Welding II

8673/36 weeks

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Acknowledgments

The components of this instructional framework were developed by the following curriculum development panelists:

- Tom Bruzdoski III, Weld Training Specialist, Oceaneering International, Chesapeake
- Mike Cook, Training Manager, Newport News Shipbuilding, Portsmouth
- Steven Fultz, Instructor, Roanoke Technical Education Center, Roanoke City Public Schools
- Matthew Gross, Welding Program Coordinator and Instructor, John Tyler Community College, Chester
- Floyd M. Jones, Owner, Moonlight Welding, Suffolk
- James Jones, Instructor, Norfolk Technical Center, Norfolk City Public Schools
- Troy Linkenhoker, Instructor, Botetourt Technical Education Center, Botetourt County Public Schools
- Christopher Overfelt, Instructor, Burton Center for Arts and Technology, Roanoke County Public Schools
Course Description

Suggested Grade Level: 11 or 12

Prerequisite Course Code/s: Welding I (8672)

This course teaches advanced welding students how to fine-tune their craft and to perform welds in various positions, using multiple welding processes. Welding is required by a wide variety of
industries—anywhere fusible materials and high heat are needed to manufacture, repair, or alter products. Professional welders are in high demand and can earn accordingly.

As noted in Superintendent’s Memo #058-17 (2-28-2017), this Career and Technical Education (CTE) course must maintain a maximum pupil-to-teacher ratio of 20 students to one teacher, due to safety regulations. The 2016-2018 biennial budget waiver of the teacher-to-pupil ratio staffing requirement does not apply.

Task Essentials Table

- Tasks/competencies designated by plus icons (➕) in the left-hand column(s) are essential
- Tasks/competencies designated by empty-circle icons (〇) are optional
- Tasks/competencies designated by minus icons (➖) are omitted
- Tasks marked with an asterisk (*) are sensitive.

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<td>Maintain a safe working environment.</td>
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<td>Identify the types of fires and the methods used to extinguish them.</td>
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<td>Demonstrate the use of a fire extinguisher.</td>
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<td>Identify personal protective equipment (PPE) requirements.</td>
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<td>Report injuries.</td>
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<td>Report personal, environmental, and equipment safety violations to the appropriate authority.</td>
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<td>Pass the safety exam.</td>
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<td>Perform safety inspections of all equipment and accessories.</td>
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<td>Set up for machine OFC track burner operations on carbon steel.</td>
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<td>Operate machine OFC track burner equipment.</td>
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<td>Set up for plasma arc operations and base metal preparation on various metals.</td>
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<td>Perform metal removal operations on carbon steel.</td>
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<td>Set up for GTAW operations and base metal preparation on ferrous and non-ferrous materials.</td>
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<td>Perform 1G-groove welds on carbon steel, limited thickness.</td>
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<tr>
<td>93</td>
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<td>Perform single-pass and multi-pass fillet welds on carbon steel in various positions.</td>
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<td>Perform groove welds on carbon steel, limited thickness, in various positions.</td>
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<td>Perform single and multi-pass pass welds on carbon steel, limited thickness, in various positions.</td>
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<td>Perform groove welds on carbon steel, limited thickness, using various modes of transfer and in various positions.</td>
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**Demonstrating Visual Examination**

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<td>Evaluate cut surfaces and edges of prepared base metal parts.</td>
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<td>98</td>
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<td>Evaluate tack, intermediate layers, and completed welds.</td>
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Legend: 🌟Essential ◯Non-essential ❌Omitted

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**Curriculum Framework**

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**Applying Basic Safety Standards**

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**Task Number 39**

**Comply with federal, state, and local safety requirements, including the Occupational Safety and Health Administration (OSHA), Virginia Occupational Safety and Health (VOSH) Program, and Environmental Protection Agency (EPA) regulations.**

**Definition**

Compliance should include the identification of the Hazard Communication (HazCom) Standard, the information included on Safety Data Sheets (SDS), and the responsibilities of employers and employees under HazCom.

**Process/Skill Questions**

- Where should hazardous materials be stored?
- What information can be found on an SDS?
Task Number 40

Maintain a safe working environment.

Definition
Maintenance should be ongoing and result in identifying potential hazards on a job site or in the lab, such as unstable or improperly erected scaffolding, electrical hazards, job-site debris, improperly stored materials, and air quality hazards. When present, hazards must be remedied by appropriate measures and in compliance with school and instructor's guidelines.

Process/Skill Questions
- What are some examples of job-site hazards?
- Why is it important to maintain a safe workspace on a job site?
- Why is it important to store materials and tools in their proper place?

Task Number 41

Explain safe working practices around electrical hazards.

Definition
Explanation should include
- identifying equipment used to test electrical circuits
- describing safe working conditions
- describing safe work habits.

Process/Skill Questions
- What is the definition of proximity work?
- What are safe working clearances according to the National Electrical Code?
- What is the unseen hazard with electrical work?

Task Number 42

Identify emergency first aid procedures.
Definition
Identification should include first aid procedures for accidents involving

- bodily fluids
- electrical injuries
- eye injuries
- falls
- burns

according to standard first aid and school policies.

Process/Skill Questions

- What are the steps that should be followed in the event of an accident?
- Why is knowing cardiopulmonary resuscitation (CPR) an important skill within the electrical trades?
- Why is it important to be certified to administer first aid?
- What are the different classifications (degrees) of electrical burns?

Task Number 43

Identify the types of fires and the methods used to extinguish them.

Definition
Identification should include

- classifications of fires (A, B, C, and D, and K)
- causes and prevention of fires
- types of extinguishers
- extinguishers associated with types of fire.

Process/Skill Questions

- Why do fires have different classifications, and what are they?
- What is the fire triangle?
- What are the three things necessary to start a fire?
• Why is it important to know the classification of fire when trying to extinguish it?
• Why should extinguishers be inspected, and how often should they be inspected?
• What are the classifications of extinguishers?

Task Number 44 Optional

Demonstrate the use of a fire extinguisher.

Definition
Demonstration should include use of the PASS (pull, aim, squeeze, sweep) method.

Process/Skill Questions
• Why is it important to know how to use a fire extinguisher?
• When might one have to use a fire extinguisher while welding?

Task Number 45

Identify personal protective equipment (PPE) requirements.

Definition
Identification should include procedures for donning, wearing, and doffing PPE (e.g., eye protection, respirator, hard hat, gloves, safety harness, hearing protection, steel-toed/leather shoes).

Process/Skill Questions
• What is the difference between passive lenses and auto-darkening lenses (ADF)?
• How does one determine the appropriate protective clothing?

Task Number 46

Inspect PPE to determine whether it is safe to use.
**Definition**
Inspection should include determining whether items are clean, unexpired, and safe to use.

**Process/Skill Questions**
- What are some dangerous effects of exposure, and how can one significantly prevent these effects?
- Why is wearing jewelry prohibited while in the lab or on the job site?

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**Task Number 47**

**Describe ventilation requirements and regulations pertaining to welding.**

**Definition**
Description should include determining

- the ventilation system and heating/cooling system in the work area
- the need for a personal breathing apparatus when welding in confined spaces or using fume extractors.

**Process/Skill Questions**
- What is the welding lab's ventilation system? What are its components?
- Why should there always be a clean supply of fresh air available?
- Which welding jobs or circumstances would require one to use a personal breathing apparatus?

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**Task Number 48**

**Inspect hand and power tools to visually identify defects.**

**Definition**
Inspection should include

- verifying that components of machinery (e.g., guards, blades, moving parts, start/stop switches) are in good working condition
• identifying any defects in tools, parts, or functions
• adhering to standard safety procedures (i.e., lab practices and manufacturer recommendations)
• demonstrating the safe operation and use of all welding equipment, tools, and machines.

Process/Skill Questions

• What are some of the basic power tools used in construction?
• Why should a power tool always be grounded?
• What are the steps to take before using an electrical angle grinder?
• What are the dangers of running a grinder wheel over its rated RPM?

Task Number 49

Demonstrate lifting and carrying techniques.

Definition
Demonstration involves lifting and carrying materials and equipment based on the principles of

• lifting with one’s legs
• keeping one’s back straight
• holding load close to the body
• getting help, if necessary

in accordance with government regulations and instructor’s guidelines.

Process/Skill Questions

• What are common injuries associated with improper lifting techniques?
• What can one do to prevent injury?
• How does positioning affect technique?

Task Number 50

Identify types of ladders.
Definition
Identification of types of ladders may include

- wall (straight) ladder
- extension ladder
- roof ladder
- attic ladder
- special-purpose ladders (e.g., "A" ladder, folding ladder, pompier ladder)
- solid beam ladder
- truss beam wood ladder
- aluminum ladder
- wood and aluminum truss ladder
- fiberglass ladder.

Process/Skill Questions

- When would one use a wall ladder? Extension ladder?
- Why is it important to know the different types and functions of ladders?

Task Number 51 Optional

Demonstrate safe laddering techniques for various types of ladders.

Definition
Demonstration should involve following safety procedures while using aluminum ladders (e.g., three-point contact), while carrying ladders (e.g., two people at all times), and while erecting and setting ladders.

Process/Skill Questions

- Why are ladders rated for certain weights?
- Why is the apex (highest point) of a step ladder not considered a step?
- When would one want to choose a wood or fiberglass ladder over an aluminum ladder?
Task Number 52
Describe safe scaffolding techniques.

Definition
Description should include inspecting settings, duty ratings, and safety tags.

Process/Skill Questions
• How can one determine the safe weight limit of any particular scaffolding?
• In what situations is scaffolding preferred or required?

Task Number 53
Report injuries.

Definition
Report should consist of an immediate oral statement of the job-related or non-job-related injury to the instructor or supervisor, and may be followed by a written confirmation reporting the date, extent of the injury, and circumstances of the incident.

Process/Skill Questions
• Why is it important to report injuries?
• What are common reporting procedures?
• Why is it important to report an injury promptly, before leaving the job site?
• What is workers' compensation?
• What are the key components of a report?

Task Number 54
Report personal, environmental, and equipment safety violations to the appropriate authority.
Definition
Report should include an oral or written statement identifying the violation and the date it was observed and should be given to the instructor, supervisor, or local OSHA inspectors.

Process/Skill Questions
- What ethical considerations might be involved when reporting coworkers?
- Why is it important to follow reporting procedures?
- What is liability?

Task Number 55
Pass the safety exam.

Definition
Passing the safety exam, when complemented with the OSHA 10 card, should allow the instructor to approve the student for working with course materials and equipment.

Process/Skill Questions
- How often should one participate in safety training programs?
- How does insurance affect the requirement of continuous retraining for safety?

Working with Documents and Drawings

Task Number 56
Interpret elements of a drawing or sketch.

Definition
Interpretation should be based on the elements of a sketch or drawing, such as
- line development
- dimensions
- materials
- tolerances
- views/projection (e.g., first angle, third angle)
- bill of materials and requirements
- line types
- tolerances
- title block
- scale
- notes and revisions.

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**Task Number 57**

**Interpret welding symbol information.**

**Definition**
Interpretation should be based on identifying the basic welding symbols, such as

- fillet weld
- plug/slot weld
- groove weld.

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**Task Number 58**

**Convert metric system measurements to and from U.S. customary (standard) system measurements.**

**Definition**
Conversion should include metric to standard system measurements and standard to metric system measurements.
Task Number 59

Apply basic measuring skills to welding operations.

Definition
Application should include choosing and using instruments such as

- English or standard ruler
- tape measure
- dial calipers
- weld gauges
- combination square
- micrometer.

Task Number 60

Calculate dimensions from a drawing with incomplete dimensions.

Definition
Calculation should be achieved by determining the objective of the weldment and the complete dimensions, based on factoring from given dimensions.

Task Number 61

Follow the instructions on a job specifications sheet.

Definition
Following instructions should include

- reading and comprehending all instructions
- checking off each step as completed
- reviewing completed instructions to ensure all steps have been completed
• seeking approval from an inspector or instructor (i.e., final sign-off).

Task Number 62

Interpret dimensions from a drawing with incomplete dimensions.

Definition
Interpretation should be achieved by determining the objective of the weldment and complete dimensions, based on factoring from given dimensions.

Task Number 63

Fabricate simple parts from a drawing or a sketch.

Definition
Fabrication should include

• identifying the basic fabrication components (e.g., materials, dimensions, machine application)
• adhering to specifications.

Demonstrating Machine Oxyfuel Gas Gutting (OFC Track Burner)

Task Number 64

Describe the theories behind machine OFC track burner.
Definition
Description should include basic variations in machine OFC track burner.

Task Number 65 Optional
Perform safety inspections of all equipment and accessories.

Definition
Performance should include a visual inspection of the following OFC Track Burner equipment and accessories on a daily basis, in accordance with the instructor's or employer's policy:

- Hoses
- Cords
- Gauges

Task Number 66 Optional
Identify minor external repairs to all equipment and accessories.

Definition
Identification should include minor repairs to OFC track burner equipment and accessories (e.g., hoses, gauges, tip), in accordance with manufacturers' recommendations, school policies, and the instructor's guidelines.

Task Number 67 Optional
Set up for machine OFC track burner operations on carbon steel.

Definition
Setup should include
• adhering to written or verbal instructions
• using PPE
• assembling components (e.g., gauges, hoses)
• completing a leak test.

Task Number 68 Optional

Operate machine OFC track burner equipment.

Definition
Operation should include

• following the written or verbal welding assignment
• adjusting equipment to obtain a neutral flame
• adjusting travel speed
• identifying types of cuts (e.g., bevel, straight)
• cutting the metal to the designated dimensions
• shutting down equipment at the end of the job.

Task Number 69 Optional

Perform straight-cutting operations on carbon steel.

Definition
Performance should result in a straight-cut surface that meets the written or verbal specifications.

Task Number 70 Optional

Perform bevel-cutting operations on carbon steel.
Definition
Performance should result in a bevel-cut surface that meets the written or verbal specifications.

Demonstrating Thermal Cutting for Oxyfuel, Plasma, and Carbon Arc Cutting

Task Number 71
Describe the theories behind thermal cutting processes.

Definition
Description should include basic variations in thermal cutting, such as
- oxyfuel cutting
- plasma cutting
- carbon arc cutting.

Task Number 72
Explain why one form of cutting is preferable to another.

Definition
Explanation should include the benefits and challenges of various forms of cutting.

Task Number 73
Perform safety inspections of all equipment and accessories.
Definition
Performance should include a visual inspection of thermal cutting equipment and accessories on a daily basis, in accordance with the instructor's or employer's policy.

Task Number 74

Identify minor external repairs to all equipment and accessories.

Definition
Identification should include minor repairs to thermal cutting equipment and accessories in accordance with manufacturers' recommendations, school policies, and the instructor's guidelines.

Task Number 75

Set up for manual OFC operations and base metal preparation on carbon steel.

Definition
Setup should include

- adhering to written or verbal instructions
- wearing PPE
- identifying types of gases
- assembling components (e.g., gauges, hoses, torch, cutting tip)
- completing a leak test.

Task Number 76

Operate manual OFC equipment.
Definition
Operation should include

- following the written or verbal welding assignment
- adjusting equipment to obtain a neutral flame
- visually examining cut surfaces
- identifying types of flames
- properly shutting down equipment at the end of the job
- using PPE.

Task Number 77
Set up for plasma arc operations and base metal preparation on various metals.

Definition
Setup should include

- adhering to written or verbal instructions
- wearing PPE.

Task Number 78
Operate plasma arc equipment.

Definition
Operation should include

- following the written or verbal welding assignment
- visually examining cut surfaces
- properly shutting down equipment at the end of the job
- using PPE.
Task Number 79

Set up for manual air carbon arc cutting (CAC-A) equipment.

Definition
Setup should include

- using basic CAC-A theory
- setting air pressure, amperage, and polarity for electrode size, work lead to work piece
- installing carbon electrode into the torch line, using correct extension
- positioning air holes
- commencing operations by turning the air-release button to “on”
- adhering to the written or verbal specifications.

Task Number 80

Operate carbon arc equipment.

Definition
Operation should include

- following the written or verbal welding assignment
- visually examining cut surfaces
- properly shutting down equipment at the end of the job
- using PPE.

Task Number 81 Optional

Perform metal removal operations on carbon steel.
**Definition**

Performance should include

- removing weld metal
- separating structural members for salvage
- adhering to assignment specifications.

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**Demonstrating Gas Tungsten Arc Welding (GTAW)**

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**Task Number 82**

**Describe the theories behind GTAW.**

**Definition**

Description should include basic variations in GTAW.

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**Task Number 83**

**Perform safety inspections of all equipment and accessories.**

**Definition**

Performance should include a visual inspection of the following GTAW equipment and accessories on a daily basis, in accordance with the instructor's or employer's policy:

- Regulator
- Hoses
- Welding leads (e.g., gun, torch, work cable)
Task Number 84

Identify minor external repairs to all equipment and accessories.

Definition
Identification should include minor repairs to GTAW equipment and accessories (e.g., cups, coolant), in accordance with manufacturers’ recommendations, school policies, and the instructor’s guidelines.

Task Number 85

Set up for GTAW operations and base metal preparation on ferrous and non-ferrous materials.

Definition
Setup should include

- adhering to written or verbal instructions or specifications
- using PPE
- selecting tungsten electrode, shielding gas, and filler material
- preparing tungsten electrode, shielding gas, and filler material
- adjusting polarity and current.

Task Number 86

Operate GTAW equipment.

Definition
Operation should include following the written or verbal welding assignment.
Task Number 87

Perform 1F and 2F fillet welds on various materials.

Definition
Performance should include

- adherence to welding techniques
- filler rod selection
- torch angle
- material preparation
- use of hand tools.

Task Number 88

Perform 1G-groove welds on carbon steel, limited thickness.

Definition
Performance should be demonstrated in the flat position, according to the written or verbal assignment, drawing, or specifications.

Task Number 89

Perform 1F–2F welds on aluminum.

Definition
Performance should be demonstrated in the flat position, according to the assignment, drawing, or op sheet specifications.

Task Number 90

Perform 1G welds on aluminum.
Definition
Performance should be demonstrated in the flat position, according to the assignment, drawing, or op sheet specifications.

Task Number 91

Perform 1F–2F welds on stainless steel.

Definition
Performance should be demonstrated in the flat position, according to the written or verbal assignment, drawing, or specifications.

Task Number 92

Perform 1G–2G welds on stainless steel.

Definition
Performance should be demonstrated in the flat position, according to the written or verbal assignment, drawing, or specifications.

Demonstrating Shielded Metal Arc Welding (SMAW)

Task Number 93

Perform single-pass and multi-pass fillet welds on carbon steel in various positions.

Definition
Performance should include
● adhering to welding techniques in all positions
● using hand tools
● following the written or verbal assignment.

Task Number 94

Perform groove welds on carbon steel, limited thickness, in various positions.

Definition
Performance should include

● adhering to welding techniques in all positions
● identifying electrode
● selecting electrode angle
● preparing material
● using hand tools
● following the written or verbal assignment.

Task Number 95

Perform single and multi-pass pass welds on carbon steel, limited thickness, in various positions.

Definition
Performance should include

● adherence to welding techniques in all positions
● wire selection
● gun angle
● material preparation
- use of hand tools
- following the written or verbal assignment.

---

**Task Number 96**

**Perform groove welds on carbon steel, limited thickness, using various modes of transfer and in various positions.**

**Definition**

Performance should include

- adhering to welding techniques in all positions
- selecting wire (electrode) and shielding gas
- selecting gun angle
- using hand tools
- following the written or verbal assignment.

---

**Demonstrating Visual Examination**

---

**Task Number 97**

**Evaluate cut surfaces and edges of prepared base metal parts.**

**Definition**

Evaluation should include

- making a visual examination of surfaces of material for serious notches, grooves, or gouges
- planning steps necessary to correct defects, if possible, or prevent similar outcomes.
### Task Number 98

**Evaluate tack, intermediate layers, and completed welds.**

**Definition**
Evaluation should include

- performing a visual inspection of tacks and welds for defects and discontinuities (e.g., undercut, slag inclusion, overlap)
- planning necessary steps to correct defects, if possible, or prevent similar outcomes.

### SOL Correlation by Task

<table>
<thead>
<tr>
<th>Task/Competency</th>
<th>SOL Correlations</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Applying Basic Safety Standards</strong></td>
<td></td>
</tr>
<tr>
<td>39</td>
<td>Comply with federal, state, and local safety requirements, including the Occupational Safety and Health Administration (OSHA), Virginia Occupational Safety and Health (VOSH) Program, and Environmental Protection Agency (EPA) regulations.</td>
</tr>
<tr>
<td></td>
<td>English: 11.5, 11.8, 12.5, 12.8</td>
</tr>
<tr>
<td></td>
<td>History: WHII 8 VUS 8 Govt 7, 8, 9</td>
</tr>
<tr>
<td></td>
<td>Science: CH.1</td>
</tr>
<tr>
<td>40</td>
<td>Maintain a safe working environment.</td>
</tr>
<tr>
<td></td>
<td>English: 11.5, 12.5</td>
</tr>
<tr>
<td></td>
<td>History: WHII 8 VUS 8 Govt 7, 8, 9</td>
</tr>
<tr>
<td>41</td>
<td>Explain safe working practices around electrical hazards.</td>
</tr>
<tr>
<td></td>
<td>English: 11.3, 11.5, 12.3, 12.5</td>
</tr>
<tr>
<td></td>
<td>History:</td>
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<tr>
<td>Task/Competency</td>
<td>SOL Correlations</td>
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<tr>
<td>--------------------------------------------------------------------------------</td>
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</tr>
<tr>
<td>42 Identify emergency first aid procedures.</td>
<td>English: 11.5, 12.5</td>
</tr>
<tr>
<td></td>
<td>History: VUS 8</td>
</tr>
<tr>
<td></td>
<td>Govt 7, 8, 9</td>
</tr>
<tr>
<td>43 Identify the types of fires and the methods used to extinguish them.</td>
<td>English: 11.5, 12.5</td>
</tr>
<tr>
<td></td>
<td>History: VUS 8</td>
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<tr>
<td></td>
<td>Govt 7, 8, 9</td>
</tr>
<tr>
<td></td>
<td>Science: CH.1</td>
</tr>
<tr>
<td>44 Demonstrate the use of a fire extinguisher.</td>
<td>History: VUS 8</td>
</tr>
<tr>
<td></td>
<td>Govt 7, 8, 9</td>
</tr>
<tr>
<td>45 Identify personal protective equipment (PPE) requirements.</td>
<td>English: 11.5, 12.5</td>
</tr>
<tr>
<td></td>
<td>History: VUS 8</td>
</tr>
<tr>
<td></td>
<td>Govt 7, 8, 9</td>
</tr>
<tr>
<td>46 Inspect PPE to determine whether it is safe to use.</td>
<td>English: 11.5, 12.5</td>
</tr>
<tr>
<td></td>
<td>History: VUS 8</td>
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<tr>
<td></td>
<td>Govt 7, 8, 9</td>
</tr>
<tr>
<td>47 Describe ventilation requirements and regulations pertaining to welding.</td>
<td>English: 11.5, 12.5</td>
</tr>
<tr>
<td></td>
<td>History: VUS 8</td>
</tr>
<tr>
<td></td>
<td>Govt 7, 8, 9</td>
</tr>
<tr>
<td>48 Inspect hand and power tools to visually identify defects.</td>
<td>English: 11.5, 12.5</td>
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<tr>
<td></td>
<td>History: VUS 8</td>
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<td>Govt 7, 8, 9</td>
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<tr>
<td>49 Demonstrate lifting and carrying techniques.</td>
<td>WHII 8</td>
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<td></td>
<td>VUS 8</td>
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<tr>
<td></td>
<td>Govt 7, 8, 9</td>
</tr>
<tr>
<td>50 Identify types of ladders.</td>
<td>English: 11.5, 12.5</td>
</tr>
<tr>
<td>51 Demonstrate safe laddering techniques for various types of ladders</td>
<td>History: WHII 8</td>
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<tr>
<td></td>
<td>VUS 8</td>
</tr>
<tr>
<td></td>
<td>Govt 7, 8, 9</td>
</tr>
<tr>
<td>52 Describe safe scaffolding techniques.</td>
<td>English: 11.5, 12.5</td>
</tr>
<tr>
<td>53 Report injuries.</td>
<td>History: WHII 8</td>
</tr>
<tr>
<td></td>
<td>VUS 8</td>
</tr>
<tr>
<td></td>
<td>Govt 7, 8, 9</td>
</tr>
<tr>
<td>54 Report personal, environmental, and equipment safety violations to the</td>
<td>English: 11.1, 11.5</td>
</tr>
<tr>
<td>appropriate authority.</td>
<td>11.6, 11.7, 12.1, 12.5, 12.6, 11.7</td>
</tr>
<tr>
<td></td>
<td>History: WHII 8</td>
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<td></td>
<td>VUS 8</td>
</tr>
<tr>
<td></td>
<td>Govt 7, 8, 9</td>
</tr>
<tr>
<td>55 Pass the safety exam.</td>
<td>English: 11.5, 12.5</td>
</tr>
<tr>
<td></td>
<td>History: WHII 8</td>
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<tr>
<td></td>
<td>VUS 8</td>
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<td>SOL Correlations</td>
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<td>-----------------</td>
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<tr>
<td><strong>Working with Documents and Drawings</strong></td>
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</tr>
<tr>
<td>56</td>
<td>Interpret elements of a drawing or sketch.</td>
</tr>
<tr>
<td>57</td>
<td>Interpret welding symbol information.</td>
</tr>
<tr>
<td>58</td>
<td>Convert metric system measurements to and from U.S. customary (standard) system measurements.</td>
</tr>
<tr>
<td></td>
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</tr>
<tr>
<td>59</td>
<td>Apply basic measuring skills to welding operations.</td>
</tr>
<tr>
<td>60</td>
<td>Calculate dimensions from a drawing with incomplete dimensions.</td>
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<td></td>
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<tr>
<td>61</td>
<td>Follow the instructions on a job specifications sheet.</td>
</tr>
<tr>
<td>62</td>
<td>Interpret dimensions from a drawing with incomplete dimensions.</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>63</td>
<td>Fabricate simple parts from a drawing or a sketch.</td>
</tr>
<tr>
<td><strong>Oxyfuel Gas Cutting (OFC Track Burner)</strong></td>
<td></td>
</tr>
<tr>
<td>64</td>
<td>Describe the theories behind machine OFC track burner.</td>
</tr>
<tr>
<td>65</td>
<td>Perform safety inspections of all equipment and accessories.</td>
</tr>
<tr>
<td>66</td>
<td>Identify minor external repairs to all equipment and accessories.</td>
</tr>
<tr>
<td>67</td>
<td>Set up for machine OFC track burner operations on carbon steel.</td>
</tr>
<tr>
<td>68</td>
<td>Operate machine OFC track burner equipment.</td>
</tr>
<tr>
<td>69</td>
<td>Perform straight-cutting operations on carbon steel.</td>
</tr>
<tr>
<td>70</td>
<td>Perform bevel-cutting operations on carbon steel.</td>
</tr>
<tr>
<td><strong>Demonstrating Thermal Cutting for Oxyfuel, Plasma, and Carbon Arc Cutting</strong></td>
<td></td>
</tr>
<tr>
<td>71</td>
<td>Describe the theories behind thermal cutting processes.</td>
</tr>
<tr>
<td>72</td>
<td>Explain why one form of cutting is preferable to another.</td>
</tr>
<tr>
<td>73</td>
<td>Perform safety inspections of all equipment and accessories.</td>
</tr>
<tr>
<td>74</td>
<td>Identify minor external repairs to all equipment and accessories.</td>
</tr>
<tr>
<td>75</td>
<td>Set up for manual OFC operations and base metal preparation on carbon steel.</td>
</tr>
<tr>
<td>76</td>
<td>Operate manual OFC equipment.</td>
</tr>
<tr>
<td>77</td>
<td>Set up for plasma arc operations and base metal preparation on various metals.</td>
</tr>
<tr>
<td>78</td>
<td>Operate plasma arc equipment.</td>
</tr>
<tr>
<td>79</td>
<td>Set up for manual air carbon arc cutting (CAC-A) equipment.</td>
</tr>
<tr>
<td>Task/Competency</td>
<td>SOL Correlations</td>
</tr>
<tr>
<td>--------------------------------------------------------------------------------</td>
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</tr>
<tr>
<td>80 Operate carbon arc equipment.</td>
<td>English: 11.5, 12.5</td>
</tr>
<tr>
<td>81 Perform metal removal operations on carbon steel.</td>
<td>English: 11.5, 12.5</td>
</tr>
</tbody>
</table>

**Demonstrating Gas Tungsten Arc Welding (GTAW)**

| 82 Describe the theories behind GTAW.                                          | English: 11.5, 12.5 |
| 83 Perform safety inspections of all equipment and accessories.                | English: 11.5, 12.5 |
| 84 Identify minor external repairs to all equipment and accessories.           | English: 11.5, 12.5 |
| 85 Set up for GTAW operations and base metal preparation on ferrous and non-ferrous materials. | English: 11.5, 12.5 |
| 86 Operate GTAW equipment.                                                     | English: 11.5, 12.5 |
| 87 Perform 1F and 2F fillet welds on various materials.                        | English: 11.5, 12.5 |
| 88 Perform 1G-groove welds on carbon steel, limited thickness.                 | English: 11.5, 12.5 |
| 89 Perform 1F–2F welds on aluminum.                                            | English: 11.5, 12.5 |
| 90 Perform 1G welds on aluminum.                                               | English: 11.5, 12.5 |
| 91 Perform 1F–2F welds on stainless steel.                                     | English: 11.5, 12.5 |
| 92 Perform 1G–2G welds on stainless steel.                                     | English: 11.5, 12.5 |

**Demonstrating Shielded Metal Arc Welding (SMAW)**

| 93 Perform single-pass and multi-pass fillet welds on carbon steel in various positions. | English: 11.5, 12.5 |
| 94 Perform groove welds on carbon steel, limited thickness, in various positions.     | English: 11.5, 12.5 |
| 95 Perform single and multi-pass pass welds on carbon steel, limited thickness, in various positions. | English: 11.5, 12.5 |
| 96 Perform groove welds on carbon steel, limited thickness, using various modes of transfer and in various positions. | English: 11.5, 12.5 |

**Demonstrating Visual Examination**

| 97 Evaluate cut surfaces and edges of prepared base metal parts.                | English: 11.1, 11.5, 12.1, 12.5 |
| 98 Evaluate tack, intermediate layers, and completed welds.                   | English: 11.1, 11.5, 12.1, 12.5 |
Appendix: Credentials, Course Sequences, and Career Cluster Information

Industry Credentials: Only apply to 36-week courses

- College and Work Readiness Assessment (CWRA+)
- Core: Introductory Craft Skills Entry-Level Assessment
- Customer Service Examination
- Customer Service Specialist (CSS) Examination
- Flux Core Arc Welding (FCAW) Examination
- Gas Metal Arc Welding Examination
- Gas Tungsten Arc Welding (GTAW) Examination
- Manufacturing Specialist Certification Examination
- Manufacturing Technician Level I Certification Examination
- National Career Readiness Certificate Assessment
- Professional Communications Certification Examination
- SENSE Training Program Certification Examination (Level 1, Entry-Level Welder)
- Shielded Metal Arc Welding (SMAW) Examination
- Welding Assessment
- Welding Examination
- Welding Level One Entry-Level Assessment
- Workplace Readiness Skills for the Commonwealth Examination

Concentration sequences: A combination of this course and those below, equivalent to two 36-week courses, is a concentration sequence. Students wishing to complete a specialization may take additional courses based on their career pathways. A program completer is a student who has met the requirements for a CTE concentration sequence and all other requirements for high school graduation or an approved alternative education program.

- Welding I (8672/36 weeks, 140 hours)

<table>
<thead>
<tr>
<th>Career Cluster: Manufacturing</th>
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</thead>
<tbody>
<tr>
<td><strong>Pathway</strong></td>
</tr>
<tr>
<td>Health, Safety, and</td>
</tr>
<tr>
<td>Environmental Assurance</td>
</tr>
<tr>
<td>Maintenance, Installation,</td>
</tr>
<tr>
<td>and Repair</td>
</tr>
<tr>
<td>Production</td>
</tr>
</tbody>
</table>