



COURSE OVERVIEW PE1008
Separator Design Considerations and Operations-PET-SF74
(E-Learning Module)

Course Title

Separator Design Considerations and Operations-PET-SF74 (E-Learning Module)

Course Reference

PE1008

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 course is designed to provide participants with a detailed and up-to-date overview of separator design consideration and operations. It covers the principal components of the separator and the positioning of oil and gas separator; the internal devices and separations aids for separator and functional descriptions of separators for O&G; the three-stage compressor train and glycol dehydration system; the advantages and disadvantages of horizontal and vertical separators; the vessel impact on separator performance and the processing of foamy crudes through separators; the two-phase separator designed for foam breaking; the effect of vessel size on slosh frequency; and the advantages and disadvantages of horizontal and vertical baffles for slosh mitigation.

Further, the course will also discuss the phase separation theory, retention-time method and droplet-settling method; the solids-removal or sand protection, maintenance and troubleshooting; the operation fundamentals of separators in the oil and gas industry; the general components and features of a separator; the principle of separator operation and the classification of oilfield separators; the monotube and dual tube oilfield separators; the functional, operating pressure and application classification of oilfield separators; the separation of oil from the gas, removal of gas from the oil, separation of the oil from water and maintenance of the optimum separator pressure; and the liquid seal in the separator.



During this course, participants will learn the methods to remove oil and gas using separators; the methods to remove gas from oil in separators; the measurement of flow in oil and gas separators and calibration of flow instruments in separator; the operations and maintenance of separators; and the periodic inspection for corrosion and erosion.

Course Objectives

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

- Apply and gain an in-depth knowledge on separator design considerations and operations
- Identify the principal components of the separator and positioning the oil and gas separator
- Recognize internal devices and separations aids for separator and the functional descriptions of separators for O&G
- Describe the three-stage compressor train and glycol dehydration system
- Explain the advantages and disadvantages of horizontal and vertical separators
- Determine the vessel impact on separator performance and process foamy crudes through separators
- Recognize two-phase separator designed for foam breaking
- Discuss the effect of vessel size on slosh frequency including the advantages and disadvantages of horizontal and vertical baffles for slosh mitigation
- Explain phase separation theory and apply retention-time method and droplet-settling method
- Employ solids-removal or sand protection, maintenance and troubleshooting
- Describe the operation fundamentals of separators in the oil and gas industry including the general components and features of a separator
- Apply the principle of separator operation and recognize the classification of oilfield separators
- Differentiate monotube versus dual tube oilfield separators and review functional, operating pressure and application classification of oilfield separators
- Separate the oil from the gas, remove the gas from the oil, separate the oil from water, maintain the optimum separator pressure and liquid seal in the separator
- Recognize the methods to remove oil and gas using separators and methods to remove gas from oil in separators
- Measure flow in oil and gas separators and calibrate flow instruments in separators
- Carryout operations and maintenance of separators and periodic inspection for corrosion and erosion

Who Should Attend


This course provides an overview of all significant aspects and considerations of separator design considerations and operations for those who are directly involved in supervising gas processing operations such as managers and process engineers who are mainly in charge of planning and development of new gas processing facilities or modifying existing facilities.

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: -


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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.

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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.

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 Fee

As per proposal

Course Contents

- Other Names for Separators
- Principal Components of the Separator
- Positioning of the Oil and Gas Separator
- Internal Devices and Separations Aids for Separator
- Separator Requirements
- Requirements of Separators
- Bulk Water Removal
- Functional Descriptions of Separators for O&G
- Separator Components
- Functions of a Separator
- Requirements of Separators
- Separator Depressurization
- GOM Process Train
- Bulk Water Removal
- Metering
- Three-stage Compressor Train
- Glycol Dehydration System
- Vertical vs. Horizontal Separators
- Advantages and Disadvantages of Horizontal and Vertical Separator

- Design Considerations
- Separator Inlet Zone
- Flow Distribution Zone
- Gravity / Coalescing Zone
- Outlet Zone
- Separator Performance
- Interior Vessel Impact on Separator Performance
- Foaming in Oil and Gas Separators – Bad News
- Signal Strength
- Processing Foamy Crudes through Separators
- Two-phase Separator Designed for Foam Breaking (Courtesy of CDS Separation Technologies Inc.).
- Solids and Salt Handling
- Corrosion in Oil and Gas Separators
- Sloshing
- Effect of Vessel Size on Slosh Frequency
- Advantages and Disadvantages of Horizontal and Vertical Baffles for Slosh Mitigation
- Level Controls for Oil and Gas Separators
- Typical Separator Level Settings
- Spacing of the Levels in Oil and Gas Separators
- Nomenclature
- Phase Separation Theory
- Retention-Time Method
- Droplet-Settling Method
- Horizontal Separators
- Overall Design Considerations
- Required Data
- Impurities
- Vessel Design
- Function
- Accessories
- Potential Problems
- CO₂-Rich Streams
- Solids-Removal or Sand Production

- Paraffins, Waxes, Hydrates
- Flow Variations
- Maintenance and Troubleshooting
- Maintenance
- Periodically
- Yearly
- Troubleshooting
- Low Liquid Level
- High Liquid Level
- Troubleshooting
- Low Pressure in Separator
- High Pressure in Separator
- All the Oil Going Out Gas Line
- Mist Going Out Gas Line
- Free Gas Going Out Oil Valve
- Gas Going Out Water Valve On 3-Phase
- Too Much Gas Going to Tank with the Oil
- Condensate and Water not Separating in 3-phase Separator
- Diaphragm Operated Dump Valve not Opening
- Nomenclature
- Operation Fundamentals of Separators in the Oil and Gas Industry
- Description
- Various Names for Separators or Similar Vessels
- Use at Oilfield Well Sites
- General Components and Features of a Separator
- Principle of Separator Operation
- Classification of Oilfield Separators
- Vertical Separator
- Horizontal Separator
- Spherical Separator
- Classification of Oilfield Separators
- Monotube vs. Dual Tube Oilfield Separators
- Functional Classification of Oilfield Separators
- Operating Pressure Classification of Separators

- Application Classification of Oilfield Separators
- Test Separators
- Low Temperature Separator
- Metering Separator
- Separating the Oil from the Gas
- Removing the Gas from the Oil
- Removing the Gas from the Oil – Coalescer
- Coalescer
- Separating the Oil from the Water
- Maintaining the Optimum Separator Pressure
- Maintaining the Liquid Seal in the Separator
- Methods to remove Oil and Gas Using Separators
- Density Differences – Gravity Separation
- Impingement Methods
- Flow Direction Change
- Use of Centrifugal Force
- Methods to Remove Gas from Oil in Separators
- Agitation Process to Separate Nonsolution Gas
- Heat Effect in the Separator Process
- Centrifugal Force for Separators
- Measurement of Flow in Oil and Gas Separators
- Calibration of Flow Instruments in Separators
- Operations and Maintenance (O&M) of Separators
- Periodic Inspection for Corrosion and Erosion
- Installing Safety Devices
- Low Temperature Precautions
- Corrosive Fluid Precautions
- Horizontal Three Phase Separator Schematic
- Vertical Three Phase Separator Schematic
- Controls and Features for Oil and Gas Separators
- Valves
- Emergency Shutdown (ESD) Valves
- Accessories for Oil and Gas Separators
- High- and Low-Level Controls for Separators

- High and Low Temperature Controls for Separators
- Safety Relief Valve on Oil and Gas Separators
- Safety Heads and Rupture Disks on Separators
- Instrumentation and Control System
- Vessel Instrumentation
- Pressure Control
- Level Control
- Oil Level Control
- Level Control
- Level Measurement
- Level Transmitter
- Level Indication
- Level Switches
- Level Control Settings
- Flow Control
- Process Monitoring
- Control Valve Standard
- Liquid Levels Definition
- Safety Devices in Separator
- Comparison of Vertical and Horizontal Support Structures
- Geometry
- Prv Built Up Backpressure
- Process Design Considerations
- Pressure Nomenclature
- Normal Operating
- Maximum Operating
- Design Pressure
- Process Design Conditions
- Sizes and Capacities
- Level Control Settings
- P&ID
- Phase Separation
- Separator
- Functions

- Characteristics of Flow Stream
- Well Production
- Well Fluids
- Natural Gas Solubility
- Separation Terminology
- Factors Affecting Separations
- Gas Liquid Separations Principles
- Separation Mechanisms
- Separator Classification
- Classification of Separators
- Based on Geometry
- Vertical Separator
- Horizontal Separator
- Horizontal Separator with a Boot or Water Pot
- Double Barrel Separator
- Advantage and Disadvantage of Horizontal Separator
- Spherical Separator
- Separator Types Comparing
- Separator Types and Selection Guide
- Classification of Separators
- Based on Application
- Test Separator
- Well Manifold
- Production Separator
- Low Temperature Separator
- Free Water Knock Out Drum
- Free Water Knockout
- No Emulsion Treatment
- Emulsion Treatment by Heating
- Total Liquid Knockout
- Foam Separator
- Filter Separator
- Based on Function
- Two Phase Horizontal Separator

- Two Phase Vertical Separator
- Three Phase Separator
- Operating Pressure
- Multi Stage Separator
- Single Stage Separator
- Knockout Drum
- Flare Knockout Drum
- Slug Catcher (Finger Type)
- Slug Catcher (Vessel Type)
- Scrubber
- Compressor Suction Scrubber
- Filter
- Skimmer
- Gas Liquid Ratio
- Process Vessels Design Considerations
- Process Vessels -Types and Functions
- Separation
- Accumulation
- Reaction
- Process Vessels- Vapor Liquid Separation
- Vertical Separators
- Horizontal Separators
- Gas Liquid Separator
- Example Vertical Separator with Wire Mesh Mist Extractor
- Process Vessels- Solid Liquid Separation
- Process Vessels - Design Considerations
- Design Orientation
- Process Vessels Sizing Criteria
- Vapor Velocity
- Process Vessels Sizing Criteria
- Liquid Hold-Up Time
- Liquid Setting Space
- Liquid Settling
- Design Pressure

- Maximum Allowable Working Pressure
- Process Vessels Calculations
- Expansion Factor Chart
- Trail Vessel Size
- Check Vapor Velocity
- Water Draw Off Pot
- General Tips in Process Vessels Design
- Typical Operating Problems
- Design Temperature and Pressure
- Details of the 5 incidents
- Hydro Test of a New Vertical Vessel
- Emptying of a Vertical Tank
- Quantifying Separation Performance
- Gas/Liquid Separator
- Introduction
- Separator Parts
- Flow Pattern and Entrainment
- Flowpipe Geometry
- Entrainment
- Droplet Sizes and Distribution
- Inlet Device
- Inlet Device Separation Efficiency
- Figure 9 Inlet Devices Liquid Separator Efficiency and Effect on Droplet Sizes
- Gas Gravity Separation Section
- Droplet Settling Calculations
- The Relationship of the Drag Coefficient (c_d) to the Reynolds Number (Re_p) for Spheres
- Droplet Setting Calculation
- Separator
- Mist Extractor
- Mesh Pads
- Use of Different Mist Extractor Types in Series
- Liquid Gravity Separation Section
- Quantification of Gas Entrainment into Liquid by a Plunging Jet

- Handling Intermittent Flow
- The Smoothing Out of Intermittent Feed Flow
- Table 6 Design Factors to Account for Unsteady Flow
- Conclusion
- Separator Configurations and Sizing
- Configurations
- Horizontal Separators
- Vertical Separators
- Horizontal Three Phase Separators with Boot
- Horizontal Three Phase Separators with Overflow Weir
- Horizontal Three Phase Separators with Overflow Weir and Bucket
- Horizontal Three Phase Separators with Coalescer
- Factors that Determine Vessel Orientation
- Advantage of Vertical Separators
- Advantage of Horizontal Separators
- Separator Sizing
- Data and Information Required to Specify and Size Separators
- Criterion for Horizontal Three Phase Separator Sizing
- Vapor Liquid Separation Zone Without Mesh
- Liquid-Liquid Separation Zone Conventional
- Liquid-Liquid Separation Zone with Boot
- Liquid-Liquid Separation Zone with Overflow Weir
- Gas/Liquid Separation Theory
- Liquid Droplet Settling
- Liquid Retention Time
- Oil/Water Separation Theory
- Oil Drop/Water Drop Settling
- Oil/Water Retention Time
- Separator Sizing: Two-Phase Separator
- General Sizing Procedure
- Vertical Separator Sizing Procedure
- Example of Separator Selection
- Horizontal Separator Sizing Procedure
- Example of Separator Selection

- Separator Internals
- Sections of Separator
- Primary Separation Section
- The Velocity
- The Pressure
- The Change
- Secondary Separation Section
- Retention Time
- Mist Extraction Section
- Liquid Accumulation Section
- Mechanical Devices
- Components of Separator
- Inlet Diverters
- Cyclonic Inlet Diverters
- Half Pipe Inlet Diverters
- Efficiency
- Straightening Vanes
- Mist Extractor
- Features of Impingement Type Mist Extractors
- Foam Breaker
- Vortex in Vessels
- Vortex Breaker
- Sand Jets and Drains
- Weir
- Troubleshooting Oil and Gas Separators
- Separation of Phases
- Vapor + Liquid
- Vapor-Liquid Separation
- Gas Liquid Separators
- Gravity Settling
- Souders-Brown Approximation
- Liquid/Liquid Separations
- Fluid-Fluid Separators
- Three Phase Separators

- Horizontal Three-Phase Separator
- Figure 5.2 Horizontal Three Phase Separator Schematic
- To Water Disposal
- Separator Purpose's
- Separator's Must Perform the following
- Horizontal Separator
- A well Stream Separator Must
- Three Phase Separators Introduction
- Zones
- Three Phase Separator General Figure
- Factors Affecting Separator Efficiency
- Factors Flow Pattern at Separator Inlet
- Factors Feed Pipe Geometry
- Factors Inlet Devices
- Inlet Devices
- Review of Inlet Devices Diverter Plate
- Inlet Devices Half Pipe
- Inlet Devices Vane Distributor
- Inlet Devices Inlet Cyclone
- Comparison of Inlet Devices
- Factors Other Internals
- Factors Entrainment
- Factors Misc.
- Foam in Oil Gas Separators
- Foam in Crude Oil
- Foaming in a Separating Vessel is a Three-Fold Problem
- Foaming Tendency
- How to Overcome this Foamy Crude Phenomenon?
- Defoaming Plates in 3-phase Separator
- Operation Problems
- Retention Time
- Sizes and Capacities
- Potential Problems
- Maintenance and Troubleshooting
- Troubleshooting