Machinery Lubricant Analyst I (MLA I) General Information

Level I Machinery Lubricant Analyst

The purpose for the Level I Machinery Lubricant Analyst (MLA I) certification is to verify that technicians practicing in the field of machinery lubrication, as it is applied to machinery condition monitoring and maintenance, are qualified to perform the following tasks:

- Manage lubricant delivery, storage and dispensation
- Manage a route for machinery re-lubrication and/or inspection
- Properly change and/or top the oil in mechanical equipment found in common industrial sites
- Use simple techniques to select lubricants with the proper base oil and additive system for machinery commonly found in industrial settings
- Use simple techniques to select grease lubricants appropriate for machines commonly found in industrial settings
- Use simple techniques to select grease application methods (including automated delivery) that are least intrusive and most effective for machines commonly found in industrial settings
- Use simple techniques to estimate re-grease volume and interval for machines commonly operated in industrial settings
- Properly maintain automatic lubrication systems (auto-grease, mist systems, etc.)
- Employ basic oil analysis techniques to identify and troubleshoot abnormal lubricant degradation conditions, and use simple techniques to adjust the lubricant specification accordingly

Common job titles for the individual who would become Level I MLA certified include Lubrication Technician, PM Technician, Millwright, Mechanic, etc. Generally, this individual has regular contact with the machine and has routine influence over the condition of lubricants and hydraulic fluids in use. The individual is likely to be directly involved in the machine lubrication process.

Level I MLA Certification Requirements

To become certified, an individual must meet the following requirements:

- **Education and/or Experience** - Candidates must have at least 12 months experience in the field of lubricant-analysis-based machinery condition monitoring (based on 16 hours minimum per month of experience).
- **Training** - Candidate must have received 24 hours of documented formal training as outlined in the Body of Knowledge of the MLA I. For online or recorded training, exercises, lab tasks, practice exams, and review exercises may be included in the training time total but shall not exceed four hours of the required course time. Candidate shall be able to provide a record of this training to ICML that shall include the candidate's name, the name and signature of the instructor, the dates of the training, and the number of hours spent in the training.

ICML does not require, recommend, endorse or authorize any specific training course as official or approved. It is the responsibility of each candidate to research the training options available in his/her area and make a decision as to the training provider of his/her choice. ICML recommends the outline of the course of choice be compared to the exam's Body of Knowledge. It is in the person's best interest and their responsibility as an ICML candidate to ensure they are being trained in the same subject areas in which they will be tested. ICML's Bodies of Knowledge are of public domain and can be utilized by companies in the development of courses, as well as by any prospective candidate for evaluating the appropriateness of chosen training.

- **Examination** - Each candidate must successfully pass a 100-question multiple-choice examination that evaluates the candidate's knowledge of the topic. Candidates have three hours to complete the closed-book examination. A score of 70% is required to pass the examination and achieve certification.

Level I MLA Body of Knowledge

The Level I MLA Body of Knowledge is an outline of concepts that one should have in order to pass the exam, in accordance with ISO 18436-4, Category I, Annex A.

References from which exam questions were derived can be found in the Domain of Knowledge below.

I. Maintenance Strategy (10%)
A. Why machines fail
B. The impact of poor maintenance on company profits
C. The role of effective lubrication in failure avoidance
D. Lube routes and scheduling
E. Oil analysis and technologies to assure lubrication effectiveness
F. Equipment tagging and identification

II. Lubrication Theory/Fundamentals (18%)
A. Fundamentals of tribology
B. Functions of a lubricant
C. Hydrodynamic lubrication (sliding friction)
D. Elasto-hydrodynamic lubrication (rolling friction)
E. Mixed-film lubrication
F. Base-oils G. Additives and their functions
H. Oil lubricant physical, chemical and performance properties and classifications
I. Grease lubrication
    1. How grease is made
    2. Thickener types
    3. Thickener compatibility
    4. Grease lubricant physical, chemical and performance properties and classifications

III. Lubricant Selection (10%)
A. Viscosity selection
B. Base-oil type selection
C. Additive system selection
D. Machine specific lubricant requirements
    1. Hydraulic systems
    2. Rolling element bearings
    3. Journal bearings
    4. Reciprocating engines
    5. Gearing and gearboxes
E. Application and environment related adjustments

IV. Lubricant Application (18%)
A. Basic calculations for determining required lubricant volume
B. Basic calculations to determine re-lube and change frequencies
C. When to select oil; when to select grease
D. Effective use of manual delivery techniques
E. Automatic delivery systems
    1. Automated deliver options
        a) Automated grease systems
        b) Oil mist systems
        c) Drip and wick lubricators
    2. Deciding when to employ automated lubricators
    3. Maintenance of automated lubrication systems

V. Lubricant Storage and Management (10%)

A. Lubricant receiving procedures
B. Proper storage and inventory management
C. Lube storage containers
D. Proper storage of grease-guns and other lube application devices
E. Maintenance of automatic grease systems
F. Health and safety assurance

VI. Lubricant Condition Control (10%)

A. Filtration and separation technologies
B. Filter rating
C. Filtration system design and filter selection

VII. Oil Sampling (10%)

A. Objectives for lube oil sampling
B. Sampling methods C. Managing interference
   1. Bottle cleanliness and management
   2. Flushing
   3. Machine conditions appropriate for sampling

VIII. Lubricant health monitoring (10%)

A. Lubricant failure mechanisms
   1. Oxidative degradation
      a) The oxidation process
      b) Causes of oxidation
      c) Effects of oxidative degradation
   2. Thermal degradation
      a) The thermal failure process
      b) Causes of thermal failure
      c) Effects of thermal degradation
   3. Additive depletion/degradation
      a) Additive depletion mechanisms
      b) Additives at risk for depletion/degradation by the various mechanisms
B. Testing for wrong or mixed lubricants
   1. Baselining physical and chemical properties tests
   2. Additive discrepancies
C. Fluid properties test methods and measurement units – applications and limitations
   1. Kinematic Viscosity (ASTM D445)
   2. Absolute (Dynamic) Viscosity (ASTM D2983)
   3. Viscosity Index (ASTM D2270) 4. Acid Number (ASTM D974 et al)
   5. Base Number (ASTM D974 et al)
   6. Fourier Transform Infrared (FTIR) analysis
   7. Rotating Pressure Vessel Oxidation Test (ASTMD2272)
   8. Atomic Emission Spectroscopy

IX. Wear Debris Monitoring and Analysis (4%)

A. Common machine wear mechanisms

Domain of Knowledge

- ASTM D4378, Standard Practice of In-Service Monitoring of Mineral Turbine Oils for Steam and Gas Turbines
- ASTM D 6224, Standard Practice for In-Service Monitoring of Lubricating Oil for Auxiliary Power Plant Equipment
- Bannister, K. (2007) Lubrication for Industry, Industrial Press, Inc., New York, USA
- Bloch, H., Bannister, K. (2017) Practical Lubrication for Industrial Facilities, 3rd Edition. The Fairmont Press, Lilburn, Georgia, USA
- Denis, J., J Briant, & J. Hipeaux (1997) Lubricant Properties Analysis & Testing. Editions TECHNIP, Paris, France
- Evans J.S., & Hunt T.M. (2008) Oil Analysis Handbook. Coxmoor Publishing Co., Longborough, England
- Hodges, P. (1996) Hydraulic Fluids, Arnold Publish, London and John Wiley & Sons, New York, USA
- Landsdown, A. (1994) High Temperature Lubrication, Mechanical Engineering Publications, Ltd., London, UK
- Landsdown, A. (2004) Lubrication and Lubricant Selection, Professional Engineering Publications, Ltd., London, UK
- Scott, R., Fitch J., & Leugner, L. (2012) The Practical Handbook of Machinery Lubrication, Noria Publishing, Tulsa, OK USA
- NLGI, (2017) Lubricating Grease Guide, 6th ed., The National Lubricating Grease Institute, Kansas City, MO USA
- Ludema, K. (1996) Friction, Wear, Lubrication: A Textbook in Tribology, CRC Press, Boca Raton, FL USA
- Pirro, D. M., & Wessol, A. A. (2016) Lubrication Fundamentals, Marcel Dekker, Inc., New York, USA
- Roylance, B., & T. Hunt (1999) The Wear Debris Analysis Handbook. Coxmoor Publishing, Oxford, UK
- The Lubrication Engineer's Manual, (2010) Association of Iron and Steel Engineers, Pittsburgh, PA USA
- Toms, L.A., & Toms, A.M. (2008) Machinery Oil Analysis. Co-published by STLE, Park Ridge, IL USA
- Troyer, D., & J. Fitch (2010) Oil Analysis Basics. Noria Publishing, Tulsa, OK USA

Level I Machinery Lubricant Analyst Recertification

ICML Certification is valid for three years from the date of issue. Individuals certified as Machinery Lubricant Analysts (MLAs) must recertify their competency every three years. The purpose for recertification is to ensure that certified individuals keep their skills current and up to date. Recertification must be achieved by a points system. To recertify by points, individuals must accumulate 15 recertification points over the three-year period and submit a completed application to ICML. Points may be claimed using the following criteria:

Category	Points	Maximum	Documentation
Conference Attendance	1 point per conference day	6 points	Proof of attendance (certificate, badge or letter from conference organizer in its letterhead) and copy of program
Employment	4 points per year	12 points	Letter from employer, in company letterhead, with title of signer shown
Publication or Presentation	2 points per work	6 points	Copy of publication, table of contents of the book, proceedings, magazine or journal in which it was published. Proof of conference presentation
Training	1 point per day	10 points	Proof of attendance (certificate or letter from training company in its letterhead) and a copy of the course outline

Criteria of Acceptability

- **Conference Attendance** - Topics related to oil analysis, lubrication or other topics important to effective equipment maintenance and management.
- **Employment** - Employment must be in a field related to industrial lubrication and/or oil analysis.
- **Publication/Presentation** - Publications (articles, journals, magazines, books, proceeding, etc.) and presentations about a topic within the body of knowledge for oil analysis, lubrication or equipment maintenance or management.
- **Training** - Topics related to oil analysis, lubrication or other topics important to effective equipment maintenance and management.

All points must be earned during the time the certification is in effect. Points earned before or after the certification period will not be accepted. Points may be applied to multiple ICML certifications held by the individual, assuming that the points are applicable and approved for each individual re-certification.

If a candidate's only source of re-certification points is employment, the extra points required may be earned via participation in employment-related best practices activities, as per below criteria:

- Activities related to elimination and/or prevention of lubricant failure
- Development of lubricant procedures and best practices
- Development of lubricant specifications
- Development of lubricant-related work management systems
- Lubricant program auditing tasks

Frequently Asked Questions

- **How many questions are on the exams?**
  MLA I exam has 100 multiple-choice questions
- **How long do I have to complete the exams?**
  You have three hours to complete the exam
- **What score is required to pass an exam?**
  70% correct answers

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