Agricultural Equipment Technician

Guide to Course Content

2024

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Saskatchewan Apprenticeship and Trade Certification Commission

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Recognition:
To promote transparency and consistency, portions of this document has been adapted from the 2021 Agricultural Equipment Technician Red Seal Occupational Standard (Employment and Social Development Canada).

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

STRUCTURE OF THE GUIDE TO COURSE CONTENT

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

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

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

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

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

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

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

TRAINING REQUIREMENTS FOR THE AGRICULTURAL 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
Agricultural 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

AGRICULTURAL EQUIPMENT TECHNICIAN
TASK MATRIX CHART

This chart outlines the major work activities, tasks and sub-tasks from the 2021 Agricultural Equipment Technician Red Seal Occupational Standard (RSOS). Each sub-task details the corresponding essential skill and level of training (apprenticeship year) 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 — 5%

A-1 Performs safety-related functions	**1.01 Maintains safe work environment** 1	**1.02 Uses personal protective equipment (PPE) and safety equipment** 1			
A-2 Performs routine work practices	**2.01 Conducts operational tests** 1, In Context in 2,3,4	**2.02 Maintains fluids, lubricants and coolants** 1, In Context in 2,3,4	**2.03 Services filters** 1, In Context in 2,3,4	**2.04 Maintains hoses, tubing and fittings** 1, In Context in 2,3,4	**2.05 Services bearings, bushings and seals** 1, In Context in 2,3,4
	2.06 Uses fasteners, sealing devices, adhesives and gaskets 1, In Context in 2,3,4	**2.07 Cleans components** 1, In Context in 2,3,4	**2.08 Verifies equipment and components repairs** 1, In Context in 2,3,4	**2.09 Performs failure analysis** 1, In Context in 2,3,4	
A-3 Organizes work	**3.01 Uses documentation** 1, In Context in 2,3,4	**3.02 Plans daily tasks** 1, In Context in 2,3,4			
A-4 Uses and maintains tools and equipment	**4.01 Uses tools and equipment** 1, 3	**4.02 Uses hoisting, lifting and securing equipment** 1	**4.03 Uses electronic devices and systems for diagnostics and programming** 2		

A-5 Uses communication and mentoring techniques	5.01 Uses communication techniques 1	5.02 Uses mentoring techniques 4

B – Diagnoses and Repairs Engines and Engine Support Systems 15%

B-6 Diagnoses engines and engine support systems	6.01 Diagnoses base engines 2, 3, 4	6.02 Diagnoses lubrication systems 2, 3, 4	6.03 Diagnoses cooling systems 2	6.04 Diagnoses intake and exhaust systems 2, 3, 4	6.05 Diagnoses fuel delivery systems 2, 3
	6.06 Diagnoses engine management systems 2, 3	6.07 Diagnoses emissions control systems 2, 3			
B-7 Repairs engines and engine support systems	7.01 Repairs base engines 2, 3, 4	7.02 Repairs lubrication systems 2, 3, 4	7.03 Repairs cooling systems 2, 3	7.04 Repairs intake and exhaust systems 2, 3, 4	7.05 Repairs fuel delivery systems 2, 3
	7.06 Repairs engine management systems 2, 3	7.07 Repairs emissions control systems 2, 3			

C – Diagnoses and Repairs Drive Trains 13%

C-8 Diagnoses drive trains	8.01 Diagnoses dry clutches 1	8.02 Diagnoses driveline systems and components 1, 2, 3	8.03 Diagnoses wet clutches, transmissions and gear cases 1, 2, 3	8.04 Diagnoses differentials and final drives 2, 3
C-9 Repairs drive trains	9.01 Repairs dry clutches 1	9.02 Repairs driveline systems and components 1, 2, 3	9.03 Repairs wet clutches, transmissions and gear cases 1, 2, 3	9.04 Repairs differentials and final drives 2, 3

D – Diagnoses and Repairs Hydraulic, Hydrostatic and Pneumatic Systems

17%

D-10 Diagnoses hydraulic, hydrostatic and pneumatic systems	10.01 Diagnoses hydraulic and hydrostatic systems 1, 3, 4	10.02 Diagnoses pneumatic systems 1, 2, 3, 4
D-11 Repairs hydraulic, hydrostatic and pneumatic systems	11.01 Repairs hydraulic and hydrostatic systems 1, 3, 4	11.02 Repairs pneumatic systems 1, 2, 3, 4

E – Diagnoses and Repairs Electrical and Electronic Systems

19%

E-12 Diagnoses electrical/electronic power and control monitoring systems	12.01 Diagnoses electrical power and control monitoring systems 1, 2, 3, 4	12.02 Diagnoses electronic power and control monitoring systems. 1, 2, 3, 4
E-13 Repairs electrical/electronic power and control monitoring systems.	13.01 Repairs electrical power and control monitoring systems 1, 2, 3, 4	13.02 Repairs electronic power and control monitoring systems 1, 2, 3, 4

F – Diagnoses and Repair Steering, Brakes and Suspensions — 10%

F-14 Diagnoses steering and brake systems	14.01 Diagnoses steering systems 1, 4	14.02 Diagnoses brake systems 1, 4	
F-15 Repairs steering and brake systems	15.01 Repairs steering systems 1, 4	15.02 Repairs brake systems 1, 4	
F-16 Diagnoses track, wheel and suspension systems	16.01 Diagnoses track systems 1, 4	16.02 diagnoses wheel assemblies 1, 4	16.03 Diagnoses suspension systems 1, 4
F-17 Repairs track, wheel and suspension systems	17.01 Repairs track systems 1, 4	17.02 Repairs wheel assemblies 1, 4	17.03 Repairs suspension systems 1, 4

G – Diagnoses and Repairs Structural Components and Operator Stations — 6%

G-18 Diagnoses structural components	18.01 Diagnoses frame components 1, 3	18.02 Verifies condition of operator protective structures 1, 4	18.03 Diagnoses equipment body 1, 3
G-19 Repairs structural components.	19.01 Repairs frame components 1, 3	19.02 Replaces operator protective structures 1, 4	19.03 Repairs equipment body 1, 3
G-20 Diagnoses climate control systems.	20.01 Diagnoses heating and ventilation systems 1, 4	20.02 Diagnoses air conditioning systems 1, 4	

G-21 Repairs climate control systems.	21.01 Repairs heating and ventilation systems 1, 4	21.02 Repairs air conditioning systems 1, 4

H – Diagnoses and Repairs Agricultural Equipment — 15%

H-22 Prepares agricultural equipment	22.01 Performs assembly and pre-delivery adjustments on agricultural equipment 1, 4	22.02 Performs preparation and installation of agricultural equipment 1, 4	22-03 Installs precision farming equipment 1, 3, 4
H-23 Diagnoses precision farming equipment	23.01 Diagnoses precision farming equipment on site 1, 2, 3, 4	23.02 Diagnoses precision farming equipment remotely 1, 2, 3, 4	
H-24 Repairs precision farming equipment	24.01 Repairs precision farming equipment on site 1, 2, 3, 4	24.02 Repairs precision farming equipment remotely 1, 2, 3, 4	
H-25 Diagnoses land preparation tillage and seeding/planting equipment	25.01 Diagnoses land preparation and tillage equipment 1, 2, 4	25.02 Diagnoses seeding planting equipment 1, 2, 4	
H-26 Repairs land preparation, tillage and seeding/planting equipment	26.01 Repairs land preparation and tillage equipment 1, 2, 3, 4	26.02 Repairs seeding and planting equipment 1, 2, 3, 4	

H-27 Diagnoses harvesting, hay and forage equipment	**27.01 Diagnoses cutting, conditioning, gathering and processing equipment** **2**	**27.02 Diagnoses material handling equipment** **2**
H-28 Repairs harvesting, hay and forage equipment	**28.01 Repairs cutting, conditioning, gathering and processing equipment** **2, 3**	**28.02 Repairs material handling equipment** **2, 3**
H-29 Diagnoses application and irrigation equipment	**29.01 Diagnoses application equipment** **2**	**29.02 Diagnoses irrigation equipment** **2**
H-30 Repairs application and irrigation equipment	**30.01 Repairs application equipment** **2**	**30.02 Repairs irrigation equipment** **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
Air Conditioning and Heating	AIR 100 - Theory	15
	AIR 101 - Shop	15
Basic Electrical	ELEC 122 - Theory	30
	ELEC 123 - Shop	30
Diesel Fuel Systems	ENGN 117 - Theory	15
	ENGN 118 - Shop	15
Basic Hydraulic Systems	HYDR 105 - Theory	30
	HYDR 106 - Shop	30
Seeding and Tillage Equipment	EQPT 163 - Theory	15
	EQPT 164 - Shop	15
Powertrains 1	TRNM 105 - Theory	15
	TRNM 106 - Shop	15
		240

Level Two	Transcript Code	Hours
Electrical Diagnostic	ELEC 274 - Theory	30
	ELEC 275 - Shop	30
Engine Operation and System Components	ENGN 274 - Theory	30
	ENGN 275 - Shop	30
Harvesting, Hay and Forage	EQPT 270 - Theory	30
	EQPT 271- Shop	30
Sprayers and Applicators	EQPT 272- Theory	15
	EQPT 273- Shop	15
Powertrains 2	TRNM 270 - Theory	15
	TRNM 271 - Shop	15
		240

Level Three	Transcript Code	Hours
Electrical and Electronics	ELEC 388 - Theory	15
	ELEC 389 - Shop	15
Diesel Fuel System Diagnostics	ENGN 388 - Theory	30
	ENGN 389 - Shop	30
Hydraulic Systems	HYDR 388 - Theory	15
	HYDR 389 - Shop	15
Powertrains 3 Advanced	TRNM 388 - Theory	30
	TRNM 389 - Shop	30
Welding	WELD 372 - Theory	30
	WELD 373 - Shop	30
		240

Level Four	Transcript Code	Hours
Electrical and Electronic Diagnosis	ELEC 490 - Theory	30
	ELEC 491 - Shop	30
Engine Support Systems	ENGN 486 - Theory	30
	ENGN 487 - Shop	30
Hydraulic System Diagnosis	HYDR 486 - Theory	30
	HYDR 487 - Shop	30
Machinery Diagnosis	EQPT 486 - Theory	15
	EQPT 487 - Shop	15
Equipment Performance	TRNM 486- Theory	15
	TRNM 487 - Shop	15
		240

TECHNICAL TRAINING COURSE CONTENT

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

Level One — 8 weeks — 240 hours

Air Conditioning and Heating – Theory — 15 hours

- discuss refrigerants and lubricants
- identify types of heater system malfunctions
- identify types of air conditioning system malfunctions
- identify types of HVAC systems
- describe pneumatics systems

Air Conditioning and Heating – Shop — 15 hours

- troubleshoot heater system malfunctions
- troubleshoot air conditioning system malfunctions
- evaluate pneumatics suspension systems

RSOS topics covered in this section of training:

D-10 Diagnoses hydraulic, hydrostatic and pneumatic systems
D-10.02 Diagnoses pneumatic systems

D-11 Repairs hydraulic, hydrostatic and pneumatic systems
D-11.02 Repairs pneumatic systems

G-20 Diagnoses climate control systems
G-20.01 Diagnoses heating and ventilation systems
G-20.02 Diagnoses heating and ventilation systems

G-21 Repairs climate control systems
G-21.01 Repairs heating and ventilation systems
G-21.02 Repairs air conditioning systems

Basic Electrical – Theory — 30 hours

- describe the operation of an electrical circuit
- describe the relationship between electricity and magnetism
- discuss the construction and properties of series, parallel and series-parallel circuits
- describe the operation and function of circuit control devices
- identify basic electrical system symbols
- describe the difference between analog and digital signals

Basic Electrical – Shop — 30 hours

- perform boosting procedures
- troubleshoot basic electrical circuit problems
- repair wiring harness and connectors
- use basic electrical system symbols
- discuss wet cell batteries
- service wet cell batteries

RSOS topics covered in this section of training:

A-3 Organizes work
A-3.01 Uses documentation
A-3.02 Plans daily tasks

A-4 Uses and maintains tools and equipment
A-4.03 Uses electronic devices and systems for diagnostics and programming

E-12 Diagnoses electrical/electronic power and control monitoring systems
E-12.01 Diagnoses electrical power and control monitoring systems

E-13 Repairs electrical/electronic power and control monitoring systems
E-13.01 Repairs electrical power and control monitoring systems

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Diesel Fuel Systems – Theory — 15 hours

- discuss the procedure to evaluate air induction systems
- discuss the procedure to maintain fuel systems
- discuss the repair of low and high-pressure fuel system components
- explain diesel engine combustion chamber designs
- discuss the repair of diesel fuel injectors
- discuss internal and external threading operations
- discuss the procedure to perform compression and leak tests on a diesel engine

Diesel Fuel Systems – Shop — 15 hours

- perform compression and leak down tests on a diesel engine
- evaluate an air induction system
- service fuel systems
- repair low and high-pressure fuel system components
- inspect diesel engine combustion chamber designs
- service diesel fuel injectors
- inspect internal and external threads

RSOS topics covered in this section of training:

A-2 Performs routine work practices
A-2.01 Conducts operational tests
A-2.02 Maintains fluids, lubricants and coolants
A-2.03 Services filters
A-2.04 Maintains hoses, tubing and fittings
A-2.05 Services bearings, bushings and seals
A-2.06 Uses fasteners, sealants, adhesives and gaskets
A-2.07 Cleans components
A-2.08 Verifies equipment and component repairs
A-2.09 Performs failure analysis

A-4 Uses and maintains tools and equipment
A-4.01 Uses tools and equipment

Basic Hydraulic Systems – Theory — 30 hours

- read basic hydraulic systems symbols
- identify hoses and fittings
- explain the operation of hydraulic pumps
- explain the operation of pressure control valves
- explain the operation of flow control valves

- explain the operation of directional control valves
- explain the operation of basic hydraulic brakes
- explain the operation of hydraulic actuators

Basic Hydraulic Systems – Shop **30 hours**

- inspect hydraulic brake components
- service hydraulic systems
- repair cylinders and motors
- install hydraulic system components
- perform basic troubleshooting procedures on a hydraulic system

RSOS topics covered in this section of training:

A-2 Performs routine work practices
A-2.02 Maintains fluids, lubricants and coolants
A-2.03 Services filters
A-2.04 Maintains hoses, tubing and fittings

D-10 Diagnoses hydraulic, hydrostatic and pneumatic systems
D-10.01 Diagnoses hydraulic and hydrostatic systems

D-11 Repairs hydraulic, hydrostatic and pneumatic systems
D-11.01 Repairs hydraulic and hydrostatic systems

F-14 Diagnoses steering and brake systems
F-14.01 Diagnoses steering systems
F-14.02 Diagnoses brake systems

F-15 Repairs steering and brake systems
F-15.01 Repairs steering systems
F-15.02 Repairs brake systems

Seeding and Tillage Equipment – Theory **15 hours**

- describe anhydrous ammonia safety and the operation of anhydrous applicators
- describe the principles and theory of operation for seed carts, seeding tools, and tillage equipment
- describe equipment adjustments for various seeding rates and field conditions
- describe basic hydraulic and electrical principles as they apply to seeding and tillage equipment
- explain basic global positioning system functions

Seeding and Tillage Equipment – Shop **15 hours**

- perform pre-delivery and service requirements for various types of seed carts, seeding tools, and tillage equipment by using manufacturer's procedures
- apply operating principles of various components on seed carts, seeding tools, and tillage equipment
- apply the operating principles of hydraulic and electrical components for seeding and tillage equipment
- inspect global positioning system components for variable rate metering

RSOS topics covered in this section of training:

A-1 Performs safety-related functions
A-1.01 Maintains safe work environment
A-1.02 Uses personal protective equipment (PPE) and safety equipment

A-5 Uses communication and mentoring techniques
A-5.01 Uses communication techniques

G-18 Diagnoses structural components
G-18.01 Diagnoses structural components
G-18.02 Verifies condition of operator protective structures
G-18.03 Diagnoses equipment body

G-19 Repairs structural components
G-19.01 Repairs frame components
G-19.02 Replaces operator protective structures
G-19.03 Repairs equipment body

H-22 Prepares agricultural equipment
H-22.01 Performs assembly and pre-delivery adjustments on agricultural equipment
H-22.02 Performs preparation and installation of agricultural equipment
H-22-03 Installs precision farming equipment

H-23 Diagnoses precision farming equipment
H-23.01 Diagnoses precision farming equipment on site
H-23.02 Diagnoses precision farming equipment remotely

H-25 Diagnoses land preparation, tillage and seeding/planting equipment
H-25.01 Diagnoses land preparation and tillage equipment
H-25.02 Diagnoses seeding and planting equipment

H-26 Repairs land preparation, tillage and seeding/planting equipment
H-26.01 Repairs land preparation and tillage equipment
H-26.02 Repairs seeding and planting equipment

Powertrains 1 – Theory — 15 hours

- explain lifting and hoisting procedures
- describe the construction and operation of clutch linkages and transmission brakes
- describe clutch system components
- describe safety precautions when separating tractors
- describe steering axles and their functions
- describe theory of gears, gear ratios and bearing construction

Powertrains 1 – Shop — 15 hours

- perform lifting and hoisting procedures
- perform procedures to support, block, and lift equipment
- split tractor to repair or replace components
- adjust clutch linkages and transmission brakes
- perform inspection of clutch system components
- align clutch components and flywheel

RSOS topics covered in this section of training:

A-2 Performs routine work practices
A-2.01 Conducts operational tests
A-2.02 Maintains fluids, lubricants and coolants
A-2.03 Services filters
A-2.04 Maintains hoses, tubing and fittings
A-2.06 Uses fasteners, sealants, adhesives and gaskets
A-2.07 Cleans components

A-3 Organizes work
A-3.01 Uses documentation

A-4 Uses and maintains tools and equipment
A-4.02 Uses hoisting, lifting and securing equipment

C-8 Diagnoses drive trains
C-8.01 Diagnoses dry clutches
C-8.02 Diagnoses driveline systems and components
C-8.03 Diagnoses wet clutches, transmissions and gear cases

C-9.01 Repairs drive trains
C-9.01 Repairs dry clutches
C-9.02 Repairs driveline systems and components
C-9.03 Repairs wet clutches, transmissions and gear cases

F-14 Diagnoses steering and brake systems
F-14.01 Diagnoses steering systems

F-15 Repairs steering and brake systems
F-15.02 Repairs brake systems

F-16 Diagnoses track, wheel and suspension systems
F-16.01 Diagnoses track systems
F-16.02 Diagnoses wheel assemblies
F-16.03 Diagnoses suspension systems

F-17 Repairs track, wheel and suspension systems
F-17.01 Repairs track systems
F-17.02 Repairs wheel assemblies
F-17.03 Repairs suspension systems

G-18 Diagnoses structural components
G-18.01 Diagnoses structural components
G-18.02 Verifies condition of operator protective structures
G-18.03 Diagnoses equipment body

G-19 Repairs structural components
G-19.01 Repairs frame components
G-19.02 Replaces operator protective structures
G-19.03 Repairs equipment body

Level Two — 8 weeks — 240 hours

Electrical Diagnostic – Theory — 30 hours

- describe the operation of capacitors, diodes, and transistors
- describe the operation of the charging system components
- describe the operation of the starting system components
- describe the evolution of network systems on modern agricultural equipment

Electrical Diagnostic – Shop — 30 hours

- test capacitors, diodes and transistors
- repair charging system and components
- repair starting system components
- explain how to connect a CAN BUS implement to a CAN BUS tractor using the ISO connector

RSOS topics covered in this section of training:

A-4 Uses and maintains tools and equipment
A-4.03 Uses electronic devices and systems for diagnostics and programming

E-12 Diagnoses electrical/electronic power and control monitoring systems
E-12.02 Diagnoses electronic power and control monitoring systems

E-13 Repairs electrical/electronic power and control monitoring systems
E-13.02 Repairs electronic power and control monitoring systems

H-23 Diagnoses precision farming equipment
H-23.01 Diagnoses precision farming on site
H-23.02 Diagnoses precision farming equipment remotely

Engine Operation and System Components – Theory — 30 hours

- explain the principles of combustion
- describe the operation of a two-stroke cycle and four-stroke cycle engine
- explain the difference between air-cooled and liquid-cooled engines
- identify methods to repair damaged threads
- discuss the inspection of cooling system components
- explain precision measuring tools
- discuss splash and pressurized lubrication systems
- discuss the inspection of cylinder heads
- describe the inspection of internal engine components
- describe operation of emission systems

Engine Operation and System Components – Shop — 30 hours

- examine the components of a four-stroke cycle engine
- examine air-cooled and liquid-cooled engines
- perform internal and external threading procedures
- inspect cooling system components
- use hydraulic presses and pullers
- inspect cylinder heads
- use precision measuring tools
- inspect internal engine components
- reassemble engine

RSOS topics covered in this section of training:

B-6 Diagnoses engines and engine support systems
B-6.01 Diagnoses base engines

B-6.02 Diagnoses lubrication systems
B-6.03 Diagnoses cooling systems
B-6.04 Diagnoses intake and exhaust systems
B-6.05 Diagnoses fuel delivery systems
B-6.07 Diagnoses emissions control systems

B-7 Repairs engines and engine support systems
B-7.01 Repairs base engines
B-7.02 Repairs lubrication systems
B-7.03 Repairs cooling systems
B-7.04 Repairs intake and exhaust systems
B-7.06 Repairs engine management systems
B-7.05 Repairs fuel delivery systems
B-7.07 Repairs emissions control systems

Harvesting, Hay and Forage – Theory — 30 hours

- describe the construction of belts, chains and power take off (PTO) shafts
- describe hydrostatic drive systems
- describe the theory of operation for combines
- describe the theory of operation for combine component monitoring
- describe yield monitoring and satellite-based yield mapping components and sensors
- describe the operation of hay and forage equipment

Harvesting, Hay and Forage – Shop — 30 hours

- inspect belts, chains and PTO shafts
- inspect basic hydrostatic drive systems
- inspect components on hay and forage equipment
- repair harvesting equipment components
- perform adjustments on harvesting equipment for various harvesting conditions
- inspect yield monitoring and satellite-based yield mapping components

RSOS topics covered in this section of training:

B-6 Diagnoses engines and engine support systems
B-6.06 Diagnoses engine management systems

C-8 Diagnoses drive trains
C-8.02 Diagnoses driveline systems and components
C-8.03 Diagnoses wet clutches, transmissions and gear cases

H-23 Diagnoses precision farming equipment
H-23.01 Diagnoses precision farming equipment on site
H-23.02 Diagnoses precision farming equipment remotely

H-27 Diagnoses harvesting, hay and forage equipment
H-27.01 Diagnoses cutting, conditioning, gathering and processing equipment
H-27.02 Diagnoses material handling equipment

H-28 Repairs harvesting, hay and forage equipment
H-28.01 Repairs cutting, conditioning, gathering and processing equipment
H-28.02 Repairs material handling equipment

Sprayers and Applicators – Theory — 15 hours

- describe the pneumatic suspension systems
- describe the operation of sprayer and applicator systems

- identify the steps for safe handling of chemicals

Sprayers and Applicators – Shop **15 hours**

- perform pre-delivery and inspection of sprayers
- inspect pneumatic suspension systems
- inspect sprayer systems
- calibrate sprayer systems

RSOS topics covered in this section of training:

D-10 Diagnoses hydraulic, hydrostatic and pneumatic systems
D-10.02 Diagnoses pneumatic systems

D-11 Repairs hydraulic, hydrostatic and pneumatic systems
D-11.02 Repairs pneumatic systems

H-22 Prepares agricultural equipment
H-22.03 Installs precision farming equipment

H-29 Diagnoses application and irrigation equipment
H-29.01 Diagnoses application equipment
H-29.02 Diagnoses irrigation equipment

H-30 Repairs application and irrigation equipment
H-30.01 Repairs application equipment
H-30.02 Repairs irrigation equipment

Powertrains 2 – Theory **15 hours**

- describe various gearbox types
- describe planetary drives, bull pinion and front wheel assist axles
- discuss steering geometry
- describe advanced brake systems

Powertrains 2 – Shop **15 hours**

- inspect various gearbox types
- inspect front wheel assist axle assemblies
- inspect steering geometry
- inspect inboard and outboard final drives
- inspect hydraulic brake components
- inspect brake assemblies

RSOS topics covered in this section of training:

C-8 Diagnoses drive trains
C-8.02 Diagnoses driveline systems and components
C-8.03 Diagnoses wet clutches, transmissions and gear cases
C-8.04 Diagnoses differentials and final drives

C-9 Repairs drive trains
C-9.02 Repairs driveline systems and components
C-9.03 Repairs wet clutches, transmissions and gear cases
C-9.04 Repairs differentials and final drives

Level Two topics that are taught in context:

A-2 Routine Work Practices
A-3 Organizes Work

For details regarding the In Context Topic, see page 28

Level Three — 8 weeks — 240 hours

Electrical and Electronics – Theory — 15 hours

- identify electrical schematics
- describe the operation of control circuits
- describe the operation of circuit protection devices
- describe the operation of sensor circuits
- describe the operation of controllers
- describe the four faults in an electrical system
- explain Controller Area Network (CAN) BUS and its functions

Electrical and Electronics – Shop — 15 hours

- perform test procedures
- perform circuit protection tests
- perform sensor circuits tests
- test controllers
- troubleshoot the four faults in an electrical system
- troubleshoot electrical systems using on-board diagnostic procedures

RSOS topics covered in this section of training:

A-4 Uses and maintains tools and equipment
A-4.03 Uses electronic devices and systems for diagnostics and programming

E-12 Diagnoses electrical/electronic power and control monitoring systems
E-12.02 Diagnoses electronic power and control monitoring systems

E-13 Repairs electrical/electronic power and control monitoring systems
E-13.02 Repairs electronic power and control monitoring systems

H-23 Diagnoses precision farming equipment
H-23.01 Diagnoses precision farming on site
H-23.02 Diagnoses precision farming equipment remotely

Diesel Fuel System Diagnostics – Theory — 30 hours

- discuss the removal and installation of injection system components
- compare injection system timing methods
- discuss turbochargers
- explain the removal and installation of electronic injectors
- discuss fuel delivery control methods
- discuss emission control process
- discuss methods used to diagnose fuel and emission system problems

Diesel Fuel System Diagnostics – Shop — 30 hours

- complete the removal and installation of injection components
- perform injection system timing
- analyze fuel system components
- evaluate turbochargers
- perform the removal and installation of electronic injectors
- troubleshoot electronic fuel systems
- troubleshoot emission system components
- perform diagnosis and repair of fuel systems

RSOS topics covered in this section of training:

B-6 Diagnoses engines and engine support systems
B-6.01 Diagnoses base engines

B-6.02 Diagnoses lubrication systems
B-6.04 Diagnoses intake and exhaust systems
B-6.05 Diagnoses fuel delivery systems
B-6.06 Diagnoses engine management systems
B-6.07 Diagnoses emissions control systems

B-7 Repairs engines and engine support systems
B-7.01 Repairs base engines
B-7.02 Repairs lubrication systems
B-7.04 Repairs intake and exhaust systems
B-7.05 Repairs fuel delivery systems
B-7.06 Repairs engine management systems
B-7.07 Repairs emissions control systems

Hydraulic Systems – Theory — 15 hours

- describe the operation of a hydrostatic steering system
- describe the operation of a power brake system
- describe pneumatic and hydraulic trailer braking systems
- describe the operation of a 3-point hitch system
- describe the operation of a hydrostatic transmission

Hydraulic Systems – Shop — 15 hours

- evaluate steering control valves
- evaluate power brake control valves
- evaluate 3-point hitch components
- evaluate hydrostatic transmission components

RSOS topics covered in this section of training:

B-7 Repairs engines and engine support systems
B-7.06 Repairs engine management systems

C-8 Diagnoses drive trains
C-8.03 Diagnoses wet clutches, transmissions and gear cases

C-9 Repairs drive trains
C-9.03 Repairs wet clutches, transmissions and gear cases

D-10 Diagnoses hydraulic, hydrostatic and pneumatic systems
D-10.01 Diagnoses hydraulic and hydrostatic systems

D-11 Repairs hydraulic, hydrostatic and pneumatic systems
D-11.01 Repairs hydraulic and hydrostatic systems

Powertrains 3 Advanced - Theory — 30 hours

- describe standard gear transmissions
- describe power shift transmissions
- describe transmission diagnostics procedures
- describe continuously variable transmission (CVT) operation
- describe CVT calibration

Powertrains 3 Advanced – Shop — 30 hours

- perform the disassembly and inspection of gear transmissions and transfer cases
- perform the disassembly and inspection of power shift transmissions
- diagnose power shift transmission components
- Calibrate continuously variable transmission (CVT)

RSOS topics covered in this section of training:

C-8 Diagnoses drive trains
C-8.02 Diagnoses driveline systems and components
C-8.03 Diagnoses wet clutches, transmissions and gear cases
C-8.04 Diagnoses differentials and final drives

C-9 Repairs drive trains
C-9.02 Repairs driveline systems and components
C-9.03 Repairs wet clutches, transmissions and gear cases
C-9.04 Repairs differentials and final drives

Welding – Theory — 30 hours

- describe the safe assembly, operations, shut down and equipment for oxy-fuel cutting (OFC) and plasma arc cutting (PAC)
- describe the safe assembly, operations, shut down and equipment for Gas Metal Arc Welding (GMAW)
- describe the safe assembly, operations, shut down and equipment for Shield Metal Arc Welding (SMAW)

Welding – Shop — 30 hours

- demonstrate the safe set up, operation and maintenance when performing oxy-fuel cutting (OFC)
- demonstrate the safe set up, operation and maintenance when plasma arc cutting (PAC)
- demonstrate the safe set up, operation and maintenance when performing Gas Metal Arc Welding (GMAW) in multiple positions on various gauges of metal
- demonstrate the safe set up, operation and maintenance when performing Shield Metal Arc Welding (SMAW)

RSOS topics covered in this section of training:

A-4 Uses and maintains tools and equipment
A-4.01 Uses tools and equipment

G-18 Diagnoses structural components
G-18.01 Diagnoses frame components
G-18.03 Diagnoses equipment body

G-19 Repairs structural components
G-19.01 Repairs frame components
G-19.03 Repairs equipment body

H-26 Repairs land preparation, tillage and seeding/planting equipment
H-26.01 Repairs land preparation and tillage equipment

H-28 Repairs harvesting, hay and forage equipment
H-28.01 Repairs cutting, conditioning, gathering and processing equipment
H-28.02 Repairs material handling equipment

H-30 Repairs application and irrigation equipment
H-30.01 Repairs application equipment
H-30.02 Repairs irrigation equipment

Level Three topics that are taught in context:

A-2 Routine Work Practices
A-3 Organizes Work

For details regarding the In Context Topic, see page 28

Level Four — 8 weeks — 240 hours

Electrical and Electronic Diagnosis – Theory — 30 hours

- describe the operations of communication systems
- identify faulty communication system
- identify faulty electrical and electronic circuits
- discuss diagnostic procedures on charging, starting and monitoring systems

Electrical and Electronic Diagnosis – Shop — 30 hours

- connect diagnostic equipment to machinery following manufacturer's procedures
- analyze information received from diagnostic equipment
- repair faulty communication system
- discuss diagnostic procedures on charging, starting and monitoring systems

RSOS topics covered in this section of training:

E-12 Diagnoses electrical/electronic power and control monitoring systems
E-12.01 Diagnoses electrical power and control monitoring systems
E-12.02 Diagnoses electronic power and control monitoring systems

E-13 Repairs electrical/electronic power and control monitoring systems
E-13.01 Repairs electrical power and control monitoring systems
E-13.02 Repairs electronic power and control monitoring systems

H-23 Diagnoses precision farming equipment
H-23.01 Diagnoses precision farming equipment on site
H-23.02 Diagnoses precision farming equipment remotely

H-24 Repairs precision farming equipment
H-24.01 Repairs precision farming equipment on site
H-24.02 Repairs precision farming equipment remotely

H-27 Diagnoses harvesting, hay and forage equipment
H-27.01 Diagnoses cutting, conditioning, gathering and processing equipment
H-27.02 Diagnoses material handling equipment

Engine and Engine Support Systems – Theory — 30 hours

- discuss cylinder heads
- discuss pistons, rods and sleeves
- discuss valve train components
- discuss cylinder block, crankshaft and bearings
- discuss the use of sealing components
- discuss vibration dampeners, flywheels and inertia balancers
- discuss the assembled engine

Engine and Engine Support Systems – Shop — 30 hours

- evaluate cylinder heads
- evaluate pistons, rods and sleeves
- evaluate valve train components
- evaluate cylinder block, crankshaft and bearings
- evaluate sealing components
- evaluate vibration dampeners, flywheels and inertia balancers
- perform repair procedures

RSOS topics covered in this section of training:

B-6 Diagnoses engines and engine support systems
B-6.01 Diagnoses base engines
B-6.02 Diagnoses lubrication systems
B-6.04 Diagnoses intake and exhaust systems

B-7 Repairs engines and engine support systems
B-7.01 Repairs base engines
B-7.02 Repairs lubrication systems
B-7.04 Repairs intake and exhaust systems

Hydraulic System Diagnosis – Theory — 30 hours

- interpret hydraulic system test procedures
- analyze hydraulic schematic diagrams
- analyze hydrostatic drive systems

Hydraulic System Diagnosis – Shop — 30 hours

- develop a diagnostic plan and record sheet
- perform hydraulic and powertrain system diagnostics
- interpret hydraulic schematic diagrams

RSOS topics covered in this section of training:

D-10 Diagnoses hydraulic, hydrostatic and pneumatic systems
D-10.01 Diagnoses hydraulic and hydrostatic systems

D-11 Repairs hydraulic, hydrostatic and pneumatic systems
D-11.01 Repairs hydraulic and hydrostatic systems

Machinery Diagnosis – Theory — 15 hours

- describe the diagnostic procedures for Heating, Ventilation and Air Conditioning (HVAC) systems
- describe diagnostic procedures for agricultural equipment

Machinery Diagnosis – Shop — 15 hours

- analyze the operation of the Heating, Ventilation and Air Conditioning (HVAC) system
- analyze the operation of agricultural equipment

RSOS topics covered in this section of training:

G-20 Diagnoses climate control systems
G-20.01 Diagnoses heating and ventilation systems
G-20.02 Diagnoses heating and ventilation systems

G-21 Repairs climate control systems
G-21.01 Repairs heating and ventilation systems
G-21.02 Repairs air conditioning systems

H-22 Prepares agricultural equipment
H-22.01 Performs assembly and pre-delivery adjustments on agricultural equipment
H-22.02 Performs preparation and installation of agricultural equipment
H-22.03 Installs precision farming equipment

H-23 Diagnoses precision farming equipment
H-23.01 Diagnoses precision farming equipment on site
H-23.02 Diagnoses precision farming equipment remotely

H-24 Repairs precision farming equipment
H-24.01 Repairs precision farming equipment on site
H-24.02 Repairs precision farming equipment remotely

Equipment Performance – Theory — 15 hours

- evaluate clutches, steering, brakes, differentials, and planetaries
- evaluate the importance of pre-delivery procedures
- compare methods of ballasting tractors
- evaluate the use of the dynamometer to test horsepower and torque
- plan diagnostic procedures
- evaluate the importance of pre-delivery procedures

Equipment Performance – Shop — 15 hours

- use a dynamometer
- evaluate torque and horsepower curves

RSOS topics covered in this section of training:

F-14 Diagnoses steering and brake systems
F-14.01 Diagnoses steering systems
F-14.02 Diagnoses brake systems

F-15 Repairs steering and brake systems
F-15.01 Repairs steering systems
F-15.02 Repairs brake systems

F-16 Diagnoses track, wheel and suspension systems
F-16.01 Diagnoses track systems
F-16.02 Diagnoses wheel assemblies
F-16.03 Diagnoses suspension systems

F-17 Repairs track, wheel and suspension systems
F-17.01 Repairs track systems
F-17.02 Repairs wheel assemblies
F-17.03 Repairs suspension systems

H-22 Prepares agricultural equipment
H-22.01 Performs assembly and pre-delivery adjustments on agricultural equipment
H-22.02 Performs preparation and installation of agricultural equipment

H-25 Diagnoses land preparation, tillage and seeding/planting equipment
H-25.01 Diagnoses land preparation and tillage equipment
H-25.02 Diagnoses seeding and planting equipment

H-26 Repairs land preparation, tillage and seeding/planting equipment
H-26.01 Repairs land preparation and tillage equipment
H-26.02 Repairs seeding and planting equipment

Level Four topics that are taught in context:

A-2 Routine Work Practices
A-3 Organizes Work

For details regarding the In Context Topic, see page 28

IN CONTEXT TOPICS

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

A-2 Routine Work Practices
2.01 Conducts operational tests
2.02 Maintains fluids, lubricants and coolants
2.03 Services filters
2.04 Maintains hoses, tubing and fittings
2.05 Services bearings, bushings and seals
2.06 Uses fasteners, sealants, adhesives and gaskets
2.07 Cleans components
2.08 Verifies equipment and component repairs
2.09 Performs failure analysis

A-3 Organizes Work
3.01 Uses documentation
3.02 Plans daily tasks