IMM STANDARD

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INSULATION INSTALLATION SKILL COMPETENCY LEVEL OF SKILL PERSONS: BASIS FOR SKILLS CERTIFICATION SCHEME

INSTITUTE OF MATERIALS, MALAYSIA

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FOREWORD

The Institute of Materials, Malaysia (IMM) was established in 1987 as a non-profit professional society dedicated to the development of Materials Science, Technology and Engineering training, education, research & development, and skills certification. The work of preparing IMM Skills Certification Standards is carried out by the respective IMM Technical Working Committees in collaboration with the IMM Standards Development Committee.

The development of this Skills Certification Standard has been referenced to ISO-18436-2 Standard for Condition Monitoring and Diagnostics of Machines – Requirements for Qualification and Assessment of Personnel; and ISO-15257 Competency Levels of Cathodic Protection Persons: Basis for a Certification Scheme.

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This document was prepared by the IMM Insulation Technical Task Force Working Committee under the IMM Education Committee of 2022-2024 Term.

INTRODUCTION

This document enables the competence of Insulation Installation Skill Competency candidates to carry out the installation in an efficient manner and these installation activities can be well defined and verified.

The relevant insulation and prefabrication on site installations cover all insulation on equipment and pipes, pressure vessels, machinery, equipment, structures, facilities and materials used in all industries which required good thermal insulation installations.

Demonstration of competence is possible by certification. This document offers a certification scheme in accordance with ISO/IEC 17024 Conformity Assessment – General Requirements for Bodies Operating Certification of Persons.

In preparation of Sections 4 and 5, a detailed Job Task Analysis (JTA) was undertaken by consensus of the experts in the Insulation Technical Task Force Committee. It is considered that Sections 4 and 5, constitute a rigorous JTA.

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1. SCOPE

This document specifies skill framework for establishing critical knowledge, skills and performance levels that a skill insulator or practitioner working in the field of Thermal Insulation Systems shall have in order to carry out a good insulation practices sets put to highlight to the owner or client, and the contractor, what must be considered between them to ensure that an effective insulation system is installed to meets the plant requirements and functions effectively in the Malaysia's local environments/conditions.

This Standard defines the skill insulators or practitioners' competence levels and their minimum requirements. The levels of competence (details in Clause 4) include but not limited to physical installation processes of various insulation systems but the knowledge of product's knowledge and health and safety aspects too.

A list of equipment and tools of the trade is given in Annex E. The list of equipment descriptions listed is not exhaustive and shall include new developments and new technologies over time.

Competence levels and their minimum requirements shall be defined according to best recommended practices and requirements in specific application sectors such as oil & gas, marine, power plants, etc.

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 the 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.

ISO/IEC 17000, Conformity Assessment – Vocabulary and General Principles.

Other ISO conformity assessments like ISO- 1527, ISO-18436, ISO-14918 are considered too.

3. TERMS AND DEFINITIONS

For the purposes of this document, the terms and definitions given in ISO/IEC 17000 and the following apply

3.1. Assessment Committee

Group appointed by the **Certification Body (3.3)** who reviews applications and examination results and determines compliance with the requirements for Certified Insulation Installer Level 1 – level 4 certification offered by the Certification Body.

3.2. Certificate

Document issued by a Certification Body indicating that the named person has fulfilled the **Certification Requirements (3.5)**

3.3. Certification Body

Organization that meets the requirements of ISO/IEC 17024 for third-party certification bodies and issues a certificate of conformity.

3.4. Certification Candidate

The person who undertakes the certification scheme. Once the person has fulfilled the certification requirements, he or she becomes a certified person.

3.5. Certification Requirements

Set of specified requirements, including requirements of the scheme to be fulfilled to establish or maintain certification.

3.6. Competence

Ability to apply knowledge and skill to achieve results.

3.7. Examination Centre

Place for the examination of competence in insulation skill or insulation practitioner.

3.8. Examiner

A person competent to conduct and score an examination, where the examination requires professional judgement.

3.9. Examination Moderator

Person competent to review the Examination Questions and Answers and co-ordinate the arrangement of multiple sets of Questions and Answers for the Questions & Answers Bank.

3.10. Expert Witness

A person whose level of competence and knowledge in a particular field qualifies them to present their opinion about the facts of sound insulation installations

3.11. Invigilator

A person is authorized by the Certification Body to supervise examinations but does not evaluate the competence of the candidate.

3.12. Materials

Objects or materials used in the thermal insulation systems (Cold or Hot system).

3.13. Peer Review Panel

A group of qualified individuals, with similar or better competencies, appointed by the Certification body to review and assess candidates applying for Level 4 certification in this document

3.14. Safety issue

Issue that encompasses one or more contributing factors and other unsafe conditions

3.15. Significant Interruption

Period in which a Certified Insulator or Insulation Practitioner has not practiced the duties or undertaken training corresponding to their level of competence. The proof of practice is by logbook signed off by respective project's owner/client.

3.16. Technical Instruction

Written/Oral description, method statement or written/oral instruction stating the precise steps to be followed in best recommended insulation activities to an established Standard, Code, Specification or Procedure

3.17. Training

Theoretical and practical instructions given in conformity to a pre-established program to furnish or increase the knowledge and the ability of the skill persons in carrying out their duties

3.18. Training Centre

A Centre where training for Insulation Skill or Insulation Practitioner is carried out. The Training Centre shall possess demonstration and installation facilities to simulate the conditions that normally exist in real situations of installation.

3.19. Trustees

Person who establishes the examination elements of the scheme in accordance with this document.

4. LEVELS OF COMPETENCE AND AUTHORITY

4.1. General

The competence of Certified Insulation Installer Level 1 – Level 4 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.

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 specialization or Inspector level of certified personnel in relevant field shall be mentioned in a bracket behind each competency level. This shall be applicable to Level 3 and Level 4.

4.2. Certified Insulation Installer Level 1

Level 1 certified personnel shall have few good years of hand-on skill knowledge about the behavior of insulation materials, good insulation system practices, and safety issues. The certified personnel shall also demonstrate good hand-on knowledge of good insulation practices.

Level 1 certified personnel shall be competent in at least one or more thermal insulation systems. The certified personnel shall be able to learn and install new insulation systems over time.

Level 1 certified personnel shall get approval from Level 3 and/or Level 4 – certified Insulation Practitioners/Inspectors for all QA/QC related insulation installations.

Level 1 certified personnel shall not be responsible for QA/QC insulation report writing, but they shall be allowed to verify the installation progress report for internal usage only.

Level 1 certified personnel shall not have the authority to endorse (stamp) a report.

Level 1 certified personnel can act as “Expert Witness” according to their technical and installation skills and knowledge as per Section 5, Table 2.

4.3. Certified Insulation Installer Level 2

Level 2 certified personnel shall have knowledge about the behavior of insulation materials including degradation phenomenon due to mechanical or water ingress, physical and chemical properties of the materials, related characterization, engineering drawings, methodology to perform installations, safety issues and applicable standards relating to specific insulation materials.

Level 2 certified personnel shall be competent in at least three or more insulation system installation.

Level 2 certified personnel shall be able to troubleshoot, to verify the performance or quality of the installations.

Level 2 certified personnel should be able to guide the Level 1 certified personnel on the proper insulation installation process.

Level 2 certified personnel shall not be responsible for the interpretation of the installation report writing. The Level 2 certified personnel shall verify or guide the Level 1 certified personnel on such activities.

The Level 2 certified personnel shall work under the supervision of Level 3 or Level 4 certified personnel.

Level 2 certified personnel can act as “Expert Witness” according to their technical and installation skills and knowledge as per Section 5, Table 2.

4.4. Certified Insulation Installer Level 3 (Certified Insulation Inspector – CII)

Level 3 certified personnel shall have knowledge about the behavior of the insulation materials including degradation phenomenon, physical and chemical properties of the insulation materials, related characterization behaviors, engineering drawings, methodology to perform best recommended installation practices, safety related issues and applicable standards relating to specific testing of the insulation materials.

The Level 3 certified personnel shall be able to demonstrate knowledge of at least six insulation related materials, standard installation methodology, able to understand and able to perform calculation of thermal conductivity values.

Level 3 certified personnel shall be able to identify installation errors and/or to check or verify the owner’s insulation specifications like the thermal efficiency of insulation systems depending on the quality of the work done.

Level 3 certified personnel shall guide the Level 1 & 2 certified personnel by providing the standard and modified test methods.

Level 3 certified personnel shall act as a QA/QC holding point as he will be responsible for the interpretation of installation report writing and preliminary progress recommendations for correction (if needed).

Level 3 certified personnel shall be allowed or have the authority to endorse the test results for external usage and Level 3 can be considered as a Certified Insulation Inspector (CII)

The Level 3 certified personnel can verify or endorse the progress installation report (internal) report by Level 1 & Level 2 certified personnel.

Level 3 certified personnel shall be able to work independently in Competence Insulation Practitioner including establishing suitable installation QA/QC report, analyzing results, correlating to insulation specifications and identifying modes of failures, and provides recommendations as well as demonstrate leadership in guiding Level 1 & Level 2.

Level 3 certified personnel can act as “Expert Witness” according to their technical and installation skills and knowledge as per Section 5, Table 2.

4.5. Certified Insulation Installer Level 4 (Certified Insulation Specialist – CIS)

Level 4 certified personnel shall possess wide technical insulation knowledge and experience or exposure to other disciplines including Design parameters, Coatings, NDT equipment testing and analyze installation reports/results, evaluate data, draw conclusions and make recommendations.

Level 4 certified personnel shall have the authority to endorse the test results for external usage as Level 4 can be considered as a Certified Insulation Specialist (CIS)

Level 4 certified personnel shall be able to verify the tests (both internal and external) reported by Level 1-3 certified personnel.

Level 4 certified personnel shall be able to work independently as an Insulation Inspector/Specialization including establishing suitable installation methods, analyzing results, correlating and identifying modes of bad installations, and providing recommendations as well as demonstrating leadership in guiding Level 1-3 team in correcting errors during installations.

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

4.6. Designation of Competence levels

Levels 1 to 4 are definitive terms. The Certification Body may use any appropriate name for the certification level. The eligibility for competence assessment for Levels 1 to 4 shall comply with ANNEX A, Table A.1.

4.7. Additional Assessment Requirements

The Certification Body may impose additional assessment requirements for assessing the competency of a Level 1 to 4 candidate to ensure the candidate has sufficient experience and expertise covering (i) the specific area of industry / range of industries, or (ii) specific materials / range of materials, or a combination of both.

5. REQUIREMENTS FOR COMPETENCE OF CERTIFIED PERSON

5.1. General

Certified personnel for competence levels 1 to level 4 shall be knowledgeable in the **Knowledge Categories** and related topics in Table 1 and shall be competent to undertake the tasks detailed in Table 2.

The certified person 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 certified personnel shall be according to technical instructions issued by certified personnel of Level 3 or Level 4. Higher-level certified personnel shall retain the responsibility for the work performed by lower-level 1-2 certified personnel.

A certified person of a particular level shall not undertake tasks at a higher level, as defined in Table 2.

5.2. 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. These Knowledge Categories shall also be used for the pre-requisite training programs. The term materials cover both structural and functional insulation materials.

Table 1: Knowledge Categories required by personnels for all levels.

KNOWLEDGE CATEGORY NUMBER	Title and Topics of Knowledge for All Levels 1 - 4	Specific Topics for Level 1 & Level 2 Assessment
1	**Selection of Insulation Materials** • Understanding the importance of correct selection of insulation materials for the right applications to avoid failures or CUI. • Appreciation of what failures can occur should the wrong materials be selected for the respective applications especially to prevent water ingress to the insulation systems. • Non-contact insulation systems should be applied for CUI mitigation and best practices for hot thermal insulation.	i. Selecting materials based on its insulation thermal properties and its objectives. ii. Selecting materials for pipelines carrying different fluids (Hot or Cold or Cryogenic) iii. Selecting materials for corrosion and chemical resistance.

2	**Properties of Insulation Materials** • 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	i. Understanding mechanical and thermal properties of the insulation materials ii. Relationship of each material property to failure mechanisms.
3	**Insulation materials for "Hot" pipelines & "Hot" Process Equipment** • Mineral Wools (GW) • Flexible Elastomeric foam (FEF) • Calcium Silicate (CS) • Polyethylene foam tubing (PEF) • High temperature glass fiber (HT-GF) • Cellular Glass (CG) • Expanded Perlite (EP) • Microporous Silica (MPS) • Aerogel Blanket (AB) **Hot Insulating Auxiliary Materials** • Bands – aluminum, SS, • Binding Wire – SS or Galvanized • Adhesive synthetic tape • Self-taping screws • Blind rivets • Storm band • Sealants (non-acetic cured)	Minimum process temperatures for each of these insulation materials for "Hot" pipelines and hot process equipment. Relationship of each material property to failure mechanisms
4	**Insulation Materials for "Cold" insulation for Pipelines, fittings and equipment** • Flexible elastomeric foam (FEF) • Extruded polystyrene foam (XPS) • Polyisocyanurate /Polyurethane Rigid Foam (PIR/PUR). • Cellular Glass (CG) • Aerogel Blanket (AB) **Insulation for "Cryogenic" – Need special discussion (as per Material Supplier's recommendation & specification) to control heat conservation.**	Minimum process temperatures for each of these insulation materials for "Cold" pipelines and hot process equipment. Relationship of each material property to failure mechanisms. **Materials are the same as Cold Insulation, but the installations are more complex and as per Supplier's recommendation.** • Vapor Stop Sealer for PIR/PUR • Vapor Stop Sealer for CG. • Vapor Stop 2-component sealer • Vapors stop epoxy resin • 2-component adhesive
5	**Installations for "Hot" Pipelines/Equipment** • Mineral Wools (GW)	Minimum process temperatures for each of these insulation materials for "Hot" pipelines and hot process equipment.

	• Flexible Elastomeric foam (FEF) • Calcium Silicate (CS) • Polyethylene foam tubing (PEF) • High temp. glass fiber (HT-GF) • Cellular Glass (CG) • Expanded Perlite (EP_ • Microporous Silica (MPS) • Aerogel Blanket (AB) **Hot Insulating Auxiliary Materials** • Bands – aluminum, SS, • Binding Wire – SS or Galvanized • Adhesive synthetic tape • Sealants (non-acetic cured) • Self-taping screws • Blind rivets • Storm band. • Sealants (non-acetic cured)	Relationship of each material property to failure mechanisms.
6	**Installations for "Cold" insulation for Pipelines, fittings and equipment** • Flexible elastomeric foam (FEF) • Extruded polystyrene foam (XPS) • Polyisocyanurate foam/Polyurethane Rigid Foam (PIR/PUR). • Cellular Glass (CG) • Expanded Perlite (EP) • Aerogel Blanket (AB) **Insulation for "Cryogenic" – Need special discussion (as per Material Supplier's recommendation & specification) to control heat conservation**	Minimum process temperatures for each of these insulation materials for "Cold" pipelines and hot process equipment. Relationship of each material property to failure mechanisms. Materials are the same as Cold Insulation, but the installations are more complex and as per Supplier's recommendation • Vapor Stop Sealer for PIR/PUR • Vapor Stop Sealer for CG. • Vapor Stop 2-component sealer • Vapors stop epoxy resin • 2-component adhesive
7	**Jacketing or Cladding Materials + Auxiliary Materials (External Covers) METALS** • Aluminum claddings/bands • Aluminized steel cladding • Aluzinc steel cladding • Stainless steel cladding **FLEXIBALE MATERIALS** • Ethyl-Vinyl acetate-based mastic	

	• Latex based vapor barrier mastic • Elastomer based vapor barrier mastic. • UV-curing glass-fiber-reinforced polyes (GRP) **TAPES** • Aluminum tape • Rubber Mastic tape • Vinyl tape • Vapor barrier multiplex aluminum / polyester tape or foil **AUXILIARY MATERIALS** • Folded butyl rubber sheet (Cold) • Thermal Block (Cold) • Hand yarns • Machine yarns • Fastening clips and plates • Tie threads / tacking threads • Sealants (non-acetic cured) • Non-contact insulation accessories	
8	**Insulation Thickness & Heat Conservation Definitions & Differences in respective values** • **K-Value** • **R-Value** • **U-Value** • **C-Value**	Understanding the basic thermal properties of the insulation materials and the differences between these values.
9	**Standards and Codes of Practice relevant to Insulation Systems** • Understanding the importance of Standards and Codes of Practice in Insulation Systems • Ability to identify important points in each Standard and Code of Practice • Ability to cross-reference between Standards and Codes of Practice	
10	**Health, Safety and Environmental issues relating to Insulation Systems** • Safety of personnel in handling insulation materials. • Insulation Waste disposal requirements. • Ability to understand the Insulation Materials MSDS	

11	**Code of Ethics and Professional Conduct of Insulation Practitioners.** • Professionalism in conducting evaluation of insulation materials with accurate reporting of results • Professionalism in conducting installation failure investigation with accurate reporting of findings • Non-compromise on Code of Ethics when reporting controversial results and findings	

The level of knowledge in Table 1 shall be progressively increased from Level 1 to level 4 to conform to the levels of competency defined in Section 5

Certified personnel are not required to be an expert in all the insulation knowledge categories listed in Table 1.
However, a Level 1 and Level 2 certified candidate needs to have general basic knowledge about insulation material properties (knowledge category 1-12)

Level 3 and Level 4 are required to have extensive insulation material knowledge and installation skills to perform good installation of thermal insulation systems (knowledge category 1-12) in more comprehensive knowledge and understanding of its uses.

5.3 Tasks to be fulfilled in all application sectors for Levels 1 to 4

Table 2 details the tasks for each level of competence from Levels 1 to 4.

Table 2: Tasks to be fulfilled by the various competency levels.

Task Number	Description of Task	Level 1	Level 2	Level 3	Level 4
1	Inspection of Insulation materials on site before starting the installation process.	Yes	Yes	Yes	Yes
2	Visiting the site for workflow information before starting installation work	Yes	Yes	Yes	Yes
3	Confirm the correctness of the insulation materials with the specification provided by owner, client or contractor.	Yes	Yes	Yes	Yes
4	Pre-fabricating of external covers/cladding with the pipelines/equipment before starting any installation work.	Yes	Yes	Yes	Yes

5	Prepare technical insulation work instructions/proposal	No	Yes	Yes	Yes
6	Select installation methods based on available Standards/Code of Practice	No	Yes	Yes	Yes
7	Ability to propose modified installation work methods	No	Yes	Yes	Yes
8	Performing calibration of equipment at Fabrication Shop	No	No	No	No
9	Verify calibration of selected equipment(s) Fabrication Shop	No	Yes	Yes	Yes
10	Set up fabrication tools and equipment and verify correctness of tools for installation.	Yes	Yes	Yes	Yes
11	Perform risk assessments on health, safety & environmental compliances before commencement of installation.	No	Yes	Yes	Yes
12	Supervise installation materials work carried out by others	No	Yes	Yes	Yes
13	Understand the working principle of insulation materials and its principal properties.	Yes (at least one)	Yes (at least three)	Yes (at least six)	Yes (at least six)
14	Perform drawings of flanges or valves for the installation project.	Yes (at least one)	Yes (at least three)	Yes (at least minimum six drawings)	Yes (at least minimum six drawings)
15	Perform insulation or finishing cladding details for piping.	Yes	Yes	Yes	Yes
16	Prepare/understand surface requirement of insulation systems	Yes	Yes	Yes	Yes
17	Perform silicon rubber sealant finishing details on metal jacketing (Non-acid based)	Yes	Yes	Yes	Yes
18	Checking insulation thickness prior to installing metal jacketing.	Yes	Yes	Yes	Yes
19	Perform drainage plug to avoid accumulation of trapped water in the hot insulation system	Yes	Yes	Yes	Yes
20	Understand of heat tracing cables, steam and thermocouple wire from the equipment before the insulation.	No	No	Yes	Yes

21	Understand on flanges area for Hydrogen & Oxygen shall never be insulated & only install with metal jacketing with hole.	No	No	Yes	Yes
22	Understand In situ or prefab sprayed PUR insulation systems. The material shall be applied in accordance with the manufacturers instructions the material specifications shall match those of the adjacent material.	No	No	Yes	Yes
23	Perform insulation or finishing cladding details for equipment or vessels.	Yes	Yes	Yes	Yes
24	Perform a table to determine the number of jacket segments required for 90 deg, for elbows.	Yes	Yes	Yes	Yes
25	Perform removable flange box – Horizontal	Yes	Yes	Yes	Yes
26	Perform removable flange box – Vertical	Yes	Yes	Yes	Yes
27	Perform insulation for Valves. Flanges and Fittings	Yes	Yes	Yes	Yes
28	Monitor health, safety & environment compliances of Insulation activities at site.	Yes	Yes	Yes	Yes
29	Perform acoustic insulation installation by the number of layers of insulation for Hot process materials (as per client's requirements)	Yes	Yes	Yes	Yes
30	Perform acoustic insulation on "Cold" insulation system – on top of secondary vapor layer to prevent condensation inside the acoustic insulation.	Yes	Yes	Yes	Yes
31	Provide corrective actions/suggestions to prevent recurrence of wrong installation for Hot or Cold acoustic insulation.	No	No	Yes	Yes
32	Perform removal and disposal of insulation materials including ancillary materials.	Yes	Yes	Yes	Yes
33	Prepare full QA/QC report for submission to customer.	No	No	Yes	Yes

34	Authorized to stamp and sign on Installation Report or QA/QC Report.	No	No	Yes	Yes
35	Authorized to stamp and sign on Full Insulation System Report	No	No	Yes	Yes
36	Authorized to act as an Examination Moderator.	No	No	Yes	Yes
37	Expert Witness in the Court of Law. The testimony shall be relevant to the expertise of each level.	No	No	Yes	Yes
38	Provide full-course Skill Insulation training – practical and theory.	No	No	Yes##	Yes
39	Training a trainer	No	No	Yes	Yes
40	Authorized to dispute on merits of thermal insulation systems by others.	No	No	Yes	Yes

##Given enough work experience, Level 3 certified candidates can proceed to Level 4 for Peer Review to become Certified Insulation Specialist (CIS).

ANNEX A

(Normative)

CERTIFICATION SCHEME: ELIGIBILITY FOR COMPETENCE ASSESSMENT FOR LEVEL 1 TO 4.

A.1 General

The eligibility of Certified Skill Insulator or Certified Insulation Practitioner personnel 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 Certified Skill Insulator or Certified Insulation Practitioner personnel shall fulfil the requirements for thermal insulation systems experience as defined in this section and shall pass the relevant assessment as detailed in Annex B.

A.2 Work Experience

The minimum requirements for duration of insulation skills or insulation practitioner's working experience to be gained prior to certification shall not be less than that indicated in Table A.1.

The time in these tables refers to a minimum of 25% of activities in insulation skills or insulation materials. For example, 12 months' work experience shall refer to 25% of 40 working hours per week over 12 months as an example of 25% activities computation.

Table A.1 is for candidates with and without previous thermal insulation work experience to the knowledge and tasks as detailed in Section 5.

Tables A.1 is translated into a Process Flow Chart in Annex D.

Table A.1 – Minimum education and experience requirements for each level of candidates with and without previous certification.

Target Level	Education	Minimum experience in Insulation Installer Level 1 – Level 4
1	Technical vocational education (minimum Level 4), technician certificate or equivalent, plus specialized training and education in the field of insulation or related to insulation materials.	Logbook + 3r +A
	SPM/STPM (requires basic hand-on skills or working experience) plus specialized industrial training or education in the field of insulation related field.	Logbook + 3r + A
	Candidates without SPM/STPM should have a minimum 3 years working hand on skills or working experience in the field of insulation but required to submit testimonial for admission and assessment.	Logbook +4r + A
2	Technical vocational education (minimum Level 4), technician certificate or equivalent, plus specialized industrial training and education in the field of insulation or related to insulation materials.	Level 1+ 3r$^{\#}$ + Logbook + A
	SPM/STPM (requires basic mathematical skills) plus specialized industrial training and education in the field of insulation or related to insulation materials.	Level 1+ 3r$^{\#}$ + Logbook + A
	Diploma plus specialized industrial training and education in the field of materials or related to insulation materials.	Logbook + A
3	Relevant engineering, technology, or materials science discipline degree plus specialized industrial training and/or education related to insulation materials.	Level 2 + Logbook + A
4	Relevant engineering, technology, or scientific/materials science discipline degree plus specialized industrial training and/or education related to insulation materials	Level 3+ dossier + PR

r minimum experience in having completed number of thermal insulations (any insulation materials) as the main contributor within the last five years (target 3 completed works)

r$^{\#}$ having participated and active in insulation installation or one of the contributors that leads to the success of the thermal insulation systems installed (Logbook)

A evaluation by Assessment Committee appointed by Certification body (IMM)

PR assessment by Peer Review Panel appointed by Certification body Logbook

refers to a log of training acquired by candidate as listed out in section A.4

A Dossier to refer to the list of documentation required as per Annex B Clause B.4.5

A.3 Training

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

The thermal insulation materials person shall provide documentary proof that they have completed a period of training or working experience covering the Knowledge Categories at the respective Level within 3 years prior to taking the certification examination/assessment. The training period, method and syllabus shall be sufficient to deliver the knowledge and skill as detailed in Section 5. Documentation may be retrospective. Training may be by the employer or through accredited course(s) at a training center.

Training shall be delivered by people/personnel (physically) at or above the Level (1, 2, and 3) of the training to be delivered. A logbook and proof of related training or certifications shall be kept by the candidate. They shall be stored in a centralized repository (e.g. the IMM website) where the candidate can follow up with their development progress.

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

a) Level 1: documented on-the-job training (in the form of logbook) relating to thermal insulation materials/installation within 3 years prior to taking the certification examination/assessment

b) Levels 2 & 3: documented on-the-job training in the form of logbook relating to thermal insulation or installation within 3 years prior to taking the certification examination/assessment.

For all levels, candidates shall provide evidence of continuous professional development such as but not limited to attending or providing/delivering presentations at training courses, seminars, conferences, etc. relating to thermal insulation materials development / installation best practices / degradation (CUI) and related subjects and/or active participation in technical committees of scientific societies or engineering societies or technological associations.

At all Levels, training days shall include both practical, theory components and case studies either at own company premises or at external training facilities.

For those without full academia qualifications may take Level 1 by attending theory components briefing and to pass practical case examinations plus Logbook for Level 1 entry. On the job training (Logbook) is related to their personal involvement and contribution in specific area of thermal insulation.

A.3.2 Training Centre

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

A training center shall provide the following components, any of which may be combined:

i. A demonstration and/or a workshop or a fabrication shop with appropriate tools and equipment that allow candidates to undergo practical training and perform mockup installation related to the thermal insulation materials/systems.
ii. A classroom has appropriate equipment and facilities for teaching the theoretical principles of thermal insulation.

All instruments, devices, equipment, mockup materials, etc at the workshop shall be maintained in good condition and they shall be calibrated where applicable.

ANNEX B

(Normative)

CERTIFICATION SCHEME: EXAMINATION AND ASSESSMENT

B.1 General

Bodies performing certification of the competence levels of Thermal Insulation 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 center 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 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
5	Examination Brochure for Level 4 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 4
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 people 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 carried out with consistency.

The Examination Moderators shall also carry out a periodic review of the Questions and Answers Bank to ensure the assessment of updated and latest technologies and developments in the field. The Examination Moderators shall initiate an exercise to develop new Questions and Answers at least once every five (5) years to meet technological changes.

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 and examination results. The Assessment Committee shall review candidate's 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 review and approve all examination results, including review of any appeals from candidates.

The Assessment Committee shall be appointed by the certification body and shall consist of people 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 and/or above of higher qualifications.

B.4 Examination and Assessments for Levels 1 to 4

B.4.1 General

The examination system shall be established and maintained to assess competence in accordance with Section 5.

The knowledge topics and tasks listed in Section 5 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 at the levels concerned,
b) apply a documented quality management procedure,
c) have the resources needed to administer examinations, including practical and theory.

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 include mockup thermal insulation facilities to simulate the conditions that normally exist in real life thermal insulation installation activities.

B.4.3 Theoretical Examination Session for Levels 1 to 3

The theoretical examination session shall require candidates to demonstrate their knowledge and competence to undertake tasks in accordance with Section 5.

The theorical examination may include oral assessment or interview to enable examiners to assess the candidate's competence. Candidates shall be required to demonstrate their competence to fulfil the requirements of Section 5.

The theoretical examination session shall include a series of multiple choice and/or written questions on the principles and processes of good thermal insulation systems.

The time allowed for candidates to complete each examination shall be based upon the number and difficulty of the questions depending on Level 1, 2, 3, and 4.

B.4.4 Practical Examination Session for Levels 2 to 3

The practical examination may include oral assessment or interview to enable examiners to assess the candidate's competence. Candidates shall be required to demonstrate their competence to fulfil the requirements of Section 5.

B.4.5 Peer Review Examination Session for Level 4

Level 4 certified personnel shall be examined via a Peer Review conducted by at least three (3) examiners who have similar levels with at least 10 years of experience each in the field of Thermal Insulation Systems. 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 a broad range of understanding and competence in all areas of thermal insulation systems.
- Proof of Continuing Professional Development in the areas related to thermal insulation systems.
- 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) Thermal Insulation projects with sole or primary responsibility within the last five (5) years. Candidates shall submit a list of titles and brief descriptions of the thermal insulation systems 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.

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.

Examinations shall be impartial in accordance with ISO/IEC 17024. The risk resulting from the following situations must 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 Examinations for Levels 1 to 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 Section 5 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. For Level 3, the theoretical examinations should have equal or greater weight than the practical examination session.

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 to allow the candidate to re-sit one paper without re-sitting the other.

B.4.8 Assessment for Level 4

Level 4 certified personnel's dossier shall be reviewed and assessed by the **Peer Review Panel (3.14)** and approved for Level 4 certification. Upon approval, the Peer Review Panel shall submit its approval to the Assessment Committee (see Annex B.3) for final endorsement. 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.

B.4.9 Final Assessment for Levels 1 to 4

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

B.4.10 Re-assessment

Candidates failing for reasons of unethical behavior 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 the thermal insulation certification, the 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 should be designed to reduce the risks of counterfeiting.

C.2 Validity

The period of validity of the certification shall be five (5) years for Level 1 to Level 3.

For Level 4, the certification period shall be for a lifetime. The initial period of validity shall commence when all 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 behavior 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 thermal insulation work activity without significant interruption and updating of technical knowledge. In addition, continuing professional development and/or proof of work as defined in Clause C.3.2 should be required.

C.3.2 Continuing Professional Development

Level 1 - 4 personnel shall demonstrate their continued competence to meet the requirements of Section 5 by submission of proof of work and/or continuing professional development (CPD) records in accordance with 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 (5) years after the establishment of the scheme.

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 trustees the need to ensure that all participants of the Thermal Insulation 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 expertise.
- Thermal Insulation Systems service companies.
- Thermal Insulation Consulting companies and individuals.
- Academics with competence in Mechanical or Materials Sciences.

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 2 certification people and shall each have a minimum of ten years' experience in thermal insulation.

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-year (5) transition period for the establishment of the scheme, examiners who have been formally assessed and certified to a higher level than Level 2 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 thermal insulation, 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, are considered as fulfilling the requirements of this document.

Consequently, Certificates 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.

Equivalent certificates from other recognized and accredited certification bodies can be used to qualify for certain competence level of thermal insulation in this document.

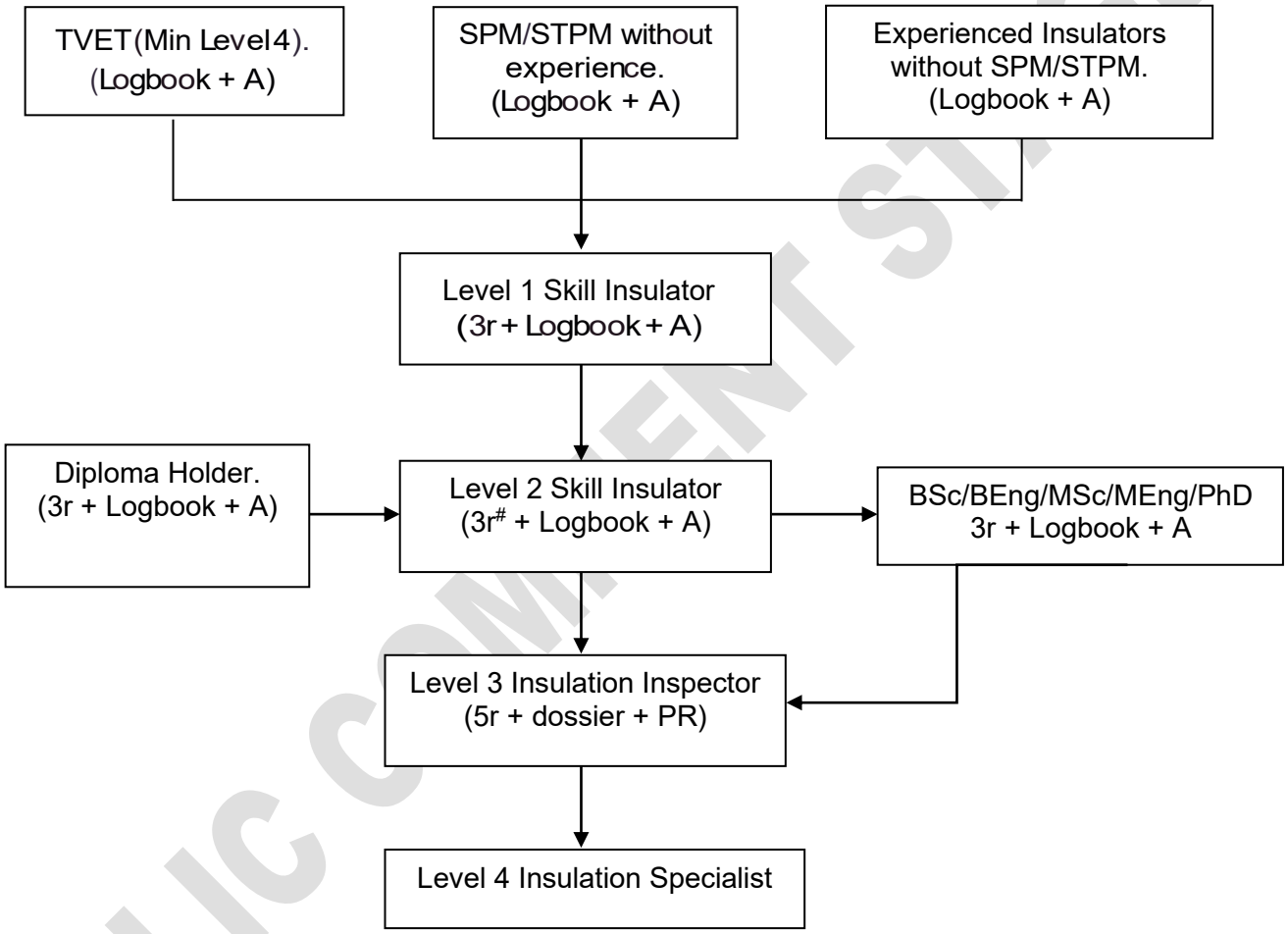
C.4.3 Transition Period for Existing Experienced Personnel

During the initial three (3) years of implementation of this Certification Scheme, personnel with sufficient experience and/or qualifications meeting the requirements specified in Annex A may apply for recognition of their experiences and/or qualifications to be awarded the respective Levels of Certification without any need to sit for the certification assessment nor examination. Their applications shall include evidence of work experience validated by the relevant organizations and/or referees which shall be reviewed by the Assessment Committee.

ANNEX D

(Normative)

CERTIFICATION PROCESS FLOW CHART



r having prepared and completed number of thermal insulation work.
r# having participated in thermal insulation installation or one of the contributors that leads to the success of thermal insulation installed.
A evaluation by Assessment Committee appointed by Certification body
PR assessment by Peer Review Panel appointed by Certification body

Logbook refers to a log of training acquired by candidate as listed out in section A.4

Dossier to refer to the list of documentation required as per Annex B Clause B.4.5

ANNEX E

(Normative)

FACILITY CHECK LIST
INSULATION SKILL AND PRACTITIONERS' CERTIFICATION ASSESSMENT

The Test Centre shall provide the following at its premises to conduct the Assessment and Examination for Certification of Skill Insulator (Level 1 & 2) Practitioners Level 3 and Level 4.

A Test Centre may conduct the assessment for only one level or all levels subject to their provision of facilities required for each level.

E.1 ASSESSMENT VENUE/FACILTY FOR ALL LEVELS (for theory & oral exams)

ITEM	DESCRIPTION	QUANTITY	CONDITION	
			ACCEPTABLE & REMARKS	NOT-ACCEPTABLE & REMARKS
1	Air-conditioned classroom with tables & chairs for examiners + 1 invigilator + all candidates			
2	Tables & chairs			
3	Writing paper & pen for each candidate			
4	Proper car parking & toilet facilities			
5	Proper security and safety at the premises			
6	Prayer room for Muslims			
7	Simple tea/coffee + refreshment & lunch for examiners, invigilator & all candidates if exam takes more than 6 hours			

Note: For Level 4 Peer Review Assessment can also be conducted via online platform.

E.2 VENUE FOR PRACTICAL ASSESSMENT FOR LEVELS 1, 2 & 3.

ITEM	DESCRIPTION	QUANTITY	CONDITION	
			ACCEPTABLE & REMARKS	NOT-ACCEPTABLE & REMARKS
1	Air-conditioned classroom with tables & chairs for examiners + 1 invigilator + all candidates			
2	Writing paper & pen for each candidate			
3	Simple tea + refreshments & lunch for candidates + examiners + invigilator for full day assessment			
4	Mineral water: 3 bottles each for examiners, invigilator & candidates			
5	Covered workshop area for the Practical Assessment (Optional)			
6	Proper car parking & toilet facilities			
7	Prayer room for Muslims			
8	Proper security and safety at the premises			

E.3 INSULATION SKILL AND EQUIPMENT FOR LEVEL 1, 2 & 3 PRACTICAL ASSESSMENT

This section shall be "**mandatory"**. These equipment and tools are recommended in the event such practical assessments have been designed into the examinations.

ITEM	DESCRIPTION	LEVEL 1 & 2	LEVEL 3
A	Appropriate tools at the machine shop or fabrication shop e.g. banding machine, scissors, cutter machine, hand tools, knife, measurement tapes.		
B	Appropriate Insulation Materials for each candidate for practical assessments.		
C	Sample of Specification & engineering drawings like Isometric.		
D	Sample Work Packs or Insulation work instructions.		
E	Pre-formed insulation sections, slab or insulation mattresses/blankets.		
1	Weathering Resistant Mastics or Non-acid based Sealants		
2	Stud welded pins		
3	Work bench with stools		
4	Vapor Barrier/Water Stop		
5	Drain Plug / CUI Spacers		
6	Waste disposal area		
7	Cotton gloves		
8	Latex gloves		
9	Cotton rags / Scrim cloth or tape		
10	Face masks		
11	Face shields or safety goggle		
12	Safety helmet		
13	Ear plugs		
14	Appropriate pipes or flanges, Elbows or Tee for practical assessments.		

E.4 MACHINE & EQUIPMENT OPERATORS

This section shall **not** be mandatory. These personnel are recommended in the event the equipment in Annex E Clause E.3 is required for the practical examinations.

Facility Provider shall provide one (1) or more assistants to oversee the operation of the bending/cutting equipment and machines during the practical assessment.

E.5 PERSONAL PROTECTIVE EQUIPMENT (PPE) FOR PRACTICAL ASSESSMENT

This section shall not be mandatory. This equipment and tools are recommended in the event the equipment in Annex E Clause E.3 is required for the practical examinations.

All candidates shall be notified to be equipped with their own PPE according to the facility environment requirement such as coverall (for workshop), safety goggles, safety helmet, safety shoes, and face masks throughout the practical assessment session. Appropriate safety equipment and tools shall be provided by the Test Centre.

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- ASTM D2826 Test Method for Open Cell Content of Rigid Cellular Plastics
- ASTM D3014 Test Method for Flame Height, Time of Burning & Loss of Mass of Rigid Thermoset Cellular Plastics in a Vertical Position
- ASTM E84 Test Method for Surface Burning Characteristics of Building Materials
- ASTM E96 Test Method for Water Vapour Transmission of Materials
- ASTM D216 Test Method for response of Rigid Cellular Plastics to Thermal & Humid Aging
- ASTM C165 Test Method for Measuring Compressive Properties of Thermal Insulation
- ASTM C195 Mineral Fibre Thermal Insulating Cement
- ASTM C303 Test Method for Density of Preformed Block Type Thermal Insulation
- ASTM C335 Test Method for Steady-State Heat Transfer Properties
- ASTM C449 Mineral Fibre Hydraulic Setting Thermal Insulation and Finishing Cement
- ASTM C518 Test Method for Steady-State Heat Transmission Properties
- ASTM C547 Mineral Fibre Pre formed Pipe Insulation
- ASTM C552 Cellular Glass Block and Pipe Insulation
- ASTM C591 Un-faced Preformed Rigid Cellular Polyurethane Thermal Insulation
- ASTM C592 Mineral Fibre Blanket Insulation
- ASTM C612 Mineral Fibre Block & Board Thermal Insulation
- ASTM D1621 Test Method for Compressive Properties of Rigid Cellular Plastics
- ASTM D1622 Test Method for Apparent Density of Rigid Cellular Plastics
- ASTM C610 Molded Expanded Perlite Block and Pipe Thermal Insulation
- ASTM C1696 Industrial Thermal Insulation Systems
- A167 Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip (With-drawn 2014)[3]
- A240/A240M Specification for Chromium and Chromium- Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications
- A653/A653M Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
- A792/A792M Specification for Steel Sheet, 55 % Aluminum-Zinc Alloy-Coated by the Hot-Dip Process B209 Specification for Aluminum and Aluminum-Alloy Sheet and Plate
- C165 Test Method for Measuring Compressive Properties ofThermal Insulations
- C167 Test Methods for Thickness and Density of Blanket orBatt Thermal Insulations
- C168 Terminology Relating to Thermal Insulation
- C177 Test Method for Steady-State Heat Flux Measure- ments and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus
- C195 Specification for Mineral Fiber Thermal InsulatingCement
- C203 Test Methods for Breaking Load and Flexural Proper- ties of Block-Type Thermal Insulation
- C209 Test Methods for Cellulosic Fiber Insulating Board C240 Test Methods of Testing

Cellular Glass Insulation Block

- C272/C272M Test Method for Water Absorption of Core Materials for Sandwich Constructions
- C302 Test Method for Density and Dimensions of Pre- formed Pipe-Covering-Type Thermal Insulation
- C303 Test Method for Dimensions and Density of Pre- formed Block and Board–Type Thermal Insulation
- C335/C335M Test Method for Steady-State Heat Transfer Properties of Pipe Insulation
- C351 Test Method for Mean Specific Heat of Thermal Insulation (Withdrawn 2008)[3]
- C356 Test Method for Linear Shrinkage of Preformed High- Temperature Thermal Insulation Subjected to Soaking Heat
- C411 Test Method for Hot-Surface Performance of High- Temperature Thermal Insulation
- C446 Test Method for Breaking Load and Calculated Modu- lus of Rupture of Preformed Insulation for Pipes (With- drawn 2002)[3]
- C447 Practice for Estimating the Maximum Use Tempera- ture of Thermal Insulations
- C449 Specification for Mineral Fiber Hydraulic-Setting Thermal Insulating and Finishing Cement
- C450 Practice for Fabrication of Thermal Insulating Fitting Covers for NPS Piping, and Vessel Lagging
- C518 Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus
- C533 Specification for Calcium Silicate Block and PipeThermal Insulation
- C534/C534M Specification for Preformed Flexible Elasto- meric Cellular Thermal Insulation in Sheet and Tubular Form
- C547 Specification for Mineral Fiber Pipe Insulation C552 Specification for Cellular Glass Thermal Insulation
- C553 Specification for Mineral Fiber Blanket Thermal Insu- lation for Commercial and Industrial Applications
- C578 Specification for Rigid, Cellular Polystyrene Thermal Insulation
- C591 Specification for Unfaced Preformed Rigid Cellular Polyisocyanurate Thermal Insulation
- C592 Specification for Mineral Fiber Blanket Insulation and Blanket-Type Pipe Insulation (Metal-Mesh Covered) (In- dustrial Type)
- C610 Specification for Molded Expanded Perlite Block and Pipe Thermal Insulation
- C612 Specification for Mineral Fiber Block and Board Thermal Insulation
- C665 Specification for Mineral-Fiber Blanket Thermal Insu- lation for Light Frame Construction and Manufactured Housing
- C680 Practice for Estimate of the Heat Gain or Loss and the Surface Temperatures of Insulated Flat, Cylindrical, and Spherical Systems by Use of Computer Programs
- C692 Test Method for Evaluating the Influence of Thermal Insulations on External Stress Corrosion Cracking Ten- dency of Austenitic Stainless Steel
- C795 Specification for Thermal Insulation for Use in Con- tact with Austenitic Stainless Steel
- C871 Test Methods for Chemical Analysis of Thermal Insu- lation Materials for Leachable Chloride, Fluoride, Silicate, and Sodium Ions
- C1029 Specification for Spray-Applied Rigid Cellular Poly- urethane Thermal Insulation
- C1055 Guide for Heated System Surface Conditions that Produce Contact Burn Injuries

- C1104/C1104M Test Method for Determining the Water Vapor Sorption of Unfaced Mineral Fiber Insulation
- C1126 Specification for Faced or Unfaced Rigid Cellular Phenolic Thermal Insulation
- C1139 Specification for Fibrous Glass Thermal Insulation and Sound Absorbing Blanket and Board for Military Applications
- C1289 Specification for Faced Rigid Cellular Polyisocyanu-rate Thermal Insulation Board
- C1393 Specification for Perpendicularly Oriented Mineral Fiber Roll and Sheet Thermal Insulation for Pipes and Tanks
- C1427 Specification for Extruded Preformed Flexible Cel- lular Polyolefin Thermal Insulation in Sheet and Tubular Form
- C1511 Test Method for Determining the Water Retention (Repellency) Characteristics of Fibrous Glass Insulation (Aircraft Type)
- C1559 Test Method for Determining Wicking of Fibrous Glass Blanket Insulation (Aircraft Type)
- C1617 Practice for Quantitative Accelerated Laboratory Evaluation of Extraction Solutions Containing Ions Leached from Thermal Insulation on Aqueous Corrosion of Metals
- D1621 Test Method for Compressive Properties of Rigid Cellular Plastics
- D1622/D1622M Test Method for Apparent Density of RigidCellular Plastics
- D2126 Test Method for Response of Rigid Cellular Plastics to Thermal and Humid Aging
- D2842 Test Method for Water Absorption of Rigid Cellular Plastics
- D3574 Test Methods for Flexible Cellular Materials—Slab, Bonded, and Molded Urethane Foams
- E84 Test Method for Surface Burning Characteristics of Building Materials
- E96/E96M Test Methods for Water Vapor Transmission of Materials
- E136 Test Method for Behavior of Materials in a Vertical Tube Furnace at 750°C
- E176 Terminology of Fire Standards
- E659 Test Method for Autoignition Temperature of Chemicals
- E2652 Test Method for Behavior of Materials in a Tube Furnace with a Cone-shaped Airflow Stabilizer, at 750°C

ACKNOWLEDGEMENTS

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