INTERNATIONAL STANDARD

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Ceramic tiles —

Part 14:
Determination of resistance to stains

Carreaux et dalles céramiques —

Partie 14: Détermination de la résistance aux taches

Reference number
ISO 10545-14:1995(E)

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.

Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

International Standard ISO 10545-14 was prepared by Technical Committee ISO/TC 189, *Ceramic tile*.

ISO 10545 consists of the following parts, under the general title *Ceramic tiles*:

— *Part 1: Sampling and basis for acceptance*

— *Part 2: Determination of dimensions and surface quality*

— *Part 3: Determination of water absorption, apparent porosity, apparent relative density and bulk density*

— *Part 4: Determination of modulus of rupture and breaking strength*

— *Part 5: Determination of impact resistance by measurement of coefficient of restitution*

— *Part 6: Determination of resistance to deep abrasion for unglazed tiles*

— *Part 7: Determination of resistance to surface abrasion for glazed tiles*

— *Part 8: Determination of linear thermal expansion*

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— *Part 9: Determination of resistance to thermal shock*

— *Part 10: Determination of moisture expansion*

— *Part 11: Determination of crazing resistance for glazed tiles*

— *Part 12: Determination of frost resistance*

— *Part 13: Determination of chemical resistance*

— *Part 14: Determination of resistance to stains*

— *Part 15: Determination of lead and cadmium given off by glazed tiles*

— *Part 16: Determination of small colour differences*

— *Part 17: Determination of coefficient of friction*

Annexes A and B form an integral part of this part of ISO 10545.

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Ceramic tiles —

Part 14:
Determination of resistance to stains

1 Scope

This part of ISO 10545 specifies a method for determining the resistance to stains of the proper surface of ceramic tiles.

2 Normative reference

The following standard contains provisions which, through reference in this text, constitute provisions of this part of ISO 10545. At the time of publication, the edition indicated was valid. All standards are subject to revision, and parties to agreements based on this part of ISO 10545 are encouraged to investigate the possibility of applying the most recent edition of the standard indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO 10545-7:—[1], *Ceramic tiles — Part 7: Determination of resistance to surface abrasion for glazed tiles.*

3 Principle

Determination of the resistance to stains by maintaining test solutions and materials in contact with the proper surface of the tiles for a suitable length of time; the surfaces are then subjected to defined cleaning methods, and finally inspected for visual changes.

4 Staining agents[2]

4.1 Stains leaving a trace (pastes)

4.1.1 Green staining agent in light oil, in accordance with the specifications of annex A.

4.1.2 Red staining agent in light oil (for green-coloured tiles only), in accordance with the specifications of annex B.

4.2 Stains having chemical/oxidizing action

4.2.1 Iodine, 13 g/l solution in alcohol.

4.3 Stains, forming a film

4.3.1 Olive oil, according to the definitions of the International Olive Oil Agreement (1979).

5 Cleaning

5.1 Cleaning agents

5.1.1 Hot water, at a temperature of (55 ± 5) °C.

5.1.2 Weak cleaning agent: a commercial agent, not containing abrasive, with a pH of 6,5 to 7,5.

1) To be published.

2) The stains specified are only examples of basic groups. There are many other staining materials which may, upon agreement by the parties concerned, be tested using the procedure specified in this part of ISO 10545.

5.1.3 Strong cleaning agent: a commercial cleaning agent, containing abrasive, with a pH of 9 to 10.

The cleaning agents used shall not contain hydrofluoric acid or its compounds.

5.1.4 Suitable solvents.

5.1.4.1 Hydrochloric acid, diluted 3 + 97.

5.1.4.2 Potassium hydroxide, 200 g/l solution.

5.1.4.3 Acetone.

If other specific solvents are used, they shall be specified in the test report.

5.2 Cleaning procedures and apparatus

5.2.1 Procedure A

Clean the test specimen with running hot water (5.1.1) for 5 min, then wipe the surface with a damp cloth.

5.2.2 Procedure B

Clean the test specimen manually with the weak cleaning agent (5.1.2), using a natural, non-abrasive sponge or a cloth, then rinse the surface with running water, and finally wipe it with a damp cloth.

5.2.3 Procedure C

Clean the test specimen mechanically with the strong cleaning agent (5.1.3). Example of apparatus:

— Rotating brush, with hard bristles, having a 8 cm diameter, rotational frequency approximately 500 r/min.

— Tank for the cleaning agent, equipped with a suitable feeder, and connected to the brush.

Carry out cleaning for 2 min, then rinse the surface with running water and finally wipe it with a damp cloth.

5.2.4 Procedure D

Immerse the test specimen for 24 h in a suitable solvent (5.1.4), then thoroughly rinse the surface with running water and finally wipe it with a damp cloth.

Cleaning is considered to be accomplished if any one of the solvents (5.1.4) removes the stain.

5.3 Auxiliary apparatus

5.3.1 Drying oven, capable of being operated at (110 ± 5) °C.

Microwave, infrared or other drying systems which allow shorter drying times, may be used provided that it has been determined that the same results are obtained.

6 Test specimens

Five unused and undamaged test specimens shall be used, and they shall consist of whole tiles or cut tiles. However, a sufficient surface area is required to ensure separation of the stains. If the tiles are too small, additional ones may be used. The test specimens shall be thoroughly cleaned with water and then dried in the oven (5.3.1) adjusted to (110 ± 5) °C until constant mass is reached, i.e. until the difference between two successive weighings is less than 0,1 g. The test specimens shall then be cooled to room temperature in a desiccator.

When it is agreed to test unglazed tiles after abrasion, the samples shall be prepared according to the procedure specified in ISO 10545-7, at 600 rev.

7 Procedure

7.1 Application of the staining agent

Spread 3 or 4 drops of the paste (4.1.1 or 4.1.2) on the surface. Allow 3 or 4 drops of each of the liquids (4.2.1 and 4.3.1) to cover separate areas of the test surface. Place a convex watch glass of diameter approximately 30 mm on the applied drops, in order to spread them to an approximately circular area. Leave staining agents in place for 24 h.

7.2 Attempts to remove stains

Subject the test specimens, treated according to 7.1, successively to the cleaning procedures described in 5.2 (procedures A, B, C and D).

After each cleaning procedure, dry the test specimens in the oven (5.3.1) adjusted to (110 ± 5) °C and subject them to a visual examination. Examine the surface with the naked eye or with spectacles if usually worn, at a distance of 25 cm to 30 cm in daylight or artificial illumination of approximately 300 lx, but avoid direct sunlight.

In the case of stains listed in 4.1, staining shall only be reported when the pigment is visible. If there is no visible effect, i.e. if the stain has been removed,

record the cleanability class according to figure 1; if the stain is not removed, proceed to the following cleaning procedure.

8 Classification of results

In consequence of the procedure described in 7.1 and 7.2, ceramic surfaces are divided into five classes given in figure 1.

Record the result for each test specimen (unabraded and, if agreed, after abrasion for unglazed tiles) with each staining agent.

Class 5 corresponds to the greatest ease of removing the particular stain; Class 1 corresponds to the impossibility of removing the particular stain with any of the test procedures and/or to irreversible damage of the proper surface.

9 Test report

The test report shall include the following information:

a) reference to this part of ISO 10545;

b) a description of the tiles, including means of preparing the test specimens;

c) the staining and cleaning agents;

d) the classification for each test specimen and for each staining agent (unabraded and, if agreed, after abrasion for unglazed tiles), according to figure 1.

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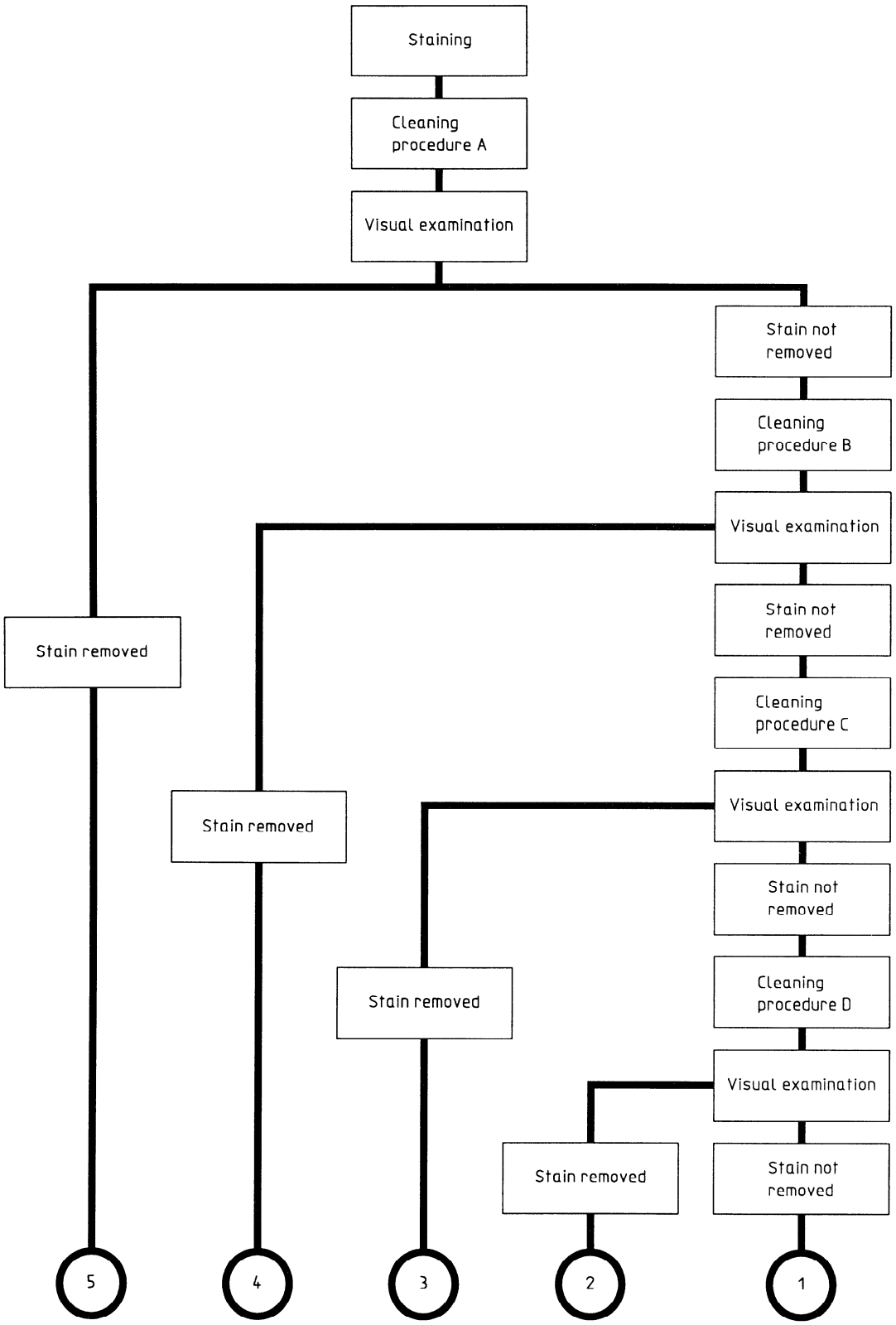

Figure 1 — Classification of the results of the stain resistance test

Annex A
(normative)

Specifications for "Green staining agent in light oil"

A.1 Green staining agent (chrome green)

Formula: Cr_2O_3

Typical grain size distribution:

% <	µm
10,0	0,5
29,2	1,0
43,7	2,0
50,0	3,0
66,3	5,0
78,8	10,0
89,6	20,0
93,0	32,0
97,4	64,0
100,0	96,0

A.2 Light oil

An oil composed of an ester of glycerol and organic acid(s). The relative molecular mass of the ester is in the range of 300 to 500.

Two examples are as follows:

a) Propanetriol monodecanoate dioctanoate (the preferred common name is glyceryl monocaprate dicaprylate). The trade name is Myritol 318, obtainable from Henkel KGaA, D4000 Dusseldorf 1, Germany. This information is given for the convenience of users of this part of ISO 10545 and does not constitute an endorsement by ISO of the product named. Equivalent products may be used if they can be shown to lead to the same results.

b) Propanetriol tributanoate (alternative common names are glyceryl tributyrate and tributyrin, obtainable from chemical laboratory suppliers).

A.3 Test paste

The test paste contains 40 % (*m/m*) of Cr_2O_3. The paste shall be mixed in such a way as to ensure complete dispersion.

Annex B
(normative)

Specifications for "Red staining agent in light oil"

B.1 Red staining agent[3)]

Formula: Fe_2O_3

Typical grain size distribution:

% <	µm
51,3	1,0
53,9	2,0
71,0	5,0
82,2	10,0
88,3	15,0
88,8	20,0
96,5	25,0
96,5	41,0
100,0	64,0

B.2 Light oil

An oil composed of an ester of glycerol and organic acid(s). The relative molecular mass of the ester is in the range of 300 to 500.

Two examples are as follows:

a) Propanetriol monodecanoate dioctanoate (the preferred common name is glyceryl monocaprate dicaprylate). The trade name is Myritol 318, obtainable from Henkel KGaA, D4000 Dusseldorf 1, Germany. This information is given for the convenience of users of this part of ISO 10545 and does not constitute an endorsement by ISO of the product named. Equivalent products may be used if they can be shown to lead to the same results.

b) Propanetriol tributanoate (alternative common names are glyceryl tributyrate and tributyrin, obtainable from chemical laboratory suppliers).

B.3 Test paste

The test paste contains 40 % (*m/m*) of Fe_2O_3. The paste shall be mixed in such a way as to ensure complete dispersion.

3) To be used only fro green-coloured tiles.

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