

AG. 225 AGRICULTURAL SYSTEMS/ELECTRICITY AND HYDRAULICS

COURSE DESCRIPTION: A course designed to develop skills in operation of tools and equipment, wiring, controls, electric motors, and hydraulics.

UNITS OF INSTRUCTION	MINUTES OF INSTRUCTION
Safety	235
Electric Tools and Equipment	235
Electricity and Wiring	1,175
Electrical Controls	940
Electric Motors	940
Agricultural Hydraulic Systems	705
TOTAL MINUTES	4,230

A. Safety

1. Identify safety equipment necessary for agricultural power technology
2. Apply basic laboratory safety instruction
3. Describe safety practices when using electrical equipment
4. Apply safety practices when using tools and equipment

B. Electrical Tools and Equipment

1. Identify, adjust, maintain and properly use the following tools:
 - a. volt meter
 - b. amp meter
 - c. ohm meter
 - d. portable GFCI
 - e. wire stripper
 - f. circuit tester
 - g. continuity tester
 - h. linesman pliers
 - i. conduit bender
 - j. fish-tape
 - k. deburring tool
 - l. growler

C. Electricity and Wiring

1. Describe electrical energy and how it works
2. Define common electrical terms and their relationships
3. Determine the amount of electrical energy used
4. Compute the cost of using electrical energy
5. Read and interpret wiring plans
6. Locate and mark routes for small appliances, general purpose and individual circuits
7. Install device boxes and outlet boxes
8. Install 120-volt, 120/240-volt circuits
9. Connect receptacles, switches and fixtures for each circuit
10. Ground the electrical system and equipment
11. Determine the type and size of service entrance equipment to install
12. Install service entrance equipment using cable or conduit with overhead or underground conductors
13. Install ground fault circuit interrupters
14. Install conduit
15. Estimate wiring costs
16. Install wiring for agricultural and other utility buildings

D. Electrical Controls

1. Describe the function and importance of controls and control circuits in the operation of electric equipment
2. Explain the terminology and symbols used in discussing electric control circuits
3. Identify the characteristics of automatic and non-automatic control systems
4. Identify the characteristics of switches most commonly used in control circuits
5. Connect the tumbler switch having a built-in overload protector into a motor circuit
6. Explain how the overload protection device protects the motor from short circuit or overload damage
7. Identify the function of a limit switch
8. Connect a limit switch into a motor circuit
9. List the characteristics of relays and the function of relay devices in control circuits
10. Connect the relay into a control circuit
11. Connect a time-delay relay into a motor control circuit
12. Identify the characteristics and types of motor control devices in an electrical circuit
13. Connect a commercial type starter switch and stop-start push-button stations into a motor control circuit
14. Describe the automatic sensing control devices available and how they might be applied in the control circuits used on the farm and in the home
15. Connect automatic sensing control devices into a control circuit
16. Explain how the automatic sensing control devices control an electric load

E. Electric Motors

1. Describe factors needing consideration if electric motors were to be replaced by alternative power sources
2. Use nameplate information to describe an electric motor
3. Identify electric motors by type
4. Match types of electric motors to starting load and duty characteristics
5. Identify major construction characteristics of electric motors by type of enclosures, mounts, bearings and lubrication systems
6. Spot motor ailments by sight, sound and touch
7. Use an organized trouble shooting procedure to identify the specific problem
8. Decide which problems can be corrected in place and which require removal to repair station
9. Identify possible causes and results of overloading an electric motor without overload protection
10. Recognize the modus operandi for overload protection devices
11. Replace or reset activated overload protection devices
12. Determine and order proper size of components for drive systems needing replacement
13. Remove and replace the needed drive systems
14. Explain how the poles of permanent magnet and electro-magnet attract and repel each other
15. Describe how the attracting and repelling forces of an electro-magnet can cause a free rotating magnet to turn
16. Identify a split-phase motor and a shaded-pole motor based on major internal parts and characteristics

17. Explain the operating principles of a split phase and shaded-pole motor integrating the parts and characteristics identified
18. List and describe loads requiring low starting torque
19. Identify capacitor-start motors based on major internal parts and characteristics
20. Explain the operating principles of the capacitor start motor integrating the parts and characteristics identified
21. List and describe loads requiring moderate starting torque
22. Identify repulsion-start and universal motors based on major internal parts and characteristics
23. Explain the operating principals of a repulsion start and universal motors integrating the parts and characteristics identified
24. List and describe loads requiring high starting torque
25. Identify electric motors that are reversible and are dual-voltage based on operating principles, nameplate information and wiring diagrams
26. Identify the leads to the starting and running windings of electric motors
27. Explain the operating principles involves when changing rotation and/or voltage of electric motors

28. Change the rotation and voltage of electric motors
29. Use the following terms in analyzing electric motors:
 - a. torque
 - b. starting current
 - c. horsepower
 - d. voltage drop
 - e. efficiency
 - f. power factor
 - g. apparent power
 - h. real power
30. Use a prony break, watt meter, volt meter, amp meter and appropriate formulas to collect data on various motors
31. Analyze the data and draw appropriate conclusion
32. Select an electric motor for a particular work situation according to the following variables:
 - a. power requirement of the load
 - b. capacity of the electric service entrance
 - c. speed requirements of the load
 - d. duty time required
 - e. starting torque required
 - f. direction of rotation
 - g. cost
33. Select the type of motor enclosure needed for a particular environment
34. Select the type of bearings and lubrications system needed based on the method and frequency of lubrication and the mounting position
35. Use a manufacturer's catalog and order the motor most nearly matching specifications given
36. Select the correct size of wire for the electric motor used
37. Order or purchase materials for installation of a motor
38. Evaluate hypothetical or real motor installations

F. Agricultural Hydraulic Systems

1. Identify the applications of hydraulics in agriculture
2. Identify the components of a hydraulics system
3. Define terminology associated with hydraulic systems
4. Describe operating principles of hydraulic systems
5. List the advantages and disadvantages of utilizing hydraulics in agriculture
6. Read and interpret basic hydraulic schematic diagrams
7. Select the proper hydraulic fluid for a specific hydraulic system and operating condition
8. Drain, flush and refill hydraulic systems on agricultural equipment
9. Service and maintain hydraulic seals and packings
10. Select hydraulic tubing, pipe and remove hoses to fulfill specific pressure, volume and exposure requirements
11. Service, maintain and/or operate hydraulic fittings and couplers

12. Service and maintain hydraulic fluid filters
13. Trouble-shoot hydraulic motor operating problems
14. Select hydraulic motors to fit specific applications on agriculture equipment and power units
15. Determine relief valve pressure setting by the T-test method