# WELD 0002B - GAS METAL ARC WELDING OF STAINLESS STEEL

## Catalog Description

Prerequisite: Completion of WELD 2A with grade of "C" or better
Hours: 72 (18 lecture, 54 laboratory)
Description: Covers equipment, metal preparation, and welding of stainless steels in all positions using Gas Metal Arc Welding. Students will learn to read and correctly complete welding procedures performed in industry. Helps prepare students for employment in high demand jobs. (not transferable)

## Course Student Learning Outcomes

- CSLO #1: Explain the different types of respiratory protection associated with welding and cutting fumes and describe correct applications of each type of respiratory protection equipment.
- CSLO #2: Compare and contrast the metallurgical properties and common applications of austenitic, ferritic, martensitic, and duplex stainless steels.
- CSLO #3: Explain the 4 transfer modes of gas metal arc welding, describing the differences and uses as applied to stainless steel welding.
- CSLO #4: Apply welding procedures and demonstrate proper manipulative skills to achieve proper fusion when welding stainless steel using GMAW in multiple welding positions.
- CSLO #5: Interpret Welding Procedure Specification by performing the correct weldment listed on the WPS.

## Effective Term

Fall 2019

## Course Type

Credit - Degree-applicable

## Contact Hours

72

## Outside of Class Hours

36

## Total Student Learning Hours

108

## Course Objectives

Lecture Objectives
1. Evaluate safety issues as they pertain to shop safety, industrial safety, and personal safety and apply appropriate safety protective measures, particularly as it relates to welding stainless steel.
2. Recall common terminology used in the application of stainless steel welding operations.
3. Interpret all aspects of welding symbols as they apply to various types of groove welds.
4. Organize common weld joint considerations and list the types of welds that can be applied to each joint.
5. Analyze welding operation requirements for stainless steel applications and select the proper power source.
6. Explain the difference between austenitic, ferritic, martensitic, and duplex stainless steels and their common applications and welding considerations.
7. Name various stainless steel GMAW filler metals and discuss their advantages/disadvantages for welding various stainless steel alloys.
8. Summarize shielding gases used in GMAW of stainless steels and describe their characteristics and effectiveness.
9. Recall and describe the 4 GMAW modes of transfer (Short Circuit, Globular, Pulsed-Spray, & Spray) and explain which ones are used for welding stainless steel and why.
10. Examine related equipment maintenance requirements.
11. Label common types of weld discontinuities found when welding stainless steels and examine their root cause and prevention measures.
12. Read, comprehend, and analyze a description of a joint to be welded. Then correctly translate that information into a functioning Welding Procedure Specification.
13. Use basic fractional, computational, and algebraic math to perform common welding procedures, such as determine correct lead gauge for a given lead length and amp capacity, create a cut list and bill of materials from a print drawing, calculate heat input of a weld based on travel speed, WFS, and Volts.
14. Build a basic part by correctly interpreting print drawings.
Laboratory Objectives
1. Exhibit safe practices in welding shop environment including wearing proper respiratory equipment for welding stainless steels.
2. Itemize and demonstrate pre- and post-weld metal preparation in a shop environment for maximizing weld quality and minimizing cross contamination when welding and assembling stainless steel parts.
3. Assemble AND identify the parts of a GMAW welding station and wire feeder specifically for welding stainless steels.
4. Apply correct maintenance tasks to ensure safe and effective operation of equipment.
5. Demonstrate pre-weld procedures and apply correct welding parameter adjustment tasks.
6. Apply foundational skills to weld stainless steel in multiple positions and thicknesses.
7. Create weld beads using the short-circuit transfer mode in and out of position on various thicknesses of stainless steel in lap, tee, corner, and butt joints to industry-based acceptance criteria.
8. Create weld beads using the pulse-spray transfer mode in and out of position on various thicknesses of stainless steel in lap, tee, corner, and butt joints to industry-based acceptance criteria.
9. Create weld beads using the spray transfer mode in 1F, 1G, & 2F positions on various thicknesses of stainless steel in lap, tee, corner, and butt joints to industry-based acceptance criteria.
10. Demonstrate employment ready work ethic in lab environment.
11. Demonstrate ability to read and comprehend a series of Welding Procedure Specifications by using the documents to make sound weldments in the correct joint configurations.
12. Use math in weld shop to make sound weldments with specific placement, dimensions, and quantities called for in the Welding Procedure Specifications.

## 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
## Methods of Evaluation

- Essay Examinations
  - Example: Explain the difference between a flare bevel and a flange joint? Grade based on industry standard.
- Objective Examinations
  - Example: When looking at a welding symbol, the number located to the left of the weld symbol denotes what? A) Weld Length (wrong) B) Weld Size (correct) C) Groove angle (wrong) D) Bevel angle (wrong)
- Projects
  - Example: During the assembly of assigned project, the student will perform fit up steps and tacking procedures. Grading based on industry standard.
- Skill Demonstrations
  - Example: Student will perform a groove welding test. Instructor will assess the visual appearance of the weld based upon criteria outlined in "AWS D1.6 Structural Welding of Stainless Steel." If welding test is deemed acceptable per industry standard, then student will receive a passing grade for the assignment.

## Repeatable

No

## Methods of Instruction

- Laboratory
- Lecture/Discussion
- Distance Learning

Lab:

1. With instructor demonstration and oversight, students will apply various welding techniques using Short Circuit, Spray, and Pulsed-Spray Transfers.
2. Following class lecture, video presentation, and lab demonstration, instructor will supervise while students practice how to properly set up the welding equipment for stainless steel welding using GMAW.

Lecture:

1. Instructor lecture and student group discussion on the various types and applications of welding modes, such as welding on stainless steel using spray vs pulsed-spray mode.

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 GMAW transfer modes of short circuit, globular, spray transfer, and related materials 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 and be prepared to discuss in class. 3. The student will read a Welding Procedure Specification and interpret it and be prepared to discuss in class.

## Writing, Problem Solving or Performance

1. The student will create a report of the different chemical compositions from the reading assignments welding procedures for stainless steel alloys. 2. Students demonstrate their performance of each of the various welds, such as pulsed spray transfer, on lab assignments during each class meeting. 3. Students will be given a welding problem prompt and be asked to write a corrective action in the form of a Welding Procedure Specification.

## Other (Term projects, research papers, portfolios, etc.)
## Required Materials

- Welding Principles and Practices
  - Author: Edward R. Bohnart
  - Publisher: McGraw Hill
  - Publication Date: 2017
  - Text Edition: 5th
  - Classic Textbook?:
  - OER Link:
  - OER:
- Welding Skills
  - Author: B. J. Moniz & R. T. Miller
  - Publisher: American Technical
  - Publication Date: 2014
  - Text Edition: 5th
  - Classic Textbook?:
  - OER Link:
  - OER:
- Welding: Principles and Applications
  - Author: Larry F. Jeffus
  - Publisher: Delmar / Cengage Learning
  - Publication Date: 2011
  - Text Edition: 7th
  - Classic Textbook?:
  - OER Link:
  - OER:
- Gas Metal Arc Welding
  - Author: William H. Minnick
  - Publisher: Goodheart-Willcox
  - Publication Date: 2008
  - Text Edition: 5th
  - Classic Textbook?:

    - OER Link:
    - OER:
- Flux Cored Arc Welding
    - Author: William H. Minnick
    - Publisher: Goodheart-Willcox
    - Publication Date: 2009
    - Text Edition: 3rd
    - Classic Textbook?:
    - OER Link:
    - OER:

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