

Welding Engineering Best Practices: Advanced Welding Technologies, Metallurgy, Weldability, Quality Control & Defect Analysis

OVERVIEW

Modern welding engineering plays a critical role in manufacturing, fabrication, construction, energy production, mining, oil & gas, transportation, and heavy industry. The quality and reliability of welded structures directly influence operational safety, equipment performance, lifecycle cost, and regulatory compliance.

This intensive training course provides participants with a comprehensive understanding of advanced welding technologies, welding metallurgy, weldability assessment, quality control systems, inspection techniques, and welding defect analysis.

The program combines theoretical principles with practical industrial applications to help participants understand how welding processes affect material behavior, structural integrity, productivity, and reliability.

LEARNING OUTCOMES

By the end of this course, participants will be able to:

- Understand the principles and applications of advanced welding technologies
- Evaluate welding processes for different materials and service conditions
- Understand welding metallurgy and heat-affected zone (HAZ) behavior
- Assess weldability of ferrous and non-ferrous materials
- Distinguish between Welder Qualification and Welding Procedure Qualification, and apply both correctly
- Interpret welding procedures and qualification requirements
- Apply welding quality control and inspection techniques
- Identify and analyze common welding defects
- Conduct root cause analysis of welding failures
- Improve welding productivity and process efficiency
- Apply international welding codes and standards
- Develop corrective and preventive actions for welding-related problems

WHO SHOULD ATTEND

- Welding Managers
- Welding inspection personnel
- Welding supervisor personnel
- Project/Design Engineers
- Metallurgists
- Quality Control Technicians
- Quality Assurance Personnel

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Welding Engineering Best Practices

Fundamentals of Welding Engineering

- Principles of welding and joining
- Heat generation and fusion mechanisms
- Classification of welding processes
- Welding terminology
- Joint design fundamentals
- Industrial applications of welding technologies

Conventional Arc Welding Processes

- Shielded Metal Arc Welding (SMAW)
- Gas Metal Arc Welding (GMAW/MIG)
- Flux-Cored Arc Welding (FCAW)
- Gas Tungsten Arc Welding (GTAW/TIG)
- Submerged Arc Welding (SAW)
- Process advantages and limitations
- Welding parameter optimization

Advanced Welding Technologies

- Laser welding
- Electron beam welding
- Friction stir welding
- Plasma arc welding
- Hybrid welding systems
- Automated and robotic welding
- Additive manufacturing and wire-arc deposition

Welding Process Development & Optimization

- Welding procedure development
- Heat input control
- Distortion management
- Productivity optimization
- Welding consumable selection
- Process monitoring and control

Fundamentals of Welding Metallurgy

- Metallurgical principles of welding
- Solidification and microstructure development
- Heat-Affected Zone (HAZ)
- Cooling rates and phase transformations
- Residual stresses and distortion
- Weld metal chemistry

Weldability of Engineering Materials

- Carbon steels
- Low-alloy steels
- Stainless steels
- Aluminum alloys
- Nickel alloys

Welding Defects — Formation & Metallurgical Causes

- Cracking mechanisms
- Porosity
- Lack of fusion
- Slag inclusions
- Undercut
- Burn-through
- Distortion and residual stress failures

Residual Stress, Distortion & Failure Prevention

- Thermal stresses in welding
- Distortion mechanisms
- Stress relief methods
- Fixturing and restraint techniques
- Heat control strategies
- Design considerations for minimizing distortion

Welding Quality Assurance Systems

- Welding quality management systems
- Welding Procedure Specifications (WPS)
- Procedure Qualification Records (PQR)
- Welder qualification tests
- Welder Qualification vs. Procedure Qualification
- Documentation and traceability
- Quality auditing

Welding Codes & Standards

- Introduction to major welding standards
- Code compliance requirements
- Acceptance criteria
- Inspection documentation

Welding Inspection & Non-Destructive Testing (NDT)

- Visual inspection techniques
- Dimensional inspection
- Dye penetrant testing (PT)
- Magnetic particle testing (MT)
- Ultrasonic testing (UT)
- Radiographic testing (RT)
- Hardness testing
- Defect interpretation

Welding Failure Analysis & Root Cause Investigation

- Systematic troubleshooting approaches
- Root Cause Analysis (RCA) methodologies (5-Why, fishbone/Ishikawa, fault tree)
- Failure investigation methodology, from evidence collection to reporting

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Live Online Training | 26 -27 August 2026

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DELEGATE**

Booking Contact (Approving Official) Mr/Mrs/Ms

Full Names: _____

Company name: _____

Direct Tel No: _____ E-mail: _____ Fax: _____

VAT No: _____

Address: _____

Signature _____

Person Responsible for Finance: _____ Direct Tel No: _____ Date of Payment: _____

BANKING DETAILS:

Independent Training Management Pty Ltd
Bank: FNB South Africa
Account Number: 62685879276
Branch Code: 251650
Branch: Randburg

THE FOLLOWING HEREBY CONFIRM ATTENDANCE TO THE WORKSHOP

Delegate1: Names _____

Position: _____ E-Mail: _____

Delegate 2: Names _____

Position: _____ E-Mail: _____

Delegate 3: Names _____

Position: _____ E-Mail: _____

Delegate 4: Names _____

Position: _____ E-Mail: _____

Delegate 5: Names _____

Position: _____ E-Mail: _____

All fees are current at the time of going to print; however, we reserve the right to change them.

2. Additional Delegate Rates:

Additional delegate rates apply when bookings are made at the same time on the same course.

3. Confirmation Instructions:

On receipt of this submitted booking form and payment or purchase order you will receive a confirmation letter by email confirming your participation in the training event. This includes a location map with directions and venue details and starting times.

4. Attendance:

Please note that no learner will be permitted to attend any training course without proof of payment or an order no.

5. Delegate Substitution:

Substitutes can be made at any time without incurring a penalty. Please inform us in writing so we can make the necessary arrangements for the new learner.

6. Payment:

Payment can be made by cheque or by electronic transfer, and must be received 5 working days prior to the commencement of the course.

Please quote the reference number from your invoice and organisation name so that payments can be tracked. All cancellations must be done in writing and emailed directly to Independent Training. Management Inform us immediately if you have to re-schedule or cancel the booking so that we can inform the caterers and conference venue.

The following charges apply if you cancel:

- 11 - 30 days before a course = 10% of the course fee
- 6 - 10 days before a course = 20% of the course fee
- 4 - 6 days before a course = 30% of the course fee
- 1-3 days before a course = 50% of the course fee