



2026

Agricultural Technology and Mechanical Systems

2026 Updates

Below is a summary of updates to the Agricultural Technology and Mechanical Systems Handbook for the 2026 convention cycle. We plan to release handbook changes that may impact instruction in June of the year prior but may finalize smaller updates through February of the competition year. All updates and changes aim to provide a positive, relevant experience for all competitors.

HANDBOOK UPDATE:

JULY 2025

JANUARY 2026

Policies and Guidelines

I. Eligibility of Students

Added — Eligibility is based on the **National FFA membership year (August 1–July 31)**—not a school’s academic calendar or “rising grade” designation.

Rationale: Clarifying that a student must be a 7th-grade member on the date of the qualifying event to compete or qualify at a state qualifying event. A student who is still a 6th-grade member on that date is not eligible to qualify and may compete for 7th-grade consideration only in qualifying events held on or after August 1.

Refer to the National FFA Career and Leadership Events webpage on [FFA.org](https://www.ffa.org) for the most up-to-date career and leadership development handbook edition.

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FFA VISION

Growing the next generation of leaders who will change the world.

FFA MISSION

FFA makes a positive difference in the lives of students by developing their potential for premier leadership, personal growth and career success through agricultural education.

FFA CODE OF CONDUCT

FFA members participating in National FFA programs understand and agree to abide by the National FFA Code of Conduct at: <https://ffa.app.box.com/s/x6l2lkovv4x9tgiegy73mei30zvli5j>

Guiding Principles

National awards and competitive events should:

1. Inspire members to explore, learn, and be prepared for future careers related to the AFNR career pathways and FFA AFNR Value Chain.
2. Recognize achievements in skill development and knowledge, including:
 - a. leveraging relevant technologies
 - b. utilizing creative problem-solving
 - c. meeting developmentally appropriate learning objectives (Bloom's Taxonomy)
 - d. utilizing employability skills (teamwork, communication, collaboration)
3. Be accessible and engaging for all students and FFA members.
4. Provide awards and recognition opportunities for students at all levels.
5. Work with other groups to utilize or partner with existing experiences.
6. Provide feedback that promotes personal and professional growth.

Agriculture, Food and Natural Resources (AFNR) Career Cluster Content Standards

The National Council for Agricultural Education has permitted the National FFA Organization to use the National AFNR Career Cluster Content Standards in developing their educational resource materials. The National Council for Agricultural Education is the owner and developer of the National AFNR Career Cluster Content Standards ©2024 and reserves all rights to the original material used here with permission. In addition, the National Association of State Directors of Career and Technical Education/National Career Technical Education Foundation (NASDCTE/NCTEF) has provided permission to use the Common Career and Technical Core (CCTC) Standards in support of this project. NASDCTE/NCTEF are the owners and developers of the Common Career and Technical Core (CCTC) Standards © 2012 and reserve all rights to the original material used here with permission.

The National FFA Organization has adopted the AFNR Career Cluster Content Standards and integrated them into the national award and recognition programs for the benefit of members, school administration, and agriculture as a whole. For a complete set of the standards, please visit the [2024 AFNR Career Cluster Content Standards](https://ffa.app.box.com/s/hrxlqvw7g6zo54xfi5x5ktylyusqjhy0). You may access the standards alignments for this event at <https://ffa.app.box.com/s/hrxlqvw7g6zo54xfi5x5ktylyusqjhy0>.

Professional Integrity

FFA members participating in national FFA programs and events understand and agree that all work must result from their own effort and ability, created, and completed alone (except for partner or chapter applications). When outside sources (direct quotes or phrases, specific dates, figures, or other materials) are used for a project, document, or application, the required reference citation must be completed according to the rules specified by the applicable handbook.

While participating in National FFA programs, FFA members are prohibited from:

- Plagiarizing
- Violating copyright
- Cheating
- Falsifying information
- Using another person's results or thoughts as their own, even with this person's permission. This includes work done by a family member or a mentor.
- Using information or data obtained from the internet without proper citation.

Any attempt to gain an unfair advantage will not be tolerated. Non-compliance represents plagiarism and will automatically disqualify a member.

Use of Artificial Intelligence (AI) for National Programs and Events

Artificial intelligence (AI) refers to computer systems capable of performing complex tasks that historically only a human could do, such as reasoning, making decisions, or solving problems. As AI continues to evolve, it can be a tremendous tool to help companies, organizations and individuals enhance their productivity and work. Therefore, the National FFA Organization allows the use of AI tools. FFA members may use AI tools, such as ChatGPT, Gemini, and CoPilot, to assist them in their learning.

Appropriate uses of AI may include:

- generating ideas for any FFA-related assignments, projects, contests and award applications
- checking facts of a phenomenon
- checking for and correcting grammatical errors in a paper written by a member

For more information, please see the [Standard Operating Procedures on the Use of Artificial Intelligence \(AI\) for National Programs and Events document](#).

Member Safety

At National FFA, we're committed to creating a safe, inclusive, and supportive environment for all members— students, educators, and families alike. We believe in fostering premier leadership, personal growth, and career success, and that starts with a community built on respect and professionalism. These guidelines outline the expectations for behavior and conduct across all FFA activities and spaces. By upholding these principles, members help ensure FFA remains a place where everyone can thrive.

Please take a moment to review these policies, [here](#) (Member Safety at FFA.org), which includes an agreement to abide by the [National FFA Code of Conduct](#). Adherence is essential—violations may result in disciplinary action, including restricted access to events.

2026 CAREER AND LEADERSHIP DEVELOPMENT EVENTS GUIDELINES

POLICIES AND GUIDELINES

I. Eligibility of Students

- a. Eligibility is based on the National FFA membership year (August 1–July 31)—not a school's academic calendar or "rising grade" designation.
- b. Each student must be a student FFA member on the current roster in good standing with the local chapter, state FFA association, and the National FFA Organization during the school year in which the student qualified to participate at the national level.
- c. If a student's name is not on the chapter's official roster, please work with the National FFA membership team to update the membership before the national event.
- d. The student, at the national event, must be:
 - i. A secondary education (grades 7-12) FFA member during the school year in which the participant qualified to participate at the national level as determined by the roster at the time of qualifying.
 - ii. A graduating senior is eligible to compete in state and national career and leadership development events up to and including their first national convention following graduation.)
 - iii. Participants in the Creed Speaking and Conduct of Chapter Meetings LDEs must qualify as a 7th, 8th, or 9th grade member.
- e. If a student moves to a different chapter or a different state once the student has qualified as a state representative in an event, that student may be allowed to compete in the national event with the school they qualified with during the qualifying year.
- f. A student may only participate in the same official CDE/LDE once. No student may participate in more than one National FFA event each year.
- g. Each student participating in a national event must complete an online Waiver and release of Liability through the convention registration system.

II. Selection/Certification of State Teams

- a. Each state will submit a team declaration form by July 1, before the national FFA convention. Participation in each declared event will incur an entry processing fee. [State Staff Declaration Instructions](#)
- b. Each team will be composed of the number of members determined by the specific event rules and formats. The members of a state team must be from the same chapter.
- c. All students must be certified online by the designated deadline of Sept. 1 or within 10 days of the qualifying date if after the deadline. Advisors or state staff must certify members in each event by the certification deadline. [How to certify a team or member instructions.](#)
- d. Once the original certification has been completed, no member may be added without first deleting a member. [\(See III. Drop/Add Process\).](#)
- e. State staff shall approve that students are eligible (See I. Eligibility of Students). [State Staff Certification Approval Instructions](#) If an ineligible student participates in any career or leadership development event, the member will be disqualified, which may also impact the team's ranking.
- f. States may approve teams comprised of fewer members than the required members.
- g. Substitutions of any student or team are subject to the determination and approval of the state association.
- h. If reputable international competitions invite teams to competition the national organization will certify National FFA Career and Leadership Development Event winners for international competition when states request. This is with the understanding that the state team will provide their travel expenses.

III. Drop/Add Process

- a. If a student needs to be substituted or dropped, the online drop/add process must be used to substitute or drop the team member. A team member must be dropped before another team member may be substituted. [How to Drop/Add a team member Instructions](#)
- b. The Drop/Add must be submitted one hour before the first event component or official activity of an event as listed in the schedule of events. Changes will not be permitted after this time.
- c. Members added to any team must meet all the eligibility and membership requirements described in this Guide's other sections.
- d. Substitutions may be allowed after the online document submission date (See individual Event Handbooks for details).
- e. Event superintendents may stop any student if they deem their manner hazardous to themselves or others. Such action may result in a zero or lower score for that student for that section of the career or leadership development event.
- f. Students who start an event and do not complete it without notifying event officials at the time of departure may be disqualified. This can affect the overall team rank and position; in some events, it could also disqualify the entire team.
- g. Students will not be allowed to utilize personal electronic communication devices other than those approved by the event officials during the entire event. Students who access personal electronic communication devices without prior approval from the event officials may be disqualified from the national event.

IV. Disqualification

- a. FFA members participating in national FFA programs and events understand and agree that all work must result from their effort and ability, created and completed alone (except for partner or chapter applications). Details about Professional Integrity, the Use of Artificial Intelligence (AI) for National Programs and Events, and the National FFA Code of Conduct are included in event handbooks.
- b. Any verbal or non-verbal communication between students during an event that is not part of the event will be sufficient cause to eliminate the team member involved from the career development event.
- c. Teams or students arriving after the career development event has begun may be disqualified or penalized. This includes a zero or lower score for that team or student for the missed section of the career or leadership development event.
- d. Any assistance given to a student from any source other than the career development event officials or assistants will be sufficient to disqualify that student from the career and leadership development event.
- h. Any CDE/LDE student, team, advisor, or coach who is proven to have gained access to event materials intended for or utilized by the event committee during the competition will be disqualified from the national event.

Purpose

Technological advances in America continue to influence how students prepare for their futures.

Students entering the workforce need a strong knowledge base and the ability to comprehend the interaction of complex systems. Employers want productive workers and managers who can access and use a broad range of information. The most sought-after employees are those who communicate effectively, stay current with modern technology, and work successfully and effectively as individuals and team members. Students with these skills and abilities are more competitive in the job market, receive financial rewards and are selected for advancement.

Agricultural technology and mechanical systems are comprised of strong technical content and are complemented by the development of practical, hands-on skills. The subject matter areas and skill development practices have been grouped into five “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 five systems areas are described with examples on the pages that follow.

Each agricultural technology and mechanical systems activity is in response to a problem or need encountered in the workplace. Solving such problems depends on how each decision or solution imposed on one component will influence the other system components. Solving one component of a problem without using a “systems approach” can, and often does, result in additional problems. An example of this is observed in the many obstacles agricultural producers face regarding environmental pollution, groundwater contamination and stricter governmental regulations. Decisions and solutions made in the past 100 years have negatively impacted the environment and resulted in new problems.

The National FFA Agricultural Technology and Mechanical Systems Career Development Event recognizes students with agricultural technology and mechanical systems competencies important to the modern workplace. The technical content and required skills include all traditional agricultural technology and mechanical systems areas. Additionally, the operation of modern equipment, the application of new management strategies and the mastering of advanced technologies are increasingly emphasized.

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

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

Event Rules and Format

Review the **Career and Leadership Development Event Policy and Guidelines** for information on eligibility, selection, certification, team member changes, disqualification and more. [General Information for National Competition](#) provides general guidance on preparing for the national competition.

Each team will be comprised of four members.

- All four participant scores will determine the total team score.

Equipment

Students Must Provide Safety Materials. Each event participant must adhere to the appropriate safe practices and work habits when performing required activities. Participants are responsible for and must provide all personal safety equipment, including welding PPE.

Eye Protection

Each team member must wear eye protection. Safety glasses must have the Z87+ rating. Individuals with prescription glasses will need either prescription safety glasses or safety glasses that can be worn over prescription glasses. Do not bring tinted safety glasses.

Individuals Must Wear Style B.

Industrial-quality eye protection should be used during the team activity and the skill/problem-solving activities. Safety glasses do not have to be worn while completing the written exam. Those with prescription eyewear, not Style B, must also wear safety glasses or goggles while participating in this event. Acceptable spectacles or goggles must adhere to the American National Standard Practice for Occupational and Education Eye and Face Protection, Z87.1 – 1979 (or Z87.1 – 1968) and revisions approved by ANSI.

Descriptions of styles A, B and C Industrial Quality Eye Protection are as follows:

Style A: This style is not acceptable for use in the event. These safety spectacles without side shields are for limited-hazard use, requiring only frontal protection. Adding accessory side shields that are not firmly secured does not upgrade style A to style B or C.

Style B: Acceptable — These are safety spectacles with wire mesh, perforated plastic or non-perforated side shields. The side shields shall be tapered, with an anatomical periphery extending at least halfway around the circumference of the lens frame. Industrial-quality eye protection for those not wearing prescription glasses shall be style B.

Style C: This style is not acceptable for use in the event. These safety spectacles have a semi- or flat-fold shield that must be firmly secured to the frame. Style C glasses do not provide maximum protection from the top and bottom angles.

Clothing

Each individual shall furnish and wear appropriate clothing for this event, such as long pants, a long-sleeved cotton shirt, coveralls, etc. Clothing must be in good repair and fit properly. Oversized or loose-fitting clothing is dangerous around agricultural equipment and is not allowed. Long sleeves must be worn when welding or oxy-fuel cutting. No open-toed or mesh-top footwear shall be worn during the event.

Other Materials

Each participant must have a clipboard, two sharpened No. 2 pencils and an electronic calculator. Calculators used in this event should be battery-operated and silent. Electronic communication devices such as cell phones, smartwatches, and PDAs cannot be used as calculators.

Computers

Each team must bring a laptop with a functioning USB port and the necessary user and administrative privileges. Students should set up and operate their laptops independently.

A USB flash drive will be provided for saving and printing documents. Minimum computer specifications will be available on the event webpage and in the team orientation packet. Laptops must be compatible with Microsoft Office® and capable of reading .pdf files.

There will be no internet access, so web-based applications are not allowed. Visit the event website (<https://schumacherl.mufaculty.umsystem.edu/home/national-ffa-webpage>) to download the checklist for computer and calculator requirements.

Make sure you can download activity instructions from the USB and submit your document in a format readable by a Windows-based system for judging.

Specialized safety equipment

- Each team should provide necessary personal protective equipment (PPE), including safety glasses (Z87+), basic welding helmets or goggles with a minimum of a shade 10 lens, fire-resistant welding jackets/shirts, gauntlet-style welding gloves, welding leathers, hearing protection devices in good condition (i.e., no frays on pants), and shoes without mesh. Hooded shirts do not qualify as welding jackets. **Participants without proper PPE and welding attire will not be allowed to weld.**
- All other required tools and equipment, not including PPE, will be furnished for the event. Teams/individuals may choose to use their equipment **subject to approval by the event superintendent**. Requests to the superintendent should be completed by Sept. 1 or within 10 days of the qualifying date. Requests will be denied if the use of the equipment places the team/individual at an unfair advantage or disadvantage.
- Team members who need specialized or modified equipment due to disability, as defined by the Americans with Disabilities Act, must submit a [Request for Accommodation Form \(ADA and Other\)](#) to the National FFA Organization 30 business days before the start of the event. Advisors of students needing reasonable accommodations (ADA, food allergies, IEP, or other conditions) that may affect event participation must complete the online Request for Accommodation Form at least 30 days in advance (**by September 15**). If any student is not in your classroom, please **confirm their status with their other teachers**. National FFA cannot guarantee that we can secure and provide the requested accommodation for late or on-site requests. This may result in the student being denied participation in a component of the event.
- All requests will remain confidential, and a national FFA staff member will contact the participant's advisor to gather additional information and/or discuss the requested reasonable accommodation(s) or assistance. For questions about the ADA and/or other Accommodation Process, please email ADARequests@ffa.org.
- If a team member needs modified equipment due to physical size and stature, the student must supply this equipment, and a request should be submitted. The team

member or coach must present the student-supplied equipment to the event superintendent before the start of the event for approval.

- On-site requests will be reviewed; however, National FFA makes no guarantee that we can secure and provide the requested accommodation.

Event Areas

The National FFA Agricultural Technology and Mechanical Systems Career Development Event is divided into the following areas. Each area includes competencies common to agriculture. Students will be assessed on their proficiency as individuals and as a team. Specific competencies will be identified annually from the following areas:

- **Machinery and Equipment:** Repair and maintenance, materials handling, processing, adjustments, metal fabrication.
- **Electricity:** AC/DC power, electrical safety, electrical standards, sensing devices, electrical wiring, controls, electronics, motors and other electrical loads, operating instructions, and manufacturer's recommendations.
- **Compact Equipment:** Mechanical power, electrical power, hydraulic power, engine operation, maintenance, troubleshooting, repair.
- **Structures:** Structures, storage, concrete, masonry, plumbing, electrical, fabrication, construction, building materials, ventilation, heating, and air conditioning.
- **Environment and Natural Resources:** Water quality, sustainable agricultural practices, soil and water conservation, surveying, biological waste handling.

TEAM ACTIVITIES

The individuals on each state team will work together and be evaluated as a team while solving the multi-system agricultural problem(s) selected from the skills and problem-solving components of the five system competency areas.

The specific problem scenario is presented to the team on the day of the event. Team members will utilize the materials and equipment provided to solve the problem(s) and prepare a computer-generated report. Teams will organize themselves, assign duties and complete tasks together or separately depending on individual skills and abilities. Each team will receive a score, and each team member will receive one-quarter of the total team activity score. The team activity score will be based on the finished product, the process, teamwork, and the written report.

The team activity will be evaluated as follows:

- **Teamwork process:** 100 points.
- **Team report:** 50 points.
- **Finished product:** 250 points.
- **Total for team activity:** 400 points.

INDIVIDUAL ACTIVITIES

Students should be prepared to convert decimals to fractions throughout the event.

Five practicum areas

Each student is individually evaluated in each of the five areas. The specific activities occurring in each event are not announced before the event. Each student is allowed 25 minutes to complete each of the five activities.

Written examination

Each student will complete an examination consisting of 25 problem-solving and multiple-choice questions, with each question worth two points. The exam includes five questions from each of the five areas of agricultural technology and mechanical systems, featuring a combination of three math questions and two systems-based questions. Students will have 60 minutes to complete this portion of the career development event.

Each student needs a calculator to complete this examination. Calculators may not be shared between students, and cell phone calculator apps cannot be used. Formulas and conversion values are provided.

Do not round off intermediate answers when using the calculator to solve these problems. If a diagram, picture, or table from another page is needed to answer a question, the question will refer to the appropriate figure/page.

Annual Event Announcements

Agricultural Technology and Mechanical Systems (ATMS) CDE Workroom is posted on the [CDE/LDE webpage](#) on FFA.org. Specific information and event updates generally occur following each year's event during November, June and August. The schedule for announcing event information and equipment selection details is governed by equipment availability and changes from equipment manufacturers, dealers, and contributors.

Scoring

Event participants are evaluated as follows:

Activity	Individual Points	Team Points
Written examination	50	200
Individual activities :(5 @ 30 points each) • Machinery and Equipment • Electricity • Compact Equipment • Structures • Environment & Natural Resources	150	600
Team activity (1/4 of total team activity score) • Teamwork process: 100 points • Team report: 50 points • Finished product: 250 points	100	400
Total Possible Score	300	1200

Tiebreakers

Team

The team activity scores will break a tie in the team rankings. If a tie still exists, the combined written exam scores will be used to break the tie.

Individual

If a tie exists among individuals, the combined highest individual/activities scores will break the tie(s). If the tie persists, the highest written examination score will be used to break the tie.

Awards

Awards will be presented to individuals and teams at the awards ceremony based on their rankings. Advisors of cash award recipients will receive information about claiming their award following the convention. Guidelines for amounts and recipients of cash awards can be found [here](#).

The high-scoring individual in each of the five system skill/problem-solving areas and the high-scoring team in the team activity will be recognized with a certificate. The scores used to award this recognition include the exam questions and individual problem-solving/skill activity associated with each system area.

References and Resources

This list of references is not intended to be all-inclusive. Other sources may be utilized, and teachers are encouraged to use the best instructional materials available. The following list contains references that may prove helpful during event preparation.

The National FFA Agricultural Technology and Mechanical Systems Career Development Event aims to guide and promote quality instructional programs in agricultural technology and mechanical systems. The multiple-choice test questions are written to be generic in nature and are selected from a variety of sources. The intent of the national event committee is to reflect current technological practices common to the agricultural production industry. Refer to the CDE website for additional references and resources.

Past CDE materials and other resources are available on [FFA.org](https://www.ffa.org)

Information specific to each annual event is available under the heading “**Workroom**” on the National FFA Agricultural Technology and Mechanical Systems Career Development Event webpage at <https://www.ffa.org/participate/cde-1de/>.

Specific information and event updates generally occur following each year's event during November, June and August.

- FOS. John Deere
- FMO. John Deere
- Agricultural Power and Machinery. (CD format) CEV Multimedia. LTD
- Agricultural Engineering Technology. (ASABE) Springer Science + Business Media, LLC
- Mechanics in Agriculture. Prentice Hall
- Agricultural Mechanics Fundamentals and Applications. Delmar and Thompson
- Modern Agricultural Mechanics, V3. Prentice Hall
- Developing Shop Safety Skills. American Association for Vocational Instructional Materials
- Power Tool Safety and Operation. Hobar Publications
- Practical Farm Buildings. Prentice Hall
- National Electrical Code (latest edition). NFPA
- Ag Wiring Handbook. Rural Electricity Resource Council
- Mechanical Technology in Agriculture. Prentice Hall
- Agricultural Mechanics and Technology Systems, 2nd Edition, <https://www.g->

w.com/agricultural-mechanics-technology-systems-2024

- Agricultural Technical Systems and Mechanics by Koel, Maur, Moniz & Radcliff, American Technical Publishers (ATP)
- Industry websites
 - [Briggs and Stratton](#)
 - [Caterpillar | Caterpillar Inc.](#)
 - [John Deere](#)
 - [New Holland](#)
 - [Lincoln Electric](#)

Event-Related Competencies

The following statements with specific understandings and performances are examples of the areas of the system identified. Examination questions are primarily developed from problem-solving categories.

The skills categories are the basis for performance activities. Problem-solving activities are developed from both problem-solving and skills categories. In each system area, the requirements for effective communication, problem-solving activities and the application of modern technology—specifically computers and computer software—are strongly emphasized. The industry has identified important skills, abilities, and competencies that new employees need. These important attributes are *described following the list of system competencies*.

Machinery/Equipment Systems Competencies

- Identify safe machinery operational practices.
- Identify the recommended service and maintenance operations from the operator's manual.
- Identify and use the Nebraska Tractor Test or PAMI results.
- Select lubricants for machinery and equipment.
- Identify functions of machinery components.
- Identify parts and functions of hydraulic systems.
- Identify and compute harvest losses.
- Identify safe adjustment [level] on power equipment.
- Select pipe sizes to meet pressure and flow requirements.
- Identify repair procedures, techniques and materials.
- Match tractors to implement.
- Check and adjust driveline components.
- Adjust equipment hitches and drives.
- Install, adjust and service belt and chain drives.
- Select and use test equipment, including meters, tachometers and timing devices, to determine proper machine operation.
- Adjust and/or calibrate chemical application, seeding, fertilizing, harvesting, processing and materials handling machinery.
- Install, operate, maintain, adjust and evaluate machine systems for field conditions.

- Inflate tires to proper air pressure (e.g., load inflation tables).
- Join metals with appropriate fasteners.
- Select tools and materials for specific repair jobs.
- Select and use appropriate safety equipment.
- Identify safe machinery operation practices for field and highway conditions.
- Identify the recommended service and maintenance operations from the operator's manual.
- Select fuels, lubricants, hydraulic fluids and coolants for proper operation.
- Operating and interpreting circuit diagrams and flowcharts for electrical, hydraulic, fuel, oil, cooling, intake and exhaust systems.
- Identify the function and operating principles of clutches, transmissions, control devices and brakes.
- Describe principles of power transmission.
- Identify the parts and functions of electrical, hydraulic, lubrication, cooling, governor and fuel systems.
- Select proper ballast for machinery weighting.
- Conduct a pre-operation inspection of a tractor or implement.
- Start, stop and operate machinery/engines.
- Perform recommended periodic service jobs (as found in operator's manuals).
- Conduct onboard tractor monitor checks as identified in the operator's manual.
- Select and use engine overhaul equipment, including valve, cylinder, piston, seal and bearing tools.
- Service and maintain fuel, air intake and exhaust, cooling and lubrication systems.
- Operate the engine and adjust or check ignition timing, engine speed and carburetor adjustments.

Electrical Systems Competencies

- Use appropriate standards for agricultural applications, including the National Electrical Code (NEC), Electrical Testing Laboratory (ETL), Factory Mutual, Underwriters Laboratory (UL), Canadian Standard Association (CSA) and/or OSHA standards.
- Identify the characteristics of single and three-phase circuits.
- Plan and evaluate proper grounding systems and ground-fault protection.
- Determine volt, amp and ohm relationships (Ohm's and other application laws).
- Select adequate and appropriate lighting fixtures.
- Select motors based on the type of application.
- Interpret electric motor nameplate data.
- Identify electric motors and motor parts.
- Identify methods of providing electric motor protection.
- Interpret power (horsepower, kilowatt), power factor, torque and other motor selection criteria.
- Calculate heating and cooling loads.
- Identify and describe basic principles of controls, including thermostats, humidistats, photoelectric, magnetic relays; programmable controllers; proximity switches and

sensors; ultrasonics; timers and other time-delay equipment and pressure, motion, limit, float and sail switches.

- Select controls from supply catalogs/websites.
- Select appropriate wire sizes and protection devices for specific circuit loads and lengths.
- Use low-voltage electrical control equipment.
- Use electrical test instruments such as a VOA (volt-ohm-amp) meter, DMM (digital multimeter) and tachometer.
- Read schematics and sketch wiring circuits.
- Install service entrance for single-phase 120/240V service or three-phase power.
- Connect and operate electrical motors to the power source.
- Change the direction of electric motor rotation.
- Select and mount an electric motor on a machine.

Compact Equipment Systems Competencies

Compact Equipment is defined here as being 30 horsepower or less.

- Interpret horsepower, torque and other power measurement criteria.
- Compare costs of alternative machine uses.
- Describe the operating principles of two-stroke and four-stroke spark or compression ignition engines.
- Evaluate engine/electric motor performance under load and no-load operation.
- Determine hydraulic cylinder force and speed.
- Interpret wiring diagrams/schematics.
- Identify and select devices for automated systems.
- Match tractors to implements.
- Select energy-efficient equipment and materials.
- Identify energy conservation measures to reduce costs and operation(s).
- Determine energy consumption and cost savings of alternatives.
- Conduct equipment pre-operation inspection.
- Start, stop and operate machinery and engines.
- Perform recommended periodic service jobs (as found in operator's manuals).
- Use measuring tools and test instruments such as micrometer and telescoping gauges, dial indicator, compression tester, torque wrench, VOA (volt-ohm-amp) meter, DMM (digital multi-meter), timing devices, tachometer and dynamometer for determining test procedures.
- Remove, service and replace electrical components.
- Test and service batteries, charging, lighting, warning and cranking systems.
- Select and use engine overhaul equipment, including valve, cylinder, piston, seal and bearing tools.
- Service and maintain fuel, air intake and exhaust, cooling and lubrication systems.
- Operate the engine and adjust or check ignition timing, engine speed and carburetor adjustments.
- Measure energy output or consumption by devices and cost savings of alternatives.

Environmental and Natural Resources Systems Competencies

- Identify environmental problems in livestock and crop handling and processing buildings.
- Read and interpret maps, including those of conservation, land use, soils, topographic, aerial, remote sensing and geological surveys.
- Describe principles involved in appropriate conservation and/or land-use planning.
- Interpret legal land descriptions and determine land area.
- Conduct land surveying practices
- Select terracing and water diversion options for soil conservation.
- Select strip-cropping principles and practices.
- Select water management techniques, including grassed waterways, parallel terrace outlets, tile outlet systems and erosion control structures.
- Determine types of vegetative cover and mulch for erosion stabilization.
- Determine and select appropriate cultural tillage or mechanical practices of equipment for specific soil types and residue management.
- Calculate soil loss using universal equations and determine the effects of the components of the equations.
- Determine appropriate types, locations and uses of erosion- and sedimentation-control basins.
- Describe and/or calculate surface and subsurface drainage and irrigation techniques.
- Determine land shaping and grading requirements.
- Select irrigation systems for specific conditions.
- Select irrigation equipment and techniques.
- Determine power requirements and pump size for specific applications.
- Apply water pressure, flow and head concepts.
- Select pumps and power sources and compare efficiencies.
- Interpret pump characteristics' curves.
- Utilize GPS systems and components.
- Lay out grade stakes for cuts/fills.
- Determine soil types and select appropriate structures or practices.
- Use water-testing equipment.
- Layout and map contour lines.
- Measure crop residue on the land.
- Identify soil limitations and determine the effects on land use.
- Assemble turf irrigation equipment.
- Install drainage systems or components.
- Install components of irrigation systems for specific applications.

Structures Systems Competencies

- Determine the size, specifications and layout of a building.
- Develop a bill of materials.
- Interpret plans and working drawings.
- Select and plan concrete construction.

- Interpret lumber and manufactured wood product grade stamps.
- Determine ventilation air requirements for intake and exhaust fan capacity.
- Select alternative construction styles and components (stud frame, post frame, rigid arch and stressed skin).
- Select arc welding machines and accessories.
- Read drawings and welding symbols.
- Test weld quality.
- Select, assemble and check welding equipment and supplies.
- Operate welding equipment and accessories for metal joining operations.
- Select tools and perform operations for cold-metal working.
- Read metal-working plans and prints.
- Select paint and other finishing materials.
- Use and maintain concrete and masonry tools and equipment.
- Fabricate and install reinforcing steel bars and welded wire mesh.
- Select and apply appropriate roofing, insulation and vapor barrier materials.
- Identify types of metals.
- Recommend metals based on load-bearing strength.
- Fuse and braze weld basic joints on mild steel and cast iron.
- Estimate and calculate welding materials costs.
- Cut metal with a plasma cutting unit.
- Operate power tools such as nibblers, drills and saws.
- Operate hand tools such as saws and files.
- Select appropriate metals for projects (strength).
- Cut and assemble plastic pipe.
- Solder copper fittings, tubing and copper wire.

General Cluster Skills

- Demonstrate strong interpersonal communication abilities.
- Demonstrate knowledge combined with leadership qualities and the ability to delegate responsibilities.
- Use people skills to deal with customers, the public and large groups.
- Identify and interpret the correct resources to make an educated decision.
- Understand and apply principles of mathematics, economics, biology and physics.
- Have a high level of common sense, logic and critical thinking skills.
- Think independently and analytically.
- Ability to understand and follow detailed instructions — written and oral.
- Display motivation to learn from various methods of instruction.
- Utilize current technologies — computers, electronics, mechanical systems, etc.
- Calculate cost per unit, hour, bushel, acre, etc.
- Estimate the value of equipment and recommend future buying decisions.
- Use technology to eliminate waste of time and resources.
- Use computer hardware, software, internet, etc.

- Productively use time, money and people.
- Be knowledgeable of global agriculture, which encompasses planning, production, marketing, and finance.
- Use cash flow for critical business planning and operation.
- Measure and estimate costs and develop plans for business/ industry improvements.
- Write annual goals with specific objectives and measurement tools for review.
- Demonstrate skills in business operations and management.
- Use a systematic approach to diagnose equipment problems.
- Service and maintain equipment to maintain optimum productivity.
- Use on-board computerized systems that monitor, test, store and report equipment operation.
- Be familiar with computerized recognition of crop productivity and quality, field conditions and pests.
- Understand electrical circuits — amperage, watts, voltage, resistance and transistors.
- Understand hydraulic system operation — flow, resistance and temperature.
- Understand mechanical system operation — mechanical advantage, material specifications and gear design.
- Read schematics and replace components, including control modules.
- Diagnosis of electrical, computer, mechanical and hydraulic systems.
- Analyze mechanical system failures.

Safety Rubric

25 POINTS

	Very strong evidence of skill 5–4 points	Moderate evidence of skill 3–2 points	Weak evidence of skill 1–0 points	Points Earned	Weight	Total Points
Safety glasses	Safety glasses are worn by all team members at all times with one or no reminders.	Safety glasses are worn by team members most of the time with two to three reminders.	Safety glasses are worn rarely by team members with four or more reminders.		X2	
Safety practices	Safety practices used at all times.	Safety practices used most of the time with minor violations.	Moderate to major violations of safety practices observed.		X1	
Injuries	No injuries occurred during the activity.	Minor injuries occurred during the activity requiring no medical attention.	Moderate to severe injuries occurred during the activity.		X2	
TOTAL POINTS EARNED OUT OF 25 POSSIBLE						

Team Activity Process Rubric

100 POINTS

	Very strong evidence of skill 5–4 points	Moderate evidence of skill 3–2 points	Weak evidence of skill 1–0 points	Points Earned	Weight	Total Points
Communication	All team members effectively communicate with each other throughout the entire activity.	Most team members communicate fairly effectively with each other during most of the activity.	Communication between team members is ineffective and sporadic during the activity.		X4	
Work distribution	Work was evenly distributed between all team members and all team members were employed at all times.	Work was distributed between two to three team members, and these members were employed most of the time.	Work was completed by only one team member with little employment of the other members.		X8	
Time management	All team members managed their time efficiently.	Most team members managed their time fairly efficiently.	One (or no) team member managed their time efficiently.		X4	
Team organization	Team started right away, had no down time and was not rushed at the end of the task.	Team was delayed in starting, had down time and was somewhat rushed at the end of the task.	Team delayed starting, had long down times and did not complete all tasks during the time allotted.		X4	
TOTAL POINTS EARNED OUT OF 100 POSSIBLE						

Team Activity Writing Summary Rubric

50 POINTS

	Very strong evidence of skill 5–4 points	Moderate evidence of skill 3–2 points	Weak evidence of skill 1–0 points	Points Earned	Weight	Total Points
Introduction <i>Written in narrative form</i>	Concise and brief overview of the team activity is provided and written in narrative form that accurately describes the activity.	Somewhat elaborate and lengthy overview of the team activity is provided and partially written in narrative form that somewhat describes the activity.	Introduction rambles without describing the activity or was too brief to adequately describe the activity. Narrative form was not used.		X1	
Delegation of tasks <i>Begins with an introductory sentence. The remainder can be written with bullet points.</i>	Fully explains how the labor and responsibilities were divided and how the group worked as a team. Identifies the division of labor and management.	Partially explains how the labor and responsibilities were divided and how the group worked as a team. Partially identifies the division of labor and management.	Vaguely explains how the labor and responsibilities were divided and how the group worked as a team. Vaguely identifies the division of labor and management.		X2	
Discussion and success or challenges <i>Begin with an introductory sentence. The remainder can be written with bullet points.</i>	Fully identifies portions of the activity where the team succeeded and portions of the activity where the team struggled.	Partially identifies successes and challenges by only including successes or only including challenges. Partially describes successes and challenges.	Omits success and challenges or rambles without clearly identifying what portions of the activity were successful for the team or what portions were struggles.		X1	
Steps to designing the product <i>Use this section to briefly describe the process you went through to design the product</i>	All needed steps are included for designing the product constructed. All steps are clearly described.	Most steps are included for designing the product constructed. Some steps included are not clearly described.	A few or none of the steps are included for designing the product constructed. Steps included do not describe the steps to designing the product.		X1	
SUBTOTAL POINTS EARNED						

	Very strong evidence of skill 5–4 points	Moderate evidence of skill 3–2 points	Weak evidence of skill 1–0 points	Points Earned	Weight	Total Points
Steps to construction Explain to another group the process of constructing the product built in this activity. <i>Begin with an introductory sentence. The remainder can be presented in numbered statements.</i> <i>This part of the report can be an opportunity to make suggestions that would improve the process where you experienced specific challenges.</i>	Complete and thorough steps are listed including suggestions to improve the process. Steps provide clarity so another team could follow the steps and construct the same product.	A partial list of steps are listed including suggestions to improve the process. Steps provide moderate clarity for another team to construct the same product.	Few, if any, steps are listed with minimum suggestions to improve the process. Steps are vague, and another team would struggle to construct the same product using these steps.		X2	
Annual team activity details <i>Each year this will vary depending on activity details.</i>	A complete description related to the annual team activity is provided.	A partial description related to the annual team activity is provided.	Few, if any, details are related to the team activity.		X1	
Safety	A complete list of safety practices is included in the report	A partial list of safety practices is included in the report.	Few, if any, safety practices are included in the report.		X1	
Conclusion	A concise, complete description of what the team learned and the benefits of completing the activity are included.	A somewhat elaborate, and lengthy, incomplete description of what the team learned and the benefits of completing the activity are included. Or a very brief conclusion that only partially describes what the team learned is included.	An elaborate and lengthy conclusion, with little or no description of what the team learned or the benefits of completing the activity is included. Or a missing or extremely brief conclusion does not describe what the team learned.		X1	
TOTAL POINTS EARNED OUT OF 50 POSSIBLE						