



## ***Lubrication Certification Requirements for ICML Certifications including:***

- MLT I, II

# Lubrication Certification Requirements (ICML MLT)

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# Lubrication Certification Requirements (ICML MLT)

## ICML



The International Council for Machinery Lubrication (ICML) is a vendor-neutral, not-for-profit organization founded to serve global industry as the world-class authority on machinery lubrication that advances the optimization of asset reliability, utilization and costs.

## Scope

ICML was originally established to be a vehicle for the exchange of ideas and best practices, to assure the skills of those who work in our field, to recognize excellence and accomplishments, and to invite new participants to join our industry.

Today they support individuals and organizations through programs that strengthen machinery lubrication and oil analysis as technical fields of endeavor. They are a certification body, a standards body, a membership body, and an awards body.

## Skills-based Testing and Certification

Certification is the mark of a professional. It helps to ensure that individuals who practice a craft, be it lubricant analysis or medicine, have a defined measure of skills. For the field of machine lubrication, formal certification serves these three vital purposes:

- Creates a formal framework of knowledge
- Raises the profiles of those working in the field
- Provides managers with assurance of skills



# Lubrication Certification Requirements (ICML MLT)

## ICML – MLT I

### Level I, MLT (Machinery Lubrication Technician)

**Education and/or Experience** - Candidates must have at least two years education (post-secondary) or on-the-job training in one or more of the following fields: machine lubrication, engineering, mechanical maintenance and/or maintenance trades.

**Training** - Candidate must have received 16 hours of documented formal training in machinery lubrication as outlined in the Body of Knowledge of the MLT I. For online or recorded training, exercises, practice exams, and review exercises may be included in the training time total but shall not exceed three 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.

Note: 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. Contact ICML about the availability of the exam in other languages.



## Body of Knowledge MLT I

The Level I MLT Body of Knowledge is an outline of concepts that one should have in order to pass the exam.

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

### **I. Maintenance Strategy (5%)**

- A. Why machines fail
- B. The impact of poor maintenance on company profits
- C. The role of effective lubrication in failure avoidance

### **II. Lubrication Theory (10%)**

- A. Fundamentals of tribology
- B. Functions of a lubricant
- C. Hydrodynamic lubrication (sliding friction)
- D. Elasto-hydrodynamic lubrication (rolling friction)
- E. Mixed-film lubrication



### **III. Lubricants (15%)**

- A. Base-oils
- B. Additives and their functions
- C. Oil lubricant physical, chemical and performance properties and classifications
- D. Grease lubrication
  - 1. How grease is made
  - 2. Thickener types
  - 3. Thickener compatibility
  - 4. Grease lubricant physical, chemical and performance properties and classifications

### **IV. Lubricant Selection (15%)**

- 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

### **V. Lubricant Application (25%)**

- 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



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- b) Oil mist systems
- c) Drip and wick lubricators
- 2. Deciding when to employ automated lubricators
- 3. Maintenance of automated lubrication systems

### VI. Preventive and Predictive Maintenance (10%)

- A. Lube routes and scheduling
- B. Oil analysis and technologies to assure lubrication effectiveness
- C. Equipment tagging and identification

### VII. Lube Condition Control (10%)

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

### VIII. Lube 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



# Lubrication Certification Requirements (ICML MLT)

## ICML – MLT II

### Level II, MLT (Machinery Lubrication Technician)

**Education and/or Experience** - Candidates must have at least three years education (post-secondary) or on-the-job training in one or more of the following fields: machinery lubrication, engineering, mechanical maintenance and/or maintenance trades.

Hold Level I Machinery Lubrication Technician (MLT) certification.

**Training** - Candidate must have received 16 hours of documented formal training in machinery lubrication as outlined in the Body of Knowledge of the MLT II. For online or recorded training, exercises, practice exams, and review exercises may be included in the training time total but shall not exceed three hours of the required course time. These 16 hours are in addition to the previous 16 hours of training required for MLT I, for a total cumulative training of 32 hours. 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.

Note: 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 tests the candidate's mastery of the body of knowledge. Candidates have three hours to complete the closed-book examination. A score of 70% is required to pass the examination and achieve certification. Contact ICML about the availability of the exam in other languages.



# Lubrication Certification Requirements (ICML MLT)

## Body of Knowledge MLT II

The Level II MLT Body of Knowledge is an outline of concepts that one should have in order to pass the exam.

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

### **I. Maintenance Strategy (5%)**

- A. The impact of lubrication on machine reliability
- B. The impact of lubrication on lubricant life and consumption
- C. Maintenance program strategies for achieving lubrication excellence

### **II. Lubrication Theory (5%)**

- A. Friction & Tribology
  - 1. Types of friction and wear
    - a) Wear modes and influencing factors
    - b) Machine frictional surfaces most at risk for specific wear modes (e.g., abrasion)
  - 2. Mechanisms of Lubrication regimes
    - a) Boundary
    - b) Mixed film
    - c) Hydrodynamic
    - d) Elastohydrodynamic
- B. Lubricant categories
  - 1. Gaseous
  - 2. Liquid
  - 3. Cohesive
  - 4. Solid

### **III. Lubricant Formulation (10%)**

- A. Base-oil Refining Methods and API categories
  - 1. Solvent-refined
  - 2. Hydro-treated
  - 3. Severely Hydro-treated
  - 4. Hydrocracked
- B. Mineral Base Oils
  - 1. Naphthenic
  - 2. Paraffinic
  - 3. Aromatic
- C. Vegetable Base Oils & Biolubes
- D. Synthetic lubricant characteristics/applications/compatibility
  - 1. Synthesized hydrocarbons (e.g., Polyalphaolifins)
  - 2. Dibasic acid esters
  - 3. Polyol esters
  - 4. Phosphate esters
  - 5. Polyalkylene glycol
  - 6. Silicones
  - 7. Fluorocarbons
  - 8. Polyphenyl Ethers
- E. Food Grade lubricant Classification





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- F. Types and Functions of additives
- G. Types and Functions of solid additives
- H. Modes of additive depletion

## IV. Grease Application and Performance (5%)

- A. Grease applications requiring high consistency
- B. Grease applications requiring low consistency
- C. Causes of grease separation
- D. Multipurpose greases
- E. Performance and application of specific grease thickeners
- F. High temperature greases
- G. Coupling greases

## V. Lubricant Selection (15%)

- A. Viscosity selection/adjustments according to machinery condition/environmental conditions
- B. When to use synthetic lubricants
- C. When to use biodegradable lubricants
- D. Lubricant consolidation
- E. Select lubricating oils for:
  1. Fire-resistant applications
  2. Hydraulics – Mobile/industrial
  3. Turbines
  4. Compressors
  5. Bearings
  6. Chains/conveyors
  7. Mist applications
  8. Gears – Automotive/industrial
  9. Engines – Diesel/Gas/Gasoline
  10. Pneumatic tools
  11. Spindles
  12. Ways/slides
- F. Selecting greases for:
  1. Chassis
  2. Couplings
  3. Anti friction bearings
  4. Journal bearings
  5. Automotive bearings
  6. Automatic Lubrication Systems
- G. Lubricant Selection standards development
- H. Procedures for testing and quality assurance of incoming lubricants
  - I. Procedures for approval of candidate lubricants



## VI. Lubricant Testing and Performance Analysis (10%)

- A. Viscosity
- B. Flash/Fire point
- C. Pour ASTM D97/Cloud point ASTM D2500
- D. Foam ASTM D892
- E. Air release properties ASTM D3427



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- F. Neutralization number
  1. Acid Number ASTM D 664/D974
  2. Base Number ASTM D 974/D2896
- G. Filterability ISO 13357
- H. Oxidation stability
  1. Turbine Oil Oxidation Stability Test ASTM D943
  2. Rotary Pressure Vessel Oxidation Test ASTM D2272
- I. Rust and Corrosion tests
  1. Turbine Oil Rust Test ASTM D665
  2. Copper strip corrosion ASTM D130
- J. Anti-wear tests
  1. Four ball wear test ASTM D2266
  2. Vickers wear pump test ASTM D2882
  3. SRV Test
- K. Extreme Pressure
  1. Four ball EP test ASTM D2596
  2. Timken Extreme Pressure Test ASTM D2509
  3. Falex EP/Wear Test ASTM D2670
  4. FZG Four Square Gear Test Rig ASTM D5182.97
- L. Demulsibility ASTM D 1401
- M. Grease consistency ASTM D217
- N. Dropping point of grease ASTM D2265
- O. Mechanical Stability of greases ASTM D217A
- P. Rolling Stability of Greases ASTM D1831
- Q. Water washout test for greases ASTM D1264
- R. Water spray test for greases ASTM D4049
- S. Rolling bearing rust test ASTM D1743
- T. Koppers Centrifugal Stability Test
- U. Oil separation in grease storage ASTM D1742
- V. Oxidation Stability – Greases ASTM D942



### VII. Lubricant Application (15%)

- A. Procedures for:
  1. Oil drain
  2. Reservoir/system flushing
  3. Disassembling/cleaning reservoirs and sumps
  4. Filling
  5. Top-up
  6. Grease packing
  7. Re-greasing
  8. Grease changeout
- B. Determine/calculate correct amount for re-greasing
- C. Determine/calculate correct frequency interval for re-greasing
- D. Select and manage optimum equipment/systems for lubricant application according to machinery requirements
- E. Safety/health requirements for lubricant application
- F. Manage proper maintenance of lubrication equipment
- G. Manage proper maintenance of automatic lubrication systems
- H. Create/update lube survey
- I. Record execution of lube program



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- J. Proactive management and detection of leaks
- K. Waste oil/filters management/disposal
- L. Writing a lubrication PM

### VIII. Preventive and Predictive Maintenance (10%)

- A. Creating and managing lube PMs and routes
- B. Creating and manage lubrication inspection check list
- C. Used oil analysis to determine optimum condition based oil changes
- D. Used oil analysis to troubleshoot abnormal lubricant degradation conditions
- E. Used oil analysis to troubleshoot abnormal wear related to lubricant degradation/contamination
- F. Procedures and methods for identifying root cause of lubricant failure
- G. Use of technology aids to determine optimum re-grease frequency/quantity (ultrasonic, temperature monitoring, shock impulse, etc.)

### IX. Lubricant Condition Control (20%)

- A. Proper sampling procedures
- B. Proper sampling locations
- C. Proper selection of breathers/vents
- D. Proper selection of filters according to cleanliness objectives
- E. Filter rating – Beta Ratio
- F. Sump/Tank Management to reduce:
  - 1. Air entrainment/foam
  - 2. Particles
  - 3. Water
  - 4. Sediments
  - 5. Heat
  - 6. Silt/sediments
  - 7. Unnecessary lubricant volume
- G. Proper selection of reconditioning systems for:
  - 1. Water
  - 2. Air/gas
  - 3. Particles
  - 4. Oxidation products
  - 5. Additive depletion
- H. Lube reclamation
  - 1. Requirements
  - 2. Feasibility
  - 3. Procedures for reclaiming/reconditioning
  - 4. Use of oil analysis to approve reclaimed/reconditioned lubricants



### X. Lube Storage and Management (5%)

- A. Design optimum storage room
- B. Defining maximum storage time according to environmental conditions/lubricant type
- C. Safety/Health requirements
- D. Proper sampling procedures/locations for sampling stored lubricants
- E. Procedures for reconditioning/filtering stored lubricants

