COURSE OVERVIEW IE0780
Compressor Control & Protection

Course Title
Compressor Control & Protection

Course Date/Venue
January 07-11, 2024/Kizkulesi, Crown Plaza Istanbul Asia Hotels & Convention Center, Istanbul, Turkey

Course Reference
IE0780

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 our state-of-the-art simulators.

This course is designed to provide delegates with a detailed and up-to-date overview of compressor control and protection. It covers the various types of compressors and their functions; the characteristics of surge including its consequences; the key aspects of compressor control and anti-surge protection and preventions; and the various applications of advanced compressor control and how to control using loop decoupling.

The course will also discuss the effects of operating conditions and improves knowledge on surge curve plotting methods; the turbine control objectives and principles according to actuator speed kW droop control; and the turbine system availability objectives and the correct level of redundancy.

During this interactive course, participants will learn to apply several integrated turbine and compressor control approaches as well as the technology updates and distinguish the functions of various control and protection devices in relation to internal relief value, internal motor temperature sensors and crankcase heaters.

Course Objectives

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

- Apply and gain an in-depth knowledge on compressor control and protection
- Identify the various types of compressors as well as their functions
- Determine the characteristics of surge including its consequences
- Employ the key aspects of compressor control and anti-surge protection and preventions
- Recognize the various applications of advanced compressor control and train how to control using loop decoupling
- Illustrate the effects of operating conditions and improves knowledge on surge curve plotting methods
- Implement the turbine control objectives and principals according to actuator speed and kW droop control
- Recognize the turbine system availability objectives and choose the correct level of redundancy
- Apply several integrated turbine and compressor control approaches as well as the technology updates
- Distinguish the functions of various control and protection devices in relation to internal relief value, internal motor temperature sensors, and crankcase heaters

Who Should Attend

This course provides an overview of all significant aspects and considerations of compressor control and protection for engineers and other technical and operation staff who are responsible for the implementation and efficient operation, control and protection of compressors.

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$ 6,000 per Delegate + **VAT**. This rate includes Participants Pack (Folder, Manual, Hand-outs, etc.), buffet lunch, coffee/tea on arrival, morning & afternoon of each day.

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:-

- USA International Association for Continuing Education and Training (IACET)

  Haward Technology is an Authorized Training Provider by the International Association for Continuing Education and Training (IACET), 2201 Cooperative Way, Suite 600, Herndon, Virginia 20171, USA. In obtaining this authority, Haward Technology has demonstrated that it complies with the **ANSI/IACET 1-2013 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 1-2013 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 Association 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.

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. Ahmed El-Sayed, PhD, MSc, BSc, is a **Senior Electrical & Instrumentation Engineer** with **35 years** of extensive experience within the **Oil**, **Gas**, **Power**, **Petroleum**, **Petrochemical** and **Utilities** industries. His experience widely covers in the areas of **Bently Vibration Rack 3500 Training**, Maintenance & Troubleshooting of **11KV Breaker ABB type VD4**, **Rotork make MOVS** Operation & Maintenance, **Air Compressor "Atlas Copco"**, **Compressor** Control & Protection, Advanced Distributed Control System (**DCS**), **DCS** Operation & Configuration, **DCS** Troubleshooting, **DCS Yokogawa** ProSafe-RS Safety Instrumented System, **DCS Yokogawa** Centum VP, **DCS Emerson** DeltaV, **DCS GE Mark VI**, Programable Logic Controller (**PLC**), Supervisory Control & Data Acquisition (**SCADA**) Systems, Siemens **PLC Simatic S7-400/S7-300/S7-200**, **Siemens SIMATIC S7** Maintenance & Configuration, **Siemens WINCC**, SCADA System: Siemens **SIMATIC & WinCC**, **Process Control**, **Control Systems & Data Communications**, **Instrumentation**, **Automation**, **Valve Tuning**, Safety Instrumented Systems (**SIS**), Safety Integrity Level (**SIL**), Emergency Shutdown (**ESD**), **Telemetry** Systems, **Boiler Control & Instrumentation**, Advanced Process Control (**APC**) Technology, Practical **Fiber-Optics** Technology, **GE Gas Turbines**, **Alarm** Management Systems, **Engine** Management System, **Fieldbus** Systems, **NEC** (National Electrical Code), **NESC** (National Electrical Safety Code), **Electrical Safety**, **Electrical Hazards** Assessment, **Electrical Equipment**, Electrical Transient Analysis Program (**ETAP**), Power **Quality**, Power **Network**, Power **Distribution**, **Distribution Systems**, **Power Systems Control**, **Power Systems Security**, Power **Electronics**, **Power System** Harmonics, **Power System** Planning, Control & Stability, **Power Flow** Analysis, **Smart Grid & Renewable** Integration, **Power System Protection & Relaying**, Economic Dispatch & Grid Stability Constraints in Power Plants, Electrical Demand Side Management (DSM), Electrical **Substations**, **Substation Automation** Systems & Application (IEC 61850), **Distribution Network** System Design, **Distribution Network Load**, Electrical **Distribution** Systems, **Load Forecasting** & System Upgrade (Distribution), **Overhead Power Line** Maintenance & Patrolling, High Voltage **Switching** Operations, Industrial **UPS Systems & Battery** Power Supplies, Electric **Motors & Variable Speed Drives**, **Generator** Maintenance & Troubleshooting, **Generator** Excitation Systems & AVR, **Transformer** Maintenance & Testing, Lock-Out & Tag-Out (**LOTO**), Confined Workspaces and **Earthing & Grounding**, He is currently the **Systems Control Manager** of **Siemens** where he is in-charge of Security & Control of Power **Transmission Distribution** & **High Voltage** Systems and he further takes part in the Load Records Evaluation & Transmission Services Pricing.

During his career life, Dr. Ahmed has been actively involved in different Power System Activities including Roles in Power System Planning, Analysis, Engineering, **HV Substation** Design, Electrical Service Pricing, Evaluations & Tariffs, Project Management, Teaching and Consulting. His vast industrial experience was honed greatly when he joined many International and National Companies such as **Siemens**, **Electricity Authority**, Egyptian Electricity Holding, Egyptian Refining Company (ERC), **GASCO**, Tahrir Petrochemicals Project, and **ACETO** industries as the **Instrumentation & Electrical Service Project Manager**, **Energy Management Engineer**, **Department Head**, **Assistant Professor**, **Project Coordinator**, **Project Assistant and Managing Board Member** where he focused more on dealing with Technology Transfer, System Integration Process and Improving Localization. He was further greatly involved in manufacturing some of **Power System** and **Control & Instrumentation Components** such as Series of Digital Protection **Relays**, MV **VFD**, **PLC** and **SCADA** System with intelligent features.

Dr. Ahmed has **PhD**, **Master's** & **Bachelor's** degree in **Electrical Engineering** from the **University of Wisconsin Madison**, **USA** and **Ain Shams University**, respectively. Further, he is a **Certified Instructor/Trainer**, a **Certified Internal Verifier/ Assessor/Trainer** by the **Institute of Leadership and Management** (**ILM**), an active member of IEEE and ISA as well as numerous technical and scientific papers published internationally in the areas of Power Quality, Superconductive Magnetic Energy Storage, SMES role in Power Systems, Power System **Blackout** Analysis, and Intelligent Load Shedding Techniques for preventing Power System Blackouts, HV **Substation Automation** and Power System Stability.

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, 07th of January 2024***

0730 – 0800	*Registration & Coffee*
0800 – 0815	*Welcome & Introduction*
0815 – 0830	***PRE-TEST***
0830 – 0930	***Overview of Compressors*** *General Types ● Centrifugal Compressors ● Axial Compressors*
0930 – 0945	*Break*
0945 – 1145	***Overview of Surge*** *Surge versus Stall ● Static Instability ● Dynamic Instability ● Characteristics of Surge ● Consequences of Surge*
1145 – 1230	***Compressor Control Introduction & Principals*** *Defining Compressor Surge and its Consequences ● Anti-Surge Protection and Prevention ● Surge Detection and Recovery● Compressor Control ● Performance Control*
1230 – 1245	*Break*
1245– 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 One*

Day 2: ***Monday, 08th of January 2024***

0730 – 0930	***Advanced Compressor Control*** *The Surge Parameter ● Changing Parameter Considerations ● Compressor Loadsharing ● Anti-Surge Control Challenges and Solutions ● Train Control Using Loop Decoupling*
0930 – 0945	*Break*
0945 – 1100	***Effect of Operating Conditions*** *Surge Curve Plotting Method ● Suction Pressure ● Suction Temperature● Molecular Weight ● Specific Heat Ratio*
1100 – 1230	***Effect of Operating Conditions (cont'd)*** *Compression Ratio● Speed ● Vane Position*
1230 – 1245	*Break*
1245 – 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: ***Tuesday, 09th of January 2024***

0730 – 0930	***Turbine Control Objectives & Principals*** *Speed Control ● Actuator Interface and Control ● Speed and kW Droop Control ● Header Pressure Control*
0930 – 0945	*Break*

0945 – 1100	***Turbine Control System Availability Objectives*** *System Reliability and Availability Basics*
1100 – 1230	***Turbine Control System Availability Objectives (cont'd)*** *Choosing the Correct Level of Redundancy ● Control Philosophy Considerations (Integration, Distribution, etc.)*
1230 – 1245	*Break*
1245 – 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 Three*

Day 4: Wednesday, 10th of January 2024

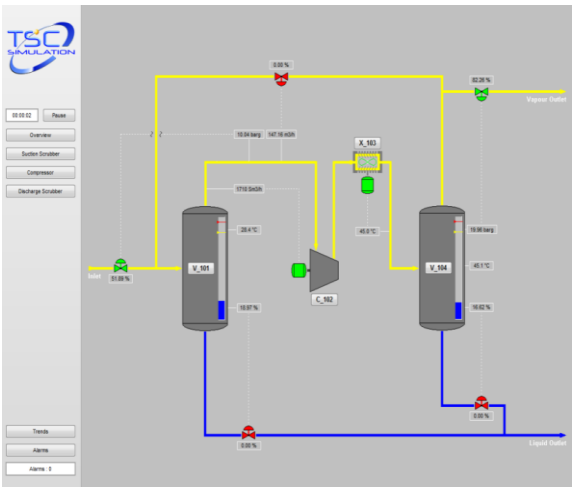
0730 – 0930	***Integrated Turbine & Compressor Control Approaches*** *DCS, PLC, and Dedicated Controller Philosophies ● Compressor-Loop Response Analysis-How Fast is Fast Enough?*
0930 – 0945	*Break*
0945 – 1100	***Integrated Turbine & Compressor Control Approaches (cont'd)*** *Case Study: Control Recursion Rates and their Effect on Performance*
1100 – 1230	***Integrated Turbine & Compressor Control Approaches (cont'd)*** *Technology Update: Upcoming Technologies in Turbine Control*
1230 – 1245	*Break*
1245 – 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 Four*

Day 5: Thursday, 11th of January 2024

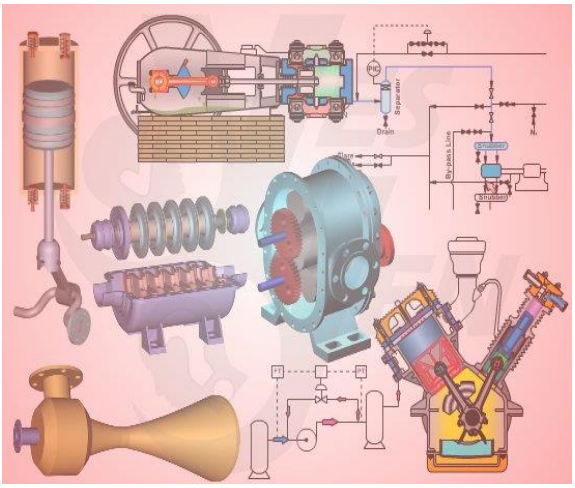
0730 – 0830	***Control & Protection Devices*** *High and Low Pressure Controls ● Oil Failure Control ● Internal Relief Value*
0830 – 0930	***Control & Protection Devices (cont'd)*** *Motor Starters and Overload ● Internal Motor Temperature Sensors ● Crankcase Heaters*
0930 – 0945	*Break*
0945 – 1215	***Practical Sessions***
1215 – 1230	*Break*
1230 – 1345	***Practical Sessions (cont'd)***
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)

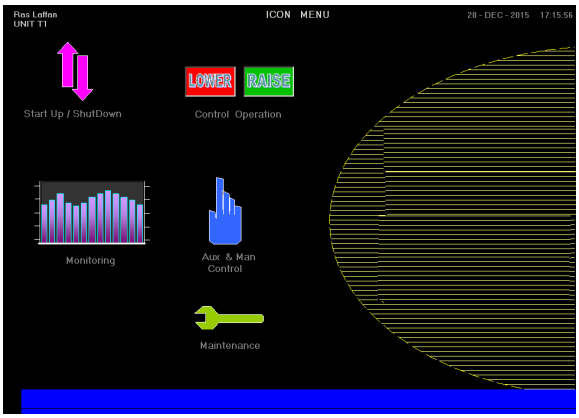
Practical session will be organized during the course for delegates to practice the theory learnt. Delegates will be provided with an opportunity to carryout various exercises using our state-of-the-art simulators "SIM 3300 Centrifugal Compressor", "CBT on Compressors" and "MARK V" video simulator.

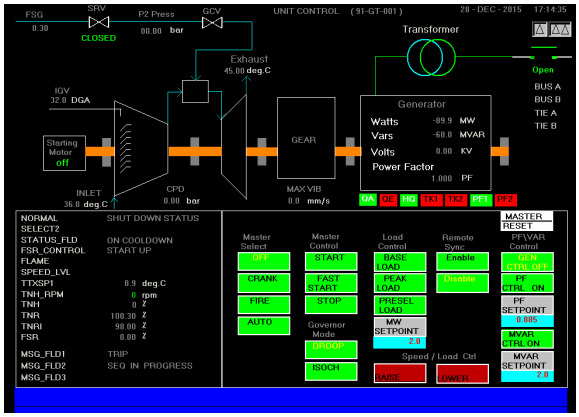


SIM 3300 Centrifugal Compressor Simulator



CBT on Compressors





Course Coordinator

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