

Virginia 4-H Contest Guide- Arc Welding

Developed by: Dan Swafford, 4-H Curriculum Specialist, and Andy Seibel, Associate Extension Specialist

Description of Contest

This event provides 4-H members an opportunity to demonstrate their knowledge and skills in arc welding. The contest includes the following events:

1. Written examination
2. Presentation
3. Arc welding skill demonstration

One (1) 4-H participant from each county may participate in the state event. Designated judges will preside over the contest and the judge's decisions and placings are final.

Levels of Competition

Unit (county), District, State, National

Age Categories:

Senior contestants for the Virginia 4-H Arc Welding Competition must be 14-18 years old as of January 1 of the competition year. This is in accordance with National Contest Guidelines

Awards to be Earned

Danish Awards: Blue Ribbon 300-200, Red Ribbon 199 and below.

Top senior individual (at least 14 years of age, but not older than 19 years of age as of January 1 of the present year) at the state contest is eligible to compete at the National Youth Engineering Challenge, Purdue University, West Lafayette, Indiana.

Rules for this Contest

1. Written Examination

The written examination will consist of 25 questions (true-or-false, multiple-choice). Included will be question on safety, equipment, methods, power sources, weld types and weld quality. The test questions will be taken from the project literature and related references. A time limit is announced when the examination is given. Each question is worth 4 points. Therefore, the number of questions missed x 4 = total number of points to be deducted.

References

“Lincoln Electric Welder’s Guide” (1M-237-G)

“Arcs and Sparks, Shielded Metal Arc Welding” (4-H 572), The Ohio State University Extension

Rules

- 1) Four penalty points will be given for each question answered incorrectly.

Scoring: Question missed _____ x 4 = total Penalty Points _____

2. Visual Presentation

The presentation will be of a SMAW weldment project that the participant has completed this year. (Presentation of a weldment from a non-4-H project is prohibited.) The presentation should explain what the weldment is; describe how the welding was done, and how well the weldment has functioned in its intended use. Visual aids such as photos, slides, videos or posters should be used for the presentation. Contestants must furnish their own demonstration materials. Visual aids should be readable from twenty feet. There is a fifteen minute time limit on the presentation. The event is worth 100 points.

3. SMAW Skills

For the SMAW skills event each welding contestant will demonstrate their SMAW ability by making the following welds: a 3” long bead on plate weld, a 3” long double square groove weld and a 3” long fillet weld. Welding will be done using a Shielded Metal Arc Welding Power Source and 1/8” diameter, AWS type E-6011 electrodes. The power sources, base metal, electrodes and fully equipped welding stations will be provided. Each contestant will be given a copy of Welding Procedure for Event No. III - SMAW SKILLS for study and use during event III.

NOTE: Each contestant will be suitably attired for SMAW, by wearing industrial quality

eye protection, long sleeve shirt, long pants and high top foot protection (no athletic foot wear). Gauntlet leather welding gloves and welding helmets with a #10 filter plate will be provided but any welding contest participant may bring and use their own welding equipment. Contestants wearing shorts, short sleeved shirt or any inappropriate clothing or footwear will not be permitted to weld. Industrial quality eye protection (clear or shaded) will be worn in the contest area where the Weldment is being created and especially under the welding helmet during welding.

Rules

- 1) One penalty point will be given for each evaluation point missed (100 - Total evaluation points awarded).
- 2) Time limit is 30 minutes

Scoring: Evaluation Points Missed x 1 = Penalty Points

Procedure:

1. Determine that the low carbon steel base metal (1/4 inch thick) and filler metal (E-6011 electrode, 1/8 inch diameter) are sufficient and suitable for use.
2. Check the set-up of the SMAW power source and equipment. If not operating properly, ask for assistance.
3. Set the arc welding current selector of the power source to a value based upon the low carbon steel base metal thickness and the electrode (diameter) selected (use either 90, 105 or 120 AMPS). Use a 3x3 piece of base metal for setting power source and practicing welding.
4. Insert the electrode into the electrode holder at a 90E angle.
5. Start the arc by striking the electrode like a match. Using the backhand welding technique maintain a travel angle of 10E - 30E with an "effective" work angle of 90E.
6. Hold a constant arc length (1/8 inch or equal to the diameter of the electrode core wire).
7. Use a uniform travel speed, ripples (with slag removed) will show a half moon or crescent shape.
8. Bead width, including the slag cover, should be approximately 2 but less than 3 electrode (coating) diameters wide.
9. When stopping the weld, raise the electrode slowly and go back over about 1/2 to 3/4 inch of the weld, then lift the electrode to extinguish the arc. This technique will provide filler metal to fill the weld crater as the weld pool solidifies.
10. After running a sample bead on your test plate; readjust the current selector, as necessary. If the electrode sticks to the base metal, increase the current setting. If the electrode spatters too much and the crater becomes too large, then decrease current setting.
11. For the **Weld Bead**, make a single pass across one 3x3 piece of base metal. The weld bead should be 2 1/2 inches long. The weld bead is to be made in the flat or 1G position. Make the weld after you have tacked the pieces together for the groove weld. See illustration.
12. For the **Groove Welded, Butt Joint**, space 2 pieces of 3x3 base metal 1/16 to 1/8 inch apart or equal to the electrode core wire diameter. Then without changing the space between the two pieces of base metal; tack weld both pieces of base metal together in the flat or 1G position. See illustration.
13. Now, make one pass on each side of the butt joint using the welding technique of Para 5 above. Before making the pass on the second side; clean the side, removing all slag at the root.
14. Hold the proper arc length (approximately 1/8 inch) with the arc pushed halfway into the groove. Travel fast enough to keep the arc at the front edge of the weld pool.
15. Allow the completed square groove weld to cool.
16. For the **Fillet Welded, Corner- Joint**, tack weld the 2 inch ends of the 2 pieces of 2x3 base metal to the middle of the 3x3 base metal (without the weld bead) forming a corner joint. See illustration.
17. Now, make a single pass fillet weld progressing vertically uphill (3F-up). Use the backhand welding technique with a slight weaving motion or using a whipping motion. Maintain a travel angle of 0E-10E with a work angle of 45E. Start the weld a 1/2 inch above the lower piece of base metal.
18. Hold a short arc length (no more than an 1/8 inch). Travel fast enough to keep the arc at the front edge of the weld pool and the weld pool under control.
19. Allow the completed weldment to cool. There should be three welds on the weldment - a weld bead, a double square groove weld and a single fillet weld.
20. Clean all welds with a chipping hammer and wire brush. Also, clean up all unused electrodes, electrode stubs and any other waste material by properly disposing of these items in the stub bucket.
21. Once weldment has been cooled and cleaned, submit the weldment to your judge for evaluation.

SMAW Skills Rubric					
Evaluation	Point Definition	Stringer Bead	Groove Weld	Fillet Weld	Constructive Comments
	1 Point				
Bead Width	The bead width, including the slag cover, should be 2 but less than 3 electrodes (coatings) wide.				
Bead Height	The bead height is uniform and has a smooth appearance.				
Appearance	Use a uniform travel speed, ripples (with slag removed) will show a half moon or crescent shape.				
Face of Weld	Slightly convex, free of porosity and free of excessive reinforcement.				
Edge of Bead	Sides and edges are smooth blending into each weld. Undercutting is kept to a minimum; Weld does not float on surface.				
Start and Stop	End of each weld is complete; the line does not taper off				
Followed Welding Procedure	The welding project was completed as instructed.				
Safety Practice	All of the safety procedures followed; welding helmet on, welding gloves on, long sleeves were down, welding curtain closed, proper dress every day of work on the assignment				
	Subtotal 10 Points max				
	Weighting Factor	X 2	X 4	X4	
	Total Points				

The Presenter (20 points)					
Indicators	Very strong evidence skill is present 5-4	Moderate evidence skill is present 3-2	Strong evidence skill is not present 1-0	Total Score	Constructive Comments
A. Appearance	The 4-H member is dressed in a professional business manner and is exhibiting desirable professional behavior.	The 4-H member is dressed in a casual business attire and is caring themselves in a professional manner.	The 4-H member is dressed in a manner that does not communicate professional attire.		
B. Voice/Tone	Voice is upbeat, impassioned and under control. Emitted a clear, audible voice for the audience present.	Voice is somewhat upbeat, impassioned and under control. Emitted a somewhat clear, audible voice for the audience present.	Voice is not upbeat; lacks passion and control. Emitted a barely audible voice for the audience present.		
C. Poised	Is extremely well poised. Poised and in control at all times.	Usually is well poised. Poised and in control most of the time; rarely loses composure.	Isn't always well poised. Sometimes seems to lose composure		
D. Pronunciation	Pronunciation of words is very clear and intent is apparent.	Pronunciation of words is usually clear, sometimes mumbled.	Pronunciation of words is difficult to understand; unclear.		
Presentation (35 points)					
A. Introduction	Strong introduction and is able to effectively articulate information	Good introduction and is able to, for the most part, articulate information	Weak introduction, but is unable to articulate information.		
B. Mannerisms/ Appropriate method	Does not have distracting mannerisms that affect effectiveness. No nervous habits and the member conducted an illustrated presentation.	Sometimes has distracting mannerisms that pull from the presentation. Sometimes exhibits nervous habits or ticks, and the member attempted to conduct an illustrated presentation.	Have mannerisms that pull from the effectiveness of the presentation. Displays some nervous habits – fidgets or anxious ticks. Presentation was more like a demonstration.		

Virginia 4-H Arc Welding Presentation Rubric – Continued

C. Gestures/ Attention (eye contact)	Gestures are purposeful and effective. Hand motions are expressive and used to emphasize talking points. Constantly looks at the entire audience (90-100% of the time).	Usually uses purposeful gestures. Hands are sometimes used to express or emphasize. Mostly looks around the audience (60-80% of the time).	Occasionally gestures are used effectively. Hands are not used to emphasize talking points; hand motions are sometimes distracting. Occasionally looks at someone or some groups (less than 50% of the time).		
D. Teaching Aids	Teaching aids look professional and are used in a purposeful manner and effectively assist in communicating information.	Teaching aids are look neat and are used and they help assist in communicating information	Teaching aids are not neat and are used in an ineffective manner and they do not assist in communicating information.		
E. Organization	Is able to stay fully detail oriented. Always provides details which support the topic; is well organized.	Is mostly good at being detail oriented. Usually provides details which are supportive of the topic; displays good organizational skills.	Has difficulty being detail oriented. Sometimes overlooks details that could be very beneficial to the issue; lacks organization		
F. Audience View	Speaker uses power of presentation to engage and captivate the audience with the message of the speech.	Speaker presents speech as mere repeating of facts and speech comes across as a report	Speaker bores the audience with lack of enthusiasm and power to deliver the speech.		
Subject Matter 15 points					
Reason for Choice	The speaker clearly articulated the reasoning behind selecting this topic. Examples utilized demonstrated a clear understanding of the topic.	The speaker attempted to articulate the reasoning behind selecting this topic. Examples utilized demonstrated an understanding of the topic.	The speaker did not communicate the reasoning behind selecting this topic. Examples utilized did not demonstrated understanding of the topic.		
One Basic Theme	The content was limited to a single topic area that can be effectively covered during the allotted time frame.	The content was covered somewhat effectively during the allotted time frame.	The content was broadly covered during the allotted time frame.		

Virginia 4-H Arc Welding Presentation Rubric – Continued

Practical	Complete knowledge and application of the subject matter is demonstrated. The application of the knowledge is conveyed through the content of the speech.	Knowledge of the subject is evidenced, but the speaker fails to relate and convey a clear understanding of the content.	Minimal knowledge of the subject is evidenced in the speech; the content does not support the participant's understanding of the topic.		
Information Presented 20 points					
Accurate	The speaker always provides details which support topic.	The speaker usually provides details which are supportive of the topic	The speaker sometimes overlooks details that could be very beneficial to the topic.		
Up-to -Date	The speaker's information is up to date and realistic examples are clearly communicated.	The speaker's information is current but the examples used do not demonstrate understanding.	The speaker's information is not current and the member does not demonstrate understanding.		
Complete	The speakers examples where original, logical, relevant and clearly explained.	The speaker's examples where effective, but need more originality or thought and clarification.	The speaker's examples where sometimes confusing, leaving the listeners with questions.		
Appropriate for Age and Experience	The topic and information are challenging but appropriate for speaker's age and skill level.	The topic and information are somewhat appropriate for speaker's age and skill level.	The topic could be more challenging for speaker.		
Knowledge of Subject 10 points					
Principles	The speaker shows passion, and obviously has firsthand experience that was effectively communicated.	The speaker shows enthusiasm, and provided examples of the experience.	The speaker shows little enthusiasm, and did not provide examples of the knowledge gained.		
Application	The speaker demonstrated real world application throughout the presentation.	The speaker demonstrated some ability for application during the presentation.	The speaker failed to demonstrate an understanding of the application of the knowledge gained.		
			Rank		
Items under the major divisions I, II and III should be scored. Space under "Constructive Comments" is for additional suggestions and ideas. First place will be determined by high score.					
Time limit is 15 minutes maximum; 10 to 12 minutes preferred.					

Objectives:

1. To show skill(s) in the safe handling and application of SWAM equipment and supplies.
2. To show skills in selecting and utilizing SWAM equipment and supplies.
3. To show skills in making a weld bead in the flat position (1G), a square groove welded, butt joint in the flat position (1G) and fillet welded, corner joint in the vertical position - up direction (3F-Up).

Material and Equipment:

1. 3 pieces 3 inches x 3 inches
2 pieces 2 inches x 3 inches
2. Filler metal - 1/8 inch diameter E6001 electrodes
3. Safety equipment (eye, face, hand, and body)
4. SWAM power source and equipment
5. Chipping hammer with wire brush
6. Combination and Vice-Grip™ pliers
7. Cooling and stub buckets
8. Welding table

