COURSE OVERVIEW ME1153
Rotating Equipment Maintenance & Troubleshooting

Course Title
Rotating Equipment Maintenance & Troubleshooting

Course Reference
ME1153

Course Duration/Credits
Five days/3.0 CEUs/30 PDHs

Course Date/Venue

Session(s)	Course Date	Venue
1	May 25-29, 2025	Safir Meeting Room, Divan Istanbul, Taksim, Turkey
2	July 13-17, 2025	Olivine Meeting Room, Fairmont Nile City, Cairo, Egypt
3	September 28-October 02, 2025	Tamra Meeting Room, Al Bandar Rotana Creek, Dubai, UAE

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 participants with a detailed and up-to-date overview of Rotating Equipment Maintenance & Troubleshooting. It covers the applications and importance of rotating equipment in process industry; the equipment classification and operating principles and critical versus non-critical equipment; the centrifugal versus positive displacement, component identification and function and common pump failures; the pump curves and performance analysis, seal and bearing maintenance, inspection, repair and reassembly procedures and troubleshooting pump problems; and the maintenance planning covering preventive versus predictive tasks, maintenance intervals and documentation and spare parts inventory control.

During this interactive course, participants will learn the fault diagnosis, compressor types and applications and gas and steam turbines; aligning and inspecting gearboxes and the common failure modes and lubrication and contamination control; troubleshooting and vibration root causes, shaft alignment fundamentals, coupling types and installation and static and dynamic balancing; the vibration analysis, oil analysis techniques and temperature and acoustic monitoring; and the systematic troubleshooting approach, root cause failure analysis

(RCFA) and hands-on troubleshooting scenarios.

Course Objectives

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

- Apply and gain an in-depth knowledge on rotating equipment maintenance and troubleshooting
- Discuss the applications and importance of rotating equipment in process industry including equipment classification and operating principles and critical versus non-critical equipment
- Differentiate centrifugal versus positive displacement and recognize component identification and function and common pump failures
- Carryout pump curves and performance analysis, seal and bearing maintenance, inspection, repair and reassembly procedures and troubleshooting pump problems
- Apply maintenance planning covering preventive versus predictive tasks, maintenance intervals and documentation and spare parts inventory control
- Employ hands-on fault diagnosis and discuss compressor types and applications as well as gas and steam turbines
- Align and inspect gearboxes, identify common failure modes and apply lubrication and contamination control
- Determine troubleshooting and vibration root causes, shaft alignment fundamentals, coupling types and installation and static and dynamic balancing
- Apply vibration analysis, oil analysis techniques and temperature and acoustic monitoring
- Implement systematic troubleshooting approach, root cause failure analysis (RCFA) and hands-on troubleshooting scenarios

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 rotating equipment maintenance and troubleshooting for maintenance engineers, mechanical technicians and fitters, reliability engineers, plant engineers and supervisors, operations and production personnel, project engineers and designers and other technical staff.

Course Certificate(s)

Internationally recognized certificates will be issued to all participants of the course completed a minimum of 80% of the total tuition hours.

Certificate Accreditations

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**. 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.

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. Andrew Ladwig is a **Senior Process & Mechanical Maintenance Engineer** with over **25 years** of extensive experience within the **Oil & Gas**, **Refinery**, **Petrochemical & Power** industries. His expertise widely covers in the areas of **Ammonia Manufacturing & Process Troubleshooting**, **Distillation Towers**, **Crude Oil Distillation**, **Ammonia Storage & Loading** Systems, **Operational Excellence** in **Ammonia Plants**, **Fertilizer Storage** Management (Ammonia & Urea), **Fertilizer Manufacturing** Process Technology, **Sulphur Recovery**, Phenol Recovery & Extraction, **Refining Process & Petroleum Products**, **Refinery Planning & Economics**, **Hydrotreating & Hydro-processing**, **Separators** in **Oil & Gas** Industry, **Gas Testing & Energy** Isolations, **Industrial Liquid Mixing**, **Extractors**, **Fractionation**, **Water Purification**, **Water Transport** & Distribution, **Environmental Emission Control**, **Process Plant** Troubleshooting & Engineering Problem Solving, **Process Plant Performance**, **Plant Startup & Shutdown**, **Process Troubleshooting** Techniques and Oil & Gas Operation/Surface Facilities. Further, he is also well-versed in **Rotating Machinery** (**BRM**), **Rotating Equipment** Operation & Troubleshooting, Root Cause Analysis (**RCA**), **Process Plant** Shutdown, Turnaround & Troubleshooting, Planning & Scheduling **Shutdowns & Turnarounds**, Optimizing **Equipment Maintenance** & Replacement Decisions, **Maintenance Planning & Scheduling**, **Material Cataloguing**, Maintenance, Reliability & Asset Management Best Practices, **Storage Tanks Operations** & Measurements, **Tank** Inspection & Maintenance, **Pressure Vessel** Operation, **Flare & Relief** System, **Flaring System** Operation, **PSV** Inspection & Maintenance, **Centrifugal & Reciprocating Compressor**, **Screw Compressor** Troubleshooting, **Heat Exchanger** Overhaul & Testing, **Pipe Stress** Analysis, **Control Valves & Actuators**, **Vent & Relief System**, **Centrifugal & Reciprocating Pump** Installation & Repair, **Heat Exchanger** Troubleshooting & Maintenance, **Steam Trapping & Control**, **Control & ESD** System and Detailed Engineering Drawings, Codes & Standards.

During his career life, Mr. Ladwig has gained his practical experience through his various significant positions and dedication as the **Mechanical Engineer**, **Project Engineer**, **Reliability & Maintenance Engineer**, **Maintenance Support Engineer**, **Process Engineer**, **HSE Supervisor**, **Warehouse Manager**, **Quality Manager**, **Business Analyst**, **Senior Process Controller**, **Process Controller**, **Safety Officer**, **Mechanical Technician**, **Senior Lecturer** and **Senior Consultant/Trainer** for various companies such as the Sasol Ltd., Sasol Wax, Sasol Synfuels, just to name a few.

Mr. Ladwig has a **Bachelor's** degree in **Chemical Engineering** and a **Diploma** in **Mechanical Engineering**. Further, he is a **Certified Instructor/Trainer**, a **Certified Internal Verifier/Assessor/Trainer** by the **Institute of Leadership & Management** (**ILM**) and has delivered various trainings, workshops, seminars, courses and conferences 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

Istanbul	**US$ 6,000** per Delegate + **VAT**. This rate includes H-STK® (Haward Smart Training Kit), buffet lunch, coffee/tea on arrival, morning & afternoon of each day.
Dubai/Egypt	**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

0730 – 0800	*Registration & Coffee*
0800 – 0815	*Welcome & Introduction*
0815 – 0830	***PRE-TEST***
0830 – 0930	***Overview of Rotating Equipment in Oil & Gas*** *Applications and Importance in Process Industries • Key Types: Pumps, Compressors, Turbines • Equipment Selection Criteria • Overview of Process Flow Integration*
0930 – 0945	*Break*
0945 – 1030	***Equipment Classification & Operating Principles*** *Classification: Dynamic versus Positive Displacement • Mechanical Working Principles • Kinetic and Potential Energy in Rotating Systems • Functional Impact on Overall Plant Operation*
1030 – 1130	***Critical versus Non-Critical Equipment*** *Defining Criticality in Plant Systems • Maintenance Priority Planning • Redundancy and Reliability Factors • Cost and Risk Implications*
1130 – 1215	***Pump Types: Centrifugal versus Positive Displacement*** *Working Mechanisms • Flow and Pressure Characteristics • Application Scenarios • Strengths and Limitations*
1215 – 1230	*Break*

1230 – 1330	***Component Identification & Function*** *Shafts, Seals, Impellers, Bearings • Casing Types and Materials • Couplings and Foundation Components • Flow Path and Pressure Zones*
1330 – 1420	***Common Pump Failures*** *Mechanical Seal Leaks • Cavitation and Flow Blockage • Vibration and Misalignment • Bearing Failure Causes*
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

0730 – 0830	***Pump Curves & Performance Analysis*** *Flow versus Head Curve Interpretation • BEP (Best Efficiency Point) Importance • System Curve and Intersection • Cavitation Zone Identification*
0830 – 0930	***Seal & Bearing Maintenance*** *Mechanical Seal Types and Installation • Bearing Types: Sleeve, Roller, Ball • Lubrication Schedules and Practices • Troubleshooting Seal/Bearing Wear*
0930 – 0945	*Break*
0945 – 1100	***Inspection, Repair & Reassembly Procedures*** *Inspection Checkpoints and Tolerances • Gasket and Seal Replacement • Bolt Torqueing and Alignment • Final Testing and Start-up Checks*
1100 – 1215	***Troubleshooting Pump Problems*** *Flow Loss and Suction Issues • Overheating and Unusual Noises • Vibration and Axial Misalignment • Electrical versus Mechanical Root Causes*
1215 – 1230	*Break*
1230 – 1330	***Maintenance Planning*** *Preventive versus Predictive Tasks • Maintenance Intervals and Documentation • Spare Parts Inventory Control • Coordination with Operations*
1330 – 1420	***Hands-on Fault Diagnosis*** *Problem Simulation • Pump Dismantling and Defect Identification • Checklist Usage • Corrective Action Planning*
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

0730 – 0830	***Compressor Types & Applications*** *Reciprocating versus Centrifugal Compressors • Staging, Cooling, and Inter-cooling • Valve Mechanisms and Clearance Volume • Compressor Performance Indicators*
0830 – 0930	***Gas & Steam Turbines*** *Operating Cycle and Energy Conversion • Control Systems: Governor and Actuators • Turbine Blade Inspection and Cleaning • Inlet/Outlet Temperature and Pressure Trends*
0930 – 0945	*Break*
0945 – 1100	***Gearboxes: Alignment & Inspection*** *Gear Types and Reduction Ratios • Mounting and Foundation Checks • Backlash and Tooth Wear Assessment • Lubrication System Maintenance*

1100 – 1215	***Common Failure Modes*** *Vibration and Imbalance • Temperature Rise and Hot Bearings • Seal and Oil Leakage • Rotor-Stator Clearance Issues*
1215 – 1230	*Break*
1230 – 1330	***Lubrication & Contamination Control*** *Types of Lubrication Systems • Oil Sampling and Testing • Filtration and Flushing Methods • Contaminant Sources and Mitigation*
1330 – 1420	***Troubleshooting & Vibration Root Causes*** *Unbalanced Rotor • Misalignment-Induced Vibration • Shaft Eccentricity • Foundation Issues*
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

0730 – 0830	***Shaft Alignment Fundamentals*** *Misalignment Effects on Equipment Life • Laser versus Dial Indicator Methods • Alignment Tolerances • Alignment Report Interpretation*
0830 – 0930	***Coupling Types & Installation*** *Rigid versus Flexible Couplings • Selection Criteria • Installation and Torqueing Techniques • Wear Patterns and Failure Symptoms*
0930 – 0945	*Break*
0945 – 1100	***Static & Dynamic Balancing*** *Importance of Rotor Balance • Balancing Machines versus Field Balancing • Static Imbalance versus Couple Imbalance • Balancing Weights and Planes*
1100 – 1215	***Basics of Vibration Analysis*** *Vibration Terminology and Units • Frequency Spectrum and FFT • Common Fault Signatures • Vibration Severity Guidelines*
1215 – 1230	*Break*
1230 – 1330	***Oil Analysis Techniques*** *Oil Sampling and Viscosity • Water and Particle Contamination • Wear Debris Analysis • Lubricant Life Monitoring*
1330 – 1420	***Temperature & Acoustic Monitoring*** *Infrared Thermography • Acoustic Emission Detection • Motor Current Signature Analysis • Trend-Based Maintenance Alert*
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*

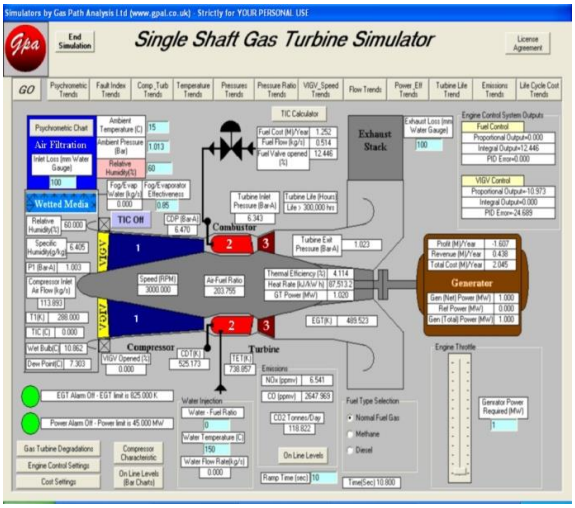
Day 5

0730 – 0930	***Systematic Troubleshooting Approach*** *Step-by-Step Problem Diagnosis • Observation, Measurement, Analysis • Tool Usage and Documentation • Decision Trees and Logic Flow*
0930 – 0945	*Break*
0945 – 1100	***Root Cause Failure Analysis (RCFA)*** *RCFA Principles and Objectives • Tools: 5 Whys, Fishbone Diagram • Data Collection and Evidence Handling • Reporting and Corrective Actions*

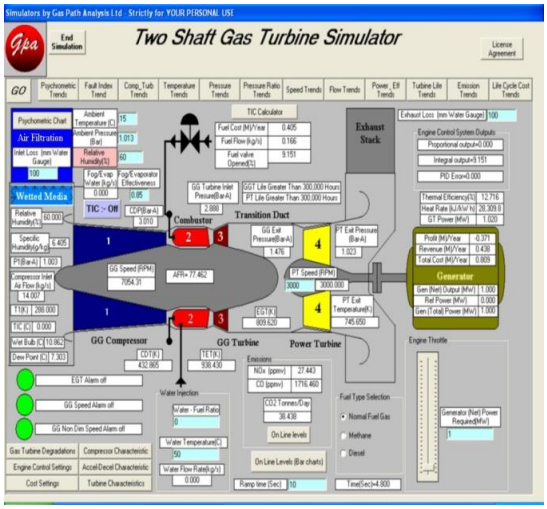
1100 – 1215	***Case Studies of Common Field Issues*** *Pump Cavitation in Chemical Plant • Compressor Vibration in Gas Facility • Gearbox Overheating in Refinery • Real Scenarios and Group Discussions*
1215 – 1230	*Break*
1230 – 1345	***Hands-on Troubleshooting Scenarios*** *Simulated Fault Setups • Troubleshooting Tools Usage • Group Problem-Solving • Corrective Recommendations*
1345 – 1400	***Course Conclusion*** *Using this Course Overview, the Instructor(s) will Brief Participants about t 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)

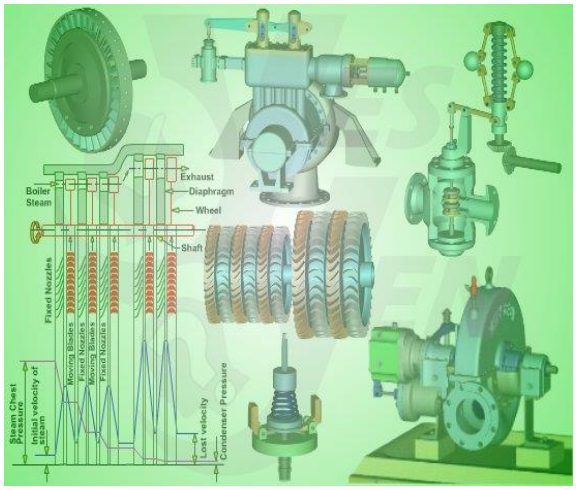
Practical sessions will be organized during the course for delegates to practice the theory learnt. Delegates will be provided with an opportunity to carryout various exercises using our state-of-the-art "Single Shaft Gas Turbine Simulator" and "Two Shaft Gas Turbine Simulator", "Steam Turbine & Governing System", "Centrifugal Pumps and Troubleshooting Guide 3.0", "SIM 3300 Centrifugal Compressor Simulator", "CBT on Compressors" Simulators, "MTBF Calculator" and "ManWinWin Express CMMS Software".



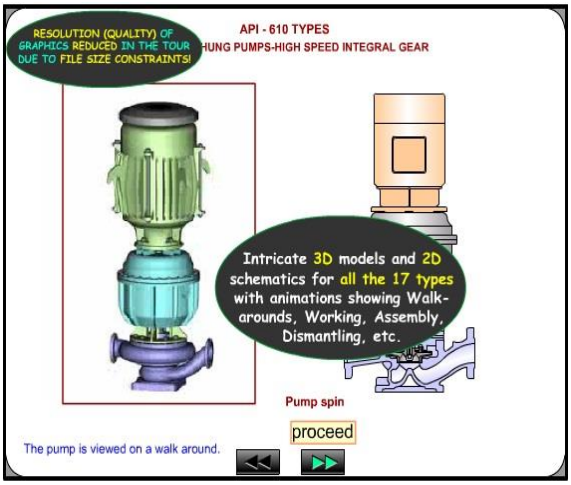
Single Shaft Gas Turbine Simulator



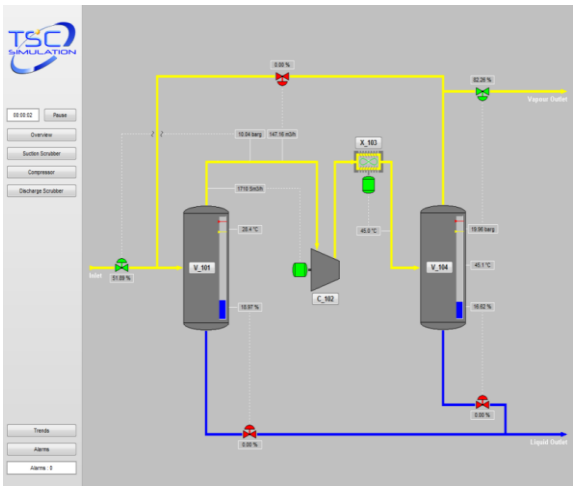
Two Shaft Gas Turbine Simulator



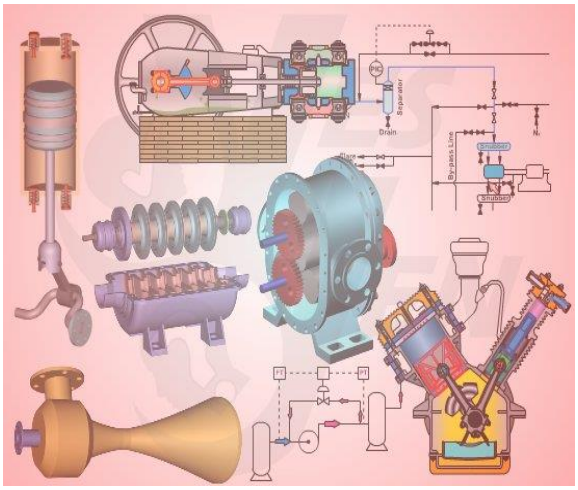
Steam Turbine & Governing System



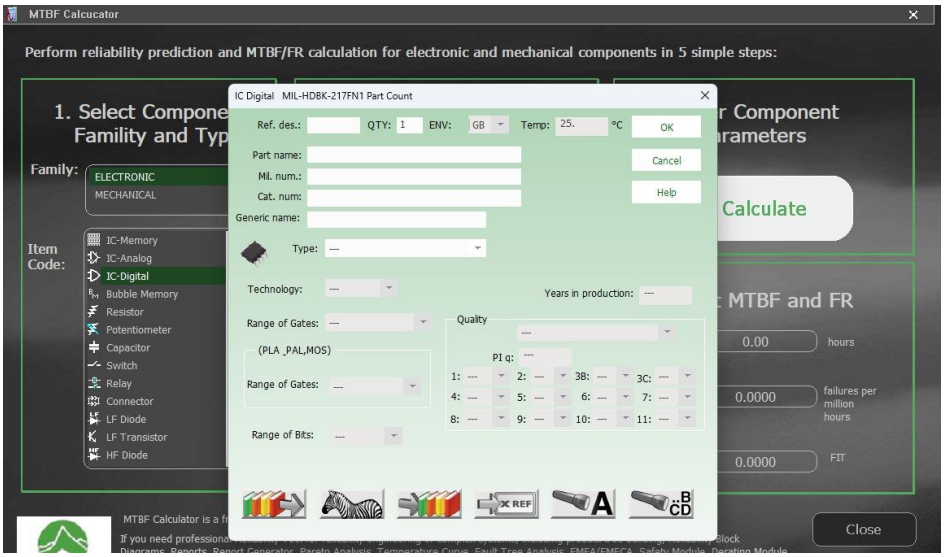
Centrifugal Pumps and Troubleshooting Guide 3.0



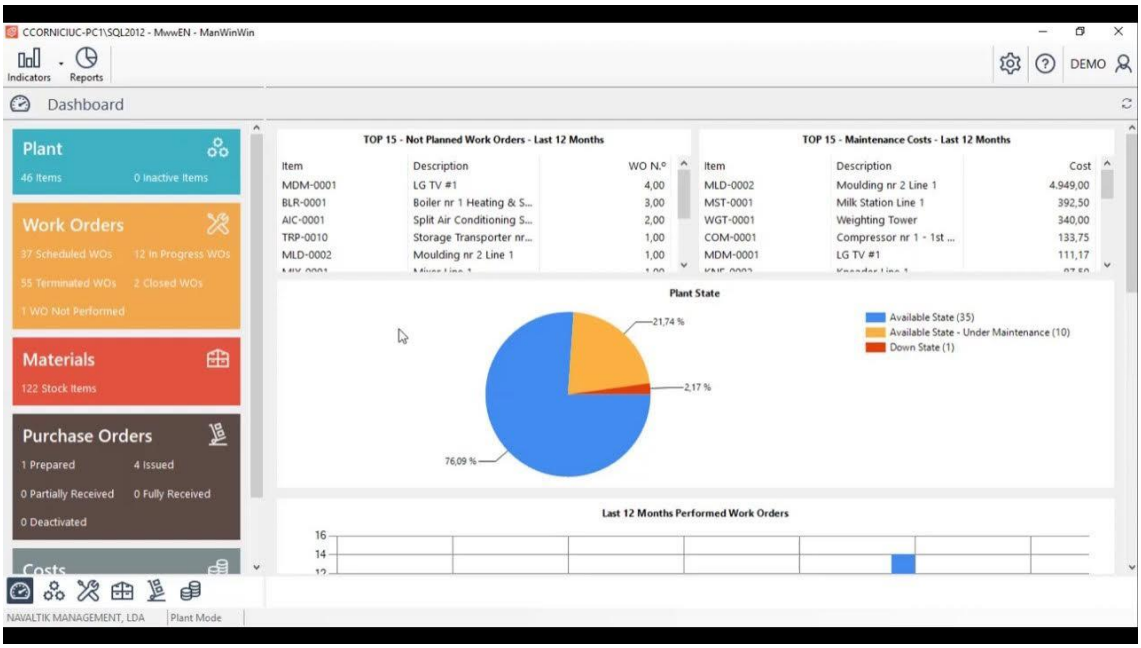
SIM 3300 Centrifugal Compressor Simulator



CBT on Compressors



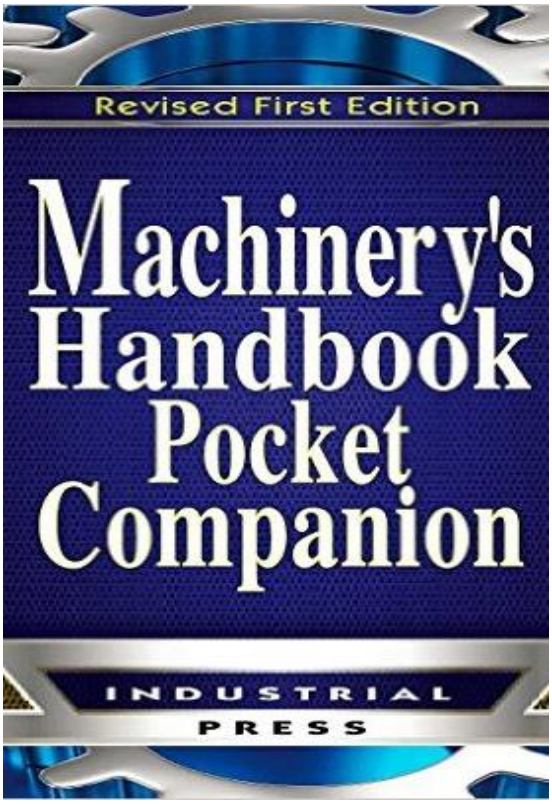
MTBF Calculator



ManWinWin Express CMMS Software

Book(s)

As part of the course kit, the following e-book will be given to all participants:



Title : Machinery's Handbook Pocket Companion
ISBN : 9780831130954
Author : Christopher McCauley
Publisher : Industrial Press

Course Coordinator

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