COURSE OVERVIEW ME0568
Gas Engine (Power Plant)

Course Title
Gas Engine (Power Plant)

Course Date/Venue
October 06-10, 2024/SAS Meeting Room, Holiday Inn Muscat al Seeb, an IHG Hotel, Muscat, Oman

Course Reference
ME0568

Course Duration/Credits
Five days 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 the PD compressor and gas turbine simulators.

The course is designed to provide participants with an up-to-date overview on maintaining gas engines. It covers the troubleshooting operation and maintenance of gas turbine generator; the best preventative maintenance requirements of the gas turbine support systems; the major gas turbine mechanical maintenance procedures; the construction, support systems and the mechanical maintenance of the gas turbine generator; the different types of reciprocating compressors; the materials of construction; and the effect of ring type on leakage control.

By the end of the course, participants will be able to set the internal clearances of the compressor for maximum operating efficiency; specify the appropriate preventive and predictive maintenance procedure; explain the different controlling mechanisms for efficient and safe compressor operation; evaluate reciprocating compressors and eliminate problems with troubleshooting techniques; and carryout preventive, predictive and corrective maintenance on gas and diesel engines including CRU's and generators.

Course Objectives

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

- Maintain gas engines in a professional manner
- Troubleshoot, operate and maintain gas turbine generator efficiently
- Apply the best preventative maintenance requirements of the gas turbine support systems
- Review and improve the major gas turbine mechanical maintenance procedures
- Identify the construction, support systems and the mechanical maintenance of the gas turbine generator
- Discuss the different types of reciprocating compressors
- Identify the materials of construction and apply lubrication of reciprocating compressors and compressor packaging
- Recognize the effect of ring type on leakage control
- Set the internal clearances of the compressor for maximum operating efficiency
- Specify appropriate preventive and predictive maintenance procedure
- Explain the different controlling mechanisms for efficient and safe compressor operation
- Evaluate reciprocating compressor and eliminate problems with troubleshooting techniques
- Carryout preventive, predictive and corrective maintenance on gas and diesel engines including CRU's and generators

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**.*

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Who Should Attend

This course covers systematic techniques and methodologies on maintaining gas engines for mechanical maintenance engineers, mechanical maintenance technicians, mechanical and rotating equipment engineers, plant maintenance engineers, production operations engineers, process engineers, supervisors, foremen and other technical staff.

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 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 **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.

Accommodation

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

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. Mervyn Frampton is a **Senior Engineer** with over **35 years** of industrial experience within the **Oil & Gas**, **Refinery**, **Petrochemical** and **Utilities** industries. His expertise lies extensively in the areas of **Tanks & Tank Farms**, **Tank Contractions**, **Tank Failure**, **Tank Design & Engineering**, Piping Systems & Process Equipment, **Pressure Vessel** Design & Analysis, **Pressure Vessel** Operation, **Heat Exchanger**, **Heat Exchangers** Inspection, Heater Fabrication, Heat Transfer, **Pipeline** Systems, **Pipeline** Design & Construction, **Pipeline** Operation & Maintenance, **Demulsifier** Chemical, **Destabilization** & **Gravitational** Separation, **Destabilizing** Emulsions, **Demulsifier** Selection Criteria, Selection & Injection, Analysing & Diagnosing **Demulsifier**, **Oil Demulsification** Optimization, **Naphtha & Kerosene Hydrotreater**, **Condensate Stabilizer**, **Condensate & Gas Production**, **Refinery** Optimization, **Refinery** Operations Troubleshooting, **Refinery** Production Operations, **Refinery** Process Safety, **Petroleum Refinery** Process, **Asset Operational Integrity**, **Refinery Induction**, **Crude Distillation**, **Crude Oil Properties**, **Distillation Column** Operation & Control, **Oil Movement** Storage & Troubleshooting, **Process Equipment** Design, Applied **Process Engineering** Elements, **Process Plant** Optimization, **Revamping & Debottlenecking**, **Process Plant** Troubleshooting & Engineering Problem Solving, **Process Plant** Monitoring, **Process Plant** Start-up & Commissioning, **Clean Fuel** Technology & Standards, Flare, Blowdown & Pressure Relief Systems, **Oil & Gas Field Commissioning** Techniques, **Gas Processing**, **Chemical** Engineering, **Process Reactors** Start-Up & Shutdown, **Gasoline Blending** for Refineries, **Urea Manufacturing** Process Technology, Continuous Catalytic Reformer (**CCR**), **De-Sulfurization** Technology, Advanced Operational & Troubleshooting Skills, Principles of Operations Planning, **Rotating Equipment** Maintenance & Troubleshooting, **Heat Exchangers & Fired Heaters** Operation & Troubleshooting, **Process Plant**, **Commissioning & Start-Up**, **Alkylation**, **Hydrogenation**, **Dehydrogenation**, **Isomerization**, **Hydrocracking & De-Alkylation**, **Fluidized Catalytic Cracking**, **Catalytic Hydrodesulphuriser**, **Kerosene Hydrotreater**, **Thermal Cracker**, **Catalytic Reforming**, **Sulphur Extraction Plant**, **Acid Plant Revamp** and **Crude Pumping**. Further, he is also well-versed in HSE Leadership, Project and Programme Management, Project Coordination, Project Cost & Schedule Monitoring, Control & Analysis, Team Building, Relationship Management, Quality Management, Performance Reporting, Project Change Control, Commercial Awareness and Risk Management.

During his career life, Mr. Frampton held significant positions as the **Site Engineering Manager**, **Senior Project Manager**, **Project Engineering Manager**, **Construction Manager**, **Site Manager**, **Area Manager**, **Procurement Manager**, **Factory Manager**, **Technical Services Manager**, **Senior Project Engineer**, **Project Engineer**, **Assistant Project Manager**, **Handover Coordinator** and **Engineering Coordinator** from various international companies such as the **Fluor Daniel**, **KBR** South Africa, **ESKOM**, MEGAWATT PARK, CHEMEPIC, PDPS, CAKASA, **Worley Parsons**, Lurgi South Africa, **Sasol**, **Foster Wheeler**, **Bosch** & **Associates**, **BCG** Engineering Contractors, Fina Refinery, Sapref Refinery, Secunda Engine Refinery just to name a few.

Mr. Frampton has a **Bachelor's degree** in **Industrial Chemistry** from **The City University** in **London**. Further, he is a **Certified Instructor/Trainer**, a **Certified Internal Verifier/Trainer/Assessor** by the **Institute of Leadership & Management** (**ILM**) 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 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 be always met:

Day 1: Sunday, 06th of October 2024

0930 – 0935	*Registration, Coffee, Welcome &Introduction*
0935 – 0945	***PRE-TEST***
0945 – 1030	***Gas Turbine Overview*** *Gas Turbine Basics ● Gas Turbine Construction ● Gas Turbine Device Summary ● Gas Turbine Instrumentation (function and maintenance) ● Gas Turbine-Generator Arrangement ● Operating and Maintenance Factor Considerations ● Standard Practices ● Clearance Diagrams ● Weights and Center of Gravity Diagram*
1030 – 1100	***Gas Turbine Support Systems: Description, Maintenance & Troubleshooting*** *Turbine and Auxiliary System Preventive Maintenance Scheduling ● Inlet, Exhaust, and Control Air ● Inlet Cooling ● Lube Oil ● Hydraulic and Control Oil ● Lift Oil ● Trip Oil ● Cooling Water ● Cooling and Sealing Water ● Fuel Systems(s) – Gas & Liquid ● Atomizing Air ● Purge Air ● Water Injection ● Heating and Ventilation ● Fire Protection ● Hazardous Gas ● Inlet Bleed Heat ● Inlet Guide Vanes ● Starting Means ● Water Wash ● Power Augmentation (steam) ● Performance Monitoring*
1100 – 1105	*Break*
1105 – 1130	***Major Gas Turbine Mechanical Maintenance*** *Combustion Inspection ● Hot Gas Path Inspection ● Major Inspection ● Borescope Inspection ● Gears – Accessory and/or Load*
1130 – 1135	*Break*
1135 – 1205	***Generator Overview*** *Machine Theory (Generator Basics) ● Generator Construction ● Generator Arrangement and Load Gear (if applicable) ● Weights and Center of Gravity Diagrams*
1205 – 1325	***Generator Support Systems*** *Seal Oil ● Hydrogen Gas ● Lube Oil ● Cooling Air Inlet ● Lift/Jacking Oil ● Collector Brush Rigging/Brushless Exciter ● Coolers ● High Voltage Bushings ● Condition Monitor*
1325 – 1330	***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*
1330	*Lunch & End of Day One*

Day 2:	Monday, 07th of October 2024
0930 – 1030	***Generator Mechanical Maintenance*** *Rotor Removal ● Turbine Generator Alignment ● Load Gear*
1030 - 1100	***Introduction to Reciprocating Compressors*** *What is a Compressor? ● How Compressors Work ● Methods of Compression ● Types of Compressors ● Compressor Definitions ● Pressure ● Pressure Definitions Associated with Compressors ● Theory of Reciprocating Compressors ● Characteristics of Reciprocating Compressors ● Compressor Type Selection ● Reciprocating Compressor Cylinder Arrangements*
1100 – 1105	*Break*
1105 – 1130	***Double Acting, Single and Multi Stage Reciprocating Compressor*** *Principle of Operation ● Crankcase Main Bearing/Con-Rod Big End Bearing ● Cylinder and Packing Lubrication ● Crankcase/Crank Shaft/Connecting Rod/Crosshead ● Clearance Pocket Unloading*
1130 – 1200	***Materials of Construction*** *Non-Lubricated or Oil-Free Cylinder Construction ● Piston Rod Column or Frame Loading ● Disturbing or Shaking Forces ● Foundations for Reciprocating Compressors ● Compressor Piping and Pulsation ● Design Overview of Labyrinth Piston Compressors*
1200 – 1205	*Break*
1205 – 1325	***Lubrication of Reciprocating Compressors*** *Operational Problems and Maintenance of Compressor Valves ● Compressor Piston Rod Packing ● Compressor Control Systems ● Compressor Cylinder Cooling ● Non-Lubricated Compressor Maintenance ● Labyrinth-Piston Compressors*
1325 - 1330	***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*
1330	*Lunch & End of Day Two*

Day 3:	Tuesday, 08th of October 2024
0930 – 1030	***Compressor Packing*** *Breaker Rings ● Packing Ring Type BT ● Packing Ring Type BD ● Common Packing Ring Characteristics ● Packing Ring Materials ● Lubricated, Semilubricated and Nonlubricated Packing ● Packing Ring Type TU ● Thermal Effects Undersized Rods ● Oversized Rods x Contents ● Tapered Rods Packing Leakage ● Ring Leakage at Low Pressure ● Problems Associated with Low Suction Pressure ● Problems Associated with Low Leakage Requirements*
1030 - 1100	***Effect of Ring Type on Leakage Control*** *Leakage Control with Distance Piece Venting ● Static Compressor Sealing ● Compressor Barrier Fluid Systems for Fugitive Emissions ● Control Wiper Packing ● High Pressure (Hyper) Packings ● Compressor Piston Rings ● Compressor Rider Rings ● Piston Ring Leakage ● Compressor Ring Materials ● Seal Ring Friction ● Cooling Reciprocating Compressor Packing*
1100 – 1105	*Break*

1105 – 1130	***Rule of Thumb for General Running Clearances*** *Compressor Alignment ● Web Deflection Measurements ● Compressor Cylinder Alignment ● Foundation Problems and Repairs*
1130 – 1200	***Compressor*** *Bearing Maintenance and Replacement ● Cylinder Repair and Maintenance ● Compressor Piston Maintenance ● Rebuilding Compressor Pistons ● Installing Piston Rods*
1200 – 1205	*Break*
1205 – 1300	***Setting Piston End Clearances*** *Inspection and Reconditioning Piston Rods ● Manufacture of Compressor Piston Rods ● Other Compressor Component Repairs ● Compressor Part Replication ● Introduction ● Compressor Maintenance ● Emergency Repairs should be Minimized ● Effectiveness of Preventive Maintenance ● Compressor Preventive Maintenance Program ● Spare Parts ● Vendor Selection ● Personnel Training ● Maintenance Contractors*
1300 - 1325	***Predictive Maintenance*** *Integrated Condition Monitoring Systems*
1325 - 1330	***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*
1330	*Lunch & End of Day Three*

Day 4: Wednesday, 09th of October 2024

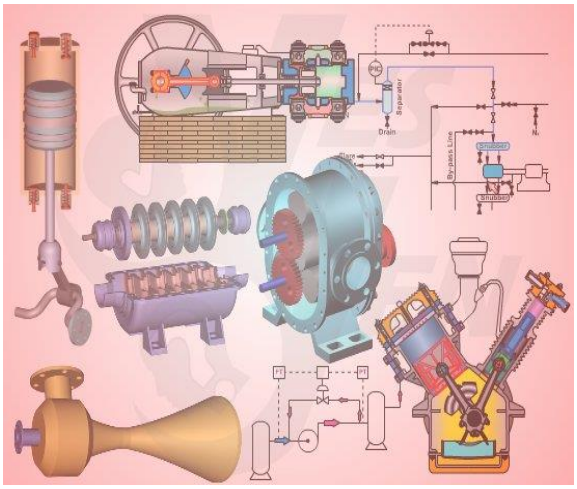
0930 – 1000	***Reciprocating Compressor*** *Crankcase Compressor Cylinders ● Lube Oil Selection ● Oil Additives ● Optimum Lubrication ● Oil Removal ● Non-lube (NL) Compressors ● Synthetic Lubricants ● Compressor Lubrication Equipment*
1000 – 1030	***Compressors & their Bearings*** *General Bearing Principles ● Conventional Bearings ● Low-Speed Bearings ● High-Speed and High-Temperature Bearings ● Cryogenic Applications*
1030 – 1100	***Compressor Valves*** *Survey of Valve Design Theory ● Valve Materials ● Valve Life ● Methods to Vary the Capacity of a Compressor*
1100 – 1105	*Break*
1105 – 1130	***Compressor Control*** *Systems Controls – Definitions 21.2 ● Reciprocating Compressor Monitoring System ● Considerations System Selection – Define the Scope Human Factors ● Electrical and Electronic Controls ● Pneumatic Controls ● Manual Controls ● Prelube-Post Lube System ● Loading-Unloading*
1130 – 1200	***Sensor Classification – (Alarm Classes)*** *Special Compressor Controls ● Temperature Control (Oil and Water)*
1200 – 1205	*Break*
1205 – 1325	***Electric Motor and Pneumatically Operated Temperature Control*** *Valves Energy Management Systems ● Specifications, Codes and Standards*
1325 - 1330	***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*
1330	*Lunch & End of Day Four*

Day 5: ***Thursday, 10th of October 2024***

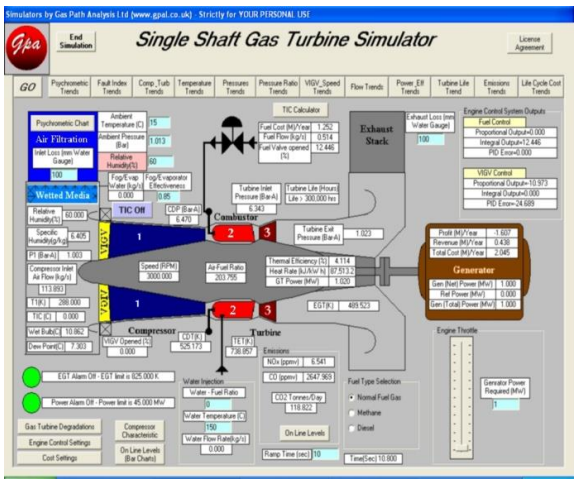
0930 – 1030	***Compressor Problems*** *Typical Compressor Problems ● Troubleshooting Lubrication Systems ● Significance of Intercooler Pressures ● Interstage Pressures ● Belt Drives ● Motor Controls ● Diagnostic Tests*
1030 - 1100	***Evaluating Reciprocating Compressor*** *Condition Using Ultrasound and Vibration Patterns ● Compressor Service Technician Reports ● Basic Air Compressor System Evaluation*
1100 – 1105	*Break*
1105 – 1130	***Basic Safety Rules*** *Lock-Out/Tag-Out Program ● Safe Maintenance Procedures Restated ● Valve Installation ● Fires and Explosions ● Summary ● Air Piping*
1130 - 1200	***CB Gas Engines & Reciprocating Compressors***
1200 – 1205	*Break*
1205 – 1310	***Practical Class on Preventive, Predictive & Corrective Maintenance on Gas Engines & Compressors*** *CRU'S ● Control Systems (F.T.50) ● Fuel Systems ● Lube Oil Systems ● Troubleshooting, Maintenance & Overhauling & Clearances*
1310 - 1315	***Course Conclusion*** *Using this Course Overview, the Instructor(s) will Brief Participants about the Course Topics that were Covered During the Course*
1315 - 1330	***POST-TEST***
1330	*Lunch & End of Course*

Simulator (Hands-on Practical Sessions)

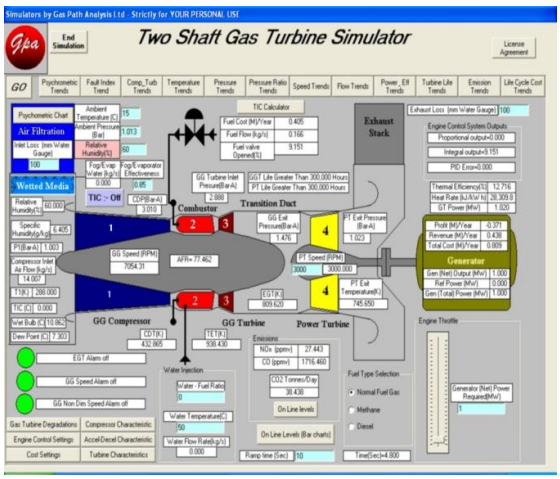
Practical session will be organized during the course for delegates to practice the theory learnt. Delegates will be provided with an opportunity to carryout various exercises using the simulators “CBT on Compressors”, “Single Shaft Gas Turbine Simulator” and “Two Shaft Gas Turbine Simulator” and “MARK V” simulator.



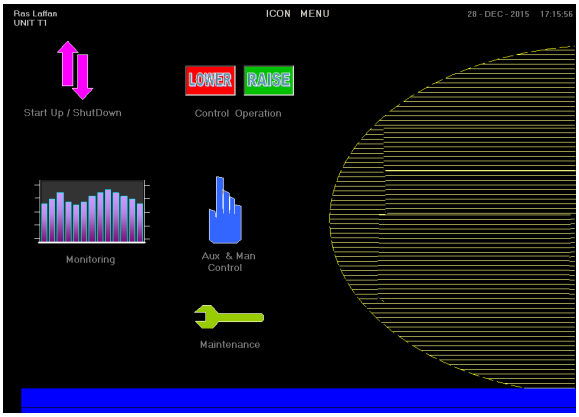
CBT on Compressors

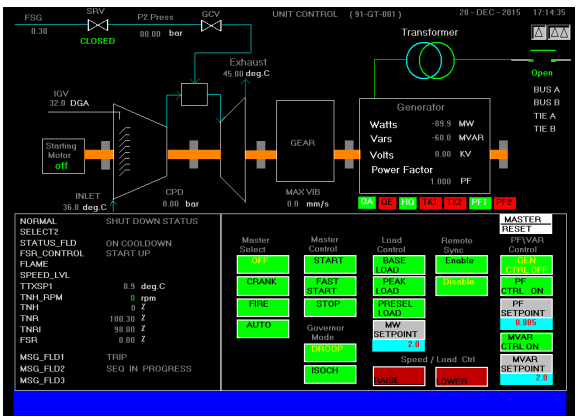


Single Shaft Gas Turbine Simulator



Two Shaft Gas Turbine Simulator





Course Coordinator

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