

Agricultural Technology & Mechanics

Nebraska Career Development Event
Handbook and Rules for 2022-2026

1. PURPOSE

Agricultural Technology and Mechanical systems is composed of strong technical content and complimented by the development of practical, hands-on skills. The subject matter areas and skill development practices have been grouped into three 'systems' areas, so named because of the complex interaction and synergistic processes common to agriculture. The term 'system' is used to emphasize the interactive relationship between each area of agricultural technology and mechanical systems. These three systems are: Small Gas Engines or Hydraulic/Pneumatic, Electrical, and Machines.

2. OBJECTIVES

A. Team Activity:

The student team will compute/answer a series of questions (10 to 25) for a given scenario using provided information and actions based on the current year's theme which is listed for each year below. Engines will consist of diagnosing and fixing an issue in the internal portion of the engine.

B. Individual Activities:

1. **Small Gas Engines** (2022, 2024, 2026)
 - a. The student will identify parts of a typical small gas engine (including vertical shaft, horizontal shaft, 4 cycle, 2 cycle, overhead valve, and L – head valve) from the list provided. See Appendix A
 - b. The student will identify specialty tools used with small gas engines from the list provided. See Appendix A
 - c. The student will demonstrate the correct usage & reading of a micrometer.
 - d. The student will correctly answer 25 questions about SGE safety, maintenance, assembly, theory, and conclude the various systems (lubrication, ignition, carburation, etc.)
2. **Hydraulic/Pneumatic** (2023, 2025)
 - a. The student will identify hydraulic/pneumatic symbols from the list provided. See Appendix B.
 - b. The student will identify hydraulic/pneumatic parts from the list provided. See Appendix B.
 - c. A total of 25 from the two lists will be displayed.
 - d. The student will correctly answer 25 questions about hydraulic/pneumatic safety, power systems, and general cylinder computations for force, psi, cylinder ram travel distance, and pressure losses.
3. **Electricity** (every year)
 - a. The student will correctly connect three electrical devices (switch, lamp, receptacle) in a circuit as illustrated in a schematic diagram in the CDE instructions (score sheet) according to NEC guidelines. Scoring criteria includes: correct wire color usage for power and neutral and appropriate screws, correct insulation removal, wires hooked clockwise around screws, amount of bare wire exposed, amount of wire and insulation inside device box (too much or too little), following instructions (correct sequence of devices and instructed fastening of devices and wire clamps) and satisfactory wire nut tightness.
 - b. The student will answer 25 questions over AC and DC electrical safety, devices,

theory, practices, or equipment.

4. **Machine** (every year)
 - a. The student will identify the primary parts, safety features, observations (oil leak), or specifications on an identified type of machine/equipment related to the national Ag Mechanics Theme.
 - b. The student will use an appropriate operator's manual (provided at event) to answer pertinent questions covering safety features/warnings, specifications, manufacturing information, capacities, and other relevant information to the operation of the machine. The type of machine will be given in advance, but the specific model, etc. will be provided at the event.
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3. ELIGIBILITY

- A. Grades 9-12.
 - B. Top 25% of total schools in a district qualify for the State CDE.
 - C. A team may compete with less than 4 individuals but will incur a deduction in points for the team score.
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4. REQUIRED AND RECOMMENDED ATTIRE

A. Required Attire

- a. Each student **must** have the following in order to participate. No exceptions.
 - i. Safety Glasses
 - ii. Closed-toed shoes
 - iii. Long Pants, in good repair (NO holes or frays, etc.)
 - iv. Note: Oversized or loose fitting clothing is dangerous, and is therefore **banned** (i.e. hoodies, etc.)

B. Recommended Attire

- a. A long or short sleeved collared shirt or coveralls are recommended.
 - i. **T-shirts are NOT recommended.**
 - ii. Official FFA Dress is allowed, but is NOT recommended.

5. REQUIRED SUPPLIES AND EQUIPMENT

Everyone will be given a safety briefing during orientation. Please observe all safety rules, and if you see something that doesn't look safe; let a competition official know. Teams will need to bring the following items with them (each individual will need all of these things):

- #2 pencils for each person
- Safety glasses for each person
- Calculator (NO cell phones & NO graphing calculators)
- Wire stripper
- Flat screwdriver
- Phillips screwdriver
- Needle nose pliers
- Diagonal Cutters
- Small set of wrenches both metric and standard (engines)
- Set of sockets and ratchet (engines)
- **No knives are allowed.**

6. EVENT SEQUENCE

- A. Schools will be divided into two groups. Teams should plan to arrive and register not more than 30 minutes prior to start time and not less than 5 minutes prior to start time. Each section should be completed within 2 hours and 45 minutes, start to finish.
 - a. Section I, including teams from $\frac{1}{2}$ of the districts will start promptly, please be there 30 minutes early a.m. b. Section II, including teams from the other $\frac{1}{2}$ of the districts will start promptly, please be there at least 30 minutes early.
 - b. Individuals will be divided for the 6 individual activities and rotate every 15 minutes. (Approximately 15 contestants will begin at each activity table.)
 - c. Every team will be together for one 25-30 minute activity. We will start with the first 5 school numbers (1-5) at the team activity and the rest of the contestants divided among individual areas. Every second rotation will bring the next 5 school numbers (6-10, etc.) to the team activity. After the team activity, students will return to their next individual rotation area from where they left off.
- B. Check the CDE schedule for specific arrival, start and end times, and the event location.

7. ANNUAL THEME

The annual theme is derived from the National CDE. The theme affects the contest specific machinery/equipment and the team component.

- 2022 - Material Handling Systems
- 2023 - Processing Systems
- 2024 - Plant Production Systems
- 2025 - Integrated Pest Management Systems
- 2026 - Animal Production Systems

8. EVENT FORMAT

A. Team Activity

All four team members from each team will work together and be evaluated as a team while solving complex, multi-system agricultural problems. The problem scenario is presented to the team on the day of the event and members utilize the materials and equipment provided to undertake and prepare a solution to the problem. Teams organize themselves, assigning duties and completing tasks together or separately depending on individual skills and abilities. Each team receives a maximum score of 150 points. In 2025 there will be an engine diagnostic and repair.

B. Individual Activities

Each team member will rotate through 6 individual activities with a maximum time of 15 minutes for each activity. Each individual team member will receive a maximum individual score of 50 points per station with a total individual score of 300 points. Individual activities are listed as follows:

- a. **Small Gas Engines** (2022, 2024, 2026)
 - i. Small gas engine part identification, tool identification and micrometer measurements practicum. (Appendix A)
 1. A total of 25 from the two lists and micrometer measurements will be displayed
 - ii. A 25 question test over small gas engines and theory. See Resources List b. Hydraulics/Pneumatics (2019)
 - iii. Identify a total of 25 hydraulic/pneumatic symbols and hydraulic/pneumatic parts from the lists provided. (Appendix B)
 - iv. A 25 question test over hydraulics/pneumatics will be given. See Study Materials

- b. **Electricity** (every year)
 - i. Wiring a single pole switch circuit to a light and outlet.
 - 1. A 1' by 2' board will be provided with switch and lamp boxes pre attached and required lengths of wire pre-cut
 - 2. A switch, a light fixture, an outlet, and wire nuts will be available.
 - 3. Competitors would strip the insulation to the correct length and attach the wires to the devices for the competition.
 - 3. The devices will not have to be tightened or grounded to the boxes, rather left out to check correct procedures.
 - 4. Sixteen boards will be laid out with 8 extra available during each rotation to provide enough ready to use for each group.
 - 5. Completed boards will be replaced with blanks, scored, and 'reset' after each rotation.
 - 6. A diagram will be provided at the activity.
 - ii. A 25 question test over basic electrical terms, safety, etc. is given. See the Study Materials.
- c. **Hydraulic/Pneumatic** (2023, 2025)
 - i. The Student Will identify hydraulic/pneumatic symbols from the list provided. See Appendix B.
 - ii. The Student Will identify hydraulic/pneumatic parts from the list provided. See Appendix B.
 - iii. A total of 25 from the two lists will be displayed.
 - iv. The Student Will correctly answer 25 questions about hydraulic/pneumatic safety, power systems, and general cylinder computations for force, psi, cylinder ram travel distance, and pressure losses.
- d. **Machinery** (every year)
 - i. Identify 10-25 basic parts and safety decals from a theme related piece of machinery or equipment.
 - ii. A 25 question test to find specifications from a theme related piece of machinery or equipment operator's manual.
 - 1. Examples: Recommended tire pressure, load capacity, safety protocols, travel speed, etc.
 - iii. Operator manuals, or copies, will be provided at the activity

9. SCORING

The following represents how team and individual scores are calculated:

		Individual Points	Team Points
INDIVIDUAL COMPONENTS			
	Small Engine / Hydraulic Practicum	50	200
	Small Engine / Hydraulic Test	50	200
	Electrical Wiring Practicum	50	200
	Electrical Wiring Test	50	200
	Theme Machinery / Equipment Practicum	50	200
	Theme Machinery / Equipment Test	50	200
TEAM COMPONENTS			
	Team Activity		150
TOTALS		300	1,350

10. TIEBREAKER

- A. Team Scores: (total team scores for each)
 - a. Team Activity Score
 - b. Electrical
 - c. Machines
 - d. Small Gas Engines or Hydraulic/Pneumatic
- B. Individual: (total score for each)
 - a. Electrical
 - b. Machines
 - c. Small Gas Engines or Hydraulic/Pneumatic

11. RESOURCE MATERIALS

The event superintendent will annually notify teachers of appropriate study materials and manuals that will be utilized in the event.

Appendix 1. Small Engine Parts & Tools

Appendix 2. Hydraulic/Pneumatic Symbols & Parts

Appendix 3. Electrical Writing Activity Scorecard

12. STUDY MATERIALS

See the sample activities and tests located in the study materials folder, which is located on the Ag Technology and Mechanics CDE Rules page.

13. DEBRIEFING OPPORTUNITY

All teachers and students are allowed to walk through the CDE after the completion of the last team of Section II until 30 minutes after the conclusion of Section II of this CDE.

APPENDIX

Appendix 1. Small Engine Parts & Tools

Appendix 2. Hydraulic/Pneumatic Symbols & Parts

Appendix 3. Electrical Writing Activity Scorecard

Appendix 1. Small Engine Parts & Tools

WRITE THE NUMBER FROM BESIDE THE PART OR TOOL NEXT TO ITS CORRECT NAME

Small Gas Engine Parts

- | | | |
|-----------------------------|----------------------------|---------------------------|
| ___ Air Filter | ___ Engine Head Gasket | ___ Piston Top - Concave |
| ___ Armature | ___ Fins | ___ Piston Top - Domed |
| ___ Butterfly Valve | ___ FlyWheel | ___ Piston Top - Flat |
| ___ Camshaft | ___ FlyWheel Magnet | ___ Points |
| ___ Carburetor - Gravity | ___ Fuel Filter | ___ Scraper Piston Ring |
| ___ Carburetor - Vacuum | ___ Exhaust Valve | ___ Serial Number |
| ___ Carburetor - Diaphragm | ___ Fuel Tank | ___ Spark Plug |
| ___ Carburetor Float | ___ Governor | ___ Starter Clutch |
| ___ Carburetor Vacuum Tubes | ___ Horizontal Shaft Block | ___ Starter Recoil Spring |
| ___ Choke | ___ Intake Valve | ___ Starting Cord |
| ___ Code Number | ___ Lifter Rod | ___ Tappet |
| ___ Condenser | ___ Model Number | ___ Throttle Cable |
| ___ Connecting Rod | ___ Muffler | ___ Timing Marks |
| ___ Crankshaft | ___ Needle Valve | ___ Valve Spring |
| ___ Crankshaft Bearing | ___ Oil Dipper | ___ Valve Spring Keeper |
| ___ Cylinder Head | ___ Oil Slinger | ___ Vane |
| ___ Dipstick | ___ Piston | ___ Vertical Shaft Block |
| ___ Engine Block Gasket | ___ Piston Rings | ___ Woodruff Key |

Name _____

Small Gas Engine Tools

_____ Caliper

_____ Contact Tachometer

_____ Cylinder Hone

_____ Cylinder Pressure Gauge

_____ Flywheel Brake

_____ Gear Puller

_____ Leaf Gauge

_____ Micrometer

_____ Piston Ring Compressor

_____ Piston Ring Expander

_____ Ridge Reamer

_____ Spark Tester

_____ Starter Clutch Wrench

_____ Telescoping Gauge

_____ Valve Face Grinder

_____ Valve Seat Grinder

_____ Valve Spring Compressor

_____ Wire Gauge

Appendix 2. Hydraulic/Pneumatic Symbols & Parts

WRITE THE NUMBER FROM BESIDE THE PART OR SYMBOL NEXT TO ITS CORRECT NAME

Pneumatic/Hydraulic Parts Pneumatic/Hydraulic Parts

____ Check Valve ____ Motor - Hydraulic ____ ____ Compressor - Pneumatic ____ Motor - Pneumatic ____

____ Cylinder -Double Port ____ O-Ring ____ ____ Cylinder Bore ____ Pneumatic Air Filter ____ ____

Cylinder Cap ____ Pneumatic Lubricating Oil ____ ____ Cylinder Piston ____ Pneumatic Pressure Switch ____

____ Cylinder Ram ____ Pressure Gauge ____ ____ Cylinder -Single Port ____ Pump ____ ____ Flow

Control Valve -Variable ____ Reservoir - Non-Pressurized ____ ____ Hose ____ Reservoir - Pressurized ____

____ Hydraulic Coupler - John Deere ____ Temperature Gauge ____ ____ Hydraulic Coupler - Pioneer ____

____ Hydraulic Oil ____ ____ Hydraulic Oil Filter ____ Hydraulic Pressure Switch ____

Pneumatic/Hydraulic Symbols

____ In-line Quick Disconnect - Hydraulic ____ Check Valve ____ ____ In-line Quick Disconnect - Pneumatic

____ Check Valve with Spring ____ ____ Line ____ Cylinder - Double Port ____

Name _____

Pneumatic/Hydraulic

Symbols Cylinder - Single Port

Flow Control Valve - Variable

Hydraulic Filter

Hydraulic Line

Hydraulic Reservoir -

Non-Pressurized Hydraulic Reservoir

Pressurized In-line Quick Disconnect

Motor

Pneumatic Filter

Pneumatic Line

Pneumatic Tank

Pressure Gauge

Pressure Switch

Pump

Temperature Gauge

Three Way Closed Center Valve

Three Way Open Center Valve

Variable Pump

Appendix 3. Electrical Writing Activity Scorecard

Name _____
Contestant Number _____
School _____

Do Not tighten box clamps or attach devices and ground wires to boxes.

All wires should be connected or wire nutted.

Switch Complete (20) Receptacle Complete (20) Lamp Complete (10) Total (50)

_____ = _____

NEC Violations.....One Point Deduction for Each

Romex ¼ Inch inside Box _____ Cardboard Inside Box _____ Excess
Copper Showing _____ Nicks or Cuts in Insulation _____ Wires
Counter-clockwise or Not Under Screw _____ Wire Nuts Pull Off or Not
On _____ Significant Less Than 6 Inches Wire in Box _____

Total Violations _____

Wiring Score _____