

Annex A

Specification of stain test strips with standardized soiling

A.1 Artificial soils

The washing performance of a household **washing machine** is the result of mechanical and chemical action, and a combination of both. Natural soils contain fatty matter, proteins and organic and inorganic pigments in complex mixtures. Some kinds of natural soil are more sensitive to mechanical action, and some to chemical action, such as oxidation (bleaching), solubilisation and emulsification. High temperatures increase the effect of mechanical and chemical action.

In this document soil removal performance of a **washing machine** is determined by means of the following different types of standard artificial soils. These soils are based on specially developed stains that are intended to assess each of the main washing parameters. They have been found to be suitable for the assessment of washing performance:

- specimen based on artificial sebum enabling the measurement of the scouring effect, mainly due to mechanical and thermal action;
- specimen based on carbon black and mineral oil enabling the measurement of the scouring effect, mainly due to mechanical and thermal action;
- specimen based on blood enabling the measurement of the removal of protein pigments;
- specimen based on cocoa enabling the measurement of the removal of organic pigments;
- specimen based on red wine enabling the measurement of the bleaching effect.

A.2 Supporting fabric for soil

A.2.1 Material

The fabric used as support for the soil is of pure cotton.

A.2.2 Weaving

Final textile characteristics (after pre-treatment – see A.2.3):

Weight (EN 12127) (200 ± 10) g/m²

Yarn twist (ISO 2061)

Warp (700 ± 100) T/m

Weft (450 ± 100) T/m

Thread count

Warp (34 ± 2) double thread /cm

Weft (20 ± 2) thread /cm

Yarn count (ISO 2060)

Warp (30 ± 1) Tex

Weft (50 ± 1) Tex

A.2.3 Pre-Treatment

A.2.3.1 General

The fluidity index shall be between 0,4 Pa·s and 0,5 Pa·s. The pre-treatment may include singeing, desizing, scouring and calendering. Fluorescent and optical brightener shall not be used.

The fabric is pre-treated through bleaching to obtain the following characteristics.

A.2.3.2 Reflectance

Tristimulus value Y: greater than 86 % for unsoiled cloth, measured with an instrument specified in 5.4.3.

A.2.4 Reproducibility

Only specialized manufacturers, manufacturing large quantities of textiles, are likely to be able to supply this fabric with an adequate reproducibility.

A.3 Artificial soil

A.3.1 Soiling composition

Annex A

Specification of stain test strips with standardized soiling

A.3.1.1 Composition of soil based on sebum/pigment

Synthetic sebum:

Cows fat : 32,8 %
Wool fat : 18,3 %
Free fatty acid : 18,0 %
Cholesterol : 3,7 %
Squalen : 8,9 %
Coconut oil : 3,6 %
Hard paraffin : 3,1 %

Pigment:

Carbon black (see A.3.1.2)
Kaoline
Iron oxide (yellow and black)

The proportion of pigments and sebum shall be such as to obtain the reflectance specified in A.4.2.

A.3.1.2 Composition of soil based on carbon black and mineral oil

Pigment, carbon black:

Average size of grains : 295 Å
Average surface of grains : 94 m²/g
Carbon content : 96,0 %

Oil, paraffin oil:

Specific weight : 0,885
Ignition temperature : 221 °C
Liquefaction temperature : -26 °C

The proportion of pigments and fatty materials shall be such as to obtain the reflectance specified in A.4.2.

A.3.1.3 Composition of soil based on blood

Pig's blood, fresh and stabilized by the addition of 10 g/l ammonium citrate.

A.3.1.4 Composition of soil based on chocolate with milk

Unsweetened cocoa (20/22 % fat, not alkalised) with sugar, full-cream cow's milk and water.

A.3.1.5 Composition of soil based on red wine

"Alicante" red wine treated with hot air.

NOTE Alicante is a trademark. This information is given for the convenience of users of this European Standard and does not constitute an endorsement by IEC of this trademark. Equivalent products may be used if it can be shown to produce equivalent results.

A.4 Stain test strips

A.4.1 Application of soil

The application of soil by immersing the textile is recommended.

The treatment may include the following operations:

- immersion;
- calendering;
- drying;
- new immersion, if necessary;
- calendering;
- drying;
- ageing.

A.4.2 Soil checking after deposition of soil

Annex A

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The manufacturer should make sure that soil is evenly and regularly deposited. At the end of preparation, the Y tristimulus reflectance measurements on a dry sample using an instrument specified in 5.4.3, shall be within the range specified below for each soil:

- sebum /pigment: (50 ± 3)
- carbon black/mineral oil: (25 ± 3)
- blood: (19 ± 3)
- chocolate/milk: (37 ± 3)
- red wine: (44 ± 3)

The difference between front and back should be within the defined limits.

NOTE The unsoiled reflectance prior to soiling is given in A.2.3.12.

A.4.3 Washed reflectance values

From each of the following **programmes**, five **test runs** in the **reference machine** using programmes described and shall be carried out:

- cotton 60 °C, 180 g detergent A*
- cotton 40 °C, 180 g detergent A*
- cotton 60 °C, 90 g detergent A*

The optical reflectance is measured using an instrument specified in 5.4.3 and evaluated in accordance with 9.2. (Refer to SANS 1695:2016/IEC 60456:2011).

The ratios and tolerances between the different **programmes** are defined in Table A.1 and shall be certified by the supplier of the material.

**Table A.1 – Ratios and tolerances of standardized soils,
Reference Machine CLS and MP Lab**

Soil type	Ratio cotton 40 °C/ cotton 60 °C	Cotton 60 °C Ratio: 90 g /180 g
Sebum/pigment	$0,93 \pm 0,03$	$0,98 \pm 0,03$
Carbon black/oil	$0,88 \pm 0,03$	$0,94 \pm 0,03$
Blood	$0,91 \pm 0,04$	$0,92 \pm 0,05$
Chocolate/milk	$0,86 \pm 0,04$	$0,88 \pm 0,05$
Red wine	$0,86 \pm 0,03$	$0,89 \pm 0,03$
Sum (with sebum)	$0,89 \pm 0,02$	$0,92 \pm 0,02$

These ratios define the total test system of reference machines, **base load**, detergent, stain test strips (making up a **test load**) and reflectance measurement. Therefore ratios may be used as general qualification criteria for the test system within a laboratory, and can be used to assess the additional uncertainty from laboratory to laboratory.

A.5 Marking of stain test strips and accompanying data

Each batch of stain test strips shall be marked with a batch number and delivered with the following information:

- Batch number to permit checking date of manufacture;
- expiry date (the maximum period should be not more than one year from date of manufacture);
- reflectance value of the non-soiled fabric (see A.2.3.12);
- reflectance values of the soiled fabrics (unwashed) (see A.4.2);
- reflectance values after washing consisting of the tristimulus values Y for the individual soil types after washing in the reference washing machine at 60 °C and also for 40 °C and 60 °C with 90 g detergent A* together with the resulting ratios according to A.4.3.