

COURSE OVERVIEW FE0433
Welding Defects Analysis

Course Title

Welding Defects Analysis

Course Date/Venue

Session 1: February 18-22, 2024/The Mouna Meeting Room, The H Dubai Hotel, Sheikh Zayed Rd - Trade Centre, Dubai, UAE

Session 2: March 03-07, 2024/Oryx Meeting Room, Doubletree By Hilton Doha-Al Sadd, Doha, Qatar



Course Reference

FE0433



Course Duration/Credits

Five days/3.0 CEUs/30 PDHs

Course Description



This practical and highly-interactive course includes practical sessions and exercises where participants carryout welding inspection. Theory learnt in the class will be applied using our state-of-the-art simulators.



This course is designed to provide participants with an up-to-date overview on welding defects analysis. It covers the identification of various welding imperfections and defects; the relevant welding technology related to visual inspection, documentation in welding and code and standards related to inspection requirements; the proper inspection of parent materials and consumables; the visual inspection of welds; the reporting and assessing with specified acceptance criteria; the factors which influence the quality of fusion welds in steels; and the characteristics of commonly used welding process in relation to quality control and specifications of drawing instructions and symbols.



The course will further discuss the validity of a welding procedure; the origin of weld defects; the features of a fracture surface; the detailed reports plan, the use of skilled inspectors and NDT personnel; the various types of weld defects and how it is expected to appear on a radiographic image and what causes them; the gas pour, linear porosity and lack of fusion; and the various types of cracks and weld repair methods.

During the course, participants will be able to cover the theoretical background of phased array applications; the scan data for location and size of defects in typical welded butt joints; the basic theory of X- and gamma radiography and radiograph; the proper radiographic techniques and the difference between film faults and defect indications; the basic principles of magnetic particles inspection methods; the magnetic particle inspection and detection of cracks, surface and near-surface in welds; the PWSCC effects on reactor welds; the reactor vessel nozzle weld problems, the helium time effect on aging reactor welds; and the steam generator weld problems.

Course Objectives

Upon the successful completion of this course, each participant will be able to:-

- Apply and gain a comprehensive knowledge on welding defects analysis
- Identify the various welding imperfections and defects and discuss the relevant welding technology related to visual inspection, documentation in welding and code and standards related to inspection requirements
- Determine proper inspection of parent materials and consumables covering the visual inspection of welds as well as reporting and assessing their compliance with specified acceptance criteria
- Analyse the factors which influence the quality of fusion welds in steels and describe the characteristics of commonly used welding process in relation to quality control and specifications of drawing instructions and symbols
- Assess the validity of a welding procedure, recognize the origin of weld defects, interpret features of a fracture surface, prepare detailed reports plan, organize and supervise use of skilled inspectors and NDT personnel, etc
- Describe the various types of weld defects and analyse how it is expected to appear on a radiographic image and what causes them
- Recognize gas pour, linear porosity and lack of fusion as well as the various types of cracks and weld repair methods
- Explain the theoretical background of phased array applications
- Analyse scan data for location and size of defects in typical welded butt joints and explain the basic theory of X- and gamma radiography and radiograph
- Employ proper radiographic techniques and differentiate between film faults and defect indications
- Explain the basic principles of magnetic particles inspection methods, carryout magnetic particle inspection and detect cracks, surface and near-surface in welds
- Discuss PWSCC effects on reactor welds and identify the reactor vessel nozzle weld problems, helium time effect on aging reactor welds and steam generator weld problems

Exclusive Smart Training Kit - H-STK®



Participants of this course will receive the exclusive “Haward Smart Training Kit” (H-STK®). The H-STK® consists of a comprehensive set of technical content which includes **electronic version** of the course materials, sample video clips of the instructor’s actual lectures & practical sessions during the course conveniently saved in a **Tablet PC**.

Who Should Attend

This course provides an overview of all significant aspects and considerations of welding defects analysis for engineers, product designers, tools and dye makers, welding maintenance and launch personnel.

Training Methodology

All our Courses are including **Hands-on Practical Sessions** using equipment, State-of-the-Art Simulators, Drawings, Case Studies, Videos and Exercises. The courses include the following training methodologies as a percentage of the total tuition hours:-

- 30% Lectures
- 20% Practical Workshops & Work Presentations
- 30% Hands-on Practical Exercises & Case Studies
- 20% Simulators (Hardware & Software) & Videos

In an unlikely event, the course instructor may modify the above training methodology before or during the course for technical reasons.

Course Fee

Dubai	US\$ 5,500 per Delegate + VAT . This rate includes H-STK® (Haward Smart Training Kit), buffet lunch, coffee/tea on arrival, morning & afternoon of each day.
Doha	US\$ 6,000 per Delegate. This rate includes H-STK® (Haward Smart Training Kit), buffet lunch, coffee/tea on arrival, morning & afternoon of each day.

Accommodation

Accommodation is not included in the course fees. However, any accommodation required can be arranged at the time of booking.

Course Certificate(s)

Internationally recognized certificates will be issued to all participants of the course who completed a minimum of 80% of the total tuition hours.

Certificate Accreditations


Certificates are accredited by the following international accreditation organizations: -

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The International Accreditors for Continuing Education and Training (IACET - USA)

Haward Technology is an Authorized Training Provider by the International Accreditors for Continuing Education and Training (IACET), 2201 Cooperative Way, Suite 600, Herndon, VA 20171, USA. In obtaining this authority, Haward Technology has demonstrated that it complies with the **ANSI/IACET 2018-1 Standard** which is widely recognized as the standard of good practice internationally. As a result of our Authorized Provider membership status, Haward Technology is authorized to offer IACET CEUs for its programs that qualify under the **ANSI/IACET 2018-1 Standard**.

Haward Technology's courses meet the professional certification and continuing education requirements for participants seeking **Continuing Education Units (CEUs)** in accordance with the rules & regulations of the International Accreditors for Continuing Education & Training (IACET). IACET is an international authority that evaluates programs according to strict, research-based criteria and guidelines. The CEU is an internationally accepted uniform unit of measurement in qualified courses of continuing education.

Haward Technology Middle East will award **3.0 CEUs** (Continuing Education Units) or **30 PDHs** (Professional Development Hours) for participants who completed the total tuition hours of this program. One CEU is equivalent to ten Professional Development Hours (PDHs) or ten contact hours of the participation in and completion of Haward Technology programs. A permanent record of a participant's involvement and awarding of CEU will be maintained by Haward Technology. Haward Technology will provide a copy of the participant's CEU and PDH Transcript of Records upon request.

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British Accreditation Council (BAC)

Haward Technology is accredited by the **British Accreditation Council for Independent Further and Higher Education** as an **International Centre**. BAC is the British accrediting body responsible for setting standards within independent further and higher education sector in the UK and overseas. As a BAC-accredited international centre, Haward Technology meets all of the international higher education criteria and standards set by BAC.

Course Instructor(s)

This course will be conducted by the following instructor(s). However, we have the right to change the course instructor(s) prior to the course date and inform participants accordingly:



Mr. Mohamed Kader (FE), BSc, PgDip, PMI-PMP, NDT, CSWIP, API is a **Senior Inspection Engineer** with over **20 years** of practical experience within the **Oil & Gas, Petrochemical and Refinery industries**. His expertise widely covers in the areas of **Tank Repairs, Design, Fabrication, Construction, Installation, Commissioning, Inspection & Maintenance of Process Equipment, Aboveground Storage Tank Inspection, Tank Repair, Alteration & Reconstruction, Tank & Vessels Inspection, Repair & Modification, Pressure Vessels Inspection, Steam Generator Repair, Boilers, Piping Systems, Pipeline Operation & Maintenance, Pipeline**

Systems, Pipeline Design & Construction, Pipeline Inspection & Rehabilitation, Corrosion, Fitness for Service (FFS), Risk Based Inspection (RBI), Integrity Management, Pipeline Rehabilitation & Repair, Pipeline Design & Maintenance, Pipeline Integrity Assessment, Corrosion Monitoring & Cathodic Protection, Pressure & Leak Testing, Piping Inspection, Pipe Lines, Piping Fabrication, Pipe Flow, Gas Pipe Line, Non-Destructive Testing & Engineering Materials, NDT Methods & Application, Magnetic Particle Inspection & Testing, Radiographic Inspection & Testing, Visual Inspection, Leak Testing, Cathodic Protection, Welding Inspection, Welding Technology, Welding & Fabrication, Welding Defects Analysis, Welding Engineering, Welding Procedure Specification, Welding Quality & Control, Damage Mechanisms, Pressure Vessels, Tanks, Heat Exchangers, RT Films Interpretation, Fire Heaters Revamping, Waste Water Heater, Distillation Towers, Crude Oil Tank, Steam Power Plant, Spherical Tanks and Asset Integrity Management. Further, he is also well-versed in **Contract Management & Administration, Project Management, Project Scheduling & Cost Control, Project Supervision, Project Reporting, Project Investment & Risk Analysis, Project Delivery & Governance Framework, Project Risk Management, Risk Identification Tools & Techniques, Project Life Cycle, Project Stakeholder & Governance, Project Time Management, Project Cost Management, Project Quality Management and Quality Assurance.** He is currently the **Project Manager** of SOPCO wherein he is managing the project team, evaluating projects and ensuring that the projects meet the quality standards.

During his career life, Mr. Mohamed occupied several significant positions and dedication as the **Projects Engineer, Piping & QC Leader, Piping Engineer, QA/QC Engineer and Senior Trainer/Instructor** for various international companies like the Gulf of Suez Petroleum Company (GUPCO), Khalda Petroleum Company (KPC), ADMA-OPCO, Kahalda Petroleum Company, East Gas and MASSA Inspection and Consultation Company.

Mr. Mohamed has a **Bachelor's degree in Mechanical Power Engineering** and a **Postgraduate Diploma in Welding Science & Technology**. Further, he is a **Certified Instructor/Trainer, a Certified Project Management Professional (PMI-PMP), a Certified Senior Welding Inspector (CSWIP 3.1), a Certified API 510 Pressure Vessel Inspector, a Certified API 570 Piping Inspector, a Certified API 653 Tank Inspector and a Certified NDT Level II Inspector** in Radiographic Testing (RT), Ultrasonic Testing (UT), Magnetic Particle Testing (MT) and liquid Penetrant Testing (PT). He has further delivered numerous trainings, courses, seminars, conferences and workshops internationally.

Course Program

The following program is planned for this course. However, the course instructor(s) may modify this program before or during the course for technical reasons with no prior notice to participants. Nevertheless, the course objectives will always be met:

Day 1

0730 – 0800	Registration & Coffee
0800 – 0815	Welcome & Introduction
0815 – 0830	PRE-TEST
0830 – 0930	Weld Imperfections (Defects) Welding Technology related to Visual Inspection • Understand the Need for Documentation in Welding • Codes & Standards related to Inspection Requirements
0930 – 0945	Break
0945 – 1100	Inspection of Parent Materials & Consumables Visual Inspection of Welds, Report on them & Assess their Compliance with Specified Acceptance Criteria
1100 – 1230	Inspection of Parent Materials & Consumables (cont'd) Factors which Influence the Quality of Fusion Welds in Steels
1230 – 1245	Break
1245 – 1420	Inspection of Parent Materials & Consumables (cont'd) Characteristics of Commonly Used Welding Processes in Relation to Quality Control
1420 – 1430	Recap
1430	Lunch & End of Day One

Day 2

0730 – 0930	Inspection of Parent Materials & Consumables (cont'd) Drawing Instructions & Symbols to ensure that Specifications are Met
0930 – 0945	Break
0945 – 1100	Validity Assessment of a Welding Procedure Origins of Weld Defects
1100 – 1230	Validity Assessment of a Welding Procedure (cont'd) Interpret Features of a Fracture Surface & Prepare Detailed Reports • Scrutinise & Correct Inspection Reports
1230 – 1245	Break
1245 – 1420	Validity Assessment of a Welding Procedure (cont'd) Scrutinise & Correct Inspection Reports • Plan, Organise & Supervise Use of Skilled Inspectors & NDT Personnel • Conduct Pre, During & Post Welding Audits
1420 – 1430	Recap
1430	Lunch & End of Day Two

Day 3

0730 – 0930	Types of Weld Defects in Cross Section How it is Expected to Appear on a Radiographic Image? • What Causes Them: Worm Hole or Linear Slag Inclusion?
0930 – 0945	Break
0945 – 1100	Gas Pore, Linear Porosity & Lack of Fusion



1100 – 1230	Various Types of Cracks
1230 – 1245	Break
1245 – 1420	Weld Repair Methods
1420 – 1430	Recap
1430	Lunch & End of Day Three

Day 4

0730 – 0830	Theoretical Background of Phased Array Applications Select Probe/Wedge to Examine Welded Butt Joints • Calibrate & Set up the Phased Array Ultrasonic Equipment • Locate & Evaluate Flaws in the Weld Body, HAZ & Parent Metal Lamination
0830 – 0930	Scan Data Analyzation for Location & Size of Defects in Typical Welded Butt Joints Accurately Report Weld Condition • Differentiate Defects from Geometric Features
0930 – 0945	Break
0945 - 1100	Basic Theory of X - & Gamma Radiography Select Film Type & Energy Levels, Select & Prepare Techniques for a Given Specimen • Theory of Film Processing & Carryout Practical Dark-Room Work • Working Knowledge of Basic Radiation Safety • Plot & Evaluate Film Characteristics (Sensitometry)
1100 – 1230	Film Faults - Basic Theory of Radiograph
1230 – 1245	Break
1230 – 1315	Radiographic Techniques List of Radiographic Techniques • State Origins of Defects • Recognise & Differentiate between Film Faults & Defect Indications
1315 – 1345	Radiographs Interpretation Basic Principles of Magnetic Particle Inspection Methods • Magnetic Particle Inspection
1345 – 1420	Detection of Cracks, Surface & Near-Surface in Welds
1420 – 1430	Recap Using this Course Overview, the Instructor(s) will Brief Participants about the Topics that were Discussed Today & Advise Them of the Topics to be Discussed Tomorrow
1430	Lunch & End of Day Four

Day 5

0730 – 0930	PWSCC Effect on Reactor Welds
0930 – 0945	Break
0945 – 1100	Reactor Vessel Nozzle Weld Problems
1100 – 1230	Helion Time Effect on Aging Reactor Welds
1230 – 1245	Break
1245 – 1345	Steam Generator Weld Problems
1345 – 1400	Course Conclusion
1400 – 1415	POST-TEST
1415 – 1430	Presentation of Course Certificates
1430	Lunch & End of Course



Practical Sessions

Practical sessions will be organized during the course for delegates to practice the theory learnt. Delegates will be provided with an opportunity to carryout welding inspection using the “American Welding Society (AWS) Tool Kit” and “Structural Weld Replica Kit”, suitable for classroom training.



American Welding Society (AWS) Tool Kit and Structural Weld Replica Kit

Course Coordinator

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