COURSE OVERVIEW PE0240
Chemical Handling and Injection System Startup, Shutdown, Normal Operations and Troubleshooting

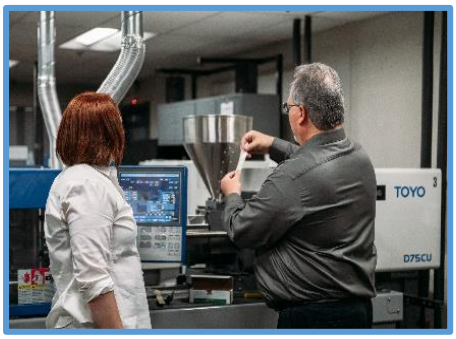
Course Title
Chemical Handling and Injection System Startup, Shutdown, Normal Operations and Troubleshooting

Course Date/Venue
October 13-17, 2025/Ajman Meeting Room, Grand Millennium Al Wahda Hotel, Abu Dhabi, UAE

Course Reference
PE0240

Course Duration/Credits
Five days/3.0 CEUs/30 PDHs

Course Description



This practical and highly-interactive course includes real-life case studies and exercises where participants will be engaged in a series of interactive small groups and class workshops.

This course is designed to provide participants with a detailed and up-to-date overview of Chemical Handling and Injection System Startup, Shutdown, Normal Operations and Troubleshooting. It covers the purpose and significance in industrial processes and the types of chemicals commonly used in injection systems; the chemical properties and compatibility as well as system components and equipment; the process safety and chemical handling; and the regulatory and compliance framework.

Further, the course will also discuss how to inspect system components for integrity, verify chemical inventory and storage conditions and review startup procedure documentation; the priming and preparing the injection system; the initial system calibration, chemical transfer procedures and monitoring during startup; the common hazards during startup operations and mitigating overpressurization and thermal expansion risks; the system performance monitoring, chemical inventory management and routine maintenance; the use of PPE, continuous gas detection and monitoring for leaks; and managing and mitigating fatigue or operator errors.

During this interactive course, participants will learn the data recording and reporting, managing change in process conditions and planning pre-shutdown procedures; the system depressurization, draining and cleaning the system and deactivating pumps and controls; the post-shutdown safety measures and shutdown documentation; the common issues in chemical injection systems and systematic troubleshooting approach; and the advanced monitoring techniques and preventive maintenance best practices

Course Objectives

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

- Apply and gain an in-depth knowledge on chemical handling and injection system startup, shutdown, normal operations and troubleshooting
- Discuss the purpose and significance in industrial processes and the types of chemicals commonly used in injection systems
- Identify the chemical properties and compatibility as well as system components and equipment
- Apply process safety and chemical handling as well as discuss the regulatory and compliance framework
- Inspect system components for integrity, verify chemical inventory and storage conditions and review startup procedure documentation
- Recognize priming and prepare the injection system as well as carryout initial system calibration
- Employ chemical transfer procedures and monitor during startup through early detection of system leaks or irregularities and checking for pump cavitation and suction issues
- Identify the common hazards during startup operations and mitigate overpressurization and thermal expansion risks
- Carryout system performance monitoring, chemical inventory management and routine maintenance
- Reinforce the use of PPE, apply continuous gas detection and monitoring for leaks and manage and mitigate fatigue or operator errors
- Apply data recording and reporting, manage change in process conditions and plan pre-shutdown procedures
- Recognize system depressurization, draining and cleaning the system and deactivating pumps and controls
- Employ post-shutdown safety measures and shutdown documentation
- Identify the common issues in chemical injection systems and apply systematic troubleshooting approach
- Carryout advanced monitoring techniques and preventive maintenance best practices

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 conveniently saved in a **Tablet PC**.*

Who Should Attend

This course provides a basic overview of all significant aspects and considerations of chemical handling and injection system startup, shutdown, normal operations and troubleshooting for operations personnel, maintenance technicians, process engineers, safety officers, plant managers, control room operators, technicians/engineers involved in troubleshooting, quality control/assurance personnel, health, safety, and environment (HSE) personnel and other technical staff.

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 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.

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

Haward's certificates are accredited by the following international accreditation organizations: -

- British Accreditation Council (BAC)

  Haward Technology is accredited by the **British Accreditation Council** for **Independent Further and Higher Education** as an **International Centre**. Haward's certificates are internationally recognized and accredited by the British Accreditation Council (BAC). 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.

- 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.

Course Instructor

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. Andrew Ladwig is a **Senior Process & Mechanical Engineer** with over **25 years** of extensive experience within the **Oil & Gas**, **Refinery**, **Petrochemical & Power** industries. His expertise widely covers in the areas of **Ammonia Manufacturing & Process Troubleshooting**, **Distillation Towers**, **Crude Oil Distillation**, **Fundamentals of Distillation** for Engineers, **Distillation** Operation and Troubleshooting, **Advanced Distillation** Troubleshooting, **Distillation** Technology, Vacuum **Distillation**, **Ammonia Storage & Loading** Systems, **Ammonia Plant** Operation, Troubleshooting & Optimization, **Ammonia Recovery**, **Ammonia Plant Safety**, Hazard of **Ammonia Handling**, Storage & Shipping, **Operational Excellence** in **Ammonia Plants**, **Fertilizer Storage** Management (Ammonia & Urea), **Fertilizer Manufacturing** Process Technology, **Sulphur Recovery**, Phenol Recovery & Extraction, **Wax Sweating & Blending**, **Petrochemical & Fertilizer** Plants, **Nitrogen Fertilizer** Production, **Petroleum Industry Process** Engineering, **Refining Process & Petroleum Products**, **Refinery Planning & Economics**, Safe **Refinery Operations**, **Hydrotreating & Hydro-processing**, **Separators** in **Oil & Gas** Industry, **Gas Testing & Energy** Isolations, Gas Liquor Separation, **Industrial Liquid Mixing**, **Wax Bleachers**, **Extractors**, **Fractionation**, Operation & Control of **Distillation**, Process of **Crude ATM & Vacuum Distillation** Unit, **Water Purification**, **Water Transport** & Distribution, **Steam & Electricity**, **Flame Arrestors**, **Coal Processing**, **Environmental Emission Control**, R&D of **Wax Blending**, **Wax** Molding/Slabbing, **Industrial Drying**, Principles, Selection & Design, Certified **Process Plant** Operations, Control & Troubleshooting, **Operator** Responsibilities, **Tank Farm Operations**, **Storage Tanks Operations** & Measurements, **Process Plant** Troubleshooting & Engineering Problem Solving, **Process Plant Performance**, Efficiency & Optimization, Continuous Improvement & Benchmarking, **Process Troubleshooting** Techniques, Oil & Gas Operation/Introduction to **Surface Facilities**, **Pressure Vessel** Operation, **Process Equipment** Performance & Troubleshooting, **Plant Startup & Shutdown**, **Startup & Shutdown** the Plant While Handling Abnormal Conditions, **Flare & Relief** System, **Process Gas Plant** Start-up, Commissioning & Problem Solving, **Process Liquid** and **Process Handling & Measuring** Equipment. Further, he is also well-versed in **Compressors & Turbines** Operation, Maintenance & Troubleshooting, **Heat Exchanger** Overhaul & Testing Techniques, Balancing of **Rotating Machinery** (**BRM**), **Pipe Stress** Analysis, **Valves & Actuators** Technology, Inspect & Maintain **Safeguarding Vent & Relief System**, Certified Inspectors for **Vehicle & Equipment**, Optimizing **Equipment Maintenance** & Replacement Decisions, Certified Maintenance Planner (**CMP**), Certified Planning and Scheduling Professional (**AACE-PSP**), **Tank Design**, Construction, Inspection & Maintenance, **Material Cataloguing**, Specifications, Handling & Storage, **Steam Trap** Design, Operation, Maintenance & Troubleshooting, **Steam Trapping & Control**, **Column**, **Pump & Exchangers**, Troubleshooting & Design, **Rotating Equipment** Operation & Troubleshooting, **Control & ESD** System, **Detailed Engineering Drawings**, Codes & Standards, **Budget** Preparation, Allocation & Cost Control, Root Cause Analysis (**RCA**), **Production Optimization**, Permit to Work (**PTW**), Project Engineering, **Data** Analysis, **Process Hazard** Analysis (**PHA**), **HAZOP** Study, Sampling & Analysis, **Training** Analysis, **Job Analysis** Techniques, Storage & Handling of **Toxic Chemicals & Hazardous Materials**, **Hazardous Material** Classification & Storage/Disposal, **Dangerous Goods**, Environmental Management System (**EMS**), Supply Chain, Purchasing, Procurement, **Logistics** Management & **Transport** & **Warehousing** & **Inventory**, **Risk** Monitoring Authorized Gas Tester (**AGT**), Confined Space Entry (**CSE**), Personal Protective Equipment (**PPE**), Fire & Gas, First Aid and Occupational Health & Safety.

During his career life, Mr. Ladwig has gained his practical experience through his various significant positions and dedication as the **Mechanical Engineer**, **Project Engineer**, **Reliability & Maintenance Engineer**, **Maintenance Support Engineer**, **Process Engineer**, **HSE Supervisor**, **Warehouse Manager**, **Quality Manager**, **Business Analyst**, **Senior Process Controller**, **Process Controller**, **Safety Officer**, **Mechanical Technician**, **Senior Lecturer** and **Senior Consultant/Trainer** for various companies such as the Sasol Ltd., Sasol Wax, Sasol Synfuels, just to name a few.

Mr. Ladwig has a **Bachelor's** degree in **Chemical Engineering** and a **Diploma** in **Mechanical Engineering**. Further, he is a **Certified Instructor/Trainer**, a **Certified Internal Verifier/Assessor/Trainer** by the **Institute of Leadership & Management** (**ILM**) and has delivered various trainings, workshops, seminars, courses and conferences internationally.

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, 13th of October 2025***

0730 – 0800	*Registration & Coffee*
0800 – 0815	*Welcome & Introduction*
0815 – 0830	***PRE-TEST***
0830 – 0930	***Overview of Chemical Handling Systems*** *Purpose & Significance in Industrial Processes • Types of Chemicals Commonly Used in Injection Systems • Applications in Various Industries (Oil & Gas, Petrochemicals, etc.) • Safety & Regulatory Compliance Requirements*
0930 – 0945	*Break*
0945 – 1030	***Chemical Properties & Compatibility*** *Understanding Chemical Classifications (Corrosive, Flammable, etc.) • Material Compatibility with Chemicals • Chemical Stability & Storage Conditions • Chemical Interactions & Potential Risks*
1030 – 1130	***System Components & Equipment*** *Overview of Injection Pumps (Diaphragm, Plunger, Gear) • Tanks, Vessels, & Piping for Chemical Storage & Transport • Flow Meters, Valves, & Monitoring Devices • Injection System Automation & Control Equipment*
1130 - 1230	***Basics of Process Safety*** *Identifying Hazards in Chemical Handling • Hazard Communication Standards (e.g., SDS & Labeling) • Importance of Safety Barriers & Risk Assessments • Emergency Response Protocols*
1230 - 1245	*Break*
1245 – 1330	***Chemical Handling Basics*** *Proper Chemical Storage & Inventory Management • Personal Protective Equipment (PPE) Selection & Usage • Chemical Handling Tools & Techniques • Containment & Spill Prevention Measures*
1330 - 1420	***Regulatory & Compliance Framework*** *Overview of OSHA, EPA, & other Regulatory Standards • Key Documentation Requirements (Permits, SDS, Compliance Reports) • Environmental Concerns in Chemical Handling • Audit & Inspection Processes*
1420 – 1430	***Recap*** *Using this Course Overview, the Instructor(s) will Brief Participants about the Topics that were Discussed Today and Advise Them of the Topics to be Discussed Tomorrow*
1430	*Lunch & End of Day One*

Day 2: ***Tuesday, 14th of October 2025***

0730 – 0830	***Pre-Startup Checks*** *Inspecting System Components for Integrity • Verifying Chemical Inventory & Storage Conditions • Ensuring PPE Availability & Calibration of Monitoring Equipment • Reviewing Startup Procedure Documentation*
0830 - 0930	***Priming & Preparing the Injection System*** *Steps to Prime Injection Pumps & Remove Airlocks • Setting Initial Flow Rates & Injection Pressure • Aligning Valves & Opening Lines • Testing the Chemical Flow through the System*
0930 – 0945	*Break*

0945 – 1030	***Initial System Calibration*** *Adjusting Dosing Rates According to Process Requirements • Using Flow Meters to Measure Accuracy • Monitoring Pressure Gauges & Troubleshooting Irregularities • Logging Calibration Data for Future Reference*
1030 – 1130	***Chemical Transfer Procedures*** *Safe Transfer of Chemicals to Storage Tanks • Managing Temperature-Sensitive or Reactive Chemicals • Preventing Contamination During Chemical Transfer • Emergency Response for Spills or Overflows*
1130 - 1230	***Monitoring During Startup*** *Early Detection of System Leaks or Irregularities • Checking for Pump Cavitation & Suction Issues • Ensuring Smooth Operation of Automation Controls • Documentation of Initial Startup Performance*
1230 - 1245	*Break*
1245 – 1330	***Startup Safety Considerations*** *Common Hazards During Startup Operations • Mitigating Overpressurization & Thermal Expansion Risks • Communication Protocols During Startup • Immediate Response to Alarms or System Deviations*
1330 - 1420	***Recap*** *Using this Course Overview, the Instructor(s) will Brief Participants about the Topics that were Discussed Today and Advise Them of the Topics to be Discussed Tomorrow*
1420 – 1430	*Lunch & End of Day Two*

Day 3: ***Wednesday, 15th of October 2025***

0730 – 0830	***System Performance Monitoring*** *Key Performance Indicators (Flow Rate, Pressure, Chemical Concentration) • Interpreting Flow Meter & Analyzer Data • Identifying Deviations from Normal Operating Conditions • Maintaining System Logs*
0830 – 0930	***Chemical Inventory Management*** *Tracking Consumption & Reorder Schedules • Managing Storage Levels to Prevent Stockouts or Overstocking • Conducting Regular Inspections for Chemical Degradation • Using Inventory Management Software*
0930 – 0945	*Break*
0945 – 1030	***Routine Maintenance Activities*** *Cleaning Injection Nozzles & Pump Filters • Lubrication & Inspection of Moving Parts • Calibration of Flow Meters & Analyzers • Replacing Worn-Out Components (Seals, Valves, etc.)*
1030 – 1130	***Operational Safety*** *Reinforcing the Use of PPE • Continuous Gas Detection & Monitoring for Leaks • Managing & Mitigating Fatigue or Operator Errors • Conducting Regular Safety Briefings*
1130 - 1230	***Data Recording & Reporting*** *Proper Documentation of Operational Metrics • Analyzing Historical Data for Performance Trends • Preparing Reports for Compliance & Audits • Communicating Findings to Stakeholders*
1230 - 1245	*Break*

1245 - 1420	***Managing Change in Process Conditions*** *Adjusting Flow Rates or Chemical Concentration • Responding to Upstream or Downstream Process Changes • Coordination with other Process Units • Documentation & Approval of Process Modifications*
1420 – 1430	***Recap*** *Using this Course Overview, the Instructor(s) will Brief Participants about the Topics that were Discussed Today and Advise Them of the Topics to be Discussed Tomorrow*
1430	*Lunch & End of Day Three*

Day 4: ***Thursday, 16th of October 2025***

0730 – 0830	***Pre-Shutdown Planning*** *Reviewing Shutdown Procedures & Checklist • Informing Stakeholders About Shutdown Activities • Preparing System for Chemical Draining • Safety Planning for the Shutdown Process*
0830 - 0930	***System Depressurization*** *Safe Depressurization of Lines & Equipment • Preventing Vacuum Formation in Tanks or Pipelines • Monitoring for Residual Pressure During Shutdown • Steps to Prevent Environmental Release of Chemicals*
0930 – 0945	*Break*
0945 – 1030	***Draining & Cleaning the System*** *Draining Chemicals from Lines, Tanks, & Pumps • Proper Disposal or Storage of Drained Chemicals • Cleaning Equipment to Prevent Corrosion or Fouling • Using Cleaning Agents Safely & Effectively*
1030 – 1130	***Deactivating Pumps & Controls*** *Safely Shutting Down Injection Pumps & Automation Systems • Isolating Electrical Circuits to Prevent Accidental Startups • Lockout/Tagout (LOTO) Procedures for Critical Equipment • Final Inspection of Deactivated Systems*
1130 - 1230	***Post-Shutdown Safety Measures*** *Managing Residual Chemicals & Vapors • Conducting Gas Monitoring in Confined Spaces • Ensuring Proper Ventilation in Storage Areas • Reviewing Safety Protocols with the Team*
1230 - 1245	*Break*
1245 - 1420	***Shutdown Documentation*** *Recording Shutdown Activities & Deviations • Preparing Reports for Management & Regulatory Bodies • Updating System Logs & Maintenance Records • Lessons Learned & Improvements for Future Shutdowns*
1420 – 1430	***Recap*** *Using this Course Overview, the Instructor(s) will Brief Participants about the Topics that were Discussed Today and Advise Them of the Topics to be Discussed Tomorrow*
1430	*Lunch & End of Day Four*

Day 5:	***Friday, 17th of October 2025***
0730 – 0830	***Common Issues in Chemical Injection Systems*** *Pump Cavitation & Flow Irregularities • Leaks & Blockages in Piping Systems • Chemical Degradation or Contamination • Sensor & Instrumentation Failures*
0830 - 0930	***Systematic Troubleshooting Approach*** *Identifying Root Causes of Operational Issues • Using Diagnostic Tools & Techniques • Applying Cause-&-Effect Analysis (e.g., Fishbone Diagrams) • Documenting Troubleshooting Efforts*
0930 – 0945	*Break*
0945 – 1030	***Advanced Monitoring Techniques*** *Implementing Real-Time Monitoring Systems • Using Predictive Analytics for Maintenance • Optimizing Dosing Rates Based on Process Data • Integrating Advanced Sensors for Accuracy*
1030 - 1230	***Case Studies & Problem-Solving Exercises*** *Analyzing Real-World Incidents in Chemical Handling • Group Exercises on Troubleshooting Scenarios • Developing Action Plans for Similar Issues • Presenting Solutions to Peers for Feedback*
1230 - 1245	*Break*
1245 - 1345	***Preventive Maintenance Best Practices*** *Scheduling Regular Inspections & Tune-Ups • Using Condition-Based Maintenance Techniques • Training Personnel on Early Detection of Issues • Maintaining a Robust Spare Parts Inventory*
1345 - 1400	***Course Conclusion*** *Using this Course Overview, the Instructor(s) will Brief Participants about the Course Topics that were Covered During the Course*
1400 – 1415	***POST-TEST***
1415 – 1430	*Presentation of Course Certificates*
1430	*Lunch & End of Course*

Practical Sessions

This practical and highly-interactive course includes real-life case studies and exercises:-

Course Coordinator

Mari Nakintu, Tel: +971 2 30 91 714, Email: mari1@haward.org