COURSE OVERVIEW IE0782
Compressor Control, Instrumentation & Troubleshooting

Course Title
Compressor Control, Instrumentation & Troubleshooting



Course Date/Venue
November 29-December 03, 2026/TBA Meeting Room, Elite Byblos Hotel, Al Barsha, Sheikh Zayed Road, Dubai, UAE

Course Reference
IE0782

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, Instrumentation & Troubleshooting. It covers the compressor fundamentals and applications and compressor operating principles and performance; the centrifugal compressor characteristics, compressor control system fundamentals and compressor capacity control methods; the compressor operating limits and protection and compressor instrumentation architecture; the pressure measurement, instrumentation, temperature measurement, monitoring, flow measurement and control; the vibration, speed and position monitoring and auxiliary system instrumentation; and the compressor control loops and strategies, compressor surge fundamentals and anti-surge control system.

During this interactive course, participants will learn the recycle valve and anti-surge valve performance; the compressor load sharing, performance control and control system tuning and optimization; the compressor alarm, trip and shutdown philosophy; the compressor start-up and shutdown control sequences; troubleshooting pressure and flow problems, temperature problems, vibration, mechanical problems, instrumentation and control problems; the compressor performance and anti-surge system troubleshooting; the seal, bearing and lubrication system troubleshooting; and the control system diagnostic techniques and compressor reliability and predictive maintenance.

Course Objectives/Outcomes & Benefits for the Participants

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

- Apply and gain an in-depth knowledge on compressor control, instrumentation and troubleshooting
- Discuss the compressor fundamentals and applications as well as compressor operating principles and performance
- Identify centrifugal compressor characteristics, compressor control system fundamentals and compressor capacity control methods
- Recognize compressor operating limits and protection and compressor instrumentation architecture
- Apply pressure measurement and instrumentation, temperature measurement and monitoring and flow measurement and control
- Employ vibration, speed and position monitoring and auxiliary system instrumentation
- Explain compressor control loops and strategies, compressor surge fundamentals and anti-surge control system
- Determine recycle valve and anti-surge valve performance and apply compressor load sharing and performance control and control system tuning and optimization
- Discuss compressor alarm, trip and shutdown philosophy as well as compressor start-up and shutdown control sequences
- Troubleshoot pressure and flow problems, temperature problems, vibration and mechanical problems and instrumentation and control problems
- Implement compressor performance and anti-surge system troubleshooting including seal, bearing and lubrication system troubleshooting
- Apply control system diagnostic techniques and compressor reliability and predictive maintenance

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 compressor control, instrumentation and troubleshooting for compressor engineers and specialists, instrumentation and control engineers, mechanical engineers, rotating equipment engineers, process and production engineers, maintenance engineers and supervisors, reliability and condition monitoring engineers, operations engineers and supervisors, control system and automation engineers, instrument technicians and other technical staff.

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

Haward's certificates are accredited by the following international accreditation organizations: -

- British Accreditation Council (BAC)

  Haward Technology is accredited by the **British Accreditation Council** for **Independent Further and Higher Education** as an **International Centre**. Haward's certificates are internationally recognized and accredited by the British Accreditation Council (BAC). 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.

- 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.

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 **30 years** of extensive experience within the **Oil**, **Gas**, **Power**, **Petroleum**, **Petrochemical** and **Utilities** industries. His experience widely covers in the areas of **Flow Measurement** Devices, **PLC-HMI Controls**, Total Quality Management (**TQM**), Internal Audit Techniques in **TQM**, Quality Management System (**QMS**), **Water Network** Pipe Materials & Fittings, **Mapping & Inventory** of Pipes & Fittings in the Water Supply System, **Water Distribution System** Operator, **Sewer System and Sewage Flows**, **Ultrasonic Inspection**, and **Advanced Visual Techniques** of Predictive Maintenance, Water Meter Reading (**MMR**), **Waste Water System** Planning & Design, **Network Management & Supervision**, **Leakage Prevention & Control**, **Water Leak Detection**, Waste Water Treatment, **Water Utility Regulation and Economics**, **Water Network Systems**, **Health & Safety Rules & Regulations**, Safety Procedures in **Water Networks**, **Safety Management**, Principles of **Routine** and **Preventive Maintenance**, **Accident Investigation**, **Operation** & **Maintenance of Sewerage System**, 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, **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, **Compressor** Control & Protection, **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.

Training Methodology

Our courses employ an interactive, learner-centred methodology that integrates theoretical knowledge with practical application. The training is delivered through a suitable combination of some or all of the following methods, selected according to the course content and learning objectives:

- Instructor-led presentations and facilitated discussions
- Practical workshops and participant presentations
- Hands-on exercises and real-world case studies
- Equipment demonstrations and technical drawings
- Hardware- and software-based simulations
- Gamification & Role Play in soft-skills courses only
- Virtual Reality (VR) and Augmented Reality (AR)
- Instructional videos and other relevant training resources

This blended approach encourages active participation, strengthens practical skills and supports the effective application of acquired knowledge in the workplace.

Learning Design & Customization

This course can be customized to the exact requirements of clients. Haward Technology is so proud of our huge capabilities in tailoring our courses to the training needs of our valued clients.

Accommodation

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

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 workshop for technical reasons with no prior notice to participants. Nevertheless, the course objectives will always be met:

Day 1: ***Sunday, 29th of November 2026***

0730 – 0800	*Registration & Coffee*
0800 – 0815	*Welcome & Introduction*
0815 – 0830	***PRE-TEST***
0830 – 0930	***Compressor Fundamentals & Applications*** *Compressor Types: Centrifugal, Axial, Reciprocating & Rotary • Compressor Applications in Oil, Gas, Petrochemical & Process Industries • Major Compressor Components & Their Functions • Compressor Selection Based on Process & Operating Requirements*
0930 – 0945	*Break*
0945 – 1030	***Compressor Operating Principles & Performance*** *Pressure, Temperature, Flow & Compression Ratio Relationships • Compressor Head, Power, Efficiency & Capacity • Compressor Performance Curves & Operating Maps • Effects of Gas Properties & Process Conditions on Performance*

1030 – 1130	***Centrifugal Compressor Characteristics*** *Impeller, Diffuser, Casing, Bearings & Seal Systems • Aerodynamic Principles of Centrifugal Compression • Operating Range, Best Efficiency Point & Performance Limits • Influence of Suction & Discharge Conditions on Compressor Performance*
1130 – 1215	***Compressor Control System Fundamentals*** *Objectives & Functions of Compressor Control Systems • Capacity, Pressure, Flow & Load Control Strategies • Control Loops, Setpoints, Process Variables & Controller Outputs • Interaction Between Compressor & Process Control Systems*
1215 – 1230	*Break*
1230 – 1330	***Compressor Capacity Control Methods*** *Suction Throttling & Discharge Pressure Control • Variable Speed Control & Driver Speed Regulation • Inlet Guide Vanes & Variable Geometry Control • Recycle, Bypass & Blow-Off Control Methods*
1330 – 1420	***Compressor Operating Limits & Protection*** *Surge, Stonewall/Choke & Minimum Stable Flow • Maximum Speed, Temperature & Pressure Limitations • Compressor Operating Envelope & Safe Operating Region • Alarm, Trip, Shutdown & Protective Functions*
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, 30th of November 2026***

0730 – 0830	***Compressor Instrumentation Architecture*** *Field Instruments, Transmitters, Controllers & Final Control Elements • Compressor Control Panel, PLC, DCS & Safety Systems • Signal Types, Communication Interfaces & Instrument Loops • Reading Compressor P&IDs, Instrument Tags & Loop Diagrams*
0830 – 0930	***Pressure Measurement & Instrumentation*** *Suction, Discharge, Differential & Seal Pressure Measurement • Pressure Transmitters, Gauges & Switches • Instrument Range, Accuracy, Calibration & Installation • Diagnosing Abnormal Pressure Indications & Measurement Errors*
0930 – 0945	*Break*
0945 – 1100	***Temperature Measurement & Monitoring*** *Suction & Discharge Temperature Monitoring • Bearing, Lube Oil & Seal System Temperature Measurement • RTDs, Thermocouples & Temperature Transmitters • High-Temperature Alarms, Trips & Troubleshooting*
1100 – 1215	***Flow Measurement & Control*** *Compressor Suction, Discharge & Recycle Flow Measurement • Differential Pressure, Orifice, Venturi & Other Flow Technologies • Flow Compensation for Pressure & Temperature • Flow Measurement Errors & Their Impact on Compressor Control*
1215 – 1230	*Break*

1230 – 1330	***Vibration, Speed & Position Monitoring*** *Radial Vibration & Axial Position Measurement • Proximity Probes, Accelerometers & Velocity Sensors • Speed, Phase Reference & Overspeed Monitoring • Vibration Alarm/Trip Levels & Basic Diagnostic Interpretation*
1330 – 1420	***Auxiliary System Instrumentation*** *Lube Oil Pressure, Temperature & Level Monitoring • Dry Gas Seal & Seal Oil System Instrumentation • Cooling System & Bearing Monitoring • Instrument Air, Utility & Auxiliary System Alarms*
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, 01st of December 2026***

0730 – 0830	***Compressor Control Loops & Strategies*** *Pressure, Flow, Temperature & Speed Control Loops • PID Controller Principles & Control Response • Cascade, Override, Split-Range & Constraint Control • Control Loop Interaction & Stability*
0830 – 0930	***Compressor Surge Fundamentals*** *Causes & Physical Mechanism of Compressor Surge • Surge Line, Surge Limit & Surge Control Line • Effects of Surge on Compressor Components & Process Stability • Recognizing Surge Through Process & Vibration Parameters*
0930 – 0945	*Break*
0945 – 1100	***Anti-Surge Control System*** *Purpose & Architecture of Anti-Surge Control • Calculation of Compressor Operating Point • Surge Control Margin & Control Line Configuration • Anti-Surge Controller Response During Process Disturbances*
1100 – 1215	***Recycle Valve & Anti-Surge Valve Performance*** *Anti-Surge Valve Sizing & Flow Capacity • Valve Characteristics, Actuator Response & Positioners • Fast-Opening Requirements & Fail-Safe Philosophy • Troubleshooting Slow, Unstable or Sticking Recycle Valves*
1215 – 1230	*Break*
1230 – 1330	***Compressor Load Sharing & Performance Control*** *Multiple Compressor Operation in Parallel • Load Sharing & Capacity Distribution • Header Pressure & Master Control Strategies • Preventing Control Interaction Between Parallel Compressors*
1330 – 1420	***Control System Tuning & Optimization*** *PID Gain, Integral & Derivative Settings • Identifying Oscillation, Hunting & Slow Response • Optimizing Anti-Surge & Capacity Control Loops • Trend Analysis for Evaluating Control System Performance*
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*

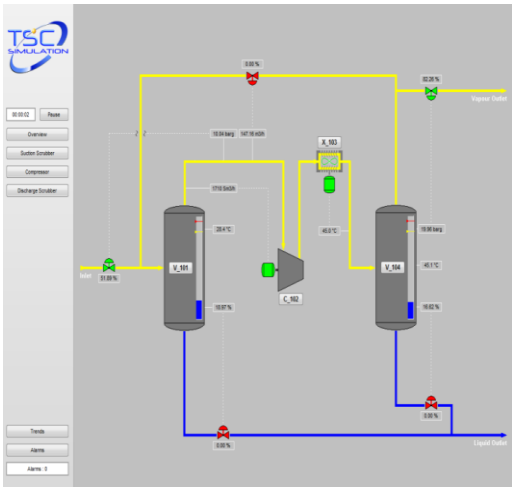
Day 4:	Wednesday, 02nd of December 2026
0730 – 0830	***Compressor Alarm, Trip & Shutdown Philosophy*** *Alarm, Alert, Trip & Shutdown Classification • First-Out Logic & Sequence of Events • Permissives, Interlocks & Protective Logic • Emergency Shutdown & Safe Compressor Depressurization*
0830 – 0930	***Compressor Start-Up & Shutdown Control Sequences*** *Pre-Start Checks & Start Permissives • Lube Oil, Seal System & Auxiliary Equipment Sequencing • Loading, Unloading & Recycle Valve Control During Start-Up • Normal Shutdown, Emergency Shutdown & Post-Shutdown Actions*
0930 – 0945	*Break*
0945 – 1100	***Troubleshooting Pressure & Flow Problems*** *Low Suction Pressure & High Discharge Pressure • Reduced Compressor Capacity & Unstable Flow • Abnormal Pressure Ratio & Performance Deterioration • Instrument, Process & Mechanical Causes of Pressure/Flow Problems*
1100 – 1215	***Troubleshooting Temperature Problems*** *High Discharge Temperature & Excessive Compression Heating • High Bearing & Lube Oil Temperatures • Cooler Fouling & Cooling System Problems • Differentiating Process, Instrumentation & Mechanical Causes*
1215 – 1230	*Break*
1230 – 1330	***Troubleshooting Vibration & Mechanical Problems*** *Unbalance, Misalignment, Looseness & Mechanical Rubbing • Bearing Defects, Rotor Instability & Resonance • Surge-Related & Process-Induced Vibration • Using Vibration Trends to Support Fault Diagnosis*
1330 – 1420	***Troubleshooting Instrumentation & Control Problems*** *Faulty Sensors, Transmitters & Incorrect Signals • Controller Hunting, Oscillation & Poor Loop Response • Control Valve, Actuator & Positioner Problems • Systematic Troubleshooting Using Trends, Alarms & Loop Checks*
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, 03rd of December 2026
0730 – 0830	***Compressor Performance Troubleshooting*** *Comparing Actual Performance with Design Conditions • Identifying Efficiency & Capacity Deterioration • Fouling, Internal Leakage & Process Condition Changes • Using Performance Data to Identify Developing Problems*
0830 – 0930	***Anti-Surge System Troubleshooting*** *False Surge Detection & Incorrect Operating Point Calculation • Flow, Pressure & Temperature Measurement Errors • Recycle Valve Response & Controller Performance Problems • Diagnosing Repeated Surge Events Using Historical Trends*
0930 – 0945	*Break*
0945 – 1030	***Seal, Bearing & Lubrication System Troubleshooting*** *Dry Gas Seal & Seal Oil System Problems • Low Lube Oil Pressure & Contamination • Bearing Temperature & Vibration Abnormalities • Root Causes, Corrective Actions & Failure Prevention*

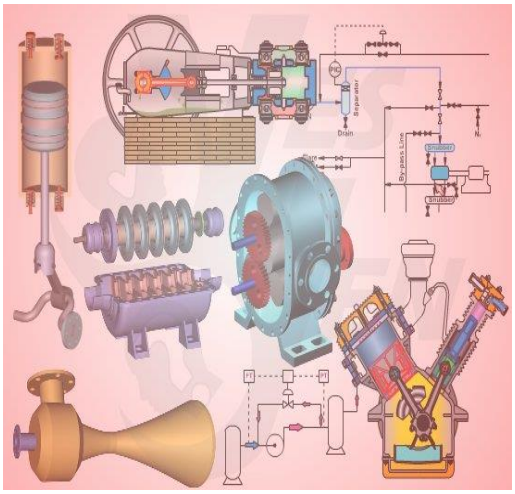
1030 – 1130	***Control System Diagnostic Techniques*** *DCS/PLC Trends & Sequence-of-Events Analysis • Alarm History & Trip Log Interpretation • Instrument Loop Checking & Signal Verification • Distinguishing Process, Instrumentation, Control & Mechanical Faults*
1130 – 1230	***Compressor Reliability & Predictive Maintenance*** *Condition Monitoring & Performance Trending • Vibration, Temperature & Process Parameter Trending • Predictive & Condition-Based Maintenance Strategies • Failure Prevention, Reliability Improvement & Maintenance Planning*
1230 – 1245	*Break*
1245 – 1345	***Practical Troubleshooting Workshop & Case Studies*** *Troubleshooting Compressor Surge & Unstable Operation • Diagnosing High Vibration, Temperature & Pressure Conditions • Analyzing Compressor Trips & Control System Failures • Developing Root Cause, Corrective Action & Prevention Plans*
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)

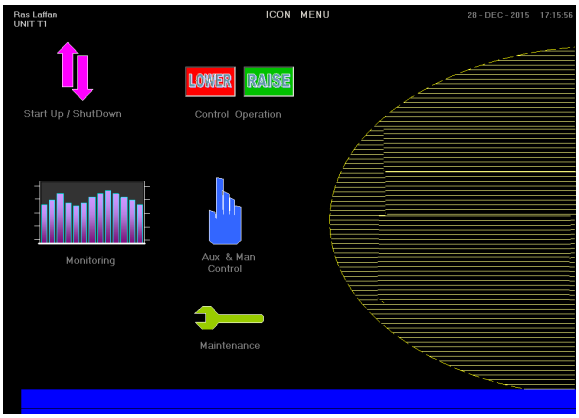
Practical session will be organized during the course for delegates to practice the theory learnt. Delegates will be provided with an opportunity to carryout various exercises using our state-of-the-art simulators "SIM 3300 Centrifugal Compressor", "CBT on Compressors" and "MARK V" video simulator.



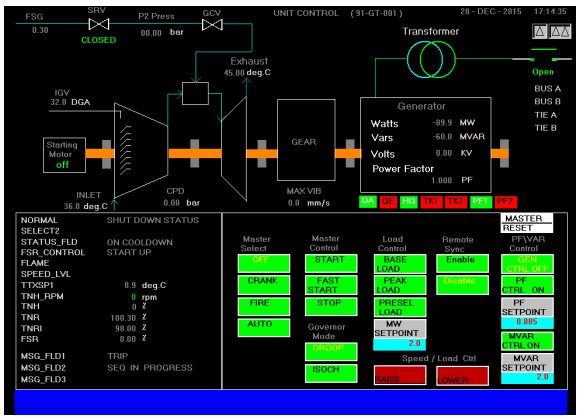
SIM 3300 Centrifugal Compressor Simulator



CBT on Compressors







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