Escondido Union High School District

Welding and Metal Fabrication 1

EUHSD Board Approval Date: 4/17/18
The EUHSD Welding and Metal Fabrication I curriculum document identifies what students should be able to know by grade level in a comprehensive standards-based course of study in the Manufacturing and Product Development Pathway. This curriculum document may be revised based on student academic achievement data, research and best practices, and input from stakeholders. The EUHSD curriculum document contains the following documents and/or information:

A. Course Description
B. Course Guidelines/Requirements - graduation credit information, transcript information, adopted materials, adopted technology, assessment outline
C. Instructional Materials References
D. Scope and Sequence Map with Essential Standards outlined by Unit
E. References to key essential design and implementation documents

A comprehensive course of study and/or program is designed so that all students have access to the rigorous curriculum necessary to graduate high school demonstrating college and career readiness skills. Student-centered learning provides opportunity for collaboration, communication, and a robust learning environment and provides opportunities for all students to meet the goals of the district’s Instructional Focus at the time of this writing: “All students communicate their thinking, ideas and understanding by effectively using oral, written and/or non-verbal expression.” A key design consideration in the transition to the updated California State Standards is a focus on changes to pedagogy with an emphasis on ensuring students are engaged via relevant learning experiences.

A key design consideration in the transition to the new California State Standards is a focus on changes to pedagogy. The CA Learning Standards describe key instructional shifts, which guide classroom teaching and learning and provide a foundation of curriculum and instructional design based on student inquiry and a focus on rigorous literacy tasks. These instructional shifts are described on the California Department of Education’s website at the following URL: https://www.cde.ca.gov/Re/cc/

The curriculum document is aligned to the California Learning Standards and—more specifically—the Model Career Technical Education Standards, the CTE Knowledge and Performance Anchor Standards, and the Pathway Standards specific to this course of study. All CTE standards are located here: https://www.cde.ca.gov/ci/ct/st/
Welding and Metal Fabrication 1 Course Description

The Welding and Metal Fabrication 1 course provides students with the foundational concepts required for pursuing career pathways in the welding and metal fabrication industries and is part of the EUHSD Manufacturing and Product Development Pathway. In this course, students engage in an instructional program that integrates academic and technical preparation and focuses on career awareness, career exploration, and skill preparation. This pathway emphasizes real world, occupationally relevant experiences of significant scope and depth. The knowledge and skills are acquired within a sequential, standards-based pathway program that integrates hands-on, project-based, and work-based instruction. More specifically, this course provides entry-level and upgrade training for employment in the welding industry in hard facing heavy equipment and structural steel; welding and joining applications include, gas, arc, MIG and TIG welding. Students use equipment, which includes oxyacetylene welding, and cutting equipment, electric welding machines, and cutoff saws and shears. Approximately 180 hours are required to complete the course.

Course Requirements

<table>
<thead>
<tr>
<th>Course Length: Year Long</th>
<th>Grade Level: 10-12</th>
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<tbody>
<tr>
<td>UC/CSU Requirement:</td>
<td>Graduation Requirement: EUHSD Elective Credit or CTE Requirement</td>
</tr>
<tr>
<td>Course Number (Semester A): 6360</td>
<td>Transcript Abbreviation (Semester A): WELD MTL FAB 1 P A</td>
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<tr>
<td>Course Number (Semester B): 6361</td>
<td>Transcript Abbreviation (Semester B): WELD MTL FAB 1 P B</td>
</tr>
<tr>
<td>Credits (Semester A): 5 Elective or CTE</td>
<td>Credits (Semester B): 5 Elective or CTE</td>
</tr>
<tr>
<td>Required Prerequisite/s: None</td>
<td>Required Prerequisite/s: None</td>
</tr>
<tr>
<td>Industry Sector: Manufacturing and Product Development</td>
<td>Career Pathway: Welding and Materials Joining</td>
</tr>
<tr>
<td>Board Approval Date (Curriculum): 4/17/18</td>
<td>Board Approval Date (Materials):</td>
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Core Instructional Material/s:
- Hobart Institute of Welding Technology Complete Course Materials for: GTAW, SMAW and GMAW. (DVDs, Instructor Guides, Technical Guides, Student Workbook, Written Tests)
- S/P2 Welding Safety Course

Supplemental Instructional Material/s:

Teacher Resources:
- Gas Metal Arc Welding Handbook, W. Minnick. Goodheart-Willcox Publisher
- Shielded Metal Arc Welding, Walker/Polainin. G-W Publisher
- Oxyfuel Gas Welding, Bowditch/Bowditch. G-W Publisher
- Flux Cored Arc Welding Handbook, W. Minnick. G-W Publisher
- Gas Tungsten Arc Welding Handbook, Minnick/Prosser. G-W Publisher

Technology Resource/s: Students utilize a variety of technical equipment in the work/lab space including a variety of safety apparatus, welding and metal working tools and machines, and occasional access to computer workstations loaded with content specific software.

Assessments: The course is designed as a project-based curriculum and includes a variety of formative and summative assessments. Each unit outlines specific skills and/or long-term projects, which serve as unit and course assessments.

Meeting the Needs of ELs:
Our student information system is used by site leaders and instructors to acquire the language levels of EUHSD English Learners to ensure they are identified and their specific needs are met. Our approach to supporting English learners in based on the CA Department of Education (CDE) adopted language level proficiency descriptors and updated ELD Learning Standards. Visit the following website to learn more about those new descriptors and corresponding standards: [http://www.cde.ca.gov/sp/el/er/documents/eldstdspublication14.pdf](http://www.cde.ca.gov/sp/el/er/documents/eldstdspublication14.pdf) EUHSD uses the ELA-ELD Framework to inform pedagogical practices related to supporting English Learners. Visit the following URL to learn more about the new frameworks which describe in detail specific research-based best practices used to support English Learners: [http://www.cde.ca.gov/ci rl/ci6/documents/elaeldfwchapter11.pdf](http://www.cde.ca.gov/ci rl/ci6/documents/elaeldfwchapter11.pdf)
**Instructional Resources:**

- *Machinery’s Handbook*
- [https://sp2.org/site/](https://sp2.org/site/) (Unit 1)
- [www.osha.gov](http://www.osha.gov) (Unit 1)
- [www.youtube.com](http://www.youtube.com)
- Safety Manual
- *Precision Machining Technology, Section 4: “Drill Press”* (Unit 2)
- [http://www.globalclassroom.org/rulergame200/](http://www.globalclassroom.org/rulergame200/) (Unit 3)
- Intro/comparison of OFC vs PAC  [https://www.youtube.com/watch?v=84xB6ULeAUc](https://www.youtube.com/watch?v=84xB6ULeAUc) (Unit 4)
- Welding Tips And Trick’s tips on passing the weld test plate (Unit 5):
  - Part 1: [https://www.youtube.com/watch?v=C7PmksNDhY](https://www.youtube.com/watch?v=C7PmksNDhY)
  - Part 2: [https://www.youtube.com/watch?v=kblmdScfQU](https://www.youtube.com/watch?v=kblmdScfQU)
- Welding Tips And Trick’s tips on passing the vertical MIG certification test (Unit 5):
  - [https://www.youtube.com/watch?v=FYsZROIcVv](https://www.youtube.com/watch?v=FYsZROIcVv)

**Instructional Strategies:**

- Teacher led modeling and direct instruction
- Industry guest presentations
- Video demonstrations
- Group work and/or pair work
- Differentiate vocabulary or use of glossary
- Teacher led demonstrations on all equipment prior to safety tests
- Use of instructional notebooks
The Scope and Sequence Guide for this course is informed by the California Learning Standards and delineates the concepts and skills students are expected to acquire in order to meet College and Career Readiness expectations set for by the state and local board approved guidelines. Each unit of study is designed to build upon the previous unit and/or prerequisite coursework in support of student mastery of specific standards based skills. This Scope and Sequence document provides guidelines for instructors to ensure they have the necessary information related to content and pedagogy to guarantee students can meet the learning objectives of the course. The document is updated as needed based on input from all stakeholders to ensure it meets the needs of students.

All Career Technical Education coursework in the EUHSD is based on a series of state-adopted CTE standards which include the CTE Knowledge and Performance Anchor Standards, the California Standards for Career Ready Practice, and the CTE Model Curriculum Pathway Specific Standards. Not every standard and its related learning objective is included in the Scope and Sequence Guide since this document provides the essential pathway focus standards and key learning objectives for each unit with the related assignments and assessments. However, all of the CTE model Curriculum Pathway Standards are imbued in the student tasks throughout the course with specific standards emphasized in particular units in order to ensure students build the skills to ensure their success.

The CTE Standards for Career Ready Practice and CTE Model Curriculum Pathway Specific Standards below are integrated throughout the units and describe the fundamental knowledge and skills that a career ready student needs in order to prepare for transition to postsecondary education, career training, or the workforce. These standards are not exclusive to a career pathway, a CTE program of study, a particular discipline, or level of education. Standards for Career Ready Practice are taught and reinforced in all career exploration and preparation programs with increasingly higher levels of complexity and expectation as a student advances through a given pathway/program of study.

<table>
<thead>
<tr>
<th>CTE Standards for Career Ready Practice</th>
<th>CTE Model Curriculum Pathway Specific Standards</th>
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<tbody>
<tr>
<td>1. Apply appropriate technical skills and academic knowledge.</td>
<td>1.0 Academics: Analyze and apply appropriate academic standards...</td>
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<td>2. Communicate clearly, effectively, and with reason [both in writing and verbally].</td>
<td>2.0 Communications: Acquire and accurately use general academic and domain specific words...</td>
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<tr>
<td>3. Develop an education and career plan aligned with personal goals.</td>
<td>3.0 Career Planning and Management: Integrate multiple sources of information...</td>
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<td>4. Apply technology to enhance productivity.</td>
<td>4.0 Technology: Use technology, including the Internet, to produce, publish, and update writing...</td>
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<td>5. Utilize critical thinking to make sense of problems and persevere in solving them.</td>
<td>5.0 Problem Solving and Critical Thinking: Conduct short as well as more sustained research...</td>
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<tr>
<td>6. Practice personal health and understand financial literacy.</td>
<td>6.0 Health and Safety: Determine the meaning of symbols, key words [related to health and safety...]</td>
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<tr>
<td>7. Act as a responsible citizen in the workplace and the community.</td>
<td>7.0 Responsibility and Flexibility: Initiate and participate in a range of collaborative discussions...</td>
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<td>8. Model integrity, ethical leadership, and effective management.</td>
<td>8.0 Ethics and Legal Responsibilities: Respond thoughtfully to diverse perspectives...</td>
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<tr>
<td>9. Work productively in teams while integrating cultural and global competence.</td>
<td>9.0 Leadership and Teamwork: Work with peers...[to] set clear goals,...establish individual roles...</td>
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<td>10. Demonstrate creativity and innovation.</td>
<td>10.0 Technical Knowledge and Skills: Use technology...to produce, publish, and update...products...</td>
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<tr>
<td>11. Employ valid and reliable research strategies.</td>
<td>11.0 Demonstration and Application: Demonstrate and apply the knowledge and skills contained in the Industry-sector anchor standards, pathway standards, and performance indicators...</td>
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Welding and Metal Fabrication 1 Scope and Sequence
Unit 1 – Workshop Safety
Length: 1 Week and Ongoing

**Unit Description:** In Unit 1, students participate in hands-on activities designed to build their foundational understanding of participation in a workshop classroom environment. Students will examine specific safety and use policies, procedures, and practices. Students will examine workspaces for safety and/or health concerns. They will be expected to demonstrate a variety of safety practices through various classroom assignments and activities and will demonstrate their understanding through completion of a required safety test. All of the skills and procedures acquired in unit 1 will be used in subsequent units of study.

**Focus Unit Standards:**

**Manufacturing and Product Development Anchor Standards:**
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).

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

**Learning Objectives:**

Students will:
- Explain what a Material Safety Data Sheet is, where to access it, and how to apply its information to enhance personal safety.
- Use a workshop protocol document to know what they are responsible for in the workshop.
- Properly store, clean and maintain tools, equipment and supplies.
- Safely set up their work areas to avoid health hazards and injuries.
- Demonstrate safe and proper techniques when moving equipment and supplies.
- Demonstrate how to prevent and respond to work related accidents, injuries and emergencies.
- Maintain a safe and healthful work environment.
- Recall 2-3 OSHA laws, which pertain to worker safety.

**Key Unit Assignments and Assessments:**

- Students will work in groups of 2-3 to create a poster diagramming and outlining key components of workshop safety. Students will present their posters to two other groups, and groups will evaluate one another's posters and presentation quality.
- Students will be assessed regarding safety protocols and expectations; they must pass the assessment with 90% accuracy prior to utilizing equipment and/or working in the shop area. All wrong questions will be written out with the correct answers, and will contain reasoning as to why the correct answer is appropriate.
- Students will develop a housekeeping/clean-up plan for each shop based on photographs and videos of the workshops as they appear during actual work. The plan will be in a spreadsheet format, identifying potential hazards and ways to mitigate those hazards so they do not result in injuries.
- Students will complete a series of measurement tests designed to assess their understanding and mastery of basic measurements utilized throughout the course. This may be either a hands on and/or paper demonstration of understanding (fraction, inch, decimal inch, dial caliper, micrometer, etc.).
- Evaluation of safety posters determining accuracy and relevance.
- Written safety test with 100% correct responses.
- Pass Measuring Test with passing score of 85%. 

<table>
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<tr>
<th>Focus Unit Standards:</th>
<th>Learning Objectives:</th>
<th>Key Unit Assignments and Assessments:</th>
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<tbody>
<tr>
<td>Manufacturing and Product Development Anchor Standards:</td>
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<td>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</td>
<td>Explain what a Material Safety Data Sheet is, where to access it, and how to apply its information to enhance personal safety.</td>
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<td>6.1 Locate, and adhere to, Material Safety Data Sheet (MSDS) instructions.</td>
<td>Use a workshop protocol document to know what they are responsible for in the workshop.</td>
<td>- Students will develop a housekeeping/clean-up plan for each shop based on photographs and videos of the workshops as they appear during actual work. The plan will be in a spreadsheet format, identifying potential hazards and ways to mitigate those hazards so they do not result in injuries.</td>
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<td>6.2 Interpret policies, procedures, and regulations for the workplace environment, including employer and employee responsibilities.</td>
<td>Properly store, clean and maintain tools, equipment and supplies.</td>
<td>- Students will complete a series of measurement tests designed to assess their understanding and mastery of basic measurements utilized throughout the course. This may be either a hands on and/or paper demonstration of understanding (fraction, inch, decimal inch, dial caliper, micrometer, etc.).</td>
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<tr>
<td>6.3 Use health and safety practices for storing, cleaning, and maintaining tools, equipment, and supplies.</td>
<td>Safely set up their work areas to avoid health hazards and injuries.</td>
<td>- Evaluation of safety posters determining accuracy and relevance.</td>
</tr>
<tr>
<td>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.</td>
<td>Demonstrate safe and proper techniques when moving equipment and supplies.</td>
<td>- Written safety test with 100% correct responses.</td>
</tr>
<tr>
<td>6.5 Practice personal safety when lifting, bending, or moving equipment and supplies.</td>
<td>Demonstrate how to prevent and respond to work related accidents, injuries and emergencies.</td>
<td>- Pass Measuring Test with passing score of 85%.</td>
</tr>
<tr>
<td>6.6 Demonstrate how to prevent and respond to work-related accidents or injuries and emergencies.</td>
<td>Maintain a safe and healthful work environment.</td>
<td></td>
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</tbody>
</table>
In Unit 2, after receiving an introduction about various metalworking tools and machine tools, students will be trained in the safe operation of each machine and through written, verbal and demonstration methods, demonstrate/list procedures for each of those tools. These various tools will be used in support of completing the major projects for the Welding & Fabrication 1 course.

**Focus Unit Standards:**

**Manufacturing and Product Development Pathway Standards:**

- B1.0 Validate that a provided part meets specifications from its engineering drawing by comparing specifications (geometric dimensioning and tolerancing) and by demonstrating proper technique using appropriate precision measuring tools.
- B1.2 Demonstrate the correct use of precision measuring tools such as Vernier and dial calipers and height gauges, utilizing both English and Metric systems.
- B2.4 Use a surface plate, surface gage, height gage, prick and center punches, scriber, layout dye, and other appropriate tools to locate hole centers, radii, and locations matching the specifications provided.
- B4.0 Demonstrate a cutoff saw operation(s) to produce a length of bar stock to specification.
- B4.1 Using a length of bar stock and a process specification or drawing, cut a length of bar stock matching the cut list and demonstrate no sharp edges.
- B5.2 Describe and demonstrate the care and use of the common file which can be used to form radii on a variety of commercially available metals or those that have been casted or forged.
- B5.9 Complete a layout project using a detailed set of sequential instructions to manufacture the project to plan specifications.
- B7.1 Set up and safely operate a drill press.
- B7.3 Drill, tap, or ream holes according to specifications.
- B7.4 Research the proper material machinability and tooling recommendations from trade resources such as ‘Machinery’s Handbook’; choose the correct tool and holder; and calculate the spindle rpm and the feed rate for holes.
- B7.5 Perform secondary operations on each hole to specification including reaming, counter-sinking, counter boring, tapping, and deburring.
- 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.

**Learning Objectives:**

**Students will…**

- Safely use a variety of metalworking and finishing tools (machine tools, portable electric tools, pneumatic tools, layout tools, hand tools, etc.) in order to complete the required projects.
- Use measuring tools to verify conformance of parts according to technical drawings.
- Use measuring tools to accurately create layout lines for the purposes of cutting out material or outlining a part’s edges.
- Explain the major parts and functions of a twist drill bit.
- Set up and use various tool-holding and work-holding devices on the drill press.
- Set up and safely operate a drill press.
- Calculate the appropriate RPM for a given work-piece.
- Perform drill press operations such as drilling, reaming, countersinking, counter boring, tapping, and deburring.

**Key Unit Assignments and Assessments:**

- Students will become knowledgeable about the working parts of various machines by reading and discussing information regarding the machinery and by completing Machine Parts related assignments and tasks.
- Students will read about tools and complete Workbook Section 4, Unit 2 questions entitled “Tools, Tool Holding, and Work holding” for the Drill Press in order to familiarize them with the various tools used on the drill press.
- Students will be guided through peer-to-peer Set-up and Operation Observation Checklist so they will be able to evaluate one another.
- Students will cut out raw stock, perform deburring operations, layout dimension and feature lines, and remove excess metal to produce parts to specific dimensions which are with tolerance, and perform finishing techniques to produce complete parts.
- Students will perform measurements and inspections to ensure that their projects are made to specifications in order to evaluate their own, as well as their peers' projects.
- **Student Safety Project:** Students will, through written, verbal and demonstration methods, demonstrate/list procedures for preventing common hazardous conditions associated with the use of power tools in order to prevent accidents and injuries.
# Unit 3 - Fabrication Techniques and Shop Practices

Length: Skills in Unit 3 are reinforced and refined throughout the school year. Initial instruction time is approximately 4 weeks

| Unit Description: | In Unit 3, students are introduced to industry skills and traits, which are desirable to employers; they explore the importance of practicing those traits both in an individual as well as the workplace setting. Students learn how a workplace is not only maintained in a social and collaborative nature, but also how a healthy management system ensures the safety and success of each employee as well as the overall business. As part of the controls for quality within an organization, students learn quality assurance techniques such as inspection of parts to ensure their conformance to technical plans and drawings. Students learn about the English and Metric measuring systems and demonstrate the ability to use various measuring tools such as the English and Metric Rule, Decimal Rule, and Dial Caliper to create and/or check measurements on a specific project. Students complete two simple projects as their summative tasks and use the skills and traits learned in the unit to do so. |
| Focus Unit Standards: Manufacturing and Product Development Anchor Standards: | 7.4 Practice time management and efficiency to fulfill responsibilities.  
7.7 Demonstrate the qualities and behaviors that constitute a positive and professional work demeanor, including appropriate attire for the profession.  
8.4 Explain the importance of personal integrity, confidentiality, and ethical behavior in the workplace.  
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 employers and employment opportunities.  
9.6 Respect individual and cultural differences and recognize the importance of diversity in the workplace. |
| Focus Unit Standards: Manufacturing and Product Development Pathway Standards: | B1.2 Demonstrate the correct use of precision measuring tools such as vernier and dial calipers and height gauges, utilizing both English and Metric systems.  
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.  
C2.1 Introduce joint preparation methods and explain how to identify joint specifications.  
C2.2 Apply the processes used for finishing welded materials.  
C2.3 Assess how to select an appropriate finishing process to meet the design criteria of a specific welded product.  
C1.1 Know how scheduling, quality control, accident prevention, and inventory control are used efficiently and appropriately in a welding production management system. |
| Learning Objectives: | Students will...  
• Implement time management and efficiency protocols to effectively complete work/fulfill responsibilities.  
• Interpret weld symbols on drawings and locate dimension, tolerance, process, and finishing information.  
• Create isometric and orthographic drawings from a representative object.  
• Solve basic welding fabrication math problems including round numbers.  
• Convert mixed units, fractions and decimal fractions.  
• Reduce fractions and decimal fractions.  
• Regularly practice the traits of responsible and capable employees (such as punctuality, integrity, showing initiative, having a safe attitude, and maintaining a commitment to excellence). |
| Key Unit Assignments and Assessments: | • Students will, through written, verbal and demonstration methods, demonstrate/list employee traits and skills.  
• Students will, through written, verbal and demonstration methods, demonstrate the manner in which parts are checked for workmanship and accuracy against the products’ technical drawings and dimensions.  
• Students will select an appropriate finishing process to meet the design criteria of a specific welded product, and apply the process to a manufactured part.  
• Coat Hook Design Project: Students will engage in the project designs of a coat hook including design, fabrication and welding, and project assembly and finishing.  
• Shoe Rack Design Project: Students will design a shoe rack including fabrication and welding, and assembly and finishing. |
Welding and Metal Fabrication 1 Scope and Sequence

Unit 4 - Welding and Cutting Processes

Length: Skills in Unit 4 are reinforced and refined throughout the school year

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<th>Learning Objectives:</th>
<th>Key Unit Assignments and Assessments:</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Manufacturing and Product Development</strong></td>
<td><strong>Students will…</strong></td>
<td><strong>Items 1 and 2 will be part of the student’s certification process. Students will spend a significant amount of time throughout the school year, practicing items 1 and 2.</strong></td>
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<tr>
<td><strong>Pathway Standards:</strong></td>
<td>• Describe necessary preparations for various welded joints.</td>
<td><strong>Item 3-7 will not be part of the student’s certification process. Items 3-7 are in response to Industry Standards and Expectations.</strong></td>
</tr>
<tr>
<td>C2.2 Use standard and new emerging welding tools and equipment, <strong>such as oxygen fuel cutting (OFC),</strong> 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.</td>
<td>• Properly install the major components of a GMAW machine to prepare for welding.</td>
<td>1. Students will, through written, verbal and demonstration methods, demonstrate/list procedures for completing a weldment, which includes outside corner, butt, lap, and tee joints in the flat position on carbon steel using the GMAW, SMAW and OFW processes.</td>
</tr>
<tr>
<td>C2.3 Use welding tools and equipment such as oxygen 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.</td>
<td>• Achieve the correct shielding gas flow, voltage, and wire feed settings in preparation for welding a given thickness of metal on a GMAW machine.</td>
<td>2. Students will, through written, verbal and demonstration methods, demonstrate/list procedures for using the oxy-acetylene gas-cutting torch to make straight cuts through weld joints for the purpose of re-using the metal for welding practice.</td>
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<tr>
<td>C3.1 <strong>Use welding tools</strong> 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.</td>
<td>• Properly install the major components of a SMAW machine to prepare for welding.</td>
<td>3. Students will, through written, verbal and demonstration methods, demonstrate/list procedures for making straight, bevel and pierce cuts on ¼” thick mild steel plate.</td>
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<tr>
<td>C6.1 Select and use appropriate welding tools, equipment, and inspection devices to manufacture parts or products.</td>
<td>• Select the correct electrode type, electrode size, and set the correct amperage in preparation for welding a given thickness of metal on a SMAW machine.</td>
<td>4. Students will, through written, verbal and demonstration methods, demonstrate/list procedures for completing the “SkillsUSA” test plate for OAC.</td>
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<tr>
<td>C8.1 <strong>Recognize the importance of base metal preparation and joint fit-up and alignment.</strong></td>
<td>• Properly install the major components of an OFW setup to prepare for welding.</td>
<td>5. Students will, through written, verbal and demonstration methods, demonstrate/list procedures to correctly set up and operation of the Oxygen Acetylene Cutting torch. Utilizing this cutting process, students will perform skill-building practice cuts on ¼” thick mild steel plate. As a performance task, students will cut out a 5” x 5” dimensioned test plate with various features.</td>
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<tr>
<td>C8.3 <strong>Produce a completed fabrication, an assembly, or a repair by using appropriate joining and mechanical fastening techniques and processes.</strong></td>
<td>• Select the appropriate torch tip and filler metal size and achieve the correct gas pressures in preparation for welding a given thickness of metal on an OFW machine.</td>
<td>6. Students are assessed in the following areas as well:</td>
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<td>• Select the appropriate torch tip and filler metal size and achieve the correct gas pressures in preparation for cutting a given thickness of metal on an OFW machine.</td>
<td>• Inspected and acceptable welds in each process for the outside corner, butt, lap, and tee joints.</td>
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<td>• Use the oxy-acetylene gas-cutting torch to make straight cuts through weld joints for the purpose of re-using the metal for welding practice.</td>
<td>• Passing result of a break test on the standard 3-piece weldment using the GMAW process.</td>
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**Unit Description:** In Unit 4, after receiving comprehensive instruction on the various machines, students select and use the appropriate welding and cutting tools, processes (GMAW, SMAW, OFW, OFC) and machinery to produce practice weldments and fabrication projects. The focus of the unit is the production of a completed fabrication, assembly, or repair using appropriate joining and mechanical fastening techniques and processes.
<p>| | |</p>
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|   | • Passing result of a break test on the standard 3-piece weldment using the SMAW process.  
   | • Passing result of a break test on the standard 3-piece weldment using the OFW process.  
   | • Evaluation of cut edges by instructor.  
   | • Evaluation of cut quality and dimensions of OAC test plate.  
   | 7. Final project-based assessment to determine the overall competency of the various preparations and knowledge of welding machines, hand tools, power tools and fabricating machines via student demonstration. |
### Welding and Metal Fabrication 1 Scope and Sequence

#### Unit 5 – Summative Unit: Weld Inspection, Testing, and Certification

**Length:** 8 Weeks

**Unit Description:** In Unit 5, students learn to perform semi-precision measurements thus enabling them to verify project parameters and requirements. They complete a weld sample designed to demonstrate understanding of quality assurance and how it is used to produce parts that are within workmanship acceptability. After completing a welding sample, the welded piece will be tested using destructive testing and, upon passing the test, students will be issued welding certifications from the American Welding Society (AWS) for structural steel (D1.1).

<table>
<thead>
<tr>
<th>Focus Unit Standards:</th>
<th>Learning Objectives:</th>
<th>Key Unit Assignments and Assessments:</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Manufacturing and Product Development</strong></td>
<td><strong>Students will…</strong></td>
<td><strong>In order to receive the welding certification, students must demonstrate competency by performing the following skills:</strong></td>
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<td><strong>Pathway Standards:</strong></td>
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<td>- Students will, through written, verbal and demonstration methods, demonstrate/list procedures for…</td>
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<tr>
<td>C2.1 Introduce joint preparation methods and explain how to identify joint specifications.</td>
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<td>- preparing weld plates (grinding mill scale, grinding bevels),</td>
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<tr>
<td>C4.2 Apply the processes used for finishing welded materials.</td>
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<td>- fitting together and tacking weld plates.</td>
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<td>C5.1 Identify and explain weld imperfections and their causes.</td>
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<td>- completing groove weld stringer passes and a cover pass.</td>
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<tr>
<td>C5.2 Identify and explain destructive and nondestructive examination practices.</td>
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<td>- removing a backing strip and grinding off weld reinforcement.</td>
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<td>C5.4 Analyze and identify the steps to check for distortion, joint misalignment, and poor fit-up before and after welding.</td>
<td></td>
<td>- measuring out test strip specimens.</td>
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<tr>
<td>C8.1 Recognize the importance of base metal preparation and joint fit-up and alignment.</td>
<td></td>
<td>- cutting out test strip specimens.</td>
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<tr>
<td>C8.3 Produce a completed fabrication, an assembly, or a repair by using appropriate joining and mechanical fastening techniques and processes.</td>
<td></td>
<td>- post-processing test strip specimens and radusing sharp edges in preparation for a destructive bend test.</td>
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<td><strong>Performance Task:</strong></td>
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<td><strong>Performance Task:</strong></td>
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<td>- Students will present their completed work products for visual inspection of welded plates for acceptability according to the standards set forth in previous lessons/tasks. Their work will also be tested according to conformance of weld test specimens and bend test results to AWS Structural Steel D1.1 Welding Code specifications.</td>
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<td>- Students will create a reflection of the process used to produce the test plates and the weldment, describing the excision, and bending of specimens which they will present verbally and in writing.</td>
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<td>- Students gather, organize, and present the skills, concepts, and products they learned/created throughout Course 1 and share this portfolio of work with their peers in the course as well as outside audiences including industry representatives and others. They are encouraged to present/display their work at state and local events.</td>
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</tbody>
</table>