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Textiles — Tests for colour fastness —

Part G02:
Colour fastness to burnt-gas fumes

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Textiles — Essais de solidité des teintures —

Partie G02: Solidité des teintures aux fumées de gaz brûlés

Reference number
ISO 105-G02:1993(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 105-G02 was prepared by Technical Committee ISO/TC 38, *Textiles*, Sub-Committee SC 1, *Tests for coloured textiles and colorants*.

This second edition cancels and replaces the first edition (included in ISO 105-G:1978), of which it constitutes a minor revision.

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ISO 105 was previously published in thirteen “parts”, each designated by a letter (e.g. “Part A”), with publication dates between 1978 and 1985. Each part contained a series of “sections”, each designated by the respective part letter and by a two-digit serial number (e.g. “Section A01”). These sections are now being republished as separate documents, themselves designated “parts” but retaining their earlier alphanumeric designations. A complete list of these parts is given in ISO 105-A01.

Annexes A and B form an integral part of this part of ISO 105.

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Textiles — Tests for colour fastness —

Part G02:
Colour fastness to burnt-gas fumes

1 Scope

1.1 This part of ISO 105 specifies a method for determining the resistance of the colour of textiles of all kinds and in all forms, except loose fibres, to exposure to atmospheric oxides of nitrogen as derived from the combustion of chemically pure butane gas.

1.2 This method may be used for rating the colour fastness of dyes by applying the dye to textiles by a specified procedure and at a specified depth of colour and testing the dyed textiles.

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this part of ISO 105. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this part of ISO 105 are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO 105-A01:1989, *Textiles — Tests for colour fastness — Part A01: General principles of testing.*

ISO 105-A02:1993, *Textiles — Tests for colour fastness — Part A02: Grey scale for assessing change in colour.*

ISO 105-C06:1987, *Textiles — Tests for colour fastness — Part C06: Colour fastness to domestic and commercial laundering.*

ISO 105-D01:1987, *Textiles — Tests for colour fastness — Part D01: Colour fastness to dry cleaning.*

3 Principle

A specimen of the textile and a test-control fabric are exposed simultaneously to oxides of nitrogen from burnt-gas fumes until the test control shows a change in colour corresponding to that of a standard of fading. The change in colour of the specimen is assessed with the grey scale. If no colour change is observed in the specimen after one exposure period or cycle, exposure may be continued for either a specified number of periods or for the number of periods required to produce a specified amount of colour change in the specimen.

4 Apparatus and materials

4.1 Exposure chamber (see annex A).

4.2 Test control (see annex B).

4.3 Standard of fading (see annex B).

4.4 Grey scale for assessing change in colour, complying with ISO 105-A02.

4.5 Butane gas, chemically pure, and a suitable **burner**.

Any gas burner may be used and either a yellow luminous or a blue-green flame is suitable, though the latter is to be preferred in order to minimize the for-

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mation of soot. A wire gauze placed above the flame at a distance which causes it to be heated to somewhere between red and white heat will increase the percentage of oxides of nitrogen and will thereby accelerate the fading of the test control and specimens. Brass, iron, Monel alloy and stainless-steel gauzes give practically the same results.

4.6 Urea, solution containing, per litre, 10 g of urea (NH_2CONH_2), buffered to pH 7 by the addition of 0,4 g of sodium dihydrogen orthophosphate dodecahydrate ($NaH_2PO_4.12H_2O$) and 2,5 g of disodium hydrogen orthophosphate dihydrate ($Na_2HPO_4.2H_2O$), and containing 0,1 g or less of a rapid-wetting surface-active agent, for example sodium dioctyl sulfosuccinate.

4.7 If required, **perchloroethylene, Stoddard solvent** or **trichloroethylene** (see 5.4).

NOTE 1 All the inhibitors available at present are soluble to some extent in water and therefore tend to be removed by washing. These inhibitors are in general not soluble in the ordinary dry-cleaning solvents, and fabrics treated with suitable inhibitors should withstand several dry-cleanings without losing their resistance to gas fading provided the dry-cleaning operation does not include spotting or sponging with water). The inhibitors also tend to lose their efficiency if the fabrics come into frequent contact with perspiration.

4.8 If required, **AATCC reference detergent WOB** (see 5.5), as specified in ISO 105-C06:1987, subclause 8.2.

5 Test specimens

NOTE 2 When an acetate fabric is pressed with an iron which is hot enough to remove all wrinkles, there is a danger of sealing the surface of the fabric, which would increase the resistance to gas fading. This technique is not conducive to accurate test results and should be avoided on fabrics of this type.

5.1 If the textile to be tested is fabric, use a specimen measuring 40 mm × 100 mm.

5.2 If the textile to be tested is yarn, knit it into fabric and use a specimen measuring 40 mm × 100 mm.

5.3 For fastness to oxides of nitrogen in storage or use, use a specimen of the original fabric.

5.4 For fastness to oxides of nitrogen after dry-cleaning (see note 1), use the method specified in ISO 105-D01. Immerse one specimen in cold perchloroethylene (4.7) for 10 min, squeeze and allow it to dry in the air. If desired, Stoddard solvent or trichloroethylene may be substituted for perchloroethylene. Retain a specimen after dry-cleaning and before testing to compare with the tested specimen.

5.5 For fastness to oxides of nitrogen after washing (see note 1), unless a specific wash-test is specified, wash the test specimen in a detergent solution containing 5 g of AATCC reference detergent WOB per litre of water of approximately zero hardness for 10 min at 40 °C, rinse in warm water and allow it to dry in the air. Retain a specimen after washing and before testing to compare with the tested specimen.

6 Procedure

6.1 Freely suspend each specimen and a piece of the test control in the test chamber (4.1) so that they are not in contact with each other and do not come into direct contact with any hot metallic surface. If fewer specimens than are required to fill the chamber are to be tested, fill the chamber with cuttings of undyed fabric of the same kind. Light the gas burner (4.5) and adjust the flame and ventilating equipment so that the temperature in the chamber does not exceed 60 °C.

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NOTE 3 Other things being equal, the fading of the specimens will vary according to the temperature in the exposure chamber, which in turn depends upon the amount of gas consumed in a given period. Exposure for 8 h to 12 h at 60 °C may cause as much colour destruction as exposure for 96 h at 21 °C to 27 °C. Apart from this, the temperature may vary somewhat in different parts of the exposure chamber from time to time.

The fading of dyes on acetate, triacetate and polyester by oxides of nitrogen will occur at low relative humidities, as would be obtained in the conventional chamber at temperatures approaching 60 °C. For other fibres such as nylon, viscose or cotton, it is necessary to use high humidities in order to produce results which correlate with service performance. A suggested procedure for raising the level of humidity in the chamber, if this is necessary, is to place containers of water on the floor of the chamber. If the humidity is raised by this or any other procedure, this shall be noted in the test report.

Keep the specimens in the chamber until the test control shows a change in colour corresponding to that of the standard of fading (4.3), when compared in daylight or equivalent artificial illumination (see ISO 105-A01:1989, clause 14).

6.2 Remove the specimens from the test chamber and immediately make a preliminary assessment of the change in colour by the use of the grey scale for assessing change in colour (4.4).

6.3 Those specimens showing a colour change, a piece of the original textile from which each specimen was taken, and the test control shall, without delay, be plunged into the buffered urea solution (4.6) for

5 min. They shall be squeezed out, thoroughly rinsed in water, and dried in air at a temperature not above 60 °C. When dry, assess the change in colour of each specimen against the portion of the original textile which has been treated with buffered urea solution, using the grey scale. If retained, store in the dark.

6.4 After the first cycle, return to the test chamber any specimens which do not show a colour change and which were not treated with the buffered urea solution, along with a fresh piece of the test-control fabric, and continue the test until the second test control shows a change in colour corresponding to that of the standard of fading.

6.5 The procedure may be repeated either for a specified number of cycles or until the specimens show a specified amount of colour change.

6.6 After each exposure period, remove the specimens from the chamber and immediately compare them with the respective originals.

6.7 The effect on the colour of the specimens after any desired number of cycles can be expressed and defined by reference to the grey scale for assessing change in colour.

7 Test report

The test report shall include the following particulars:

a) The number and date of publication of this part of ISO 105, i.e. ISO 105-G02:1993;

b) all details necessary for the identification of the sample tested;

c) the numerical rating for the change in colour of each specimen and the number of cycles for which it was exposed;

d) the average temperature employed and, if humidity was increased, the method employed.

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Annex A
(normative)

Exposure chamber

A.1 The exposure chamber may be of any suitable construction but shall provide an enclosure in which specimens can be exposed in an atmosphere of air which has passed over a butane gas burner and contains the by-products of combustion from the lighted burner. The apparatus shall be equipped with a suitable means of suspending the specimens so that there is free circulation of the atmosphere around them and so that only a minimum amount of the specimen at its point of suspension is in direct contact with any hot metallic surface. Either a motor-driven fan to move the air around in the test chamber or a motor-driven rotating specimen rack shall be employed in order to ensure as nearly as possible that all specimens are exposed to the same conditions of gas concentration, temperature and humidity.

Adjustable vents or dampers in the top of the unit, together with adjustment of the height of the flame of the gas burner, shall be used to regulate the temperature of the exposure chamber, but temperature and humidity will vary with that of the room in which the exposure chamber is being operated.

A.2 Several forms of suitable apparatus are illustrated in the *American Dyestuff Reporter*, July 22, 1940, pp. 368-9. Blueprints of a suitable apparatus may be purchased from AATCC, P.O. Box 12215, Research Triangle Park, NC 27709-2215, USA.

A.3 A gas-fading apparatus suitable for large-scale testing collects the fumes from a safety-type burner located in a lower chamber. In order to ensure uniform fading of the test specimens, the arms on which they are hung are revolved at a frequency of 2 min^{-1} by a motor drive, thus ensuring that all specimens are exposed under identical, controlled conditions. Since the test apparatus has been primarily designed for more accurate control work, it is recommended that the temperature be adjusted so as to complete one test in 7 h to 16 h.

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Annex B
(normative)

Test control and standard of fading

B.1 The test-control fabric shall be acetate uniformly dyed in an open-width dyeing machine with 0,4 % (on mass of fabric) CI Celliton FFRN (Disperse Blue 3, Colour Index, 3rd Edition), in a dye-bath containing 1 g/l of a neutral non-ionic dispersing agent at a liquor ratio of 10:1.

The dyeing begins at 40 °C and the temperature is raised to 80 °C within 30 min. The dyeing is continued for a further 60 min. The fabric is rinsed in cold water and dried.

The colour coordinates of this dyeing are $x = 0{,}198\ 8$, $y = 0{,}190\ 4$, $Y = 23{,}20$, using Illuminant C.

The tolerance may be 2 AN (40) units maximum.

B.2 Pieces of the original lot of control fabric were hung in air in three separate places in Southern New Jersey, USA, for 6 months. It was assumed that the atmosphere in these places contained an average content of oxides of nitrogen. At the end of the exposure period, samples from the three locations were assembled and compared with the original material. All had changed about equally, being decidedly duller and redder than the original. The faded shade was then matched with vat dyes on acetate satin and this became the original standard of fading for that lot of control fabric. This produced a standard of fading which was more permanent than the exposed pieces of the control fabric, which would have continued to change with even very small amounts of oxides of nitrogen.

B.3 Since different lots and sources of both the dyestuff and undyed fabric will produce variations in both the original shade and its fading rate, it is therefore necessary to establish accurately a new standard of fading for each dyed lot of control fabric so that comparable test results can be obtained when using different lots of the control and their respective standards of fading. In conducting tests, only the standard of fading applicable to that lot of control fabric may be used.

B.4 The standard of fading is a fabric of similar appearance dyed to match a faded specimen of the test control. Both the test control and the standard of fading can be obtained from national standards organizations.

B.5 Both the control fabric and the standard of fading must be kept in suitable containers or enclosures to protect them from possible exposure and colour change to oxides of nitrogen and other contaminants which might be present in the atmosphere during transportation and storage.

B.6 The control fabrics are also sensitive to other atmospheric contaminants such as ozone. Their fading rates will vary considerably at different humidities and temperatures, and their use in natural conditions or end-use testing as a measure of exposure to ozone is not recommended. The colour change produced on the controls will reflect the combined effects of the atmospheric contaminants present and temperature-humidity variations — not just the effects of exposure to oxides of nitrogen.

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