
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: WELD2380

COURSE TITLE: GTAW (TIG)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 1330, WELD 1370; or permission of instructor

COURSE DESCRIPTION:

This course introduces students to the Gas Tungsten Arc Welding (GTAW) American Society for Mechanical Engineers (ASME) pipe welding standards. Students will develop their welding skills and prepare for Certification of Qualification in ASME Section IX Code. Laboratory sessions will provide hands-on time to develop skills to produce quality welds with GTAW process on pipe. At the conclusion of this course, students take either a 5G or 6G pass/fail welder qualification test using the GTAW process according to the ASME Section IX code. The course covers functions and specific uses of manual welding equipment, various GTAW 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 GTAW weld pipe to the ASME Section IX standards in the 2G, 5G and 6G pipe position.

OUTCOMES:

The course will:

1. Reinforce essential safety principles, procedures and equipment in welding.
2. Enable students to recognize an acceptable weld that is properly produced using various techniques utilized in the 5G and 6G positions and the safety techniques involved.
3. Enable students to recognize the importance of fit up, understand the various welding techniques in the 2G,5G and 6G positions and the use of various electrodes and cup sizes.

4. Review the various power sources, current requirements and control panel required to produce welds in the 2G, 5G and 6G positions for GTAW welding.
 5. Reinforce instruction in the various tests and examinations for the qualification of a welder per ASME code.
 6. Reinforce instruction in the mechanical properties of a weld, including tensile and yield strength, toughness, per cent reduction of area, and percent of elongation.
 7. Reinforce instruction in how voltage and amps relate to the welding arc.
 8. Provide instruction on the various methods of starting the GTAW welding arc.
 9. Provide students with experience in GTAW welding of pipe in the 2G, 5G and 6G positions.
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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 gas tungsten arc welding.
 2. Describe the safety equipment and its function in welding.
 3. Weld 6" schedule 40 & 80 pipe to ASME standard in 2G, 5G & 6G position.
 4. Properly set the machine controls for the transformer, rectifier, and motor generator power sources for the specific welding task.
 5. Produce an acceptable pipe weld in the 2G, 5G and 6G positions using the Gas tungsten arc welding method.
 6. Produce an acceptable vertical up root pass with the GTAW process to the ASME code.
 7. Produce an acceptable vertical up fill and cap weld using GTAW electrode to the ASME code.
 8. Produce an acceptable vertical up GTAW 6" sch. 40 & 80 test pipe and bend specimens.
 9. Describe the qualification tests used by ASME code.
 10. Demonstrate proficiency in the proper welding and fit up technique on the GTAW process in the 5G or 6G position according to the ASME Section IX code as taken from the pipe prepared and tested by the Instructor.
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COURSE OUTLINE:

- I. Pipe Welding and Code Standards
 - 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
- II. Safety
 - A. E205 safety hand out

- B. ANSI Z49.1
- C. MSDS Sheets
- D. Safety Glasses
- E. Warning
- F. Safety Label

III. Positions for Pipe Welding

- A. 1G Rotated parallel to the ground
- B. 2G Fixed Pipe vertical weld is horizontal
- C. 5G Fixed pipe parallel with ground weld in vertical position
- D. 6G Fixed pipe at a 45 degree angle weld in a compound angle (Arkansas)
- E. 6GR fixed pipe at 45 degree angle with a restrictor plate around the pipe weld at a compound angle

IV. ASME Fit Up

- A. Bevel angles
 - 1. Degrees
 - 2. Root face (land)
 - a. Knife edge
 - 3. Root opening (gap)
 - a. 3/32 or 1/8
 - 4. Typically welded vertical up

V. Pipe Welding Fit Up

- A. Root face (land)
 - 1. Grinder
 - 2. File
 - 3. Mechanical beveller
- B. Root opening (Gap)
 - 1. Bare electrodes
 - 2. Nickle or a dime
 - 3. Sheet metal shims
 - 4. Anything that is equal to the gap on the pipe
- C. Internal alignment of the pipe (high Low)

VI. Tack Up

- A. Tack
 - 1. 1/2" to 3/4" long
 - a. If it tack good it will weld good
 - b. Adjust your amps while you are tacking up your pipe
- B. 12 o'clock
- C. 6 o'clock
- D. 3 o'clock
- E. 9 o'clock

VII. Transitions On To Tacks

- A. Trim filler at a 45 degree angle so it fits into transition of the tack weld

VIII. Root Pass

- A. Walking the cup technique 5 or 6 cup
 - 1. ASME
 - a. DC- 1/8" 100% argon 15 to 20 CFH 105 to 110 amps ER70s-6 filler

IX. FILL PASSES (COULD BE MULTIPLE PASSES) ASME

- A. 6 or 7 cup
 - 1. 2 point contact 1st 3 passes
- B. 4 out to cap pass
 - 1. 7 or 8 cup 3point of contact
- C. Cap pass 8 cup
 - 1. Figure 8 technique

- X. GTAW PROCESS
 - A. Tungsten
 - 1. Non consumable electrode
 - 2. EWX AWS numbering
 - B. Argon 100%
 - 1. CFH 15 20
 - C. Polarity
 - 1. DC-
 - D. Power source
 - 1. Constant Current CC
- XI. CUP WALKING
 - D. 5 or 6 cup on the root
 - E. 6 or 7 cup fill pass
 - F. 8 or 10 cup
- XII. Welder Qualification Test
 - A. Hands-on skills test of student's ability to make acceptable GTAW welds
 - 1. Take a 6G Certification of Qualification test in the GTAW process according to the ASME Section IX code.
 - 2. Pass/fail test
 - 3. Industry Recognized Certification of Qualification is awarded to students passing independent 3rd party test of welds made 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.

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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.			
5.	Explores perspectives relevant to an issue or idea.			
6a.	Identifies options or positions.			
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.			D
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.