COURSE OVERVIEW PE0984
Gas Processing and Compression (E-Learning Module)

Course Title
Gas Processing and Compression (E-Learning Module)

Course Reference
PE0984

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 an up-to-date overview of gas processing and compression. It covers the process raw natural gas and pound of air pollutants produced per billion Btu of energy; the environmental advantages of natural gas and the major natural gas reserves by country and world energy consumption by fuel; the distribution of natural gas from well head through consumption; the composition of natural gas resources; the natural gas classification. processing and the principal products; and the combustion characteristics, API gravity, brent crude oil specification, purification, and inlet liquid handling facilities.

During this course, participants will learn the nature of hydrates and the major conditions affecting hydrate formation; the prediction of hydrate formation using gas gravity (relative density), hydrate inhibition and dehydration by absorption; the process of molecules reaching the interior of the adsorbent; the typical concentration versus time curve at an adsorber outlet; the important properties of a silica gel and molecular sieve; the dehydration, mercury removal and the importance of de-hydration unit; the de-hydration schematic; the reasons for dehydrating gas, choice of glycol and problems encountered; the hydrostatic testing and gas processing; and the types of water used and natural gas components.

Course Objectives

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

- Apply and gain a comprehensive knowledge on gas processing and compression
- Explain why it is necessary to process raw natural gas and identify pounds of air pollutants produced per billion Btu of energy
- Identify the environmental advantages of natural gas and the major natural gas reserves by country and world energy consumption by fuel
- Describe the distribution of natural gas from well head through consumption
- Determine the composition of natural gas resources of the lower-48 United States
- Employ natural gas classification and processing as well as identify the principal products
- Describe combustion characteristics, API gravity, brent crude oil specification, purification, and inlet liquid handling facilities
- Discuss the nature of hydrates and the major conditions affecting hydrate formation
- Predict hydrate formation using gas gravity (relative density) and employ hydrate inhibition and dehydration by absorption
- Explain how the molecules reach the interior of the adsorbent
- Differentiate typical concentration versus time curve at an adsorber outlet
- Identify the important properties of a silica gel and molecular sieve
- Carryout dehydration and mercury removal and explain the importance of de-hydration unit
- Review de-hydration schematic and discuss the reasons for dehydrating gas, choice of glycol and problems encountered
- Perform hydrostatic testing and gas processing as well as recognize types of water used and natural gas components

Who Should Attend

This course is intended for those seeking a complete and detailed overview of the various operations that take place in the oil and gas fields. This includes managers, engineers, supervisors and other technical staff. Further, the course is very useful for new recruits and for those who just started to handle responsibilities related to oil and gas operations.

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.

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

- Natural Gas Processing
- Why it is necessary to process raw natural gas?
- Pounds of Air Pollutants Produced Per Billion Btu of Energy
- Environmental Advantages of Natural Gas
- The World Picture for Natural Gas - World Total output of Primary Energy
- Major Natural Gas Reserves by Country
- World Natural Gas Production - Data (billion cubic feet) for 1998
- Natural gas in the World
- World Energy Consumption by Fuel
- The distribution of natural Gas from well head Through consumption
- Natural Gas in the United States - Data for 2000
- Origin
- Composition
- Natural Gas Composition
- Composition of Natural Gas Resources of the Lower-48 United States
- Natural Gas Classification
- Natural Gas Processing and Principal Products
- Generic Raw Gas and Product Slate

- Product Specifications
- Pipeline Quality Gas
- Trace Components
- Other Characteristics
- Combustion Characteristics
- API Gravity
- Brent Crude Oil Specification
- Purification
- Inlet Liquid Handling Facilities
- Dehydration
- Hydrates
- The Nature of Hydrates
- The Major Conditions Affecting Hydrate Formation
- Prediction of Hydrate Formation Using Gas Gravity (Relative Density)
- Hydrate Inhibition
- Dehydration by Absorption
- Glycol Absorption Unit
- How the Molecules Reach the Interior of the Adsorbent?
- Zones in an Adsorbent Bed
- Adsorption Disadvantages
- Properties of Industrial Adsorbents
- The Three Zones in an Adsorber
- Typical Concentration versus Time Curve at an Adsorber Outlet
- Important Properties of a Silica Gel and Molecular Sieve
- Dehydration and Mercury Removal
- The Purpose of the De-hydration Unit
- Process Introduction
- Process Description
- De-hydration Schematic
- Glycol Units
- Reasons for Dehydrating Gas
- Choice of Glycol
- Gas Dehydration
- Problems Encountered

- Treatment
- K-437
- Summary
- Gas Sweetening Units / Amine Units
- Amine Units
- Typical Alkanolamines
- Gas Scrubbing Unit
- Problems
- Hydrostatic Testing
- Types of Water Used
- Recommendations
- Discharging Hydrotest Waters
- Similar Applications
- Gas-Handling Facilities
- Natural Gas Components
- Design of Gas-Handling Systems & Facilities
- Gas Impurities
- Gas Processing
- Principles of Gas Processing
- Separation
- Metering
- Gas Gathering
- Processing
- Typical Meter Station
- Contaminants
- Water
- Liquid Desiccants
- Absorption
- Solid Bed Desiccants
- Molecular Sieve Bed
- Tow-Tower Solid Desiccant Dehydration Unit
- Chemical Reaction Processes
- Batch Processes
- Lo-Cat Process

- Principles of Gas Processing Operation
- Cryogenics
- Cryogenic Processing
- Expander Process
- Refrigerant
- Lean Oil Absorption
- Fractionation Flow
- Glycol Dehydration Unit Operation
- Liquid Desiccants
- Glycol Dehydration Process
- Gas Flow
- Glycol Flow
- Dew Point
- Dew Point Temperature
- Dew Point Depression
- Process Variables
- Water Vapor Content of Natural Gas at Saturation
- Inlet Glycol Temperature
- Glycol Concentration
- Glycol Dehydration Control - Inlet Separator
- Contactor Column
- Tray with Bubble Caps
- Bubble Cap
- Packed Contractor Column
- Structured Packing
- Mist Eliminator
- Glycol Carryover
- Gas-Condensate-Glycol Separator
- Regenerator
- Still Column Flooding
- Surge Tank
- Glycol/Gas Heat Exchanger
- Water Content
- Mono Ethanol Amine (MEA)

- Di Ethanol Amine (DEA)
- Tri Ethanol Amine (TEA) and Methyl Di Ethanol Amine (MDEA)
- Absorption
- Heat Transfer
- Basic process
- Inlet separator
- Tray Contractor Column
- Flash Tank
- Lean / Rich Heat Exchanger
- Stripper Column
- Re-boiler
- Reclaimer
- Surge Tank
- Gas / Liquid Separators
- Separators
- Types of Separators
- Recycling Separator
- Internals
- Separator Internals
- Knitted Wire Mesh
- Disengaging Space
- Cyclone Separators
- Separator Sizing
- Gas Capacity - Vertical Separators
- Residence Time (Liquid Retention Time)
- Products
- Separator Case Studies - Problem # 1: Vertical 2-Ph Separator
- Separator Case Studies - Problem # 2: Vertical 3-Ph Separator
- Separator Case Studies - Problem # 3: Horizontal 2-Ph Separator
- Separator Case Studies - Problem # 4: Horizontal 3-Ph Separator
- Slug Catcher
- Surge/Slug Capacity
- Flow Regimes
- Flow Regime Map

- Vertical Flow Regimes
- Vertical Flow Regime Map
- Twister Supersonic Separator
- Twister Supersonic Separator – Benefits
- Twister Supersonic Separator – System Design
- Twister Supersonic Separator – Process Flow Diagram of a Typical Twister System
- Twister Supersonic Separator – Cross section of a twister tube
- Principles of Gas Processing Operation
- Separation
- Three – Phase Vertical Separator
- Metering
- Gas Gathering
- Processing
- Typical Meter Station
- Contaminants
- Water
- Hydrogen Sulfide
- Non-Combustible Inert Gases
- Removal of Water
- Liquid Desiccants
- Solid Bed Desiccants
- Molecular Sieve Bed
- Solid Desiccant Dehydrators
- Methanol Injection
- Removal of Hydrogen Sulfide (H2S)
- Chemical Reaction Processes
- Basic Process
- Membrane Separation Process
- Batch Processes
- Iron Sponge
- Lo – cat process
- Removal of Non-Combustible Inert Gases
- Questions (to be answered}

- Principles of Gas Processing Operation
- Cryogenics
- Natural Gas Stream
- Cryogenic Processing
- Expander Process
- Refrigeration
- Refrigerant
- Lean Oil Absorption
- Fractionation Flow
- Fractionation
- Glycol Dehydration Unit Operation
- Liquid Desiccants
- Natural Gas Dehydration
- Glycol Dehydration process
- Gas Flow
- Glycol Flow
- Dew Point
- Dew Point Temperature
- Dew Point Depression
- Process Variables
- Inlet Gas Temperature
- Water Vapor Content of Natural Gas at Saturation
- Inlet Gas Pressure
- Gas Flow Rate
- Inlet Glycol Temperature
- Glycol Concentration
- Glycol Circulation Rate
- Glycol Dehydration Unit
- Glycol Dehydration Control
- General
- Inlet Separator
- Contactor Column
- Tray Contactor Column
- Packed Contactor Column

- Gas-Condensate-Glycol Separator
- Gas – Condensate – Glycol Separator
- Filters
- Solids Removal
- Dissolved Contaminants Removal
- Regenerator
- Still Column Flooding
- Surge Tank
- Pumps
- Heat Exchangers
- Glycol/Gas Heat Exchanger
- Glycol/Glycol Heat Exchanger(s)
- Glycol Conditioning Reducing Glycol Losses
- Temperature and Pressure Conditions
- Inlet Gas Temperature
- Inlet Glycol Temperature
- Re-Boiler Temperature
- Still Overhead Temperature
- Heat Exchanger Temperature
- Contactor Pressure
- Regenerator Pressure
- Filter Pressure
- G-C-G Separator Pressure:
- Reducing Glycol Losses
- Glycol Tests
- Glycol Weight Percentage
- Water Content
- Hydrocarbon Content
- Salt Content
- Solids Content
- Iron Content
- Foaming
- Principles of Amine Sweetening
- Acid Gases in Natural Gas

- Gas Sweetening
- Alkanol Amines
- Mono Ethanol Amine (MEA)
- Di Ethanol Amine (DEA)
- Tri Ethanol Amine (TEA) And Methyl Di Ethanol Amine (MDEA)
- Absorption
- Distillation
- Heat Transfer
- Basic Process
- Amine Sweetening - Process Flow and Components
- Inlet Separator
- Contactor Column
- Tray Contactor Column
- Packed Contactor Column
- Flash Tank
- Filters
- Lean/Rich Heat Exchanger
- Stripper Column
- Tray Stripper Column
- Reflux Condenser/Accumulator
- Re-Boiler
- Reclaimer
- Surge Tank
- Trim Cooler
- Gas Sweetening
- Process Capabilities
- Acid Gases (H2S, CO2, CS2, COS & RSH)
- Amine Processes
- MEA Loading & Corrosion
- Sulfinol Sweetening Unit
- Amine Gas Sweetening Unit
- Case Study & Troubleshooting
- MEA Case Study
- DEA Case Study

- DGA Case Study
- MDEA Case Study
- Troubleshooting
- Specific Process and Troubleshooting
- Dirty Amine
- The Seeds of Destruction
- Dirty Amine Ruins Operation
- Foaming
- Plugged Instrument Taps
- Condenser Fouling
- Reboiler Tube Failures
- Filter Plugging
- Regenerator Flooding
- Corrosion Inhibitors
- Reboiler Corrosion
- Regenerator Feed Temperature
- Reclaimer Operation
- Washing the Reclaimer
- Extending Reclaimer Tube Life
- Using a Reclaimer Instead of a Filter
- Early Warning System
- Causes and Cures or Foaming
- Corrosion Inhibitors
- Silicone Antifoam
- Pumps
- Schematic Drawing of Centrifugal Pump
- Typical Centrifugal Pump
- Water Jackets
- Radial Flow
- Axial Flow
- Multi – Stage Pump
- Positive Displacement
- Positive Displacement Pump
- Packing Lubrication

- Safety Loop
- Acting Steam – Driven Piston Pump
- Power Plunger Pump
- Classification of Reciprocating Pump
- Piston Action in a Duplex Pump
- Piston Pump
- Backstroke
- Forward stroke
- Single – Acting Pump
- Double – Acting Pump
- Dampener
- Stuffing Box
- Plunger Pump
- Diaphragm Pump
- Suction Stroke
- Discharge Stroke
- Lobe pump
- Two – Screw Timed Pump
- Three Screw Pumps
- Casing with Seal
- Rotor Shaft Bearings
- Small Vertical Centrifugal Pump
- Centrifugal Pump
- Vertical Centrifugal Pump
- Plunger Pump Arrangement
- Mechanical Seal Assembly
- Dual, Closed Impellers
- Plunger Pump
- Power Driven Plunger Pump Cross-Section
- Double-Acting Piston Pump
- Mechanically Actuated Diaphragm
- Rotary Pumps
- Volute Centrifugal Pump
- Fluid Velocity Within A Volute Pump

- Single-Stage, Single-Inlet Volute Pump
- Diffuser Pumps
- Impeller Designs
- Vertical Pumps
- Double Suction Pump
- Two-Stage Volute Pump with Opposed Impellers
- Five-Stage Volute Pump
- Volute Pump with Horizontally Split Casing
- High Pressure Nine-Stage Barrel-Type Feed Pump
- Barrel Pump Casing Arrangement
- Vertical Axial Flow Pump
- Mixed Flow Pump
- Wearing Rings
- Impeller and Casing Wearing Rings (Courtesy of Allis-Chalmers Mfg. Co.)
- Stuffing Box with Packing
- Stuffing Box with Lantern Ring
- Pumped Liquid to Seals
- Shaft Sleeve
- Rotating Steel
- Stationary Seal
- Self-Aligning Shell Bearing
- Single-Stage Centrifugal Pump with Ball Bearings
- Unbalanced Axial Thrust
- Balanced Axial Thrust
- Balancing Drum
- Simple Balancing Disc
- Pump with Check Valve and Separate Recirculation Control Valve
- Pump with Automatic Recirculation Valve
- ARC Valve Cutaway
- Pump Priming Methods
- Liquid Head and Pressure in a Tank
- Pump Static Head Arrangements
- Static Discharge Head Above Liquid Level
- Pressure Heads on a Pump

- Gas Dehydration & TEG Regeneration Units First Impression
- Condensate Stabilization
- Fixed Roof Tanks (Limitation of Use)
- External Floating Roof tanks (Limitation of Use)
- Safety
- Safety - Fire and explosion
- Safety – Ignition Sources
- Safety – Oxygen
- Safety – Combustible Material
- Safety – Hydrogen Sulphide (H2S) Awareness
- Safety – Nitrogen (N2) Awareness
- Safety – Personal Protective Equipment (PPE)
- Safety – Positive Isolation
- Safety – Safe Draining
- Safety – Vessel Entry
- Safety – Temporary Hose Connections
- Safety – Static Electricity
- Safety – Pyrophoric Iron Sulphide
- Safety – Purging
- The Effect of Pressure and Temperature on the Water Content of Gas