COURSE OVERVIEW ME0615-4D
Pumps & Compressors
Operation, Maintenance & Troubleshooting

Course Title
Pumps & Compressors: *Operation, Maintenance & Troubleshooting*

Course Date/Venue
November 18-21, 2024/ Jubail Hall, Signature Al Khobar Hotel, Al Khobar, KSA

Course Reference
ME0615-4D

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

Pumps and compressors are used extensively in the process industries. There are many types with widely varying configurations and applications. They represent a significant part of the capital and operating costs of most plants, and optimizing their selection, operation and maintenance are therefore, of major economic importance.

The course deals with efficiencies, operating characteristics, reliability, maintenance and troubleshooting implications of pumps and compressors.

The course will cover the operating principles of pumps and compressors, specifications, thermodynamics, effects of efficiency on operating costs, energy usage, and effect on plant costs, materials of construction, selection, troubleshooting and maintenance.

The course will also cover plant run-length extension surveys, organizing for successful turnarounds and on-going reliability improvement, and preventive vs. predictive maintenance strategy decisions.

The course will provide the participant with a basic as well as advanced pump and compressor technology knowledge, inventory required to successfully select, apply, operate, troubleshoot and maintain pumps and compressors.

At the end of this course, participants will have gained a thorough understanding of the various types of pumps and compressors available to most industrial users, including sizing and application criteria, maintainability, reliability, vulnerability and troubleshooting issues. Participants will learn simple techniques and short-cut methods of machinery sizing and selection. This replaces tedious hand or other methods of calculation and will serve as a fast way to arrive at sensitivity or influence of parameter changes on equipment performance.

Course Objectives

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

- Apply systematic techniques in the operation, maintenance and troubleshooting of pumps and compressors
- Discuss the concepts of pump types and terminology and introduce the theory and operating characteristics of centrifugal pumps
- Identify the common types of compressors and the ranges of application and limitation and have an overview of centrifugal compressors including its type and function
- Recognize the principles of equipment failure patterns including its type and review the common factors of why equipment fails
- Differentiate between the different aspects of machinery corrosion and to make the correct selection of material for a given application
- Determine the basic approaches to machinery troubleshooting and troubleshoot most possible faults and failures of pumps and compressors and discover the various approaches to be considered in applying corrective actions
- Employ the principles of dry gas, packing and mechanical seals and recognize their components and functions
- Develop a good background on seal support systems including its selection strategies and other applications and explain the features of dry gas seal for centrifugal gas compressor
- Analyze and troubleshoot mechanical seal failure and identify the various maintenance & repair methods used
- Discuss the basic concept of bearing care & maintenance, bearing classification and lubrication management
- Identify the various types of couplings and recognize their purpose & function and list-down the different alignment methods used
- Recognize and implement the various preventive and predictive maintenance techniques and strategies used for pumps & 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 provides an overview of all significant aspects and considerations of pumps and compressors for those who are involved in the operation, maintenance and troubleshooting of such equipment. This includes rotating equipment and machinery engineers, plant and maintenance engineers and other technical staff involved in turbomachinery management, operation and maintenance. Further, it is suitable for operations, process and process unit contact, mechanical and project engineers.

Course Certificate(s)

Internationally recognized certificates will be issued to all participants of the course.

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. Attalla Ersan, PEng, MSc, BSc, is a **Senior Mechanical Engineer** with over **35 years** of extensive experience within the **Oil & Gas**, **Hydrocarbon** and **Petrochemical** industries. His expertise widely covers the areas of **Boiler & Steam System** Management, **Waste Heat Recovery**, **Boiler Plant Safety**, **Boiler Controls**, **Steam Distribution** Systems, **Steam Traps**, Pollution Control, Cracked **Gas Compressor**, **Reboilers**, Selection & Operation, **Boiler** Inspection & Maintenance, **Boiler** instrumentation & Controls, **Boiler** Start-up & Shutdown, **Boiler** Operation & Steam System Management, **Boiler** Water Chemistry & Treatment, **Boiler** Efficiency & Waste Heat Recovery, **Boiler** Inspection & Testing, **Boiler** Troubleshooting & Safety, **Boiler** Emissions & Pollution Control, **Pumps Maintenance & Troubleshooting**, **Valve** Maintenance, **Plunger Valve**, **Maintenance & Reliability** Best Practices, **Maintenance & Reliability** Management, **Process Plant** Operations, **Process Plant Startup & Operating Procedure**, **Ethylene & Vinyl Chloride**, **Ethane Cracking Furnaces** Operations, **Ethylene & Polyethylene** Operation, **Acid Gas Treatment**, **Sulphur Recovery**, **EDC & VCM**, Caustic Soda Storage, Debottle-necking, **Process Operation**, **Safety Audits**, **Process Engineering**, **Root Cause Investigations**, **Pyrolysis Cracking**, **Gas Plant Commissioning**, **Loss Prevention Techniques**, **Occupational Hazards**, Hot Tapping & Tie-Ins, Pre-Start-Up Safety Review (**PSSR**), Standard Operating Procedure (**SOP**), Emergency Operating Procedure (**EOP**), Permit to Work Systems (**PTW**), **Steam Cracking**, **Steam Generation**, **Binary Fractionators** Operations, **Tanks Farm & Metering Station Techniques**, **Gas Treatment**, **Sulphur Recovery Process Unit Operation**, **Permit to Work System**, **Emergency Response Planning**, **Sulphur Unit Air Blower**, **Steam Turbine**, **Distillation Columns**, **Gas Treatment**, **Waste & Water Treatment Units**, **Water Meter Reading System** (**MMR**), **Utility Regulation**, **Best Water Equipment**, **Water Fittings**, **Water Tanks Filling Stations, Pumping Station**, **Water Chemistry**, **Water Network Design**, **Pumps**, **Compressors**, **Turbines**, **Motors**, **Turbo-expanders**, **Gears**, **Heat Exchanger**, Hazard and Operability (**HAZOP**) Study, Process Hazards Analysis (**PHA**), **HAZOP** Facilitation, **Loss Prevention**, Consequence Analysis Application, **Gas Detectors** Operation, **Accident/Incident Investigation (Why Tree Method)**, **Occupational Exposure Assessment**, **Fire Fighting & First Aid**, **Environmental Management** and **Basic Safety** Awareness. Further, he is also well-versed in Project Management, Human Resources Consultancy, Manpower Planning, Job Design & Evaluation, Recruitment, Training & Development and Leadership, Creative Problem Solving Skills, Work Ethic, Job Analysis Evaluation, Training & Development Needs, Bidding & Tendering, Technical Report Writing, Supervisory Leadership, Effective Communication Skills and Total Quality Management (TQM). He is currently the **CEO** of **Ersan Petrokimya Teknoloji Company Limited** wherein he is responsible for the design and operation of Biogas Process Plants.

During his career life, Mr. Ersan has gained his practical and field experience through his various significant positions and dedication as the **Policy**, **Organization & Manpower Development Head**, **Training & Development**, **Head**, **Ethylene Plant – Pyrolysis Furnace Engineer**, **Production Engineer**, **Mechanical Engineer**, **Boiler Mechanic**, Process Training Coordinator, Ethylene Plant Shift Supervisor, Ethylene Plant Panel & Fit Operator, Process Training & Development Coordinator, **Technical Consultant**, and **Instructor/Trainer** for Qatar Vinyl Company Limited and Qatar Petroleum Company (QAPCO).

Mr. Ersan is a **Registered Professional Engineer** and has a **Master's degree** of **Education** in **Educational Training & Leadership** and a **Bachelor's degree** of **Petrochemical Engineering**. Further, he is a **Certified Instructor/Trainer** and has delivered numerous trainings, courses, workshops, conferences and seminars 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$ 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 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	***Introduction*** *Overview of Rotating Equipment ● Understanding How Equipment Works*
0930 – 0945	*Break*
0945 – 1100	***Pump Types & Terminology*** *Pump Basics ● Pump Terminology ● Nomenclature and Definitions*
1100 – 1215	***Centrifugal Pumps Overview*** *Centrifugal Pump Theory ● Operating Characteristics ● Centrifugal ● Pump Operation ● Cavitation and NPSH • Minimum Continuous Safe Flow (MCSF) ● Types of Centrifugal Pumps ● Troubleshooting and Preventive Maintenance for Pumps*
1215 – 1230	*Break*
1230 – 1330	***Compressor Types & Terminology*** *Centrifugal ● Axial ● Reciprocating ● Helical Screw ● Ranges of Application and Limitations*
1330 – 1420	***Centrifugal Compressors Overview*** *Rotors ● Balancing ● Rotor Dynamics ● Impellers ● Casings ● Troubleshooting and Preventive Maintenance for Compressors ● Bearings ● Seals: Labyrinths, Oil Seals & Self Acting Gas Seals ● Couplings ● Controls*
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	***Equipment Failure Patterns*** *Materials Selection ● Types of Corrosion ● Bath-Tub Curve ● Actual Equipment Failure Patterns ● Actions to Minimize Failure Effect*
0930 – 0945	*Break*
0945 – 1100	***Basic Approaches to Machinery Troubleshooting*** *Examples from Recent Failure Incidents Attributed to Design Defects ● Processing and Manufacturing Deficiencies*
1100 – 1215	***Case Studies***
1215 – 1230	*Break*
1230 – 1245	***Troubleshooting Faults & Applying Corrective Action*** *Equipment Performance Monitoring ● Vibration Analysis ● Fast Fault Finding • Acoustical Troubleshooting ● Infra-red Inspection ● Oil Analysis*
1245 – 1400	***Vibration Analysis DVD's***
1400 – 1415	***Introduction to Dry Gas Seals*** *Principle of Operation ● Materials of Construction ● Manufacturing and Verificatio*
1415 – 1420	***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 Two*

Day 3: Wednesday, 20th of November 2024

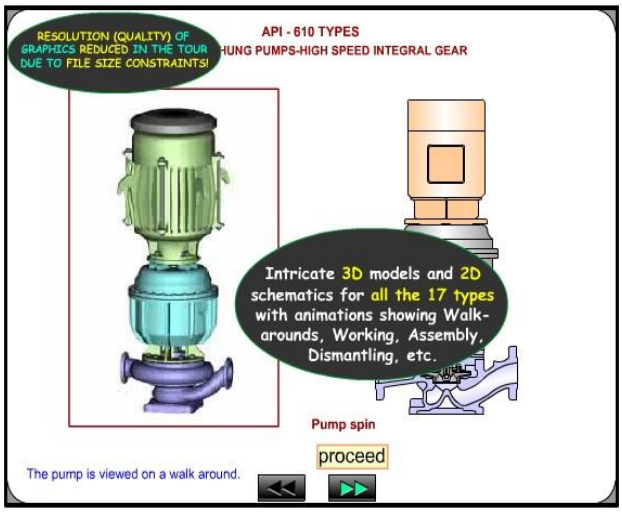
0730 – 0930	***Packing & Mechanical Seals*** *Compression Packing ● Molded (Automatic) Packing ● Basic Principles of Mechanical Seals ● Face Materials ● Secondary Seal Materials ● Single Mechanical Seals ● Single Mechanical Seal ● Flushing Plans*
0930 – 0945	*Break*
0945 – 1100	***Flowserve DVD***
1100 – 1215	***Case Studies***
1215 – 1230	*Break*
1230 – 1300	***Seal Support Systems*** *Dual Sealing Systems and Flushing Plans ● API 682 Reference Guide ● Gas Barrier Seal Technology for Pumps ● Support Systems for Dry Gas (Self Acting) Compressor Seals ● Mechanical Seal Selection Strategies*
1300 – 1330	***Dry Gas Seal for Centrifugal Gas Compressors***
1330 – 1400	***Mechanical Seal Failure Analysis & Troubleshooting*** *Failure Analysis ● Mechanical Seal Troubleshooting ● Determining Leakage Rates ● Ascertaining Seal Stability*
1400 – 1420	***Mechanical Seal Maintenance & Repair*** *Bellows Seal Repair ● Cartridge Seal Installation and Management ● Seal Fa*
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

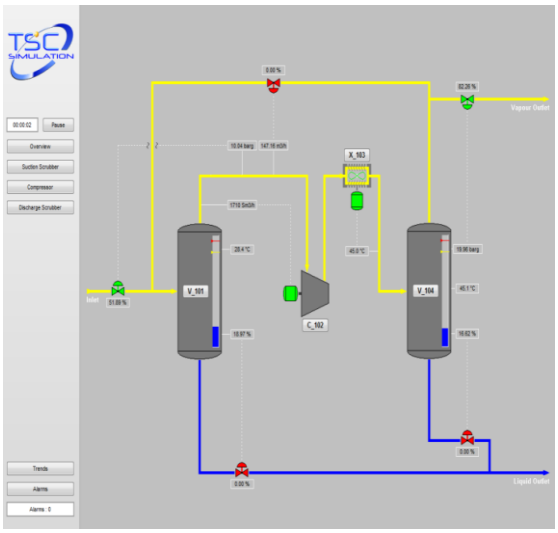
0730 – 0800	***Bearing Care & Maintenance*** *Basic Bearing Concepts ● Bearing Classifications ● Bearing Care and Maintenance ● Lubrication Management Break*
0800 – 0915	***Couplings & Alignment*** *Purpose of Couplings ● Types of Couplings ● Alignment Methods ● Foundation and Grouting Guidelines*
0915 – 0930	***Preventive Maintenance-Lubrication*** *Cost of Poor Lubrication ● Fundamentals-Oil & Grease ● Storage & Handling Methods • Comparative Viscosity ● Classifications*
0930 – 0945	*Break*
0945 – 1200	***Flowserve DVD***
1200 – 1215	***Lubrication DVD***
1215 – 1230	*Break*
1230 – 1345	***Preventive Maintenance*** *General Philosophy ● Equipment Sparing Factor and Maintenance Approach*
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)

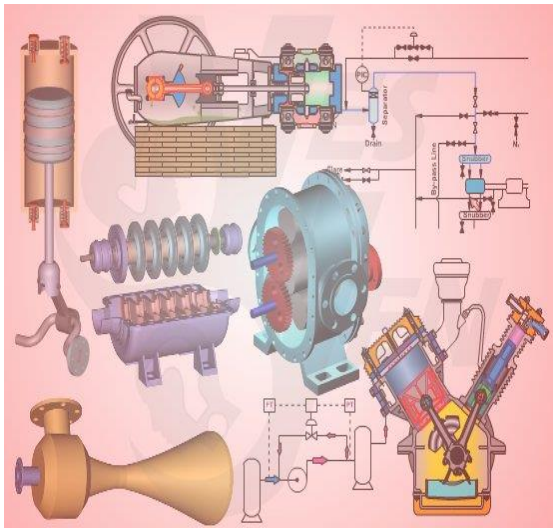
Practical sessions will be organized during the course for delegates to practice the theory learnt. Delegates will be provided with an opportunity to carryout various exercises using the simulators “Centrifugal Pumps and Troubleshooting Guide 3.0”, “SIM 3300 Centrifugal Compressor” and “CBT on Compressors”.



Centrifugal Pumps and Troubleshooting Guide 3.0



SIM 3300 Centrifugal Compressor Simulator



CBT on Compressors

Course Coordinator

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