Welding III

8674/36 weeks

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Acknowledgments

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

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- 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
Course Description

Suggested Grade Level: 12

Prerequisite Course Code/s: Welding I (8672); Welding II (8673)
This welding capstone course teaches students the industry's emerging technologies, along with shielded metal arc welding (SMAW) and flux-cored arc welding (FCAW). Students will also learn to operate a computer numerical control (CNC) cutting table. Students are prepared to earn relevant industry credentials toward employment in production or manufacturing facilities.

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.

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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>Describe safe scaffolding techniques.</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>Describe the industrial applications for various materials.</td>
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<tr>
<td>57</td>
<td>Describe emerging technologies in the welding industry.</td>
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**Demonstrating Shielded Metal Arc Welding (SMAW) Pipe Welding**

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<tr>
<td>58</td>
<td>Prepare pipe for SMAW applications and procedures.</td>
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<td>Fit pipe to prepare for SMAW.</td>
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<td>Tack pipe to prepare for SMAW.</td>
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**Demonstrating Gas Tungsten Arc Welding (GTAW)**

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<td>Fit pipe to prepare for GTAW.</td>
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<td>Perform maintenance and minor repairs on the CNC machine.</td>
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<td>73</td>
<td>Transfer graphic designs to/from CNC program.</td>
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<td>74</td>
<td>Adjust parameters.</td>
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<td>75</td>
<td>Troubleshoot the CNC machine.</td>
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**Exploring the Techniques of Fabrication**

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<td>Fabricate a practical item.</td>
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Legend: ✫Essential ☐Non-essential ☐Omitted

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**Curriculum Framework**

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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 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 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 labor 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 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?

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**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?
- When would one want to choose a wood or fiberglass ladder over an aluminum ladder?

Task Number 51 Optional

Demonstrate safe laddering techniques.

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?

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? Why?
- How does insurance affect the requirement of continuous retraining for safety?

Exploring Specialized Welding

Task Number 56

Describe the industrial applications for various materials.

Definition
Description could include key industries in which welding plays a significant role, such as

- aerospace
- military contracting
- transportation (e.g., automobiles, motorcycles)
- civil engineering
- architecture and construction
- manufacturing
- shipbuilding
- energy
- motorsports
- sculpting/art.

Task Number 57

Describe emerging technologies in the welding industry.
Definition
Description should include the technology that supports specialized welding occupations, such as the following:

- Underwater welding (wet and dry)
- Laser beam welding
- Plasma welding
- Ultrasonic welding
- Robotics and computer numerical control (CNC) operations
- Mirror welding

Demonstrating Shielded Metal Arc Welding (SMAW) Pipe Welding

Task Number 58 Optional

Prepare pipe for SMAW applications and procedures.

Definition
Preparation should include

- beveling the pipe (by torch or machine) with a land or feather edge
- cleaning the pipe inside and out
- following the written or verbal instructions.

Task Number 59 Optional

Fit pipe to prepare for SMAW.
Definition
Fit should include

- aligning pipes to find best fit
- maintaining a 3/32-inch gap.

Task Number 60 Optional
Tack pipe to prepare for SMAW.

Definition
Tacking should include making four tack welds, placed 90 degrees apart (nickel 3/32-inch gap and dime 1/16-inch edge).

Task Number 61 Optional

Definition
Performance should include

- conducting a visual inspection (inside and outside)
- ensuring the weld is complete and presentable
- maintaining a melt-through on the root and minimum reinforcement on the cover (build-up) of the pipe.

Demonstrating Gas Tungsten Arc Welding (GTAW)

Task Number 62
Perform groove welds on carbon steel, limited thickness.

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

Task Number 63
Perform welds on aluminum.

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

Task Number 64
Perform welds on stainless steel.

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

Demonstrating Gas Metal Arc Welding (GMAW) and Flux-cored Arc Welding (FCAW)

Task Number 65
Perform groove welds on carbon steel, unlimited thickness, using various modes of transfer and in various positions.

Definition
Performance should include

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

Task Number 66

Make multiple-pass fillet welds on carbon steel, using various modes of transfer and in various positions.

Definition
Performance should include

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

Demonstrating Gas Tungsten Arc Welding (GTAW) Pipe Welding
Task Number 67 Optional

Prepare pipe for GTAW applications and procedures.

Definition
Preparation should include

- beveling the pipe (by torch or machine) with a land or feather edge
- cleaning the pipe inside and out.

Task Number 68 Optional

Fit pipe to prepare for GTAW.

Definition
Fit should include

- aligning pipes to find the best fit
- maintaining the standard gap.

Task Number 69 Optional

Tack pipe to prepare for GTAW.

Definition
Tacking should include making four tack welds, placed 90 degrees apart.

Task Number 70 Optional

Perform 1G, 2G, 5G, and 6G GTAW on pipe.

Definition
Performance should include
- conducting a visual inspection (inside and outside)
- ensuring the weld is complete and presentable
- maintaining a melt-through on the root and minimum reinforcement on the cover (build-up) of the pipe.

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**Programming the CNC Cutting Table**

**Task Number 71**

**Identify the components of the CNC machine.**

**Definition**
Identification should include

- computer
- drive motors for the X, Y, and Z axis
- basic table
- plasma arc power source
- control module.

**Task Number 72**

**Perform maintenance and minor repairs on the CNC machine.**

**Definition**
Performance may include

- replacing worn parts
- checking work leads and clamps
• checking cables and cable lengths
• administering lubrication
• keeping the machine clean
• identifying when assistance is needed.

_____________________________________________________

Task Number 73

Transfer graphic designs to/from CNC program.

Definition
Transferring should include

• implementing the input phase of a program, which will include getting information into
  the program by way of user interaction, data statements, and/or file input
• filtering out invalid data (error trapping)
• implementing the output phase of a computer program, which will include accessing a
  variety of output devices, using output statements, and labeling results
• implementing computer graphics, which will include topics appropriate for the available
  programming environment as well as student background.

_____________________________________________________

Task Number 74

Adjust parameters.

Definition
Adjustments should include

• program specifications that define the constraints of a given problem
• settings (e.g., cut speed, piercing time, amperage, height control).

_____________________________________________________

Task Number 75
**Troubleshoot the CNC machine.**

**Definition**
Troubleshooting should include

- applying programming techniques and skills to solve practical, real-world problems
- analyzing data and debugging the program
- making adjustments.

**Exploring the Techniques of Fabrication**

**Task Number 76**

**Explain basic elements of a drawing or sketch.**

**Definition**
Explanation 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)
- bill of materials and requirements
- line types
- tolerances
- title block
- scale
- notes and revisions.
Task Number 77

Create welding symbol information.

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

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

Task Number 78

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 79

Convert basic measurements.

Definition
Conversion should include

- fractions to decimals
- decimals to fractions
- tolerances to one-eighth inch.
Task Number 80

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

**Definition**

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

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Task Number 81

**Apply basic measuring skills to welding operations.**

**Definition**

Application should include appropriately choosing and using instruments such as

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

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Task Number 82

**Create a lab drawing of a practical item.**

**Definition**

Creation should include multiple views, including top, front, and side; dimensions; and related tolerances.
Task Number 83
Fabricate a practical item.

Definition
Fabrication should include using the proper equipment for the selected process.

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### SOL Correlation by Task

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<td>CH.1</td>
</tr>
<tr>
<td>44</td>
<td>Demonstrate the use of a fire extinguisher.</td>
<td>English: 12.5</td>
</tr>
<tr>
<td>45</td>
<td>Identify personal protective equipment (PPE)</td>
<td>English: 12.5</td>
</tr>
<tr>
<td></td>
<td>requirements.</td>
<td></td>
</tr>
<tr>
<td>46</td>
<td>Inspect PPE to determine whether it is safe to use.</td>
<td>English: 12.5</td>
</tr>
<tr>
<td>47</td>
<td>Describe ventilation requirements and regulations</td>
<td>English: 12.5</td>
</tr>
<tr>
<td></td>
<td>pertaining to welding.</td>
<td></td>
</tr>
<tr>
<td>48</td>
<td>Inspect hand and power tools to visually identify</td>
<td>English: 12.5</td>
</tr>
<tr>
<td></td>
<td>defects.</td>
<td></td>
</tr>
<tr>
<td>49</td>
<td>Demonstrate lifting and carrying techniques.</td>
<td>English: 12.5</td>
</tr>
<tr>
<td>50</td>
<td>Identify types of ladders.</td>
<td>English: 12.5</td>
</tr>
<tr>
<td>Task No.</td>
<td>Task/Competency</td>
<td>SOL Correlation</td>
</tr>
<tr>
<td>---------</td>
<td>-----------------</td>
<td>-----------------</td>
</tr>
<tr>
<td>51</td>
<td>Demonstrate safe laddering techniques.</td>
<td>English: 12.5</td>
</tr>
<tr>
<td></td>
<td></td>
<td>History: WHII 8 VUS 8 Govt 7, 8, 9</td>
</tr>
<tr>
<td>52</td>
<td>Describe safe scaffolding techniques.</td>
<td>English: 12.5</td>
</tr>
<tr>
<td></td>
<td></td>
<td>History: WHII 8 VUS 8 Govt 7, 8, 9</td>
</tr>
<tr>
<td>53</td>
<td>Report injuries.</td>
<td>English: 12.5, 12.6, 12.7</td>
</tr>
<tr>
<td></td>
<td></td>
<td>History: WHII 8 VUS 8 Govt 7, 8, 9</td>
</tr>
<tr>
<td>54</td>
<td>Report personal, environmental, and equipment safety violations to the appropriate authority.</td>
<td>English: 12.5, 12.6, 12.7</td>
</tr>
<tr>
<td></td>
<td></td>
<td>History: WHII 8 VUS 8 Govt 7, 8, 9</td>
</tr>
<tr>
<td>55</td>
<td>Pass the safety exam.</td>
<td>English: 12.5, 12.8</td>
</tr>
<tr>
<td></td>
<td></td>
<td>History: WHII 8 VUS 8 Govt 7, 8, 9</td>
</tr>
</tbody>
</table>

**Exploring Specialized Welding**

<table>
<thead>
<tr>
<th>Task No.</th>
<th>Task/Competency</th>
<th>SOL Correlation</th>
</tr>
</thead>
<tbody>
<tr>
<td>56</td>
<td>Describe the industrial applications for various materials.</td>
<td>English: 12.5, 12.8</td>
</tr>
<tr>
<td>57</td>
<td>Describe emerging technologies in the welding industry.</td>
<td>English: 12.5, 12.8</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Task No.</th>
<th>Task/Competency</th>
<th>SOL Correlation</th>
</tr>
</thead>
<tbody>
<tr>
<td>58</td>
<td>Prepare pipe for SMAW applications and procedures.</td>
<td>English: 12.5</td>
</tr>
<tr>
<td>59</td>
<td>Fit pipe to prepare for SMAW.</td>
<td>English: 12.5</td>
</tr>
<tr>
<td>60</td>
<td>Tack pipe to prepare for SMAW.</td>
<td>English: 12.5</td>
</tr>
</tbody>
</table>

**Demonstrating Gas Tungsten Arc Welding (GTAW)**
<table>
<thead>
<tr>
<th>Task No.</th>
<th>Task/Competency</th>
<th>SOL Correlation</th>
</tr>
</thead>
<tbody>
<tr>
<td>62</td>
<td>Perform groove welds on carbon steel, limited thickness.</td>
<td>English: 12.5</td>
</tr>
<tr>
<td>63</td>
<td>Perform welds on aluminum.</td>
<td>English: 12.5</td>
</tr>
<tr>
<td>64</td>
<td>Perform welds on stainless steel.</td>
<td>English: 12.5</td>
</tr>
<tr>
<td>65</td>
<td>Perform groove welds on carbon steel, unlimited thickness, using various modes of transfer and in various positions.</td>
<td>English: 12.5</td>
</tr>
<tr>
<td>66</td>
<td>Make multiple-pass fillet welds on carbon steel, using various modes of transfer and in various positions.</td>
<td>English: 12.5</td>
</tr>
<tr>
<td></td>
<td><strong>Demonstrating Gas Metal Arc Welding (GMAW) and Flux-cored Arc Welding (FCAW)</strong></td>
<td></td>
</tr>
<tr>
<td>67</td>
<td>Prepare pipe for GTAW applications and procedures.</td>
<td>English: 12.5</td>
</tr>
<tr>
<td>68</td>
<td>Fit pipe to prepare for GTAW.</td>
<td>English: 12.5</td>
</tr>
<tr>
<td>69</td>
<td>Tack pipe to prepare for GTAW.</td>
<td>English: 12.5</td>
</tr>
<tr>
<td>70</td>
<td>Perform 1G, 2G, 5G, and 6G GTAW on pipe.</td>
<td>English: 12.5</td>
</tr>
<tr>
<td></td>
<td><strong>Programming the CNC Cutting Table</strong></td>
<td></td>
</tr>
<tr>
<td>71</td>
<td>Identify the components of the CNC machine.</td>
<td>English: 12.5</td>
</tr>
<tr>
<td>72</td>
<td>Perform maintenance and minor repairs on the CNC machine.</td>
<td>English: 12.5</td>
</tr>
<tr>
<td>73</td>
<td>Transfer graphic designs to/from CNC program.</td>
<td>English: 12.5, Mathematics: COM.10, COM.11, COM.12</td>
</tr>
<tr>
<td>74</td>
<td>Adjust parameters.</td>
<td>English: 12.5</td>
</tr>
<tr>
<td>75</td>
<td>Troubleshoot the CNC machine.</td>
<td>English: 12.5</td>
</tr>
<tr>
<td></td>
<td><strong>Exploring the Techniques of Fabrication</strong></td>
<td></td>
</tr>
<tr>
<td>76</td>
<td>Explain basic elements of a drawing or sketch.</td>
<td>English: 12.5</td>
</tr>
<tr>
<td>77</td>
<td>Create welding symbol information.</td>
<td>English: 12.5</td>
</tr>
<tr>
<td>78</td>
<td>Follow the instructions on a job specifications sheet.</td>
<td>English: 12.5</td>
</tr>
<tr>
<td>79</td>
<td>Convert basic measurements.</td>
<td>English: 12.5</td>
</tr>
<tr>
<td>80</td>
<td>Interpret dimensions from a drawing with incomplete dimensions.</td>
<td>English: 12.5</td>
</tr>
<tr>
<td>81</td>
<td>Apply basic measuring skills to welding operations.</td>
<td>English: 12.5</td>
</tr>
<tr>
<td>82</td>
<td>Create a lab drawing of a practical item.</td>
<td>English: 12.5</td>
</tr>
<tr>
<td>83</td>
<td>Fabricate a practical item.</td>
<td>English: 12.5</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 Level One Entry-Level Assessment
- Workplace Readiness Skills for the Commonwealth Examination

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