Arc Welding Operations

Course 419: Arc Welding Operations

Covers shielded metal arc welding, selecting electrodes for SMAW, gas metal and tungsten arc welding, preheating, reheating, welding ferrous and nonferrous metals, pipe welding, hard facing, and rebuilding.

TPC Training is accredited by IACET to offer **1.0 CEU** for this program.

Lesson 1: Shielded Metal Arc Welding

Topics

How to Process Works; Welding Current and Measurement; Arc Length; Welding Machines (Power Sources); Polarity; Tools and Accessories; Selecting an Electrode; Equipment Setup and Operation; Personal Protection for Welding

Objectives

- Explain how the shielded metal arc welding process works.
- Tell what provides the shield in shielded metal arc welding.
- Define arc length and explain its importance.
- List factors to consider when selecting an electrode.
- Describe the personal protective equipment necessary for welding.

Lesson 2: Selecting Electrodes for SMAW

Topics

Electrodes for Shielded Metal Arc Welding; Identification of Electrodes; Current Ranges; Electrode Coverings; Electrode Selection; Commonly Used Electrodes; Handling, Storing, and Conserving Electrodes

Objectives

- Explain the factors involved in selecting SMAW electrodes.
- Explain how to identify different welding electrodes.
- Give examples of several kinds of electrode coverings and tell when each is used.
- Describe correct procedures for handling, storing, and conserving electrodes.

Lesson 3: Gas Metal Arc Welding

Topics

The Gas Metal Arc Process; Comparing GMAW to SMAW; Metal Transfer Methods; Short-Circuit Transfer; Shielding Gases; Electrode Wire; Equipment and Accessories; GMAW Gun Operation; Preparing to Weld; How to Stop Welding; Welding Conditions and Variables; Safety Practices

Objectives

- Name and describe the three basic types of metal transfer for GMAW.
- Name the most common shielding gases used in GMAW and tell what factors influence their selection.
- List factors that affect the selection of an electrode for GMAW.
- Describe GMAW gun operation.

Lesson 4: Gas Tungsten Arc Welding

Topics

The GTAW Process; GTAW Equipment; GTAW Welding Machines and Current; GTAW Torches; Electrodes for GTAW; Shaping Tungsten Electrode; Shielding Gases; Filler Metals; Preparing to Weld; Welding Procedures; Adding Filler Metal; Techniques for Welding Common Materials; GTAW Spot Welding; Safety Practices

Objectives

- List the advantages of GTAW over other welding processes.
- Describe the equipment and supplies needed for GTAW.
- Explain the purpose of the electrode in GTAW and tell how this differs from other types of welding.
- Properly select shielding gases and filler metals for GTAW.
- Describe how to use GTAW to weld common metals.

Lesson 5: Other Welding Processes

Topics

Resistance Welding; Flash Welding; Percussion Welding; Flux-Cored ARC Welding; Submerged Arc Welding; Plasma Arc Welding; Stud Welding; Laser Beam Welding; Friction Welding; Ultrasonic Welding

Objectives

- Describe resistance spot welding and resistance seam welding.
- Define flash welding, upset welding, and percussion welding, and tell how they differ.
- Explain how submerged arc welding and plasma arc welding differ from other arc welding methods.
- Describe the three forms of friction welding.
- Describe two advantages of ultrasonic welding.

Lesson 6: Preheating and Postheating

Topics

Preheating; Stress; Changes in Mechanical Properties; Postheating; When to Preheat; When to Postheat; Equipment for Preheating and Postheating; Preheating Methods; Consider Shape When Preheating; Spot Preheating; Postheating Methods; Consider Shape When Cooling

Objectives

- Describe the effects of uneven or rapid heating and cooling on base metals and weld beads.
- Define the heat-affected zone and tell what changes can occur there during welding.
- Explain the benefit of preheating and when it should be used.
- List several factors in welding jobs that make postheating advisable.
- Describe methods and materials for preheating and postheating.

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Lesson 7: Welding Ferrous Metals

Topics

Ferrous Metals; Cast Irons; Carbon Steels; Alloy Steels; Effects of Production on Carbon Steels; Effects of Rolling on Carbon Steels; How to Identify Ferrous Metals; Edge Preparation; Welding Cast Irons; Welding Cast Irons with SMAW; Welding Carbon Steels; Welding Low-Carbon Steels with SMAW; Welding Carbon Steels with GTAW; Welding Carbon Steels with GMAW; Welding Alloy Steels; Low-Hydrogen Welding for Alloy Steels

Objectives

- Define ferrous metals and describe their characteristics, including weldability.
- Explain cleaning and edge preparation required prior to welding ferrous metals.
- Name the welding processes and practices that are used for different types and thicknesses of ferrous metals.
- List several different electrode types and their advantages for welding ferrous metals.
- Explain specific procedures to use when welding alloy steels.

Lesson 8: Welding Nonferrous Metals

Topics

Nonferrous Metals; Production of Nonferrous Metals; How to Indentify Nonferrous Metals; Edge Preparation; Cleaning; Welding Aluminum; Welding Stainless Steel; Welding Nickel; Welding Copper

Objectives

- Name the special properties of several nonferrous metals and explain how these properties affect welding preparations and procedures.
- Describe some of the methods of identifying different nonferrous metals.
- Compare seven arc cutting processes used for edge preparation of nonferrous metals.
- Explain proper methods of cleaning nonferrous metals prior to welding.
- Identify the welding processes that are suitable for nonferrous metals.

Lesson 9: Pipe Welding

Topics

Types of Piping Systems and Joints; Codes and Qualifications; Metal Pipe Materials and Applications; Pipe Sizes; Pipe Repair Safety; Arc Welding Processes; Oxyfuel Welding Processes; Types of Welding Joints; Edge Preparation and Fitup; Preheating and Postheating; Welding Procedures

Objectives

- Compare the advantages of welded pipe joints to bolted or screwed connections.
- Discuss pipe welding codes and what they cover.
- List the welding processes used for joining pipe and their advantages and disadvantages.
- Identify some special methods and accessories that are used in pipe welding as opposed to flat welding.
- Give examples of the uses of preheating and postheating in pipe welding.

Lesson 10: Hard Facing and Rebuilding

Topics

Surfacing; Uses of Hard Facing and Rebuilding; Types of Wear; Types and Uses of Surfacing Alloys; Base Metals; Preparing the Base Metal; Preheating; Surface Bonding; Oxyacetylene Hard Facing; Manual Arc Hard Facing; Semiautomatic Hard Facing; Automatic Hard Facing; Thermal Spraying; Hard-Facing Patterns

Objectives

- List several purposes of hard facing and rebuilding.
- Identify the different types of surfacing alloys and their particular uses.
- Describe effective cross-checking and explain why it is desirable.
- Explain the special techniques used in hard facing and tell why they are necessary.
- Name the welding processes used in hard facing and tell why they are adapted to this work.