
LAKELAND COMMUNITY COLLEGE - COURSE OUTLINE FORM

*** WORK-IN-PROCESS VERSION, NOT YET APPROVED ***

ORIGINATION DATE:	9/29/17	APPROVAL DATE:	
LAST MODIFICATION DATE:	11/16/17	EFFECTIVE TERM/YEAR:	FALL/ 18

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COURSE ID: WELD2370
COURSE TITLE: Advanced Pipe Welding

	LECTURE	LAB	CLINICAL	TOTAL	OBR MIN	OBR MAX
CREDITS:	1.00	2.00	0.00	3.00	2.00	3.00
CONTACT HOURS:	1.00	4.00	0.00	5.00		

PREREQUISITE:

WELD 1040 (can be taken concurrently), WELD 1320; or permission of instructor

COURSE DESCRIPTION:

This course introduces students to advanced American Society of Mechanical Engineers (ASME), American Petroleum Industry (API), and American Welding Society (AWS) pipe welding standards in the vertical and overhead positions using the SMAW process on steel pipe. Students will choose one of these three standards to develop their welding skills and to prepare them for Certification of Qualification to the respective code. At the conclusion of this course, students take a 6G pass/fail welder qualification test using the Shielded Metal Arc Welding (SMAW) process. Laboratory sessions will provide hands-on time to develop skills to produce quality weldments on pipe. The course covers functions and specific uses of manual welding equipment, various SMAW welding techniques, prepping and fitting of pipe coupons, and welding certification requirements. The student must furnish: long pants; welding helmet (shade #10 or above); safety glasses; work gloves; welding jacket; leather work boots, preferably steel toe; 8" crescent wrench; soapstone and holder; tape measure; combination square; chipping hammer; wire brush; tool bag; center punch; and 12 oz. ball peen hammer. 4 1/2" grinder is optional.

RATIONALE FOR COURSE:

This course is designed to introduce students how to prep, fit, tack, and SMAW weld pipe to the ASME or API standards in the vertical and overhead pipe position.

OUTCOMES:

The course will:

1. Reinforce students understanding of the safety principles, procedures and equipment in the pipe welding field.
2. Enable students to recognize an acceptable weld that is properly produced using various techniques utilized in the vertical and overhead positions and the safety techniques involved.

3. Enable students to recognize the importance of fit up, understand the various welding techniques in the vertical and overhead positions and the use of various electrodes.
 4. Provide instruction in how to manipulate the puddle in various positions in pipe welding.
 5. Reinforce instruction in the various tests and examinations for the qualification of a welder per ASME and API code.
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PERFORMANCE INDICATORS:

Upon completion of the course, the student should be able to

1. Describe the various safety hazards involved in arc welding in the vertical and overhead positions.
 2. Describe the safety equipment to be worn or utilized and their function and purpose in welding.
 3. Identify the different welding positions: 1G, 2G, 5G, 6G, and 6GR.
 4. Describe the difference between schedule 40 and schedule 80 pipe wall thickness.
 5. Weld 6" schedule 40 & 80 pipe to ASME or API standard in the 5G and 6G position.
 6. Properly set the machine controls for the transformer, rectifier, and motor generator power sources for the specific welding task.
 7. Produce an acceptable vertical up or vertical down root pass depending on the code the welder has chosen while welding using E6010 electrodes in the 5G and 6G positions.
 8. Produce an acceptable vertical up or vertical down fill and cap weld using E6010 or 7018 electrodes determined by the respective code in the 5G and 6G positions.
 9. Produce an acceptable vertical up or vertical down 6" schedule 40 & 80 test pipe and bend specimens.
 10. Describe the qualification tests as used by API and ASME, and demonstrate the proper welding and fit up technique.
 11. Identify the difference between API, ASME and AWS codes.
 12. Demonstrate proficiency in the SMAW process in the 6G position according to the appropriate ASME Section IX or API 1104 code as taken from the pipe prepared and tested by Instructor.
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COURSE OUTLINE:

- I. Difference Between Pipe Welding Codes
 - A. ASME
 1. American Society of Mechanical Engineering
 - a. Most of the time done in the up-hill position
 - b. Power plants in house piping
 - i. High pressure
 - ii. High volume
 - B. API

- 1. American Petroleum Institute
 - a. Most of the time done in the down-hill position
 - b. Oil and gas industry Cross country pipeline
 - i. Low pressure
 - ii. High volume
 - C. AWS
 - 1. American Welding Society
 - a. Structural
- II. Review and Reinforce Understanding Safety Related To Pipe Welding
 - A. E205 safety hand out
 - B. ANSI Z49.1
 - C. MSDS Sheets
 - D. Safety Glasses and other PPE
 - E. Warning
 - F. Safety Label
 - G. Body positions
 - 1. Start uncomfortable move to comfortable
 - 2. Head positioning and movement to insure continues good view of weld puddle
- III. Advanced Pipe Welding Positions
 - A. 5G Fixed pipe parallel with ground weld in vertical position (Bell hole)
 - B. 6G Fixed pipe at a 45 degree angle weld in a compound angle (Arkansas Bell hole)
 - C. 6GR fixed pipe at 45 degree angle with a restrictor plate around the pipe weld at a compound angle
- IV. Review and Reinforce Understanding Of Fit Up Requirements
 - A. ASME and AWS
 - B. API
 - C. Tacking
 - D. Grinding of tacks
- V. Root Pass (Stringer Bead) Technique
 - A. Drag technique
 - B. Stitch technique
- VI. Wagon Track
 - A. Slag trapped alongside of the root pass
- VII. Grinding Of The Root Pass
 - A. Grind down the high spot on the root pass to expose the wagon tracks
- VIII. Hot Pass ASME 5G and 6G
 - A. Burn out the wagon track DC+ ten amps greater than that of the root pass
 - B. 10 minutes to put in the hot pass after the root pass is put in
- IX. Fill Passes (Could Be Multiple Passes) ASME 5G and 6G
 - A. 7018
 - 1. Slight drag or weave
 - B. 6010
 - 1. Shuffle or whip
- X. API Hot Pass 5G and 6G
 - A. Shuffle step
 - 1. burn out wagon tacks
 - 2. Rod angle 10 to 15 degree drag angle
- XI. Fill and Stripper Pass 5G and 6G

- A. Shuffle step
 - 1. Stripper pass is the fill pass on the pipe between 2 O'clock and 5 O'clock and between 7 O'clock and 10 O'clock this is where the weld might become thin because of the travel speed was picked up because of gravity and fluidity of the puddle.
- XIII. API Cap Pass 5G and 6G
- A. Stinger
 - B. Weave
 - 1. Europe full stove means Vertical down welding full joint
 - 2. Dolly Mix means Vertical up root vertical down fill and cap
- XIII. Review and Reinforce the Understanding of the Six Things That Control the Key Hole
- A. Land
 - B. Gap
 - C. Amperage
 - D. Travel speed
 - E. Rod angle
 - F. Pressure
- XIV. Welder Qualification Test
- A. Hands-on skills test of student's ability to make acceptable SMAW weld
 - 1. Can take either 6G Certification of Qualification Test in respective code
 - 2. Pass/fail test
 - 3. Industry Recognized Certification of Qualification is awarded to students passing independent 3rd party test of welds using a qualified or pre-qualified Welding Procedure Specification

INSTRUCTIONAL PROCEDURES THAT MAY BE UTILIZED:

Lectures, Project Based Learning, videos, online, or handouts may be used for instruction of the fundamental concepts. Students set up and practice welding using various types of welding equipment during laboratory.

GRADING PROCEDURES:

Examinations and/or quizzes
 Class participation and discussion
 Lab work, individual projects, papers or reports and/or
 Homework

COURSE EVALUATION PROCEDURES:

This course will be reviewed bi-annually by faculty and the Advisory Committee. Students will complete course evaluations each semester. This workforce product was funded by a grant awarded by the U.S. Department of Labor's Employment and Training Administration. The product was created by the grantee and does not necessarily reflect the official position of the U.S. Department of Labor. The U.S. 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. The course and services are available without regard to a participant's race, color, religion, ancestry, age, handicap, sex, marital status or national origin. The number for TDD/TYY or relay services is 440-525-7006.



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LAKELAND STUDENT LEARNING OUTCOMES

LEARNS ACTIVELY	I	R	D
1. Takes responsibility for his/her own learning.			
2. Uses effective learning strategies.			
3. Reflects on effectiveness of his/her own learning strategies.			
THINKS CRITICALLY	I	R	D
4. Identifies an issue or idea.			D
5. Explores perspectives relevant to an issue or idea.			
6a. Identifies options or positions.			D
6b. Critiques options or positions.			
7. Selects an option or position.			D
8a. Implements a selected option or position.			D
8b. Reflects on a selected option or position.			
COMMUNICATES CLEARLY	I	R	D
9a. Uses correct spoken English.			
9b. Uses correct written English.			
10. Conveys a clear purpose.			
11. Presents ideas logically.			D
12a. Comprehends the appropriate form(s) of expression.			
12b. Uses the appropriate form(s) of expression.			D
13. Engages in an exchange of ideas.			
USES INFORMATION EFFECTIVELY	I	R	D
14. Develops an effective search strategy.			
15a. Uses technology to access information.			
15b. Uses technology to manage information.			
16. Uses selection criteria to choose appropriate information.			
17. Uses information responsibly.			
INTERACTS IN DIVERSE ENVIRONMENTS	I	R	D
18a. Demonstrates knowledge of diverse ideas.			
18b. Demonstrates knowledge of diverse values.			
19. Describes ways in which issues are embedded in relevant contexts.			
20a. Collaborates with others.			
20b. Collaborates with others in a variety of situations.			
21. Acts with respect for others.			

Definitions:

Introduces (I)

Students first learn about key ideas, concepts, or skills related to the performance indicator. This usually happens at a general or very basic level, such as learning one idea or concept related to the broader outcome.

Reinforces (R)

Students are given the opportunity to synthesize key ideas of skills related to the performance indicator at increasingly proficient levels.

Demonstrates (D)

Students should demonstrate mastery of the performance indicator with the level of independence expected of a student attaining an associate's degree.