



COURSE OVERVIEW RE0176

Reliability-Centered Maintenance (RCM) Introduction & Predictive Maintenance Awareness

Course Title

Reliability-Centered Maintenance (RCM)
Introduction & Predictive Maintenance
Awareness

Course Reference

RE0176

Course Duration/Credits

Five days/3.0 CEUs/30 PDHs

Course Date/Venue

Sessions	Date	Venue
1	August 10-14, 2026	Glasshouse Meeting Room, Grand Millennium Al Wahda Hotel, Abu Dhabi, UAE
2	August 17-21, 2026	
3	August 24-28, 2026	



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 Reliability-Centered Maintenance (RCM) Introduction & Predictive Maintenance Awareness. It covers the reliability-centered maintenance (RCM), maintenance strategies and principles of reliability and maintainability; the RCM framework and process flow and standards, guidelines and industry practices; the failure mode and effects analysis (FMEA) and failure modes, effects and criticality analysis (FMECA); the failure data collection and analysis; and the criticality analysis, asset prioritization and RCM logic and decision process.



Further, the course will also discuss the RCM-based maintenance program; integrating RCM with preventive maintenance (PM) programs and RCM implementation methodology; the reliability and maintenance optimization tools and key performance indicators (KPIs) for RCM; the predictive maintenance (PdM) and condition monitoring techniques; the electrical and process condition monitoring, data acquisition and sensors; and the IoT in predictive maintenance and predictive analytics and machine learning.

During this interactive course, participants will learn the integration of RCM and PdM in asset management systems; the RCM program governance and sustainability; the continuous improvement in RCM/PdM programs; the cost-benefit analysis of RCM implementation, ROI and payback period calculations and budget allocation and lifecycle cost modelling; the digital transformation and future trends; the smart maintenance systems and industry 4.0, role of AI, AR/VR and digital twins; and the cloud-based reliability dashboards and future direction of autonomous maintenance systems.

Course Objectives

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

- Apply and gain an fundamental knowledge on reliability-centered maintenance (RCM) and predictive maintenance
- Discuss reliability-centered maintenance (RCM), maintenance strategies and principles of reliability and maintainability
- Review the RCM framework and process flow including standards, guidelines and industry practices
- Carryout failure mode and effects analysis (FMEA), failure modes, effects and criticality analysis (FMECA) and failure data collection and analysis
- Employ criticality analysis, asset prioritization and RCM logic and decision process
- Develop the RCM-based maintenance program, integrate RCM with preventive maintenance (PM) programs and apply RCM implementation methodology
- Identify reliability and maintenance optimization tools and apply key performance indicators (KPIs) for RCM, predictive maintenance (PdM) and condition monitoring techniques
- Carryout electrical and process condition monitoring, data acquisition, sensors and IoT in predictive maintenance and predictive analytics and machine learning
- Integrate RCM and PdM in asset management systems and apply RCM program governance and sustainability as well as continuous improvement in RCM/PdM programs
- Apply cost-benefit analysis of RCM implementation, ROI and payback period calculations and budget allocation and lifecycle cost modelling
- Recognize digital transformation and future trends covering smart maintenance systems and industry 4.0, role of AI, AR/VR and digital twins, cloud-based reliability dashboards and future direction of autonomous maintenance systems

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 reliability-centered maintenance (RCM) and predictive maintenance for reliability engineers and asset integrity engineers, operations and production supervisors, rotating equipment, static equipment, and utilities engineers, maintenance engineers and 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:

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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.

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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:



Mr. Andrew Ladwig is a **Senior 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 **Maintenance Optimization & Best Practices, Process Plant Shutdown & Turnaround, Maintenance Auditing & Benchmarking, Reliability Management, Reliability Centered Maintenance Principles & Application, Efficient Shutdowns, Machinery Lubrication, Maintenance Planning & Scheduling, Coupling & Shaft**

Alignment Techniques, Maintenance Auditing & Benchmarking, Reliability Management, Reliability Centered Maintenance Principles & Application, Efficient Shutdowns, Machinery Lubrication, Maintenance Planning & Scheduling, Coupling & Shaft Alignment Techniques, Reliability, Availability & Maintainability (RAM), Root Cause Analysis, Maintenance Process, Reliability-Centered Maintenance (RCM), Reliability Engineering Analysis (RE), Root Cause Analysis (RCA), Asset Integrity Management (AIM), Reactive & Proactive Maintenance, Pressure Safety Relief Valve Repair & Recalibration, PSV/PRV Troubleshooting, PRV Testing & Repair, Valve Testing & Inspection, Valve Sealing, Valve Calibration, Control Valves & Actuators, Boiler Inspection & Maintenance, Boiler Systems, 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 Maintenance, Boiler Troubleshooting & Safety, Boiler Emissions & Pollution Control, Combustion Analysis & Tuning Procedures, Water Treatment Technology, Heat Recovery Steam Generating (HRSG), Impulse Tube Installation & Inspection, Parker Compression Fittings, Pipes & Fittings, PSV Inspection, Root Cause Failure Analysis, Tank Design & Engineering, Tank Shell, Tanks & Tank Farms, Vacuum Tanks, Gas Turbine Operating & Maintenance, Reciprocating & Centrifugal Compressors, Screw Compressor, Compressor Control & Protection, Gas & Steam Turbines, Turbine Operations, Gas Turbine Technology, Valves, Process Control Valves, Bearings & Lubrication and Advanced Machinery Dynamics.

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

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.

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 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	Introduction to Reliability-Centered Maintenance (RCM) Definition and Objectives of RCM • Historical Evolution and Importance in Asset Management • Benefits: Safety, Availability, Cost Optimization, Compliance • Differences Between RCM, TPM, and Preventive Maintenance
0930 – 0945	Break
0945 – 1030	Maintenance Strategies Breakdown (Reactive) Maintenance • Preventive, Predictive, and Proactive Maintenance • Condition-Based vs Time-Based Maintenance Approaches • Strategy Selection Criteria Based on Asset Criticality
1030 – 1130	Principles of Reliability & Maintainability Key Definitions: Reliability, Maintainability, Availability • Mean Time Between Failures (MTBF) and Mean Time to Repair (MTTR) • Reliability Function and Bathtub Curve • Practical Reliability Calculations and Examples
1130 – 1215	The RCM Framework & Process Flow The Seven Classical RCM Questions (SAE JA1011 Framework) • Identifying System Functions and Functional Failures • Failure Modes, Effects, and Consequences Analysis • Output: Maintenance Tasks and Intervals Determination



1215 – 1230	Break
1230 – 1330	Standards, Guidelines & Industry Practices SAE JA1011 & JA1012 Overview • ISO 55000 and Its Linkage to RCM Principles • OREDA and API 580 References • Integration with Corporate Asset Integrity Systems
1330 – 1420	RCM Introduction Case Study Review a Sample Equipment Failure History • Identify Potential Functional Failures • Map Different Maintenance Strategies Applied • Discuss Lessons Learned and Expected Improvements
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	Failure Mode & Effects Analysis (FMEA) Basics Purpose and Structure of FMEA • Components: Failure Modes, Effects, Causes, and Controls • Risk Priority Number (RPN) and Risk Ranking Process • Limitations of Traditional FMEA in RCM Context
0830 – 0930	Failure Modes, Effects & Criticality Analysis (FMECA) Extension of FMEA to Include Criticality and Consequence • Qualitative vs Quantitative Criticality Evaluation • Integration of FMECA with Reliability Databases • Use of FMECA to Drive Maintenance Prioritization
0930 – 0945	Break
0945 – 1100	Failure Data Collection & Analysis Sources of Failure Data: CMMS, Field Logs, OEM Manuals • Statistical Data Analysis (Weibull, Exponential, Lognormal) • Data Cleansing and Classification (Equipment Hierarchy, Tag IDs) • Developing a Failure Database for RCM Projects
1100 – 1215	Criticality Analysis & Asset Prioritization Identifying Critical Equipment Using Risk Matrices • Business, Environmental, and Safety Criticality • Scoring Models for Prioritization (A, B, C Ranking) • Linking Criticality to Maintenance Strategy Decisions
1215 – 1230	Break
1230 – 1330	RCM Logic & Decision Process Functional Failure Consequence Categorization (Safety, Operational, Non-Operational) • Task Selection Logic: Condition-Based, Scheduled Restoration, Replacement, Run-To-Failure • Cost-Effectiveness and Feasibility Considerations • Documenting the RCM Decision Tree
1330 – 1420	FMECA & Criticality Ranking Exercise Conduct a Mini FMECA for a Pump or Compressor • Determine Risk Ranking Using RPN or Criticality Matrix • Select Appropriate Maintenance Strategies • Group Presentation and Peer Review
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	Developing the RCM-Based Maintenance Program Translating Analysis into Maintenance Tasks • Identifying Inspection, Lubrication, and Overhaul Activities • Establishing Frequencies and Intervals • Developing Maintenance Job Plans and Procedures
0830 – 0930	Integrating RCM with Preventive Maintenance (PM) Programs Evaluating Existing PM Tasks and Redundancies • Eliminating Non-Value-Added Activities • Optimizing Schedules and Resources • Linking RCM to CMMS (SAP PM, Maximo, etc.
0930 – 0945	Break
0945 – 1100	RCM Implementation Methodology Project Planning and Team Formation • Data Collection and System Boundaries Definition • Analysis Workshops and Validation Process • Pilot Implementation and Rollout Strategy
1100 – 1215	Reliability & Maintenance Optimization Tools RCM Software Applications and Databases • Reliability Block Diagrams (RBD) and Fault Trees • Monte Carlo Simulation for Failure Forecasting • Data Visualization and KPI Dashboards
1215 – 1230	Break
1230 – 1330	Key Performance Indicators (KPIs) for RCM Maintenance Performance Metrics (Availability, Reliability, Cost) • Leading vs Lagging Indicators • Failure Rate Trends and MTBF Analysis • KPI Dashboard Examples and Benchmarking
1330 – 1420	Develop an RCM-Based Maintenance Plan Build a Simplified RCM Plan for a Critical Rotating Equipment • Identify and Justify Maintenance Tasks and Intervals • Define Monitoring Tools and Responsibilities • Present the Maintenance Strategy to Management Panel
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	Basics of Predictive Maintenance (PdM) Definition and Objectives of PdM • Evolution from Preventive to Predictive Maintenance • Benefits and Challenges in Industrial Implementation • Comparison of PdM and Condition-Based Maintenance
0830 – 0930	Condition Monitoring Techniques Vibration Analysis and Dynamic Balancing • Infrared Thermography and Temperature Profiling • Ultrasonic Testing and Acoustic Emission Monitoring • Oil Analysis and Wear Debris Monitoring
0930 – 0945	Break
0945 – 1100	Electrical & Process Condition Monitoring Motor Current Signature Analysis (MCSA) • Partial Discharge Monitoring for Electrical Systems • Process Parameter Trending (Pressure, Temperature, Flow) • Integration with DCS and Historian Systems
1100 – 1215	Data Acquisition, Sensors & IoT in Predictive Maintenance Smart Sensors and Wireless Monitoring Technologies • Data Acquisition Systems (DAQ) and Gateways • Industrial IoT (IIoT) Connectivity and Cloud Platforms • Data Synchronization and Storage for PdM Analytics

1215 – 1230	Break
1230 – 1330	Predictive Analytics & Machine Learning Time-Series Data Analysis and Anomaly Detection • Use of AI/ML for Predictive Modeling • Digital Twins for Asset Performance Prediction • Examples of AI-Enabled Reliability Systems
1330 – 1420	PdM Technology Demonstration & Analysis Sample Case Study: Vibration and Oil Analysis Results Interpretation • Identify Fault Signatures and Trends • Define Corrective Action Plan • Discussion: PdM Integration Roadmap for Facility Assets
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

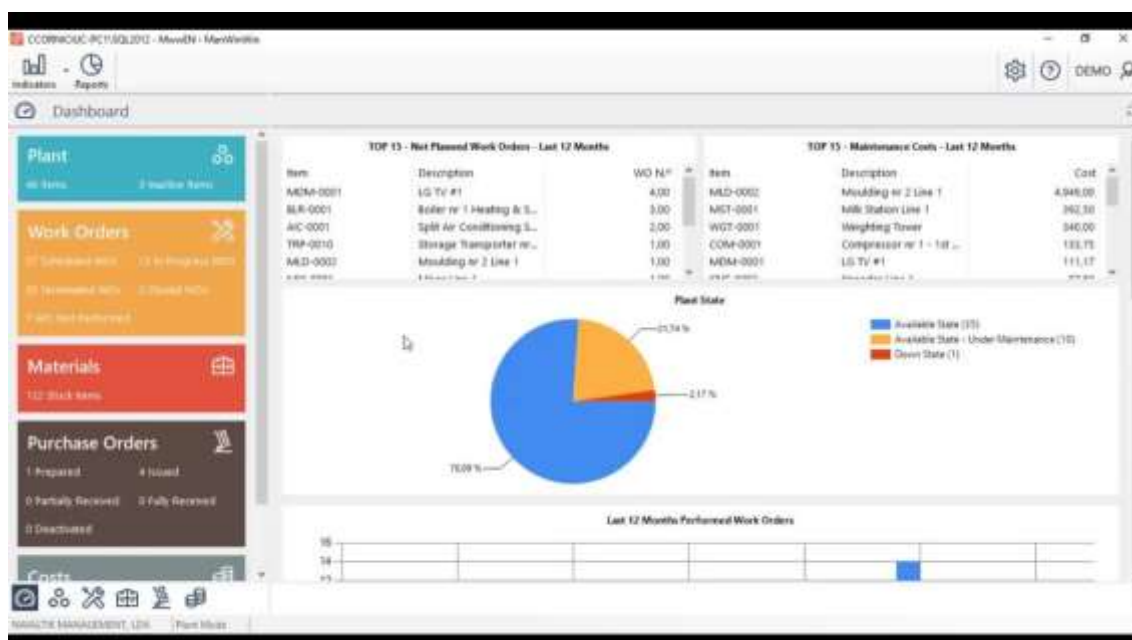
Day 5

0730 – 0830	Integration of RCM & PdM in Asset Management Systems Linking RCM and PdM Workflows • Integration with AIM and ISO 55001 Systems • Using RCM Outputs to Drive PdM Priorities • Aligning Maintenance and Reliability Departments
0830 – 0930	RCM Program Governance & Sustainability Roles and Responsibilities within Maintenance Organization • Periodic Reviews and Program Revalidation • Managing Changes in Asset Condition or Operations • Documentation, Audits, and Performance Review
0930 – 0945	Break
0945 – 1100	Continuous Improvement in RCM/PdM Programs PDCA Cycle (Plan-Do-Check-Act) for Reliability Processes • Capturing Lessons Learned and Updating Maintenance Strategies • Root Cause Analysis (RCA) Feedback Loop • Reliability Improvement Projects and Success Tracking
1100 – 1215	Cost Optimization & Business Case Justification Cost-Benefit Analysis of RCM Implementation • ROI and Payback Period Calculations • Budget Allocation and Lifecycle Cost Modeling • Case Study: Cost Savings from Predictive Maintenance
1215 – 1230	Break
1230 – 1300	Digital Transformation & Future Trends Smart Maintenance Systems and Industry 4.0 • Role of AI, AR/VR, and Digital Twins • Cloud-Based Reliability Dashboards • Future Direction of Autonomous Maintenance Systems
1300 – 1345	RCM-PdM Integration Plan Develop a Facility-Wide Reliability Improvement Plan • Combine RCM-Based and PdM-Based Strategies • Define KPIs and Implementation Roadmap • Course Review, Knowledge Assessment, and Certification
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

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 state-of-the-art simulator “MTBF Calculator” and “ManWinWin Express CMMS Software”.



MTBF Calculator



ManWinWin Express CMMS Software

Course Coordinator

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