Welding I

8672/36 weeks

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Acknowledgments

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Course Description

Suggested Grade Level: 10 or 11
Welding is required by a wide variety of industries—anywhere fusible materials and high heat are needed to manufacture, repair, or alter tools and products. Students in Welding I are taught to use manual welding, cutting, and electrical arc welding processes to fabricate and join metal parts according to diagrams, blueprints, and specifications. Students will also learn all safety-related practices and techniques, including earning the Occupational Safety and Health Administration (OSHA) 10 card.

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 (◯) are optional
- Tasks/competencies designated by minus icons (⊙) are omitted
- Tasks marked with an asterisk (*) are sensitive.

<table>
<thead>
<tr>
<th>Task Number</th>
<th>8672</th>
<th>Tasks/Competencies</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Applying Basic Safety Standards</strong></td>
<td></td>
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<tr>
<td>39</td>
<td>+</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>
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<tr>
<td>40</td>
<td>+</td>
<td>Maintain a safe working environment.</td>
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<tr>
<td>41</td>
<td>+</td>
<td>Explain safe working practices around electrical hazards.</td>
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<tr>
<td>42</td>
<td>+</td>
<td>Identify emergency first aid procedures.</td>
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<tr>
<td>43</td>
<td>+</td>
<td>Identify the types of fires and the methods used to extinguish them.</td>
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<tr>
<td>44</td>
<td>◯</td>
<td>Demonstrate the use of a fire extinguisher.</td>
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<td>45</td>
<td>+</td>
<td>Identify personal protective equipment (PPE) requirements.</td>
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<tr>
<td>46</td>
<td>+</td>
<td>Inspect PPE to determine whether it is safe to use.</td>
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<tr>
<td>47</td>
<td>+</td>
<td>Describe ventilation requirements and regulations pertaining to welding.</td>
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<td>Inspect hand and power tools to ensure safety and usability.</td>
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<td>Demonstrate lifting and carrying techniques.</td>
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<td>Identify types of ladders.</td>
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<td>51</td>
<td>◯</td>
<td>Demonstrate safe laddering techniques for various types of ladders.</td>
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<tr>
<td>52</td>
<td>+</td>
<td>Describe safe scaffolding techniques.</td>
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<tr>
<td>53</td>
<td>+</td>
<td>Report injuries.</td>
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<tr>
<td>54</td>
<td>+</td>
<td>Report personal, environmental, and equipment safety violations to the appropriate authority.</td>
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<td>55</td>
<td>+</td>
<td>Earn the OSHA 10 card.</td>
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<tr>
<td>56</td>
<td>🟡</td>
<td>Pass the safety exam.</td>
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<td>57</td>
<td>🟡</td>
<td>Identify common metals used in the welding profession.</td>
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<td>58</td>
<td>🟡</td>
<td>Identify the main regulatory bodies and regulations affecting the welding profession in the United States.</td>
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<td>59</td>
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<td>Identify minor external repairs to all equipment and accessories.</td>
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<tr>
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<td>Identify basic elements of a drawing or sketch.</td>
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<td>61</td>
<td>🟡</td>
<td>Identify welding symbol information.</td>
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<tr>
<td>62</td>
<td>🟡</td>
<td>Follow the instructions on a job specifications sheet.</td>
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<td>63</td>
<td>🟡</td>
<td>Apply basic measuring skills to welding operations.</td>
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<tr>
<td>64</td>
<td>🟡</td>
<td>Convert basic measurements.</td>
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<tr>
<td>65</td>
<td>🟡</td>
<td>Interpret dimensions from a drawing with incomplete dimensions.</td>
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<td>Describe the theories behind SMAW.</td>
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<td>🟡</td>
<td>Perform safety inspections of all equipment and accessories.</td>
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<td>Identify minor external repairs to all equipment and accessories.</td>
</tr>
<tr>
<td>69</td>
<td>🟡</td>
<td>Set up for SMAW operations and base metal preparation on carbon steel.</td>
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<tr>
<td>70</td>
<td>🟡</td>
<td>Operate SMAW equipment.</td>
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<tr>
<td>71</td>
<td>🟡</td>
<td>Perform single-pass fillet welds, 1F and 2F, on carbon steel.</td>
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<tr>
<td>73</td>
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<td>Identify minor external repairs to all equipment and accessories.</td>
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<td>Set up for GMAW and GMAW-S operations and base metal preparation on carbon steel.</td>
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<tr>
<td>77</td>
<td>🟡</td>
<td>Operate GMAW and GMAW-S equipment.</td>
</tr>
<tr>
<td>78</td>
<td>🟡</td>
<td>Perform single-pass fillet welds, all positions, on carbon steel, using different modes of transfer.</td>
</tr>
<tr>
<td>79</td>
<td>🟡</td>
<td>Perform groove welds, all positions, on carbon steel, using different modes of transfer.</td>
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<tr>
<td>80</td>
<td>🟡</td>
<td>Describe the theories behind FCAW-G.</td>
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<tr>
<td>81</td>
<td>🟡</td>
<td>Perform safety inspections of all equipment and accessories.</td>
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<tr>
<td>82</td>
<td>🟡</td>
<td>Identify minor external repairs to all equipment and accessories.</td>
</tr>
<tr>
<td>83</td>
<td>🟡</td>
<td>Set up for FCAW-G operations and base metal preparation on carbon steel.</td>
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<tr>
<td>84</td>
<td>🟡</td>
<td>Operate FCAW-G equipment.</td>
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<tr>
<td>85</td>
<td>🟡</td>
<td>Describe the theories behind FCAW-S.</td>
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<tr>
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<td>🟡</td>
<td>Perform single-pass welds on carbon steel, using different modes of transfer.</td>
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<tr>
<td>87</td>
<td>🟡</td>
<td>Explain why one form of cutting is preferable to another.</td>
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<td>Task Number</td>
<td>Tasks/Competencies</td>
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<tr>
<td>88</td>
<td>Describe the theories behind manual thermal cutting.</td>
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<tr>
<td>89</td>
<td>Perform safety inspections of all equipment and accessories.</td>
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<tr>
<td>90</td>
<td>Identify minor external repairs to all equipment and accessories.</td>
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<tr>
<td>91</td>
<td>Set up for manual OFC operations and base metal preparation on carbon steel.</td>
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<td>92</td>
<td>Operate manual OFC equipment.</td>
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<td>93</td>
<td>Operate PAC.</td>
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<td>94</td>
<td>Operate CAC.</td>
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<td>95</td>
<td>Perform straight-cutting operations on carbon steel.</td>
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<tr>
<td>96</td>
<td>Describe the theories behind machine OFC track burner.</td>
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<tr>
<td>97</td>
<td>Perform safety inspections of all equipment and accessories.</td>
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<td>Identify minor external repairs to all equipment and accessories.</td>
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<td>99</td>
<td>Set up for machine OFC track burner operations on carbon steel.</td>
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<tr>
<td>100</td>
<td>Operate machine OFC track burner equipment.</td>
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</table>

**Demonstrating Visual Examination Procedures**

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<thead>
<tr>
<th>Task Number</th>
<th>Tasks/Competencies</th>
</tr>
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<tbody>
<tr>
<td>101</td>
<td>Examine cut surfaces and edges of prepared base metal parts.</td>
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<tr>
<td>102</td>
<td>Examine tack, intermediate layers, and completed welds.</td>
</tr>
</tbody>
</table>

Legend: ✗Essential ○Non-essential ➥Omitted

**Curriculum Framework**

**Applying Basic Safety Standards**

**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 the school's 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 procedures for accidents involving

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

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, D, and K)
- causes and prevention of fires
- types of extinguishers
• extinguishers associated with types of fires

**Process/Skill Questions**

• Why do fires have different classifications, and what are they?
• What is the fire triangle?
• What are the three things needed to start a fire?
• Why is it important to know the classification of a 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 the use of the pull, aim, squeeze, sweep (PASS) 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, safety shoes steel-toed/leather boots).

**Process/Skill Questions**

• What is the difference between passive lenses and auto-darkening lenses (ADF)?
• How do you 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?

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 your welding lab's ventilation system? What are its components?
- Why should there always be a clean supply of fresh air available?
- How does one decide when to use a personal breathing apparatus when completing welding tasks?

Task Number 48

Inspect hand and power tools to ensure safety and usability.

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 should include

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

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 should 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? When would one use an 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 stepladder 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 and identifying and adhering to 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, which 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
- providing an oral or written statement identifying the violation and the date it was observed
- submitting it 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**

**Earn the OSHA 10 card.**

**Definition**
Earning an OSHA 10 card requires completing the formal training program.

**Process/Skill Questions**
- What are the benefits of earning the OSHA 10 card?
- What is OSHA, and how are its standards validated?
- Why was OSHA established, and how has it evolved?

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**Task Number 56**

**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?
Exploring the Basics of Welding

Task Number 57 Optional

Identify common metals used in the welding profession.

Definition
Identification should include

- copper/nickel
- titanium
- stainless steel
- carbon
- aluminum
- cast iron
- brass.

Task Number 58

Identify the main regulatory bodies and regulations affecting the welding profession in the United States.

Definition
Identification should include

- American Welding Society (AWS)
- American Society of Mechanical Engineers (ASME)
- American Petroleum Institute (API)
- federal regulations (e.g., OSHA)
- state regulations (e.g., the fire marshal).
Task Number 59

Identify minor external repairs to all equipment and accessories.

Definition
Identification should include following manufacturers' recommendation, school policy, and the instructor's guidelines for repairing

- shielded metal arc welding (SMAW)–checking ground lead and electrode holder
- gas metal arc welding (GMAW), short-circuit gas metal arc welding (GMAW-S), self-shielded flux-cored arc welding (FCAW-S), and gas-shielded flux-cored arc welding (FCAW-G)–changing contact tips, drive rollers, and gas diffusers
- gas tungsten arc welding (GTAW)–changing cups and collets and checking coolant
- oxy-fuel cutting (OFC) and OFC track burner–checking hoses for leaks, making sure gauges are in proper working order, and ensuring that tip is free of obstruction
- air carbon arc cutting (CAC-A)–checking for moisture in the air compressor lines, making sure gauges are in proper working order, and identifying frayed, nicked, or loose connectors
- plasma arc cutting (PAC)–inspecting electrical wiring for frayed, nicked, or loose connections; ensuring air compressor lines are clear of moisture; and checking condition of the plasma torch nozzle and tip.

Working with Welding Documents, Drawings and Measurements

Task Number 60 Optional

Identify basic elements of a drawing or sketch.

Definition
Identification should include the basic elements of a sketch or drawing, such as
• line development
• dimensions
• materials
• tolerances
• views/projection (e.g., first angle, third angle).

Task Number 61 Optional

Identify welding symbol information.

Definition
Identification should include

• fillet weld
• plug/slot weld
• groove weld.

Task Number 62 Optional

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 63 Optional
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 64 Optional

**Convert basic measurements.**

**Definition**
Conversion should include

- fractions to decimals
- decimals to fractions
- tolerances to one-eighth inch.

Task Number 65 Optional

**Interpret dimensions from a drawing with incomplete dimensions.**

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

Task Number 66

Describe the theories behind SMAW.

Definition
Description should include basic variations in SMAW.

Task Number 67

Perform safety inspections of all equipment and accessories.

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

- Groundwork lead
- Electrode cable

Task Number 68

Identify minor external repairs to all equipment and accessories.

Definition
Identification should include minor repairs to SMAW equipment and accessories (e.g., groundwork lead and clamp, electrode holder and lead) in accordance with manufacturers' recommendations, school policies, and the instructor's guidelines.
Task Number 69

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

Definition
Setup should include

- adhering to written or verbal instructions
- wearing PPE
- selecting electrode
- adjusting polarity and current.

Task Number 70

Operate SMAW equipment.

Definition
Operation should include the five essentials of welding.

Task Number 71

Perform single-pass fillet welds, 1F and 2F, on carbon steel.

Definition
Performance should include

- adhering to welding techniques in all positions
- using hand tools
- following the written or verbal assignment.
Task Number 72 Optional

Perform groove welds, 1G and 2G, on carbon steel, limited thickness.

Definition
Performance should include

- adhering to welding techniques in all positions
- using proper electrode angle
- using hand tools
- following the written or verbal assignment.

Demonstrating Gas Metal Arc Welding (GMAW)

Task Number 73

Describe the theories behind GMAW and GMAW-S.

Definition
Description should include basic variations in GMAW and GMAW-S.

Task Number 74

Perform safety inspections of all equipment and accessories.

Definition
Performance should include a visual inspection of the following GMAW and GMAW-S 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, ground cable)

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Task Number 75

Identify minor external repairs to all equipment and accessories.

Definition
Identification should include minor repairs to GMAW and GMAW-S equipment and accessories (e.g., contact tips, drive rollers, gas diffusers) in accordance with manufacturers' recommendations, school policies, and the instructor's guidelines.

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Task Number 76

Set up for GMAW and GMAW-S operations and base metal preparation on carbon steel.

Definition
Setup should include

• adhering to written or verbal instructions
• wearing PPE
• selecting wire electrode and shielding gas
• adjusting polarity and current.

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Task Number 77

Operate GMAW and GMAW-S equipment.
Definition
Operation should include

- adhering to the written or verbal welding assignment
- selecting material
- using PPE.

Task Number 78

Perform single-pass fillet welds, all positions, on carbon steel, using different modes of transfer.

Definition
Performance should include

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

Task Number 79 Optional

Perform groove welds, all positions, on carbon steel, using different modes of transfer.

Definition
Performance should include

- adhering to welding techniques in all positions
- selecting wire, shielding gas, and gun angle
- using hand tools
- following the written or verbal assignment.
Demonstrating Flux-cored Arc Welding

Task Number 80
Describe the theories behind FCAW-G.

Definition
Description should include basic variations in FCAW-G.

Task Number 81
Perform safety inspections of all equipment and accessories.

Definition
Performance should include a visual inspection of the following FCAW-G 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, ground leads)

Task Number 82
Identify minor external repairs to all equipment and accessories.

Definition
Identification should include minor repairs to FCAW-G equipment and accessories (e.g., contact tips, drive rollers, gas diffusers) in accordance with manufacturers' recommendations, school policies, and the instructor's guidelines.
Task Number 83
Set up for FCAW-G operations and base metal preparation on carbon steel.

Definition
Setup should include

- adhering to verbal or written instructions
- wearing PPE
- adjusting voltage and current.

Task Number 84
Operate FCAW-G equipment.

Definition
Operation should include

- following the written or verbal welding assignment
- using accessories.

Task Number 85
Describe the theories behind FCAW-S.

Definition
Description should include basic variations in FCAW-S.

Task Number 86 Optional
Perform single-pass welds on carbon steel, using different modes of transfer.

Definition
Performance should include

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

Demonstrating Thermal Cutting

Task Number 87

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 88

Describe the theories behind manual thermal cutting.

Definition
Description should include

- OFC
- PAC
Task Number 89

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 90

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 91

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 92**

**Operate manual OFC equipment.**

**Definition**

Operation should include

• following 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 93**

**Operate PAC.**

**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 94**
Operate CAC.

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 95

Perform straight-cutting operations on carbon steel.

Definition
Performance should result in a straight production cut surface to specifications of the written or verbal assignment.

Task Number 96 Optional

Describe the theories behind machine OFC track burner.

Definition
Description should include basic variations in machine OFC track burner.

Task Number 97 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:
Task Number 98 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 99 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 100 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.

Demonstrating Visual Examination Procedures

Task Number 101
Examine cut surfaces and edges of prepared base metal parts.

Definition
Examination 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 102
Examine tack, intermediate layers, and completed welds.
**Definition**

Examination should include

- making a visual inspection of tacks and welds for defects and discontinuities (e.g., undercut, slag inclusion, overlap)
- planning steps necessary 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: 10.5, 10.8, 11.5, 11.8</td>
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<tr>
<td></td>
<td>WHII 8</td>
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<td>VUS 8</td>
</tr>
<tr>
<td></td>
<td>Govt 7, 8, 9</td>
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<tr>
<td></td>
<td>Science:</td>
</tr>
<tr>
<td></td>
<td>CH.1</td>
</tr>
<tr>
<td>40</td>
<td>Maintain a safe working environment.</td>
</tr>
<tr>
<td></td>
<td>English: 10.5, 11.5</td>
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<tr>
<td></td>
<td>History:</td>
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<tr>
<td></td>
<td>WHII 8</td>
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<td>VUS 8</td>
</tr>
<tr>
<td></td>
<td>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: 10.5, 11.5</td>
</tr>
<tr>
<td></td>
<td>History:</td>
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<td></td>
<td>WHII 8</td>
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<td>VUS 8</td>
</tr>
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<td></td>
<td>Govt 7, 8, 9</td>
</tr>
<tr>
<td>42</td>
<td>Identify emergency first aid procedures.</td>
</tr>
<tr>
<td></td>
<td>English: 10.5, 11.5</td>
</tr>
<tr>
<td></td>
<td>History:</td>
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<td></td>
<td>WHII 8</td>
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<td>VUS 8</td>
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<td></td>
<td>Govt 7, 8, 9</td>
</tr>
<tr>
<td>Task/Competency</td>
<td>SOL Correlations</td>
</tr>
<tr>
<td>----------------</td>
<td>------------------</td>
</tr>
</tbody>
</table>
| 43 Identify the types of fires and the methods used to extinguish them. | English: 10.5, 11.5  
History: WHII 8  
VUS 8  
Govt 7, 8, 9  
Science: CH.1 |
| 44 Demonstrate the use of a fire extinguisher. | English: 10.5, 11.5  
History: WHII 8  
VUS 8  
Govt 7, 8, 9 |
| 45 Identify personal protective equipment (PPE) requirements. | English: 10.5, 11.5  
History: WHII 8  
VUS 8  
Govt 7, 8, 9 |
| 46 Inspect PPE to determine whether it is safe to use. | English: 11.5, 12.5  
History: WHII 8  
VUS 8  
Govt 7, 8, 9 |
| 47 Describe ventilation requirements and regulations pertaining to welding. | English: 10.5, 11.5  
History: WHII 8  
VUS 8  
Govt 7, 8, 9 |
| 48 Inspect hand and power tools to ensure safety and usability. | English: 10.5, 11.5  
History: WHII 8  
VUS 8  
Govt 7, 8, 9 |
| 49 Demonstrate lifting and carrying techniques. | History: WHII 8  
VUS 8  
Govt 7, 8, 9 |
<p>| 50 Identify types of ladders. |</p>
<table>
<thead>
<tr>
<th>Task/Competency</th>
<th>SOL Correlations</th>
</tr>
</thead>
<tbody>
<tr>
<td>51 Demonstrate safe laddering techniques for various types of ladders.</td>
<td>History:</td>
</tr>
<tr>
<td></td>
<td>WHII 8</td>
</tr>
<tr>
<td></td>
<td>VUS 8</td>
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<td></td>
<td>Govt 7, 8, 9</td>
</tr>
<tr>
<td>52 Describe safe scaffolding techniques.</td>
<td>History:</td>
</tr>
<tr>
<td></td>
<td>English: 10.5, 11.5</td>
</tr>
<tr>
<td></td>
<td>History:</td>
</tr>
<tr>
<td></td>
<td>WHII 8</td>
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<td>VUS 8</td>
</tr>
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<td></td>
<td>Govt 7, 8, 9</td>
</tr>
<tr>
<td>53 Report injuries.</td>
<td>History:</td>
</tr>
<tr>
<td></td>
<td>English: 10.5, 10.6, 10.7, 11.5, 11.6, 11.7</td>
</tr>
<tr>
<td></td>
<td>History:</td>
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<td></td>
<td>WHII 8</td>
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<td>VUS 8</td>
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<td></td>
<td>Govt 7, 8, 9</td>
</tr>
<tr>
<td>54 Report personal, environmental, and equipment safety violations to the appropriate authority.</td>
<td>History:</td>
</tr>
<tr>
<td></td>
<td>English: 10.5, 10.6, 10.7, 11.5, 11.6, 11.7</td>
</tr>
<tr>
<td></td>
<td>History:</td>
</tr>
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<td></td>
<td>WHII 8</td>
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<td>VUS 8</td>
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<td></td>
<td>Govt 7, 8, 9</td>
</tr>
<tr>
<td>55 Earn the OSHA 10 card.</td>
<td>History:</td>
</tr>
<tr>
<td></td>
<td>English: 10.5, 11.5</td>
</tr>
<tr>
<td></td>
<td>History:</td>
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<td></td>
<td>WHII 8</td>
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<td>VUS 8</td>
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<td>Govt 7, 8, 9</td>
</tr>
<tr>
<td>56 Pass the safety exam.</td>
<td>History:</td>
</tr>
<tr>
<td></td>
<td>English: 10.5, 11.5</td>
</tr>
<tr>
<td></td>
<td>History:</td>
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<td>VUS 8</td>
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<tr>
<td></td>
<td>Govt 7, 8, 9</td>
</tr>
<tr>
<td><strong>Exploring the Basics of Welding</strong></td>
<td></td>
</tr>
<tr>
<td>57 Identify common metals used in the welding profession.</td>
<td>English: 10.5, 11.5</td>
</tr>
<tr>
<td>58 Identify the main regulatory bodies and regulations affecting the welding profession in the United States.</td>
<td>English: 10.5, 10.8, 11.5, 11.8</td>
</tr>
<tr>
<td></td>
<td>History:</td>
</tr>
<tr>
<td></td>
<td>WHII 8</td>
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<td>VUS 8</td>
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<td>Govt 7, 8, 9</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>59 Identify minor external repairs to all equipment and accessories.</td>
<td>English: 10.5, 10.8, 11.5, 11.8</td>
</tr>
<tr>
<td></td>
<td>History: WHII 8, VUS 8</td>
</tr>
<tr>
<td></td>
<td>Govt 7, 8, 9</td>
</tr>
</tbody>
</table>

**Working with Welding Documents, Drawings and Measurements**

<table>
<thead>
<tr>
<th>Task/Competency</th>
<th>SOL Correlations</th>
</tr>
</thead>
<tbody>
<tr>
<td>60 Identify basic elements of a drawing or sketch.</td>
<td>English: 10.5, 11.5</td>
</tr>
<tr>
<td></td>
<td>Mathematics: G.2, G.3</td>
</tr>
<tr>
<td>61 Identify welding symbol information.</td>
<td>English: 10.5, 11.5</td>
</tr>
<tr>
<td>62 Follow the instructions on a job specifications sheet.</td>
<td>English: 10.5, 11.5</td>
</tr>
<tr>
<td>63 Apply basic measuring skills to welding operations.</td>
<td>English: 10.5, 11.5</td>
</tr>
<tr>
<td>64 Convert basic measurements.</td>
<td>English: 10.5, 11.5</td>
</tr>
<tr>
<td>65 Interpret dimensions from a drawing with incomplete dimensions.</td>
<td>English: 10.5, 11.5</td>
</tr>
<tr>
<td></td>
<td>Mathematics: G.8, G.9, AII.3</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Task/Competency</th>
<th>SOL Correlations</th>
</tr>
</thead>
<tbody>
<tr>
<td>66 Describe the theories behind SMAW.</td>
<td>English: 10.5, 11.5</td>
</tr>
<tr>
<td>67 Perform safety inspections of all equipment and accessories.</td>
<td>History: WHII 8, VUS 8</td>
</tr>
<tr>
<td></td>
<td>Govt 7, 8, 9</td>
</tr>
<tr>
<td>68 Identify minor external repairs to all equipment and accessories.</td>
<td>English: 10.5, 11.5</td>
</tr>
<tr>
<td>69 Set up for SMAW operations and base metal preparation on carbon steel.</td>
<td>English: 10.5, 11.5</td>
</tr>
<tr>
<td>70 Operate SMAW equipment.</td>
<td></td>
</tr>
<tr>
<td>71 Perform single-pass fillet welds, 1F and 2F, on carbon steel.</td>
<td>English: 10.5, 11.5</td>
</tr>
<tr>
<td>72 Perform groove welds, 1G and 2G, on carbon steel, limited thickness.</td>
<td>English: 10.5, 11.5</td>
</tr>
</tbody>
</table>

**Demonstrating Gas Metal Arc Welding (GMAW)**

<table>
<thead>
<tr>
<th>Task/Competency</th>
<th>SOL Correlations</th>
</tr>
</thead>
<tbody>
<tr>
<td>73 Describe the theories behind GMAW and GMAW-S.</td>
<td>English: 10.5, 11.5</td>
</tr>
<tr>
<td>74 Perform safety inspections of all equipment and accessories.</td>
<td>English: 10.5, 11.5</td>
</tr>
<tr>
<td>Task/Competency</td>
<td>SOL Correlations</td>
</tr>
<tr>
<td>-----------------</td>
<td>------------------</td>
</tr>
<tr>
<td>75 Identify minor external repairs to all equipment and accessories.</td>
<td>English: 10.5, 11.5</td>
</tr>
<tr>
<td>76 Set up for GMAW and GMAW-S operations and base metal preparation on carbon steel.</td>
<td>English: 10.5, 11.5</td>
</tr>
<tr>
<td>77 Operate GMAW and GMAW-S equipment.</td>
<td>English: 10.5, 11.5</td>
</tr>
<tr>
<td>78 Perform single-pass fillet welds, all positions, on carbon steel, using different modes of transfer.</td>
<td>English: 10.5, 11.5</td>
</tr>
<tr>
<td>79 Perform groove welds, all positions, on carbon steel, using different modes of transfer.</td>
<td>English: 10.5, 11.5</td>
</tr>
</tbody>
</table>

**Demonstrating Flux-cored Arc Welding**

<table>
<thead>
<tr>
<th>Task/Competency</th>
<th>SOL Correlations</th>
</tr>
</thead>
<tbody>
<tr>
<td>80 Describe the theories behind FCAW-G.</td>
<td>English: 10.5, 11.5</td>
</tr>
<tr>
<td>81 Perform safety inspections of all equipment and accessories.</td>
<td>English: 10.5, 11.5</td>
</tr>
<tr>
<td>82 Identify minor external repairs to all equipment and accessories.</td>
<td>English: 10.5, 11.5</td>
</tr>
<tr>
<td>83 Set up for FCAW-G operations and base metal preparation on carbon steel.</td>
<td>English: 10.5, 11.5</td>
</tr>
<tr>
<td>84 Operate FCAW-G equipment.</td>
<td>English: 10.5, 11.5</td>
</tr>
<tr>
<td>85 Describe the theories behind FCAW-S.</td>
<td>English: 10.5, 11.5</td>
</tr>
<tr>
<td>86 Perform single-pass welds on carbon steel, using different modes of transfer.</td>
<td>English: 10.5, 11.5</td>
</tr>
</tbody>
</table>

**Demonstrating Thermal Cutting**

<table>
<thead>
<tr>
<th>Task/Competency</th>
<th>SOL Correlations</th>
</tr>
</thead>
<tbody>
<tr>
<td>87 Explain why one form of cutting is preferable to another.</td>
<td>English: 10.5, 11.5</td>
</tr>
<tr>
<td>88 Describe the theories behind manual thermal cutting.</td>
<td>English: 10.5, 11.5</td>
</tr>
<tr>
<td>89 Perform safety inspections of all equipment and accessories.</td>
<td>English: 10.5, 11.5</td>
</tr>
<tr>
<td>90 Identify minor external repairs to all equipment and accessories.</td>
<td>English: 10.5, 11.5</td>
</tr>
<tr>
<td>91 Set up for manual OFC operations and base metal preparation on carbon steel.</td>
<td>English: 10.5, 11.5</td>
</tr>
<tr>
<td>92 Operate manual OFC equipment.</td>
<td>English: 10.5, 11.5</td>
</tr>
<tr>
<td>93 Operate PAC.</td>
<td>English: 10.5, 11.5</td>
</tr>
<tr>
<td>94 Operate CAC.</td>
<td>English: 10.5, 11.5</td>
</tr>
<tr>
<td>95 Perform straight-cutting operations on carbon steel.</td>
<td>English: 10.5, 11.5</td>
</tr>
<tr>
<td>96 Describe the theories behind machine OFC track burner.</td>
<td>English: 10.5, 11.5</td>
</tr>
<tr>
<td>97 Perform safety inspections of all equipment and accessories.</td>
<td>English: 10.5, 11.5</td>
</tr>
<tr>
<td>98 Identify minor external repairs to all equipment and accessories.</td>
<td>English: 10.5, 11.5</td>
</tr>
<tr>
<td>99 Set up for machine OFC track burner operations on carbon steel.</td>
<td>English: 10.5, 11.5</td>
</tr>
<tr>
<td>Task/Competency</td>
<td>SOL Correlations</td>
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</tr>
<tr>
<td>100</td>
<td>Operate machine OFC track burner equipment.</td>
</tr>
<tr>
<td><strong>Demonstrating Visual Examination Procedures</strong></td>
<td></td>
</tr>
<tr>
<td>101</td>
<td>Examine cut surfaces and edges of prepared base metal parts.</td>
</tr>
<tr>
<td>102</td>
<td>Examine tack, intermediate layers, and completed welds.</td>
</tr>
</tbody>
</table>
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 II (8673/36 weeks, 280 hours)

Career Cluster: Manufacturing

<table>
<thead>
<tr>
<th>Pathway</th>
<th>Occupations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Health, Safety, and Environmental Assurance</td>
<td>Occupational Health and Safety Specialist</td>
</tr>
<tr>
<td>Maintenance, Installation, and Repair</td>
<td>Millwright</td>
</tr>
<tr>
<td>-------------------------------------</td>
<td>------------</td>
</tr>
<tr>
<td>Production</td>
<td>Welder</td>
</tr>
</tbody>
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