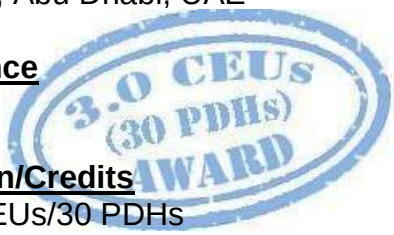
COURSE OVERVIEW ME0670
Centrifugal Compressor Operations

Course Title
Centrifugal Compressor Operations

Course Date/Venue
Session 1: January 19-23, 2025/Boardroom 1, Elite Byblos Hotel Al Barsha, Sheikh Zayed Road, Dubai, UAE
Session 2: July 21-25, 2025/Fujairah Meeting Room, Grand Millennium Al Wahda Hotel, Abu Dhabi, UAE



Course Reference
ME0670

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 using our state-of-the-art simulators.

This course is designed to provide delegates with a good working knowledge on centrifugal MEK compressors - hands on training. It covers the general description and key features of compressors including shaft, implellers/blades, balance drum and thrust collar, casing and diaphragm bundle/stator vanes, journal and thrust bearing, oil seals and instrumentation.

The course will also discuss the gas path, abnormal operating conditions, compressor performance curves and regulations. It will further cover the compressor operations, compressor control system, line up procedure, startup procedure, shutdown procedure, safety protection system and troubleshooting.

After the completion of the course, participants will be able to apply compressor maintenance in general, antisurge protection system, lube oil system, sealing system, assembly, disassembly and maintenance procedures.

Course Objectives

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

- Apply proper techniques, tools and procedures in the operation, control, startup, shutdown, maintenance and troubleshooting of centrifugal gas compressor
- Discuss the general description of compressors and identify its key features
- Identify the principles of gas path and fluid flow in a centrifugal compressor
- Recognize the abnormal operating conditions practices in centrifugal compressors
- Illustrate compressor performance curves including its design and efficiency
- Describe the compressor operations, control system, lineup procedure, startup procedure, shutdown procedure, safety protection system and troubleshooting
- Discuss the general overview of compressor maintenance
- Identify the proper compressor maintenance procedures used in antisurge protection system, lube oil system and sealing system
- Discuss the maintenance of compressors during assembly and disassembly
- Employ the detailed maintenance procedure used in centrifugal compressors

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, control, startup, shutdown, maintenance and troubleshooting of centrifugal gas compressors for engineers, shift supervisors, foremen 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 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

Certificates are accredited by the following international accreditation organizations: -

- 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.

- 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.

Accommodation

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

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:

Mr. Mohamed Refaat, MSc, BSc, is a **Senior Mechanical & Maintenance Engineer** with almost **30 years** of extensive experience in **Rotating Equipment** and **Machinery** including **Pumps**, **Compressors**, **Turbines**, **Motors**, **Turbo-expanders**, **Gears**, etc. His wide experience also covers **Centrifugal Compressor & Steam Turbine**, **Centrifugal Pump**, **Pump** Technology, **Gas Turbine** Technology, **Heat Exchanger**, **Turbines & Motors**, **Variable Speed Drives**, **Seals**, **Control Valves**, Advanced **Valve** Technology, **Dry Seal**, **Fired Heaters**, **Air Coolers**, **Crude Desalter**, **Process Vessels & Valves**, **Industrial Equipment & Rotating Machinery**, **Mechanical** Engineering, **Mechanical Equipment & Turbomachinery**, **Piping**, **Pipelines**, **Valves**, **Lubrication Technology**, **Vibration Analysis**, **Power System Hydraulics**, **Security Detection** Systems & Operation, **Process Plant** Equipment, Troubleshooting **Process Operations**, **Maintenance Management** Best Practices, **Rotating Equipment** Reliability Optimization, Practical **Machinery Vibration**, **Vibration** Techniques, Effective **Reliability Maintenance**, Excellence in **Maintenance & Reliability** Management, **Preventive & Predictive Maintenance**, Machinery Failure Analysis (**RCFA**), **Reliability** Optimization & Continuous Improvement, **Maintenance** Planning, Scheduling & Work Control, **Maintenance Management** Strategy, **Mechanical & Rotating Equipment** Troubleshooting, Preventive Maintenance, Predictive Maintenance, Reliability Centered Maintenance (**RCM**), Condition Based Monitoring (**CBM**), **FMEA** and Troubleshooting of machinery and rotating equipment including turbines, bearings, compressors, pumps etc. He is currently the **Mechanical Maintenance Section Head** of the **Arab Petroleum Pipelines Company** where he is in charge of planning, scheduling & managing the execution of preventive & corrective mechanical maintenance activities for all equipment. He is responsible for executing the scheduled inspections & major overhauls for gas turbines, valves & pumps, carrying out off-line vibration monitoring plans, troubleshooting, fault diagnosing & investigating failures of machinery.

During his career life, Mr. Mohamed was able to modify the gas turbines self cleansing system to improve its maintainability and extend the air filters' lifetime. He was responsible for defining & updating the equipment codes and parameters for replacing the old **CMMS** with **MAXIMO**. He also worked as the Operations Supervisor wherein he was closely involved with the operation of the crude oil internal **pipeline** system between the tankers and tank farm, operation & control of the booster pumps for pumping crude oil for main pipelines and the development & implementation of the plans & procedures for draining the main terminal internal lines for maintenance purposes. He also held the position of Measurement Engineer where he was responsible for the crude oil custody transfer, performing loss control analysis and operating the crude oil automatic sampler & related equipment. Prior to that, he was the Design Engineer responsible for the design phase of the Truck Mixer Manufacturing Project of the Mechanical Design Department.

Mr. Refaat has **Master** and **Bachelor** degrees in **Mechanical Engineering** and a General Certificate of Education (**GCE**) from the **University of London**, **UK**. Further, he is a **Certified Instructor/Trainer**, a **Certified Internal Verifier/Assessor/Trainer** by the **Institute of Leadership & Management** (**ILM**) and a member of the Engineering Syndicate of Egypt. He has further delivered numerous training, courses, workshops, seminars and conferences worldwide.

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

0730 – 0800	*Registration & Coffee*
0800 – 0815	*Welcome & Introduction*
0815 – 0830	***PRE-TEST***
0830 – 0930	***Compressors - General Description & Key Features*** *Shaft ● Impellers/Blades ● Balance Drum and Thrust Collar ● Casing and Diaphragm Bundle/Stator Vanes ● Journal & Thrust Bearings ● Oil Seals ● Instrumentation*
0930 – 0945	*Break*
0945 – 1100	***Gas Path*** *Fluid Flow in Centrifugal Compressor ● Axial Thrust*
1100 – 1215	***Abnormal Operating Conditions - Overview*** *Centrifugal compressor Unsteady Flows ● Rotating Stall ● Surge ● Choking*
1215 – 1230	*Break*
1230 – 1420	***Compressor Performance Curves & Regulations*** *Design Considerations ● Efficiency Considerations ● Operating Planes ● Basic Principle of Compressors Operations ● System Resistance Curve Modification*
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

0730 – 0830	***Compressor Operations***
0830 – 0930	***Compressor Control System***
0930 – 0945	*Break*
0945 – 1100	***Line Up Procedure***
1100 – 1230	***Startup Procedure***
1230 – 1245	*Break*
1245 – 1420	***Shutdown Procedure***
1420 – 1430	***Recap***
1430	*Lunch & End of Day Two*

Day 3

0730 – 0930	***Safety Protection System***
0930 – 0945	*Break*
0945 – 1230	***Troubleshooting***
1230 – 1245	*Break*

1245 – 1330	***Compressor Maintenance-General*** *Suction Temperature Variation ● Suction Pressure Variation ● Compressor Internal Leakage ● Fouling Effect*
1330 – 1420	***Compressor Maintenance-Antisurge Protection System*** *Protection System Philosophy ● Mechanical Failure Alarm ● Lube Oil Alarm ● Seal Oil Alarm ● Condition Monitoring*
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

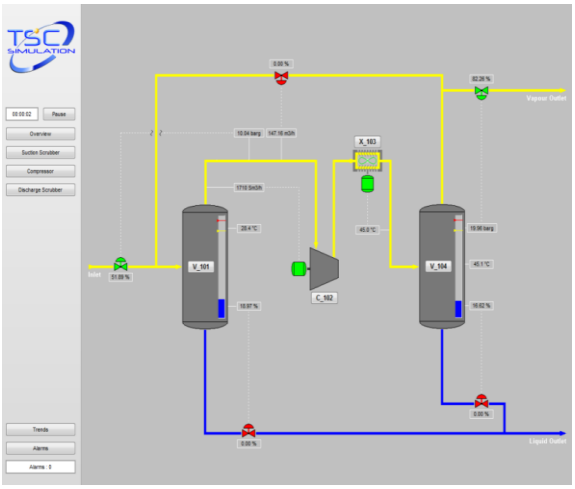
0730 – 0930	***Compressor Maintenance-Lube Oil System*** *Description of Components ● Electrical Instruments-Typical Loops ● Jacking Oil System (if applicable) ● Alarm and Shut-Down*
0930 – 0945	*Break*
0945 – 1100	***Compressor Maintenance-Lube Oil System (cont'd)*** *Routine Check During Normal Operation ● Identifying Malfunctions & Faults*
1100 – 1230	***Compressor Maintenance-Sealing System*** *Scope of the System ● Description of Components ● Electrical Instruments-Typical Loops*
1230 – 1245	*Break*
1245 – 1420	***Compressor Maintenance-Sealing System (cont'd)*** *Alarm and Shut-Down ● Seal Operation ● Routine Check During Normal Operation ● Identifying Malfunctions & Faults*
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

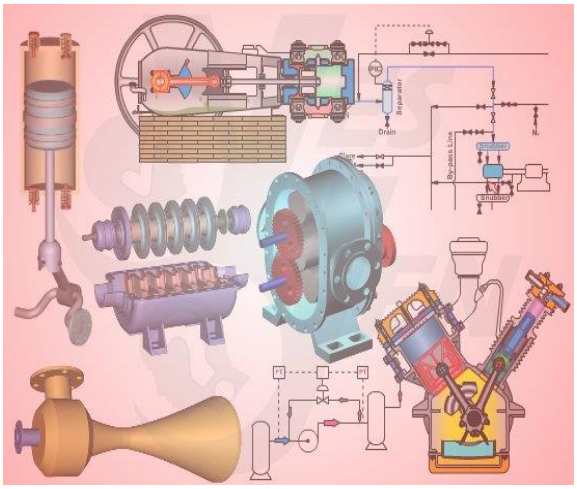
0730 – 0930	***Compressor Maintenance-Assembly & Disassembly*** *Special Tools ● Clearance Measurements*
0930 – 0945	*Break*
0945 – 1100	***Compressor Maintenance-Maintenance Procedures*** *Minor and Major Maintenance ● Preventive Maintenance ● IMO&R Planning*
1100 – 1230	***Compressor Maintenance-Maintenance Procedures (cont'd)*** *Execution ● Documentation*
1230 – 1245	*Break*
1245 – 1345	***Compressor Maintenance-Maintenance Procedures (cont'd)*** *Q&As ● Troubleshooting*
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 "SIM 3300 Centrifugal Compressor" and "CBT on Compressors" simulators.



SIM 3300 Centrifugal Compressor Simulator



CBT on Compressors

Course Coordinator

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