

## COURSE OUTLINE

**Course Number:** WLD-210  
**Title:** Beginning Shielded Metal Arc Welding Pipe Welding  
**Approval Date:** June 2011

**Credits:** 2  
**Length of Course:** 44 lecture/lab hours

*For each credit, the student will be expected to spend, on average, 3 hours per week in combination of in-class and out-of-class activity.*

**Grading Method:** A-F or Pass/No Pass  
**Prerequisites:** Pass WLD-112  
**Co-requisites:** None  
**Recommended:** None  
**Required:** None

**Certified General Education Area(s):** None  
**Related Instruction Area:** None  
**Uses library resources:** None

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**Department:** Welding  
**Outline Developed by:** Kelly Steigleder  
**Course Approved as:** Career Technical Preparatory

### Course Description:

Provides an opportunity to acquire the knowledge and skills to perform open root groove welds on plate and pipe using E6010 and E7018. Oxy-fuel pipe cutting is included.

### Student Learning Outcomes:

*Upon successful completion of this course, students will be able to:*

1. prepare an open root butt joint on plate for welding,
2. weld a satisfactory root pass using E6010 electrodes,
3. weld a satisfactory hot pass using E6010 electrodes,
4. weld satisfactory filler passes using E7018 electrodes,
5. weld a satisfactory cover pass using E7018 electrodes,
6. practice preparing open root butt joints on pipe for welding,
7. weld a root pass using E6010 electrodes,
8. weld a hot pass using E6010 electrodes,
9. weld filler passes using E7018 electrodes,
10. weld a cover pass using E7018 electrodes.

### Major Topic Outline:

1. Safety.

2. E6010 and E7018 fundamentals.
  3. Plate preparation.
  4. Open root plate welds.
  5. Root pass.
  6. Hot pass.
  7. Filler passes.
  8. Cover pass.
  9. Pipe preparation.
  10. Pipe welding positions.
  11. Inspection.
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## AAOT/ASOT GENERAL EDUCATION OUTCOMES COURSE OUTLINE MAPPING CHART

### Mark outcomes addressed by the course:

- Mark "C" if this course completely addresses the outcome. Students who successfully complete this course are likely to have attained this learning outcome.
- Mark "S" if this course substantially addresses the outcome. More than one course is required for the outcome to be completely addressed. Students who successfully complete all of the required courses are likely to have attained this learning outcome.
- Mark "P" if this course partially addresses the outcome. Students will have been exposed to the outcome as part of the class, but the class is not a primary means for attaining the outcome and assessment for general education purposes may not be necessary.

***This course does not include assessable General Education outcomes.***

*As a result of completing the AAOT/ASOT general education requirements, students will be able to:*

### **WR: Writing Outcomes**

- \_\_\_\_\_ 1. Read actively, think critically, and write purposefully and capably for academic and, in some cases, professional audiences.
- \_\_\_\_\_ 2. Locate, evaluate, and ethically utilize information to communicate effectively.
- \_\_\_\_\_ 3. Demonstrate appropriate reasoning in response to complex issues.

### **SP: Speech/Oral Communication Outcomes**

- \_\_\_\_\_ 1. Engage in ethical communication processes that accomplish goals.
- \_\_\_\_\_ 2. Respond to the needs of diverse audiences and contexts.
- \_\_\_\_\_ 3. Build and manage relationships.

### **MA: Mathematics Outcomes:**

- \_\_\_\_\_ 1. Use appropriate mathematics to solve problems.
- \_\_\_\_\_ 2. Recognize which mathematical concepts are applicable to a scenario, apply appropriate mathematics and technology in its analysis, and then accurately interpret, validate, and communicate the results.

### **AL: Arts and Letters Outcomes**

- \_\_\_\_\_ 1. Interpret and engage in the Arts & Letters, making use of the creative process to enrich the quality of life.
- \_\_\_\_\_ 2. Critically analyze values and ethics within range of human experience and expression to engage more fully in local and global issues.

### **SS: Social Science Outcomes**

- \_\_\_\_\_ 1. Apply analytical skills to social phenomena in order to understand human behavior.
- \_\_\_\_\_ 2. Apply knowledge and experience to foster personal growth and better appreciate the diverse social world in which we live.

### **SC: Science or Computer Science Outcomes**

- \_\_\_\_\_ 1. Gather, comprehend, and communicate scientific and technical information in order to explore ideas, models, and solutions and generate further questions.
- \_\_\_\_\_ 2. Apply scientific and technical modes of inquiry, individually, and collaboratively, to critically examine the influence of scientific and technical knowledge on human society and the environment.
- \_\_\_\_\_ 3. Assess the strengths and weaknesses of scientific studies and critically examine the influence of scientific and technical knowledge on human society and the environment.

## COURSE SYLLABUS

**Instructor information:**

Gordon Rickard  
 Office Location: T 157  
 Phone: 503-594-6112  
 Email: [gordonr@clackamas.edu](mailto:gordonr@clackamas.edu)  
 Office Hours: By Appointment

**Class Times:**

**Days/Times:** Monday- Wednesday  
 1pm–4:50pm

**Course Title:** Intro SMAW Pipe  
 Welding

**Course Number:** WLD-210

**Credits:** 4 = 88 credit hours

**Date:** Spring 2014

**Institution:** Clackamas Community College

**Outline Developed By:** Gordon Rickard

**Type of Program:** Career Technical Education  
 Preparatory

**Course Description:** Provides an opportunity to acquire the knowledge and skills to perform open root groove welds on plate and pipe using E6010 and E7018. Oxy-fuel pipe cutting, and basic instructions and hands on with a virtual welder.

**Student Learning Outcomes:** Upon successful completion of this course, the student will be able to:

1. Practice preparing open root butt joints on pipe for welding
  - a. Weld a root pass using E6010 electrodes
  - b. Weld a hot pass using E6010 electrodes
  - c. Weld a filler passes using E7018 electrodes
  - d. Weld a cover pass using E7018 electrodes
  - e. Properly set up and use virtual welder

**Grades will be assigned as follows:**

A = 90 - 100%

B = 80 - 89%

C = 70 - 79%

D = 60 - 69%

F = 59 and below

**Grading Criteria:** Grades will be based on the following criteria:

1. Attendance - 30%
2. Completed welding assignments – 40%
3. Virtual welding practical - 10%
4. Final exam – 20%

**Prerequisites:** Pass WLD 111 8 credits or WLD 111 4 credits

**Required Text:** SHIELDED METAL ARC WELDING 6 INCH PIPE, Hobart Institute of Welding Technology.

**Optional Texts:** Welding Principles and Applications, seventh edition, by Larry Jeffus, Delmar publishing

### **Myclackamas**

**Notice:** Confirmation of registration and grading will no longer be mailed to your home. To access your grades, financial account, register for classes or to print out a transcript use myclackamas. Learn more at:

<http://my.clackamas.edu/>

Note that your student i.d. number is stated in your admissions letter.

**Cell phones:** To avoid disturbing others, please turn your phone off before class.

**Disabled Student Services:** If you have a documented disability and would like to discuss academic accommodations, please contact your instructor as soon as possible.

### **Sexual Harassment and Discrimination:**

The policy of Clackamas Community College is that it will not tolerate sexual harassment or discrimination of any student. If such an incident should occur, it should be reported to the instructor so that immediate and appropriate action can be taken. Students should read the student handbook to be aware of their rights and the code of conduct.

**Academic Dishonesty:** A student who submits the work of another as her/his own or deliberately fails to properly credit words or ideas from another source is guilty of plagiarism. A student who uses notes other than those specified, takes an exam for another student, copies answers from another student's exam, shares answers with other students or engages in any other similar conduct aimed at making false representation with respect to a student's academic performance is guilty of cheating.

**Attendance and Cooperation:** Students are expected to come to class having read the assigned textbook chapters and completed all written assignments. Students should also be ready to discuss the assigned reading material. The student **must** maintain a professional attitude (**see code of conduct in student handbook**) in the classroom, shop, and work cooperatively with the instructor and other students in the classroom.

**School Locker Policy:** The school provides lockers to the students on a first come first serve basis. These lockers are located in the hallway between the welding lab and the restrooms. Specific locks are required and can be purchased from the automotive department parts desk located in Barlow Hall for \$6.00 a piece. Any locks that are not keyed to our master lock system will be removed. No metal storage is allowed in these lockers. Student lockers are required to be cleaned out between each term and the locks removed. Any remaining locks will be removed between terms and all contents will be forfeit to the department.

### **Required Equipment:**

3-ring notebook and pen or pencil

ANSI approved safety glasses  
Lightweight leather work gloves  
Leather arc welding gloves  
Leather jacket  
Leather work boots, ankle high

### **Recommended Equipment:**

Welding Calculator (available in book store)  
Fillet weld gauge  
Combination square  
Pliers and wire cutters or welper tool  
Vice grips  
Half round double cross cut 10-12 inch file  
Scratch awl or scribe  
Tape measure  
Soapstone  
Wire brush for steel  
Slag hammer  
\*\*4-½ in. angle grinder with wire wheel  
\*\* Striker  
\*\* Clear face shield  
\*\* Arc welding hood with a #10 and #11 shade filter lens and clear replacement lenses  
or an electronic variable shade (9-12) hood with extra clear lenses  
\*\* Welding/cutting goggles or glasses with # 5 shade filter lens, or face shield shade # 5

**\*\* These items are occasionally available for students to borrow on a first come first serve basis if you forget your supplies.**

### **Tentative Class Schedule:**

#### **Week 1**

Day 1

Class: Introduction to the Syllabus, safety rules, lab policies, student responsibilities, and Virtual welder demo. Assign reading, Topics 2, 3.

Shop: Vrtex-360, 1g,2g,3g,4g plate

Day 2

Class: Review topics 2,3, Quiz topic 2,3,

Shop: Vrtex-360, 1g,2g,3g,4g plate

#### **Week 2**

Day 1

Class: Assign reading, Topics 4, 5,

Shop: Vrtex-360, 1g,2g,3g,4g plate

Day 2

Class: Review topics 4,5, Quiz topic 4,5, Handouts: blue prints open root plate

Shop: Demo on setting up and welding out open root plate, Bevel plate for open root 1g,2g,3g,4g

#### **Week 3**

Day 1

Class: Assign reading, Topics 6, 7.

Shop: Weld out open root plate in all positions, Practice stops and starts.

**Day 2**

Class: Review topics 6,7, Quiz topic 6,7,

Shop: Continue working on open root plate, Practice stops and starts.

**Week 4****Day 1**

Class: Assign reading, Topic 8.

Shop: Continue working on open root plate, Practice stops and starts.

**Day 2**

Class: Review topics 8, Quiz topic 8, Pipe Welding Video

Shop: Vrtex-360, 2g,5g,6g,

**Week 5****Day 1**

Class: Assign reading, Topic 9, write a one page paper on your experience and thoughts on the virtual welder due next week for discussion.

Shop: Vrtex-360, 2g,5g,6g,

**Day 2**

Class: Review topic 9, Quiz topic 9,

Shop: Vrtex-360, 2g,5g,6g, Pipe beveling and set up of pipe demo,

**Week 6 – Midterm****Day 1**

Class: Midterm Test: class discussion on vrtex 360, Assign reading topic 10

Shop: bevel pipe for open root 1g with positioner, 2g,5g,6g,

**Day 2**

Class: Review topic 10, Quiz topic 10, write a one page paper with two different sources on what kind of company has and uses virtual welders in there shop, paper due week 10 for class discussion.

Shop: Continue working on open root pipe, Practice starts and stops

**Week 7****Day 1**

Class: Assign reading, Topic 11,

Shop: Continue working on open root pipe, Practice stops and starts.

**Day 2**

Class: Review topics 11, Quiz topic 11,

Shop: Continue working on open root pipe, Practice starts and stops

**Week 8****Day 1**

Class: Assign reading, Topic 12,

Shop: Continue working on open root pipe, Practice starts and stops

**Day 2**

Class: Review topic 12, Quiz topic 12,

Shop: Continue working on open root pipe, Practice starts and stops

**Week 9****Day 1**

Class: Assign reading, Topic 16.

Shop: Continue working on open root pipe, Practice starts and stops

**Day 2**

Class: Review topic 16, Quiz topic 16,

Shop: Continue working on open root pipe, Practice starts and stops

**Week 10**

Day 1

Class: class discussion on virtual welding paper

Shop: Continue working on open root pipe, Practice starts and stops

Day 2

Shop: Continue working on open root pipe, Practice starts and stops

**Week 11 - Final**

Class: Final test

Shop: Shop cleanup.



# ITENERARY FOR WLD 210

## **Lecture – Final Inspection**

Final inspection can vary greatly in scope depending on the part being fabricated, its intended use, and the fabricator. Inspection can be as simple as a quick visual inspection, or as difficult as multiple types of destructive testing that will determine the physical and mechanical properties of the part. Some common testing methods are as follows:

Non destructive testing (NDT)

- Visual inspection (VT)
- Penetrant inspection (PT)
- Magnetic particle inspection (MT)
- Radiographic inspection (RT)
- Ultrasonic Inspection (UT)
- Eddy current Inspection (ET)
- Leak checking

Destructive testing (DT)

- Tensile testing
- Fatigue testing
- Shear strength testing
- Nick break testing
- Guided-bend testing
- Fillet weld break testing
- Acid etch testing
- Impact testing

## **Lecture – Structural strength**

What is structural strength? I define it as the overall integrity of a fabricated entity.

What affects structural strength?

- The mechanical properties of the material being used
  1. Hardness
  2. Brittleness
  3. Ductility
  4. Toughness
  5. Strength
    - Tensile
    - Compression
    - Shear
    - Torsion
- The type of joining process
- The joint design
- Type of reinforcement if any (gusset)
- Mechanical design or shape
- Heat treating or stress relieving.

## **ITINERARY FOR WLD 210,**

**Take roll**

**Hand out Syllabus**

**Review expectations of the class**

- **Weekly test on lecture topics**
- **11 weekly test (including midterm and final) that relate to the topic of the week**
- **Writing assignment due day 1 of week 2, one writing assignment due at midterm, and one due at final**

**Review Syllabus**

**Review first writing assignment**

- **Due beginning of class on Monday week 2**
- **First assignment is on Shop Safety and Industrial Safety which will be covered during walk through of shop**
- **Source material can be found in books, periodicals, and internet**
- **Quoting should be used to emphasize a point you are trying to make, not write your paper for you**
- **Quote sources using any standardized method.**
- **Examples of papers are available**

**Tour the shop and emphasize safety**

**Take Moodle safety test**

## WLD-210 Week 1 Test

Name \_\_\_\_\_

1. The \_\_\_\_\_ position indicates that the pipe is clamped for welding with the pipe axis horizontal; and the weld plane is vertical.
2. The \_\_\_\_\_ position indicates that the pipe is clamped for welding with the pipe axis vertical; and the weld plane is horizontal.
3. The \_\_\_\_\_ position indicates that the pipe is clamped for welding with the pipe axis horizontal, the weld plane is vertical, and the pipe is fixed in position and not rotated.
4. The \_\_\_\_\_ position indicates that the pipe is clamped for welding with the pipe axis at a 45 degree angle, and the weld plane is also at a 45 degree angle.
5. According to ASME pipe welding code."...if a welder passes a qualification test in the \_\_\_\_\_ position, the welder is automatically qualified for all other plate and pipe positions."
6. Do not weld in a \_\_\_\_\_ space without taking special precautions.
7. Do not weld on \_\_\_\_\_ that have held combustibles without taking special precautions.
8. If the keyhole becomes too large and the welder has difficulty controlling the puddle, the welder should:
  - \_\_\_\_\_
  - \_\_\_\_\_
  - \_\_\_\_\_
9. If the keyhole becomes too small and the puddle is small, the welder should:
  - \_\_\_\_\_
  - \_\_\_\_\_
  - \_\_\_\_\_
10. Increasing the arc length \_\_\_\_\_ the arc voltage and \_\_\_\_\_ the amperage slightly.

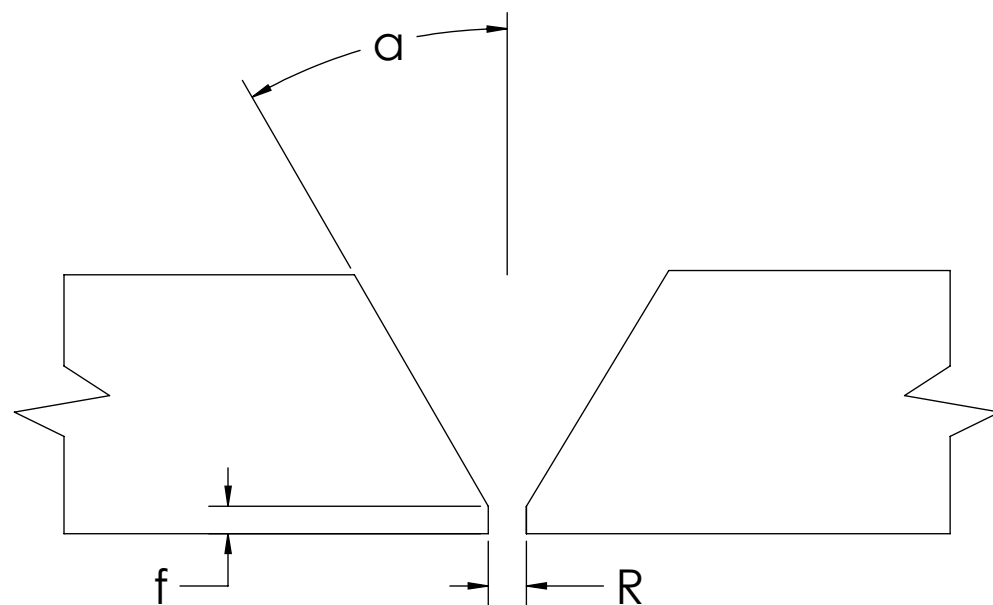
## WLD-210 Week 2 Test

Name \_\_\_\_\_

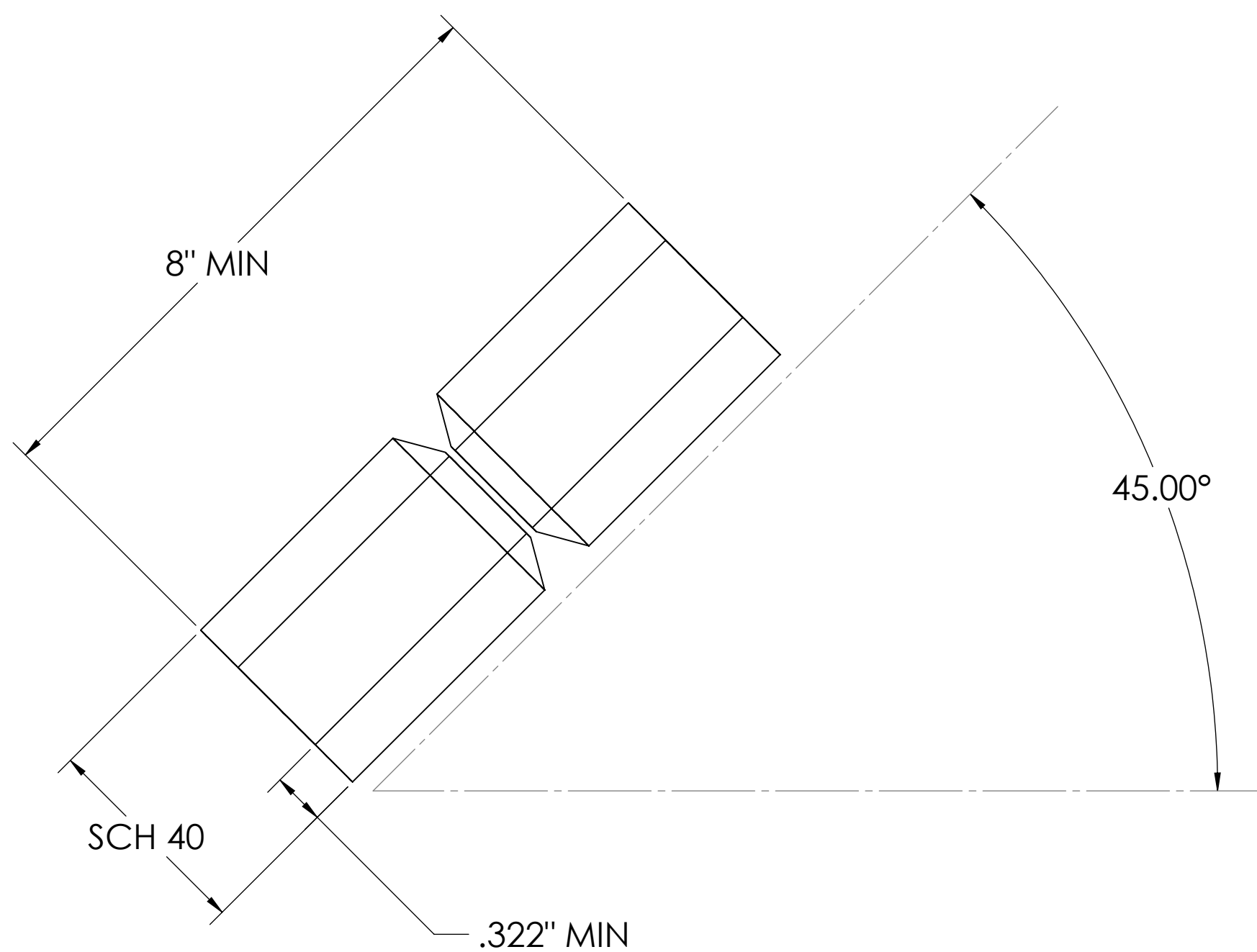
1. Shortening the arc length \_\_\_\_\_ the arc voltage and \_\_\_\_\_ the amperage slightly.
2. As a general rule, when \_\_\_\_\_ is set within the specified range, arc length should not exceed the \_\_\_\_\_ of the electrode.
3. \_\_\_\_\_ can result from too long an arc length.
4. Too short an arc length, or pushing the electrode too deep into the joint may result in \_\_\_\_\_.
5. If the root face is \_\_\_\_\_, the heat of welding melts the edges of the joint, forming a large keyhole.
6. The root face on each of the pipe bevels should be between \_\_\_\_\_ and \_\_\_\_\_.
7. For a 2G pipe weld, the work angle for the root pass is \_\_\_\_\_ from the surface of the pipe with a \_\_\_\_\_ to \_\_\_\_\_ drag travel angle.
8. Shallow craters are susceptible to rapid cooling called \_\_\_\_\_ when the arc is withdrawn from the puddle.
9. In order to avoid problems with porosity make sure the base metal is free of \_\_\_\_\_.
10. When preparing test weld specimens for test samples, each strap should be \_\_\_\_\_ wide.



# STANDARD WELDING PROCEDURE SPECIFICATION for Shielded Metal Arc Welding of Carbon Steel (M-1/P-1/S-1, Group 1 or 2) SCH 40 E6010 Followed by E7018 As-Welded Condition



$\alpha = 30^\circ + 10^\circ - 0^\circ$   
 $f = 1/16 \text{ in.} \pm 1/32 \text{ in.}$   
 $R = 1/8 \text{ in.} \pm 1/16 \text{ in.}$   
 I.D. MISMATCH = 1/16 in. MAX.



**For Further Information, Refer to WPS:  
AWS B2.1-1-205-96 (R2007)**

BASE METALS AND PLATE SIZE:

Carbon Steel M-1, P-1, or S-1  
Group 1 or 2 to M-1, P-1, or S-1  
SCH 40 8" Long Minimum

POSITIONS:

Permitted Positions: 6G  
Vertical Progression: UPHILL

PREHEAT AND INTERPASS TEMPERATURES:

Preheat Temperature: 50°F MIN, 175° MAX  
Interpass Temperature: 50°F MIN, 175° MAX

FILLER METALS:

**Penetrating Enhancing Flux:** Not Permitted  
Weave or Stringer Bead: Either  
Maximum Bead Thickness: 1/4 in  
Single or Multiple Passes: Either. All pressure retaining welds shall be a minimum or two passes

TECHNIQUE:

**Pulsing Current:** Not Permitted  
Specification: ANSI/AWS A5.1 or ASME SFA 5.1 A Number 1, F Number 3 for E6010 and F Number 4 for E7019  
Classification: E8010 and E7018  
Deposit Thickness Range: 1/8 in

ELECTRICAL CHARACTERISTICS:

Layer	Electrodes		Current	
	Classification	Dia. (in.)	Amperes	Type/Polarity
Root	E6010	3/32	40-80	DCEP (Reverse)
Root	E6010	1/8	75-125	DCEP (Reverse)
Fill	E7018	3/32	70-100	DCEP (Reverse)
Fill	E7018	1/8	115-165	DCEP (Reverse)

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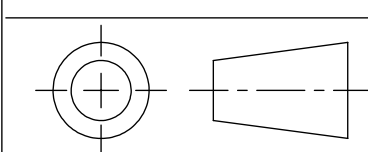
Equal Employment Opportunity CASE is a WIA Title I- financially assisted program and is therefore an equal opportunity employer/program which provides auxiliary aids and services upon request to individuals with disabilities by calling 711 or 800.648.3458 TTY. US Department of Labor The CASE grant project (\$18,679,289) is 100% funded through the US Department of Labor's Trade Adjustment Assistance Community College and Career Training program. DOI. Attribution This workforce solution was funded by a grant awarded by the US Department of Labor's Employment and Training Administration. The solution was created by the grantee and does not necessarily reflect the official position of the US Department of Labor. The Department of Labor makes no guarantees, warranties or assurances of any kind, express or implied, with respect to such information, including any information on linked sites and including, but not limited to, accuracy of the information or its completeness, timeliness, usefulness, adequacy, continued availability or ownership.



For coupon size, see Detail A on back

UNLESS OTHERWISE SPECIFIED  
MILLIMETERS INCHES  
DECIMALS: mm in  
X ±2.5 ±.1  
XX ±0.25 ±.01  
XXX ±0.127 ±.005  
ANGULAR: ±1/2°  
FINISH: 3.2µm 125µin

THIRD ANGLE PROJECTION



TITLE  
6G SMAW E6010 Followed by E7018