

Truck and Transport Mechanic Guide to Course Content

2019



Online: www.saskapprenticeship.ca

Recognition:

To promote transparency and consistency, this document has been adapted from the 2015 Truck and Transport Mechanic National Occupational Analysis (Employment and Social Development Canada).

A complete version of the Occupational Standard can be found at www.red-seal.ca

STRUCTURE OF THE GUIDE TO COURSE CONTENT

To facilitate understanding of the occupation, this guide to course content contains the following sections:

Description of the Truck and Transport Mechanic trade: an overview of the trade's duties and training requirements.

Essential Skills Summary: an overview of how each of the nine essential skills is applied in this trade.

Elements of harmonization of apprenticeship training: includes adoption of Red Seal trade name, number of levels of apprenticeship, total training hours (on-the-job and in-school) and consistent sequencing of technical training content. Implementation for harmonization will take place progressively. Level one to be implemented in 2017/2018, level two 2018/2019, level three 2019/2020, and level four in 2020/2021.

Task Matrix: a chart which outlines graphically the major work activities, tasks and sub-tasks of this standard detailing the essential skills and the level of training where the content is covered.

Major Work Activity (MWA): the largest division within the standard that is comprised of a distinct set of trade activities.

Task: distinct actions that describe the activities within a major work activity.

Sub-task: distinct actions that describe the activities within a task.

Training Profile Chart: a chart which outlines the model for Saskatchewan Apprenticeship and Trade Certification Commission (SATCC) technical training.

Technical Training Course Content for the Truck and Transport Mechanic trade: a chart which outlines the model for SATCC technical training sequencing. For the harmonized level of training, a cross reference to the Harmonized apprenticeship technical training sequencing, at the learning outcome level, is provided.

Appendix A: Post Harmonization Training Profile Chart: a chart which outlines the finalized model for SATCC technical training sequencing with a cross reference to the Harmonized apprenticeship technical training sequencing, at the topic level.

The Red Seal Truck and Transport Mechanic Curriculum Outline, which provides additional detail of the Harmonized technical training, can be found at www.red-seal.ca

DESCRIPTION OF THE TRUCK AND TRANSPORT MECHANIC TRADE

Truck and Transport Mechanics perform the maintenance, repair, overhaul, inspection, reconditioning, and diagnostic troubleshooting of motorized trucks, buses and road transport vehicles

Truck and transport mechanics inspect, repair and maintain commercial trucks, emergency vehicles, buses and road transport vehicles. In some jurisdictions, they may also work on commercial trailers and recreation vehicles. Truck and transport mechanics work on the structural, mechanical, electrical and electronic vehicle systems and components such as engines, cab, chassis and frames, brakes, steering, suspension, drive train, heating, ventilation and air conditioning (HVAC), emissions, fuel systems and hydraulic systems. In addition, truck and transport mechanics perform preventative maintenance and diagnosis of vehicles.

Truck and transport mechanics use specialized tools including hand tools, test meters, hoisting and lifting equipment, staging equipment, welding and cutting equipment, hydraulic equipment, safety equipment, recycle and recovery equipment, and complex electronics and computer diagnostic test equipment.

Truck and transport mechanics are employed in the agricultural, construction, mining, forestry, petrochemical and transportation sectors. They may be employed in small repair shops, motor vehicle dealers, fleet maintenance companies, public transportation companies, government highway departments, railways and construction companies.

Work environments for truck and transport mechanics differ from one job to another. The truck and transport mechanic frequently works in awkward positions, and must often climb, stoop, crouch and kneel. They also must handle heavy parts and tools. Truck and transport mechanics are sometimes required to work in adverse weather conditions.

There is some risk of injury involved in working with heavy equipment and power tools. Common occupational hazards are exposure to chemicals and harmful materials, repetitive motion, noise and sharp edges.

Key attributes for individuals entering this trade are mechanical aptitude, manual dexterity, good hand-eye coordination and strength. They must also have a good understanding of computerized machinery, good problem-solving and analytical skills, and the ability to read and understand service manuals. Good communication skills and patience are also important. Other assets include good vision, hearing and sense of smell to diagnose problems.

This analysis recognizes similarities or overlaps with the work of automotive service technicians, agricultural equipment technicians, heavy duty equipment technicians, recreation vehicle service technicians and transport trailer technicians.

With experience, truck and transport mechanics act as mentors and trainers to apprentices in the trade. They may also advance to supervisory, service manager and training positions.

Training Requirements: To graduate from each level of the apprenticeship program, an apprentice must successfully complete the required technical training and compile enough on-the-job experience to total at least 1800 hours each year. Total trade time required is 7200 hours and at least 4 years in the trade.

There are four levels of technical training delivered by Saskatchewan Polytechnic in Saskatoon.

- Level One: 8 weeks
- Level Two: 8 weeks
- Level Three: 8 weeks
- Level Four: 8 weeks

The information contained in this guide to course content details the technical training delivered for each level of apprenticeship. An apprentice spends approximately 15% of their apprenticeship term in a technical training institute learning the technical and theoretical aspects of the trade. The hours and percentages of technical and practical training may vary according to class needs and progress.

The content of the technical training components is subject to change without notice.

Entrance Requirements for Apprenticeship Training

Your grade twelve transcripts (with no modified classes) or GED 12 is your guarantee that you meet the educational entrance requirements for apprenticeship in Saskatchewan. In fact, employers prefer and recommend apprentices who have completed high school. This ensures the individual has all of the necessary skills required to successfully complete the apprenticeship program, and receive journey person certification.

Individuals with “modified” or “general” classes in math or science do not meet our entry requirements. These individuals are required to take an entrance assessment prescribed by the SATCC.

English is the language of instruction in all apprenticeship programs and is the common language for business in Saskatchewan. Before admission, all apprentices and/or “upgraders” must be able to understand and communicate in the English language. Applicants whose first language is not English must have a minimum Canadian Language Benchmark Assessment of six (CLB6).

Note: A CLB assessment is valid for a one-year period from date of issue.

Designated Trade Name	Math Credit at the Indicated Grade Level ^❶	Science Credit at Grade Level
Truck and Transport Mechanic	Grade 11	Grade 10
<p>❶ - (One of the following) WA – Workplace and Apprenticeship; or F – Foundations; or P – Pre-calculus, or a Math at the indicated grade level (Modified and General Math credits are not acceptable.).</p> <p>*Applicants who have graduated in advance of 2015-2016, or who do not have access to the revised Science curricula will require a Science at the minimum grade level indicated by trade.</p> <p>For information about high school curriculum, including Math and Science course names, please see: http://www.curriculum.gov.sk.ca/#</p> <p>Individuals not meeting the entrance requirements will be subject to an assessment and any required training.</p>		

ESSENTIAL SKILLS SUMMARY

Essential skills are needed for work, learning and life. They provide the foundation for learning all other skills and enable people to evolve with their jobs and adapt to workplace change.

Through extensive research, the Government of Canada and other national and international agencies have identified and validated nine essential skills. These skills are used in nearly every occupation and throughout daily life in different ways.

A series of CCDA-endorsed tools have been developed to support apprentices in their training and to be better prepared for a career in the trades. The tools can be used independently or with the assistance of a tradesperson, trainer, employer, teacher or mentor to:

- understand how essential skills are used in the trades;
- learn about individual essential skills strengths and areas for improvement; and
- improve essential skills and increase success in an apprenticeship program.

The tools are available online or for order at: www.esdc.gc.ca/eng/jobs/les/profiles/index.shtml

The application of these skills may be described throughout this document within the skills and knowledge which support each sub-task of the trade. The most important essential skills for each sub-task have also been identified. The following are summaries of the requirements in each of the essential skills, taken from the essential skills profile. A link to the complete essential skills profile can be found at www.red-seal.ca.

READING

Truck and transport mechanics read a variety of paper-based and electronic documents for troubleshooting and servicing, including manufacturers' instructions, technical service bulletins and operating procedures. They read and interpret government regulations that specify vehicle inspection procedures and roadworthiness requirements of trucks and transports. They locate information on labels such as part numbers and serial numbers.

DOCUMENT USE

Truck and transport mechanics interpret technical drawings and flowcharts to understand and troubleshoot systems. They study graphed data generated by diagnostic equipment to locate information such as duration, speed and revolutions per minute. Truck and transport mechanics also complete a variety of forms including truck inspection forms.

WRITING

Truck and transport mechanics write remarks on the complaint/issue, the cause of a problem and the work completed to correct a problem. They may leave reminder notes for co-workers on other shifts including warnings about defective equipment. Truck and transport mechanics complete pre-job safety checklists. They may also write reports for insurance claims or to report workplace accidents.

ORAL COMMUNICATION

Truck and transport mechanics exchange technical repair and troubleshooting information with apprentices, co-workers and manufacturers. They speak with service managers about topics such as work assignments, repair procedures and the condition of tools and equipment. They may speak with

customers to respond to questions, gather information about a problem to be fixed or explain the results of inspections and repairs.

NUMERACY

Truck and transport mechanics analyze and compare a variety of measurements such as energy, dimension, speed, horsepower, temperature and torque to specifications. They calculate the effect that modifications have on vehicle performance. They may use some measurements to determine approximate service life of components.

THINKING

Truck and transport mechanics evaluate the severity of vehicle defects, assess the conditions of parts and decide what repairs or replacements are to be done. They decide on the most efficient course and sequence of actions to complete a job and ensure the vehicle is safe for operation. An understanding of systems is important in completing the work. Truck and transport mechanics coordinate their work with co-workers if needed.

WORKING WITH OTHERS

Truck and transport mechanics may work independently or with others. They are part of a team which includes other mechanics, service managers and parts and warehouse personnel.

DIGITAL TECHNOLOGY

Truck and transport mechanics use diagnostic equipment such as scan tools and analyzers to determine the operational condition of components. They use computer equipment to complete repairs, download data from on-board computers and monitor systems. They may use databases to retrieve repair information and technical drawings or to input information about repairs. Truck and transport mechanics use the Internet to access online manuals, technical service bulletins and recall notices. They also use computers for daily tasks which may include e-mail, file management and using fleet management software.

CONTINUOUS LEARNING

Truck and transport mechanics are continuously learning to keep up with the changes in the industry. They may participate in training seminars to learn about new equipment and how to troubleshoot and perform repairs effectively.

ELEMENTS OF HARMONIZATION FOR APPRENTICESHIP TRAINING

At the request of industry, the Harmonization Initiative was launched in 2013 to *substantively align* apprenticeship systems across Canada by making training requirements more consistent in the Red Seal trades. Harmonization aims to improve the mobility of apprentices, support an increase in their completion rates and enable employers to access a larger pool of apprentices.

As part of this work, the Canadian Council of the Directors of Apprenticeship (CCDA) identified four main harmonization priorities in consultation with industry and training stakeholders:

1. Trade name

The official Red Seal name for this trade is Truck and Transport Mechanic.

2. Number of Levels of Apprenticeship

The number of levels of technical training recommended for the Truck and Transport Mechanic trade is four.

3. Total Training Hours during Apprenticeship Training

The total hours of training, including both on-the-job and in-school training for the Truck and Transport Mechanic trade is 7200.

4. Consistent sequencing of training content (at each level) using the most recent Occupational Standard

Implementation for harmonization will take place progressively. Level one to be implemented in 2017/2018, level two 2018/2019, level three 2019/2020, and level four in 2020/2021. See Appendix A for the finalized curriculum comparisons.

White boxes are “Topics,” grey boxes are “In Context”. In context means learning that has already taken place and is being applied to the applicable task. Learning outcomes for in context topics are accomplished in other topics in that level.

Level 1 (2017/2018 implementation)	Level 2 (2018/2019 implementation)	Level 3 (2019/2020 implementation)	Level 4 (2020/2021 implementation)
Scheduled Maintenance	Scheduled Maintenance	Scheduled Maintenance	Scheduled Maintenance
Operational Testing	Operational Testing	Operational Testing	Operational Testing
Planning and Communication	Planning and Communication	Planning and Communication	Planning and Communication
	Electrical		Electrical
Safety			

Level 1 (2017/2018 implementation)	Level 2 (2018/2019 implementation)	Level 3 (2019/2020 implementation)	Level 4 (2020/2021 implementation)
Tools and Equipment			
Hoisting and Lifting			
Hydraulic Systems • Basic Service, Introduction to Diagnostics	Hydraulic Systems Advanced • Diagnose and Repair		
Pneumatics • Basic Service, Introduction to Diagnostics Tools			
Electrical I • Basic Service, Introduction to Diagnostics Tools	Electrical	Electrical 2 • Diagnose and repair • Starting and charging systems	
Frames, Steering and Suspension • Basic Service, Introduction to Diagnostics	Frames, Steering and Suspension • Diagnose and Repair		
Brakes • Service • Basic Diagnostics and Repair	Brakes Advanced • Diagnose and Repair		
Structural Components • Service Basic structural components	Structural Components and Accessories • Diagnose and repair working attachments		
Heating, Ventilation and Air Conditioning/ Environmental Controls • Safety and Awareness			Heating, Ventilation and Air Conditioning/ Environmental Controls
	Trailer		
		Engines and Engine Support Systems	Engines and Engine Support Systems
		Alternate Fuel	

Level 1
(2017/2018
implementation)

Level 2
(2018/2019
implementation)

Level 3
(2019/2020
implementation)

Level 4
(2020/2021
implementation)

**Drivetrain
(Powertrain)**

**Drivetrain
(Powertrain)**

TRUCK AND TRANSPORT MECHANIC TASK MATRIX CHART

This chart outlines the blocks, tasks and sub-tasks from the 2015 Truck and Transport Mechanic National Occupational Analysis (NOA)*.

*The Task Matrix Chart will be updated every year until Harmonization implementation is complete. Implementation for harmonization will take place progressively. Level one to be implemented in 2017/2018, level two 2018/2019, level three 2019/2020, and level four in 2020/2021.

A – COMMON OCCUPATIONAL SKILLS

A-1 Performs safety related functions	1.01 Maintains safe work environment 1	1.02 Uses personal protective equipment (PPE) and safety equipment 1			
A-2 Uses and maintains tools and equipment	2.01 Maintains hand, power, measuring, testing, and diagnostic tools 1	2.02 Maintains shop equipment 1	2.03 Uses hoisting and lifting equipment 1	2.04 Uses welding and cutting equipment 1, 2	
A-3 Performs routine trade activities	3.01 Uses documentation and reference materials (1, 2, 3 in context)	3.02 Maintains fluids, lubricants, and coolants (1, 2, 3 in context)	3.03 Services hoses, tubing, and fittings (1, 2, 3 in context)	3.04 Services filters (1, 2,3 in context)	3.05 Services bearings, bushing and seals (1, 2, 3 in context)
	3.06 Uses fasteners, sealing devices, adhesives and gaskets (1, 2, 3 in context)				

B – ENGINES AND SUPPORTING SYSTEMS

B-11 Services, diagnoses and repairs cooling system	11.01 Services cooling system 3	11.02 Diagnoses cooling system 3	11.03 Repairs cooling system 3
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C – AIR SYSTEMS AND BRAKES

C-12 Services, diagnoses and repairs air systems	12.01 Services air systems 1, 2	12.02 Diagnoses air systems 1, 2	12.03 Repairs air systems 1, 2
C-13 Services, diagnoses and repairs brake systems	8.01 Services brake systems 1, 2	8.02 Diagnoses brake system 1, 2	8.03 Repairs brake systems 1, 2

D – ELECTRICAL AND ELECTRONIC SYSTEMS

D-14 Services, diagnoses and repairs batteries	14.01 Performs servicing and repair of batteries 1	14.02 Diagnoses batteries 1	
D-15 Services, diagnoses and repairs charging systems	15.01 Services charging systems 1, 2	15.02 Diagnoses charging systems 1, 2	15.03 Repairs charging systems 1, 2
D-16 Services, diagnoses and repairs spark ignition systems	16.01 Performs servicing and repair of spark ignition systems 1	16.02 Diagnoses spark ignition systems 1	

D-17 Services, diagnoses and repairs starting systems

17.01 Performs servicing and repairs of starting systems

1, 2

17.02 Diagnoses starting systems

1, 2

D-18 Services, diagnoses and repairs electrical components and accessories

18.01 Performs servicing and repairs of electrical components and accessories

3

18.02 Diagnoses electrical components and accessories

3

D-19 Services, diagnoses and repairs vehicle management systems and electronic components

19.01 Services vehicle management systems and electronic components

3

19.02 Diagnoses vehicle management systems and electronic components

3

19.03 Repairs vehicle management systems and electronic components

3

E – DRIVETRAIN

E-20 Services, diagnoses and repairs clutches

20.01 Services clutches

3

20.02 Diagnoses clutches

3

20.03 Repairs clutches

3

E-21 Services, diagnoses and repairs manual transmission and transfer cases

21.01 Services manual transmission and transfer cases

3

21.02 Diagnoses manual transmission and transfer cases

3

21.03 Repairs manual transmission and transfer cases

3

E-22 Services, diagnoses and repairs automatic transmissions

22.01 Services automatic transmissions

3

22.02 Diagnoses automatic transmissions

3

22.03 Repairs automatic transmissions

3

E-23 Services, diagnoses and repairs automated transmissions	23.01 Services automated transmissions 3	23.02 Diagnoses automated transmission 3	23.03 Repairs automated transmissions 3
E-24 Services, diagnoses and driveline systems	24.01 Services driveline system 3	24.02 Diagnoses driveline systems 3	24.03 Repairs driveline systems 3
E-25 Services, diagnoses and repairs differentials	25.01 Services differentials 3	25.02 Diagnoses differentials 3	25.03 Repairs differentials 3
E-26 Services, diagnoses and repairs drivetrain retarders	26.01 Services drivetrain retarders 3	26.02 Diagnoses drivetrain retarders 3	26.03 Repairs drivetrain retarders 3

F – STEERING, CHASSIS/FRAMES, SUSPENSION, WHEELS, HUBS AND TIRES

F-27 Services, diagnose, and repairs steering systems	27.01 Services steering systems 1, 2	27.02 Diagnoses steering systems 1, 2	27.02 Repairs steering systems 1, 2
F-28 Services, diagnoses, and repairs chassis/frames	28.01 Services chassis/frames 1, 2	28.02 Diagnoses chassis/frames 1, 2	28.03 Repairs chassis/frames 1, 2
F-29 Services, diagnoses, and repairs suspension	29.01 Services suspension 1, 2	29.02 Diagnoses suspension 1, 2	29.03 Repairs suspension 1, 2

F-30 Services, diagnoses, and repairs hitches and couplers	30.01 Services hitches and couplers 1, 2	30.02 Diagnoses hitches and couplers 1, 2	30.03 Repairs hitches and couplers 1, 2
F-31 Services, diagnoses, and repairs tires, wheels and hubs	31.01 Services tires, wheels and hubs 1, 2	31.02 Diagnoses tires, wheels and hubs 1, 2	31.03 Repairs tires, wheels and hubs 1, 2

G – CAB

G-32 Services, diagnoses, and repairs interior cab components	32.01 Services interior cab components 2	32.02 Diagnoses interior cab components 2	32.03 Repairs interior cab components 2
G-33 Services, diagnoses and repairs exterior cab components	33.01 Services exterior cab components 1	33.02 Diagnoses exterior cab components 1	33.03 Repairs exterior cab components 1

H – TRAILERS

H-34 Services, diagnoses and repairs trailer components and accessories	34.01 Services trailer components and accessories 2	34.02 Diagnoses trailer components and accessories 2	34.03 Repairs trailer components and accessories 2
H-35 Services, diagnoses and repairs heating refrigeration systems	35.01 Services, heating refrigeration systems 2	35.02 Diagnoses heating refrigeration systems 2	35.03 Repairs heating refrigeration systems 2

I – CLIMATE CONTROL

I-36 Services, diagnoses and repairs heating and ventilation systems	36.01 Services heating and ventilation systems 1	36.02 Diagnoses heating and ventilation systems 1	36.03 Repairs heating and ventilation systems 1
I-37 Services, diagnoses and repairs air conditioning systems	37.01 Services, air conditioning systems 1	37.02 Diagnoses air conditioning systems 1	37.03 Repairs air conditioning systems 1

J – HYDRAULIC SYSTEMS

J-38 Services, diagnoses and repairs hydraulic components	38.01 Services hydraulic components 1, 2	38.02 Diagnoses hydraulic components 1, 2	38.03 Repairs hydraulic components 1, 2
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TRAINING PROFILE CHART

This Training Profile Chart represents Saskatchewan Apprenticeship and Trade Certification Commission (SATCC) apprenticeship technical training at the topic level. The Training Profile Chart will be updated every year until Harmonization implementation is complete. Implementation for harmonization will take place progressively. Level one to be implemented in 2017/2018, level two 2018/2019, level three 2019/2020, and level four in 2020/2021.

Level One (Harmonized)	Transcript Code	Hours
Basic Tools	TOOL 145 – Theory	12
	TOOL 146 – Shop	12
Brake Systems	BRAK 111 – Theory	24
	BRAK 112 – Shop	36
Electrical	ELCT 100 – Theory	14
	ELCT 101 – Shop	16
Environmental Control Systems	HVAC 100	6
Hydraulics	HYDR 108 – Theory	24
	HYDR 109 – Shop	36
Steering Systems	STER 100 – Theory	12
	STER 101 – Shop	18
Structural Components	MAIN 100 – Theory	12
	MAIN 101 – Shop	18
		240

Level Two (Harmonized)	Transcript Code	Hours
Braking Systems ABS	BRAK 206 – Theory	12
	BRAK 207 – Shop	18
Drivetrain Systems	DRTR 201 – Theory	24
	DRTR 202 – Shop	36
Electrical	ELCT 202 – Theory	12
	ELCT 203 – Shop	18
Hydraulics	HYDR 206 – Theory	12
	HYDR 207 – Shop	18
Steering and Directional Control Systems	STER 204 – Theory	12
	STER 205 – Shop	18
Truck and Trailer Systems	TRLR 200 – Theory	24
	TRLR 201 – Shop	36
		240

Level Three (Harmonized)	Transcript Code	Hours
Alternate Fuels	FUEL 304 – Theory	10
	FUEL 305 – Shop	20
Electrical	ELCT 301 – Theory	14
	ELCT 302 – Shop	16
Engine and Engine Support Systems	ENGN 306 – Theory	55
	ENGN 307 – Shop	65
Powertrain Systems	TRNM 308 – Theory	26
	TRNM 309 – Shop	34
		240

Level Four	Transcript Code	Hours
Diesel Fuel Systems	FUEL 484 – Theory	60
	FUEL 485 – Shop	30
Electrical and Electronics	ELEC 488 – Theory	60
	ELEC 489 – Shop	30
Fuel Ignition Systems and Auxiliary Equipment	HYDR 488 – Theory	40
	HYDR 489 – Shop	20
		240

TECHNICAL TRAINING COURSE CONTENT

This chart outlines the model for Saskatchewan Apprenticeship and Trade Certification Commission (SATCC) technical training sequencing. For the harmonized level of training, a cross reference to the Red Seal Occupational Standard (RSOS) apprenticeship technical training sequencing, at the learning outcome level, is provided.

Implementation for harmonization will take place progressively. Level one to be implemented in 2017/2018, level two 2018/2019, level three 2019/2020, and level four in 2020/2021.

Sub-tasks listed are the minimum to be covered in a topic. Related sub-tasks not listed may be used as a reference and taught “in context” in other topics.

Level One	8 weeks	240 hours
<p>Basic Tools – Theory</p> <ul style="list-style-type: none"> • describe safety rules and regulations • describe the purpose and care of shop and hand tools • describe various types of fasteners, adhesives and sealing devices 		12 hours
<p>Basic Tools – Shop</p> <ul style="list-style-type: none"> • demonstrate safety • explain legislative regulations • demonstrate use and care of hand tools and shop equipment 		12 hours
NOA topics covered in this section of training:		
A-1 Performs safety-related functions.		
A-1.01 Maintains safe work environment		
<ul style="list-style-type: none"> • perform visual inspection of vehicles and surrounding work area to identify potential hazards such as air lines, light cords and broken equipment, and fluids and gases under high pressure in hydraulic, pneumatic and air conditioning systems • handle and store hazardous materials according to Material Safety Data Sheets (MSDS), and workplace and jurisdictional policies • perform general housekeeping duties such as sweeping, discarding defective components and keeping area clear of obstacles • utilize ventilation equipment to contain and extract fumes, smoke and dust • recognize safe lifting locations or points according to manufacturers’ specifications 		
A-1.02 Uses personal protective equipment (PPE) and safety equipment		
<ul style="list-style-type: none"> • store PPE and safety equipment according to company policy and manufacturers’ recommendations • recognize worn, damaged or defective PPE and safety equipment • ensure proper fit of PPE and safety equipment • identify location of safety stations, first aid kits and fire extinguishing equipment • select PPE according to work conditions and requirements such as wearing coveralls, footwear, gloves, and eye and hearing protection 		
A-2 Uses and maintains tools and equipment		
A-2.01 Maintains hand, power, measuring, testing and diagnostic tools		
<ul style="list-style-type: none"> • store hand, power, measuring, testing and diagnostic tools • clean hand, power, measuring, testing and diagnostic tools • recognize worn, damaged or defective hand, power, measuring, testing and diagnostic tools, and tag, repair or remove from service • lubricate power tools according to manufacturers’ specifications • calibrate measuring tools according to manufacturers’ specifications 		

A-2.02 Maintains shop equipment

- recognize and interpret tags on shop equipment identifying load limits
- visually inspect shop equipment to recognize worn, damaged or defective equipment, and remove from service
- store shop equipment
- maintain solvent washers and biological parts washers
- recognize potential hazards such as ceiling heights, overhead wires and uneven surfaces
- ensure certification dates are current, according to jurisdictional regulations
- lubricate and clean shop equipment according to manufacturers' specifications

A-2.04 Uses welding and cutting equipment

- clean welding and cutting tips according to manufacturers' guidelines
- transport welding and cutting equipment according to jurisdictional regulations such as Transportation of Dangerous Goods (TDG)
- recognize and remove worn, damaged or defective cutting and welding equipment from service
- determine when repair task should be completed by a certified welder
- determine equipment and material selection according to materials being worked on, such as aluminum or steel
- set up welding and cutting equipment such as adjusting voltages and regulators for task being performed
- prepare vehicle for welding according to manufacturers' recommendations to prevent damage to vehicle and electronic components

Brake Systems – Theory

24 hours

- describe hydraulic brake system operation
- describe air brake system operation
- describe various types of park brake systems

Brake Systems – Shop

36 hours

- evaluate hydraulic brake system operation
- evaluate air brake system operation
- evaluate various park brake systems
- conduct final adjustments and performance tests
- repair faults

NOA topics covered in this section of training:

C-12 Services, diagnoses and repairs air systems

C-12.01 Services air systems

- perform sensory inspections of air systems to identify worn, damaged or defective components such as air lines, air dryers, governors, compressors, brake chambers (pots) and air tanks
- measure air pressures to determine if they meet manufacturers' specifications and jurisdictional requirements
- release stored energy such as air pressure by opening air valves and fanning down brakes
- remove and replace air dryer filters according manufacturers' specifications and employer maintenance schedule
- recycle and/or dispose of consumable air dryer filters and brake chambers according to jurisdictional regulations
- record service information and inspection findings according to manufacturers' requirements for warranty, and for future reference and tracking
- adjust governing air pressures to meet manufacturers' specifications

C-12.02 Diagnoses air systems

- obtain details of symptoms associated with complaint to establish a starting point for diagnostics
- perform audible and visual inspections of components such brake chambers, air lines, tanks, valves, air gauges and air dryers to confirm complaint and establish a preliminary diagnosis

- perform diagnostic procedure by following troubleshooting tree or schematic supplied by manufacturer to determine failure
- perform specialized testing procedures such as pressure tests, timed tests and leakdown to assess components for wear, damage or defects by using diagnostic tools such as soap and water, gauges and hand tools
- compare test results to manufacturers' specifications or expected values to verify diagnosis
- record test results and inspection findings according to manufacturers' requirements for warranty, and for future reference and tracking

C-12.03 Repairs air systems

- remove and replace worn, damaged or faulty components such as air lines, relay valves, brake chambers, modulating valves, governors, compressors and air dryer filters
- rebuild components such as air compressors, brake chambers, air dryers and purge valves by replacing worn parts, according to manufacturers' specifications
- repair components such as air starters, compressors, air dryers and driver warning systems by replacing parts causing the failure, according to manufacturers' specifications
- perform adjustment procedures such as air governors and ride height valves (leveling valves) to ensure proper operation of air system
- verify repair by using methods such as road testing, load testing and sensory observations
- document that repairs and verifications have been performed for warranty, liability, future reference and tracking

C-13 Services, diagnoses and repairs brake systems

C-13.01 Services brake systems

- clean brake system components such as ABS components, drums, shoes, pads, rotors, cams and slack adjustors
- perform sensory inspections of brake components to identify leaks or worn, damaged or defective components such master cylinders, ABS modules, worn shoes and drums, broken springs, slack adjustors and cams
- measure brake system components such as slack adjustors, brake lining and rotors for brake stroke measurements, drum wear and thicknesses to determine if they meet manufacturers' specifications and jurisdictional requirements
- check fluid levels in master cylinders to determine if they meet manufacturers' specifications
- release stored energy in components such as brake chamber springs
- remove and replace consumable components such as brake linings and fluids according manufacturers' specifications
- adjust brakes and lubricate components according to manufacturers' specifications
- recalibrate sensors for ABS according to manufacturers' specifications
- bleed hydraulic brakes according to manufacturers' specifications
- identify types of power assisted hydraulic brakes
- record service information and inspection findings according to manufacturers' requirements for warranty, and for future reference and tracking

C-13.02 Diagnoses brake systems

- obtain details of symptoms associated with complaint to establish a starting point for diagnostics
- perform sensory inspections such as braking performance, ABS lights, oil and air leaks to confirm complaint and establish a preliminary diagnosis
- measure brake system components such as slack adjustors, brake lining and rotors for brake stroke measurements, drum wear and thicknesses
- perform diagnostic procedure by following troubleshooting tree or schematic supplied by manufacturer to determine failure
- perform specialized testing procedures such as leakdown test, performance test and road test to assess components for wear, damage or defects using ABS and hydraulic diagnostic equipment
- interpret schematics and compare test results to manufacturers' specifications or expected values to verify diagnosis
- perform failure analysis to determine root cause of failure

- record test results and inspection findings according to manufacturers' requirements for warranty, and for future reference and tracking

C-13.03 Repairs brake systems.

- remove and replace worn, damaged or faulty brake components such as slack adjusters, brake chambers, cables, wheel cylinders and master cylinders
- rebuild and repair components such as master cylinders, calipers, air lines, hydraulic lines and ABS components according to manufacturers' specifications
- perform adjustment procedures by adjusting components such as brakes, ABS sensors and parking brakes to ensure proper operation and according to manufacturers' specifications
- verify repair by using methods such as road testing, load testing and sensory observations
- document that repairs and verifications have been performed for warranty, liability, future reference and tracking

Electrical – Theory

14 hours

- apply scientific principles to explain electrical theory and magnetism
- identify electrical circuit types and faults utilizing test equipment
- explain the function and operation of a lead acid battery

Electrical – Shop

16 hours

- measure electrical values and check circuit operation
- evaluate a lead acid battery
- repair faults

NOA topics covered in this section of training:

D-14 Services, diagnoses and repairs batteries

D-14.01 Performs servicing and repair of batteries

- clean battery components such as terminals and connections
- perform visual inspection of battery to identify defects such as corroded and loose terminals, missing caps or casing damage
- load test to confirm battery maintains proper charge
- measure specific gravity of each cell using a hydrometer
- compare test results to manufacturers' specifications or expected values
- replace faulty or damaged battery
- adjust electrolyte levels if applicable
- recharge battery according to manufacturers' specifications
- disconnect and connect batteries in proper sequence
- apply anti-corrosion compounds to terminals and connections
- recycle and/or dispose of battery according to jurisdictional regulations

D-14.02 Diagnoses batteries

- obtain details of symptoms associated with complaint to establish a starting point for diagnostics
- perform visual inspection of battery to identify defects such as corroded and loose terminals, missing caps or casing damage
- load test to assess battery condition and capacity
- measure specific gravity to assess the condition of each cell for lack of clarity due to sulfating and for correct electrolyte value
- compare test results to manufacturers' specifications or expected values to verify diagnosis
- perform failure analysis to determine root cause of failure such as an amperage draw

D-15 Services, diagnoses and repairs charging systems

D-15.01 services charging systems

- clean terminals and connections of charging system components
- perform sensory inspections to identify worn, damaged or defective components such as belts, wiring and cooling fins
- adjust voltage regulator and belt tension to OEM specifications

D-15.02 Diagnoses charging systems

- obtain details of symptoms associated with complaint to establish a starting point for diagnostics
- perform sensory inspections to identify worn, damaged or defective components such as belts, wiring and cooling fins to confirm complaint and establish a preliminary diagnosis
- check alternator charging rate
- perform diagnostic procedure by following troubleshooting tree or schematic supplied by manufacturer which may include specialized testing procedures such as full fielding the alternator
- compare test results to manufacturers' specifications or expected values to verify diagnosis
- perform failure analysis to determine root cause of failure

D-15.03 Repairs charging systems

- remove and replace worn, damaged or faulty components such as belts, pulleys, alternators and regulators
- adjust belt tension to OEM specifications
- construct or repair cables by crimping and soldering connectors and terminals
- rebuild components such as alternators by replacing brushes and bearings, and testing armatures, stators, diodes and regulators according to manufacturers' specifications
- verify repair by using methods such as full fielding or bench testing

D-16 Services, diagnoses and repairs spark ignition systems

D-16.01 Performs servicing and repair of spark ignition systems

- replace components such as spark plugs, coils, high tension wires and distributor caps
- repair components such as loose and corroded connections
- adjust spark plug gap
- perform visual inspection to identify defects such as damaged wires and coil terminals
- measure coil resistance to determine if it meets manufacturers' specifications

D-16.02 Diagnoses spark ignition systems.

- obtain details of symptoms associated with complaint to establish a starting point for diagnostics
- perform visual inspection to identify defects such as damaged wires and coil terminals
- perform diagnostic procedure by following troubleshooting tree or schematic supplied by manufacturer to determine failure
- measure resistance in primary and secondary circuits to verify they fall within manufacturers' specifications
- test high tension leads to verify they fall within manufacturers' specifications
- compare test results to manufacturers' specifications or expected values to verify diagnosis

D-17 Services, diagnoses and repairs starting systems

D-17.01 Performs servicing and repair of starting systems

- perform visual inspections of starter mounting and identify loose, worn or corroded cables
- clean components such as connections and terminals
- remove and replace starter
- replace components such as solenoid, relays, cables, connections and ignition switches
- rebuild starter by replacing solenoid, brushes, bushings and starter drives, testing armatures and field windings, and setting starter drive air gap according to manufacturers' specifications
- verify repair by using methods such as bench and starter draw testing to confirm repair

D-17.02 Diagnoses starting systems

- obtain details of symptoms associated with complaint to establish a starting point for diagnostics
- perform visual inspections of starter system components to identify loose, worn or corroded cables
- perform diagnostic procedure by following troubleshooting tree or schematic supplied by manufacturer to determine failure
- perform specialized testing procedures such as starter draw and voltage drop tests
- compare test results to manufacturers' specifications or expected values to verify diagnosis

- perform failure analysis to determine root cause of failure

Environmental Control Systems

6 hours

- complete the Heating, Refrigeration and Air Conditioning Institute's course on ozone depleting substances

NOA topics covered in this section of training:

I-36 Services, diagnoses and repairs heating and ventilation systems

I-36.01 Services heating and ventilation systems

- clean heating and ventilation system components such as filters and heater cores
- perform sensory inspections of heating and ventilation system to identify worn, damaged or defective components such bent or plugged fins, burnt heater controls and leaking flow valve
- measure heating and ventilation system components such as for air temperature and flow to determine if they meet manufacturers' specifications
- remove and replace consumable components such as coolant according manufacturers' specifications
- recycle and/or dispose of coolant according to jurisdictional regulations
- record service information and inspection findings according to manufacturers' requirements for warranty, and for future reference and tracking

I-36.02 Diagnoses heating and ventilation systems

- obtain details of symptoms associated with complaint to establish a starting point for diagnosis
- perform sensory inspections such as temperature, coolant leaks and air flow to confirm complaint and establish a preliminary diagnosis
- perform diagnostic procedure by following troubleshooting tree or schematic supplied by manufacturer to determine failure
- perform testing procedures such as bringing vehicle to operating temperature to assess components for wear, damage or defects such as thermostat failure
- test system and component operation to isolate problem
- perform failure analysis to determine root cause of failure
- record test results and inspection findings according to manufacturers' requirements for warranty, and for future reference and tracking

I-36.03 Repairs heating and ventilation systems

- remove and replace worn, damaged or faulty components such as thermostats, blowers, flow valves and heater cores
- rebuild components such as heater cores, radiators and heater boxes by replacing parts according to manufacturers' specifications
- repair components such as flow valves by replacing the cable, heater core by soldering components and heater motors by fixing the wiring, according to manufacturers' specifications
- clean and replace filters
- adjust cables on flow valves and doors on heater boxes to ensure proper operation of component/equipment
- verify repair by using methods such as road testing and sensory observations
- document that repairs and verifications have been performed for warranty, liability, future reference and tracking
- disassemble and reassemble dashboard and firewall components for access

I-37 Services, diagnoses and repairs air conditioning systems

I-37.01 Services air conditioning systems

- clean air conditioning system components such as condenser and evaporator cores
- perform sensory inspections of air conditioning systems to identify worn, damaged or defective components such chaffed lines, defective expansion valves, plugged condensers and damaged evaporators
- measure temperature and air flow of air conditioning system to determine if it meets manufacturers' specifications

- record service information and inspection findings according to manufacturers' requirements for warranty, and for future reference and tracking
- I-37.02 diagnoses air conditioning systems
- obtain details of symptoms associated with complaint to establish a starting point for diagnosis
 - perform sensory inspections of air conditioning systems to identify worn, damaged or defective components such as chaffed lines, defective expansion valves, plugged condensers and damaged evaporators to confirm complaint and establish a preliminary diagnosis
 - perform diagnostic procedure by following troubleshooting tree or schematic supplied by manufacturer to determine failure
 - pressure test for high/low pressure to assess components for wear, damage or defects using tools and equipment such as air conditioning recovery machines
 - perform electrical testing to isolate problem
 - run system to isolate problem
 - compare test results to manufacturers' specifications or expected values to verify diagnosis
 - perform failure analysis to determine root cause of failure
 - record test results and inspection findings according to manufacturers' requirements for warranty, and for future reference and tracking
- I-37.03 Repairs air conditioning systems
- remove and replace worn, damaged or faulty components such as expansion valves, evaporators, belt, condensers and sensors
 - remove and replace consumables such as Freon according manufacturers' specifications and employer maintenance schedule to minimize breakdowns
 - adjust Freon pressures to ensure proper operation of component/equipment
 - recycle Freon according to jurisdictional regulations using equipment such as air conditioning recovery system
 - verify repair by running air conditioning system
 - document that repairs and verifications have been performed for warranty, liability, future reference and tracking
 - use welding equipment to braze or solder lines
 - disassemble and reassemble dashboard and firewall components for access, according to manufacturers' specifications evacuate, clean and recharge system refrigerant according to manufacturer's specifications

Hydraulics – Theory

24 hours

- explain the fundamentals of a basic hydraulic system and related components
- interpret hydraulic symbol diagrams
- describe hydraulic system maintenance and testing procedures
- describe open and closed center hydraulic systems

Hydraulics – Shop

36 hours

- service hydraulic system and various components
- test hydraulic systems using correct tools and procedures

NOA topics covered in this section of training:

J-38 Services, diagnoses and repairs hydraulic components

J-38.01 Services hydraulic components

- clean hydraulic components such as inlet screen and reservoir
- perform sensory inspections of hydraulic components to identify worn, damaged or defective components such chaffed hoses, leaking gaskets, seals or hoses, low hydraulic oil levels and abnormal sounds
- release stored energy such as high pressure in a controlled manner without releasing fluid from the system

- remove and replace consumables such as filters and oil according manufacturers' specifications
- recycle and/or dispose of consumables according to jurisdictional regulations
- record service information and inspection findings according to manufacturers' requirements for warranty, and for future reference and tracking

J-38.02 Diagnoses hydraulic components

- obtain details of symptoms associated with complaint to establish a starting point for diagnosis
- release stored energy such as high pressure in a controlled manner without releasing fluid from the system
- perform sensory inspections to confirm complaint and establish a preliminary diagnosis
- perform diagnostic procedure by following schematics supplied by manufacturer to determine failure
- perform specialized testing procedures such as pressure, flow and vacuum to assess components for wear, damage or defects using tools and equipment such as pressure gauges, flowmeters, temperature gauges and vacuum gauges
- compare test results to manufacturers' specifications or expected values to verify diagnosis
- perform failure analysis to determine root cause of failure
- record test results and inspection findings according to manufacturers' requirements for warranty, and for future reference and tracking

J-38.03 Repairs hydraulic components

- release stored energy such as high pressure in a controlled manner without releasing fluid from the system
- remove and replace worn, damaged or faulty components such as damaged hoses, worn pumps, worn or damaged actuators, improperly vented reservoir, and worn damaged or faulty valves
- rebuild components such as actuators, pumps and valves, according to manufacturers' specifications
- repair components such as actuators, pumps and valves, by replacing parts causing the failure, according to manufacturers' specifications
- perform adjustments such as setting pressure and flow to ensure proper operation of component/equipment
- verify repair using methods such as operational tests, verifying pressures and flow according to manufacturers' recommendations
- document that repairs and verifications have been performed for warranty, liability, future reference and tracking

Steering Systems – Theory

12 hours

- explain basic wheel and frame alignment angles
- explain manual and integral steering system operation
- describe mounting procedures for tires, rims and hubs

Steering Systems – Shop

18 hours

- perform a basic wheel alignment
- evaluate manual and integral power steering systems
- perform mounting procedures for tires, rims and hubs
- repair system faults

NOA topics covered in this section of training:

F-27 Services, diagnoses and repairs steering system

F-27.01 Services steering systems

- perform sensory inspections of steering system to identify worn, damaged or defective components such king pins, drag links, steering boxes, pitman arms and hydraulic cylinders
- measure steering system components such as king pins, drag links and tie rods for end play to determine if they meet manufacturers' specifications and jurisdictional requirements

- remove and replace consumable components such as oils and filters according manufacturers' specifications and employer maintenance schedule to minimize breakdowns
- recycle and/or dispose of consumable components according to jurisdictional regulations
- record service information and inspection findings according to manufacturers' requirements for warranty, and for future reference and tracking
- lubricate components such as tie rods, king pins and u-joints according to manufacturers' recommendations

F-27.02 Diagnoses steering systems

- obtain details of symptoms associated with complaint to establish a starting point for diagnostics
- perform sensory inspections such as looking for leaks, feeling for vibrations during road testing and visually inspecting tire for incorrect wear pattern to confirm complaint and establish a preliminary diagnosis
- perform diagnostic procedure by following troubleshooting tree or schematic supplied by manufacturer to determine failure
- perform specialized testing procedures such as performance, pressure and volume tests to assess components for wear, damage or defects using tools and equipment such as pressure gauges, dial indicators and prybars
- compare test results to manufacturers' specifications or expected pressure values to verify diagnosis
- perform failure analysis to determine root cause of failure
- record test results and inspection findings according to manufacturers' requirements for warranty, and for future reference and tracking
- interpret tire wear patterns

F-27.03 Repairs steering systems

- remove and replace worn, damaged or faulty components such as king pins, drag links, steering boxes, pitman arms and hydraulic cylinders
- rebuild components such as power steering box and hydraulic cylinders by replacing seals, O-rings and internal components of steering box, according to manufacturers' specifications
- repair or replace components such as steering boxes, pumps, hoses, lines, seals, u-joints and reservoirs according to manufacturers' specifications
- perform adjustment procedures such as poppet valves, pitman arms and worm gear to ensure proper operation of component/equipment
- verify repair by using methods such as road testing, front end alignments, load testing and sensory observations
- document that repairs and verifications have been performed for warranty, liability, future reference and tracking

F-28 Services, diagnoses and repairs chassis/frames

F-28.01 Services chassis/frames

- clean frame rails, cross-members and gussets
- perform sensory inspections of frame rails, cross-members and gussets for loose mounting hardware, cracks and distortions such as corrosion
- measure frame rails to determine if the frame meets manufacturers' specifications

F-28.02 Diagnoses chassis/frames

- obtain details of symptoms associated with complaint to establish a starting point for diagnostics
- perform sensory inspections such as looking for cracked or damaged frames, corrosion, and missing or loose hardware to establish a preliminary diagnosis
- perform failure analysis using diagnostic equipment such as laser alignment tools, calipers and straight edges to determine root cause of failure
- record test results and inspection findings according to manufacturers' requirements for warranty, and for future reference and tracking

F-28.03 Repairs chassis/frames

- remove and replace worn, damaged or faulty components such as cross- members, gussets and mounting hardware
- repair and replace components such as cross-members, gussets and frame rail by welding and plating according to manufacturers' specifications
- verify repair using tools such as laser alignments, calipers and straight edges
- modify chassis/frame such as adding inserts, drilling frames and adjusting length
- document that repairs and verifications have been performed for warranty, liability, future reference and tracking

F-29 Services, diagnoses and repairs suspension

F-29.01 Services suspension

- clean suspension components
- perform sensory inspections of suspension to identify worn, damaged or defective components such as bolster springs, I- beams, torque rods, ride height valves and air bags
- measure suspension components such as frame for ride height and bushings for excessive play to determine if they meet manufacturers' specifications
- release stored energy by draining the air tank and spring tension
- adjust ride height valve according to manufacturers' specifications
- lubricate suspension components
- record service information and inspection findings according to manufacturers' requirements for warranty, and for future reference and tracking

F-29.02 Diagnoses suspension

- obtain details of symptoms associated with complaint to establish a starting point for diagnostics
- perform sensory inspections of suspension to identify worn, damaged or defective components such as bolster springs, I-beams, torque rods, ride height valves and air bags to confirm complaint and establish a preliminary diagnosis
- perform testing procedures to assess components for wear, damage or defects using tools and equipment such as tape measures, soapy water and dial indicators
- compare test results to manufacturers' specifications or expected values to
- verify diagnosis
- record test results and inspection findings according to manufacturers' requirements for warranty, and for future reference and tracking

F-29.03 Repairs suspension

- remove and replace worn, damaged or faulty components such as springs, spring guides, bushings and torque rods
- repair components such as air lines, air springs and leaf spring assemblies according to manufacturers' specifications
- perform adjustment procedures such as setting ride height valves to ensure proper operation of component/equipment
- verify repair by using methods such as road testing, load testing and sensory observations
- use welding and cutting equipment to repair axle stops, shackle assemblies and hanger assemblies
- document that repairs and verifications have been performed for warranty, liability, future reference and tracking

F-30 Services, diagnoses and repairs hitches and couplers

F-30.01 Services hitches and couplers

- clean 5th wheel, slide rails and pintle components
- perform sensory inspections of 5th wheel and pintles to identify worn, damaged or defective components such as bushings, jaws, slide rail locks and clevis pin
- measure hitch and coupler components such as 5th wheel plate, side rail locks, bushings, pins and jaws for play to determine if they meet manufacturers' specifications
- adjust 5th wheel jaws and side rail locks to meet manufacturers' specifications
- lubricate components
- record service information and inspection findings according to

- manufacturers' requirements for warranty, and for future reference and tracking
- F-30.02 Diagnoses hitches and couplers
- obtain details of symptoms associated with complaint to establish a starting point for diagnostics
 - perform sensory inspections of 5th wheel and pintles to identify worn, damaged or defective components such as bushings, jaws, slide rail locks and clevis pin to confirm complaint and establish a preliminary diagnosis
 - perform specialized testing procedures such as testing for play to assess components for wear, damage or defects using tools and equipment such as king pin tool
 - test hitch and coupler operation
 - compare test results to manufacturers' specifications or expected values to verify diagnosis
 - record test results and inspection findings according to manufacturers' requirements for warranty, and for future reference and tracking
- F-30.03 Repairs hitches and couplers
- remove and replace worn, damaged or faulty components such as jaws, 5th wheels, springs and pins
 - repair and rebuild 5th wheel components such as jaws, pins, springs and bushings by using rebuild kits, according to manufacturers' specifications
 - adjust 5th wheel to ensure proper operation of component/equipment
 - verify repair by using methods such as coupling and uncoupling
 - lubricate components
 - document that repairs and verifications have been performed for warranty, liability, future reference and tracking

F-31 Services, diagnoses and repairs tires, wheels and hubs

- F-31.01 Services tires, wheels and hubs
- perform sensory inspections of tires, wheels and hubs to identify worn, damaged or defective components such as oil leaks from the hubs, air leaks from tires and cracked rims
 - measure tire components such as tread depth for wear and air pressure for air leaks, to determine if they meet manufacturers' specifications
 - measure hub components such as bearing end play to determine if they meet manufacturers' specifications and jurisdictional requirements
 - torque nuts to ensure fasteners meet manufacturers' specifications
 - release stored energy by draining air from tires
 - remove and replace consumable components such as oils in hubs according to manufacturers' specifications
 - recycle and/or dispose of consumable components according to jurisdictional regulations
 - adjust tire pressure according to manufacturers' specifications
 - torque tire according to manufacturers' specifications
 - recognize hazards associated with removal of tires such as spoke wheels and wedges
 - identify mismatched tires by casing and tread depth
 - record service information and inspection findings according to manufacturers' requirements for warranty, and for future reference and tracking
- F-31.02 Diagnoses tires, wheels and hubs
- obtain details of symptoms associated with complaint to establish a starting point for diagnostics
 - perform sensory inspections of tires, wheels and hubs to identify worn, damaged or defective components such as oil leaks from hubs, air leaks from tires and cracked rims to confirm complaint and establish a preliminary diagnosis
 - perform diagnostic procedure by following troubleshooting tree supplied by manufacturer to determine failure
 - measure components for wear, damage or defects using diagnostic equipment such as dial indicators, torque wrenches, air gauges, tire pressure/heat warning devices and tread depth gauges
 - compare test results to manufacturers' specifications or expected values to verify diagnosis

- perform failure analysis to determine root cause of failure
- record test results and inspection findings according to manufacturers' requirements for warranty, and for future reference and tracking

F-31.03 Repairs tires, wheels and hubs

- remove and replace worn, damaged or faulty components such as tires, rims, bearings and studs
- rebuild components such as hub assemblies by replacing bearings and races according to manufacturers' specifications
- repair components such as tires and hub assemblies by replacing seals, bearings, races, patches and plugs, according to manufacturers' specifications
- perform procedures such as bearing adjustment to ensure proper operation of component/equipment
adjust air pressure and run-out and torque on spoke wheels according to manufacturers' specifications
- verify repair by using methods such as wheel alignment, road testing and checking for end play, according to manufacturers' specifications
- document that repairs and verifications have been performed for warranty, liability, future reference and tracking

Structural Components – Theory

12 hours

- describe preventative maintenance programs
- identify hoisting and rigging techniques
- describe tractor frame construction and suspension systems
- describe truck and trailer coupling and docking systems

Structural Components – Shop

18 hours

- perform preventative maintenance checks
- perform hoisting and rigging techniques
- repair various hitching and docking systems
- inspect frame and suspension systems

NOA topics covered in this section of training:

A-2 Uses and maintains tools and equipment

A-2.03 Uses hoisting and lifting equipment

- inspect hoisting and lifting equipment for wear, damage, leaks and defects
- repair or replace worn, damaged and defective components on hoisting and lifting equipment
- store hoisting and lifting equipment
- position and connect hoisting and lifting equipment
- operate hoisting and lifting equipment
- secure hoisting and lifting to prevent movement
- select hoisting and lifting equipment according to equipment limitations and job requirements

F-28 Services, diagnoses and repairs chassis/frames

F-28.01 Services chassis/frames

- clean frame rails, cross-members and gussets
- perform sensory inspections of frame rails, cross-members and gussets for loose mounting hardware, cracks and distortions such as corrosion
- measure frame rails to determine if the frame meets manufacturers' specifications

F-28.02 Diagnoses chassis/frames

- obtain details of symptoms associated with complaint to establish a starting point for diagnostics
- perform sensory inspections such as looking for cracked or damaged frames, corrosion, and missing or loose hardware to establish a preliminary diagnosis
- perform failure analysis using diagnostic equipment such as laser alignment tools, calipers and straight edges to determine root cause of failure

- record test results and inspection findings according to manufacturers' requirements for warranty, and for future reference and tracking

F-28.03 Repairs chassis/frames

- remove and replace worn, damaged or faulty components such as cross- members, gussets and mounting hardware
- repair and replace components such as cross-members, gussets and frame rail by welding and plating according to manufacturers' specifications
- verify repair using tools such as laser alignments, calipers and straight edges
- modify chassis/frame such as adding inserts, drilling frames and adjusting length
- document that repairs and verifications have been performed for warranty, liability, future reference and tracking

G-33 Services, diagnoses and repairs exterior cab components

G-33.01 Services exterior cab components

- perform sensory inspections of exterior to identify worn, damaged or defective components such as cracks in the frame and loose fasteners and fairings
- remove and replace consumable components such as lights, wipers and washer fluid according to manufacturers' specifications
- recycle and/or dispose of consumable components according to jurisdictional regulations
- record service information and inspection findings according to manufacturers' requirements for warranty, and for future reference and tracking

G-33.02 Diagnoses exterior cab components

- obtain details of symptoms associated with complaint to establish a starting point for diagnosis
- perform sensory inspections of exterior to identify worn, damaged or defective components such as cracks in the cab frame and loose fasteners and fairings
- inspect cab mounts and cab suspension for proper operation, and worn and damaged bushings, leaking shocks, and leaking or damaged valves
- measure and adjust cab ride height to manufacturers' specifications or expected values to verify diagnosis
- perform failure analysis to determine root cause of failure
- record test results and inspection findings according to manufacturers' requirements for warranty, and for future reference and tracking

G-33.03 Repairs exterior cab components

- perform door, hood and cab adjustments to ensure proper operation of component/equipment
- replace or repair worn, damaged or faulty components such as windshields, mirrors, lights, hood, hood cables, moldings, fenders and cab mounts
- use welding and cutting equipment to repair components
- verify repair to ensure it is within manufacturers' specifications
- document that repairs and verifications have been performed for warranty, liability, future reference and tracking

Level One topics from the NOA that are taught in context:

Scheduled Maintenance

Operational Testing

Planning and Communication

For details regarding the In Context Topic, see page 55

Level Two

8 weeks

240 hours

Brake Systems ABS – Theory

12 hours

- describe antilock braking system components

- describe electric braking system components

Brake Systems ABS – Shop

18 hours

- evaluate antilock braking systems
- evaluate an electric braking system
- repair system faults

NOA topics covered in this section of training:

C-12 Services, diagnoses and repairs air systems

C-12.01 Services air systems

- perform sensory inspections of air systems to identify worn, damaged or defective components such as air lines, air dryers, governors, compressors, brake chambers (pots) and air tanks
- measure air pressures to determine if they meet manufacturers' specifications and jurisdictional requirements
- release stored energy such as air pressure by opening air valves and fanning down brakes
- remove and replace air dryer filters according manufacturers' specifications and employer maintenance schedule
- recycle and/or dispose of consumable air dryer filters and brake chambers according to jurisdictional regulations
- record service information and inspection findings according to manufacturers' requirements for warranty, and for future reference and tracking
- adjust governing air pressures to meet manufacturers' specifications

C-12.02 Diagnoses air systems

- obtain details of symptoms associated with complaint to establish a starting point for diagnostics
- perform audible and visual inspections of components such brake chambers, air lines, tanks, valves, air gauges and air dryers to confirm complaint and establish a preliminary diagnosis
- perform diagnostic procedure by following troubleshooting tree or schematic supplied by manufacturer to determine failure
- perform specialized testing procedures such as pressure tests, timed tests and leakdown to assess components for wear, damage or defects by using diagnostic tools such as soap and water, gauges and hand tools
- compare test results to manufacturers' specifications or expected values to verify diagnosis
- record test results and inspection findings according to manufacturers' requirements for warranty, and for future reference and tracking

C-12.03 Repairs air systems

- remove and replace worn, damaged or faulty components such as air lines, relay valves, brake chambers, modulating valves, governors, compressors and air dryer filters
- rebuild components such as air compressors, brake chambers, air dryers and purge valves by replacing worn parts, according to manufacturers' specifications
- repair components such as air starters, compressors, air dryers and driver warning systems by replacing parts causing the failure, according to manufacturers' specifications
- perform adjustment procedures such as air governors and ride height valves (leveling valves) to ensure proper operation of air system
- verify repair by using methods such as road testing, load testing and sensory observations
- document that repairs and verifications have been performed for warranty, liability, future reference and tracking

C-13 Services, diagnoses and repairs brake systems

C-13.01 Services brake systems

- clean brake system components such as ABS components, drums, shoes, pads, rotors, cams and slack adjusters
- perform sensory inspections of brake components to identify leaks or worn, damaged or defective components such master cylinders, ABS modules, worn shoes and drums, broken springs, slack adjusters and cams

- measure brake system components such as slack adjusters, brake lining and rotors for brake stroke measurements, drum wear and thicknesses to determine if they meet manufacturers' specifications and jurisdictional requirements
- check fluid levels in master cylinders to determine if they meet manufacturers' specifications
- release stored energy in components such as brake chamber springs
- remove and replace consumable components such as brake linings and fluids according manufacturers' specifications
- adjust brakes and lubricate components according to manufacturers' specifications
- recalibrate sensors for ABS according to manufacturers' specifications
- bleed hydraulic brakes according to manufacturers' specifications
- identify types of power assisted hydraulic brakes
- record service information and inspection findings according to manufacturers' requirements for warranty, and for future reference and tracking

C-13.02 Diagnoses brake systems

- obtain details of symptoms associated with complaint to establish a starting point for diagnostics
- perform sensory inspections such as braking performance, ABS lights, oil and air leaks to confirm complaint and establish a preliminary diagnosis
- measure brake system components such as slack adjusters, brake lining and rotors for brake stroke measurements, drum wear and thicknesses
- perform diagnostic procedure by following troubleshooting tree or schematic supplied by manufacturer to determine failure
- perform specialized testing procedures such as leakdown test, performance test and road test to assess components for wear, damage or defects using ABS and hydraulic diagnostic equipment
- interpret schematics and compare test results to manufacturers' specifications or expected values to verify diagnosis
- perform failure analysis to determine root cause of failure
- record test results and inspection findings according to manufacturers' requirements for warranty, and for future reference and tracking

C-13.03 Repairs brake systems

- remove and replace worn, damaged or faulty brake components such as slack adjusters, brake chambers, cables, wheel cylinders and master cylinders
- rebuild and repair components such as master cylinders, calipers, air lines, hydraulic lines and ABS components according to manufacturers' specifications
- perform adjustment procedures by adjusting components such as brakes, ABS sensors and parking brakes to ensure proper operation and according to manufacturers' specifications
- verify repair by using methods such as road testing, load testing and sensory observations
- document that repairs and verifications have been performed for warranty, liability, future reference and tracking

Drivetrain Systems – Theory

24 hours

- identify various seals and bearing types
- discuss various clutch types
- discuss manual transmission operation
- discuss differential operation
- discuss planetary and final drives
- discuss driveline operation

Drivetrain Systems – Shop

36 hours

- perform the removal and replacement of various seals and bearings
- evaluate various clutch types
- evaluate manual transmission operation
- evaluate differential operation

- evaluate planetary and final drive systems
- evaluate driveline systems
- repair faults

This section of training (Drivetrain Systems) exceeds NOA scope of work in Level Two and exceeds the minimum sequencing as set out in the Truck and Transport Mechanic NOA. Its purpose is mainly to assist in the understanding of the topic Steering and Directional Control Systems. *Note: Content covered in this course is reviewed in TBD – POWERSHIFT TRANSMISSIONS Harmonized Level Three.*

Electrical – Theory

12 hours

- explain the operation of a cranking system and related components
- explain the operation of an alternating current (AC) charging system and related components

Electrical – Shop

18 hours

- evaluate cranking and charging systems
- repair faults

NOA topics covered in this section of training:

D-15 Services, diagnoses and repairs charging systems

D-15.01 services charging systems

- clean terminals and connections of charging system components
- perform sensory inspections to identify worn, damaged or defective components such as belts, wiring and cooling fins
- adjust voltage regulator and belt tension to OEM specifications

D-15.02 Diagnoses charging systems

- obtain details of symptoms associated with complaint to establish a starting point for diagnostics
- perform sensory inspections to identify worn, damaged or defective components such as belts, wiring and cooling fins to confirm complaint and establish a preliminary diagnosis
- check alternator charging rate
- perform diagnostic procedure by following troubleshooting tree or schematic supplied by manufacturer which may include specialized testing procedures such as full fielding the alternator
- compare test results to manufacturers' specifications or expected values to verify diagnosis
- perform failure analysis to determine root cause of failure

D-15.03 Repairs charging systems

- remove and replace worn, damaged or faulty components such as belts, pulleys, alternators and regulators
- adjust belt tension to OEM specifications
- construct or repair cables by crimping and soldering connectors and terminals
- rebuild components such as alternators by replacing brushes and bearings, and testing armatures, stators, diodes and regulators according to manufacturers' specifications
- verify repair by using methods such as full fielding or bench testing

D-17 Services, diagnoses and repairs starting systems

D-17.01 Performs servicing and repair of starting systems

- perform visual inspections of starter mounting and identify loose, worn or corroded cables
- clean components such as connections and terminals
- remove and replace starter
- replace components such as solenoid, relays, cables, connections and ignition switches
- rebuild starter by replacing solenoid, brushes, bushings and starter drives, testing armatures and field windings, and setting starter drive air gap according to manufacturers' specifications
- verify repair by using methods such as bench and starter draw testing to confirm repair

D-17.02 Diagnoses starting systems

- obtain details of symptoms associated with complaint to establish a starting point for diagnostics
 - perform visual inspections of starter system components to identify loose, worn or corroded cables
 - perform diagnostic procedure by following troubleshooting tree or schematic supplied by manufacturer to determine failure
 - perform specialized testing procedures such as starter draw and voltage drop tests
 - compare test results to manufacturers' specifications or expected values to verify diagnosis
 - perform failure analysis to determine root cause of failure
-

Hydraulics – Theory

12 hours

- describe the operation of the different types of flow control valves
- describe a power-beyond hydraulic systems
- describe open and closed loop hydrostatic systems

Hydraulics – Shop

18 hours

- evaluate various types of hydraulic systems and flow control valves
- evaluate open and closed loop hydraulic systems
- repair faults

NOA topics covered in this section of training:

J-38 Services, diagnoses and repairs hydraulic components

J-38.01 Services hydraulic components

- clean hydraulic components such as inlet screen and reservoir
- perform sensory inspections of hydraulic components to identify worn, damaged or defective components such chaffed hoses, leaking gaskets, seals or hoses, low hydraulic oil levels and abnormal sounds
- release stored energy such as high pressure in a controlled manner without releasing fluid from the system
- remove and replace consumables such as filters and oil according manufacturers' specifications
- recycle and/or dispose of consumables according to jurisdictional regulations
- record service information and inspection findings according to manufacturers' requirements for warranty, and for future reference and tracking

J-38.02 Diagnoses hydraulic components

- obtain details of symptoms associated with complaint to establish a starting point for diagnosis
- release stored energy such as high pressure in a controlled manner without releasing fluid from the system
- perform sensory inspections to confirm complaint and establish a preliminary diagnosis
- perform diagnostic procedure by following schematics supplied by manufacturer to determine failure
- perform specialized testing procedures such as pressure, flow and vacuum to assess components for wear, damage or defects using tools and equipment such as pressure gauges, flowmeters, temperature gauges and vacuum gauges
- compare test results to manufacturers' specifications or expected values to verify diagnosis
- perform failure analysis to determine root cause of failure
- record test results and inspection findings according to manufacturers' requirements for warranty, and for future reference and tracking

J-38.03 Repairs hydraulic components

- release stored energy such as high pressure in a controlled manner without releasing fluid from the system
- remove and replace worn, damaged or faulty components such as damaged hoses, worn pumps, worn or damaged actuators, improperly vented reservoir, and worn damaged or faulty valves

- rebuild components such as actuators, pumps and valves, according to manufacturers' specifications
- repair components such as actuators, pumps and valves, by replacing parts causing the failure, according to manufacturers' specifications
- perform adjustments such as setting pressure and flow to ensure proper operation of component/equipment
- verify repair using methods such as operational tests, verifying pressures and flow according to manufacturers' recommendations
- document that repairs and verifications have been performed for warranty, liability, future reference and tracking

Steering and Directional Control Systems – Theory **12 Hours**

- explain the operating principles of tandem steering systems
- explain the operating principles of an auxiliary steering systems
- discuss pilot control and orbital steering systems

Steering and Directional Control Systems – Shop **18 Hours**

- evaluate a tandem steering system
- evaluate an auxiliary steering systems
- evaluate pilot control and orbital steering systems
- repair system faults

NOA topics covered in this section of training:

F-27 Services, diagnoses and repairs steering system

F-27.01 Services steering systems

- perform sensory inspections of steering system to identify worn, damaged or defective components such king pins, drag links, steering boxes, pitman arms and hydraulic cylinders
- measure steering system components such as king pins, drag links and tie rods for end play to determine if they meet manufacturers' specifications and jurisdictional requirements
- remove and replace consumable components such as oils and filters according manufacturers' specifications and employer maintenance schedule to minimize breakdowns
- recycle and/or dispose of consumable components according to jurisdictional regulations
- record service information and inspection findings according to manufacturers' requirements for warranty, and for future reference and tracking
- lubricate components such as tie rods, king pins and u-joints according to manufacturers' recommendations

F-27.02 Diagnoses steering systems

- obtain details of symptoms associated with complaint to establish a starting point for diagnostics
- perform sensory inspections such as looking for leaks, feeling for vibrations during road testing and visually inspecting tire for incorrect wear pattern to confirm complaint and establish a preliminary diagnosis
- perform diagnostic procedure by following troubleshooting tree or schematic supplied by manufacturer to determine failure
- perform specialized testing procedures such as performance, pressure and volume tests to assess components for wear, damage or defects using tools and equipment such as pressure gauges, dial indicators and prybars
- compare test results to manufacturers' specifications or expected pressure values to verify diagnosis
- perform failure analysis to determine root cause of failure
- record test results and inspection findings according to manufacturers' requirements for warranty, and for future reference and tracking
- interpret tire wear patterns

F-27.03 Repairs steering systems

- remove and replace worn, damaged or faulty components such as king pins, drag links, steering boxes, pitman arms and hydraulic cylinders

- rebuild components such as power steering box and hydraulic cylinders by replacing seals, O-rings and internal components of steering box, according to manufacturers' specifications
- repair or replace components such as steering boxes, pumps, hoses, lines, seals, u-joints and reservoirs according to manufacturers' specifications
- perform adjustment procedures such as poppet valves, pitman arms and worm gear to ensure proper operation of component/equipment
- verify repair by using methods such as road testing, front end alignments, load testing and sensory observations
- document that repairs and verifications have been performed for warranty, liability, future reference and tracking

F-28 Services, diagnoses and repairs chassis/frames

F-28.01 Services chassis/frames

- clean frame rails, cross-members and gussets
- perform sensory inspections of frame rails, cross-members and gussets for loose mounting hardware, cracks and distortions such as corrosion
- measure frame rails to determine if the frame meets manufacturers' specifications

F-28.02 Diagnoses chassis/frames

- obtain details of symptoms associated with complaint to establish a starting point for diagnostics
- perform sensory inspections such as looking for cracked or damaged frames, corrosion, and missing or loose hardware to establish a preliminary diagnosis
- perform failure analysis using diagnostic equipment such as laser alignment tools, calipers and straight edges to determine root cause of failure
- record test results and inspection findings according to manufacturers' requirements for warranty, and for future reference and tracking

F-28.03 Repairs chassis/frames

- remove and replace worn, damaged or faulty components such as cross- members, gussets and mounting hardware
- repair and replace components such as cross-members, gussets and frame rail by welding and plating according to manufacturers' specifications
- verify repair using tools such as laser alignments, calipers and straight edges
- modify chassis/frame such as adding inserts, drilling frames and adjusting length
- document that repairs and verifications have been performed for warranty, liability, future reference and tracking

F-29 Services, diagnoses and repairs suspension

F-29.01 Services suspension

- clean suspension components
- perform sensory inspections of suspension to identify worn, damaged or defective components such as bolster springs, I- beams, torque rods, ride height valves and air bags
- measure suspension components such as frame for ride height and bushings for excessive play to determine if they meet manufacturers' specifications
- release stored energy by draining the air tank and spring tension
- adjust ride height valve according to manufacturers' specifications
- lubricate suspension components
- record service information and inspection findings according to manufacturers' requirements for warranty, and for future reference and tracking

F-29.02 Diagnoses suspension

- obtain details of symptoms associated with complaint to establish a starting point for diagnostics
- perform sensory inspections of suspension to identify worn, damaged or defective components such as bolster springs, I-beams, torque rods, ride height valves and air bags to confirm complaint and establish a preliminary diagnosis
- perform testing procedures to assess components for wear, damage or defects using tools and equipment such as tape measures, soapy water and dial indicators

- compare test results to manufacturers' specifications or expected values to
- verify diagnosis
- record test results and inspection findings according to manufacturers' requirements for warranty, and for future reference and tracking

F-29.03 Repairs suspension

- remove and replace worn, damaged or faulty components such as springs, spring guides, bushings and torque rods
- repair components such as air lines, air springs and leaf spring assemblies according to manufacturers' specifications
- perform adjustment procedures such as setting ride height valves to ensure proper operation of component/equipment
- verify repair by using methods such as road testing, load testing and sensory observations
- use welding and cutting equipment to repair axle stops, shackle assemblies and hanger assemblies
- document that repairs and verifications have been performed for warranty, liability, future reference and tracking

F-30 Services, diagnoses and repairs hitches and couplers

F-30.01 Services hitches and couplers

- clean 5th wheel, slide rails and pintle components
- perform sensory inspections of 5th wheel and pintles to identify worn, damaged or defective components such bushings, jaws, slide rail locks and clevis pin
- measure hitch and coupler components such as 5th wheel plate, side rail locks, bushings, pins and jaws for play to determine if they meet manufacturers' specifications
- adjust 5th wheel jaws and side rail locks to meet manufacturers' specifications
- lubricate components
- record service information and inspection findings according to
- manufacturers' requirements for warranty, and for future reference and tracking

F-30.02 Diagnoses hitches and couplers

- obtain details of symptoms associated with complaint to establish a starting point for diagnostics
- perform sensory inspections of 5th wheel and pintles to identify worn, damaged or defective components such bushings, jaws, slide rail locks and clevis pin to confirm complaint and establish a preliminary diagnosis
- perform specialized testing procedures such as testing for play to assess components for wear, damage or defects using tools and equipment such as king pin tool
- test hitch and coupler operation
- compare test results to manufacturers' specifications or expected values to verify diagnosis
- record test results and inspection findings according to manufacturers' requirements for warranty, and for future reference and tracking

F-30.03 Repairs hitches and couplers

- remove and replace worn, damaged or faulty components such as jaws, 5th wheels, springs and pins
- repair and rebuild 5th wheel components such as jaws, pins, springs and bushings by using rebuild kits, according to manufacturers' specifications
- adjust 5th wheel to ensure proper operation of component/equipment
- verify repair by using methods such as coupling and uncoupling
- lubricate components
- document that repairs and verifications have been performed for warranty, liability, future reference and tracking

F-31 Services, diagnoses and repairs tires, wheels and hubs

F-31.01 Services tires, wheels and hubs

- perform sensory inspections of tires, wheels and hubs to identify worn, damaged or defective components such oil leaks from the hubs, air leaks from tires and cracked rims

- measure tire components such as tread depth for wear and air pressure for air leaks, to determine if they meet manufacturers' specifications
- measure hub components such as bearing end play to determine if they meet manufacturers' specifications and jurisdictional requirements
- torque nuts to ensure fasteners meet manufacturers' specifications
- release stored energy by draining air from tires
- remove and replace consumable components such as oils in hubs according manufacturers' specifications
- recycle and/or dispose of consumable components according to jurisdictional regulations
- adjust tire pressure according to manufacturers' specifications
- torque tire according to manufacturers' specifications
- recognize hazards associated with removal of tires such as spoke wheels and wedges
- identify mismatched tires by casing and tread depth
- record service information and inspection findings according to manufacturers' requirements for warranty, and for future reference and tracking

F-31.02 Diagnoses tires, wheels and hubs

- obtain details of symptoms associated with complaint to establish a starting point for diagnostics
- perform sensory inspections of tires, wheels and hubs to identify worn, damaged or defective components such oil leaks from hubs, air leaks from tires and cracked rims to confirm complaint and establish a preliminary diagnosis
- perform diagnostic procedure by following troubleshooting tree supplied by manufacturer to determine failure
- measure components for wear, damage or defects using diagnostic equipment such as dial indicators, torque wrenches, air gauges, tire pressure/heat warning devices and tread depth gauges
- compare test results to manufacturers' specifications or expected values to verify diagnosis
- perform failure analysis to determine root cause of failure
- record test results and inspection findings according to manufacturers' requirements for warranty, and for future reference and tracking

F-31.03 Repairs tires, wheels and hubs

- remove and replace worn, damaged or faulty components such as tires, rims, bearings and studs
- rebuild components such as hub assemblies by replacing bearings and races according to manufacturers' specifications
- repair components such as tires and hub assemblies by replacing seals, bearings, races, patches and plugs, according to manufacturers' specifications
- perform procedures such as bearing adjustment to ensure proper operation of component/equipment
adjust air pressure and run-out and torque on spoke wheels according to manufacturers' specifications
- verify repair by using methods such as wheel alignment, road testing and checking for end play, according to manufacturers' specifications
- document that repairs and verifications have been performed for warranty, liability, future reference and tracking

Truck and Trailer Systems – Theory

24 Hours

- describe trailer frame and suspension systems
- describe operational fundamentals of trailer heat, ventilation and air conditioning systems
- describe SGI safety inspection procedures for truck and trailers
- describe the operation of cab and engine heaters and auxiliary power generation units

Truck and Trailer Systems – Shop

36 Hours

- evaluate trailer frame and suspension systems
- evaluate trailer heating, ventilation and air conditioning systems
- perform SGI safety Inspection
- evaluate the engine and cab heating and auxiliary power generation units
- repair defects

NOA topics covered in this section of training:

F-30 Services, diagnoses and repairs hitches and couplers

F-30.01 Services hitches and couplers

- clean 5th wheel, slide rails and pintle components
- perform sensory inspections of 5th wheel and pintles to identify worn, damaged or defective components such bushings, jaws, slide rail locks and clevis pin
- measure hitch and coupler components such as 5th wheel plate, side rail locks, bushings, pins and jaws for play to determine if they meet manufacturers' specifications
- adjust 5th wheel jaws and side rail locks to meet manufacturers' specifications
- lubricate components
- record service information and inspection findings according to
- manufacturers' requirements for warranty, and for future reference and tracking

F-30.02 Diagnoses hitches and couplers

- obtain details of symptoms associated with complaint to establish a starting point for diagnostics
- perform sensory inspections of 5th wheel and pintles to identify worn, damaged or defective components such bushings, jaws, slide rail locks and clevis pin to confirm complaint and establish a preliminary diagnosis
- perform specialized testing procedures such as testing for play to assess components for wear, damage or defects using tools and equipment such as king pin tool
- test hitch and coupler operation
- compare test results to manufacturers' specifications or expected values to verify diagnosis
- record test results and inspection findings according to manufacturers' requirements for warranty, and for future reference and tracking

F-30.03 Repairs hitches and couplers

- remove and replace worn, damaged or faulty components such as jaws, 5th wheels, springs and pins
- repair and rebuild 5th wheel components such as jaws, pins, springs and bushings by using rebuild kits, according to manufacturers' specifications
- adjust 5th wheel to ensure proper operation of component/equipment
- verify repair by using methods such as coupling and uncoupling
- lubricate components
- document that repairs and verifications have been performed for warranty, liability, future reference and tracking

G-32 Services, diagnoses and repairs interior cab components

G-32.01 Services interior cab components

- clean, adjust and lubricate components such as brake, throttle and clutch pedal pivot points, bed lifts, SRS (airbags) and seat tracks
- perform sensory inspections of interior components such as seats, seat belts, safety equipment, gauges, warning devices and driver controls including lighting, horns and switches to identify worn, damaged or defective components

G-32.02 Diagnoses interior cab components

- obtain details of symptoms associated with complaint to establish a starting point for diagnosis
- perform sensory inspections of interior components such as seats, seat belts, safety equipment, gauges, warning devices and driver controls including lighting, horns and switches to identify worn, damaged or defective components

- perform diagnostic procedure by following troubleshooting tree or schematic supplied by manufacturer to determine failure

G-32.03 Repairs interior cab components

- repair or replace components such as door panels, seat belts, seats, window regulators, motors, switches and dash valves
- adjust components such as brake and clutch switches
- verify repair under normal operating conditions to ensure it is within manufacturers' specifications
- document that repairs and verifications have been performed for warranty, liability, future reference and tracking

H-34 Services, diagnoses and repairs trailer components and accessories

H-34.01 Services trailer components and accessories

- clean, lubricate and test movement of trailer components and accessories such as bogie rails, doors and hinges, landing gear and interior of trailer
- perform visual inspections to identify worn, damaged or defective components such as king pins, doors, bogie rails, cross members, canvas air chute, body panels, flooring, roof, wall studs, lift axles, kick plates and landing gear components including legs, feet, gearing, handles, cross tubes, brackets and bracing
- record service information and inspection findings according to manufacturers' requirements for warranty, and for future reference and tracking

H-34.02 Diagnoses trailer components and accessories

- obtain details of symptoms associated with complaint to establish a starting point for diagnostics
- perform visual inspections to identify worn, damaged or defective components such as king pins, doors, bogie rails, cross members, canvas air chutes, body panels, flooring, roof, wall studs, lift axles, kick plate and landing gear components including legs, feet, gearing, handles, cross tubes, brackets and bracing
- determine faults such as wear, corrosion, overloading, loose fasteners and lack of lubrication
- perform failure analysis to determine root cause of failure
- record test results and inspection findings according to manufacturers' requirements for warranty, and for future reference and tracking

H-34.03 Repairs trailer components and accessories

- replace or repair components and accessories such as king pins, doors, bogie rails, cross members, canvas air chute, body panels, flooring, roof, wall studs, lift axles, kick plate and landing gear components such as legs, feet, gearing, handles, cross tubes, brackets and bracing
- perform adjustments to components such as locks and doors
- rebuild components such as floors, walls, cross members, scuff rails and gear box according to manufacturers' specifications
- verify repair to ensure it is within manufacturers' specifications
- document that repairs and verifications have been performed for warranty, liability, future reference and tracking

H-35 Services, diagnoses and repairs heating and refrigeration systems

H-35.01 Services heating and refrigeration systems

- perform visual inspections to identify worn, damaged or defective components
- lubricate cleaned electrical connections using dielectric grease
- clean electrical connections on starters, alternators and batteries using electrical contact cleaner and terminal brushes
- adjust belt tension with belt tension gauge according to manufacturers' specifications
- perform preventative maintenance checks such as battery load test and checking for water in tank
- drain water from tank and add stabilizer or conditioner according to seasonal requirements
- secure fuel lines using fasteners such as insulated clamps and separators to prevent chafing or kinking of lines

- remove and replace consumable components such as oil, fuel, coolant and related filters according manufacturers' specifications
- recycle and/or dispose of consumable components according to jurisdictional regulations
- record service information and inspection findings according to manufacturers' requirements for warranty, and for future reference and tracking

H-35.02 Diagnoses heating and refrigeration systems

- obtain details of symptoms associated with complaint to establish a starting point for diagnostics
- inspect starting and charging systems for worn, damaged or defective components such as corroded electric connectors and broken or loose belts
- load test battery for proper CCA and operating condition (state of charge)
- test starting and charging system for appropriate voltage and amperage draw using a multimeter and/or ammeter
- interpret diagnostic results to determine next steps such as repairing and replacing starting and charging system components
- perform sensory inspection of fuel lines to detect problems such as loose fittings, and chafed or kinked lines in order to detect leaks
- check operation of fuel delivery system components on heating units such as fuel pumps and gas regulators
- inspect fuel tank condition such as tank expiry date and physical damage
- inspect fuel system mounting hardware for wear and damage such as loose or worn tank straps, cracked mounting brackets and broken fasteners
- interpret diagnostic results to determine next steps such as repairing and replacing fuel system components
- compare test results to manufacturers' specifications or expected values to verify diagnosis
- perform failure analysis to determine root cause of failure
- record test results and inspection findings according to manufacturers' requirements for warranty, and for future reference and tracking

H-35.03 Repair heating and refrigeration systems

- replace defective components such as chafed or kinked fuel lines, starters, alternators, pulleys, idler pulleys, belts and batteries
- remove and reinstall fuel tanks and brackets
- prime fuel system after repair or replacement of components
- operate and adjust refrigeration and heating unit temperature controls depending on load requirements
- adjust belt tension with belt tension gauge according to manufacturers' specifications
- verify repair to ensure it is within manufacturers' specifications
- document that repairs and verifications have been performed for warranty, liability, future reference and tracking

Level Two topics from the NOA that are taught in context:

Scheduled Maintenance

Operational Testing

Planning and Communication

For details regarding the In Context Topic, see page 55

Level Three

8 weeks

240 hours

Alternative Fuels – Theory

10 hours

- describe the ignition process of a spark ignition engine
- describe the fuel delivery process for various fuel types

Alternative Fuels – Shop

20 hours

- perform servicing, diagnoses and replacement of spark ignition components
- perform servicing, diagnosing and replacement of components related to fuel delivery

NOA topics covered in this section of training:

B-8 Services, diagnoses and repairs fuel delivery system

B-8.01 Services fuel delivery system

- clean fuel delivery system components using lint-free rags and solvents
- perform sensory inspections such as smelling or looking for fuel leaks, looking for excessive exhaust smoke and listening for engine miss
- remove and replace consumables according manufacturers' maintenance schedule and specifications
- recycle and/or dispose of consumables according to jurisdictional regulations
- record service information and inspection findings according to
- manufacturers' requirements for warranty, and for future reference and tracking

B-8.02 Diagnoses fuel delivery system

- obtain details of symptoms associated with complaint to establish a starting point for diagnostics
- perform sensory inspections such as smelling and looking for leaks, listening for poor engine performance and looking for excessive exhaust smoke to confirm complaint and establish a preliminary diagnosis
- perform diagnostic procedure by following troubleshooting tree or schematic supplied by manufacturer to determine failure
- perform specialized testing procedures to assess components for wear, damage or defects using manufacturer's recommended tools and equipment, and following jurisdictional safety guidelines
- compare test results to manufacturers' specifications or expected values to verify diagnosis
- perform failure analysis to determine root cause of failure
- record test results and inspection findings according to manufacturers' requirements for warranty, and for future reference and tracking
- interpret fuel system flow schematics

B-8.03 Repairs fuel delivery system

- remove and replace worn, damaged or faulty components such as leaking injectors, worn pumps and plugged lines
- perform updates according to manufacturers' specifications
- perform measurements such as injector height, fuel pressure and pump inlet restriction to determine if they meet manufacturers' specifications
- repair fuel delivery system by replacing or cleaning parts causing the failure and adjusting ECM parameters, according to manufacturers' specifications
- perform adjustment procedures such as setting injector height and setting pump timing according to manufacturers' specifications, to ensure proper operation of component/equipment
- verify repair using methods such as running equipment at operating condition and performing manufacturers' test procedures
- document that repairs and verifications have been performed for warranty, liability, future reference and tracking

Electrical – Theory

14 hours

- explain common electrical components and their applications
- interpret wiring diagrams
- explain common electrical faults

Electrical – Shop

16 hours

- construct electrical circuits
- measure electrical values
- analyze circuit operation

NOA topics covered in this section of training:

D-18 Services, diagnoses and repairs electrical components and accessories

D-18.01 Performs servicing and repair of electrical components and accessories

- clean components such as corroded terminals, sockets and junction boxes
- perform visual inspections to identify worn, damaged or defective components and connections
- identify high voltage electrical systems such as hybrid drive systems requiring specialized training and safety precautions
- interpret wiring schematics to understand system operation
- replace components such as light bulbs, fuses, harnesses and plug-in connectors
- repair components such as faulty wiring, corroded terminals and sockets
- identify and tighten loose connections
- apply anti-corrosion compound
- select and match components such as wires, resistors, fuses, relays and switches to electrical load
- install or replace electrical accessories
- recycle and/or dispose of consumable components such as light ballast and fluorescent lighting according to jurisdictional regulations

D-18.02 Diagnoses electrical components and accessories

- obtain details of symptoms associated with complaint to establish a starting point for diagnostics
- perform visual inspections to identify worn, damaged or defective components and connections
- identify high voltage electrical systems such as hybrid drive systems requiring specialized training and safety precautions
- perform diagnostic procedure by following troubleshooting tree or wiring schematics supplied by manufacturer to determine failure
- perform specialized testing procedures such as measuring voltage, amperage and resistance values in electrical circuits
- compare test results to manufacturers' specifications or expected values to verify diagnosis
- perform failure analysis on accessories to determine root cause of failure
- record test results and inspection findings according to manufacturers' requirements if required for warranty purposes

D-19 Services, diagnoses and repairs vehicle management systems and electronic components

D-19.01 Services vehicle management systems and electronic components

- perform visual inspection to identify component securement, loose and faulty wiring, and other signs of damage such as overheating and exposure to moisture and contaminants
- check for fault codes on vehicle management and electronic systems
- remove power supply and release stored energy by disconnecting power sources and allowing capacitors to discharge in SRS modules

D-19.02 Diagnoses vehicle management systems and electronic components

- obtain details of symptoms associated with complaint to establish a starting point for diagnostics
- perform visual inspection to identify loose and faulty wiring, and other signs of damage such as overheating and exposure to moisture or other contaminants
- check and interpret fault codes using OEM reference material
- perform diagnostic procedure by following troubleshooting tree or schematic supplied by manufacturer to determine failure which may include the use of specialized equipment such as scan tools, multimeters or OEM supplied diagnostic tools
- compare test results to manufacturers' specifications or expected values to verify diagnosis
- perform failure analysis to determine root cause of failure

- record test results and inspection findings according to manufacturers' requirements for warranty purposes
- D-19.03 Repairs vehicle management systems and electronic components
- check and perform software updates following manufacturers' recommended procedures
 - remove power supply and release stored energy by disconnecting power sources and allowing capacitors to discharge in SRS modules
 - replace components such as ECMs, connectors, switches and solenoids
 - repair components such as wiring, connectors and terminals according to manufacturers' specifications
 - adjust components such as actuators, switches and sensors
 - reprogram ECM to accommodate accessories and modifications such as the addition of auxiliary lighting systems
 - verify repair under normal operating conditions to ensure it is within manufacturers' specifications
 - document that repairs and verifications have been performed for warranty, liability, future reference and tracking

Engine and Engine Support Systems – Theory

55 hours

- describe the operational characteristics of a diesel engine
- describe metallurgy and fluid analysis as it pertains to diesel engines
- describe the operational characteristics of various diesel engine support systems
- describe the procedures involved in a diesel engine overhaul
- describe the processes involved in determining component serviceability.
- describe diesel engine failure diagnosis

Engine and Engine Support Systems – Shop

65 hours

- evaluate a diesel engine for potential faults prior to disassembly
- disassemble engine using correct procedures and shop practices
- evaluate engine components for serviceability
- assemble a diesel engine using proper procedures and serviceable components
- evaluate engines after assembly and inspect for potential faults
- evaluate operating engine for faults
- repair defects as required

NOA topics covered in this section of training:

B-4 Services, diagnoses and repairs base engine

B-4.01 Services base engine

- collect oil sample according to sample kit instructions
- visually inspect oil sample for residual contaminants and send sample for analysis according to employer practices and customer request
- visually inspect upper cylinder head for worn, damaged or defective components such as chipped or worn cam lobes, broken valve springs and damaged rocker arms
- adjust clearance of valve train components according to manufacturers' specifications
- record service information and inspection findings according to manufacturers' requirements for warranty, and for future reference and tracking

B-4.02 Diagnoses base engine

- obtain details of symptoms associated with complaint to establish a starting point for diagnostics
- perform sensory inspections such as feeling for vibrations, listening for abnormal sounds and smelling for burning oil to confirm complaint and establish a preliminary diagnosis
- perform diagnostic procedure by following troubleshooting tree or schematic supplied by manufacturer to determine failure

- perform specialized testing procedures such as testing for excessive crankcase pressure to assess components for wear, damage or defects using tools and equipment such as manometers
- interpret oil sample analysis results to determine specific component wear
- compare test results to manufacturers' specifications or expected values to verify diagnosis
- perform failure analysis to determine root cause of failure
- record test results and inspection findings according to manufacturers' requirements for warranty, and for future reference and tracking

B-4.03 Repairs base engine

- remove and replace worn, damaged or faulty components such as worn bearings, worn piston rings, and scored or cavitated liners
- perform updates according to manufacturers' specifications
- rebuild cylinder head by cleaning, replacing worn parts such as valves, seats and springs according to manufacturers' specifications
- rebuild base engine by cleaning, replacing worn or damaged components such as scored or loose liners, cracked block and broken crankshaft
- repair base engine using methods such as replacing parts causing the failure, grinding valves, shimming cylinder liners and using oversized bearings, according to manufacturers' specifications
- perform adjustment procedures such as adjusting valve train clearances to ensure proper operation of component/equipment
- verify repairs using methods such as road testing and dynamometer testing
- document that repairs and verifications have been performed for warranty, liability, future reference and tracking

B-5 Services, diagnoses and repairs lubrication system

B-5.01 Services lubrication system

- clean lubrication system components using lint-free rags and solvents
- perform sensory inspections such as looking for leaks, smelling for burnt oil and checking magnetic drain plug for contamination
- measure oil pressure, temperature and level to determine if they meet manufacturers' specifications
- remove and replace consumables such as oil filter and oil according manufacturers' maintenance schedule and specifications
- recycle and/or dispose of consumables according to jurisdictional regulations
- record service information and inspection findings according to manufacturers' requirements for warranty, and for future reference and tracking

B-5.02 Diagnoses lubrication system

- obtain details of symptoms associated with complaint to establish a starting point for diagnostics
- perform sensory inspections such as listening for engine knock, smelling for burnt oil and looking for leaks to confirm complaint and establish a preliminary diagnosis
- perform diagnostic procedure by following troubleshooting tree or schematic supplied by manufacturer to determine failure
- perform specialized testing procedures such as oil pressure and temperature, pump cavitation and aeration (pseudo cavitation)
- compare test results to manufacturers' specifications or expected values to verify diagnosis
- perform failure analysis to determine root cause of failure
- record test results and inspection findings according to manufacturers' requirements for warranty, and for future reference and tracking

B-5.03 Repairs lubrication system

- remove and replace worn, damaged or faulty components such as defective pumps, faulty oil thermostats and broken or plugged piston cooling nozzles
- verify repair by using methods such as checking oil pressure and temperature while running engine at operating condition

- document that repairs and verifications have been performed for warranty, liability, future reference and tracking

B-6 Services, diagnoses and repairs intake and exhaust system

B-6.01 Services intake and exhaust systems

- clean intake components
- perform sensory inspections of intake and exhaust systems to identify worn, damaged or defective components such as looking for soot deposits indicating leaks, listening for air escaping and looking for incorrect fit or installation of piping
- remove and replace consumables according to manufacturers' specifications and maintenance schedule
- recycle and/or dispose of consumables according to jurisdictional regulations
- record service information and inspection findings according to
- manufacturers' requirements for warranty, and for future reference and tracking

B-6.02 Diagnoses intake and exhaust systems

- obtain details of symptoms associated with complaint to establish a starting point for diagnostics
- perform sensory inspections to confirm complaint and establish a preliminary diagnosis
- perform diagnostic procedure by following troubleshooting tree or schematic supplied by manufacturer to determine failure
- perform specialized testing procedures on exhaust system such as turbocharger actuator test and CAC pressure drop test to assess components for wear, damage or defects
- perform specialized testing procedures on exhaust system such as back pressure exhaust test to assess components for wear, damage or defects
- compare test results to manufacturers' specifications or expected values to verify diagnosis
- perform failure analysis to determine root cause of failure
- record test results and inspection findings according to manufacturers' requirements for warranty, and for future reference and tracking

B-6.03 Repairs intake and exhaust systems

- remove and replace worn, damaged or faulty components such as cracked intake manifold or CAC, corroded piping and damaged turbocharger seals
- remove and replace worn, damaged or faulty starting aid components
- use welding and cutting equipment to repair piping, remove broken fasteners, and cut and weld intake and exhaust piping
- perform adjustment procedures such as calibrating turbocharger actuator to ensure proper operation of component/equipment
- verify repairs using methods such as pressure testing intake system and performing sensory observations of exhaust system
- document that repairs and verifications have been performed for warranty, liability, future reference and tracking

B-7 Services, diagnoses and repairs engine management system

B-7.01 Services engine management system

- adjust ECM parameters such as shutdowns, cruise controls and fan controls
- perform engine management system software updates
- download engine management system logged data

B-7.02 Diagnoses engine management system

- obtain details of symptoms associated with complaint to establish a starting point for diagnostics
- perform sensory inspections to confirm complaint and establish a preliminary diagnosis
- perform diagnostic procedure by following troubleshooting tree or schematic supplied by manufacturer to determine failure
- perform specialized testing procedures such as fault code retrieval, resistance test, voltage drop test and commanded actuator test using tools and equipment such as computers, multimeters, pin-out equipment and break-out harnesses
- compare test results to manufacturers' specifications or expected values to verify diagnosis

- perform failure analysis to determine root cause of failure
- record test results and inspection findings according to manufacturers' requirements for warranty, and for future reference and tracking

B-7.03 Repairs engine management system

- remove and replace damaged or faulty components such as faulty ECMs, chaffed harnesses and open/shorted sensors or actuators
- perform updates according to manufacturers' specifications
- repair components such as harnesses and connections by soldering, splicing and crimping, according to manufacturers' specifications
- calibrate engine management components such as injectors, turbochargers and speed control sensors
- verify repair by using methods such as verifying that fault codes remain inactive and performing operational tests
- document that repairs and verifications have been performed for warranty, liability, future reference and tracking

B-8 Services, diagnoses and repairs fuel delivery system

B-8.01 Services fuel delivery system

- clean fuel delivery system components using lint-free rags and solvents
- perform sensory inspections such as smelling or looking for fuel leaks, looking for excessive exhaust smoke and listening for engine miss
- remove and replace consumables according manufacturers' maintenance schedule and specifications
- recycle and/or dispose of consumables according to jurisdictional regulations
- record service information and inspection findings according to manufacturers' requirements for warranty, and for future reference and tracking

B-8.02 Diagnoses fuel delivery system

- obtain details of symptoms associated with complaint to establish a starting point for diagnostics
- perform sensory inspections such as smelling and looking for leaks, listening for poor engine performance and looking for excessive exhaust smoke to confirm complaint and establish a preliminary diagnosis
- perform diagnostic procedure by following troubleshooting tree or schematic supplied by manufacturer to determine failure
- perform specialized testing procedures to assess components for wear, damage or defects using manufacturer's recommended tools and equipment, and following jurisdictional safety guidelines
- compare test results to manufacturers' specifications or expected values to verify diagnosis
- perform failure analysis to determine root cause of failure
- record test results and inspection findings according to manufacturers' requirements for warranty, and for future reference and tracking
- interpret fuel system flow schematics

B-8.03 Repairs fuel delivery system

- remove and replace worn, damaged or faulty components such as leaking injectors, worn pumps and plugged lines
- perform updates according to manufacturers' specifications
- perform measurements such as injector height, fuel pressure and pump inlet restriction to determine if they meet manufacturers' specifications
- repair fuel delivery system by replacing or cleaning parts causing the failure and adjusting ECM parameters, according to manufacturers' specifications
- perform adjustment procedures such as setting injector height and setting pump timing according to manufacturers' specifications, to ensure proper operation of component/equipment
- verify repair using methods such as running equipment at operating condition and performing manufacturers' test procedures

- document that repairs and verifications have been performed for warranty, liability, future reference and tracking

B-9 Services, diagnoses and repairs emission systems for diesel engines

B-9.01 Services emission systems for diesel engines

- clean emission system components such as DPF and fluid dosing nozzles
- perform sensory inspections of emission systems such looking for leaks, observing DEF levels and looking for accumulation of urea crystals
- perform software updates according to manufacturers' recommendations
- remove and replace consumables and components according to manufacturers' specifications and maintenance schedule
- recycle and/or dispose of consumables and components according to jurisdictional regulations
- record service information and inspection findings according to manufacturers' requirements for warranty, and for future reference and tracking

B-9.02 Diagnoses emission systems for diesel engines

- obtain details of symptoms associated with complaint to establish a starting point for diagnostics
- perform sensory inspections to confirm complaints and establish a preliminary diagnosis
- perform diagnostic procedure by following troubleshooting tree or schematic supplied by manufacturer to determine failure
- perform specialized testing procedures such as computer-based testing to assess components for wear, damage or defects
- compare test results to manufacturers' specifications or expected values to verify diagnosis
- perform failure analysis to determine root cause of failure
- record test results and inspection findings according to manufacturers' requirements for warranty, and for future reference and tracking

B-9.03 Repairs emission systems for diesel engines

- release stored energy using any means necessary without releasing fluid from system
- remove and replace worn, damaged or faulty components such DPF, EGR, cooler and piping, and leaking dosing nozzles
- perform computer-based updates according to manufacturers' recommendations
- reprogram parameters after repair according to manufacturers' recommendations
- verify repair by using methods such as operating vehicle, parked regeneration and monitoring operation
- document that repairs and verifications have been performed for warranty, liability, future reference and tracking

B-10 Services, diagnoses and repairs engine retarder systems

B-10.01 Services and repairs engine retarder systems

- remove and replace worn, damaged or faulty components such as open/shorted solenoids, damaged O-rings and stuck exhaust valves
- perform ECM software updates according to manufacturers' specifications
- repair components such as damaged harnesses, exhaust valves and slave pistons according to manufacturers' specifications
- perform adjustment procedures such as valve clearances and parameters for operator preferences to ensure proper operation of component/equipment
- verify repair using methods such as road testing and function testing
- document that repairs and verifications have been performed for warranty, liability, future reference and tracking

B-10.02 Diagnoses engine retarder systems

- obtain details of symptoms associated with complaint to establish a starting point for diagnostics
- perform sensory inspections to confirm complaint and establish a preliminary diagnosis
- perform diagnostic procedure by following troubleshooting tree or schematic supplied by manufacturer to determine failure

- perform specialized testing procedures such as pressure tests, electrical resistance tests and commanded operational tests to assess components for wear, damage or defects
- compare test results to manufacturers' specifications or expected values to verify diagnosis
- perform failure analysis to determine root cause of failure
- record test results and inspection findings according to manufacturers' requirements for warranty, and for future reference and tracking

B-11 Services, diagnoses and repairs cooling system

B-11.01 Services cooling system

- flush cooling system according to manufacturers' specifications and maintenance schedule
- visually inspect cooling system to identify problems such as improper speed of fan hub, cracked or missing fan blades, plugged radiators, damaged hoses, contamination in coolant, low coolant level and white exhaust
- adjust belt tension to manufacturers' specifications
- measure coolant pH, sulphate and chloride levels to determine if they meet manufacturers' specifications based on type of coolant
- test freezing point of coolant using refractometers, test strips and hydrometers
- release stored energy such as heat and pressure by allowing system to cool
- remove and replace consumables such as coolant filter and coolant according to manufacturers' maintenance schedule and specifications
- recycle and/or dispose of consumables according to jurisdictional regulations
- record service information and inspection findings according to manufacturers' requirements for warranty, and for future reference and tracking

B-11.02 Diagnoses cooling system

- obtain details of symptoms associated with complaint to establish a starting point for diagnostics
- perform sensory inspections such as looking for leaks, cracked hoses, smelling for coolant, feeling hoses for pliability and integrity, to confirm complaint and establish a preliminary diagnosis
- perform diagnostic procedure by following troubleshooting tree or schematic supplied by manufacturer to determine failure
- perform specialized testing procedures to assess system function such as correct operation of thermostat, water pump and fan hub using manufacturer's recommended tools and equipment, and following jurisdictional safety guidelines
- pressure test radiator cap to rated pressure according to manufacturers' specifications to ensure its proper operation
- compare test results to manufacturers' specifications or expected values to verify diagnosis
- perform failure analysis to determine root cause of failure
- record test results and inspection findings according to manufacturers' requirements for warranty, and for future reference and tracking

B-11.03 Repairs cooling system

- remove and replace worn, damaged or faulty components such as defective thermostats, worn pumps and degraded hoses
- rebuild components such as fan hubs by replacing parts according to manufacturers' rebuild procedures
- adjust belt tension to ensure proper operation of fan and water pump
- verify repair by using methods such as road testing and pressure testing
- document that repairs and verifications have been performed for warranty, liability, future reference and tracking

Powertrain Systems – Theory

24 hours

- describe operating principles of a manual transmission
- describe operating principles of an automatic transmission

Powertrain Systems – Shop

36 hours

- evaluate manual transmissions
- evaluate automatic transmissions
- repair defects

NOA topics covered in this section of training:

E-20 Services, diagnoses and repairs clutches

E-20.01 Services clutches

- lubricate cross shafts, linkages and release bearings
- adjust clutch and linkages to obtain manufacturer's tolerance between release bearing and clutch brake
- inspect master and slave cylinders for leaks and damage
- inspect and adjust cables, linkages and clutch brakes to ensure efficient operation

E-20.02 Diagnoses clutches

- obtain details of symptoms associated with complaint to establish a starting point for diagnostics
- perform sensory inspections such as pedal feel and observing burnt clutch material, and worn or broken components to confirm complaint and establish a preliminary diagnosis
- inspect master and slave cylinder for leaks and damage
- use diagnostic tools such as feeler gauges, spring gauges and other measuring devices
- compare results to manufacturers' specifications or expected values to verify diagnosis
- perform failure analysis to determine root cause of failure

E-20.03 Repairs clutches

- remove and replace worn, damaged or faulty components such as linkages, cross shafts, bushings, clutch brakes, clutch and pressure plate
- ensure flywheels reconditioned according to manufacturers' specifications
- ensure proper alignment of discs and pressure plates
- adjust clutch and linkages to obtain manufacturer's tolerance between release bearing and clutch brake
- bleed air from master and slave cylinders
- verify repair using methods such as road testing and sensory observations
- document that repairs and verifications have been performed for warranty, liability, future reference and tracking

E-21 Services, diagnoses and repairs manual transmissions and transfer cases

E-21.01 Services manual transmissions and transfer cases

- clean components such as breathers and transmission cases for inspection
- remove and replace oil according manufacturers' specifications and employer maintenance schedule
- inspect slave cylinders, range valves, air lines and seals for leakage
- record service information and inspection findings according to manufacturers' requirements for warranty, and for future reference and tracking

E-21.02 Diagnoses manual transmissions and transfer cases

- obtain details of symptoms associated with complaint to establish a starting point for diagnostics
- perform diagnostic procedure by following troubleshooting tree or schematic supplied by manufacturer to confirm complaint
- compare test results to manufacturers' specifications or expected values in order to assess components for wear, damage or defects
- perform failure analysis to determine root cause of failure
- record test results and inspection findings according to manufacturers' requirements for warranty, and for future reference and tracking

E-21.03 Repairs manual transmissions and transfer cases

- remove and replace worn, damaged or faulty components such as slave cylinders, range valves, lines, cases, seals, gears and synchronizers
-

- rebuild components such as transmissions and transfer cases by replacing worn or broken parts according to manufacturers' specifications
- repair or replace components such as synchronizers, bearings, main shafts, and counter shafts according to manufacturers' specifications
- time gears and adjust bearing pre-loads to ensure proper operation of component/equipment
- install power take-offs (PTOs) and ensure gear backlash is adjusted according to manufacturers' specifications
- verify repair using methods such as road testing or sensory observations
- document that repairs and verifications have been performed for warranty, liability, future reference and tracking

E-22 Services, diagnoses and repairs automatic transmissions

E-22.01 Services automatic transmissions

- perform sensory inspections of components to identify leaks
- check and perform software updates following manufacturers' recommended procedures
- remove and replace consumable components such as oil and filters according to manufacturers' specifications and employer maintenance schedule
- recycle and/or dispose of consumable components according to jurisdictional regulations

E-22.02 Diagnoses automatic transmissions

- obtain details of symptoms associated with complaint to establish a starting point for diagnostics
- check for external leaks and oil condition
- perform diagnostic procedure by following troubleshooting tree or schematic supplied by manufacturer to determine failure
- perform road test to assess components for wear, damage or defects using diagnostic tools such as pressure gauges, computers or other specialized equipment provided by the manufacturer
- interpret fault codes and test results to ensure operation is within manufacturers' specifications
- record test results and inspection findings according to manufacturers' requirements for warranty

E-22.03 Repairs automatic transmissions

- remove and replace worn, damaged or faulty components such as solenoids, valves, sensors, hoses, lines and wiring harnesses
- confirm most current version of software is installed in the ECM
- rebuild transmission to manufacturers' specifications
- repair transmission by replacing internal components (torque converters, pumps and valve bodies) and external components (oil coolers) according to manufacturers' specifications
- ensure road test is performed to verify repair operates to manufacturers' specifications
- document that repairs and verifications have been performed for warranty, liability, future reference and tracking

E-23 Services, diagnoses and repairs automated transmissions

E-23.01 Services automated transmissions

- perform sensory inspections of components to identify leaks, breaks and excessive wear
- check and perform software updates following manufacturers' recommended procedures
- replace oil according manufacturers' specifications and maintenance schedule
- recycle and/or dispose of consumable components according to jurisdictional regulations

E-23.02 Diagnoses automated transmissions

- obtain details of symptoms associated with complaint to establish a starting point for diagnostics
- perform sensory inspections such as checking for leaks and completing a road test to confirm complaint and establish a preliminary diagnosis
- perform diagnostic procedure by following troubleshooting tree or schematic supplied by manufacturer to determine failure
- ensure specialized tests are performed using diagnostic tools including computers or other specialized equipment provided by the manufacturer

- compare test results to manufacturers' specifications or expected values to verify diagnosis
- interpret and record test results according to manufacturers' requirements for warranty, and for future reference and tracking

E-23.03 Repairs automated transmissions

- remove and replace worn, damaged or faulty components such as valves, sensors, hoses, lines, actuators, ECMs, gaskets and wiring harnesses
- confirm most current version of software is installed in the ECM
- rebuild transmission to manufacturers' specifications
- repair components such as wiring harnesses and connectors
- ensure road test is completed to verify repair operates to manufacturers' specifications
- document that repairs and verifications have been performed for warranty, liability, future reference and tracking

E-24 Services, diagnoses and repairs driveline systems

E-24.01 Services driveline systems

- perform sensory inspections of yokes, u-joints, mounting hardware and steady bearings to identify worn, damaged, loose or defective components
- lubricate serviceable u-joints and slip-joints

E-24.02 Diagnoses driveline systems

- obtain details of symptoms associated with complaint to establish a starting point for diagnostics
- inspect u-joints, slip-joints and steady bearings to establish a preliminary diagnosis
- check driveshaft for correct phasing and orientation
- perform specialized testing procedures to determine cause of complaint or failure using diagnostic equipment such as vibration analyzer, angle gauges and computers
- confirm proper driveline alignment by checking ride height and driveline angles
- compare test results to manufacturers' specifications or expected values to verify diagnosis

E-24.03 Repairs driveline systems

- remove and replace worn, damaged or faulty components such as u-joints, steady bearings and slip joints
- perform adjustment procedures such as phasing, balancing and driveline angle adjustment to ensure proper operation
- lubricate u-joints and slip joints according to manufacturers' specifications
- verify repair by ensuring a road test is performed

E-25 Services, diagnoses and repairs differentials

E-25.01 Services differentials

- clean components such as breathers and vents
- check oil level and visually inspect oil condition during scheduled maintenance
- replace oil and filters according to manufacturers' specifications
- inspect seals and gaskets for leaks
- service bearings and planetary gear sets according to manufacturers' specifications
- recycle and/or dispose of oil and filter according to jurisdictional regulations

E-25.02 Diagnoses differentials

- obtain details of symptoms associated with complaint to establish a starting point for diagnostics
- check oil level and condition
- inspect components such as fork, bearings, crown and pinion gears for incorrect backlash, wear or incorrect pre-load
- ensure road test is performed to confirm complaint
- perform diagnostic procedure by following troubleshooting tree or schematic supplied by manufacturer to determine failure

E-25.02 Repairs differentials

- remove and replace worn, damaged or faulty components such as seals, gaskets, bearings and outboard planetary gear sets

- clean components such as vents, housings, gasket surfaces, gears and hubs to remove debris and contaminants
- repair components such as housings and spindle threads
- perform overhaul procedures such as setting and adjusting preload and backlash, and checking and adjusting crown and pinion gear tooth pattern
- verify repair using methods such as marking paste, dial indicators and weight scale
- adjust wheel bearings according to manufacturers' specifications
- refill housing using lubricant according to manufacturers' specifications
- ensure road test is performed to confirm repairs
- document that repairs and verifications have been performed for warranty, liability, future reference and tracking

E-26 Services, diagnoses and repairs drive train retarders

E-26.01 Services drive train retarders

- check for fluid leaks, secure component mountings, and damaged or corroded wiring
- update software
- replace oil and filter according to manufacturers' specifications and maintenance schedule
- recycle and/or dispose of consumable components according to jurisdictional regulations

E-26.02 Diagnoses drive train retarders

- obtain details of symptoms associated with complaint to establish a starting point for diagnostics
- check for external leaks and loose, broken, damaged or corroded wiring
- perform diagnostic procedure by following troubleshooting tree or schematic supplied by manufacturer to determine failure
- ensure road test is performed to assess components for wear, damage or defects using diagnostic tools such as pressure gauges, computers,
- multimeters or other specialized equipment provided by the manufacturer
- interpret fault codes and test results to ensure operation is within manufacturers' specifications
- record test results and inspection findings according to manufacturers' requirements for warranty

E-26.03 Repairs drive train retarders

- remove and replace worn, damaged or faulty components such as solenoids, valves, sensors, pressure switches, potentiometers, lines, wiring and connectors
- confirm most current version of software is installed in the ECM
- rebuild transmission to manufacturers' specifications
- repair driveline retarder components to manufacturers' specifications
- remove and replace internal transmission components such as torque converters, pumps, clutch pack assemblies and valve bodies according to manufacturers' specifications
- ensure road test is performed to verify repairs meet manufacturers' specifications
- document that repairs and verifications have been performed for warranty, liability, future reference and tracking

Level Three topics from the NOA that are taught in context:

Scheduled Maintenance

Operational Testing

Planning and Communication

For details regarding the In Context Topic, see page 55

Level Four	8 weeks	240 hours
Diesel Fuel Systems – Theory		60 hours
<ul style="list-style-type: none"> operating principles of common diesel fuel injection systems fuel and support system maintenance 		
Diesel Fuel Systems – Shop		30 hours
<ul style="list-style-type: none"> diesel engine troubleshooting, system failure and analysis 		
Electrical and Electronics – Theory		60 hours
<ul style="list-style-type: none"> review of electrical fundamentals, charging and starting systems fundamentals of semi-conductors, diode types and operation monitoring and alarm systems and automatic shut-down devices electrical circuit types, identification and labeling electrical accessories computer and electronically controlled systems 		
Electrical and Electronics – Shop		30 hours
<ul style="list-style-type: none"> troubleshooting electrical systems communication between computers and computer components analog/digital signals, voltage and input measurements 		
Fuel Ignition Systems and Auxiliary Equipment – Theory		40 hours
<ul style="list-style-type: none"> theory of diagnosis and repair of gasoline engines inspection, servicing, and repair of gasoline conventional electronic and computer controlled ignition systems 		
Fuel Ignition Systems and Auxiliary Equipment – Shop		20 hours
<ul style="list-style-type: none"> diagnosis and repair of gasoline fuel delivery and injection systems inspection, testing and repair of gasoline emission control systems engine/cab heater systems generator sets alternate fuel and hybrid 		

In Context Topics

In context means learning that has already taken place and is being applied to the applicable task. Learning outcomes for in context topics are accomplished in other topics in that level.

Scheduled Maintenance

A-3 Performs routine trade activities

A-3.01 Uses documentation and reference materials

- locate information on vehicle such as vehicle identification numbers (VIN) and component serial numbers
- locate and reference most recent original equipment manufacturer (OEM) manuals, service bulletins and support documentation (paper or electronic) for diagnostic, servicing and repair procedures
- interpret shop service and parts manuals, troubleshooting trees, schematics, technical drawings and regulations
- complete service records, motor vehicle inspections and warranty forms according to manufacturers' requirements and jurisdictional regulations
- use diagnostic equipment to test fluid properties such as coolant strength, oil pour point and temperature
- create parts lists according to repair required
- match replacement part to original part

A-3.02 Maintains fluids, lubricants and coolants

- verify fluid levels such as engine, transmission, differentials and hydraulic using tools and equipment such as dip sticks and sight glass to ensure fluid is within operating range
- select types and grades of fluids and lubricants according to manufacturers' specifications
- select types of coolants and additives according to manufacturers' specifications
- verify coolant has been mixed properly using tools and equipment such as refractometers and test strips
- store fluids, lubricants and coolants according to regulations
- take fluid samples according to instructions
- interpret fluid sample results to indicate issues such as contamination, abnormal wear or signs of premature failure

A-3.03 Services hoses, tubing and fittings

- relieve pressure from air and fluid systems before disconnecting hoses, tubing and fittings
- identify and replace hoses and tubing according to the application such as size and pressure limits
- identify and replace fittings and clamping devices according to the application such as thread and fitting size compatibility
- construct hose/tube assemblies using tools and equipment such as crimping tools and tube flaring tools

A-3.04 Services filters

- relieve system pressure before removing filters
- remove filters using appropriate tool for the application
- identify performance issues and symptoms related to plugged filters to determine if replacement of filter is required
- select and install filters according to manufacturers' specifications
- dispose of filters according to jurisdictional regulations

A-3.05 Services bearings, bushings and seals

- inspect bearings and bushings for defects such as pitting, scoring, discolouration and excessive wear
- inspect seals and sealing surfaces for damage
- lubricate and install bearings and bushings to the allowable tolerances according to application

- install seals according to manufacturers' specifications
 - adjust bearing according to manufacturers' specifications
- A-3.06 Uses fasteners, sealing devices, adhesives and gaskets
- select and install fasteners for the application according to type, grade, thread pitch and size
 - select and apply sealing devices such as weather-stripping and window channel, aerobic and anaerobic sealants, gaskets, and adhesives for the application
 - verify quality product selected such as OEM item
 - remove broken fasteners while minimizing damage to threads
 - repair threads using tools such as taps, dies, chasers and thread inserts
 - remove sealants, gaskets and adhesives while minimizing damage to sealing surface
 - fabricate gaskets for application

Operational Testing

In context with learning. No specific Sub-tasks with direct relation to or listed for *Operational Testing* in the harmonized curriculum.

Planning and Communication

In context with learning. No specific Sub-tasks with direct relation to or listed for *Planning and Communication* in the harmonized curriculum.

Electrical

In context with learning. Levels One and Three and Trade Specific Level (Two) as required.

APPENDIX A: POST HARMONIZATION TRAINING PROFILE CHART

This chart which outlines the finalized model for SATCC technical training sequencing with a cross reference to the Harmonized apprenticeship technical training sequencing, at the topic level.

Implementation for harmonization will take place progressively. Level one to be implemented in 2017/2018, level two 2018/2019, level three 2019/2020, and level four in 2020/2021.

SATCC Level One	Transcript Code	Hours	Pan-Canadian Harmonized Level One
<i>*in context</i>	<i>*in context</i>		* Scheduled Maintenance
			* Operational Testing
			* Planning and Communication
Basic Tools	TOOL 145 – Theory	12	Safety
	TOOL 146 – Shop	12	Tools and Equipment
Brake Systems	BRAK 111 – Theory	24	Brakes <ul style="list-style-type: none"> • Service • Basic Diagnostics and Repair
	BRAK 112 – Shop	36	Pneumatics <ul style="list-style-type: none"> • Basic Service, Introduction to Diagnostic Tools
Electrical	ELCT 100 – Theory	14	Electrical 1 <ul style="list-style-type: none"> • Basic Service, Introduction to Diagnostics
	ELCT 101 – Shop	16	
Environmental Control Systems	HVAC 100	6	Heating Ventilation and Air Conditioning <ul style="list-style-type: none"> • Safety and Awareness
Hydraulics	HYDR 108 – Theory	24	Hydraulic Systems <ul style="list-style-type: none"> • Basic Service, Introduction to Diagnostic Tools
	HYDR 109 – Shop	36	
Steering Systems	STER 100 – Theory	12	Frames, Steering and Suspension <ul style="list-style-type: none"> • Basic Service, Introduction to Diagnostics
	STER 101 – Shop	18	
Structural Components and Accessories	MAIN 100 – Theory	12	Structural Components <ul style="list-style-type: none"> • Service • Basic Structural Components
	MAIN 101 – Shop	18	Hoisting and Lifting
		240	

SATCC Level Two	Transcript Code	Hours	Pan-Canadian Harmonized Level Two
<i>*in context</i>	<i>*in context</i>		* Scheduled Maintenance
			* Operational Testing
			* Planning and Communication
Braking Systems ABS	BRAK 206 – Theory	14	Brakes – Advanced <ul style="list-style-type: none"> • Diagnose and Repair
	BRAK 207 – Shop	16	
Drivetrain Systems	DRTR 201 – Theory	24	* (EXCEED) – <i>Content covered in this course is reviewed in TRNM 3XX – POWERSHIFT TRANSMISSIONS Level 3</i>
	DRTR 202 – Shop	36	
Electrical	ELCT 202 – Theory	12	* Electrical

	ELCT 203 – Shop	18	
Hydraulics	HYDR 206 – Theory	30	Hydraulics, Hydrostatics and Pneumatics • Diagnose and Repair
	HYDR 207 – Shop	30	
Steering and Directional Control Systems	STER 204 – Theory	12	Frames, Steering and Suspension • Diagnose and Repair
	STER 205 – Shop	18	
Truck and Trailer Systems	TRLR 200 – Theory	12	Structural Components and Accessories • Diagnose and Repair Working Attachments
	TRLR 201 – Shop	18	Trailer
		240	

SATCC Level Three	Transcript Code	Hours	Pan-Canadian Harmonized Level Three
<i>*in context</i>	<i>*in context</i>		* Scheduled Maintenance
			* Operational Testing
			* Planning and Communication
Alternative Fuels	FUEL 304 – Theory	10	Alternate Fuel Systems
	FUEL 305 – Shop	20	
Electrical	ELCT 301 – Theory	14	Electrical 2 • Diagnose and Repair • Starting and Charging Systems
	ELCT 302 – Shop	16	
Engine and Engine Support Systems	ENGN 306 – Theory	55	Engines and Engine Support Systems
	ENGN 307 – Shop	65	
Powertrain Systems	TRNM 308 – Theory	24	Drivetrain (Power Train)
	TRNM 309 – Shop	36	Hydraulics (Exceed)
		240	

SATCC Level Four	Transcript Code	Hours	Pan-Canadian Harmonized Level Four
<i>*in context</i>	<i>*in context</i>		* Scheduled Maintenance
			* Operational Testing
			* Planning and Communication
			* Electrical
Drivetrains	TBD	12	Drivetrain (Power Train)
	TBD	18	
Electrical	TBD	40	* Electrical
	TBD	50	
Environmental Control Systems	TBD	12	Heating, Ventilation and Air Conditioning
	TBD	18	• Environmental Controls
Fuel Systems	TBD	40	Engine and Engine Support Systems
	TBD	50	
		240	

Exceed Topics

Throughout this guide to course content there are topics which exceed the minimum scope of work as set out in the Truck and Transport Mechanic NOA. Industry in Saskatchewan has deemed certain topics to fall within the scope of work of the Truck and Transport Mechanic trade in Saskatchewan and therefore require technical training to cover these topics.