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**Textiles — Tests for colour fastness —
Part E: Colour fastness to aqueous agencies**

Textiles — Essais de solidité des teintures — Partie E: Solidité des teintures aux agents aqueux

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards institutes (ISO member bodies). The work of developing International Standards is carried out through ISO technical committees. Every member body interested in a subject for which a technical committee has been set up 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.

Draft International Standards adopted by the technical committees are circulated to the member bodies for approval before their acceptance as International Standards by the ISO Council.

International Standard ISO 105/E was developed by Technical Committee ISO/TC 38, *Textiles*.

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This part of ISO 105 cancels and replaces group E of ISO 105-1978, originally published as parts 4, 5, 16, 22, 23 and 24 of ISO Recommendation R 105/I-1959, parts 1, 2, 3 and 5 of ISO Recommendation R 105/II-1963, part 1 of ISO Recommendation R 105/IV-1968, and part 3 of ISO Recommendation R 105/V-1969.

NOTE — International Standard ISO 105 is presented in the form of parts. Each of these parts corresponds to a group and is split up into its different component sections. This form facilitates the replacement of existing sections by successive editions as necessary.

Contents of ISO 105

ISO 105/A Textiles — Tests for colour fastness —

Part A : General principles

- A01 General principles of testing
- A02 Grey scale for assessing change in colour
- A03 Grey scale for assessing staining

ISO 105/B Textiles — Tests for colour fastness —

Part B : Colour fastness to light and weathering

- B01 Colour fastness to light : Daylight
- B02 Colour fastness to light : Xenon arc
- B03 Colour fastness to weathering : Outdoor exposure
- B04 Colour fastness to weathering : Xenon arc
- B05 Detection and assessment of photochromism

ISO 105/C Textiles — Tests for colour fastness —

Part C : Colour fastness to washing and laundering

- C01 Colour fastness to washing : Test 1
- C02 Colour fastness to washing : Test 2
- C03 Colour fastness to washing : Test 3
- C04 Colour fastness to washing : Test 4
- C05 Colour fastness to washing : Test 5
- C06 Colour fastness to domestic and commercial laundering

ISO 105/D Textiles — Tests for colour fastness —

Part D : Colour fastness to dry cleaning

- D01 Colour fastness to dry cleaning
- D02 Colour fastness to rubbing : Organic solvents

ISO 105-E:1978

ISO 105/E Textiles — Tests for colour fastness —

Part E : Colour fastness to aqueous agencies

- E01 Colour fastness to water
- E02 Colour fastness to sea water
- E03 Colour fastness to chlorinated water (swimming-bath water)
- E04 Colour fastness to perspiration
- E05 Colour fastness to spotting : Acid
- E06 Colour fastness to spotting : Alkali
- E07 Colour fastness to spotting : Water
- E08 Colour fastness to water : Hot water
- E09 Colour fastness to potting
- E10 Colour fastness to decatizing
- E11 Colour fastness to steaming
- E12 Colour fastness to milling : Alkaline milling
- E13 Colour fastness to acid-felting : Severe
- E14 Colour fastness to acid-felting : Mild

ISO 105/F Textiles — Tests for colour fastness —

Part F : Standard adjacent fabrics

- F01 Specification for standard adjacent fabric : Wool
- F02 Specification for standard adjacent fabric : Cotton and viscose
- F03 Specification for standard adjacent fabric : Polyamide
- F04 Specification for standard adjacent fabric : Polyester
- F05 Specification for standard adjacent fabric : Acrylic
- F06 Specification for standard adjacent fabric : Silk

ISO 105/G Textiles — Tests for colour fastness —

Part G : Colour fastness to atmospheric contaminants

- G01 Colour fastness to nitrogen oxides
- G02 Colour fastness to burnt gas fumes
- G03 Colour fastness to ozone in the atmosphere

ISO 105/J Textiles — Tests for colour fastness —
Part J : Measurement of colour and colour differences
J01 Method for the measurement of colour and colour differences

ISO 105/N Textiles — Tests for colour fastness —
Part N : Colour fastness to bleaching agencies
N01 Colour fastness to bleaching : Hypochlorite
N02 Colour fastness to bleaching : Peroxide
N03 Colour fastness to bleaching : Sodium chlorite : Mild
N04 Colour fastness to bleaching : Sodium chlorite : Severe
N05 Colour fastness to stoving

ISO 105/P Textiles — Tests for colour fastness —
Part P : Colour fastness to heat treatments
P01 Colour fastness to dry heat (excluding pressing)
P02 Colour fastness to pleating : Steam pleating

ISO 105/S Textiles — Tests for colour fastness —
Part S : Colour fastness to vulcanizing
S01 Colour fastness to vulcanizing : Hot air
S02 Colour fastness to vulcanizing : Sulphur monochloride
S03 Colour fastness to vulcanizing : Open steam

ISO 105/X Textiles — Tests for colour fastness —
Part X : Tests not included in parts A to S or part Z
X01 Colour fastness to carbonizing : Aluminium chloride
X02 Colour fastness to carbonizing : Sulphuric acid
X03 Colour fastness to chlorination
X04 Colour fastness to mercerizing
X05 Colour fastness to organic solvents
X06 Colour fastness to soda boiling ISO 105-E:1978
X07 Colour fastness to cross-dyeing : Wool ISO 105-E:1978
X08 Colour fastness to degumming ISO 105-E:1978
X09 Colour fastness to formaldehyde
X10 Assessment of migration of textile colours into polyvinyl chloride coatings
X11 Colour fastness to hot pressing
X12 Colour fastness to rubbing
X13 Colour fastness of wool dyes to processes using chemical means for creasing, pleating and setting

ISO 105/Z Textiles — Tests for colour fastness —
Part Z : Colorant characteristics
Z01 Colour fastness to metals in the dye-bath : Chromium salts
Z02 Colour fastness to metals in the dye-bath : Iron and copper

Textiles – Tests for colour fastness

E01 Colour fastness to water

1 SCOPE AND FIELD OF APPLICATION

This method is intended for determining the resistance of the colour of textiles of all kinds and in all forms to immersion in water.

2 PRINCIPLE

A specimen of the textile in contact with adjacent fabrics is immersed in water, drained and placed between two plates under a specified pressure in a testing device (see 8.1). The specimen and the adjacent fabrics are dried separately. The change in colour of the specimen and the staining of the adjacent fabrics are assessed with the grey scales.

3 REFERENCES

ISO 105 :

Section A01, *General principles of testing.*

Section A02, *Grey scale for assessing change in colour.*

Section A03, *Grey scale for assessing staining.*

4 APPARATUS

4.1 Testing device, consisting of a frame of stainless steel into which a weight-piece of mass 5 kg and base of 11,5 cm × 6 cm is closely fitted, so that a pressure of 12,5 kPa can be applied on test specimens measuring 10 cm × 4 cm placed between glass or acrylic resin plates. If the weight-piece is removed during the test, the testing device shall be so constructed that the pressure of 12,5 kPa remains unchanged (see 8.1).

4.2 Oven maintained at 37 ± 2 °C.

4.3 Distilled water.

4.4 Two adjacent fabrics, each measuring 10 cm × 4 cm, one piece made of the same kind of fibre as that of the textile to be tested, or that predominating in the case of

blends, the second piece made of the fibre as indicated in the table below or, in the case of blends, of the kind of fibre second in order of predominance, or as otherwise specified.

If the first adjacent fabric is :	Second piece to be :
cotton	wool
wool	cotton
silk	cotton
linen	wool
viscose	wool
acetate or triacetate	viscose
polyamide	wool or cotton
polyester	wool or cotton
acrylic	wool or cotton

4.5 Grey scales for assessing change in colour and staining (see clause 3).

5 TEST SPECIMEN

5.1 If the textile to be tested is fabric, place a specimen 10 cm × 4 cm between the two adjacent fabrics (4.4) and sew along one of the shorter sides to form a composite specimen.

5.2 If the textile to be tested is yarn, knit it into fabric and treat it as in 5.1 or form a layer of parallel lengths of it between the two adjacent fabrics (4.4), the amount of yarn taken being approximately equal to half the combined mass of the adjacent fabrics (4.4). Sew along two opposite sides to hold the yarn in place and to form a composite specimen.

5.3 If the textile to be tested is loose fibre, comb and compress an amount approximately equal to half the combined mass of the adjacent fabrics (4.4) into a sheet

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E01 page 1

10 cm × 4 cm. Place the sheet between the two adjacent fabrics and sew along all four sides to hold the fibres in place and to form a composite specimen.

6 PROCEDURE

6.1 Thoroughly wet the composite specimen in distilled water at room temperature. Pour off the water and place the composite specimen between two glass or acrylic resin plates, measuring about 11,5 cm × 6,0 cm, under a pressure of 12,5 kPa.

6.2 Place the apparatus containing the composite specimen in the oven for 4 h at 37 ± 2 °C.

6.3 Open out the composite specimen and dry it by hanging it in air at a temperature not exceeding 60 °C with the three parts in contact only at the remaining line of stitching.

6.4 Assess the change in colour of the specimen and the staining of the adjacent fabrics with the grey scales.

7 TEST REPORT

Report the numerical rating for change in colour and the numerical rating for staining of each kind of adjacent fabric used.

8 NOTES

8.1 Suitable testing devices are the Hydrotest, the Perspiration Tester and the Perspirometer. If the dimensions of the composite specimen differ from the size of 10 cm × 4 cm, such a weight-piece has to be used that a pressure of 12,5 kPa is applied to the specimen.

8.2 Other devices may be used provided that the same results are obtained as with the apparatus described in 4.1.

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Textiles – Tests for colour fastness

E02 Colour fastness to sea water

1 SCOPE AND FIELD OF APPLICATION

This method is intended for determining the resistance of the colour of textiles of all kinds and in all forms to immersion in sea water.

2 PRINCIPLE

A specimen of the textile in contact with specified adjacent fabrics is immersed in a sodium chloride solution, drained, and placed between two plates under a specified pressure in a testing device (see 8.1). The specimen and the adjacent fabrics are dried separately. The change in colour of the specimen and the staining of the adjacent fabrics are assessed with the grey scales.

3 REFERENCES

ISO 105 :

Section A01, *General principles of testing*.

Section A02, *Grey scale for assessing change in colour*.

Section A03, *Grey scale for assessing staining*.

4 APPARATUS AND REAGENT

4.1 Testing device, consisting of a frame of stainless steel into which a weight-piece of mass 5 kg and a base of 11,5 cm × 6 cm is closely fitted, with glass or acrylic resin plates of the same size and of 0,15 cm thickness. In this case the size of the composite specimen must be 10 cm × 4 cm (see 8.1).

4.2 Oven maintained at 37 ± 2 °C.

4.3 Sodium chloride, 30 g/l solution.

4.4 Two adjacent fabrics, each measuring 10 cm × 4 cm, one piece made of the same kind of fibre as that of the textile to be tested, or that predominating in the case of blends, the second piece made of the fibre as indicated in

the table below or, in the case of blends, of the kind of fibre second in order of predominance, or as otherwise specified.

If the first adjacent fabric is :	Second piece to be :
cotton	wool
wool	cotton
silk	cotton
linen	wool
viscose	wool
acetate or triacetate	viscose
polyamide	wool or cotton
polyester	wool or cotton
acrylic	wool or cotton

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4.5 Grey scales for assessing change in colour and staining (see clause 3).

5 TEST SPECIMEN

5.1 If the textile to be tested is fabric, place a specimen 10 cm × 4 cm between the two adjacent fabrics (4.4) and sew along one of the shorter sides to form a composite specimen.

5.2 If the textile to be tested is yarn, knit it into fabric and treat it as in 5.1 or form a layer of parallel lengths of it between the two adjacent fabrics (4.4), the amount of yarn taken being approximately equal to half the combined mass of the adjacent fabrics. Sew along two opposite sides to hold the yarn in place and to form a composite specimen.

5.3 If the textile to be tested is loose fibre, comb and compress an amount approximately equal to half the combined mass of the adjacent fabrics (4.4) into a sheet 10 cm × 4 cm. Place the sheet between the two adjacent fabrics and sew along all four sides to hold the fibres in place and to form a composite specimen.

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E02 page 1

6 PROCEDURE

6.1 Thoroughly wet the composite specimen in the sodium chloride solution (4.3) at room temperature. Pour off the solution and place the composite specimen between two glass or acrylic resin plates measuring 11,5 cm × 6,0 cm under a pressure of 12,5 kPa.

6.2 Place the apparatus containing the composite specimen in the oven for 4 h at 37 ± 2 °C.

6.3 Open out the composite specimen and dry it by hanging it in air at a temperature not exceeding 60 °C, with the three parts in contact only at the remaining line of stitching.

6.4 Assess the change in colour of the specimen and the staining of the adjacent fabrics with the grey scales.

7 TEST REPORT

Report the numerical rating for change in colour and the numerical rating for staining of each kind of adjacent fabric used.

8 NOTES

8.1 Suitable testing devices are the Hydrotest, the Perspiration Tester and the Perspirometer. If the dimensions of the composite specimen differ from the size of 10 cm × 4 cm, such a weight-piece has to be used that a pressure of 12,5 kPa is applied to the specimen.

8.2 Other devices may be used provided that the same results are obtained as with the apparatus described in 4.1.

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Textiles — Tests for colour fastness

E03 Colour fastness to chlorinated water (swimming-bath water)

1 SCOPE AND FIELD OF APPLICATION

This method is intended for determining the resistance of the colour of textiles of all kinds and in all forms to the action of active chlorine in concentrations such as are used to disinfect swimming-bath water (break point chlorination).

2 PRINCIPLE

A specimen of the textile is treated with a very weak chlorine solution and dried. The change in colour of the specimen is assessed with the grey scale.

3 REFERENCES

ISO 105 :

Section A01, *General principles of testing.*

Section A02, *Grey scale for assessing change in colour.*

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4 APPARATUS AND REAGENTS

4.1 Glass container or glazed china container, which can be closed, for specimen and chlorine solution.

4.2 Sodium hypochlorite (NaOCl) solution, of the following composition :

- active chlorine : 140 to 160 g/l
- sodium chloride (NaCl) : 120 to 170 g/l
- sodium hydroxide (NaOH) : 20 g/l maximum
- sodium carbonate (Na₂CO₃) : 20 g/l maximum
- iron (Fe) : 0,01 g/l maximum

4.3 Sodium hypochlorite solution, containing 20 mg of active chlorine per litre, at pH 8,5 (see clause 8).

4.4 Grey scale for assessing change in colour (see clause 3).

5 TEST SPECIMEN

5.1 If the textile to be tested is fabric, use a specimen 10 cm × 4 cm.

5.2 If the textile to be tested is yarn, knit it into fabric and use a specimen 10 cm × 4 cm or make a wick of parallel lengths 10 cm long and about 0,5 cm in diameter, tied near both ends.

5.3 If the textile to be tested is loose fibre, comb and compress enough of it to form a sheet 10 cm × 4 cm, and sew it on to a piece of cotton adjacent cloth to support the fibre.

6 PROCEDURE

6.1 Immerse the specimen in the sodium hypochlorite solution (4.3), liquor ratio 100 : 1, ensuring that the specimen is thoroughly wetted. Close the container and allow to stand at 20 ± 2 °C for 4 h in subdued light.

6.2 Remove the specimen from the container, squeeze or hydro-extract it to contain its own mass of solution, and dry it by hanging it in air at room temperature.

6.3 Assess the change in colour with the grey scale.

7 TEST REPORT

Report the numerical rating for change in colour.

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8 NOTE

A hypochlorite solution of 20 mg of active chlorine per litre, at pH 8,5, may be obtained as follows :

- solution A : dilute 4 ml of sodium hypochlorite solution (4.2) to 1 litre;
- solution B : dissolve in 51,0 ml of 1 N sodium hydroxide (NaOH) solution, 18,64 g of potassium chloride (KCl) and 15,46 g of boric acid (H_3BO_3), and dilute to 1 litre.

To 50 ml of solution A add excess potassium iodide (KI)

and hydrochloric acid (HCl), and titrate the liberated iodine with 0,1 N sodium thiosulphate ($Na_2S_2O_3$) solution, using starch as an indicator. Let the volume of 0,1 N sodium thiosulphate solution required be V ml.

For each 100 ml of working solution required, add $(28,2/V)$ ml of solution A to 20 ml of solution B, and dilute to 100 ml.

The pH of the solution should be checked against a standard buffer solution.

The solution should be prepared just prior to use.

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Textiles – Tests for colour fastness

E04 Colour fastness to perspiration

1 SCOPE AND FIELD OF APPLICATION

This method is intended for determining the resistance of the colour of textiles of all kinds and in all forms to the action of human perspiration.

2 PRINCIPLE

Specimens of the textile in contact with adjacent fabrics are treated in two different solutions containing histidine, drained, and placed between two plates under a specified pressure in a testing device (see 8.1). The specimens and the adjacent fabrics are dried separately. The change in colour of each specimen and the staining of the adjacent fabrics are assessed with the grey scales.

3 REFERENCES

ISO 105 :

Section A01, *General principles of testing.*

Section A02, *Grey scale for assessing change in colour.*

Section A03, *Grey scale for assessing staining.*

4 APPARATUS AND REAGENTS

4.1 Testing device, consisting of a frame of stainless steel into which a weight-piece of mass 5 kg and a base of 11,5 cm × 6 cm is closely fitted, with glass or acrylic resin plates of the same size and of 0,15 cm thickness. In this case the size of the composite specimen must be 10 cm × 4 cm (see 8.1).

4.2 Oven, maintained at 37 ± 2 °C.

4.3 Alkaline solution, freshly prepared, containing, per litre,

0,5 g of *l*-histidine monohydrochloride monohydrate ($C_6H_9O_2N_3 \cdot HCl \cdot H_2O$);

5 g of sodium chloride (NaCl);

5 g of disodium hydrogen orthophosphate dodecahydrate ($Na_2HPO_4 \cdot 12H_2O$), or

2,5 g of disodium hydrogen orthophosphate dihydrate ($Na_2HPO_4 \cdot 2H_2O$).

The solution is brought to pH 8 with 0,1 N sodium hydroxide solution.

4.4 Acid solution, freshly prepared, containing, per litre,

0,5 g of *l*-histidine monohydrochloride monohydrate ($C_6H_9O_2N_3 \cdot HCl \cdot H_2O$);

5 g of sodium chloride (NaCl);

2,2 g of sodium dihydrogen orthophosphate dihydrate ($NaH_2PO_4 \cdot 2H_2O$).

The solution is brought to pH 5,5 with 0,1 N sodium hydroxide solution.

4.5 Two adjacent fabrics, each measuring 10 cm × 4 cm, one piece made of the same kind of fibre as that of the textile to be tested, or that predominating in the case of blends, the second piece made of the fibre as indicated in the table below or, in the case of blends, of the kind of fibre second in order of predominance, or as otherwise specified.

If first piece is :	Second piece to be :
cotton	wool
wool	cotton
silk	cotton
linen	wool
viscose	wool
acetate	viscose
polyamide	wool or viscose
polyester	wool or cotton
acrylic	wool or cotton

4.6 Grey scales for assessing change in colour and staining (see clause 3).

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E04 page 1

5 TEST SPECIMEN

5.1 If the textile to be tested is fabric, place a specimen 10 cm × 4 cm between the two adjacent fabrics (4.5) and sew along one of the shorter sides to form a composite specimen. Two such composite specimens are required.

5.2 If the textile to be tested is yarn, knit it into fabric and treat it as in 5.1 or form a layer of parallel lengths of it between the two adjacent fabrics (4.5), the amount of yarn taken being approximately equal to half the combined mass of the adjacent fabrics. Sew along two opposite sides to hold the yarn in place and to form a composite specimen. Two such composite specimens are required.

5.3 If the textile to be tested is loose fibre, comb and compress an amount approximately equal to half the combined mass of the adjacent fabrics (4.5) into a sheet 10 cm × 4 cm. Place the sheet between the two adjacent fabrics and sew along all four sides to hold the fibres in place and to form a composite specimen. Two such composite specimens are required.

6 PROCEDURE

6.1 Thoroughly wet one composite specimen in each of the solutions (4.3 and 4.4) at a liquor ratio of 50 : 1, and allow them to remain in the solutions at room temperature for 30 min. Press and move them from time to time to ensure good and uniform penetration of the liquor. Pour off the solutions and wipe the excess liquor off the specimens between two glass rods. Then place each composite specimen between two glass or acrylic resin

plates measuring about 11,5 cm × 6 cm under a pressure of 12,5 kPa. Use separate apparatus for the alkaline and the acid test.

6.2 Place both sets of apparatus containing a composite specimen in the oven for 4 h at 37 ± 2 °C.

6.3 Open out the composite specimen by breaking the stitching on all sides except one of the shorter sides and dry it by hanging it in air at a temperature not exceeding 60 °C with the three parts in contact only at the remaining line of stitching.

6.4 Assess the change in colour of each specimen and the staining of the adjacent fabrics with the grey scales.

7 TEST REPORT

For each of the solutions specified in 4.3 and 4.4 report the numerical rating for the change in colour of the test specimen and for the staining of each kind of adjacent fabric used.

8 NOTES

8.1 Suitable testing devices are the Hydrotest, the Perspiration Tester and the Perspirometer. If the dimensions of the composite specimen differ from the size of 10 cm × 4 cm, such a weight-piece has to be used that a pressure of 12,5 kPa is applied to the specimen.

8.2 Other devices may be used provided that the same results are obtained as with the apparatus described in 4.1.

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