Welding

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This five-day course provides the participants with hands-on instruction on the tools, procedures, and processes used in the welding and cutting of metals. This course is designed for students with a limited knowledge of welding and focuses on the hands-on skills and techniques used in modern welding.

I. Blueprint Reading

- Drawing Types
- Line Types
- Views
- Dimensions
- Sections

II. Welding Symbols

- Basic Symbols
- Basic Types of Joints and Welds
- Fillet Welds
- Groove Welds
- Plug and Slot Welds

III. Job Setup and Layout

- Layout Tools
- Layout Procedures
- Layout Rules

IV. Basic Oxy-Acetylene Flame Cutting and Brazing

- Oxy-Acetylene Equipment and Gases
- Safety and Health in Oxy-Fuel Applications
- Equipment Setup
- Manual Flame Cutting
- Bevel Cutting

V. Introduction to Uphill Shielded Metal Arc Welding (SMAW)

- SMAW Uphill Principles
- Equipment
- Uphill Pipe Welding Nomenclature
- Fillet Welds for Pipe
- The Five Essentials for Quality Pipe Welds

VI. How to Read and Apply Pipe Welding Procedure

- Purpose of a Pipe Welding Procedure
- Welding Procedure Interpretation
- Preparing a Weld Specimen for Testing
- Electrodes/Filler Metal
- Weld Joint Specifications
- Preheating
- Electrical Characteristics
- Operations During Welding
- Post-Weld Operations
- Testing of the Welded Joint
- Welding Procedure Specification (WPS)
- Procedure Qualification Record (PQR)

VII. Preparation and Assembly of a Pipe Joint without Backing

- Preparation of Weld Surface
- Assembly and Alignment
- Tack Weld Installation

VIII. Preparation and Assembly of a Pipe Joint without Backing

- Reading the Puddle
- Weld Defect Interpretation
- Re-Start of Low Hydrogen Electrodes
- Using Travel Angle to Control Heat Input
- Weld Defects
- Joint Preparation

IX. Applying the Root Pass

- Processes/Electrodes for Welding of Pipe
- Processes for Applying a Root Pass

X. Pre-heat and Interpass Temperatures

- Purpose of Pre-heating
- Pre-heat Temperature
- Pre-heating Methods
- Monitoring Preheat Temperatures
- Pre-heat and Weld Quality
- Maintaining Inter-pass Temperatures

XI. Preparation and Assembly of a Pipe Joint with a Backing Ring

- Workpiece Preparation
- Workpiece Assembly

XII. Introduction to Gas Tungsten Arc Welding (GTAW)

- Method of Operation
- Equipment
- Application
- Skill Level
- Preparation for Welding, Equipment Startup, Adjustments, and Shutdown
    - GTAW Electrodes
    - Electrode Preparation (DC and AC)
    - The GTAW Torch and its Parts
    - Equipment Startup
    - Equipment Adjustment
    - General Welding Application
    - Equipment Shutdown
- Welding Characteristics of Carbon Steel
    - Types of Steel
    - Classification of Steel
    - Classification of Filler Metal
    - Weld Quality (Low Carbon Steel)
- Effect of Equipment Adjustments on the Welding Arc
    - Direct Current Characteristics
    - Alternating Current Characteristics
    - Shielding Gas
    - Electrodes
- Gas Tungsten Arc Welding (GTAW) Pipe and Tubing
    - Method of Operation
    - GTAW Pipe Advantages
    - Equipment and Adjustments
- Preparation and Assembly of a Pipe Joint for GTAW
    - Equipment Setup and Preparation
    - Assembly and Alignment

    - Tack Weld Installation
    - Workpiece Positioning
    - Visual Inspection
- Single Vee Groove Weld G2 and G5 Position Visual and Guided Bend Test
    - Preparation of Workpiece
    - Standards of Acceptability
    - Welder Identification
    - Orientation of Test Specimens
- Pipe Weld Quality
    - Variables that Determine a Quality Pipe Weld
    - Weld Quality (Fusion and Penetration)
    - Common GTAW Defects
- Joint Design for Gas Tungsten Arc Welding (GTAW) Pipe
    - GTAW Joint Design Factors
    - GTAW Joint Design Application
    - GTAW Consumable Inserts
    - GTAW Welding Methods

XIII. Nondestructive Testing

- Inspection by Visual Testing
- Liquid Penetrant Testing (Dye Penetrant)
- Magnetic Particle Testing
- Radiographic Testing
- Ultrasonic Testing