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Ceramic tiling systems — Sustainability for ceramic tiles and installation materials —

Part 2: Specification for tile installation materials

Systèmes de carreaux céramiques - Durabilité des carreaux céramiques et des matériaux de pose —

Partie 2: Spécification pour les matériaux de pose de carreaux

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Contents

Page

Foreword ..... **iv**
Introduction ..... **v**
1 Scope **1**
2 Normative references **1**
3 Terms, definitions, symbols and abbreviated terms **2**
3.1 Sustainability 2
3.2 Environment 2
3.3 Materials input 3
3.4 Sustainability management 4
3.5 Products and production 4
3.6 Waste materials 5
3.7 Health and safety 5
3.8 Symbols 6
3.9 Abbreviated terms 6
4 Principle criteria for sustainable products **7**
4.1 General 7
4.2 Environmental criteria 8
4.3 Economic and functional criteria 8
4.4 Social criteria 8
5 Assessment **8**
5.1 General 8
5.2 Environmental criteria 8
5.2.1 General 8
5.2.2 Raw materials 8
5.2.3 Manufacture 10
5.2.4 Distribution and installation 13
5.2.5 Use 14
5.2.6 Product environmental mark/labelling 16
5.3 Economic and functional criteria 16
5.3.1 General 16
5.3.2 Product quality, performance level, fitness for use 17
5.4 Social criteria 17
5.4.1 General 17
5.4.2 Occupational health and safety in manufacture 17
5.4.3 Health and safety prior and during installation 20
5.4.4 Labour agreement 20
6 Classification and designation **21**
6.1 Approach 21
6.2 Final rating calculation 21
6.3 Classification 22
6.4 Final report 22
Annex A (informative) **Criteria for sustainable products** **23**
Bibliography **29**

Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 189, *Ceramic tile*.

A list of all parts in the ISO 17889 series can be found on the ISO website.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Introduction

This document outlines the requirements for sustainable tiles and installation materials including environmental, economic and social criteria, in order to:

— promote the development and use of sustainable ceramic tiles and installation materials;

— guide all stakeholders in environmental responsibility throughout the supply chain for tiles and installation materials;

— provide a verifiable resource for tile product specification and for design professionals, contractors and consumers to identify sustainable tiles and installation materials;

— increase the value of sustainable tiles and installation materials throughout the supply chain by creating greater market awareness and demand.

This document provides a system for sustainability assessment using the life cycle approach, qualitative and quantitative indicators for environmental, economic and social performance of ceramic tiling systems. This document is focused on tile installation materials.

This document can be used to assess the sustainability performance of the product of interest. Evaluation schemes, taking into account the materials mentioned in the product standards, to enable comparability of the results of assessment, are part of this document.

Ceramic tiling systems — Sustainability for ceramic tiles and installation materials —

Part 2:
Specification for tile installation materials

1 Scope

This document specifies sustainability requirements together with assessment methods and evaluation schemes for ceramic tiles and installation materials.

This document includes relevant criteria across product life cycle from raw material through manufacturing, use, and end-of-life management.

This document applies to ceramic tile installation materials including: ceramic tiles, adhesives, grouts, membranes, etc. This document deals with adhesives and other tiling materials.

2 Normative references

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

ISO 11890-1, *Paints and varnishes — Determination of volatile organic compound (VOC) content — Part 1: Difference method*

ISO 11890-2, *Paints and varnishes — Determination of volatile organic compounds(VOC) and/or semi volatile organic compounds (SVOC) content — Part 2: Gas-chromatographic method*

ISO 14024, *Environmental labels and declarations — Type I environmental labelling — Principles and procedures*

ISO 14025, *Environmental labels and declarations — Type III environmental declarations — Principles and procedures*

ISO 16000-3, *Indoor air — Part 3: Determination of formaldehyde and other carbonyl compounds in indoor and test chamber air — Active sampling method*

ISO 16000-6, *Indoor air — Part 6: Determination of organic compounds (VVOC, VOC, SVOC) in indoor and test chamber air by active sampling on sorbent tubes, thermal desorption and gas chromatography using MS or MS FID*

ISO 16000-9, *Indoor air — Part 9: Determination of the emission of volatile organic compounds from building products and furnishing - Emission test chamber method*

ISO 16000-11, *Indoor air — Part 11: Determination of the emission of volatile organic compounds from building products and furnishing — Sampling, storage of samples and preparation of test specimens*

ISO 17889-1, *Ceramic tiling systems — Sustainability for ceramic tiles and installation materials — Part 1: Specification for ceramic tiles*

ISO 21930, *Sustainability in buildings and civil engineering works — Core rules for environmental product declarations of construction products and services*

EN 13284-1, *Stationary source emissions - Determination of low range mass concentration of dust - Part 1: Manual gravimetric method*

ASTM D2369-10,*Standard Test Method for Volatile Content of Coatings*

ASTM D6886-18, *Standard Test Method for Determination of the Weight Percent Individual Volatile Organic Compounds in Waterborne Air-Dry Coatings by Gas Chromatography*

3 Terms, definitions, symbols and abbreviated terms

For the purposes of this document, the terms and definitions given in ISO 17889-1 and the following apply.

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at https://www.electropedia.org/

3.1 Sustainability

3.1.1
environmental sustainability
state in which the ecosystem and its functions are maintained for the present and future generation

3.1.2
economic sustainability
ability to provide sustainable, successful places in an economic context

Note 1 to entry: Economic considerations include employment, competitiveness, wealth and distribution, welfare, accounting and regulation.

3.1.3
social sustainability
ability to provide sustainable, successful places in a social context

Note 1 to entry: It combines design of the physical realm with design of the world, infrastructure to support social and cultural life, provides social amenities, systems for citizen engagement and spaces for people and places to evolve.

3.1.4
LCA
life-cycle assessment
systematic evaluation of the *environmental impact* (3.2.3) of a product(s) that includes all stages of its life cycle

3.2 Environment

3.2.1
environment
surroundings in which an organization operates, including air, water, land, natural resources, flora, fauna, humans, and their interrelation

Note 1 to entry: Surroundings in this context extend from within an organization to the global system.

[SOURCE: ISO 14001:2015, 3.2.1, modified — Note 2 to entry deleted.]

3.2.2
environmental aspect
element of an organization's activities or products or services that can interact with the *environment* (3.2.1)

[SOURCE: ISO 14001:2015, 3.2.2, modified — Notes to entry deleted.]

3.2.3
environmental impact
change to the *environment* (3.2.1), whether adverse or beneficial, wholly or partially resulting from an organization's *environmental aspects* (3.2.2)

[SOURCE: ISO 14001:2015, 3.2.4]

3.3 Materials input

3.3.1
raw material
basic material that can be converted by processing or manufacturing, or a combination of both, into a new product

Note 1 to entry: A raw material may be virgin, recycled, harvested, extracted, recovered, or manufactured when used as an ingredient in a new material.

3.3.2
indigenous raw material
raw material (3.3.1) that is recovered, harvested, or extracted within an 800 km radius of the manufacturing site

Note 1 to entry: Where materials are transported by water or rail, the distance to the manufacturing site shall be determined by multiplying the distance that the materials are transported by water or rail by 0,25 and adding that number to the distance transported by means other than water or rail.

3.3.3
fresh water
surface water and groundwater withdrawn for manufacturing use

3.3.5
packaging material
material intended for presentation to a consumer that is used for the containment, protection, handling, or preservation of a product

Note 1 to entry: Included tools in a kit or parts of the packaging that are used directly in the combining or installation of the product shall be excluded from this definition.

3.3.6
primary packaging
material that first envelops and holds the *product of interest* (3.5.2)

Note 1 to entry: It is intended to be the smallest unit of distribution or use and is the package which is in direct contact with the contents. For *ceramic tiles* (3.5.1) the primary packaging is restricted to the following materials: paper, cardboard or corrugate.

3.3.7
shipping material
material that is used for the containment, protection, handling, or preservation of a product while en route from one location to another and that is generally not intended for presentation to a consumer

EXAMPLE Pallet, industrial carton, banding, freight panels, wood/lumber bracing, etc.

3.4 Sustainability management

3.4.1
EEMS
energy efficiency management system
energy management procedures to monitor, control, evaluate and improve the performance of the used energy

3.4.2
EMS
environmental management system
environmental management procedures to monitor, control, evaluate and improve the organization environmental performance

3.4.3
OHSMS
occupational health and safety management system
health and safety management system
procedures to monitor, control, evaluate and improve the system performance as regards health and safety

3.4.4
environmental product declaration
EPD
standardized and *life-cycle assessment* (3.1.4) (LCA)-based tool—type III environmental declaration—to communicate the environmental performance of a product or system

3.4.5
type I label
life-cycle assessment (3.1.4) (LCA)-based label which identifies products or services proven environmentally preferable overall, within a specific product or service category

3.4.6
certified
product or management system validated by a certification body (3.4.7) in accordance with the relevant standard

3.4.7
certification body
third-party conformity assessment body operating certification schemes

3.4.8
maintenance
service
actions which have the objective of retaining or restoring a product in or to a state in which it can perform its intended function

3.5 Products and production

3.5.1
ceramic tile
ceramic surfacing unit, usually relatively thin in relation to facial area, having either a glazed or unglazed face and fired above red heat in the course of manufacture to a temperature sufficiently high to produce specific physical properties and characteristic

3.5.2
product of interest
single product or line of products with homogeneous technical characteristics and equal *environmental impacts* (3.2.3) and performances

Note 1 to entry: In case of product-specific environmental criteria a "worst case scenario" analysis of a single product may suffice to extend the boundaries of the product of interest to be representative of the facility's entire *production* (3.5.3).

3.5.3
production
industrial processes involving steps resulting in the manufacture of products or items

3.5.4
transport
movement of goods from one location to another

Note 1 to entry: The goods can be, for example, products, *raw materials* (3.3.1).

3.6 Waste materials

3.6.1
post-consumer material
waste material generated by households or by commercial, industrial and institutional facilities in their role as end-users of the product, which can no longer be used for its original intended purpose

3.6.2
pre-consumer material
material, solid and/or liquid, diverted from a waste stream generated by the manufacturing process

Note 1 to entry: Reutilization of materials (i.e. rework, regrind or scrap generated in a process that does not enter the waste stream and that is capable of being reclaimed within the same process that generated it) is excluded.

3.6.3
reclaimed waste
waste, scrap material, or water generated during manufacturing processes that, in lieu of disposal, is captured and reused to manufacture more of the same product

3.7 Health and safety

3.7.1
hazard
source, situation, or act with a potential for harm in terms of human injury or *ill health* (3.7.3), or a combination of theseNote 1 to entry: Adapted from ISO 45001.

3.7.2
hazard identification
process of recognizing that a *hazard* (3.7.1) exists and defining its characteristics

3.7.3
ill health
identifiable, adverse physical or mental condition arising from and/or made worse by a work activity and/or work-related situation

3.7.4
safety in use
level of risks associated with the installation and use of the products

3.8 Symbols

Symbols	Description	Units
a_{ave}	arithmetical average	
$c_{PM,i}$	PM concentration in the *i*-th chimney stack	mg/Nm^3
$F_{E,j}$	emission factor of the pollutant "*j*" (PM, HF) through emissions into the atmosphere	g/kg
I	incidence of indigenous raw materials	%
M_{post}	post-consumer material input	kg
M_{pre}	pre-consumer material input	kg
p_I	quantity of indigenous raw materials in the body of the product of interest	kg
p_t	quantity (weight) of the body of the product of interest	kg
P_{sm}	annual ceramic tile production	m^2/year
P_t	annual ceramic tile production	t/year
P_W	annual production water utilized	L/year
P_{WD}	annual production waste water discharged	L/year
Q_i	volume flow rate of the *i*-th chimney stack	Nm^3/h
R_C	recycled and/or reclaimed waste content	%
$R_{C,post}$	post-consumer recycled content	%
$R_{C,pre}$	pre-consumer recycled content	%
R_{WC}	reclaimed waste content	
R_{MC}	recycled material content of packaging materials	%
R_w	reclaimed waste input	kg
S_{ra}	sustainability rating	%
t_i	operation time of the *i*-th chimney stack	h/year
T_{GW}	total grinding water	kg
T_{RM}	total raw materials used in the product of interest	kg
V_1	voluntary pass/fail requirements (V1)	
V_2	voluntary multirating managerial requirements (V2)	
V_3	voluntary multirating quantitative and performance requirements (V3)	
W_D	waste water discharge	%

3.9 Abbreviated terms

EEMS energy efficiency management system

EMAS eco management and auditing scheme[5]

EMS environmental management system

EPD environmental product declaration

HF hydrogen fluoride

M mandatory requirements

Nm^3 cubic meter of gas measured in normal conditions (temperature = 273 K, pressure = 101,3 kPa)

OHSMS occupational health and safety management system

PM	particulate matter
POTW	publicly owned treatment works for wastewater
PPE	personal protective equipment
RCS	respirable crystalline silica
SDS	safety data sheet
Sm^3	cubic meter of gas measured in standard conditions (temperature = 273 K, pressure = 101,3 kPa)
V1	voluntary pass-fail requirements
V2	voluntary multirating managerial requirements
V3	voluntary multirating quantitative and performance requirements
VOC	volatile organic compounds

4 Principle criteria for sustainable products

4.1 General

The criteria are based on the "three pillar model" of sustainability: environmental, economic and social sustainability, as stipulated in the World Summit Conference 2005.

Environmental, economic, and social sustainability criteria are detailed in Tables A.1 to A.3 which report the requirements that shall be used for the sustainability assessment according to this document.

Two categories of requirements are adopted:

Mandatory requirements: PASS/FAIL requirements, whose compliance is a pre-requisite for a product assessed as sustainable. No rating is acknowledged for products compliant with mandatory requirements. If a product isn't compliant with all mandatory requirements cannot be classified as sustainable.

Multirating, voluntary requirements: requirements which a product can comply with at different levels, awarded through a different rating. The compliance level to multirating requirements contributes to the final rating of the product, as specified in Clause 6.

All multirating, voluntary requirements require a mandatory minimum 100 % tier.

The requirements are listed in Annex A, Tables A.1, A.2 and A.3 are marked with the same numbers used in Clause 5, and are classified according to the type:

M = mandatory requirement;

V1 = voluntary pass/fail requirements;

V2 = voluntary multirating managerial requirements;

V3 = voluntary multirating quantitative and performance requirements.

Reference to this classification of sustainability requirements will be made in Clause 6.

4.2 Environmental criteria

The environmental criteria are (see Annex A Table A.1):

— raw materials;

— manufacture;

— distribution and installation;

— use;

— product environmental mark/labelling.

4.3 Economic and functional criteria

The economic and functional criteria are (see Annex A, Table A.2) product quality, performance level and fitness for use.

4.4 Social criteria

The social criteria are (see Annex A, Table A.3):

— health and safety in manufacture;

— health and safety during installation;

— health and safety in use.

5 Assessment

5.1 General

This clause describes the criteria and defines the requirements for the evaluation of sustainable installation product for ceramic tiles.

For each of the criteria listed in Annex A, Tables A.1, A.2 and A.3, the requirements (either mandatory or multirating), the test methods and/or calculation methods, and the units of measurement are indicated for installation materials.

5.2 Environmental criteria

5.2.1 General

The environmental pillar requires the protection of the environment and the preservation of resources, with implementation of good operational practices. For installation materials, sustainability means optimized utilization of raw materials, including utilities (water and energy), as well as optimized production and optimized transport.

5.2.2 Raw materials

5.2.2.1 General

Adhesives, sealants and waterproofing products for the installation of ceramic tiles have their main impact on the environment due to the raw materials used in the formulation, especially hydraulic and organic binders.

The quality and durability of the products are related to the raw materials and allow to decrease waste coming from demolition and depletion of both mineral and elemental.

The control on the supply chain is essential to reduce environmental impacts coming from the extraction and the transport of the raw materials in the plant.

5.2.2.2 Requirements for the evaluation

5.2.2.2.1 Materials records

The manufacturer shall maintain a list of all materials used in the manufacture of the product of interest. The term "all materials" includes just the materials going into the final product. Materials used for maintenance or auxiliary purposes shall not be considered in the framework of this requirement. At a minimum, the list shall report the name of each material and its ingredient(s) listed in the respective safety data sheet (SDS).

Calculation: the manufacturer shall give evidence of the availability of such records [YES/NO].

Mandatory requirement:	**YES**

5.2.2.2.2 Transport – Indigenous raw materials

The higher the amount of indigenous raw materials used to manufacture an installation product, the lower the environmental impact of the transport of the raw materials from their extraction area to the manufacturing site. The parameter used to quantify this sustainability aspect is I [%], the incidence of indigenous raw materials on the body of the product of interest. See Formula (1), Table 1 and A.2.

$$I = p_I \times 100 / p_t \quad (1)$$

where

I is the incidence of indigenous raw materials, in percentage;

p_I is the quantity of indigenous raw materials in the body of the product of interest, in kg;

p_t is the quantity (weight) of the body of the product of interest, in kg.

Table 1 — Multirating requirements for indigenous raw materials

Rating (%)	100	110	120	130
References (%)	$I < 50$	$50 \leq I < 75$	$75 \leq I < 90$	$I \geq 90$

5.2.2.2.3 Recycled and/or reclaimed waste content

According to this requirement, the higher the amount of waste materials in the product, the higher the sustainability of the product of interest itself. The parameter used to quantify this aspect is R_C [%], the recycled and/or reclaimed waste content. See Formula (2) and Table 2.

$$R_C = R_{C,\,post} + ½\, R_{C,\,pre} + ½\, R_{WC} \quad (2)$$

where

$R_{C,\,post} = M_{post} \times 100/(T_{RM} + T_{GW})$;

$R_{C,\,pre} = M_{pre} \times 100/(T_{RM} + T_{GW})$;

$R_{WC} = R_w \times 100/(T_{RM} + T_{GW})$;

R_C is the recycled and/or reclaimed waste content;

$R_{C,\,post}$ is the post-consumer recycled content;

$R_{C,\,pre}$ is the pre-consumer recycled content;

R_{WC} is the reclaimed waste content;

M_{post} is the post-consumer material input, in kg;

M_{pre} is the pre-consumer material input, in kg;

T_{RM} is the total raw materials used in the product of interest, in kg;

T_{GW} is the total grinding water, in kg;

R_w is the reclaimed waste input, in kg.

Conservatively, a "worst case scenario" analysis of a single product with the lowest concentration of recycled and/or reclaimed waste content may suffice to represent a facility's entire production.

Table 2 — Multirating requirements for recycled and/or reclaimed waste content

Rating (%)	100	110	120	130
References (%)	$3 \leq R_C < 5$	$5 \leq R_C < 15$	$15 \leq R_C < 30$	$R_C \geq 30$

5.2.2.2.4 Raw materials and outsourced services environmental buying agreement

The manufacturer of the product of interest shall have a written environmental policy statement with each immediate supplier of raw materials (which make up, in aggregate, 90 % by weight of the finished product) and with each provider of outsourced manufacturing and/or packaging services.

The written environmental policy statement shall provide documentation concerning the following:

Compliance with environmental regulations: compliance declaration with the relevant environmental national regulations and laws by each immediate raw material supplier, outsourced manufacturer and packaging service provider is in compliance.

Where the immediate supplier is a distributor and not a producer, the provisions listed above shall be applied by the distributor to the producer of the supplied materials.

Calculation: the manufacturer shall give evidence of such records [YES/NO].

Mandatory requirements	**YES**

5.2.3 Manufacture

5.2.3.1 General

The manufacturing process is commonly considered as the phase of the installation products life cycle which is characterized by low environmental impact factors.

5.2.3.2 Requirements for the evaluation

5.2.3.2.1 Environmental management system (EMS)

The implementation of an appropriate environmental management system is a fundamental step towards sustainability. The existence and the operation of this system defines the compliance to this requirement. See Table 3.

Calculation: the manufacturer shall give evidence of the implementation of an environmental management system based on documentation records (EMS) [YES/NO].

Optionally, the EMS may be developed pursuant to ISO 14001 [PURSUANT], with the minimum requirements as follows:

— documentation that the manufacturer has evaluated the environmental aspects of its activities (see ISO 14001:2015, 4.3.1);

— established objectives to prevent pollution, and promote continuous improvement (see ISO 14001:2015, 4.3.3);

— provisions for control and maintenance of environmental documents (see ISO 14001:2015, 4.4.5);

— establishment, implementation and maintenance of a procedure for dealing with actual and potential nonconformity, including corrective and preventive actions (see ISO 14001:2015, 4.5.3).

Furthermore, the EMS may be certified by a certification body according to ISO 14001, EMAS.

Table 3 — Multirating requirements for EMS

Rating (%)	100	110	120	130
References	YES		PURSUANT	CERTIFIED

5.2.3.2.2 Energy efficiency management system (EEMS)

The implementation of an appropriate energy management system is a fundamental step towards sustainability. The existence and the operation of this system defines the compliance to this requirement. See Table 4.

Calculation: the manufacturer shall give evidence of the implementation and basic characteristics of an energy efficiency management system based on documentation records (EEMS) [YES/NO].

Optionally, the EEMS may be developed pursuant to ISO 50001 with the minimum requirement of a certified audit of heat fuel systems at least once every 5 years [PURSUANT].

Furthermore, the EEMS may be certified by a certification body according to ISO 50001 [CERTIFIED].

Table 4 — Multirating requirements for EEMS

Rating (%)	100	110	120	130
References	YES		PURSUANT	CERTIFIED

5.2.3.2.3 Renewable energy usage (solar, hydro-electric, wind, marine, or geothermal)

The manufacturer shall give evidence of the adoption/implementation of measures aimed to improve the use of renewable energy sources, in the unit in which the product(s) of interest is (are) manufactured. See Table 5.

Calculation: the facility, manufacturing line, or manufacturing process associated to the product of interest shall utilize renewable energy (purchased or created on-site or off-site) for at least 10 % of its electric energy or 10 % of its gas energy, or a combination of the two [YES/NO].

Table 5 — Multirating requirements for renewable energy usage

Rating (%)	100	110	120	130
References	NO			YES

5.2.3.2.4 PM emission factor through emissions into the atmosphere

Technology for installation-products manufacturing can also be a powder technology, with associated emission of particulate matter (PM) into the atmosphere. A large part of the total PM emitted is transported by the suction lines installed in the manufacturing sections, in order to reduce the risks of exposure to airborne particulates of the workers in the working environment. The parameter used to quantify PM emission from the manufacture of the product of interest is the total PM emission factor, $F_{E,PM}$ which can be calculated with reference to the unit product expressed either in m^2 or in t. Total PM concentration measurements shall be carried out in all the chimney stacks of the manufacturing line, with the method reported in EN 13284-1 or any equivalent standard included in the national legislation. See Table 6.

Calculation: a reference is made to the "*i*-th" of the "*n*" chimney stacks of the manufacturing unit under consideration, emitting into the atmosphere the pollutant "PM".

$$F_{E,\,PM} = \sum_i (c_{PM,i} \times Q_i \times t_i \times 10^{-3})/P_t \quad (3)$$

where

$c_{PM,i}$ is the PM concentration in the *i*-th chimney stack, in mg/Nm^3;

Q_i is the volume flow rate of the *i*-th chimney stack, in Nm^3/h;

t_i is the operation time of the *i*-th chimney stack, in h/year;

P_t is the annual production of ceramic tiles, in t/year;

10^{-3} is the conversion factor, in g/mg.

NOTE Formula (3) is expressed in (g/t).

Table 6 — Multirating requirements for PM emission factor

Rating (%)	100	110	120	130
References (g/t)	$300 < F_{E,\,PM} \leq 700$	$100 < F_{E,\,PM} \leq 300$	$50 < F_{E,\,PM} \leq 100$	$F_{E,\,PM} \leq 50$

5.2.3.2.5 Internal or external reuse/recycling of packaging materials

Calculation: the facility in which the product of interest was manufactured shall have mechanisms to reuse internally or recycle externally 50 % (by weight, volume, or item) of incoming shipping materials, included but not limited to paper, plastic, cardboard, corrugate, and wood. For example, a carton baler for cardboard and corrugate and recycling containers for paper, reuse and/or repair of incoming pallets, and use of a pallet recycling company for unusable pallets [YES/NO]. See Table 7.

Table 7 — Multirating requirements for internal or external reuse/recycling of packaging materials

Rating (%)	100	110	120	130
References	0	> 20	> 40	> 50

5.2.3.2.6 Reuse/recycling or separate collection of other materials

Calculation: the facility in which the product of interest was manufactured shall have mechanisms to reuse internally or recycle externally or organize separate collection of all plastics, metals, exhausted (used) oil, lead batteries and used packaging for materials [YES/NO].

Mandatory requirements	**YES**

5.2.3.2.7 Waste water discharge

The parameter used to quantify this aspect is W_D (%), the waste water discharge. See Formula (4) and Table 8.

$$W_D = P_{WD} / P_W \times 100 \quad (4)$$

where

W_D is the waste water discharge, in %;

P_{WD} is the annual production waste water discharged, in L/year;

P_W is the annual production water utilized, in L/year.

NOTE An example of waste water discharged is to publicly owned treatment works (POTW).

Any other way of water discharge shall be taken into consideration.

Table 8 — Multirating requirements for waste water discharge

Rating (%)	100	110	120	130
References (%)	$20 < W_D \leq 50$	$W_D \leq 20$	$W_D \leq 10$	$W_D \leq 5$

5.2.4 Distribution and installation

5.2.4.1 General

The most significant environmental aspects associated with the distribution and installation of products involve packaging and waste generated from the installation process.

5.2.4.2 Requirements for the evaluation: packaging

5.2.4.2.1 Weight of packaging

Calculation: the manufacturer shall package the product of interest using minimal material for 95 % of the time, based on annual production of the product manufactured, in tons. The weight of primary packaging ≤ 5 % of the total weight of product being packaged [YES/NO]. See Table 9.

Table 9 — Multirating requirements for weight of packaging

Rating (%)	100	110	120	130
References	> 5	≤ 5	≤ 2	≤ 1

5.2.4.2.2 Recycled material content of packaging materials

The product shall be packaged using material with recycled content. The manufacturer shall provide a declaration from packaging supplier indicating the percentage and type (pre-consumer or post-consumer) of recycled content. The parameter used to quantify this aspect is R_{MC} (%), recycled material content of packaging materials. See Formula (5) and Table 10.

$$R_{MC} = R_{C,\,post} + R_{C,\,pre} \quad (5)$$

where

R_{MC} is the recycled material content of packaging materials, in %;

$R_{C,\,post}$ is the post-consumer recycled content, in %;

$R_{C,\,pre}$ is the pre-consumer recycled content, in %.

Table 10 — Multirating requirements for recycled material content of packaging materials

Rating (%)	100	110	120	130
References (%)	$R_{MC} \leq 10$	$10 < R_{MC} \leq 20$	$20 < R_{MC} \leq 30$	$R_{MC} > 30$

5.2.4.2.3 Environmental property of packaging materials

Calculation: the packaging material shall be recyclable and labelled as such with the appropriate recycling classification (where applicable). See Table 11.

Table 11 — Multirating requirements for environmental property of packaging materials

Rating (%)	100	110	120	130
References	0	≥ 20	≥ 50	≥ 85

5.2.4.3 Requirements for the evaluation: installation

5.2.4.3.1 Environmentally friendly installation — Guidance from manufacturer

Calculation: the manufacturer shall provide instructions to guide the applicator towards a correct execution of the installation operations, with regards to the main environmental aspects/impacts. The manufacturer shall provide information regarding responsible management of packaging materials during and after the installation process [YES/NO].

Mandatory requirements	**YES**

5.2.5 Use

5.2.5.1 General

The most potential for a significant environmental impact of products for installation of tiles can be associated with the application and use activities, due to substances contained in the materials and their emissions into indoor air. These aspects can affect both the applicator and the final users.

5.2.5.1.1 Product formulation

The products shall contain no substances of very high concern (SVHC) in a concentration more than 0,1 % (by unit weight).

Reference [6] lists SVHCs.

Alternatively, products shall not contain substances listed in the Red list[8]:

— alkylphenols;

— asbestos;

— bisphenol A (BPA);

— cadmium;

— chlorinated polyethylene;

— chlorosulfonated polyethlene (CSPE);

— chlorofluorocarbons (CFCs);

— chlorobenzene;

— chloroprene (neoprene);

— chromium VI;

— chlorinated polyvinyl chloride (CPVC);

— formaldehyde (added);

— halogenated flame retardants (HFRs);

— hydrochlorofluorocarbons (HCFCs);

— lead (added);

— mercury;

— polychlorinated biphenyls (PCBs);

— perfluorinated compounds (PFCs);

— phthalates;

— polyvinyl chloride (PVC);

— polyvinylidene chloride (PVDC);

— short chain chlorinated paraffins;

— wood treatments containing creosote, arsenic or pentachlorophenol;

— volatile organic compounds (VOCs) in wet applied products.

Calculation: the manufacturer shall provide a declaration, specifying the compliance with the requirements.

5.2.5.1.2 Product VOC emission and content criteria

The product of interest shall demonstrate very low volatile organic compound (VOC) emissions and content by meeting its relevant criteria. See Table 12.

Calculation: the building products shall be tested in emission chambers and determined compliant in accordance with ISO 16000-3, ISO 16000-6, ISO 16000-9, ISO 16000-11.

Reference [7], or Reference [9] are also equivalent methods.

In addition to meeting the general requirements for VOC emissions, on-site wet-applied products shall meet the VOC content criteria as follows:

VOC content: testing of VOC content shall comply with ASTM D2369-10, ISO 11890-1, ASTM D6886-18 or ISO 11890-2.

If a product cannot reasonably be tested as specified above, all adhesives and sealants (including flooring adhesives and sealants) wet-applied on site shall be aware of the applicable chemical content requirements of Reference [5].

Table 12 — Multirating requirements for product VOC emission and content criteria

Rating (%)	100			130
References (%)	VOC content		-	VOC content and general emission evaluation (EC1^{PLUS}, Blauer Engel, CDPH Section 01350)

5.2.6 Product environmental mark/labelling

5.2.6.1 General

The adoption of voluntary mark/labelling which expressly communicates the environmental impacts of a product can assist end users in making informed decisions when selecting installation materials.

5.2.6.2 Requirements for the evaluation

5.2.6.2.1 External Type I

The product of interest shall have an external Type I label, meaning that it has been third party-certified to a standard other than this one, which contains multiple environmental criteria, per ISO 14024. The Type I label shall apply either solely to the product of interest or at the factory level to a host of products which includes the product of interest. See Table 13.

Calculation: the manufacturer shall give evidence of the application, to the product of interest, of an external Type I label according to ISO 14024 [Type I].

Table 13 — Multirating requirements for external Type I

Rating (%)	100	110	120	130
References	NO			YES

5.2.6.2.2 Type III environmental product declaration (EPD)

The product of interest shall obtain a Type III EPD, either specifically for that product (proprietary) or generically via an industry-wide effort (generic), under the management of a program operator, per ISO 14025 or ISO 21930. See Table 14.

Calculation: the manufacturer shall give evidence of the application, to the product of interest, of a Type III EPD, either industry-wide [generic Type III], product-specific [proprietary Type III], or both.

Table 14 — Multirating requirements Type III EPD

Rating (%)	100	110	120	130
References	NO	Generic Type III	Proprietary Type III	Generic Type III + proprietary Type III

5.3 Economic and functional criteria

5.3.1 General

Economic and functional sustainability of installation materials and systems involves aspects related to cost/benefit ratio.

In the “benefits of installation materials” several potentialities can be included, in particular, durability, (which allows to decrease waste coming from demolition) service behaviour and performance, safety in use, with respect to risks of accidents, risks of contamination, etc.

Quality and performance of ceramic tiling materials may be necessary conditions for an acceptable cost/benefit ratio for ceramic tiling, but are not sufficient conditions, without suitable and correct design/specification and installation procedures and guidelines.

No essential functionality of products shall be damaged by the required compliance with the environmental sustainability criteria specified in 5.2.

5.3.2 Product quality, performance level, fitness for use

5.3.2.1 General

Sustainable adhesives, grouts and waterproofing membranes shall comply with the quality criteria specified in the relevant international standards.

Installation products shall be characterized by essential characteristics, basically associated to the objective of safety of the users of a building. These essential characteristics cover mechanical performance, durability and safety aspects. These characteristics may include reaction to fire, breaking strength, slipperiness, release of dangerous substances, bond strength adhesion, etc.

5.3.2.2 Requirements for the evaluation

5.3.2.2.1 Product compliance with the relevant product standards and manufacturer declarations

Calculation: the manufacturer shall give evidence that the product of interest has been tested and assessed as fit for its intended use, and to communicate the relevant results on request by the buyer/specifier/user.

Adhesives and other installation products: meets or exceeds the ISO 13007 series [YES/NO].

Mandatory requirements	**YES**

5.4 Social criteria

5.4.1 General

Social criteria refer to the impacts of tiles on health, safety and comfort of persons who, during their work or in normal living conditions, are in contact with adhesives and other installation products in any phase of the life cycle (from raw materials to manufacture, from distribution and installation to the use phase). The following social sustainability criteria are focused, in particular, on manufacture, installation and use phases.

Correct information, at an appropriate level compared to the addressed categories' characteristics and needs, represents a basic requirement in the framework of social sustainability criteria: a requirement which shall involve the workers in the manufacture sites, the tiling installers and the final users of ceramic tiling.

5.4.2 Occupational health and safety in manufacture

5.4.2.1 General

In the different phases of the manufacturing cycle of installation materials, proper management of worker's exposure to chemical and physical agents, which may represent a risk for their health and safety, is necessary.

5.4.2.2 Requirements for the evaluation

5.4.2.2.1 Information to the workers about the exposure risks to chemical and physical agents

Calculation: the manufacturer shall give evidence that the workers are informed about the chemical and physical risks and/or hazards associated to the workroom and working conditions [YES/NO].

Mandatory Requirements	**YES**

5.4.2.2.2 Dust suction line(s) with particulate filtration in each of the relevant sections of the production unit

Calculation: the manufacturer shall give evidence that dust suction lines and filters are in proper operation according to the equipment manufacturer's specifications in each of the following sections: raw materials receiving and preparation (including grinding and spray drying); pressing; glaze preparation; glaze application [YES/NO].

NOTE YES means that suction lines and filters are in proper operating condition in all of the above-mentioned sections/operations, where applicable to the production unit of interest.

Mandatory requirements	**YES**

5.4.2.2.3 **Periodic audits** (number of aspects periodically audited)

The manufacturer shall give evidence that periodic audits are carried out and recorded at least every four years, with the indication of the following results: methods adopted and laboratories involved, per section of the manufacturing unit. See Table 15.

The audit shall cover the following relevant aspects:

— environmental concentrations of RCS and airborne particles;

— biological indicators of exposure to lead in glazes/stains (only in processes where lead is intentionally added);

— exposure levels to noise;

— number of accidents and professional diseases per hours worked;

— sanitary employer's controls.

Calculation: the manufacturer shall give evidence of the number of aspects audited with reference to the list above in this subclause. All results shall be measured as 8 h time weighted averages.

Table 15 — Multirating requirements for periodic audits

Rating (%)	100	110	120	130
References (n°)	2	3	4	≥ 5

5.4.2.2.4 Personal protective equipment (PPE)

The manufacturer shall give evidence that job hazard analyses have been completed to identify what, if any, personal protective equipment is needed to safely perform the work. The manufacturer shall make the appropriate PPE available and ensure it is correctly used by the worker for the specified activities/functions.

Examples of the relevant PPE include, but are not limited to, the following:

— safety shoes;

— safety gloves;

— safety face mask;

— safety goggles;

— safety glasses (including prescription eyewear if needed);

— safety earplugs;

— helmet (hard hat);

— safety harness.

Calculation: the manufacturer shall give evidence of the number of job hazard analyses performed and quantity and types of PPE available and used with reference to the list above in this subclause. See Table 16.

Table 16 — Multirating requirements for PPE

Rating (%)	100	110	120	130
References (n°)	4	5	6	≥ 7

5.4.2.2.5 Occupational health and safety management system (OHSMS)

Calculation: the manufacturer shall give evidence of the implementation and basic characteristics of an occupational health and safety management system (OHSMS) [YES/NO]. Optionally, the OHSMS may be developed pursuant to ISO 45001 with a minimum requirement of establishing, implementing and maintaining a procedure(s) for the ongoing hazard identification, risk assessment, determination of necessary controls and monitor/measure performances [PURSUANT] or certified by a certification body according to ISO 45001 [CERTIFIED]. See Table 17.

Table 17 — Multirating requirements for OHSMS

Rating (%)	100	110	120	130
References	YES		PURSUANT	CERTIFIED

5.4.2.2.6 Raw materials and outsourced services health and safety buying agreement

The manufacturer of the product of interest shall have a health and safety written vendor buying agreement with each immediate supplier of raw materials (which make up, in aggregate, 90 % by weight of the finished product) and outsourced manufacturing and/or packaging services.

The vendor-buying agreement between the supplier and the manufacturer of the product of interest shall require the supplier to provide documentation concerning the following.

— Compliance with health and safety regulations: compliance declaration with the relevant health and safety national regulations and laws by each immediate raw material supplier, outsourced manufacturer and packaging-service provider.

— Where the immediate supplier is a distributor and not a producer, the provisions listed above shall be applied by the distributor to the producer of the supplied materials.

Calculation: the manufacturer shall give evidence of such records [YES/NO].

Mandatory requirements	**YES**

5.4.3 Health and safety prior and during installation

5.4.3.1 General

The main health and safety risk prior to and during installation is from the manual handling and transportation of tile cartons (and large heavy individual tiles) in the workplace. A further possible risk during installation is from dust caused by dry sawing of tiles. Ceramic tiles can be considered as an inert material that do not release organic (VOCs) or inorganic materials.

5.4.3.2 Requirements for the evaluation

5.4.3.2.1 Information provided to installers

Calculation: the manufacturer shall provide information and guidelines on the correct and safe handling procedures.

Mandatory requirements	**YES**

5.4.3.2.2 Materials safety data sheets

Calculation: the safety data sheets of ceramic tiles shall be made available by the manufacturer to the dealer and/or the tiling installer.

Mandatory requirements	**YES**

5.4.4 Labour agreement

5.4.4.1 General

A labour-buying agreement along the supply chain is significantly associated to: i) raw materials supplier, ii) outsourced manufacturers, iii) outsourced packaging service.

5.4.4.2 Requirements for the evaluation

5.4.4.2.1 Raw materials and outsourced services labour-buying agreement

The manufacturer of the product of interest shall have a written labour vendor buying agreement with each immediate supplier of raw materials (which make up, in aggregate, 90 % by weight of the finished product) and outsourced manufacturing and/or packaging services.

The vendor-buying agreement between the supplier and the manufacturer of the product of interest shall require the supplier to provide documentation concerning the following.

— Compliance with labour regulations: compliance declaration with the relevant labour national regulations and law by each immediate raw material supplier, outsourced manufacturer and packaging service provider.

— Prohibitions on forced labour: compliance declaration that each immediate raw material supplier, outsourced manufacturer and packaging service provider does not engage in or permit the use of forced or compulsory labour.

— Prohibitions on child labour: compliance declaration that each immediate raw material supplier, outsourced manufacturer and packaging service provider does not engage child labour.

— Where the immediate supplier is a distributor and not a producer, the provisions of this list shall be applied by the distributor to the producer of the supplied materials.

Calculation: the manufacturer shall give evidence of such records [YES/NO].

Mandatory requirements	**YES**

6 Classification and designation

6.1 Approach

As specified in Clause 5, the sustainability criteria can be classified in the following categories:

— **Mandatory criteria:** N° 12 "Pass/Fail" criteria (**M** criteria), that any product shall comply with, in order to be assessed as sustainable. No rating is awarded to any product against the compliance with mandatory criteria. This compliance shall be regarded as a pre-requisite of the sustainability assessment. This compliance is therefore, a necessary condition for sustainability.

— **Multirating criteria:** N° 17 multirating, voluntary (**V**) criteria, classified in three categories – **V1**, **V2** and **V3** - as reported in 4.1. In each of these multirating criteria the sustainability assessment is based on reference values, which are specified for each individual requirement, in order to define different levels of sustainability. For each of these 17 multirating criteria the following ratings can be attributed: 100 %, 110 %, 120 % and 130 %, where 100 % is the lowest level of sustainability, and 130 % is the highest level of sustainability. For each of the multirating criteria, the 100 % rating corresponds to the minimum acceptable level of sustainability.

Different weight of the multirating criteria: the multirating criteria/requirements identified in the framework of this document are different as regards the difficulty or the cost or the efforts for implementation, the quantitative knowledge required, the area of interest (technical or organization/management areas), etc. In particular, the requirements V1 generally require the confirmation that a certain plant or service exists, while the requirements V2 go deeper, dealing with the management and organization systems in the factory. The requirements V3, in turn, deal with the sustainability performance as regards measurable parameters like pollutant emissions or water or waste recycle. Therefore, these criteria require both experimental measurements, carried out with specified methods, and the calculation of special indicators. For these reasons, a different weight has been associated to each of the three classes above:

— **V1** = voluntary pass/fail requirements: weight = 1

— **V2** = voluntary multirating managerial requirements: weight = 3

— **V3** = voluntary multirating quantitative and performance requirements: weight = 6

Each of the 17 multirating criteria above is applicable to any type of product or production. All of these 17 multirating criteria shall be measured, calculated and considered in the final rating of each individual product/production: otherwise, misleading results could be achieved in the final rating, if one or more criteria would have been omitted. The only exemption is for the requirement 5.2.2.2.3 with the limitation to fired products with a thickness of 6 mm or less.

For some requirements more than one expression, or even more than one calculation method is possible. Moreover, some requirements can be calculated having either a complete or a partial manufacturing cycle as reference. For all these requirements, the applicant shall only adopt the unique way considered as more convenient in terms of sustainability and coherent with the manufacturing cycle of the product/production of interest.

6.2 Final rating calculation

The base document is Annex A, Tables A.4 to A.7, where all the requirements are listed.

The mandatory requirements shall be considered only for the purpose of verifying and giving evidence that all the mandatory conditions are complied with. As specified in 4.1, the mandatory requirements do not contribute to the final rating.

The rating for each of the 17 multirating requirements are attributed in this way:

— the required "*i*-th" measure (or verification, or evaluation) is carried out, and the result achieved is to be reported in the column "Value" of Tables A.4 to A.7;

— this value is compared to the respective reference values, reported in the same table;

— on the base of this comparison, the class of the result is identified, and the rating is established. This rating can assume one of the following values: 100 %, 110 %, 120 %, 130 %.

The arithmetical average (a_{ave}) of the ratings is calculated, for each of the three classes of multirating requirements following Formulae (6) to (8):

— $a_{ave,\,V1} = (1/7) \times \sum V_{1i}$ $(i = 1 - 7)$ (6)

— $a_{ave,\,V2} = (1/7) \times \sum V_{2i}$ $(i = 1 - 7)$ (7)

— $a_{ave,\,V3} = (1/9) \times \sum V_{3i}$ $(i = 1 - 9)$ (8)

NOTE 1 Each arithmetic average, a_{ave}, can range from 100 % to 130 %.

The final sustainability rating, S_{ra}, is calculated as weighed average of the arithmetical averages above, using the weights indicated in 6.1 using Formula (9):

$$S_{ra} = [1/(1 + 3 + 6)] \times [(1 \times a_{ave,\,V1}) + (3 \times a_{ave,\,V2}) + (6 \times a_{ave,\,V3})] \quad (9)$$

NOTE 2 The final sustainability rating, S_{ra}, can range from 100 % and 130 %.

6.3 Classification

On the base of the final sustainability rate calculated, each individual product/production shall be deemed as conformant to this document if the following criteria are met:

1) all mandatory requirements are satisfied throughout the document;

2) a minimum sustainability final rating of 117,5 is achieved for multirating requirements.

6.4 Final report

A report with the sustainability assessment of a given product/production shall be developed as the final result of the evaluation process according to this document. This final report shall contain:

— the confirmation of the compliance with the above-mentioned criteria (compliance with all the mandatory requirements);

— a minimum final rating S_{ra} of 118 % for multirating voluntary requirements.