



Western Technical College

## 10442109 Welding for Maintenance

### Course Outcome Summary

#### Course Information

<b>Description</b>	This course is a basic introduction to welding concepts for industrial maintenance personnel in a hands-on lab environment. MIG welding will be the main emphasis of the course along with an introduction to Stick and TIG processes. Plasma cutting and Torch skills will also be included.
<b>Career Cluster</b>	Manufacturing
<b>Instructional Level</b>	Associate Degree Courses
<b>Total Credits</b>	3
<b>Total Hours</b>	72

#### Textbooks

No textbook required.

#### Learner Supplies

Welding sateen jacket, welding work gloves (long leather gauntlet, short leather work gloves), welding helmet, leather cape and sleeves. **Vendor:** To be discussed in class. Required.

Six inch leather steel toed work boots - \$75.00-150.00. **Vendor:** To be discussed in class. Required.

Safety glasses with side eye protection that meet Z87 OSHA guidelines. **Vendor:** Campus Shop. Required.

#### Course Competencies

## **1. Identify the components of each major arc welding process.**

### **Assessment Strategies**

- 1.1. Written Objective Test

### **Criteria**

*You will know you are successful when*

- 1.1. you identify SAMW electrodes.
- 1.2. you identify GTAW electrodes, fillers, and gases.
- 1.3. you identify GMAW (and FCAW) electrodes and filler.
- 1.4. you differentiate the equipment for SMAW, GTAW, and GMAW.
- 1.5. you identify the powersource for SMAW, GTAW, and GMAW.

### **Learning Objectives**

- 1.a. Identify the equipment (electrodes, fillers, gases, wire, etc) for each of the major arc welding processes.
- 1.b. Identify the powersource for each of the major arc welding processes.
- 1.c. Explore the significance of electrode polarity in the SMAW, GMAW, and GTAW processes.
- 1.d. Identify weld puddle shielding methods in the SMAW, GMAW, and GTAW processes.
- 1.e. Determine the differences and points of use for consumable and non-consumable electrodes.
- 1.f. Identify the factors which determine amperage settings.
- 1.g. Examine how arc length is controlled in the SMAW, GMAW, and GTAW processes.
- 1.h. Identify the advantages and disadvantages of each of the major arc welding processes.
- 1.i. Identify common applications for each of the major arc welding processes.

## **2. Classify various joint designs and types of welds.**

### **Assessment Strategies**

- 2.1. Written Objective Test

### **Criteria**

*You will know you are successful when*

- 2.1. you interpret the welding abbreviations.
- 2.2. you describe the joint to be welded.
- 2.3. you describe the weld process based on the information given.

### **Learning Objectives**

- 2.a. Examine welding joints (Tee, lap, corner, etc).
- 2.b. Identify welding positions.
- 2.c. Interpret common weld abbreviations (1F, 2G, 5F, etc...).
- 2.d. Determine weld joint position prior to welding.

## **3. Demonstrate safe operation of welding equipment.**

### **Assessment Strategies**

- 3.1. Demonstration

### **Criteria**

*You will know you are successful when*

- 3.1. you wear PPE according to industry standards.
- 3.2. you operate welding equipment safely.
- 3.3. you operate cutting equipment safely.

### **Learning Objectives**

- 3.a. Identify safety concerns and practices in the welding laboratory
- 3.b. Demonstrate proper inspection and use of personal protective equipment (PPE)
- 3.c. Apply safety rules and safe working practices in a welding environment.
- 3.d. Demonstrate how to operate the plasma arc cutting machine.
- 3.e. Demonstrate how to operate an oxy-acetylene torch.
- 3.f. Demonstrate how to operate GMAW, SMAW, and GTAW equipment.

## **4. Cut carbon steel with Oxy-Acetylene torch.**

### **Assessment Strategies**

- 4.1. Demonstration
- 4.2. Written Objective Test
- 4.3. Project

### **Criteria**

*You will know you are successful when*

- 4.1. you operate oxy-fuel cutting equipment on carbon steel in compliance with safe operating procedures.
- 4.2. you turn on, ignite torch, and adjust flame for use.
- 4.3. you demonstrate the three flames.
- 4.4. you shut down torch and secure gear properly.
- 4.5. you clean the torch tip.
- 4.6. you demonstrate two piercing techniques.
- 4.7. you cut a 1" strip using soapstone marking.
- 4.8. you cut a 1" strip using a straight edge.
- 4.9. you cut 3 holes of different sizes using inside and outside cuts.
- 4.10. you cut 2 different shapes using inside and outside cuts.
- 4.11. you chip slag from cuts.
- 4.12. you explain safe operation of torch equipment.

### **Learning Objectives**

- 4.a. Setup equipment and light torch appropriately.
- 4.b. Adjust torch flame.
- 4.c. Shut down equipment and torch properly.
- 4.d. Cut different structural shapes (channel, square tube, angles).
- 4.e. Practice cutting thin and thick (1" plate) material.
- 4.f. Identify the purpose of inside and outside cuts for cutting holes and shapes.
- 4.g. Practice brazing.
- 4.h. Practice scarfing material.
- 4.i. Practice heating and bending of material.
- 4.j. Practice oxy-fuel welding.

## **5. Cut various metals using Plasma Arc Cutting (PAC) process.**

### **Assessment Strategies**

- 5.1. Demonstration
- 5.2. Written Objective Test
- 5.3. Project

### **Criteria**

*You will know you are successful when*

- 5.1. you operate plasma cutting equipment on carbon steel, stainless steel, and aluminum in compliance with safe operating procedures.
- 5.2. you cut straight lines using the soapstone marking method.
- 5.3. you cut straight lines using a straight edge.
- 5.4. you explain safe operation of Plasma Arc Cutting equipment.

### **Learning Objectives**

- 5.a. Set up plasma cutting equipment for carbon steel, stainless steel, and/or aluminum.
- 5.b. Operate plasma cutting equipment on carbon steel, stainless steel, and/or aluminum.
- 5.c. Practice cutting on thin and thick material.
- 5.d. Cut straight lines.
- 5.e. Shut down equipment properly and clean-up work area.

## **6. Produce SMAW welds in various positions with various joint designs on carbon steel.**

### **Assessment Strategies**

- 6.1. Demonstration
- 6.2. Project

### **Criteria**

*You will know you are successful when*

- 6.1. you operate SMAW welding equipment on carbon steel in compliance with safe operation procedures.
- 6.2. you fillet weld in the 1F position a pad of beads on 1/4" carbon steel plate.
- 6.3. you demonstrate industry-accepted restarts of SMAW welds.
- 6.4. you fillet weld in the 2F position a lap joint on 3/16" carbon steel plate using E6010 electrode.
- 6.5. you fillet weld in the 2F position a lap joint on 3/16" carbon steel plate using E7018 electrode.
- 6.6. you fillet weld in the 2F position a tee joint on 3/16" carbon steel plate using E6010 electrode.
- 6.7. you fillet weld in the 2F position a tee joint on 3/16" carbon steel plate using E7018 electrode.

#### **Learning Objectives**

- 6.a. Perform safety inspection and set-up welding equipment and accessories.
- 6.b. Review Welding Procedure Sheet.
- 6.c. Identify type of weld/repair needed.
- 6.d. Practice fillet welds in the 1F position.
- 6.e. Practice fillet welds in the 2F position.
- 6.f. Clean-up welding booth and shut-down equipment.

### **7. Produce GMAW welds on carbon steel in various positions with various joint designs.**

#### **Assessment Strategies**

- 7.1. Demonstration
- 7.2. Project

#### **Criteria**

*You will know you are successful when*

- 7.1. you operate GMAW welding equipment on carbon steel in compliance with safe operation procedures.
- 7.2. you fillet weld in the 1F position a pad on beads on carbon steel using GMAW processes.
- 7.3. you demonstrate industry accepted restarts of GMAW welds.
- 7.4. you fillet weld in the 2F position a lap joint on 3/16" carbon steel plate.
- 7.5. you fillet weld in the 2F position a tee joint on 3/16" carbon steel plate.
- 7.6. you fillet weld in the 2F position an outside corner on 1/4" carbon steel plate.
- 7.7. you fillet weld in the 2F position a pipe to plate.
- 7.8. you fillet weld in the 3F position a down lap and tee joint.

#### **Learning Objectives**

- 7.a. Perform safety inspection and set-up welding equipment and accessories.
- 7.b. Review WPS.
- 7.c. Identify type of weld/repair needed.
- 7.d. Practice fillet welds in the 1F position.
- 7.e. Practice fillet welds in the 2F position.
- 7.f. Practice fillet welds in the 3F position.
- 7.g. Practice welding pipe to plate.
- 7.h. Clean-up welding booth and shut-down equipment.

### **8. Produce GTAW welds on carbon steel in various positions with various joints designs.**

#### **Assessment Strategies**

- 8.1. Demonstration
- 8.2. Project

#### **Criteria**

*You will know you are successful when*

- 8.1. you operate GTAW welding equipment on carbon steel in compliance with safe operation procedures.
- 8.2. you fillet weld in the 1F position a pad of beads on 3/16" steel plate using ER70S-2.
- 8.3. you fillet weld in the 2F position a lap joint on 1/8" carbon steel using ER70S-2.
- 8.4. you fillet weld in the 2F position a tee joint on 1/8" carbon steel using ER70S-2.

#### **Learning Objectives**

- 8.a. Perform safety inspection and set-up welding equipment and accessories.
- 8.b. Review Welding Procedure Sheet.
- 8.c. Identify type of weld/repair needed.

- 8.d. Practice fillet welds in the 1F position on carbon steel with filler.
- 8.e. Practice fillet welds in the 2F position on carbon steel with filler.
- 8.f. Clean-up welding booth and shut-down equipment.

**9. Produce GTAW welds on stainless steel in with various joint designs.**

**Assessment Strategies**

- 9.1. Demonstration
- 9.2. Project

**Criteria**

*You will know you are successful when*

- 9.1. you operate GTAW welding equipment on stainless steel in compliance with safe operation procedures.
- 9.2. you fillet weld in the 2F position a tee joint on 1/8" stainless steel using ER308L.
- 9.3. you fillet weld in the 2F position a lap joint on 1/8" stainless steel using ER308L.

**Learning Objectives**

- 9.a. Perform safety inspection and set-up welding equipment and accessories.
- 9.b. Review Welding Procedure Sheet.
- 9.c. Identify type of weld/repair needed.
- 9.d. Practice fillet welds in the 1F position on stainless steel with filler.
- 9.e. Practice fillet welds in the 2F position on stainless steel with filler.
- 9.f. Clean-up welding booth and shut-down equipment.