

SWEETWATER UNION HIGH SCHOOL DISTRICT
DIVISION OF ADULT EDUCATION
Career Technical Education

Welding: F.C.A.W

COURSE APPROVAL

Mission: The Division of Adult Education, a community-focused organization, promotes and facilitates life-long learning for adults to meet the challenges of the 21st century.

Student Learning Outcomes

- Students will establish personal, academic and/or workforce goals and demonstrate progress toward them
- Students will solve problems
- Students will communicate clearly and collaborate with others
- Students will use resources, including technology, to research, organize and communicate information

Course approved by the Sweetwater Board of Trustees

08/27/87

Course Revision:

June 20, 1990

December 16, 2002

December 13, 2004

December 11, 2006

December 15, 2008

July 26, 2010

July 23, 2012

Title Change:

 Nee: "Combination Welder"

August 18, 2008

December 15, 2008

May 12, 2014

Revision: June 27, 2016

WELDING: F.C.A.W

Basic Course Information

Course Title:	Welding: F.C.A. W			
CTE Industry Sector:	Manufacturing and Product Development			
Career Pathway:	Welding and Materials Joining			
Course Level:	Introductory	x	Concentration	Capstone
Course Number:	2635			
CBEDS Title:	Welding Technology			
CBEDS Number:	5619			
Course Hours:	216 Hours			
Prerequisites:	Read, comprehend, and pass safety test with 100% accuracy.			
Evaluation:	<ol style="list-style-type: none"> 1. Teacher observation and testing on student welding projects for each competency in the program. 2. Attendance 3. Practical welding demonstrations and adherence to safety requirements. 4. Proficiency and accuracy in the operation and use of welding and cutting equipment and accessories. 5. Satisfactory interpretation of assigned drawings for a specific project as evaluated by the instructor. 6. Instructor observation of the setting up of welding machines: AC, DCSP, and DCRP, voltage, and current. 7. Instructor observation of the selection of the electrode. 8. Instructor assessment of test plates through one or more of the following criteria: <ol style="list-style-type: none"> a. Visual inspection b. Bend test 			
Conditions for Repetition:	Students who have failed to satisfactorily complete the requirements of the course due to their inability to master competencies of the materials provided may repeat the course with instructor approval.			
Articulation Information:	NA			
Articulation Credit:	NA			
High School Elective Credit:	This course is offered on a CREDIT/NONCREDIT basis. Upon successful completion of course objectives, students may earn up to two (2) high school elective credits			
Advisory Committee Meetings:	Annually			

Course Description

The Welding program of study is a comprehensive program that consists of four courses in addition to OSHA for maritime training. It is designed to prepare participants in the various welding processes required for entry level employment. Welding instruction will include the following processes: Oxy fuel, Mig, Tig (GTAW, GMAW & FCAW) Arc Welding (SMAW) metal cutting, and blueprint reading. Participants will learn to weld in the basic positions: horizontal overhead, vertical and flat. Students will also learn to weld basic joints, pipe, ferrous/non-ferrous metal, low/high carbon steel and stainless steel.

Instructional Strategies

Instructor lecture and demonstrations.....	20%
Class and small group discussions.....	10%
Student operation and use of tools and equipment.....	30%
Instructor supervision and assistance with lab projects and welding media.....	15%
Instructor/student conferences.....	05%
Text, instructional handouts, selected reading material and films.....	10%
Evaluations.....	10%

Instructional Materials

Textbooks: *Welding: Principles and Applications, 6th Edition* and *Study Guide with Lab Manual for Jeffus' Welding: Principles and Applications, 6th Edition*

Career Plan: How this Course fits into the Course Sequence

Sequence of Courses	Course Level			Primary Funding Source		Perkins Funded Yes or No	Total Duration (In hours)
	Intro.	Concentration	Capstone	District/COE	ROCP		
Welding: S.M.A.W	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Yes	216
Welding: G.M.A.W	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Yes	216
Welding F.C.A.W	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Yes	216
Welding: G.T.A.W	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Yes	216

Occupations for Identified Pathway

Pathway occupations organized by level of education and training required for workplace entry. (Asterisked occupations require certification or licensure.)	
Postsecondary Training (certification and/or AA degree)	College University (bachelor's degree or higher)
<ul style="list-style-type: none"> • Welder • Ironworker • Robotics Technician 	<ul style="list-style-type: none"> • Metallurgist * • Quality Control Inspector

Course Goals

1. Learn the responsibilities and requirements for employment as a welder.
2. Learn to identify safety hazards in the workplace and apply safe work practices in the shop.
3. Understand the basics of Flux Core Welding and how it differs from other welding processes.
4. Learn efficient welding procedures including the selection of proper electrodes, ampere settings, base metal preparation, and welding techniques for type, thickness and condition of metal and work to be done.
5. Become familiar with standardized symbols, lines, and numerical figures used in welding drawings and blueprints as well as basic mathematics applicable to drawing and blueprint interpretation.
6. Learn and understand the importance of maintaining documentation for welding systems, and keeping inventory and control of various welding and cutting equipment of different types.

Instructional Module/Unit

Unit 1	Introduction	Class Hrs.	3	Lab Hrs.	
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Description:

Students gain an introduction to the course and learn class expectations. They are introduced to the common traits exhibited by people successfully working in this field, personal qualifications, interests, aptitudes, and knowledge of skills necessary to succeed this career pathway. Students examine the historical and economic background of this field as well as current opportunities available. In addition students will examine the personal, professional, and educational requirements needed to meet their goals.

Unit 1 Competency: Upon Completion of this unit, the student is able to:

1. Identify the personal qualifications, interests, aptitudes, knowledge, and skills of successful **welders**.

2. Demonstrate an understanding of personal, professional, and educational requirements of this career field.

Anchor Standard: 3.1 Identify personal interests, aptitudes, information and skills necessary for informed career decision making success.

Anchor Standard: 3.2 Evaluate personal character traits such as trust, respect, and responsibility and understand the impact they can have on career success.

Anchor Standard: 3.4 Research the scope of career opportunities available and the requirements for education, training, certification, and licensure.

Anchor Standard: 3.9 Develop a career plan that reflects career interests, pathways, and postsecondary options.

Academic Standards: LS 11-12.3

Unit 2	Shop Safety	Class Hrs.	5	Lab Hrs.	
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Description:

Students will learn to apply safe work practices in the shop area and carry them into the workplace. They will be introduced to Osha for Maritime and receive certification at the end of the course.

Unit 2 Competency: Upon Completion of this unit, the student is able to:

1. Learn basic safety in the shop and safe handling of equipment.

2. Identify hazards in the shop and apply methods to avoid, control and prevent.

3. Identify and utilize personal protective equipment.

4. Use ergonomics and proper lifting techniques to avoid injury, repetitive motion and muscle strains.

Anchor Standard:6.2 Interpret policies, procedures, and regulations for the workplace environment, including employer and employee responsibilities.

Anchor Standard:6.3 Use health and safety practices for storing, cleaning, and maintaining tools, equipment, and supplies.

Anchor Standard:6.4 Set up a work area, or shop, to avoid potential health concerns and safety hazards including but not limited to ergonomics, electrical (shock), wires (tripping), fumes (lung health), noise (hearing loss), fire (burns), and so forth, incorporating ergonomics.

Anchor Standard 6.5 Practice personal safety when lifting, bending, or moving equipment or supplies.

Anchor Standard: 6.6 Demonstrate how to prevent and respond to work-related accidents or injuries and emergencies.

Anchor Standard: 6.7 Maintain a safe and healthful working environment.

Anchor Standard: 6.8 Be informed of laws/acts pertaining to the Occupational Safety and Health Administration (OSHA).

Academic Standards: LS 11-12.3, RSIT 11-12.7

Unit 3	Basics of Flux Core Welding	Class Hrs.	4	Lab Hrs.	
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Description

Students will gain an introduction to Flux Core Welding. They will also be introduced to the different types of fluxing agents used in Flux Core welding process.

Unit 3 Competency: Upon Completion of this unit, the student is able to:

1. Explain the differences between self-shielded and gas shielded FCAW and understand the benefits to each.

2. Understand the process of flux core welding and how it may be applied.

3. Understand how Flux Core welding differs from other welding processes.

Anchor Standard:2.3 Interpret verbal and nonverbal communications and respond appropriately.

Pathway Standard: C6.2 Compare and contrast the various welding systems used in conventional manufacturing industries in order to select and use appropriate tools, equipment, and inspection devices.

Pathway Standard: C7.1 Recognize materials and processes in relation to welding systems.

Academic Standards: LS 11-12.3

Unit 4	Flux Core Welding	Class Hrs.	10	Lab Hrs.	140
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Description

Students will be instructed as to the different welding position when welding fillets on

carbon steel plate with a flux core wire. They will also be instructed as to the AWS specifications.

Unit 4 Competency: Upon Completion of this unit, the student is able to:

1. Weld fillets on carbon steel plate with a flux core wire in all positions (horizontal, vertical and overhead), to AWS specifications.

2. Weld vee-grooved carbon steel plates in the horizontal, vertical, and overhead positions to AWS specifications.

3. Demonstrate fundamental knowledge of metal shrinkage as applied to minimizing distortion.

Anchor Standard:3.6 Recognize the role and function of professional organizations, industry associations, and organized labor in a productive society.

Anchor Standard:10.3 Construct projects and products specific to the Manufacturing and Product Design sector requirements and expectations.

Anchor Standard:10.4 Collaborate with industry experts for specific technical knowledge and skills.

Anchor Standard: 11.1 Utilize work-based/workplace learning experiences to demonstrate and expand upon knowledge and skills gained during classroom instruction and laboratory practices specific to the Manufacturing and Product Design sector program of study.

Anchor Standard: 11.2 Demonstrate proficiency in a career technical pathway that leads to certification, licensure, and/or continued learning at the postsecondary level.

Pathway Standard: C1.4 Critique the design parameters across welding processes to produce a welded part or product.

Pathway Standard: C2.1 Introduce joint preparation methods and explain how to identify joint specifications.

Pathway Standard: C2.3 Use welding tools and equipment such as oxy fuel welding (OFW), shielded metal arc welding (SMAW), gas metal arc welding (GMAW), flux-cored arc welding (FCAW), gas tungsten arc welding (GTAW), forge, and furnace to combine or join manufactured parts and products resulting in a finished product that meets the standards of the AWS or a similar industry standard.

Pathway Standard: C2.4 Compare and contrast the physical qualities of various industrial materials to be processed to produce useful welded parts and products.

Pathway Standard: C3.1 Use welding tools such as OFW, SMAW, GMAW, FCAW, GTAW, forge, and furnace and the equipment and assembly processes appropriate to the design criteria of a specific product to result in a finished part or product that meets the standards of the AWS or similar industry welding standards.

Pathway Standard: C5.1 Identify and explain weld imperfections and their causes.

Pathway Standard: C8.1 Recognize the importance of base metal preparation and joint fit-up and alignment.

Pathway Standard: C8.3 Produce a completed fabrication, an assembly, or a repair by using appropriate joining and mechanical fastening techniques and processes.

Academic Standards: LS 11-12.3 RSLT 11-12.2, 11-12.3, 11-12.7 SEP 4 CC 6, 7

Unit 5	Blueprint Reading – Industry Vocabulary	Class Hrs.	25	Lab Hrs.	14
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Description

Students will be introduced to the specialized vocabulary and the symbols, lines and numerical figures used in welding drawings and blueprints.

Unit 5 Competency: Upon Completion of this unit, the student is able to:

1. Demonstrate fundamental knowledge of standardized symbols, lines, and numerical figures used in welding drawings and blueprint with 100% accuracy.
2. Use selected tables, charts, reference handbooks, and other reference materials to interpret and/or compute data on drawings and prints.
3. Use equipment, dimensioning, letters, tables, and specifications to complete a drawing for an assigned project.
4. Demonstrate a thorough knowledge of welding terminology.
Anchor Standard: 5.2 Solve predictable and unpredictable work-related problems using various types of reasoning (inductive, deductive) as appropriate.
Anchor Standard:5.4 Interpret information and draw conclusions, based on the best analysis, to make informed decisions.
Anchor Standard:7.5 Apply high-quality techniques to product or presentation design and development.
Pathway Standard: C1.2 Interpret scaled welding blueprints; gather design and materials information; perform calculations; and use the detail to plan, lay out, and produce parts or finished products.
Pathway Standard: C1.3 Analyze welding symbols on drawings, specifications, and welding procedure specifications.
Academic Standards: LS 11-12.3 RSIT 11-12.7, RLST 11-12.2, 11-12.3, 11-12.4 WHSST 11-12.9 SEP 4, 8

Unit 6	Documentation	Class Hrs.	5	Lab Hrs.	10
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Description

Students will be introduced to the documentation that is necessary when working in the Manufacturing and Product Development Industry and how to accurately complete paperwork.

Unit 6 Competency: Upon Completion of this unit, the student is able to:

1. Demonstrate the ability to fill out inventory papers, as well as control papers with important information like machine serial numbers, type of machine and non-consumable materials.

Anchor Standard:2.4 Demonstrate elements of written and electronic communication such as accurate spelling, grammar, and format.

Anchor Standard:8.3 Demonstrate ethical and legal practices consistent with Manufacturing and Product Design sector workplace standards.

Pathway Standard: C7.2 Understand the importance of maintaining documentation for welding systems.

Pathway Standard: C9.1 Know how scheduling, quality control, accident prevention, and inventory control are used efficiently and appropriately in a welding production management system.

Academic Standards: RLST 11-12.2, 11-12.3, 11-12.7 SEP 8

Totals	Theory Hrs.	52	Lab Hrs.	164	Total Hrs.	216
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APPENDIX A:

MATRIX FOR ALL ASPECTS OF THE INDUSTRY

All Aspects of the Industry is a key element of the Carl D. Perkins Vocational and Applied Technology Education Act and the School-to Work Opportunities Act. Both acts emphasize giving students a comprehensive perspective and range of skills across an industry. The Perkins Act requires programs to “provide students with strong experience in and understanding of all aspects of the industry students are preparing to enter”. The Act identifies eight aspects in particular, which are common to any business or industry. Programs receiving Perkins funds are required to include the teaching of these concepts to provide students with the skills necessary to be successful in their employment.

STRATEGIES

Below is a matrix showing the components of “All Aspects of the Industry for the *Welding: FCAW*. A list of strategies is provided for each component.

ASPECTS	SEQUENCE OF COURSES
	<p>Course 1: Shielded Metal Arc Welding Course 2: Gas Metal Arch Welding Course 3: Flux-Cored Arc Welding Course 4: Gas Tungsten Arc Welding</p> <p>The following All Aspects of Industry Apply to each course as they move through the program and learn each type of welding technique.</p>
Planning	Students are required to design, plan and build various projects. It is reinforced that proper planning at any level (industry and firm) saves time, materials, and increases efficiency.
Management	In the class, students learn that in a school system, there is a management system similar to the industry management system. Students are reminded that decisions made by upper level management impact them.
Finance	Students know the type of business, labor cost, and costs of consumables related to arc welding and are able to plan projects accordingly.
Technical & Production Skills	Use selected tables to demonstrate a basic understanding of the principles of the properties of the metal electrode arc including AC, DCEN, DCEP, voltage and current relative to the types and thickness of metal to be welded.
Underlying Principles Of Technology	Select proper welding electrodes through the use of AWS/ANSI identifying number classifications.
Labor Issues	Workers’ rights and responsibilities are discussed as well as the impact of labor agreements on business operations. Job acquisition skills/lifelong learning opportunities, certifications. Learn standards, codes from different classifications such as AWS, ASME, API.
Community Issues	Community service school projects using applied welding skills on new projects or repairs.
Health, Safety, & Environmental Issues	Application of safety in different working conditions in shop/field. Understand different shop/field signs, prevent accidents.