



Western Technical College

## 10442110 Robotic Welding Operation

### Course Outcome Summary

#### Course Information

<b>Description</b>	Students will learn basic skills necessary to operate a robotic welder. This course touches upon safety, the fundamentals of a teach pendant and arc tool programming language, controls, positioning, commands, set-up, and recovery will be addressed. Students will be able to perform basic movements and perform simple welds upon completion and identify project applications.
<b>Career Cluster</b>	Manufacturing
<b>Instructional Level</b>	Associate Degree Courses
<b>Total Credits</b>	2
<b>Total Hours</b>	54

#### Textbooks

No textbook required.

#### Success Abilities

1. Cultivate Passion: Enhance Personal Connections
2. Cultivate Passion: Expand a Growth-Mindset
3. Cultivate Passion: Increase Self-Awareness
4. Live Responsibly: Develop Resilience
5. Live Responsibly: Embrace Sustainability
6. Live Responsibly: Foster Accountability
7. Refine Professionalism: Act Ethically
8. Refine Professionalism: Improve Critical Thinking

9. Refine Professionalism: Participate Collaboratively
10. Refine Professionalism: Practice Effective Communication

## Course Competencies

### 1. Examine all aspects of safety related robotic welding.

#### Assessment Strategies

- 1.1. Written Objective Test
- 1.2. Skill Demonstration

#### Criteria

*You will know you are successful when*

- 1.1. you identify the safety hazard given a scenario.
- 1.2. you describe safety response related to a given emergency/scenario.
- 1.3. you label potential hazards given a cell diagram.
- 1.4. you describe the purpose of safeguarding measures.
- 1.5. you apply safety precautions consistently while working with the robotic welder.

#### Learning Objectives

- 1.a. Identify general robot hazards.
- 1.b. Identify electrical hazards.
- 1.c. Identify blunt force hazards.
- 1.d. Identify pinch point hazards.
- 1.e. Explore operator strain and fatigue.
- 1.f. Examine methods of safeguarding.
- 1.g. Apply welding safety principles with robotic welders.
- 1.h. Develop an awareness of surroundings related to machine safety.

### 2. Examine the components of a robotic welding system.

#### Assessment Strategies

- 2.1. Written Objective Test

#### Criteria

*You will know you are successful when*

- 2.1. you label the components of a robotic welding system given a diagram.
- 2.2. you describe the purpose or function of each part.
- 2.3. you demonstrate ability to use each component of the welding robotic system according to industry standards.

#### Learning Objectives

- 2.a. Identify parts of a robotic welding system (arm, controller, welding power supply, shielding gas, filler wire).
- 2.b. Identify components common to all robots.
- 2.c. Explore the purpose of each part/component.

### 3. Explore the types of human machine interfaces (HMI).

#### Assessment Strategies

- 3.1. Written Objective Test
- 3.2. Skill Demonstration

#### Criteria

*You will know you are successful when*

- 3.1. you label the controls on the operator station given a diagram.
- 3.2. you label the controls on the teaching pendant given a diagram.
- 3.3. you demonstrate the ability to operate the robot from the operator station.
- 3.4. you demonstrate the ability to operate the robot from the pendant.
- 3.5. you demonstrate the ability to prepare the welding subsystem for operation.

### **Learning Objectives**

- 3.a. Examine the controls at the operator station.
- 3.b. Examine the controls of the teach pendant layout.
- 3.c. Examine the controls of the welding subsystem.

## **4. Jog the robot based on programming situation.**

### **Assessment Strategies**

- 4.1. Demonstration
- 4.2. Written Objective Test

### **Criteria**

*You will know you are successful when*

- 4.1. you describe the different types of coordinates used in robotic welding.
- 4.2. you describe purpose for varying speeds on the robotic welder.
- 4.3. you explain the purpose of each type of coordinate system.
- 4.4. you demonstrate the ability to jog the robot at various speeds in various directions based on given coordinate system.

### **Learning Objectives**

- 4.a. Explore the differences between joint movement and axis movement.
- 4.b. Identify the Right Hand Rule.
- 4.c. Examine coordinate systems: Polar, Cartesian, World, tool, and frames.
- 4.d. Examine varying travel speeds and their applications.
- 4.e. Develop the skills needed to apply the Right Hand Rule correctly.

## **5. Examine the principles behind motion instructions for the robot.**

### **Assessment Strategies**

- 5.1. Written Objective Test
- 5.2. Demonstration

### **Criteria**

*You will know you are successful when*

- 5.1. you calculate point translations based on given scenario.
- 5.2. you determine the outcome of the robotic welder given various types of moves.
- 5.3. you program the robotic welder to move around obstacles in most efficient manner.
- 5.4. you verify programming using a test run.
- 5.5. you modify the program based on changed obstacles.

### **Learning Objectives**

- 5.a. Record points.
- 5.b. Determine the difference for moves between recorded points for efficiency vs. moves between recorded points for application.
- 5.c. Choose the appropriate motion for the given sets of points.
- 5.d. Choose the appropriate speed for the robot based on the application.
- 5.e. Verify the programming with a test run.
- 5.f. Modify the programming based on results of the test run aka touching up points.

## **6. Apply welding tool action.**

### **Assessment Strategies**

- 6.1. Project

### **Criteria**

*You will know you are successful when*

- 6.1. you weld a bead that meets inspection criteria.
- 6.2. you weave welds that meet inspection criteria.
- 6.3. you weld a fillet weld that meets inspection and testing criteria.
- 6.4. you weld a groove weld that meets inspection and testing criteria.
- 6.5. you apply different robotic welding skills to complete project.

### **Learning Objectives**

- 6.a. Verify all welding components are set up.
- 6.b. Establish the welding point types and number of points for the required weld.
- 6.c. Establish welding parameters at the corresponding points.
- 6.d. Access weld schedules between the welder and the robot.
- 6.e. Access weaving schedules to practice weaving.
- 6.f. Practice weaving variables to produce a satisfactory weld.
- 6.g. Review inspection and testing criteria of fillet and groove welds.

## **7. Explore basic administrative functions related to controller computation.**

### **Assessment Strategies**

- 7.1. Skill Demonstration
- 7.2. Project

### **Criteria**

*You will know you are successful when*

- 7.1. you identify functions and programming steps given a written program.
- 7.2. you identify the welds to construct the final project.
- 7.3. you identify the programming needed to complete the welds.
- 7.4. you program the pendant to complete the welds (project).
- 7.5. you follow industry standards of programming conventions (i.e. comments).

### **Learning Objectives**

- 7.a. Explore variables and loops.
- 7.b. Identify comment syntax and use in programming.
- 7.c. Explore written codes and programs to identify key functions.
- 7.d. Explore programming steps needed to execute a specific function.
- 7.e. Examine the various menus and their purposes within the software.
- 7.f. Practice programming the robotic welder.

## **8. Explore basic maintenance requirements for the robot.**

### **Assessment Strategies**

- 8.1. Skill Demonstration
- 8.2. Written Product

### **Criteria**

*You will know you are successful when*

- 8.1. you change batteries.
- 8.2. you run Torchmate to verify TPP location accuracy.
- 8.3. you clean nozzle and tip as needed.
- 8.4. you maintain clean work space.
- 8.5. you backup and restore programs and system software.

### **Learning Objectives**

- 8.a. Change batteries.
- 8.b. Examine torch tip.
- 8.c. Run Torchmate as needed.
- 8.d. Maintain clean work space.
- 8.e. Verify system integrity after a crash.
- 8.f. Examine features of key functions related to file and software maintenance (i.e. copy, delete, print, etc.).

## **9. Explore the basics of fixturing in robotic welding.**

### **Assessment Strategies**

- 9.1. Skill Demonstration

### **Criteria**

*You will know you are successful when*

- 9.1. you select the appropriate clamp for the application.
- 9.2. you apply the appropriate sensor or control for the application.

9.3. you determine how to hold parts that minimizes interference in the weld areas.

**Learning Objectives**

- 9.a. Identify ways to hold parts without interfering with the weld areas
- 9.b. Identify methods to clamp materials.
- 9.c. Identify sensors and I/O controls that are commonly used in fixturing