

**North Carolina FFA Association
Agricultural Mechanics Career Development Event**

Three (3) of the following Agricultural Mechanics Performance Skills will be selected for the state competition.

Agricultural Mechanics Performance Skill 1P

Make a Butt Joint Weld in the Flat Position

Instructions to Participant

Using the proper safety and welding equipment and the electric arc welder, choose two or three pieces of ¼" x 2" x L" metal and the correct electrodes from the choices provided as directed by the event superintendent. Place practice beads on the third piece of metal to adjust the welder amperage to match the metal characteristics if so desired. **The practice metal is not required and will not be graded.**

Perform the skill for grading using one electrode and two pieces of properly prepared ¼" x 2" x 4" metal. This bead weld is to be performed in the flat position and applied to only one side of the metal pieces. Place the metal so that the butt joint is formed as a **single pass weld along the 4" joint.** **The weld will be judged on quality penetration and appearance.**

Safety Equipment Needed:

Welding helmet with adjustable shading lens or minimum #10 shaded lens

Safety glasses and/or goggles for use at all times

Welding gloves and proper leather closed-toe shoes that covers the entire sock or skin

Clothing that covers the entire body to include the arms and legs

Agricultural Mechanics Performance Skill 1.1P

Make a Butt Joint Weld in the Flat Position (length to be determined by Event Official)

Instructions to Participant

Using the proper safety and welding equipment and the electric arc welder, choose two or three pieces of $\frac{1}{4}$ " x 2" x L" metal and the correct electrodes from the choices provided as directed by the event superintendent. Place practice beads on the third piece of metal to adjust the welder amperage to match the metal characteristics if so desired. **The practice metal is not required and will not be graded.**

Perform the skill for grading using electrode(s) and two pieces of properly prepared $\frac{1}{4}$ " x 2" x L" metal. This butt weld is to be performed in the flat position as a **single pass bead along the L" joint** with the weld bead applied evenly to the topside of both metal pieces. **The weld will be judged on quality, appearance, penetration and equal bead placement on both pieces of metal.** (1.1J Rubric as specific criteria)

L" or Length in Inches may vary and will be determined by the event superintendent.
Multiple electrodes will usually be required to complete the weld.

Safety Equipment Needed:

Welding helmet with adjustable shading lens or minimum #10 shaded lens.

Safety glasses and/or goggles for use at all times.

Welding gloves and proper leather closed-toe shoes that cover the entire sock or skin.

Clothing that covers the entire body to include the arms and legs.

Agricultural Mechanics Performance Skill 1.2P Make a T fillet Weld in the Flat Position

Instructions to Participant

Using the proper safety and welding equipment and the electric arc welder, choose two or three pieces of $\frac{1}{4}$ " x 2" x L" metal and the correct electrodes from the choices provided as directed by the event superintendent. Place practice beads on the third piece of metal to adjust the welder amperage to match the metal characteristics if so desired. **The practice metal is not required and will not be graded.**

Perform the skill for grading using electrodes and two pieces of properly prepared $\frac{1}{4}$ " x 2" x L" metal. Place the two pieces of metal so the ***T-joint*** is formed and tack weld before rotating them to rest on the provided 45° jig so that the joint to weld is facing up in the flat position. **(The event superintendent will provide the jig).** Then weld a single pass along the L"-length of the upward facing joint, placing the bead evenly on both pieces of the metal. **The weld will be judged on quality, appearance, penetration and equal bead placement on both pieces of metal.** (1.2J Rubric as specific criteria)

L" or Length in Inches may vary and will be determined by the event superintendent.
Multiple electrodes will usually be required to complete the weld.

Safety Equipment Needed:

Welding helmet with adjustable shading lens or minimum #10 shaded lens

Safety glasses and/or goggles for use at all times

Welding gloves and proper leather closed-toe shoes that covers the entire sock or skin

Clothing that covers the entire body to include the arms and legs

Agricultural Mechanics Performance Skill 1.3P Make a T fillet Weld in the Horizontal Position

Instructions to Participant

Using the proper safety and welding equipment and the electric arc welder, choose two or three pieces of $\frac{1}{4}$ " x 2" x L" metal and the correct electrodes from the choices provided as directed by the event superintendent. Place practice beads on the third piece of metal to adjust the welder amperage to match the metal characteristics if so desired. **The practice metal is not required and will not be graded.**

Perform the skill for grading using electrodes and two pieces of properly prepared $\frac{1}{4}$ " x 2" x L" metal. Place the two pieces of metal so the ***T-joint*** is formed and tack weld before rotating them to rest on the provided 45° jig so that the joint to weld is facing outward in the horizontal position. **(The event superintendent will provide the jig).** Then weld a single pass along the L"-length of the outward facing joint, placing the bead evenly on both pieces of the metal. **The weld will be judged on quality, appearance, penetration and equal bead placement on both pieces of metal.** (1.3J Rubric as specific criteria)

L" or Length in Inches may vary and will be determined by the event superintendent.
Multiple electrodes will usually be required to complete the weld.

Safety Equipment Needed:

Welding helmet with adjustable shading lens or minimum #10 shaded lens

Safety glasses and/or goggles for use at all times

Welding gloves and proper leather closed-toe shoes that covers the entire sock or skin

Clothing that covers the entire body to include the arms and legs

Agricultural Mechanics Performance Skill 1.4P Make an Outside Corner Joint Weld

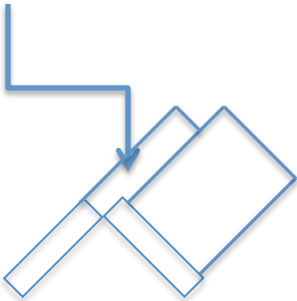
Instructions to Participant

Using the proper safety and welding equipment and the electric arc welder, choose three pieces of $\frac{1}{4}$ " x 2" x L" metal and the most appropriate electrodes from the choices provided. Place practice beads on one piece of metal to adjust the welder amperage to match the metal characteristics if so desired. **(The practice metal is not required and will not be graded.)**

Perform the skill for grading using selected electrodes and two pieces of properly prepared $\frac{1}{4}$ " x 2" x L" metal. Place the metal so that the butt joint is formed as seen in the picture below. This weld is to be performed in the flat position as a single pass weld and applied evenly to both metal pieces along the upward facing L" joint. **The weld will be judged on quality, appearance, penetration and equal bead placement on both pieces of metal.** (1.4J Rubric as specific criteria)

L" or Length in Inches may vary and will be determined by the event superintendent.
Multiple electrodes will usually be required to complete the weld.

single pass weld along the L" joint



Safety Equipment Needed:

Welding helmet with adjustable shading lens or minimum #10 shaded lens

Safety glasses and/or goggles for use at all times

Welding gloves and proper leather closed-toe shoes that covers the entire sock or skin

Clothing that covers the entire body to include the arms and legs

Agricultural Mechanics Performance Skill 1.5P Make a Vertical Up Butt Joint Weld

Instructions to Participant

Using the proper safety and welding equipment and the electric arc welder, choose two or three pieces of ¼" x 2" x L" metal and the correct electrodes from the choices provided as directed by the event superintendent. Place practice beads on the third piece of metal to adjust the welder amperage to match the metal characteristics if so desired. **The practice metal is not required and will not be graded.**

Perform the skill for grading using electrodes and two pieces of properly prepared ¼" x 2" x L" metal. The participant is to place the metal so that the butt joint is formed as a **single pass weld along the L" joint** in the **vertical up position** and is to apply the weld bead evenly to the facing side of both metal pieces. **The weld will be judged on quality, appearance, penetration and equal bead placement on both pieces of metal.** (1.5J Rubric as specific criteria)

L" or Length in Inches may vary and will be determined by the event superintendent.
Multiple electrodes will usually be required to complete the weld.

Safety Equipment Needed:

Welding helmet with adjustable shading lens or minimum #10 shaded lens

Safety glasses and/or goggles for use at all times

Welding gloves and proper leather closed-toe shoes that covers the entire sock or skin

Clothing that covers the entire body to include the arms and legs

Agricultural Mechanics Performance Skill 1.6P Make a Lap Joint Fillet Weld in the Flat Position

Instructions to Participant

Using the proper safety and welding equipment and the electric arc welder, choose two or three pieces of ¼" x 2" x L" metal and E7018 electrodes from the choices provided as directed by the event superintendent. Place practice beads on the third piece of metal to adjust the welder amperage to match the metal characteristics if so desired. **The practice metal is not required and will not be graded.**

Perform the skill for grading using E7018 electrodes and two pieces of properly prepared ¼" x 2" x L" metal. This lap joint weld is to be performed in the flat position as a **single pass bead along the L" joint** with the bead evenly placed on the top surface of both pieces of the metal. **The weld will be judged on quality, appearance, penetration and equal bead placement on both pieces of metal.** (1.6J Rubric as specific criteria)

L" or Length in Inches may vary and will be determined by the event superintendent.
Multiple electrodes will usually be required to complete the weld.

Safety Equipment Needed:

Welding helmet with adjustable shading lens or minimum #10 shaded lens.

Safety glasses and/or goggles for use at all times.

Welding gloves and proper leather closed-toe shoes that cover the entire sock or skin.

Clothing that covers the entire body to include the arms and legs.

Agricultural Mechanics Performance Skill 1.7P Make an Open Root Butt Joint Weld in the Flat Position

Instructions to Participant

Using the proper safety and welding equipment and the electric arc welder, choose two or three pieces of ¼" x 2" x L" metal and the correct electrodes from the choices provided as directed by the event superintendent. Place practice beads on the third piece of metal to adjust the welder amperage to match the metal characteristics if so desired. **The practice metal is not required and will not be graded.**

Perform the skill for grading using electrodes and two pieces of properly prepared ¼" x 2" x L" metal. The participant is to place the metal so that the butt joint is formed as an **open root weld along the L" joint** in the **flat position** and is to apply the weld bead evenly to the topside of both metal pieces. **The weld will be judged on quality, appearance, penetration and equal bead placement on both pieces of metal.** (1.7J Rubric as specific criteria)

L" or Length in Inches may vary and will be determined by the event superintendent.
Multiple electrodes will usually be required to complete the weld.

Safety Equipment Needed:

Welding helmet with adjustable shading lens or minimum #10 shaded lens

Safety glasses and/or goggles for use at all times

Welding gloves and proper leather closed-toe shoes that covers the entire sock or skin

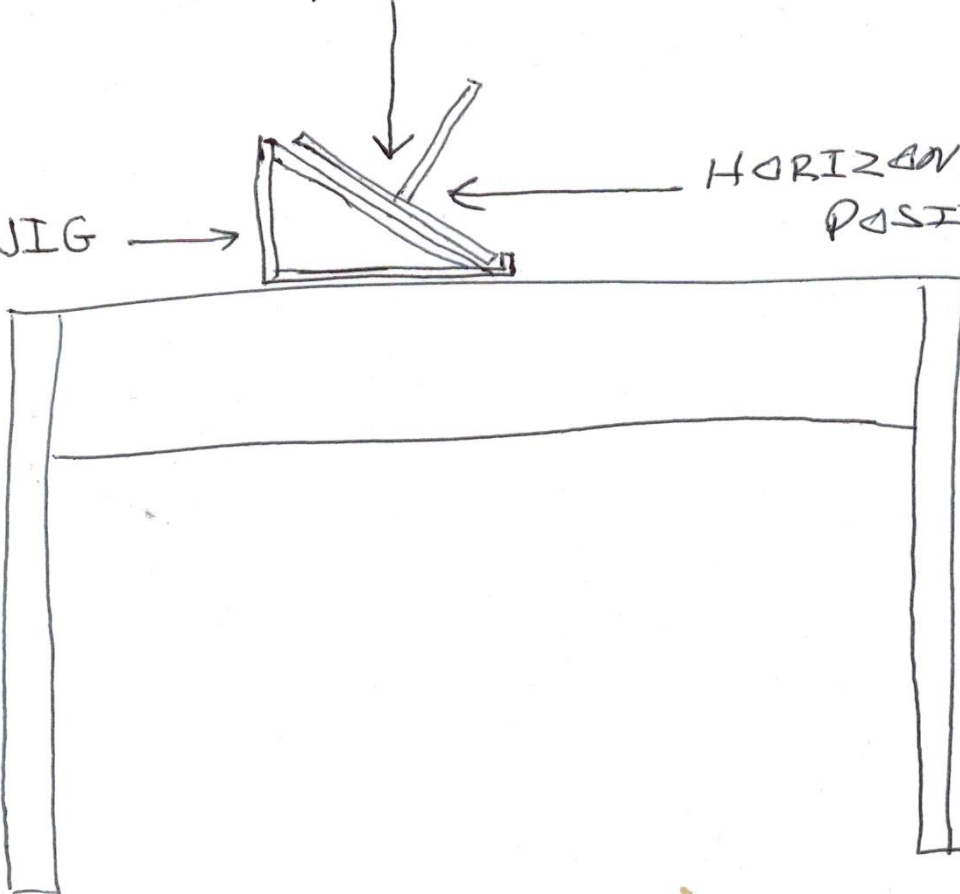
Clothing that covers the entire body to include the arms and legs

FILLET WELDS (T-JOINT)

FLAT POSITION

HORIZONTAL
POSITION

45° JIG



Agricultural Mechanics Performance Skill 2
Make a vertical fillet weld using the MIG welding system.

Participant Name _____ Score _____

Chapter _____ Participant Number _____

Instructions to Participant

Using the proper safety and welding equipment and the MIG welder, choose three pieces of 1/8" x 2" x 4" metal for welding. Use manufacturer's recommendations to reach approximate settings for wire speed, amperage and gas flow for the metal thickness and wire diameter being used by referring to the manufacturer's chart for the wire diameter provided. Record the manufacturer's recommendations on the **Job Sheet** below. **(Fine tune and adjust to the final settings prior to welding using one piece of metal for practice.)** Select the other two pieces of metal and place them so that a fillet joint is formed in the vertical position. Perform this weld in the vertical position by placing an inside fillet weld along the 4" length joint.

Safety Equipment Needed:

Welding helmet with adjustable shading lens or minimum #10 shaded lens

Safety glasses and/or goggles for use at all times

Welding gloves and proper leather closed-toe shoes that covers the entire sock or skin

Clothing that covers the entire body to include the arms and legs

Job Sheet for Skill 2

The proper approximate voltage for this job according to manufacturer's recommendations is: _____.

The proper approximate wire speed for this job according to manufacturer's recommendations is: _____.

The proper approximate gas flow for this job according to manufacturer's recommendations is: _____.

Agricultural Mechanics Performance Skill 3
Sweating a Piece of Copper Pipe into a Fitting

Participant Name _____ Score _____

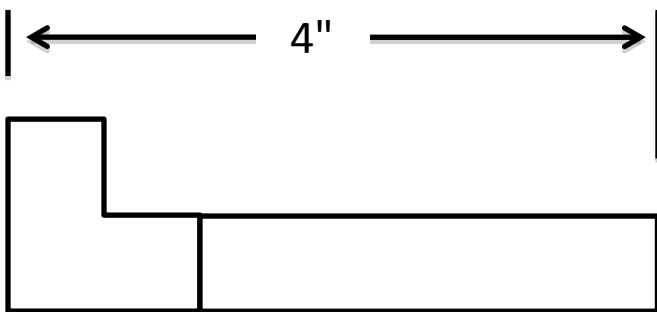
Chapter _____ Participant Number _____

Instructions to Participant

Wear the proper safety equipment for this activity. Select and use the proper tools to cut a piece of copper pipe according to the accompanying diagram and dimensions. **(Diagram and dimensions are subject to change without notice.)** Properly prepare and sweat the pipe into a copper fitting using the provided propane torch. Upon completion, use a paint pen to identify your product.

Safety Equipment Needed:

- Safety glasses and/or goggles for use at all times
- Leather gloves
- Long pants and proper leather closed-toe shoes



Agricultural Mechanics Performance Skill 4

Use a compression tester to determine if the compression for engine falls within specs.

Participant Name _____ Score _____

Chapter _____ Participant Number _____

Instructions to Participant

Wear the proper safety equipment for this activity. Select and use the proper tools to remove the spark plug, check the compression, and reinstall the spark plug to the proper torque as specified by the manufacturer for a provided single cylinder small engine. **(The appropriate engine manual will be provided.)** Perform three compression tests and determine if the compression for the engine meets manufacturer's specifications. Use the Job Sheet below to record engine specifications and compression tests results.

Safety Equipment Needed:

Safety glasses and/or goggles for use at all times
Long pants and proper leather closed-toe shoes

Job Sheet Engine Evaluation Guide

Engine Number _____

Engine Model-Series _____ - _____

Manufacturer's specification for compression for this engine: _____

Compression results: Test 1 _____ psi Test 2 _____ psi Test 3 _____ psi

Does engine meet required compression? _____ YES _____ NO

Manufacturer's specification for torque on spark plug _____ fp

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Agricultural Mechanics Performance Skill 5

Remove head on L-Head engine, inspect and record piston damage, and reinstall head according to manual specifications.

Participant Name _____ Score _____

Chapter _____ Participant Number _____

Instructions to Participant

Wear the proper safety equipment for this activity. Locate the engine model and serial number and record on Job Sheet. Select and use the proper tools to remove the head on the single cylinder L-head small engine provided, examine the piston head for damage, and record results on the Job Sheet. Use the engine manual to determine torque specifications and tightening pattern and record information on the Job Sheet and engine diagram provided below. **(The appropriate engine manual will be provided.)** Reinstall the cylinder head according to manual specifications. The participant will submit the Job Sheet to the judge upon completion.

Safety Equipment Needed: Safety glasses and/or goggles for use at all times; long pants and proper leather closed-toe shoes.

Job Sheet Information
Engine Evaluation Guide

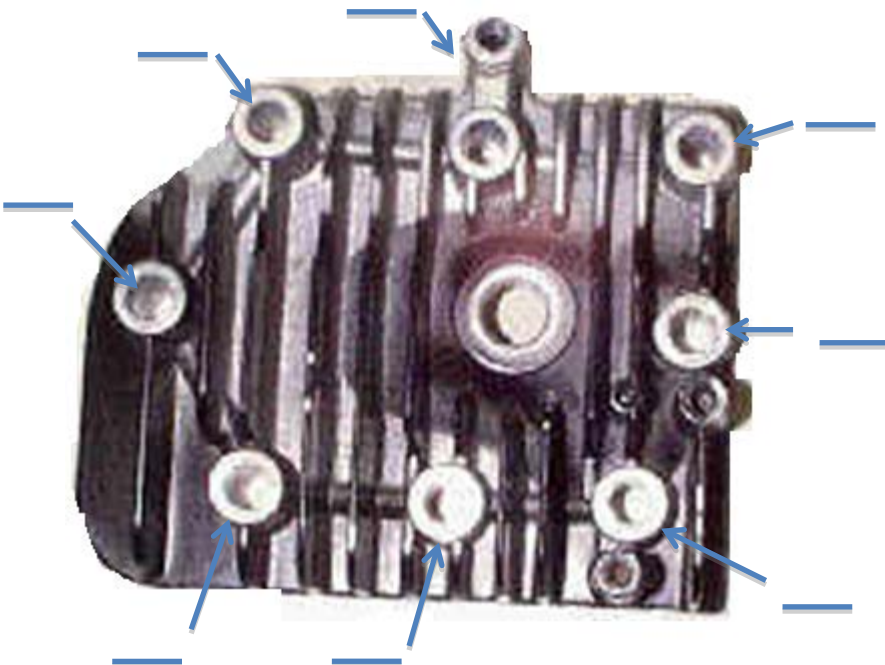
Engine Number _____

Engine Model-Series: _____ - _____

Does piston have damage? YES NO

Torque Specifications _____ in/lbs.

Diagram of L-Head cylinder: Place the tightening order on the diagram below. The number 1 will be the first bolt tightened followed in sequential order through number 8 which will be the last bolt tightened.



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Agricultural Mechanics Performance Skill 6
Service a small engine by checking oil level and gapping the spark plug to proper setting.

Participant Name _____ Score _____

Chapter _____ Participant Number _____

Instructions to Participant

Wear the proper safety equipment for this activity. Locate the engine model and serial number and record the information on Job Sheet below. Inspect and service the small engine by checking the oil level and removing, gapping, and reinstalling the spark plug to the proper specifications. **(The appropriate engine manual will be provided.)** Record the oil level; spark plug gap specification; and spark plug torque information on the Job Sheet and submit to the judge upon completion of the reinstallation of the spark plug.

Safety Equipment Needed:

Safety glasses and/or goggles for use at all times
Long pants and proper leather closed-toe shoes

Job Sheet Engine Evaluation Guide

Participant Number _____

Assigned Engine Number (1, 2, 3, etc.) _____

Engine Model-Type: _____ - _____

Oil Level: _____ Full _____ Low

Spark plug gap specifications according to manual: _____

Spark plug torque specifications _____ in/lbs.

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Agricultural Mechanics Performance Skill 7
Layout and cut a round hole according to specified blueprint using a jig saw.

Participant Name _____ Score _____

Chapter _____ Participant Number _____

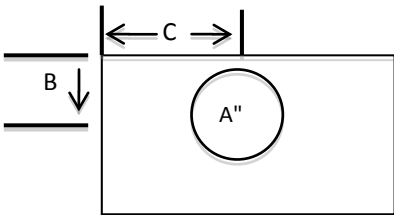
Instructions to Participant

Wear the proper safety equipment for this activity. Secure a given piece of plywood lumber and the drawing provided below. Measure and mark a circle on the plywood according to the dimensions provided on the drawing. After the circle has been drawn on the plywood, secure and properly cut the circle out using the equipment provided. **Size and placement of the circle may or may not be in the center of the board and will depend upon dimensions specified for the drawing. (See drawing below.) Scoring will factor in the final placement and dimensions of the circle on the plywood.**

Safety Equipment Needed:

Safety glasses and/or goggles for use at all times
Long pants and shirt, closed-toe shoes

A = Diameter of circle in inches
B = Vertical distance from center of circle to the edge of the board
C = Horizontal distance from center of circle to edge of the board



**North Carolina FFA Association
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**Agricultural Mechanics Performance Skill 8
Level transit and determine difference in elevation between two points.**

Participant Name _____ **Score** _____

Chapter _____ **Participant Number** _____

Instructions to Participant

Wear the proper safety equipment for this activity. Properly level the assigned transit and then take two elevation readings from given points and record the findings on the Job Sheet below. Determine the difference in the elevation for the two points and record the difference on the Job Sheet and submit to the judge upon completion of this activity.

Safety Equipment Needed:

Safety glasses and/or goggles for use at all times

Long pants and proper leather closed-toe shoes

**Job Sheet
Use of Transit Skill**

Elevation Reading on Grade Stick 1 (to the nearest tenth of a foot) _____

Elevation Reading on Grade Stick 2 (to the nearest tenth of a foot) _____

Difference in elevation between Grade Stick 1 and Grade Stick 2 _____

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Agricultural Mechanics Performance Skill 9

Construct a frame according to specified dimension using designated fasteners.

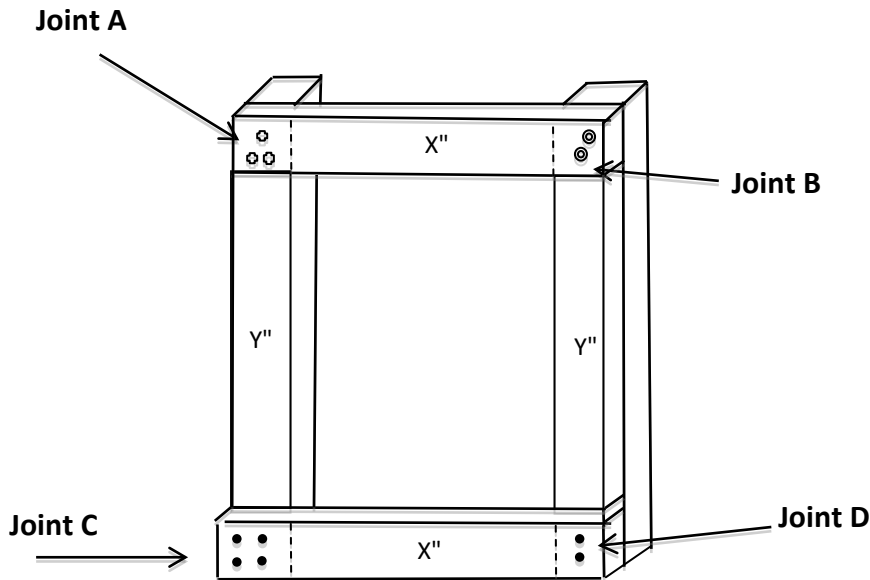
Participant Name _____ Score _____

Chapter _____ Participant Number _____

Instructions to Participant

Wear the proper safety equipment for this activity. Use the provided equipment and materials to secure, mark, and cut four pieces of lumber according to drawing dimensions. Then assemble the cut pieces to form a rectangular frame using the fasteners and pattern specified for the drawing.

(See the drawing below.)



- Joint A – Three _____ wood screws placed in a triangle pattern 1" apart.
- Joint B – Two _____ size carriage bolts placed in diagonal 1" apart.
- Joint C – Three _____ finishing nails placed in square pattern 1/2" apart.
- Joint D – Two _____ common nails placed in vertical pattern.

Safety Equipment Needed:

- Safety glasses and/or goggles for use at all times.
- Long pants and shirt; proper leather closed-toe shoes.

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**Agricultural Mechanics Performance Skill 10
Braze Flat Materials in a Lap Joint**

Participant Name _____ Score _____

Chapter _____ Participant Number _____

Instructions to Participant

Wear the proper safety equipment at all times for this activity. Use the oxy-fuel equipment and tools provided for this activity to properly braze two pieces of 1/8" x 2" x 2" non-galvanized steel plate in a lap joint. **(A third piece of metal may be used for practice and/or support. The practice metal is not required but it may help form a tight fit for the two pieces being used. The practice metal will not be graded.)** Use the Emory cloth provided to properly clean a one inch strip along one edge of each of the two pieces of metal. Place the two pieces of the metal so as to form a lap joint along the clean edges. Properly light the oxy-fuel torch and adjust to a neutral flame. **(Regulators are pre-set to the appropriate pressures).** Use the provided flux-coated welding rod to properly apply filler metal to the lap joint on one side only.

Safety Equipment Needed:

Safety glasses and/or goggles for use at all times

Safety shaded lens # 5

Long pants and proper leather closed-toe shoes

Agricultural Mechanics Performance Skill 11

Light and adjust the oxy-fuel torch to cut a 3/8" thick steel plate to squared and specified dimensions prior to properly shutting down the oxy-fuel system.

Instructions to Participant

Wear the proper safety equipment at all times for this activity. Use the oxy-fuel equipment and tools provided for this activity to properly cut a section of 3/8" thick steel plate. The judge will provide dimensions and the steel plate. Upon being given the dimensions, use the appropriate square and soapstone to mark the plate for cutting. Once the plate is positioned for cutting, turn the oxy-fuel system on and adjust to appropriate pressures. **(The participant may elect to refer to provided charts to determine the correct pressure.)** Assume the correct torch cutting position and proceed to cut the steel plate. After cutting the plate, properly shut down the oxy-fuel system. Prior to leaving the skill area, cool and properly identify the plate and present it to the judge for inspection.

Safety Equipment Needed:

Safety glasses and/or goggles for use at all times

Safety shaded lens # 5

Long pants and shirt, close toed shoes

**North Carolina FFA Association
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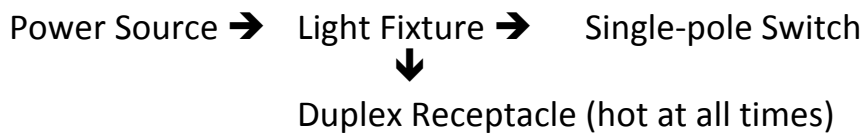
Agricultural Mechanics Performance Skill 12

Wire a light fixture controlled by a single-pole switch in the middle of a run with power being first supplied to the light fixture. The student will include a duplex receptacle beyond the light fixture which is to remain hot at all times.

Instructions to Participant

Wear the proper safety equipment at all times for this activity. Use the non-metallic sheathed cable, wire nuts and/or Stacons (connectors) and wiring tools provided to complete this wiring exercise in accordance with electrical materials provided. Leave all connections outside the box as if waiting for electrical inspection. Prior to leaving the area, ask the judge to inspect all work.

Safety Equipment Needed: safety eyewear, long pants, closed toe shoes



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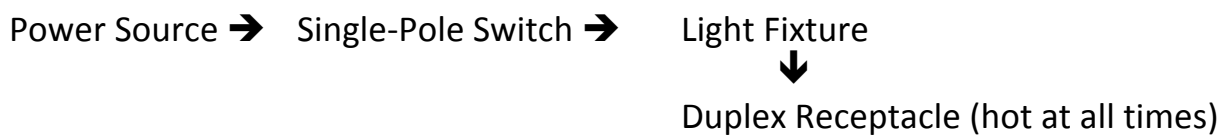
Agricultural Mechanics Performance Skill 13

Wire a light fixture controlled by a single-pole switch with power being first supplied to the single-pole switch. The student will include a duplex receptacle beyond the light fixture which is to remain hot at all times.

Instructions to Participant

Wear the proper safety equipment at all times for this activity. Use the non-metallic sheathed cable, electrical devices, wire nuts, "Stacon" wire connectors (if provided), and wiring tools to complete this wiring exercise in accordance with the diagram given below. Leave all connections outside the boxes as if waiting for electrical inspection. Prior to leaving the area, ask the judge to inspect all work.

Safety Equipment Needed: safety eyewear, long pants, closed toe shoes



**North Carolina FFA Association
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Agricultural Mechanics Performance Skill 14

Wire a light fixture controlled by three-way switches when the power is first supplied to one of the switches and with the light located between the switches.

Instructions to Participant

Wear the proper safety equipment at all times for this activity. Use the non-metallic sheathed cable, electrical devices, wire nuts, "Staconn" wire connectors (if provided), and wiring tools to complete this wiring exercise in accordance with the diagram given below. Leave all connections outside the boxes as if waiting for electrical inspection. Prior to leaving the area ask the judge to inspect all work.

Safety Equipment Needed: safety eyewear, long pants, closed toe shoes

Power Source → Three-Way Switch ↔ Light Fixture ↔ Three-Way Switch

**North Carolina FFA Association
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Agricultural Mechanics Performance Skill 15

**Wire a light fixture controlled by three-way switches
when the power is first supplied to the light fixture.**

Instructions to Participant

Wear the proper safety equipment at all times for this activity. Use the non-metallic sheathed cable, electrical devices, wire nuts, "Stacon" wire connectors (if provided), and wiring tools to complete this wiring exercise in accordance with the diagram given below. Leave all connections outside the boxes as if waiting for electrical inspection. Prior to leaving the area ask the judge to inspect all work.

Safety Equipment Needed: safety eyewear, long pants, closed toe shoes

Power Source → Light Fixture ↔ Three-Way Switch ↔ Three-Way Switch

North Carolina FFA Association
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Agricultural Mechanics Performance Skill 16

Wire a GFCI receptacle with single-location protection.

Participant Name _____ Score _____

Chapter _____ Participant Number _____

Instructions to Participant

Wear the proper safety equipment at all times for this activity. Use the non-metallic sheathed cable, electrical devices, wire nuts, "Stacon" wire connectors (if provided), and wiring tools to complete this wiring exercise in accordance with the diagram given below. Leave all connections outside the boxes as if waiting for electrical inspection. Prior to leaving the area ask the judge to inspect all work.

Safety Equipment Needed: safety eyewear, long pants, closed toe shoes

Power Source → GFCI Duplex Receptacle ↔ Duplex Receptacle

North Carolina FFA Association
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Agricultural Mechanics Performance Skill 17

Wire a GFCI receptacle with multiple-location protection for a single-pole switch controlling a light downline.

Participant Name _____ Score _____

Chapter _____ Participant Number _____

Instructions to Participant

Wear the proper safety equipment at all times for this activity. Use the non-metallic sheathed cable, electrical devices, wire nuts, "Staconn" wire connectors (if provided), and wiring tools to complete this wiring exercise in accordance with the diagram given below. Leave all connections outside the boxes as if waiting for electrical inspection. Prior to leaving the area ask the judge to inspect all work.

Safety Equipment Needed: safety eyewear, long pants, closed toe shoes

Power Source → GFCI Duplex Receptacle ↔ Single-Pole Switch ↔ Light Fixture