COURSE OVERVIEW PE0405

Introduction to Crude Treatment Facilities - Fundamental (E-Learning Module)

Course Title

Introduction to Crude Treatment Facilities – Fundamental (E-Learning Module)

Course Reference

PE0405

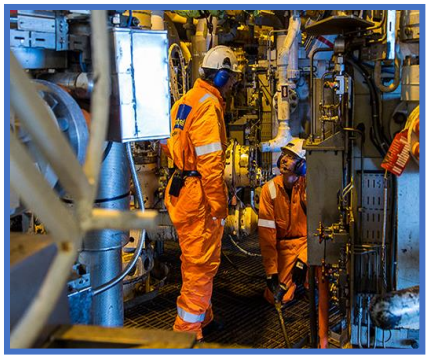
Course Format & Compatibility

SCORM 1.2. Compatible with IE11, MS-Edge, Google Chrome, Windows, Linux, Unix, Android, IOS, iPadOS, macOS, iPhone, iPad & HarmonyOS (Huawei)

Course Duration

30 online contact hours
(3.0 CEUs/30 PDHs)

Course Description



This E-Learning is designed to provide participants with a detailed and up-to-date overview of crude treatment facilities. It covers the field production phase, flow test, manifold's configurations, design and selection of gas oil separation plant and surface production facilities and typical oil production facility flow diagram; the three-phase separation with heating and desalting, efficient desalting system, separation and sweetening, heating control system and oil and gas separation; the horizontal separator (two-phase), vertical separator, spherical separator, two barrels two-phase separator, separator's internals and inlet diverter; and the procedure for sizing horizontal separators, selection of horizontal separator, model of a vertical separator and approximate shell length from liquid level height.

Further, the course will also discuss the crude oil desalting and treatment; the factors to be studied prior selection of oil treatment method; the vertical treater, horizontal heater and electrostatic-treater schematic, heat exchangers, flow arrangement, produced- water treating systems and skimmer sizing equations; the heavy oil treatment facilities, heavy and extra-heavy crude oils, flare operation and flare system major components; the hydraulic design, knock-out drum, liquid seal, flare system purge requirements, flare types and tip design, integrated pilot system and flare recovery system; and the other flaring reduction best practices, flare operation and flare maintenance.

During this interactive course, participants will learn the various types of compressors, induced gas flotation (IGF), cyclonic separation, pressure tank, tank accessories, stress analysis and internal piping design; the KOC operational facilities colour coding standards for different flow lines; the piping fundamentals, selection of piping materials, engineering materials and most commonly used materials in refineries; the flanges, bolts & gaskets, valves, piping layout, insulation, filters and strainers, correction factors and pump head requirements; the effect of doubling positive displacement pump speed on pump system operating point; the effect of two identical positive displacement pumps operating in parallel; and the effect of bringing positive displacement pump in line in parallel with identical operating pump

Course Objectives

At the end of this course, the Trainee will be able to:-

- Apply and gain a fundamental knowledge on crude treatment facilities
- Explain the main purpose and function of the Crude Treatment Facilities (Gathering Centres, EPFs, Heavy Oil Treatment Facilities, etc.)
- Describe process and design of oil routes and main equipment associated with the crude treatment systems from inlet lines to export (oil receiving systems, separation system, storage and export system, etc.)
- Describe process and design of the gas route through the crude treatment facility from inlet lines to export (gas compression system, CRU, TV compressor, flare system, gas export to booster stations, etc.)
- Describe process and design of the water route through the crude treatment facility from inlet lines to export (water knockout system, Induced Gas Floatation (IGF), hydro-cyclones, corrugated plate Interceptor, etc.)
- Explain KOC operational facilities colour coding standards for different flow lines.
- Describe types and functions of equipment associated with crude treatment facilities (valves, pipes, pumps, compressors, flanges, filters, strainers, and other rotating and stationary equipment)
- Describe working principals of tanks, separators, pumps, compressors and other related equipment
- Discuss wellhead, flow line and inlet manifold including intermediate casing, tubing head, christmas tree, flow control and chokes
- Illustrate field production phase, flow test, manifold's configurations, design and selection of gas oil separation plant and surface production facilities and typical oil production facility flow diagram
- Describe three-phase separation with heating and desalting, efficient desalting system, separation and sweetening, heating control system and oil and gas separation
- Identify horizontal separator (two-phase), vertical separator, spherical separator, two barrels two-phase separator, separator's internals and inlet diverter

- Apply procedure for sizing horizontal separators, selection of horizontal separator, model of a vertical separator and approximate shell length from liquid level height
- Carryout crude oil desalting and treatment and identify the factors to be studied prior selection of oil treatment method
- Discuss vertical treater, horizontal heater and electrostatic-treater schematic, heat exchangers, flow arrangement, produced- water treating systems and skimmer sizing equations
- Describe heavy oil treatment facilities, heavy and extra-heavy crude oils, flare operation and flare system major components
- Recognize hydraulic design, knock-out drum, liquid seal, flare system purge requirements, flare types and tip design, integrated pilot system and flare recovery system
- Employ other flaring reduction best practices, flare operation and flare maintenance
- Identify the various types of compressors, induced gas flotation (IGF), cyclonic separation, pressure tank, tank accessories, stress analysis and internal piping design
- Discuss KOC operational facilities colour coding standards for different flow lines
- Identify piping fundamentals, selection of piping materials, engineering materials and most commonly used materials in refineries
- Determine flanges, bolts & gaskets, valves, piping layout, insulation, filters and strainers, correction factors and pump head requirements
- Discuss the effect of doubling positive displacement pump speed on pump system operating point, two identical positive displacement pumps operating in parallel and bringing positive displacement pump in line in parallel with identical operating pump

Who Should Attend

This course provides a basic overview of crude treatment facilities for engineers, supervisors and operators.

Training Methodology

This Trainee-centered course includes the following training methodologies:-

- Talking presentation Slides (ppt with audio)
- Simulation & Animation
- Exercises
- Videos
- Case Studies
- Gamification (learning through games)
- Quizzes, Pre-test & Post-test

Every section/module of the course ends up with a Quiz which must be passed by the trainee in order to move to the next section/module. A Post-test at the end of the course must be passed in order to get the online accredited certificate.

Course Certificate(s)

Internationally recognized certificates will be issued to all participants of the course.

Certificate Accreditations

Certificates are accredited by the following international accreditation organizations: -

- USA International Association for Continuing Education and Training (IACET)

  Haward Technology is an Authorized Training Provider by the International Association 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 1-2013 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 1-2013 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 Association 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.

- 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 Fee

As per proposal

Course Contents

- Wellhead, Flow Line and Inlet Manifold
- Wellhead and Flow Control Equipment: Flowing Wells
- Wellheads
- High-Pressure Wellhead
- Low Pressure Wellhead
- Wellhead Equipment - A Typical Wellhead
- Casing Heads
- Casing Hangers
- Intermediate Casing
- Tubing Head
- Christmas Tree
- Christmas Trees Assembly
- Flow Control
- Chokes
- Types of Chokes
- Adjustable Chokes
- The advantage of using an adjustable choke
- Choke Selection and Sizing
- Flow-Rate Calculation
- Quiz-1
- Arrangement and Working of Multiport Flow Selector (MPFS) Valve in Production Manifold
- Field production phase
- Flow Test
- Manifold's Configurations
- Design and Selection of Gas Oil Separation Plant and Surface Production Facilities
- Typical Oil Production Facility Flow Diagram
- Gas Oil Separation Plant
- Three-phase separation with heating and desalting
- An Efficient Desalting System

- Separation and Sweetening by Cold Stripping with Associated Gas
- Heating Control System
- Heating Control Loop Block Diagram
- General Control Loop Block Diagram
- Oil and Gas Separation
- Horizontal Separator (Two-phase)
- Vertical Separator
- Spherical Separator
- Two Barrels Two-phase Separator
- Separator's Internals
- Inlet Diverter
- Separator's Internals – Wave Beaker plates
- Wire Mesh Mist Eliminator
- Typical Mist Extractor
- Centrifugal Mist Eliminator
- A Coalescing Pack Mist Extractor
- Design & Selection of a Two-phase Horizontal Separator
- Seam-to-Seam Length and Slenderness Ratio
- Procedure for Sizing horizontal Separators
- Selection of Horizontal Separator
- Model of a Vertical Separator
- Approximate shell length from liquid level height
- Vertical Separator
- Determination of Oil Pad Height
- Vortex Breaker
- Three-phase Oil & Gas Separation
- Quiz - 2
- Three-phase Horizontal Separation
- Bucket & Weir Design
- Gas Capacity
- Retention Time
- Settling Equation
- Procedures for Sizing Horizontal Three-phase Separator

- Mist Extractor
- Radial Gas Scrubber
- Vertical Gas Scrubber
- Case Study-1: Sand Separation in Surface Facilities for Heavy and Extra Heavy Oil
- Selection of a De-sander
- Quiz - 3
- Crude Oil Desalting and Treatment
- Crude Oil Desalting
- Case Study 2 - Desalter Interface Control
- Quiz – 4
- Crude Oil Treatment
- Factors to be studied prior selection of oil treatment method
- Vertical Treater
- Horizontal Heater-Treater Schematic
- Horizontal electrostatic Treater Schematic
- Heat Exchangers
- Flow Arrangement
- Types of Heat Exchangers
- Double Pipe Heat Exchanger
- Double Pipe Heat Exchanger Applications
- Shell and Tube Heat Exchanger
- Types of Shell Tube Heat Exchangers
- Shell and Tube heat Exchanger Applications
- Plate Heat Exchanger
- Plate Heat Exchanger Applications
- Spiral Heat Exchanger
- Spiral Heat Exchanger Applications
- Selection
- Maintenance
- Case Study 3 - SHELL & TUBE HEAT EXCHANGER STEADY-STATE
- Quiz - 5
- Produced- Water Treating Systems
- Case Study 4 - Waste water treatment plant Case study

- Produced-Water Treating Equipment
- Treating Equipment
- Vertical skimmer schematic
- Horizontal skimmer schematic
- Skimmer Sizing Equations
- Horizontal Rectangular Cross Section Tank
- Vertical Cylindrical Tank
- Parallel Plate Interceptor (PPI)
- Corrugated Plate Interceptor (CPI)
- A Typical CPI pack
- Cross-Flow Devices
- Free-Flow Turbulent Coalescers (SP Packs)
- Skim tank with SP Packs installed
- Heavy Oil Treatment Facilities
- Heavy and extra-heavy crude oils
- Special treatment unit
- Quiz - 6
- Flare Operation
- Typical Flows to Flare Systems
- Typical Flare System
- Flare System Major Components
- Typical Flare Header System
- Hydraulic Design
- Hydraulic Issues
- Knock-Out Drum
- Typical Knock-Out Drum
- Case Study 5 - Repair of a Vertical Knock-Out Drum
- Liquid Seal
- Flare System Purge Requirements
- Purge Requirements
- Purge Reduction Devices (Stack Seal)
- Flare Types
- Flare Tip Design

- Single Point Flare
- Air Flare
- Multi-Point Flare
- Enclosed Ground Flare
- Integrated Pilot System
- Pilot Assembly
- Flare System Operational Controls
- Flare System Monitoring Instrumentation
- Flare system operation monitoring
- Typical Flare Recovery System
- Flare Recovery System
- Other Flaring Reduction Best Practices
- Flare Operation
- Operation - Weather Effects
- Operational Flow Control
- Factors that can Affect Flame Stability
- Operating Hazards and Limitations
- Flare Maintenance
- Quiz - 7
- Gas Compression
- Introduction
- Objectives
- Classifications
- Definitions Related to a Compressor
- Types of Compressors
- Reciprocating Compressors
- Two Stages Compressor
- Advantages of Multi-staging
- Intercooling
- Efficiencies for Compressor
- Centrifugal Compressor
- Understanding Natural Gas Compressors
- Inside a compressor building

- Compression station yard
- Emergency shutdown valve on incoming pipeline
- Compressor station
- Case Study 6 - Compressor Station Optimization During Gas Injection into Underground Storage
- Quiz - 8
- Induced gas flotation (IGF)
- Froth Flotation
- Flotation Chart
- Cyclonic Separation
- Trajectory of suspension for the conventional hydrocyclone filtering device scheme
- Working Principals
- Internal Working of a Cyclone
- Factors Affecting Hydrocyclone Performance
- Corrugated Plate Interceptor
- Parallel Plate Interceptor
- Crude Oil Storage Tanks
- Vertical Fixed Roof Tank
- External Floating Roof Tank
- Contact Deck Internal Floating Roof Tank
- Pressure Tank
- Foundations for Above Ground Tanks
- Tank Design Data and Calculations
- Other Considerations
- Tank Shell Testing
- Tank Volume Calibration
- Tank Accessories – Valves, Instrumentation, Mixers and Appurtenances
- Valves, Instrumentation and Appurtenances Valve Types
- Maintenance, Inspection and Testing
- External Piping Design
- Stress Analysis
- Internal Piping Design
- Tank Heaters

- Tank Overfilling Protection
- Sizing of Vertical Tanks
- Case Study 7 - Crude Oil Storage – Sludge Happens Litigation, Asia
- Quiz - 9
- KOC operational facilities colour coding standards for different flow lines
- Piping & Flanges Fundamentals
- Piping Fundamentals
- Piping
- Selection of Piping Materials
- Engineering Materials
- Most commonly used materials in refineries
- Preparation of Standard PMS/VMS
- Flanges
- Types of Flanges
- Material
- Bolts & Gaskets
- Valves
- Piping Flexibility
- Piping Layout
- Insulation
- Materials Used for Insulation
- Case Study 8 - Piping and Distribution
- Quiz - 10
- Different Types of Valves used in Piping – A Complete Guide of Pipe Valves
- What is Valve?
- Types of Valves
- Gate Valve
- Globe Valve
- Check Valve
- Plug valve
- Ball Valve
- Butterfly Valve
- Needle Valve

- Pinch Valve
- Pressure Relief Valve
- Valves Types based on Functions
- Classification of Valves Based on Function
- Classification of Valves Based on Types of Actuator it Used
- New flow control valve addresses demanding oil well injection application
- Case Study - 9
- Filters and Strainers
- Transfer Pumps and Piping System
- Flow versus Head of a Centrifugal Pump
- Calculations of Hydraulic Friction Loss Factor
- Quiz - 11
- Pump Energy: Function in Head & Flow
- Quiz - 12
- Correction Factors
- Affinity Laws
- Cavitation in a Centrifugal Pump
- Case Study 10 - Detection of Cavitation in Centrifugal Pump by Fluid-Borne Noise Diagnostic
- Quiz - 13
- NPSH
- Quiz - 14
- Design of a Flow line
- Optimum Flowline Size
- Quiz - 15
- Pump Head Requirements
- Effective characteristic curve, two identical centrifugal pumps operating in parallel
- Non- identical centrifugal pumps in parallel
- Operating point for two identical centrifugal pumps operating in parallel
- Centrifugal pumps operating in series
- Effective characteristic curve for identical centrifugal pumps in series
- Operating points for two identical centrifugal pumps in series
- Non-identical positive displacement pumps in parallel
- Positive displacement pump characteristic curve

- Effect of doubling positive displacement pump speed on pump system operating point
- Effect of characteristic curve, two identical positive displacement pumps operating in parallel
- Effect of bringing positive displacement pump in line in parallel with identical operating pump