COURSE OVERVIEW PE0631
Flaring System Operation - Advanced (E-Learning Module)

Course Title
Flaring System Operation - Advanced (E-Learning Module)

Course Reference
PE0631

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 advanced overview of flaring system operation. It covers the start-up, monitor, shutdown and troubleshooting of flaring systems and equipment including elevated and ground flare systems, incinerators and equipment; resolving operational problems like iced lines, high levels in pots/vessels, smoke from flare, flame out, lack of header purge flow, flash back, inconsistent header composition, blockage and cold feed to warm header; the process safety implications of working with flare system and associated equipment; and the key components and purpose of relief and flare systems.

Further, the course will discuss the pressure recommendations; the relief and flare system codes and standards; the general types of pressure safety valve design; the rupture pins to rupture discs; the relief valve troubleshooting checklist; the flare drum, knock-out drum, flare, purge gas system and hydraulic and gas seals; the molecular seal/purge reduction device, pilots and ignition system, relief system discharge and the types of flares and main components; the elevated flares, steam assisted flares, unassisted flares, single-point flares, multi-point flares, sonic flare, ground flare, combination systems, cold vent, burn pit and sizing criteria; and the acceptable radiation levels including solar radiation.

During this interactive course, participants will learn the flare sizing and design, flow rate and gas composition; the calculation procedures, flare system operational considerations, flare operation, pilot assembly and flare system operational controls; the flare system operation monitoring, flare system monitoring instrumentation, flare operation and operational flow control; the factors that can affect flame stability including operating hazards and limitations and flaring efficiency; the blowdown operation consideration, environmental considerations, flaring impacts on health, safety and environment, flare performance testing and reliability; the process safety fundamentals, dangerous substances in the business and process safety concepts; the process integrity, plant and equipment, incident impacts, incident distribution and iceberg concept; the hazard barrier diagram, layers of safety, stages of safety, inherent safety principles, layers of protection; the process relief and flare, relief and blowdown valves, pressure terminology and the various types of pressure relief devices; the conventional pressure relief valves including pilot, piston - type pilot and diaphragm - type pilot - operated pressure relief valve; the balanced bellows pressure relief valve, balanced bellows with auxiliary balancing piston, power - actuated pressure relief valves and temperature - actuated pressure relief valves; the pressure vacuum vent valves, rupture disk, rupture and buckling pin relief valves, blowdown valve and flare and atmospheric ventilation; the flare system control, safety and maintenance; and the safe purging, vessel maintenance, flare gas recovery and zero flaring system.

Course Objectives

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

- Apply and gain an advanced knowledge on flaring system operation
- Demonstrate a significant understanding of operating and monitoring elevated (HP and LP, single point and multipoint, smokeless and non-smokeless, air-assisted and steam-assisted, COANDA), incinerators and ground (burn-pits) flare systems
- Explain the purpose and working of flare system equipment (safety relief devices, headers (warm/cold, high pressure/low pressure (HP/LP) and wet/dry), knock out drum, flare tip (single point, multipoint and enclosed), stack seals, pilot system, blowers, steam systems, monitoring instrumentation, recovery systems, drains, pumps, pilot fuel/emergency fuel systems, purge systems, interlocks and other safety systems, ignition systems and liquid burners/systems).
- Perform start-up, monitor, shutdown and troubleshooting of flaring systems and equipment including elevated and ground flare systems, incinerators and equipment
- Resolve operational problems like iced lines, high levels in pots/vessels, smoke from flare, flame out, lack of header purge flow, flash back, inconsistent header composition, blockage and cold feed to warm header etc
- Describe the process safety implications of working with flare system and associated equipment
- Recognize the key components and purpose of relief and flare systems
- Set pressure recommendations and discuss relief and flare system codes and standards
- Identify the general types of pressure safety valve design and compare rupture pins to rupture discs

- Review relief valve troubleshooting checklist and determine flare drum, knock-out drum, flare, purge gas system and hydraulic and gas seals
- Describe molecular seal/purge reduction device, pilots and ignition system, relief system discharge and the types of flares and main components
- Determine elevated flares, steam assisted flares, unassisted flares, single-point flares, multi-point flares, sonic flare, ground flare, combination systems, cold vent, burn pit and sizing criteria
- Discuss the acceptable radiation levels including solar radiation as well as illustrate the flare sizing and design, flow rate and gas composition
- Employ calculation procedures, flare system operational considerations, flare operation, pilot assembly and flare system operational controls
- Apply flare system operation monitoring, flare system monitoring instrumentation, flare operation and operational flow control
- Identify the factors that can affect flame stability including operating hazards and limitations and flaring efficiency
- Discuss the blowdown operation consideration, environmental considerations, flaring impacts on health, safety and environment, flare performance testing and reliability
- Explain process safety fundamentals, the dangerous substances in the business and process safety concepts
- Determine process integrity, plant and equipment, incident impacts, incident distribution and iceberg concept
- Illustrate hazard barrier diagram, layers of safety, stages of safety, inherent safety principles, layers of protection
- Identify process relief and flare, relief and blowdown valves, pressure terminology and the various types of pressure relief devices
- Recognize conventional pressure relief valves including pilot, piston - type pilot and diaphragm - type pilot - operated pressure relief valve
- Describe balanced bellows pressure relief valve, balanced bellows with auxiliary balancing piston, power - actuated pressure relief valves and temperature - actuated pressure relief valves
- Discuss pressure vacuum vent valves, rupture disk, rupture and buckling pin relief valves, blowdown valve and flare and atmospheric ventilation
- Carryout flare system control, safety and maintenance as well as safe purging, vessel maintenance, flare gas recovery and zero flaring system

Who Should Attend

This course provides an overview of all significant aspects and considerations of advanced flaring system operation for operations personnel, supervisors & engineers, maintenance personnel & supervisors, senior plant supervisors, operations process support engineers, design engineers, cost engineers and other professionals who are involved in the design, operation and maintenance of flare, blowdown and pressure relief systems.

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

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 Contents

- Key Components of Relief and Flare Systems
- Course Introduction & Pre-assessment
- Relief and Flare System
- Purpose of Typical Relief and Flare Systems
- Combustion
- Fields of Application
- Relief and Flare System Terminologies
- Pressure Terminology
- Maximum allowable working pressure (MAWP):
- Design pressure
- Set pressure
- Overpressure
- Back pressure
- Accumulation
- Burst pressure
- Simmer
- Chattering
- Blowdown
- Superimposed Back Pressure

- Built-up Back Pressure
- Set Pressure Recommendations
- ASME Code Section VIII Division 1 Pressure Vessels (External Fire)
- Piping per ASME/ANSI B31.3
- Relief and Flare System Codes and Standards
- Applicable Codes and Standards
- Code Requirements
- Key Components of Relief and Flare Systems
- Flare System Flow Diagram
- P&ID of Typical Flare System with Elevated Flare
- Relief Devices
- General Types of Pressure Safety Valve Design
- Direct acting type
- Pilot operated type
- Relief Devices
- Types of Pressure Safety Valves
- Conventional
- Balanced
- Spring Operated Valves
- Conventional Relief Valve
- Pros & Cons: Conventional Valve
- Balanced Bellows Type
- Bellows Relief Valve
- Pros & Cons: Balanced Bellows Valve
- Advantages
- Disadvantages
- Piston Type: Pilot Operated Safety Relief Valve
- Pros & Cons: Pilot Operated Valve
- Rupture Devices
- Conventional Metal Rupture Disc
- Rupture Disc
- Rupture Discs are Well Suited for Some Applications
- Typical RD/PRV Installation

- Rupture Pins
- Conventional Rupture Pin Device
- Comparison of Rupture Pins to Rupture Discs
- Potential Uses for Rupture Pins
- Relief Valve Troubleshooting: Chatter
- Chatter - Principal Causes
- Causes of Chatter
- Chatter Mechanism
- Chatter Solutions
- Chatter: Non-Piping Solutions
- Chatter Solutions: Excessive Built-up Back Pressure
- Causes of Chatter: Improper Valve Sizing
- Chatter Problem (<25%)
- Staggered PSV's
- Inlet Line Considerations
- Outlet Line Considerations
- Relief Valve Troubleshooting Checklist
- Segregation of Fluids to be Flared
- Headers and Sub-Headers
- Flare Drum: Knock-out Drum
- Knock-out Drum
- System to Burn or Release the Gas and/or Liquid
- Flare Tip
- Pipe Flare
- Sonic Flare
- Purge Gas System
- Hydraulic and Gas Seals
- Water Seal
- Molecular Seal/Purge Reduction Device
- Purge – Why?
- Pilots and Ignition System
- Pilot Burners
- Pilot Ignition

- Relief System Discharge
- Open Discharge
- Closed Discharge
- Class Exercise
- Overpressure Protection Philosophy
- Determination of Relief Requirements and Defining Set Point Pressures
- Scenarios to be Considered for Sizing a Relief Valve and Criteria Used for Sizing a Depressurizing Valve
- Types of Flares and Main Components
- Selection and sizing of key components
- Overpressure Protection Philosophy
- What is the Hazard?
- Potential Lines of Defense
- Reminder of the “Swiss Cheese Model”
- Strategic Concepts
- Hazardous Event Probability and Time Line
- Determination of Relief Requirements and Defining Set Point Pressures
- Locating Reliefs – Where?
- Choosing Relief Types
- Choose Type – When to Use a Spring-Operated Valve
- Choose Type – When to Use a Rupture Disc/Pin
- Choose Type – When to Use Both Types
- Relieving Scenarios (Plant Upset Conditions)
- General or Partial Utility Failure
- Local Equipment or Operation Failure
- Relieving Scenarios (Plant Upset Conditions)
- Scenarios to be Considered for Sizing a Relief Valve and Criteria Used for Sizing a Depressurizing Valve
- Relief Event Scenarios
- Sizing Reliefs
- Size Reliefs (Single Phase) – A Special Issue: Chatter
- Size Reliefs (Single Phase) – Chatter – Principal Causes
- Worst Case Event Scenario
- Types of Flares and Main Components

- Elevated Flares
- Steam Assisted Flares
- Unassisted Flares
- Single-Point Flares
- Multi-Point Flares
- Sonic Flare
- Ground Flare
- Combination Systems
- Cold Vent
- Burn Pit
- Sizing Criteria
- Determination of Individual Relieving Rates
- Heat Radiation Levels
- Acceptable Radiation Levels Including Solar Radiation
- Line Sizing
- Line Downstream Relieving Devices, Flare, Cold Vent Headers and Sub-Headers
- Terms Definitions
- Flare Drum
- Purge Gas
- Vapor Depressurization (Blow Down)
- Installation
- Conventional PSV's Designation
- Case Study
- "Class Exercise"
- Flare Sizing and Design
- What is the correct definition of design?
- Factors Influencing Flare Design
- Flow Rate
- Gas Composition
- Gas Temperature
- Gas Pressure
- Utility Costs and Availability
- Safety Requirements

- Thermal radiation
- Reliable ignition
- Environmental Requirements
- Social Requirements
- Flare Design Considerations
- Sizing a Flare Stack Approach
- Calculation Procedures
- Sizing a Flare Stack
- Sizing a Flare Stack Using Simple Approach
- Flare System Operational Considerations and Flare Operation
- Flare Pilot and Ignition Systems
- Ignition Panel
- Integrated Pilot System
- Pilot Assembly
- Flare System Operational Controls
- Steam or air flow to flare tip
- Water seal level
- Flare system operation monitoring
- Flare System Monitoring Instrumentation
- Flare Operation
- Operation -Weather Effects
- Operational Flow Control
- Factors that can Affect Flame Stability
- Operating Hazards and Limitations
- Flaring Efficiency
- What is the efficiency of a gas flare
- What affects the efficiency of gas flares
- Products of flaring
- Concerns with gas flaring
- Global impact of gas flaring
- Blow-down/Depressurizing
- Purpose & Design Considerations
- The Blowdown Operation Consideration

- Emergency and Planned Depressuring
- Example, Comprises 3 System Depressuring
- Environmental Considerations
- Flaring Impacts on health, safety and environment
- Emissions
- Regulations
- Flare Performance Testing and Reliability
- Thermal radiation
- Noise
- Use of Environmental Friendly Strategies as “Zero flaring”
- Zero Flaring Philosophy
- Flare Gas Recovery System Advantages
- Saving the environment
- Saving money by capturing and compressing the recovered flare gases
- Saving the flare tip
- Case Study on Flare Gas Recovery
- Flare Gas Recovery Case Study-Introduction
- Existing and Proposed Facilities
- Flare Gas Recovery Case Study – Approach
- Flare Gas Recovery Case Study: Benefits
- Flare Gas Recovery Unit
- Flaring Gas Without Recovery
- Quiz Review
- Process Safety Fundamentals
- What is Process Safety?
- What are the Dangerous Substances in your Business?
- Exercise 1
- Process Safety Concepts
- Hazardous Incident Scenarios
- Process Integrity
- Plant and Equipment
- Incidents
- Incident Impacts

- Incident Distribution
- Iceberg Concept
- Hazard Barrier Diagram
- Layers of Safety
- Stages of Safety
- Inherent Safety Principles
- Layers of Protection
- Process Relief & Flare
- Relief & Blowdown Valves
- Introduction
- Pressure Terminology
- Types of Pressure Relief Devices
- Conventional Pressure Relief Valves
- Pilot - Operated Pressure Relief Valve
- Piston - Type Pilot - Operated Pressure Relief Valve
- Diaphragm - Type Pilot - Operated Pressure Relief Valve
- Balanced Bellows Pressure Relief Valve
- Balanced Bellows with Auxiliary Balancing Piston
- Power - Actuated Pressure Relief Valves
- Temperature - Actuated Pressure Relief Valves
- Pressure Vacuum Vent Valves
- Rupture Disk
- Application of Rupture Disks
- Types of Rupture Disks
- Conventional Rupture Disks
- Scored Tension - Loaded Rupture Disks
- Composite Rupture Disks
- Reverse - Acting Rupture Disks
- Graphite Rupture Disks
- Rupture Pin Relief Valves
- Buckling Pin Relief Valves
- Blowdown Valve
- Flare & Atmospheric Ventilation

- Flare System Control, Safety & Maintenance
- Safe Purging
- Fire and Explosion
- Nitrogen Awareness
- Vessel Maintenance
- Opening a Flange
- Flare Gas Recovery: Near Zero Flaring for the Refinery Industry
- Next-Generation Flare Gas Recovery Minimizes or Eliminates Flaring Occurrences
- Performance by Design
- Compliance Reliance
- Scaling Up Global Gas Flaring Reduction
- GGFR Initiative
- GGFR Partners
- Gas Flaring – Magnitude of the Issue
- Global Flaring – Seen from Satellites
- GGFR – Achieving Important Results
- GGFR - Project Development
- GGFR Scales up efforts 2013-2015
- Sustainable Energy for All
- Flare Gas Recovery & Zero Flare Solutions
- Time to Change
- How Ejectors Work
- Why Choose Flare Gas Ejectors
- Typical Ejector Control Options
- Driving your Ejectors
- Multi-Ejector Solutions
- Compressor Replacement & Flare Gas Recovery
- The Transvac 'Universal Design'
- Why do I Need Universal Design?
- Gas Recovery Solutions
- Zero Flaring System
- Main Features
- Basic Elements of the System

- Compression Systems – Compressor Selection
- Low Pressure Gas Recovery – Challenges
- Low Pressure Gas Recovery – Solutions
- Reliable & Safe Ignition of Flare
- Low Pressure Flare Ignition System
- Video
- Utilization of Recovered Gas
- Zero Flaring Building Blocks
- Towards Zero Flaring
- Countdown to Zero
- Coping with the Pressure
- Action in Abu Dhabi
- Turning Off the Gas
- Clean & Cost Effective
- The Zero Continuous Flaring Technology
- Facts
- History
- New Flare Practice on Gullfaks Oil Field
- Illustration of Continuous & Non-continuous Flaring
- Estimates of Reduced Flaring
- Area Classification
- ATEX Zone 2 Hazardous Duty Motors: Frequently Asked Questions