Welding Technology and Weld Inspection: Processes, Procedures, Defects and NDT

1 – 5 March 2027
London - Central London four-star



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Introduction:

Welding technology decides whether a steel structure, pipeline or pressure vessel holds under load, yet many weld failures trace back to the wrong process, uncontrolled heat input, an unqualified procedure, a missed defect or a poorly planned repair. This Core Concept course follows the weld from process selection and metallurgy through procedure qualification, joint design, defect recognition, visual inspection and NDT to repair and quality control. Participants build a Weld Quality Control and Inspection Plan for a welded item from their own work.

Course Objectives:

- Select an arc welding process, consumable and shielding method for a given material, position and joint
- Control heat input, preheat, interpass temperature and post-weld heat treatment to protect the heat-affected zone
- Review a WPS against its supporting PQR and welder qualification records as ASME Section IX and AWS D1.1 describe them
- Interpret welding symbols and joint preparations on fabrication drawings and check fit-up before welding
- Identify weld discontinuities by visual inspection, relate them to their causes and choose RT, UT, MT or PT to confirm them
- Plan weld repairs, hold points and inspection records that keep production welding under quality control

Target Audience:

- Welding engineering staff who select processes, write procedures and approve consumables
- Welding supervisors who run fabrication crews and control parameters on the shop floor and in the field
- QA/QC weld inspection staff who witness qualification tests, inspect welds and accept or reject joints
- Fabrication and construction engineering staff who plan welding on structures, pipelines and pressure equipment
- NDT coordination staff who schedule examinations and review weld examination reports
- Maintenance engineering staff who plan in-service weld repairs during shutdowns

Course Outline:

Day 1: Arc Welding Processes and Consumables

- Arc Physics, Current Type, Polarity and Welding Power Source Characteristics
- SMAW and GTAW: Covered Electrodes, Tungsten Electrodes and Filler Rod Practice
- GMAW and FCAW: Wire Feed, Metal Transfer Modes and Shielding Gas Selection
- SAW: Flux and Wire Combinations and High-Deposition Mechanised Welding
- Consumable Classification, Storage, Baking and Traceability Records

Day 2: Weld Metallurgy, Heat-Affected Zone and Heat Treatment

- Fusion Zone Solidification and Heat-Affected Zone Microstructure Changes
- Heat Input Calculation from Voltage, Current and Travel Speed
- Carbon Equivalent, Hydrogen Control and Preheat Temperature Selection
- Interpass Temperature Limits and Post-Weld Heat Treatment Cycles
- Welding Carbon, Low-Alloy and Stainless Steels: Dissimilar Joint Considerations

Day 3: Welding Procedures, Qualification and Joint Design

- WPS Content: Essential, Supplementary Essential and Non-Essential Variables
- PQR Test Coupons: Tensile, Bend, Macro and Impact Test Results Review
- Welder Performance Qualification WPQ Ranges and Continuity Records
- Butt, Fillet and Branch Joint Preparations: Bevel Angle, Root Face and Root Gap
- Welding Symbols on Fabrication Drawings and Fit-Up Tolerance Checks

Day 4: Weld Defects, Visual Inspection and NDT Methods

- Weld Discontinuity Catalogue: Porosity, Slag, Lack of Fusion, Undercut and Cracks
- Hydrogen Cracking, Solidification Cracking and Lamellar Tearing Root Causes
- Visual Inspection Before, During and After Welding With Gauges and Acceptance Criteria
- RT and UT Weld Examination: Technique Selection and Report Interpretation
- MT and PT Surface Examination: Applicability, Indications and Record Sheets

Day 5: Pipeline and Pressure Equipment Welds: Walkthrough and Weld Quality Plan

- Walkthrough Case: Pipeline Girth Weld Root, Hot Pass and Cap Inspection
- Walkthrough Case: Pressure Vessel Nozzle Weld Preheat and PWHT Records
- Weld Repair Procedure: Excavation, Re-Welding and Re-Examination Sequence
- Weld Map, Hold Points and Non-Conformance Report Drafting
- Weld Quality Control and Inspection Plan Peer Review

Skills You Will Gain:

- Welding Process Selection
- Heat Input Control
- Preheat and PWHT Planning
- WPS and PQR Review
- Welding Symbol Interpretation
- Weld Defect Diagnosis
- Visual Weld Inspection
- NDT Report Interpretation

Why Attend This Course:

- Take home a Weld Quality Control and Inspection Plan for a welded item from your own work
- Stop repeat weld rejections by linking each defect to the parameter or practice that caused it
- Challenge contractor procedures and qualification records with clear variable and test checks
- Compare welding practice with engineers, supervisors and inspectors from oil and gas, power, construction and fabrication

Conclusion:

Sound welds come from a qualified procedure, controlled heat, correct joint preparation and inspection that catches discontinuities before service. The course moves from arc welding processes and consumables, through weld metallurgy and heat treatment, to WPS, PQR and welder qualification, joint design and symbols, then defects, visual inspection and NDT. The final day applies these checks on pipeline and pressure equipment walkthrough cases and completes a Weld Quality Control and Inspection Plan ready for fabrication or repair work.