



Agricultural Equipment Technician

On-the-Job Training Guide

2024

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Saskatchewan
Apprenticeship and
Trade Certification
Commission

Online: www.saskapprenticeship.ca

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 ON-THE-JOB-TRAINING GUIDE

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

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

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

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

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

On-the-Job and In-school Training Content for the Agricultural Equipment Technician Trade: a chart which outlines the topics of technical training with on-the-job examples for apprentices to achieve relevant experience at work.

TRAINING REQUIREMENTS FOR THE AGRICULTURAL EQUIPMENT TECHNICIAN TRADE

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

Journeyman to apprentice ratio for this trade is: 1:2

The information contained in this document serves as a guide for employers and apprentices. Apprenticeship training is mutually beneficial to both employer and apprentice. The employer's investment in training apprentice's results in skilled and certified workers. The document summarizes the tasks to be covered by the apprentice during their on-the-job portion of apprenticeship training. An apprentice spends approximately 85% of their apprenticeship term training on-the-job.

It is the employer's or journeyman's responsibility to supervise an apprentice's practical skills development until a satisfactory level of proficiency has been reached.

EMPLOYER TRAINING RESPONSIBILITY

- promote a safety-conscious workplace
- provide mentored, hands-on practice in the use of tools and equipment
- provide the opportunity for apprentices to service AET systems and products
- further the apprentice's ability to interpret technical drawings
- ensure that the apprentice can evaluate the end product.

Employers should make every effort to expose their apprentices to work experience in as many areas of the trade as possible.

In the On-the-Job Training Guide, in-school instruction is listed first; on-the-job suggestions to help employers assist the apprentice to prepare for in-school training are listed next.

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

A - Performs Common Occupational Skills

5%

A-1 Performs safety-related functions	1.01 Maintains safe work environment 1	1.02 Uses personal protective equipment (PPE) and safety equipment 1			
A-2 Performs routine work practices	2.01 Conducts operational tests 1, In Context in 2,3,4	2.02 Maintains fluids, lubricants and coolants 1, In Context in 2,3,4	2.03 Services filters 1, In Context in 2,3,4	2.04 Maintains hoses, tubing and fittings 1, In Context in 2,3,4	2.05 Services bearings, bushings and seals 1, In Context in 2,3,4
	2.06 Uses fasteners, sealing devices, adhesives and gaskets 1, In Context in 2,3,4	2.07 Cleans components 1, In Context in 2,3,4	2.08 Verifies equipment and components repairs 1, In Context in 2,3,4	2.09 Performs failure analysis 1, In Context in 2,3,4	
A-3 Organizes work	3.01 Uses documentation 1, In Context in 2,3,4	3.02 Plans daily tasks 1, In Context in 2,3,4			
A-4 Uses and maintains tools and equipment	4.01 Uses tools and equipment 1, 3	4.02 Uses hoisting, lifting and securing equipment 1	4.03 Uses electronic devices and systems for diagnostics and programming 2		
A-5 Uses communication and mentoring techniques	5.01 Uses communication techniques 1	5.02 Uses mentoring techniques 4			

B – Diagnoses and Repairs Engines and Engine Support Systems

15%

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

C – Diagnoses and Repairs Drive Trains

13%

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

D – Diagnoses and Repairs Hydraulic, Hydrostatic and Pneumatic Systems

17%

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

E – Diagnoses and Repairs Electrical and Electronic Systems

19%

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

F – Diagnoses and Repair Steering, Brakes and Suspensions

10%

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

G – Diagnoses and Repairs Structural Components and Operator Stations

6%

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

G-21 Repairs climate control systems.

21.01 Repairs heating and ventilation systems

1, 4

21.02 Repairs air conditioning systems

1, 4

H – Diagnoses and Repairs Agricultural Equipment

15%

H-22 Prepares agricultural equipment

22.01 Performs assembly and pre-delivery adjustments on agricultural equipment

1, 4

22.02 Performs preparation and installation of agricultural equipment

1, 4

22.03 Installs precision farming equipment

1, 3, 4

H-23 Diagnoses precision farming equipment

23.01 Diagnoses precision farming equipment on site

1, 2, 3, 4

23.02 Diagnoses precision farming equipment remotely

1, 2, 3, 4

H-24 Repairs precision farming equipment

24.01 Repairs precision farming equipment on site

1, 2, 3, 4

24.02 Repairs precision farming equipment remotely

1, 2, 3, 4

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

25.01 Diagnoses land preparation and tillage equipment

1, 2, 4

25.02 Diagnoses seeding planting equipment

1, 2, 4

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

26.01 Repairs land preparation and tillage equipment

1, 2, 3, 4

26.02 Repairs seeding and planting equipment

1, 2, 3, 4

H-27 Diagnoses harvesting, hay and forage equipment	27.01 Diagnoses cutting, conditioning, gathering and processing equipment 2	27.02 Diagnoses material handling equipment 2
H-28 Repairs harvesting, hay and forage equipment	28.01 Repairs cutting, conditioning, gathering and processing equipment 2, 3	28.02 Repairs material handling equipment 2, 3
H-29 Diagnoses application and irrigation equipment	29.01 Diagnoses application equipment 2	29.02 Diagnoses irrigation equipment 2
H-30 Repairs application and irrigation equipment	30.01 Repairs application equipment 2	30.02 Repairs irrigation equipment 2

TRAINING PROFILE CHART

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

Level One	Transcript Code	Hours
Air Conditioning and Heating	AIR 100 - Theory	15
	AIR 101 - Shop	15
Basic Electrical	ELEC 122 - Theory	30
	ELEC 123 - Shop	30
Diesel Fuel Systems	ENGN 117 - Theory	15
	ENGN 118 - Shop	15
Basic Hydraulic Systems	HYDR 105 - Theory	30
	HYDR 106 - Shop	30
Seeding and Tillage Equipment	EQPT 163 - Theory	15
	EQPT 164 - Shop	15
Powertrains 1	TRNM 105 - Theory	15
	TRNM 106 - Shop	15
		240

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

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

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

ON-THE-JOB AND IN-SCHOOL TRAINING CONTENT FOR THE AGRICULTURAL EQUIPMENT TECHNICIAN TRADE

This chart outlines on-the-job examples for apprentices to achieve relevant work experience to prepare for the topics of technical training. Topics of technical training are provided with the associated learning outcomes.

Level One	8 weeks	240 hours
<p>Air Conditioning and Heating – Theory</p> <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 		15 hours
<p>Air Conditioning and Heating – Shop</p> <ul style="list-style-type: none"> troubleshoot heater system malfunctions troubleshoot air conditioning system malfunctions evaluate pneumatics suspension systems 		15 hours
<p>Mentors can assist the apprentice to prepare for this section of technical training by:</p> <ul style="list-style-type: none"> demonstrating safe handling and selecting of refrigerants and lubricants identifying the various types of heater system malfunctions identifying the various types of air conditioning system malfunctions identifying the various types of heating, ventilation and air conditioning (HVAC) systems explaining pneumatic systems providing opportunity to troubleshoot heater system malfunctions providing opportunity to troubleshoot air conditioning system malfunctions providing opportunity to evaluate pneumatics systems 		
<p>Electrical – Theory</p> <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 		30 hours
<p>Electrical – Shop</p> <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 		30 hours

Mentors can assist the apprentice to prepare for this section of technical training by:

- explaining the operation of an electrical circuit
- explaining the relationship between electricity and magnetism
- identifying the construction and properties of series, parallel and series-parallel circuits
- explaining the operation and function of circuit control devices
- identifying basic electrical system symbols
- providing opportunity to perform boosting procedures
- providing opportunity to troubleshoot basic electrical circuit problems
- providing opportunity to repair wiring harness and connectors
- to demonstrate the understanding of basic electrical wiring symbols
- providing opportunity to perform a wet battery service

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

Mentors can assist the apprentice to prepare for this section of technical training by:

- explaining the procedure to evaluate air induction systems
- explaining the procedure to maintain fuel systems
- explaining the repair of low and high-pressure fuel system components
- describing diesel engine combustion chamber designs
- explaining the repair of diesel fuel injectors
- explaining internal and external threading operations
- explaining the procedure to perform compression and leak tests on a diesel engine
- providing instruction on performing a compression and leak down tests on a diesel engine
- providing opportunity to evaluate an air induction system
- providing instruction on servicing a fuel pump
- providing opportunity to repair low and high-pressure fuel system components
- providing instruction on inspecting diesel engine combustion chamber designs
- providing opportunity to service diesel fuel injectors

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

Mentors can assist the apprentice to prepare for this section of technical training by:

- *explaining lifting and hoisting procedures*
- *explaining basic hydraulic system symbols*
- *explaining hoses and fittings*
- *explaining the operation and function of hydraulic pumps*
- *explaining the operation and function of pressure control valves*
- *explaining the operation and function of flow control valves*
- *explaining the operation and function of directional control valves*
- *explaining the operation and function of basic hydraulic brakes*
- *explaining the operation and function of hydraulic actuators*
- *demonstrating lifting and hoisting procedures*
- *providing opportunity to inspect hydraulic brake components*
- *providing opportunity to service hydraulic systems*
- *providing opportunity to repair cylinders and motors*
- *providing opportunity to install hydraulic system components*
- *providing instruction on 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

Mentors can assist the apprentice to prepare for this section of technical training by:

- explaining anhydrous ammonia safety and the operation of anhydrous applicators
- explaining the principles and theory of operation for seed carts, seeding tools and tillage equipment
- demonstrating equipment adjustments for various seeding rates and field conditions
- explaining basic hydraulic and electrical principles as they apply to seeding and tillage equipment
- explaining basic global positioning system functions
- providing opportunity to perform pre-delivery and service requirements for various types of seed carts, seeding tools and tillage equipment by using manufacturer's procedures
- understanding the operating principles of various components on seed carts, seeding tools and tillage equipment
- understanding the operating principles of hydraulic and electrical components for seeding and tillage equipment
- inspecting global positioning system components for variable rate metering

Powertrains 1 – Theory

15 hours

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

Mentors can assist the apprentice to prepare for this section of technical training by:

- explaining the construction and operation of clutch linkages and transmission brakes
- identifying clutch system components
- demonstrating safety precautions while separating tractors
- explaining the steering axles and their functions
- providing instruction on the procedures to support, block and lift equipment
- providing instruction on splitting a tractor to repair or replace components
- providing opportunity to adjust clutch linkages and transmission brakes
- providing opportunity to perform inspections of clutch system components
- providing opportunity to align clutch components and flywheel

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

Mentors can assist the apprentice to prepare for this section of technical training by:

- *explaining electrical systems and testing equipment*
 - *identifying capacitors, diodes and transmitters*
 - *explaining the components, operation and repair of ignition systems*
 - *explaining the components, operation and repair of charging systems*
 - *explaining the components, operation and repair of starting systems*
-

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

Mentors can assist the apprentice to prepare for this section of technical training by:

- *identifying the construction and operation of various engine systems*
- *explaining the operation of two and four-stroke engines*
- *explaining cooling and lubrication systems*
- *explaining intake and exhaust systems*
- *providing opportunity to test, disassemble, inspect and assemble small diesel engines*
- *providing opportunity to inspect cylinder heads, rods, pistons and sleeves*

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

Mentors can assist the apprentice to prepare for this section of technical training by:

- *providing instruction on the diagnoses, inspection, repair, and adjustment of balers (round, square), bale processors, forage harvesters, mower conditioners, bale wagons, and mix mills*
- *explain the theory of combine operations*
- *providing instruction on the diagnoses, inspection, repair, and adjustment of combine harvesting equipment (conventional, rotary)*
- *explaining electrical and hydraulic principles that apply to combines*
- *explaining basic principles of global position systems as applied to combines*

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

Mentors can assist the apprentice to prepare for this section of technical training by:

- *explaining the theory of operation of sprayer systems*
- *demonstrating pre-delivery, inspection, repair and calibration of sprayer systems*
- *demonstrating the safe handling of spray products*
- *explaining dry box applicators and anhydrous ammonia applicators*
- *explaining the basic principles of global position systems as applied to sprayers and applicators*

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

Mentors can assist the apprentice to prepare for this section of technical training by:

- *explaining the components, operation, repair and adjustment of manual hydraulic, wet and dry, disc and drum brake systems*
- *explaining basic principles of differentials, final drives, planetary drives, and MFWD axles*

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

Mentors can assist the apprentice to prepare for this section of technical training by:

- *explaining electrical system wiring, circuits, and testing*
 - *providing instruction on the operation and testing of microcomputers, sensor circuits, output devices and on-board diagnostic procedures*
 - *interpreting schematic drawings*
 - *providing opportunity to perform diagnostic procedures on electrical/electronic circuits*
-

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

Mentors can assist the apprentice to prepare for this section of technical training by:

- *providing instruction on the diagnoses of diesel injection and fuel system malfunctions*
- *providing opportunity to remove, repair and replace injection system components*
- *providing instruction on the diagnoses, inspection and repair intake and exhaust systems, inter/after coolers and turbochargers*

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 lift 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

Mentors can assist the apprentice to prepare for this section of technical training by:

- *explaining open and closed centre hydraulic systems*
- *providing instruction on testing and diagnoses of hydraulic pumps (gear, vane, piston), control valves (pressure regulating, priority, flow dividers, directional, steering, brake), hydraulic cylinders, rockshafts*
- *explaining hydrostatic transmission systems*

Powertrains 3 Advanced – Theory**30 hours**

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

Powertrains 3 Advanced – Shop**30 hours**

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

Mentors can assist the apprentice to prepare for this section of technical training by:

- *explaining the components, operation, repair and adjustment of gear transmissions*
- *explaining the components, operation, repair and adjustment of hydraulic assist and power-shift transmissions*
- *providing instruction on the inspection, testing, repair, adjustments and calibration of power train components*

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)

Mentors can assist the apprentice to prepare for this section of technical training by:

- *identifying basic oxy-acetylene equipment*
- *explaining basic oxy-acetylene equipment*
- *explaining basic SMAW welding equipment*
- *explaining basic GMAW welding equipment*
- *providing instruction on filler rod welding in various positions*
- *providing instruction on cutting torch operation*
- *providing instruction on basic arc welding equipment*
- *providing opportunity to perform weld a variety of metal thicknesses using different types of rods and in various positions*

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

Mentors can assist the apprentice to prepare for this section of technical training by:

- providing instruction on reviewing electrical principles, theories, systems and components
 - providing instruction on operations of the communications systems (CAN, ISO Bus) used on agricultural equipment
 - providing opportunity using various computer systems for diagnostic evaluation and adjustments
 - providing opportunity to diagnose and repair faulty communication systems
-

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

Mentors can assist the apprentice to prepare for this section of technical training by:

- providing instruction on testing, diagnoses, inspection, and performing major overhaul procedures on large displacement engines
 - providing opportunity to use computers to diagnose faults and test engine systems
 - providing opportunity to diagnose diesel fuel systems, injectors, injection pumps, governors and electronic engine controls for fuel system control
-

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

Mentors can assist the apprentice to prepare for this section of technical training by:

- *explaining the construction and operation of mobile hydraulic systems*
 - *providing opportunity to perform major diagnostics of hydraulics systems and 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

Mentors can assist the apprentice to prepare for this section of technical training by:

- *providing instruction on the operation, adjustment and diagnostic procedures for seeding, tillage, hay and forage, harvesting, material handling equipment*
-

Equipment Performance – Theory

15 hours

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

Equipment Performance – Shop

15 hours

- use a dynamometer
- evaluate torque and horsepower curves

Mentors can assist the apprentice to prepare for this section of technical training by:

- *providing instruction on performing tractor pre-delivery*
- *providing instruction on the methods, components and procedures for ballasting tractors*
- *providing instruction on performing tractor dynamometer testing*
- *explaining the theory of continuously variable transmissions*
- *explaining the theory and operation of clutches, steering, brakes, differentials, MFWD, standard and power-shift transmissions*
- *explaining the steps used in a diagnostic procedure*

Consider apprenticeship training as an investment in the future of your company and in the future of your workforce. Ultimately, skilled and certified workers increase your bottom line.

Get involved in the apprenticeship training system. Your commitment to training helps to maintain the integrity of the trade.

Do you have employees who have been working in the trade for a number of years but don't have trade certification? Contact your local apprenticeship office for details on how they might obtain the certification they need.

Saskatchewan Apprenticeship & Trade Certification Commission

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