



INSTITUTE OF MATERIALS, MALAYSIA

IMM CERTIFIED MATERIALS FAILURE INVESTIGATION PRACTITIONER - LEVEL 4 (MFIP-L4)

INTRODUCTION

IMM Certified Materials Failure Investigation Practitioner (MFIP) Level 4 Certification Examination will assess candidates who have the necessary qualifications and experience in the field of Materials Failure Investigation.

The competence of Materials Failure Investigation Practitioners shall be classified into different levels according to required knowledge and competence.

A detailed description of the requirements of knowledge and competence is given in Section 5 of IMM-MFIP-01:2024 Certification Standard.

Each defined level of competence shall also include the competence of the corresponding lower levels. The level of authority shall be defined for each level.

The current levels of certification will not have specialization. All current levels of certification shall cover for Materials as a whole. In the future, IMM may embark on assessments for different specializations such as Metals, Non-Metals, Polymers, Ceramics, etc. This shall be applicable to Level 3 and above.

IMM has been accredited to ISO-17024 International Standard for Recognition of Skill Personnel Certification Bodies by the Department of Standards Malaysia Accreditation no: ACB PS 0006 since March 2021 for 4 certification programs to-date i.e., IMM Coating Inspector Level 1 & 2 Certifications and IMM Mechanical Joint Integrity Technician Certifications. In contrast to other types of conformity assessment bodies, one of the characteristic functions of the ISO-17024 Accredited Certification Body for skill personnel is to conduct an examination which uses objective criteria to measure competence and scoring. It is recognized that such an examination, if well planned and structured by the Certification Body, can substantially serve to ensure impartiality of operations and reduce the risk of conflict of interest. ISO-17024 serves as the basis for the recognition of the Certification Body for skill personnel and the certification schemes under which the persons are certified, in order to facilitate their acceptance at the national and international level.

COMPETENCY AND AUTHORITY OF MFIP LEVEL 4

Level 4 certified personnel shall possess the knowledge and experience to analyse results, evaluate data, draw conclusions and make recommendations.

Level 4 certified personnel shall have the authority to endorse the test results for external usage. The Level 4 certified personnel shall be able to verify the tests (both internal and external) reported by Level 1-3 certified personnel.



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The Level 4 certified personnel shall be able to work independently in an investigation (including establishing suitable test methods, analysing results, correlating and identifying modes of failures, and provide recommendations) as well as demonstrate leadership in guiding technical team (e.g. engineers/scientists/technologists or equivalent) in failure investigation.

Level 4 certified personnel shall have the required knowledge, skills and experience to act as an “Expert Witness” as per Section 5, Table 2.

REFERENCE STANDARDS

(Reference shall refer preferably to the latest published document):

1. IMM MFIP-01:2024 Materials Failure Investigation Practitioners - Competency Levels of Skill Persons: Basis for Skills Certification Scheme.
2. All Domestic and International Technical Standards covering all relevant Materials Testing techniques and methods listed in the Bibliography of IMM MFIP-01:2024 Standard.

WHO CAN APPLY

Anyone who fulfils the minimum requirements specified in IMM MFIP-01:2024 Certification Standard can apply for level 4 certification.

CANDIDATE’S ELIGIBILITY FOR ASSESSMENT

Level	Education	Minimum experience in materials failure investigation
4	Relevant engineering, technology, or scientific discipline degree/diploma plus specialized training and education in the field of materials.	5r + 4m + dossier + PR

- r having prepared number of reports for materials failure investigation as the main contributor within the last 5 years
- m having been involved in failure investigation work covering different modes of failures
- PR assessment by Peer Review Panel appointed by Certification body

Dossier to refers to the list of documentation required as per Annex B Clause B.4.5 of IMM MFIP-01:2024 Certification Standard.

Candidates shall submit evidence of reports (r) with collectively different number of modes of failures (m) plus dossier together with application for the peer review.



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KNOWLEDGE CATEGORIES

The Knowledge Categories and their respective titles and topics detailed in Table 1 constitute a common core for certification examination/assessment for all levels. The term materials cover both structural and functional materials.

Table 1: Knowledge Categories required by persons for all levels

Knowledge Category Number	Title and Topics of Knowledge
1	<p>Selection of Materials</p> <ul style="list-style-type: none"> • Understanding the importance of correct selection of materials for the right applications to avoid failures • Appreciation of what failures can occur should the wrong materials be selected for the respective applications
2	<p>Properties of Materials</p> <ul style="list-style-type: none"> • Understanding what properties of materials are important to avoid failures • Appreciation of the various properties of materials and how they affect the performance of materials in their respective applications
3	<p>Testing of Materials Failures</p> <ul style="list-style-type: none"> • Understanding the various types of testing methods required for failure investigation. The test methods include but not limited to <ul style="list-style-type: none"> ○ Mechanical tests, such as hardness, tensile, impact tests ○ Chemical tests, such as optical emission spectroscopy, X-ray fluorescence, X-ray diffraction, energy dispersive spectroscopy ○ Visual examination ○ Micrography, such as scanning electron microscopy ○ Other required techniques • Appreciation of the correct and incorrect types of testing to be conducted during failure investigations • Appreciation of the test results and how to analyse the test results • Appreciation of the potential flaws in certain testing techniques
4	<p>Failure Investigation Methodology</p> <ul style="list-style-type: none"> • Planning the investigation and understanding the preliminary actions to be taken • Appreciation of the equipment required for on-site and laboratory investigation • Understanding the difficulties associated with sample extraction and preservation • Predicting the testing required • Understanding the need for established standards • Understanding the need for established procedures • Writing the failure report
5	<p>Failure Analysis</p> <ul style="list-style-type: none"> • Understanding the problems associated with data acquisition • Knowing when to use finite element analysis or other stress evaluation



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	<p>tools</p> <ul style="list-style-type: none"> • Understand when there is a need for statistical analysis • Appreciation of root cause analysis techniques such as 5 Why's, FMEA etc. • Understanding of different failure modes • Organising the data in tables and trees • Understanding the need for feedback of information into the investigation process
6	<p>Writing Failure Investigation Reports</p> <ul style="list-style-type: none"> • Key elements of a failure investigation report • Avoid rushing into making conclusions • Thinking outside the box • Compilation of different inputs from various experts where necessary • Getting second and third opinions, if necessary
7	<p>Other Factors that Influence Failure</p> <ul style="list-style-type: none"> • Process • Human factors • Act of nature • Biohazard
8	<p>Standards and Codes of Practice relevant in materials testing and failure investigation</p> <ul style="list-style-type: none"> • Understanding the importance of Standards and Codes of Practice in Materials Testing & Failure Investigation • Ability to identify important points in each Standard and Code of Practice • Ability to cross-reference between Standards and Codes of Practice
9	<p>Health, Safety and Environmental issues relating to materials testing & failure investigation tasks</p> <ul style="list-style-type: none"> • Safety of personnel in handling samples • Safety of personnel in handling test equipment • Safety of facilities while testing materials • Safety of personnel while investigating failure sites
10	<p>Code of Ethics and Professional Conduct of Materials Failure Investigation persons</p> <ul style="list-style-type: none"> • Professionalism in conducting testing of materials with accurate reporting of results • Professionalism in conducting failure investigation with accurate reporting of findings • Non-compromise on Code of Ethics when reporting controversial results and findings • Practice of impartiality in delivery of deductions and conclusions in technical report Free from corrupt practices
11	<p>Interpersonal Communication Skills</p> <ul style="list-style-type: none"> • Ability to communicate instructions to subordinates clearly to avoid error in sample collection and testing • Ability to communicate effectively with peers to ensure collective agreement on the process of materials testing and failure investigation



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	<ul style="list-style-type: none">• Ability to deliver technical presentation of results and findings clearly to audience• Ability to communicate deductions and conclusions convincingly to audience
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EVALUATION FORMAT (PEER REVIEW ASSESSMENT)

Level 4 certified personnel shall be examined via a Peer Review conducted by at least three (3) examiners who have similar level with at least 10 years of experience each in the field of Materials Failure Investigation. The Peer Review will consist of a review of the candidate's dossier detailing and documenting the following: -

- Educational, scientific, or engineering qualifications.
- Examples of work documents, reports or technical papers prepared by the candidate to demonstrate the broad range of understanding and competence in all areas of materials failure investigation.
- Proof of Continuing Professional Development in the areas related to materials failure investigation.
- Participation in at least one technical committee in professional societies or associations in materials science and engineering fields within the last fifteen (15) years.
- Executed at least five (5) materials failure investigation projects with sole or primary responsibility within the last five (5) years. Candidates shall submit list of titles and brief descriptions of the failure investigation reports. The full reports shall not be submitted to the examination body. The candidates can show the full reports to examiners during the oral assessment. The full reports will not be retained by the examination body.

The dossier shall demonstrate compliance with all the requirements for the application for Level 4 Certification.

The dossier shall be verified by at least two validators from the candidate's past or present employers, clients, or Level 4 Certified Materials Failure Investigation Practitioners.

The Peer Review shall include a session for the candidate to demonstrate his/her knowledge and experience through presentation/demonstration to the examiners. The Peer Review session will be limited to three hours. The presentation on a particular aspect of the previous materials failure investigation case will be limited to 20 minutes with additional time for demonstration, if required.

LANGUAGE OF EXAMINATION

The Peer Review session will be conducted in English. Candidates are expected to be proficient in the English Language.

CRITERIA FOR CERTIFICATION

Meet all requirements for MFIP Level 4 assessment.



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EYE ACUITY TEST

Candidates shall have an eye vision test to ensure natural or corrected near distance acuity in at least one eye such that the applicant is capable of reading a minimum Jaeger Number 2 or equivalent type and size letter at the distance designated on the chart but not less than 12in. (30.5cm) on a standard Jaeger test chart. The ability to perceive an Ortho-Rater minimum of 8 or similar test pattern is also acceptable. For colour contrast differentiation, the examination should demonstrate the capability of distinguishing and differentiating contrast among colours or shades of grey used in the method as determined by the employer. This shall be conducted prior to the certification examination and at five-year intervals thereafter. Vision examinations expire on the last day of the month of expiration.

Eye examinations shall be administered by an Ophthalmologist, Optometrist, Medical Doctor, Registered Nurse or Certified Physician's Assistant or by other ophthalmic medical personnel and must include the Examiner's License/Registration/Certification number. Eye Acuity Examinations shall be performed not more than one (1) year prior to the date of the certification examination or the expiration date for renewals and recertifications. New visual acuity records do not need to be supplied for retests occurring within one (1) year from the original examination date.

All applicants must pass the Eye Acuity Examination, with or without corrective lenses, to prove near vision acuity on Jaeger J2 at 12 in. or greater (≥ 30.5 cm). All applicants shall take a color perception test.

Eye examination results must be documented on the IMM Visual Acuity Examination Record Form (see below) and submitted with the exam application form.

CERTIFICATE OF AWARD

IMM Certified Materials Failure Investigation Practitioner Level 4.

VALIDITY PERIOD OF CERTIFICATION

Lifetime. Certified persons may use the abbreviations "Certified IMM MFIP Level 4 # cert no: 1234".

NOTE: Level 4 Practitioners shall renew their IMM membership every 5 years to maintain their MFIP L4 Certification.