Skilled Trades Ontario | Métiers spécialisés Ontario

Apprenticeship Curriculum Standard

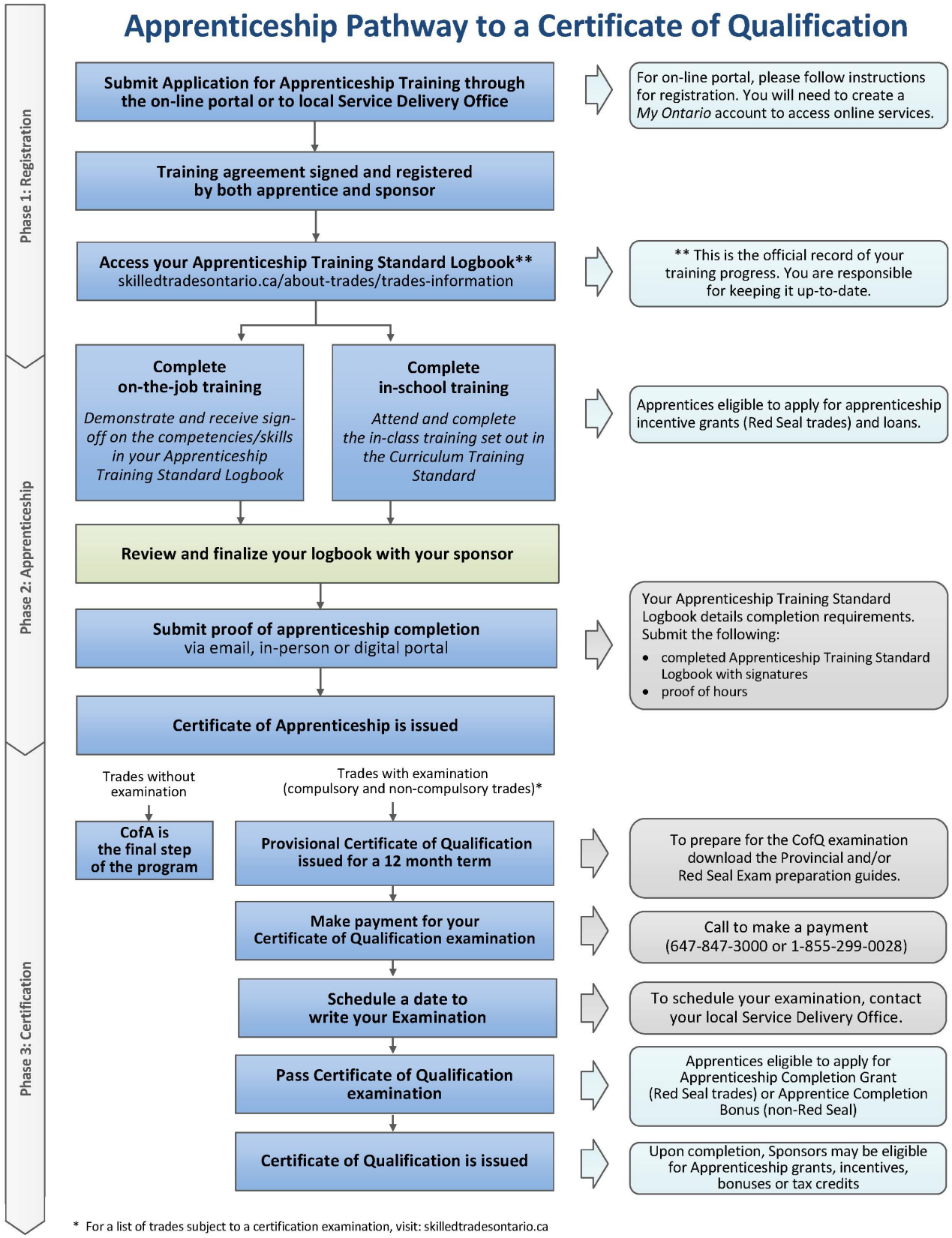
Truck-Trailer Service Technician

Levels 1 & 2

310J

2011

Apprenticeship Pathway to a Certificate of Qualification



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

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Table of Contents

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 2011 (V100)

Preface

This curriculum standard for the Truck-Trailer Service Technician trade program is based upon the on-the-job performance objectives, located in the industry-approved training standard.

The curriculum is organized into 2 levels of training. The Reportable Subjects Summary chart (located on page 2) 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.

Hours Disclaimer (if applicable)

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

Suggested Equipment for Training Delivery Agencies

The listing of tools on page 154 does not list minimum quantities based on the understanding that the delivering TDA is in the best position to determine the need based on its delivery methodology.

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

Number	Reportable Subjects	Hours Total	Hours Theory	Hours Practical
Level 1				
1651	Workshop Practice	16	11	5
1652	Fluid Power Systems	24	18	6
1653	Brake Systems I	32	16	16
1654	Tires and Wheels	32	16	16
1655	Frames and Trailer Support Systems	32	19	13
1656	Body Systems I	32	18	14
1657	Electrical Systems I	40	26	14
1658	Welding I	32	9	23
	Total	**240**	**133**	**107**
Level 2				
1659	Brake Systems II	32	18	14
1660	Axle Assemblies	16	10	6
1661	Suspension Systems and Coupling Devices	40	26	14
1662	Body Systems II	40	28	12
1663	Electrical Systems II	48	27	21
1664	Welding II	32	12	20
1665	Trailer Refrigeration and Cargo Heating Systems	32	20	10
	Total	**240**	**143**	**97**

Level 1

Reportable Subject Summary – Level 1

Number	Reportable Subjects	Hours Total	Hours Theory	Hours Practical
1651	Workshop Practice	16	11	5
1652	Fluid Power Systems	24	18	6
1653	Brake Systems I	32	16	16
1654	Tires and Wheels	32	16	16
1655	Frames and Trailer Support Systems	32	19	13
1656	Body Systems I	32	18	14
1657	Electrical Systems I	40	26	14
1658	Welding I	32	9	23
	Total	**240**	**133**	**107**

Number:	S1651		
Title:	**Workshop Practice**		
Duration:	Total Hours: 16	Theory: 11	Practical: 5

Number:	S1651.1		
Title:	**Personal Safety**		
Duration:	Total Hours: 4	Theory: 4	Practical: 0
Cross-Reference to Training Standard: U5755.0			

General Learning Outcomes

Upon successful completion, the Apprentice is able to describe the basics of personal safety, technician's legal responsibilities and customer relations in the trailer service facility.

Learning Outcomes and Content

Upon successful completion, the apprentice is able to:

S1651.1.1 Define the basics of personal safety, technician's legal responsibilities and customer relations in the trailer service facility.

S1651.1.2 Define the legal responsibilities as they apply to work orders, WHMIS and statutory requirements.

S1651.1.3 Define the technician's role in the workplace with reference to customer relations and employer / employee relations.

S1651.1.4 Complete a sample repair order and time ticket.

Learning Content

S1651.1.1 Define the basics of personal safety, technician's legal responsibilities and customer relations in the trailer service facility.

- protective attire
  - safety glasses, shields, hearing protection
  - guards
  - ventilation and breathing apparatus
  - clothing, gloves and shoes
- fire extinguishers
  - application of specific types of extinguishers
- cleaning agents
  - handling and storage
  - safety hazards
- oxy-acetylene equipment
  - storage
  - fire regulations
- identify repair ordering systems

- identify systems for staff and documentation control
- identify data retention devices
  - microcomputer, network, modem

S1651.1.2 Define the legal responsibilities as they apply to work orders, WHMIS and statutory requirements.

- personal safety
  - lifting techniques
  - handling of tools and equipment
  - working conditions
  - organization of work area
  - legal aspects
- WHMIS
- health and safety
- legal responsibility of trades
  - the work order as a legal document
  - legal requirements for wheel end torque
  - vehicle
  - workplace facility
  - employee responsibility
  - clocking system
  - customer charges
  - employee pay
  - distinguish between internal warranty and manufacturers' warranty
  - policy adjustments

S1651.1.3 Define the technician’s role in the workplace with reference to customer relations and employer / employee relations.

- customer relations
- personal hygiene
- Commercial Vehicle Operations Registry *(CVOR)*
  - describe system
  - describe compliance legislative expectations
  - operators maintenance statements
  - maintenance files
  - pre-trip inspection reports
  - insurance coverage documents
  - supportive documents used to assess compliance
- estimating
- applied communications
- employer/employee relations
- time clocks
- time management
- interpersonal relationships
- *Ontario College of Trades and Apprenticeship Act, 2009*

S1651.1.4 Complete a sample repair order and time ticket.

- identify essential requirements for a repair order to meet compliance requirements.
- date
- unit # / VIN #
- license #
- diagnosis/description of operation(s) completed
- materials used
- certificates or informational inclusion
- technician information
- identify the requirements of a time ticket

Number:	S1651.2		
Title:	**Precision Measuring Tools**		
Duration:	Total Hours: 5	Theory: 2	Practical: 3
Cross-Reference to Training Standard: U5757.03, U5758.03, U5759.03, U5761.03, U5762.03, U5763.03, U5763.06, U5763.09, U5764.03, U5765.03			

General Learning Outcomes

To use precision measuring tools following manufacturers' recommendations.

Learning Outcomes and Content

Upon successful completion, the apprentice is able to:

S1651.2.1 Explain the purpose and fundamentals of precision and non-precision measuring tools.

S1651.2.2 Describe the construction features, types and application of precision measuring tools.

S1651.2.3 Explain the principles of operation of precision measuring tools.

S1651.2.4 Perform manufacturer maintenance and calibration procedures for precision and non- precision measuring tools

Learning Content

S1651.2.1 Explain the purpose and fundamentals of precision and non-precision measuring tools.

- Système International d'Unités (S.I.) and Imperial
- measurements and conversions
- accuracy and reliability vs. the cost of measuring tools

S1651.2.2 Describe the construction features, types and application of precision measuring tools.

- micrometer
  - inside, outside, depth
- small hole gauges
- calipers
  - precision vernier
  - non-precision
- telescoping gauges
- straight edge

- torque wrenches
  - click type
  - dial type
  - flexing beam
  - adapters and extension

S1651.2.3 Explain the principles of operation of precision measuring tools.

- micrometer
  - inside, outside, depth
- small hole gauges
- calipers
  - precision vernier
  - non-precision
- telescoping gauges
- straight edge
- thickness gauge (feeler gauges)
- dial indicators
- torque wrenches
  - click type
  - dial type
  - flexing beam
  - adapters and extension

S1651.2.4 Perform manufacturer maintenance and calibration procedures for precision and non- precision measuring tools.

- describe basic tool maintenance procedures
  - storage
  - lubrication
  - methods of restoring critical surfaces
  - adjustments, calibration
- perform precision measuring activities on various components
  - i.e. brake drums, brake camshafts, etc.

Number:	S1651.3		
Title:	**Hoisting and Jacking Tools and Equipment**		
Duration:	Total Hours: 4	Theory: 3	Practical: 1
Cross-Reference to Training Standard: U5755.0			

General Learning Outcomes

To explain the principles of operation and safely use hoisting and jacking tools and other shop equipment following manufacturer's recommendations.

Learning Outcomes and Content

Upon successful completion, the apprentice is able to:

S1651.3.1 Define the purpose and fundamentals of hoisting and jacking tools and shop equipment.

S1651.3.2 Describe the construction features, types and application of hoisting and jacking tools and shop equipment.

S1651.3.3 Explain the principles of operation of hoisting and jacking tools and shop equipment.

S1651.3.4 Perform inspection, testing and diagnostic procedures.

Learning Content

S1656.3.1 Define the purpose and fundamentals of hoisting and jacking tools and shop equipment.

- hoisting and jacking equipment
  - mechanical, electrical, hydraulic, pneumatic
  - wheel dollies
  - safety stands

S1651.3.2 Describe the construction features, types and application of hoisting and jacking tools and shop equipment.

- hoisting and jacking equipment
  - mechanical
  - electrical
  - hydraulic
  - pneumatic
  - wheel dollies
  - safety stands

- power cutting tools
- carpenter square
- power drilling equipment

S1651.3.3 Explain the principles of operation of hoisting and jacking tools and shop equipment.

- hoisting and jacking equipment
  - mechanical
  - electrical
  - hydraulic
  - pneumatic
  - wheel dollies
  - safety stands
- power cutting tools
- carpenter square
- power drilling equipment

S1651.3.4 Perform inspection, testing and diagnostic procedures.

- inspect hoisting and jacking equipment
  - impact damaged
  - wear
  - oil leaks
- test hoisting and jacking equipment
  - operation of controls
  - lifting mechanisms
  - leakage
  - lifting ability
- diagnose hoisting and jacking equipment
  - control problems
  - lifting mechanism defects

Number:	S1651.4		
Title:	**Fasteners and Locking Devices**		
Duration:	Total Hours: 3	Theory: 2	Practical: 1
Cross-Reference to Training Standard: U5755.0			

General Learning Outcomes

To describe the replacement procedures for fasteners, locking devices, seals, sealants and gaskets following manufacturer's recommendations and specifications.

Learning Outcomes and Content

Upon successful completion, the apprentice is able to:

S1651.4.1 Define the purpose and fundamentals and repair of fasteners and locking devices.

S1651.4.2 Describe the types, properties and application of fasteners and locking devices.

S1651.4.3 Explain the principles of operation of fasteners and locking devices.

S1651.4.4 Describe removal and repair procedures of fasteners and locking devices.

Learning Content

S1651.4.1 Define the purpose and fundamentals and repair of fasteners and locking devices.

- fasteners
  - identification methods
  - loading factors
  - factors that affect torque/tension
    - lubrication
    - temperature
    - length and diameter
    - grade
- thread terminology, fastener grades/application
  - yield strength
  - tensile strength
  - shear strength
  - fatigue
  - grade, pitch, threads per inch
  - diameter, length and head size

- seals
  - dynamic seals
  - static seals
  - seal selection

S1651.4.2 Describe the types, properties and application of fasteners and locking devices.

- explain the material requirements for heavy duty fasteners and locking devices.
  - keys
  - lock rings
  - wheel studs
  - frame
  - suspension

S1651.4.3 Explain the principles of operation of fasteners and locking devices.

- use of special fasteners for:
  - frames
  - hitching devices
  - locking devices
    - self-locking nuts
    - lock washers
    - metal locks
    - loctite
  - thread replacement devices
  - helicoil
  - thread inserts

S1651.4.4 Describe removal and repair procedures of fasteners and locking devices.

- broken bolts / studs
- thread repair
  - drill size
  - tap and die
- stud removal tools

Evaluation and Testing: Assignments related to theory and appropriate application skills.
Minimum of one mid-term test during the term
Final exam at end of term
Periodic quizzes

Evaluation Structure		
Theory Testing	Practical Application Testing	Final Assessment
60%	25%	15%

Number:	S1652		
Title:	**Fluid Power Systems**		
Duration:	Total Hours: 24	Theory: 18	Practical: 6

Number:	S1652.1		
Title:	**Fluid Power Fundamentals**		
Duration:	Total Hours: 6	Theory: 6	Practical: 0
Cross-Reference to Training Standard: U5765.0			

General Learning Outcomes

Upon successful completion, the Apprentice is able to perform basic calculations of pressure, force and area using Imperial and System International Units.

Learning Outcomes and Content

Upon successful completion, the apprentice is able to:

S1652.1.1 Define the fundamental information of hydraulic systems.

S1652.1.2 Describe hydraulic terms and applications.

S1652.1.3 Perform calculations of pressure, force, and area using basic laws.

Learning Content

S1652.1.1 Define the fundamental information of hydraulic systems.
- basic laws and applications
  - Pascal's law
  - Boyle's law
  - Charles's law
  - Gay-Lussac's law

S1652.1.2 Describe hydraulic terms and applications.
- basic terms
  - hydrostatics
  - hydrodynamics
  - positive and negative pressures
- basic applications of hydraulics
  - fluid power leverage

S1652.1.3 Perform calculations of pressure, force, and area using basic laws.
- calculations of pressure, force and area using:
  - imperial system
  - Systeme International d'Unites (S.I)

Number:	S1652.2		
Title:	**Fluid Power Hydraulic Fluids and Filters**		
Duration:	Total Hours: 3	Theory: 3	Practical: 0
Cross-Reference to Training Standard: U5765.0			

General Learning Outcomes

Describe the properties of hydraulic fluids and the construction features and service procedures of filters.

Learning Outcomes and Content

Upon successful completion, the apprentice is able to:

S1652.2.1 Define the purpose and fundamentals of hydraulic fluids.

S1652.2.2 Describe the composition and properties of hydraulic fluids

S1652.2.3 Describe the function, construction features and service procedures of hydraulic fluid filters.

Learning Content

S1652.2.1 Define the purpose and fundamentals of hydraulic fluids.
- power transfer medium
- lubrication
- cooling

S1652.2.2 Describe the composition and properties of hydraulic fluids.
- viscosity
- fire supporting
  - volatility
  - flammability
- fire retarding
- synthetic

S1652.2.3 Describe the function, construction features and service procedures of hydraulic fluid filters.
- basic filtration
- media types
  - surface
  - depth

- beta ratio
- micron rating
- delta pressure
- full-flow
- by-pass
- servicing procedures:
  - maintenance schedule
  - selection of fluid type

Number:	S1652.3		
Title:	**Fluid Power Hydraulic Conductors and Connectors**		
Duration:	Total Hours: 6	Theory: 3	Practical: 3
Cross-Reference to Training Standard: U5765.0			

General Learning Outcomes

Perform inspection and testing procedures on hydraulic system conductors and connectors following manufacturers' recommendations and specifications.

Learning Outcomes and Content

Upon successful completion, the apprentice is able to:

S1652.3.1 Define the purpose and fundamentals of hydraulic conductors and connectors.

S1652.3.2 Describe the construction features, types and appellation of conductors and connectors.

S1652.3.3 Perform fabrication, inspection, and testing procedures for hydraulic conductors and connectors.

Learning Content

S1652.3.1 Define the purpose and fundamentals of hydraulic conductors and connectors.
- lines
- pipes and tubing
- fittings

S1652.3.2 Describe the construction features, types and appellation of conductors and connectors.
- lines and hoses
- hydraulic fittings

S1652.3.3 Perform fabrication, inspection, and testing procedures for hydraulic conductors and connectors.
- describe the procedure for fabricating hydraulic hoses
- identify hazards related to line replacement
- identify the inspection procedure for hydraulic conductors and connectors
- perform hose and line fabrication

Number:	S1652.4		
Title:	**Fluid Power Components and Maintenance**		
Duration:	Total Hours: 9	Theory: 6	Practical: 3
Cross-Reference to Training Standard: U5765.0			

General Learning Outcomes

Perform inspection, testing and maintenance procedures of hydraulic system conductors and connectors.

Learning Outcomes and Content

Upon successful completion, the apprentice is able to:

S1652.4.1 Define the purpose and fundamentals of hydraulic components.

S1652.4.2 Describe the function and types of hydraulic components.

S1652.4.3 Locate hydraulic system components.

S1652.4.4 Describe hydraulic system maintenance procedures.

S1652.4.5 Perform maintenance procedures of hydraulic systems.

Learning Content

S1652.4.1 Define the purpose and fundamentals of hydraulic components.

- pumps and compressors
- gear
- vane
- piston
- valves
- pressure relief valve
- directional control valve
- pressure relief valve
- directional control valve
- volume control valve
- actuators
  - linear
  - rotary
- reservoirs and receivers
  - vented
  - pressurized

S1652.4.2 Describe the function and types of hydraulic components.

- pumps and compressors
- gear
- vane
- piston
- valves
- pressure relief valve
- directional control valve
- pressure relief valve
- directional control valve
- volume control valve
- actuators
  - linear
  - rotary
- reservoirs and receivers
  - vented
  - pressurized

S1652.4.3 Locate hydraulic system components.

- hydraulic component location activities:
  - locate hydraulic components using schematics
  - outline repair procedures for trailer hydraulic components
  - locate hydraulic components using schematics
  - use a trailer hydraulic schematic to trace through components
  - identify the components on a car-hauler trailer
  - lift gate systems

S1652.4.4 Describe hydraulic system maintenance procedures.

- define the importance of regular maintenance service schedules.
  - fluid servicing
  - filter servicing
  - fluid inspection
  - fluid identification
  - air system components
  - reservoir flushing
  - inspection schedules

S1652.4.5 Perform maintenance procedures of hydraulic systems.

- service filters
- service air system components
- check oil contamination
- inspect for leaks

Evaluation and Testing: Assignments related to theory and appropriate application skills.
Minimum of one mid-term test during the term
Final exam at end of term
Periodic quizzes

Evaluation Structure		
Theory Testing	Practical Application Testing	Final Assessment
60%	25%	15%

Number:	S1653		
Title:	**Brake Systems I**		
Duration:	Total Hours: 32	Theory: 16	Practical: 16

Number:	S1653.1		
Title:	**Air Brake Systems**		
Duration:	Total Hours: 21	Theory: 13	Practical: 8
Cross-Reference to Training Standard: U5762.0, U5763.0			

General Learning Outcomes

Upon successful completion, the Apprentice is able to perform basic calculations of pressure, force and area using Imperial and System International Units.

Learning Outcomes and Content

Upon successful completion, the apprentice is able to:

S1653.1.1 Define the purpose and fundamentals of air brake systems.

S1653.1.2 Describe the construction features, types, and application of air brake systems.

S1653.1.3 Explain the principles of operation of air brake systems.

S1653.1.4 Perform inspection, testing and diagnostic procedures of air brake systems.

S1653.1.5 Perform assigned repair and maintenance procedures following manufacturers' of air brake systems.

Learning Content

S1653.1.1 Define the purpose and fundamentals of air brake systems.

- advantages of using air brakes
- law of levers, mechanical advantage
- coefficient of friction
- pneumatic principles
- pressure / area, volume relationship
- factors that affect friction
  - temperature – brake fade
  - contamination - oil, grease, dirt
    - kinetic energy
    - heat energy
    - static friction
    - cmvss121
    - potential energy

S1653.1.2 Describe the construction features, types, and application of air brake systems.

- air supply system
  - tractor primary circuit
  - tractor secondary circuit
- trailer supply circuit
- trailer service brake circuit
- parking emergency circuit
- foundation assemblies
  - cam brakes
    - identity characteristic of shoe styles (Q, Q-plus, etc.)
    - Identity characteristic of cam styles (Q, Q-plus, etc.)
  - disc brakes
  - brake chambers
  - slack adjusters
  - glad hand assemblies
  - trailer mounted air dryers
  - lines, hoses and fittings

S1653.1.3 Explain the principles of operation of air brake systems.

- air supply system
  - tractor primary circuit
  - tractor secondary circuit
- trailer supply circuit
- trailer service brake circuit
- parking emergency circuit
- foundation assemblies
  - cam brakes
  - wedge brakes
  - disc brakes
  - brake chambers
  - slack adjusters
  - glad hand assemblies
  - trailer mounted air dryers
  - lines, hoses and fittings

S1653.1.4 Perform inspection, testing and diagnostic procedures of air brake systems.

- inspect foundation assemblies
- adjust air control governors
- test control valves for recommended operation
- general failure analysis
- identify polarized gladhands
- trailer mounted air dryers
- identify quick release gladhands
- basic troubleshooting techniques

S1653.1.5 Perform assigned repair and maintenance procedures following manufacturers' of air brake systems.

- outline / perform procedures for removal and installation of:
  - lines and hoses
  - fittings
  - couplings
  - component disassembly techniques
- perform air brake slack adjuster maintenance
  - manual slack adjusters
  - automatic slack adjusters
  - forward stroke sensing
  - backward stroke sensing
- identification of statutorily approved pneumatic hoses and lines
- assemble pneumatic hoses and lines
- cage spring brake chambers
  - disarm spring brake chambers
  - demonstrate brake disc and drum machining operations on both new and used components
  - measure drums and rotors for service tolerances
  - lubrication practices
- perform air brake slack adjuster adjustment
- check self adjusting slack adjusters
- perfom the disassembly and reassembly of trailer foundation brake
- assemblies

Number:	S1653.2		
Title:	**Trailer Foundation Brakes**		
Duration:	Total Hours: 6	Theory: 0	Practical: 6
Cross-Reference to Training Standard: U5762.0, U5763.0			

General Learning Outcomes

Perform inspection, testing and maintenance procedures of hydraulic system conductors and connectors.

Learning Outcomes and Content

Upon successful completion, the apprentice is able to:

S1653.2.1 Perform inspection, testing and diagnostic procedures on foundation brake systems.

S1653.2.2 Perform assigned repair operations on foundation brake systems.

Learning Content

S1653.2.1 Perform inspection, testing and diagnostic procedures on foundation brake systems.

- application and control valves
- troubleshooting techniques
- pressure balance
- failure analysis

S1653.2.2 Perform assigned repair operations on foundation brake systems.

- outline and perform procedures for removal and installation of:
  - lines and fittings
  - connectors
  - components
- perform air brake slack adjuster adjustment according to recommended Technology Maintenance Council (TMC) and statutory procedures
- identify statutory pneumatic hoses and fittings
- assemble pneumatic hoses and fittings
- describe disc and drum machining operations
- describe failure analysis observations

Number:	S1653.3		
Title:	**Air Brake Schematics**		
Duration:	Total Hours: 5	Theory: 3	Practical: 2
Cross-Reference to Training Standard: U5760.0, U5761.0, U5762.0			

General Learning Outcomes

Upon successful completion, the Apprentice is able to use air brake system schematics to explain the principles of operation testing and diagnosis of air brake systems following manufacturers' specifications.

Learning Outcomes and Content

Upon successful completion, the apprentice is able to:

S1653.3.1 Define the purpose and fundamentals of air brake schematics.

S1653.3.2 Describe the construction features, types and application of air brake schematics and graphic symbols.

Learning Content

S1653.3.1 Define the purpose and fundamentals of air brake schematics.

- basic air brake systems
- pneumatic schematics and graphic symbols
- symbols and colour codes
- TMC and CMVSS requirements

S1653.3.2 Describe the construction features, types and application of air brake schematics and graphic symbols.

- pneumatic schematics and graphic symbols
- types of OEM pneumatic schematics
- identify combination valves and pressure protected circuits
- identify redundancy circuits
- perform brake balance calculations

Evaluation and Testing: Assignments related to theory and appropriate application skills.
Minimum of one mid-term test during the term
Final exam at end of term
Periodic quizzes

Evaluation Structure		
Theory Testing	Practical Application Testing	Final Assessment
50%	35%	15%

Number:	S1654		
Title:	**Tires and Wheels**		
Duration:	Total Hours: 32	Theory: 16	Practical: 16

Number:	S1654.1		
Title:	**Tire and Wheels**		
Duration:	Total Hours: 6	Theory: 4	Practical: 2
Cross-Reference to Training Standard: U5762.0, U5763.0			

General Learning Outcomes

Upon successful completion, the Apprentice is able to perform inspection and diagnostic techniques and describe the repair procedures for tires following manufacturer's recommendations and specifications and approved industry standards.

Learning Outcomes and Content

Upon successful completion, the apprentice is able to:

S1654.1.1 Define the purpose and fundamentals of tires.

S1654.1.2 Describe the construction features, types and application of trailer tires.

S1654.1.3 Explain the principles of operation of tires.

S1654.1.4 Perform inspection, testing and diagnosis on tires.

S1654.1.5 Describe the repair and balancing procedures of tires.

Learning Content

S1654.1.1 Define the purpose and fundamentals of tires.
- static and dynamic balance
  - centrifugal force
- wear bars
- sliding and rolling friction
- rolling radius

S1654.1.2 Describe the construction features, types and application of trailer tires.
- construction materials
- radius, bias ply
- super singles
- tubeless
- ratings and sizes
- tread design
  - retreaded
  - retreading process
  - valves

S1654.1.3 Explain the principles of operation of tires.

- radials
- bias ply
- tire dynamics
- tire matching
- super singles dynamics
- rolling radius
- side thrust
- sliding friction
- rolling friction
- low profile

S1654.1.4 Perform inspection, testing and diagnosis on tires.

- visual inspection
  - mounting hardware
  - tread wear pattern
    - hydroplaning
    - water/air
  - cuts or bulges
  - tire matching/ OEM
  - rolling radius
  - sizing/ metric and standard
  - tracking
  - inflation
  - out of service criteria
  - axial and radial run-out

S1654.1.5 Describe the repair and balancing procedures of tires.

- describe disassembly and reassembly of tires and rims.
- outline static and dynamic tire balancing procedures.

Number:	S1654.2		
Title:	**Wheel Assemblies**		
Duration:	Total Hours: 4	Theory: 2	Practical: 2
Cross-Reference to Training Standard: U5761.0			

General Learning Outcomes

Upon successful completion, the Apprentice is able to perform assigned repair and failure analysis procedures of wheel assemblies following manufacturer's recommendations and specifications and approved industry standards.

Learning Outcomes and Content

Upon successful completion, the apprentice is able to:

S1654.2.1 Define the purpose and fundamentals of wheel assemblies.

S1654.2.2 Describe the construction features, types and application of wheel assemblies

S1654.2.3 Explain the principles of operation of wheel assemblies.

S1654.2.4 Perform assigned repair and failure analyses procedures of wheel assemblies.

Learning Content

S1654.2.1 Define the purpose and fundamentals of wheel assemblies.
- centrifugal force
- sliding and rolling friction
- ferrous and non-ferrous materials
  - electrolysis
  - plastic spacers between aluminum and steel components

S1654.2.2 Describe the construction features, types and application of wheel assemblies.
- drop centres
- semi-drop
- three piece flat base
- lock rings
- disc
- wheel spacers

S1654.2.3 Explain the principles of operation of wheel assemblies.

- dual wheels
- drop centres
- semi-drop
- drop multi/piece
- lock rings
- disc
- wide base

S1654.2.4 Perform assigned repair and failure analyses procedures of wheel assemblies.

- view demonstration of disassembly and assembly of wheel assemblies
- remove and replace a rim assembly from trailer
- identify causes of failures

Number:	S1654.3		
Title:	**Wheel Hub Assemblies**		
Duration:	Total Hours: 6	Theory: 2	Practical: 4
Cross-Reference to Training Standard: U5761.0			

General Learning Outcomes

Upon successful completion, the Apprentice is able to perform assigned repair and failure analyses procedures of wheel hub assemblies following manufacturer's recommendations and specifications and approved industry standards.

Learning Outcomes and Content

Upon successful completion, the apprentice is able to:

S1654.3.1 Define the purpose and fundamentals of wheel hub assemblies.

S1654.3.2 Describe the construction features, types and application of wheel hub assemblies.

S1654.3.3 Explain the principles of operation of wheel hub assemblies.

S1654.3.4 Perform assigned repair procedures wheel hub assemblies.

Learning Content

S1654.3.1 Define the purpose and fundamentals of wheel hub assemblies.
- ferrous and non-ferrous materials
- static and dynamic balance
- load ratings

S1654.3.2 Describe the construction features, types and application of wheel hub assemblies.
- cast spoke
- hub piloted
- stud piloted
- locking devices

S1654.3.3 Explain the principles of operation of wheel hub assemblies.

- hubs and fastening devices
- left/right studs and nuts
- torque specifications
- end/play
- preload
- TMC standard

Perform inspection, testing and diagnosis on wheel hub assemblies.

- visual inspection
  - wear and damage
  - overheating
- checking procedures for cracks and structural degradation

S1654.3.4 Perform assigned repair procedures wheel hub assemblies.

- remove and replace a wheel hub assembly
  - follow recommended torquing procedures
  - outline drum mounting procedure for each type of hub assembly

Number:	S1654.4		
Title:	**Wheel Bearings**		
Duration:	Total Hours: 8	Theory: 4	Practical: 4
Cross-Reference to Training Standard: U5761.0			

General Learning Outcomes

Upon successful completion, the Apprentice is able to perform assigned repair and failure analysis procedures of wheel hub assemblies following manufacturer's recommendations and specifications and approved industry standards.

Learning Outcomes and Content

Upon successful completion, the apprentice is able to:

S1654.4.1 Define the purpose and fundamentals of wheel bearing assemblies.

S1654.4.2 Describe the construction features, types and applications of wheel bearing assemblies.

S1654.4.3 Explain the principles of wheel bearings and wheel end assemblies.

S1654.4.4 Perform inspection, testing and diagnosis on wheel bearings.

S1654.4.5 Describe and perform assigned repair and service procedures of wheel bearing assemblies.

Learning Content

S1654.4.1 Define the purpose and fundamentals of wheel bearing assemblies.
- sliding and rolling friction
- load carrying bearings
- lubrication

S1654.4.2 Describe the construction features, types and applications of wheel bearing assemblies.
- bearings and retaining locks
- tapered roller
- cups
- cones
- ball bearing assemblies
- race
- cage assemblies

S1654.4.3 Explain the principles of wheel bearings and wheel end assemblies.

- lubrication
- oil
- grease –semi solid
- synthetic
- API specifications
- reduced maintenance
- end play factors
- preload factors
- bearing dynamics

S1654.4.4 Perform inspection, testing and diagnosis on wheel bearings.

- perform visual inspection
  - bearing wear patterns
  - heat and discoloring
  - galling
  - spalling
  - bearing match
  - failure analysis
  - bearing end play
  - bearing fit
  - hubs
  - spindles

S1654.4.5 Describe and perform assigned repair and service procedures of wheel bearing assemblies.

- describe removal and replacement of a wheel bearing assembly
- perform recommended torque procedure
- outline and perform the TMC wheel end procedure for steel and aluminum hubs
- outline bearing cleaning precautions
- outline service procedures
  - wet
  - grease

Number:	S1654.5		
Title:	**Wheel Seals**		
Duration:	Total Hours: 8	Theory: 4	Practical: 4
Cross-Reference to Training Standard: U5761.0			

General Learning Outcomes

Upon successful completion, the Apprentice is able to perform assigned repair and failure analyses procedures of wheel seals following manufacturer's recommendations and specifications and approved industry standards

Learning Outcomes and Content

Upon successful completion, the apprentice is able to:

S1654.5.1 Define the purpose and fundamentals of wheel seals.

S1654.5.2 Describe the construction features, types and applications of wheel seals.

S1654.5.3 Explain the principles of wheel bearings and wheel seals.

S1654.5.4 Perform inspection, testing and diagnosis on wheel seals.

Learning Content

S1654.5.1 Define the purpose and fundamentals of wheel seals.
- lubrication
- friction

S1654.5.2 Describe the construction features, types and applications of wheel seals.
- oil
- grease
- synthetic
- integral
- 2-piece
- wear rings
- oil caps
- hubometers
- sealants and materials
- pressured hub inflation system

S1654.5.3 Explain the principles of wheel bearings and wheel seals.

- temperature effects
- lubrication action
- static seals
- dynamic seals
- anaerobic action
- pressured hub inflation systems

S1654.5.4 Perform inspection, testing and diagnosis on wheel seals.

- perform visual inspection
- seal wear patterns
- seal match
- alignment
- checking of seal condition

Describe and perform assigned repair and service procedures of wheel seals.

- describe removal a wheel seal
- describe installation techniques:
- replaceable wear rings.
- seal selection and cross-referencing
- use seal removal and installation tools
- outline seal failure analysis procedure

Evaluation and Testing: Assignments related to theory and appropriate application skills.
Minimum of one mid-term test during the term
Final exam at end of term
Periodic quizzes

Evaluation Structure		
Theory Testing	Practical Application Testing	Final Assessment
50%	40%	10%

Number:	S1655		
Title:	**Frames and Trailer Support Systems**		
Duration:	Total Hours: 32	Theory: 19	Practical: 13

Number:	S1655.1		
Title:	**Landing Gear**		
Duration:	Total Hours: 6	Theory: 4	Practical: 2
Cross-Reference to Training Standard: U5757.0, U5760.0			

General Learning Outcomes

Upon successful completion, the Apprentice is able to perform assigned repair and diagnostic procedures for landing gear assemblies following manufacturer's recommendations and specifications.

Learning Outcomes and Content

Upon successful completion, the apprentice is able to:

S1655.1.1 Define the purpose and fundamentals of landing gear.

S1655.1.2 Describe the construction features, types and applications of landing gear.

S1655.1.3 Explain the principles of operation of landing gear.

S1655.1.4 Perform inspection, testing and diagnosis on landing gear.

S1655.1.5 Describe repair and service procedures of landing gear.

Learning Content

S1655.1.1 Define the purpose and fundamentals of landing gear.
- hydraulics
- pneumatics
- basic gear theory

S1655.1.2 Describe the construction features, types and applications of landing gear.
- mechanical
- drop support legs with lock pin
- two-speed gear crank support legs
- self-leveling
- air over hydraulic
- hydraulic

S1655.1.3 Explain the principles of operation of landing gear.

- mechanical
- drop support legs with lock pin
- two-speed gear crank support legs
- self-leveling
- air over hydraulic
- hydraulic
- gear ratios and types
- timing
- lubrication
- k bracing and wing plates
- cross shaft

S1655.1.4 Perform inspection, testing and diagnosis on landing gear.

- perform visual inspection
  - wear patterns
  - damage
  - cracks
  - corrosion
  - lubrication
  - identification of load ratings
  - identify shoe types
  - identify shoe securing devices

S1655.1.5 Describe repair and service procedures of landing gear.

- interpret manufacturers' overhaul procedure
- interpret hydraulic schematic
- mounting procedure
- mounting brackets
- describe overhaul procedure
- cross-reference parts

Number:	S1655.2		
Title:	**Frame Theory**		
Duration:	Total Hours: 10	Theory: 6	Practical: 4
Cross-Reference to Training Standard: U5757.0			

General Learning Outcomes

Upon successful completion, the Apprentice is able to assess damage to trailer frames following manufacturer's recommendations and specifications.

Learning Outcomes and Content

Upon successful completion, the apprentice is able to:

S1655.2.1 Define the purpose and fundamentals of frames.

S1655.2.2 Describe the construction features, types and applications of frames.

S1655.2.3 Explain the principles of operation of frames.

S1655.2.4 Assess damage to trailer frames.

Learning Content

S1655.2.1 Define the purpose and fundamentals of frames.
- basic trailer frame theory
- bridge and beam fundamentals

S1655.2.2 Describe the construction features, types and applications of frames.
- ladder
- monocoque
- unibody
- combination
- Telescoping

S1655.2.3 Explain the principles of operation of frames.
- frame characteristics
- tensional and compressional loading
- neutral fibre
- section modulus
- material strength factors/yield and tensile strength
- resist bend moment (RBM)
- RBM calculations

- frame materials
- aluminum alloys
- tempered aluminum
- mild steel
- tempered steel
- bridge formula
  - axle weight legislation
  - RTAC standards
- frame oscillation

S1655.2.4 Assess damage to trailer frames.

- project a trailer frame diagram to floor
- use alignment equipment to verify frame integrity
- verify measurements with manufacturers' specifications

Number:	S1655.3		
Title:	**Ladder Frames**		
Duration:	Total Hours: 8	Theory: 4	Practical: 4
Cross-Reference to Training Standard: U5757.0			

General Learning Outcomes

Upon successful completion, the Apprentice is able to perform assigned repair and diagnostic procedures of ladder frames following manufacturer's recommendations and specifications and approved industry standards.

Learning Outcomes and Content

Upon successful completion, the apprentice is able to:

S1655.3.1 Define the purpose and fundamentals of ladder frames.

S1655.3.2 Describe the construction features, types and applications of ladder frames.

S1655.3.3 Explain the principles of operation of ladder frames.

S1655.3.4 Perform inspection and describe diagnosis of ladder frames.

S1655.3.5 Describe and perform assigned repair and service procedures of ladder frames.

Learning Content

S1655.3.1 Define the purpose and fundamentals of ladder frames.
- basic trailer frame theory

S1655.3.2 Describe the construction features, types and applications of ladder frames.
- main rails
- structural
- fabricated
- frame sections
- I beams
- C channels
- U channels
- pressed / formed channels
- flatbed decking / flooring
- cross bracing
- fastening devices

S1655.3.3 Explain the principles of operation of ladder frames.

- frame characteristics
- tensional and compressional loading
- neutral fibre
- section modulus
- material strength factors/yield and tensile strength
- resist bend moment (RBM)
- rbm calculations
- frame materials
- aluminum alloys
- mild steels
- tempered steels
- bridge formula
- frame dynamics
- load effects
- effects of electrolysis

S1655.3.4 Perform inspection and describe diagnosis of ladder frames.

- perform visual inspection
  - wear patterns
  - damage assessment
    - cracks
    - corrosion
    - bends, twists
    - diamond, sag, side sway
  - buckle
  - techniques for projecting frame diagrams
    - plumb bob, chalk line, tape
  - identify shoe types

S1655.3.5 Describe and perform assigned repair and service procedures of ladder frames.

- outline sandblasting procedure
- outline painting procedure
- preventive maintenance
- frame repair techniques
  - drilling
  - reaming
  - welding
  - fastening
  - riveting
  - bolting

- magnalock / huck fasteners
- ladder frame reinforcement
  - fish plate / overlay web section
  - L reinforcement
  - inverted L
  - U section
  - effects on section modulus
  - gussets
  - cross member replacements
  - vertical stiffeners
- frame alteration
- extension
- reduction
- frame failures
- effects on structural integrity

Number:	S1655.4		
Title:	**Monocoque Unibody Frames**		
Duration:	Total Hours: 8	Theory: 5	Practical: 3
Cross-Reference to Training Standard: U5757.0			

General Learning Outcomes

Upon successful completion, the Apprentice is able to perform assigned repair and diagnostic procedures of monocoque / unibody frames following manufacturer's recommendations and specifications and approved industry standards.

Learning Outcomes and Content

Upon successful completion, the apprentice is able to:

S1655.4.1 Define the purpose and fundamentals of monocoque / unibody frames.

S1655.4.2 Describe the construction features, types and applications of monocoque / unibody frames.

S1655.4.3 Explain the principles of operation of monocoque / unibody frames.

S1655.4.4 Perform inspection, testing and diagnosis on monocoque / unibody frames.

S1655.4.5 Describe and perform assigned repair procedures of monocoque / unibody frames.

Learning Content

S1655.4.1 Define the purpose and fundamentals of monocoque / unibody frames.
- basic trailer frame theory

S1655.4.2 Describe the construction features, types and applications of monocoque / unibody frames.
- monocoque / unibody designs
- van bodies
  - floor-roof-rails
  - sidewalls
  - door frame
  - front wall
  - sub-frames
  - upper coupler

- tankers
  - shell
  - external bolsters
  - shell stiffeners
  - bulk head
  - internal baffles
  - sub-frame
  - upper coupler
- bridge trailers
- section modulus
- upper coupler
- bogie sub-frame

S1655.4.3 Explain the principles of operation of monocoque / unibody frames.

- frame characteristics
- tensional and compressional loading
- material strength factors/yield and tensile strength
- resist bend moment (RBM)
- RBM calculations
- frame materials
- aluminum alloys
- mild steels
- tempered steels
- bridge formula
- frame dynamics
- load effects
- effects of electrolysis

S1655.4.4 Perform inspection, testing and diagnosis on monocoque / unibody frames.

- perform visual inspection
  - upper coupler
  - galvanic corrosion
- check fasteners
  - posts to lower side rail
  - post to upper side rail
  - upper side rail to roof bows
  - lower side rail to cross members
- check mounting of underside guard and conformity of dimensions
- check rear door opening for squareness

S1655.4.5 Describe and perform assigned repair procedures of monocoque / unibody frames.

- outline sandblasting procedure
- outline painting procedure
- surface preparation
- neutralizing electrolyte action of dissimilar materials
- wooden floor inspection
- manufacturers' preventive maintenance
- frame repair techniques
  - drilling
  - reaming
  - welding
  - fastening
  - riveting
  - bolting
- magnalock / huck fasteners
- cross member replacements
- frame alteration
- extension
- reduction
- frame failures
- effects on structural integrity
- importance on floor assembly in unibody trailers

Evaluation and Testing: Assignments related to theory and appropriate application skills.
Minimum of one mid-term test during the term
Final exam at end of term
Periodic quizzes

Evaluation Structure		
Theory Testing	Practical Application Testing	Final Assessment
60%	25%	15%

Number:	S1656		
Title:	**Body Systems I**		
Duration:	Total Hours: 32	Theory: 18	Practical: 14

Number:	S1656.1		
Title:	**Trailer Dry Vans**		
Duration:	Total Hours: 20	Theory: 11	Practical: 9
Cross-Reference to Training Standard: U5759.0			

General Learning Outcomes

Upon successful completion, the Apprentice is able to perform testing, diagnosis and assigned repair procedures to dry trailer vans following manufacturer's recommendations and specifications and approved industry standards.

Learning Outcomes and Content

Upon successful completion, the apprentice is able to:

S1656.1.1 Define the purpose and fundamentals of dry trailer vans.

S1656.1.2 Describe the construction features types and application of dry van trailers.

S1656.1.3 Explain the principles of operation of dry trailer van bodies.

S1656.1.4 Perform inspection, testing and diagnosis on dry trailer van bodies.

S1656.1.5 Perform assigned repair and service operations on dry trailer van bodies.

Learning Content

S1656.1.1 Define the purpose and fundamentals of dry trailer vans.

- frame types
  - sub frame
  - full frame
  - unibody / monocoque

S1656.1.2 Describe the construction features types and application of dry van trailers.

- conventional
  - curtain sided
  - open top
  - cross member
  - upper and lower rail
  - roof and roof bows
  - swing and roll-up doors
  - vent doors
  - side panels
  - floors, headers
  - sills and posts

- scuff liners
- logistics posts
- corner caps
- curtain walls
- composites
- load security

S1656.1.3 Explain the principles of operation of dry trailer van bodies.

- unitized/ monocoque construction
  - cross member
  - upper and lower rail
  - roof, roof bows
  - swing and roll-up doors
  - vent doors
  - side panels
  - floors
  - headers
  - sills and posts
  - scuff liners
  - logistics posts
  - corner caps
  - radius corners
  - composites
  - upper coupler assembly

S1656.1.4 Perform inspection, testing and diagnosis on dry trailer van bodies.

- perform visual inspection
  - damage assessment
  - structural
  - non-structural
- identify different types of floors
- identify body materials
- seals and sealing devices
- leak testing methods
- damage appraisal
- preventative maintenance inspections
- upper coupler inspection

S1656.1.5 Perform assigned repair and service operations on dry trailer van bodies.

- preventative maintenance practices
- upper coupler repairs
- structural
- non-structural
  - roof, sidewall, rail splice and floor repairs or replacement
  - material repair technique
  - welding repair techniques
- perform selected repairs on trailer vans

Number:	S1656.2		
Title:	**Platform and Float Trailers**		
Duration:	Total Hours: 7	Theory: 4	Practical: 3
Cross-Reference to Training Standard: U5759.0			

General Learning Outcomes

Upon successful completion, the Apprentice is able to describe and perform testing, diagnosis and assigned repair and service procedures to platform and float trailers following manufacturer's recommendations and specifications and approved industry standards.

Learning Outcomes and Content

Upon successful completion, the apprentice is able to:

S1656.2.1 Define the purpose and fundamentals of platform and float trailers.

S1656.2.2 Describe the construction features, types and applications of platform and float trailers.

S1656.2.3 Explain the principles of operation of platform and float trailers.

S1656.2.4 Perform inspection, testing and diagnosis on platform and float trailers.

S1656.2.5 Describe and perform assigned repair and service procedures on platform and float trailers.

Learning Content

S1656.2.1 Define the purpose and fundamentals of platform and float trailers.

- platform
- straight
- low bed
- floats
- low-bed gooseneck
- straight with beaver tail

S1656.2.2 Describe the construction features, types and applications of platform and float trailers.

- deck materials
- deck types
- frame assemblies
- upper coupler assembly
- auxiliary loading equipment
- under-ride protection
- floor extensions
- stake pockets
- coil wells
- tarping systems
- racks
- goosenecks
  - integral
  - swing
  - detachable
  - double goosenecks
  - load securement provision

S1656.2.3 Explain the principles of operation of platform and float trailers.

- detachable goosenecks
- loaded / unloaded frame characteristics

S1656.2.4 Perform inspection, testing and diagnosis on platform and float trailers.

- perform visual inspection
- damage assessment
- structural
- non-structural
- identify deck materials
- identify frame materials
- seals and sealing devices
- damage appraisal
- preventative maintenance inspections

S1656.2.5 Describe and perform assigned repair and service procedures on platform and float trailers.

- preventative maintenance practices
- upper coupler repairs
  - structural
  - non-structural
- roof, sidewall, rail splice and floor repairs or replacement
  - material repair technique
  - welding repair techniques
- refinishing methods
  - washing
  - degreasing
  - abrasive blasting
- aluminum repair preparation procedure
  - electrolytic / galvanic action
  - preparation and priming
  - paint touch-up

Number:	S1656.3		
Title:	**Trailers Dumps and Hoppers**		
Duration:	Total Hours: 5	Theory: 3	Practical: 2
Cross-Reference to Training Standard: U5759.0			

General Learning Outcomes

Upon successful completion, the Apprentice is able to describe and perform testing, diagnosis and assigned repair and service procedures to trailer dumps and hoppers following manufacturer's recommendations and specifications and approved industry standards.

Learning Outcomes and Content

Upon successful completion, the apprentice is able to:

S1656.3.1 Define the purpose and fundamentals of trailer dumps and hoppers.

S1656.3.2 Describe the construction features, types and applications of trailer dumps and hoppers.

S1656.3.3 Explain the principles of operation of trailer dumps and hoppers.

S1656.3.4 Perform inspection, testing and diagnosis on trailer dumps and hoppers.

S1656.3.5 Describe and perform assigned repair and service procedures on trailer dumps and hoppers.

Learning Content

S1656.3.1 Define the purpose and fundamentals of trailer dumps and hoppers.
- conventional dumps
- hoppers
- bulk

S1656.3.2 Describe the construction features, types and applications of trailer dumps and hoppers.
- conventional dumps
- hoppers
- bulk
- grain
- chipper
- fruit

- tailgates
- high gates / rail gates
- walking floors
- shakers
- load securement
- hydraulic hoisting devices
  - tanks
  - pumps
  - filters
  - flow regulators
  - rams and cylinders
  - lines, hoses and fittings
  - hydraulic fluid

S1656.3.3 Explain the principles of operation of trailer dumps and hoppers.

- tailgates
- hoisting dynamics
- design characteristics

S1656.3.4 Perform inspection, testing and diagnosis on trailer dumps and hoppers.

- perform visual inspection
  - damage assessment
  - structural
  - non-structural
- outline testing procedure
  - hydraulic hoisting devices
  - tailgates and latching devices
  - load securement devices
  - unloading devices
  - check tailgate electrical circuit

S1656.3.5 Describe and perform assigned repair and service procedures on trailer dumps and hoppers.

- repair and reinforcement of dump bodies, hinges, locking and spreading mechanisms
- re-skinning dump trailer floors, chassis repair, mud flaps, hinge pin
- removal and replacement
- outline the procedure for hoisting system repairs
- load securement methods
- tailgates
- loading and unloading devices

Evaluation and Testing: Assignments related to theory and appropriate application skills.
Minimum of one mid-term test during the term
Final exam at end of term
Periodic quizzes

Evaluation Structure		
Theory Testing	Practical Application Testing	Final Assessment
50%	40%	10%

Number:	S1657		
Title:	**Electrical Systems I**		
Duration:	Total Hours: 40	Theory: 26	Practical: 14

Number:	S1657.1		
Title:	**Introduction to Electricity**		
Duration:	Total Hours: 2	Theory: 2	Practical: 0
Cross-Reference to Training Standard: U5760.0			

General Learning Outcomes

Upon successful completion, the Apprentice is able to describe the fundamentals of electricity according to sound scientific principles.

Learning Outcomes and Content

Upon successful completion, the apprentice is able to:

S1657.1.1 Define the fundamentals of electricity.

Learning Content

S1657.1.1 Define the fundamentals of electricity.

- atomic structure
- conductors and insulators
- electrons and conventional theories
- sources of electricity
  - heat
  - pressure
  - friction
  - chemical
  - light
  - magnetism

Number:	S1657.2		
Title:	**Electrical Laws**		
Duration:	Total Hours: 2	Theory: 2	Practical: 0
Cross-Reference to Training Standard: U5760.0			

General Learning Outcomes

Upon successful completion, the Apprentice is able to describe the fundamental laws of electricity according to sound scientific principles.

Learning Outcomes and Content

Upon successful completion, the apprentice is able to:

S1657.2.1 Define the fundamentals of electrical laws.

S1657.2.2 Perform calculations using the fundamental laws of electricity.

Learning Content

S1657.2.1 Define the fundamentals of electrical laws.

- Ohms Law
  - state law
  - mathematical relationship between current, voltage and
  - resistance
- Watts Law
  - mathematical relationship between current, voltage and wattage
- Kirchhoff's Law
  - state law
  - mathematical relationship of individual voltage drops to
  - circuit voltage

S1657.2.2 Perform calculations using the fundamental laws of electricity.

- Ohm's law
- Watt's law
- Kirchhoff's law

Number:	S1657.3		
Title:	**Electrical Test Equipment**		
Duration:	Total Hours: 6	Theory: 4	Practical: 2
Cross-Reference to Training Standard: U5760.0			

General Learning Outcomes

Upon successful completion, the Apprentice is able to describe the operation and application of electrical test equipment on trailer electrical systems following manufacturer's recommendations.

Learning Outcomes and Content

Upon successful completion, the apprentice is able to:

S1657.3.1 Identify the types of electrical test equipment.

S1657.3.2 Define the function, types and application of electrical test equipment.

S1657.3.3 Explain the principles of operation of electrical test instruments and perform self-test procedures.

S1657.3.4 Perform the following measurements using electrical test equipment.

Learning Content

S1657.3.1 Identify the types of electrical test equipment.
- digital multimeters (DMM)
  - voltmeter
  - ammeter
  - ohmmeter
  - inductive clamp
- reader programmers
- ATA trailer light cord test box
- proprietary testers

S1657.3.2 Define the function, types and application of electrical test equipment.
- digital multimeters
  - voltmeter
  - ammeter
  - ohmmeter

S1657.3.3 Explain the principles of operation of electrical test instruments and perform self-test procedures.

- digital multimeters
- reader programmers
- ATA trailer cord light test box
- proprietary ABS testers
- precautions of use on electronic systems
  - test lamps

S1657.3.4 Perform the following measurements using electrical test equipment.

- voltage
- resistance
- amperage
- continuity
- impedance
- Induction

Number:	S1657.4		
Title:	**Electrical Circuits and Calculations**		
Duration:	Total Hours: 6	Theory: 3	Practical: 3
Cross-Reference to Training Standard: U5760.0			

General Learning Outcomes

Upon successful completion, the Apprentice is able to describe the graphics and construction of electrical circuit schematics and use to proof calculations and verify circuit operation according to manufacturer's recommendations.

Learning Outcomes and Content

Upon successful completion, the apprentice is able to:

S1657.4.1 Define the purpose and fundamentals of electrical circuits.

S1657.4.2 Define the function, types and application of electrical circuits.

S1657.4.3 Perform circuit calculations using Ohms and Kirchhoff's laws.

Learning Content

S1657.4.1 Define the purpose and fundamentals of electrical circuits.
- applying electrical fundamentals to electrical circuits

S1657.4.2 Define the function, types and application of electrical circuits.
- electrical schematics and symbols
- electrical circuit formulae
- series, parallel and series-parallel circuits
- circuit characteristics

S1657.4.3 Perform circuit calculations using Ohms and Kirchhoff's laws.
- Ohm's law applied to:
  - series circuits
  - parallel circuits
  - series-parallel circuits
- Kirchhoff's law applied to voltage drops

Number:	S1657.5		
Title:	**Electrical Circuits Protection Devices**		
Duration:	Total Hours: 6	Theory: 4	Practical: 2
Cross-Reference to Training Standard: U5760.0			

General Learning Outcomes

Upon successful completion, the Apprentice is able to describe the construction, operation and testing of electrical circuit protection devices on trailer electrical systems following manufacturer's recommendations.

Learning Outcomes and Content

Upon successful completion, the apprentice is able to:

S1657.5.1 Define the purpose and fundamentals of trailer circuit protection devices.

S1657.5.2 Define the construction features, types and applications of trailer circuit protection devices.

S1657.5.3 Perform component location exercises.

Learning Content

S1657.5.1 Define the purpose and fundamentals of trailer circuit protection devices.
- schematics
- symbols
- fuses/breakers/fusible links
- circuit identification

S1657.5.2 Define the construction features, types and applications of trailer circuit protection devices.
- wiring schematics
  - line type
  - valley forge type
  - illustrated
- electrical symbols
- protection devices
  - circuit breakers
  - fuses
  - fusible links

- wiring and connectors
- wire size configuration
  - society of automotive engineers
  - systems international
  - metric
- identification
- composition
- terminal configuration (multi-pin, layout)

S1657.5.3 Perform component location exercises.

- pin out test
- component function test
  - switches
  - relays
  - use vehicle schematics

Number:	S1657.6		
Title:	**Electrical Circuit Repair**		
Duration:	Total Hours: 4	Theory: 2	Practical: 2
Cross-Reference to Training Standard: U5760.0			

General Learning Outcomes

Upon successful completion, the Apprentice is able to perform electrical circuit repair procedures on trailer electrical systems following manufacturer's recommendations.

Learning Outcomes and Content

Upon successful completion, the apprentice is able to:

S1657.6.1 Define the different types of circuit failures.

S1657.6.2 Define the characteristics of circuit failures.

S1657.6.3 Describe the construction features, types and application of electrical circuit connectors.

S1657.6.4 Perform assigned repairs to electrical circuits.

Learning Content

S1657.6.1 Define the different types of circuit failures.
- opens
- shorts
- grounds
- high resistance conditions

S1657.6.2 Define the characteristics of circuit failures.
- opens
- shorts
- grounds
- high resistance conditions

S1657.6.3 Describe the construction features, types and application of electrical circuit connectors.

- proprietary connectors
  - weatherpack
  - deutch
- solder and solder-less joints
- heat shrink tubing
- connectors
- corrosion protection materials

S1657.6.4 Perform assigned repairs to electrical circuits.

- proprietary connectors
  - weatherpack
  - deutch
- solder and solder-less joints
- heat shrink tubing
- connectors
- corrosion protection materials

Number:	S1657.7		
Title:	**Electromagnetic Devices**		
Duration:	Total Hours: 7	Theory: 6	Practical: 1
Cross-Reference to Training Standard: U5760.0			

General Learning Outcomes

Upon successful completion, the Apprentice is able to perform operational tests on trailer electromagnetic devices following manufacturer's recommendations.

Learning Outcomes and Content

Upon successful completion, the apprentice is able to:

S1657.7.1 Define the purpose and fundamentals of electromagnetic devices.

S1657.7.2 Define the construction features and applications types of electromagnetic devices.

S1657.7.3 Explain the principles of operation of electromagnetic devices.

S1657.7.4 Illustrate relay and solenoid operation.

Learning Content

S1657.7.1 Define the purpose and fundamentals of electromagnetic devices.

- magnetism
- electromagnetism
- current flow and magnetic principles as applied to relays, solenoids and motors.
- right and left hand rules
- counter electromotive force effects

S1657.7.2 Define the construction features and applications types of electromagnetic devices.

- electric motors
- solenoids
- relays
- coils
- stepper motors

S1657.7.3 Explain the principles of operation of electromagnetic devices.

- motors
- torque and power
- solenoids
- relays
- coils
- stepper motors

S1657.7.4 Illustrate relay and solenoid operation.

- bench testing of component operation

Number:	S1657.8		
Title:	**Battery Fundamentals**		
Duration:	Total Hours: 7	Theory: 3	Practical: 4
Cross-Reference to Training Standard: U5760.0			

General Learning Outcomes

Upon successful completion, the Apprentice is able to perform testing and maintenance procedures on lead acid batteries following manufacturer's recommendations and specifications.

Learning Outcomes and Content

Upon successful completion, the apprentice is able to:

S1657.8.1 Define the purpose and fundamentals of lead acid batteries.

S1657.8.2 Describe the construction features, types and applications of lead acid batteries.

S1657.8.3 Explain the principles of operation of lead acid batteries.

S1657.8.4 Perform inspection and test procedures of lead acid batteries.

S1657.8.5 Perform assigned maintenance procedures of lead acid batteries.

Learning Content

S1657.8.1 Define the purpose and fundamentals of lead acid batteries.

- electrical storage device
- battery ratings
  - cranking amps
  - amp hour
- temperature effects
  - internal resistance
  - electrolyte characteristics

S1657.8.2 Describe the construction features, types and applications of lead acid batteries.

- lead acid
- low maintenance
- gel cell
- adsorbed glass mat (AGM)

S1657.8.3 Explain the principles of operation of lead acid batteries.
- chemical action
- temperature/internal resistance effects
- charge/ discharge cycle (constant voltage/current)

S1657.8.4 Perform inspection and test procedures of lead acid batteries.
- visual inspection
  - leakage
  - corrosion
  - loose posts
  - bulging case
- state of charge
- surface discharge
- testing
  - high rate discharge
  - 3 minute charge
  - refractometer
  - impedance

S1657.8.5 Perform assigned maintenance procedures of lead acid batteries.
- maintenance
  - cleaning
  - electrolyte
  - charging
- storage procedures
- removal and replacement procedures

Evaluation and Testing: Assignments related to theory and appropriate application skills.
Minimum of one mid-term test during the term
Final exam at end of term
Periodic quizzes

Evaluation Structure		
Theory Testing	Practical Application Testing	Final Assessment
50%	40%	10%

Number:	S1658		
Title:	**Welding I**		
Duration:	Total Hours: 32	Theory: 29	Practical: 23

Number:	S1658.1		
Title:	**Oxy-Acetylene Cutting and Heating**		
Duration:	Total Hours: 10	Theory: 4	Practical: 6
Cross-Reference to Training Standard: U5757.0, U5760.0			

General Learning Outcomes

Upon successful completion, the Apprentice is able to perform oxy-acetylene equipment cutting and heating operations according government safety regulations and manufacturer's recommendations.

Learning Outcomes and Content

Upon successful completion, the apprentice is able to:

S1658.1.1 Define the purpose and fundamentals of oxy-acetylene cutting and heating.

S1658.1.2 Describe the construction features, types and application of oxy-acetylene cutting and heating equipment.

S1658.1.3 Explain the principles of operation of oxy-acetylene cutting and heating equipment.

S1658.1.4 Perform inspection and test procedures of oxy-acetylene cutting and heating equipment.

S1658.1.5 Perform assigned maintenance, heating and cutting procedures of oxy-acetylene cutting and heating equipment.

Learning Content

S1658.1.1 Define the purpose and fundamentals of oxy-acetylene cutting and heating.

- combustion
- oxidation
- acetylene
- compressed air
- propane

S1658.1.2 Describe the construction features, types and application of oxy-acetylene cutting and heating equipment.

- oxy-acetylene gauges and regulators
- oxygen cylinders
- acetylene cylinders
- hoses
- flashback arrestors
- fusible plugs
- rupture discs
- mixing chambers
- torches
- tips
- cutting-heating
- cylinder storage / transport
- hazardous material training

S1658.1.3 Explain the principles of operation of oxy-acetylene cutting and heating equipment.

- oxidation reactions
- combustion
- basic metallurgy
- gauges
- regulators
- cutting tips
- mixing chambers
- torches
- safety devices

S1658.1.4 Perform inspection and test procedures of oxy-acetylene cutting and heating equipment.

- visual inspection of:
  - cylinders
  - gauges
  - hoses
  - regulators
  - safety apparatus
  - tanks
- test operation of equipment

S1658.1.5 Perform assigned maintenance, heating and cutting procedures of oxy-acetylene cutting and heating equipment.

- maintenance
- cleaning
- hose connections
- storage procedures
- perform cutting and heating

Number:	S1658.2		
Title:	**Shielded Metal Arc Welding**		
Duration:	Total Hours: 22	Theory: 5	Practical: 17
Cross-Reference to Training Standard: U5757.0, U5758.0, U5759.0, U5760.0, U5761.0			

General Learning Outcomes

Upon successful completion, the Apprentice is able to perform down hand and positional arc welding operations on mild steel according government safety regulations and manufacturer's recommendations.

Learning Outcomes and Content

Upon successful completion, the apprentice is able to:

S1658.2.1 Define the purpose and fundamentals of shielded metal arc welding.

S1658.2.2 Describe the construction features, types and application of shielded metal arc equipment and electrodes.

S1658.2.3 Explain the principles of operation of shielded metal arc equipment.

S1658.2.4 Perform inspection and test procedures of shielded metal arc equipment.

S1658.2.5 Perform shielded metal arc welding and destructive and non-destructive testing on welding coupons.

Learning Content

S1658.2.1 Define the purpose and fundamentals of shielded metal arc welding.

- Polarity
- power sources
- gas shield
- open circuit voltage
- closed circuit voltage

S1658.2.2 Describe the construction features, types and application of shielded metal arc equipment and electrodes.

- power-sources
- rectifier
- generator
- transformer
- consumables
- electrode classifications
- electrode coatings
- tensile strength

S1658.2.3 Explain the principles of operation of shielded metal arc equipment.

- power sources
- rectifier
- generator
- electrode coatings
- wire specifications
- gun and cable assembly
- weld analysis
- composition of steels
- SAE steel codes
- steel alloys
- aluminum alloys
- fusion principles

S1658.2.4 Perform inspection and test procedures of shielded metal arc equipment.

- visual inspection of:
  - cables
  - gun assembly
  - generator
- test operation of equipment
- perform simple destructive test
- cut material

S1658.2.5 Perform shielded metal arc welding and destructive and non-destructive testing on welding coupons.

- perform welding procedures:
  - downhand welding
  - positional metal arc welding
  - vertical up
  - horizontal
  - vertical down
- clean and maintain arc welding equipment
- perform broken stud removal
- weld out bearings
- arc air

Evaluation and Testing: Assignments related to theory and appropriate application skills.
Minimum of one mid-term test during the term
Final exam at end of term
Periodic quizzes

Evaluation Structure		
Theory Testing	Practical Application Testing	Final Assessment
25%	60%	15%

Level 2

Reportable Subject Summary – Level 2

Number	Reportable Subjects	Hours Total	Hours Theory	Hours Practical
1659	Brake Systems II	32	18	14
1660	Axle Assemblies	16	10	6
1661	Suspension Systems and Coupling Devices	40	26	14
1662	Body Systems II	40	28	12
1663	Electrical Systems II	48	27	21
1664	Welding II	32	12	20
1665	Trailer Refrigeration and Cargo Heating Systems	32	20	10
	Total	**240**	**143**	**97**

Number:	S1659		
Title:	**Brake Systems II**		
Duration:	Total Hours: 32	Theory: 18	Practical: 14
Prerequisites:	Level I - Reportable Subjects		

Number:	S1659.1		
Title:	**Anti-Lock Braking Systems and Rollover Stability Control**		
Duration:	Total Hours: 6	Theory: 4	Practical: 2
Cross-Reference to Training Standard: U5763.0			

General Learning Outcomes

Upon successful completion, the Apprentice is able to describe and perform assigned testing, diagnostic, repair and maintenance procedures for anti-lock brake systems (ABS) following manufacturers' recommendations and Truck Maintenance Council (TMC) and statutory procedures.

Learning Outcomes and Content

Upon successful completion, the apprentice is able to:

S1659.1.1 Define the purpose and fundamentals of anti-lock brake systems.

S1659.1.2 Describe the construction features, types and application of anti-lock brake systems.

S1659.1.3 Explain the principles of operation of anti-lock brake systems.

S1659.1.4 Perform inspection, testing and diagnostic procedures of anti-lock brake systems.

S1659.1.5 Describe repair procedures and perform assigned maintenance checks on anti-lock brake systems.

Learning Content

S1659.1.1 Define the purpose and fundamentals of anti-lock brake systems.

- pneumatic brake system fundamentals
- electrical fundamentals
- computer fundamentals
- overview of anti-lock brake systems

S1659.1.2 Describe the construction features, types and application of anti-lock brake systems.

- anti-lock brake hardware
- electronic control module (ECM)
- anti-lock modulator controller
- wheel sensors
- tire rolling radius
- fail relays
- diagnostic displays

S1659.1.3 Explain the principles of operation of anti-lock brake systems.

- electronic control module (ECM)
- anti-lock modulator controller
  - wheel sensors
  - fail relay
  - pneumatic timing
  - brake balance
  - brake phasing
- valve crack pressures
- dynamic braking effect
  - load transfer
  - pressure protection devices
  - break away protection devices
  - brake interlock systems
  - safety equipment in series with brake
  - release mechanism
  - pressure protection
  - brake system management from tractor
  - multiplexing SAE J1939 requirements
  - active suspension / brake systems

S1659.1.4 Perform inspection, testing and diagnostic procedures of anti-lock brake systems.

- outline current trailer ABS systems
- diagnostic procedure for pneumatic brakes
  - outline dynamic and static testing
  - fault code interpretation
- electronic control module (ECM)
- anti-lock modulator controller
  - wheel sensors
  - fail relay
- pneumatic timing
- brake balance

- brake phasing effect
- valve crack pressures
- dynamic braking
  - load transfer
  - brake interlock systems
- interpret pneumatic and ABS system components using manufacturers' schematics
- static discharge precautions

S1659.1.5 Describe repair procedures and perform assigned maintenance checks on anti-lock brake systems.

- perform prescribed preventive maintenance checks
- outline procedures for removal and replacement
- applied safety precautions
  - eye and hand protection
  - hoist, jack and stand use
  - air pressure protection
  - grease and friction materials
  - high pressure auto grease systems
  - electronic system static electricity precautions

Number:	S1659.2		
Title:	**Air Brake Troubleshooting and Failure Analysis**		
Duration:	Total Hours: 8	Theory: 4	Practical: 4
Cross-Reference to Training Standard: U5763.0			

General Learning Outcomes

Upon successful completion, the Apprentice is able to perform assigned troubleshooting and failure analyses procedures for trailer brake systems following manufacturer's specifications and recommendations.

Learning Outcomes and Content

Upon successful completion, the apprentice is able to:

S1659.2.1 Define the purpose and fundamentals of air brake troubleshooting and failure analysis.

S1659.2.2 Describe the functions and application of air brake troubleshooting and failure analysis.

S1659.2.3 Explain the principle of operation of air brake troubleshooting and failure analysis.

S1659.2.4 Perform inspection, testing and diagnostic procedures of anti-lock brake systems.

Learning Content

S1659.2.1 Define the purpose and fundamentals of air brake troubleshooting and failure analysis.

- legal requirements of trailer systems
- ABS and interlock safety devices
- outline sequential steps of troubleshooting
- outline sequential steps of failure analyses

S1659.2.2 Describe the functions and application of air brake troubleshooting and failure analysis.

- use of OEM troubleshooting flow charts
  - component identification and interchangeability
- interpret OEM literature
  - schematics
  - flowcharts
  - interchangeability

S1659.2.3 Explain the principle of operation of air brake troubleshooting and failure analysis.

- OEM flow charts and service literature
- diagnostic software
- fault codes
- audit trails
- Commercial Vehicles Operators Registry (CVOR)
- brake balance
  - pneumatic balance
  - torque balance

S1659.2.4 Perform inspection, testing and diagnostic procedures of anti-lock brake systems.

- application of OEM flow charts and service literature
  - cross reference of components
  - pneumatic performance testing
  - electronic performance testing

Number:	S1659.3		
Title:	**Hydraulic Brake Systems**		
Duration:	Total Hours: 10	Theory: 6	Practical: 4
Cross-Reference to Training Standard: U5763.0, U5765.0			

General Learning Outcomes

Upon successful completion, the Apprentice is able to describe the inspection, diagnostic and maintenance procedures of hydraulic brake systems following manufacturers' specifications and recommendations and Truck Maintenance Council (TMC) and statutory procedures.

Learning Outcomes and Content

Upon successful completion, the apprentice is able to:

S1659.3.1 Define the purpose and fundamentals of hydraulic brake systems.

S1659.3.2 Describe the construction features, types and applications of hydraulic brake system components.

S1659.3.3 Explain the principles of operation of hydraulic brake systems.

S1659.3.4 Describe inspection and diagnostic procedures and perform assigned checks of hydraulic brake system components.

S1659.3.5 Describe the preventive maintenance procedures of hydraulic brake systems.

Learning Content

S1659.3.1 Define the purpose and fundamentals of hydraulic brake systems.

- basic hydraulic brake system overview
- hydraulic brake system schematics and graphic symbols
- brake fluid and servo action

S1659.3.2 Describe the construction features, types and applications of hydraulic brake system components.

- trailer hydraulic brake systems
  - master cylinders
  - calipers / wheel cylinders
  - brake lines and fluid
  - drums, shoes
  - discs and calipers
  - manual and self-adjusters

S1659.3.3 Explain the principles of operation of hydraulic brake systems.

- trailer hydraulic brake systems
  - master cylinders
  - calipers / wheel cylinders
  - brake lines and fluid
  - drums, shoes
  - discs and calipers
  - manual and self-adjusters

S1659.3.4 Describe inspection and diagnostic procedures and perform assigned checks of hydraulic brake system components.

- trailer hydraulic brake systems
- hydraulic components
  - master cylinders
  - calipers and wheel cylinders
  - fluid level and condition
  - brake lines for integrity and routing and securement
  - disc and drum measurements for OEM minimum recommended thickness and condition
- outline recommended hydraulic system bleeding methods
- check brake shoes for OEM minimum recommended thickness and condition

S1659.3.5 Describe the preventive maintenance procedures of hydraulic brake systems.

- adjustment
- cleaning
- line repair and routing
- wiring repair and routing
- dust control methods

Number:	S1659.4		
Title:	**Electric Brake Systems**		
Duration:	Total Hours: 4	Theory: 2	Practical: 2
Cross-Reference to Training Standard: U5763.0, U5765.0			

General Learning Outcomes

Upon successful completion, the Apprentice is able to describe the inspection, testing, diagnostic and maintenance procedures of trailer electric brake following manufacturers' specifications and recommendations and Truck Maintenance Council (TMC) and statutory procedures.

Learning Outcomes and Content

Upon successful completion, the apprentice is able to:

S1659.4.1 Describe the construction features, types, and applications of electric brake system components.

S1659.4.2 Explain the principles of operation of electric brake systems.

S1659.4.3 Describe inspection, testing and diagnostic procedures of electric brake systems.

S1659.4.4 Describe maintenance procedures and outline service operations for electric brake systems.

Learning Content

S1659.4.1 Describe the construction features, types, and applications of electric brake system components.

- overview of trailer electric brake system
- trailer electric brake systems
  - control devices
  - hand and foot controllers
  - wheel units
  - magnetic apply mechanisms
  - wheel actuators

S1659.4.2 Explain the principles of operation of electric brake systems.

- trailer electric brake systems
  - control devices
  - hand and foot controllers
  - wheel units
  - magnetic apply mechanisms
  - wheel actuators
- wiring schematics
  - trace circuits and identify components

S1659.4.3 Describe inspection, testing and diagnostic procedures of electric brake systems.

- trailer electric brake systems
  - control devices
  - hand and foot controllers
  - wheel units
  - magnetic apply mechanisms
  - wheel actuators
  - application devices
  - solenoids

S1659.4.4 Describe maintenance procedures and outline service operations for electric brake systems.

- adjustment/cleaning
- line repair and routing
- wiring repair and routing
- dust control methods
- application devices

Number:	S1659.5		
Title:	**Roll Over Stability Systems**		
Duration:	Total Hours: 4	Theory: 2	Practical: 2
Cross-Reference to Training Standard: U5763.0, U5765.0			

General Learning Outcomes

Upon successful completion, the Apprentice is able to describe inspection, testing, diagnostic, maintenance and repair procedures of roll over stability systems (ROS) following manufacturers' specifications and recommendations and Truck Maintenance Council (TMC) and statutory procedures.

Learning Outcomes and Content

Upon successful completion, the apprentice is able to:

S1659.5.1 Describe the fundamentals, construction features and application of roll over stability system components.

S1659.5.2 Explain the principles of operation of roll over stability systems.

S1659.5.3 Describe inspection, testing and diagnostic procedures of roll over stability systems.

S1659.5.4 Describe maintenance and repair procedures of roll over stability systems.

Learning Content

S1659.5.1 Describe the fundamentals, construction features and application of roll over stability system components.

- overview of trailer roll over stability systems.
- system components:
  - wheel sensors
  - diagnostic displays
  - tractor trailer signaling and warnings
  - accelerometers
  - gyroscopic sensors

S1659.5.2 Explain the principles of operation of roll over stability systems.

- system operation:
  - wheel sensors
  - load transfer
  - tractor trailer communication
  - multiplexing
  - gyroscopic sensors
  - yaw evaluation

S1659.5.3 Describe inspection, testing and diagnostic procedures of roll over stability systems.

- electronic control module (ECM)
- outline dynamic and static testing
- interpret fault codes
- roll and directional tracking sensors

S1659.5.4 Describe maintenance and repair procedures of roll over stability systems.

- describe prescribed preventive maintenance procedures
- outline removal and replacement procedures
- identify programming options
  - input circuit components
  - output circuit components

Evaluation and Testing: Assignments related to theory and appropriate application skills.
Minimum of one mid-term test during the term
Final exam at end of term
Periodic quizzes

Evaluation Structure		
Theory Testing	Practical Application Testing	Final Assessment
50%	40%	10%

Number:	S1660		
Title:	**Axle Assemblies**		
Duration:	Total Hours: 16	Theory: 10	Practical: 6
Prerequisites:	Level I - Reportable Subjects		

Number:	S1660.1		
Title:	**Trailer Axle Assemblies**		
Duration:	Total Hours: 7	Theory: 5	Practical: 2
Cross-Reference to Training Standard: U5760.0, U5751.0			

General Learning Outcomes

Upon successful completion, the Apprentice is able to describe testing, diagnostic and repair procedures of trailer axle assemblies following manufacturer's recommendations and specifications and approved industry standards.

Learning Outcomes and Content

Upon successful completion, the apprentice is able to:

S1660.1.1 Define the purpose and fundamentals of trailer axle assemblies.

S1660.1.2 Describe the construction features, types and applications of trailer axle assemblies.

S1660.1.3 Explain the principles of operation of trailer axle assemblies.

S1660.1.4 Perform inspection and describe testing and diagnostic procedures of trailer axle assemblies.

S1660.1.5 Describe repair procedures of trailer axle assemblies.

Learning Content

S1660.1.1 Define the purpose and fundamentals of trailer axle assemblies.
- rigid beam axles
- axle geometry
- axle mounting configurations

S1660.1.2 Describe the construction features, types and applications of trailer axle assemblies.
- box section
  - tubular
  - solid
- axle width/tracking
- trailer steering axles

- lift axles
- spindles
  - tempered steels
  - wear limits
- independent

S1660.1.3 Explain the principles of operation of trailer axle assemblies.

- box section
  - tubular
  - solid
- load effects
- trailer steering axles
- alignment
  - camber and toe-in
- bridge formula
- lift axles
- king pins

S1660.1.4 Perform inspection and describe testing and diagnostic procedures of trailer axle assemblies.

- visual inspection
  - mounting hardware
  - mounting surfaces
  - stress points
  - magnetic crack detection
  - spindle wear tolerances
- alignment test
- determine if axle is bent

S1660.1.5 Describe repair procedures of trailer axle assemblies.

- describe disassembly and reassembly of axle assemblies.
  - attachment brackets
  - saddles
  - axles
- outline welding procedures and precautions
- describe effects of heat on axles and hardened spindles

Number:	S1660.2		
Title:	**Alignment**		
Duration:	Total Hours: 6	Theory: 2	Practical: 4
Cross-Reference to Training Standard: U5761.0			

General Learning Outcomes

Upon successful completion, the Apprentice is able to describe alignment test results and recommended adjustments and repairs to trailers following manufacturer's recommendations and specifications and approved industry standards.

Learning Outcomes and Content

Upon successful completion, the apprentice is able to:

S1660.2.1 Define the purpose and fundamentals of trailer alignment.

S1660.2.2 Describe the construction features, types and operation of trailer alignment equipment.

S1660.2.3 Perform inspection, testing, diagnosis and failure analyses of trailer alignment.

S1660.2.4 Describe alignment test results and trailer alignment assessment criteria.

Learning Content

S1660.2.1 Define the purpose and fundamentals of trailer alignment.

- camber
- caster
- KPI
- toe-in, neutral toe and toe-out factors
- steering geometry dynamics
- steering geometry performance analysis
  - tractor alignment factors
  - tractor – trailer alignment factors
  - coach alignment factors

S1660.2.2 Describe the construction features, types and operation of trailer alignment equipment.

- computerized alignment equipment
- trammel gauge (bar)
- trailer alignment applications
- bazooka
- plumb bob and chalk line

S1660.2.3 Perform inspection, testing, diagnosis and failure analyses of trailer alignment.

- visual inspection
  - mounting hardware
  - damage
  - wear
  - fractures
- adjustment of critical steering system components
- analyze tire wear patterns
- test steering system wear limits and compare to statutory requirements
- check alignment of trailer assemblies
- identify causes of component failures

S1660.2.4 Describe alignment test results and trailer alignment assessment criteria.

- describe replacement procedure of suspension and steering components
- outline trailer alignment procedures
- outline tractor-trailer combination alignment procedures

Number:	S1660.3		
Title:	**Self Steer Axle Assemblies**		
Duration:	Total Hours: 3	Theory: 3	Practical: 0
Cross-Reference to Training Standard: U5751.0, U5760.0			

General Learning Outcomes

Upon successful completion, the Apprentice is able to describe the construction and operation of trailer self steer axle system in accordance with manufacturer's recommendations.

Learning Outcomes and Content

Upon successful completion, the apprentice is able to:

S1660.3.1 Describe the construction features and application of self steer axle assemblies.

S1660.3.2 Explain the principles of operation of trailer axle assemblies.

Learning Content

S1660.3.1 Describe the construction features and application of self steer axle assemblies.

- king pins
  - bushings
  - pin tempered steel
- actuator
- steering damper
- tie-rod assembly
- air chamber
- steering knuckles
- spiders
- axle beams

S1660.3.2 Explain the principles of operation of trailer axle assemblies.

- king pin assemblies
- actuator
- steering damper
- tie-rod assemblies
- air chambers
- steering knuckles
- spiders
- axle beams

Evaluation and Testing: Assignments related to theory and appropriate application skills.
Minimum of one mid-term test during the term
Final exam at end of term
Periodic quizzes

Evaluation Structure		
Theory Testing	Practical Application Testing	Final Assessment
50%	40%	10%

Number:	S1661		
Title:	**Suspension Systems and Coupling Devices**		
Duration:	Total Hours: 40	Theory: 26	Practical: 14
Prerequisites:	Level I - Reportable Subjects		

Number:	S1661.1		
Title:	**Suspension System Theory**		
Duration:	Total Hours: 6	Theory: 6	Practical: 0
Cross-Reference to Training Standard: U5757.0, U5760.0			

General Learning Outcomes

Upon successful completion, the Apprentice is able to explain the operating principles of trailer suspension systems following manufacturer's recommendations and specifications.

Learning Outcomes and Content

Upon successful completion, the apprentice is able to:

S1661.1.1 Define the purpose and fundamentals of suspension systems.

S1661.1.2 Describe the construction features types and application of suspension systems.

S1661.1.3 Explain the principles of operation of suspension systems.

Learning Content

S1661.1.1 Define the purpose and fundamentals of suspension systems.

- laws of levers
- articulation
- equalization
- isolation
- centre of gravity
- vehicle stability
- dampening
- pneumatics
- hydraulics

S1661.1.2 Describe the construction features types and application of suspension systems.

- leaf springs
  - auxiliary
  - tandem
  - two stage
- rubber spring

- torsion bar
- air spring
  - pressure regulators
- shock absorber
- axle systems
  - walking beams
  - radius rods / torque rods
  - equalizers
  - hangers
  - bushings
  - saddles
  - towers
  - U-bolts
- ferrous metal properties
- sliding bogies
  - manual release
  - air release

S1661.1.3 Explain the principles of operation of suspension systems.

- leaf springs
  - constant rate
  - progressive rate auxiliary
  - tandem
  - two stage
  - deflection rate
- jounce and rebound
- oscillation
- comparison of leaf spring systems with other suspension systems
- air spring suspension and control system
- solid rubber spring suspensions
- combination air and leaf spring suspensions
- dampening
- stresses: tensile, compression and sheer

Number:	S1661.2		
Title:	**Mechanical Suspension Systems**		
Duration:	Total Hours: 8	Theory: 4	Practical: 4
Cross-Reference to Training Standard: U5760.0			

General Learning Outcomes

Upon successful completion, the Apprentice is able to perform inspection and describe testing, diagnosis and failure analysis of mechanical suspension systems following manufacturer's recommendations, specifications and approved industry standards.

Learning Outcomes and Content

Upon successful completion, the apprentice is able to:

S1661.2.1 Define the purpose and fundamentals of mechanical suspension systems.

S1661.2.2 Describe the construction features, types and applications of mechanical suspension systems.

S1661.2.3 Explain the principles of operation of mechanical suspension.

S1661.2.4 Perform inspection and describe testing, diagnosis and failure analyses of mechanical suspension.

S1661.2.5 Describe repair procedures of mechanical suspension systems.

Learning Content

S1661.2.1 Define the purpose and fundamentals of mechanical suspension systems.
- enhance fundamentals

S1661.2.2 Describe the construction features, types and applications of mechanical suspension systems.
- leaf springs
  - steel
  - composite leaf
  - constant rate
  - progressive rate
  - auxiliary
  - tandem
  - two stage

- suspension system components
  - walking beams
  - radius
  - rods/torque
  - rods
  - equalizers
  - hangers
  - bushings
  - saddles
  - towers
  - u-bolts

S1661.2.3 Explain the principles of operation of mechanical suspension.

- leaf springs
  - steel
  - composite leaf
  - constant rate
  - progressive rate
  - auxiliary
  - tandem
  - two stage
- suspension system components
  - walking beams
  - radius
  - rods/torque
  - rods
  - equalizers
  - hangers
  - bushings
  - saddles
  - towers
  - u-bolts
- rubber spring suspension components
  - tower
  - trunnion
  - restrictor can
  - rubber spring
- stresses: tensile, compressional and shear
- spring rate
- dynamics
- wheel hop and wind up
- sprung and unsprung weight

S1661.2.4 Perform inspection and describe testing, diagnosis and failure analyses of mechanical suspension.

- visual inspection
  - mounting hardware
  - rust
  - wear
  - fractures/cracks
- describe diagnostic procedures
- leaf integrity and alignment
- radius and torque rod bushings
- slipper blocks and hangers
- equalizer blocks
- analyze component failures

S1661.2.5 Describe repair procedures of mechanical suspension systems.

- describe replacement procedure of system components
  - leaf springs
  - spring mounting hardware / hangers and brackets
  - equalizers and torque rods

Number:	S1661.3		
Title:	**Air Suspension Systems**		
Duration:	Total Hours: 12	Theory: 6	Practical: 6
Cross-Reference to Training Standard: U5760.0, U5762.0			

General Learning Outcomes

Upon successful completion, the Apprentice is able to perform inspection, testing and assigned repair procedures of air suspension systems following manufacturer's recommendations and specifications and approved industry standards.

Learning Outcomes and Content

Upon successful completion, the apprentice is able to:

S1661.3.1 Define the purpose and fundamentals of pneumatic suspension systems.

S1661.3.2 Describe the construction features, types and application of pneumatic suspension system components.

S1661.3.3 Explain the principles of operation of pneumatic suspension systems.

S1661.3.4 Perform inspection, testing and describe diagnostic procedures of air suspension systems.

S1661.3.5 Perform service and repair procedures of pneumatic suspension systems.

Learning Content

S1661.3.1 Define the purpose and fundamentals of pneumatic suspension systems.
- basic trailer suspension systems
- application of pneumatics and hydraulics

S1661.3.2 Describe the construction features, types and application of pneumatic suspension system components.
- air spring assemblies
  - pedestals
  - jounce blocks
  - air bags
  - single and double convoluted bellows
  - pressure regulators
  - equalizer valves

  - height control valve
  - height control linkage
  - pilot valves/electrically controlled shuttle valves
  - shock absorber types
- air lift axle systems
- suspension system components
  - walking beams
  - radius rods/ torque rods
  - equalizers
  - hangers
  - bushings
  - saddles
  - U-bolts

S1661.3.3 Explain the principles of operation of pneumatic suspension systems.

- articulation
- equalization
- isolation
- centre of gravity
- vehicle stability
  - dampening
  - pressure regulators
  - height control valve
  - reaction delay
  - height control linkage
  - pilot valves/electrically controlled shuttle valves
  - manual or automatic “dump” valves
  - combination valves
- combination air and leaf spring suspensions
- shock absorber function
- shock absorber types
  - single acting
  - double acting
- pressure protection
- shure-cock system/ dock walk protection

S1661.3.4 Perform inspection, testing and describe diagnostic procedures of air suspension systems.

- Perform visual inspection
  - wear patterns
  - damage assessment
  - cracks
  - corrosion
  - rust
  - chafing

- test vehicle ride height and adjust to OEM specifications.
- test air bag system and check for leaks and damage
- test internal and external oil leaks

S1661.3.5 Perform service and repair procedures of pneumatic suspension systems.

- perform height control valve adjustment
- outline / perform procedures for servicing and repair of:
  - spring hangers and brackets
  - air valves and height control valves
  - air springs and pedestals
  - pneumatic plumbing
  - rubber cushions
- Describe the removal and replacement procedures of air springs/shock absorbers and bushings

Number:	S1661.4		
Title:	**Coupling Devices**		
Duration:	Total Hours: 8	Theory: 4	Practical: 4
Cross-Reference to Training Standard: U5757.0			

General Learning Outcomes

Upon successful completion, the Apprentice is able to perform inspection and test operation of tractor to trailer and trailer to trailer coupling devices following manufacturer's recommendations and specifications and approved industry standards.

Learning Outcomes and Content

Upon successful completion, the apprentice is able to:

S1661.4.1 Define the purpose and fundamentals of coupling devices.

S1661.4.2 Describe the construction features, types and application of coupling devices.

S1661.4.3 Explain the principles of operation of coupling systems.

S1661.4.4 Perform inspection, testing and diagnosis on coupling devices.

S1661.4.5 Perform performance test and describe maintenance and repair procedures of coupling devices.

Learning Content

S1661.4.1 Define the purpose and fundamentals of coupling devices.
- articulation
- traction / tractive vehicle dynamics

S1661.4.2 Describe the construction features, types and application of coupling devices.
- fifth wheels
  - semi-oscillating
  - fully-oscillating
  - non-tilt convertible
  - compensating
  - rigid
  - stationary
  - sliding

- locking devices
  - no slack
  - cast head
  - pressed head/fabricated
- brackets, saddles, pins and bushings
- kingpins
- SAE ratings
- pintle hooks
  - eyes, ball hitches, coupler plates
- tensile strength of fasteners
- safety chains
- mounting brackets
- mounting location

S1661.4.3 Explain the principles of operation of coupling systems.

- fifth wheels
  - locking principles
  - secondary locks
  - specifications and ratings
  - mounting height and location
- pintle hooks
  - buffer assembly
  - articulation
  - eyes
  - ball hitches
- king pins
- coupler plates

S1661.4.4 Perform inspection, testing and diagnosis on coupling devices.

- perform visual inspection
  - missing fasteners
  - cracks
  - wear
- check air controls
  - leaks
  - operation
- check coupling devices for:
  - locking ability and security
  - wear tolerances
  - correct engagement
  - adjustment
  - lubrication
  - tongue weight
  - welding integrity
  - condition of fasteners/ chains, hooks and cables

S1661.4.5 Perform performance test and describe maintenance and repair procedures of coupling devices.

- describe removal and cleaning practices
- measuring practices
- describe overhaul procedures
- perform performance test on assembly

Number:	S1661.5		
Title:	**Truck Trailer Combinations**		
Duration:	Total Hours: 6	Theory: 6	Practical: 0
Cross-Reference to Training Standard: U5757.0			

General Learning Outcomes

Upon successful completion, the Apprentice is able to perform inspection and test operation of tractor to trailer and trailer to trailer coupling devices following manufacturer's recommendations and specifications and approved industry standards.

Learning Outcomes and Content

Upon successful completion, the apprentice is able to:

S1661.5.1 Define the purpose and fundamentals of combination truck trailer units.

S1661.5.2 Describe the construction features types and applications of combination truck trailer units.

S1661.5.3 Explain the principles' of operation of combination truck trailer units.

Learning Content

S1661.5.1 Define the purpose and fundamentals of combination truck trailer units.

- articulation
- bridge formula
- braking requirements
- bridge and beam characteristics

S1661.5.2 Describe the construction features types and applications of combination truck trailer units.

- a, b, and c trains
- super b
- leads and pups
- converter dolly
- stability
- full and semi-trailers
- upper couplers
- coupling mechanisms

- steering axles
- total vehicle length and weight
- axle ratings
- weight over axle calculations
- brake timing requirements
- outline coupling / uncoupling procedures

S1661.5.3 Explain the principles' of operation of combination truck trailer units.

- fifth wheels
  - locking principles
  - secondary locks
  - specifications and ratings
  - mounting height and location
- pintle hooks
  - buffer assembly

Evaluation and Testing: Assignments related to theory and appropriate application skills.
Minimum of one mid-term test during the term
Final exam at end of term
Periodic quizzes

Evaluation Structure		
Theory Testing	Practical Application Testing	Final Assessment
60%	25%	15%

Number:	S1662		
Title:	**Body Systems II**		
Duration:	Total Hours: 40	Theory: 28	Practical: 12
Prerequisites:	Level I - Reportable Subjects		

Number:	S1662.1		
Title:	**Insulated Trailer Bodies**		
Duration:	Total Hours: 10	Theory: 6	Practical: 4
Cross-Reference to Training Standard: U5759.0			

General Learning Outcomes

Upon successful completion, the Apprentice is able to perform inspection, testing, diagnosis and assigned repairs to insulated trailer bodies following manufacturer's recommendations and specifications and approved industry standards.

Learning Outcomes and Content

Upon successful completion, the apprentice is able to:

S1662.1.1 Define the purpose and fundamentals of insulated trailer bodies.

S1662.1.2 Describe the construction features types and applications of insulated trailer bodies.

S1662.1.3 Explain the principles of operation of insulated trailer bodies.

S1662.1.4 Perform inspection, testing and diagnosis on insulated trailer bodies.

S1662.1.5 Perform assigned repair procedures and describe maintenance operations and on ladder frames.

Learning Content

S1662.1.1 Define the purpose and fundamentals of insulated trailer bodies
- frame types
  - sub frame
  - full frame
  - unibody / monocoque

S1662.1.2 Describe the construction features types and applications of insulated trailer bodies.
- cross member
- upper and lower rail, roof, roof bows, swing and posts, scuff liners, logistics, posts, corner caps
  - composites
  - load security

- composites
- load security
- insulating material types
- moisture protection (sealant)
- cargo venting systems
- thermal barriers
- curtains

S1662.1.3 Explain the principles of operation of insulated trailer bodies.

- unitized/ monocoque construction
  - cross member
  - Upper and lower rail
  - roof, roof bows
  - swing and roll-up doors
  - vent doors
  - side panels
  - floors
  - headers
  - sills and posts
  - scuff liners
  - logistics posts
  - corner caps
  - radius corners
  - composites
  - upper coupler assembly
  - insulating materials
  - heat loss factors
  - ventilation
  - thermal barriers
- front wall “H” reinforcement
- side door reinforcement

S1662.1.4 Perform inspection, testing and diagnosis on insulated trailer bodies.

- perform visual inspection
  - damage assessment
  - structural
  - non-structural
- identify different types of floors
- identify body materials
- seals and sealing devices
- leak testing methods
- damage appraisal
- preventative maintenance inspections
- upper coupler inspection

S1662.1.5 Perform assigned repair procedures and describe maintenance operations and on ladder frames.

- preventative maintenance practices
- upper coupler repairs
  - structural
  - non-structural
- roof, sidewall, rail splice and floor repairs or replacement
  - material repair techniques
  - welding repair techniques
- perform selected repairs on trailer vans
- refinishing methods
  - washing
  - degreasing
  - abrasive blasting
- aluminum repair preparation procedure
  - electrolytic / galvanic action
  - preparation and priming
  - paint touch up

Number:	S1662.2		
Title:	**Tankers and Pressure Vessels**		
Duration:	Total Hours: 18	Theory: 12	Practical: 6
Cross-Reference to Training Standard: U5759.0			

General Learning Outcomes

Upon successful completion, the Apprentice is able to perform inspection, assigned testing, diagnostic and maintenance and repair procedures to tankers and pressure vessels following manufacturer's recommendations and specifications and approved industry standards.

Learning Outcomes and Content

Upon successful completion, the apprentice is able to:

S1662.2.1 Define the purpose and fundamentals of tankers and pressure vessels.

S1662.2.2 Describe the construction features, types and applications of tankers and pressure vessels.

S1662.2.3 Explain the principles of operation of tankers and pressure vessels.

S1662.2.4 Perform inspection, testing and diagnosis on tankers and pressure vessels.

S1662.2.5 Describe repair procedures and describe maintenance operations of tankers and pressure vessels.

Learning Content

S1662.2.1 Define the purpose and fundamentals of tankers and pressure vessels.
- dry bulk
- liquid
- pressure vessel

S1662.2.2 Describe the construction features, types and applications of tankers and pressure vessels.
- bulk tanker construction materials
  - loading and unloading systems
  - self loader
  - source of air supply
  - closed loop systems
  - filtration

- body styles
- air supply
- liquid tankers
  - electronic bottom loading system
  - vapour recovery system
  - catwalk and safety rail
  - body styles
  - exterior skin
- pressure vessels
  - body styles
- safety equipment
- loading and unloading systems
- rupture disc
- static electricity and grounding
- HACCP product concerns

S1662.2.3 Explain the principles of operation of tankers and pressure vessels.

- dry bulk tanker construction materials
  - loading and unloading systems
  - resistance pressure air volume
  - temperature “friction”
  - product throttling valves
  - blow down
  - pressure relief line and tank
- body styles
- liquid tankers
  - electronic bottom loading system
  - vapour recovery system
  - pressure vessel / gauges, lines and couplings
- safety precautions
- loading and unloading systems
  - catwalk and safety rail
  - safety interlock system
- vacuum and pressure relief
- rupture disc
- manholes
- static electricity and grounding
- HACCP product concerns

S1662.2.4 Perform inspection, testing and diagnosis on tankers and pressure vessels.

- perform visual inspection
  - damage assessment
  - structural
  - non-structural
- seals and sealing devices
- leak testing methods
- damage appraisal
- preventative maintenance inspections

S1662.2.5 Describe repair procedures and describe maintenance operations of tankers and pressure vessels.

- preventative maintenance practices
- outline repair techniques for tanker vessels
  - stress cracks
  - reinforce rigging cracks
  - HACCP customer specifications
- outline re-skinning operations
  - material repair technique
  - welding repair techniques and explosion and confined space precautions
  - safety training policy
- outline washing and steam cleaning procedure
- refinishing methods
  - washing/ degreasing/ abrasive blasting
- aluminum repair preparation procedure
  - electrolytic / galvanic action
  - preparation and priming
  - paint touch-up
- cam locks
- pressure gauges
- gasket replacement/ lines and couplings
- product valves
  - safety valves/vacuum/pressure
  - filtration devices
- fire / explosion concerns when welding
- pressure testing/loss

Number:	S1662.3		
Title:	**Special Commodity Trailers**		
Duration:	Total Hours: 12	Theory: 10	Practical: 2
Cross-Reference to Training Standard: U5759.0			

General Learning Outcomes

Upon successful completion, the Apprentice is able to perform inspection and describe testing, diagnostic and repair procedures for special commodity trailers following manufacturer's recommendations and specifications and approved industry standards.

Learning Outcomes and Content

Upon successful completion, the apprentice is able to:

S1662.3.1 Define the purpose and fundamentals of special commodity trailers.

S1662.3.2 Describe the construction features types and applications of special commodity trailers.

S1662.3.3 Explain the principles of operation of special commodity trailers.

S1662.3.4 Perform inspection and describe testing and diagnostic procedures of special commodity trailers.

S1662.3.5 Describe repair and service procedures of special commodity trailers.

Learning Content

S1662.3.1 Define the purpose and fundamentals of special commodity trailers.

- bulk carriers
- car carrier
- livestock
- compactor
- pole trailers

S1662.3.2 Describe the construction features types and applications of special commodity trailers.

- car carrier
  - load retainers, ramps, frame rails
- all structural
- solid and liquid load capabilities
- livestock
- pole trailers
- container chassis and body

S1662.3.3 Explain the principles of operation of special commodity trailers.

- bulk carrier
- car carrier
- livestock
- compactor
- container chassis and body

S1662.3.4 Perform inspection and describe testing and diagnostic procedures of special commodity trailers.

- perform visual inspection
  - damage assessment
  - structural
  - non-structural
- outline testing procedure
  - hydraulic hoisting devices
  - walking floors
  - livestock carriers
  - tailgates and latching devices
  - load securing devices
  - unloading devices
  - trombone trailers
  - custom trailers
  - utility trailers

S1662.3.5 Describe repair and service procedures of special commodity trailers.

- describe repair and reinforcement of trailer bodies, hinges, locking and spreading mechanisms
- describe re-skinning trailer floors, chassis repair, mud flaps, hinge pin
- outline removal and replacement
- outline the procedure for:
  - hoisting system repairs
  - load securing methods
  - tailgates
  - walking floors
  - utility trailers
  - trombone trailers
  - custom trailers

Evaluation and Testing: Assignments related to theory and appropriate application skills.
Minimum of one mid-term test during the term
Final exam at end of term
Periodic quizzes

Evaluation Structure		
Theory Testing	Practical Application Testing	Final Assessment
60%	25%	15%

Number:	S1663		
Title:	**Electrical Systems II**		
Duration:	Total Hours: 48	Theory: 27	Practical: 21
Prerequisites:	Level I - Reportable Subjects		

Number:	S1663.1		
Title:	**Electrical Circuits**		
Duration:	Total Hours: 13	Theory: 6	Practical: 7
Cross-Reference to Training Standard: U5756.0			

General Learning Outcomes

Upon successful completion, the Apprentice is able to perform inspection, testing, diagnosis and assigned repair procedures of electrical circuits following manufacturer's recommendations and specifications and approved industry standards.

Learning Outcomes and Content

Upon successful completion, the apprentice is able to:

S1663.1.1 Define the purpose and fundamentals of trailer electrical circuits.

S1663.1.2 Describe the construction features, types and applications of trailer electrical circuits.

S1663.1.3 Explain the principles of operation of trailer electrical circuits.

S1663.1.4 Perform inspection, testing and diagnosis trailer electrical circuits.

S1663.1.5 Perform assigned repair procedures on trailer electrical circuits.

Learning Content

S1663.1.1 Define the purpose and fundamentals of trailer electrical circuits.
- fundamentals enhancement
- circuit calculations
- legal requirements

S1663.1.2 Describe the construction features, types and applications of trailer electrical circuits.
- ATA wiring codes
- ATA power supplies
- junction blocks
- wire gauge
- weather proofing
- exterior lighting circuits
- interior lighting circuits

- switches
- circuit protection devices
  - breakers
  - cycling/ non-cycling
  - fuses
  - virtual fusing
  - electronic circuit protection
- electrical connectors
- junction blocks
- lighting/illumination circuits
  - lamps
  - LEDs
  - reflectors
  - conspicuity tape
  - legal requirements
- heavy duty batteries
  - classifications
  - ratings

S1663.1.3 Explain the principles of operation of trailer electrical circuits.

- static electricity
- trailer electrical circuit calculations
- series, parallel and series / parallel circuits
- opens, shorts, grounds
- wire gauge
- weather proofing
- temperature effect
- lighting circuits
- lamps
- LEDs
- breakers
- cycling / non-cycling fuses

S1663.1.4 Perform inspection, testing and diagnosis trailer electrical circuits.

- applications of diagnostic equipment
  - analogue multimeters
  - digital multimeters
  - voltage drop testing
- characteristics of trailer light circuits
- type and rating of bulbs
  - wattage
  - lenses/sockets and pigtails

- lighting circuits
  - lamps
  - sealed light units
  - LED lamps
  - conspicuity tape
- test heavy duty batteries
- characteristics of trailer wiring systems
  - colour coding
  - seven-way receptacle / connector
  - six-way receptacle / connector
  - junction blocks
  - sealed wiring harnesses
  - legal requirements
- outline troubleshooting techniques

S1663.1.5 Perform assigned repair procedures on trailer electrical circuits.

- circuit wiring repair techniques
- cleaning splicing, crimping, soldering, corrosion protection
- weather proofing

Number:	S1663.2		
Title:	**Electrical Components**		
Duration:	Total Hours: 21	Theory: 13	Practical: 8
Cross-Reference to Training Standard: U5760.0			

General Learning Outcomes

Upon successful completion, the Apprentice is able to perform inspection, testing, diagnosis and assigned repair procedures of trailer electrical components following manufacturer's recommendations and specifications.

Learning Outcomes and Content

Upon successful completion, the apprentice is able to:

S1663.2.1 Define the purpose and fundamentals of trailer electrical components.

S1663.2.2 Describe the construction features, types and applications of trailer electrical components.

S1663.2.3 Explain the principles of operation of trailer electrical components.

S1663.2.4 Perform inspection, testing and diagnosis of trailer electrical components.

S1663.2.5 Perform wiring repair procedures on trailer electrical components.

Learning Content

S1663.2.1 Define the purpose and fundamentals of trailer electrical components.

- solenoids
- connectors
- junction blocks
- relays
- breakers
- fuses
- DC motors
- charging system components
- power sources

S1663.2.2 Describe the construction features, types and applications of trailer electrical components.

- solenoids
- relays
- DC motors
- switches
- pilot switches
- connectors
- junction blocks
- conduit requirements
- wiring schematics
- alternators
- battery isolation devices

S1663.2.3 Explain the principles of operation of trailer electrical components.

- solenoids/ relays
- DC motors
  - series wound
- cranking motors
- switches
- pilot switches
- alternators
- actuators

S1663.2.4 Perform inspection, testing and diagnosis of trailer electrical components.

- applications of diagnostic equipment
  - analogue multimeters
  - digital multimeters
  - voltage drop testing
  - diagnose trailer wiring system malfunctions
  - DC motor defects
  - Solenoids
  - Relays
  - Switches
  - pilot switches
  - charging systems

S1663.2.5 Perform wiring repair procedures on trailer electrical components.

- circuit wiring repair techniques
- cleaning splicing, crimping, soldering, corrosion protection
- weather proofing
- disassembly, testing and assembly of DC motors, relays, solenoids
- outline repair methods for electrical components.

Number:	S1663.3		
Title:	**Computer Control Systems**		
Duration:	Total Hours: 14	Theory: 8	Practical: 6
Cross-Reference to Training Standard: U5756.0, U5763.0			

General Learning Outcomes

Upon successful completion, the Apprentice is able to perform inspection, testing, diagnosis and assigned maintenance procedures for trailer computer control systems, following manufacturer's specifications and recommendations.

Learning Outcomes and Content

Upon successful completion, the apprentice is able to:

S1663.3.1 Define the purpose and fundamentals of computer control systems.

S1663.3.2 Describe the types and applications of computer control systems.

S1663.3.3 Explain the principles of operation of computer control systems.

S1663.3.4 Perform inspection, testing and diagnosis of computer control systems.

S1663.3.5 Perform assigned computer controlled system management maintenance procedures.

Learning Content

S1663.3.1 Define the purpose and fundamentals of computer control systems.
- electrical fundamentals
- electronic fundamentals
- computer fundamentals

S1663.3.2 Describe the types and applications of computer control systems.
- ECMs
- CPU, RAM, ROM, PROM, EEPROM
- sensors
- reluctor wheels
- analogue sensors
- output devices
- solenoids and relays
- analogue and digital converters

S1663.3.3 Explain the principles of operation of computer control systems.

- ECMs
- CPU, RAM, ROM, PROM, EEPROM
- data retention
- programming
- bussing
- multiplexing
  - trailer to tractor communication
- sensors
- reluctor wheels
- analogue sensors
- output devices
- solenoids and relays
- switch circuits
- sensor circuits
- actuator circuits
- reference voltages
- logic gates
- analogue and digital converters

S1663.3.4 Perform inspection, testing and diagnosis of computer control systems.

- describe reader/programmer diagnostic tests
- use digital multimeters
  - test sensors and output devices
- perform diagnostic fault code extraction and interpret results

S1663.3.5 Perform assigned computer controlled system management maintenance procedures.

- outline recommended procedure for system maintenance
- ABS
- active suspensions
- refrigeration system management
- cargo heating system management

Evaluation and Testing: Assignments related to theory and appropriate application skills.
Minimum of one mid-term test during the term
Final exam at end of term
Periodic quizzes

Evaluation Structure		
Theory Testing	Practical Application Testing	Final Assessment
50%	35%	15%

Number:	S1664		
Title:	**Welding II**		
Duration:	Total Hours: 32	Theory: 12	Practical: 20
Prerequisites:	Level I - Reportable Subjects		

Number:	S1664.1		
Title:	**Metal Inert Gas (MIG) Welding**		
Duration:	Total Hours: 18	Theory: 6	Practical: 12
Cross-Reference to Training Standard: U5757.0, U5760.0			

General Learning Outcomes

Upon successful completion, the Apprentice is able to perform metal inert gas welding operations according to government safety regulations and manufacturer's recommendations.

Learning Outcomes and Content

Upon successful completion, the apprentice is able to:

S1664.1.1 Define the purpose and fundamentals of metal inert gas welding.

S1664.1.2 Describe the construction features, types and applications of metal inert gas welding equipment.

S1664.1.3 Explain the principles of operation of metal inert gas welding equipment.

S1664.1.4 Perform inspection and testing procedures of metal inert gas welding.

S1664.1.5 Perform metal inert gas shielded welding on mild steel, aluminum and stainless steel.

Learning Content

S1664.1.1 Define the purpose and fundamentals of metal inert gas welding.

- polarity
- power sources
- wire feeders
- gas shielding
- open circuit voltage
- closed circuit voltage

S1664.1.2 Describe the construction features, types and applications of metal inert gas welding equipment.

- power sources
  - rectifier
  - generator
- wire types
- electrode wire coatings
- wire specifications
- shielding gases
- inner shield
- MIG welding equipment
  - contact tips
  - gun and cable assembly
  - wire feeder types
  - water cooled
- shielding gas types
  - argon
  - argon/ox
  - helium
  - carbon dioxide
  - tungsten inert gas

S1664.1.3 Explain the principles of operation of metal inert gas welding equipment.

- fusion
- properties of metals
- oxidation
- power sources
  - rectifier
  - generator
- electrode coatings
- wire specifications
- shielding gases
- inner shield
- shielding gas types
  - argon
  - argon/ox
  - helium
  - carbon dioxide
  - tungsten inert gas
- basic operating principles

S1664.1.4 Perform inspection and testing procedures of metal inert gas welding.

- visual inspection of:
  - rectifier
  - generator
  - electrodes
  - wire shielding gases
  - tanks
- perform simple destructive test
- bend test coupon
- cut metal

S1664.1.5 Perform metal inert gas shielded welding on mild steel, aluminum and stainless steel.

- perform MIG welding equipment set up
- perform basic welds
- outline the service requirements of rectifiers, transformers, cables, electrode holders, wire drive roll pressure, cable conduit cleanliness, contact tip condition and gas nozzle condition
- liner replacement
- position welding
- vertical welding
- horizontal welding
- vertical down
- metal preparation for aluminum

Number:	S1664.2		
Title:	**Plasma Cutting**		
Duration:	Total Hours: 5	Theory: 2	Practical: 3
Cross-Reference to Training Standard: U5757.0, U5758.0, U5759.0, U5760.0, U5761.0			

General Learning Outcomes

Upon successful completion, the Apprentice is able to perform plasma cutting according government safety regulations and manufacturer's recommendations.

Learning Outcomes and Content

Upon successful completion, the apprentice is able to:

S1664.2.1 Define the purpose and fundamentals of plasma cutting equipment.

S1664.2.2 Describe the function, types and application of plasma cutting equipment.

S1664.2.3 Explain the principles of operation of plasma cutting equipment.

S1664.2.4 Perform inspection and test procedures of plasma cutting equipment.

S1664.2.5 Perform plasma cutting procedures.

Learning Content

S1664.2.1 Define the purpose and fundamentals of plasma cutting equipment.
- fundamentals of plasma cutting process
- benefits/advantages

S1664.2.2 Describe the function, types and application of plasma cutting equipment.
- applications and limitations
- consumable selection
- equipment set up
- analysis of cuts
- gas selection
  - air
  - inert

S1664.2.3 Explain the principles of operation of plasma cutting equipment.
- operation of equipment
- cutting techniques

S1664.2.4 Perform inspection and test procedures of plasma cutting equipment.
- visual inspection of equipment
- test operation of equipment
- setup and maintain equipment

S1664.2.5 Perform plasma cutting procedures.
- mild steel cutting
- stainless steel cutting
- aluminum cutting

Number:	S1664.3		
Title:	**Tungsten Inert Gas (TIG) Welding**		
Duration:	Total Hours: 9	Theory: 4	Practical: 5
Cross-Reference to Training Standard: U5757.0, U5758.0, U5759.0, U5760.0, U5761.0			

General Learning Outcomes

Upon successful completion, the Apprentice is able to perform tungsten inert gas welding according government safety regulations and manufacturer's recommendations.

Learning Outcomes and Content

Upon successful completion, the apprentice is able to:

S1664.3.1 Define the purpose and fundamentals of tungsten inert gas welding.

S1664.3.2 Describe the construction features, types and application of tungsten inert gas welding equipment.

S1664.3.3 Explain the principles of operation of tungsten inert gas welding equipment.

S1664.3.4 Perform set-up and identify maintenance procedures of tungsten inert gas welding equipment.

S1664.3.5 Perform tungsten inert gas welding.

Learning Content

S1664.3.1 Define the purpose and fundamentals of tungsten inert gas welding.

- fundamentals of tungsten inert gas welding process
- benefits/advantages
- polarity for steel and aluminum
- gas shielding
- wave forms
- high frequency
- polarity balance

S1664.3.2 Describe the construction features, types and application of tungsten inert gas welding equipment.
- applications and limitations
- consumable selection
- analysis of welds
- shielded gas selection
- torch and cable design
  - air cooled
  - water cooled
- filler rods
- power sources

S1664.3.3 Explain the principles of operation of tungsten inert gas welding equipment.
- equipment set up
- operation of equipment
- effects of polarity selection
- effects of digging and cleaning setting selection
- effects of pre and post flow setting selection
- shielding gas characteristics and selection
- consumable characteristics and selection
- electrode characteristics and selection
- cutting techniques

S1664.3.4 Perform set-up and identify maintenance procedures of tungsten inert gas welding equipment.
- visual inspection of equipment
- test operation of equipment
- set-up and maintain equipment

S1664.3.5 Perform tungsten inert gas welding.
- perform lap and fillet welds on:
  - aluminum coupons in horizontal position

Evaluation and Testing: Assignments related to theory and appropriate application skills.
Minimum of one mid-term test during the term
Final exam at end of term
Periodic quizzes

Evaluation Structure		
Theory Testing	Practical Application Testing	Final Assessment
25%	60%	15%

Number:	S1665		
Title:	**Trailer Refrigeration and Cargo Heating Systems**		
Duration:	Total Hours: 32	Theory: 22	Practical: 10
Prerequisites:	Level I - Reportable Subjects		

Number:	S1665.1		
Title:	**Refrigeration and Cargo Heating Systems**		
Duration:	Total Hours: 32	Theory: 22	Practical: 10
Cross-Reference to Training Standard: U5757.0, U5760.0			

General Learning Outcomes

Upon successful completion, the Apprentice is able to perform inspection, testing and describe maintenance procedures of refrigeration and cargo heating systems according to government safety regulations and manufacturer's recommendations.

Learning Outcomes and Content

Upon successful completion, the apprentice is able to:

S1665.1.1 Define the purpose and fundamentals of refrigeration and cargo heating systems.

S1665.1.2 Describe the construction features, types and applications of refrigeration and cargo heating systems.

S1665.1.3 Explain the principles of operation of refrigeration and cargo heating systems.

S1665.1.4 Perform inspection and testing procedures of refrigeration and cargo heating systems.

S1665.1.5 Describe manufacturers' repair and maintenance procedures and perform assigned operations for refrigeration and cargo heating systems.

Learning Content

S1665.1.1 Define the purpose and fundamentals of refrigeration and cargo heating systems.

- thermodynamics
- electronics fundamentals
- legal requirements
- environmental concerns
- chlorine dioxide
- ozone depletion
- cargo heating requirements

S1665.1.2 Describe the construction features, types and applications of refrigeration and cargo heating systems.

- refrigeration system components
  - compressor
  - condenser
  - thermostatic expansion valves
  - drier
  - evaporator
  - system controls
  - electronic controls
  - compressor drive
  - refrigerant types
  - recovery, recycling, evacuation and recharging equipment
- cargo heating systems
  - layout
  - components
  - electronic controls

S1665.1.3 Explain the principles of operation of refrigeration and cargo heating systems.

- principles of thermodynamics
- refrigeration system operation
- refrigeration system components
  - compressor
  - condenser
  - metering devices
  - drier
  - evaporator
  - system controls
  - electronic control
  - refrigerant types
- reclamation systems
- environmental considerations (o.d.p.)
- cargo heating systems
  - layout and construction
  - compressed gas safety and handling precautions
  - propane
  - natural gas
  - storage
  - refilling practices
- diesel engine maintenance
  - oil change
  - oil filter change
  - fuel filter change
  - bleeding of fuel systems
  - belt inspection replacement, adjustment

S1665.1.4 Perform inspection and testing procedures of refrigeration and cargo heating systems.

- visual inspection of refrigeration system.
  - identify location of components
  - identify condition of components and fastening devices
  - leaks
- install manifold gauge set
- test for refrigerant leaks
- test system operating pressures and control functions
- perform compressor pump down
- test compressor performance
- perform low side pump down
- test refrigerant valve operation
- check refrigerant level
- test electrical system/electronic controls
- perform troubleshooting

S1665.1.5 Describe manufacturers' repair and maintenance procedures and perform assigned operations for refrigeration and cargo heating systems.

- describe removal and replacement procedures of compressors, evaporators, condensers, driers, thermostatic expansion valves and control devices.
- describe recovery, recycling, evacuation and recharging procedures.
- perform line repairs
- describe out of service criteria (O.O.S.)

Evaluation and Testing: Assignments related to theory and appropriate application skills.
Minimum of one mid-term test during the term
Final exam at end of term
Periodic quizzes

Evaluation Structure		
Theory Testing	Practical Application Testing	Final Assessment
60%	25%	15%

APPENDIX A: Acronyms List

This list of acronyms encompasses the following Motive Power Curriculum documents:

Level One Commercial Vehicles and Equipment (Common Core)
Level Two Heavy Duty Equipment Technician
Level Three Heavy Duty Equipment Technician
Level Two Truck and Coach Technician
Level Three Truck and Coach Technician
Level Two Farm Equipment Technician
Level Three Farm Equipment Technician
Level Two Powered Lift Truck Technician
Level Three Powered Lift Truck technician

ABS	Anti-lock Braking System
AC	Alternating Current
A/C	Air Conditioning
AFC	Air Fuel Control
API	American Petroleum Institute
ANSI	American National Standards Institute
ATA	American Trucking Association
ATC	Automatic Traction Control
AVR	Amp, Volt, Ohmmeter
AWG	American Wire Gauge
AWS	American Welding Society
BCM	Body Control Module
BSP	British Standard Pipe
BTM	Brushless Torque Motor
CB	Citizen Band
CDI	Capacitor Discharge Ignition
CD ROM	Compact Disc Read Only Memory
CFC	Chlorofluorocarbons
CI	Compression Ignited
CMVSS	Canadian Motor Vehicle Safety Standard

CNG	Compressed Natural Gas
CPU	Central Processing Unit
CSA	Canadian Standards Association
CVSA	Canadian Vehicle Standards Association
CWS	Collision Warning Systems
DC	Direct Current
DDC	Detroit Diesel Corporation
DFF	Direct Fuel Feed
DIN	Deutsch Institute fur Normung (German Standards Institute)
DMM	Digital Multimeter
DOS	Disk Operating System
DOT	Department of Transportation
ECM	Electronic Control Module
ECU	Electronic Control Unit
EPROM	Erasable Programmable Read Only Memory
EEPROM	Electronically Erasable Programmable Read Only Memory
EG	Ethylene Glycol
EGR	Exhaust Gas Recirculation
ELC	Extended Life Coolant
EPA	Environmental Protection Agency
EST	Electronic Service Tool
EUI	Electronic Unit Injector
EUP	Electronic Unit Pump
FET	Farm Equipment Technician
FHSL	Federal Health and Safety Legislation
FMVSS	Federal Motor Vehicle Safety Standards
FOPS	Falling Object Protection System
FRP	Fiberglass Reinforced Plywood

GCWR	Gross Combined Weight Rating
GFI	Gasoline Fuel Injection
GPS	Global Positioning Satellite
GVW	Gross Vehicle Weight
GVWR	Gross Vehicle Weight Rating
HACCP	Hazard Analysis and Critical Control Points certification
HC	Hydrocarbon
HDET	Heavy Duty Equipment Technician
HEUI	Hydraulically Actuated Electronic Unit Injector
HCFC	Hydrochorofluorocarbons
HFC	Hydrofluorocarbons
HPI-TP	High Pressure Injector-Time Pressure (Cummins)
HVAC	Heating, Ventilation and Air Conditioning
ID	Inside Diameter
ISO	International Standards Organization
JIC	Joint Industry Conference
JIS	Japanese Industrial Standard
JIT	Just In Time
KPI	King Pin Inclination
LED	Light Emitting Diode
LPG	Liquid Petroleum Gas
LVD	Low Voltage Disconnect
MAP	Manifold Absolute Pressure
MIG	Metal Inert Gas
MSDS	Material Safety Data Sheet

MUI	Mechanical Unit Injector
MVSA	Motor Vehicle Safety Act (Canadian)
N/A	Not Applicable
NOP	Nozzle Opening Pressure
NPN	Negative Positive Negative Semi-conductor
NPT	National Pipe Thread
NV-RAM	Non-Volatile Random Access Memory
OD	Outside Diameter
ODP	Ozone Depletion Potential
OEM	Original Equipment Manufacturer
OHSA	Occupational Health and Safety Act
OOS	Out of Service Criteria
OPS	Operator Protection System
ORB	O-Ring Boss
ORFS	O-Ring Face Seal
PC	Personal Computer
PCV	Positive Crankcase Ventilation
PFI	Port Fuel Injection
PG	Propylene Glycol
PHSL	Provincial Health and Safety Legislation
PLTT	Powered Lift Truck Technician
PNP	Positive Negative Positive Semi-Conductor
PROM	Programmable Read Only Memory
PT	Pressure Time
PTA	Pressure Time (injector) A Series
PTG-AFC	Pressure Time Governor/Air Fuel Control
PTD	Pressure Time (injector) B Series
PTG	Pressure Time Governor (control pump)

PTO	Power Take-Off
PWM	Pulse Width Modulation
RAM	Random Access Memory
RBM	Resist Bend Moment
ROM	Read Only Memory
ROPS	Roll Over Protection System
RP	Recommended Practices
RPM	Revolutions per Minute
SAE	Society of Automotive Engineers
SALT	Sealed and Lubricated Tracks
SCA	Supplemental Coolant Additives
SI	Spark Ignited
SI	Système Internationale d'unités
SMAW	Shielded Metal Arc Welding
SRS	Supplemental Restraint Systems
STC	Step Timing Control
TBI	Throttle Body Injection
TCT	Truck and Coach Technician
TDS	Total Dissolved Solids
TP	Time/Pressure Injector
TPS	Throttle Position Sensor
TQM	Total Quality Management
TMC	Truck Maintenance Council
VCO	Valve Closes Orifice
VIN	Vehicle Identification Number
WHMIS	Workplace Hazardous Materials Information System

APPENDIX B: Tools and Equipment List

Hoists jacks and stands
Spring brake disarmament chamber
Dual wheel dolly
Tire removal and installation equipment
Explosion meters
Safety lock out pins
Digital voltmeter, ohmmeter, ammeter
Gas metal arc welding machines and consumables
AC, DC and combination metal arc equipment
Oxy-acetylene cutting and heating equipment
Plasma cutting equipment and consumables
Tungsten inert gas welding machines and consumables
Heavy duty battery testers
Ventilation equipment
Approved welding booth areas
Vehicle electronic testing equipment
Reader/ Programmer
Brake dust vacuums
Pressure gauges
Flow rate tester
Hydraulic steering analyzer
Slider spring compressor
Lock testers
King pin gauge
Manufacturers' special service tools
Ultra sonic testing devices
Oxygen sensors
Lap top computer diagnostics
Wire strippers, crimpers, soldering equipment
Light and heavy duty hand tools
Thread repair tools
OEM special tools

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Transport Trailer Technician