Agricultural Equipment Technician

Guide to Course Content

2024

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Recognition:
To promote transparency and consistency, 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:

Description of the Agricultural Equipment Technician trade: an overview of the trade's duties and training requirements.

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

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

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

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

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

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

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

Technical Training Course Content for the 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.

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

DESCRIPTION OF THE AGRICULTURAL EQUIPMENT TECHNICIAN TRADE

Agricultural equipment technicians set up, maintain, service, diagnose, repair and recondition agricultural equipment.

This equipment includes tractors and combines, as well as a variety of implements for agricultural functions such as tillage, seeding, planting, harvesting, haying, spraying and application. Agricultural equipment technicians may also work on outdoor power equipment. While they are involved in preventative maintenance, agricultural equipment technicians spend most of their time diagnosing and repairing malfunctioning or out of service equipment, either in the shop or in the field.

Agricultural equipment technicians must be able to service and repair gasoline and diesel engines, drive train systems and components, hydraulic, hydrostatic and pneumatic systems, electrical and electronic systems, steering and braking systems, structural components, operator station and other related support systems. They also assemble and adjust new agricultural equipment, perform scheduled maintenance service such as oil changes, lubrication and tune-ups, take defective units apart, and repair or replace broken, worn-out or faulty parts. Agricultural equipment technicians may specialize in certain types of equipment or in repairing one particular manufacturer's product line.

Agricultural equipment technicians must also have good communication and customer service skills, since they often interact with clients. They teach clients how to operate new equipment, discuss equipment operation, and consult with them to pinpoint problems and determine their specific needs.

Agricultural equipment technicians work in the agriculture sector for equipment manufacturers, dealerships and independent repair shops or on large farms. They can also be self-employed. The equipment they work on and the hours tend to change according to the season.

The work often requires considerable standing, climbing, crouching, balancing on equipment and heavy lifting. Technicians must be able to diagnose complex problems and interpret technical manuals and schematics.

Due to the size and complexity of the equipment, safety is of prime importance. Technicians must practice safe operating procedures and be conscious of the impact on people, equipment, work area and environment when performing their work. There is risk of serious injury when working with agricultural equipment.

This analysis recognizes similarities or overlaps with the work of automotive service technicians, truck and transport mechanics, heavy duty equipment technicians, small engine mechanics and welders. With experience, agricultural equipment technicians may act as mentors and trainers to apprentices in the trade. They may also advance to become shop supervisors, service managers, salespeople or manufacturers' service representatives. Some may also open their own dealerships or businesses.

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

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

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

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

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

Entrance Requirements for Apprenticeship Training

Your grade twelve transcripts (with no modified classes) or GED 12 is your guarantee that you meet the educational entrance requirements for apprenticeship in Saskatchewan. In fact, employers prefer and recommend apprentices who have completed high school. This ensures the individual has all of the necessary skills required to successfully complete the apprenticeship program, and receive 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 10	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

ESSENTIAL SKILLS SUMMARY

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

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

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

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

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

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

READING

Agricultural equipment technicians read documents such as service bulletins, instruction and service manuals, brochures, pamphlets and work orders to diagnose problems, determine repairs and determine operation of machinery. They may also read farm periodicals to broaden their agricultural knowledge. They read safety related information such as Material Safety Data Sheets (MSDS) to learn how to safely handle hazardous materials.

DOCUMENT USE

Documents that agricultural equipment technicians work with include work orders, checklists, and service manuals. They also consult and interpret a variety of graphs, charts and technical drawings such as tables, sketches and schematics.

WRITING

Agricultural equipment technicians write detailed notes and descriptions about jobs. They must write detailed notes to keep records of their observations and recommendations for themselves, manufacturers, colleagues and clients.

ORAL COMMUNICATION

Agricultural equipment technicians use oral communication skills to discuss job details with colleagues, apprentices, manufacturers and clients. They need the ability to translate technical information to common terms. They may also instruct and instil understanding and knowledge of equipment to clients when assisting in setting up new machines.

NUMERACY

Agricultural equipment technicians use numeracy skills to take a variety of measurements such as tolerances, rates of flow and pressure. They also calculate perimeters, volumes and areas. They may estimate and calculate labour time to prepare repair quotes and invoices.

THINKING

Problem solving skills are used by agricultural equipment technicians to diagnose the cause of problems. Agricultural equipment technicians use decision making skills to decide the course of action to recommend after identifying the problem. They plan and organize their work in order to accomplish their tasks efficiently.

WORKING WITH OTHERS

Agricultural equipment technicians mostly work independently but they may seek advice and assistance from other technicians. At farm sites, they work in close communication with the client.

DIGITAL TECHNOLOGY

Agricultural equipment technicians use databases to access customer information, specifics of previously completed work and details on parts information and prices. They use communications software such as email to exchange information with manufacturers, colleagues and clients. They use diagnostic equipment that runs software applications and codes to determine operational data. They may access specifications, technical drawings and training materials through the Internet, CDs and DVDs.

CONTINUOUS LEARNING

Agricultural equipment technicians learn by talking to colleagues, manufacturers and service managers and by reading trade specific publications, operators manuals and repair manuals. They read bulletins about new products and specific problems. They may attend in-house presentations or training from manufacturers. They also continuously learn through a variety of work experiences.

ELEMENTS OF HARMONIZATION FOR APPRENTICESHIP TRAINING

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

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

1. Trade name

The official Red Seal name for this trade is Agricultural Equipment Technician.

2. Number of Levels of Apprenticeship

The number of levels of technical training recommended for the Agricultural Equipment Technician trade is four.

3. Total Training Hours during Apprenticeship Training

The total hours of training, including both on-the-job and in-school training for the Agricultural Equipment Technician trade is 7200.

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

Implementation for harmonization was implemented progressively. Level one was implemented in 2017/2018, level two 2018/2019, level three 2019/2020, and level four in 2020/2021.

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

Level 1	Level 2	Level 3	Level 4
	Routine Work Practices	Routine Work Practices	Routine Work Practices
Organizes Work	Organizes Work	Organizes Work	Organizes Work
Safety-Related Functions			
Routine Work Practices			
Organizes Work			
Tools and Equipment	Tools and Equipment		

Level 1	Level 2	Level 3	Level 4
Communication and Mentoring Techniques			Mentoring Techniques
	Engine and Engine Support Systems (Diagnoses)	Engine and Engine Support Systems (Diagnoses)	
	Engine and Engine Support Systems (Repairs)	Engine and Engine Support Systems (Repairs)	
	Drive Train (Diagnoses)	Drive Train (Diagnoses)	
	Drive Train (Repairs)	Drive Train (Repairs)	
Hydraulic, Hydrostatic and Pneumatic Systems (Diagnoses)		Hydraulic, Hydrostatic and Pneumatic Systems (Diagnoses)	Hydraulic, Hydrostatic and Pneumatic Systems (Diagnoses)
Hydraulic, Hydrostatic and Pneumatic Systems (Repairs)		Hydraulic, Hydrostatic and Pneumatic Systems (Repairs)	Hydraulic, Hydrostatic and Pneumatic Systems (Repairs)
Electrical Power and Control Monitoring Systems (Diagnoses)	Electrical Power and Control Monitoring Systems (Diagnoses)	Electrical Power and Control Monitoring Systems (Diagnoses)	Electrical Power and Control Monitoring Systems (Diagnoses)
Electrical Power and Control Monitoring Systems (Repairs)	Electrical Power and Control Monitoring Systems (Repairs)	Electrical Power and Control Monitoring Systems (Repairs)	Electrical Power and Control Monitoring Systems (Repairs)
Steering and Brake Systems (Diagnoses)			Steering and Brake Systems (Diagnoses)
Steering and Brake Systems (Repairs)			Steering and Brake Systems (Repairs)
Track, Wheel and Suspension Systems (Diagnoses)			Track, Wheel and Suspension Systems (Diagnoses)
Track, Wheel and Suspension Systems (Repairs)			Track, Wheel and Suspension Systems (Repairs)

Level 1	Level 2	Level 3	Level 4
Structural Components (Diagnoses)			Structural Components (Diagnoses)
Structural Components (Repairs)			Structural Components (Repairs)
Climate Control Systems (Diagnoses)			Climate Control Systems (Diagnoses)
Climate Control Systems (Repairs)			Climate Control Systems (Repairs)
	Agricultural Equipment (Prepares)		Agricultural Equipment (Prepares)
	Precision Farming Equipment (Diagnoses) Introduction		Precision Farming Equipment (Diagnoses)
	Precision Farming Equipment (Repairs)		Precision Farming Equipment (Repairs)
	Land Preparation, Tillage and Seeding/Planting Equipment (Diagnoses)		Land Preparation, Tillage and Seeding/Planting Equipment (Diagnoses)
	Land Preparation, Tillage and Seeding/Planting Equipment (Repairs)		Land Preparation, Tillage and Seeding/Planting Equipment (Repairs)
	Harvesting, Hay and Forage Equipment (Diagnoses)		
	Harvesting, Hay and Forage Equipment (Repairs)		

Level 1	Level 2	Level 3	Level 4
	Application and Irrigation Equipment (Diagnoses)		
	Application and Irrigation Equipment (Repairs)		

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 delivered in training. *

* Sub Tasks with numbers in the boxes is where the content will be delivered in training. The Task Matrix will be updated every year until Harmonization implementation is complete. Implementation for harmonization was implemented progressively. Level one was implemented in 2017/2018, level two 2018/2019, level three 2019/2020, and level four in 2020/2021.

A - Performs common occupational skills — 5%

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

Task 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 — 14%

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

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

D – Diagnoses and repairs hydraulic, hydrostatic and pneumatic systems

17%

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

E – Diagnoses and repairs electrical and electronic systems

19%

Task 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
Task 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 — 11%

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

G – Diagnoses and repairs structural components and operator stations — 6%

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

Task 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%

Task H-22 Prepares agricultural equipment	22.01 Performs assembly and pre-delivery adjustments on agricultural equipment 4	22.02 Performs preparation and installation of agricultural equipment 4	22-03 Installs precision farming equipment 3,4
Task 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	
Task 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	
Task H-25 Diagnoses land preparation tillage and seeding/planting implements	25.01 Diagnoses land preparation and tillage implements 2,4	25.02 Diagnoses seeding planting implements 2,4	
Task H-26 Repairs land preparation, tillage and seeding/planting implements	26.01 Repairs land preparation and tillage implements 2,4	26.02 Repairs seeding and planting implements 2,4	
Task 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	

Task H-28 Repairs harvesting, hay and forage equipment	**28.01 Repairs cutting, conditioning, gathering and processing equipment** **2**	**28.02 Repairs material handling equipment** **2**
Task H-29 Diagnoses application and irrigation equipment	**29.01 Diagnoses application equipment** **2**	**29.02 Diagnoses irrigation equipment** **2**
Task 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
Electrical	ELEC 122 - Theory	30
	ELEC 123 - Shop	30
Diesel Fuel Systems	ENGN 117 - Theory	15
	ENGN 118 - Shop	15
Basic Hydraulics	HYDR 105 - Theory	30
	HYDR 106 - Shop	30
Seeding and Tillage Equipment	MACH 173 - Theory	15
	MACH 174 - Shop	15
Powertrains 1	TRNM 105 - Theory	15
	TRNM 106 - Shop	15
		240

Level Two	Transcript Code	Hours
Electrical Systems	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	MACH 270 - Theory	30
	MACH 271- Shop	30
Sprayers and Applicators	MACH 272- Theory	15
	MACH 273- Shop	15
Powertrains 2	TRNM 270 - Theory	15
	TRNM 271 - Shop	15
		240

Level Three	Transcript Code	Hours
Electrical/Electronic Intro	ELEC 388 - Theory	15
	ELEC 389 - Shop	15
Diesel Fuel Systems Diagnostics	ENGN 388 - Theory	30
	ENGN 389 - Shop	30
Hydraulic Systems	HYDR 388 - Theory	15
	HYDR 389 - Shop	15
Powertrains Advanced	TRNM 388 - Theory	30
	TRNM 389 - Shop	30
OFC/SMAW Welding	WELD 372 - Theory	30
	WELD 373 - Shop	30
		240

Level Four	Transcript Code	Hours
Electrical/Electronic Diagnosis	ELEC 490 - Theory	30
	ELEC 491 - Shop	30
Advanced Engines and Overhaul	ENGN 486 - Theory	30
	ENGN 487 - Shop	30
Hydraulic System Diagnostics	HYDR 486 - Theory	30
	HYDR 487 - Shop	30
Machinery Diagnosis	MACH 486 - Theory	15
	MACH 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:

G-20 Diagnoses climate control systems

G-20.01 Diagnoses heating and ventilation systems

- heating and ventilation systems, their components, characteristics, applications and operation
- diagnosing heating and ventilation systems and their components

G-20.02 Diagnoses heating and ventilation systems

- air conditioning systems, their components, characteristics, applications and operation
- diagnosing air conditioning systems and their components
- training and certification requirements pertaining to air conditioning systems and refrigerants
- regulatory requirements pertaining to air conditioning systems and refrigerants

G-21 Repairs climate control systems

G-21.01 Repairs heating and ventilation systems

- heating and ventilation systems, their components, characteristics, applications and operation
- repairing heating and ventilation systems and their components

G-21.02 Repairs air conditioning systems

- air conditioning systems, their components, characteristics, applications and operation
- repairing air conditioning systems and their components
- training and certification requirements pertaining to air conditioning systems and refrigerants
- regulatory requirements pertaining to air conditioning systems and refrigerants

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

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:

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

- electrical power and control monitoring systems, their components, characteristics, applications and operation
- **diagnosing electrical power and control monitoring systems and their components**

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

- electrical power and control monitoring systems, their components, characteristics, applications and operation
- repairing electrical power and control monitoring systems and their components

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

- operational tests, their characteristics, purposes and applications
- conducting operational tests

A-2.02 Maintains fluids, lubricants and coolants

- fluids, lubricants and coolants, and describe their characteristics, purposes and applications
- maintaining fluids, lubricants and coolants
- certification requirements to maintain air conditioning refrigerant
- regulatory requirements pertaining to disposal of oil, antifreeze, air conditioning refrigerant, contaminated fuels and filters

A-2.03 Services filters

- filters, their characteristics, purposes and applications
- servicing filters
- regulatory requirements to dispose of oil, antifreeze, contaminated fuels and filters

A-2.04 Maintains hoses, tubing and fittings
- hoses, tubing and fittings, their characteristics, purposes and applications
- maintaining hoses, tubing and fittings

A-2.05 Services bearings, bushings and seals
- bearings, bushings and seals, their characteristics, purposes and applications
- servicing bearings, bushings and seals

A-2.06 Uses fasteners, sealants, adhesives and gaskets
- fasteners, sealants, adhesives and gaskets, their characteristics, purposes and applications
- using fasteners, sealants, adhesives and gaskets
- regulatory requirements pertaining to adhesives and gaskets

A-2.07 Cleans components
- cleaning tools, solutions and solvents, their characteristics, purposes and applications
- cleaning methods used to clean components
- regulatory requirements pertaining to use and disposal of cleaning solution and solvents

A-2.08 Verifies equipment and component repairs
- verifying equipment and component repairs

A-2.09 Performs failure analysis
- performing failure analysis

A-4 Uses and maintains tools and equipment

A-4.03 Uses electronic devices and systems for diagnostics and programming
- using electronic devices for diagnostics and programming
- certification requirements for use of electronic devices for diagnostics and programming

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Basic Hydraulics – 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 Hydraulics – 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:

F-14 Diagnoses steering and brake systems

F-14.01 Diagnoses steering systems
- steering systems, their components, characteristics, applications and operation
- diagnosing steering systems and their components

F-14.02 Diagnoses brake systems
- brake systems, their components, characteristics, applications and operation
- diagnosing brake systems and their components
- disassembling and reassembling brake systems

F-15 Repairs steering and brake systems

F-15.01 Repairs steering systems

- steering systems, their components, characteristics, applications and operation
- repairing steering systems and their components

F-15.02 Repairs brake systems

- brake systems, their components, characteristics, applications and operation
- repairing brake systems and their components

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:

G-18 Diagnoses structural components

G-18.01 Diagnoses structural components

- frame components, their characteristics, applications and operation
- structural components, their characteristics, applications and operation
- diagnosing frame components

G-18.02 Verifies condition of operator protective structures

- operator protective structures, their characteristics, applications and operation
- verifying condition of operator protective structures

G-18.03 Diagnoses equipment body

- equipment body components, their characteristics, applications and operation
- diagnosing equipment body components

G-19 Repairs structural components

G-19.01 Repairs frame components

- frame components, their characteristics, applications and operation
- repairing frame components

G-19.02 Replaces operator protective structures

- operator protective structures, their characteristics, applications and operation
- replacing operator protective structures

G-19.03 Repairs equipment body

- equipment body components, their characteristics, applications and operation
- repairing equipment body components

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
- operational tests, their characteristics, purposes and applications
- conducting operational tests

A-2.02 Maintains fluids, lubricants and coolants
- fluids, lubricants and coolants, their characteristics, purposes and applications
- maintaining fluids, lubricants and coolants
- certification requirements to maintain air conditioning refrigerant
- regulatory requirements pertaining to disposal of oil, antifreeze, air conditioning refrigerant, contaminated fuels and filters

A-2.03 Services filters
- filters for components are located
- servicing filters
- regulatory requirements to dispose of oil, antifreeze, contaminated fuels and filters

A-2.04 Maintains hoses, tubing and fittings
- hoses, tubing and fittings, their characteristics, purposes and applications
- maintaining hoses, tubing and fittings

A-2.06 Uses fasteners, sealants, adhesives and gaskets
- fasteners, sealants, adhesives and gaskets, their characteristics, purposes and applications
- fasteners, sealants, adhesives and gaskets
- regulatory requirements pertaining to adhesives and gaskets

A-2.07 Cleans components
- cleaning tools, solutions and solvents, their characteristics, purposes and applications
- cleaning methods used to clean components
- regulatory requirements pertaining to use and disposal of cleaning solution and solvents

A-3 Organizes work

A-3.01 Uses documentation
- trade-related documentation and its use
- procedures to use and complete documentation
- confidentiality guidelines
- regulatory requirements pertaining to use of documentation

Level Two — 8 weeks — 240 hours

Electrical Systems – 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 Systems – 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

- using electronic devices for diagnostics and programming
- certification requirements for use of electronic devices for diagnostics and programming

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

E-12.02 Diagnoses electronic power and control monitoring systems

- electronic power and control monitoring systems, their components, characteristics, applications and operation
- diagnosing electronic power and control monitoring systems and their components

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

E-13.02 Repairs electronic power and control monitoring systems

- electronic power and control monitoring systems, their components, characteristics, applications and operation
- repairing electronic power and control monitoring systems and their components

H-23 Diagnoses precision farming equipment

H-23.01 Diagnoses precision farming on site

- precision farming equipment, their components and accessories, characteristics, applications and operation
- diagnosing precision farming equipment components and accessories on site

H-23.02 Diagnoses precision farming equipment remotely

- precision farming equipment, their components and accessories, characteristics, applications and operation
- diagnosing precision farming equipment components and accessories 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:

A-4 Uses and maintains tools and equipment

A-4.01 Uses tools and equipment

- tools and equipment, their accessories, characteristics, applications, maintenance and procedures for use
- measuring, testing and diagnostic tools and equipment, their characteristics, applications, maintenance and procedures for use

B-6 Diagnoses engines and engine support systems

B-6.01 Diagnoses base engines

- base engines, their components, characteristics, applications and operation
- diagnosing base engines

B-6.02 Diagnoses lubrication systems

- lubrication systems, their components, characteristics, applications and operation
- diagnosing lubrication systems
- regulatory requirements pertaining to lubrication systems

B-6.03 Diagnoses cooling systems

- cooling systems, their components, characteristics, applications and operation
- diagnosing cooling systems
- regulatory requirements pertaining to cooling systems

B-6.04 Diagnoses intake and exhaust systems

- intake and exhaust systems, their components, characteristics, applications and operation
- diagnosing intake and exhaust systems
- regulatory requirements pertaining to intake and exhaust systems

B-7 Repairs engines and engine support systems

- B-7.01 Repairs base engines
- demonstrate knowledge of base engines, their components, characteristics, applications and operation
- repairing base engines
- B-7.02 Repairs lubrication systems
- lubrication systems, their components, characteristics, applications and operation
- repairing lubrication systems
- regulatory requirements pertaining to lubrication 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:

A-4 Uses and maintains tools and equipment

A-4.01 Uses tools and equipment

- tools and equipment, their accessories, characteristics, applications, maintenance and procedures for use
- measuring, testing and diagnostic tools and equipment, their characteristics, applications, maintenance and procedures for use

B-6 Diagnoses engines and engine support systems

B-6.06 Diagnoses engine management systems

- engine management systems, their components, characteristics, applications and operation
- diagnosing engine management systems
- regulatory requirements pertaining to engine management systems

C-8 Diagnoses drive trains

C-8.02 Diagnoses driveline systems and components

- driveline systems, their components, characteristics, applications and operation
- diagnosing driveline systems and their components
- regulatory requirements pertaining to driveline systems

C-8.03 Diagnoses wet clutches, transmissions and gear cases

- wet clutches, transmissions and gear cases, their components, characteristics, applications and operation
- diagnosing wet clutches, transmissions and gear cases

H-23 Diagnoses precision farming equipment

H-23.01 Diagnoses precision farming equipment on site

- precision farming equipment, their components and accessories, characteristics, applications and operation
- diagnosing precision farming equipment components and accessories on site

H-23.02 Diagnoses precision farming equipment remotely

- precision farming equipment, their components and accessories, characteristics, applications and operation

diagnosing precision farming equipment components and accessories remotely

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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
- pneumatic systems, their components, characteristics, applications and operation
- diagnosing pneumatic systems and their components

D-11 Repairs hydraulic, hydrostatic and pneumatic systems
D-11.02 Repairs pneumatic systems
- pneumatic systems, their components, characteristics, applications and operation
- repairing pneumatic systems and their components
- H-22 Prepares agricultural equipment
- H-22.03 Installs precision farming equipment
- precision farming equipment, their components and accessories, characteristics, applications and operation
- precision farming and describe its characteristics, applications and advantages
- installing precision farming equipment components and accessories
- regulatory requirements pertaining to precision farming

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-8.01 Diagnoses drive trains
- dry clutches, their components, characteristics, applications and operation
- diagnosing dry clutches
- regulatory requirements pertaining to hazardous materials

C-8.02 Diagnoses driveline systems and components
- driveline systems, their components, characteristics, applications and operation
- diagnosing driveline systems and their components

C-8.03 Diagnoses wet clutches, transmissions and gear cases
- wet clutches, transmissions and gear cases, their components, characteristics, applications and operation
- diagnosing wet clutches, transmissions and gear cases

C-8.04 Diagnoses differentials and final drives
- differential systems, their components, characteristics, applications and operation
- final drives, their components, characteristics, applications and operation
- diagnosing differentials and final drives

C-9 Repairs drive trains
C-9.01 Repairs dry clutches
- dry clutches, their components, characteristics, applications and operation

- repairing dry clutches
- regulatory requirements pertaining to dry clutches

C-9.02 Repairs driveline systems and components

- driveline systems, their components, characteristics, applications and operation
- repairing driveline systems and their components
- regulatory requirements pertaining to driveline systems

C-9.03 Repairs wet clutches, transmissions and gear cases

- wet clutches, transmissions and gear cases, their components, characteristics, applications and operation
- repairing wet clutches, transmissions and gear cases

C-9.04 Repairs differentials and final drives

- differential systems, their components, characteristics, applications and operation
- final drives, their components, characteristics, applications and operation
  repairing differentials, final drives and their components

Level Two topics that are taught in context:

- ***Routine Work Practices***
- ***Organizes Work***

For details regarding the In Context Topic, see page 36

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

- using electronic devices for diagnostics and programming
- certification requirements for use of electronic devices for diagnostics and programming

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

E-12.02 Diagnoses electronic power and control monitoring systems

- electronic power and control monitoring systems, their components, characteristics, applications and operation
- diagnosing electronic power and control monitoring systems and their components

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

E-13.02 Repairs electronic power and control monitoring systems

- electronic power and control monitoring systems, their components, characteristics, applications and operation
- repairing electronic power and control monitoring systems and their components

H-23 Diagnoses precision farming equipment

H-23.01 Diagnoses precision farming on site

- precision farming equipment, their components and accessories, characteristics, applications and operation
- diagnosing precision farming equipment components and accessories on site

H-23.02 Diagnoses precision farming equipment remotely

- precision farming equipment, their components and accessories, characteristics, applications and operation
- diagnosing precision farming equipment components and accessories remotely

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30 hours

Diesel Fuel System Diagnostics – Theory

- 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
- base engines, their components, characteristics, applications and operation
- diagnosing base engines

B-6.02 Diagnoses lubrication systems
- lubrication systems, their components, characteristics, applications and operation
- diagnosing lubrication systems
- regulatory requirements pertaining to lubrication systems

B-6.03 Diagnoses cooling systems
- cooling systems, their components, characteristics, applications and operation
- diagnosing cooling systems
- regulatory requirements pertaining to cooling systems

B-6.04 Diagnoses intake and exhaust systems
- intake and exhaust systems, their components, characteristics, applications and operation
- diagnosing intake and exhaust systems
- regulatory requirements pertaining to intake and exhaust systems

B-6.05 Diagnoses fuel delivery systems
- fuel delivery systems, their components, characteristics, applications and operation
- diagnosing fuel delivery systems
- regulatory requirements pertaining to fuel delivery systems

B-6.06 Diagnoses engine management systems
- engine management systems, their components, characteristics, applications and operation
- diagnosing engine management systems
- regulatory requirements pertaining to engine management systems

B-6.07 Diagnoses emissions control systems
- emissions control systems, their components, characteristics, applications and operation
- diagnosing emissions control systems
- regulatory requirements pertaining to emissions control systems

B-7 Repairs engines and engine support systems

B-7.01 Repairs base engines
- base engines, their components, characteristics, applications and operation
- repairing base engines

B-7.02 Repairs lubrication systems

- lubrication systems, their components, characteristics, applications and operation
- repairing lubrication systems
- regulatory requirements pertaining to lubrication systems

B-7.04 Repairs intake and exhaust systems
- intake and exhaust systems, their components, characteristics, applications and operation
- repairing intake and exhaust systems
- regulatory requirements pertaining to intake and exhaust systems

B-7.05 Repairs fuel delivery systems
- fuel delivery systems, their components, characteristics, applications and operation
- repairing fuel delivery systems
- regulatory requirements pertaining to fuel delivery systems

B-7.06 Repairs engine management systems
- engine management systems, their components, characteristics, applications and operation
- repairing engine management systems
- regulatory requirements pertaining to engine management systems

B-7.07 Repairs emissions control systems
- emissions control systems, their components, characteristics, applications and operation
- repairing emissions control systems
- regulatory requirements pertaining to emissions control systems

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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
- engine management systems, their components, characteristics, applications and operation
- repairing engine management systems
- regulatory requirements pertaining to engine management systems

C-8 Diagnoses drive trains

C-8.03 Diagnoses wet clutches, transmissions and gear cases
- wet clutches, transmissions and gear cases, their components, characteristics, applications and operation
- diagnosing wet clutches, transmissions and gear cases

C-9 Repairs drive trains

C-9.03 Repairs wet clutches, transmissions and gear cases
- wet clutches, transmissions and gear cases, their components, characteristics, applications and operation
- repairing wet clutches, transmissions and gear cases

D-10 Diagnoses hydraulic, hydrostatic and pneumatic systems

D-10.01 Diagnoses hydraulic and hydrostatic systems
- hydraulic and hydrostatic systems, their components, characteristics, applications and operation
- diagnostic manuals

- diagnosing hydraulic and hydrostatic systems and their components

D-11 Repairs hydraulic, hydrostatic and pneumatic systems

D-11.01 Repairs hydraulic and hydrostatic systems

- hydraulic and hydrostatic systems, their components, characteristics, applications and operation
- repairing hydraulic and hydrostatic systems and their components

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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-8.01 Diagnoses drive trains

- dry clutches, their components, characteristics, applications and operation
- diagnosing dry clutches
- regulatory requirements pertaining to hazardous materials

C-8.02 Diagnoses driveline systems and components

- driveline systems, their components, characteristics, applications and operation
- diagnosing driveline systems and their components

C-8.03 Diagnoses wet clutches, transmissions and gear cases

- wet clutches, transmissions and gear cases, their components, characteristics, applications and operation
- diagnosing wet clutches, transmissions and gear cases

C-8.04 Diagnoses differentials and final drives

- differential systems, their components, characteristics, applications and operation
- final drives, their components, characteristics, applications and operation
- diagnosing differentials and final drives

C-9 Repairs drive trains

C-9.01 Repairs dry clutches

- dry clutches, their components, characteristics, applications and operation
- repairing dry clutches
- regulatory requirements pertaining to dry clutches

C-9.02 Repairs driveline systems and components

- driveline systems, their components, characteristics, applications and operation
- repairing driveline systems and their components
- regulatory requirements pertaining to driveline systems

C-9.03 Repairs wet clutches, transmissions and gear cases

- wet clutches, transmissions and gear cases, their components, characteristics, applications and operation
- repairing wet clutches, transmissions and gear cases

C-9.04 Repairs differentials and final drives

- differential systems, their components, characteristics, applications and operation

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

- tools and equipment, their accessories, characteristics, applications, maintenance and procedures for use
- measuring, testing and diagnostic tools and equipment, their characteristics, applications, maintenance and procedures for use
- welding and cutting equipment, their characteristics, applications, maintenance and procedures for use
- certification requirements for use of welding and cutting equipment
- regulatory requirements pertaining to transport and storage of welding and cutting equipment

Level Three topics that are taught in context:

- ***Routine Work Practices***
- ***Organizes Work***

For details regarding the In Context Topic, see page 36

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:

H-27 Diagnoses harvesting, hay and forage equipment

H-27.01 Diagnoses cutting, conditioning, gathering and processing equipment

- cutting, conditioning, gathering and processing equipment, their components, characteristics, applications and operation
- diagnosing cutting, conditioning, gathering and processing equipment, and their components

H-27.02 Diagnoses material handling equipment

- material handling equipment, their components, characteristics, applications and operation
- diagnosing material handling equipment and their components

H-28 Repairs harvesting, hay and forage equipment

H-28.01 Repairs cutting, conditioning, gathering and processing equipment

- cutting, conditioning, gathering and processing equipment, their components, characteristics, applications and operation
- repairing cutting, conditioning, gathering and processing equipment, and their components

H-28.02 Repairs material handling equipment

- material handling equipment, their components, characteristics, applications and operation
- repairing material handling equipment and their components

Engine and Engine Support – 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 – 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

- base engines, their components, characteristics, applications and operation
- diagnosing base engines

B-6.02 Diagnoses lubrication systems

- lubrication systems, their components, characteristics, applications and operation
- diagnosing lubrication systems
- regulatory requirements pertaining to lubrication systems

B-6.03 Diagnoses cooling systems

- cooling systems, their components, characteristics, applications and operation
- diagnosing cooling systems
- regulatory requirements pertaining to cooling systems

B-6.04 Diagnoses intake and exhaust systems

- intake and exhaust systems, their components, characteristics, applications and operation
- diagnosing intake and exhaust systems
- regulatory requirements pertaining to intake and exhaust systems

B-7 Repairs engines and engine support systems

B-7.01 Repairs base engines

- base engines, their components, characteristics, applications and operation
- repairing base engines

B-7.02 Repairs lubrication systems

- lubrication systems, their components, characteristics, applications and operation
- repairing lubrication systems
- regulatory requirements pertaining to lubrication systems

B-7.04 Repairs intake and exhaust systems

- intake and exhaust systems, their components, characteristics, applications and operation
- repairing intake and exhaust systems
- regulatory requirements pertaining to intake and exhaust systems

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Hydraulic System Diagnostics – Theory — 30 hours

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

Hydraulic System Diagnostics – 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

- hydraulic and hydrostatic systems, their components, characteristics, applications and operation
- diagnostic manuals
- diagnosing hydraulic and hydrostatic systems and their components

D-11 Repairs hydraulic, hydrostatic and pneumatic systems

D-11.01 Repairs hydraulic and hydrostatic systems

- hydraulic and hydrostatic systems, their components, characteristics, applications and operation
- repairing hydraulic and hydrostatic systems and their components

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

- heating and ventilation systems, their components, characteristics, applications and operation
- diagnosing heating and ventilation systems and their components

G-20.02 Diagnoses heating and ventilation systems

- air conditioning systems, their components, characteristics, applications and operation
- diagnosing air conditioning systems and their components
- training and certification requirements pertaining to air conditioning systems and refrigerants
- regulatory requirements pertaining to air conditioning systems and refrigerants

G-21 Repairs climate control systems

G-21.01 Repairs heating and ventilation systems

- heating and ventilation systems, their components, characteristics, applications and operation
- repairing heating and ventilation systems and their components

G-21.02 Repairs air conditioning systems

- air conditioning systems, their components, characteristics, applications and operation
- repairing air conditioning systems and their components
- training and certification requirements pertaining to air conditioning systems and refrigerants

regulatory requirements pertaining to air conditioning systems and refrigerants

H-22 Prepares agricultural equipment

H-22.01 Performs assembly and pre-delivery adjustments on agricultural equipment

- agricultural equipment, their components, implements, characteristics, applications and operation
- assembling and adjusting agricultural equipment components and implements

H-22.02 Performs preparation and installation of agricultural equipment

- agricultural equipment, their components, implements, accessories, characteristics, applications and operation
- preparing and installing agricultural equipment components, implements and accessories

H-22.03 Installs precision farming equipment

- precision farming equipment, their components and accessories, characteristics, applications and operation
- precision farming and describe its characteristics, applications and advantages
- installing precision farming equipment components and accessories
- regulatory requirements pertaining to precision farming

H-23 Diagnoses precision farming equipment

H-23.01 Diagnoses precision farming equipment on site

- precision farming equipment, their components and accessories, characteristics, applications and operation
- diagnosing precision farming equipment components and accessories on site

H-23.02 Diagnoses precision farming equipment remotely

- precision farming equipment, their components and accessories, characteristics, applications and operation
- diagnosing precision farming equipment components and accessories remotely

H-24 Repairs precision farming equipment

H-24.01 Repairs precision farming equipment on site

- precision farming equipment, their components and accessories, characteristics, applications and operation
- repairing precision farming equipment components and accessories on site

H-24.02 Repairs precision farming equipment remotely

- precision farming equipment, their components and accessories, characteristics, applications and operation
- repairing precision farming equipment components and accessories 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

- steering systems, their components, characteristics, applications and operation
- diagnosing steering systems and their components

F-14.02 Diagnoses brake systems

- brake systems, their components, characteristics, applications and operation
- diagnosing brake systems and their components
- disassembling and reassembling brake systems

F-15 Repairs steering and brake systems

F-15.01 Repairs steering systems

- steering systems, their components, characteristics, applications and operation
- repairing steering systems and their components

F-15.02 Repairs brake systems

- brake systems, their components, characteristics, applications and operation
- repairing brake systems and their components

H-22 Prepares agricultural equipment

H-22.01 Performs assembly and pre-delivery adjustments on agricultural equipment

- agricultural equipment, their components, implements, characteristics, applications and operation
- assembling and adjusting agricultural equipment components and implements

H-22.02 Performs preparation and installation of agricultural equipment

- agricultural equipment, their components, implements, accessories, characteristics, applications and operation
- preparing and installing agricultural equipment components, implements and accessories

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

H-25.01 Diagnoses land preparation and tillage equipment

- land preparation and tillage equipment, their components, characteristics, applications and operation
- diagnosing land preparation and tillage equipment and their components

H-25.02 Diagnoses seeding and planting equipment

- seeding and planting equipment, their components, characteristics, applications and operation
- diagnosing seeding and planting equipment and their components

Level Four topics that are taught in context:

- ***Routine Work Practices***
- ***Organizes Work***

For details regarding the In Context Topic, see page 36

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.

Routine Work Practices

- Conducts operational tests
- Maintains fluids, lubricants and coolants
- Services filters
- Maintains hoses, tubing and fittings
- Services bearings, bushings and seals
- Uses fasteners, sealants, adhesives and gaskets
- Cleans components
- Verifies equipment and component repairs
- Performs failure analysis

Organizes Work

- Uses documentation
- Plans daily tasks

APPENDIX A: POST HARMONIZATION TRAINING PROFILE CHART

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

Implementation for harmonization was implemented progressively. Level one was implemented in 2017/2018, level two 2018/2019, level three 2019/2020, and level four in 2020/2021.

SATCC Level One	Transcript Code	Hours	Pan-Canadian Harmonized Level One
			Scheduled Maintenance (In-Context)
Air Conditioning and Heating	AIR 100 - Theory	15	Operational Testing (In-Context)
			Planning and Communication (in-Context)
	AIR 101 - Shop	15	Safety
Electrical	ELEC 122- Theory	30	Tools and Equipment
	ELEC 123 - Shop	30	Hoisting and Lifting
Diesel Fuel Systems	ENGN 117- Theory	15	Hydraulic Systems
	ENGN 118- Shop	15	Frames, Steering And Suspension
Basic Hydraulics	HYDR 105 - Theory	30	Brakes
	HYDR 106 - Shop	30	Structural Components
Seeding and Tillage Equipment	MACH 173 - Theory	15	Heating, Ventilation and Air - Conditioning/Environment Controls
	MACH 174 - Shop	15	
Powertrains 1	TRNM 105 - Theory	15	Pneumatics
	TRNM 106 - Shop	15	Electrical 1
		240	

SATCC Level Two	Transcript Code	Hours	Pan-Canadian Harmonized Level Two
			Scheduled Maintenance (In-Context)
			Operational Testing (In-Context)
			Planning and Communication (In-Context)
Electrical Systems	ELEC 274 - Theory	30	Engine and Engine Support Systems
	ELEC 275- Shop	30	Electrical 2
Engine Operation and System Components	ENGN 274- Theory	30	Drivetrain (Powertrain)
	ENGN 275 - Shop	30	Hydraulics, Hydrostatics and
			Pneumatics - advanced
Harvesting, Hay and Forage	MACH 270- Theory	30	Frames, Steering and Suspension
	MACH 271 - Shop	30	Structural Components and Accessories
Sprayers and Applicators	MACH 272- Theory	15	Agricultural Equipment and Accessories
	MACH 273 - Shop	15	
Powertrains 2	TRNM 270 -Theory	15	
	TRNM 271 - Shop	15	
		240	

SATCC Level Three	Transcript Code	Hours	Pan-Canadian Harmonized Level Three
			Scheduled Maintenance (In-Context)
			Operational Testing (In-Context)
			Planning and Communication (In-Context)
Electrical and Electronics	ELEC 388 - Theory	15	Heating, Ventilation and Air Conditioning/Environmental Controls
	ELEC 389 - Shop	15	
Diesel Fuel Systems	ENGN 388 -Theory	30	Engines and Engine Support Systems
	ENGN 389 -Shop	30	Drivetrain (Powertrain)
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	

SATCC Level Four	Transcript Code	Hours	Pan-Canadian Harmonized Level Three
			Scheduled Maintenance (In-Context)
			Operational Testing (In-Context)
			Planning and Communication (In-Context)
Electrical and Electronic Diagnosis	ELEC 490 - Theory	30	Electrical
	ELEC 491 - Shop	30	
Engine and Engine Support	ENGN 486 -Theory	30	Engines and Engine Support Systems
	ENGN 487 -Shop	30	
Hydraulic System Diagnostics	HYDR 486 -Theory	30	Drivetrain (Powertrain)
	HYDR 487 -Shop	30	
Machinery Diagnosis	MACH 486 -Theory	15	
	MACH 487 -Shop	15	
Equipment Performance	TRNM 486 -Theory	15	
	TRNM 487 -Shop	15	
		240	

Exceed Topics

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