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

Part 1: Specification for ceramic tiles

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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 of products throughout their life cycle using qualitative and quantitative indicators for environmental performance and for social and economic responsibility pertaining to the design, manufacture, installation, and use of ceramic tiling systems. This document is focused on ceramic tiles, as part of the tiling system.

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 1:
Specification for ceramic tiles

1 Scope

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

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

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 13006, *Ceramic tiles — Definitions, classification, characteristics and marking*

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 air and test chamber air — Active sampling method*

ISO 16000-6, *Determination of volatile organic compounds in indoor and test chamber air by active sampling on Tenax TA sorbent, 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 21930, *Sustainability in buildings and civil engineering works — Core rules for environmental product declarations of construction products and services*

3 Terms and definitions

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

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

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

— IEC Electropedia: available at http://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: Social sustainability 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

EXAMPLE Period from installation to uninstalling.

3.2 Environment

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

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 was removed.]

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 — The notes to entry were removed.]

3.2.3
environmental impact
any change to the *environment* (3.2.1), whether adverse or beneficial, wholly or partially resulting from an organisation'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

3.3.4
packaging material
any 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.

Note 2 to entry: *Shipping material* (3.3.6) is not considered to be packaging material.

3.3.5
primary packaging
any 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.

Note 2 to entry: For *ceramic tiles* (3.5.1) the primary packaging is restricted to the following materials: paper, cardboard or corrugate.

3.3.6
shipping material
any material that is used for the containment, protection, handling, or preservation of a product while en route from one location to another 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
energy efficiency management system
EEMS
procedures to monitor, control, evaluate and improve the performance of the used energy

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

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

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

3.4.5
type I environmental label
LCA (3.1.4) 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 that is certified 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 [e.g. products, *raw materials* (3.3.1)] from one location to another

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

3.6.4
waste water
liquid waste resulting from industrial processes, including but not necessarily limited to water mixed with *raw materials* (3.3.1), contact cooling water, condensing waters, and water that comes in contact with process materials, products or by-product, but excluding sanitary sewage, cafeterias, irrigation, storm water runoff

3.6.5
waste water discharged
production (3.5.3) *waste water* (3.6.4) generated in the manufacturing process, that is discharged in the external *environment* (3.2.1)

Note 1 to entry: The waste water can be discharged, for example, to publicly owned treatment works (POTW).

3.6.6
waste management
collection, *transport* (3.5.4), processing, recycling or disposal, and monitoring of waste materials

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 these

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

3.7.5
sanitary employers' control
surveillance program including generic or specific medical check-up, according to risk assessment

4 Symbols and abbreviated terms

4.1 Symbols

Symbols	Description	Units
a_{ave}	arithmetical average	
A_{ch}	exposed surface area of the test specimen in the chamber	m^2
c_B	estimated emission concentration within the context of a building	$\mu g/m^3$
$c_{HF,i}$	HF concentration in the i-th chimney stack	mg/Nm^3
$c_{PM,i}$	is the PM concentration in the i-th chimney stack	mg/Nm^3
c_{ta}	measured concentration of the target VOC, formaldehyde or other carbonyl compound	$\mu g/m^3$
c_0	corresponding measured concentration in the chamber operating without a test specimen	$\mu g/m^3$
C_f	fuel consumption (annual)	(GJ/year, TJ/year, or Sm^3/year)
C_{FW}	specific fresh water consumption	(L/m^2 or L/t)
$F_{E,A}$	area-specific emission factor	$\mu g\ m^{-2}\ h^{-1}$
$F_{E,j}$	emission factor of the pollutant "j" (PM, HF) through emissions into the atmosphere	(g/m^2 or g/kg)
$F_{N,1}$	normalization factor	1 GJ/m^2
$F_{N,2}$	normalization factor	1 GJ/t
F_R	process waste recycle/reuse factor	%
F_{SFC}	normalized specific fuel consumption factor	adimensional
I	quantity of indigenous raw materials in the body of the product of interest	%
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	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_A	area specific air flow rate	m/ h
Q_i	volume flow rate of the i-th chimney stack	Nm^3/h
R_C	recycled and/or reclaimed waste content in the body of the product of interest	%
$R_{C,post}$	post-consumer recycled content	%
$R_{C,pre}$	pre-consumer recycled content	%
R_{WC}	reclaimed waste content	
R_{MC}	recycled materials 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_{FWC}	total fresh water consumption	L/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_P	total process wastes produced in the production unit of interest	t/years
W_D	waste water discharge	%

4.2 Abbreviated terms

For the purposes of this document, the following abbreviated terms are used.

Abbreviated terms	Description
EEMS	energy efficiency management system
EMAS	eco management and auditing scheme
EMS	environmental management system
EPD	environmental product declaration
HF	hydrogen fluoride
LP gas	liquefied petroleum gas
M	mandatory requirements
NCV	net calorific value
Nm^3	cubic meter of gas measured in Normal conditions (T = 273 K, p = 101,3 kPa)
PM	particulate matter
POTW	publicly owned treatment works for waste water
PPE	personal protective equipment
RCS	respirable crystalline silica
SDS	safety data sheet
Sm^3	cubic meter of gas measured in Standard conditions (T = 298 K, p = 101,3 kPa)
V1	voluntary pass-fail requirements
V2	voluntary multirating managerial requirements
V3	voluntary multirating quantitative and performance requirements
VOC	volatile organic compounds

5 Principle criteria for sustainable products

5.1 General

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

Environmental sustainability, economic sustainability, and social sustainability criteria are detailed in Tables A.1, A.2 and A.3, respectively, 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 it cannot be classified as sustainable.

Multirating, voluntary requirements: requirements to which a product can comply with at different levels, awarded through a different rating. All multirating, voluntary requirements require a mandatory minimum 100 % tier. The compliance level to multirating requirements contributes to the final rating of the product, as specified in Clause 7 of this document.

The requirements listed in Annex A, Tables A.1, A.2 and A.3, are marked with the same numbers used in Clause 6, and are classified according to the type:

M = mandatory requirement;

V1 = voluntary pass/fail requirements;

V2 = voluntary multi-rating managerial requirements;

V3 = voluntary multirating quantitative and performance requirements.

Reference to this classification of sustainability requirements will be made in Clause 7.

5.2 Environmental criteria

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

— raw materials;

— manufacture;

— distribution and installation;

— use;

— end of life;

— product environmental mark/labelling.

5.3 Economic and functional criteria

The economic and functional criteria are (see Annex A, Table A.2):

— product quality,

— performance level, and

— fitness for use.

5.4 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.

6 Assessment

6.1 General

This clause describes the criteria and defines the requirements for the evaluation of sustainable 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 ceramic floor and wall tiles.

6.2 Environmental criteria

6.2.1 General

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

6.2.2 Raw materials

6.2.2.1 General

Most of the ceramic tiles are characterized by recycling of waste materials of internal origin and the re-use of waste of different external origins in raw materials and bodies. The sustainability of this recycling/re-use practice is based on both the inertization potential of any given waste material in a ceramic matrix, and the associated saving of natural raw materials and reducing expenses (economic benefit).

6.2.2.2 Requirements for the evaluation

6.2.2.2.1 Materials records

The manufacturer shall maintain a list of all raw materials used in the manufacture of the product of interest. The term "all raw materials" includes just the raw 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 raw 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

6.2.2.2.2 Transport – Indigenous raw materials

The higher the amount of indigenous raw materials used to manufacture a ceramic tile product, the lower the environmental impact of the transport of the raw materials from their extraction area to the manufacturing site is. 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;

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 (%)	$I < 50$	$50 \leq I < 75$	$75 \leq I < 90$	$I \geq 90$

6.2.2.2.3 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.

This requirement can be applied only to fired products with a thickness higher than 6 mm.

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

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.

All materials shall be considered with the relevant content of humidity.

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

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

6.2.2.2.4 Raw materials and outsourced services environmental buying agreement

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

The written environmental declaration 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 to give evidence of such records [YES/NO].

Mandatory requirements: YES

6.2.3 Manufacture

6.2.3.1 General

The manufacturing process is commonly considered as the phase of the ceramic tiles life cycle which is characterized by the most significant environmental impact factors.

6.2.3.2 Requirements for the evaluation

6.2.3.2.1 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(ies), 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 or EMAS [CERTIFIED].

Table 3 — Multirating requirements for EMS

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

6.2.3.2.2 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

6.2.3.2.3 Cogeneration or combined heat and power systems

The manufacturer shall give evidence of the adoption/implementation of measures aimed to increase energy efficiency and to reduce specific energy consumption, in the unit in which the product(s) of interest is (are) manufactured. See Table 5.

Calculation: the manufacturer shall give evidence that at least one cogeneration plant has been installed and is in operation in the unit(s) in which the product(s) of interest is(are) manufactured [YES/NO].

Table 5 — Multirating requirements for cogeneration or combined heat and power systems

Rating (%)	100	110	120	130
References	NO			YES

6.2.3.2.4 Heat recovery systems

The manufacturer shall give evidence of the adoption/implementation of measures aimed to increase energy efficiency and to reduce specific energy consumption, in the unit in which the product(s) of interest is (are) manufactured. See Table 6.

Calculation: the manufacturer shall demonstrate implementation of heat recovery systems in at least 30 % of kilns in which the product of interest is manufactured [YES/NO].

Table 6 — Multirating requirements for heat recovery systems

Rating (%)	100	110	120	130
References	NO			YES

6.2.3.2.5 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 7.

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 7 — Multirating requirements for renewable energy usage

Rating (%)	100	110	120	130
References	NO			YES

6.2.3.2.6 Fuel type used

The facility(ies) in which the product(s) of interest is (are) manufactured shall only use fuel types included in the following list:

— natural gas;

— LP gas;

— landfill generated methane;

— bio-based fuel.

Calculation: the manufacturer shall declare [YES/NO] (NO = use if different fuels, not included in the list).

Mandatory requirement: YES

6.2.3.2.7 Specific fuel consumption for firing kilns

The ceramic tile manufacture is based on thermal processes, like spray drying of powders, drying of green ware and firing at relatively high temperature of dried, glazed and unglazed tiles in kilns. The present requisite consists in specific fuel consumption in the firing phases, the phase where most of fuel consumption is concentrated. This requisite is indicated as:

F_{SFC} = normalized specific fuel consumption factor (adimensional). See Formulae (3) and (4), and Tables 8, 9 and 10.

Calculation:

Table 8 — Measured, calculated and recorded data

Fuel (see 6.2.3.2.6)	**NCV (net calorific value)**[a]	**UM**
Natural gas[b]	48,0	TJ/Gg
	35,014	MJ/Sm^3
LP gas	47,3	TJ/Gg
Landfill generated methane	50,4	TJ/Gg
Bio-based fuel	50,4	TJ/Gg

[a] Commission Regulation (EU) N°601/2012 of 21 June 2012, on the monitoring and reporting of greenhouse gas emissions pursuant to the Directive 2003/87/EC. Annex 6 – Reference values for calculation factors.

[b] The following example calculations refer to natural gas.

Table 9 — Symbols and units for specific fuel consumption

	Symbol	**UM**
Annual fuel consumption	$C_{f,\,GJ}$	GJ/year
	$C_{f,\,TJ}$	TJ/year
	$C_{f,\,Sm^3}$	Sm^3/year
Annual ceramic tile production	P_{sm}	m^2/year
	P_t	t/year

Table 9 *(continued)*

	Symbol	UM
Normalization factor	$F_{N,1}$	1 GJ/m^2
	$F_{N,2}$	1 GJ/t

$$F_{SFC,sm} = (C_{f,GJ} / P_{sm}) / F_{N,1} \quad (3)$$

$$F_{SFC,t} = (C_{f,GJ} / P_t) / F_{N,2} \quad (4)$$

where

$F_{SFC,sm}$ is the normalized specific fuel consumption factor, calculated using the annual ceramic tile production, expressed in m^2;

$F_{SFC,t}$ is the normalized specific fuel consumption factor, calculated using the annual ceramic tile production, expressed in t;

$C_{f,GJ}$ is the annual fuel consumption, in GJ/year;

P_{sm} is the annual ceramic tile production, in m^2/year;

$F_{N,1}$ is the normalization factor, in GJ/m^2;

$F_{N,2}$ is the normalization factor, in GJ/t.

Table 10 — Multirating requirements for the specific fuel consumption for firing kilns

References (%)	100	110	120	130
$F_{SFC,sm}$	$F_{SFC,sm} > 0{,}16$	$0{,}16 \geq F_{SFC,sm} > 0{,}12$	$0{,}12 \geq F_{SFC,sm} > 0{,}08$	$F_{SFC,sm} \leq 0{,}08$
$F_{SFC,t}$	$F_{SFC,t} > 8$	$8 \geq F_{SFC,t} > 6$	$6 \geq F_{SFC,t} > 4$	$F_{SFC,t} \leq 4$

6.2.3.2.8 PM emission factor through emissions into the atmosphere

Ceramic technology is a powder technology, with associated emission of particulate matter (PM) into the atmosphere. A quite 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 should be carried out in all the chimney stacks of the manufacturing line, with the method reported in EN 13284-1. For facilities that control particulate emissions from process equipment, the maximum PM concentration, based on pollution control equipment specifications, can be used in the formula for calculating emission factor. See Table 11.

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".

$$F_{E,PM} = \sum_i (c_{PM,i} \times Q_i \times t_i \times 10^{-3}) / P_{sm} \quad (5)$$

$$F_{E,PM} = \sum_i (c_{PM,i} \times Q_i \times t_i \times 10^{-3}) / P_t \quad (6)$$

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_{sm} is the annual production of ceramic tiles, in m^2/year;

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

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

NOTE 1 Formula (5) is expressed in (g/m^2) and Formula (6) is expressed in (g/t).

Table 11 — Multirating requirements

Rating (%)	100	110	120	130
References	$7,5 < F_{E, PM}{}^a \leq 10$	$6 < F_{E, PM}{}^a \leq 7,5$	$5 < F_{E, PM}{}^a \leq 6$	$F_{E, PM}{}^a \leq 5$
(g/m^2)	$1,9 < F_{E, PM}{}^b \leq 2,5$	$1,5 < F_{E, PM}{}^b \leq 1,9$	$1,25 < F_{E, PM}{}^b \leq 1,5$	$F_{E, PM}{}^b \leq 1,25$
(g/t)	$375 < F_{E, PM}{}^a \leq 500$	$300 < F_{E, PM}{}^a \leq 375$	$250 < F_{E, PM}{}^a \leq 300$	$F_{E, PM}{}^a \leq 250$
	$95 < F_{E, PM}{}^b \leq 125$	$75 < F_{E, PM}{}^b \leq 95$	$60 < F_{E, PM}{}^b \leq 75$	$F_{E, PM}{}^b \leq 60$
Reference can be made to the following manufacturing cycles of the product of interest:				
a From raw materials to final product.				
b From shaping to final product.				

NOTE 2 In case of the complete cycle "from raw materials to final product", the calculation does not take into account any spray dry powder sold to a third party.

6.2.3.2.9 Fluorides emission factor from firing emissions into the atmosphere

The parameter used to quantify fluorides (HF) emissions from the firing of the product of interest is $F_{E, HF}$, emission factor of fluorine compounds as HF, which can be calculated with reference to the unit product expressed either in m^2 or in t. HF concentration measurements should be carried out in all the chimney stacks of the manufacturing line, with the method reported in ISO 15713. For facilities that control HF emissions from process equipment, the HF concentration or emission rate, as locally permitted, can be used in the formula for calculating emission factor. See Table 12.

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 "HF".

$$F_{E, HF} = \sum_i (c_{HF,i} \times Q_i \times t_i \times 10^{-3})/P_{sm} \quad (7)$$

$$F_{E, HF} = \sum_i (c_{HF,i} \times Q_i \times t_i \times 10^{-3})/P_t \quad (8)$$

where

$c_{HF,i}$ is the HF 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_{sm} is the annual production of ceramic tiles in m^2, in m^2/year;

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

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

NOTE Formula (7) is expressed in (g/m^2) and Formula (8) is expressed in (g/t).

Table 12 — Multirating requirements

Rating (%)	100	110	120	130
References (g/m2)	$1 < F_{E,\,HF} \leq 2$	$0{,}6 < F_{E,\,HF} \leq 1$	$0{,}2 < F_{E,\,HF} \leq 0{,}6$	$F_{E,\,HF} \leq 0{,}2$
(g/t)	$50 < F_{E,\,HF} \leq 100$	$30 < F_{E,\,HF} \leq 50$	$10 < F_{E,\,HF} \leq 30$	$F_{E,\,HF} \leq 10$

6.2.3.2.10 Process waste recycle/reuse factor

$$F_R = R_{PW} \times 100 \,/\, w_P \quad (9)$$

where

F_R is the recycled/reused process waste, in %;

R_{PW} is the total process wastes, of both internal and external origin, recycled both internally and externally, in t/year;

w_P is the total process wastes produced in the production unit of interest, in t/years.

NOTE 1 100 % means that all the waste produced internally is recycled, internally or externally.

NOTE 2 Values higher than 100 % are associated to production units which recycle all the waste produced internally and waste from external origin.

See Table 13.

Table 13 — Multirating requirements

Rating (%)	100	110	120	130
References (%)	$50 < F_R \leq 65$	$65 < F_R \leq 80$	$80 < F_R \leq 95$	$F_R > 95$

6.2.3.2.11 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 14.

Table 14 — Multirating requirements

Rating (%)	100	110	120	130
References	NO			YES

6.2.3.2.12 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 and/or recycle externally and/or organize separate collection of all plastics, metals, exhausted (used) oil, lead batteries, glass fibres and insulating materials from kilns, digital inks and used packaging for dangerous materials [YES/NO].

Mandatory requirement: YES

6.2.3.2.13 Specific fresh water consumption

The parameter used to quantify this aspect is C_{FW} [%], the specific fresh water consumption.

$$C_{FW} = T_{FWC}/P_{sm} \quad (10)$$

$$C_{FW} = T_{FWC}/P_{t} \quad (11)$$

where

C_{FW} is the specific fresh water consumption, in L/m^2 or L/t;

T_{FWC} is the total fresh water consumption, in L/year;

P_{sm} is the annual production of ceramic tiles in m^2, in m^2/year;

P_{t} is the annual production of ceramic tiles in t, in t/year.

NOTE Formula (10) is expressed in (L/m^2) and Formula (11) is expressed in (L/t),

Reference is made to full cycle manufacturing process (from raw materials to final product) of the product of interest. In partial cycle (from shaping to final product) any results shall be multiply per factor 2. See Table 15.

Table 15 — Multirating requirements

Rating (%)	100	110	120	130
References (L/m^2)	$C_{FW} > 28$	$24 < C_{FW} \leq 28$	$20 < C_{FW} \leq 24$	$C_{FW} \leq 20$
(L/t)	$C_{FW} > 1\,400$	$1\,200 < C_{FW} \leq 1\,400$	$1\,000 < C_{FW} \leq 1\,200$	$C_{FW} \leq 1\,000$

6.2.3.2.14 Waste water discharge

The parameter used to quantify this aspect is WD (%), the waste water discharge. See Formula (12) and Table 16.

$$W_D = P_{WD} / P_w \times 100 \quad (12)$$

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 16 — Multirating requirements

Rating (%)	100	110	120	130
References (%)	$30 < W_D \leq 50$	$W_D \leq 30$	$W_D \leq 20$	$W_D \leq 10$

6.2.4 Distribution and installation

6.2.4.1 General

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

6.2.4.2 Requirements for the evaluation: Packaging

6.2.4.2.1 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 square meters or tons. The weight of primary packaging is ≤ 1,5 % of the total weight of product being packaged [YES/NO].

See Table 17.

Table 17 — Multirating requirements

Rating (%)	100	110	120	130
References	NO			YES

6.2.4.2.2 Recycled materials content of packaging materials

The product shall be packaged using material with recycled content. The manufacturer shall provide a letter 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 materials content of packaging materials. See Formula (13) and Table 18.

$$R_{MC} = R_{C,\,post} + R_{C,\,pre} \tag{13}$$

where

R_{MC} is the recycled materials 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 18 — Multirating requirements

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

6.2.4.2.3 Environmental property of packaging materials

Calculation: (85 % of) the packaging material shall be recyclable and labelled as such with the appropriate recycling classification (where applicable) and or product shall be packaged using primary packaging materials which are inherently biodegradable [YES/NO].

See Table 19.

Table 19 — Multirating requirements

Rating (%)	100	110	120	130
References	NO			YES

6.2.4.3 Requirements for the evaluation: installation

6.2.4.3.1 Environmentally friendly installation - Guidance from manufacturer

Calculation: the manufacturer shall provide instructions to guide the tile fixer toward a correct execution of the installation operations with regards to the main environmental aspects/impacts such as waste management (responsible on-site management). The manufacturer shall provide information regarding re-usability and/or responsible management of packaging materials during the installation process [YES/NO].

Mandatory requirement: YES

6.2.5 Use

6.2.5.1 General

The most potential for a significant environmental impact of ceramic tiles in use is associated with the maintenance procedures and activities. No significant environmental impacts on air, water and soil quality/contamination occur, associated with installed ceramic tiles, provided that the tiling has been correctly designed, installed and managed.

6.2.5.2 Requirements for the evaluation

6.2.5.2.1 Environmentally friendly routine maintenance/service of ceramic tiling – Ceramic tiles

Calculation: the manufacturer shall provide guidance, publicly available to the users. These instructions shall specify the use of non-hazardous and non-polluting products for cleaning and maintenance [YES/NO].

Mandatory requirement: YES

6.2.5.2.2 Product VOC emission criteria

The product of interest shall demonstrate little to no volatile organic compound (VOC) emissions by meeting its relevant criteria below. See Table 20.

Calculation: tiles fired above red heat, after which have not received any post-fire adhesives, waxes, coatings, layering or surface applications are deemed inherently inorganic and "non-emitting" with no requirement for testing. [NE]

Tiles with post-fire adhesives, waxes, coatings, layering or surface applications shall be tested according to ISO 16000-3, ISO 16000-6 and ISO 16000-9 for VOC emissions. VOC emissions shall be measured following the method described in A.3.

— A tile's calculated area-specific emission factor, $F_{E,A}$, shall be "below quantifiable level" [BQL], or

— If a tile's area-specific emission factor is quantifiable, its estimated emission concentration within the context of a building, c_B, calculated using an area specific air flow rate, q_A, based on a relevant exposure scenario, shall be less than or equal to the maximum allowable concentration for each target VOC, formaldehyde or other carbonyl compound as reported in A.3.

Table 20 — Multirating requirements

Rating (%)	100	110	120	130
References (%)	c_B meets A.3 limits			NE or $F_{E,A}$ (BQL)

6.2.6 End of life

6.2.6.1 General

The end of life of a ceramic tile installation is its demolition. This involves the removal of materials which are inherently inert. Therefore, the demolition wastes from tiling, not including membranes or other organic layers, do not have significant environmental impacts. Moreover, tiling demolition wastes are regularly repurposed for different useful applications in civil engineering (including, for example, aggregates for concrete).

6.2.6.2 Requirements for the evaluation

6.2.6.2.1 Environmentally friendly demolition of ceramic tiling

Calculation: the manufacturer of the tiling materials shall provide instructions and guidelines on separation and management of waste materials from tiling demolition [YES/NO].

Mandatory requirement: YES

6.2.7 Product environmental mark/labelling

6.2.7.1 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 tiles and related installation materials.

6.2.7.2 Requirements for the evaluation:

6.2.7.2.1 External Type I

6.2.7.3 The product of interest shall have an external Type I environmental 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 21.

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 21 — Multirating requirements

Rating (%)	100	110	120	130
References	NO			YES

6.2.7.3.1 Type III environmental product declaration (EPD)

The product of interest shall obtain a Type III EPD, according to ISO 14025 or ISO 21930, either specifically for that product (proprietary) or generically via an industry-wide effort (generic), under the management of a program operator. See Table 22.

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 22 — Multirating requirements

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

6.3 Economic and functional criteria

6.3.1 General

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

In the category "benefits of ceramic tiling" several tiling potentialities can be included, in particular durability (several qualified experiences are reported of tiling with a durability level of the same, or greater, order as a building), cleanability, maintenance and 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 ceramic tiling shall be damaged by the required compliance with the environmental sustainability criteria specified in the previous section. Ceramic tiling and social housing: the cost/benefit ratio of ceramic tiling is coherent with the needs and requirements of social housing: the cost of tiling (material and installation) is counterbalanced by a high durability, low maintenance and service costs, good functionality (of course, provided that tiling has been correctly designed and installed), high level of user safety against risks of contamination, accidents, etc.

6.3.2 Product quality, performance level, fitness for use

6.3.2.1 General

Ceramic tiles shall be fit for their intended use. This means that ceramic tiles shall be characterized by essential characteristics, basically associated to the objective of safety of the users of a building. These essential characteristics are correlated to the tiling destination (internal or external, floor, wall or ceiling covering), and cover both mechanical performance, durability and safety aspects. These characteristics may include reaction to fire, breaking strength, slipperiness, durability (frost resistance), release of dangerous substances, bond strength adhesion, etc.

The correct specification of tiles, as well as of the tiling system, in the frame of ceramic tiling design, is based on a careful and documented comparison of the tiles and tiling materials mechanical, chemical and hygro-thermal performance level, to the expected mechanical, chemical and hygro-thermal requirements of the destination environment.

The possible destination of ceramic tiles is substantially based on their respective performance level.

6.3.2.2 Requirements for the evaluation

6.3.2.2.1 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.

— Tile: meets or exceeds ISO 13006 [YES/NO].

Mandatory requirements: YES

6.4 Social criteria

6.4.1 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 ceramic tiles 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.

6.4.2 Occupational health and safety in manufacture

6.4.2.1 General

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

6.4.2.2 Requirements for the evaluation

6.4.2.2.1 Information of 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

6.4.2.2.2 Dust suction line(s) with particulate filtration in each of the relevant section 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 requirement: YES

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

The manufacturer shall give evidence that periodic audits are carried out and recorded at least every 4 years, with the indication of the following results, methods adopted and laboratories involved, per section of the manufacturing unit. See Table 23.

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 employers' controls.

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

Table 23 — Multirating requirements

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

6.4.2.2.4 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 specified activities/functions. See Table 24.

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.

Table 24 — Multirating requirements

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

6.4.2.2.5 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 45001with a minimum requirement of establish, implement and maintain 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 25.

Table 25 — Multirating requirements

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

6.4.2.2.6 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 % of the 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 requirement: YES

6.4.3 Health and safety prior and during installation

6.4.3.1 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.

6.4.3.2 Requirements for the evaluation

6.4.3.2.1 Information provided to the tile merchants and installers

Calculation: the manufacturer shall provide information and guidelines on the correct and safe handling procedures as dictated by the weight and size of the tile and its carton.

The manufacturer should also provide information and guidelines on safe tile cutting procedures.

Mandatory requirement: YES

6.4.3.2.2 Materials safety data sheets

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

Mandatory requirement: YES

6.4.4 Health and safety in use

6.4.4.1 General

Health and safety in use are significantly associated to:

— materials - ceramic tiles - quality and performance,

— correct specification of materials,

— correct design and installation procedures,

— correct maintenance and cleaning materials and procedures.

6.4.4.2 Requirements for the evaluation

6.4.4.2.1 Information provided to the user on user friendly tiling

Calculation: the manufacturer shall provide information and/or guidelines, tailored on the user needs and competence, about the correct use and maintenance of ceramic tiling surface.

Mandatory requirement: YES

6.4.5 Labour agreement

6.4.5.1 General

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

6.4.5.2 Requirements for the evaluation

6.4.5.2.1 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 % of the 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 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 requirement: YES

7 Classification and designation

7.1 Approach

As specified in Clause 6, the sustainability criteria can be classified in the following categories:

— **Mandatory criteria**: N° 15 "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° 23 multirating, voluntary (**V**) criteria, classified in 3 categories – **V1**, **V2** and **V3** - as reported in 5.1. 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 23 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 23 multirating criteria above is applicable to any type of product or production. All of these 23 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 6.2.2.2.3 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.

EXAMPLE The applicant chooses only one of the 4 possibilities reported in the table below.

Environmental Requirement 6.2.3.2.8 PM emission factor through emission into the atmosphere	PM Emissions into the atmosphere -"from raw materials to final product"	PM emission factor	g/m^2
			g/t
	-"from shaping to final product"	PM emission factor	g/m^2
			g/t

For this requirement, 4 options are proposed, according to the unit of measurement (g/m^2 or g/kg), and according as well to the manufacturing cycle of the product/production of interest.

7.2 Final rating calculation

The base document is Annex A, Table A.5, 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 5.1, the mandatory requirements do not contribute to the final rating.

The rating for each of the 23 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.5 to A.8;

— 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 (14) to (16):

— $$a_{ave,\,V1} = (1/7) \times \sum V_{1i} \qquad (i = 1 - 7) \tag{14}$$

— $$a_{ave,\,V2} = (1/7) \times \sum V_{2i} \qquad (i = 1 - 7) \tag{15}$$

— $$a_{ave,\,V3} = (1/9) \times \sum V_{3i} \qquad (i = 1 - 9) \tag{16}$$

where

V_{1i} are the voluntary pass/fail requirements (V1);

V_{2i} are the voluntary multirating managerial requirements (V2);

V_{3i} are the voluntary multirating quantitative and performance requirements (V3).

NOTE 1 Each 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 7.1 using Formula (17):

$$S_{ra} = [1/(1 + 3 + 6)] \times [(1 \times a_{ave,\,V1}) + (3 \times a_{ave,\,V2}) + (6 \times a_{ave,\,V3})] \tag{17}$$

NOTE 2 The S_{ra} can also range from 100 % and 130 %.

7.3 Classification

On the base of the S_{ra} calculated, each individual product/production shall be deemed as conformant to this document if the following criteria are met:

1. all mandatory requirements shall be satisfied throughout the document;
2. a minimum SR of 117,5 % shall be achieved for multirating requirements.

7.4 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 S_{ra} of 117,5 % for multirating voluntary requirements.

Annex A
(normative)

Criteria for sustainable products

A.1 Requirements

The list of all the requirements are reported in Tables A.1, A.2 and A.3 as follows:

Table A.1 — Environmental requirements

Criteria		M	V1	V2	V3
6.2.2 **Raw materials**	6.2.2.2.1 Materials records	■			
	6.2.2.2.2 Transport – Indigenous raw materials				■
	6.2.2.2.3 Recycled and/or reclaimed waste content				■
	6.2.2.2.4 Raw materials and outsourced services environmental buying agreement	■			
6.2.3 **Manufacture**	6.2.3.2.1 Environmental management system (EMS)			■	
	6.2.3.2.2 Energy efficiency management system (EEMS)			■	
	6.2.3.2.3 Cogeneration or combined heat and power systems		■		
	6.2.3.2.4 Heat recovery systems		■		
	6.2.3.2.5 Renewable energy usage		■		
	6.2.3.2.6 Fuel type used	■			
	6.2.3.2.7 Specific fuel consumption for firing kilns				■
	6.2.3.2.8 PM emission factor through emissions into the atmosphere				■
	6.2.3.2.9 Fluorides emission factor from firing emissions into the atmosphere				■
	6.2.3.2.10 Process waste recycle/reuse factor				■
	6.2.3.2.11 Internal or external reuse/ recycling of packaging materials		■		
	6.2.3.2.12 Reuse/ recycling or separate collection of other materials	■			
	6.2.3.2.13 Specific fresh water consumption				■
	6.2.3.2.14 Waste water discharge				■

Table A.1 *(continued)*

Criteria		M	V1	V2	V3
6.2.4 **Distribution and installation**	6.2.4.2.1 Weight of packaging		■		
	6.2.4.2.2 Recycled materials content of packaging materials (RMC)			■	
	6.2.4.2.3 Environmental property of packaging materials		■		
	6.2.4.3.1 Environmentally friendly installation. Guidance from manufacturer	■			
6.2.5 **Use**	6.2.5.2.1 Environmentally friendly routine maintenance/ service of ceramic tiling	■			
	6.2.5.2.2 Product VOC emission criteria				■
6.2.6 **End of life**	6.2.6.2.1 Environmentally friendly demolition of ceramic tiling	■			
6.2.7 **Product environmental mark/labelling**	6.2.7.2.1 External Type I		■		
	6.2.7.3.1 Type III environmental product declaration (EPD)			■	

Table A.2 — Economic and functional requirements

Criteria		M	V1	V2	V3
6.3.2 **Product quality, performance level, fitness for use**	6.3.2.2.1 Product compliance with the relevant product standards and manufacturer declarations.	■			

Table A.3 — Social requirements

Criteria		M	V1	V2	V3
6.4.2 **Health and safety in manufacture**	6.4.2.2.1 Information of the workers about the exposure risks to chemical and physical agents	■			
	6.4.2.2.2 Dust suction line(s) with particulate filtration in each of the relevant section of the production unit	■			
	6.4.2.2.3 Periodical audits			■	
	6.4.2.2.4 Personal protective equipment (PPE)			■	
	6.4.2.2.5 Occupational health and safety management system (OHSMS)			■	
	6.4.2.2.6 Health and safety raw materials and outsourced services buying agreement	■			
6.4.3 **Health and safety prior and during installation**	6.4.3.2.1 Information provided to the tile merchant and the tile installer	■			
	6.4.3.2.2 Materials safety data sheets	■			
6.4.4 **Health and safety in use**	6.4.4.2.1 Information provided to the user on user friendly tiling	■			

Table A.3 *(continued)*

Criteria		M	V1	V2	V3
6.4.5 Labour agreement	6.4.5.2.1 Raw materials and outsourced services buying agreement/labour compliance	■			

The total number of requirements is **38**, distributed as follows in the classes introduced in 5.1:

M: N° 15	V1: N° 7	V2: N°7	V3: N°9

A.2 Indigenous raw materials: geographical example of calculation

For the calculation all the linear distance between the site of extraction of raw materials and the manufacturing site shall be taken into account. As an example, a geographical example is reported taking into account the transport of clay from the quarry located in Uzak (Turkey) and the manufacturing site in Sassuolo (Italy).

Itinerary

Uzak (Turkey) - Izmir (Turkey) = 200 km by truck

Izmir (Turkey) - Ravenna (Italy) = 1 410 km by ship

Ravenna (Italy) - Dinazzano (Italy) = 117 by rail

Dinazzano (Italy) - Sassuolo (Italy) = 4 km by truck

Calculation

Total distance = 200 + (1 410 + 117) × 0,25 + 4 = 586 km

A.3 VOC Emission method

Test specimens shall be collected, prepared, and managed in accordance with ISO 16000-11, and shall be conditioned for 10 days prior to testing in accordance with ISO 16000-9. Following the 10-day conditioning period, the specimen shall be inserted into a small-scale environmental chamber, designed following ISO 16000-9. A 96-h test shall commence using the following parameters:

— chamber volume: (0,05 to 1,0) m^3;

— loading factor: (0,3 to 1,0) $m^2\ m^{-3}$;

— air exchange rate: (1,0 ± 0,05) h^{-1};

— area specific flow rate: (1,0 – 3,3) $m\ h^{-1}$;

— temperature: (23 ± 1) °C;

— relative humidity: 50 ± 5 %.

After 96 h, air sampling within the chamber shall be conducted to characterize VOC emissions which have been collected. For each target VOC, formaldehyde, or other carbonyl compound that has been detected, the product's area-specific emission factor, $F_{E,A}$ (µg m^{-2} h^{-1}), shall be calculated using Formula (A.1):

$$F_{E,A} = Q \times (c_{ta} - c_0) / A_{ch} \quad \text{(A.1)}$$

where

$F_{E,A}$ is the product's area-specific emission factor, in µg m^{-2} h^{-1};

Q is the measured flow rate of air into the chamber, in m^3 h^{-1};

c_{ta} is the measured concentration of the target VOC, formaldehyde or other carbonyl compound, in µg m^{-3};

c_0 is the corresponding measured concentration in the chamber operating without a test specimen, in µg m^{-3};

A_{ch} is the exposed surface area of the test specimen in the chamber, in m^2.

c_{ta} typically are not detectable below 2 µg m^{-3}. Where c_{ta} cannot be detected, $F_{E,A}$ shall be deemed "below quantifiable level," or "BQL".

Using the product's calculated area-specific emission factor, $F_{E,A}$, for each target VOC, formaldehyde or other carbonyl compound, estimate its emission concentration within the context of a building, c_B (µg m^{-3}), using the Formula (A.2):

$$c_B = F_{E,A} / q_A \quad \text{(A.2)}$$

where

q_A is the area-specific air flow rate, depending on the exposure scenario, in m h^{-1}:

standard classroom floor covering: q_A = 2,14 m h^{-1};

standard classroom wall covering: q_A = 2,02 m h^{-1};

standard private office floor covering: q_A = 1,86 m h^{-1};

standard private office wall covering q_A = 0,62 m h^{-1};

single family residence floor covering: q_A = 0,602 m h^{-1};

single family residence wall covering: q_A = 0,226 m h^{-1}.

If the relevant exposure scenario is not declared prior to testing, the default scenario is "private office floor covering."

The maximum allowable estimated concentration, c_B, for each target VOC, formaldehyde or other carbonyl compound is reported in Table A.4 as follows.