

Course No. 1663

Welding Engineering & Technology

**MATERIALS, WELDING & FABRICATION ENGINEERING
INDUSTRIAL ENGINEERING, MAINTENANCE & OPERATIONS**

DURATION

5 Days

DELIVERY

Classroom



Course Overview

The Welding Engineering & Technology Training Course provides a comprehensive and practical framework for understanding advanced welding engineering principles, welding technologies, process selection, material behavior, joint design, welding procedures, quality requirements, and process control. The course is designed to strengthen the technical capabilities required to plan, evaluate, supervise, and optimize welding operations across demanding industrial environments.

Welding is a critical manufacturing and joining technology used in pressure equipment, pipelines, storage tanks, structural systems, rotating equipment, process facilities, and heavy industrial components. Welding performance directly influences structural integrity, reliability, service life, fabrication cost, and operational safety. Effective welding engineering therefore requires an integrated understanding of materials, heat input, welding processes, joint design, metallurgical behavior, defects, inspection, and quality control.

The program covers major welding processes and their industrial applications, including arc welding technologies, gas-shielded welding, submerged arc welding, resistance welding, and specialized welding applications. Participants will examine process selection, welding parameters, joint preparation, consumable selection, preheating, interpass temperature control, post-weld heat treatment, distortion management, and the effects of welding thermal cycles on material properties.

A strong focus is placed on welding metallurgy and material compatibility. Participants will explore weldability considerations for carbon steels, low-alloy steels, stainless steels, high-strength materials, and other engineering alloys. The course also addresses heat-affected zones, microstructural changes, residual stresses, hydrogen-related cracking, solidification cracking, distortion, and other factors that can influence weld performance.

Through practical exercises, engineering case studies, welding procedure evaluations, defect analysis, and process optimization activities, participants will develop the ability to select appropriate welding technologies, establish suitable welding parameters, assess weldability, improve welding procedures, control common welding problems, and support effective fabrication quality. The course provides a practical foundation for integrating welding engineering with production, inspection, materials engineering, maintenance, and asset integrity requirements.

Objectives

- Analyze fundamental welding engineering principles and evaluate their application across industrial fabrication and manufacturing environments.
- Evaluate major welding processes according to material type, component design, thickness, production requirements, and service conditions.
- Apply systematic methods for selecting welding processes, consumables, joint configurations, and process parameters.
- Analyze the effects of welding heat input, thermal cycles, preheating, interpass temperature, and cooling rates on material performance.
- Evaluate weldability characteristics of carbon steels, low-alloy steels, stainless steels, high-strength materials, and selected engineering alloys.
- Develop appropriate welding procedure considerations based on material properties, joint requirements, service conditions, and fabrication constraints.
- Assess common welding defects and determine their relationship to process parameters, materials, joint preparation, and welding technique.
- Apply practical methods for controlling distortion, residual stresses, cracking, and other welding-related problems.
- Evaluate post-weld heat treatment requirements and their influence on welded component performance.
- Improve welding productivity and process consistency through appropriate parameter control, equipment selection, and work practices.
- Integrate welding engineering principles with inspection, quality assurance, fabrication, maintenance, and asset integrity requirements.
- Develop a practical welding technology improvement plan addressing process selection, weld quality, productivity, and technical risks by the end of the course.

Who Should Attend

This training course is designed for welding engineers, materials engineers, metallurgical engineers, mechanical engineers, fabrication engineers, production engineers, quality engineers, inspection engineers, and technical specialists responsible for welding technology and fabrication activities. It is also suitable for welding supervisors, fabrication supervisors, welding coordinators, quality control personnel, and technical professionals involved in the development and implementation of welding procedures.

The program is particularly relevant to professionals working in oil and gas, petrochemical, power generation, manufacturing, engineering and construction, shipbuilding, heavy industry, pipelines, pressure equipment, structural fabrication, and industrial maintenance. It is suitable for professionals responsible for welding process selection, weldability assessment, procedure development, production control, defect prevention, and technical problem solving.

The course also benefits engineering managers, fabrication managers, production managers, inspection and quality managers, project engineers, asset integrity professionals, and decision makers responsible for welding performance, fabrication quality, equipment reliability, production efficiency, and compliance with technical requirements.

Learning Outcomes

- Explain the principles and industrial applications of major welding processes and technologies.
- Select appropriate welding processes based on material, component geometry, thickness, production requirements, and service conditions.
- Determine suitable welding parameters and evaluate their influence on weld quality and productivity.
- Assess material weldability and identify potential metallurgical and fabrication challenges.
- Evaluate the effects of welding thermal cycles on the weld metal, heat-affected zone, and base material.
- Identify common welding defects and determine their probable technical and process-related causes.
- Apply practical techniques for controlling cracking, distortion, residual stresses, and other welding problems.
- Evaluate welding consumables according to material compatibility, mechanical requirements, and service conditions.
- Assess preheating, interpass temperature control, and post-weld heat treatment requirements.
- Review and improve welding procedures to achieve greater process consistency and weld quality.
- Integrate welding engineering with inspection, quality control, production, maintenance, and asset integrity activities.
- Develop a practical welding technology improvement plan for an industrial fabrication or

manufacturing environment.

Course Outline

DAY 01

Welding Engineering Principles & Welding Technologies

- Fundamentals of welding engineering and the role of welding in industrial manufacturing
- Classification and applications of fusion, pressure, and solid-state welding processes
- Shielded metal arc welding, gas-shielded welding, submerged arc welding, and resistance welding
- Welding equipment, power sources, electrodes, shielding gases, and process consumables

PRACTICAL APPLICATION

Evaluate an industrial fabrication requirement and select the most appropriate welding technology

DAY 02

Welding Metallurgy, Materials & Weldability

- Metallurgical principles of welding and weld thermal cycles
- Carbon steels, low-alloy steels, stainless steels, high-strength materials, and engineering alloys
- Heat-affected zone formation and microstructural changes
- Weldability assessment and material compatibility

PRACTICAL APPLICATION

Assess the weldability of selected materials and identify potential risks related to cracking, hardness, toughness, and microstructural changes

DAY 03

Welding Procedure Development & Process Control

- Welding joint design, joint preparation, fit-up, and welding sequence
- Welding parameters including current, voltage, travel speed, heat input, and shielding conditions
- Preheating, interpass temperature control, cooling conditions, and consumable management
- Welding procedure development, qualification considerations, and process documentation

PRACTICAL APPLICATION

Develop and evaluate a welding procedure for a selected industrial component

DAY 04

Welding Defects, Distortion & Quality Optimization

- Common welding defects and discontinuities and their technical causes
- Cracking mechanisms including hydrogen-related cracking, solidification cracking, and liquation cracking
- Welding distortion, residual stresses, shrinkage, and dimensional control
- Defect prevention, repair welding, process troubleshooting, and quality improvement

PRACTICAL APPLICATION

Analyze a complex welding failure case, identify root causes, and develop corrective and preventive measures

DAY 05

Advanced Welding Applications, Productivity & Technology Improvement

- Advanced welding technologies and their industrial applications
- Welding automation, mechanization, process monitoring, and productivity improvement
- Integration of welding engineering with inspection, quality control, maintenance, and asset integrity
- Welding performance indicators, process optimization, and continuous improvement

DAY 05 — CONTINUED

FINAL WORKSHOP

Develop an integrated welding technology improvement plan covering process selection, materials, parameters, quality control, productivity, defect prevention, and implementation priorities

Register or Request More Information

Course page: <https://quest-training.com/courses/welding-engineering-technology>

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