COURSE OVERVIEW PE0862
Gas Compression Thermodynamics & Compressor's Control & Start-Up

Course Title
Gas Compression Thermodynamics & Compressor's Control & Start-Up

Course Date/Venue
October 20-25, 2025/Glasshouse Meeting Room, Grand Millennium Al Wahda Hotel, Abu Dhabi, UAE

Course Reference
PE0862

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

Course Description

This practical and highly-interactive course includes various practical sessions and exercises. Theory learnt will be applied using our state-of-the-art simulators

This course is designed to provide participants with a detailed and up-to-date overview on Gas Compression Thermodynamics & Compressor's Control & Start-Up. It covers the gas compression, thermodynamic principles and compression process fundamentals; the compressor components and operation, performance characteristics and gas compression in power and industrial plants; the polytropic and isentropic efficiency, energy balance in compressors, multistage compression, real gas effects and thermodynamic losses and optimization; the compressor control, capacity control methods, anti-surge control and load sharing and parallel operation; the key sensors of flow, pressure, temperature and vibration; and the DCS and PLC integration, alarms and interlocks and remote monitoring and diagnostics.

During this interactive course, participants will learn the mechanical inspection and alignment, lubrication and cooling system readiness, electrical and instrumentation checks and safety system verification; the start-up sequence, normal operating procedures and shut-down procedures; the common start-up failures, trips and alarms during start-up and restart after trips; the role of operators and control systems; the vibration issues and imbalance, surge and stall problems, high temperature and pressure deviations and seal and bearing failures; and the diagnostic techniques, maintenance practices and safety in compressor operation.

Course Objectives

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

- Apply and gain an in-depth knowledge on gas compression thermodynamics and compressor's control and start-up
- Discuss gas compression, thermodynamic principles and compression process fundamentals
- Identify compressor components and operation, performance characteristics and gas compression in power and industrial plants
- Recognize polytropic and isentropic efficiency, energy balance in compressors, multistage compression, real gas effects and thermodynamic losses and optimization
- Apply compressor control, capacity control methods, anti-surge control and load sharing and parallel operation
- Identify key sensors of flow, pressure, temperature and vibration and apply DCS and PLC integration, alarms and interlocks and remote monitoring and diagnostics
- Carryout mechanical inspection and alignment, lubrication and cooling system readiness, electrical and instrumentation checks and safety system verification
- Illustrate start-up sequence, normal operating procedures and shut-down procedures
- Identify the common start-up failures, apply trips and alarms during start-up and restart after trips and define the role of operators and control systems
- Recognize vibration issues and imbalance, surge and stall problems, high temperature and pressure deviations and seal and bearing failures
- Apply diagnostic techniques, maintenance practices and safety in compressor operation

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 an overview of all significant aspects and considerations of gas compression thermodynamics and compressor's control and start-up for mechanical, process, and chemical engineers, operation and production engineers, maintenance and reliability engineers dealing with troubleshooting, instrumentation and control engineers engaged in compressor start-up, shutdown, and control logic and other technical staff.

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(s)

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:

Dr. Tony Dimitry, PhD, MSc, BSc, is a **Senior Mechanical Engineer** with over **30 years** of industrial experience. His expertise covers **Pumps, Compressors, Turbines & Troubleshooting**, **Centrifugal Pumps**, Maintenance of **Gas Compressors**, **Compressor & Steam Turbine**, **Pressure Safety Relief Valve** Repair & Recalibration, **PSV/PRV** Troubleshooting, **PRV** Testing & Repair, **Valve** Testing & Inspection, **Valve** Sealing, **Valve** Calibration, **Process Equipment**, **Vibration Analysis**, **Heat Exchanger**, **Siemens Steam Turbine Maintenance**, **Electromechanical Maintenance**, **Machinery Alignment**, **Lubrication Technology**, **Compressors**, **HVAC & Refrigeration Systems**, **Piping System**, **Blower & Fan**, **Shaft Repair**, **Control Valve & Actuator**, **Safety Relief Valves**, **Pipelines**, **Piping Vibration Analysis**, **Pressure Vessels**, **Dry Gas Seal**, **Process Equipment**, **Diesel Engine & Crane Maintenance**, **Maintenance Management** (**Preventive**, **Predictive**, **Breakdown**), **Reliability Management**, **Condition-Based Monitoring**, **Rotating Equipment**, **Tanks & Tank Farms**, **Pneumatic System**, **Static Equipment**, **Failure Analysis**, **FMEA**, **Corrosion**, **Metallurgy**, Planning, Scheduling, Cost Control, Preventive and Predictive Maintenance. Currently, he is the Maintenance Manager of the PPC Incorporation wherein he is responsible for the maintenance and upgrade of all plant components, monitoring the thermal stresses and the remaining life of steam pipes, turbine casing, mills, fans and pumps. He is in-charge of the metallurgical failure analysis and the usage of fracture mechanics for determining crack propagation in impellers of turbines, assessing all alterations and developments for upgrading the plant.

During his career life, Dr. Dimitry was a **Senior Engineer** in **Chloride Silent** (**UK**) wherein he was responsible for the mechanical, thermal and electrical modelling of battery problems for electric vehicles and satellites as well as an **Operations Engineer** of the **National Nuclear Corporation** (**UK**) wherein he was responsible for the optimization of the plant. Prior to this, he was a **Professor** at the **Technical University of Crete** and an Assistant **Professor** of the **University of Manchester** (**UK**).

Dr. Dimitry has **PhD**, **Master** and **Bachelor** degrees in **Mechanical Engineering** from the **Victory University of Manchester** and the **University of Newcastle**, **UK** respectively. Further, he is a **Certified Instructor/Trainer,** a **Certified Internal Verifier/Assessor/Trainer** by the **Institute of Leadership & Management** (**ILM**) and an associate member of the American Society of Mechanical Engineers (**ASME**) and Institution of Mechanical Engineers (**IMechE**). He has further delivered various trainings, seminars, courses, workshops and conferences internationally.

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 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, 20th of October 2025***

0730 – 0800	*Registration & Coffee*
0800 – 0815	*Welcome & Introduction*
0815 – 0830	***PRE-TEST***
0830 – 0930	***Introduction to Gas Compression*** *Role of Gas Compressors in Process Industries • Types of Compressors (Reciprocating, Centrifugal, Rotary, Screw) • Basic Compressor Applications in Oil, Gas & Power Industries • Energy Efficiency & Performance Parameters*
0930 – 0945	*Break*
0945 – 1040	***Thermodynamic Principles*** *Laws of Thermodynamics & Their Application to Compression • Isothermal, Adiabatic & Polytropic Processes • Work Input Requirements & Efficiency Concepts • Real Gas versus Ideal Gas Behavior*
1040 – 1135	***Compression Process Fundamentals*** *Compression Ratio & Pressure-Volume Relationship • Heat Generation During Compression • Influence of Gas Composition on Compression • Temperature Rise & Cooling Requirements*
1135 – 1230	***Compressor Components & Operation*** *Cylinders, Rotors, Impellers & Diffusers • Bearings, Seals & Lubrication Systems • Suction & Discharge Systems • Cooling & Intercooling Arrangements*
1230 – 1245	*Break*

1245 - 1340	***Performance Characteristics*** *Performance Curves (Head, Flow, Efficiency) • Surge & Choke Regions • Compressor Maps & Stability Zones • Effect of Ambient & Process Conditions*
1340 - 1420	***Gas Compression in Power & Industrial Plants*** *Applications in Gas Turbines & Pipeline Transport • Role in Chemical & Petrochemical Plants • Refrigeration & Cryogenic Applications • Reliability Requirements in Power Sector*
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, 21st of October 2025

0730 – 0830	***Polytropic & Isentropic Efficiency*** *Definitions & Differences • Efficiency Determination Methods • Impact on Compressor Power Requirement • Case Studies with Different Gases*
0830 – 0930	***Energy Balance in Compressors*** *First Law of Thermodynamics Applications • Work Input Calculation for Different Processes • Heat Loss & Cooling Requirements • Effect of Intercooling & Aftercooling*
0930 – 0945	*Break*
0945 - 1105	***Multistage Compression*** *Need for Multistaging • Advantages & Design Considerations • Temperature & Pressure Balancing • Impact on Efficiency & Reliability*
1105 – 1230	***Real Gas Effects*** *Non-Ideal Gas Behavior at High Pressures • Compressibility Factor (Z) Corrections • Equation of State Applications • Practical Examples with Hydrocarbon Gases*
1230 – 1245	*Break*
1245 – 1340	***Thermodynamic Losses & Optimization*** *Mechanical, Hydraulic & Leakage Losses • Minimizing Losses in Design & Operation • Efficiency Improvement Methods • Performance Monitoring*
1340 - 1420	***Case Studies in Compressor Thermodynamics*** *Centrifugal Compressor Thermodynamics • Reciprocating Compressor Work Balance • Gas Turbine Compressor Analysis • Energy Savings in Power Plant Compressors*
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 Two*

Day 3: Wednesday, 22nd of October 2025

0730 – 0830	***Basics of Compressor Control*** *Objectives of Control Systems • Safety & Reliability Aspects • Types of Control Methods • Integration with Plant Control*
0830 – 0930	***Capacity Control Methods*** *Throttle Control & Suction Throttling • Bypass Control & Recycle Systems • Variable Speed Drives (VSDs) • Guide Vane Control for Centrifugal Compressors*

0930 – 0945	*Break*
0945 - 1105	***Anti-Surge Control*** *Surge Phenomena & Causes • Surge Detection Methods • Anti-Surge Valve Operation • Control Strategies for Surge Prevention*
1105 – 1230	***Load Sharing & Parallel Operation*** *Compressor Train Operation • Equal Load Sharing Methods • Series versus Parallel Operation Control • Matching Compressors with System Demand*
1230 – 1245	*Break*
1245 – 1340	***Instrumentation & Automation*** *Key Sensors: Flow, Pressure, Temperature, Vibration • DCS & PLC Integration • Alarms & Interlocks • Remote Monitoring & Diagnostics*
1340 - 1420	***Case Studies in Compressor Control*** *Anti-Surge Control in Gas Transmission • Capacity Control in LNG Plants • Integrated Control in Combined Cycle Plants • Lessons from Failures*
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, 23rd of October 2025***

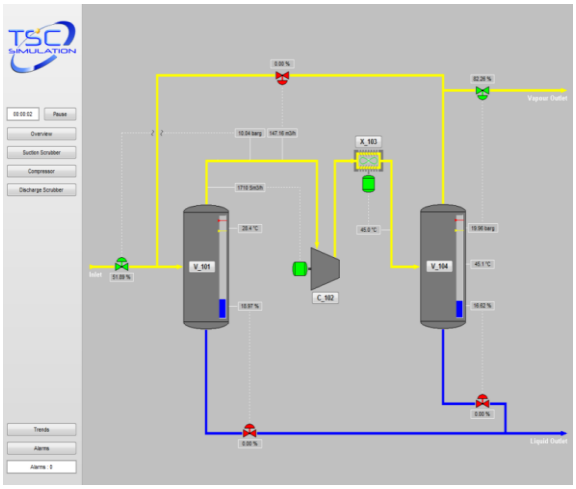
0730 – 0830	***Pre-Start-Up Checks*** *Mechanical Inspection & Alignment • Lubrication & Cooling System Readiness • Electrical & Instrumentation Checks • Safety System Verification*
0830 – 0930	***Start-Up Sequence*** *Initial Purging & Pressurization • Step-by-Step Start-Up Logic • Role of Interlocks & Permissives • Controlled Acceleration & Load Application*
0930 – 0945	*Break*
0945 - 1105	***Normal Operating Procedures*** *Steady-State Operation Monitoring • Load Adjustments • Efficiency Optimization • Troubleshooting During Operation*
1105 – 1230	***Shut-Down Procedures*** *Normal Shut-Down Sequence • Emergency Shut-Down (ESD) • Depressurization & Venting • Preservation & Storage Considerations*
1230 – 1245	*Break*
1245 – 1340	***Start-Up Challenges*** *Common Start-Up Failures • Trips & Alarms During Start-Up • Restart After Trips • Role of Operators & Control Systems*
1340 - 1420	***Practical Examples*** *Start-Up in Gas Pipeline Compressors • LNG Refrigeration Compressor Start-Up • Power Plant Gas Turbine Compressor Start-Up • Emergency Scenarios Case Studies*
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, 24th of October 2025***

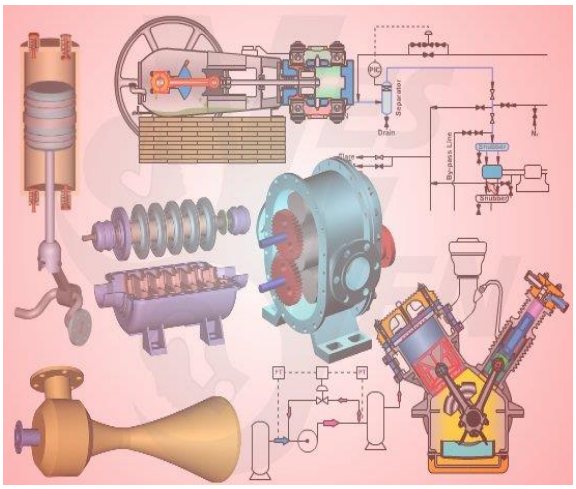
0730 – 0830	***Common Operating Problems*** *Vibration Issues & Imbalance • Surge & Stall Problems • High Temperature & Pressure Deviations • Seal & Bearing Failures*
0830 – 0930	***Diagnostic Techniques*** *Vibration Analysis & Monitoring • Thermodynamic Performance Analysis • Lubricant & Seal Condition Monitoring • Predictive Maintenance Tools*
0930 – 0945	*Break*
0945 – 1100	***Maintenance Practices*** *Preventive & Predictive Maintenance • Overhaul Procedures • Spares & Inventory Management • Reliability-Centered Maintenance (RCM)*
1100 – 1230	***Safety in Compressor Operation*** *HAZOP for Compressor Systems • Fire & Explosion Risks • Pressure Relief Systems • Emergency Response*
1230 – 1245	*Break*
1245 - 1345	***Case Studies in Start-Up & Control Failures*** *Gas Compressor Surge Incident • Control Valve Malfunction • Seal Leakage Case Study • Start-Up Failure & Corrective Actions*
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*

Simulator (Hands-on Practical Sessions)

Practical session will be organized during the course for delegates to practice the theory learnt. Delegates will be provided with an opportunity to carryout various exercises using the state-of-the-art simulators "SIM 3300 Centrifugal Compressor Simulator" and "CBT on Compressors".



SIM 3300 Centrifugal Compressor Simulator



CBT on Compressors

Course Coordinator

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