

# Welding Principles

## Course 417: Welding Principles

Covers fundamentals of welding, Discusses welding safety considerations and precautions. Covers both oxyfuel and arc welding equipment. Describes welding techniques. Discusses ways to avoid weld faults.

TPC Training is accredited by IACET to offer **0.6 CEU** for this program.



### Lesson 1: Fundamentals of Welding

#### Topics

The Working of Metals; Common Welding Processes; Production Welding Processes; Kinds of Welded Joints; Kinds of Welds; Identifying Weld Parts; Fusion and Penetration; Joint Design and Fitup

#### Objectives

- Describe fusion welding, resistance welding, filler rods, and electrodes.
- Compare the oxyfuel and arc welding processes and compare the SMAW, GMAW, and GTAW processes.
- Describe and sketch the following kinds of joints—butt, lap, tee, corner, and edge.
- Describe the following kinds of welds—groove, fillet, plug, slot, spot, and seam.
- Name and locate the parts of a weld.
- Discuss basic considerations in joint design and fitup.

### Lesson 2: Welding Safety

#### Topics

Your Surroundings; Fire and Explosion Hazards; Burns; Fumes and Gases; Ventilation and Respiratory Protection; Eye and Face Protection; Protective Clothing; Hearing Protection; Fuel Cylinders; Oxygen Cylinders; Handling Cylinders; Regulators, Hoses, Torches, and Tips; Electric Shock

#### Objectives

- Explain the importance of good housekeeping in an area where welding is taking place.
- List at least three precautions to take to avoid fires and explosions when welding.
- Describe two methods of protecting yourself against the fumes and gases associated with welding.
- Describe the personal protective equipment required when welding.
- Explain the precautions to take when using and handling cylinders and regulators.

### Lesson 3: Oxyfuel Welding Equipment

#### Topics

The Oxyfuel Welding Process; Equipment and Accessories; Gas Pressure Regulators; Check Valves; Welding Hoses; Welding Torches and Tips; The Sparklighter; Filler Rods; Protective Gear; Preparing to Weld; Adjusting the Flame; Making a Weld; Shutdown Procedures

#### Objectives

- Briefly describe the oxyfuel welding process and the components of an oxyfuel welding outfit, including the lighting device.
- Discuss safety precautions and personal protective gear required for working with oxyfuel equipment.
- List the steps involved in preparing to weld.
- Compare the neutral, carburizing, and oxidizing flames.
- List the steps in safely shutting down an oxyfuel welding system.

### Lesson 4: Arc Welding Equipment

#### Topics

Comparison of Oxyfuel and Arc Welding; Welding with Electricity; AC and DC Welding Currents; Constant Current Power Sources; Constant Voltage Power Sources; Welding Machine Ratings; Kinds of Welding Machines; Welding Cables; Electrode Holders; Electrodes for Arc Welding; Arc Welding Safety Gear and Accessories

#### Objectives

- List similarities and dissimilarities between oxyfuel welding and arc welding.
- Describe the electric welding circuit, including choice of ac or dc, dc polarity, and power sources.
- Discuss welding machine ratings in terms of amperage and duty cycle and describe features and uses of transformer, generator, rectifier, and inverter welding machines.
- Discuss welding cable considerations and describe the electrodes and electrode holders used for SMAW, GMAW, and GTAW processes.
- Discuss the personal safety gear and precautions necessary for arc welding and explain how arc welding accessories are used.

### Lesson 5: Welding Techniques

#### Topics

Selecting a Welding Process; Welding Positions; Oxyfuel Welding Procedures; SMAW Procedures; GMAW Procedures; GTAW Procedures; How to Develop Practical Welding Techniques

#### Objectives

- Explain what considerations affect the selection of a welding process.
- Describe the four welding positions.
- Explain why overhead welds are difficult to make and tell how to make them.
- Describe the preparation required for oxyfuel welding, SMAW, GMAW, and GTAW processes.
- Describe the procedures involved in oxyfuel welding, SMAW, GMAW, and GTAW processes.

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## Lesson 6: Avoiding Weld Faults

### Topics

Proper Welding Procedures; Common Weld Problems; Effects of Poor Fitup; Shape and Dimensional Problems; Internal Defects; Effects of Heat; Controlling Expansion and Contraction; Identifying Metals

### Objectives

- Describe the effects of electrode selection, current, arc length, and travel speed on arc welding procedures.
- Describe common causes of arc blow, a hard-to-start arc, and spatter, and explain why proper fitup is important.
- Define the terms overlap, undercut, blowhole, and inclusion and explain the causes of each.
- Explain how expansion and contraction can be controlled when welding.
- Name and describe the various tests used to identify metals.