COURSE OVERVIEW ME0312-4D
Steam Turbine Maintenance & Troubleshooting

Course Title
Steam Turbine Maintenance & Troubleshooting

Course Date/Venue
November 18-21, 2024/Fujairah Meeting Room, Grand Millennium Al Wahda Hotel, Abu Dhabi, UAE

Course Reference
ME0312-4D

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

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 designed is to provide participants with a detailed overview on the operation and maintenance of steam turbines and their auxiliary support systems. It covers the STG component construction and maintenance procedures as well as the fundamental knowledge of the auxiliary systems function and preventive maintenance requirements which allow participants to approach maintenance activities including troubleshooting with confidence.

Further, the course will also discuss the STG component construction and maintenance procedures; the auxiliary systems function and preventive maintenance requirements; the maintenance activities approach including troubleshooting with confidence; the fundamentals of steam turbine and basic steam cycle; the main components of turbine systems including lubricating oil systems, steam and water seal systems and hydraulic power units; the irregular operations within a systems; the locations and functions of the turbine supervisory instrument; the major components of steam turbine; the fundamentals of steam turbine control concepts; and the controls section to describe the purpose and function of the controls system, including protective functions of the turbine.

During this interactive course, participants will learn the STG major components, equipment arrangements and associated maintenance requirements of each section of the turbine; how to source information in the STG service manuals; the proper troubleshooting and turbine operations; the operation of a steam turbine and how it inter-relates with the rest of the power plant; the effect on maintenance intervals; the steam turbine maintenance procedures including practices, disassembly, inspection, evaluation and reassembly sequence; the maintenance planning, scheduling, decision making and reviewing of standard practices, tooling and parts needed to successfully conduct inspections; the turbine shells, casings, rotors, journal bearing, thrust bearings and couplings; the key elements including rotor, diaphragms, bearings, valves and steam seal systems; the steam valve, alignment and irregular operating conditions caused by vibration of different components; the abnormal conditions, verifying potential results and operator action to prevent loss; and the purpose, function and routine preventive maintenance of various turbine support systems.

Course Objectives

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

- Maintain and troubleshoot steam turbine in a professional manner
- Apply STG component construction and maintenance procedures, identify auxiliary systems function and preventive maintenance requirements and illustrate maintenance activities approach including troubleshooting with confidence
- Discuss the fundamentals of steam turbine and basic steam cycle
- Describe the main components of turbine systems including lubricating oil systems, steam and water seal systems and hydraulic power units and discuss irregular operations within a systems
- Identify the locations and functions of the turbine supervisory instrument and assemble the major components of steam turbine
- Describe and explain the fundamentals of steam turbine control concepts as well as the controls section to describe the purpose and function of the controls system, including protective functions of the turbine
- Review STG major components, equipment arrangements and associated maintenance requirements of each section of the turbine
- Illustrate how to source information in the STG service manuals and apply proper troubleshooting
- Perform turbine operations and discuss the theory of operation of a steam turbine and how it inter-relates with the rest of the power plant as well as identify the effect on maintenance intervals
- Employ steam turbine maintenance procedures including practices, disassembly, inspection, evaluation and reassembly sequence as well as maintenance planning, scheduling, decision making and reviewing of standard practices, tooling and parts needed to successfully conduct inspections
- Determine turbine shells, casings, rotors, journal bearing, thrust bearings and couplings
- Design and construct the key elements including rotor, diaphragms, bearings, valves and steam seal systems
- Maintain steam valve, perform alignment and identify irregular operating conditions caused by vibration of different components
- Assess and detect abnormal conditions, verify potential results and illustrate operator action to prevent loss
- Enumerate the purpose, function and routine preventive maintenance of the various turbine support systems

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, sample video clips of the instructor's actual lectures & practical sessions during the course conveniently saved in a **Tablet PC**.*

Who Should Attend

The course covers systematic techniques and methodologies on steam turbine maintenance and troubleshooting for the engineering graduates and other technical staff being exposed relatively recently to the turbomachinery field. Experienced specialists, project engineers and supervisory personnel involved in management, selection, operation and maintenance of steam turbines will definitely profit from attending this course. This includes rotating equipment, machinery, plant, maintenance and mechanical engineers, 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 Fee

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.

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. Roshdi Alkam is a **Senior Mechanical & Maintenance Engineer** with over **35 years** of extensive experience within the **Oil & Gas**, **Petrochemical** and **Refining Industries**. His specialization widely covers in the areas of **Facilities Management**, **Reliability Centred Maintenance** (**RCM**), **Reliability Management**, **Reliability** Management and **Rotating Equipment**, Housing & **Facilities Maintenance** Management, Reliability-Availability-Maintainability (**RAM**), **Machinery Root Cause Failure Analysis** (**RCFA**), **Condition Based Monitoring**, **Piping System**, **Process Equipment**, **Mechanical Integrity**, **Maintenance Management**, Total Plant Maintenance (**TPM**), **Engineering Drawings** and **P&ID** Reading, Interpretation & Developing, **Diesel Engine** Maintenance, **Centrifugal & Reciprocating Compressors**, **Pump Technology**, **Lubrication & Bearing** Maintenance, **Valve** Troubleshooting, **Mechanical & Dry Gas Seals**, **Gas & Steam Turbine**, **Boiler** Operation, **Mechanical Governors**, **Burners**, **Storage Tanks** Maintenance, **Pressure Vessel & Reactors**, **Heat Exchangers**, **Cooling Towers & Heaters**, **Steam Traps** Operation, **Flanges & Blinding**, **Piping System & Online Leak Sealing**, **Mechanical & Rotor Alignment & Balancing**, **Pump** Technology, **Pump** Selection & Installation, **Centrifugal Pumps & Troubleshooting**, **Compressor** Control & Protection, **Turbine** Operations, **Valves**, **Bearings & Lubrication**, Advanced **Machinery Dynamics**, **Heat Transfer**, **Process Plant Shutdown & Turnaround**, **Maintenance Optimization & Best Practices** and **Maintenance Auditing & Benchmarking**.

Throughout Mr. Roshdi's professional career, he has handled key positions as the **Technical Instructor** for **Mechanical Trade**, **Maintenance Manager** and **Mechanical Engineer** for international companies and organizations such as United Nations Relief and Works Agency (**UNRWA**), The United Nations Educational, Scientific and Cultural Organization (**UNESCO**) and Azmi Sabri Contracting Company just to name a few. Further he has been the **Certified Process Operator Program** (**CPO**) **(Accredited by City & Guilds**) **Instructor** contracted by **KNPC** for the year 2014-2015 in delivering **Certified Program for Kuwaiti Contractor Employee**.

Mr. Roshdi has a **Bachelor's** degree and **Diploma** in **Mechanical Engineering** from the **University of Annaba**. He is also an active member of the **Jordan Engineers Association**, **JICA Alumni Association**, **GIZ Forum** (**Germany**) and the **UNESCO-UNEVOC e-Forum**. Further, he is a **Certified Instructor/Trainer** and has delivered numerous training, courses, seminars, workshops and conferences in his field of expertise.

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, 18th of November 2024***

0730 – 0800	*Registration & Coffee*
0800 – 0815	*Welcome & Introduction*
0815 – 0830	***PRE-TEST***
0830 – 0930	***Steam Turbine Fundamental Review*** *Theory ● Turbine Sections ● Component Descriptions ● Basic Steam Cycle*
0930 – 0945	*Break*
0945 – 1100	***Turbine Systems*** *Lubricating Oil Systems ● Gland Steam & Water Seal Systems ● Hydraulic Power Unit ● Abnormal Operations*
1100 – 1215	***Turbine Supervisory Instrument Location & Function*** *Eccentricity ● Speed Detection ● Valve Position ● Vibration ● Shell Expansion ● Differential Expansion ● Metal Temperatures ● Function & Assembly of the Major Components of a Steam Turbine*
1215 – 1230	*Break*
1230 – 1330	***Steam Turbine Control Concepts*** *Fundamentals of Steam Turbine Controls ● Speed Control ● Load Control ● Limiters ● Flow Control ● Extraction Turbines ● Overspeed & Reset System ● Overspeed Trip ● Controls Section to Describe the Purpose & Function of the Controls System, Including Protective Functions of the Turbine*
1330 - 1420	***STG Major Components, Equipment Arrangements & Associated Maintenance Requirements of Each Section of the Turbine***
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, 19th of November 2024***

0730 – 0930	***How to Source Information in the STG Service Manuals?***
0930 – 0945	*Break*
0945 – 1100	***Troubleshooting***
1100 – 1215	***Turbine Normal Operations*** *Theory of Operation of a Steam Turbine & How it Inter-Relates with the Rest of the Power Plant ● Thorough Examination of the Cause & Effect of Thermal Stress ● Starting & Loading Procedures ● Drains ● Pre-Warming Procedures ● Normal Operations ● Load Changes ● Shutdown ● Turbine Operation & the Effect on Maintenance Intervals*
1215 – 1230	*Break*
1230 – 1330	***Steam Turbine Maintenance Procedures*** *Safety Practices ● Disassembly ● Inspection ● Evaluation & Reassembly Sequence*

1330 - 1420	***Maintenance Planning, Scheduling & Decision Making*** *Understanding the Major Items That Must be Considered Prior to Commencing A Scheduled Turbine-Generator Outage ● Items That Need to be Considered When Making Repair/Replace/Reuse Decisions ● Reviewing of Standard Practices, Tooling & Parts Needed to Successfully Conduct Inspections*
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, 20th of November 2024***

0730 – 0930	***Turbine Shells, Casings & Rotors*** *Safe and Efficient Ways Disassemble/Reassemble Major Turbine Components ● How to Improve Inspection/Repair Techniques, Communications on Equipment and Make Better Replace/Repair/Reuse Decisions ● Different Types of Distress Typically Found on These Components*
0930 – 0945	*Break*
0945 – 1100	***Journal & Thrust Bearings*** *Different Types of Bearings and Their Applications ● Disassembly/Reassembly Procedures ● Inspection Techniques ● Typical Types of Distress as Well as Causes*
1100 – 1215	***Couplings*** *Types of Couplings Used on T-G Sets ● How Torque Is Transferred ● How to Properly Disassemble/Reassemble ● How to Inspect, What Measurements to Take, and What They Mean*
1215 – 1230	*Break*
1230 – 1330	***Design & Construction of the Key Elements*** *Rotor ● Diaphragms ● Bearings ● Valves ● Steam Seal Systems*
1330 - 1420	***Steam Valve Maintenance*** *Purpose of the Various Steam Turbine Valves ● How to Properly Disassemble/Reassemble ● How to Inspect ● What Are the Typical Types of Distress ● What Measurements to Take, and What They Mean*
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*

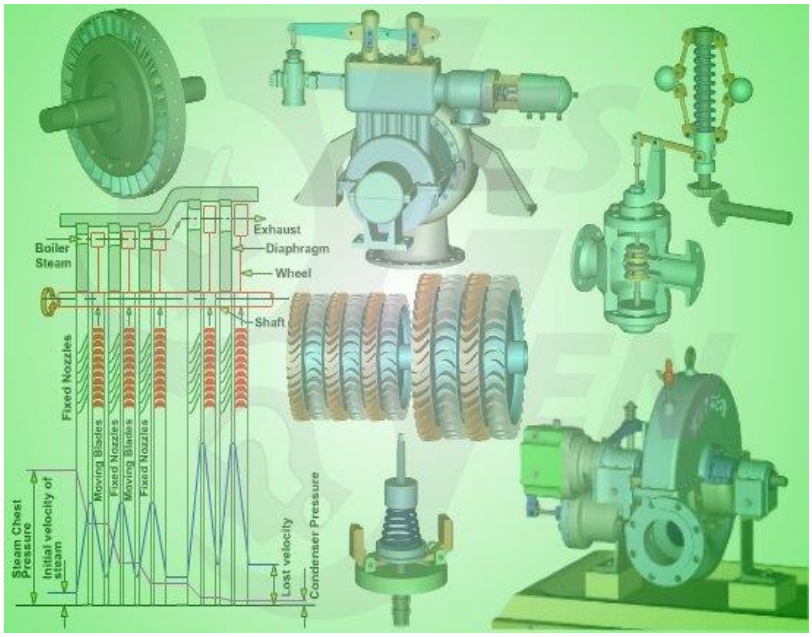
Day 4: ***Thursday, 21st of November 2024***

0730 – 0830	***Alignment*** *How to Properly Take Clearance/Alignment and How to Evaluate ● How to Calculate and Make Moves for Stationary Equipment Such as Diaphragms and Inner Shells ● How to Take Coupling Rim/Face Readings ● How to Calculate Moves to Correct for Coupling Misalignment ● How to Calculate and Make Moves to Bearings to Accomplish Alignment Objectives*
0830 – 0845	*Break*

0845 – 1000	***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*
1000 - 1100	***Abnormal Conditions: Detection, Potential Results & Operator Action to Prevent Loss*** *Loss of Turning Gear ● Extended Turning Gear Operation ● Inability to Stay on Turning Gear During Pre-Warm ● Abnormal Cooler Discharge Oil Temperatures ● Bearing Wipes ● Water Induction ● Excessive Differential Expansion ● Axial Rubs ● Low Speed Operation ● Sling-Shot Starts ● Low Frequency Operation ●*
1100 – 1115	*Break*
1115 – 1230	***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*
1230 - 1350	***Purpose, Function & Routine Preventive Maintenance of the Various Turbine Support Systems***
1350 – 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

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