

Middle Tennessee FFA

Agricultural Mechanics Handbook 2024

Purpose

Technological advances in America continue to influence the way students must 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 that can access and use a broad range of information. The most sought after employees are those who communicate effectively, continue to stay current with modern technology and work successfully and effectively as individuals and as 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 is comprised of strong technical content and complimented 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 and examples appear on the pages that follow.

Each agricultural technology and mechanical systems activity is in response to a problem or need encountered in the workplace. The solving of such problems is dependent upon 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 where this has occurred is observed in the many obstacles that agricultural producers currently face regarding environmental pollution, ground water contamination and stricter governmental regulations. Decisions and solutions made in the past 100 years have impacted the environment negatively and resulted in a new set of problems.

The Tennessee 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 continue to include all traditional areas of agricultural technology and mechanical systems. 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:

- 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

TEAM MAKE-UP

Teams will consist of up to 13 members. All member's scores count. Team ranking is determined by combining the scores of all students from each team.

SPECIFICS AND REGULATIONS

- The regional event will be held at Tennessee Tech University.
- Each district must have their contestants registered to Jason Walker (Jason.walker@fcstn.net) by the deadline set from him each year in order to compete.
- The Small Engines test will be made by an agriculture teacher from outside our region as well as the Tool ID test.
- Small Engines measurements will be given a 10 minute time limit for both measurements.
- The Small Engines test will be 15 questions with 25 minutes to complete.
- There will be a judges meeting prior to the contest. Arrive early to prepare students for an efficiently ran event.
- No "easy read" tape measures or any measuring tools that have fractions printed on them will be allowed in any of the skill areas.
- Small Gasoline Engine - Reference Manual for exam is changed. The 4/02 edition is no longer available. That part number 272147 has been revised to include only Vanguard engines. The new manual is Part number 276781 and includes engines except Vanguard. (These manuals are available through local TN Farmer's Co-op, small engine shop for approximately \$20. They may also be available through Briggs and Stratton and other outlets)
- Small Gasoline Engine - Top Operating speed is factory set based on the application of the engine or what it is to be used on. For CDE purposes, the top operating RPM will be set to a range of 3500 to 4000. This is added to procedures and score sheet.
- Small Gasoline Engine - (Low) Idle speed should be set at 1750 plus/minus 50. This is added to procedure and score sheet.
- Three - way Switch–The length of 14/3 cable is changed to 6 feet to allow for the longest of the three possible wiring problems.
- **Safety Glasses must be OSHA Approved. Prescription glasses will not be sufficient for safety glasses. The only exceptions are for those students competing in land measuring and land evaluation. The contestant is subject to disqualification for the removal of safety lens except when cleaning them.**
- Time will only be used to break a tie and will not factor into scoring.
- The Middle Tennessee FFA Agricultural Mechanics Skills CDE Rules and Regulations may be found on the Middle TN FFA Website. <http://www.middletnffa.ffanow.org>
- Contestants must provide all tools and supplies needed for their respective skills.
- Only active FFA members (currently enrolled in agricultural education) will be eligible to compete.
- The DISTRICT team first place winner will participate in the Regional CDE. IN case the winner cannot participate, the FIRST PLACE ADVISOR for that team will notify the SECOND PLACE WINNER's ADVISOR, as well as their DISTRICT ADVISOR.

- Each contestant must remain in the area designed for his skill until they are released by the person in charge of the skill.
- No one may coach or give assistance to contestants. Judges may disqualify a contestant when assistance has been given.
- Ag Ed teachers will serve as judges in the regional contest. Districts will be responsible for procuring their own judges.
- A certain amount of time will be allotted to each skill. No additional time will be given a contestant for being late. A notification will be given at the end of time for each skill and all work must stop immediately. Unfinished products will be judged.
- Any discrepancy with judging results **must** be challenged by the registered Advisor
- Each contestant must register prior to the contest in their skill and no substitutes or additions will be allowed after registration.
- The host chapter is to be notified in advance of special needs or handicaps for any contestant involved in the CDE.
- A committee of 3 consisting of the coordinator and advisors from the northern and southern section with the highest rank from the previous years contest that is present. This will be established by the coordinator prior to the start of the event to settle any issues that may arise.
- A district that sends a single chapter from that district to the Middle Tennessee Regional Competition, must bring at least two advisors from that district to help in judging the CDEs. The single team's advisor may make arrangements with competent advisors from **ANY** district to serve as judges if they cannot find enough from their own district.
- In regional competitions, **judges will rank the contestants through twelves places.**
- **Points toward the award trophy will be allowed as follows:**

DISTRICT: (Chapter's "OVERALL" TEAM District Placing)

1 st	2 nd	3 rd	4 th	5 th	Others
15	13	11	9	7	5

REGIONAL: ("INDIVIDUAL" Participant in Each Skill Area):

1 st	2 nd	3 rd	4 th	5 th	6 th	7 th	8 th	9 th	10 th	11 th	12 th	13 th	14 th
19	17	15	13	11	9	8	7	6	5	4	3	2	1

EQUIPMENT

SAFETY MATERIALS STUDENTS MUST PROVIDE.

Each event participant must adhere to the safe practices and work habits appropriate when performing required activities. Participants are responsible and must provide all personal safety equipment including:

Eye protection:

Each team member must wear proper eye protection. Individuals with prescription glasses will need either

prescription safety glasses or safety glasses than can be worn over prescription glasses. Do not bring tinted safety glasses.

Clothing

Each individual shall furnish and wear appropriate clothing such as long pants and long sleeved cotton shirt, coveralls, etc., for this event. 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 footwear shall be worn during the event.

Other Materials

Each participant must have a clear clipboard, two sharpened No. 2 pencils and an electronic, non-programmable calculator. Calculators used in this event should be battery operated and silent. A laptop and printer may be required at the state event. The event superintendent will notify teams prior to the event if this equipment is needed.

LAYING BLOCK

Materials to furnish at site of contest:

1. Rating Sheets
2. Hose
3. Water
4. Tar paper or suitable area covering (if desired)

Materials to be furnished by contestant

1. Three CORNER and Three STRETCHER Blocks
2. Mortar boards
3. Pails (if needed)
4. Wheel barrow
5. Hoe
6. Soapstone
7. Square-nosed, short-handled shovel
8. Enough Sand for laying 6 blocks
9. Enough type N mortar for laying 6 blocks
10. One trowel
11. One level
12. One "S" jointer
13. One six-foot folding ruler
14. One carrying bag (if desired)
15. One pencil
16. One framing Square
17. One Brush or Burlap Sack to clean blocks
18. Safety Glasses must be worn while performing task or the contestant will be disqualified. Exception is only when cleaning the lens of their safety glasses.

Procedure for student doing skill:

1. Mix Sand and type N mortar "on site" for the block laying exercise.
2. Square corner on concrete shop floor, driveway, or other existing suitable hard surface. (covered with tar paper if desired)
3. Lay a corner masonry unit using three 8" x 8" x 16" corner blocks and three 8" x 8" x 16" stretcher blocks.
(two- or three-core blocks may be used)
4. Joint the blocks.
5. Clean the blocks with the use of a brush or burlap bag.

Procedure for judging:

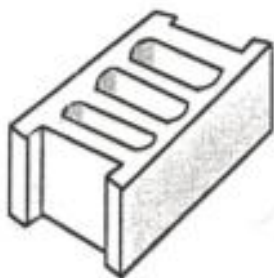
1. Judges will be present to observe the proceeding of the entire contest.
2. Observe the thickness of the mud mixture.
3. Observe the correctness of design, neatness, speed, block and use of tools.
4. Observe the correctness of height, level, plum, square, uniform joints.
5. Contestants will be allowed one hour to complete the exercise.

BLOCK LAYING SCORE SHEET

Contestant	1	2	3	4	5	6	7	8	9	10	11	12
Height 10 Points												
Level 10 Points												
Plumb 10 Points												
Neatness 10 Points												
Correct Design 10 Points												
Square 10 Points												
Use of Tools 10 Points												
Uniform 10 Points												
Mud Mixture 10 Points												
Total Points 90 Points												

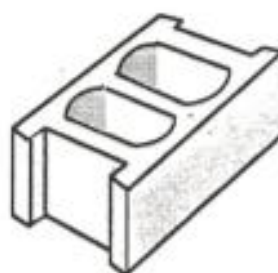
RANK:1st5th9th2nd6th10th3rd7th11th4th8th12th

INFORMATION SHEET

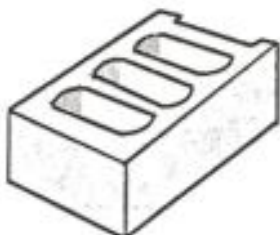


3-CORE STRETCHER BLOCK**

- * * The actual measurement of an 8 x 8 x 16 inch block is 7 5/8 x 7 5/8 x 15 5/8 inches. If the block is laid with a 3/8 inch mortar joint, the height area will be 8 inches and the length area 16 inches.



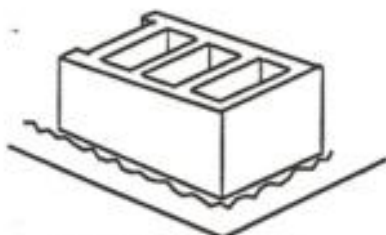
2-CORE STRETCHER BLOCK**



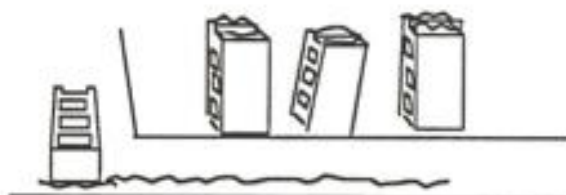
CORNER BLOCK **



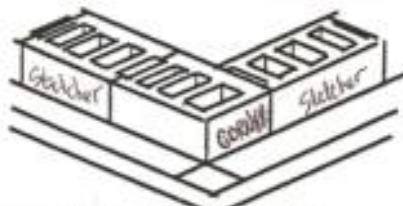
CORNER BLOCK EXERCISE



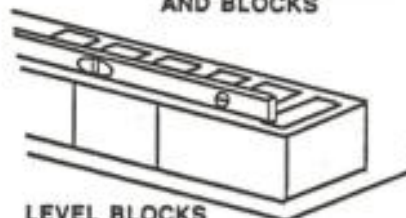
LAY CORNER BLOCK



APPLY MORTAR TO FOUNDATION AND BLOCKS



ALIGNING FIRST COURSE



LEVEL BLOCKS

Refer to Vocational Instructional Services
Texas A & M College Station, Texas
V-E-1 Basic V.A. IV for an excellent unit on masonry

RAFTER CUTTING

Materials to be furnished at site of contest:

1. Two 2"x4"x8' or 10' for Rafter Ties
2. Two 2" x 6" x 8' (square edge) for Rafter Plates to nail Rafters
3. Plates provided at proper distance (determined by judge)
4. Four Blocks to elevate the Rafter Plate Frame off of floor

Procedure for students in doing skill:

1. Layout and make pair of rafters including:
 - Upper Plumb Cut
 - Bird's Mouth
 - Horizontal Projection (overhang).
2. Contestants will measure Span set up by Judge(s).
3. Judge(s) will give contestants the following specifications:
 - Rise per Foot of Run
 - Horizontal Projection (overhang)
4. Bird's Mouth is to be 2" from top line of rafters, measured perpendicular from the top of the rafter.
5. Safety Glasses must be worn while performing task or the contestant will be disqualified. Exception is only when cleaning the lens of safety glasses.
6. Saw Rafters using tools from the lists below.
7. Nail pair of rafters together at Upper Plumb Cut. Then nail or screw to the plates.
8. Contestant may get another contestant in Rafter Construction to hold rafters while attaching.
9. Multiple cuts can be made before the boards touch the frame, once the rafter boards touch the frame, no more cuts can be made.
10. Maximum time allowed for skill is One (1) Hour.

Materials to be provided by Contestant:

1. Safety Glasses
2. Clear Clipboard, clean paper, pencil, calculator (writing information given by judge and figuring exercise)
3. Provide two 2"x4"x8' (with square edge) for cutting Rafters
4. Power tools that may be used are as follows:

a. Circular Saw	d. Power Miter Saw
b. Jigsaw	e. Extension cord
c. Reciprocating Saw	f. Cordless Drill
5. Hand tools that may be used are as follows:

a. Handsaw	f. Saw Horse(s)
b. Rule or Tape Measure	g. Clamp
c. Calculator	h. Claw Hammer
d. Framing Square	i. Nails
e. Wood Screws	

Procedure for Judging:

1. Observe length and cuts.
2. Observe erected pair of rafters as to fit at: **Upper Plumb Cut, Ridge, Bird's Mouth**
3. Observe the rise.
4. Observe as to horizontal projection (overhang) and lower plumb cut.

RAFTER CUTTING SCORE CARD

Contestant #	General Appearance	Placement of Bird's Mouth	Length of Rafter	Accuracy of Cuts	Horizontal Projection	Total Points	Contestant Rank
	10 Points (1)	20 Points (2)	20 Points (3)	30 Points (4)	20 Points (5)		

- (1) All points are divided by 2, then applied to Each Rafter
 (2) 3 points are deducted for each 1/16" off from 2" Work line
 (3) 3 points are deducted for each 1/4" difference from correct length (0 minimum)
 (4) 10 points are given for each cut (Bird's mouth, lower and upper plumbs). One point is deducted for 1/16" difference. (0 minimum)
 (5) 5 points are deducted for each 1/4" from correct Horizontal Projection measurement.

NOTE: In case of tie, use 1/32" and 1/16" in place of 1/16" and 1/4" respectively, with same point weights.

NOTE: Contestant will be disqualified for the removal of safety glasses except when cleaning glasses.

BOARD FITTING

Eligibility

The skill is for enrolled Freshmen and Sophomore FFA members. If a Junior High and a Senior High FFA Chapter both exist for a school, and since the Senior High is ineligible to participate, the Senior High Chapter will receive the points earned by the Junior High Chapter.

Materials to be furnished at site of contest:

Area for CDE to be conducted

Materials to be furnished by contestant:

1. A 2" x 6" x 24" board with uneven ends checked by judge
2. Tools allowed:
 - a. handsaw (no miter saw or backsaw)
 - b. square
 - c. rule of tape measure (without fraction labels)
 - d. pencil
 - e. saw horse
 - f. clamp
3. Safety Glasses

Procedure for student in doing the skill:

1. Cut board to length determined by judge.
2. Only one (1) cut may be made on each end.
3. The clamp may be used to hold board steady.
4. No jig of any type may be used and a square is not to be used as a guide while cutting.
5. Time limit shall be thirty (30) minutes.
6. Safety Glasses must be worn while performing task or contestant will be disqualified. Exception is only when cleaning lens of glasses.

Procedure for judging:

1. Length-40 points
2. Horizontal Squareness (6")-20 points (10 points each end)
3. Vertical Squareness (2")-20 points (10 points each end)
4. Correct use of tools-20 points

PLUMBING

Procedure for Skill

1. Contestant will measure template board once and record the distance center to center of nails for the upright position of the copper and plastic, pvc pipe. (E)
2. Galvanized tee shall be centered between the copper and plastic pipes and centered on the template at centering nail and upright copper and plastic pipe will lay between the nails contestant measured. (copper pipe on left and plastic pipe on right)
3. Cut all pipe to required lengths.
4. Prepare pipe: ream, thread, remove burrs, clean, and apply cement, solder, Teflon tape, or joint compound.
5. Assemble according to exercise plan.
 - a. Leave 1 to 1 1/2 threads showing past galvanized fittings.
 - b. Plastic and Copper adapters tighten until a secure joint is achieved.
 - c. Use Teflon tape or joint compound on all male fittings attaching to galvanized fittings.
 - d. Use copper/stainless crimp rings for pex tube
6. Lengths of pipes A, B, C, and D are the same (minimum of 10 inches long) to be given by the judge.
7. Contestants will be allowed a maximum of one hour to complete the project. After time limit expires product will be judged as is.
8. Contestant will be disqualified for the removal of safety glasses except when cleaning safety glasses lenses.
9. Refer to Illustration Page for exercise example.

Procedure for Judging:

1. Check pipe measurements by using template (25 points)
2. Check assembly to see if according to plan (10 points)
3. Check general appearance (15 points)
4. Check for water leaks by applying 100 psi air pressure to fixture while submerging in a bucket of water (50 points)

Materials to be provided by host:

1. Template, 1" x 10" x 24", for laying out fitting exercise.
2. Five, eight-penny finishing nails for setting
3. Air Hose and source.
4. Shut off valve with pressure gauge to attach to fixture (refer to Illustration for Valve construction)
5. Tub with water to check for leaks

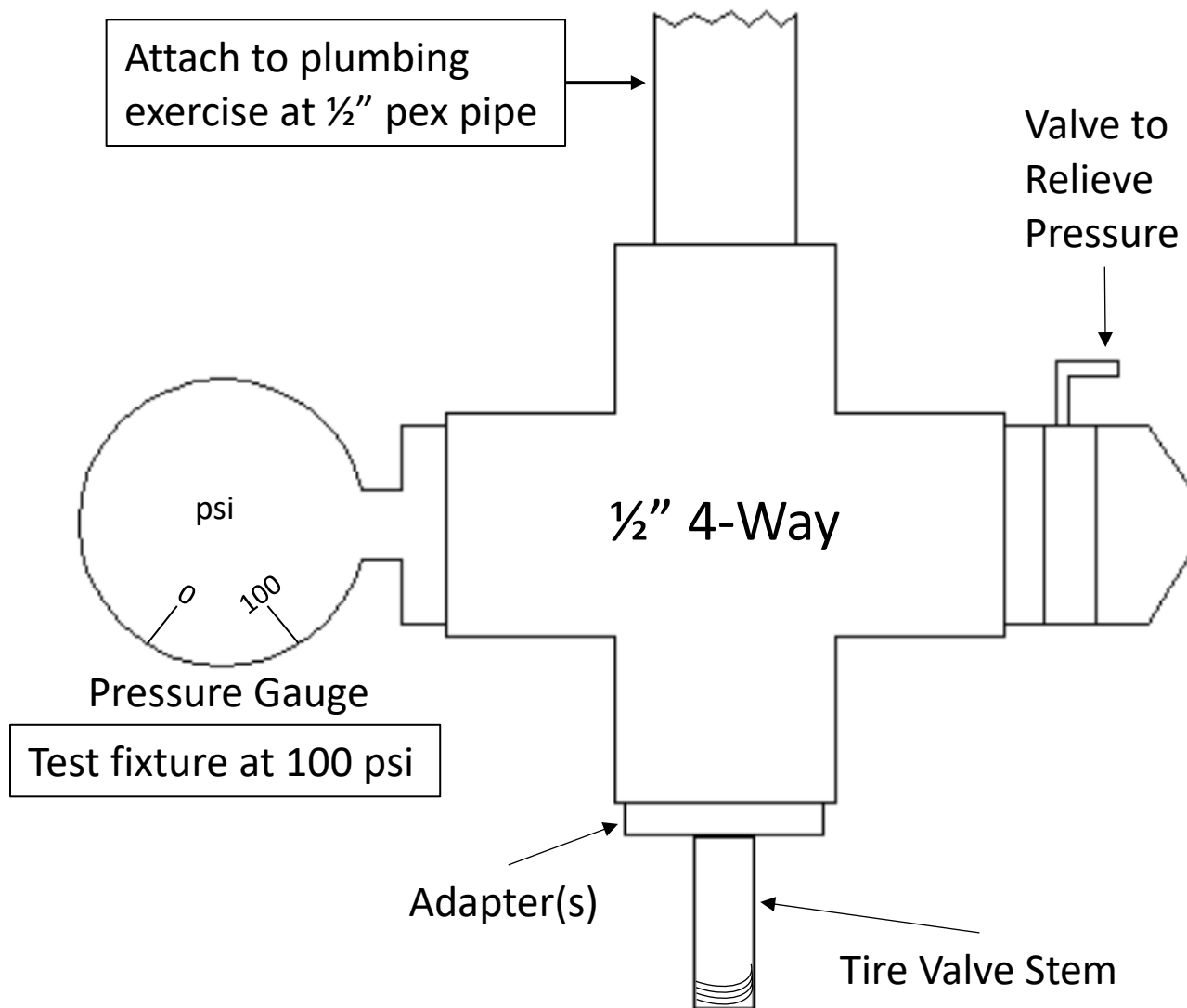
Template set-up by Host:

1. Judge drive two pairs of eight penny nails into the board and in a straight line from each other at predetermined distance.
2. This predetermined distance shall be 12", or more, apart.
3. Place 5th finishing nail three (3) inches below two paired nails to center Galvanized Tee
4. The nails for the Copper tubing side shall be 3/4" apart
5. The nails for the CPVC tubing shall be 3/4" apart (this will need to be 1" for PVC pipe)

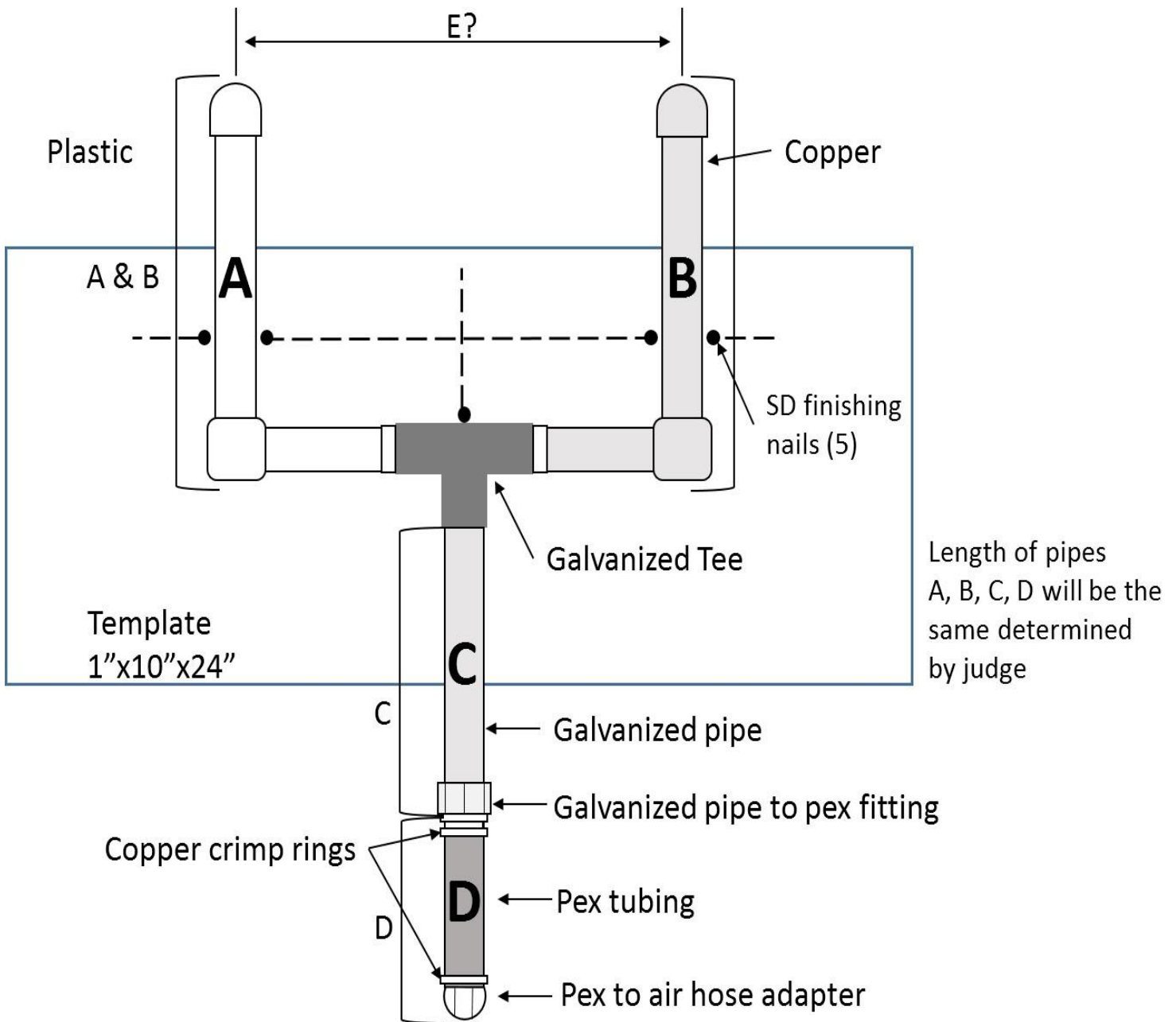
Materials to be furnished by contestant:

1. Galvanized pipe and tools:
 - a. 18" of 1/2" galvanized pipe
 - b. One 1/2" galvanized tee
 - c. Pipe joint compound or Teflon tape
 - d. Pipe vise
 - e. Pipe cutter.
 - f. 1/2" pipe thread die and ratchet
 - g. Pipe Reamer
 - h. Pipe Wrench
 - i. File
2. Copper pipe and tools:
 - a. 18" of 1/2" hard copper tubing
 - b. One 1/2" copper elbow
 - c. One 1/2" copper cap
 - d. One 1/2" copper to galvanized adapter
 - e. Copper tube cutter or hack saw
 - f. Steel wool or emery cloth
 - g. Paste or acid flux for copper sweating
 - h. "Lead Free" and "Acid Free" silver bearing solder
 - i. Butane torch or any other source of heat
 - j. Clean wiping cloth
3. Plastic pipe and tools:
 - a. 18" of hard CPVC or PVC plastic pipe
 - b. One 1/2" CPVC/PVC elbow
 - c. One 1/2" CPVC/PVC cap
 - d. One 1/2" CPVC/PVC plastic to galvanized adapter
 - e. Hacksaw or Tubing Cutter
 - f. Sandpaper or emery cloth for dressing cuts
 - g. Plastic pipe cleaner
 - h. Purple Primer
 - i. Plastic Pipe cement
4. Pex tube and Tools:
 - a. 18" of pex tube 5/8" OD (should be 1/2" ID)
 - b. One 1/2" pex to galvanized adapter (female fitting)
 - c. One 1/2" pex to air manifold adapter (male fitting)
 - d. Two copper/stainless crimp rings
 - e. Tubing cutter
 - f. Sandpaper or emery cloth for dressing cuts
 - g. Crimping tool
5. Tools & Equipment
 - a. Safety Glasses
 - b. Adjustable Wrench or combination wrench for adapters
 - c. Lubricating Oil
 - d. Can or tub to catch excess lubricating oil when threading pipe

PLUMBING FIXTURE TEST APPARATUS



HOW TO MEASURE FOR PLUMBING EXERCISE



A & B – Bottom of elbow to top of cap

C – Bottom of Tee to end of female pex fitting

D – Bottom of female pex to end of male fitting

PLUMBING SCORE SHEET

- Water leaks will be tested by judge by attaching to PEX.
- 100 psi of Air Pressure will be applied and placed in a bucket or tub of water where leaks will be evident
- No student is to be involved in administering this test.

Contestant	1	2	3	4	5	6	7	8	9	10	11	12
Fits Template 25 Points												
Correct Assembly 10 Points												
General Appearance 15 points												
Water Tight 100 psi 50 Points												
Total Points 100 Points												

RANK:

1st

5th

9th

2nd

6th

10th

3rd

7th

11th

4th

8th

12th

DIFFERENTIAL FARM LEVEL

Preparations for Contest Site

1. Prior to the contest, an accurate method will be used to determine the difference in elevation between two points.
2. Selection of points should allow the judges to determine elevation with one instrument setup.
3. Correct readings should be insured by waving the rod or by making sure it is perfectly vertical.
4. The starting and ending points will be designated on permanent bench marks such as concrete steps, walks, or fire hydrants.
5. Blank Field Note forms for field notes will be provided at site.
6. For Official Results, it is strongly recommended to use the UT Extension Service, Soil Conservation, or Professional Land Surveyor.

Procedure for completing CDE Exercise

1. Safety Glasses are not required for this contest.
2. A three or four screw Bostrom Level or one of equal quality and magnifying power will be used.
3. Auto-Leveling (Self-leveling without contestant's assistance) instruments and instruments which assist in leveling will not be used. The level is not self-leveling it has 3-4 knobs to adjust the level. A torpedo level may be used on the measuring stick.
4. Calculators that are not programmable nor graphing may be used.
5. Clean Clipboards and paper should be free of notes.
6. Only Field Note Forms will be provided at contest site.
7. Contestants should bring all equipment needed to complete the contest.
8. The judges will indicate that "Station A" has an Elevation of 100'.
9. Judges will show the layout of the course.
10. Each team will be required to set up Instrument a "Minimum of 3 Times".
11. A team may run the course only one time.
12. Each team has a time limit of one hour to run course and turn in results.
13. All Field Notes will be turned in on the form provided.
14. Notes should be recorded on the Field Note Form in Feet to the nearest Hundredth. Not in feet & inches!
15. A Positive or Negative Difference in elevation between "Station A" and "Station B" is to be determined by each team.
16. Each team is to answer the additional question at the bottom of the Field Note Form.

Scoring

80 Points – Accuracy of difference in elevation between Station A and Station B

10 Points – Proper set up procedures, care of equipment, and use of instrument

10 Points – Accuracy, neatness, and legibility of field notes

100 Points Total

DIFFERENTIAL FARM LEVEL SCORE SHEET

Contestant	1	2	3	4	5	6	7	8	9	10	11	12
Start Time												
End Time												
Total Time												
Accuracy 80 Points												
Procedure 10 Points												
Field Notes 10 Points												
Total Points 100 Points												

RANK:1st5th9th2nd6th10th3rd7th11th4th8th12th

DIFFERENTIAL FARM LEVEL FIELD NOTES*Two pages may be used if needed for longer runs*

Chapter Name: _____

Contestant Name: _____

Contestant Name: _____

Station	BS	HI	FS	Elevation
A				
TP 1				
TP 2				
TP 3				
TP 4				
B				

Difference in Elevation in nearest Foot/Feet and Hundredths: _____

Is there an Increase or Decrease in Elevation? _____

ARC WELDING

Materials to be furnished at Contest Site

1. AC and DC Welders (you may provide your own, but welders will be available)
2. Welding Tables
3. Stand for Vertical Weld

Materials to furnished by Contestant

1. Safety Glasses
2. Six pieces of Mild Steel 1/4" x 3" x 4"
3. Welding helmet
4. Chipping hammer
5. Wire brush
6. Welding gloves
7. Electrodes of choice
8. Square
9. Soap Stone
10. Vise Grips / Clamps

Procedure for Contestant Doing Skill

1. Safety Glasses must be worn (refer to Rules and Regulations)
2. Contestant check welder
3. Turn on welder
4. Run trial bead on one piece of metal
5. Make any adjustment necessary to amperage
6. Center top, upright piece of metal length wise to bottom piece of Mild Steel – "T" (refer to illustration)
7. Run single Horizontal 1/4" Fillet Weld on one side of "T" pieces of metal
8. Chip off slag with chipping hammer and wire brush weld
9. Turn in to Judge
10. Repeat steps 3 – 4 – 5
11. May Tack Weld "T" in Horizontal Position on one end to secure pieces for Horizontal and Vertical Weld
12. Run single Vertical 1/4" Fillet Weld, bottom up, on one side of "T" pieces of metal (lap weld)
13. Chip off slag with chipping hammer and wire brush weld
14. Turn in to Judge
15. Turn Welder off and remove any tools and equipment belonging to contestant
16. No Touching Up of Either Weld

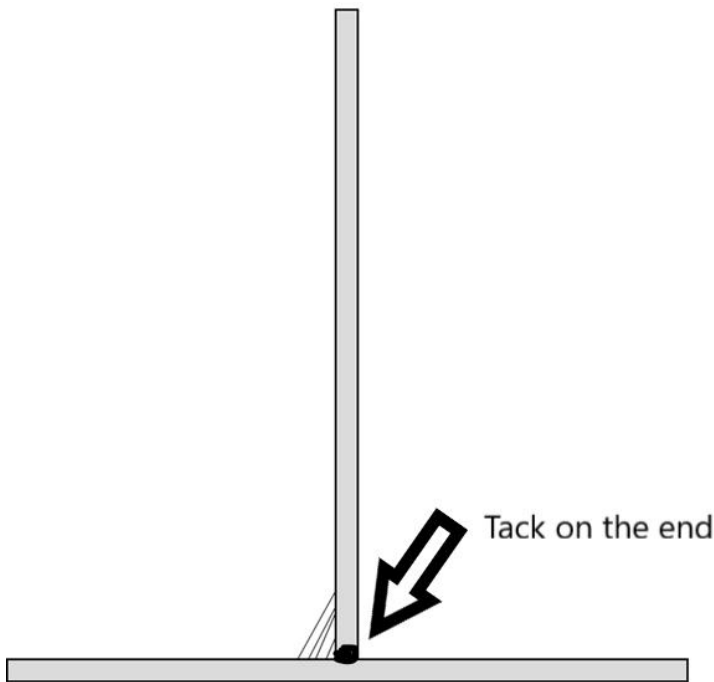
Procedures for Judging

Explain the use of the specific welder to all contestants

Safety - Safety Glasses must be worn!!!! Lack of use will result in disqualification!!

1. Technique in use of equipment
2. Efficiency and Speed
3. General appearance as evidenced by smoothness, lack of splattering, etc.
4. Strength of weld as evidenced by penetration, leg length, and lack of under cutting leg (See Illustration)
5. Horizontal and Vertical Welds centered

ARC WELDING DIAGRAM



- Top piece of metal centered to the width of the bottom piece
- Make it look like a "T"
- Use same format for horizontal and vertical welds
- Vertical weld will be completed from bottom to top
- Contestant may tack weld the vertical exercise in horizontal position

Testing of Strength:

Penetration: Making sure the weld penetrates both metals. Weld should have a slightly concave appearance to ensure equal penetration.

Undercut: Should be no undercut on top piece of metal. If occurs, then too much heat was used.

Leg Length: Weld should be the same thickness as the piece of metal that is being welded.

ARC WELDING SCORE SHEET

Contestant	1	2	3	4	5	6	7	8	9	10	11	12
Technique in use of equipment 5 points												
Efficiency & Speed 10 points												
General Appearance 20 points												
Vertical "T" Centered 20 points												
<u>Strength</u>												
1. Penetration 15 points												
2. Undercutting 15 points												
3. Leg length 15 points												
Total Points 100 Points												

RANK:1st5th9th2nd6th10th3rd7th11th4th8th12th

SMALL ENGINE

General Instructions:

The skill will be performed by one contestant. The skill will consist of troubleshooting and repairing an engine which has been faulted by the judges. Each contestant is to deliver their engine to the judge prior to the start of the CDE. The engine will be labeled so that each contestant will work on their own engine. If the judge "faults" the engine with the replacement of non-functional parts, the contestant must ask for replacement parts. Points will be deducted if the wrong part is asked for. The engine must run properly after the faults are corrected. Contestants will take an exam while the judge faults the engines.

Materials to be furnished at the Contest Site

1. Provide a crankshaft
2. Engine with ring inserted in cylinder before contest
3. Piston with compression rings
4. Gasoline for Engines

These items are to be separate from any running engines that the contestant brings to contest.

Suggested Tools Contestants are to Furnish

1. One-two six-inch or eight-inch clamps for securing engine to the bench when starting.
2. Suggested Basic Tools:
Soft or plastic faced hammer, brass hammer, needle nose pliers, 6" adjustable wrench, spark plug sockets, 1/4" socket set, socket wrench for flywheel nut, Phillips standard screwdriver, Phillips standard screwdriver, carburetor screwdriver (B&S Stratton Special Tool), spark plug wire gauge and bender, leaf type feeler gauge, and dial caliper. NOTE: digital dial caliper will not be used
3. Tachometer
4. Flywheel *holder, *wrench, *puller
5. Extra Fly-wheel Key (Judge nor host are responsible for fly-wheel key)
6. Part number 276781 Briggs and Stratton Service and Repair Manuel, Official Repair Manuel for CDE
7. Spark tester
8. Pencil and Clipboard for Exam
9. Tool, or home-made too, to secure crankshaft while loosening and tightening Flywheel Nut to help reduce chance of breaking cooling fins on flywheel.

Engine Specifications

NOTE: The engine should be mounted on a board or stand that can be clamped to a table.

1. Briggs and Stratton 5 1/2 hp overhead valve engine (OHV) or 127-208cc OHV.
2. Must have Horizontal crankshaft
3. Straight power shaft (no gear reductions)
4. Recoil starter
5. Crankcase properly filled with oil
6. Engine should not have any missing or broken parts
7. No parts are to be marked or labeled in any manner

Engine Faults Limited to:

1. Flywheel nut loose
2. Idle adjustment changed
3. Ignition system grounded
4. Air cleaner restricted
5. Spark plug gap closed or changed
6. Armature air gap changed
7. Kill switch wire short

Judging and Scoring

(May use present score sheet)

1. Observation of work

- a. Safety, dress, and work habits-20 points
- b. Proper use of tools-20 points

2. Evaluation of engine's performance: For the accuracy of speed adjustment, the contestant's tachometer will be used by the judge.

- a. Idle speed accuracy 1750 RPM-15 points (in a range of 1700-1800 RPM)
- b. Top Operating Speed Accuracy Range 3500-4000-15 points

NOTE: Idle speed should be written within plus or minus 50 rpms of Manufacturer's specifications.

4. Measurements: Checking for *Most Wear*

-You will have 5 minutes to complete all measurements

Dial Caliper Use

NO DIGITAL CAPILERS!

- a. Caliper reading of Crankshaft PTO end-10 points
- b. Caliper reading of Crankshaft Crankpin-10 points
- c. Caliper reading of Crankshaft Magneto End-10 points

Feeler Gauge Use

- a. Feeler Gauge reading of Ring Groove-10 points
- b. Feeler Gauge reading of Ring Gap-10 points

5. Exam

Exam Possible Points-100 points

The test will consist of 15 questions and will have 25 minutes to complete

6. Engine Faults

- a. The engine faults exercise will be given 30 minutes to complete.
- b. The judge will record the time and order which students finish. *Time* will be used to *break a tie* in points only.

SMALL GASOLINE ENGINE SCORE SHEET

[illegible]

LAND AREA MEASURING

Materials to be furnished at Contest Site:

1. Plot of Land a minimum of 1/2 Acre in size with no obstructions.
2. Stakes
3. Official Answer Extension Service, Soil Conservation, Certified Land Surveyor
4. Layout must NOT go thru a fence or any other obstructions

Materials to be furnished by Contestants:

1. 100 foot tape measure marked in feet and inches, or feet and tenths
2. Clear Clipboard, pencil and non-programmable, nor graphing calculator
3. Flags, rods, pencil, etc. to mark their pulls greater than 100' between stakes
4. These contestant markers are to be removed as measurements are taken

Procedure for Contestants in Doing Skill

1. Measure plot of land that has been staked off by the judges
2. Measurements will be made from the center of the stakes
3. Measure one time only
4. 1 Hour to complete CDE Event
5. Two students will work together on this skill
6. Use only a 100 foot tape measure marked in feet and inches, or feet and tenths
7. Answer will be to the nearest ten thousandths of an acre
8. Figure will be divided into three triangles by contestants
9. The Heron Method will be used for calculation of each triangle's square footage
10. A Calculator may be used
11. Programmable Calculators are not to be used

Procedure for Judging:

1. Official will stake off area and calculate acreage to the nearest ten thousandths of an acre
2. Dimension lines are to be straight and will include five sides, no more, no less
3. Plot will be 1/2 acre or more including at least one 90-degree angle
4. Corners will be marked by a maximum 1/2" diameter metal posts
5. Measurements will be made at ground level
6. The posts should be marked with flags on top for visibility
7. The judge must identify the perimeter for contestants

Heron Method

Figure the Area for Each Triangle using the Following Method

$S = \frac{A + B + C}{2}$ Use this formula for each Triangle

2

Take the Square Root of $S(S-A)(S-B)(S-C)$ for each Triangle

Add All Three Areas of the figure and divide by 43,560 Square Feet to get Acreage

LAND AREA MEASURING SCORE SHEET

*Teams Measure Course one time only

*Time must be kept on each team

Time will be used to Break Ties Only

	TEAM 1	TEAM 2	TEAM 3
Time Measuring Started			
Time Calculations Complete			
Total Time 1 Hour Maximum			
Measuring Answer			
	TEAM 1	TEAM 2	TEAM 3
Time Measuring Started			
Time Calculations Complete			
Total Time 1 Hour Maximum			
Measuring Answer			
	TEAM 1	TEAM 2	TEAM 3
Time Measuring Started			
Time Calculations Complete			
Total Time 1 Hour Maximum			
Measuring Answer			
	TEAM 1	TEAM 2	TEAM 3
Time Measuring Started			
Time Calculations Complete			
Total Time 1 Hour Maximum			
Measuring Answer			
	TEAM 1	TEAM 2	TEAM 3
Time Measuring Started			
Time Calculations Complete			
Total Time 1 Hour Maximum			

TOOL IDENTIFICATION

Eligibility:

1. This skill is limited to FFA Members who are freshmen and sophomores.
2. A student may enter this skill two years

Preparations for CDE:

1. Delmar, Agricultural Mechanics – Fundamentals & Applications 7th Edition, UNIT 7 is the Official for the CDE. A PDF copy of this will be located on the Middle Tennessee regional website.
2. The Tools to be identified will come from Unit 7.
3. The Tool ID Exam will come from Unit 7.
4. The Written Exam will ask students questions about the use of the tools and materials on the list and will be 10 questions and count 2.5 points each.

Materials Furnished at Contest Site:

1. Host will select 10 tools and 5 materials from Unit 7
2. These will be numbered and placed on a table or other workspace for identification
3. Judge will be arranged by host chapter

Materials Furnished by Contestant:

1. Clear, Clipboards (must be clean and no writing on them)
2. Pencils
3. No Paper or other Materials allowed

Procedure:

1. Use Test Sheet provided taken from Unit 7
2. Five (5) Minutes will be allowed to identify the Tools and Materials
3. Only the Name from the list will be accepted because of "common" names
4. Students will compete separately
5. No "Word Bank" or "Memory Aid" will be used
6. Time needed by each contestant for identification will be kept by judge to break ties.
7. Students will be given a maximum of Ten (10) Minutes for the Written Exam
8. Papers collected at the time limit for each section

Scoring:

1. 100 Points Total Score – 75 for Tool Identification & 25 for Written Exam
2. Tool Identification Time will be used as a Tie Breaker
3. Contestant will not be penalized for spelling errors
4. Written Exam will be Multiple Choice
5. Contestant suspected of cheating will be disqualified

TOOL IDENTIFICATION EXAM SHEET

Contestant Number: _____

Chapter: _____

Contestant Name: _____

You will be given five minutes to complete the tool identification. Please have materials ready and ask any questions you have before time begins. Time for tool identification will be used only to break a tie. Each tool is numbered. Write the name of the tool beside the matching number. *Turn in your paper as soon as you complete it.*

1. _____

2. _____

3. _____

4. _____

5. _____

6. _____

7. _____

8. _____

9. _____

10. _____

11. _____

12. _____

13. _____

14. _____

15. _____

TOOL IDENTIFICATION SCORE SHEET

Contestant	1	2	3	4	5	6	7	8	9	10	11	12
Tool Identification 15 Tool ID's (5 points each)												
Written Exam (10 questions) (25 points each)												
Total Points 100 Points												
Tool Identification Time (Tie Breaker)												

RANK:1st5th9th2nd6th10th3rd7th11th4th8th12th

3-WAY ELECTRIC SWITCH INSTALLATION

Options of Wiring:

Person in charge of CDE shall determine by lot, which of the three types of 3-Way Switch is to be constructed.

1. Light between switches, source of energy at light
2. Light before the switches, source of energy at light
3. Light beyond the switches, source of energy at switch most distant from light (8" from base)

Minimum Materials to be furnished by Contestant:

1. Safety Glasses: Contestant will be disqualified for not wearing Safety Glasses during CDE, except when cleaning them.
2. Two Plastic wall boxes 3" x 2" x 3" or comparable; One for Switch, One for Duplex (mount to frame before CDE)
3. One Metal wall box 3" x 2" x 3" or comparable (mount to frame before CDE)
4. One Duplex Receptacle with green screw
5. One Pre-Fabricated Power Source Cord for Duplex Receptacle.
6. One 4" plastic or metal ceiling box (mount to frame before CDE, must be large enough for the number of wires in the box)
7. One light Receptacle
8. 14/3 non-metallic sheathed cable with ground 6 Feet Long; 14/2 non-metallic sheathed cable with ground 8 feet long.
(Judges Note: students should not be penalized for using #12 wire since this could be a 15 amp or 20 amp circuit.
However, only one size wire can be used throughout the circuit)
9. Sufficient number of Solderless Connectors to fit above listed wires and green pigtails for grounding metal boxes
10. Two Switch Box Covers
11. One Duplex Receptacle Cover
12. Wood Frame according to drawing
13. Required number of 1/2" non-metallic sheath cable fasteners (romex connectors)
14. Necessary Tools to complete this CDE (power drivers are acceptable)
15. required number of electrical approved staples

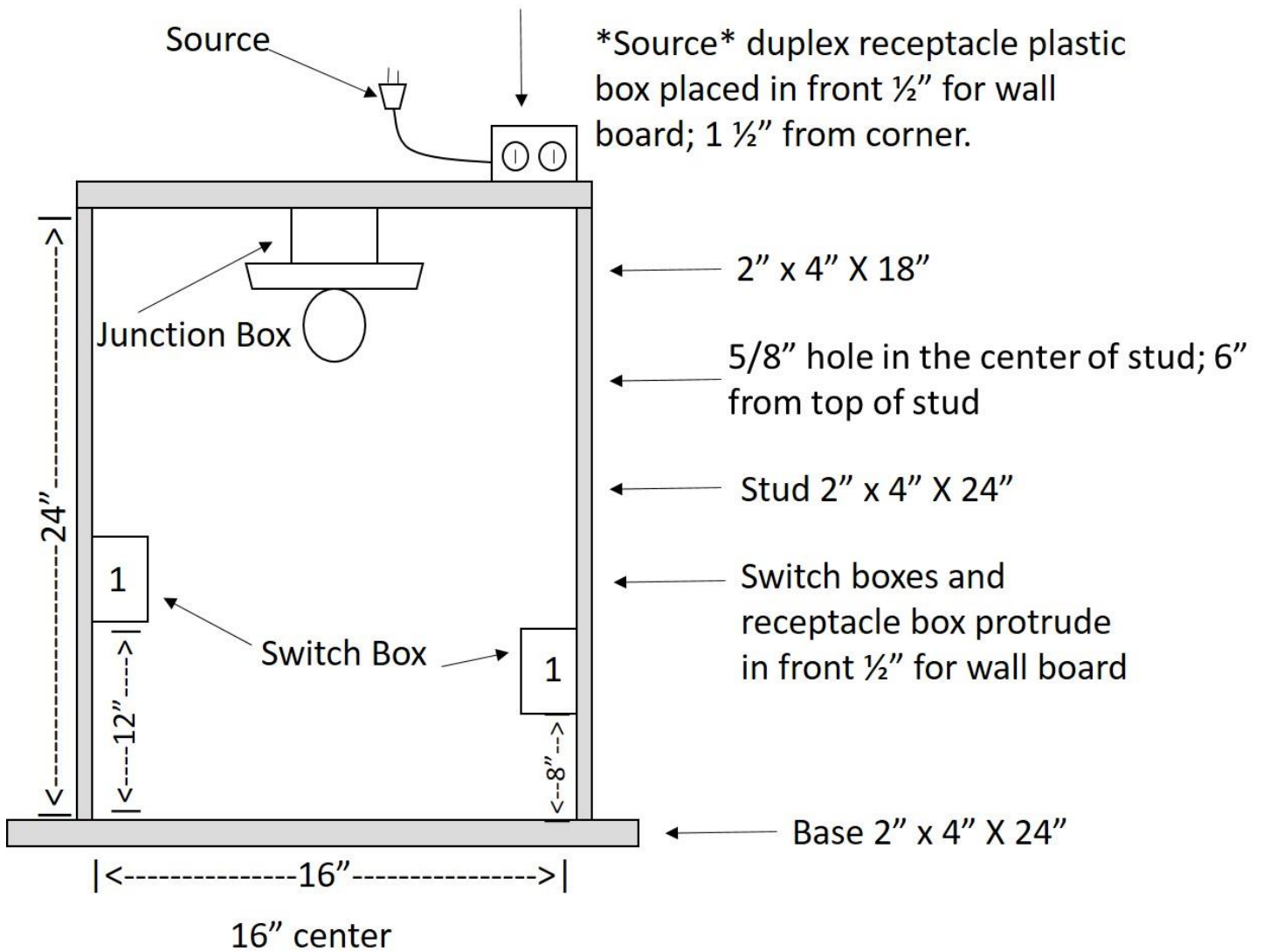
Materials Furnished at Contest Site:

1. Extension Cord six feet or longer for plugging male end of Duplex Receptacle Power Cord for testing lights
2. Tables to mount Frames to for Event

Procedure for CDE Exercise:

1. This skill is designed to teach Electric Principles rather than Carpentry.
2. Mount all electrical boxes on specified Frame before CDE
3. BEFORE CDE EVENT: Construct an 18", 14/2 non-metallic sheathed with ground, Male Plug on one end and 8" of sheath stripped on other end for insertion into the Duplex Box to serve as "Source" (should be 12/2 if using #12 wire in rest of the circuit).
4. Male plug will plug into the Extension Cord for testing. Note to your students that this is not an acceptable wiring practice for codes, but is used in this exercise for safety reasons when connecting the project to an electrical source in the contest)
5. Frame must be secured to table with clamp before contest begins
6. All work must be completed with frame clamped to the table right side up
7. Run a 14/2 cable with ground from the duplex receptacle box, through the 5/8" hole pre-drilled in stud
8. Proceed to run 14/2 cable to designated for the source wire to enter (either the light, or switch box)
9. Install wires in boxes (see score sheet for measurements)
10. Connect wires to switches and to receptacles and line
11. Solderless connectors (i.e. wire nuts) used, if using wire nuts wires in Solderless Connectors must be twisted together
12. Connect and exit the 18" pre-fabricated "Source Cable with Male Plug" from the left side of the Duplex Receptacle box
13. 1 Hour Time Limit to complete this CDE Event

3-WAY ELECTRIC SWITCH DIAGRAM



3-WAY ELECTRIC SWITCH INSTALLATION SCORE SHEET

Contestant	1	2	3	4	5	6	7	8	9	10	11	12
Operates Properly 50 points												
Correctly Wired 50 points												
Inside Appearance 50 points												
Outside Appearance 50 points												
Total Points 200 Points												
Rank												

NOTE: Subtract one to five points from the above total for each deficiency below.

OUTSIDE APPEARANCE

- Boxes properly installed (1/2" past wall stud)
- Wires properly installed in boxes (Outside installation goes under Romex connectors)
- Neat corner bends (very little daylight between wire and wall stud)
- Wires properly installed (staple hold wires firmly in place but does not cut into outside installation)
- Wires going into plastic box must be stapled within 8" of the box

INSIDE APPEARANCE

- Insulation properly stripped (1/2" to 5/8"). Inside insulation should come up to terminal but not go under terminal
- Terminal attachment (wires wrapped clockwise)
- No nicked or cut insulation
- Splices properly turned (clockwise) if using wire nuts
- Insulation under Solderless connectors (no bare wire exposed)
- Loose wires (wires held tight under terminal)
- Grounding screws installed properly
- Length (sheathing stripped to no less than 1/4" from the inside back of the box but no more than 3/4". Unsheathed wires should extend at least 8" from the inside back of the box)
- Grounding wires in plastic wall box must be spliced together with Solderless connectors
- Grounding wires in metal boxes must be spliced together with Solderless connectors with one wire connected to each metal box with screw and green pigtail
- A single ground wire in the plastic wall box must be grounded to the switch

OXY-ACETYLENE CUTTING

Minimum Materials to be Furnished by Contestant:

1. Safety Glasses: Contestant will be disqualified for not wearing Safety Glasses during CDE, except when cleaning them.
2. Tinted goggles approved for cutting torch. (Sunglasses are not expectable unless approved by judge)
3. Two pieces 1/4"X4"X4" piece of metal
4. Straight-edge
5. Chalk
6. Measuring device (May not be easy read)
7. Heat Resistant Gloves
8. Pliers
9. Chipping Hammer
10. Contestants may bring their own torch body but must have a quick connect body, If not contestant will use what is provided.

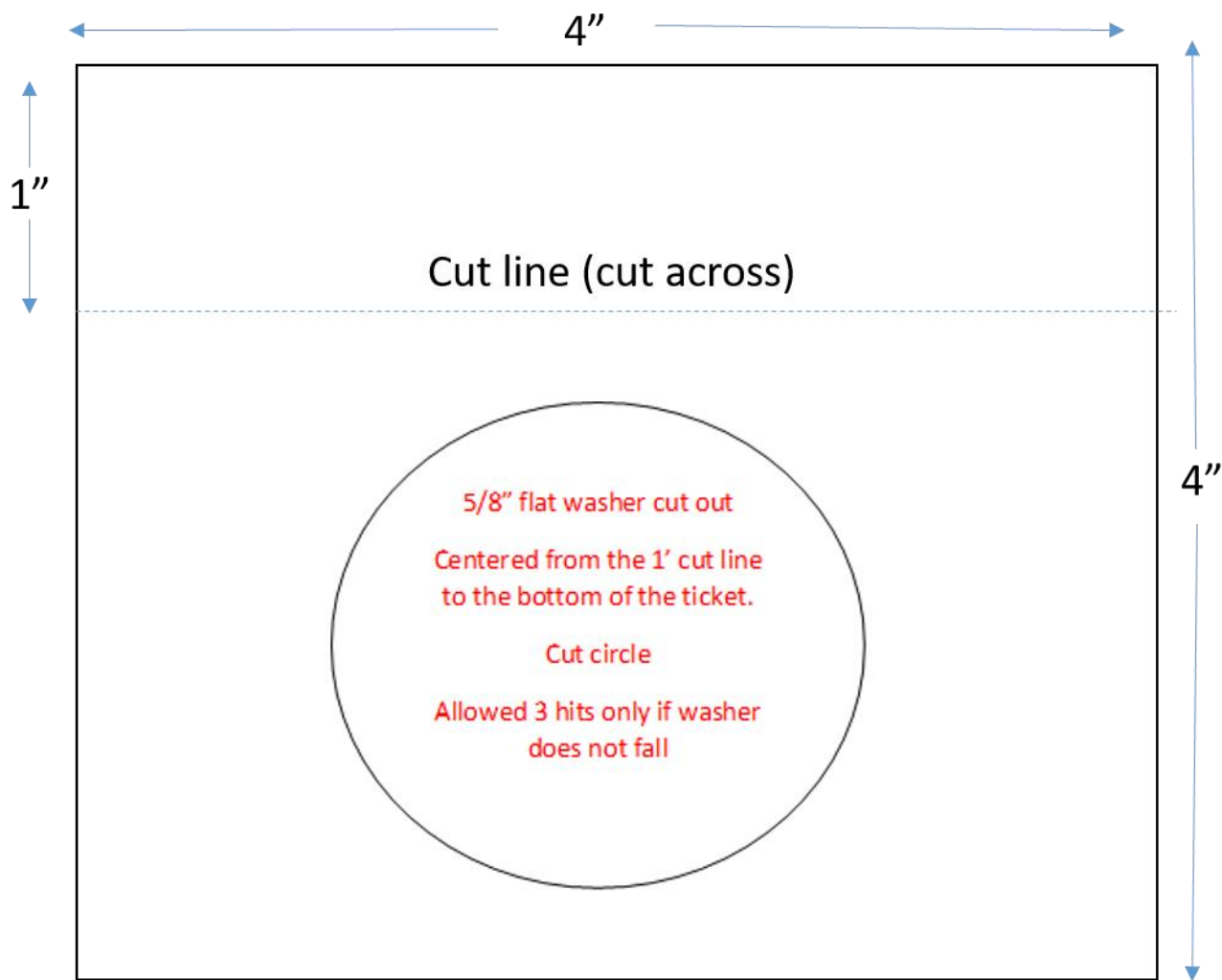
Materials Furnished at Contest Site:

1. Oxy-Acetylene Torch Set-up. (Students may bring their own torch body with quick connects only)
2. 5/8" washer
2. Table or vise for metal to be cut on.

Procedure for CDE Exercise:

1. Pre-mark metal for straight line cut and with 5/8 washer to mark circle for both cuts to save on cool down time (see drawing for specs)
2. Judge will attach the student's torch body. NO STUDENT IS ALLOWED TO ATTACH OR DETACH.
3. Check equipment
4. Clean tip if necessary
5. Use practice piece for heat setting
6. Student will cut the 1" line and then the outer diameter of the 5/8 flat washer.
- 7. 3 hits will be allowed on the flat washer only if it does not fall out.**
8. Contestants have 30 minutes to complete.

OXY-ACETYLENE DIAGRAM



SCORING RUBRIC FOR CUTTING EXERCISE

Contestant	1	2	3	4	5	6	7	8	9	10	11	12
Safety and Technique Use in Equipment (20 points)												
Appearance:Smoothness and Uniformity (20 points)												
Horizontal Cut (30 Points)												
Flat Washer Cut (30 Points)												
Rank												

Safety and Technique: For each improper use of equipment Judge may deduct up to 5 Points

Appearance: Judge may deduct up to 5 points for each deformity found

Horizontal Cut: Judge may deduct the following

1. 10 points each for the straightness of the cut horizontally and vertically
2. 10 points for too much slag.

Flat Washer Cut: Judge may deduct the following

1. 15 points for out of round
2. 5 points for too much slag
3. 10 points for vertical straightness

****Cuts that are attempted but not complete will receive 0 Points.**