Welding
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