



IMM STANDARD

IMM CM-01:2024

**CORROSION MONITORING
COMPETENCY LEVELS OF
CORROSION MONITORING PERSONS:
BASIS FOR CERTIFICATION SCHEME**

INSTITUTE OF MATERIALS, MALAYSIA

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Foreword

Institute of Materials, Malaysia (IMM) is a non-profit professional society that promotes honourable practice, professional ethics and encourages education in materials science, technology and engineering. Engineers, academicians, technicians, skilled workers and professionals are amongst its members exceeding 6800. Registered with the Registrar of Societies on 6th November 1987, the Malaysian Materials Science & Technology Society (MMS) changed its name to the Institute of Materials, Malaysia (IMM) on 16th June 1997. The objectives of the IMM include the following:

- Training and development of individuals and companies in Malaysia to attain professional recognition in various fields of materials science, technology and engineering.
- Development of IMM standards as recommended guidelines for good technical practice for consideration and implementation by various industries of materials science, technology and engineering.

IMM CM-01:2022, CORROSION MONITORING COMPETENCY LEVELS OF CORROSION MONITORING PERSONS: BASIS FOR CERTIFICATION SCHEME

This standard will be subjected for review to reflect current needs and conditions. Users and other interested parties may submit comments on the contents of this standard for consideration in future versions.

Compliance with this Standard does not of itself confer immunity from legal obligations.

Introduction

This document enables the competence of Corrosion Monitoring personnel carrying out corrosion monitoring inspection, measurements, data collection & recording, results analysis, troubleshooting, and report writing to be defined and verified.

The relevant application sectors concern on-land and offshore structures, equipment and facilities exposed internally and externally to corrosive environments.

Demonstration of competence is possible by certification. This document offers a certification scheme in accordance with ISO/IEC 17024.

In preparation of Clauses 4, 5 and 6, a detailed Job Task Analysis (JTA) was undertaken by consensus of the experts in the IMM Corrosion Monitoring Working Sub-Committee. This JTA was then reviewed by a Technical Review Team within the IMM Corrosion Monitoring Working Sub-Committee. It is considered that Clauses 4, 5 and 6, constitute a rigorous JTA.

CORROSION MONITORING
COMPETENCY LEVELS OF CORROSION MONITORING PERSONS:
BASIS FOR CERTIFICATION SCHEME

1. Scope

This Standard defines three levels of competence (details in Clause 4) for persons working in the field of corrosion monitoring (CM) including monitoring of internal and external corrosion of pipes and equipment using destructive and non-destructive testing and survey methods such as corrosion coupons, ultrasonic probes, electric resistance probes, linear polarization probes, electrochemical techniques, and other basic and advance techniques to monitor the effectiveness of corrosion inhibition systems and cathodic protection systems. For the other basic and advanced techniques, competence of awareness level on eddy current techniques, electromagnetic techniques, chemical techniques, acoustic sound techniques, magnetic memory, coating application and breakdown survey.

It specifies a framework for establishing these competence levels and their minimum requirements.

Competence levels apply to all application sectors in all industries.

This document specifies the requirements to be used for establishing a certification scheme as defined in ISO/IEC 17024. This certification scheme is detailed in Annexes A, B and C.

2. Normative References

The following documents are referred to in the text in such a way that some or all their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the reference document (including any amendments) applies.

ISO/IEC 17024, Conformity assessment – General requirements for bodies operating certification of persons.

3. Terms and definitions

For the purposes of this document, the following terms and definitions apply.

3.1. Access Fitting

The access fitting body is the specialized pipe fitting which is permanently attached to the process plant vessel or pipe. Access fitting bodies can be welded or flange mounted.

3.2. Application Sector

Particular section of industry or technology or facilities where specialized corrosion monitoring activities are carried out such as monitoring of corrosion inhibitor effectiveness in the internals of pipes and equipment, monitoring of the effectiveness of cathodic protection systems for underground and underwater facilities and equipment, and monitoring the effectiveness of protective coatings on buried pipelines. Corrosion Monitoring persons require specific sector-related knowledge, skill, equipment and training to perform such activities.

3.3. Assessment Committee

Group appointed by the Certification Body which reviews applications and examination results and determines compliance with the requirements for Corrosion Monitoring Skills Certification offered by the Certification Body.

3.4. Competence

Ability to apply knowledge and skill to achieve results.

3.5. Corrosion Coupon

A removable test strip or disk of metal used in a gaseous or liquid medium to provide an indication of the corrosivity between the medium and that type of metal.

3.6. Corrosion Monitoring Practitioner

A person who devotes a regular and significant percentage of professional activity to the practical application of corrosion monitoring within one or more of the Application Sectors.

3.7. CP Interference

Stray current electrolysis caused by the effects of a cathodic protection system being close to a foreign pipeline or structure with or without a cathodic protection system resulting in corrosion damage to one or both pipelines or structures.

3.8. Electrical Resistance Probe (ER)

Corrosion monitoring technique which provides a measurement of the change in cross sectional area of an electrically conducting material probe through a test of its resistance.

3.9. Examination Centre

Place for the examination of competence in corrosion monitoring.

3.10. Examiner

Person with relevant technical and personal qualifications, competent to conduct and/or score an examination.

3.11. Industrial Corrosion Monitoring Experience

Practice in the applicable corrosion monitoring techniques and application sectors concerned, which leads to the required skill and knowledge.

3.12. Linear Polarisation Resistance Probe (LPR)

Corrosion monitoring technique using two or three electrodes to provide an indication of the change in resistance to polarisation.

3.13. Reference Electrode

A reference electrode is an electrode which has a stable and well-known electrode potential.

3.14. Retrieval Tool

A precision tool which allows safe, easy insertion and removal of various equipment and tools through an access fitting without de-pressuring the pipeline or vessel.

3.15. Significant Interruption

Period of time in which a Corrosion Monitoring person has not practiced the duties or undertaken training corresponding to his level of competence within an Application Sector.

3.16. Technical Instruction

Written description, method statement or written instruction stating the precise steps to be followed in Corrosion Monitoring activities to an established Standard, Code, Specification or Corrosion Monitoring Procedure.

3.17. Technical Report

Written report intended to transmit engineering information of a complex, analytical nature.

3.18. Training

Theoretical and practical instructions given in conformity to a pre-established programme in order to furnish or increase the knowledge and the ability of the Corrosion Monitoring persons in carrying out their duties.

3.19. Training Centre

A Center where training of Corrosion Monitoring persons is carried out. The Training Centre includes demonstration and testing facilities to simulate the conditions that normally exist in real corrosion monitoring of operating industrial facilities from a given Application Sector.

3.20. Ultrasonic Testing Thickness Gauge (UTT)

Ultrasonic test equipment used for measurement of metal wall thickness.

4. Levels of Competence**4.1. General**

The competence of Corrosion Monitoring Persons shall be classified in one or more of the following levels, depending on their competence in particular application sectors.

A detailed description of the requirements of competence is given in Clause 6.

Each defined level of competence shall also include the competence of the corresponding lower levels.

Corrosion Monitoring Persons shall have an annual vision test to ensure natural or corrected near distance acuity in at least one eye such that the applicant can read 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 should be conducted upon initial certification and at five-year intervals thereafter. Vision examinations expire on the last day of the month of expiration.

4.2. Level 1 Certified Corrosion Monitoring Practitioner

Level 1 corrosion monitoring person shall be capable to collect corrosion monitoring data and perform other basic tasks in accordance with technical instructions and procedures produced by Level 2 or higher Corrosion Monitoring persons. He shall record the data to a format produced by Level 2 or higher Corrosion Monitoring persons and under their responsibility. Level 1 persons shall not be responsible for analyzing the data. Level 1 persons shall understand the fundamentals of the measurements that they are required to undertake, the common causes of errors in these measurements and the related safety issues. The measurements shall include routine system function measurements, as well as a limited number of specific measurements to determine the performance effectiveness of the corrosion protection systems.

4.3. Level 2 Certified Corrosion Monitoring Practitioner

In addition to the competencies of Level 1 persons, Level 2 persons shall be competent to undertake a range of corrosion monitoring measurement, inspection and supervisory activities in accordance with technical instructions and procedures by Corrosion Monitoring persons of Level 3 or higher, collate and classify the data under their responsibility. Higher than Level 3 Corrosion Monitoring Practitioner certification may include an organization's personnel with seniority over the Level 3 or personnel with higher level of skill certification such as Level 3 or higher certification in Corrosion Technology/ Corrosion engineering from recognized professional bodies.

Level 2 persons shall have knowledge of the fundamentals of electricity, corrosion principles, corrosion control by inhibitors, corrosion coupons, electric resistance probes, linear polarization resistance probes, cathodic protection, protective coatings, measurement techniques, safety issues and applicable standards.

Level 2 persons shall be competent to check the calibration validity of the measuring equipment, supervise and perform the measurements, and carry out routine maintenance work on the corrosion monitoring equipment.

Level 2 persons shall not be responsible for the choice of test method, the technique to be used, and the interpretation of the test results.

4.4. Level 3 Certified Corrosion Monitoring Practitioner

In addition to the competencies for Level 2 persons, Level 3 persons shall have the knowledge and expertise of the more in depth principles of corrosion, corrosion inhibition, corrosion monitoring, cathodic protection, the principles of electricity, the significance of coatings and their influence on internal and external corrosion protection, and a detailed knowledge of corrosion monitoring test procedures and cathodic protection test procedures and related safety issues.

Level 3 persons shall understand and be competent to perform corrosion monitoring and cathodic protection tasks according to established or recognized procedures. They shall be competent to carry out and supervise all Level 1 and Level 2 duties, provide guidance for persons at Level 1 and Level 2. They shall be competent to prepare technical instructions for all persons of lower-level competence and assess all data collected from these tasks. Level 3 persons shall be competent to prepare technical reports. Level 3 persons shall also be

competent to conduct investigation and troubleshooting where data collected exhibit peculiarities.

4.5. Designation of Competence Levels

Levels 1 to 3 are definitive terms. The terms Corrosion Monitoring Practitioner is used above in an indicative purpose only. The Certification Body may use any appropriate name for the certification level. The eligibility for competence assessment for Levels 1 to 3 shall comply to ANNEX A, Table A.1 and Table A2.

5. Application Sectors

5.1. General

Any of the following application sectors shall be used in the establishment of competence levels of corrosion monitoring persons. For each of the application sectors, national or international specific standards may apply.

In addition to the specific knowledge for each application sector, a common core of knowledge is required.

5.2. Onshore Facilities

The following topics are relevant to this application sector: -

5.2.1 Fundamentals of Corrosion for onshore environment

5.2.2 Internal and External Corrosion Protection Methods

- 5.2.2.1 Corrosion Inhibition and Preservation
- 5.2.2.2 Principles of Corrosion Monitoring
- 5.2.2.3 Principles of Cathodic Protection
- 5.2.2.4 Basic knowledge of Protective Coatings

5.2.3 Internal and External Corrosion Monitoring Techniques

- 5.2.3.1 Corrosion coupons Electric Resistance Probes
- 5.2.3.2 Linear Polarization Probes
- 5.2.3.3 Corrosion Rate Measurement Instruments
- 5.2.3.4 Wall Thickness Measurements
- 5.2.3.5 Transformer Rectifiers
- 5.2.3.6 Sacrificial Anodes
- 5.2.3.7 Impressed Current Anodes
- 5.2.3.8 Cathodic Protection Reference Electrodes
- 5.2.3.9 Cathodic Protection Measurements and Surveys

5.2.4 This application sector includes, for example, the following: -

- 5.2.4.1 Above ground metallic pipelines and piping
- 5.2.4.2 Above ground non-metallic pipelines and piping
- 5.2.4.3 Above ground metallic vessels
- 5.2.4.4 Above ground non-metallic vessels
- 5.2.4.5 Buried underground metallic pipelines
- 5.2.4.6 Buried underground non-metallic pipelines
- 5.2.4.7 Buried metallic and non-metallic tanks
- 5.2.4.8 Above ground metallic and non-metallic tanks

5.2.4.9 Bottoms (external) of above ground tanks

5.3. Offshore Facilities

The following topics are relevant to this application sector:-

5.3.1 Fundamentals of Corrosion for offshore environment

5.3.2 Internal and External Corrosion Protection Methods

5.3.2.1 Corrosion Inhibition and Preservation

5.3.2.2 Principles of Corrosion Monitoring

5.3.2.3 Principles of Cathodic Protection

5.3.2.4 Basic knowledge of Protective Coatings

5.3.3 Internal and External Corrosion Monitoring Techniques

5.3.3.1 Corrosion coupons

5.3.3.2 Electric Resistance Probes

5.3.3.3 Linear Polarization Probes

5.3.3.4 Corrosion Rate Measurement Instruments

5.3.3.5 Wall Thickness Measurements

5.3.3.6 Transformer Rectifiers

5.3.3.7 Sacrificial Anodes

5.3.3.8 Impressed Current Anodes

5.3.3.9 Cathodic Protection Reference Electrodes

5.3.3.10 Cathodic Protection Measurements and Surveys

5.3.4 This application sector includes, for example, the following:-

5.3.4.1 Above deck metallic pipelines and piping

5.3.4.2 Above deck non-metallic pipelines and piping

5.3.4.3 Above deck metallic vessels

5.3.4.4 Above deck non-metallic vessels

5.3.4.5 Offshore submarine pipelines

5.3.4.6 Offshore marine hulls

5.3.4.7 Offshore structural jackets

5.3.4.8 Marine Jetty piles

6. Requirements for Competence of Persons

6.1. General

Corrosion Monitoring persons of competence levels 1 to 3 shall be knowledgeable in the topics in Table 1 and competent to undertake the tasks detailed in Table 2. Corrosion Monitoring persons shall have the knowledge and skill to properly and safely undertake these tasks, to understand their purposes, to recognize possible problems with their execution and the significance of the data arising from them.

All work by Level 1 and Level 2 Corrosion Monitoring persons shall be according to technical instructions issued by Corrosion Monitoring persons of Level 3 or higher.

Corrosion Monitoring persons of a particular level may assist in tasks at higher levels than defined in Table 2 corresponding to their application sector and competence level for their level alongside and under the direct supervision of a Corrosion Monitoring person of the higher level. The higher-level person retains the responsibility for the work performed by the lower person.

Corrosion Monitoring persons of a particular level may not undertake tasks at one level higher than defined in Table 2. Each defined level of competence shall also include the competence of the corresponding lower levels.

6.2. Knowledge Categories required for all application sectors and all levels

The Knowledge Categories detailed in Table 1 constitutes a common core for all application sectors and all levels.

Table 1 : Knowledge Categories required by persons for all competence levels and all application sectors.

Knowledge Category Number	Description of Knowledge
1	Corrosion and electrochemistry relevant to corrosion monitoring.
2	Principles of Corrosion Inhibition and Preservation.
3	Process Corrosion Monitoring Techniques and Measurements.
4	Key-point Corrosion Monitoring techniques and measurements such as Ultrasonic Testing Thickness Gauge and other specialized corrosion monitoring methods.
5	Corrosion and electrochemistry relevant to cathodic protection.
6	Principles of Cathodic Protection and Coatings relevant to corrosion monitoring.
7	Monitoring techniques for Cathodic Protection Systems, including AC and DC techniques.
8	Standards and Codes of Practice in the relevant application sector.
9	Health, Safety and Environmental issues relating to corrosion monitoring tasks.
10	Code of Ethics and Professional Conduct of all corrosion monitoring persons.
11	Interpersonal Communication Skills.

The level of knowledge in Table 1 shall be progressively increased from Level 1 to level 3 to conform to the levels of competency defined in Clause 4.

6.3. Tasks to be fulfilled in all application sectors for Levels 1 to 3

Table 2 details the tasks for each level of competence from 1 to 3 whatever the application sector. Persons shall be competent in these tasks for their particular application sector.

Table 2 : Tasks to be fulfilled by the various competency levels for all application sectors.

Task Number	Description of Task	Level 1	Level 2	Level 3
1	Prepare technical instructions (Scope of work/ examination)	No	No	Yes
2	Collect general information for design purposes	No	Yes	Yes
3	Collect detailed information and data for design purposes	No	No	Yes
4	Check calibration validity of equipment based on documentation	Yes	Yes	Yes
5	Set up measuring and testing equipment and verify equipment settings	Yes	Yes	Yes
6	Perform coupon and probe retrieval	No	Yes	Yes
7	Measure weight loss of corrosion coupons	Yes	Yes	Yes

8	Interpret corrosion rate from corrosion coupon	No	No	Yes
9	Measure corrosion rate using ER Probe	Yes	Yes	Yes
10	Interpret corrosion rate from ER Probe	No	No	Yes
11	Measure corrosion rate using LPR Probe	Yes	Yes	Yes
12	Interpret corrosion rate from LPR Probe	No	No	Yes
13	Perform Bioprobe retrieval and preservation of specimen	No	Yes	Yes
14	Measure and Interpret bacteria count from Bioprobe (This activity requires specific microbial lab specialists)	No	No	No
15	Measure and record structure-to-electrolyte potential	Yes	Yes	Yes
16	Interpret structure-to-electrolyte potential result	No	No	Yes
17	Perform verification test of working portable reference electrode against master electrode of the same type based on measurement	Yes	Yes	Yes
18	Perform verification test of working portable reference electrode against another type of reference electrode	No	Yes	Yes
19	Perform verification test of stationary reference electrode against a portable reference electrode	No	Yes	Yes
20	Perform insulation checking across flanges	Yes	Yes	Yes
21	Perform checks on working parts of the transformer-rectifiers	No	Yes	Yes
22	Perform checks on anode and structure readings of DC current and voltage	No	Yes	Yes
23	Check whether the positive output of the rectifier is connected to the anode and the negative output is connected to the structure	No	Yes	Yes
24	Record and report result of the measurements in a comprehensive format	Yes	Yes	Yes
25	Classify the results of the measurements	No	Yes	Yes
26	Provide recommendation on UTTG Key Point	No	No	Yes
27	Provide recommendation of Inspection Techniques	No	No	Yes
28	Perform UTTG result interpretation	No	No	Yes
29	Perform UTTG result verification	No	No	Yes
30	Determine the validity of the data and analyze anomalies detected	No	No	Yes
31	Ensure compliance with safety requirements related to application of corrosion monitoring in the application sector, tasks and competence level.	Yes	Yes	Yes
32	Perform risk assessment of safety requirements related to application of corrosion monitoring in the application sector, tasks and competence level.	Yes	Yes	Yes
33	Write technical instructions for lower-level persons, supervise and train them in the practice of their tasks	No	No	Yes
34	Prepare/write technical reports	No	Yes	Yes
35	Perform technical reports results evaluation	No	No	Yes

Annex A (Normative)

CERTIFICATION SCHEME: ELIGIBILITY FOR COMPETENCE ASSESSMENT FOR LEVELS 1 TO 3

A.1 General

The eligibility of corrosion monitoring persons for competence assessment shall be demonstrated in sufficient detail by documentation giving personal information which includes a declaration of education, training and experience.

The competent corrosion monitoring person shall fulfil the requirements for corrosion monitoring experience as defined in this section and shall pass the relevant assessment as detailed in Annex B.

A.2 Industrial Experience

The minimum requirements for duration of corrosion monitoring experience to be gained prior to certification shall not be less than that indicated in Table A.1 and Table A.2. The time in these tables refers to a minimum of 20% activity in corrosion monitoring.

Table A.1 is for candidates without previous corrosion monitoring experience to the knowledge and tasks as detailed in Clause 6.

Table A.2 is for candidates with previous corrosion monitoring experience to the knowledge and tasks as detailed in Clause 6.

Table A.1 – Minimum education and experience requirements for each level of candidates with no previous certification in all application sectors.

Target Level	Education	Minimum experience in corrosion monitoring
1	Relevant engineering and scientific discipline degree (BSc, BEng or equivalent) and specialized education in the corrosion field (significant corrosion content at BSc or BEng level or significant postgraduate corrosion study or research).	6 months
	Technical vocational education	6 months
	Other educations (requires basic mathematical skills)	6 months
2	Relevant engineering and scientific discipline degree (BSc, BEng or equivalent) and specialized education in the corrosion field (significant corrosion content at BSc or BEng level or significant postgraduate corrosion study or research).	3 years
	Technical vocational education	4 years
	Other educations (requires basic mathematical skills)	5 years

Table A.2 – Minimum education and additional experience requirements for each level for candidates with previous certification in all application sectors.

Starting Level	Target Level	Education	Minimum additional experience in corrosion monitoring after previous certification
1	2	All levels of education.	1 year
2	3	Relevant engineering and scientific discipline degree (BSc, BEng or equivalent) and specialized education in the corrosion field (significant corrosion content at BSc or BEng level or significant postgraduate corrosion study or research).	3 years
		Technical vocational education	4 years
		Other educations (requires basic mathematical skills)	5 years

“Other educations” includes candidates who may have had no formal post-school education or whose post-school education does not include relevant scientific or engineering content.

A.3 Training

A.3.1 Training for Levels 1, 2 and 3.

Corrosion monitoring persons shall provide documentary proof that they have completed a period of training in the Level. The training period, method and syllabus shall be sufficient in order to deliver the knowledge and skill as detailed in Clause 5 and Clause 6. Documentation may be retrospective. Training may be by the employer or through recognized course(s) at a training center.

The training may be conducted by Corrosion Monitoring persons of Level 3 or higher.

The minimum duration of training that shall be undertaken is as follows:-

- a). Level 1 : Two days of formal or on-the-job documented training.
- b). Level 2 and Level 3 : Five days of formal or documented on-the-job training.

At all Levels, training days should include both practical and theory components.

A.3.2 Training Centre for Level 1, 2 and 3.

The establishment of a training center is not mandatory. A training center may be situated at an employer's premises or independently.

- a). A training center may be established for one or more application sectors.
- b). A training center shall provide the following components, any of which may be combined:

- i. demonstration and testing facilities to simulate the conditions that normally exist in real corrosion monitoring of operating industrial structures;
- ii. a classroom having appropriate equipment and facilities for teaching the theoretical principles;
- iii. A workshop or demonstration area with appropriate equipment and facilities, which shall be equipped with corrosion monitoring instruments, materials and samples for practical training and testing.

Up-to-date calibration certificates and repair records for all devices, instrumentation and equipment shall be maintained by the training center. All instruments, devices, equipment, test leads, probes, electrodes etc. shall be maintained in good condition.

Training shall be delivered by persons at or above the Level of the training to be delivered.

ANNEX B (Normative)

CERTIFICATION SCHEME: EXAMINATION AND ASSESSMENT

B.1 General

Bodies performing certification of the competence levels of corrosion monitoring persons shall be in accordance with ISO/IEC 17024 and shall establish a certification scheme as defined in that International Standard.

Demonstration of competence shall be achieved through examinations organized in an examination centre approved by the certification body.

B.2 Certification Scheme Development Committee

A Working Committee shall be established to prepare the documents for the certification scheme. The certification body shall appoint qualified and experienced individuals to prepare the documents for the certification examination including but not limited to the following list of documents: -

No.	Documents for Certification Scheme
1	Technical Standard for Certification of Skill Personnel or equivalent standards, if no international ISO, ASTM or other Skill Certification Standards are available
2	Examination Brochure for Level 1 Certification
3	Examination Brochure for Level 2 Certification
4	Examination Brochure for Level 3 Certification
6	Examination Centre Facility & Equipment Check List
7	Schedule and Timetable of Theory and Practical Exams
8	Theory Examination Papers with Questions & Answers for each Level. A Question Bank shall be established
9	Practical Examination Paper for each Level. Pass/Fail Test Parameters/Criteria for Practical Examination (if required)
10	Peer Review Examination Paper for Level 3
11	Examiner and Invigilator Qualification Requirements and their Scope of Duties & Responsibilities
12	Costing Sheet for the Examination Fees covering fees for examiners, invigilators, paper markers, examination venue facilities, equipment provision for practical examination, and administrative costs of the certification body

Members of the Working Committee to develop the certification scheme documents shall be selected by the certification body and shall consist of persons whose terms of reference are such that the confidence of all interested parties as to its competence, impartiality and integrity shall be maintained. The Working Committee shall consist of at least six (6) members and the activities shall be coordinated by the certification body.

The prepared documents shall be vetted and approved by a Technical Review Committee consisting of at least three (3) technically-qualified personnel of minimum Level 3 certification or equivalent in qualifications and experience.

The vetted and approved sets of Questions and Answers shall be additionally reviewed by a team of Examination Moderators who shall check the Questions and Answers to ensure quality of assessment as required in the Standard will be met and that re-arrangement of questions into separate sets for the Question Bank will be done carried out with consistency. The

Examination Moderators shall also carry out periodic review of the Questions and Answers Bank to ensure the assessment take into account of updated and latest technologies and developments in the field.

All final documents after final review and amendments shall be secured and filed by the Examination Committee of the certification body.

B.3 Assessment Committee

An assessment committee shall be established to review applications for certification, including examination results, application documentation, work history and other relevant information to determine the individual's competence and compliance with qualification requirements for any level.

The assessment committee shall be appointed by the certification body and shall consist of persons whose terms of reference are such that the confidence of all interested parties as to its competence, impartiality and integrity shall be maintained.

The assessment committee shall consist of at least three members, all of them having the same or higher certification level of the examination to be assessed. All assessment committee members shall be minimum Level 3 and there shall be at least two with higher than Level 3 certification.

B.4 Examination and Assessments for Levels 1, 2, and 3

B.4.1 General

The examination system shall be established and maintained in order to assess the competence in accordance with Clause 6.

The knowledge topics and tasks listed in Clause 6 shall be assessed either by theoretical or practical examination or both.

B.4.2 Examination Centre

An examination center shall

- a) have adequately qualified staff, suitable premises and sufficient equipment to ensure successful examinations for the levels concerned,
- b) apply a documented quality management procedure,
- c) have the resources needed to administer examinations, including the calibration and control of any equipment used,
- d) prepare and conduct examinations under the responsibility of examiner(s),
- e) use only test facilities suitable for the practical examinations conducted at the center, and
- f) include testing facilities to simulate the conditions that normally exist in real corrosion monitoring of operating industrial facilities.

B.4.3 Theoretical Examination Session for Levels 1 and 2

The theoretical examination session shall require candidates to demonstrate their knowledge and competence to undertake tasks in accordance with Clause 6.

The theoretical examination session shall include a series of written questions on the processes and testing procedures used.

The time allowed for candidates to complete each examination shall be based upon the number and difficulty of the questions.

B.4.4 Practical Examination Session for Level 2

A practical examination session organized on equipment or simulated equipment and systems shall be conducted. Candidates shall be required to demonstrate their competence to fulfill the requirements of Clause 6.

B.4.5 Peer Review Examination Session for Level 3

Level 3 candidates shall be examined via a Peer Review conducted by three (3) examiners who have at least 15 years of Corrosion experience each either in the field of Corrosion Monitoring, Cathodic Protection or Corrosion Control. The Peer Review will consist of an Oral Interview and a Written Paper where the candidate has to write a technical analytical report of practical situations.

B.4.6 Conduct of Examinations

At the examination center, candidates shall present valid and unambiguous proof of identification (e.g., an identity card, passport or driving license that includes a photograph for verification) and an official notification of the examination, which shall be shown to the examiner or invigilator on demand.

Examinations shall be evaluated and approved by at least one examiner.

At least one examiner shall be responsible for grading the examination.

Examiners shall be impartial in accordance with ISO/IEC 17024. The risk resulting from the following situations has to be assessed and mitigated, for example if:

- the examiner has trained that person in the past two years
- the examiner is employed in the same company
- the examiner has a business relationship with the candidate

The examiners shall attest their independence in their assessment of the candidates and that all information received in the assessment process shall be maintained in confidence.

B.4.7 Grading of Examinations for Levels 1, 2, and 3

At least one examiner shall be responsible for the grading of the examinations by comparison with model answers.

Each examination session and the overall examination shall have minimum pass grades in order that the theoretical knowledge and the practical competence required in Clause 6 are properly verified. Candidates shall successfully complete each of the examination sessions.

The examination marking scheme should ensure that there is equal or greater weight allocated to the practical examination session in Level 1 and Level 2 than the theoretical examinations.

In order that a candidate can be certified, the final grades on each examination shall not be less than the minimum score established by the certification body. The required

passing scores shall be based on the difficulty of the examination process and the functionality required by industry of the persons considered to have passed the examinations. The minimum passing scores for each examination may be different.

The theoretical examination paper shall be marked separately from the practical examination paper in order to allow the candidate to re-sit one paper without re-sitting the other.

B.4.8 Final Assessment for Levels 1, 2, and 3

Final assessment of competence of candidates shall be made by the assessment committee, which shall ensure the candidate's compliance with all requirements, including Annex A.

B.4.9 Re-assessment

Candidates failing for reasons of unethical behaviour shall wait for a period of time determined by the certification body before re-applying. Candidates who fail to obtain the pass grade required may retake any of the failed examination sessions (theory or practical) once, provided the re-examination takes place within 12 months after the original examination. Candidates who fail re-examination or do not take re-examination within 12 months may apply for and shall take the examination in accordance with the procedure established for new candidates.

B.5 COMPLAINTS AND APPEALS

Complaints and appeals shall be addressed in accordance with ISO/IEC 17024.

ANNEX C (Normative)

CERTIFICATION SCHEME: CERTIFICATE, VALIDITY, RE-CERTIFICATION, TRANSITION PERIODS

C.1 Certificate

When a corrosion monitoring person is assessed to have fulfilled all certification requirements for the level, the certification body shall issue a document or certificate to that person indicating the satisfactory completion of all the requirements.

The certification body shall maintain sole ownership of the certificates. The certificate shall take the form of a letter and/or card or other medium, signed or authorized by a responsible member of the certification body.

The certificate shall be as required in ISO/IEC 17024 and shall contain, as a minimum, the following information:

- name of the certificated person;
- name of the certification body;
- scope of the certification detailing the level of certification;
- effective date of certification and date of expiry;
- reference to this Standards document number as the certification scheme;
- a unique identification.

The certificate shall be designed to reduce the risks of counterfeiting.

C.2 Validity

The maximum period of validity of the certification shall be five years. The initial period of validity shall commence when all of the requirements for certification (training, experience, success in competence assessment) are fulfilled.

Certification shall become invalid at the option of the certification body e.g., after reviewing evidence of unethical behaviour incompatible with the certification procedures.

C.3 Re-certification

C.3.1 General

Re-certification shall be by submission every five years of documentary evidence of continued corrosion monitoring work activity without significant interruption and updating of technical knowledge. In addition, every 10 years, an examination or assessment as defined in Clause C.3.2 or C.3.3 shall be required.

C.3.2 Levels 1 and 2

Levels 1 and 2 persons shall successfully complete a practical examination organized to a simple procedure which assesses ongoing competence to carry out corresponding corrosion monitoring tasks. If the individual fails to pass this examination, the person shall be permitted to sit for the complete examination at that level. Level 1 and 2 persons shall also demonstrate their continued competence to meet the requirements of Clause 6 by submission of continuing professional development records in

accordance to the requirements specified by the certification body.

C.3.3 Level 3

Level 3 persons shall be required to produce a technical instruction suitable for use by Level 1 or Level 2 persons in any one task from the knowledge topics listed in Clause 6. In addition, Level 3 persons shall also demonstrate their continued competence to meet the requirements of Clause 6 by submission of continuing professional development records in accordance to the requirements specified by the certification body.

C.4 Transition Periods

C.4.1 Transition Period for Establishment of a Certification Body

The following requirements apply to the transition period for a certification body implementing the present certification scheme.

The transition period shall last not more than five years after the establishment of the scheme.

In order to establish a certification scheme, or to extend an existing scheme, the certification body shall appoint trustees for the scheme.

The certification body shall consider in appointing the trustees the need to ensure that all participants of the Corrosion Industry in a country proposed for inclusion in the scheme are adequately and ideally equally represented. The trustees should include representatives from, for example:

- Operating companies/Users with their own corrosion monitoring expertise;
- Corrosion monitoring service companies;
- Corrosion monitoring consulting companies and individuals;
- Academics with particular competence in corrosion monitoring.

The certification body shall appoint a minimum of three trustees who shall not be from the same companies and who shall not be commercially or personally linked.

The trustees shall each at least be qualified above Level 3 certification persons and shall each have a minimum of ten years' experience in corrosion monitoring or corrosion technology.

The certification body and the trustees shall work together to establish the examination elements of the scheme in accordance with this document.

During the transition period, the examiners shall be appointed from the trustees. After the five years of transition period for the establishment of the scheme, examiners who have been formally assessed and certified to a higher level than Level 3 in accordance with Annex B shall be appointed.

During the transition period, the assessment committee shall comprise a minimum of five personnel, each with a minimum of ten years' experience in corrosion monitoring or corrosion technology and shall, in addition, include representatives of the certification body.

C.4.2 Transition Period of Existing Certification Schemes and this document

Prior to the publication of this document, certifications that were awarded previously for the competence levels given in Table C.1, are considered as fulfilling the requirements of this document.

Consequently, Certificates listed in Table C.1 deemed as equivalent, shall be valid for a maximum period of two years after the publication of this document for acceptance for re-certification. At that time, individuals requiring certification or re-certification shall carry out the requirements of this document.

Table C.1 – Equivalence between existing certification schemes and this document during the transition period

Level 1 of this document	Level 2 of this document	Level 3 of this document
IMM Certified Corrosion Technician Level 1	IMM Certified Corrosion Technician Level 2	Not applicable

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Acknowledgements

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