Identify the principles of colour matching, formulae, tinters, and reasons for colour mismatch.

3175.1.2 Describe the theory and procedures for mixing and tinting colours.

3175.1.3 Perform mixing and adjusting colours to achieve a blendable finish with the service tools and equipment.

Learning Content

3175.1.1 Identify the principles of colour matching, formulae, toners, and reasons for colour mismatch. [3/0]

Light sources:
- CRI (Colour Rendering Index)
- lumens
- kelvins
- colour spectrum:
  - ROYGBIV (red, orange, yellow, green, blue, indigo and violet)
- metamerism
- daylight, incandescent, fluorescent
- impact of light on colour

Colour theory:
- colour wheel
- Munsell colour theory
  - value, hue, chroma
- colour evaluation
- colour blindness/deficiency

3175.1.2 Describe the theory and procedures for mixing and tinting colours. [3/0]

Colour evaluation:
- visual/colour chips
- spectra photometer

Tinting theory:
- tint to blend
- tint within a formula
- use proper lighting to view colours
- tint one toner at a time
- monitor tints made
- do not tint across the colour wheel
- tinting order:
  - value
  - hue
  - chroma
- kill colour cast
- understand tinting characteristics of:
  - solids
  - metallic
  - pearls
  - tri-stages
- understanding when to use:
  - spray out cards
  - let down panels
- toners involved to achieve a colour
- low hiding
- variation of colour:
  - how to darken
  - how to lighten
  - application variables:
    - gun distance
    - air pressure
    - gun setup
    - gun stroke
    - spray overlap

3175.1.3 Perform mixing and adjusting colours to achieve a blendable finish with the service tools and equipment. [1/5]

PPE
Mix colour according to formula
Spray out test card / let down panel
Compare to standard
Evaluate colour
Adjust colour
Record adjustments
Repeat colour adjustments as necessary to achieve a blendable colour

Number:	S3175.2		
Title:	**Top Coat Application, Spot and Panel Repair**		
Duration:	Total Hours: 18	Theory:6	Practical: 12
Cross Reference to Training Standards: U9040			

General Learning Outcomes

Upon successful completion, the Apprentice is able to demonstrate a working knowledge of vehicle top coat application involving spot and panel repairs.

Learning Outcomes

Upon successful completion, the apprentice is able to:

3175.2.1 Explain the products and procedures for blending spot repairs.

3175.2.2 Perform the paint manufacturers' procedures for blending spot repairs.

3175.2.3 Inspect the repaired finish to determine types of defects within the paint and perform repair procedures.

Learning Content

3175.2.1 Explain the products and procedures for blending spot repairs. [6/0]

Sanding products and procedures:

- evaluate top coats for surface preparation
- wet or dry
- hand or mechanical
- vehicle masking
- primer application and types used for colour match
- primer sanding
- blending techniques
- spraying stages
- flash and drying times
- compounding

3175.2.2 Perform the paint manufacturers' procedures for blending spot repairs. [0/8]

Mix paint
Prepare unit for blending
Cleaning
Sanding
Masking
Priming
Spraying
Cleanup
Detailing

3175.2.3 Inspect the repaired finish to determine types of defects within the paint and perform repair procedures. [0/4]

Inspect for defects:

- contour mapping
- dry spray
- fish eyes
- lifting
- mottling
- pin holes
- sand scratch swelling
- solvent popping
- wrinkles
- blistering
- blushing
- dirt
- low gloss
- filler bleed-through
- micro-checking
- orange peel
- runs and sags
- shrinking
- film thickness
- coverage
- clear application
- solvent blends/dry edge

Number:	S3175.3		
Title:	**Masking Material and Over-Spray Removal**		
Duration:	Total Hours: 6	Theory:3	Practical: 3
Cross Reference to Training Standards: U9022, U9023 and U9040			

General Learning Outcomes

Upon successful completion, the Apprentice is able to demonstrate a working knowledge of the removal of masking material and overspray.

Learning Outcomes

Upon successful completion, the apprentice is able to:

3175.3.1 Describe the methods of removing masking material and over spray.

3175.3.2 Perform final vehicle clean up.

Learning Content

3175.3.1 Describe the methods for removing masking materials and over spray. [3/0]

Masking removal:
- masking tape
- masking paper
- plastic sheeting
- liquid masking
- considerations
  - time
  - temperature
  - direction of pull

Overspray removal:
- clay
- solvents
- compounds
- fine steel wool
- considerations:
  - removal method
  - least aggressive product

3175.3.2 Perform final vehicle clean up. [0/3]

Interior:

- check over spray / residue on door trims
- vacuum
- wash floor mats
- clean heating ducts
- wipe down interior
- clean windows

Exterior:

- wash and dry
- blackout wheel wells
- clean tires
- clean wiper blades
- clean windows

Number:	S3176		
Title:	**Applied Mechanical**		
Duration:	Total Hours: 27	Theory:18	Practical: 9

Number:	S3176.1		
Title:	**Applied Electrical Schematics and Component Location**		
Duration:	Total Hours: 6	Theory:2	Practical: 4
Cross Reference to Training Standards: U9034			

General Learning Outcomes

Upon successful completion, the Apprentice is able to demonstrate a working knowledge of the purpose and application of electrical schematics and component location information.

Learning Outcomes

Upon successful completion, the apprentice is able to:

3176.1.1 Explain the purpose and fundamentals of electrical wiring schematics.

3176.1.2 Describe the construction, features and application of wiring diagrams.

3176.1.3 Perform assigned operations using wiring schematics to locate electrical/electronic components.

Learning Content

3176.1.1 Explain the purpose and fundamentals of electrical wiring schematics. [1/0]

Layout
Interpretation
Abbreviations

3176.1.2 Describe the construction, features and application of wiring diagrams. [1/0]

Electrical symbols
Circuit identification methods
Colour codes
Circuit number codes gauge and metric wire sizes
Connectors

3176.1.3 Perform assigned operations using wiring schematics to locate electrical/electronic components. [0/4]

Perform on-vehicle verification of wiring diagrams circuits
Locate power sources and grounds

Number:	S3176.2		
Title:	**Computer Fundamentals**		
Duration:	Total Hours: 3	Theory:3	Practical: 0
Cross Reference to Training Standards: U9034			

General Learning Outcomes

Upon successful completion, the Apprentice is able to demonstrate a working knowledge of operation of onboard computers.

Learning Outcomes

Upon successful completion, the apprentice is able to:

3176.2.1 Define the purpose and fundamentals of onboard computers.

Learning Content

3176.2.1 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
- sine wave / square wave

Multiplexing/networking

Number:	S3176.3		
Title:	**Service Electrical and Electronic Systems**		
Duration:	Total Hours: 9	Theory:6	Practical: 3
Cross Reference to Training Standards: U9034			

General Learning Outcomes

Upon successful completion, the Apprentice is able to demonstrate a working knowledge of servicing electrical/electronic systems affected by vehicle body damage.

Learning Outcomes

Upon successful completion, the apprentice is able to:

3176.3.1 Describe electric / electronic systems and components that may need servicing after repairing vehicle damage.

3176.3.2 Describe ways of protecting electric / electronic systems and components during vehicle repairs.

3176.3.3 Explain the basic procedures for testing and inspecting electric / electronic systems and components.

3176.3.4 Perform assigned operation for testing and inspecting electrical/electronic systems.

Learning Content

3176.3.1 Describe electrical/electronic systems and components that may need servicing after repairing vehicle damage. [2/0]

Restraint systems (active / passive)
Electronic steering
Electronic suspension (load leveling)
Inertia switches
Blind Spot Detection
Parking Assist
Lane Departure Warning,
Attention Assist
Adaptive Cruise Control
Pre-Collision systems
Adaptive Front Lighting
Active Head Restraints,
Knee Airbags
Keyless Entry
Raining Sensing Wipers

3176.3.2 Describe ways of protecting electric/electronic systems and components during vehicle repairs. [2/0]

To protect systems/components:
- Disconnect battery
- Connect memory saver
- Cover components with fire blankets
- Avoid static electricity
- Route wire harnesses according to OEM specifications
- Avoid proximity of welding cables to modules
- Remove computer and store
- Disconnect/reconnect modules
- Take MIG and TIG weld precautions

3176.3.3 Explain the basic procedures for testing and inspecting electric/electronic systems and components. [2/0]

Test and inspect
Perform self-diagnostics:
- warning lights
- flash codes

Perform visual inspection
Check connections
Scan tools:
- read trouble codes
- interpret data
- erase trouble codes
- reset system
- verify system operation

Test drive

3176.3.4 Perform assigned operation for testing and inspecting electrical/electronic systems. [0/3]

Test and inspect
Perform self-diagnostics:
- warning lights
- flash codes

Perform visual inspection
Check connections

Scan tools:

- read trouble codes
- interpret data
- erase trouble codes
- reset system
- verify system operation

Test drive

Number:	S3176.4		
Title:	**Air Conditioning Fundamentals**		
Duration:	Total Hours: 6	Theory:4	Practical: 2
Cross Reference to Training Standards: U9036			

General Learning Outcomes

Upon successful completion, the Apprentice is able to demonstrate a working knowledge of air conditioning systems.

Learning Outcomes

Upon successful completion, the apprentice is able to:

3176.4.1 Explain the fundamentals and principles of air conditioning systems.

3176.4.2 Identify the system types and air conditioning components.

3176.4.3 Describe the operating principles of air conditioning systems and components.

3176.4.4 Describe air conditioning service procedures.

3176.4.5 Perform air conditioning service procedures.

Learning Content

3176.4.1 Explain the fundamentals and principles of air conditioning systems. [1/0]

Methods of heat transfer
Temperature and humidity relationship
Solid, liquid and gas states
Gas laws, temperature, pressure and volume
Air conditioning thermo-dynamics:

- heat absorption
- liquid and gas states
- temperature effects
- latent heat
- ambient heat

Describe refrigerants, lubricants and sealants:

- refrigerant characteristics
- alternative refrigerants
- lubricants
- sealants
- aftermarket chemicals

3176.4.2 Identify the system types and air conditioning components. [1/0]

Types:
- TXV/H block system components and location
- orifice tube system components and location

3176.4.3 Describe the operating principles of air conditioning systems and components. [1/0]

System lubrication
Fixed orifice tube
Thermostatic expansion valve (TEV)
Control valves
- low and high pressure cut out

Evaporator temperature controls
Condenser
Receiver dryer
Accumulator
Evaporator
Compressors
Lines and hoses

3176.4.4 Describe air conditioning service procedures. [1/0]

Recovery
Replace components
Evacuation
Test for leaks
Recharge
Verify operation

3176.4.5 Perform air conditioning service procedures. [0/2]

Recovery
Replace components
Evacuation
Test for leaks
Recharge
Verify operation

Number:	S3176.5		
Title:	**Power Train**		
Duration:	Total Hours: 3	Theory:3	Practical: 0
Cross Reference to Training Standards: None			

General Learning Outcomes

Upon successful completion, the Apprentice is able to demonstrate a working knowledge of removal and replacement of power train components.

Learning Outcomes

Upon successful completion, the apprentice is able to:

3176.5.1 Outline the power train assembly removal and replacement procedures.

Learning Content

3176.5.1 Outline the power train assembly removal and replacement procedures. [3/0]

Fluid draining and storage requirements
Vehicle supporting and lifting requirements
Power train assembly lifting and supporting procedures:
- engine lift points
- transmission jack placement

Manufacturers' recommended steps to remove and replace:
- engines assemblies
- transmission assemblies
- differential assemblies

Final component alignment
Suspension alignment
Bolt torque / axle torque
Replenish fluids

Evaluation Structure	
Theory Testing	Practical Application Testing
50%	50%

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Auto Body and Collision Technician