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MACHINERY LUBRICATION ENGINEER, MLE®

ICML MLE® CERTIFICATION

International Council for Machinery Lubrication, ICML

Course Period : 5 Consecutive Days

ICML MLE Exam : 5th Day

CERTIFICATION

HRDC CLAIMABLE COURSE

INTRODUCTION

The Machinery Lubrication Engineer, MLE® is an intensive **engineering-grade course** designed for professionals in reliability, maintenance, and asset management roles—regardless of whether they hold an engineering degree. This advanced, management-level certification places strong emphasis on the strategic application of **lubrication and oil analysis** to improve equipment reliability, extend asset life, and optimize plant performance. The MLE certification exam, administered by the **International Council for Machinery Lubrication (ICML)**, assesses the candidate's ability to lead and engineer lubrication programs within industrial environments, either as internal staff or as external consultants.

The course content follows the **ICML Body of Knowledge (BoK)** for MLE and covers **24 critical topic** areas grouped into six major domains: Lubrication & Lubricants, Lubricant Application, Lubricant Condition Control, Lubricant Analysis Program Design, Preventive & Predictive Maintenance Strategies, and Lubrication Program Management. Key focus areas include lubricant selection, contamination control, oil analysis interpretation, program design and financial justification, as well as aligning lubrication strategies with reliability-centered maintenance (RCM) and **ISO standards** such as **ICML 55.1** and **55.2.** This course prepares participants to strategically **design, justify, and manage world-class lubrication programs** that contribute to sustainable operational excellence.

TRAINING OBJECTIVES

The **Machinery Lubrication Engineer, MLE®** certification is designed to verify that candidates possess the **technical knowledge, leadership capability, and problem-solving skills** necessary to:

1. **Develop and implement action plans** that may include machinery design improvements, procedure development, lubricant and hardware selection, inspection strategies, and optimization of lubrication-related preventive maintenance (PM) activities.
2. **Manage lubrication programs** at a strategic level—leading lubrication teams, coordinating with key suppliers, and ensuring effective cross-departmental communication.
3. **Troubleshoot complex lubrication issues** identified through oil analysis and inspections, and drive appropriate, data-informed corrective actions.
4. **Conduct internal training and competency development** to elevate lubrication knowledge and practices across the organization.

The **MLE Body of Knowledge** is intentionally mapped to the **twelve interconnected elements of the ICML 55 framework**, making this certification highly relevant for professionals leading initiatives toward **ICML 55.1 compliance** and advancing toward **ISO 55001 asset management** certification. Organizations that engage or employ MLE-certified individuals benefit from their ability to align lubrication decision-making with strategic asset reliability goals—ensuring a holistic, standards-based approach to lubrication excellence.

COURSE OUTLINE 1

1 Asset Management, ISO 55000 & ICML 55; Basic Elements

- Definition of Asset Management in the context of the organization
- ISO 55001 Requirements (refer also to EN 16646 for physical assets)
- Physical asset hierarchy (ISO 14224:2016)
- ICML 55 Attributes and Requirements in the context of machinery lubrication

2 Machine Reliability; Basic Elements

- Reliability philosophies and strategies
- Condition-based maintenance (see also Major Subject 4.0)
- Reliability culture
- Financial analysis and economic justification
- Failure Modes Effects Analysis (FMEA), Failure Reporting, Analysis and Corrective Action System (FRACAS), and Root Cause Analysis (RCA) (see also Major Subject 16.0)
- Asset design change process and management of change
- Criticality analysis and risk management
- Metrics, KPIs, Scorecard, Overall Equipment Effectiveness (OEE)
- Asset life cycle engineering and management
- Design for reliability, operability and maintainability
- Managing Sources of vibration and wear, including fasteners, alignment and balance

3 Machine Maintenance; Basic Elements

- Procedure-based maintenance and standardized work
- PM optimization
- Work management, planning and scheduling
- Shutdown, turnaround and outage management
- Operator-driven maintenance, autonomous maintenance, Total Productive Maintenance
- Enterprise Asset Management (EAM) and Computerized Maintenance Management System
- Stores, parts and inventory management
- Workforce management, skills and training

4 Condition-based Maintenance (CBM); Basic Elements

- Condition-based maintenance versus breakdown maintenance
- Predictive maintenance
- Proactive maintenance
- Inspection 2.0
- CBM technologies (lubricant analysis, vibration, thermography, acoustics, motor current, etc.)
- CBM for major machine categories: pumps, compressors, turbines, gearboxes
- CBM integration and program management
- CBM data management

5 Tribology, Friction, Wear, and Lubrication Fundamentals; Basic Elements

- Mechanical friction, fluid friction, dry friction
- Lubrication fundamentals
- Lubrication regimes, thick film, hydrodynamic, elastohydrodynamic, boundary
- Film thickness, specific film thickness, mixed film
- Film strength, additive and chemical-induced films
- Corrosive, cavitation and erosive wear
- Mechanical wear, abrasion, adhesion, surface fatigue

6 Lubricant Formulation for Machine Types to achieve Optimum Reliability, Energy Consumption, Safety and Environmental Protection; Basic Elements

- Liquid and grease lubricants, formulation science, base oils, common thickeners, common additives
- Solid-film lubrication and types
- Physical and chemical properties of lubricating oils and grease.
- Common lubricant laboratory test methods such as oxidation stability, viscosity index, film strength, rust suppression, air release, demulsibility, penetration number, dropping point, water washout resistance, biodegradability, etc.
- Differences and unique physical and chemical properties of major lubricant formulation categories including: engine oil, automatic transmission fluid, brake fluid, hydraulic fluid, turbine oil, gear oil, compressor lubricant, chain lubricant, wheel bearing grease, chassis grease, electric motor bearing grease, coupling grease, multipurpose grease, foodgrade lubricants

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COURSE OUTLINE 2

7 Job- and Task-based Skills/Training related to Lubrication and Reliability by User Organizations

- Skills possibly required for common tasks performed by lubrication technicians
- Skills possibly required for common tasks performed by operators and inspectors
- Skills possibly required for common tasks performed by mechanics and millwrights
- Training and knowledge required by reliability engineers and maintenance supervision
- Training and knowledge required by plant management
- Standardized training, tasked-based training and competency testing for practitioners in the lubrication field, ISO 18436

8 Lubrication Support Facilities needed in Plants and Work Sites

- Design and use of a lube room facility that meets reliability, safely and environment requirements
- Design and use of lubricant storage facilities including bulk tanks, tank farms, totes, etc. that meet reliability, safety, environment and regulatory requirements
- Standardized lubricant labeling for packaged and bulk vessels
- Proper selection, use and care of tools for inspection and reconditioning of tank, vessel and containers related to cleanliness, cross contamination, bottom sediment and water, and leakage
- Spill containment and leak protection practices for environmental protection and basic regulatory compliance
- Transfer, handling, dispensing, filtration from drums, totes and day tanks.
- Transfer, handling, dispensing, filtration from bottles, jugs, and small grease packages
- Selection and use of workplace and lube room tools and accessories (tools, benches, rooms, lockers/cabinets, etc.) and basic care and storage
- Safety practices related to the storage and handling of lubricants

9 Risk Management for Lubricated Machines; Basic Elements

- Basic elements of Reliability-centered Maintenance (RCM)
- The Pareto Principle and its application to establish maintenance strategy and focus of resources
- Failure patterns and Weibull Distributions basic elements
- Ranking of lubrication-specific failure modes and causes and the use of Failure Modes Effects Analysis (FMEA)
- Assessment of equipment to determine failure probability along with the severity/consequence of failure
- Basic elements in use of Hazard Analysis Critical Control Point (HACCP) (ISO 22000) to localize and control risk in lubricant-dependent machines and systems

10 Optimum Machine Modifications and Features Needed to Achieve and Sustain Reliability Goals

- Optimum selection, set-up and use of lubricant application devices and hardware (single-point autolubers, circulating lubrication, constant-level oilers, centralized lubrication systems, mist systems, spray, etc.)
- Optimum selection, installation and use of contamination control devices/hardware (filters, breathers, filter cart connects, headspace management, seals, dehydrators, de-aeration devices, etc.)
- Instrumentation requirements including selection and location of online oil analysis sensors
- Optimum selection, location and use of sight glasses and level gauges
- Optimum selection and use of relubrication and oil change hardware & tools
- Optimum selection and location of sampling valves and hardware
- Purpose and use of drip pans, grease traps, berms, purge ports, etc.
- Optimum selection and use of tags, labels and plates for lubricant type and lubrication practices on the machine

11 Lubricant Selection for Optimum Reliability, Safety, Energy Consumption and Environmental Protection based on Machine Type and Application

- Vendor selection based on product range, product quality, product performance, support & services
- Elements in generic lubricant specifications for common machine types, application types, operating conditions, workplace exposures, desired machine reliability, safety requirements, energy conservation, environmental protection and price. Common machine or application types include engines, driveline components, rolling-element bearings, journal bearings, enclosed & open gears, mechanical couplings, process pumps, hydraulic systems, compressors, gearboxes, turbines, chain and wire rope, and pneumatic systems. Lubricant specification elements include base oil, additives, thickeners, performance properties, physical properties, chemical properties, and health and safety properties.
- Food grade lubricant selection, application and regulations related to National Sanitation Foundation (NSF), Food Safety Modernization Act (FSMA), ISO 22000 (HACCP), ISO 21469 and similar guidelines
- Rationalized lubricant consolidation to optimize the number of lubricant grades and brands
- Lubricant cross-contamination risks, compatibility testing, and risk-management practices
- Proper labeling methods using standardized classifications and visual identification system for display on machines, containers, grease guns, lubricant transfer system, etc. Standardized classifications relate to internal and industrial standards including ISO 15380, ISO 12924/6743/12925 and many others related to engine oils, transmission fluids, axle lubricants, and brake fluids. These also include ILSAC, ACEA, API and SAE.

COURSE OUTLINE 3

12 Lubrication-related Planning, Scheduling and Work Processing

- Routine scheduled work and PMs
- Unplanned and condition-based work request processing
- Work prioritization and planning
- Work kitting, matching skill competencies to tasks, assembly of work crews
- Work scheduling
- Unplanned and planned work backlog management
- Process for troubleshooting faults and anomalies (see also Major Subject 16)
- Record keeping, documentation, CMMS

13 Periodic Lubrication Maintenance Tasks

- Control of correct lubricant supply: oil level, flow rate, drip rate, mist rate or grease volume
- Regrease, oil top-up and oil change frequency and lubricant volume (amount) criteria
- Proper oil top-up procedures for common machine types, sumps and reservoirs
- Proper grease relubrication procedures for common machine types and grease dispensing hardware
- Lubricant drain or purge criteria and methods for major machine types
- Contamination control tasks including general machine cleanliness, control of contaminant ingression, filtration, dehydration and other decontamination methods
- Machine flushing requirements, risks and benefits. Selection of flushing protocol, hardware and methodology
- Oil reclamation need and methods (see Major Subject No. 21 below)
- Lubricant waste handling, disposal and cleanup
- Leak detection, management and leak cleanup
- Safety in lubrication maintenance tasks

14 Inspection of Lubricated Machines for Optimum Reliability, Safety, Environmental Protection and Condition Monitoring

- Inspection personnel and responsibility (recognizing this vary between operators, lube technicians, mechanics, and reliability engineers)
- Inspection intervals, routes, autonomous inspection
- Selection and installation of machine inspection windows
- Selection, use and care of inspection tools and aids
- Inspection protocol for common machine types related to start-up, machine-run conditions, machine-stop conditions, repair inspection
- Inspection protocol for spare parts, stored new machines and standby machines
- Inspection personnel skill sets and training
- Inspection checklists, findings reports and documentation
- Integration of inspection with other condition monitoring practices

15 Lubricant Analysis and Condition Monitoring for Optimum Reliability Objectives

- Selection of optimum sampling tools/devices, sample point location(s), sampling frequency, and procedure for common machines, operating conditions and reliability objectives
- Selection of off-site laboratory requirements based on instrument/sample prep capabilities, industry orientation, quality, turnaround time, data reporting format and data interpretation capabilities
- Selection of onsite testing tools/laboratory requirements
- General in-service lubricant sampling and analysis program design
- New lubricant receiving requirements: testing, inspection and quality control
- Stored lubricant (package & bulk) sampling and analysis
- Selection of routine lubricant test slate and standardized methods
- Selection of exception tests, condition for use and standardized methods
- Selection of data alarms and limits
- General strategy for data interpretation
- Data management and overall program management
- Reporting and responding to non-conforming data
- Integration with other inspection and condition monitoring methods
- Accuracy and quality verification and accreditation (e.g., ISO 17025)

16 Fault/Failure Troubleshooting, Root Cause Analysis (RCA) and Remediation

- Basic problem troubleshooting procedures and guidelines
- Application of failure management and processes, e.g., the use of FRACAS policies (Failure Reporting, Analysis and Corrective Action System)
- General RCA policies and guidelines
- RCA phases: data collection, assessment, corrective action, inform and follow-up
- Data collection and evidence preservation policies
- Root cause assessment methods: fault trees, cause-and-effect, sequence of events, etc.
- Guidelines for responding to root cause conditions
- Guidelines for responding to incipient failure/faults
- Guidelines for responding to Impending/precipitous failure
- Sudden-death or catastrophic failure guidelines
- Guidelines for fault/failure findings from rebuild shops

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18 Waste and Used Lubricant Management and Environmental Compliance

- Disposal of lubricants, filters, rags, containers
- Cleaning of containers, parts, hoses, components and devices
- Labeling and documentation of hazardous waste and non-hazardous materials
- Disposal of hazardous and non-hazardous materials
- Alignment to ISO 14000

17 Supplier Compliance/Alignment and Procurement of Services and Products

- Supplier and service-provider alignment/commitment to reliability, safety, energy consumption, quality and environmental protection goals
- Incoming lubricants, parts, and machine product acceptance testing/inspection
- Certificate-of-analysis of lubricant supplies
- Internal/external cleanliness and packaging of new or rebuilt components/parts. Roll-off cleanliness of final machine assemblies.
- Lubricant supply agreement terms and conditions related to quality and services provided
- Supplier safety and lubricant quality communications and documentation
- Services of off-site service providers and rebuild shops (quality, part cleanliness, roll-off cleanliness, documentation, findings reports, etc.)

19 Energy Conservation and Environmental Protection

- Influence of lubricants and lubrication on energy conservation
- Influence of lubricants on atmospheric contamination
- Environmental-friendly lubricants (e.g., biodegradability)
- Lubricant aqueous toxicity, risk and assessment
- Organizational goals and policies related conservation and protection of the environment
- Optimized and practical use of lubricants and lubrication conservation and environment protection

20 Health and Safety

- Disposal & waste management
- Safety training, policies and guidelines
- Hazardous lubricants and toxicity
- Microbial safety risks and control of transmission (to other machines)
- Fluid pressure and fluid injection risks (blood stream injection)
- Lubricant mists in the work environment
- Confined space risks
- Fire and combustion risks
- Electrocution risks
- Other mechanical risks

21 Oil Reclamation, Decontamination, De-varnishing & Additive Reconstruction

- Lubricant conservation strategy and practices related to extended lubricant service life
- Selection of dehydration methods and practices
- Additive reconstruction of aged or damaged lubricants
- De-varnishing of fluids and machine surfaces
- Acid scavenging methods, best applications and risks

22 Lubrication during Standby, Storage and Commissioning

- Special lubrication requirements related to machine commissioning and running-in conditions
- Special lubrication-related practices to protect machines and parts in storage or standby

COURSE OUTLINE 4

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COURSE OUTLINE 5

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Program Metrics

- Fundamental elements in metrics and performance measures
- Micro metrics of machines and lubricant conditions
- Macro and big-picture metrics for overall fleet or plant machine health
- Mapping and aligning metrics to Return on Net Assets (RONA)
- Overall Equipment Effectiveness (OEE) (related to asset utilization)
- Leading metrics that predict future conditions or events (what's going to happen)
- Lagging metrics that report or summarize past conditions or events (what just happened)
- Overall lubrication performance and compliance metrics related to cleanliness compliance, lubricant health and PM compliance
- Lubricant consumption ratios/metrics
- MTBF and general machine reliability metrics
- Route compliance measurement
- Percent planned maintenance, workforce efficiency, wrench time
- Metric communication
- Performance control and remediation

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Continuous Improvement

- Culture of continuous improvement
- Improved Data Analytics (to Industry 4.0)
- Improved CBM sensor application and scope
- Improved cost reductions
- Improved production output
- Improved energy consumption
- Improved environmental protection
- Improved safety
- Improved product quality and timely delivery
- Improve profitability

***END OF THE CHAPTER**

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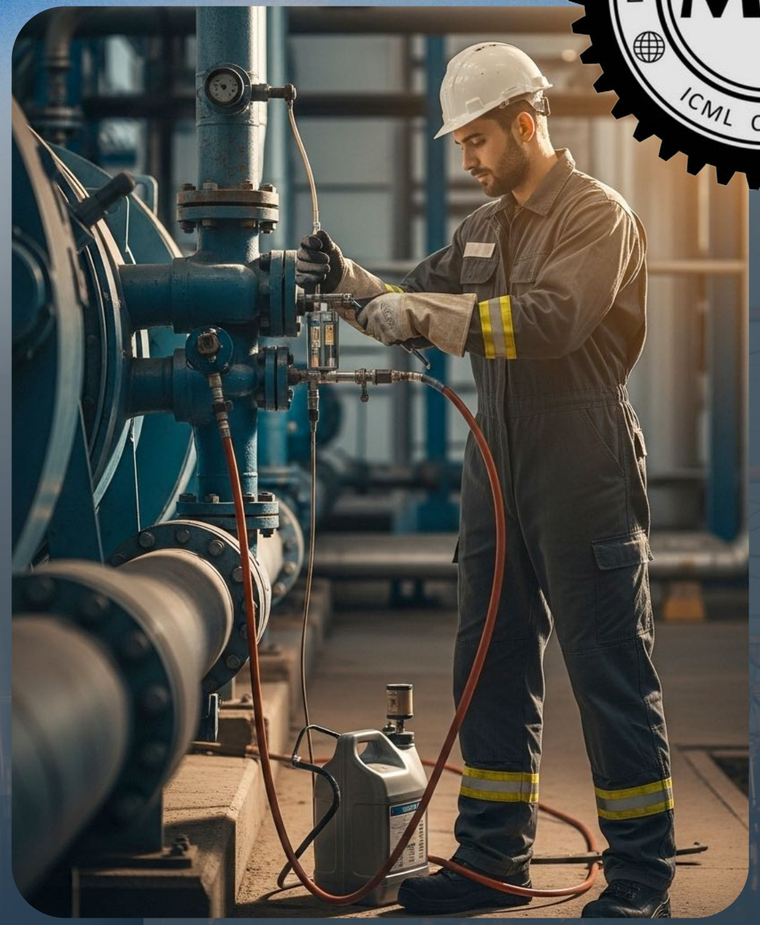
- Lubrication as a Profession, Jim Fitch, Noria, March 2004
- Develop a Corporate Education Master Plan, Jim Fitch, Noria, Oct. 2014
- Training Strategies to Control Contamination, Loren Green, Noria, June 2017
- Elevating the Status of Lubrication Personnel, Tom Hiatt & Wayne Ferguson, Eli Lilly and Company, Sept. 2007
- Education is Key to Get the Most From a Lubrication Program, Jeremy Wright, Noria, April 2012
- The Changing Roles of Lubrication Experts, Noria, Dec. 2014

COURSE OUTLINE 6



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