

NATIONAL YOUTH ENGINEERING CHALLENGE

Arc Welding Challenge

September 24-26, 2017

Tippecanoe County Fairgrounds, Lafayette, IN



These instructions are a guide for the Arc Welding contest. This contest is designed to give youth an opportunity to demonstrate their Knowledge and skills in arc welding. Safety will be stressed throughout the contest.

This contest will include (*time limits as shown*):

1. Written Examination (*20 minutes*)
2. Visual Presentation (*15 minutes maximum, 10 minutes preferred*)
3. Arc welding skills event (*30 minutes*)

Designated judges will preside over the event and their decisions will be final.

References

"Arcs and Sparks, Shielded Metal Arc Welding" (4-H 572)

Ohio State University eStore
<http://estore.osu-extension.org/>
(614) 292.1607

Lincoln Electric Welding Safety Series
<http://safety.lincolnelectric.com/>

Scoring: The points-off system will be used with penalty points given for errors. The winning contestant will be the one with the lowest total score.

It is the policy of the Cooperative Extension Service that all persons shall have equal opportunity and access to the programs, services, activities and facilities without regard to race, color, sex, religion, national origin, age, marital status, parental status, sexual orientation, disability or status as a veteran.

Contestant's Name _____ State _____ Number _____

NATIONAL YOUTH SHIELDED METAL ARC WELDING CONTEST

EVENTS	PENALTY POINTS
Written Examination	_____
SMAW Skills Event	_____
Visual Presentation	_____

Individual with the lowest penalty points will be declared the winner.

Event No. I - Written Examination

Will consist of 25-30 multiple choice, true-false and/or fill in the blank questions. Included will be question on safety, equipment, methods, power sources, weld types and weld quality. The questions will be based on the reference source: Arcs and Sparks, Shielded Metal Arc Welding (4-H 573) from The Ohio State University Extension. The reference materials can be obtained from these two sources for a small fee.

- Rules:**
1. Four penalty points will be given for each question answered incorrectly or unanswered.
 2. Time limit is 20 minutes.

Scoring: Number of Questions Missed _____ x 4 = _____ Penalty Points

Event No. II - Visual Presentation

Presentation will be of a SMAW weldment 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. Visuals should be readable at 20 feet.

- Rules:**
1. Two penalty points will be given for each evaluation point missed (100 - total evaluation points awarded).
 2. Time limit is 15 minutes.

Scoring: Evaluation Points Missed _____ x 2 = _____ Penalty Points

Contestant's Name _____ State _____ Number _____

NATIONAL YOUTH SHIELDED METAL ARC WELDING CONTEST

Event No. III - 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

Contestant's Name _____ State _____ Number _____

**NATIONAL YOUTH SHIELDED METAL ARC WELDING
CONTEST Event No. II - Visual Presentation**

Title of Presentation _____

Items under the major divisions I, II and III should be scored. Space under "Judges' Comments" is for additional scoring suggestions and ideas. Time limit is 15 minutes maximum; 10 to 12 minutes preferred.

FACTORS FOR SCORING	MAXIMUM SCORE 5 POINTS EACH	JUDGE'S COMMENTS
I. The Presenter (20 points) A. Appearance B. Voice C. Poise D. Grammar	_____ _____ _____ _____	
II. Presentation (35 points) A. Introduction B. Appropriate Method C. Verbal Presentation D. Teaching Aids E. Organization F. Audience View G. Summary	_____ _____ _____ _____ _____ _____ _____	
III. Subject Matter (45 points) A. Selection of Subject 1. Reason for Choice 2. One Basic Theme 3. Practical B. Information Presented 1. Accurate 2. Up-to-Date 3. Complete 4. Appropriate for Age and Experience C. Knowledge of Subject 1. Principles 2. Application	_____ _____ _____ _____ _____ _____ _____ _____	

TOTAL _____

NOTE: The "average score" entered on the event scoresheet is the average score calculated from the multiple judges.

(Points to consider in scoring on back)

POINTS TO CONSIDER IN SCORING VISUAL PRESENTATION

- I. The Presenter (20 points)
 - A. Appearance — Was the presenter’s dress neat and appropriate? Did the presenter have good posture? Was the presenter well groomed? Was the clothing they were wearing suitable for their presentation?
 - B. Voice — Did the presenter speak distinctly and forcefully, yet naturally. Was the presenter’s voice clear with distinct enunciation, and reasonably strong? Were they enthusiastic?
 - C. Poise — Was the presenter calm, pleasant, confident. Did the presenter keep their composure even when something appears to go wrong or does go wrong? Did they have self-assurance, yet a pleasant manner?
 - D. Grammar — Did the presenter use correct, well chosen words? Did they use correct grammar and chose words that make the meaning clear?

- II. Presentation (35 points)
 - A. Introduction — Was it effective and interesting? This is an explanation of the presentation not an introduction of the presenter. Did it get the attention of the audience?
 - B. Appropriate Method — Did the presenter choose a demonstration when an illustrated talk would have enabled them to do a better job?
 - C. Verbal Presentation — Were the steps, illustrative material and explanation coordinated? Did the presenter talk about what they were showing and explain their procedure? If information given was to fill time during the presentation, was it related to what is being shown?
 - D. Teaching Aids — Were equipment, models, charts and supplies effective and well arranged? Did the presenter choose the teaching aids that the best to tell their story? Were the charts and models neat, concise and appropriate?
 - E. Organization — Was the presentation well organized, steps clear and logical, not just memorized. Was evidence shown that the presenter had planned their presentation?
 - F. Audience View — Were aids large enough for the audience to see? Did the presenter keep space in front of them open so that the audience could see what they were doing?
 - G. Summary — Were the key points summarized?

- III. Subject Matter (45 points)
 - A. Selection of Subject
 - 1. Reason for Choice — Why did the presenter choose this particular subject? Was this stated clearly?
 - 2. One Basic Theme — Was the presentation confined to one theme or was it so broad in scope that it could not be covered in the allotted time?
 - 3. Practical — Was the subject important to the project area and to the presenter?
 - B. Information Presented
 - 1. Accurate — Was the information correct? Could you follow the directions given?
 - 2. Up-to-Date — Was it the most current information to which the presenter would have had access or was obsolete information given?
 - 3. Complete — Were all the steps in the process shown?
 - 4. Appropriate for Age and Experience — Was the presentation appropriate to the age and experience of the presenter?
 - C. Knowledge of Subject
 - 1. Principles — Did the presenter understand the principles and practices presented?
 - 2. Application — Did they understand how to correctly apply the information presented?

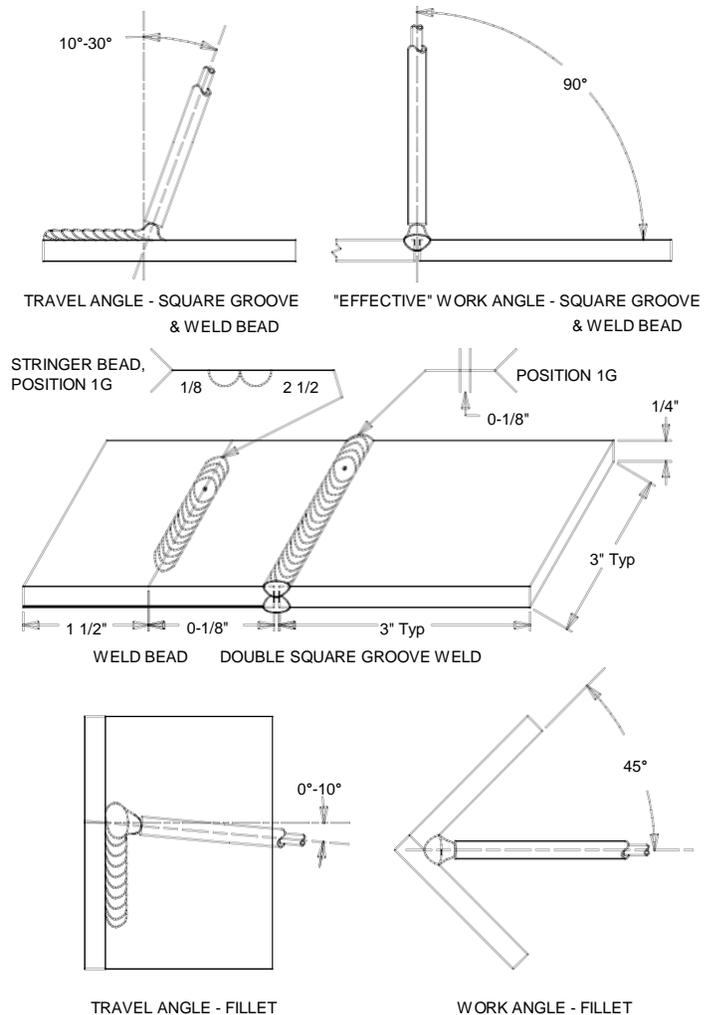
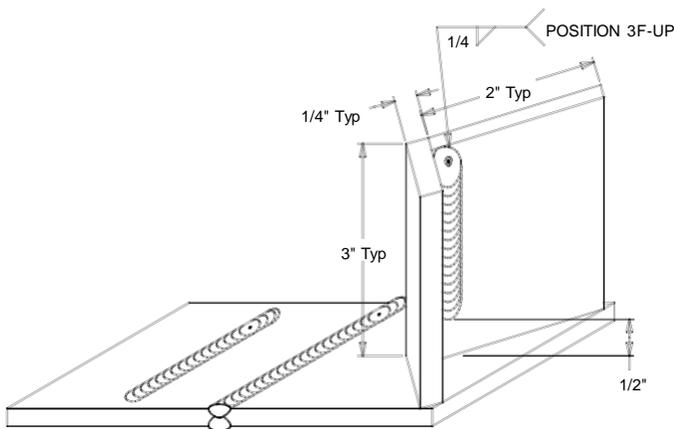
NATIONAL YOUTH SHIELDED METAL ARC WELDING CONTEST PROCEDURE for Event No. III - SMAW SKILLS

Objectives:

1. To show skill(s) in the safe handling and application of SMAW equipment and supplies.
2. To show skills in selecting and utilizing SMAW 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 E6011 electrodes
3. Safety equipment (eye, face, hand and body)
4. SMAW power source and equipment
5. Chipping hammer with wire brush
6. Combination and Vise-Grip™ pliers
7. Cooling and stub buckets
8. Welding table



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 the weldment has been cooled and cleaned, submit the weldment to your judge for evaluation.

**NATIONAL YOUTH SHIELDED METAL ARC WELDING CONTEST
Event No. III - SMAW Skills**

Evaluation: _____

Judge(s): _____

Considerations Comments	Possible Points	Weld: Bead/Groove/Fillet Points Earned
1. Bead Width	1 / /
2. Bead Height	1 / /
3. Appearance - smooth & uniform	1 / /
4. Face of weld - slightly convex, free of porosity and free of excessive reinforcement	1 / /
5. Edge of bead - no over-lapping or undercutting	1 / /
6. Start and Stop - full size	1 / /
7. Followed Welding Procedure	2 / /
8. Safety Practice	2 / /
Subtotal	10 / /
Weighting Factor		X 2 X 4 X4
TOTAL	 / /