COURSE OVERVIEW ME0420
Turbo Expander Operation, Performance, Maintenance & Troubleshooting

Course Title
Turbo Expander Operation, Performance, Maintenance and Troubleshooting



Course Date/Venue
December 27-31, 2026/Congress 1 Meeting Room, Meeting Room, Voco Dubai, an IHG Hotel, Sheikh Zayed Road, Dubai, UAE

3.0 CEUs (30 PDHs) AWARD

H-STK© INCLUDED

Course Reference
ME0420

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

Course Description







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

Turbo-expanders have been used for decades in hundreds of applications and are used to drive generators, pumps and compressors in the most demanding of applications. Turbo-expanders are manufactured in both radial inflow (centrifugal) and axial configurations in sizes ranging from a fraction of a HP up to 50,000 HP. The turboexpander is a centrifugal or axial flow turbine through which a high pressure gas is expanded to produce work that is typically used to drive a compressor. Because work is extracted from the expanding high pressure gas, the expansion is isentropic and the low pressure exhaust gas from the turbine is at a very low temperature, often as low as 200 K (-100 °F) or less.

Turbo-expanders are essential components in air separation plants; cryogenic processes; LNG plants; natural gas and propane pressure letdown applications - gas plants & pipeline compressor stations; geothermal applications; and waste heat recovery systems. It is common to have two or more turbo-expanders driving a single generator, pump or compressor. High-pressure turboexpanders, usually installed in pairs, are typically used to provide refrigeration for the production of cryogenic liquids. The expander extracts work from a high-pressure gas stream providing refrigeration to the process. The work removed from the gas stream by the expander is used to provide compression power to cycle. These applications demand high efficiency and reliability at a low installed cost. The efficiency of the turboexpander has a significant impact on the cost of the cryogenic liquid produced.

Another application for turboexpanders is in power recovery from various heat sources utilizing the Rankine cycle. The heat sources presently being considered for large scale power plants include geothermal and ocean-thermal energy, while small systems are directed at solar heat, waste heat from reactor processes, gas turbine exhaust and many other industrial waste heat sources. The number of power recovery applications is steadily increasing. Large and small demonstration plants are operating, or are about to begin operation. Some of these were built to study or minimize potential problem areas for new, large power plants in the planning stage. Indeed, the potential is for large-scale utilization of such sources as ocean-thermal energy, solar heat, geothermal, waste heat, natural gas, waste gas pressure letdown, and undoubtedly others.

This course is designed to provide participants with a complete and up-to-date overview of the turboexpanders from the basic knowledge and applications to the maintenance and troubleshooting techniques. The course will cover turboexpander fundamentals; application of cryogenic turboexpanders: processes; applications of hot gas turboexpanders; overview of turboexpander construction features; rotor dynamics; construction materials; fabrication issues; installation guides; turboexpander maintenance; failure analysis and troubleshooting.

Course Objectives/Outcomes & Benefits for the Participants

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

- Apply and gain an in-depth knowledge on operation, performance, maintenance and troubleshooting of turbo expander
- Perform the various process applications for turbo-expanders including energy conversion, power recovery, power absorption methods, etc
- Acquire a very good background on the fundamental application of turbo-expanders including its efficiency & sizing applications
- Identify cryogenic & hot gas turbo-expanders by discussing the processes, applications and importance in plants
- Determine the various specification and purchase of turbo-expanders
- Demonstrate the performance, operation and special features of the various types of turbo-expanders and recognize the importance in the performance of turbo-expanders
- Carryout complete maintenance & troubleshooting of turbo-expanders and identify scheduled maintenance activities as well as check seal clearances and shaft end-play efficiently
- Execute the disassembly and assembly of core unit & parts inspection
- Identify the various maintenance strategies of turbo-expanders and determine the optimized/reengineered design and economics of turbo-expanders

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 covers systematic techniques and methodologies on the operation, performance, maintenance & troubleshooting of turbo expander for the widest possible spectrum of engineering functions, including technical support, maintenance, operating and managerial personnel in process plants, refineries, air liquefaction, natural gas separation, geothermal mining, power generation and design contracting.

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 & Maintenance Engineer** with over **30 years** of industrial experience within the **Petroleum**, **Oil & Gas**, **Petrochemical**, **Nuclear & Power** industries. His expertise covers **Turbo Expander** Operation, Performance, Maintenance & Troubleshooting, **Turbo-Expanders**, **Fractional Columns**, **Boilers**, **Cryogenic Pumps** for **LNG**, **Heat Exchanger**, **Siemens**, **Gas & Steam Turbine Maintenance**, **Pumps & Compressors**, **Electromechanical Maintenance**, **Machinery Alignment**, **Lubrication Technology**, **Bearing & Rotary Machine**, **Blower & Fan**, **Shaft Repair**, **Control Valves & Actators**, **Safety Relief Valves**, **Pipelines**, **Piping**, **Pressure Vessels**, **Process Equipment**, **Diesel Engine & Crane Maintenance**, **Tanks & Tank Farms**, **Pneumatic System**, **Static Equipment**, **FMEA**, **Corrosion**, **Metallurgy**, **Thermal** and **Electrical Modelling** of **Battery Problems,** Revising **Engineering Drawings**, **Engineering Drawings & Diagrams**, **AutoCAD & GIS Support**, Retailed **Engineering Drawings**, Codes & Standards, **Mechanical Diagrams** Interpretation, Reading **Engineering Drawings**, **Process & Project Drawings**, **Engineering Drawings** Interpretation, **Piping Layouts & Isometrics**, **P&ID** Reading & Interpretation, Glass Reinforced Epoxy (**GRE**), Glass Reinforced Pipes (**GRP**), Glass Reinforced Vent (**GRV**), **Mechanical Pipe Fittings**, **Flange Joint Assembly**, Adhesive Bond Lamination, **Butt Jointing**, **Joint & Spool Production**, **Isometric Drawings**, **Flange Assembly** Method, **Fabrication & Jointing**, Jointing & Spool Fabrication, **Pipe Cuttings**, **Flange Bolt Tightening** Sequence, **Hydro Testing**, **Failure Analysis Methodologies**, Machinery Root Cause Failure Analysis (**RCFA**), **Preventive Maintenance** & **Condition Monitoring**, Reliability Centred Maintenance (**RCM**), Risk Based Inspection (**RBI**), Root Cause Analysis (**RCA**), **Planning & Managing Plant Turnaround**, **Scheduling Maintenance**, **Data Archive Maintenance**, **Master Milestone Schedule** (**MMS**), Piping & Mechanical **Vibration Analysis**, Preventive & Predictive Maintenance (**PPM**) **Maintenance**, Condition Based Monitoring (**CBM**), Risk Based Assessment (**RBA**), Planning & Preventive Maintenance, **Maintenance** Management (**Preventive**, **Predictive**, **Breakdown**), **Reliability** Management, Rotating Equipment, Scheduling & Cost Control, **Maximo** Foundation, **Maximo** Managing Work, **Asset Management Best Practices**, **Resource Management**, **Inventory Set-up & Management**, **Work Management**, Automatic & Work Flows & Escalations, **Vibration Analysis**. He is also well-versed in various simulators such as i**-Learn Vibration**, **AutoCAD**, **Word Access**, **Aspen One**, **Fortran**, **VB**, **C ANSYS**, **ABAQUS**, **DYNA3D**, **Ceasar**, **Caepipe**, **MS Project**, **Primavera**, **MS Excel**, **Maximo**, **Automation Studio** and **SAP**. Currently, he is the **Maintenance Manager** of the PPC Incorporation wherein he is responsible for the maintenance and upgrading of all **Power Station** components.

During his career life, Dr. Dimitry held a significant positions such as the **Operations Engineers**, **Technical Trainer**, **HSE Contracts Engineer**, **Boilers Section Engineer**, **Senior Engineer**, **Trainee Mechanical Engineer**, **Engineer**, **Turbines Section Head**, **Professor**, **Lecturer/Instructor** and **Teaching Assistant** from various multinational companies like **Chloride Silent Power Ltd.**, **Technical University of Crete**, **National Nuclear Corporation**, **UMIST Aliveri Power Station** and **HFO Fired Power Station**.

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

Our courses employ an interactive, learner-centred methodology that integrates theoretical knowledge with practical application. The training is delivered through a suitable combination of some or all of the following methods, selected according to the course content and learning objectives:

- Instructor-led presentations and facilitated discussions
- Practical workshops and participant presentations
- Hands-on exercises and real-world case studies
- Equipment demonstrations and technical drawings
- Hardware- and software-based simulations
- Gamification & Role Play in soft-skills courses only
- Virtual Reality (VR) and Augmented Reality (AR)
- Instructional videos and other relevant training resources

This blended approach encourages active participation, strengthens practical skills and supports the effective application of acquired knowledge in the workplace.

Learning Design & Customization

This course can be customized to the exact requirements of clients. Haward Technology is so proud of our huge capabilities in tailoring our courses to the training needs of our valued clients.

Accommodation

Accommodation is not included in the course fees. However, any accommodation required can be arranged at the time of booking.

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.

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: ***Sunday, 27th of December 20226***

0730 – 0800	*Registration & Coffee*
0800 – 0815	*Welcome & Introduction*
0815 – 0830	***PRE-TEST***
0830 – 0930	***Process Applications for Turbo-Expanders*** *Energy Conversion • Power Recovery • Power Absorption Methods • Turbo-Expander Qualities*
0930 – 0945	*Break*
0945 – 1100	***Fundamental Applications*** *Basic Applications • Gas Path Equations & Analysis • Cryogenic Applications • Some Future Applications • Radial Reaction versus Impulse Design • Efficiency & Sizing Applications*
1100 – 1230	***Cryogenic Turbo-Expanders*** *Natural Gas Liquefaction • Ethylene Plant Expanders • Gas Treating Methods*
1230 – 1245	*Break*

1245 – 1420	***Case Studies*** *Case Study #1: Cryogenic Application to Improve Productivity* *Case Study #2: Installation of Turbo-Expanders at Old Plant*
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: Monday, 28th of December 20226

0730 – 0930	***Hot Gas Turbo-Expanders*** *Nitric Acid Plant Applications • Integrally Geared Process Gas Radial Turbines • Geothermal Applications • Applications in Catalytic Cracking Units*
0930 – 0945	*Break*
0945 – 1100	***Hot Gas Turbo-Expanders (cont'd)*** *Microprocessor-Based Management Systems • Material Selection for Power Recovery Turbines • Turbo-Expander Testing • Solid Particle Erosion • Power Recovery and the Eddy Current Brake*
1100 – 1230	***Specification & Purchase of Turbo-Expanders*** *Cryogenic Turbo-Expanders • Power Recovery Expanders for FCC Units in Main Air Blower or Generator Drive Service*
1230 – 1245	*Break*
1245 – 1420	***Case Studies*** *Case Study #3: LNG Parallel Expanders* *Case Study #4: New Gas Reservoir Production with Offshore Oil Site*
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: Tuesday, 29th of December 20226

0730 – 0930	***Performance*** *Performance Data • Design Operating Conditions • Off-Design Operating Conditions*
0930 – 0945	*Break*
0945 – 1100	***Operation*** *Startup Operations • Shutdown Operations • Troubleshooting*
1100 – 1230	***Special Features*** *Active Magnetic Bearings & Dry Gas Seals • Squeeze Film Dampers • Radial Fit Bolts*
1230 – 1245	*Break*
1245 – 1420	***Case Studies*** *Case Study #5: Natural Gas Pipeline Application* *Case Study #6: Gas Separation Plant*
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: ***Wednesday, 30th of December 20226***

0730 – 0930	***Maintenance & Troubleshooting*** *Scheduled Maintenance Activities*
0930 – 0945	*Break*
0945 – 1100	***Maintenance & Troubleshooting (cont'd)*** *Disassembly of Core Unit & Parts Inspection • Reassembly of Core Unit*
1100 – 1230	***Maintenance & Troubleshooting (cont'd)*** *Check of Seal Clearances & Shaft End-play*
1230 – 1245	*Break*
1245 – 1420	***Case Studies*** *Case Study #7: Ethylene Plant in Kuwait* *Case Study #8: Phenol Plant*
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: ***Thursday, 31st of December 20226***

0730 – 0930	***Maintenance & Troubleshooting (cont'd)*** *Maintenance Strategies*
0930 – 0945	*Break*
0945 – 1045	***Maintenance & Troubleshooting (cont'd)*** *PRT Load Shedding Concerns*
1045 – 1230	***Maintenance & Troubleshooting (cont'd)*** *Rotor Dynamics & Vibration Analysis*
1230 – 1245	*Break*
1245 – 1330	***Maintenance & Troubleshooting (cont'd)*** *Optimized/Reengineered Design & Economics*
1330 – 1345	***Final Discussions***
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

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