WELD 0004A - FLUX CORE ARC WELDING OF MILD CARBON STEEL ON SHEET AND PLATE

Catalog Description

Hours: 72 (18 lecture, 54 laboratory)
Description: Designed for those interested in the beginning stages of welding. Students are taught to weld on mild carbon steel sheet and plate in various welding positions and joint configurations using Flux Core Arc Welding. Explores the various metal transfer modes when using the Flux Core Arc Welding process. Prepares students to work in a welding shop environment. (not transferable)

Course Student Learning Outcomes

- CSLO #1: Apply knowledge of safety standards for both a learning environment and work site environment with focus on FCAW welding processes to perform student assignments.
- CSLO #2: Define terms related to this course; wire feed speed, volts, contact tip to work distance, travel angle, work angle, travel speed, and electrode manipulation as it applies to FCAW.
- CSLO #3: Demonstrate single and multi-pass welds using FCAW on carbon steel plate in 2F, 3F, 4F, 2G, 3G, 4G positions on 1/8", 1/4", 1/2, and 1" mild steel.
- CSLO #4: Perform equipment set-up diagnostic procedures, including fixing a bird nest, tensioning drive rolls, cleaning a liner, and identifying gas leak issues with FCAW-G.

Effective Term

Fall 2026

Course Type

Credit - Degree-applicable

Contact Hours

72

Outside of Class Hours

36

Total Student Learning Hours

108

Course Objectives

Lecture Objectives

1. General Safety
    a. Identify typical safety hazards and precautions required when working in any typical metal workplace
    b. Identify personal protective equipment for head, eyes, ears, torso & arms, hands, legs, and feet that must/should be worn in a welding workspace as appropriate
    c. Describe appropriate safety measures for all individuals in a metal workplace
2. Essential Variables During the Welding Process
    a. Identify the variables that affect heat input and weld quality while performing a weld
        i. Wire-Feed Speed and Voltage
        ii. Contact Tip to Work Distance
        iii. Direction of Travel & Travel Angle
        iv. Work Angle
        v. Travel Speed
        vi. Electrode Manipulation
        vii. Gas Selection and adjustment as applicable
3. Welding Equipment FCAW
    a. Identify all external parts of applicable welding equipment
    b. List in order the process of assembly and disassembly of welding components.
    c. Describe the basic function of the welding process
    d. Explain the difference between Constant Current and Constant Voltage machines
    e. Explain why GMAW and FCAW use CV
4. Basic Welding Types, Joints, and Positions
    a. Identify the 4 basic welding types
        i. Surface, Fillet, Groove, Plug/Slot
        ii. List the 2 most common welding types
    b. Identify the 5 basic welding joints
        i. Butt, Lap, Tee, Corner, Edge
5. Basic Welding Positions and how Welding, Types, Joints, and Positions Combine
    a. Identify the 8 most common welding positions
        i. 1F- Flat Fillet, 2F- Horizontal Fillet, 3F- Vertical Fillet, 4F- Overhead Fillet
        ii. 1G- Flat Groove, 2G- Horizontal Groove, 3G- Vertical Groove, 4G- Overhead Groove
    b. Describe, draw, or demonstrate with manipulatives how welding types are applied to the 5 basic welding joints and what the corresponding welding positions are for each of those situations
6. Fillet Welds
    a. Identify the parts of a fillet weld and the 5 fillet weld profiles, (concave, flat, convex, excessive reinforcement, insufficient throat)
    b. Label which fillet weld profiles are desired, acceptable, generally unacceptable and always unacceptable.
    c. Explain the difference between a “weld symbol” and a “welding symbol”
    d. Identify a fillet weld symbol
    e. Apply all aspects of a fillet welding symbol to a joint and draw corresponding joints to dimension
        i. Identify the 3 basic parts of a welding symbol; arrow, reference line, and tail
        ii. Explain the significance of information placed above or below the reference line
7. Welding Polarities
    a. Draw out the following polarities and their electron flow pattern
        i. Direct Current Electrode Positive
        ii. Alternating Current
        iii. Direct Current Electrode Negative
8. Grinder Safety & Basic Use

   a. Identify key parts of a 4 -1/2" right angle grinder
9. Modes of Transfer
   a. List and describe the 3 modes of transfer for FCAW
   b. Enumerate the minimum and maximum voltage ranges for each transfer mode
   c. Enumerate the 3 transfer modes from least to most heat input
   d. Identify which modes of transfer are employed on various types of metal
   e. Auditory and/or Visually identify each mode of transfer
10. Plasma Arc Cutting (PAC) Safety and Operation
   a. Recite or show the safety features and hazards of a PAC system
   b. Identify the key parts of a PAC system
11. FCAW-G vs FCAW-S
   a. Compare and contrast the similarities and differences between FCAW-G and FCAW-S
   b. Discuss the pros and cons of using one process over the other process
   c. Analyze the differences in material thickness, metal deposition and penetration (fusion) between the 2 processes
12. Welding Electrodes/Filler Metals
   a. Decipher the parts of an electrode classification
   b. Name common filler metals and discuss their advantages/ disadvantages for welding various carbon steel alloys
13. Shielding Gasses
   a. Explain why certain gasses are used for various applications in the lab
   b. Summarize shielding gasses used in FCAW-G and describe their characteristics and effectiveness
   c. Know the proper psi ranges for each application
14. Cylinder Safety and Owner vs Rental Cylinders
   a. List all safety precautions for non-flammable gas cylinder storage
   b. List all safety precautions for flammable gas cylinder storage
   c. List all safety precautions for flammable and non-flammable gas cylinder transportation
   d. Identify and explain markings on cylinder shoulders
   e. Explain the differences between owning and renting cylinders and how to identify each
15. Basic Metallurgy
   a. Describe the difference between iron and steel
   b. Classify low, medium, and high carbon steel by percent carbon content
   c. Define hardness, strength, ductility, and weldability
   d. Explain basic relationship between carbon content, hardness, strength, ductility, and weldability.

Laboratory Objectives

1. Lab Assignments and/or Lab Projects
   a. Recall common terminology and concepts used in the application of welding operations and apply to the lab setting
   b. Employ pre-weld metal preparation techniques to ensure weld quality
   c. Demonstrate pre-weld procedures and apply correct welding parameter adjustment tasks.
   d. Apply foundational skills to weld carbon steel to industry-based-acceptance criteria
   e. Apply demonstrated techniques to weld beads with each welding process used in this course on the assigned student projects
   f. Demonstrate safe use of right-angle grinder with hard disc, cut-off wheel, and flap wheel
   g. Perform correct use of grinder and abrasive by minimizing abrasive degradation
   h. Assemble and dis-assemble a PAC system
   i. Perform a series of clean straight and round cuts on scrap metal
   j. Trouble Shoot a PAC system
2. Perform the following Lab Assignments:
   a. Surface beads FCAW-G and FCAW-S
   b. Repeating Corner Joint: 1/4" base metal, 2F, 3F down, and 4F.
   c. Repeating Lap Joint: 1/4" base metal, 2F, 3F down, and 4F.
   d. Repeating Tee Joint: 1/4" base metal, 2F, 3F down, and 4F.
   e. Repeating Butt Joint: 1/4" base metal, 2F, 3F down, and 4F.
   f. Extra Credit: Repeating Edge Joint: 1/4" base metal, 2F, 3F down, and 4F.
   g. Combo Joint: 1/4" base metal
   h. 1/2" Brick FCAW-G, 4 sides: Side 1 is 1F stringers, Side 2 is 2F stringers, Side 3 is 4F stringers, Side 4 is 3F up weaves. .045 or 1/16" Dualshield.
   i. 1/2" Brick FCAW-S, 4 sides: Side 1 is 1F stringers, Side 2 is 2F stringers, Side 3 is 4F stringers, Side 4 is 3F up weaves .045 or 1/16".
   j. Mock Certification Test: FCAW-G, 2G single-vee groove with backing using 1/2" base metal
   k. Mock Certification Test: FCAW-G, 3G single-vee groove with backing using 1/2" base metal
   l. Mock Certification Test: FCAW-G, 4G single-vee groove with backing using 1/2" base metal
   m. Mock Certification Test: FCAW-S, 2G single-vee groove with backing using 1/2" base metal
   n. Mock Certification Test: FCAW-S, 3G single-vee groove with backing using 1/2" base metal
   o. Mock Certification Test: FCAW-S, 4G single-vee groove with backing using 1/2" base metal
   p. Shop Skills: layout with tape measure, PAC, grind with hard disc and then flap disc, mock certification test to specifications requested.

General Education Information

- Approved College Associate Degree GE Applicability
- CSU GE Applicability (Recommended-requires CSU approval)
- Cal-GETC Applicability (Recommended - Requires External Approval)
- IGETC Applicability (Recommended-requires CSU/UC approval)

Articulation Information

- Not Transferable

Methods of Evaluation

- Objective Examinations
  - Example: Students will take a multiple choice test on welding symbols. What is the part of the welding symbol that all information sits on? a. Tail b. Arrow c, Reference Line (X) d. Weld Symbol What is the part of the reference line that points to the joint? a. Tail b. Arrow (X) c. Electrode d. Weld Symbol

- Projects
  - Example: 1. At the start of assigned project, the student will demonstrate a material layout. 2. During the assembly of assigned project, the student will perform fit up steps and tacking procedures. Grading based on industry standard.
- Skill Demonstrations
  - Example: 1. Students will demonstrate the ability to safely weld in the vertical up and overhead positions. 2. Students will perform an open groove welding test. 3. Students will demonstrate settings used for various welding modes in FCAW. Grading is based on industry standard.

Repeatable

No

Methods of Instruction

- Laboratory
- Lecture/Discussion
- Distance Learning

Lab:

1. With instructor demonstration and oversight, students will apply various welding techniques using selfshield and dualshield wires.
2. Following class lecture, video presentation, and lab demonstration, instructor will supervise while students practice with flux-cored wires.

Lecture:

1. Lecture and interpersonal group discussion on the various types and applications of welding modes, such as FCAW-G (dualshield) vs FCAW-S (selfshield).

Distance Learning

1. Instructor will use slide show presentation, instructor created video, or lecture presentation on a learning platform to teach about best safety practices in the for personal protective equipment, the weld lab environment, and/or tools & equipment. Students will be given a scenario and expected to list the best safety practices that should be employed and explain why they should be used. Students will submit the assignment via text entry, file upload, video or audio recording.

Typical Out of Class Assignments

Reading Assignments

1. The student will read chapter from the course text on FCAW types (Selfshield and dualshield) and be prepared for classroom discussion. 2. The student will look up the welding parameters for the different wire diameters and compositions to become familiar with the correct machine settings to use.

Writing, Problem Solving or Performance

1. The student will create a report of the different chemical compositions from the reading assignments welding procedures for selfshield and dualshield. 2. Students demonstrate their performance of each of the various welds, such as selfshield and dualshield, on lab assignments during each class meeting.

Other (Term projects, research papers, portfolios, etc.)

Required Materials

- Welding Principles and Practices
  - Author: Edward R. Bohnart
  - Publisher: McGraw Hill
  - Publication Date: 2024
  - Text Edition: 6th
  - Classic Textbook?: No
  - OER Link:
  - OER:
- GMAW/FCAW Handbook
  - Author: Minnick, Mosman
  - Publisher: Goodheart-Willcox
  - Publication Date: 2023
  - Text Edition: 2nd
  - Classic Textbook?: No
  - OER Link:
  - OER:

Other materials and-or supplies required of students that contribute to the cost of the course.