BS EN 16578:2016

BSI Standards Publication

Ceramics sanitary appliances — Sustainability assessment

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National foreword

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The UK participation in its preparation was entrusted to Technical Committee B/503, Sanitary appliances.

A list of organizations represented on this committee can be obtained on request to its secretary.

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Published by BSI Standards Limited 2016

ISBN 978 0 580 82572 9

ICS 91.140.70

Compliance with a British Standard cannot confer immunity from legal obligations.

This British Standard was published under the authority of the Standards Policy and Strategy Committee on 29 February 2016.

Amendments/corrigenda issued since publication

Date	Text affected

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN 16578

February 2016

ICS 91.140.70

English Version

Ceramics sanitary appliances - Sustainability assessment

Appareils sanitaires en céramique - Evaluation de durabilité

Keramische Sanitärausstattungsgegenstände - Beurteilung der Nachhaltigkeit

This European Standard was approved by CEN on 13 December 2015.

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EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

CEN-CENELEC Management Centre: Avenue Marnix 17, B-1000 Brussels

Ref. No. EN 16578:2016 E

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European foreword

This document (EN 16578:2016) has been prepared by Technical Committee CEN/TC 163 “Sanitary appliances”, the secretariat of which is held by UNI.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by August 2016, and conflicting national standards shall be withdrawn at the latest by August 2016.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN [and/or CENELEC] shall not be held responsible for identifying any or all such patent rights.

This document supports the unified approach for the assessment of sustainability of ceramic sanitary appliances, i.e. WC pans and WC suites, urinals, wash basins, bidets and communal washing troughs, in the light of the document CPR 06/10/1 of European Commission - Enterprise and Industry - Sustainable Industrial Policy and Construction.

According to the CEN-CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

Introduction

This European Standard supports the (harmonized) European Standards on ceramic sanitary appliances elaborated by CEN/TC 163 on assessing the sustainability for these products.

This European Standard provides a system for sustainability assessment of ceramic sanitary appliances using a life cycle approach, featuring qualitative and quantitative indicators for ecologic, economic and social performance of sanitary ceramic appliances. The purpose of this European Standard is to provide requirements and classification values for the assessment of the sustainability of ceramic sanitary appliances.

Selected parameters assessed in accordance with this standard represent the main parameters defined in EN 15804. This European Standard may be used to support environmental building assessment and environmental product declarations (EPDs).

The structure and the parameters of EN 15804 mandatory requirements from information modules A1 to A3 - are used as a basis for the ecological criteria of this European Standard.

A system with sustainability classes has been introduced to express the performance of ceramic sanitary appliances. The link between these classes and the assessment of the products form a framework of evaluation schemes.

Evaluation schemes enable the comparison of different ceramic sanitary appliances.

NOTE EPDs based on EN 15804 are not comparative assertions (see EN 15804:2012+A1:2013, 5.1). These EPDs are necessary for environmental assessment of building only.

1 Scope

This European Standard specifies sustainability requirements together with assessment methods and evaluation schemes for ceramic sanitary appliances, i.e. WC pans and WC suites in accordance with EN 997, urinals in accordance with EN 13407, wash basins in accordance with EN 14688, communal washing troughs in accordance with EN 14296 and bidets in accordance with EN 14528.

NOTE This European Standard may be applicable to other ceramic sanitary appliances.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EN 997, *WC pans and WC suites with integral trap*

EN 12056 (all parts), *Gravity drainage systems inside buildings*

EN 13407, *Wall-hung urinals - Functional requirements and test methods*

EN 14296, *Sanitary appliances - Communal washing troughs*

EN 14528, *Bidets - Functional requirements and test methods*

EN 14688, *Sanitary appliances - Wash basins - Functional requirements and test methods*

3 Terms and definitions

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

3.1
abiotic depletion potential for fossil resources
measures the gradual depletion of non-renewable fossil resources

Note 1 to entry: An example is raw oil.

3.2
abiotic depletion potential for non-fossil resources
measures the gradual depletion of non-renewable non-fossil resources

Note 1 to entry: An example is clay.

3.3
acidification potential of land and water
sums contributions of sulphuric acid and nitric acid to acid rain, acid snow and acid deposition

Note 1 to entry: It includes sulphur oxides (SO_2, SO_3) and nitrogen oxides (N_2O, NO and NO_2).

3.4
auxiliary
production tool

EXAMPLE Casting moulds, sponges and supports

3.5
ceramics
inorganic non-metallic material which is typically moulded from raw materials at room temperature and gains its characteristic physical properties during a firing process (after the moulding)

Note 1 to entry: The term “ceramic materials for sanitary appliances” covers both vitreous china and fine fire clay materials.

3.6
construction product
item manufactured or processed for incorporation in construction works

[SOURCE: EN 15804:2012+A1:2013]

3.7
consumption
use of materials or energy within a defined time frame

3.8
cost in use
expenses incurred while using the product

3.9
declared unit
quantity of a construction product for use as a reference unit

Note 1 to entry: Usual units for mass is t, for quantity is piece.

3.10
depletion potential of the stratospheric ozone layer
measures depletion of stratospheric ozone needed for protection against UV radiation

Note 1 to entry: This includes chlorofluorocarbons (CFCs).

3.11
energy management
system to monitor, control and evaluate the type of power supply as well as the energy consumption of a product

3.12
eutrophication potential
measures dissolved oxygen depletion by undesirable forms of biomass, such as algae

Note 1 to entry: This includes various forms of nitrogen and phosphorus.

3.13
formation potential of tropospheric ozone photochemical oxidants
puts all smog-producing chemicals on the same equivalent

3.14
glazed ceramic
ceramic body with a surface layer of silicon oxide compound applied before the firing process and chemically bonded during firing

Note 1 to entry: The glaze deemed to be a part of the ceramics and not a separate coating.

3.15
global warming potential
puts all greenhouse gases on the same denominator

Note 1 to entry: Greenhouse gases include CO_2, CH_4, N_2O and CFCs.

3.16
gypsum
dehydrate natural gypsum as used for plaster moulds

3.17
hazardous substance
solid, liquid or gas that can harm people, other living organisms, property or the environment

3.18
life cycle
consecutive and interlinked stages of a construction products life, from raw material acquisition or generation from natural resources to final disposal

3.19
maintenance
all actions to maintain or repair in order a product to continue its declared function

3.20
production
industrial process consisting of different steps in the manufacture of goods

3.21
production system
collection of unit processes with elementary and product flows, performing one or more defined functions, and which determines the life cycle of a product

3.22
raw material
single material or a mixture of different materials (e.g. feedstock, ceramic body) as being the basic material of which a product is manufactured

3.23
recycling
use of material as secondary material outside the boundary of the production system

Note 1 to entry: Examples are recycled gypsum of plaster moulds.

3.24
renewable energy
energy from renewable non-fossil sources

Note 1 to entry: Non-fossil sources are, for example, wind, solar, aerothermal, geothermal, hydrothermal and ocean energy, hydropower, biomass, landfill gas, sewage treatment plant gas, electricity generation through exhaust gas heat etc.

3.25
safety in use
characteristic of the level of risks associated with the installation and use of the product

3.26
secondary fuel
fuel recovered from previous use or from waste which substitutes primary fuels

3.27
secondary material
material recovered from previous use or from waste which substitutes primary materials

Note 1 to entry: Secondary material is measured at the point where the secondary material enters the production system from another production system.

Note 2 to entry: Materials recovered from previous use or from waste from one production system and used as an input in another production system are secondary materials e.g. use of milled scrap technical ceramics as raw material for ceramics sanitary appliances.

Note 3 to entry: Examples for secondary materials (to be measured at the boundary of the production system) are recycled sanitary appliances, tiles or technical ceramics.

3.28
transport
movement of goods (e.g. products, raw materials) from one location to another

3.29
total production
means the production of saleable ceramic sanitary appliances

Note 1 to entry: Usual unit is t/a.

3.30
user friendly
characteristic of the level of product ease of use

3.31
waste management
collection, transport, processing, recycling or disposal of waste materials and their monitoring and recycling

3.32
water saving
reduction in water use accomplished by implementation of water conservation, water reduction or water efficiency measures

4 Assessment

4.1 General

The criteria are based on the “three pillar model” of sustainability as stipulated in the World Summit Conference 2005 [4]. These “three pillars” (ecological, economic and social requirements) are generally used in terms of sustainability.

NOTE 1 Pillar 1 “Ecological requirements” covers the applicable requirements from information modules A1 to A5 of EN 15804.

Pillar 2 “Economical requirements” covers the applicable requirements from information modules B1, B6 and B7 of EN 15804.

Pillar 3 “Social requirements” covers further applicable requirements from information modules B2 to B5 of EN 15804.

This clause describes the detailed criteria and defines the requirements for the evaluation of the sustainability of ceramic sanitary appliances.

NOTE 2 The assessment of ceramic sanitary appliances is based on applicable product category rules in accordance with EN 15804.

The assessment shall be carried out per production site or per defined group/network of production sites (see Annex A).

The assessment shall take into account at least 90 % of each input or output of material(s) or energy and a correction to 100 % shall be made for each value. For example for 4.2.2.1: In case of 95 % assessed renewable energy consumption, then also 95 % of the production mass shall be taken into account.

The assessment period shall cover a period of 12 subsequent months. All parameters shall be determined within the same assessment period. All values for calculating the parameter of the various criteria are to be based on the assessment period, e.g. W_t is the total production mass over the assessment period. The assessment is valid for the following 5 years maximum.

For the purposes of assessment, the manufacturer's products may be grouped into families, where it is considered that the results for the assessed characteristics from any one product within the family are representative for the same characteristics for all products within that same family, e.g. WC of type 5, WC of type 6, WCs suites of type 6 or wash basins.

The evaluated result for each requirement shall be reported in the evaluation scheme in Annex B.

In the case when a requirement is not applicable for one product or product group, e.g. flush volume for wash basins, it has to be given “not applicable” for non-applicability into the respective line of the fields “value” and “rating”.

This assessment may be used to support environmental building assessment.

4.2 Ecological criteria

4.2.1 General

The ecological pillar covers the preservation of resources. For ceramic sanitary appliances, sustainability means optimised use of resources; optimized exploitation of raw materials, (energy-) optimised production and optimised transport (delivery chain).

Statements in 4.2.2 to 4.2.4 cover the relevant ecological criteria for the cradle to gate stage. They take into account raw material extraction and processing, processing of secondary material input (e.g. recycling processes), transport to the manufacturer, manufacturing, including provision of all materials, products and energy, as well as waste processing up to the end-of waste state or disposal of final residues during the product stage including the relevant characterization factors, where applicable.

The ecological criteria described in 4.2.5 concerns the construction process consisting of transport and installation.

NOTE Characterization factors are taken from database CML-IA, version 4.1 of October 2012 from Institute of Environmental Sciences, Leiden University (NL) or equivalent or the attachment A1:2013 of EN 15804:2012.

Further not mentioned characterization factors are available in amendments of EN 15804:2012, e.g. EN 15804:2012+A1:2013.

When assessing the ecological criteria, parameters are declared per ton (1 000 kg) of ceramic sanitary ware.

4.2.2 Parameters describing the resource use

4.2.2.1 Use of renewable primary energy (excluding renewable primary energy resources used as raw materials)

This is the proportion of the total renewable primary energy consumption per total production weight.

The renewable primary energy shall be calculated using Formula (1).

$$E_{rp} = E_{rpt}/W_t \quad (1)$$

where

E_{rp} is the renewable primary energy rate, in MJ/t;

E_{npt} is the total renewable primary energy consumption, in MJ;

W_t is the total production mass over the assessment period, in t.

4.2.2.2 Use of renewable primary energy resources used as raw materials

Not applicable for the sustainability assessment of ceramic sanitary appliances.

4.2.2.3 Total use of renewable primary energy resources (primary energy and primary energy resources used as raw materials)

The sum of used renewable primary energy resources is the sum of 4.2.2.1 and 4.2.2.2.

4.2.2.4 Use of non-renewable primary energy (excluding non-renewable primary energy resources used as raw materials)

This is the proportion of the total non-renewable primary energy consumption per total production weight.

The non-renewable primary energy shall be calculated using Formula (2).

$$E_{np} = E_{npt}/W_t \quad (2)$$

where

E_{np} is the non-renewable primary energy rate, in MJ/t;

E_{npt} is the total non-renewable primary energy consumption, in MJ;

W_t is the total production mass over the assessment period, in t.

4.2.2.5 Use of non-renewable primary energy resources used as raw materials

Not applicable for the sustainability assessment of ceramic sanitary appliances.

4.2.2.6 Total use of non-renewable primary energy resources (primary energy and primary energy resources used as raw materials)

The sum of non-renewable primary energy resources is the sum of 4.2.2.4 and 4.2.2.5.

4.2.2.7 Use of secondary material

Not applicable for the sustainability assessment of ceramic sanitary appliances.

4.2.2.8 Use of renewable secondary fuels

Not applicable for the sustainability assessment of ceramic sanitary appliances.

4.2.2.9 Use of non-renewable secondary fuels

Not applicable for the sustainability assessment of ceramic sanitary appliances.

4.2.2.10 Use of net fresh water

This is the proportion of the net fresh communal water consumption per total production weight.

The net fresh water rate shall be calculated using Formula (3).

$$F_p = F_{pt}/W_t \quad (3)$$

where

F_p is the net fresh water rate, in m^3/t;

F_{pt} is the net total fresh water consumption, in m^3;

W_t is the total production mass over the assessment period, in t.

4.2.3 Parameters describing output flows and waste categories

4.2.3.1 Hazardous waste disposed

This is the proportion of the total hazardous waste disposed per total production weight.

The hazardous waste disposed shall be calculated using Formula (4).

$$H_p = H_{tp}/W_t \quad (4)$$

where

H_p is the total hazardous waste rate, in kg/t;

H_{tp} is the total hazardous waste disposed, in kg;

W_t is the total production mass over the assessment period, in t.

NOTE An informative database of European and national provisions on dangerous substances is available at the Construction website on EUROPA.

4.2.3.2 Non-hazardous waste disposed

This is the proportion of the total non-hazardous waste disposed per total production weight.

NOTE Examples for non-hazardous waste of ceramic sanitary appliances production are plaster moulds and ceramics materials which are not recirculated into the production process.

The non-hazardous waste disposed shall be calculated using Formula (5).

$$Z_p = Z_{tp}/W_t \quad (5)$$

where

Z_p is the non-hazardous waste rate, in kg/t;

Z_{tp} is the total non-hazardous waste disposed, in kg;

W_t is the total production mass over the assessment period, in t.

4.2.3.3 Radioactive waste disposed

This is the proportion of the total radioactive waste disposed per total production weight.

The radioactive waste disposed shall be calculated using Formula (6).

$$R_p = R_{tp}/W_t \quad (6)$$

where

R_p is the radioactive waste rate, in kg/t;

R_{tp} is the total radioactive waste disposed, in kg;

W_t is the total production mass over the assessment period, in t.

4.2.3.4 Components for re-use

Not applicable for the sustainability assessment of ceramic sanitary appliances.

4.2.3.5 Materials for recycling

This is the proportion of the total of materials for recycling per total production weight.

NOTE Materials for recycling are secondary materials (see EN 15804:2012+A1:2013, Annex B) leaving the manufacturing process of ceramic sanitary appliances which are reprocessed, reused and/or recycled by third parties, e.g. plaster moulds.

The materials for recycling shall be calculated using Formula (7).

$$M_p = M_{tp}/W_t \quad (7)$$

where

M_p is the materials for recycling rate, in kg/t;

M_{tp} is the total materials for recycling, in kg;

W_t is the total production mass over the assessment period, in t.

4.2.3.6 Materials for energy recovery

Not applicable for the sustainability assessment of ceramic sanitary appliances.

4.2.3.7 Exported electrical energy

Not applicable for the sustainability assessment of ceramic sanitary appliances.

4.2.3.8 Exported thermal energy

Not applicable for the sustainability assessment of ceramic sanitary appliances.

4.2.4 Parameters describing environmental impact

4.2.4.1 General

The characterization factors are taken from EN 15804.

4.2.4.2 Global warming potential

The global warming potential is mainly influences by the emission of methane (CH_4), carbon dioxide (CO_2), nitrous oxide (N_2O) to air.

The global warming potential is the proportion of weighted emissions to air of the above mentioned substances per total production weight.

The global warming potential shall be calculated using Formula (8).

$$GWP = (25\, m_{CH_4} + m_{CO_2} + 300\, m_{N_2O}) / W_t \quad (8)$$

where

GWP is the global warming potential, in kg CO_2–equivalent/t;

m_{CH_4} is the total CH_4 emission to air, in kg/a;

m_{CO_2} is the total CO_2 emission to air, in kg/a;

m_{N_2O} is the total N_2O emission to air, in kg/a;

W_t is the total production mass over the assessment period, in t.

NOTE The characterization factors are taken from EN 15804:2012+A1:2013, Annex C, Table C.5.

4.2.4.3 Depletion potential of the stratospheric ozone layer

The depletion potential of the stratospheric ozone layer is mainly influences by the emission to air of HCFC-123, HCFC-124, HCFC-141b, HCFC-142b and HCFC-22.

The depletion potential of the stratospheric ozone layer is the proportion of weighted emissions to air of the above mentioned substances per total production weight.

The depletion potential of the stratospheric ozone layer shall be calculated using Formula (9).

$$DPS = (0{,}02\, m_{HCFC-123} + 0{,}02\, m_{HCFC-124} + 0{,}12\, m_{HCFC\text{-}141b} + 0{,}07\, m_{HCFC\text{-}142b} + 0{,}05\, m_{HCFC-22}) / W_t \quad (9)$$

where

DPS is the depletion potential of the stratospheric ozone layer, in kg CFC11–equivalent/t;

$m_{HCFC\text{-}123}$ is the total HCFC-123 emission to air, in kg/a;

$m_{HCFC\text{-}124}$ is the total HCFC-124 emission to air, in kg/a;

$m_{HCFC\text{-}141b}$ is the total HCFC-141b emission to air, in kg/a;

$m_{HCFC\text{-}142b}$ is the total HCFC-142b emission to air, in kg/a;

$m_{HCFC\text{-}22}$ is the total HCFC-22 emission to air, in kg/a;

W_t is the total production mass over the assessment period, in t.

NOTE The characterization factors are taken from EN 15804:2012+A1:2013, Annex C, Table C.4.

4.2.4.4 Acidification potential of land and water

The acidification potential is mainly influences e.g. by the emission to air of the nitrogen oxides (NO_2, NO, NO_x), ammonia (NH_3) and sulphur dioxide (SO_2).

The acidification potential is the proportion of weighted emissions to air of the above mentioned substances per total production weight.

The acidification potential shall be calculated using Formula (10).

$$AP = 0{,}5\, m_{NO_2} + 0{,}76\, m_{NO} + 1{,}6\, m_{NH_3} + 1{,}2\, m_{SO_2}) / W_t \quad (10)$$

where

AP is the acidification potential, in kg SO_2-equivalent/t;

m_{NO_2} is the total NO_2 and NO_x emission to air, in kg/a;

m_{NO} is the total NO emission to air, in kg/a;

m_{NH_3} is the total NH_3 emission to air, in kg/a;

m_{SO_2} is the total SO_2 emission to air, in kg/a;

W_t is the total production mass over the assessment period, in t.

NOTE The characterization factors are taken form EN 15804:2012+A1:2013, Annex C, Table C.3.

4.2.4.5 Eutrophication potential

The eutrophication potential is mainly influences by the emission to water or air of nitrogen and the nitrogen oxides (N, NO, NO_2, NO_x), phosphor (P), chemical oxygen demand (COD), ammonia (NH_3) and ammonium (NH_4^+).

The eutrophication potential is the proportion of weighted emissions to water or air of the above mentioned substances per total production weight.

The eutrophication potential shall be calculated using Formula (11).

$$EP = (0{,}13 m_{NO_x} + 0{,}42\, m_N + 0{,}2\, m_{NO} + 3{,}06\, m_P + 0{,}022\, COD + 0{,}35\, m_{NH3} + 0{,}35\, m_{NH_4^+} + 0{,}1\, m_{NO_3^-} + 0{,}13\, m_{NO_2^-}) / W_t \quad (11)$$

where

EP is the eutrophication potential, in kg PO_4^{3-}-equivalent/t;

m_N is the total nitrogen emission to air, in kg/a;

m_{NO_x} is the total NO_x emission to air, in kg/a;

m_{NO} is the total NO emission to air, in kg/a;

$m_{NO_2^-}$ is the total NO_2 emission to air, in kg/a;

$m_{NO_3^-}$ is the total NO_3 emission, in kg/a;

m_P is the total phosphorous emission to water, in kg/a;

COD is the total chemical oxygen demand emission, in kg/a;

$m_{NH_3^+}$ is the total NH_3 emission, in kg/a;

$m_{NH_4^+}$ is the total NH_4^+ emission, in kg/a;

W_t is the total production mass over the assessment period, in t.

NOTE The characterization factors are taken form EN 15804:2012+A1:2013, Annex C, Table C.6.

4.2.4.6 Formation potential of tropospheric ozone photochemical oxidants

The formation potential of tropospheric ozone photochemical oxidants is mainly influences by the emission to air of oil.

The formation potential of tropospheric ozone photochemical oxidants is the proportion of weighted emissions to air of oil per total production weight.

The formation potential of tropospheric ozone photochemical oxidants shall be calculated using Formula (12).

$$PO = 0{,}4\ m_{\mathrm{oil}}/W_{\mathrm{t}} \qquad (12)$$

where

PO is the formation potential of tropospheric ozone photochemical oxidants, in kg ethene-equivalent/t;

m_{oil} is the total consumption of oil, in kg/a;

W_{t} is the total production mass over the assessment period, in t.

NOTE The formation of ozone in the lower atmosphere is promoted by the presence of NO_x and hydrocarbons (not methane). The model used assumes that only the hydrocarbon stream has to be taken into account.

Aliphatic hydrocarbons are produced primary during sintering of ceramic materials. With reference to NF P01–10 an average characterization factor for oil (0,40 kg ethane-equivalent per kilogram of oil) is used in this standard.

4.2.4.7 Abiotic depletion potential for non-fossil resources

Abiotic depletion potential (ADP) for non-fossil resources is mainly influences by the consumption of

— slip (consisting of clay, feldspar, quartz and kaoline);

— glaze (composition given below);

— plaster mould (gypsum).

All raw materials need to be included in the ADP calculation. However, where slip, glaze and plaster are calculated, the ADP values within this standard can be used to satisfy the influence of these raw material components.

The ADP characterization factors for slip are based on the average chemical composition of raw materials typical for manufacturing ceramic sanitary appliances and those which may be chosen from EN 15804.

The used ADP characterization factors are only valid for generic components within the following range:

— clay: 65 % to 80 % silica (SiO_2) and 20 % to 35 % aluminium oxide (Al_2O_3);

— kaoline: 50 % to 65 % silica (SiO_2) and 35 % to 50 % aluminium oxide (Al_2O_3);

— quartz: 80 % to 95 % silica (SiO_2) and 5 % to 20 % aluminium oxide (Al_2O_3);

— feldspar: 50 % to 70 % silica (SiO_2) and 10 % to 30 % aluminium oxide (Al_2O_3), potassium (K) and sodium (Na) in total 10 % to 20 %.

The ADP characterization factors for glaze are based on the average chemical composition of raw materials typical for manufacturing ceramic sanitary appliances and those which may be chosen from EN 15804.

The used ADP characterization factors are only valid for generic components with the following range:

— feldspar: 50 % to 70 % SiO_2, 10 % to 30 % AI_2O_3, K and Na in total 10 % to 20 %;

— quartz: 80 % to 95 % SiO_2 and 5 % to 20 % AI_2O_3;

— kaoline: 50 % to 65 % SiO_2 and 35 % to 50 % AI_2O_3.

A typical composition for white sanitary glaze is:

40 % feldspar;

27 % quartz;

10 % kaoline;

7 % chalk;

4 % zinc oxide (ZnO);

4 % barium carbonate ($BaCO_3$);

2 % lithium oxide (LiO_2);

6 % stannic oxide (SnO_2).

The source for ADP characterization factor of gypsum (plaster mould(s)) is the "Datenprojekt Grundsätze Gips …" [2].

The abiotic potential for non-fossil resources is the proportion of weighted consumption of the above mentioned substances per total production weight.

The abiotic depletion potential for non-fossil resources shall be calculated using Formulae (13) to (16).

$$ADP = ADP_{\text{slip}} + ADP_{\text{glaze}} + ADP_{\text{plaster}} + ADP_{\text{resin}} \quad (13)$$

with:

$$ADP_{\text{slip}} = (2{,}7 \cdot 10^{-10}\, m_{\text{clay}} + 1{,}5 \cdot 10^{-10}\, m_{\text{kaoline}} + 3{,}05 \cdot 10^{-11}\, m_{\text{quartz}} + 1{,}49 \cdot 10^{-9}\, m_{\text{feldspar}}) / W_t \quad (14)$$

$$ADP_{\text{glaze}} = (1{,}49 \cdot 10^{-9}\, m_{\text{feldspar}} + 3{,}05 \cdot 10^{-11}\, m_{\text{quartz}} + 1{,}5 \cdot 10^{-10}\, m_{\text{kaoline}} + 0{,}081\, m_{\text{chalk}} + 5{,}38 \cdot 10^{-4}\, m_{\text{ZnO}} + 6{,}04 \cdot 10^{-6}\, m_{BaCO_3} + 1{,}15 \cdot 10^{-5}\, m_{LiO_2} + 1{,}62 \cdot 10^{-2}\, m_{SnO_2}) / W_t \quad (15)$$

$$ADP_{\text{plaster}} = [0{,}81\ (m_{\text{gi}} - m_{\text{gr}})] / W_t \quad (16)$$

where

ADP is the abiotic depletion potential for non-fossil resources, in kg Sb-equivalent/t;

ADP_{slip} is the abiotic depletion potential for non-fossil resources of slip, in kg Sb-equivalent/t;

ADP_{glaze} is the abiotic depletion potential for non-fossil resources of glaze, in kg Sb-equivalent/t;

$ADP_{plaster}$ is the abiotic depletion potential for non-fossil resources of plaster mould(s), in kg Sb-equivalent/t;

ADP_{resin} is the abiotic depletion potential for non-fossil resources of resin mould(s), in kg Sb-equivalent/t;

m_{clay} is the total clay consumption, in kg/a;

$m_{kaoline}$ is the total kaoline consumption, in kg/a;

m_{quartz} is the total quartz consumption, in kg/a;

$m_{feldspar}$ is the total feldspar consumption, in kg/a;

m_{chalk} is the total chalk consumption, in kg/a;

m_{ZnO} is the total ZnO consumption, in kg/a;

m_{BaCO_3} is the total $BaCO_3$ consumption, in kg/a;

m_{LiO_2} is the total LiO_2 consumption, in kg/a;

m_{SnO_2} is the total SnO_2 consumption, in kg/a;

m_{gi} is the total gypsum consumption for plaster mould(s), in kg/a;

m_{gr} is the total recycled gypsum, in kg/a;

W_t is the total production mass over the assessment period, in t.

4.2.4.8 Abiotic depletion potential for fossil resources

The abiotic depletion potential for fossil resources is influences by consumption of fossil form oil, gas, hard coal and soft coal.

The abiotic depletion potential for fossil resources is the proportion of weighted consumption of fossil resources per total production weight.

The abiotic depletion potential for fossil resources shall be calculated using Formula (17).

$$ADP_F = (0{,}0201\, m_{oil} + 0{,}0187\, m_{gas} + 0{,}0134\, m_{hard\ coal} + 0{,}00671\, m_{soft\ coal}) / W_t \quad (17)$$

where

ADP_F is the abiotic depletion potential for fossil resources, in MJ/t;

m_{oil} is the total consumption of oil, in kg/a;

m_{gas} is the total consumption of natural gas, in m^3/a;

$m_{hard\ coal}$ is the total consumption of hard coal, in kg/a;

$m_{soft\ coal}$ is the total consumption of soft coal, in kg/a;

W_t is the total production mass over the assessment period, in t.

4.2.5 Parameters describing the construction process

4.2.5.1 General

The installation of ceramic sanitary appliances needs to quantifiable resources. In this case, the only parameter to be considered is the transport of the product(s).

4.2.5.2 Average transport distance of sanitary appliances

This is the average transport distance of ceramic sanitary appliance from the production site to the capital of country of destination relating to a distance of 1 000 km.

Not less than 80 % of the weight of total transported ceramic sanitary appliance should be taken into consideration.

The average transport distance of sanitary appliances should be calculated using Formula (18).

$$\overline{D} = \sum_{i=1}^{n} D_{\mathrm{i}} W_{\mathrm{i}} \,/\, \sum_{i=1}^{n} W_{\mathrm{i}} \qquad (18)$$

where

$\overline{D}$ is the average transport distance of ceramic sanitary appliance related to 1 000 km, in km;

D_{i} is the transport distance from production site to country of destination i related to 1 000 km, in km;

W_{i} is the total production mass over the assessment period delivered to country of destination *i*, in t;

i is the number of specific country of destination;

n is the total number of countries of destination taken into account.

4.2.6 Recycling potential

The recycling potential is a parameter describing the supplementary information beyond the building life cycle.

The ceramic sanitary appliances are made out of inert and non-hazardous materials. Therefore, the recycling potential for this kind of materials is 100 %.

The recycling of ceramic sanitary appliances is potentially possible by producing granules. Therefore, the ceramic sanitary appliances will be rated with 100 %.

4.3 Economical criteria

4.3.1 General

An economical sustainability requires a practicable and sustainable economical system with a specific focus on the use of natural resources. The impact of the use of natural resources combined with the costs for the user will be evaluated with the requirements below.

4.3.2 Parameters describing the operational water use

4.3.2.1 General

It is in the general interest to save water. WCs and urinals have to fulfill two conflicting requirements: on one hand to use as less water as possible for cleaning the appliance and, on the other hand, to use as much water as necessary for flushing the drainage system(s) in accordance with EN 12056 series. Different drainage systems are in use in various European countries. This again leads to specific requirements for sanitary appliances. The behaviour of the end user has an equally important influence on water saving.

4.3.2.2 Requirements for the evaluation

4.3.2.2.1 Flush volume of WCs

This is the evaluation of the average flush volume of the WC in accordance with EN 997.

for single flush: $\overline{V_s} = V_f$ (19)

for dual flush: $\overline{V_d} = (V_f + 3V_r)/4$ (20)

where

$\overline{V_s}$ is the average flush volume of the WC for single flush, in l;

$\overline{V_d}$ is the average flush volume of the WC for dual-slush, in l;

V_f is the full-flush volume, in l;

V_r is the reduced flush volume, in l.

NOTE The water consumption during the use stage depends mainly on the user behaviour.

4.3.2.2.2 Flush volume of urinals

This is the evaluation of the flush volume of urinals in accordance with EN 13407.

4.3.3 Parameters describing the life cycle

4.3.3.1 General

Life cycle provides information about the period of life time for its intended use and its specific life cycle costs.

4.3.3.2 Requirements for the evaluation

4.3.3.2.1 Life time

This is the period of intended use from installation to de-mounting in which no visual changes arise and the full performance level is maintained. The life time is expressed as the feasible time of use in years. European statistics has evaluated an average time in use (i.e. life time L of ceramic sanitary appliances) of 40 years.

NOTE An example of explanation and estimation of life time is given in [6].

4.3.3.2.2 Life cycle energy

This is the proportion of total energy consumption of the production per total production massapportioned over the life of the ceramic sanitary appliance.

The life cycle energy should be calculated using Formula (21).

$$E_{lc} = (E_{rp} + E_{np})/(1000 \cdot L) \quad (21)$$

where

E_{lc} is the life cycle energy, in MJ/(kg · a);

E_{rp} is the total use of renewable primary energy resources, in MJ/t;

E_{np} is the total use of non-renewable primary energy resources, in MJ/t;

L is the life time of the ceramic sanitary appliance, in a.

4.3.4 Parameters describing the energy management

4.3.4.1 General

The type of power supply as well as the energy consumption of a product during its life time has a major economic influence.

4.3.4.2 Requirements for the evaluation

4.3.4.2.1 Operational use of energy

This is the average consumption of energy at standby-operation, expressed in W.

4.3.4.2.2 Type of power supply

This is the type of electric power supply:

D – battery;

C – chargeable battery;

B – Mains supply (transformers);

A – without electric supply.

4.4 Social and functional criteria

4.4.1 General

The social and functional aspects of ceramics sanitary appliances cover various aspects of user friendliness, safety in use and maintenance.

4.4.2 User friendliness

4.4.2.1 General

The user friendliness is defined by the quality of the ceramic sanitary appliance and the ease of the user experience while using the appliance.

4.4.2.2 Requirements for the evaluation

4.4.2.2.1 Cleaning agents and chemicals

This is the necessity of cleaning agents and/or chemical additives for cleaning the ceramic sanitary appliances.

It should be specified whether cleaning agents and/or chemical additives prescribed by the manufacturer are necessary (yes / no):

— yes: cleaning agents and/or chemical additives are prescribed by the manufacturer;

— no: ecological cleaning agents are sufficient.

4.4.2.2.2 Acoustic characteristics of inlet valves

The acoustic characteristics of inlet valves in accordance with EN 14124 may be quoted.

NOTE Where an inlet valve is complying with BS 1212, the acoustic characteristic will be unclassified.

4.4.3 Safety in use

This is the limitation of the risk of violent and immediate body injuries.

This aspect is covered within the relevant harmonized product standards for ceramic sanitary appliances, e.g. WCs (EN 997), urinals (EN 13407), communal washing troughs (EN 14296), bidets (EN 14528) and wash basins (EN 14688).

Ceramic sanitary appliances complying with harmonized standards are considered to be safe and will be rated with 100 %.

4.4.4 Maintenance, repair and replacement

Following a regular cleaning in accordance with manufacturer's instructions, ceramic sanitary appliances do not require maintenance, nor repair, nor replacement.

Ceramic sanitary appliances are considered to be durable and will be rated with 100 %.

5 Classification

For the purposes of classification, the manufacturer's products may be grouped into families, where it is considered that the results for the assessed characteristics from any single product within the family are representative for the same characteristics for all products within that same family, e.g. WC of type 5, WC of type 6, WCs suites of type 6 or wash basins.

Explanation on method to calculate the mean values is given in Annex B: calculate the sum of the numeric values of the column rating and divide this total by the number of numeric values.

Take the achieved value or percentage for sustainability out of Table B.4 and select the class of sustainability and identification code in accordance with the value range from Table 1.

Table 1 — Correlation of achieved sustainability value to sustainability class

Value range %	Class of sustainability	Identification code
< 79	1	S1
≥ 79 and < 87	2	S2
≥ 87 and < 96	3	S3
≥ 96 and < 104	4	S4
≥ 104 and < 113	5	S5
≥ 113 and < 121	6	S6
≥ 121	7	S7

Report the class of sustainability and the identification code at the evaluation scheme in accordance with Clause 4.

6 Marking and product designation

The sustainability rating is useable for product designation.

EXAMPLE Ceramic sanitary appliances complying with sustainability class 5 in accordance with this standard:

EN 16578-S5

Annex A
(informative)

Matrix of assessed data

A.1 Ecological criteria (see 4.2)

Data assessed in accordance with EN 15804 may be used as values for the parameters N^{o} 1 to 25 of Tables A.1 to A.3 reflecting the environmental impact of ceramic sanitary appliances for manufacturing.

Table A.1 — Parameters describing the resource use

Number of parameter	Clause in standard	Designation	Unit	Value
1	4.2.2.1	Use of renewable primary energy	MJ/t	
2	4.2.2.2	Use of renewable primary energy resources used as raw materials	MJ/t	n.a.
3	4.2.2.3	Total use of renewable primary energy resources	MJ/t	
4	4.2.2.4	Use of non-renewable primary energy	MJ/t	
5	4.2.2.5	Use of non-renewable primary energy resources used as raw materials	MJ/t	n.a.
6	4.2.2.6	Total use of non-renewable primary energy resources	MJ/t	
7	4.2.2.7	Use of secondary material	kg/t	n.a.
8	4.2.2.8	Use of renewable secondary fuels	MJ/t	n.a.
9	4.2.2.9	Use of non-renewable secondary fuels	MJ/t	n.a.
10	4.2.2.10	Use of net fresh water	m^3/t	

Table A.2 — Parameters describing output flows and waste categories

Number of parameter	Clause in standard	Designation	Unit	Value
11	4.2.3.1	Hazardous waste disposed	kg/t	
12	4.2.3.2	Non-hazardous waste disposed	kg/t	
13	4.2.3.3	Radioactive waste disposed	kg/t	
14	4.2.3.4	Components for re-use	kg/t	n.a.
15	4.2.3.5	Materials for recycling	kg/t	
16	4.2.3.6	Materials for energy recovery	kg/t	n.a.
17	4.2.3.7	Exported electrical energy	MJ/t	n.a.
18	4.2.3.8	Exported thermal energy	MJ/t	n.a.

Table A.3 — Parameters describing environmental impact

Number of parameter	Clause in standard	Designation	Unit	Value
19	4.2.4.2	Global warming potential	kg CO_2-eq./t	
20	4.2.4.3	Depletion potential of the stratospheric ozone layer	kg CFC11-eq./t	
21	4.2.4.4	Acidification potential of land and water	kg SO_2-eq./t	
22	4.2.4.5	Eutrophication potential	kg PO_4^{3-}-eq./t	
23	4.2.4.6	Formation potential of tropospheric ozone photochemical oxidants	kg ethene-eq./t	
24	4.2.4.7	Abiotic depletion potential for non-fossil resources	kg Sb-eq./t	
25	4.2.4.8	Abiotic depletion potential for fossil resources	MJ/t	

Table A.4 — Parameter describing the construction process

Number of parameter	Clause in standard	Designation	Unit	Value
26	4.2.5.2	Average transport distance of sanitary appliances	1000 km/t	

Table A.5 — Parameter describing the supplementary information beyond the building life cycle

Number of parameter	Clause in standard	Designation[a]	Unit	Value
27	4.2.6	Recycling potential	%	

[a] Related to the environmental impact of ceramic sanitary appliances for manufacturing (see EN 15804, information module D).

A.2 Economical criteria (see 4.3)

For the purposes of assessment, the manufacturer's products may be grouped into families, where it is considered that the results for the assessed characteristics from any single product within the family are representative for the same characteristics for all products within that same family. Tables A.6 to A.8 are related to impact one piece of ceramic sanitary appliance (per product or product group).

Table A.6 — Parameters describing the operational water use

Number of parameter	Clause in standard	Designation	Unit	Value
28	4.3.2.2.1	Flush volume of WCs	l	
29	4.3.2.2.2	Flush volume of urinals	l	

Table A.7 — Parameters describing the life cycle

Number of parameter	Clause in standard	Designation	Unit	Value
30	4.3.3.2.1	Life time	a	
31	4.3.3.2.2	Life cycle energy	MJ/(kg · a)	

Table A.8 — Parameters describing the energy management

Number of parameter	Clause in standard	Designation	Unit	Value
32	4.3.4.2.1	Operational use of energy	W	
33	4.3.4.2.2	Type of power supply	—	

A.3 Social and functional criteria (see 4.4)

For the purposes of assessment, the manufacturer's products may be grouped into families, where it is considered that the results for the assessed characteristics from any one product within the family are representative for the same characteristics for all products within that same family. Table A.9 is related to impact of one piece of ceramic sanitary appliance (per product or product group).

Table A.9 — Parameters describing the social and functional criteria

Number of parameter	Clause in standard	Designation	Unit	Value
34	4.4.2.2.1	Cleaning agents and chemicals	—	
35	4.4.2.2.2	Noise emission	dB(A)	
36	4.4.3	Safety in use	—	
37	4.4.4	Maintenance and repair	—	

Annex B
(informative)

Evaluation scheme

B.1 General

The assessment will be carried out per production site or per defined group/network of production sites.

For the purposes of classification, the manufacturer's products may be grouped into families, where it is considered that the results for the assessed characteristics from any one product within the family are representative for the same characteristics for all products within that same family, e.g. WC of type 5, WC of type 6, WCs suites of type 6 or wash basins.

The Table B.1 should be prepared for each plant or defined group/network of plants.

The Tables B.2 to B.4 should be prepared for each product or product group.

NOTE The values given in Tables B.1 and B.2 are estimated values based on publicly available data. These values will be revised after gaining further experience.

In the case that a requirement is not applicable for one product or product group, e.g. flush volume for wash basins, it should be denoted “n.a.” for “not applicable” into the respective line for value and rating.

The rating in accordance with Tables B.1 to B.3 should be calculated using the Formula (B.1):

$$R_a = 100 - (R_{100} - A)/R_1 \quad \text{(B.1)}$$

where

R_a is the rating of parameter, calculated to one decimal;

R_{100} is the 100 % value for the parameter to be rated;

A is the assessed value for the parameters to be rated;

R_1 is the 1 % value for the parameter to be rated.

The minimum of R_a is 0. In the case that the calculation result is negative the rating is 0.

The maximum of R_a is 170. In the case that the calculation result is higher than 170, 170 will be used.

EXAMPLE Given values: $R_{100} = 200$, $A = 160$, $R_1 = 2$. Calculate the rating of the parameter.

$R_a = 100 - (200 - 160)/2 = 80$

B.2 Evaluation of ecological criteria

a) Determine the value for the first requirement of 4.2.

b) Note the value in column “Assessed value” of Table B.1.

c) Calculate the rating using the Formula (B.1).

d) Write down the calculated rating percentage in column “Rating”.

e) Repeat this procedure for each applicable criteria of 4.2.

f) Calculate the average rating percentage of 4.2.

g) Write down the evaluated value in Table B.1 and Table B.4.

B.3 Evaluation of economical criteria

a) Determine the value for the first requirement of 4.3.

b) Note the value in column “Assessed value” of Table B.2.

c) Calculate the rating using the Formula (B.1).

d) Write down the calculated rating percentage in column “Rating”.

e) Repeat this procedure for each applicable criteria of 4.3.

f) Calculate the average rating percentage of 4.3.

g) Write down the evaluated value in Table B.2 and Table B.4.

B.4 Evaluation of social and functional criteria

a) Determine the value for the first requirement of 4.4.

b) Note the value in column “Assessed value” of Table B.3.

c) Calculate the rating using the Formula (B.1).

d) Write down the calculated rating percentage in column “Rating”.

e) Repeat this procedure for each applicable criteria of 4.4.

f) Calculate the average rating percentage of 4.4.

g) Write down the evaluated value in Table B.3 and Table B.4.

B.5 Evaluation of the total rating

a) Multiply the evaluated rating of Table B.1 with the weightage factor and write down the result.

b) Multiply the evaluated rating of Table B.2 with the weightage factor and write down the result.

c) Multiply the evaluated rating of Table B.3 with the weightage factor and write down the result.

d) Calculate the average rating percentage taking into account the weightage factors.

e) Write down the evaluated value for the total sustainability rating in Table B.4.

f) Select class of sustainability and identification code in accordance with Table 1 and document this in the foreseen area in Table B.4.

Table B.1 — Evaluation scheme for ecological criteria (4.2)

Number of parameter	Clause in standard	Designation	Unit	100 % value	1 % value	Assessed value	Rating[a]
Parameters describing resource use							
1	4.2.2.1	Use of renewable primary energy	MJ/t	**3 000**	**200**		
4	4.2.2.4	Use of non-renewable primary energy	MJ/t	**32 000**	**-300**		
10	4.2.2.10	Use of net fresh water	m^3/t	**15**	**-0,50**		
Parameters describing output flows and waste categories							
11	4.2.3.1	Hazardous waste disposed	kg/t	**1**	**-0,1**		
12	4.2.3.2	Non-hazardous waste disposed	kg/t	**200**	**-20**		
13	4.2.3.3	Radioactive waste disposed	kg/t	**0**	**-0,01**		
15	4.2.3.5	Materials for recycling	kg/t	**0,5**	**-0,02**		
Parameters describing environmental impact							
19	4.2.4.2	Global warming potential	kg CO_2-eq./t	1 850	−25		
20	4.2.4.3	Depletion potential of the stratospheric ozone layer	kg CFC11-eq./t	$2{,}00 \cdot 10^{-4}$	$2{,}00 \cdot 10^{-5}$		
21	4.2.4.4	Acidification potential of land and water	kg SO_2-eq./t	10	−0,50		
22	4.2.4.5	Eutrophication potential	kg PO_4^{3-}-eq./t	2	−0,20		
23	4.2.4.6	Formation potential of tropospheric ozone photochemical oxidants	kg Ethene-eq./t	1	−0,10		
24	4.2.4.7	Abiotic depletion potential for non-fossil resources	kg Sb-eq./t	$-2{,}50 \cdot 10^{-3}$	$-2{,}50 \cdot 10^{-4}$		
25	4.2.4.8	Abiotic depletion potential for fossil resources	MJ/t	25 000	−500		

Number of parameter	Clause in standard	Designation	Unit	100 % value	1 % value	Assessed value	Rating[a]
Parameters describing the construction process							
26	4.2.5.2	Average transport distance of sanitary appliances	1000 km/t	2	−0,5		
Parameters describing the supplementary information beyond the building live cycle process							
27	4.2.6	Recycling potential	%	100	1		
Rating for the ecologic criteria (4.2) to be calculated as an average out of the ratings above							

[a] The minimum of "Rating" is 0.

Table B.2 — Evaluation scheme for economic criteria (4.3)

Number of parameter	Clause in standard	Designation	Unit	100 % value	1 % value	Assessed value	Rating[a]
Parameters describing the operational water use							
28	4.3.2.2.1	Flush volume of WCs	l	3,75	−0,025		
29	4.3.2.2.2	Flush volume of urinals	l	1,5	−0,04		
Parameters describing the life cycle							
30	4.3.3.2.2	Life cycle energy	MJ/(kg · a)	0,756	−0,0108		
Parameters describing the energy management							
31	4.3.4.2.1	Operational use of energy	W	0,6	−0,05		
32	4.3.4.2.2	Type of power supply	—	—	—		b
Rating for the economic criteria (4.3) to be calculated as an average out of the ratings above							

a The minimum of "Rating" is 0.

b For No. 32 (see 4.3.4.2.2) select the rating: A = 100 %, B = 110 %, C = 90 %, D = 70 %.

Table B.3 — Evaluation scheme for social and functional criteria (4.4)

Number of parameter	Clause in standard	Designation	Unit	100 % value	1 % value	Assessed value	Rating[a]
33	4.4.2.2.1	Cleaning agents and chemicals	—	—	—		b
34	4.4.2.2.2	Acoustic characteristics of inlet valves	—	—	—		c
35	4.4.3	Safety in use				100 %	
36	4.4.4	Maintenance, repair and replacement				100 %	

a The minimum of "Rating" is 0.

b For No. 33 (see 4.4.2.2.1) select the rating: YES = 100 %, NO = 60 %.

c For No. 34 (see 4.4.2.2.2) select the rating: group I = 100 %, group II = 50 %, unclassified = 1 %.

Table B.4 — Evaluation scheme for sustainability based on Tables B.1 to B.3

	Rating	**Weightage factor** W_f	R_w[a]
Rating to be calculated as an average for the ecological criteria (Table B.1)		3	
Rating to be calculated as an average for the economical criteria (Table B.2)		2	
Rating to be calculated as an average for the social and functional criteria (Table B.3)		1	
		Sum of R_w	
Rating of the product or group of products P_R[b]			
Class of sustainability according to Table 1			
Identification code according to Table 1			

[a] R_w should be calculated using formula $R_w = W_f \cdot$ Rating

[b] Rating of the products should be calculated using formula $P_R = \frac{1}{6}\sum R_w$

Annex C
(informative)

Example for a table with typical values for the production of ceramic sanitary appliances

An example of the environmental impact of ceramic sanitary ware for information modules A1 to A3 (see EN 15804) is given in Table C.1.

Table C.1 — Example for a table with typical values for the production of ceramic sanitary appliances of ecological criteria (4.2)

Number of parameter	Clause in standard	Designation	Unit	A1: raw material	A2: transport	A3: production	A1 + A2 + A3
1	4.2.2.1	Use of renewable primary energy	MJ/t	178	13	2809	3 000
2	4.2.2.2	Use of renewable primary energy resources used as raw materials	MJ/t	—	—	—	—
3	4.2.2.3	Total use of renewable primary energy resources	MJ/t	178	13	2809	3 000
4	4.2.2.4	Use of non-renewable primary energy	MJ/t	3 214	818	27 968	32 000
5	4.2.2.5	Use of non-renewable primary energy resources used as raw materials	MJ/t	—	—	—	—
6	4.2.2.6	Total use of non-renewable primary energy resources	MJ/t	3 214	818	27 968	32 000
7	4.2.2.7	Use of secondary material	kg/t	—	—	—	—
8	4.2.2.8	Use of renewable secondary fuels	MJ/t	—	—	—	—
9	4.2.2.9	Use of non-renewable secondary fuels	MJ/t	—	—	—	—
10	4.2.2.10	Use of net fresh water	m^3/t	7,3	0,3	7,4	15
11	4.2.3.1	Hazardous waste disposed	kg/t	0	0	0,1	0,1

12	4.2.3.2	Non-hazardous waste disposed	kg/t	0	0	200	200
13	4.2.3.3	Radioactive waste disposed	kg/t	0	0	0	0
14	4.2.3.4	Components for re-use	kg/t	—	—	—	—
15	4.2.3.5	Materials for recycling	kg/t	—	—	0,5	0,5
16	4.2.3.6	Materials for energy recovery	kg/t	—	—	—	—
17	4.2.3.7	Exported electrical energy	MJ/t	—	—	—	—
18	4.2.3.8	Exported thermal energy	MJ/t	—	—	—	—
19	4.2.4.2	Global warming potential	kg CO_2-eq./t	216	48	1 586	1 850
20	4.2.4.3	Depletion potential of the stratospheric ozone layer	kg CFC11-eq./t	2,24E-5	6,97E-6	1,71E-4	2,00E-4
21	4.2.4.4	Acidification potential of land and water	kg SO_2-eq./t	1,06	0,07	8,87	10
22	4.2.4.5	Eutrophication potential	kg PO_4^{3-}-eq./t	0,45	0,11	1,44	2
23	4.2.4.6	Formation potential of tropospheric ozone photochemicals oxidants	kg Ethene-eq./t	0,27	0,03	0,70	1
24	4.2.4.7	Abiotic depletion potential for non-fossil resources	kg Sb-eq./t	2,68E-4	6,0E-5	2,17E-3	2,5E-3
25	4.2.4.8	Abiotic depletion potential for fossil resources	MJ/t	2 861	655	21 484	25 000

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