Agricultural Technology & Mechanics

Nebraska Career Development Event
Handbook and Rules for 2022-2026

1. PURPOSE

Agricultural Technology and Mechanical systems are composed of strong technical content and complemented 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.

B. Individual Activities:

1. **Small Gas Engines (SGE)** (even years)
   - 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 reading of a micrometer.
   - D. The student will correctly answer 25 questions about SGE safety, maintenance, assembly, theory, and the various systems (lubrication, ignition, carburation, compression, governing, etc.) used with small gas engines.
2. **Hydraulic/Pneumatic** (odd years)
   - 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 items 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, speed, 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 practicum instructions (score sheet) according to NEC guidelines using 12-2 w/ground wire, common for 120-volt, 20-amp, 30-foot circuits. Scoring criteria will include the completion of the three device connections (50 points), less each violation (1 point each). Satisfactory practices include correct wire color usage for power, neutral, and ground wires to appropriate screws as directed!, wires hooked clockwise under screws, correct outer sheath and wire insulation removal (4-6 inches of sheath removed and about 3/8-1/2 inch individual wire insulation removed from the end), amount of bare wire exposed (no more than 1/8 inch from screw), no wire insulation under screws, no nicks to wire insulation, amount of wire and insulation inside device box (at least ¼ inch outer sheath but not more than ¾ inch), **following instructions** using the correct sequence of devices according to wiring diagram provided, instructed fastening of wire to devices and wire clamps (no copper showing outside wire nut) (also see B. below) and satisfactory wire nut tightness. Twisting wires to cap with wire nuts is optional but must not pull out either way.
   - B. For the contest, wire clamps to boxes are not to be tightened and ground wires should be connected <u>but not</u> attached to the boxes or the devices. (While normally correct, these steps are omitted for the CDE to facilitate reassembly for the next rotation during the contest.
   - C. The student must correctly wear safety glasses during this activity!
   - D. The student will answer 25 questions over AC and DC electrical safety, devices, theory, Ohm's Law, practices, or equipment.
4. **Machine – Two Parts** (every year)

A. The student will identify the noted parts, safety features, observations (ex. oil leak, tire size, etc.), or specifications on an identified type of machine/equipment related to the State Ag Mechanics Theme.
B. The student will use an appropriate operator's manual (provided at event) to answer 25 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.
C. General identification of the equipment will be provided prior to the CDE as early as possible. Specific machines will be given when arrangements are completed as early as possible before the CDE. Suggestions to find examples of the equipment will be shared and generally examples may be found on the internet. Brand names of the equipment used will not be given prior to the competition. See Resources list for past tests to see the types of questions. Previous Operator Manuals can be found on the internet.

3. ELIGIBILITY

1. Grades 9-12.
2. Top 25% of total schools in a district qualify for the State CDE.
3. A team may compete with less than 4 individuals but will incur a deduction in points for the team score.

4. REQUIRED AND RECOMMENDED ATTIRE

1. Required Attire
a. Each student must have the following to participate. No exceptions.
i. Safety Glasses, worn when using tools.
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.)

2. 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.
iii. Lanyards tucked out of sight.
iv. Hair longer than collar length should be secured.

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
- 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 before start time and not less than 5 minutes before start time. Each section should be completed within 2 hours and 45 minutes, from start to finish.
    a. Section I, the morning section, including teams from ½ of the districts, will start promptly. Please be there 30 minutes early.
    b. Section II, the afternoon section, including teams from the other ½ of the districts, will start promptly. Please be there at least 30 minutes early.
    c. All complete teams will start with the Team Activity and will be together for one 30-minute team event. Upon completing the Team Activity, students will be separated and rotated through the individual components.
    d. Individuals will be divided among the 6 individual activities with only one student from each team in an individual event area. The individual components will rotate every 15 minutes. (Approximately 20 contestants will begin at each activity table.)
B. Check the CDE schedule for specific arrival, start and end times, and the event location.

7. ANNUAL THEME

The annual theme was 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 answers will 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 may utilize the materials and equipment provided to undertake and prepare a solution to the problem. A general topic for the Team Activity will be provided before the competition. Teams are to 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.

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:

1. **Small Gas Engines** (even years)
    i. Small gas engine part identification, tool identification and micrometer measurements practicum. (Appendix A)
    ii. A total of 25 items from the two lists will be displayed.
    iii. A 25-question test over small gas engines and theory. See the Resources folder on the CDE website for previous years' tests.
2. **Hydraulic/Pneumatic** (odd years)
    i. Hydraulic/pneumatic part and symbol identification, practicum. (Appendix B).
    ii. 1. A total of 25 items from the two lists will be displayed.

iii. Students will answer 25 questions about hydraulic/pneumatic safety, power systems, and general cylinder computations for force, psi, cylinder ram travel distance, and pressure calculations.
iv. See the Resources folder on the CDE website for previous years' tests.

3. **Electricity** (every year)
   i. Wiring a single pole switch circuit to an outlet and a lamp.
   ii. A 1-foot by 2-foot board will be provided with switch and lamp boxes pre-attached, 3 inches apart and two 16-inch lengths of wire, pre-cut (16 inches allowing for nicks if occurring)
   iii. A switch, a light fixture, an outlet, and 4 wire nuts will be available.
   iv. Competitors would strip the insulation to the correct length and attach the wires to the devices for the competition.
   v. The devices will not have to be tightened or grounded to the boxes but rather left out to check correct procedures.
   vi. Twenty boards will be laid out with 10 extras available during each rotation to provide enough boards ready to use for each group.
   vii. Completed boards will be scored and 'reset' after each rotation.
   viii. A diagram and instructions will be provided with the scoresheet when the rotation begins.
   ix. A 25-question test over basic AC and DC electrical terms, safety, etc. is given.
   x. See the Resources folder on the CDE website for previous years' tests.

2. **Machinery** (every year)
   i. Observe and identify 10-25 basic parts, conditions, labels, and safety decals from a theme-related item of machinery or equipment. Students should refrain from touching or climbing on the equipment.
   ii. A 25-question test to find specifications from a theme-related item of equipment found in the Operator Manual or a copy there-of. The Manual will be provided at the activity. This Manual will be over a different item of equipment than the Observation Activity.
   iii. See the Resources folder on the CDE website for previous years' tests.

9. SCORING

		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. See the Resources folder on the CDE website for previous years' tests.

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.

APPENDICES

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

Small Gas Engine Tools

____ Caliper
____ Contact Tachometer
____ Cylinder Hone
____ Cylinder Pressure Gauge (Compression Tester)
____ Flywheel Brake (Holder)
____ Gear Puller
____ Leaf (Feeler) 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 (Gap) 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

_____ Compressor-Pneumatic

_____ Cylinder Bore

_____ Cylinder Cap

_____ Cylinder Piston

_____ Cylinder Ram

_____ Cylinder-Double Port

_____ Cylinder-Single Port

_____ Flow Control Valve - Variable

_____ Hose

_____ Hydraulic Coupler - John Deere

_____ Hydraulic Oil Filter

_____ Hydraulic Pressure Switch

_____ Motor - Hydraulic

_____ Motor - Pneumatic

_____ Hydraulic Coupler - Pioneer

_____ Hydraulic Oil

_____ O-Ring

_____ Pneumatic Air Filter

_____ Pneumatic Lubricating Oil

_____ Pump

_____ Reservoir-Pressurized

_____ Reservoir–Non-Pressurized

_____ Temperature Gauge

_____ Pneumatic Pressure Switch

_____ Pressure Gauge

Pneumatic/Hydraulic Symbols

_____ In-line Quick Disconnect - Hydraulic

_____ Check Valve

_____ In-line Quick Disconnect - Pneumatic

_____ Check Valve with Spring

_____ Line

_____ Cylinder - Double Port

_____ 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 less than ¼" 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	_____
Significantly Less Than 6 Inches Wire in Box	_____

Total Violations _____

Wiring Score _____