

# **Truck and Transport Mechanic**

**2010**

Trades and Apprenticeship Division

Division des métiers et de l'apprentissage

Workplace Partnerships Directorate

Direction des partenariats en milieu de travail

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*The Canadian Council of Directors of Apprenticeship (CCDA) recognizes this National Occupational Analysis as the national standard for the occupation of Truck and Transport Mechanic.*

## **Background**

The first National Conference on Apprenticeship in Trades and Industries, held in Ottawa in 1952, recommended that the federal government be requested to cooperate with provincial and territorial apprenticeship committees and officials in preparing analyses of a number of skilled occupations. To this end, Human Resources and Skills Development Canada (HRSDC) sponsors a program, under the guidance of the CCDA, to develop a series of National Occupational Analyses (NOA).

The NOAs have the following objectives:

- to describe and group the tasks performed by skilled workers;
- to identify which tasks are performed in every province and territory;
- to develop instruments for use in the preparation of Interprovincial Red Seal Examinations and curricula for training leading to the certification of skilled workers;
- to facilitate the mobility of apprentices and skilled workers in Canada; and,
- to supply employers, employees, associations, industries, training institutions and governments with analyses of occupations.



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## **ACKNOWLEDGEMENTS**

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This analysis was prepared by the Workplace Partnerships Directorate of HRSDC. The coordinating, facilitating and processing of this analysis were undertaken by employees of the NOA development team of the Trades and Apprenticeship Division.

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## LIST OF PUBLISHED NATIONAL OCCUPATIONAL ANALYSES (Red Seal Trades)

TITLE	NOC* Code
Agricultural Equipment Technician (2007)	7312
Appliance Service Technician (2005)	7332
Automotive Painter (2009)	7322
Automotive Service Technician (2009)	7321
Baker (2006)	6252
Boilermaker (2008)	7262
Bricklayer (2007)	7281
Cabinetmaker (2007)	7272
Carpenter (2010)	7271
Concrete Finisher (2006)	7282
Construction Craft Worker (2009)	7611
Construction Electrician (2008)	7241
Cook (2008)	6242
Electrical Rewind Mechanic (1999)	7333
Electronics Technician – Consumer Products (1997)	2242
Floorcovering Installer (2005)	7295
Glazier (2008)	7292
Hairstylist (2009)	6271
Heavy Duty Equipment Technician (2009)	7312
Industrial Electrician (2008)	7242
Industrial Mechanic (Millwright) (2009)	7311
Instrumentation and Control Technician (2010)	2243
Insulator (Heat and Frost) (2007)	7293
Ironworker (Generalist) (2006)	7264
Ironworker (Reinforcing) (2006)	7264
Ironworker (Structural/Ornamental) (2006)	7264
Landscape Horticulturist (2010)	2225

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\* National Occupational Classification

<b>TITLE</b>	<b>NOC* Code</b>
Lather (Interior Systems Mechanic) (2007)	7284
Machinist (2010)	7231
Metal Fabricator (Fitter) (2008)	7263
Mobile Crane Operator (2009)	7371
Motorcycle Mechanic (2006)	7334
Motor Vehicle Body Repairer (Metal and Paint) (2010)	7322
Oil Burner Mechanic (2006)	7331
Painter and Decorator (2007)	7294
Partsperson (2010)	1472
Plumber (2008)	7251
Powerline Technician (2009)	7244
Recreation Vehicle Service Technician (2006)	7383
Refrigeration and Air Conditioning Mechanic (2009)	7313
Rig Technician (2008)	8232
Roofer (2006)	7291
Sheet Metal Worker (2010)	7261
Sprinkler System Installer (2009)	7252
Steamfitter – Pipefitter (2008)	7252
Tilesetter (2004)	7283
Tool and Die Maker (2005)	7232
Transport Trailer Technician (2008)	7321
Truck and Transport Mechanic (2010)	7321
Welder (2009)	7265

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## STRUCTURE OF ANALYSIS

To facilitate understanding of the occupation, the work performed by tradespersons is divided into the following categories:

<b>Blocks</b>	the largest division within the analysis that is comprised of a distinct set of trade activities
<b>Tasks</b>	distinct actions that describe the activities within a block
<b>Sub-Tasks</b>	distinct actions that describe the activities within a task
<b>Supporting Knowledge and Abilities</b>	the elements of skill and knowledge that an individual must acquire to adequately perform the sub-task

The analysis also provides the following information:

<b>Trends</b>	changes identified that impact or will impact the trade including work practices, technological advances, and new materials and equipment
<b>Context</b>	statements written to clarify the intent and meaning of tasks
<b>Related Components</b>	a list of products, items, materials and other elements relevant to the block
<b>Tools and Equipment</b>	categories of tools and equipment used to perform all tasks in the block; these tools and equipment are listed in Appendix A

The appendices located at the end of the analysis are described as follows:

<b>Appendix A – Tools and Equipment</b>	a non-exhaustive list of tools and equipment used in this trade.
<b>Appendix B – Glossary</b>	definitions or explanations for terms used in this analysis.
<b>Appendix C – Acronyms</b>	a list of acronyms used in this analysis with their full name.
<b>Appendix D – Block and Task Weighting</b>	the number of questions assigned to each block and task.
<b>Appendix E – Pie Chart</b>	a graph which depicts the number of questions assigned to blocks.
<b>Appendix F – Task Profile Chart</b>	a chart which outlines graphically the blocks, tasks and sub-tasks of this analysis.

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# DEVELOPMENT AND VALIDATION OF ANALYSIS

## Development of Analysis

A draft analysis is developed by a committee of industry experts in the field led by a team of facilitators from HRSDC. This draft analysis breaks down all the tasks performed in the occupation and describes the knowledge and abilities required for a tradesperson to demonstrate competence in the trade.

## Draft Review

The NOA development team then forwards a copy of the analysis and its translation to provincial and territorial authorities for a review of its content and structure. Their recommendations are assessed and incorporated into the analysis.

## Validation and Weighting

The analysis is sent to all provinces and territories for validation and weighting. Participating jurisdictions consult with industry to validate and weight the document, examining the blocks, tasks and sub-tasks of the analysis as follows:

- BLOCKS** Each jurisdiction assigns a percentage of questions to each block for an examination that would cover the entire trade.
- TASKS** Each jurisdiction assigns a percentage of exam questions to each task within a block.
- SUB-TASKS** Each jurisdiction indicates, with a YES or NO, whether or not each sub-task is performed by skilled workers within the occupation in its jurisdiction.

The results of this exercise are submitted to the NOA development team who then analyzes the data and incorporates it into the document. The NOA provides the individual jurisdictional validation results as well as the national averages of all responses. The national averages for block and task weighting guide the Interprovincial Red Seal Examination plan for the trade.

This method for the validation of the NOA also identifies common core sub-tasks across Canada for the occupation. If at least 70% of the responding jurisdictions perform a sub-task, it shall be considered common core. Interprovincial Red Seal Examinations are based on the common core sub-tasks identified through this validation process.

## Definitions for Validation and Weighting

YES	sub-task performed by qualified workers in the occupation in a specific jurisdiction
NO	sub-task not performed by qualified workers in the occupation in a specific jurisdiction
NV	analysis <u>N</u> ot <u>V</u> alidated by a province/territory
ND	trade <u>N</u> ot <u>D</u> esignated in a province/territory
NOT COMMON CORE (NCC)	sub-task, task or block performed by less than 70% of responding jurisdictions; these will not be tested by the Interprovincial Red Seal Examination for the trade
NATIONAL AVERAGES %	average percentage of questions assigned to each block and task in Interprovincial Red Seal Examination for the trade

## Provincial/Territorial Abbreviations

NL	Newfoundland and Labrador
NS	Nova Scotia
PE	Prince Edward Island
NB	New Brunswick
QC	Quebec
ON	Ontario
MB	Manitoba
SK	Saskatchewan
AB	Alberta
BC	British Columbia
NT	Northwest Territories
YT	Yukon Territory
NU	Nunavut

# **ANALYSIS**



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# **SCOPE OF THE TRUCK AND TRANSPORT MECHANIC TRADE**

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## **SAFETY**

Safe working procedures and conditions, accident prevention, and the preservation of health are of primary importance to industry in Canada. These responsibilities are shared and require the joint efforts of government, employers and employees. It is imperative that all parties become aware of circumstances that may lead to injury or harm. Safe learning experiences and work environments can be created by controlling the variables and behaviours that may contribute to accidents or injury.

It is generally recognized that safety-conscious attitudes and work practices contribute to a healthy, safe and accident-free work environment.

It is imperative to apply and be familiar with the Occupational Health and Safety Acts and Workplace Hazardous Materials Information System (WHMIS) Regulations. As well, it is essential to determine workplace hazards and take measures to protect oneself, co-workers, the public and the environment.

Safety education is an integral part of training in all jurisdictions. As safety is an imperative part of all trades, it is assumed and therefore it is not included as a qualifier of any activities. However, the technical safety tasks and sub-tasks specific to the trade are included in this analysis.

“Truck and transport mechanic” is this trade’s official Red Seal occupational title approved by the CCDA. This analysis covers tasks performed by truck and transport mechanics whose occupational title has been identified by some provinces and territories of Canada under the following names:

	NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
Commercial Transport Vehicle Mechanic										✓			
Heavy Equipment Technician - Truck and Transport Mechanic									✓				
Truck and Coach Technician						✓							
Truck and Transport Mechanic	✓	✓	✓		✓		✓	✓					
Truck and Transport Service Technician				✓									
Truck and Transport Technician												✓	

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. They work on the structural, mechanical, electrical and electronic vehicle systems and components such as engines, cab, chassis and frames, brakes, steering, suspension, drive train, HVAC (heating, ventilation and air conditioning), 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, large fleet maintenance companies, public transportation companies, government highway departments, railways and construction companies.

Smaller companies routinely require that truck and transport mechanics perform a wide variety of tasks. Those who work in larger shops may specialize in some of the following areas: engine and fuel systems, transmission systems, HVAC systems, steering, alignment, brakes, drive lines, suspension, hydraulics, electrical and electronic systems, truck-trailer repair or diagnostic services.

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

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, sharp edges and heavy equipment.

Key attributes for people entering this trade are mechanical aptitude, manual dexterity, good hand-eye coordination, strength, stamina and agility. 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 are 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.

## **OCCUPATIONAL OBSERVATIONS**

Many truck and transport mechanics use handheld and laptop computers and vehicle monitoring systems to diagnose problems and adjust vehicle functions. The truck and transport mechanic trade is becoming more complex due to the increasing use of electronic components in integrating systems.

Buses, trucks and trailers are coming out with electronic controls rather than manual controls. The diagnosis and service of these controls makes knowledge of electrical concepts essential to this trade. Vehicles are using more alternating current systems with varying voltages. Different tools are required for the diagnosis of these new electrical components.

Automatic and automated transmissions are becoming more common in new trucks, and servicing needs are increasing accordingly.

Vehicles are being made lighter for better fuel economy and so that heavier loads can be accommodated. Lighter materials such as aluminum, fibreglass and composite materials are being used more.

In order to increase fuel efficiency, vehicles are being produced with more streamlined designs. The market is also introducing after-market components to improve fuel economy.

There is concern regarding diesel engine emissions produced. Changes to regulations and emission standards will have an impact on the way diesel engines are constructed and on the duties of mechanics. Different issues and vehicle faults may arise because of the new designs of these engines and components.

## BLOCK A

## OCCUPATIONAL SKILLS

<b>Trends</b>	The truck and transport mechanic trade is seeing an increase in the need for more computer skills, as there is more electronic communication, equipment and documentation. Health and safety is also gaining importance, with improved equipment and regulations. New specialized tools, lubricants and fasteners are becoming more common, as are non-serviceable components such as sealed bearings, joints and driveshafts.
<b>Context</b>	Truck and transport mechanics must use tools and maintenance information to perform all tasks in their trade. Organizing work includes using documentation, communicating effectively and working within the parameters of shop policies. Truck and transport mechanics must adhere to safety procedures and regulations. Work practices in this block are those tasks which may be performed throughout this trade.
<b>Related Components</b>	All components apply.
<b>Tools and Equipment</b>	See Appendix A.

### Task 1

### Maintains tools and equipment.

#### Sub-task

#### A-1.01 Maintains hand tools.

<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YT</u>	<u>NU</u>
yes	NV	NV	ND									

#### Supporting Knowledge & Abilities

A-1.01.01	knowledge of types of hand tools
A-1.01.02	knowledge of operating procedures
A-1.01.03	knowledge of imperial system and international system (SI)

A-1.01.04	knowledge of types of specialty tools such as pullers, presses and tamper-proof tools
A-1.01.05	ability to organize hand tools
A-1.01.06	ability to store hand tools
A-1.01.07	ability to recognize worn, damaged or defective hand tools

**Sub-task**

**A-1.02 Maintains power tools.**

<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YT</u>	<u>NU</u>
yes	NV	NV	ND									

**Supporting Knowledge & Abilities**

A-1.02.01	knowledge of types of power tools such as impact guns, drills and grinders
A-1.02.02	knowledge of operating procedures
A-1.02.03	knowledge of basic repairs of power tools
A-1.02.04	knowledge of manufacturers' maintenance specifications such as lubrication and calibration schedules
A-1.02.05	knowledge of provincial regulations in regards to shop equipment maintenance
A-1.02.06	ability to organize power tools
A-1.02.07	ability to store power tools
A-1.02.08	ability to recognize worn, damaged or defective power tools

**Sub-task**

**A-1.03 Maintains measuring, testing and diagnostic tools.**

<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YT</u>	<u>NU</u>
yes	NV	NV	ND									

**Supporting Knowledge & Abilities**

A-1.03.01	knowledge of measuring devices such as micrometers, calipers and tape measures
A-1.03.02	knowledge of testing devices such as pressure gauges, flowmeters and temperature gauges

A-1.03.03	knowledge of diagnostic tools such as computer and handheld diagnostic tools
A-1.03.04	knowledge of operating procedures
A-1.03.05	knowledge of manufacturers' maintenance specifications
A-1.03.06	ability to recognize worn, damaged or defective measuring, testing and diagnostic tools
A-1.03.07	ability to reset measuring, testing and diagnostic tools
A-1.03.08	ability to store measuring, testing and diagnostic tools

---

### Sub-task

#### A-1.04      **Maintains hoisting and lifting equipment.**

<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YT</u>	<u>NU</u>
yes	NV	NV	ND									

#### Supporting Knowledge & Abilities

A-1.04.01	knowledge of types of hoisting and lifting equipment such as jacks, chain hoists and vehicle hoists
A-1.04.02	knowledge of operating procedures
A-1.04.03	knowledge of applications of hoisting and lifting equipment
A-1.04.04	knowledge of limitations of hoisting and lifting equipment
A-1.04.05	ability to recognize and interpret tags on equipment identifying load limits
A-1.04.06	ability to recognize safe lifting locations or points
A-1.04.07	ability to recognize worn, damaged or defective hoisting and lifting equipment
A-1.04.08	ability to recognize potential hazards such as ceiling heights, overhead wires and uneven surfaces

---

**Sub-task****A-1.05 Maintains personal protective equipment (PPE) and safety equipment.**

<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YT</u>	<u>NU</u>
yes	NV	NV	ND									

**Supporting Knowledge & Abilities**

- A-1.05.01 knowledge of types of PPE such as respiratory, hearing, eye and body protection
- A-1.05.02 knowledge of types of safety equipment such as caging devices, shop ventilation, eye wash station and first aid kit
- A-1.05.03 knowledge of PPE and safety equipment operations
- A-1.05.04 knowledge of workplace safety and health regulations such as fall protection and WHMIS
- A-1.05.05 knowledge of location of safety equipment
- A-1.05.06 ability to recognize worksite hazards
- A-1.05.07 ability to store PPE and safety equipment
- A-1.05.08 ability to recognize worn, damaged or defective PPE and safety equipment

---

**Sub-task****A-1.06 Maintains staging equipment.**

<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YT</u>	<u>NU</u>
yes	NV	NV	ND									

**Supporting Knowledge & Abilities**

- A-1.06.01 knowledge of types of staging equipment such as axle stands, blocking and scaffolds
- A-1.06.02 knowledge of load limitations of staging equipment and supporting devices
- A-1.06.03 ability to recognize and interpret tags on staging equipment identifying load limits
- A-1.06.04 ability to recognize worn, damaged or defective staging equipment
- A-1.06.05 ability to store staging equipment

---

**Sub-task****A-1.07 Maintains solvent washers and biological parts washers.**

<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YT</u>	<u>NU</u>
yes	yes	yes	yes	yes	no	yes	yes	no	yes	NV	NV	ND

**Supporting Knowledge & Abilities**

A-1.07.01	knowledge of operating procedures
A-1.07.02	knowledge of particle counts
A-1.07.03	knowledge of WHMIS
A-1.07.04	knowledge of recycling and disposal procedures
A-1.07.05	ability to change solvents

---

**Task 2****Organizes work.**

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**Sub-task****A-2.01 Uses documentation and reference materials.**

<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YT</u>	<u>NU</u>
yes	NV	NV	ND									

**Supporting Knowledge & Abilities**

A-2.01.01	knowledge of different types of documents and reference tools materials such as service manuals, Material Safety Data Sheets (MSDS) and check lists
A-2.01.02	knowledge of documentation and reference material formats (paper and electronic)
A-2.01.03	knowledge of jurisdictional/industry regulations
A-2.01.04	knowledge of preventative maintenance schedules
A-2.01.05	ability to locate vehicle identification numbers
A-2.01.06	ability to locate and update manuals, service bulletins and support documentation (paper or electronic)
A-2.01.07	ability to interpret shop service manuals
A-2.01.08	ability to interpret schematics and drawings
A-2.01.09	ability to document service records

A-2.01.10	ability to create parts lists
A-2.01.11	ability to match replacement part to original part
A-2.01.12	ability to refer to original equipment manufacturer (OEM) specifications, and diagnostic and servicing procedures

---

**Sub-task**

**A-2.02            Communicates with others.**

<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YT</u>	<u>NU</u>
yes	NV	NV	ND									

**Supporting Knowledge & Abilities**

A-2.02.01	knowledge of technical terminology
A-2.02.02	knowledge of industry policies and procedures, guidelines and standards
A-2.02.03	knowledge of verbal and written communication
A-2.02.04	ability to use communication equipment and media such as Internet, email and fax
A-2.02.05	ability to translate technical information into layperson's terms
A-2.02.06	ability to acquire information through questioning
A-2.02.07	ability to communicate with industry professionals such as partspersons, supervisors and other mechanics
A-2.02.08	ability to communicate with customers
A-2.02.09	ability to communicate with manufacturer representatives and salespeople

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**Sub-task**

**A-2.03            Maintains safe work environment.**

<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YT</u>	<u>NU</u>
yes	NV	NV	ND									

**Supporting Knowledge & Abilities**

A-2.03.01	knowledge of WHMIS
A-2.03.02	knowledge of types and operation of fire extinguishing equipment
A-2.03.03	knowledge of safety equipment such as first aid stations, eye wash stations and stretchers

A-2.03.04	knowledge of emergency phone numbers
A-2.03.05	knowledge of industry-related safety acts and regulations
A-2.03.06	knowledge of company policies and procedures such as evacuation routes, location of safety equipment and safety training
A-2.03.07	knowledge of disposal and recycling procedures
A-2.03.08	ability to recognize potential hazards such as fluids and gases under high pressure in hydraulic, pneumatic and air conditioning systems
A-2.03.09	ability to handle and store hazardous materials
A-2.03.10	ability to perform walk-around inspection of vehicles

### Task 3

### Performs routine trade activities.

#### Sub-task

#### A-3.01 Uses computer for diagnostics.

<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YT</u>	<u>NU</u>
yes	NV	NV	ND									

#### Supporting Knowledge & Abilities

A-3.01.01	knowledge of operation of specialized diagnostic tools such as computer and handheld devices
A-3.01.02	knowledge of components such as data connectors, receptacles and adapters
A-3.01.03	ability to use operating software
A-3.01.04	ability to use specialized diagnostic software
A-3.01.05	ability to check for and install software updates
A-3.01.06	ability to interpret diagnostic results and reports
A-3.01.07	ability to record diagnostic information
A-3.01.08	ability to download and print reports from electronic control modules (ECMs)

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**Sub-task****A-3.02 Maintains fluids, lubricants and coolants.**

<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YT</u>	<u>NU</u>
yes	NV	NV	ND									

**Supporting Knowledge & Abilities**

A-3.02.01	knowledge of types of lubricants such as synthetic, semi-synthetic and non-synthetic
A-3.02.02	knowledge of the limitation of mixing types of fluids, lubricants and coolants
A-3.02.03	knowledge of the disposal and recycling of fluids, lubricants and coolants
A-3.02.04	ability to verify fluid levels such as transmission levels, differential levels and hydraulic levels
A-3.02.05	ability to select types and grades of fluids and lubricants appropriate for the application
A-3.02.06	ability to select types of coolants appropriate for the application
A-3.02.07	ability to identify when fluids have been mixed improperly
A-3.02.08	ability to store fluids, lubricants and coolants according to regulations
A-3.02.09	ability to take fluid samples
A-3.02.10	ability to interpret fluid sample results

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**Sub-task****A-3.03 Uses fasteners, sealing devices, adhesives and gaskets.**

<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YT</u>	<u>NU</u>
yes	NV	NV	ND									

**Supporting Knowledge & Abilities**

A-3.03.01	knowledge of types of fasteners, sealing devices, adhesives and gaskets
A-3.03.02	knowledge of chemical reaction of sealants
A-3.03.03	knowledge of torque specification of fasteners
A-3.03.04	knowledge of taps, dies and thread repair kits
A-3.03.05	ability to select the appropriate sealing or gasket material for the job
A-3.03.06	ability to install fasteners, sealing devices, adhesives and gaskets
A-3.03.07	ability to identify grade, thread pitch and size of fasteners
A-3.03.08	ability to make gaskets

A-3.03.09	ability to repair threads using tools such as taps, dies, chasers and thread inserts
A-3.03.10	ability to apply specialty sealants such as aerobic and anaerobic
A-3.03.11	ability to remove broken fasteners

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**Sub-task**

**A-3.04 Services hoses, tubing and fittings.**

<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YT</u>	<u>NU</u>
yes	NV	NV	ND									

**Supporting Knowledge & Abilities**

A-3.04.01	knowledge of different types of hoses, tubing and fittings such as plastic, rubber, neoprene and steel
A-3.04.02	knowledge of regulations regarding hoses, tubing and fittings
A-3.04.03	ability to relieve pressure from air and fluid systems before disconnecting hoses, tubing and fittings
A-3.04.04	ability to remove and replace hoses, tubing and fittings
A-3.04.05	ability to match hoses, tubing and fittings to fluid being used
A-3.04.06	ability to identify pressure limits of hoses, tubing, fittings and clamps
A-3.04.07	ability to construct hose/tube assemblies
A-3.04.08	ability to flare tubing

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**Sub-task**

**A-3.05 Services bearings, bushings and seals.**

<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YT</u>	<u>NU</u>
yes	NV	NV	ND									

**Supporting Knowledge & Abilities**

A-3.05.01	knowledge of types of bearings
A-3.05.02	knowledge of types of bushings
A-3.05.03	knowledge of types of seals such as static and dynamic
A-3.05.04	knowledge of the application of bearings, bushings and seals

A-3.05.05	knowledge of types of shaft repairs such as installing wear sleeves and machining shaft
A-3.05.06	ability to identify symptoms of failing bearings, bushings and seals
A-3.05.07	ability to recognize worn, damaged or defective bearings, bushings and seals
A-3.05.08	ability to lubricate bearings, bushings and seals
A-3.05.09	ability to install bearings, bushings and seals
A-3.05.10	ability to identify the allowable tolerance of bearings and bushings
A-3.05.11	ability to adjust bearings and bushings

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### Sub-task

#### A-3.06 Services filters.

<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YT</u>	<u>NU</u>
yes	NV	NV	ND									

### Supporting Knowledge & Abilities

A-3.06.01	knowledge of different types of filters such as wash-out and pre-cleaners
A-3.06.02	knowledge of the application of filters such as air, fuel and oil
A-3.06.03	knowledge of the disposal and recycling of filters
A-3.06.04	knowledge of location of filters such as transmission, cab and differentials
A-3.06.05	ability to select tools used to remove and install filters
A-3.06.06	ability to relieve pressure from air and fluids before removing filters
A-3.06.07	ability to remove filters
A-3.06.08	ability to recognize plugged filters
A-3.06.09	ability to install filters

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**Sub-task****A-3.07 Uses welding equipment.**

<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YT</u>	<u>NU</u>
yes	no	yes	NV	NV	ND							

**Supporting Knowledge & Abilities**

A-3.07.01	knowledge of types of welding equipment such as oxy-acetylene (OAW), MIG gas metal arc welding (GMAW) and shielded metal arc welding (SMAW)
A-3.07.02	knowledge of welding materials such as electrodes, wires and shielding gases
A-3.07.03	knowledge of jurisdictional regulations for welding procedures
A-3.07.04	knowledge of welding principles and considerations
A-3.07.05	knowledge of basic welding procedures
A-3.07.06	ability to organize welding equipment
A-3.07.07	ability to store welding equipment
A-3.07.08	ability to transport welding equipment according to standards such as federal, provincial and territorial regulations and Transport of Dangerous Goods (TDG)
A-3.07.09	ability to recognize worn, damaged or defective welding equipment and potential hazards
A-3.07.10	ability to determine when structural welding must be done by welders
A-3.07.11	ability to maintain welding equipment such as cleaning welding tips

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**Sub-task****A-3.08 Uses cutting equipment.**

<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YT</u>	<u>NU</u>
yes	NV	NV	ND									

**Supporting Knowledge & Abilities**

A-3.08.01	knowledge of types of cutting equipment such as OAW and plasma
A-3.08.02	knowledge of cutting principles and considerations
A-3.08.03	knowledge of basic cutting procedures
A-3.08.04	ability to organize cutting equipment

A-3.08.05	ability to store cutting equipment
A-3.08.06	ability to transport cutting equipment according to standards such as federal, provincial and territorial regulations and TDG
A-3.08.07	ability to recognize worn, damaged or defective cutting equipment and potential hazards
A-3.08.08	ability to maintain cutting equipment such as cleaning cutting tips

### Sub-task

#### A-3.09 Verifies vehicle repairs.

<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YT</u>	<u>NU</u>
yes	NV	NV	ND									

#### Supporting Knowledge & Abilities

A-3.09.01	knowledge of industry regulations respecting vehicle repair and compliance
A-3.09.02	knowledge of company policies and procedures such as work orders and checklists
A-3.09.03	knowledge of repair procedures
A-3.09.04	ability to bench test rebuilt components such as starters, switches and electrical components
A-3.09.05	ability to perform a walk-around inspection
A-3.09.06	ability to advise operator of required follow-up procedures such as re-torques and fluid top-ups
A-3.09.07	ability to verify that dimensions/pressures are correct according to OEM specifications

### Sub-task

#### A-3.10 Conducts road tests.

<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YT</u>	<u>NU</u>
yes	no	yes	NV	NV	ND							

#### Supporting Knowledge & Abilities

A-3.10.01	knowledge of jurisdictional licensing regulations
A-3.10.02	knowledge of proper performance of vehicle
A-3.10.03	knowledge of operation of vehicle

- A-3.10.04 ability to drive the vehicle
- A-3.10.05 ability to perform sensory inspection
- A-3.10.06 ability interpret the results of a road test

## BLOCK B

## ENGINE AND SUPPORTING SYSTEMS

<b>Trends</b>	<p>Due to federal mandates on emission systems, engine and supporting systems are becoming more sophisticated and complex. Electronics are prevalent throughout engines and supporting systems, and truck and transport mechanics increasingly need better computer skills and electronic diagnostic abilities.</p>
<b>Context</b>	<p>The engine produces horsepower and torque to enable movement of the vehicle. The supporting systems maintain proper engine functioning and longevity under various operating conditions.</p> <p>Truck and transport mechanics must diagnose and service the engine and supporting systems to ensure proper engine function and reduce down time.</p> <p>Servicing includes the replacement and repair of components as well as routine maintenance.</p>
<b>Related Components (include, but not limited to)</b>	<p><b>Base engine:</b> pistons, piston rings, wrist pins, connecting rods, flywheels, vibration dampers/harmonic balancers, timing gears, crankshaft, camshafts, valve/injector trains, rocker assemblies, engine cylinder block, wet liner/sleeve, dry sleeve, cylinder head, intake manifold, exhaust manifold, oil pans/sumps.</p> <p><b>Engine management system:</b> ECM, sensors, solenoids, harnesses, actuators, connectors, potentiometers, vehicle electronic control units (VECUs).</p> <p><b>Cooling system:</b> radiator, radiator cap, coolant pumps, temperature gauge, thermostats, shutters, cooling fans, fan shroud, fan belt and pulleys, hoses.</p> <p><b>Lubrication system:</b> sump/oil pan, dipstick, oil pumps, pressure regulating valves, filters, filter bypass valves, oil coolers, oil pressure sensor, pressure gauge, low pressure warning light, relief valve, bypass valve.</p> <p><b>Fuel delivery system:</b> injectors, tanks, check valves, lines, injection pumps, lift pumps.</p> <p><b>Intake/exhaust system:</b> air cleaners, charge air coolers (CACs), turbochargers, exhaust manifold, pyrometer, exhaust piping, intake piping, mufflers, hoses, emergency shutdown devices.</p> <p><b>Starting aids:</b> pre-heaters, ether injectors, auxiliary heaters, glow plugs.</p>

**Related Components (continued)**

**Emission systems:** catalytic converters, exhaust gas recirculation systems (EGR), particulate traps, aftertreatment regeneration devices (ARDs), diesel exhaust fluid (DEF) systems, selective catalyst reduction (SCR) systems, diesel particulate filter (DPF) systems, crankcase ventilation systems and evaporative emission systems.

**Tools and Equipment**

Hand tools, power tools; measuring, testing and diagnostic equipment; welding and cutting equipment; hoisting and lifting equipment; PPE and safety equipment; staging equipment.

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**Task 4**

**Diagnoses engine and supporting systems.**

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**Sub-task**

**B-4.01 Diagnoses base engine.**

<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YT</u>	<u>NU</u>
yes	NV	NV	ND									

**Supporting Knowledge & Abilities**

- B-4.01.01 knowledge of components of base engine
- B-4.01.02 knowledge of operating principles of two-stroke and four-stroke engines
- B-4.01.03 knowledge of troubleshooting trees
- B-4.01.04 ability to perform specialized testing procedures such as dye testing, pressure testing and engine oil analysis
- B-4.01.05 ability to perform sensory inspection
- B-4.01.06 ability to interpret diagnostic readings
- B-4.01.07 ability to compare diagnostic results to industry norms
- B-4.01.08 ability to perform failure analysis

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**Sub-task****B-4.02 Diagnoses cooling system.**

<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YT</u>	<u>NU</u>
yes	NV	NV	ND									

**Supporting Knowledge & Abilities**

B-4.02.01	knowledge of cooling system principles
B-4.02.02	knowledge of cooling system components such as fans, shutters, block heaters and belts
B-4.02.03	knowledge of auxiliary heaters
B-4.02.04	knowledge of OEM auxiliary heating components
B-4.02.05	knowledge of radiator cap relief pressure
B-4.02.06	knowledge of types of coolants
B-4.02.07	knowledge of coolant additives
B-4.02.08	knowledge of hazards of pressurized cooling systems
B-4.02.09	ability to recognize failed, worn, damaged and defective components
B-4.02.10	ability to recognize contamination of coolant
B-4.02.11	ability to interpret coolant flow schematics
B-4.02.12	ability to perform specialized testing procedures such as dye testing, pressure testing and coolant analysis
B-4.02.13	ability to perform pressure test for systems and separate components
B-4.02.14	ability to perform coolant strength test and supplemental coolant additives (SCA) test

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**Sub-task****B-4.03 Diagnoses lubrication system.**

<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YT</u>	<u>NU</u>
yes	NV	NV	ND									

**Supporting Knowledge & Abilities**

B-4.03.01	knowledge of lubrication system operation
B-4.03.02	knowledge of lubrication system components such as oil pumps, filters and coolers
B-4.03.03	knowledge of inspection and testing procedures

B-4.03.04	ability to identify oil contamination
B-4.03.05	ability to perform sensory inspection
B-4.03.06	ability to interpret lubricant flow schematics
B-4.03.07	ability to perform pressure test of systems and separate components
B-4.03.08	ability to interpret test results
B-4.03.09	ability to identify failed, worn, damaged and defective components

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### Sub-task

#### **B-4.04 Diagnoses fuel delivery system.**

<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YT</u>	<u>NU</u>
yes	NV	NV	ND									

### Supporting Knowledge & Abilities

B-4.04.01	knowledge of types of fuel delivery systems such as mechanical and electronic
B-4.04.02	knowledge of fuel delivery system components such as pumps, injectors, tanks, check valves and lines
B-4.04.03	knowledge of fuel system operation
B-4.04.04	knowledge of winter and summer fuels
B-4.04.05	ability to recognize hazards of fuel delivery systems such as high voltage and high pressures
B-4.04.06	ability to interpret fuel system flow schematics
B-4.04.07	ability to perform sensory inspection
B-4.04.08	ability to identify fuel contamination
B-4.04.09	ability to use diagnostic tools such as pressure testing equipment, flowmeters and handheld devices
B-4.04.10	ability to perform pressure tests on fuel system components
B-4.04.11	ability to interpret test results
B-4.04.12	ability to recognize failed, worn, damaged and defective components

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**Sub-task****B-4.05 Diagnoses intake and exhaust systems.**

<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YT</u>	<u>NU</u>
yes	NV	NV	ND									

**Supporting Knowledge & Abilities**

B-4.05.01	knowledge of intake system components such as CACs, turbo chargers and superchargers
B-4.05.02	knowledge of emergency shutdown devices such as air dams (cable and switch operated)
B-4.05.03	knowledge of exhaust system components such as manifolds, piping and mufflers
B-4.05.04	knowledge of starting aids such as pre-heaters, ether injectors and glow plugs
B-4.05.05	ability to recognize hazards of intake and exhaust systems such as running engine in confined spaces and dangers surrounding air inlets
B-4.05.06	ability to identify intake system contamination such as dust, oil and antifreeze
B-4.05.07	ability to perform sensory inspection
B-4.05.08	ability to detect leaks in intake and exhaust systems
B-4.05.09	ability to inspect intake and exhaust components
B-4.05.10	ability to perform specialized intake testing procedures
B-4.05.11	ability to identify starting aid malfunction
B-4.05.12	ability to interpret test results

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**Sub-task****B-4.06 Diagnoses emission systems for diesel engines.**

<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YT</u>	<u>NU</u>
yes	NV	NV	ND									

**Supporting Knowledge & Abilities**

B-4.06.01	knowledge of jurisdictional regulations
B-4.06.02	knowledge of emission system components such as catalytic converters, EGR systems, particulate traps, ARDs, SCR systems, DPF systems, crankcase ventilation systems, evaporative emission systems and DEF systems

B-4.06.03	knowledge of emission system functions and operations
B-4.06.04	ability to perform sensory inspection
B-4.06.05	ability to perform specialized testing procedures using equipment such as back pressure tester, opacity meter and computer
B-4.06.06	ability to interpret test results

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**Sub-task**

**B-4.07 Diagnoses engine management system.**

<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YT</u>	<u>NU</u>
yes	NV	NV	ND									

**Supporting Knowledge & Abilities**

B-4.07.01	knowledge of engine management system components such as ECMs, sensors, solenoids, VECUs and harnesses
B-4.07.02	knowledge of the operation, design and function of engine management systems
B-4.07.03	ability to perform specialized testing to determine electronic/electrical faults using equipment such as computers, handheld devices, break-out harnesses and multimeters
B-4.07.04	ability to perform sensory inspection
B-4.07.05	ability to interpret test results

**Sub-task****B-5.01 Services base engine.**

<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YT</u>	<u>NU</u>
yes	NV	NV	ND									

**Supporting Knowledge & Abilities**

B-5.01.01	knowledge of components of base engine such as blocks, crankshaft, camshafts, cylinder head, pistons and bushings
B-5.01.02	knowledge of operating principles of two-stroke and four-stroke engines
B-5.01.03	knowledge of component compatibility with solvents and cleaning agents
B-5.01.04	ability to recognize related effect of component failure such as consequences of turbo failure
B-5.01.05	ability to use specialized tools
B-5.01.06	ability to clean components
B-5.01.07	ability to identify necessary replacement parts
B-5.01.08	ability to replace components such as cylinder heads, gaskets, water pumps and oil coolers
B-5.01.09	ability to perform update modification as per OEM specifications
B-5.01.10	ability to repair and rebuild all engine components such as cylinder heads and water pumps
B-5.01.11	ability to recognize worn, damaged or defective components
B-5.01.12	ability to measure tolerances, clearances, shims, end play and backlash such as liner protrusions, gear clearances and camshaft followers

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**Sub-task****B-5.02 Services cooling system.**

<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YT</u>	<u>NU</u>
yes	NV	NV	ND									

**Supporting Knowledge & Abilities**

B-5.02.01	knowledge of cooling system principles
B-5.02.02	knowledge of cooling system components such as fans, shutters and belts
B-5.02.03	knowledge of auxiliary heaters
B-5.02.04	knowledge of OEM auxiliary heating components
B-5.02.05	knowledge of types of coolants
B-5.02.06	knowledge of coolant additives
B-5.02.07	knowledge of controls such as ECMs, VECUs and manual switches
B-5.02.08	knowledge of radiator cap relief pressure
B-5.02.09	knowledge of hazards of cooling systems under pressure such as steam and extreme heat
B-5.02.10	ability to release pressure from system
B-5.02.11	ability to use specialized tools such as coolant recycle machine, seal drivers and belt tension gauge
B-5.02.12	ability to remove cooling system components
B-5.02.13	ability to identify necessary replacement components
B-5.02.14	ability to rebuild cooling system components
B-5.02.15	ability to replace cooling system components
B-5.02.16	ability to adjust belt tension
B-5.02.17	ability to perform recycle procedure on cooling system

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**Sub-task****B-5.03 Services lubrication system.**

<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YT</u>	<u>NU</u>
yes	NV	NV	ND									

**Supporting Knowledge & Abilities**

B-5.03.01	knowledge of lubrication system operation
B-5.03.02	knowledge of lubrication system components such as oil pumps, filters and coolers
B-5.03.03	knowledge of inspection and testing procedures
B-5.03.04	knowledge of controls such as ECMs, VECUs and manual switches
B-5.03.05	ability to use specialized tools such as pullers, presses and feeler gauges
B-5.03.06	ability to remove lubrication system components
B-5.03.07	ability to identify necessary replacement components
B-5.03.08	ability to recognize worn, damaged and defective components
B-5.03.09	ability to rebuild lubrication system components
B-5.03.10	ability to replace lubrication system components

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**Sub-task****B-5.04 Services fuel delivery system.**

<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YT</u>	<u>NU</u>
yes	NV	NV	ND									

**Supporting Knowledge & Abilities**

B-5.04.01	knowledge of types of fuel delivery systems such as mechanical and electronic
B-5.04.02	knowledge of fuel delivery system components such as pumps, injectors, tanks, check valves and lines
B-5.04.03	knowledge of fuel system operation
B-5.04.04	knowledge of controls such as ECMs, VECUs and manual switches
B-5.04.05	ability to recognize hazards of fuel delivery systems such as high voltage and high pressures
B-5.04.06	ability to interpret flow schematics
B-5.04.07	ability to determine component specifications

B-5.04.08	ability to use specialized tools such as pullers, specialized wrenches and gauges
B-5.04.09	ability to remove fuel delivery system components
B-5.04.10	ability to recognize worn, damaged and defective components
B-5.04.11	ability to identify necessary replacement components
B-5.04.12	ability to replace fuel delivery system components
B-5.04.13	ability to calibrate electronic injectors

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### Sub-task

#### B-5.05 Services intake and exhaust systems.

<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YT</u>	<u>NU</u>
yes	NV	NV	ND									

#### Supporting Knowledge & Abilities

B-5.05.01	knowledge of intake system components such as CACs, turbo chargers and superchargers
B-5.05.02	knowledge of controls such as ECMs, VECUs and manual switches
B-5.05.03	knowledge of emergency shutdown devices such as air dams (cable and switch operated)
B-5.05.04	knowledge of exhaust system components such as manifolds, piping and mufflers
B-5.05.05	knowledge of starting aids such as pre-heaters, ether injectors and glow plugs
B-5.05.06	knowledge of hazards of intake and exhaust systems such as running engine in confined spaces, extreme heat from exhaust components and dangers surrounding air inlets
B-5.05.07	ability to repair intake system components
B-5.05.08	ability to replace intake system components
B-5.05.09	ability to repair exhaust system components
B-5.05.10	ability to replace exhaust system components
B-5.05.11	ability to repair starting aid components
B-5.05.12	ability to replace starting aid components
B-5.05.13	ability to use welding equipment to repair piping, remove broken fasteners and cut exhaust pipe

B-5.05.14	ability to install starting aid components
B-5.05.15	ability to identify worn, damaged and defective components for intake and exhaust systems

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**Sub-task**

**B-5.06 Services emission systems for diesel engines.**

<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YT</u>	<u>NU</u>
yes	NV	NV	ND									

**Supporting Knowledge & Abilities**

B-5.06.01	knowledge of jurisdictional regulations
B-5.06.02	knowledge of emission system components such as catalytic converters, EGR systems, particulate traps, ARDs, SCR systems, DPF systems, crankcase ventilation systems, evaporative emission systems and DEF systems
B-5.06.03	knowledge of servicing procedures for emission systems
B-5.06.04	knowledge of emission system functions and operations
B-5.06.05	knowledge of controls such as ECMs, VECUs and manual switches
B-5.06.06	ability to replace emission system components
B-5.06.07	ability to identify worn, damaged and defective components
B-5.06.08	ability to perform maintenance on particulate traps

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**Sub-task**

**B-5.07 Services engine management system.**

<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YT</u>	<u>NU</u>
yes	NV	NV	ND									

**Supporting Knowledge & Abilities**

B-5.07.01	knowledge of the operation, design and function of engine management systems
B-5.07.02	knowledge of controls such as ECMs, VECUs and manual switches
B-5.07.03	knowledge of hazards when servicing engine management systems such as high voltage and voltage spiking
B-5.07.04	knowledge of specialized tools such as computers, handheld devices and multimeters

- B-5.07.05 knowledge of specialized connectors and harnesses such as sensor connections, injector harnesses and ECM connectors
- B-5.07.06 ability to identify engine management system components such as sensors, actuators and ECMs
- B-5.07.07 ability to repair engine management systems components such as harnesses and connectors
- B-5.07.08 ability to replace engine management components such as actuators, sensors, potentiometer and solenoids
- B-5.07.09 ability to calibrate engine management components such as injectors, turbochargers and speed control sensors
- B-5.07.10 ability to reprogram parameters such as shutdowns, cruise controls and fan controls
- B-5.07.11 ability to update engine management system software

**Trends**

Vehicles are increasingly being equipped with Central Tire Inflation (CTI) systems to keep all tires inflated to a preset pressure.

Vehicle stability control (VSC), trailer roll stability (TRS) and antilock braking system (ABS) will become standards in the industry.

There is an increasing use of disc brakes due to ease of service and improved materials and design.

**Context**

Air systems provide compressed air to control and operate vehicle systems and components such as braking, seats, wipers, trailer brakes and 5<sup>th</sup>-wheel slide cylinders.

Brake systems slow or stop the vehicle in a safe and controlled manner by using air or hydraulics in conjunction with electronic controls.

Auxiliary brake systems are an optional component used to assist the primary braking system to slow the vehicle and to prolong primary brake life.

Truck and transport mechanics must diagnose and service air systems and brakes to ensure proper function and reduce down time. Servicing includes the replacement and repair of components as well as routine maintenance.

**Related Components (include, but not limited to)**

**Air systems:** air dryer, air starters, compressors, relay valves, air tanks, relief valves, check valves, air lines, governors, pressure switches, gauges, drain valves (automatic or manual), quick release valves, low pressure indicator, dash control valves, trailer supply lines, glad hands.

**Brake systems:** brake chambers, slack adjusters (automatic and manual), rotors, calipers, S-cams, springs, pins, bushings, rollers, master cylinders, brake cylinders, hydraulic power boosters, pressure differential valves, metering valves, proportioning valves, foot valves, brake proportioning valves, trailer application valves, relay valves, quick release valves, ratio valves, inversion valves, bobtail proportioning valves, spring brake control valves, tractor protection valves, check valves, stop lamp switches, air pressure gauges, clevis pins, power assisted systems, brake drums, brake shoes, brake spiders, ECUs, sensors.

**Auxiliary brake systems:** solenoids, valves, switches, wiring, ECM, oil controls.

**Tools and Equipment**

Hand tools, power tools; measuring, testing and diagnostic equipment; lifting and hoisting equipment; welding and cutting equipment; PPE and safety equipment.

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**Task 6**

**Diagnoses air systems and brakes.**

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**Sub-task**

**C-6.01 Diagnoses air systems.**

<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YT</u>	<u>NU</u>
yes	NV	NV	ND									

**Supporting Knowledge & Abilities**

C-6.01.01	knowledge of air system design and function
C-6.01.02	knowledge of air system components such as compressors, valves and brake chambers
C-6.01.03	knowledge of common faults such as ruptured and chafed hoses, sticking valves and compressor not building air pressure
C-6.01.04	knowledge of air system specifications
C-6.01.05	ability to perform sensory inspection
C-6.01.06	ability to recognize hazards of diagnosing air systems
C-6.01.07	ability to use diagnostic tools such as soap and water, gauges and hand tools
C-6.01.08	ability to perform tests such as pressure tests, timed tests and leakdown tests

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**Sub-task****C-6.02 Diagnoses brake systems.**

<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YT</u>	<u>NU</u>
yes	NV	NV	ND									

**Supporting Knowledge & Abilities**

C-6.02.01	knowledge of types of brake systems such as air, hydraulic and emergency (parking) brake
C-6.02.02	knowledge of air brake components such as brake chambers, slack adjusters (automatic and manual), rotors, calipers, S-cams, pins and bushings
C-6.02.03	knowledge of hydraulic brake components such as master cylinders, wheel cylinders, brake proportioning valves and calipers
C-6.02.04	knowledge of common faults such as broken brake chamber springs, leaking diaphragms and loose callipers
C-6.02.05	knowledge of types of brake shoes, pads and linings
C-6.02.06	knowledge of brake system operation
C-6.02.07	knowledge of traction control and braking systems
C-6.02.08	knowledge of warning systems
C-6.02.09	ability to perform sensory inspection
C-6.02.10	ability to measure brake drums and rotors
C-6.02.11	ability to check for wear on components such as brake shoes, S-cams and bushings
C-6.02.12	ability to interpret flash/fault codes for ABS
C-6.02.13	ability to interpret schematics
C-6.02.14	ability to use ABS diagnostic equipment such as readers, computers, handheld devices and multimeters

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**Sub-task****C-6.03 Diagnoses auxiliary braking systems.**

<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YT</u>	<u>NU</u>
yes	NV	NV	ND									

**Supporting Knowledge & Abilities**

C-6.03.01	knowledge of types and operation of auxiliary/retarder braking systems such as engine, driveline, fluid and exhaust
C-6.03.02	knowledge of braking system components such as solenoids, valves and switches
C-6.03.03	knowledge of common faults such as corroded wiring, intermittent operation and weak performance
C-6.03.04	ability to perform sensory inspection
C-6.03.05	ability to use diagnostic equipment such as computer, handheld devices, multimeter and pressure gauges
C-6.03.06	ability to interpret test results

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**Task 7****Services air systems and brakes.**

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**Sub-task****C-7.01 Services air systems.**

<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YT</u>	<u>NU</u>
yes	NV	NV	ND									

**Supporting Knowledge & Abilities**

C-7.01.01	knowledge of air system design and function
C-7.01.02	knowledge of air system components such as compressors, valves and brake chambers
C-7.01.03	ability to recognize hazards of servicing air systems
C-7.01.04	ability to replace components such as air lines, relay valves, modulating valves and compressors

- C-7.01.05 ability to repair components such as air starters, compressors, air dryers and driver warning systems
- C-7.01.06 ability to perform general maintenance on air dryers and compressors

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**Sub-task**

**C-7.02 Services brake systems.**

<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YT</u>	<u>NU</u>
yes	NV	NV	ND									

**Supporting Knowledge & Abilities**

- C-7.02.01 knowledge of types of brake systems such as air, hydraulic and emergency (parking) brake
- C-7.02.02 knowledge of operating principles of ABS, roll stability protection and traction control
- C-7.02.03 knowledge of components of air brakes such as brake chambers, slack adjusters (automatic and manual), rotors, calipers, S-cams, pins and bushings
- C-7.02.04 knowledge of hydraulic brake components such as master cylinders, wheel cylinders and brake proportioning valves
- C-7.02.05 knowledge of ABS components such as wiring, ECMs, modulating valves and sensors
- C-7.02.06 knowledge of types of brake shoes, pads and linings
- C-7.02.07 knowledge of brake system operation
- C-7.02.08 ability to bleed hydraulic brakes following OEM procedures
- C-7.02.09 ability to identify types of power assisted hydraulic brakes
- C-7.02.10 ability to adjust brakes as per OEM specifications
- C-7.02.11 ability to adjust and replace sensors for ABS
- C-7.02.12 ability to service ABS components such as wiring, connectors and terminals
- C-7.02.13 ability to install new brake linings and adjust slacks

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**Sub-task****C-7.03 Services auxiliary braking systems.**

<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YT</u>	<u>NU</u>
yes	NV	NV	ND									

**Supporting Knowledge & Abilities**

C-7.03.01	knowledge of types and operation of engine compression brakes
C-7.03.02	knowledge of types and operation of engine exhaust brakes
C-7.03.03	knowledge of types and operation of driveline retarders
C-7.03.04	knowledge of types and operation of fluid retarders
C-7.03.05	knowledge of auxiliary braking system components such as solenoids, valves and switches
C-7.03.06	knowledge of the function of electronic controls used with auxiliary braking systems
C-7.03.07	ability to adjust compression brake clearances as per OEM specifications
C-7.03.08	ability to replace components such as solenoids, seals and o-rings
C-7.03.09	ability to repair components such as retarders, wiring and connectors
C-7.03.10	ability to service components such as fluid retarders

**Trends**

An increase in the use of ECMs and VECUs to control more components. In the future, there will be more use of wireless communication systems. There is a trend towards the use of global positioning systems (GPS). Increasingly, electronic systems are being used to control vehicle stability and for collision avoidance. The use of higher voltage systems will become more common.

**Context**

The electrical and electronic systems are vital to the operation of the vehicle and must work together to provide feedback to and from the driver. They control the operation of various components throughout the vehicle.

Truck and transport mechanics must diagnose and repair electrical and electronic faults in order to return the vehicle to service promptly.

Servicing includes the replacement and repair of components as well as routine maintenance.

**Related  
Components  
(include, but not  
limited to)**

**Electrical:** batteries, sensors, alternators, internal and external regulators, wiring, relays, starters, cables, switches, solenoids, lights, fuses, breakers, rotary beacons, block heaters, seat heaters, fusible links, ignition coils, pick-up coils, coil packs.

**Electronic:** light emitting diodes (LEDs), modules, actuators, circuit boards, multi-function controls, wiring, connectors, data links, communication plugs, terminating resistors, ECMs, sensors.

**Tools and  
Equipment**

Hand tools; power tools; measuring, testing and diagnostic equipment; staging equipment; PPE and safety equipment.

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**Task 8****Diagnoses electrical systems.**

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**Sub-task****D-8.01 Diagnoses batteries.**

<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YT</u>	<u>NU</u>
yes	NV	NV	ND									

**Supporting Knowledge & Abilities**

D-8.01.01	knowledge of types of batteries such as sealed, vented and gel cell
D-8.01.02	knowledge of common faults such as low voltage, cracked casing and corroded terminals
D-8.01.03	knowledge of battery ratings such as cold cranking amps (CCA), reserve capacity (RC) and amp-hour rating
D-8.01.04	ability to recognize hazards related to working with and handling batteries
D-8.01.05	ability to perform visual inspections
D-8.01.06	ability to perform a battery load test
D-8.01.07	ability to use hydrometer and refractometer to perform specific gravity tests
D-8.01.08	ability to interpret test results

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**Sub-task****D-8.02 Diagnoses charging systems.**

<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YT</u>	<u>NU</u>
yes	NV	NV	ND									

**Supporting Knowledge & Abilities**

D-8.02.01	knowledge of types of charging systems such as externally excited, internally excited, and 12- and 24-volt
D-8.02.02	knowledge of charging system components such as alternators, internal and external regulators, wiring and relays
D-8.02.03	knowledge of types of alternators such as air/oil cooled, belt driven and gear driven
D-8.02.04	knowledge of ratings of alternators
D-8.02.05	knowledge of alternator components

- D-8.02.06 ability to perform sensory inspection
- D-8.02.07 ability to use diagnostic equipment to perform tests such as full-field, amperage and voltage

**Sub-task**

**D-8.03 Diagnoses starting systems.**

<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YT</u>	<u>NU</u>
yes	NV	NV	ND									

**Supporting Knowledge & Abilities**

- D-8.03.01 knowledge of types of starting systems such as 12- and 24-volt
- D-8.03.02 knowledge of starting system components such as starter, cables, relays, switches and solenoids
- D-8.03.03 knowledge of starting system conditions requiring servicing such as no start, slow cranking and intermittent operation
- D-8.03.04 knowledge of common faults such as dead battery, frayed cables and high resistance in cables and connections
- D-8.03.05 ability to perform starter draw tests as per OEM specifications
- D-8.03.06 ability to use multimeter to perform voltage drop test
- D-8.03.07 ability to perform solenoid hold-in and pull-in test
- D-8.03.08 ability to interpret test results

**Sub-task**

**D-8.04 Diagnoses electrical components and accessories.**

<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YT</u>	<u>NU</u>
yes	NV	NV	ND									

**Supporting Knowledge & Abilities**

- D-8.04.01 knowledge of electrical components such as lights, switches, wiring, relays, fuses and breakers
- D-8.04.02 knowledge of electrical accessories such as driving lights, rotary beacons, block heaters, auxiliary power units and seat heaters
- D-8.04.03 knowledge of common faults such as blown fuses, broken wires and corroded connections

D-8.04.04	ability to interpret wiring schematics
D-8.04.05	ability to perform sensory inspection
D-8.04.06	ability to use multimeter to identify faults
D-8.04.07	ability to interpret test results

## Task 9

### Services electrical systems.

#### Sub-task

#### D-9.01 Services batteries.

<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YT</u>	<u>NU</u>
yes	NV	NV	ND									

#### Supporting Knowledge & Abilities

D-9.01.01	knowledge of types of batteries such as sealed, vented and gel cell
D-9.01.02	knowledge of common faults such as low voltage, cracked casing and corroded terminals
D-9.01.03	knowledge of battery ratings such as CCA, RC and amp-hour rating
D-9.01.04	knowledge of battery maintenance schedule
D-9.01.05	ability to recognize hazards related to working with, handling and disposing of batteries
D-9.01.06	ability to clean, refill, recharge and replace battery
D-9.01.07	ability to disconnect and connect batteries in proper sequence
D-9.01.08	ability to perform boosting procedures as per OEM specifications
D-9.01.09	ability to apply anti-corrosion compounds

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**Sub-task****D-9.02 Services charging systems.**

<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YT</u>	<u>NU</u>
yes	NV	NV	ND									

**Supporting Knowledge & Abilities**

D-9.02.01	knowledge of types of charging systems such as externally excited, internally excited, and 12- and 24-volt
D-9.02.02	knowledge of charging system components such as alternators, internal and external regulators, wiring and relays
D-9.02.03	knowledge of types of alternators such as air/oil cooled, belt driven and gear driven
D-9.02.04	knowledge of ratings of alternators
D-9.02.05	knowledge of alternator components
D-9.02.06	knowledge of rebuilding alternators and regulators
D-9.02.07	ability to replace components such as belts, pulleys, alternators and regulators
D-9.02.08	ability to repair and replace alternator mounting brackets
D-9.02.09	ability to adjust belt tension to OEM specifications
D-9.02.10	ability to repair connections by crimping and soldering
D-9.02.11	ability to clean connections

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**Sub-task****D-9.03 Services starting systems.**

<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YT</u>	<u>NU</u>
yes	NV	NV	ND									

**Supporting Knowledge & Abilities**

D-9.03.01	knowledge of types of starting systems such as 12- and 24-volt
D-9.03.02	knowledge of starting system components such as starter, cables, relays, switches and solenoids
D-9.03.03	knowledge of starting system schematics
D-9.03.04	knowledge of starter rebuilding procedures
D-9.03.05	ability to remove and replace starter

- D-9.03.06 ability to replace components such as solenoid, relays, cables, connections and ignition switches
- D-9.03.07 ability to clean components such as connections and terminals

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**Sub-task**

**D-9.04 Services electrical components and accessories.**

<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YT</u>	<u>NU</u>
yes	NV	NV	ND									

**Supporting Knowledge & Abilities**

- D-9.04.01 knowledge of electrical components such as lights, LEDs, high intensity discharge (HID) switches, wiring, relays, fuses and breakers
- D-9.04.02 knowledge of electrical accessories such as driving lights, rotary beacons, block heaters, auxiliary power units and seat heaters
- D-9.04.03 knowledge of common faults such as blown fuses, broken wires and corroded connections
- D-9.04.04 ability to interpret wiring schematics
- D-9.04.05 ability to replace components such as light bulbs, fuses, harnesses and plug-in connectors
- D-9.04.06 ability to repair components such as faulty wiring, corroded terminals and sockets
- D-9.04.07 ability to identify and tighten loose connections
- D-9.04.08 ability to apply anti-corrosion compound
- D-9.04.09 ability to clean components such as corroded terminals, sockets and junction boxes
- D-9.04.10 ability to select and match components such as wires, fuses, relays and switches to electrical load
- D-9.04.11 ability to install electrical accessories

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**Task 10****Diagnoses electronic systems.**

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**Sub-task****D-10.01 Diagnoses spark ignition systems.**

<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YT</u>	<u>NU</u>
yes	no	no	yes	NV	NV	ND						

**Supporting Knowledge & Abilities**

D-10.01.01	knowledge of spark ignition components such as distributor, spark plugs, modules, ignition coils, rotor, pick up coils, distributor cap and coil packs
D-10.01.02	knowledge of conditions requiring servicing such as intermittent problems, no start, hard starting and misfiring
D-10.01.03	knowledge of common faults such as faulty wiring, low voltage, faulty modules and bad ground
D-10.01.04	knowledge of electrical fundamentals
D-10.01.05	knowledge of engine operating principles such as firing order, ignition timing and combustion cycle
D-10.01.06	ability to perform sensory inspection
D-10.01.07	ability to identify primary and secondary sides of system
D-10.01.08	ability to use diagnostic equipment such as multimeter, timing lights, code readers, scopes and spark testers
D-10.01.09	ability to interpret test results

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**Sub-task****D-10.02 Diagnoses electronic components and accessories.**

<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YT</u>	<u>NU</u>
yes	NV	NV	ND									

**Supporting Knowledge & Abilities**

D-10.02.01	knowledge of types of electronic systems such as daytime running lights (DRL), driver communication, cruise control, satellite systems and supplemental restraint system (SRS)
D-10.02.02	knowledge of electronic system components such as actuators, circuit boards, multi-function controls, wiring and connectors

D-10.02.03	knowledge of conditions requiring servicing such as electronic malfunction indicators, intermittent operation and component failure
D-10.02.04	knowledge of common faults such as faulty modules, blown fuses and poor connections
D-10.02.05	knowledge of wiring schematics
D-10.02.06	ability to perform sensory inspection
D-10.02.07	ability to use diagnostic equipment such as multimeter and diagnostic software
D-10.02.08	ability to understand flash codes for various OEMs
D-10.02.09	ability to interpret test results

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### Sub-task

#### D-10.03 Diagnoses vehicle management systems.

<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YT</u>	<u>NU</u>
yes	NV	NV	ND									

### Supporting Knowledge & Abilities

D-10.03.01	knowledge of multiplex systems
D-10.03.02	knowledge of communication protocols
D-10.03.03	knowledge of vehicle management components such as data links, communication plugs, connectors and terminating resistors
D-10.03.04	knowledge of conditions requiring servicing such as gauges not sweeping and failure of lighting circuits
D-10.03.05	knowledge of common faults such as miscommunication over data link and loss of signal
D-10.03.06	ability to locate vehicle management system modules and communication cables
D-10.03.07	ability to perform sensory inspection
D-10.03.08	ability to interpret wiring schematics
D-10.03.09	ability to check for software updates
D-10.03.10	ability to use computer and diagnostic software
D-10.03.11	ability to interpret test results

**Task 11****Services electronic components.****Sub-task****D-11.01 Services spark ignition systems.**

<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YT</u>	<u>NU</u>
yes	no	no	yes	NV	NV	ND						

**Supporting Knowledge & Abilities**

D-11.01.01	knowledge of spark ignition system components such as distributor, spark plugs, modules, ignition coils, rotor, pick up coils, distributor cap and coil packs
D-11.01.02	knowledge of electrical fundamentals
D-11.01.03	knowledge of engine operating principles such as firing order, ignition timing and combustion cycle
D-11.01.04	ability to replace components such as spark plugs, coils, high tension wires and distributor caps
D-11.01.05	ability to repair components such as loose and corroded connections
D-11.01.06	ability to adjust engine timing and spark plug gap

**Sub-task****D-11.02 Services electronic components and accessories.**

<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YT</u>	<u>NU</u>
yes	NV	NV	ND									

**Supporting Knowledge & Abilities**

D-11.02.01	knowledge of types of electronic systems such as DRL, driver communication, cruise control and SRS
D-11.02.02	knowledge of electronic components such as actuators, circuit boards, multi-function controls, wiring and connectors
D-11.02.03	knowledge of repair procedures such as soldering, heat shrinking, terminal installation and insulation protection
D-11.02.04	knowledge of wiring schematics
D-11.02.05	knowledge of damage caused by static electricity

D-11.02.06	ability to understand flash codes for various OEMs
D-11.02.07	ability to replace components such as modules, connectors, switches and solenoids
D-11.02.08	ability to repair components such as wiring, connectors and terminals
D-11.02.09	ability to adjust components such as automatic engine shutdowns and sensors
D-11.02.10	ability to install accessories such as inverters, auxiliary coolant heaters and air heaters with electronic controls

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### Sub-task

#### D-11.03 Services vehicle management systems.

<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YT</u>	<u>NU</u>
yes	NV	NV	ND									

### Supporting Knowledge & Abilities

D-11.03.01	knowledge of multiplex systems
D-11.03.02	knowledge of communication protocols
D-11.03.03	knowledge of wiring types such as twisted pairs
D-11.03.04	knowledge of hazards such as static electricity
D-11.03.05	knowledge of tools and repair procedures required for various OEM connectors
D-11.03.06	ability to repair or replace components such as wiring, sensors, gauges and connectors
D-11.03.07	ability to replace faulty cards/circuit boards and ECMs
D-11.03.08	ability to interpret wiring schematics
D-11.03.09	ability to use computer to reprogram ECMs to update software and to accommodate new vehicle accessories
D-11.03.10	ability to locate and access vehicle management system modules and communication cables

<b>Trends</b>	<p>Components are being designed that require less maintenance and that can handle higher loads and torque ratings.</p> <p>There is an increased use of synthetic oils, resulting in longer service intervals and component life.</p> <p>There is an increased use of electronically-controlled drive train components requiring more specialized training and tooling.</p>
<b>Context</b>	<p>The drive train of a vehicle transfers power and torque from the engine to the wheels to enable movement of the vehicle. The drive train allows for selection of gear ratios needed for various load and speed conditions.</p> <p>Truck and transport mechanics must diagnose and service the drive train to reduce down time of the vehicle and return the vehicle to service in a timely manner and to ensure the safety of vehicle, driver and public.</p> <p>Servicing includes the replacement and repair of components as well as routine maintenance.</p>
<b>Related Components (include, but not limited to)</b>	<p><b>Clutches:</b> discs, center plates, release springs, bearings, pressure plates.</p> <p><b>Transmissions:</b> seals, gaskets, gears, bearings, breathers, filters, oil pumps, splined shafts, connectors, torque converters, coolers, valve bodies, clutch packs, wiring, solenoids, ECMs, shift bar housings, shift lever, knob, air lines, cylinders, gauges, sensors.</p> <p><b>Driveline systems:</b> driveshaft, u-joint, yokes, slip-joints, seals, steady bearings, support brackets, grease nipples.</p> <p><b>Differentials:</b> seals, breathers, axles, gaskets, hubs, gears, planetaries, bearings, shift forks, filters, coolers, power dividers, locking devices, sensors, wiring.</p>
<b>Tools and Equipment</b>	<p>Hand tools; power tools; measuring, testing and diagnostic equipment; lifting and hoisting equipment; welding and cutting equipment; staging equipment; PPE and safety equipment.</p>

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**Task 12****Diagnoses drive train.**

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**Sub-task****E-12.01 Diagnoses clutches.**

<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YT</u>	<u>NU</u>
yes	NV	NV	ND									

**Supporting Knowledge & Abilities**

E-12.01.01	knowledge of types of clutches such as pull, push, self-adjusting and manual adjusting
E-12.01.02	knowledge of clutch components such as discs, center plate, release springs and release bearings
E-12.01.03	knowledge of clutch controls such as cable, linkage and hydraulic
E-12.01.04	knowledge of clutch operation and adjustment
E-12.01.05	knowledge of conditions that indicate that clutch needs servicing such as hard shifting, loss of pedal free play and excessive pedal free play
E-12.01.06	knowledge of clutch faults such as shock loads, worn parts, seized release bearings and broken clutch springs
E-12.01.07	ability to perform sensory inspection
E-12.01.08	ability to perform failure analysis
E-12.01.09	ability to use diagnostic tools such as feeler gauge, tape measure and spring gauge

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**Sub-task****E-12.02 Diagnoses standard transmissions and transfer cases.**

<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YT</u>	<u>NU</u>
yes	NV	NV	ND									

**Supporting Knowledge & Abilities**

E-12.02.01	knowledge of types of standard transmissions such as 13-speed, 15-speed, double countershaft and triple countershaft
E-12.02.02	knowledge of standard transmission components such as seals, gaskets, gears and bearings

E-12.02.03	knowledge of types of transfer case and transfer case shift controls such as air, electrical and mechanical
E-12.02.04	knowledge of common component faults such as missing teeth in gears, lack of lubrication and worn synchronizers
E-12.02.05	knowledge of auxiliary shift components such as slave cylinder, air lines, regulators and shift knobs
E-12.02.06	ability to perform sensory inspection
E-12.02.07	ability to perform failure analysis

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### Sub-task

#### E-12.03 Diagnoses automatic transmissions.

<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YT</u>	<u>NU</u>
yes	NV	NV	ND									

#### Supporting Knowledge & Abilities

E-12.03.01	knowledge of automatic transmission components such as torque converters, valve bodies, pumps, dial solenoids, force motors and clutches
E-12.03.02	knowledge of component failures such as burnt clutch packs, deteriorating clutch lining and sticking valves
E-12.03.03	knowledge of hybrid transmissions
E-12.03.04	ability to perform visual inspection
E-12.03.05	ability to perform failure analysis
E-12.03.06	ability to perform diagnostic tests such as pressure checks, stall test and test for proper shift point
E-12.03.07	ability to use diagnostic tools such as pressure gauges, computers and handheld devices
E-12.03.08	ability to interpret test results

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**Sub-task****E-12.04 Diagnoses automated transmissions.**

<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YT</u>	<u>NU</u>
yes	NV	NV	ND									

**Supporting Knowledge & Abilities**

E-12.04.01	knowledge of manual transmissions and failures that can occur with them
E-12.04.02	knowledge of automated transmission components such as wiring, solenoids and ECMs
E-12.04.03	knowledge of hybrid transmissions
E-12.04.04	knowledge of data links and communication with engine ECM
E-12.04.05	ability to use diagnostic equipment such as computers, handheld devices, multimeters, test leads and break-out harnesses
E-12.04.06	ability to check for proper operation of shift solenoids using test equipment
E-12.04.07	ability to interpret test results

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**Sub-task****E-12.05 Diagnoses driveline systems.**

<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YT</u>	<u>NU</u>
yes	NV	NV	ND									

**Supporting Knowledge & Abilities**

E-12.05.01	knowledge of types of driveline systems such as standard and extended life
E-12.05.02	knowledge of methods of mounting and phasing of driveline systems
E-12.05.03	knowledge of u-joint installation and removal
E-12.05.04	knowledge of conditions requiring servicing such as vibration, noise and other reported problems
E-12.05.05	knowledge of wear limits and driveline angles as per OEM specifications
E-12.05.06	ability to perform sensory inspection
E-12.05.07	ability to perform diagnostic tests such as air ride height and driveline angles
E-12.05.08	ability to use diagnostic equipment such as vibration analyzer, angle gauges and computers
E-12.05.09	ability to interpret test results
E-12.05.10	ability to perform failure analysis

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**Sub-task****E-12.06          Diagnoses differentials.**

<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YT</u>	<u>NU</u>
yes	NV	NV	ND									

**Supporting Knowledge & Abilities**

- E-12.06.01          knowledge of types of differentials such as locking, two-speed, limited slip and outboard planetary
- E-12.06.02          knowledge of differential components such as seals, axles, gaskets, hubs, gears and bearings
- E-12.06.03          knowledge of weight ratings and gear ratios such as 4.11:1
- E-12.06.04          knowledge of differential lock activating methods such as air and electric
- E-12.06.05          knowledge of methods of securing hubs to spindles such as pre-set and conventional
- E-12.06.06          knowledge of conditions that indicate that differential needs servicing such as noise and interaxle differential lock not working
- E-12.06.07          knowledge of common faults such as missing teeth in crown and pinion gears, broken shift fork in power dividers, lack of lubrication and broken axles
- E-12.06.08          ability to perform sensory inspection
- E-12.06.09          ability to perform failure analysis

**Sub-task****E-13.01 Services clutches.**

<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YT</u>	<u>NU</u>
yes	NV	NV	ND									

**Supporting Knowledge & Abilities**

E-13.01.01	knowledge of types of clutches such as pull, push, self-adjusting and manual adjusting
E-13.01.02	knowledge of clutch components such as discs, center plate, release springs, clutch brakes and release bearings
E-13.01.03	knowledge of clutch controls such as cable, linkage and hydraulic
E-13.01.04	knowledge of clutch operation and adjustment
E-13.01.05	knowledge of clutch operation components such as hydraulic assisted and air assisted
E-13.01.06	ability to measure flywheel and flywheel housing run-out and concentricity
E-13.01.07	ability to remove and replace flywheel for resurfacing and inspection of ring gear for wear
E-13.01.08	ability to remove and replace components such as bushings, shafts, forks and clutches
E-13.01.09	ability to bleed air from master and slave cylinders
E-13.01.10	ability to align discs and pressure plates
E-13.01.11	ability to adjust clutch according to OEM specifications

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**Sub-task****E-13.02 Services standard transmissions and transfer cases.**

<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YT</u>	<u>NU</u>
yes	NV	NV	ND									

**Supporting Knowledge & Abilities**

E-13.02.01	knowledge of types of standard transmissions such as 13-speed, 15-speed, double countershaft and triple countershaft
E-13.02.02	knowledge of standard transmission components such as seals, gaskets, gears and bearings
E-13.02.03	knowledge of auxiliary shift components such as slave cylinder, air lines, regulators and shift knobs
E-13.02.04	knowledge of types of transfer case and transfer case shift controls such as air, electrical and mechanical
E-13.02.05	ability to perform a major overhaul using tools such as feeler gauges, shims and dial indicator
E-13.02.06	ability to replace components such as gears, bearings, oil coolers, oil pumps and seals
E-13.02.07	ability to perform routine maintenance
E-13.02.08	ability to repair air lines and cylinders
E-13.02.09	ability to install power take-offs (PTOs)

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**Sub-task****E-13.03 Services automatic transmissions.**

<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YT</u>	<u>NU</u>
yes	NV	NV	ND									

**Supporting Knowledge & Abilities**

E-13.03.01	knowledge of automatic transmission components such as torque converters, valve bodies, pumps and clutches
E-13.03.02	knowledge of types and locations of coolers
E-13.03.03	knowledge of servicing procedures for components such as clutch packs, bearings, seals, torque converters, bands, one-way clutches, servos and planetaries

- E-13.03.04 ability to perform routine maintenance
- E-13.03.05 ability to install PTOs

**Sub-task**

**E-13.04 Services automated transmissions.**

<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YT</u>	<u>NU</u>
yes	NV	NV	ND									

**Supporting Knowledge & Abilities**

- E-13.04.01 knowledge of manual transmissions and failures that can occur with them
- E-13.04.02 knowledge of automated transmission components such as wiring, solenoids and ECMs
- E-13.04.03 knowledge of data links and communication with engine ECM
- E-13.04.04 ability to replace components such as solenoids, ECMs, wiring harnesses and gaskets
- E-13.04.05 ability to repair components such as wiring harnesses and connectors

**Sub-task**

**E-13.05 Services driveline systems.**

<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YT</u>	<u>NU</u>
yes	NV	NV	ND									

**Supporting Knowledge & Abilities**

- E-13.05.01 knowledge of types of driveline systems such as standard and extended life
- E-13.05.02 knowledge of methods of mounting and phasing of driveline systems
- E-13.05.03 knowledge of wear limits and driveline angles as per OEM specifications
- E-13.05.04 ability to identify components that affect driveline angle
- E-13.05.05 ability to identify worn and loose yokes
- E-13.05.06 ability to replace components such as u-joints, yokes and steady bearings
- E-13.05.07 ability to lubricate u-joints and slip yokes as per OEM specifications

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**Sub-task****E-13.06 Services differentials.**

<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YT</u>	<u>NU</u>
yes	NV	NV	ND									

**Supporting Knowledge & Abilities**

E-13.06.01	knowledge of types of differentials such as locking, two-speed, limited slip and outboard planetary
E-13.06.02	knowledge of weight ratings and gear ratios such as 4.11:1
E-13.06.03	knowledge of methods of securing hubs to spindles such as pre-set and conventional
E-13.06.04	knowledge of components such as seals, axles, gaskets, hubs, gears and bearings
E-13.06.05	ability to perform overhaul procedures such as setting and adjusting preload and backlash, and checking and adjusting crown and pinion gear tooth pattern
E-13.06.06	ability to replace components such as gears, bearings, shafts and thrust washers
E-13.06.07	ability to repair components such as housings and spindle threads
E-13.06.08	ability to clean components such as housings, gears and hubs
E-13.06.09	ability to adjust wheel bearings as per OEM specifications

## BLOCK F

# STEERING, CHASSIS/FRAMES, SUSPENSION, WHEELS, HUBS AND TIRES

<b>Trends</b>	<p>Spoked hubs are less common, being replaced with hub pilot systems. There is also a trend towards a tighter turning radius.</p> <p>There is an increase in load capacities, resulting in the need for wider tires and additional axles to meet road standards.</p>
<b>Context</b>	<p>This block includes the components that are the foundation for every vehicle, upon which all other components are mounted. Truck and transport mechanics diagnose and service these systems and components in order to ensure the safe and correct operation of the vehicle.</p> <p>Servicing includes the replacement and repair of components as well as routine maintenance.</p>
<b>Related Components (include, but not limited to)</b>	<p><b>Steering system components:</b> steering boxes, steering wheel, steering knuckles, steering column, pitman arms, tie rods, king pins, connecting rods, drag links, power steering components.</p> <p><b>Chassis/frame components:</b> frame rails, cross members, mounts, hangers, gussets, unibody (monocoque) chassis.</p> <p><b>Suspension components:</b> axles (drive, steering, auxiliary), springs, bushings, air springs, levelling valves, leaf springs, spring overloads, stoppers, spring hangers, shackles, saddles, shocks, torsion bars, walking beam, u-bolts.</p> <p><b>Hitches and couplers:</b> jaw, locks, handles, ball and stud, sliders, rails, saddles, pintles, safety chains, pads, forks.</p> <p><b>Tires, wheels and hubs:</b> belts, tread, tubes, sidewall, seals, rims, spacers (corrosion control, wheel spacers), wedges, valve stems, studs, nuts, cup and cone bearings.</p>
<b>Tools and Equipment</b>	<p>Hand tools; power tools; measuring, testing and diagnostic equipment; welding and cutting equipment; hoisting and lifting equipment; staging equipment; PPE and safety equipment.</p>

**Task 14****Diagnoses steering system, chassis/frames, suspension, wheels, hubs and tires.****Sub-task****F-14.01 Diagnoses steering system.**

<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YT</u>	<u>NU</u>
yes	NV	NV	ND									

**Supporting Knowledge & Abilities**

F-14.01.01	knowledge of operating principles of steering systems
F-14.01.02	knowledge of types of steering systems such as integral, linkage, rack and pinion, and air assisted
F-14.01.03	knowledge of steering system components such as steering boxes, pitman arms, tie rods, king pins, connecting rods, drag links and power steering components
F-14.01.04	knowledge of master and slave steering systems
F-14.01.05	knowledge of common faults such as tire wear, bent tie rods and loose drag link
F-14.01.06	knowledge of steering geometry and alignment such as caster, camber, toe-in and toe-out
F-14.01.07	ability to perform tests such as pressure, volume and mechanical tests
F-14.01.08	ability to perform sensory inspection
F-14.01.09	ability to interpret tire wear
F-14.01.10	ability to use diagnostic tools
F-14.01.11	ability to inspect for leaks

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**Sub-task****F-14.02 Diagnoses chassis/frames.**

<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YT</u>	<u>NU</u>
yes	NV	NV	ND									

**Supporting Knowledge & Abilities**

F-14.02.01	knowledge of chassis/frame components such as frame rails, cross members, mounts, hangers and gussets
F-14.02.02	knowledge of unibody (monocoque) chassis design
F-14.02.03	knowledge of chassis/frame fastening systems
F-14.02.04	knowledge of common chassis/frame faults such as bending, cracking, corrosion and missing fasteners
F-14.02.05	ability to use diagnostic equipment such as laser alignment tools, calipers and straight edge
F-14.02.06	ability to perform visual inspection

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**Sub-task****F-14.03 Diagnoses suspension.**

<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YT</u>	<u>NU</u>
yes	NV	NV	ND									

**Supporting Knowledge & Abilities**

F-14.03.01	knowledge of types of suspensions such as air ride, spring, solid block and combination
F-14.03.02	knowledge of suspension components such as spring hangers, shackles, saddles, shocks, torsion bars, walking beam and u-bolts
F-14.03.03	knowledge of axle applications such as steering, drive and auxiliary
F-14.03.04	knowledge of common suspension faults such as broken springs, air springs, u-bolts, leaking shocks and worn bushings
F-14.03.05	ability to use diagnostic equipment such as dial indicators, tape measure and angle gauges
F-14.03.06	ability to perform sensory inspection
F-14.03.07	ability to interpret test results

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**Sub-task****F-14.04 Diagnoses hitches and couplers.**

<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YT</u>	<u>NU</u>
yes	NV	NV	ND									

**Supporting Knowledge & Abilities**

F-14.04.01	knowledge of types of hitches and couplers such as pintle hitch, 5 <sup>th</sup> -wheel hitch and ball hitch
F-14.04.02	knowledge of hitch and coupler applications
F-14.04.03	knowledge of common faults such as out-of-adjustment and twisted, bent and worn components
F-14.04.04	ability to use specialized diagnostic tools such as go/no-go gauge and king pin tool
F-14.04.05	ability to perform visual inspection
F-14.04.06	ability to test hitch and coupler operation

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**Sub-task****F-14.05 Diagnoses tires, wheels and hubs.**

<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YT</u>	<u>NU</u>
yes	NV	NV	ND									

**Supporting Knowledge & Abilities**

F-14.05.01	knowledge of types of tires such as radial and bias
F-14.05.02	knowledge of tire load ranges, pressures, profiles and sizes
F-14.05.03	knowledge of steering and drive tires
F-14.05.04	knowledge of types of wheels such as aluminum, steel and dual
F-14.05.05	knowledge of types of hubs such as spoked, hub pilot and stud pilot
F-14.05.06	knowledge of tire components such as belts, tread, tubes and sidewall
F-14.05.07	knowledge of wheel components such as rims, spacers, wedges and valve stems
F-14.05.08	knowledge of hub components such as studs, nuts and spacers
F-14.05.09	knowledge of common faults such as cracked rims, holes in tires, broken studs and worn locks

- F-14.05.10 ability to use diagnostic equipment such as dial indicator, torque wrench, air gauge, tire pressure/heat warning devices and tread depth gauge
- F-14.05.11 ability to perform sensory inspection

## Task 15

### Services steering system, chassis/frames, suspension, wheels, hubs and tires.

#### Sub-task

#### F-15.01 Services steering system.

<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YT</u>	<u>NU</u>
yes	NV	NV	ND									

#### Supporting Knowledge & Abilities

- F-15.01.01 knowledge of operating principles of steering systems
- F-15.01.02 knowledge of types of steering systems such as integral, linkage, rack and pinion, and air assisted
- F-15.01.03 knowledge of steering system components such as steering boxes, pitman arms, tie rods, king pins, connecting rods, drag links and power steering components
- F-15.01.04 knowledge of master and slave steering systems
- F-15.01.05 knowledge of steering geometry and alignment such as caster, camber, toe-in and toe-out
- F-15.01.06 ability to replace worn and damaged components such as pins, bushings, hoses and seals
- F-15.01.07 ability to adjust components such as pitman arms, steering box, drag link and steering wheel
- F-15.01.08 ability to repair components such as leaking hoses, reservoirs and steering box
- F-15.01.09 ability to perform alignment
- F-15.01.10 ability to grease components such as tie rods, king pins and u-joints
- F-15.01.11 ability to change steering system oil and filters

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**Sub-task****F-15.02 Services chassis/frames.**

<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YT</u>	<u>NU</u>
yes	NV	NV	ND									

**Supporting Knowledge & Abilities**

F-15.02.01	knowledge of chassis/frame components such as frame rails, cross members, mounts, hangers and gussets
F-15.02.02	knowledge of unibody (monocoque) chassis design
F-15.02.03	knowledge of chassis/frame fastening systems
F-15.02.04	knowledge of frame straightening procedures
F-15.02.05	ability to modify chassis/frame such as adding inserts, drilling frames and adjusting length
F-15.02.06	ability to repair and replace components and fasteners
F-15.02.07	ability to install new components
F-15.02.08	ability to relocate existing components

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**Sub-task****F-15.03 Services suspension.**

<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YT</u>	<u>NU</u>
yes	NV	NV	ND									

**Supporting Knowledge & Abilities**

F-15.03.01	knowledge of types of suspension such as air ride, spring, solid block and combination
F-15.03.02	knowledge of suspension components such as spring hangers, shackles, saddles, shocks, torsion bars, walking beam and u-bolts
F-15.03.03	knowledge of axle applications such as steering, drive and auxiliary
F-15.03.04	ability to repair components such as torsion bars and spring guides
F-15.03.05	ability to use welding and cutting equipment to repair axle stops, shackle assemblies and hanger assemblies
F-15.03.06	ability to replace components such as bushings, air springs and spring assemblies

F-15.03.07	ability to make suspension adjustments such as ride height and axle angle
F-15.03.08	ability to lubricate suspension components

**Sub-task**

**F-15.04 Services hitches and couplers.**

<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YT</u>	<u>NU</u>
yes	NV	NV	ND									

**Supporting Knowledge & Abilities**

F-15.04.01	knowledge of types of hitches and couplers such as pintle hitch, 5 <sup>th</sup> -wheel hitch and ball hitch
F-15.04.02	knowledge of OEM specifications such as wear limits and load capacity
F-15.04.03	knowledge of hitch and coupler applications
F-15.04.04	ability to repair and replace faulty components
F-15.04.05	ability to use welding and cutting equipment to repair and relocate hitch and coupler components
F-15.04.06	ability to perform adjustments to components such as 5 <sup>th</sup> -wheel jaws, sliders and slide rails
F-15.04.07	ability to lubricate components
F-15.04.08	ability to install hitches and couplers
F-15.04.09	ability to rebuild hitches and couplers

**Sub-task**

**F-15.05 Services tires, wheels and hubs.**

<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YT</u>	<u>NU</u>
yes	NV	NV	ND									

**Supporting Knowledge & Abilities**

F-15.05.01	knowledge of types of tires such as radial and bias
F-15.05.02	knowledge of tire load ranges, pressures, profiles and sizes
F-15.05.03	knowledge of jurisdictional requirements
F-15.05.04	knowledge of steering and drive tires
F-15.05.05	knowledge of types of wheels such as aluminum, steel and dual

- F-15.05.06 knowledge of types of hubs such as spoked, hub pilot and stud pilot
- F-15.05.07 knowledge of tire components such as belts, tread, tubes and sidewall
- F-15.05.08 knowledge of wheel components such as rims, spacers, wedges and valve stems
- F-15.05.09 knowledge of hub components such as studs, nuts and spacers
- F-15.05.10 knowledge of wheel balancing procedures
- F-15.05.11 ability to recognize hazards associated with tire inflation such as split rims and damaged tires
- F-15.05.12 ability to recognize hazards associated with removal of tires such as spoke wheels and wedges
- F-15.05.13 ability to identify mismatched tires by casing and tread depth
- F-15.05.14 ability to repair and replace components
- F-15.05.15 ability to mount tire to rim
- F-15.05.16 ability to remove tire from rim
- F-15.05.17 ability to use tools to mount and remove tires
- F-15.05.18 ability to align wheel on hub
- F-15.05.19 ability to adjust air pressure and run-out and torque on wheels

<b>Trends</b>	There is more variety in component materials such as aluminum, steel, wood and fibreglass. Advances in aerodynamic design have made the diagnosis and repair more complex for truck and transport mechanics. There are more SRSs in cabs. Rear view cameras and other video components are becoming more common.
<b>Context</b>	The cab of the vehicle is made up of both interior and exterior components surrounding the occupant. Servicing includes the replacement and repair of components as well as routine maintenance.
<b>Related Components (include, but not limited to)</b>	<b>Interior components:</b> pedals (fuel, brake and clutch), air ride seats, seat belts, side windows, door handles, visors, panels, SRSs, wheelchair accessories, dash. <b>Exterior components:</b> windshields, wipers, mirrors, door handles, steps, wind deflectors, engine bonnet/hood cables, lock-down straps, mouldings, fenders, mounts, air ride system, head light buckets, marker lights, horns.
<b>Tools and Equipment</b>	Hand tools; power tools; measuring, testing and diagnostic equipment; welding and cutting equipment; staging equipment; PPE and safety equipment.

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**Task 16****Diagnoses cab components.**

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**Sub-task****G-16.01 Diagnoses interior components.**

<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YT</u>	<u>NU</u>
yes	NV	NV	ND									

**Supporting Knowledge & Abilities**

- G-16.01.01 knowledge of interior components such as pedals, air ride seats, seat belts, wheelchair accessories, SRSs (air bags), pneumatics and air-powered accessories and side windows
  - G-16.01.02 knowledge of OEM specifications on interior component operations
  - G-16.01.03 knowledge of common faults such as sticking pedals, air leak on seat and malfunctioning window controls
  - G-16.01.04 ability to perform sensory inspection
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**Sub-task****G-16.02 Diagnoses exterior components.**

<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YT</u>	<u>NU</u>
yes	NV	NV	ND									

**Supporting Knowledge & Abilities**

- G-16.02.01 knowledge of exterior components such as windshields, wipers, mirrors, door handles, steps, wind deflectors, engine bonnet/hood cables, lock-down straps, mouldings, air ride cabs and fenders
- G-16.02.02 knowledge of OEM specifications on exterior component operations
- G-16.02.03 knowledge of common faults such as crooked door handles, broken mirrors, cracked windshields and faulty wipers
- G-16.02.04 ability to perform sensory inspection
- G-16.02.05 ability to inspect cab mounts and cab suspension

**Task 17****Services cab components.****Sub-task****G-17.01 Services interior components.**

<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YT</u>	<u>NU</u>
yes	NV	NV	ND									

**Supporting Knowledge & Abilities**

G-17.01.01	knowledge of interior components such as pedals, air ride seats, seat belts, wheelchair accessories, SRSs (air bags) and side windows
G-17.01.02	knowledge of OEM specifications on interior component operations
G-17.01.03	ability to remove and repair faulty components
G-17.01.04	ability to replace components such as door panels, seat belts, and window regulators and motors
G-17.01.05	ability to perform adjustments such as brake pedal travel, fuel pedal sensor and seat placement

**Sub-task****G-17.02 Services exterior components.**

<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YT</u>	<u>NU</u>
yes	NV	NV	ND									

**Supporting Knowledge & Abilities**

G-17.02.01	knowledge of exterior components such as windshields, wipers, mirrors, door handles, steps, wind deflectors, engine bonnet/hood cables, lock-down straps, mouldings and fenders
G-17.02.02	knowledge of OEM specifications on exterior component operations
G-17.02.03	ability to use welding and cutting equipment to repair components
G-17.02.04	ability to replace exterior components
G-17.02.05	ability to repair faulty exterior components
G-17.02.06	ability to perform door and cab adjustments

<b>Trends</b>	There is a trend towards better lighting and signage for safety on trailers. There is a trend towards the use of lighter materials such as aluminum. Many trailers are now multi-functional, having racks and enabling double stacking. There are a variety of new features such as self-loading and unloading trailers, multiple axles and sectional additions to carry large, oversized loads.
<b>Context</b>	Trailers are comprised of trailer body and landing gear. Truck and transport mechanics must be able to diagnose and service these components as they work together with the truck. Servicing includes the replacement and repair of components as well as routine maintenance.
<b>Related Components (include, but not limited to)</b>	<b>Landing gear components:</b> legs, feet, gearing, handle, cross tubes, brackets, bracing, fasteners. <b>Trailer body components:</b> doors, handles, cross members, refrigeration panels, wind deflectors, tail gates, body panels, flooring, roof, wall studs, kick plate, axle, suspension, wheels. <b>Trailer body accessories:</b> canvas air chute, curtains, bulkheads, bogie rails.
<b>Tools and Equipment</b>	Hand tools; power tools; measuring, testing and diagnostic equipment; hoisting and lifting equipment; staging equipment; welding and cutting equipment; PPE and safety equipment.

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**Task 18****Diagnoses trailer components.**

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**Sub-task****H-18.01 Diagnoses landing gear.**

<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YT</u>	<u>NU</u>
yes	NV	NV	ND									

**Supporting Knowledge & Abilities**

H-18.01.01	knowledge of landing gear components such as legs, feet, gearing, handle, cross tubes, brackets and bracing
H-18.01.02	knowledge of common faults such as seized gear boxes, stripped gears, broken handles, bent legs and pads, and bent and broken cross tubes
H-18.01.03	knowledge of capacity of landing gear components
H-18.01.04	ability to perform inspections such as measuring for the length of legs, and checking for bent and broken components
H-18.01.05	ability to determine causes of faults such as disconnecting from vehicle, manufacturers' defects and lack of lubrication

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**Sub-task****H-18.02 Diagnoses trailer body accessories and components.**

<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YT</u>	<u>NU</u>
yes	NV	NV	ND									

**Supporting Knowledge & Abilities**

H-18.02.01	knowledge of trailer body components such as doors, handles, cross members, refrigeration panels, body panels, flooring, roof, wall studs, electronic lift axles and kick plate
H-18.02.02	knowledge of trailer body accessories such as canvas air chute and bogie rails
H-18.02.03	ability to perform visual inspections
H-18.02.04	ability to determine causes of faults such as corrosion, overloading and abuse

**Task 19****Services trailer components.****Sub-task****H-19.01 Services landing gear.**

<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YT</u>	<u>NU</u>
yes	NV	NV	ND									

**Supporting Knowledge & Abilities**

H-19.01.01	knowledge of landing gear components such as legs, feet, gearing, handles, cross tubes, brackets and bracing
H-19.01.02	ability to lubricate and test movement of landing gear
H-19.01.03	ability to replace worn or damaged components
H-19.01.04	ability to repair landing gear
H-19.01.05	ability to perform adjustments
H-19.01.06	ability to use welding and cutting equipment to repair cross members, brackets and legs

**Sub-task****H-19.02 Services trailer body accessories and components.**

<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YT</u>	<u>NU</u>
yes	NV	NV	ND									

**Supporting Knowledge & Abilities**

H-19.02.01	knowledge of trailer body components such as doors, handles, cross members, refrigeration panels, body panels, flooring, roof, wall studs, electronic lift axles and kick plate
H-19.02.02	knowledge of trailer body accessories such as canvas air chute and bogie rails
H-19.02.03	knowledge of required signage, lighting and reflective material for safety
H-19.02.04	knowledge of jurisdictional regulations on reflective material, lighting and signage
H-19.02.05	ability to repair accessories and components

- H-19.02.06 ability to replace accessories and components
- H-19.02.07 ability to perform adjustments to components such as locks and doors

<b>Trends</b>	Climate control systems have become more complex. Because of environmental concerns, regulations governing the use of refrigerants have become stricter and more consistently enforced. Product tracking has become a common industry practice.
<b>Context</b>	<p>Climate control systems include heating, ventilation and air conditioning. These systems are a necessary part of a vehicle for operator comfort in the cab. Truck and transport mechanics must diagnose and service the climate control systems to ensure proper function and reduce down time.</p> <p>Servicing includes the replacement and repair of components as well as routine maintenance.</p>
<b>Related Components (include, but not limited to)</b>	<p><b>Heating and ventilation system:</b> ductwork, motors, blowers, pumps, resistors, controls, modules, heater cores, hoses, fittings.</p> <p><b>Air conditioning system:</b> evaporator, condenser, compressor, receiver dryer, expansion valves, sensors, controls, hoses, fittings, orifice tubes, accumulators, switches.</p>
<b>Tools and Equipment</b>	Hand tools; power tools; measuring, testing and diagnostic equipment; welding and cutting equipment; staging equipment; PPE and safety equipment.

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**Task 20****Diagnoses climate control systems.**

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**Sub-task****I-20.01 Diagnoses heating and ventilation systems.**

<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YT</u>	<u>NU</u>
yes	NV	NV	ND									

**Supporting Knowledge & Abilities**

I-20.01.01	knowledge of heating system components such as blowers, pumps, resistors, controls and modules
I-20.01.02	knowledge of heater operating principles such as water flow and heat exchange
I-20.01.03	knowledge of common heating system faults such as burnt resistors, worn motors and malfunctioning heat controls
I-20.01.04	knowledge of ductwork components and routing
I-20.01.05	ability to disassemble and reassemble dashboard and firewall components for access
I-20.01.06	ability to use specialized diagnostic tools
I-20.01.07	ability to test system and component operation to isolate problem
I-20.01.08	ability to interpret test results

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**Sub-task****I-20.02 Diagnoses air conditioning systems.**

<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YT</u>	<u>NU</u>
yes	NV	NV	ND									

**Supporting Knowledge & Abilities**

I-20.02.01	knowledge of air conditioning system components such as evaporator, condenser, compressor, receiver dryer, expansion valves, sensors and controls
I-20.02.02	knowledge of air conditioning operating principles and theory (compression and expansion)
I-20.02.03	knowledge of types of refrigerant oils and refrigerants such as R134A

I-20.02.04	knowledge of hazards of materials
I-20.02.05	knowledge of air conditioning electrical components
I-20.02.06	knowledge of regulations and standards relating to air conditioning material handling
I-20.02.07	ability to disassemble and reassemble dashboard and firewall components for access
I-20.02.08	ability to use specialized diagnostic tools
I-20.02.09	ability to run system to isolate problem
I-20.02.10	ability to perform specialized testing such as nitrogen pressure testing and electrical testing
I-20.02.11	ability to perform sensory inspection
I-20.02.12	ability to interpret test results

## Task 21

### Services climate control systems.

#### Sub-task

#### I-21.01 Services heating and ventilation systems.

<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YT</u>	<u>NU</u>
yes	NV	NV	ND									

#### Supporting Knowledge & Abilities

I-21.01.01	knowledge of heating system components such as blowers, pumps, resistors, controls and modules
I-21.01.02	knowledge of heater operating principles such as water flow and heat exchange
I-21.01.03	knowledge of ductwork components and routing
I-21.01.04	ability to clean and replace filters
I-21.01.05	ability to disassemble and reassemble dashboard and firewall components for access
I-21.01.06	ability to repair or replace faulty components
I-21.01.07	ability to reset monitors

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**Sub-task****I-21.02 Services air conditioning systems.**

<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YT</u>	<u>NU</u>
yes	yes	no	yes	NV	NV	ND						

**Supporting Knowledge & Abilities**

I-21.02.01	knowledge of air conditioning system components such as evaporator, condenser, compressor, receiver dryer, expansion valves, sensors and controls
I-21.02.02	knowledge of air conditioning operating principles and theory (compression and expansion)
I-21.02.03	knowledge of types of refrigerant oils and refrigerants such as R134A
I-21.02.04	knowledge of hazards of materials
I-21.02.05	knowledge of air conditioning electrical components
I-21.02.06	knowledge of regulations and standards related to air conditioning material handling such as reclaiming, recycling and disposing of material
I-21.02.07	ability to identify refrigerant types
I-21.02.08	ability to disassemble and reassemble dashboard and firewall components for access
I-21.02.09	ability to evacuate, clean and recharge system refrigerant according to OEM specifications
I-21.02.10	ability to use welding equipment to braze or solder lines
I-21.02.11	ability to repair and replace air conditioning system components
I-21.02.12	ability to install and assemble new air conditioning system

<b>Trends</b>	Hydraulic systems are getting more advanced with the introduction of more electronics.
<b>Context</b>	<p>Hydrodynamic systems are those which utilize fluid in motion at low pressure and high volume. They are used to transfer power smoothly from one system to another, without needing to engage and disengage mechanical power flow.</p> <p>Hydrostatic systems utilize fluid at high pressure and low volume. Hydrostatic systems are used by vehicles such as dump trucks and concrete mixers to lift heavy loads simply.</p> <p>Truck and transport mechanics must diagnose and service hydraulic systems to ensure proper function and reduce down time.</p> <p>Servicing includes the replacement and repair of components as well as routine maintenance.</p>
<b>Related Components (include, but not limited to)</b>	<p><b>Hydrodynamic system:</b> torque converters, fluid couplers.</p> <p><b>Hydrostatic system:</b> cylinders, motors, reservoirs, accumulators, controls, valves (relief, flow control, splitter), hoses, sensors, gauges, pumps (vane, rotary, piston, gear).</p>
<b>Tools and Equipment</b>	Hand tools; power tools; measuring, testing and diagnostic equipment; hoisting and lifting equipment; staging equipment; welding and cutting equipment; PPE and safety equipment.

**Task 22****Diagnoses hydraulic systems.****Sub-task****J-22.01 Diagnoses hydrodynamic systems.**

<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YT</u>	<u>NU</u>
yes	NV	NV	ND									

**Supporting Knowledge & Abilities**

J-22.01.01	knowledge of hydrodynamic systems theory and operating principles
J-22.01.02	knowledge of torque converters
J-22.01.03	knowledge of fluid couplers
J-22.01.04	knowledge of types of hydraulic oils
J-22.01.05	knowledge of common faults such as leaks, deterioration and worn components
J-22.01.06	ability to perform tests of hydrodynamic systems such as stall tests and oil condition verification
J-22.01.07	ability to perform sensory inspection
J-22.01.08	ability to use specialized diagnostic equipment
J-22.01.09	ability to interpret test results

**Sub-task****J-22.02 Diagnoses hydrostatic systems.**

<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YT</u>	<u>NU</u>
no	yes	NV	NV	ND								

**Supporting Knowledge & Abilities**

J-22.02.01	knowledge of hydrostatic systems theory and operating principles
J-22.02.02	knowledge of hydrostatic system components such as cylinders, motors, reservoirs, accumulators, controls, sensors and gauges
J-22.02.03	knowledge of types of pumps such as constant supply pumps and demand pumps
J-22.02.04	knowledge of types of hydraulic oils
J-22.02.05	knowledge of hydrostatic system controls

J-22.02.06	knowledge of system driving the hydrostatic system such as transmission, PTO shaft and engine
J-22.02.07	knowledge of common faults such as stuck valves, seized motors, chafed or broken hoses and leaks
J-22.02.08	ability to interpret flow schematics
J-22.02.09	ability to perform tests of hydrostatic system such as pressure and volume tests
J-22.02.10	ability to perform sensory inspection
J-22.02.11	ability to use specialized diagnostic equipment
J-22.02.12	ability to interpret test results

## Task 23

### Services hydraulic systems.

#### Sub-task

#### J-23.01 Services hydrodynamic systems.

<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YT</u>	<u>NU</u>
yes	NV	NV	ND									

#### Supporting Knowledge & Abilities

J-23.01.01	knowledge of hydrodynamic systems theory and operating principles
J-23.01.02	knowledge of torque converters
J-23.01.03	knowledge of fluid couplers
J-23.01.04	knowledge of types of hydraulic oils
J-23.01.05	ability to replace worn torque converters and fluid couplers
J-23.01.06	ability to drain and replace fluids
J-23.01.07	ability to clean and flush transmission and oil cooling systems

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**Sub-task****J-23.02 Services hydrostatic systems.**

<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YT</u>	<u>NU</u>
no	yes	NV	NV	ND								

**Supporting Knowledge & Abilities**

J-23.02.01	knowledge of hydrostatic systems theory and operating principles
J-23.02.02	knowledge of hydrostatic system components such as cylinders, motors, reservoirs, accumulators, controls, sensors and gauges
J-23.02.03	knowledge of types of pumps such as constant supply pumps and demand pumps
J-23.02.04	knowledge of types of hydraulic oils
J-23.02.05	knowledge of hydrostatic system controls
J-23.02.06	knowledge of hazards of hydrostatic systems such as accidental and planned pressure release
J-23.02.07	ability to repair components such as pumps, motors and cylinders
J-23.02.08	ability to replace components such as hoses, valves, motors, cylinders and pumps
J-23.02.09	ability to install new components
J-23.02.10	ability to adjust components such as relief valves, flow control valves and splitter valves
J-23.02.11	ability to change fluid and filters



## **APPENDICES**



**Hand Tools**

air blow gun	pick set
bushing drivers	pliers
clamps	pry bars
cutting equipment (side cutter, tube cutter, wire cutter, scissors, shears, razor knives)	pullers
emery paper	punches and chisels
feeler gauges	saws
files	scrapers
filter wrenches	screwdrivers
flashlight	slide hammer
hacksaw	sockets and ratchets
hammers	terminal tool set
magnets	torque multiplier
magnifying glass	wire brush
mirrors	wrenches

**Power Tools**

air cutoff tools	parts washers
air hammers	power saw
air ratchets	presses
air wrenches	pressure washer
drills	sanders
grinding wheels	vacuum cleaner
lighting devices (trouble lights, flood lights)	

**Measuring, Testing and Diagnostic Equipment**

antifreeze tester	dynamometer
back pressure tester	electronic blowby tester
black light	exhaust analyzer
boost gauge	feeler gauge
brake drum gauge	hydrometer
braking force test equipment	inductive pickup (amp clamp)
calipers	laser alignment tools
circuit tester	micrometer
compression gauges	multimeter
computerized diagnostic equipment (computer, handheld)	opacity meter
continuity tester	pressure gauges
dial indicators	spark plug tester
	squares

## Measuring, Testing and Diagnostic Equipment (continued)

straight edges	tire gauge
tachometers	torque wrench
tape measure	trammel gauge
telescopic gauge	tread depth gauge
temperature gauge (infrared, mechanical and electrical)	vacuum gauge
timing light	vernier calipers
	water manometer

## Welding and Cutting Equipment

MIG welding equipment	soldering gun
oxyacetylene equipment	stick welding equipment
plasma cutter	TIG welding equipment
propane torch	

## Hoisting, Lifting and Staging Equipment

axle lifts and stands	ladders
blocking	scaffolding
cranes (overhead, mobile)	stands
fork lifts	steps
hoists	stools
jacks	

## Personal Protective Equipment and Safety Equipment

aprons	goggles
carbon monoxide sensors	guard rails
coveralls	hard hats
dust masks	hearing protection
ear plugs	masks
emergency shower	respirators
exhaust ventilation	safety boots
eye wash station	safety glasses
face shields	vehicle lock-out systems (tags and locks)
fall protection system	welding curtain
fire blanket	welding helmets
fire extinguisher	welding personal protective gear wheel chocks
first aid kit	
gloves (chemical, welding, latex, nitrile, heavy duty)	

<b>accessories</b>	components for the vehicle which enhance the operation or extend longevity; for example: greasing systems, radio, air conditioning and extra lights; although some accessories are non-essential to the vehicle operation, they are sometimes required in extreme operating environments
<b>auxiliary braking systems</b>	secondary braking systems which slow or hold the vehicle by unconventional means such as: <ul style="list-style-type: none"><li>- retarding the engine with compression brakes or exhaust brakes;</li><li>- utilizing a fluid coupler; or</li><li>- creating resistance on the driveline</li></ul>
<b>base engine</b>	assembled block and head including internal components and gear trains
<b>diagnose</b>	tasks involved in inspecting, testing and determining faults in vehicle systems and components
<b>drive train</b>	mechanical portion that transfers power from the flywheel to the tires
<b>driveline (driveshaft)</b>	drive connection between a power source and a driven component
<b>electrical systems</b>	starting, charging, lighting and accessory circuits without computer control modules
<b>electronic control module (ECM)</b>	module which controls functions of a vehicle; some common ECMs are EPU (electronic processing units), ECU (electronic control units), VECU (vehicle electronic control units)
<b>electronic systems</b>	electrical systems operated via computerized electronic control modules and related sensors and wiring
<b>hydrodynamic system</b>	hydraulic system with low pressure and high volume; torque converters and fluid couplers are based on this system
<b>hydrostatic system</b>	hydraulic system which uses high pressure and low volume to transmit power through tubes or hoses to auxiliary systems
<b>landing gear</b>	components which are used to support the weight of the trailer when disconnected from the vehicle
<b>power take-off (PTO)</b>	device that couples and uncouples a power source to transfer power to auxiliary systems

<b>sensory inspection</b>	diagnosing or inspecting using sight, sound, smell and feel
<b>service</b>	activities which include repair, replacement, rebuild, adjustment and general maintenance of truck and transport vehicles and components
<b>spark ignition system</b>	system which controls a small amount of electrical power to create and transmit, through a step-up transformer, a high voltage to a sparking device, which in turn begins ignition
<b>suspension</b>	components which absorb road surface irregularities to smooth vehicle ride; it is designed to permit controlled wheel movement over irregular surfaces; basic types include spring, air and rubber block

<b>ABS</b>	antilock braking system
<b>ARD</b>	aftertreatment regeneration device
<b>CAC</b>	charge air cooler
<b>CCA</b>	cold cranking amps
<b>CTI</b>	central tire inflation
<b>DEF</b>	diesel exhaust fluid
<b>DPF</b>	diesel particulate filter
<b>DRL</b>	daytime running lights
<b>ECM</b>	electronic control module
<b>ECU</b>	electronic control unit
<b>EGR</b>	exhaust gas recirculation
<b>EPU</b>	electronic processing unit
<b>GMAW</b>	gas metal arc welding
<b>GPS</b>	global positioning system
<b>HID</b>	high intensity discharge
<b>HVAC</b>	heating, ventilation and air conditioning
<b>LED</b>	light emitting diode
<b>MIG</b>	metal inert gas
<b>MSDS</b>	Material Safety Data Sheets
<b>OAW</b>	oxy-acetylene welding
<b>OEM</b>	original equipment manufacturer
<b>PPE</b>	personal protective equipment

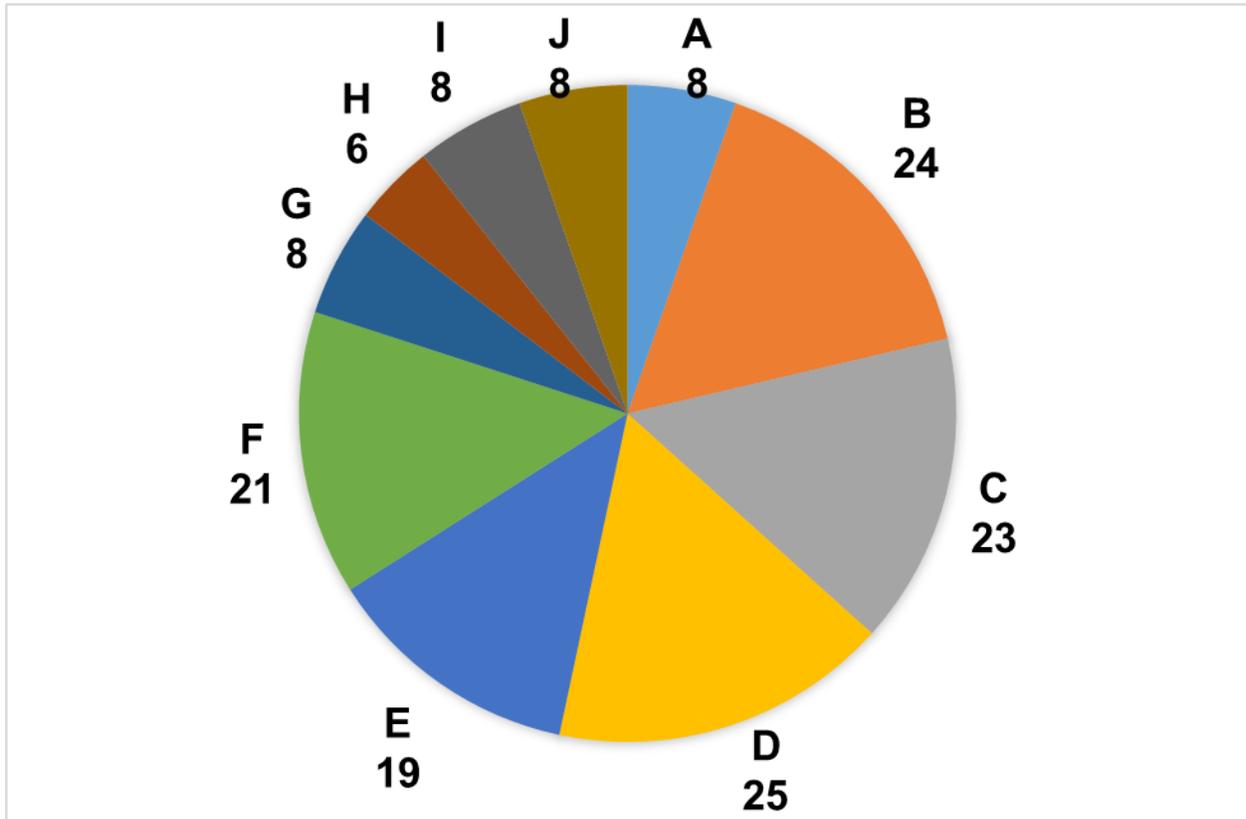
<b>PTO</b>	power take-off
<b>RC</b>	reserve capacity
<b>SCA</b>	supplemental coolant additive
<b>SCR</b>	selective catalyst reduction
<b>SI</b>	metric system
<b>SMAW</b>	shielded metal arc welding
<b>SRS</b>	supplemental restraint system
<b>TDG</b>	Transport of Dangerous Goods
<b>TIG</b>	tungsten inert gas
<b>TRS</b>	trailer roll stability
<b>VECU</b>	vehicle electronic control unit
<b>VSC</b>	vehicle stability control
<b>WHMIS</b>	Workplace Hazardous Materials Information System

## **APPENDIX D**

## **BLOCK AND TASK WEIGHTING**

<b>BLOCK A OCCUPATIONAL SKILLS</b>	<b>8 questions</b>
Task 1 Maintains tools and equipment.	2 questions
Task 2 Organizes work.	2 questions
Task 3 Performs routine trade activities.	4 questions
<b>BLOCK B ENGINE AND SUPPORTING SYSTEMS</b>	<b>24 questions</b>
Task 4 Diagnoses engine and supporting systems.	14 questions
Task 5 Services engine and supporting systems.	10 questions
<b>BLOCK C AIR SYSTEMS AND BRAKES</b>	<b>23 questions</b>
Task 6 Diagnoses air systems and brakes.	12 questions
Task 7 Services air systems and brakes.	11 questions
<b>BLOCK D ELECTRICAL AND ELECTRONIC SYSTEMS</b>	<b>25 questions</b>
Task 8 Diagnoses electrical systems.	8 questions
Task 9 Services electrical systems.	5 questions
Task 10 Diagnoses electronic systems.	7 questions
Task 11 Services electronic components.	5 questions
<b>BLOCK E DRIVE TRAIN</b>	<b>19 questions</b>
Task 12 Diagnoses drive train.	10 questions
Task 13 Services drive train.	9 questions
<b>BLOCK F STEERING, CHASSIS/FRAMES, SUSPENSION, WHEELS, HUBS AND TIRES</b>	<b>21 questions</b>
Task 14 Diagnoses steering system, chassis/frames, suspension, wheels, hubs and tires.	11 questions
Task 15 Services steering system, chassis/frames, suspension, wheels, hubs and tires.	10 questions

<b>BLOCK G CAB</b>	<b>8 questions</b>
Task 16 Diagnoses cab components.	4 questions
Task 17 Services cab components.	4 questions
<b>BLOCK H TRAILERS</b>	<b>6 questions</b>
Task 18 Diagnoses trailer components.	4 questions
Task 19 Services trailer components.	2 questions
<b>BLOCK I CLIMATE CONTROL</b>	<b>8 questions</b>
Task 20 Diagnoses climate control systems.	3 questions
Task 21 Services climate control systems.	5 questions
<b>BLOCK J HYDRAULIC SYSTEMS</b>	<b>8 questions</b>
Task 22 Diagnoses hydraulic systems.	4 questions
Task 23 Services hydraulic systems.	4 questions



**TITLES OF BLOCKS**

BLOCK A	Occupational Skills	BLOCK F	Steering, Chassis/Frames, Suspension, Wheels, Hubs and Tires
BLOCK B	Engine and Supporting Systems	BLOCK G	Cab
BLOCK C	Air Systems and Brakes	BLOCK H	Trailers
BLOCK D	Electrical and Electronic Systems	BLOCK I	Climate Control
BLOCK E	Drive Train	BLOCK J	Hydraulic Systems

\*This pie chart represents the number of questions on each section of the Red Seal Exam.

# APPENDIX F

# TASK PROFILE CHART – TRUCK AND TRANSPORT MECHANIC

BLOCKS	TASKS	SUB-TASKS				
A - OCCUPATIONAL SKILLS	1. Maintains tools and equipment.	1.01 Maintains hand tools.	1.02 Maintains power tools.	1.03 Maintains measuring, testing and diagnostic tools.	1.04 Maintains hoisting and lifting equipment.	1.05 Maintains personal protective equipment (PPE) and safety equipment.
	2. Organizes work.	1.06 Maintains staging equipment.	1.07 Maintains solvent washers and biological parts washers.	2.01 Uses documentation and reference materials.	2.02 Communicates with others.	2.03 Maintains safe work environment.
	3. Performs routine trade activities.	3.01 Uses computer for diagnostics.	3.02 Maintains fluids, lubricants and coolants.	3.03 Uses fasteners, sealing devices, adhesives and gaskets.	3.04 Services hoses, tubing and fittings.	3.05 Services bearings, bushings and seals.
	4. Diagnoses engine and supporting systems.	3.06 Services filters.	3.07 Uses welding equipment.	3.08 Uses cutting equipment.	3.09 Verifies vehicle repairs.	3.10 Conducts road tests.
	5. Services engine and supporting systems.	4.01 Diagnoses base engine.	4.02 Diagnoses cooling system.	4.03 Diagnoses lubrication system.	4.04 Diagnoses fuel delivery system.	4.05 Diagnoses intake and exhaust systems.
		4.06 Diagnoses emission systems for diesel engines.	4.07 Diagnoses engine management system.			
		5.01 Services base engine.	5.02 Services cooling system.	5.03 Services lubrication system.	5.04 Services fuel delivery system.	5.05 Services intake and exhaust systems.
		5.06 Services emission systems for diesel engines.	5.07 Services engine management system.			

BLOCKS	TASKS	SUB-TASKS				
C - AIR SYSTEMS AND BRAKES	6. Diagnoses air systems and brakes.	6.01 Diagnoses air systems.	6.02 Diagnoses brake systems.	6.03 Diagnoses auxiliary braking systems.		
	7. Services air systems and brakes.	7.01 Services air systems.	7.02 Services brake systems.	7.03 Services auxiliary braking systems.		
D - ELECTRICAL AND ELECTRONIC SYSTEMS	8. Diagnoses electrical systems.	8.01 Diagnoses batteries.	8.02 Diagnoses charging systems.	8.03 Diagnoses starting systems.	8.04 Diagnoses electrical components and accessories.	
	9. Services electrical systems.	9.01 Services batteries.	9.02 Services charging systems.	9.03 Services starting systems.	9.04 Services electrical components and accessories.	
	10. Diagnoses electronic systems.	10.01 Diagnoses spark ignition systems.	10.02 Diagnoses electronic components and accessories.	10.03 Diagnoses vehicle management systems.		
	11. Services electronic components.	11.01 Services spark ignition systems.	11.02 Services electronic components and accessories.	11.03 Services vehicle management systems.		
E - DRIVE TRAIN	12. Diagnoses drive train.	12.01 Diagnoses clutches.	12.02 Diagnoses standard transmissions and transfer cases.	12.03 Diagnoses automatic transmissions.	12.04 Diagnoses automated transmissions.	12.05 Diagnoses driveline systems.
		12.06 Diagnoses differentials.				
	13. Services drive train.	13.01 Services clutches.	13.02 Services standard transmissions and transfer cases.	13.03 Services automatic transmissions.	13.04 Services automated transmissions.	13.05 Services driveline systems.
		13.06 Services differentials.				

BLOCKS	TASKS	SUB-TASKS				
F - STEERING, CHASSIS/FRAMES, SUSPENSION, WHEELS, HUBS AND TIRES	14. Diagnoses steering system, chassis/frames, suspension, wheels, hubs and tires.	14.01 Diagnoses steering system.	14.02 Diagnoses chassis/frames.	14.03 Diagnoses suspension.	14.04 Diagnoses hitches and couplers.	14.05 Diagnoses tires, wheels and hubs.
	15. Services steering system, chassis/frames, suspension, wheels, hubs and tires.	15.01 Services steering system.	15.02 Services chassis/frames.	15.03 Services suspension.	15.04 Services hitches and couplers.	15.05 Services tires, wheels and hubs.
G - CAB	16. Diagnoses cab components.	16.01 Diagnoses interior components.	16.02 Diagnoses exterior components.			
	17. Services cab components.	17.01 Services interior components.	17.02 Services exterior components.			
H - TRAILERS	18. Diagnoses trailer components.	18.01 Diagnoses landing gear.	18.02 Diagnoses trailer body accessories and components.			
	19. Services trailer components.	19.01 Services landing gear.	19.02 Services trailer body accessories and components.			
I - CLIMATE CONTROL	20. Diagnoses climate control systems.	20.01 Diagnoses heating and ventilation systems.	20.02 Diagnoses air conditioning systems.			
	21. Services climate control systems.	21.01 Services heating and ventilation systems.	21.02 Services air conditioning systems.			
J - HYDRAULIC SYSTEMS	22. Diagnoses hydraulic systems.	22.01 Diagnoses hydrodynamic systems.	22.02 Diagnoses hydrostatic systems.			
	23. Services hydraulic systems.	23.01 Services hydrodynamic systems.	23.02 Services hydrostatic systems.			