

Advanced Agricultural Technology & Mechanical Systems



CDE Handbook

Advanced Agricultural Technology & Mechanical Systems

New for 2021

1. Purpose

The Advanced Agricultural Technology & Mechanical Systems CDE helps students develop their technical skills and knowledge and their ability to work with others to solve complex problems.

2. Objectives

This career development event selects and awards those students and teams that demonstrate:

- a. Mastery of the subject matter and skills common to the systems areas.
- b. Effective communication skills
- c. Superior problem-solving techniques.
- d. An understanding of modern technology.
- e. The ability to function as individuals and as team members working together.

3. Rules

- a. Each chapter may enter up to four members who have completed at least the 10th grade and have not been a participant in the national event.
- b. The top three scores will be added for the team score.
- c. An individual may only participate in one Agriculture Mechanics event each year.
- d. The event will be held in cooperation with Agricultural Systems Management Department at North Dakota State University.
- e. Each participant must compete in all phases of the event.
- f. Each individual must furnish their own welding gloves, safety glasses and coveralls/shop coat.
- g. Participant must wear official dress for awards presentations only.
- h. Industrial standard eye protection and other safety precautions are a must during all phases of shop work. Appropriate clothing must be worn, must be in good repair and fit properly. Long sleeves are required for welding or cutting.
- i. All tools, equipment and materials will be furnished. All written materials will be furnished, Individuals must provide their own clipboards and two sharpened number 2 lead pencils. The use of an electronic calculator is encouraged. Personal computers will be provided if needed to be used for problem solving activities.
- j. All portions of this CDE will take place on ONE day. (The written test will not be held in the evening.)
- k. Teams will be pre-registered for three time slots—7:30 am, 10:00 am, and 1:30 pm. All team members must compete in the same time slot and are responsible to show up on time for their assigned time slot or be disqualified. Team members participating in other CDEs/LDEs later in the day must register for the 7:30 am start time.
- l. The order of events: 1. Team Problem Solving Activity 2. Problem Solving/Skills Development Activities 3. Written Exam.
- m. Reference guide for technical information on themes and tool identification: Agricultural Technical Systems and Mechanics, 2nd Edition © 2019, ISBN: 978-0-8269-3680-6 and/or the 1st Edition.

4. Format

The state Advanced Agricultural Technology and Mechanical Systems CDE will be developed from the subject matter areas that are listed following each of the five systems associated with the agricultural mechanics industry.

- Machinery and Equipment Systems: repair and maintenance, materials handling, processing, adjustments, metal fabrication
- Electrical Systems: AC/DC power, electrical safety, electrical standards, sensing devices, electrical wiring, controls, electronics, motors and other electrical loads, operating instructions, and manufacturer's recommendations.
- Energy Systems: mechanical power, chemical power, wind power, solar power, hydraulic power, engine operation, maintenance, troubleshooting, repair
- Structural Systems: structures, storage, concrete, masonry, plumbing, electrical, fabrication, construction, building materials, ventilation, heating, air conditioning
- Environmental and Natural Resource Systems: water quality, sustainable agricultural practices, soil and water conservation, biological waste handling

Themes that will be used include:

- 2021 - Animal Production System—Equipment: Baler
- 2022 - Material Handling Systems—Equipment: Skid Steer Loader
- 2023 - Processing Systems—Equipment: Combine
- 2024 - Plant Production Systems—Equipment: Planter
- 2025 - Integrated Pest Management Systems—Equipment: Sprayer

a. Written Exam

1. A written exam consisting of multiple-choice questions will be developed from the five system areas.
2. Participants will have 60 minutes to complete the exam.
3. The written exam will be worth 100 points.

b. Problem Solving/Skill Development Activities

1. Each individual will perform skills associated with each of the five systems.
2. A total of 20 minutes will be allowed for each section. Each section is worth 30 points.
3. These individual performance activities will be developed from the skill competency/problem solving lists identified in the chart below.
4. Total points for this section is 150 points.

c. Team Problem Solving Activity

1. Participants will compete as a team to solve a "hands on" integrated problem associated with the theme selected with the event.
2. A broad scenario will be presented to the team, the team will then have the freedom to use any and all information, organize themselves to solve the problem in their own way, and determine how they will put their solution together.
3. A total of 30 minutes per team to complete the activity. The team activity is worth 250 points.

Odd Years	
Practicums:	Agricultural Equipment listed in the theme above. Questions may be based on actual equipment and/or operator's manual.
	Metal Fabrication (MIG or Arc) – View Rubric
	Electric Motors, controls, and sensing devices
	Engine systems (large or small engines)
	Concrete, Masonry, and plumbing
Team:	Based on equipment listed in the theme above.

Even Years	
Practicums:	Agricultural Equipment listed in the theme above. Questions may be based on actual equipment and/or operator's manual.
	Metal Fabrication (MIG or Arc) – View Rubric
	Electrical Circuits
	Engine systems (large or small engines)
	Building Construction
Team:	Based on equipment listed in the theme above.

5. Scoring

<u>Activity</u>	<u>Individual</u>	<u>Team</u>
Written Test	100	300
Problem Solving (5 @ 30 pts.)	150	450
Team Activity		250
Maximum Points	250	1000

6. Awards

a. Individual

1. Individual scores will be tabulated (and do not include the team activity) and broken into gold, silver, and bronze award areas.
2. Individual ties will not be broken.
3. The high individual receives the “baby bison” trophy and a \$100 stipend.

b. Team

1. Team scores will be tabulated by adding the top three team member scores and the team activity. They will be broken into gold, silver, and bronze.
2. The high team shall be eligible to represent North Dakota in the National Agricultural Technology & Mechanical Systems career development event. The high team receives the Traveling Trophy and travel stipends to participate in the National Event.
3. Team Tie Breakers:
 - i. Written Exam Score
 - ii. Total of Individual Performance Scores
 - iii. Team Problem Solving Score



NORTH DAKOTA

Agricultural Technology and Mechanical Systems

Formulas

$$1 \text{ acre} = 43,560 \text{ square feet}$$

$$P = I \times E$$

$$Cr = \frac{Pd + CV}{CV}$$

$$I = \frac{P}{E}$$

$$E = I \times R$$

$$E = \frac{P}{I}$$

$$I = \frac{E}{R}$$

Power Used = Sum of Individual Loads

$$R = \frac{E}{I}$$

$$hp = \frac{S \times D}{375}$$

Electrical Energy = Power x Time

Cost = Electrical Energy x Rate

1 kW = 1,000 W

$$\% \text{ Efficiency} = \frac{\text{Power Output}}{\text{Power Input}} \times 100$$

$$D1 \times N1 = D2 \times N2$$

$$88 \text{ ft/min} = 1 \text{ mph}$$

$$T1 \times N1 = T2 \times T2$$

$$1.47 \text{ ft/sec} = 1 \text{ mph}$$

$$hp = \frac{2\pi T N}{33,000}$$

$$746 \text{ Watts} = 1 \text{ hp}$$

$$1 \text{ yd}^3 = 27 \text{ ft}^3$$

$$\text{Area of a Circle} = \pi r^2 \text{ or } (\pi D^2)/4$$

$$Hp = \frac{T \times rpm}{5252}$$

$$\text{Circumference of a Circle} = 2\pi r \text{ or } \pi D$$

$$\text{Volume of a Cylinder} = \pi r^2 \times h$$

$$\text{Field Capacity} = \frac{S \times W \times \text{Eff}}{8.25}$$

$$\text{Square of Shingles} = 100 \text{ sq. ft.}$$

$$MC_{dry} = \frac{WW - DW}{DW} \times 100$$

$$1 \text{ kg} = 2.2 \text{ lb}$$

$$1 \text{ ha} = 2.47 \text{ ac}$$

$$MC_{wet} = \frac{WW - DW}{WW} \times 100$$

$$1 \text{ ft}^3 = 7.48 \text{ gal.}$$



NORTH DAKOTA

Name: _____

Chapter: _____

Contestant #: _____

ND FFA - Advanced Agricultural Technology & Mechanical Systems

Welding Practicum Rubric - Weld size required (2X metal thickness)

	Needs Improvement (3 Pts)	Average (5 Pts)	Good (7 Pts)	Excellent (10 Pts)	# of Pts.	Comments
Weld Size: Weld is uniform in width throughout the entire weld.	Weld has little to no consistency in diameter.	Majority of the weld is narrower or wider than the specified size.	Majority of the weld is equal to the specified size.	Weld is uniform in width throughout the entire weld.		
Weld Contour: Weld is uniform in contour shape throughout the entire length of the weld.	Weld has little to no consistency in contour.	Majority of the weld is too convex or concave in shape with lack of fusion on the toes of the weld.	Majority of the weld has adequate convexity without being excessive.	Weld is uniform in contour shape throughout the entire length of the weld.		
Weld Crater: Weld crater is filled.	Weld crater is not filled.	Weld crater is slightly filled.	Weld crater is filled but not to the full throat thickness.	Weld crater is filled.		
Weld Bead Area: Surrounding weld bead are free of spatter or slag.	Bead is mostly spatter lack of actual bead.	Weld bead area has excessive amounts of spatter.	Majority of the weld is free of spatter.	Surrounding weld bead are free of spatter or slag.		
Weld Bead Discontinuities: Weld is free of undercut, overlap, porosity.	Little to no bead present.	Majority of the bead has discontinuities listed below.	Majority of the bead is free of discontinuities listed below.	Weld is free of undercut, overlap, porosity.		

Total Points: _____ /50

Porosity
Underfill

Undercut
Overlap

Incomplete fusion
Concave root

Incomplete penetration
Improper Leg size

Excessive reinforcement
Slag Inclusions/arch strikes