COURSE OVERVIEW ME0315-4D
Steam Turbine Operation

Course Title
Steam Turbine Operation

Course Reference
ME0315-4D

Course Duration/Credits
Four days/2.4 CEUs/24 PDHs

Course Date/Venue

Session(s)	Date	Venue
1	January 15-18, 2024	Jubail Hall, Signature Al Khobar Hotel, Al Khobar, KSA
2	March 04-07, 2024	Cheops Meeting Room, Radisson Blu Hotel, Istanbul Sisli, Turkey
3	June 10-13, 2024	Ajman Meeting Room, Grand Millennium Al Wahda Hotel, Abu Dhabi, UAE
4	September 09-12, 2024	Boardroom 1, Elite Byblos Hotel Al Barsha, Sheikh Zayed Road, Dubai, UAE

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.

A steam turbine is powered by the energy in hot, gaseous steam—and works like a cross between a wind turbine and a water turbine. Like a wind turbine, it has spinning blades that turn when steam blows past them; like a water turbine, the blades fit snugly inside a sealed outer container so the steam is constrained and forced past them at speed. Steam turbines use high-pressure steam to turn electricity generators at incredibly high speeds, so they rotate much faster than either wind or water turbines.

This course is designed to provide delegates with a detailed and up-to-date knowledge on the operation of steam turbine. It covers the fundamental and technology of steam turbine; the main components in turbine systems including lubricating oil systems, steam and water seal systems, hydraulic power units and irregular operations within a system; locations of the turbine supervisory instrument and their functions; and the control concepts and systems of steam turbine.

Further, the course will also discuss the normal operations and performance of steam turbine; the vibration analysis as an indicator of abnormal operating conditions; the irregular operating conditions caused by vibration of different components; detection of abnormal conditions; recognizing potential results; and applying operator action to prevent loss.

Course Objectives

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

- Apply and gain an in-depth knowledge on the operation of steam turbine
- Discuss the fundamental and technology of steam turbine
- Describe the main components in turbine systems including lubricating oil systems, steam and water seal systems, hydraulic power units and irregular operations within a system
- Identify the locations of the turbine supervisory instrument and describe their functions
- Describe the control concepts and systems of steam turbine
- Carryout normal operations and performance of steam turbine
- Discuss vibration analysis as an indicator of abnormal operating conditions
- Identify irregular operating conditions caused by vibration of different components
- Detect abnormal conditions, recognize potential results and apply operator action to prevent loss

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 on the operation of steam turbine. Rotating equipment, machinery, plant, maintenance and mechanical engineers, supervisors, foremen and other technical staff being exposed relatively recently to the turbomachinery field will gain an excellent knowledge on the practical aspects of the course. Experienced specialists, project engineers and supervisory personnel involved in management, selection, operation and maintenance of steam turbines will definitely benefit from the course.

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

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 **2.4 CEUs** (Continuing Education Units) or **24 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 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 Maintenance & Reliability 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 **Modern Maintenance & Reliability** Management, **Maintenance Errors**, **Maintenance Audit & Site Inspection**, **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**), **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**, **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's** and **Bachelor's** degree 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.

Training Methodology

This interactive training course includes the following training methodologies as a percentage of the total tuition hours:-

30% Lectures
20% Workshops & Work Presentations
30% Case Studies & Practical Exercises
20% Software, Simulators & Videos

In an unlikely event, the course instructor may modify the above training methodology before or during the course for technical reasons.

Course Fee

Al Khobar	**US$ 4,500** per Delegate + **VAT**. This rate includes H-STK® (Haward Smart Training Kit), buffet lunch, coffee/tea on arrival, morning & afternoon of each day.
Istanbul	**US$ 5,000** per Delegate + **VAT**. This rate includes Participants Pack (Folder, Manual, Hand-outs, etc.), buffet lunch, coffee/tea on arrival, morning & afternoon of each day.
Abu Dhabi	**US$ 4,500** per Delegate + **VAT**. This rate includes H-STK® (Haward Smart Training Kit), buffet lunch, coffee/tea on arrival, morning & afternoon of each day.
Dubai	**US$ 4,500** 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 – 0900	***Steam Turbine Fundamental Review*** *Theory ● Turbine Sections ● Component Descriptions*
0900 – 0915	*Break*
0915 – 1100	***Technology*** *Main Types of Turbines, New Designs from Manufacturers ● Nozzles, Diaphragms, Fixed blades*
1100 – 1230	***Technology (cont'd)*** *Rotors & Bladings ● Bearings & Thrust Bearings ● Seals: Internal & Shaft Ends Sealing ● Vibrations & Critical Speeds*
1230 – 1245	*Break*
1245 – 1420	***Technology (cont'd)*** *Condenser & Vacuum Devices ● Balancing Steam ● Application: Study of Turbine, Turbine & Auxiliaries Drawings*
1420 – 1430	***Recap*** *Using this Course Overview, the Instructor(s) will Brief Participants about the Topics that were Discussed Today & Advise Them of the Topics to be Discussed Tomorrow*
1430	*Lunch & End of Day One*

Day 2

0730 – 0900	***Turbine Systems*** *Lubricating Oil Systems ● Gland Steam & Water Seal Systems ● Hydraulic Power Unit ● Abnormal Operations*
0900 – 0915	*Break*
0915 – 1100	***Turbine Supervisory Instrument Location & Function*** *Eccentricity ● Speed Detection ● Valve Position ● Vibration ● Shell Expansion ● Differential Expansion ● Metal Temperatures*
1100 – 1230	***Steam Turbine Control Concepts & Systems*** *Speed Control ● Speed Control Systems Fixed or Variable, Process Parameter Control, Generating Set Control ● Load Control ● Controllers: Characteristics of Conventional & Numeric Controllers ● Equipment Technology: Sensors, Transmitters, Controllers & Extraction Control*
1230 – 1245	*Break*
1245 – 1420	***Steam Turbine Control Concepts & Systems (cont'd)*** *Safety Devices: Overspeed, Vibrations, Temperature of Ancillaries, Control Loop & Safety Systems, T&T Valves Trip & Throttle, Governor Control, Manual Exerciser*
1420 – 1430	***Recap*** *Using this Course Overview, the Instructor(s) will Brief Participants about the Topics that were Discussed Today & Advise Them of the Topics to be Discussed Tomorrow*
1430	*Lunch & End of Day Two*

Day 3

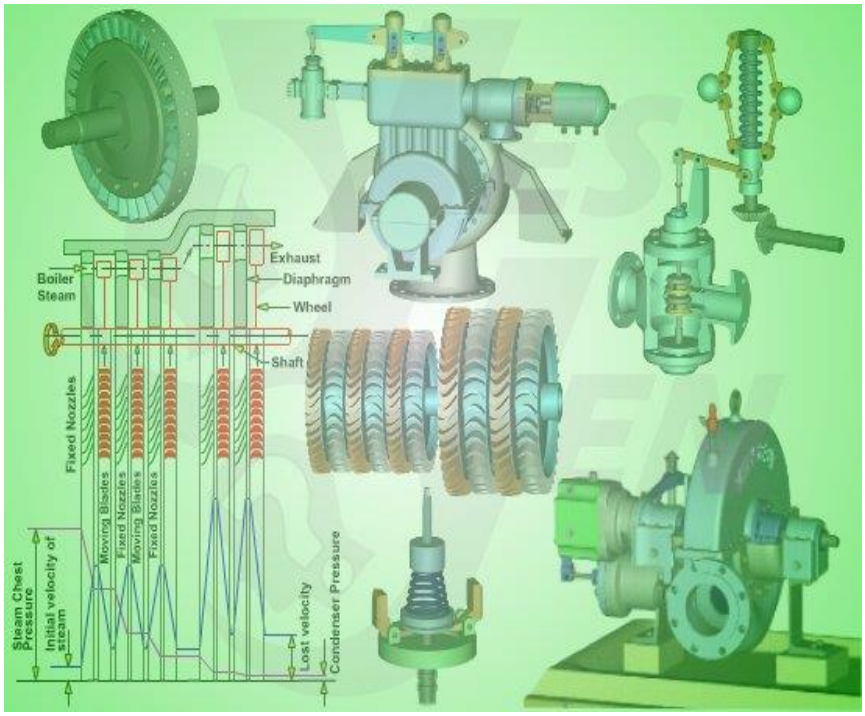
0730 – 0900	***Turbine Normal Operations*** *Thorough Examination of the Cause & Effect of Thermal Stress ● Starting & Loading Procedures ● Drains ● Pre-Warming Procedures ● Normal Operations ● Load Changes ● Shutdown ● Lubrication & Sealing Devices ● Important Factors in Turbine Operation: Heating, Expansion, Vibrations ● Start-Up After Trip*
0900 – 0915	*Break*
0915 – 1100	***Turbine Normal Operations (cont'd)*** *Monitoring of Steam Circuit & Lubrication Circuit ● Start-Up & Shutdown Sequences of Different Types of Turbines (Impulse, Reaction, Condensing & Non-Condensing Turbines) ● Incidents Occuring in the Steam Circuit, The Machine or the Ancillary Equipment ● Detailed Operational Procedures, Safety Practices, Troubleshooting ● Daily & Routine Checks for Safe & Reliable Operation, Do's & Dont's*
1100 – 1230	***Overview of Steam Turbine Performance*** *Steam Characteristics ● Inlet & Exhaust Conditions ● Ideal Expansion & Real Expansion ●*
1230 – 1245	*Break*
1245 – 1420	***Overview of Steam Turbine Performance (cont'd)*** *Expansion Mechanisms: Impulse Stage Reaction stage & Different Types of Multistage Turbine ● Turbine Back Pressure & Condensing Turbine ● Overall Performance*
1420 – 1430	***Recap*** *Using this Course Overview, the Instructor(s) will Brief Participants about the Topics that were Discussed Today & Advise Them of the Topics to be Discussed Tomorrow*
1430	*Lunch & End of Day Four*

Day 4: **Thursday, 26th of January 2023**

0730 – 0930	***Vibration Analysis as an Indicator of Abnormal Operating Conditions*** *Oil Whip ● Bowed Rotors ● Packing Rubs (Low Speed versus High Speed) ● Mechanical Unbalance ● Resonant Vibration ● Coupling Unbalance ● Cracked Rotors*
0930 – 0945	*Break*
0945 – 1045	***Abnormal Conditions: Detection, Potential Results & Operator Action to Prevent Loss (cont'd)*** *Loss of Turning Gear ● Extended Turning Gear Operation ● Inability to Stay on Turning Gear During Pre-Warm ● Abnormal Cooler Discharge Oil Temperatures*
1045 – 1200	***Abnormal Conditions: Detection, Potential Results & Operator Action to Prevent Loss (cont'd)*** *Bearing Wipes ● Water Induction ● Excessive Differential Expansion ● Axial Rubs ● Low Speed Operation ● Sling-Shot Starts ● Low Frequency Operation*
1200 – 1215	*Break*
1215 – 1345	***Abnormal Conditions: Detection, Potential Results & Operator Action to Prevent Loss (cont'd)*** *High Exhaust Hood Temperatures ● Vacuum Breaking ● Over Pressure ● Over Temperature ● Loss Boiler ● Inlet Pressure Fluctuations ● Valve Oscillation ● Governor Bobble ● Full-Load Rejection ● Hot Restarts ● Feedwater Heater Removal*
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 simulator "Steam Turbines & Governing System CBT".



Steam Turbines & Governing System CBT

Course Coordinator

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