Heavy Duty Equipment Technician

Guide to Course Content

2025

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Saskatchewan Apprenticeship and Trade Certification Commission

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Recognition:
To promote transparency and consistency, this document has been adapted from the 2014 Heavy Duty Equipment Technician National Occupational Analysis (Employment and Social Development Canada).

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

STRUCTURE OF THE GUIDE TO COURSE CONTENT

To facilitate understanding of the occupation, this on-the-job training guide contains the following sections:

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

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

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

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

Technical Training Course Content for the Heavy Duty Equipment Technician trade: a chart which outlines the model for SATCC technical training sequencing.

TRAINING REQUIREMENTS FOR THE HEAVY DUTY EQUIPMENT TECHNICIAN TRADE

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

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

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

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

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

Entrance Requirements for Apprenticeship Training

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

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

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

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

Designated Trade Name	**Math Credit** at the Indicated Grade Level❶	**Science Credit** at Grade Level
Heavy Duty Equipment Technician	Grade 11	Grade 10

❶ - (One of the following) WA – Workplace and Apprenticeship; or F – Foundations; or P – Pre-calculus, or a Math at the indicated grade level (Modified and General Math credits are not acceptable.).

*Applicants who have graduated in advance of 2015-2016, or who do not have access to the revised Science curricula will require a Science at the minimum grade level indicated by trade.

For information about high school curriculum, including Math and Science course names, please see: http://www.curriculum.gov.sk.ca/

Individuals not meeting the entrance requirements will be subject to an assessment and any required training.

HEAVY DUTY EQUIPMENT TECHNICIAN TASK MATRIX

This chart outlines the blocks, tasks and sub-tasks from the 2014 Heavy Duty Equipment Technician National Occupational Analysis (NOA). Each sub-task details the corresponding essential skill and level of training where the content is covered. *

* Sub Tasks with numbers in the boxes is where the content will be delivered in training.

A – Performs Common Occupational Skills — 8%

A-1 Uses and maintains tools and equipment	**1.01 Maintains tools and equipment** 1	**1.02 Uses hoisting and lifting equipment** 1	**1.03 Operates access equipment** 1	**1.04 Uses personal protective equipment (PPE) and safety equipment** 1	
A-2 Performs general maintenance and inspections	**2.01 Maintains fluids** 1 (2, 3, 4 in context)	**2.02 Services fasteners, sealing devices, adhesives and gaskets** 1 (2, 3, 4 in context)	**2.03 Services hoses, tubing, piping and fittings** 1 (2, 3, 4 in context)	**2.04 Services bearings and seals** 1 (2, 3, 4 in context)	**2.05 Services safety features** 1 (2, 3, 4 in context)
	2.06 Performs scheduled maintenance procedures 1 (2, 3, 4 in context)	**2.07 Identifies operational faults** 1 (2, 3, 4 in context)	**2.08 Performs operational check-out** 1 (2, 3, 4 in context)		
A-3 Organizes work	**3.01 Uses documentation and reference materials** 1 (2, 3, 4 in context)	**3.02 Completes documentation** 1 (2, 3, 4 in context)	**3.03 Communicates with others** 1 (2, 3, 4 in context)	**3.04 Prepares job action plan** 1 (2, 3, 4 in context)	**3.05 Maintains safe work environment** 1 (2, 3, 4 in context)
A-4 Performs routine trade activities	**4.01 Heats materials.** 1	**4.02 Cools materials.** 1	**4.03 Cuts materials.** 1	**4.04 Welds materials.** 1	**4.05 Cleans parts and materials.** 1

B – Engines and Engine Support Systems — 16%

B-5 Diagnoses engines and engine support systems	5.01 Diagnoses base engine 3	5.02 Diagnoses lubrication systems 3	5.03 Diagnoses cooling systems 3	5.04 Diagnoses intake and exhaust systems 3	5.05 Diagnoses fuel systems 3, 4
	5.06 Diagnoses engine control systems 3, 4	5.07 Diagnoses emission control systems 3, 4			
B-6 Repairs engines and engine support systems	6.01 Repairs base engines 3	6.02 Repairs lubrication system 3	6.03 Repairs cooling systems 3	6.04 Repairs intake and exhaust systems 3	6.05 Repairs fuel systems 3, 4
	6.06 Repairs engine control systems 3, 4	6.07 Repairs emission control systems 3, 4			

C – Hydraulic, Hydrostatic and Pneumatic Systems — 19%

C-7 Diagnoses hydraulic, hydrostatic and pneumatic systems	7.01 Diagnoses hydraulic systems 1, 2, 3	7.02 Diagnoses hydrostatic systems 3	7.03 Diagnoses pneumatic systems 1, 3
C-8 Repairs hydraulic, hydrostatic and pneumatic systems	8.01 Repairs hydraulic systems 1, 2, 3	8.02 Repairs hydrostatic systems 3	8.03 Repairs pneumatic systems 1, 3

D – Drivetrain Systems

14%

D-9 Diagnoses drivetrain systems	9.01 Diagnoses clutch systems 2, 3, 4	9.02 Diagnoses torque converters, fluid couplers and retarders 2, 3, 4	9.03 Diagnoses driveline systems 2, 3, 4	9.04 Diagnoses transmission and transfer case systems 2, 3, 4	9.05 Diagnoses axle and differential systems 2, 3, 4
	9.06 Diagnoses final drive systems 2, 3, 4				
D-10 Repairs drivetrain systems	10.01 Repairs clutch systems 2, 3, 4	10.02 Repairs torque converters, fluid couplers and retarders 2, 3, 4	10.03 Repairs driveline systems 2, 3, 4	10.04 Repairs transmission and transfer case systems 2, 3, 4	10.05 Repairs axle and differential system 2, 3, 4
	10.06 Repairs final drive systems 2, 3, 4				

E – Steering, Suspension, Brake Systems, Wheel Assemblies and Undercarriage

14%

E-11 Diagnoses steering, suspension, brake systems, wheel assemblies and undercarriage	11.01 Diagnoses steering systems 1, 2	11.02 Diagnoses suspension systems 1, 2	11.03 Diagnoses brake systems 1, 2	11.04 Diagnoses wheel assemblies 1, 2	11.05 Diagnoses undercarriage systems 1, 2
E-12 Repairs steering, suspension, brake systems, wheel assemblies and undercarriage	12.01 Repairs steering systems 1, 2	12.02 Repairs suspension systems 1, 2	12.03 Repairs brake systems 1, 2	12.04 Repairs wheel assemblies. 1, 2	12.05 Repairs undercarriage systems. 1, 2

F – Electrical and Vehicle Management Systems — 18%

F-13 Diagnoses electrical systems	13.01 Diagnoses starting/charging systems and batteries 1, 3, 4 (2 in context)	13.02 Diagnoses electrical components, motors and accessories 1, 3, 4 (2 in context)		
F-14 Repairs electrical systems	14.01 Repairs starting/charging systems and batteries 1, 3, 4 (2 in context)	14.02 Repairs electrical components, motors and accessories 1, 3,4 (2 in context)		
F-15 Diagnoses electronic vehicle management systems	15.01 Reads diagnostic trouble codes (DTCs) 3, 4	15.02 Monitors parameters 3, 4	15.03 Interprets test results 3, 4	15.04 Tests system circuitry and components 3, 4
F-16 Repairs electronic vehicle management systems	16.01 Updates component software 3, 4	16.02 Repairs components 3, 4		

G – Environmental Control Systems — 6%

G-17 Diagnoses environmental control systems	17.01 Diagnoses heating systems 1, 4	17.02 Diagnoses ventilation and filtration systems 1, 4	17.03 Diagnoses air conditioning systems 1, 4	17.04 Diagnoses sound suppression systems 1, 4
G-18 Repairs environmental control systems	18.01 Repairs heating systems 1, 4	18.02 Repairs ventilation and filtration systems 1, 4	18.03 Repairs air conditioning systems 1, 4	18.04 Repairs sound suppression systems 1, 4

H – Structural Components, Accessories and Attachments — 5%

H-19 Diagnoses structural components, accessories and attachments	19.01 Diagnoses structural components 1, 2	19.02 Diagnoses operator station components 1, 2	19.03 Diagnoses attachments and accessories 1, 2	
H-20 Repairs structural components, accessories and attachments	20.01 Performs mechanical repairs on structural components 1, 2	20.02 Repairs operator station components 1, 2	20.03 Repairs attachments and accessories 1, 2	20.04 Installs attachments and accessories 1, 2

TRAINING PROFILE CHART

This Training Profile Chart represents Saskatchewan Apprenticeship and Trade Certification Commission (SATCC) apprenticeship technical training at the topic level.

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

Level Two	Transcript Code	Hours
Braking Systems ABS	BRAK 206 – Theory	14
	BRAK 207 – Shop	16
Drivetrain Systems	DRTR 201 – Theory	24
	DRTR 202 – Shop	36
Electrical	ELCT 202 – Theory	12
	ELCT 203 – Shop	18
Hydraulics	HYDR 204 – Theory	30
	HYDR 205 – Shop	30
Steering and Directional Control Systems	STER 202 – Theory	12
	STER 203 – Shop	18
Structural Components	MAIN 200 – Theory	12
	MAIN 201 – Shop	18
		240

Level Three	Transcript Code	Hours
Alternative Fuels	FUEL 302 – Theory	12
	FUEL 303 – Shop	18
Electrical	ELCT 301 – Theory	14
	ELCT 302 – Shop	16
Engine and Engine Support Systems	ENGN 306 – Theory	55
	ENGN 307 – Shop	65
Powershift Transmissions	TRNM 306 – Theory	26
	TRNM 307 – Shop	34
		240

Level Four	Transcript Code	Hours
Drivetrains	DRTR 400 – Theory	12
	DRTR 401 – Shop	18
Electrical	ELCT 400 – Theory	40
	ELCT 401 – Shop	50
Environmental Control Systems	HVAC 400 – Theory	12
	HVAC 401 – Shop	18
Fuel Systems	FUEL 404 – Theory	40
	FUEL 405 – Shop	50
		240

TECHNICAL TRAINING COURSE CONTENT

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

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

Level One — 8 weeks — 240 hours

Basic Tools – Theory — 12 hours

- describe safety rules and regulations
- describe the purpose and care of shop and hand tools
- describe various types of fasteners, adhesives and sealing devices

Basic Tools – Shop — 12 hours

- demonstrate safety
- explain legislative regulations
- demonstrate use and care of hand tools and shop equipment

NOA topics covered in this section of training:

A-1 Uses and maintains tools and equipment
A-1.01 Maintains tools and equipment
A-1.03 Operates access equipment
A-1.04 Uses personal protective equipment (PPE) and safety equipment

A-2 Performs general maintenance and inspections
A-2.05 Services safety features

A-3 Organizes work
A-3.05 Maintains safe work environment

A-4 Performs routine trade activities
A-4.01 Heats materials
A-4.02 Cools materials
A-4.03 Cuts materials
A-4.04 Welds materials
A-4.05 Cleans parts and materials

Brake Systems – Theory — 24 hours

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

Brake Systems – Shop — 36 hours

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

NOA topics covered in this section of training:

C-7 Diagnoses hydraulic, hydrostatic and pneumatic systems
C-7.03 Diagnoses pneumatic systems

C-8 Repairs hydraulic, hydrostatic and pneumatic systems
C-8.03 Repairs pneumatic systems

E-11 Diagnoses steering, suspension, brake systems, wheel assemblies and undercarriage
E-11.03 Diagnoses brake systems

E-12 Repairs steering, suspension, brake systems, wheel assemblies and undercarriage
E-12.03 Repairs brake systems

Electrical – Theory — 14 hours

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

Electrical – Shop — 16 hours

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

NOA topics covered in this section of training:

F-13 Diagnoses electrical systems
F-13.01 Diagnoses starting/charging systems and batteries
F-13.02 Diagnoses electrical components, motors and accessories

F-14 Repairs electrical systems
F-14.01 Repairs starting/charging systems and batteries
F-14.02 Repairs electrical components, motors and accessories

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Environmental Control Systems – Theory — 6 hours

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

NOA topics covered in this section of training:

G-17 Diagnoses environmental control systems
G-17.01 Diagnoses heating systems
G-17.02 Diagnoses ventilation and filtration systems
G-17.03 Diagnoses air conditioning systems
G-17.04 Diagnoses sound suppression systems

G-18 Repairs environmental control systems
G-18.01 Repairs heating systems
G-18.02 Repairs ventilation and filtration systems
G-18.03 Repairs air conditioning systems
G-18.04 Repairs sound suppression systems

Hydraulics – Theory — 24 hours

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

Hydraulics – Shop **36 hours**

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

NOA topics covered in this section of training:

C-7 Diagnoses hydraulic, hydrostatic and pneumatic systems
C-7.01 Diagnoses hydraulic systems

C-8 Repairs hydraulic, hydrostatic and pneumatic systems
C-8.01 Repairs hydraulic systems

Steering Systems – Theory **12 hours**

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

Steering Systems – Shop **18 hours**

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

NOA topics covered in this section of training:

E-11 Diagnoses steering, suspension, brake systems, wheel assemblies and undercarriage
E-11.01 Diagnoses steering systems
E-11.02 Diagnoses suspension systems
E-11.04 Diagnoses wheel assemblies
E-11.05 Diagnoses undercarriage systems

E-12 Repairs steering, suspension, brake systems, wheel assemblies and undercarriage
E-12.01 Repairs steering systems
E-12.02 Repairs suspension systems
E-12.04 Repairs wheel assemblies
E-12.05 Repairs undercarriage systems

Structural Components and Accessories – Theory **12 hours**

- identify hoisting and rigging techniques
- describe the purpose of roll over protection system (ROPS) and operator safety systems
- describe preventative maintenance procedures

Structural Components and Accessories – Shop **18 hours**

- perform hoisting and rigging techniques
- evaluate roll over protection system (ROPS) and operator safety systems
- perform preventative maintenance procedures
- repair defects

NOA topics covered in this section of training:

H-19 Diagnoses structural components, accessories and attachments
H-19.01 Diagnoses structural components
H-19.02 Diagnoses operator station components
H-19.03 Diagnoses attachments and accessories

H-20 Repairs structural components, accessories and attachments
H-20.01 Performs mechanical repairs on structural components
H-20.02 Repairs operator station components
H-20.03 Repairs attachments and accessories
H-20.04 Installs attachments and accessories

Level Two — 8 weeks — 240 hours

Brake Systems ABS – Theory — **14 hours**

- describe antilock braking system components
- describe electric braking system components

Brake Systems ABS – Shop — **16 hours**

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

NOA topics covered in this section of training:

C-7 Diagnoses hydraulic, hydrostatic and pneumatic systems
C-7.03 Diagnoses pneumatic systems
C-8 Repairs hydraulic, hydrostatic and pneumatic systems
C-8.03 Repairs pneumatic systems

E-11 Diagnoses steering, suspension, brake systems, wheel assemblies and undercarriage
E-11.03 Diagnoses brake systems.

E-12 Repairs steering, suspension, brake systems, wheel assemblies and undercarriage
E-12.03 Repairs brake systems

Drivetrain Systems – Theory — **24 hours**

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

Drivetrain Systems – Shop — **36 hours**

- perform the removal and replacement of various seals and bearings
- evaluate various clutch types
- evaluate manual transmission operation
- evaluate differential operation
- evaluate planetary and final drive systems
- evaluate driveline systems
- repair faults

Note: **This section of training (Drivetrain Systems) exceeds NOA scope of work in Level Two and exceeds the minimum sequencing as set out in the Heavy Duty Equipment Technician NOA. Its purpose is mainly to assist in the understanding of the topic Steering and Directional Control Systems. *Note: Content covered in this course is reviewed in* TRNM 306/307 Theory/Shop – POWERSHIFT TRANSMISSIONS Level Three.**

Electrical – Theory — **12 hours**

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

Electrical – Shop — **18 hours**

- evaluate cranking and charging systems
- repair faults

NOA topics covered in this section of training:

F-13 Diagnoses electrical systems
F-13.01 Diagnoses starting/charging systems and batteries
F-13.02 Diagnoses electrical components, motors and accessories

F-14 Repairs electrical systems
F-14.01 Repairs starting/charging systems and batteries
F-14.02 Repairs electrical components, motors and accessories

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Hydraulics – Theory — 30 hours

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

Hydraulics – Shop — 30 hours

- evaluate various types of hydraulic systems and flow control valves
- evaluate a power beyond system
- evaluate open and closed loop hydraulic systems
- evaluate a load sensing hydraulic system
- evaluate various hydrostatic drive systems
- repair faults

NOA topics covered in this section of training:

C-7 Diagnoses hydraulic, hydrostatic and pneumatic systems
C-7.01 Diagnoses hydraulic systems

C-8 Repairs hydraulic, hydrostatic and pneumatic systems
C-8.01 Repairs hydraulic systems

Steering and Directional Control Systems – Theory — 12 Hours

- explain differential directional control in a crawler tractor
- explain hydrostatic directional control in a crawler tractor
- discuss pilot control and orbital steering systems describe maintenance procedure for transmission, transaxle, transfer case, differential and engine

Steering and Directional Control Systems – Shop — 18 Hours

- evaluate differential directional control in a crawler tractor
- evaluate hydrostatic directional control in a crawler tractor
- evaluate pilot control and orbital steering systems
- repair faults

NOA topics covered in this section of training:

E-11 Diagnoses steering, suspension, brake systems, wheel assemblies and undercarriage
E-11.01 Diagnoses steering systems
E-11.02 Diagnoses suspension systems
E-11.04 Diagnoses wheel assemblies
E-11.05 Diagnoses undercarriage systems

E-12 Repairs steering, suspension, brake systems, wheel assemblies and undercarriage
E-12.01 Repairs steering systems
E-12.02 Repairs suspension systems

E-12.04 Repairs wheel assemblies
E-12.05 Repairs undercarriage systems

Structural Components – Theory **12 hours**

- identify hoisting and rigging techniques
- describe undercarriage operation and troubleshooting
- identify undercarriage components and crawler tractor final drive systems

Structural Components – Shop **18 hours**

- perform hoisting and rigging techniques
- evaluate undercarriage and final drive components
- repair faults

NOA topics covered in this section of training:

H-19 Diagnoses structural components, accessories and attachments
H-19.01 Diagnoses structural components
H-19.02 Diagnoses operator station components
H-19.03 Diagnoses attachments and accessories

H-20 Repairs structural components, accessories and attachments
H-20.01 Performs mechanical repairs on structural components
H-20.02 Repairs operator station components
H-20.03 Repairs attachments and accessories
H-20.04 Installs attachments and accessories

Level Two topics that are taught in context:

Common Occupational Skills
Tools and Equipment
Routine Trade Activities
Operator Station Components

For details regarding the In Context Topics, see page 26

Level Three — 8 weeks — 240 hours

Alternative Fuels – Theory — 12 hours

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

Alternative Fuels – Shop — 18 hours

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

NOA topics covered in this section of training:

B-5 Diagnoses engine and engine support systems
B-5.05 Diagnoses fuel systems

B-6 Repairs engine and engine support systems
B-6.05 Repairs fuel systems

Electrical – Theory — 14 hours

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

Electrical – Shop — 16 hours

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

NOA topics covered in this section of training:

F-13 Diagnoses electrical systems
F-13.01 Diagnoses starting/charging systems and batteries
F-13.02 Diagnoses electrical components, motors and accessories

F-14 Repairs electrical systems
F-14.01 Repairs starting/charging systems and batteries
F-14.02 Repairs electrical components, motors and accessories

F-15 Diagnoses electronic vehicle management systems
F-15.01 Reads diagnostic trouble codes (DTCs)
F-15.02 monitors parameters
F-15.03 Interprets test results
F-15.04 Tests system circuitry and components

F-16 Repairs electronic vehicle management systems
F-16.01 Updates component software
F-16.02 Repairs components

Engine and Engine Support Systems – Theory — 55 hours

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

Engine and Engine Support Systems – Shop — 65 hours

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

NOA topics covered in this section of training:

B-5 Diagnoses engine and engine support systems

B-5.01 Diagnoses base engine
B-5.02 Diagnoses lubrication systems
B-5.03 Diagnoses cooling systems
B-5.04 Diagnoses intake and exhaust systems
B-5.06 Diagnoses engine control systems
B-5.07 Diagnoses emission control systems

B-6 Repairs engine and engine support systems
B-6.01 Repairs base engines
B-6.02 Repairs lubrication systems
B-6.03 Repairs cooling systems
B-6.04 Repairs intake and exhaust systems
B-6.06 Repairs engine control systems
B-6.07 Repairs emission control systems

Powershift Transmissions – Theory — 26 hours

- describe operation of fluid couplers and torque convertors
- describe various transmission hydraulic circuits
- describe the operation of various types of powershift and automatic transmissions
- describe the operation of transfer cases
- describe the operation of hydraulic retarders

Powershift Transmissions – Shop — 34 hours

- evaluate torque convertors
- utilize hydraulic schematics
- evaluate powershift and automatic transmissions
- evaluate transfer cases
- evaluate hydraulic retarders
- repair faults

NOA topics covered in this section of training:

C-7 Diagnoses hydraulic, hydrostatic and pneumatic systems

C-7.01 Diagnoses hydraulic systems
C-7.02 Diagnoses hydrostatic systems
C-7.03 Diagnoses pneumatic systems

C-8 Repairs hydraulic, hydrostatic and pneumatic systems
C-8.01 Repairs hydraulic systems
C-8.02 Repairs hydrostatic systems
C-8.03 Repairs pneumatic systems

D-9 Diagnoses drivetrain systems
D-9.01 Diagnoses clutch systems
D-9.02 Diagnoses torque converters, fluid couplers and retarders
D-9.03 Diagnoses driveline systems
D-9.04 Diagnoses transmission and transfer case systems
D-9.05 Diagnoses axle and differential systems
D-9.06 Diagnoses final drive systems

D-10 Repairs drivetrain systems
D-10.01 Repairs clutch systems
D-10.02 Repairs torque converters, fluid couplers and retarders
D-10.03 Repairs driveline systems
D-10.04 Repairs transmission and transfer case systems
D-10.05 Repairs axle and differential systems
D-10.06 Repairs final drive systems

Level Three topics that are taught in context:

Common Occupational Skills
Routine Trade Activities
Operator Station Components

For details regarding the In Context Topic, see page 26

Level Four — 8 weeks — 240 hours

Drivetrains – Theory — 12 hours

- describe the operation of a hybrid drive system
- describe the operating principles of an automated manual transmission
- describe electronic controls related to automated shift technology

Drivetrains – Shop — 18 hours

- evaluate hybrid drive systems
- evaluate automated manual transmissions
- diagnose electronic faults

NOA topics covered in this section of training:

D-9 Diagnoses drivetrain systems
D-9.01 Diagnoses clutch systems
D-9.02 Diagnoses torque converters, fluid couplers and retarders
D-9.03 Diagnoses driveline systems
D-9.04 Diagnoses transmission and transfer case systems
D-9.05 Diagnoses axle and differential systems
D-9.06 Diagnoses final drive systems

D-10 Repairs drivetrain systems
D-10.01 Repairs clutch systems
D-10.02 Repairs torque converters, fluid couplers and retarders
D-10.03 Repairs driveline systems
D-10.04 Repairs transmission and transfer case systems
D-10.05 Repairs axle and differential systems
D-10.06 Repairs final drive systems

Electrical – Theory — 40 hours

- apply scientific principles to explain electrical theory and magnetism
- identify electrical circuit types and faults utilizing test equipment
- explain the function and operation of a lead-acid battery
- explain the operation of cranking system and related components
- explain the operation of alternating current (AC) charging systems and related components
- explain common electrical and electronic components and their applications
- interpret wiring diagrams
- describe operation of electrical accessories and engine control circuits
- describe basic computer components using correct terminology
- explain operation of various electronic control systems and related components

Electrical – Shop — 50 hours

- diagnose electrical faults
- evaluate a lead acid battery
- evaluate an alternating current (AC) charging system and related components
- evaluate a cranking system and related components
- utilize wiring diagrams for fault diagnosis
- troubleshoot the accessory systems and engine control circuits
- operate various electronic control systems to check for proper function
- utilize diagnostic equipment

- repair defects

NOA topics covered in this section of training:

F-13 Diagnoses electrical systems
F-13.01 Diagnoses starting/charging systems and batteries
F-13.02 Diagnoses electrical components, motors and accessories

F-14 Repairs electrical systems
F-14.01 Repairs starting/charging systems and batteries
F-14.02 Repairs electrical components, motors and accessories

F-15 Diagnoses electronic vehicle management systems
F-15.01 Reads diagnostic trouble codes (DTCs)
F-15.02 monitors parameters
F-15.03 Interprets test results
F-15.04 Tests system circuitry and components

F-16 Repairs electronic vehicle management systems
F-16.01 Updates component software
F-16.02 Repairs components

Environmental Control Systems – Theory — 12 hours

- describe the operation of heating, ventilation and air conditioning systems
- identify various heating and air conditioning components
- describe proper usage of test equipment

Environmental Control Systems – Shop — 18 hours

- demonstrate service procedures
- repair air conditioning and heating components
- repair air conditioning systems

NOA topics covered in this section of training:

G-17 Diagnoses environmental control systems
G-17.01 Diagnoses heating systems
G-17.02 Diagnoses ventilation and filtration systems
G-17.03 Diagnoses air conditioning systems
G-17.04 Diagnoses sound suppression systems

G-18 Repairs environmental control systems
G-18.01 Repairs heating systems
G-18.02 Repairs ventilation and filtration systems
G-18.03 Repairs air conditioning systems
G-18.04 Repairs sound suppression systems

Fuel Systems – Theory — 40 hours

- describe preventive maintenance procedures for diesel fuel storage and delivery systems
- describe proper procedures to diagnose faults in fuel delivery and control systems
- describe proper procedures to inspect, adjust or repair fuel delivery and control systems
- describe the procedures involved in performance testing on diesel engines

Fuel Systems – Shop — 50 hours

- perform preventative maintenance

- evaluate diesel injection delivery and control components
- evaluate an operating diesel engine
- conduct performance testing
- repair faults

NOA topics covered in this section of training:

B-5 Diagnoses engine and engine support systems
B-5.05 Diagnoses fuel systems
B-5.06 Diagnoses engine control systems
B-5.07 Diagnoses emission control systems

B-6 Repairs engine and engine support systems
B-6.05 Repairs fuel systems
B-6.06 Repairs engine control systems
B-6.07 Repairs emission control systems

Level Four topics that are taught in context:

Common Occupational Skills
Tools and Equipment
Routine Trade Activities
Operator Station Components

For details regarding the In Context Topic, see page 26

IN CONTEXT TOPICS

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

A-1 Uses and maintains tools and equipment
A-1.01 Maintains tools and equipment
A-1.03 Operates access equipment
A-1.04 Uses personal protective equipment (PPE) and safety equipment

A-2 Performs general maintenance and inspections
A-2.01 Maintains fluids
A-2.02 Services fasteners, sealing devices, adhesives and gaskets
A-2.03 Services hoses, tubing, piping and fittings
A-2.04 Services bearings and seals
A-2.05 Services safety features
A-2.06 Performs scheduled maintenance procedures
A-2.07 Identifies operational faults
A-2.08 Performs operational check-out

A-3 Organizes work
A-3.01 Uses documentation and reference materials
A-3.02 Completes documentation
A-3.03 Communicates with others
A-3.04 Prepares job action plan
A-3.05 Maintains safe work environment

A-4 Performs routine trade activities
A-4.01 Heats materials
A-4.02 Cools materials
A-4.03 Cuts materials
A-4.04 Welds materials
A-4.05 Cleans parts and materials

Operator Station Components

H-19 Diagnoses structural components, accessories and attachments
H-19.02 Diagnoses operator station components

H-20 Repairs structural components, accessories and attachments
H-20.02 Repairs operator station components