

COURSE OVERVIEW FE0721
Fundamentals of Non-Destructive Testing (NDT)

Course Title

Fundamentals of Non-Destructive Testing (NDT)

Course/Exam Date/Venue

September 09-13, 2024/ Fujairah Meeting Room,
 Grand Millennium Al Wahda Hotel, Abu Dhabi,
 UAE

Course Reference

FE0721

Course Duration/Credits

Five days/3.0 CEUs/30 PDHs

Course Description



This practical and highly-interactive course includes various practical sessions and exercises. Theory learnt will be applied using our state-of-the-art simulators.

Non-destructive testing (NDT) is the process of inspecting, testing, or evaluating materials, components or assemblies for discontinuities, or differences in characteristics without destroying the serviceability of the part or system. In other words, when the inspection or test is completed the part can still be used. It's a wide group of analysis techniques used to evaluate the properties of a material, part, product, weld, or system without causing damage.



Non-destructive testing is a commonly-used tool in forensic engineering, mechanical engineering, electrical engineering, civil engineering, systems engineering, aerospace and aeronautical engineering, and medical applications. The terms Non-Destructive Examination (NDE), Non-Destructive Inspection (NDI), and Non-Destructive Evaluation (NDE) are also commonly used to describe nondestructive testing methodology. It covers the various NDT methods and techniques such as liquid penetrant testing, magnetic particle testing, electromagnetic testing, ultrasonic testing method, radiographic testing, visual testing and other NDT methods and techniques.



This course is designed to provide participants with a detailed and up-to-date overview of non-destructive

testing. It covers the NDT approach including method selection, detecting discontinuities, surface, subsurface, contrast with destructive testing, interpretive technology, test variables, standards for comparison and application; the various techniques of liquid penetrant testing and its advantages, disadvantages, limitations, types, equipment, safety precaution and personnel requirements; the proper method of magnetic particle testing covering the advantages and disadvantages as well as the basic magnetic particle process, preparation of parts, magnetization, application, assessment of discontinuities and magnetic particle testing methods.

Further, the course will also cover the electromagnetic testing including the eddy current techniques and its principles as well as the factors affecting eddy current; the ultrasonic testing method including ultrasonic principles, detection of discontinuities, pulse-echo techniques and transmission techniques; the radiographic testing including the types of radiation, principles of radiography and the exposure factors; and the procedure of visual testing, other NDT methods and techniques and certification requirements.

Course Objectives

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

- Apply and gain a comprehensive knowledge on non-destructive testing
- Discuss the NDT approach including the method selection, detecting discontinuities, surface, subsurface, contrast with destructive testing, interpretive technology, certification of technicians, test variables, standards for comparison and application
- Employ the various techniques of liquid penetrant testing and recognize its advantages, disadvantages and limitations, types, equipment, safety precaution and personnel requirements
- Carryout the proper method of magnetic particle testing and evaluate its advantages and disadvantages as well as the basic magnetic particle process, preparation of parts, magnetization, application, assessment of discontinuities and magnetic particle testing methods
- Illustrate the electromagnetic testing and discuss the eddy current techniques and its principles as well as the factors affecting eddy current
- Apply ultrasonic testing method including ultrasonic principles, detection of discontinuities, pulse-echo techniques and transmission techniques
- Interpret radiographic testing and identify the types of radiation, principles of radiography and the exposure factors
- Demonstrate the procedure of visual testing and carryout the other NDT methods and techniques as well as recognize the certification requirements

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 non-destructive testing for supervisors, engineers, managers, quality managers, condition monitoring technicians, engineering technicians, any non-technical (NDT) person responsible for NDT, technicians or ordering NDT techniques to maintain plant and equipment.

Course Fee

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.

Accommodation

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

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 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. Gert Viljoen is a Senior Inspection Engineer with over 35 years of experience within the Oil & Gas, Refineries, Petrochemical and Power industries. His expertise lies extensively in the areas of Non-destructive Testing Methods, Welding Technology, Welding Procedure Specification, Welder Performance Qualification, Piping Inspection & Testing, Piping Inspection Procedures, Piping Components Pressure Design, Fabrication & Assembly, In-Service Piping Systems Inspection & Repair, Inspection Data Evaluation & Analysis, Piping System Repairs & Alterations, Pressure Equipment Inspection, Steam Generators, Reactors, Towers, Columns, Gasifiers, Heat Exchangers, Storage Tanks, Repair Procedures Verification, Maintenance Strategies, Static & Rotating Equipment, Pipe Work, Equipment Life Assessment Review, Risk-based Inspection Verification, Ultrasonic Testing & Evaluation, Liquid Penetrant Testing, Magnetic Particle Testing, Electromagnetic Testing, Radiographic Testing, Visual Testing and Damage Assessment. He is also well-versed in Quality Management System, ISO 9000/9001, ISO 17020, SANS 10227 Systems and Root Cause Analysis & Investigation. Currently, he is the Inspection Specialist of RBI Technical Solutions International.

During his career life, Mr. Viljoen has gained his practical and field experience through his various significant positions and dedication as the **Chief Inspector, Inspection Manager, QC Manager, NDT Inspection Department Head, Flight Engineer, Fabricator, In-service/Welding Inspector, Field Supervisor and Contractor Coordinator** for numerous international companies like the **Saudi Aramco, SGS Pty Ltd., SASOL Synthetic Fuels and South African Airforce**, just to name a few.

Mr. Viljoen is a **Certified Instructor/Trainer, a Registered Technical Assessor, a Technical Instructor, a Certified ASNT NDT Level III Inspector** in Liquid Penetrant Testing (PT), Magnetic Particle Testing (MT) and Ultrasonic Testing (UT); a **Certified ASNT NDT Level II Inspector** in Radiographic Testing (RT), Infrared Thermography (IR) and Eddy Current Testing (ET); a **Certified Piping Inspector (API 570), Certified Pressure Vessel Inspector (API 510), Certified Aboveground Storage Tank Inspector (API 653); a Certified Paint Inspector Level I, a Competent Person Pressure Vessels, a Competent Person Steam Generators and a Certified Pressure Equipment Inspector.** He has further delivered numerous courses, workshops, trainings, seminars and conferences worldwide.

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: Monday 09th of September 2024

0730 – 0800	Registration & Coffee
0800 – 0815	Welcome & Introduction
0815 – 0830	PRE-TEST
0830 – 0930	An Overview of Nondestructive Testing The NDT Approach • The Need for Testing • NDT Methods • Method Selection • Detecting Discontinuities • Surface • Subsurface • Contrast with Destructive Testing • An Interpretive Technology • Certification of Technicians • Test Variables • Improving Test Results • Standards for Comparison • Automation • Applications of NDT • New Parts Manufacturing • Inservice Applications • Industrial Sectors
0930 - 0945	Break
0945 – 1130	Liquid Penetrant Testing Selecting Liquid Penetrant Testing • Advantages • Disadvantages & Limitations • Basic Technique • Leak Detection • Types of Liquid Penetrant • Sensitivity • Sensitivity Categories • Test Panels • Methods of Removal • Developers • Equipment • Portable Equipment • Stationary Testing Equipment • Small Parts Testing Unit • Automated Testing Systems • System Concept Precautions • Safety Precautions • Personnel Requirements
1130 - 1145	Break
1145 – 1230	Magnetic Particle Testing Advantages • Disadvantages • Basic Magnetic Particle Process • Preparation of Parts • Magnetization • Application of Particles • Assessment of Discontinuities • Demagnetization • Cleaning & Surface Protection • Magnetic Particle Testing Methods
1230 - 1250	Prayer Break
1250 - 1420	Magnetic Particle Testing (cont'd) Continuous • Residual • Properties of Magnetic Particles • Dry Powders • Wet Suspension • Comparison of Wet and Dry Methods • Advantages of the Dry Method • Advantages of the Wet Method • Methods of Magnetization • Longitudinal Magnetization • Induced Current Magnetization
1420 - 1430	Recap
1430	Lunch & End of Day One

Day 2: Tuesday 10th of September 2024

0730 – 0930	Magnetic Particle Testing (cont'd) Circular Magnetization • Equipment • Magnetizing Equipment • Coils and Insulated Conductors • Yokes • Prods & Clamps • Bench Testing • Magnetic Field Indicators • Interpretation of Indications • Spurious Indications • Discontinuity Indications • Meter Readings & Current Flow • Personnel Requirements
0930 – 0945	Break
0945 – 1130	Electromagnetic Testing Eddy Current Technique • Advantages • Limitations • Basic Eddy Current Principles • Applications • Capabilities • Factors Affecting Eddy Currents • Coils and Probes • Surface Probes

1130 - 1145	Break
1145 - 1230	Electromagnetic Testing (cont'd) Internal Probes • Encircling Coils • Hybrid Coils • Probe Precautions • Bridge Circuits • Detection of Discontinuities • Reference Standards • Scan Paths • Flat Surfaces • Areas Around Fasteners
1230 - 1250	Prayer Break
1250 - 1420	Electromagnetic Testing (cont'd) Radii • Holes • Corrosion Detection • Subsurface Crack Detection • Paint • Displays • Analog • Digital • Impedance Plane • Operating Point • Other Electromagnetic Approaches
1420 - 1430	Recap
1430	Lunch & End of Day Two

Day 3: Wednesday 11th of September 2024

0730 - 0930	Ultrasonic Testing Advantages • Disadvantages • Ultrasonic Principles • Acoustics • Transducers • Piezoelectric Effect • Detection of Discontinuities • Pulse-Echo Technique • Resonance Technique • Through-Transmission Technique • Displays
0930 - 0945	Break
0945 - 1130	Ultrasonic Testing (cont'd) A-scan Presentation • B-scan Presentation • C-scan Presentation • Factors Affecting Ultrasonic Testing • Effects of Temperature Changes • Sensitivity • Resolution • Dead Zone • Propagation of Ultrasonic Waves • Near Field and Far Field • Sound Attenuation in the Far Field • Ultrasound and Material Interfaces
1130 - 1145	Break
1145 - 1230	Ultrasonic Testing (cont'd) Acoustic Impedance • Couplant • Probe Designs • Normal Angle Compressional Probe • Shear & Surface Wave Probes • Twin Crystal Probes • Paintbrush Transducers • Water Immersion Probes • Thickness Gages • Gates • Phased Arrays • Calibration of Equipment
1230 - 1250	Prayer Break
1250 - 1420	Radiographic Testing Advantages • Limitations • Types of Radiation • X-rays • Gamma Rays • Principles of Radiography • Processing the Radiographic Image • Processing Units • The Darkroom • Exposure Factors • Film Speed
1420 - 1430	Recap
1430	Lunch & End of Day Three

Day 4: Thursday 12th of September 2024

0730 - 0930	Radiographic Testing (cont'd) Graininess • Contrast • Alternatives to Film • Image Enhancement • The X-ray Tube • Special Electron Accelerators • Intensifying Screens • Cassettes and Film Holders • Scatter Radiation • Reduction of Scatter • Geometric Unsharpness • Measuring Quality
0930 - 0945	Break
0945 - 1130	Radiographic Testing (cont'd) Image Quality Indicators (Penetrameters) • Radiographic Film Interpretation • Illuminators • Analyzing the Image • Identification of Radiographs • Health Issues • Permissible Radiation Dose • Protection against Radiation • Film Badges • Dose Rate Meters (Survey Meters) • Procedures, Specifications and Codes • Computerized Radiography



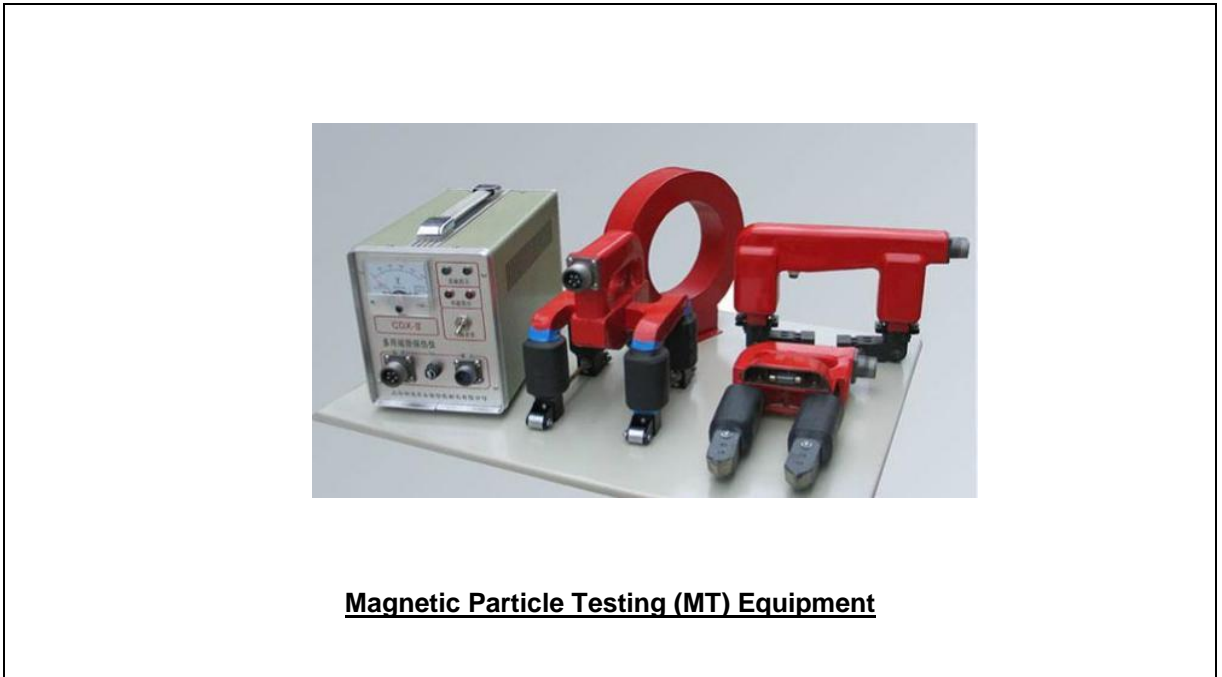
1130 - 1145	Break
1145 - 1230	Visual Testing Need for Adequate Lighting • Optical Enhancements • Mirrors • Magnifying Devices • Handheld Lenses • Pocket Microscopes • Self-Supporting Magnifiers • Eye Attachments
1230 - 1250	Prayer Break
1250 - 1420	Visual Testing (cont'd) Illuminated Magnifiers • Borescopes & Fiberscopes • Borescopes • Fiberscopes • Charge Coupled Devices • Digital Imaging • Metallographic Replication • Photoelastic Coatings • Dimensional Inspection
1420 - 1430	Recap
1430	Lunch & End of Day Four

Day 5: Friday 13th of September 2024

0730 - 0930	Other NDT Methods & Techniques Liquid Penetrant Related • Temper Etch • Magnetic Particle Related • Magnetic Barkhausen Effect • Electromagnetic Related • Strain Gages (Eddy Current) • Microwave Testing • Acoustic Based • Acoustic Emission • Vibration Analysis • Radiographically Derived Techniques • Neutron Radiography • Stereoradiography • X-ray Fluorescence • Fluoroscopy
0930 - 0945	Break
0945 - 1130	Other NDT Methods & Techniques (cont'd) Image Intensifier (Amplifier) • Fluorography • Color Radiography • Microradiography • Xeroradiography • X-ray Computed Tomography • Radiometry • Laser Methods • Stress-Inducing Methods • Leak Testing • Thermal/Infrared Testing • Dynamic Techniques • Passive Techniques • Optical Holography
1130 - 1145	Break
1145 - 1240	NDT Certification Employer-Based Certification • Central Certification • Choice of Certification System
1230 - 1250	Prayer Break
1250 - 1330	NDT Certification (cont'd) Program Documentation • NDT Specifications • NDT Terminology • Discontinuity Guide
1330 - 1400	POST-TEST
1400 - 1415	Course Conclusion
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 carryout NDT inspection using our “Liquid Penetrant Testing (PT) Equipment”, “Magnetic Particle Testing (MT) Equipment”, “Ultrasonic Testing (UT) Equipment”, our specifically designed flawed specimen test components and “American Welding Society (AWS) Tool Kit”.





Ultrasonic Testing (UT) Equipment



Flawed Specimen Test Components



Course Coordinator

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