

South Dakota FFA Ag Mechanics CDE Competencies

The Ag Mechanics CDE is also divided into five system areas.

- Machinery and Equipment Systems
- Electrical Systems
- Compact Equipment
- Structural Systems
- Environmental and Natural Resource Systems

The Individual Ag Mechanics CDE consists of three parts:

- Hands-On Operations
 - Each participant will complete 5 specific hands-on performance operations (1 from each area listed above).
 - 5 skills each worth 20 points = 100 points
- Problems Solving
 - Each participant will complete 5 problem solving/skill development activities (1 from each area listed above). (5 problems each worth 20 points = 100 points)
- Written Exam
 - Test should consist of 25 questions (around 5 questions from each of the five areas listed above).
 - 25 questions each worth 2 points each = 50 points
- Team Problem
 - A problem-solving activity and/or team hands-on activity involving the gathering of information and the use of logical solutions based on commonly accepted standards.
 - 100 points
 - Team problem does NOT count toward individual scores.

Preparation Resources:

- Past State and National FFA CDE Exams and Practicums

Machinery/Equipment Systems:

Equipment – Front wheel Assist Tractor/ Loader: Fendt Model 716 Vario or John Deere Model 6R series tractor

Text Reference

Agricultural Technical Systems and Mechanics Textbook--ATP

- Chapter 27: Engine Operation and Maintenance
- Chapter 28: Mobile Power Equipment Maintenance

Operator's Manual for Tractor & Loader

Area of Focus:

Identify the recommended service and maintenance operations from the operator's manual.

Understand the functions of machinery's hydraulic system.

Understand the functions of machinery's diesel engine components.

Understand the functions of machinery's electrical system.

Install, adjust, and service: belts, chains, filters, and fluid levels.

(Note of importance: make sure you understand hydraulic systems)

Possible Skills:

- ID parts and components of Tractor and Loader.
- Understand how to perform adjustments and replace components on Tractor and Loader.
- Understand the meaning of safety stickers and symbols used on equipment.
- Select fuels, lubricants, hydraulic fluids, and coolants for proper operation.
- ID drive system parts.

Possible Problem Solving:

- Use manuals to calculate capacities of the equipment.
- Use manuals to determine service plans.
- Use diagnostic tools to determine service and repair needs.
- Calculate hydraulic force, pressure, and area.
- Calculate gear ratios.

Electrical systems:

Electrical Control components

Text Reference

Agricultural Technical Systems and Mechanics Textbook--ATP

- Chapter 19: Electrical Principles
- Chapter 20: Electrical Components and Equipment

Areas of Focus

understand basic principles of controls including thermostats, humidistats, photoelectric, relays, programmable controllers, sensors, ultrasonics, timers, and other time-delay equipment.

Understand the principles of electricity.

Understand appropriate standards for agricultural applications, including the National Electrical Code (NEC) and OSHA standards.

Understand electrical schematics and symbols for control components.

Use electrical test instruments such as VOA (volt-ohm-amp) meter, DMM (digital multimeter) and tachometer.

Possible Skills:

- Identify types of electrical Control components.
- Wire a control device example: thermostat to control in-house air temperature.
- Demonstrate how to properly use diagnostic tools like voltmeter, ammeters, multimeters.
- Identify electric symbols.
- Identify electrical tools.

Possible Problem Solving:

- Calculate the relationship between volts, amps, and ohms.
- Select proper wire size for application.
- Identify wiring colors associated with thermostat wiring and uses of each
- Identify the correct test procedure if provided with an electrical or electronic fault. This will focus on checking for proper voltage, continuity, or resistance
- Identify whether a system utilizes AC or DC power
- Determine if batteries are arranged in parallel or series and calculate voltage of the system.

Compact Equipment:

Equipment: Motorized Water Pump: Honda WX or WB series

(Compact equipment and Structure themes could be used together for problem solving)

Text Reference

Agricultural Technical Systems and Mechanics Textbook--ATP

- Chapter 27 Engines Operation and Maintenance
- Chapter 28 Mobile Power Equipment Maintenance
- Small Gas Engine Textbook – ATP
- Operator’s Manual for Honda Pumps

Areas of Focus:

Interpret horsepower, torque and other power measurement criteria.

Use measuring tools and test instruments such as micrometer and telescoping gauges, dial indicator, torque wrench, and feeler gauge.

Identify the recommended service and maintenance operations from the operator’s manual.

Understand compact equipment’s pump components.

Possible Skills:

- Identify engine components and purpose.
- Identify compact equipment’s parts and systems.
- Measure engine components and determine if the part is within tolerance or reject.
- Properly set a torque wrench or read what a torque wrench is set at.

Possible Problem Solving:

- Calculate force, pressure, torque, work, power and horsepower as it applies to engine and transmission components
- Calculate fuel efficiency of compact equipment.
- Use manuals to determine service plans.
- Calculate pumping capacity of SGE and water pump.

Structural Systems:

Plumbing and Irrigation

Text Reference

Agricultural Technical Systems and Mechanics Textbook--ATP

- Chapter 17 Plumbing
- Chapter 18 Irrigation

Areas of Focus:

Describe and/or calculate surface and subsurface drainage and irrigation techniques.

Determine power requirements and pump size for specific applications.

Apply water pressure, flow and head concepts.

Understand the uses of different pipe materials.

Understand the different irrigation systems.

Possible Skills:

- Cut and assemble pvc pipe.
- Cut and assemble pex pipe using crimp or band fasteners.
- Cut and assemble threaded fittings using Teflon tape.
- Cut and solder copper pipe.
- Cut and assemble a plumbing system and include one or more of the following materials
- copper, pvc, pe and/or galvanized.

Possible Problems:

- Calculate water volume needed.
- Calculate water flow in hydroponics or aquaculture systems.
- Calculate capacity of water collection systems.
- Identify plumbing materials and fitting.
- Identify plumbing tools.
- Understand identification marking on plastic and copper pipe.

Environmental and Natural Resources Systems:

GPS/ GIS Systems and Agriculture Applications practices

Text Reference

Agricultural Technical Systems and Mechanics Textbook--ATP

- Chapter 9: Surveying and GPS/ GIS Applications

Apps and websites

- <https://climate.sdstate.edu/>
- <https://www.swpc.noaa.gov/>
- <https://satpredictor2.deere.com/>
- <https://extension.sdstate.edu/sites/default/files/2023-06/P-00039-2023-v2.pdf>

Areas of Focus:

Understand how to utilize GPS systems and components.

Interpret and evaluate GIS data to come to a conclusion about a scenario specific to agricultural and environmental service systems.

Interpret visibility, DOP, and elevation graphs found on the satellite predictor website.

Asses daily solar weather prediction and the impact it may have on GPS signals

Understand weather mapping Data and its effects on farming applications

Possible Skills:

- Identify longitude and latitude of an area using a GPS system.
- Determine if current GPS signal is sufficient for tractor guidance and farming operations based on information provided from a GPS display
- Identify the elevation of a specific satellite from the elevation map on satellite predictor website
- Determine the correct GPS output baud rate and Hertz settings for a machine requiring GPS from the tractor
- Determine whether the weather permits spray application based on data provided from the spray tool on climate website.

Possible Problems:

- Calculate distance between two points using a GPS system.
- Calculate the acres or hectares of a land area.
- Calculate Growing Degree Days if given daily weather information
- Convert Latitude/longitude between various written formats (decimal degrees, degrees decimal minutes, degrees, minutes, seconds)
- Utilize yield maps to identify zones in a field
- Calculate Potash application rates per acre for various zones in a field if given a yield goal, potassium soil test value, and equation from South Dakota fertilizer recommendation guide.