

WELDING

INDUSTRY SECTOR: Manufacturing and Product Development

CALPADS PATHWAY: Welding and Materials Joining (Pathway Code 213)

CALPADS COURSE TITLE: Welding Technologies and Fabrication

CALPADS COURSE CODE: 5639

HOURS:	Total	Classroom	Laboratory/CC/CVE
	360	125	235

JOB TITLE	ONET CODES	JOB TITLE	ONET CODES
Welder, Acetylene	811.684-014	Welder, Gas-Tungsten Arc	810.384-014
Welder, Apprentice, Arc	810.384-010	Welder, Helper	819.687-014
Welder, Arc	810.384-014	Welder, Plasma Arc	810.384-014
Welder, Assembler	819.381-010	Welder, Production Line	819.684-010
Welder, Boilermaker	810.384-014	Welder, Production Line, Combination	819.684-010
Welder, Combination	819.384-010	Welder, Repair	819.384-010
Welder, Flux-Cored Arc	810.384-014	Welder, Shielded-Metal Arc	810.384-014
Welder, Gas-Metal Arc	810.384-014	Welder, Structural Repair	819.361-010

COURSE DESCRIPTION: The course will include instructional units designed to give the student basic skills and understanding. It will include basic knowledge of shop safety procedures, Oxy-Acetylene Welding and Cutting, Fundamental Arc Welding, Advanced Arc Welding, Metallic Inert Gas Welding, Tungsten Inert Gas Welding, Basic Blueprint Reading and Job Selection. The student upon completion of this course will be able to perform the majority of the tasks normally involved in a welding shop or in the oilfields. The student will be able to:

- A. Follow a blueprint or shop drawing.
- B. Use the Oxy-Acetylene cutting torch.
- C. To cut off and level pipe by hand or with a pipe cutter according to the blueprint specifications.
- D. Layout and set up material in proper sequence according to welding symbols on the blueprint.
- E. Have skill and knowledge to cut, pierce or level materials according to the blueprint specifications.
- F. Place the proper size welds where the weld symbols indicate using Arc MIG or TIG welders.
- G. Use grinders, cutoff saw, band saw and drill press as needed to complete a welding project.
- H. To clean and maintain all welding equipment.
- I. Complete a job application form, prepare a job resume and participate successfully in a job interview.

Enrolled students, upon completion of the course, will have a demonstrated proficiency in welding. The course is designed for the student who wishes to follow welding in his employment. Goals in the program are to give students instruction in actual job practices used in industry today. Supplementary units or individualized units of instruction will be available during the course and at the end of the course for those students who seek enrichment or complete all of the required units of instruction prior to scheduled completion dates and times.

PREREQUISITES:

Ag Mechanics I or Ag Welding

Recommended: Algebra I

ARTICULATION:

College Name	College Course Title
Bakersfield College	WELD B53A – Shielded Metal Arc Welding

LEVEL: **Introductory** **Concentrator** **Capstone**

CERTIFICATION: NCCER Core Curriculum Certification
 OSHA 10-Hour Construction Industry via careersafeonline.com

METHOD OF STUDENT EVALUATION:

- ✓ Pre and Post test
- ✓ Student Projects
- ✓ Written work
- ✓ Observation record of student performance
- ✓ Completion of assignments and worksheets

METHOD OF INSTRUCTION:

- ✓ Lecture
- ✓ Group and Individual Applied Projects
- ✓ Demonstration
- ✓ Field Trips
- ✓ Guest Speaker

RECOMMENDED TEXTS:

Althouse, Turnquist, Bowditch, Bowditch. *Modern Welding*; 2000; Goodheart-Willcox. ISBN: 1-56637-605-X

MODEL CTE PATHWAY: The Welding and Materials Joining Pathway provides students with an understanding of manufacturing processes and systems common to careers in welding and related industries. The following pathway standards are based on, but not limited to, well established American Welding Society (AWS) EG2.0 Guidelines for the Entry Level Welder. Representative topics include the interpretation and layout of welded and assembled-part prints, cutting, mechanical bonding, joining, cohesive bonding, adhesive bonding, and mechanical fastening.

Delano High School		
Grade	Fall Semester	Spring Semester
10 th or 11 th	Ag Mechanics	Ag Mechanics
11 th or 12 th	NKVTC Welding	NKVTC Welding
Elective		

OR

Grade	Fall Semester	Spring Semester
10 th or 11 th	Ag Mechanics	Ag Mechanics
11 th or 12 th	NKVTC Welding	NKVTC Welding
Elective		

I.	Basic Knowledge of Shop and Safety Procedures	CR	LAB/ CC	STANDARDS
	A. Proper Use and Care for All Equipment <ol style="list-style-type: none"> 1. Hand grinders 2. Stationary stand grinders 3. Cut off saw 4. Band saw 5. Drill press B. Proper Welding Apparel and Eye Protective Devices <ol style="list-style-type: none"> 1. Approved safety glasses 2. Helmet, goggles, gloves, protective clothing (leathers) 	30 HR	20 HR	CTE Anchor: A6.0-A6.8; A10.0-A10.4 CTE Pathway: C2.0
II.	Oxy-Acetylene Welding and Cutting	CR	LAB/ CC	STANDARDS
	A. Oxy-Acetylene Introduction <ol style="list-style-type: none"> 1. Safety rules in handling cylinders and equipment 2. Proper use of oxygen and acetylene 3. Rod classification and selection of proper rod and/or cutting tip B. Oxy-Acetylene Cutting <ol style="list-style-type: none"> 1. Cutting sheet metal 2. Cutting, piercing and beveling plate 3. Cutting and beveling pipe C. Oxy-Acetylene Welding <ol style="list-style-type: none"> 1. Welding butt joints in all positions 2. Welding T joints in all positions D. Oxy-Acetylene Brazing <ol style="list-style-type: none"> 1. Learning temperature ranges of flux 2. Selection of proper rod 3. Braze welding butt joints in all positions 4. Braze welding T joints in all positions E. Pipe Layout and Fitting <ol style="list-style-type: none"> 1. Cutting and welding fixed position pipe in the 5, 20, 60 positions 2. Cutting and welding 2 pieces 90 degree tum in all positions 3. Cutting and welding a full size T in all positions 4. Cutting and welding a full size 45 degree lateral in all positions 5. Cutting and welding a true Y in all positions 6. Cut a 6" to 12" pipe using the pipe beveling machine F. Cast Iron Welding and Brazing <ol style="list-style-type: none"> 1. Selection proper flux and cast iron rod G. Oxy-Acetylene Aluminum Welding <ol style="list-style-type: none"> 1. Butt and T joints in all positions H. Acid and Resin Core Soldering <ol style="list-style-type: none"> 1. Soldering sheet metal and electrical wiring 	15 HR	35 HR	CTE Anchor: A6.0-A6.8; A10.0-A10.4 CTE Pathway: C2.0, C2.2, C2.3, C3.0, C3.1 C3.2, C3.3, C7.1, C8.1

III.	Fundamental Arc Welding	CR	LAB/ CC	STANDARDS
	<p>A. Fundamental Arc Welding Introduction</p> <ol style="list-style-type: none"> 1. Safety rules for arc welding 2. Proper use of electricity 3. Selection of proper lens and wearing apparel 4. Safety glasses while chipping 5. Rod classification and metal selection <p>B. Fundamental Arc Welding</p> <ol style="list-style-type: none"> 1. Run stringer beads in all positions on a 6" x 6' piece of steel plate using E-6010 electrode 2. Using a tee joint fillet in the flat position using E-60 IO electrode 3. T joint fillet weld in the flat and horizontal position using 1/8 E-7024 electrode 4. Butt joint square groove both sides in the flat position using 5/32 E-6013 electrode 5. T joint vertical up position using 5/32 E-6011 electrode 6. Butt joint square groove full melt thru using 5/32 E-6010 electrode 7. Butt joint V groove in the horizontal and vertical up position using 1/8 E-6010 electrode 8. T joint fillet in the vertical up position using weave pattern 1/8 E-6010 electrode 9. T joint fillet vertical down position using 1/8 E-6010 electrode 10. Run stringer beads in all positions on a 6" x 6' piece of steel plate using 1/8 E-7018 electrode 11. T joint fillet weld vertical up position using 1/8 E-7018 low hydrogen electrode 12. T joint fillet weld overhead position using 1/8 E-6010 and 1/8 E-7018 low hydrogen electrodes 13. Butt joint V groove overhead position root pass 1/8 E-6010 fillet passes E-7018 low hydrogen electrode 14. Butt joint flat and vertical down. Lap joint and flat vertical down using 1/8 E-6010 electrode 15. Tee joint fillet horizontal and vertical down position using 1/8 E-6010 electrode 16. Butt joint flat and vertical down using 3/32 E-6013 electrode 17. Fillet joint horizontal and flat position using 1/8 E-7024 iron powder electrodes 	20 HR	60 HR	<p>CTE Anchor: A1.0; A4.0-A4.6; A5.0-A5.4; A6.0-A6.8; A10.0-A10.4</p> <p>CTE Pathway: C1.1, C2.3, C2.4, C3.0, C3.1, C3.3, C4.0, C4.1, C4.2, C4.3, C5.0, C5.1, C5.2, C5.3, C5.4, C5.6, C7.1, C8.0, C8.1</p>
IV.	Advanced Arc Welding	CR	LAB/ CC	STANDARDS
	<p>A. Multi-Layer Passes</p> <ol style="list-style-type: none"> 1. T joint fillet weld in the horizontal position 15 passes using 5/32 E-6012 electrode 2. Fillet weld horizontal position 15 passes using 1/8 stainless steel electrode 	20 HR	30 HR	<p>CTE Anchor: A1.0; A5.0-A5.4; A6.0-A6.8; A7.4, A7.5; A10.0-A10.4</p> <p>CTE Pathway: C1.1, C2.3, C2.4, C3.0, C3.1, C3.3, C4.0, C4.1, C4.2, C4.3,</p>

	<ol style="list-style-type: none"> 3. Fillet weld vertical up position 15 passes using stringer beads with 5/32 E-60 IO electrode 4. T joint fillet weld vertical up positions using box weave and Z weave with 5/32 E-6010 electrode 5. T joint fillet weld overhead position 15 passes 5/32 E-6011 electrodes 6. Pipe on plate vertical up position 15 passes inside and out using 5/32 E-6010 electrodes 7. Pipe on plate vertical up position 15 passes inside and out using 5/32 E-7018 electrodes 8. Butt joint V groove horizontal vertical up and overhead positions using 1/8 E-6010 & 1/8 7016 electrodes 9. Test plate vertical up position 			C5.0, C5.1, C5.2, C5.3, C5.4, C5.6, C7.1, C8.0, C8.1, C8.2, C8.3
V.	Metallic Inert Gas Process (MIG)	CR	LAB/ CC	STANDARDS
	<ol style="list-style-type: none"> A. Introduction to MIG Welding <ol style="list-style-type: none"> 1. Basic knowledge of equipment 2. Wire classification 3. Explanation of MIG welding process B. Metallic Inert Gas Welding Process <ol style="list-style-type: none"> 1. Butt joint stringer bead in all positions using mild steel 2. Lap joint stringer bead in all positions using mild steel 3. T joint stringer bead in all positions using mild steel 4. Comer joint stringer bead in all positions using mild steel 5. Two piece 90 degree tum on 2" pipe in all positions 6. V groove 4" pipe fixed position vertical up 7. Butt joint stringer bead using aluminum in all positions 8. T joint stringer bead using aluminum in all positions 9. T joint fillet weld using inner shield welding process flat and horizontal positions. 	10 HR	30 HR	<p>CTE Anchor: A1.0; A5.0-A5.4; A6.0-A6.8; A7.4, A7.5; A10.0-A10.4</p> <p>CTE Pathway: C1.1, C2.3, C2.4, C3.0, C3.1, C3.3, C4.0, C4.1, C4.2, C4.3, C5.0, C5.1, C5.2, C5.3, C5.4, C5.6, C7.1, C8.0, C8.1, C8.2, C8.3</p>
VI.	Tungsten Inert Gas Process (TIG)	CR	LAB/ CC	STANDARDS
	<ol style="list-style-type: none"> A. Introduction to TIG Welding <ol style="list-style-type: none"> 1. Equipment for TIG welding 2. Wire classification 3. Explanation of TIG welding process B. Tungsten Inert Gas Welding <ol style="list-style-type: none"> 1. Butt joint stringer bed in all positions using aluminum, mild steel, and stainless steel 2. Lap joint stringer bead in all positions using aluminum, mild steel, and stainless steel 3. T joint stringer bead in all positions using aluminum, mild steel, and stainless steel 	10 HR	30 HR	<p>CTE Anchor: A1.0; A5.0-A5.4; A6.0-A6.8; A7.4, A7.5; A10.0-A10.4</p> <p>CTE Pathway: C1.1, C2.3, C2.4, C3.0, C3.1, C3.3, C4.0, C4.1, C4.2, C4.3, C5.0, C5.1, C5.2, C5.3, C5.4, C5.6, C7.1, C8.0, C8.1, C8.2, C8.3</p>

	<p>4. V groove 2" pipe in fixed position weld vertical up using mild steel and stainless steel</p> <p>5. V groove 2" pipe horizontal position using mild steel and stainless steel</p>			
VII.	Basic Blueprint Reading	CR	LAB/ CC	STANDARDS
	<p>A. Basic Blueprint Reading</p> <p>1. Fundamentals of blueprint reading</p> <p>2. Welding symbols and their significance</p> <p>3. Completion of Blueprint Reading For Welders A.E. Bennet, Louis J. Siy; Delmar Publishers</p>	20 HR	20 HR	<p>CTE Anchor: A5.0-A5.4</p> <p>CTE Pathway: C1.0-C1.4; C2.0-C2.1; C7.2</p>
VIII.	Seeking A Job	CR	LAB/ CC	STANDARDS
	<p>A. Job Resume Preparation</p> <p>B. Completing Job Application Form</p> <p>C. Performance Testing</p> <p>D. Interviewing Techniques</p> <p>E. Follow-up</p>	10 HR	10 HR	<p>CTE Anchor: A1.0; A2.0-A2.6; A3.0, A3.1, A3.5, A3.9; A4.1, A4.3; A5.0- A5.4</p> <p>CTE Pathway: C3.0-C3.3; C5.0-C5.5</p>
IX.	Standards for Career Ready Practice			
	<ol style="list-style-type: none"> 1. Apply appropriate technical skills and academic knowledge. 2. Communicate clearly, effectively, and with reason. 3. Develop an education and career plan aligned with personal goals. 4. Apply technology to enhance productivity. 5. Utilize critical thinking to make sense of problems and persevere in solving them. 6. Practice personal health and understand financial literacy. 7. Act as a responsible citizen in the workplace and the community. 8. Model integrity, ethical leadership and effective management. 9. Work productively in teams while integrating cultural and global competence. 10. Demonstrate creativity and innovation. 11. Employ valid and reliable research strategies. <p>Understand the environment, social, and economic impacts of decisions.</p>			

Manufacturing and Product Development KNOWLEDGE AND PERFORMANCE ANCHOR STANDARDS

1.0 Academics

Analyze and apply appropriate academic standards required for successful industry sector pathway completion leading to postsecondary education and employment. Refer to the Manufacturing and Product Development academic alignment matrix for identification of standards.

2.0 Communications

Acquire and accurately use Manufacturing and Product Design sector terminology and protocols at the career and college readiness level for communicating effectively in oral, written, and multimedia formats. (Direct alignment with LS 9-10, 11-12.6)

- 2.1 Recognize the elements of communication using a sender–receiver model.
- 2.2 Identify barriers to accurate and appropriate communication.
- 2.3 Interpret verbal and nonverbal communications and respond appropriately.
- 2.4 Demonstrate elements of written and electronic communication such as accurate spelling, grammar, and format.
- 2.5 Communicate information and ideas effectively to multiple audiences using a variety of media and formats.
- 2.6 Advocate and practice safe, legal, and responsible use of digital media information and communications technologies.

3.0 Career Planning and Management

Integrate multiple sources of career information from diverse formats to make informed career decisions, solve problems, and manage personal career plans. (Direct alignment with SLS 11-12.2)

- 3.1 Identify personal interests, aptitudes, information, and skills necessary for informed career decision making.
- 3.2 Evaluate personal character traits such as trust, respect, and responsibility and understand the impact they can have on career success.
- 3.3 Explore how information and communication technologies are used in career planning and decision making.
- 3.4 Research the scope of career opportunities available and the requirements for education, training, certification, and licensure.
- 3.5 Integrate changing employment trends, societal needs, and economic conditions into career planning.
- 3.6 Recognize the role and function of professional organizations, industry associations, and organized labor in a productive society.
- 3.7 Recognize the importance of small business in the California and global economies.
- 3.8 Understand how digital media are used by potential employers and postsecondary agencies to evaluate candidates.
- 3.9 Develop a career plan that reflects career interests, pathways, and postsecondary options.

4.0 Technology

Use existing and emerging technology, to investigate, research, and produce products and services, including new information, as required in the Manufacturing and Product Design sector workplace environment. (Direct alignment with WS 11-12.6)

- 4.1 Use electronic reference materials to gather information and produce products and services.
- 4.2 Employ Web-based communications responsibly and effectively to explore complex systems and issues.
- 4.3 Use information and communication technologies to synthesize, summarize, compare, and contrast information from multiple sources.
- 4.4 Discern the quality and value of information collected using digital technologies, and recognize bias and intent of the associated sources.
- 4.5 Research past, present, and projected technological advances as they impact a particular pathway.
- 4.6 Assess the value of various information and communication technologies to interact with constituent populations as part of a search of the current literature or in relation to the information task.

5.0 Problem Solving and Critical Thinking

Conduct short, as well as more sustained, research to create alternative solutions to answer a question or solve a problem unique to the Manufacturing and Product Design sector using critical and creative thinking, logical reasoning, analysis, inquiry, and problem-solving techniques. (Direct alignment with WS 11-12.7)

- 5.1 Identify and ask significant questions that clarify various points of view to solve problems.
- 5.2 Solve predictable and unpredictable work-related problems using various types of reasoning (inductive, deductive) as appropriate.
- 5.3 Use systems thinking to analyze how various components interact with each other to produce outcomes in a complex work environment.
- 5.4 Interpret information and draw conclusions, based on the best analysis, to make informed decisions.

6.0 Health and Safety

Demonstrate health and safety procedures, regulations, and personal health practices and determine the meaning of symbols, key terms, and domain-specific words and phrases as related to the Manufacturing and Product Design sector workplace environment. (Direct alignment with RSTS 9-10, 11-12.4)

- 6.1 Locate, and adhere to, Material Safety Data Sheet (MSDS) instructions.
- 6.2 Interpret policies, procedures, and regulations for the workplace environment, including employer and employee responsibilities.
- 6.3 Use health and safety practices for storing, cleaning, and maintaining tools, equipment, and supplies.
- 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.
- 6.5 Practice personal safety when lifting, bending, or moving equipment and supplies.
- 6.6 Demonstrate how to prevent and respond to work-related accidents or injuries and emergencies.
- 6.7 Maintain a safe and healthful working environment.
- 6.8 Be informed of laws/acts pertaining to the Occupational Safety and Health Administration (OSHA).

7.0 Responsibility and Flexibility

Initiate, and participate in, a range of collaborations demonstrating behaviors that reflect personal and professional responsibility, flexibility, and respect in the Manufacturing and Product Design sector workplace environment and community settings. (Direct alignment with SLS 9-10, 11-12.1)

- 7.1 Recognize how financial management impacts the economy, workforce, and community.
- 7.2 Explain the importance of accountability and responsibility in fulfilling personal, community, and workplace roles.
- 7.3 Understand the need to adapt to changing and varied roles and responsibilities.
- 7.4 Practice time management and efficiency to fulfill responsibilities.
- 7.5 Apply high-quality techniques to product or presentation design and development.
- 7.6 Demonstrate knowledge and practice of responsible financial management.
- 7.7 Demonstrate the qualities and behaviors that constitute a positive and professional work demeanor, including appropriate attire for the profession.
- 7.8 Explore issues of global significance and document the impact on the Manufacturing and Product Design sector.

8.0 Ethics and Legal Responsibilities

Practice professional, ethical, and legal behavior, responding thoughtfully to diverse perspectives and resolving contradictions when possible, consistent with applicable laws, regulations, and organizational norms. (Direct alignment with SLS 11-12.1d)

- 8.1 Access, analyze, and implement quality assurance standards of practice.
- 8.2 Identify local, district, state, and federal regulatory agencies, entities, laws, and regulations related to the Manufacturing and Product Development industry sector.
- 8.3 Demonstrate ethical and legal practices consistent with Manufacturing and Product Design sector workplace standards.
- 8.4 Explain the importance of personal integrity, confidentiality, and ethical behavior in the workplace.

9.0 Leadership and Teamwork

Work with peers to promote divergent and creative perspectives, effective leadership, group dynamics, team and individual decision making, benefits of workforce diversity, and conflict resolution as practiced in the SkillsUSA career technical student organizations. (Direct alignment with SLS 11-12.1b)

- 9.1 Define leadership and identify the responsibilities, competencies, and behaviors of successful leaders.
- 9.2 Identify the characteristics of successful teams, including leadership, cooperation, collaboration, and effective decision-making skills as applied in groups, teams, and career technical student organization activities.
- 9.3 Understand the characteristics and benefits of teamwork, leadership, and citizenship in the school, community, and workplace setting.
- 9.4 Explain how professional associations and organizations and associated leadership development and competitive career development activities enhance academic preparation, promote career choices, and contribute to employment opportunities.
- 9.5 Understand that the modern world is an international community and requires an expanded global view.
- 9.6 Respect individual and cultural differences and recognize the importance of diversity in the workplace.
- 9.7 Participate in interactive teamwork to solve real Manufacturing and Product Design sector issues and problems.

10.0 Technical Knowledge and Skills

Apply essential technical knowledge and skills common to all pathways in the Manufacturing and Product Design sector, following procedures when carrying out experiments or performing technical tasks. (Direct alignment with WS 11-12.6)

- 10.1 Interpret and explain terminology and practices specific to the Manufacturing and Product Design sector.
- 10.2 Comply with the rules, regulations, and expectations of all aspects of the Manufacturing and Product Design sector.
- 10.3 Construct projects and products specific to the Manufacturing and Product Design sector requirements and expectations.
- 10.4 Collaborate with industry experts for specific technical knowledge and skills.

11.0 Demonstration and Application

Demonstrate and apply the knowledge and skills contained in the Manufacturing and Product Design anchor standards, pathway standards, and performance indicators in classroom, laboratory, and workplace settings, and through the SkillsUSA career technical student organizations.

- 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.
- 11.2 Demonstrate proficiency in a career technical pathway that leads to certification, licensure, and/or continued learning at the postsecondary level.
- 11.3 Demonstrate entrepreneurship skills and knowledge of self-employment options and innovative ventures.
- 11.4 Employ entrepreneurial practices and behaviors appropriate to Manufacturing and Product Design sector opportunities.
- 11.5 Create a portfolio, or similar collection of work, that offers evidence through assessment and evaluation of skills and knowledge competency as contained in the anchor standards, pathway standards, and performance indicators.

Manufacturing and Product Development WELDING AND MATERIALS JOINING PATHWAY STANDARDS

C. Welding and Materials Joining Pathway

The Welding and Materials Joining pathway provides students with an understanding of manufacturing processes and systems common to careers in welding and related industries. The following pathway standards are based on, but not limited to, well established American Welding Society (AWS) EG2.0 Guidelines for the Entry Level Welder. Representative topics include the interpretation and layout of welded and assembled-part prints, cutting, mechanical bonding, joining, cohesive bonding, adhesive bonding, and mechanical fastening. Sample occupations associated with this pathway:

- Metal Fabricator
- Sales
- Welders, Cutters, and Fitters
- Welding Inspector
- Welding Engineer

C1.0 Interpret and Demonstrate the Planning and Layout Operations Used in the Welding Processes.

C1.1 Use current information technology ideation and design process systems in the manufacturing of welded parts and products.

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.

C1.3 Analyze welding symbols on drawings, specifications, and welding procedure specifications.

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

C2.0 Understand and Demonstrate How Materials can be Processed Through the Use of Welding Tools and Equipment.

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

C2.2 Use standard and new emerging welding tools and equipment, such as oxygen fuel cutting (OFC), plasma arc cutting (PAC), and carbon arc cutting (CAC) to cut materials for the purpose of completing a finished product that meets the standards of the AWS or a similar industry 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.

C2.4 Compare and contrast the physical qualities of various industrial materials and how these qualities affect the ability of the materials to be processed to produce useful welded parts and products.

C3.0 Differentiate and Apply Various Types of Welding Assembly Processes.

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.

C3.2 Produce bonded industrial materials by using adhesive such as flow, pressure, and fusion welding.

C3.3 Compare and contrast existing material bonding methods with future innovative bonding processes.

C4.0 Understand finishing processes and the differences between various types of finishing materials used in the manufacture of welded parts and products.

C4.1 Employ and explain the steps to be taken, and the choices to be made, in finishing welded materials.

C4.2 Apply the processes used for finishing welded materials.

C4.3 Assess how to select an appropriate finishing process to meet the design criteria of a specific welded product.

C5.0 Understand and Defend the Purposes and Processes of Inspection and Quality Control in Welding Manufacturing Processes.

- C5.1 Identify and explain weld imperfections and their causes.
- C5.2 Identify and explain destructive and nondestructive examination practices.
- C5.3 Describe the reasons for inspection and quality control in the manufacturing of welded parts.
- C5.4 Analyze and identify the steps to check for distortion, joint misalignment, and poor fit-up before and after welding.
- C5.5 Perform continuous online quality control inspections of welded parts.
- C5.6 Evaluate and know how to troubleshoot performance problems of welding systems.

C6.0 Explore and Understand Various Welding Systems that Require Standard Hand and Machine Tools.

- C6.1 Select and use appropriate welding tools, equipment, and inspection devices to manufacture parts or products.
- 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.
- C6.3 Research new and emerging welding systems and their effects on the standard hand and machine manufacturing industry.

C7.0 Understand Various Automated Welding Systems, Welding Design for Manufacturing, Flexible Manufacturing Systems, and Materials Resource Planning.

- C7.1 Recognize materials and processes in relation to welding systems.
- C7.2 Understand the importance of maintaining documentation for welding systems.
- C7.3 Distinguish between welding processes involved in the following manufacturing systems: “just in time,” design for manufacturing, flexible manufacturing systems, and materials resource planning.
- C7.4 Use computers to design and produce welded products, write numerical control programs, and control robots.
- C7.5 Compare and contrast the ways in which emerging welding systems may be integrated into current manufacturing processes.

C8.0 Understand Various Joining or Combining Processes, Including Welding Processes Used in Manufacturing, Maintenance, and Repair.

- C8.1 Recognize the importance of base metal preparation and joint fit-up and alignment.
- C8.2 Analyze and be able to defend various welding processes used to complete a fabrication, an assembly, or a repair.
- C8.3 Produce a completed fabrication, an assembly, or a repair by using appropriate joining and mechanical fastening techniques and processes.

C9.0 Understand How a Manufacturing Company is Organized and the Elements of Welding Production Management.

- C9.1 Know how scheduling, quality control, accident prevention, and inventory control are used efficiently and appropriately in a welding production management system.
- C9.2 Understand that a welding production management system includes planning, engineering, organizing, and controlling resources and manufacturing processes.
- C9.3 Diagram corporate structures that affect welding production.

North Kern Vocational Training Center WELDING PROFICIENCIES

1. Upon completion of the course students will be able to set up Oxy-Acetylene equipment demonstrating proper safety procedures.
2. Upon completion of the course students will be able to cut, pierce, bevel mild steel plate in all positions using oxy-acetylene set in all positions in accordance with instructor specifications.
3. Upon completion of course students will be able to weld a butt joint and tee joint in the flat position using oxy-acetylene equipment and procedures.
4. Upon completion of the course students will be able to braze a butt joint and tee joint in the flat position using oxy-acetylene set equipment and procedures.
5. Upon completion of the course students will be able to classify electrodes and select proper polarity according to A.W.S. specifications and selection of proper polarity.
6. Upon completion of the course students will be able to weld a tee joint flat and vertical up position using E-6010 and E-6011 rod in accordance with A.W.S. specification.
7. Upon completion of the course students will be able to weld a tee groove vertical up using 1/8 E-7018 electrode in accordance with A.W.S. test plate.
8. Upon completion of the course students will be able to set up MIG equipment and adjust to proper voltage and amperage for welding a butt joint in the flat and vertical down position using E-70S-3 wire and Co2 cover gas.
9. Upon completion of the course students will be able to set up MIG equipment and adjust to proper voltage and amperage for welding a butt joint and tee joint in flat and vertical down positions using 308 stainless steel wire and 75% arg 25% Co2 gas.
10. Upon completion of the course students will be able to classify rod for mild steel, stainless steel and aluminum filler materials in accordance with A.W.S. specifications.
11. Upon completion of the course students will be able to set equipment and weld a butt joint and tee joint in flat and vertical up positions using mild steel.