# COURSE OVERVIEW FE0433
# Welding Defects Analysis

**Course Title**
Welding Defects Analysis

**Course Reference**
FE0433

**Course Duration/Credits**
Five days/3.0 CEUs/30 PDHs


**Course Date/Venue**

| Session(s) | Date | Venue |
|---|---|---|
| 1 | August 03-07, 2025 | Meeting Plus 9, City Centre Rotana, Doha Qatar |
| 2 | November 23-27, 2025 | Boardroom 1, Elite Byblos Hotel Al Barsha, Sheikh Zayed Road, Dubai, UAE |
| 3 | February 01-05, 2025 | Boardroom 1, Elite Byblos Hotel Al Barsha, Sheikh Zayed Road, Dubai, UAE |

**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 hellion time effect on aging reactor welds; and the stream 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, hellion time effect on aging reactor welds and stream 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 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

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

**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: -

- 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.

- 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.

**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. George Poulos**, MBA, MSc, BSc, CEng, is a **Senior Corrosion & Metallurgical Engineer** with over **45 years** of extensive experience within the **Oil & Gas, Petrochemical, Refinery, Construction, Aircraft & Shipbuilding** Industry. His wide experiences cover in the areas of **TIG** & **Arc Welding**, **Shielded Metal Arc Welding**, **Gas Tungsten** & **Gas Metal Arc Welding**, **Welding** Procedure Specifications & Qualifications, **Aluminium Welding**, **Hot Work-Safety**, **SMAW**, **GTAW**, **Welding** Techniques, **Pipeline Welding** Practices, **Welding** Engineering, **Welding** Fatigue & Fracture Mechanics, **Welding Inspection Technology**, **Welding Safety**, **Welding** Defects Analysis, **Welding Technology**, **Welding Problems**, **Welding & Non Destructive** Testing and **Metallurgy Techniques**.**Corrosion in Urea & Ammonia Plants,** Corrosion and **Metallurgy**, Analysis & Prevention, **Corrosion** Fabrication & Inspection, **Fabrication** & **Repair**, **Corrosion** Prevention, **Corrosion** Engineering, **Corrosion Control**, **Corrosion Inhibition**, **Corrosion** Management in Process Operations, **Corrosion** & Prevention of Failures, **Pressure Vessels**, **Piping Inspection**, **Risk-Based Inspection**, **Fitness-for-Service** (**FFS**), **Metallurgical** Failure, **Metallurgy & Metallurgical Processes, Metallurgical** Lab, **Material** Selection, **Cathodic Protection** Systems, **Steel Metallurgy**, **Steel** Structure Welding, **Steelmaking** Slag, **Steel** Making Application, **Steel Making** Process, **Steel** Manufacturing, **Steel Forging**, **Steel** Manufacturing & Process Troubleshooting, **Hot Rolling** Process, **Hot Strip Mill**, **Mill** Operations, **Roll Mill**, **Electric Arc Furnace** (**EAF**), **Slit Rolling**, **Carbon Steel Pipe** Wall Thickness & Grade Selection, **Ferro-Alloys**, **Heat Treatment** & **Prevention Techniques** and **Post Weld Heat Treatment**. Further, he is also well-versed in **Welding** Inspection, **Welding** & **Machine** Techniques.

During his career life, Mr. Poulos has gained his practical and field experience through his various significant positions and dedication as the **Chief Executive**, **Head of Technical Studies**, **Manager**, **Senior Consultant**, **Lead Welding Engineer**, **Senior Welding Engineer**, **Design Engineer**, **Sales Engineer**, **Author**, **Welding Instructor**, **Visiting Lecturer** and **Technical Proposal Research Evaluator** from various international companies such as Greek Welding Institute, Hellenic Quality Forum and International Construction Companies such as Shipbuilding, Aircraft Industry and Oil and Gas Industry.

Mr. Poulos is a **Registered Chartered Engineer** and has a **Master's** degree in **Naval Architecture**, a **Bachelor's** degree in **Welding Engineering** and a Master of Business Administration (**MBA**) from the **Sunderland University**, **Aston University** and **Open University**, **UK**, respectively. Further, he is a **Certified Trainer/Instructor**, an active Member of Chartered Quality Institute (**CQI**), The British Welding Institute (**TWI**), The Royal Institution of Naval Architects (**RINA**) and American Welding Society (**AWS**), a Registered **EWF/IW** (European Welding Federation-International Welding Institute W/E) and an **IRCA** Accredited External Quality Systems Auditor through BVQI. He is an **Author** of Technical Book dealing with Protection/Health/Safety in the Welding/Cutting domain and delivered various trainings, seminars, conferences, workshops and courses globally.

## 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***

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

***Day 2***

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| *0730 – 0930* | ***Inspection of Parent Materials & Consumables (cont'd)***<br>*Drawing Instructions & Symbols to ensure that Specifications are Met* |
| *0930 – 0945* | *Break* |
| *0945 – 1100* | ***Validity Assessment of a Welding Procedure***<br>*Origins of Weld Defects* |
| *1100 – 1230* | ***Validity Assessment of a Welding Procedure (cont'd)***<br>*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)***<br>*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***

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| *0730 – 0930* | ***Types of Weld Defects in Cross Section***<br>*How it is Expected to Appear on a Radiographic Image? ● What Causes Them: Worm Hole or Linear Slag Inclusion?* |
| *0930 – 0945* | *Break* |

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| *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***

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| *0730 – 0830* | ***Theoretical Background of Phased Array Applications***<br>*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***<br>*Accurately Report Weld Condition ● Differentiate Defects from Geometric Features* |
| *0930 – 0945* | *Break* |
| *0945 - 1100* | ***Basic Theory of X - & Gamma Radiography***<br>*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***<br>*List of Radiographic Techniques ● State Origins of Defects ● Recognise & Differentiate between Film Faults & Defect Indications* |
| *1315 – 1345* | ***Radiographs Interpretation***<br>*Basic Principles of Magnetic Particle Inspection Methods ● Magnetic Particle Inspection* |
| *1345 – 1420* | ***Detection of Cracks, Surface & Near-Surface in Welds*** |
| *1420 – 1430* | ***Recap***<br>*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***

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| *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

Reem Dergham, Tel: +974 4423 1327, Email: reem@haward.org