



Agricultural Equipment Technician Course Outline

2021

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	15
	ENGN 389 - Shop	15
Hydraulic Systems	HYDR 388 - Theory	20
	HYDR 389 - Shop	40
Powertrains Advanced	TRNM 388 - Theory	25
	TRNM 389 - Shop	35
OFC/SMAW Welding	WELD 372 - Theory	30
	WELD 373 - Shop	30
		240

Level Four	Transcript Code	Hours
Electrical/Electronic Diagnosis	ELEC 490 - Theory	35
	ELEC 491 - Shop	25
Advanced Engines and Overhaul	ENGN 486 - Theory	25
	ENGN 487 - Shop	35
Hydraulic System Diagnostics	HYDR 486 - Theory	15
	HYDR 487 - Shop	45
Machinery Diagnosis	MACH 486 - Theory	20
	MACH 487 - Shop	10
Equipment Performance	TRNM 486- Theory	20
	TRNM 487 - Shop	10
		240

TECHNICAL TRAINING COURSE CONTENT

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

Level One	8 weeks	240 hours
Air Conditioning and Heating– Theory		15 hours
<ul style="list-style-type: none">• 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
<ul style="list-style-type: none">• troubleshoot heater system malfunctions• troubleshoot air conditioning system malfunctions• evaluate pneumatics suspension systems		
Electrical - Theory		15 hours
<ul style="list-style-type: none">• 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		15 hours
<ul style="list-style-type: none">• 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		
Diesel Fuel Systems– Theory		15 hours
<ul style="list-style-type: none">• 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
<ul style="list-style-type: none">• 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

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

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

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
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Level One topics that are taught in context:

- safety
- planning and communication
- operational testing
- scheduled maintenance

For details regarding the In Context Topic, see page 25

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
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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
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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
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- perform adjustments on harvesting equipment for various harvesting conditions
- inspect yield monitoring and satellite-based yield mapping components

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

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

Level Two topics that are taught in context:

- safety
- planning and communication
- operational testing
- scheduled maintenance

For details regarding the In Context Topic, see page 25

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
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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
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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

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)

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)

Level Three topics that are taught in context:

- safety
- planning and communication
- operational testing
- scheduled maintenance

For details regarding the in Context Topic, see page 25



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
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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
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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
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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

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 horse power 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

Level Four topics that are taught in context:

- safety
- planning and communication
- operational testing
- scheduled maintenance

For details regarding the In Context Topic, see page 25



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.

Safety

- uses personal protective equipment (PPE) and safety equipment
- maintains a safe work environment

Planning and Communication

- communications with others
- plans daily tasks

Operational Testing

- conducts operational tests
- performs failure analysis

Scheduled Maintenance

- maintains fluids, lubricants and coolants
- service filters
- maintain hoses, tubing and fittings
- service bearings/bushings and seals
- uses fasteners, sealing devices, adhesives and gaskets



AGRICULTURAL EQUIPMENT TECHNICIAN TASK MATRIX CHART

This chart outlines the major work activities, tasks and sub-tasks from the 2012 Agricultural Equipment Technician National Occupational Analysis (NOA). Each sub-task details the corresponding essential skill and level of training (apprenticeship year) where the content is delivered in training.

A - PERFORMS COMMON OCCUPATIONAL SKILLS

A-1 Performs safety-related functions	1.01 Uses personal protective equipment (PPE) and safety equipment.	1.02 Maintains safe work environment.			
A-2 Performs common work practices and procedures.	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, sealing devices, adhesives and gaskets.	2.07 Cleans components.	2.08 Verifies equipment and components repairs.	2.09 Plans daily tasks.	2.10 Performs failure analysis.
A-3 Uses and maintains tools and equipment.	3.01 Maintains tools and equipment.	3.02 Uses hoisting, lifting and securing equipment.	3.03 Uses computers diagnostics and programming.		

B – ENGINES AND ENGINE SUPPORT SYSTEMS

B-4 Diagnoses engine and engine support systems.	4.01 Diagnoses base engine.	4.02 Diagnoses lubrication system	4.03 Diagnoses cooling system.	4.04 Diagnoses intake and exhaust system.	4.05 Diagnoses fuel delivery system.
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	4.06 Diagnoses engine management systems.	4.07 Diagnoses emissions control systems.			
B-5 Repairs engine and engine support systems.	5.01 Repairs base engine.	5.02 Repairs lubrication system.	5.03 Repairs cooling system.	5.04 Repairs intake and exhaust system.	5.05 Repairs fuel delivery system.
	5.06 Repairs engine management systems.	5.07 Repairs emissions control systems.			

C – DRIVE TRAIN

C-6 Diagnoses drive train.	6.01 Diagnoses dry clutches.	6.02 Diagnoses driveline systems and components.	6.03 Diagnoses wet clutches, transmissions and gear cases.	6.04 Diagnoses differentials and final drives.
C-7 Repairs drive train.	7.01 Repairs dry clutches.	7.02 Repairs driveline systems and components.	7.03 Repairs wet clutches, transmissions and gear cases.	7.04 Repairs differentials and final drives.

D – HYDRAULIC, HYDROSTATIC AND PNEUMATIC SYSTEMS

D-8 Diagnoses hydraulic, hydrostatic and pneumatic systems.	8.01 Diagnoses hydraulic and hydrostatic systems.	8.02 Diagnoses pneumatic systems.
D-9 Repairs hydraulic, hydrostatic and pneumatic systems	9.01 Repairs hydraulic and hydrostatic systems.	9.02 Repairs pneumatic systems.

E – ELECTRICAL AND ELECTRONIC SYSTEMS

E-10 Diagnoses electrical/electronic power and control monitoring systems.

10.01 Diagnoses electrical power and control monitoring systems.

10.02 Diagnoses electronic power and control monitoring systems.

E-11 Repairs electrical/electronic power and control monitoring systems.

11.01 Repairs electrical power and control monitoring systems.

11.02 Repairs electronic power and control monitoring systems.

F – STEERING, SUSPENSION AND BRAKES

F-12 Diagnoses steering and brake systems.

12.01 Diagnoses steering systems.

12.02 Diagnoses brake systems

F-13 Repairs steering and brake systems.

13.01 Repairs steering systems.

13.02 Repairs brake systems.

F-14 Diagnoses suspension components.

14.01 Diagnoses wheels/tracks and track frames.

14.02 Diagnoses cushioning devices.

F-15 Repairs suspension components.

15.01 Repairs wheels/tracks and track frames.

15.02 Repairs cushioning devices

G – STRUCTURAL COMPONENTS AND OPERATOR STATION

G-16 Diagnoses structural components.

16.01 Diagnoses frame components.

16.02 Verifies condition of roll-over protective structure (ROPS).

16.03 Diagnoses equipment body.

G-17 Repairs structural components.

17.01 Repairs frame components.

17.02 Replaces roll-over protective structure (ROPS).

17.03 Repairs equipment body.

G-18 Diagnoses climate control systems.

18.01 Diagnoses heating and ventilation systems.

18.02 Diagnoses air conditioning systems.

G-19 Repairs climate control systems.

19.01 Repairs heating and ventilation systems.

19.02 Repairs air conditioning systems.

H – AGRICULTURAL EQUIPMENT

H-20 Prepares agricultural equipment.

20.01 Performs assembly and pre-delivery adjustments on agricultural equipment.

20.02 Installs agricultural equipment.

H-21 Diagnoses land preparation tillage and seeding/ planting implements.

21.01 Diagnoses land preparation and tillage implements.

21.02 Diagnoses seeding planting implements.

H-22 Repairs land preparation, tillage and seeding/ planting implements.

22.01 Repairs land preparation and tillage implements.

22.02 Repairs seeding and planting implements.

H-23 Diagnoses harvesting, hay and forage equipment.

23.01 Diagnoses cutting, conditioning, gathering and processing equipment.

23.02 Diagnoses delivery equipment.

H-24 Repairs harvesting, hay and forage equipment.

24.01 Repairs cutting, conditioning, gathering and processing equipment.

24.02 Repairs delivery equipment.

H-25 Diagnoses application and irrigation equipment.

25.01 Diagnoses application equipment.

**25.02 Diagnoses irrigation equipment.
(Not Common Core)**

H-26 Repairs application and irrigation equipment.

26.01 Repairs application equipment.

26.02 Repairs irrigation equipment. (Not Common Core)

**The Agricultural Equipment Technician National Occupational Analysis (NOA), describing the “full scope” of the trade, can be found at www.red-seal.ca.*

For more detailed information on course content, please refer to the Agricultural Equipment Technician Guide to Course Content at www.saskapprenticeship.ca.