INTERNATIONAL STANDARD

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Textiles — Tests for colour fastness —

Part G04: Colour fastness to nitrogen oxides in the atmosphere at high humidities

Textiles — Essais de solidité des coloris —

Partie G04: Solidité des coloris aux oxydes d'azote en atmosphère à taux d'humidité élevés

Reference number
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Foreword

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The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

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For an explanation on the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the WTO principles in the Technical Barriers to Trade (TBT) see the following URL: Foreword - Supplementary information.

The committee responsible for this document is ISO/TC 38, *Textiles*, Subcommittee SC 1, *Tests for coloured textiles and colorants*.

This second edition cancels and replaces the first edition (ISO 105-G04:1989), which has been technically revised. The main technical changes are the following:

a) delete the test-control fabric dyed with Disperse Blue 3;

b) add the test-control fabric dyed with Disperse Violet 1 and the test-control fabric dyed with Disperse Blue 56.

ISO 105 consists of the many parts designated by a part letter and a two-digit serial number (e.g. A01), under the general title *Textiles — Tests for colour fastness*. A complete list of these is given in ISO 105-A01.

Introduction

This method is based on a test (AATCC 164-1987), developed by AATCC in response to a specific need in the USA for the determination of fading in the presence of nitrogen oxide at high relative humidities. Such conditions are prevalent along the Gulf of Mexico coast of the USA and in Southern California. Fading of some dyes on certain man-made fibres, particularly on carpets, was observed to be quite severe under such conditions. The development of this test method enabled dye manufacturers, fibre producers and textile manufacturers to select dye/fibre combinations which were resistant to fading in the presence of nitrogen oxide at high relative humidities. The same fabrics, when tested at low humidities, showed little or no fading.

Textiles — Tests for colour fastness —

Part G04:
Colour fastness to nitrogen oxides in the atmosphere at high humidities

1 Scope

This part of ISO 105 specifies a method for determining the resistance of the colour of textiles to the action of nitrogen oxide in the atmosphere at elevated temperatures and high relative humidities.

For testing at lower humidities, see ISO 105-G01.

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.

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

ISO 105-C10, *Textiles — Tests for colour fastness — Part C10: Colour fastness to washing with soap or soap and soda*

ISO 105-D01, *Textiles — Tests for colour fastness — Part D01: Colour fastness to drycleaning using perchloroethylene solvent*

ISO 139, *Textiles — Standard atmospheres for conditioning and testing*

3 Principle

A test specimen and a piece of test-control fabric are simultaneously exposed to nitrogen oxide in an atmosphere which is maintained at 87,5 % ± 2,5 % relative humidity and a temperature of 40 °C ± 1 °C until the test-control fabric shows a colour change-corresponding to that of a standard of fading.

The exposure/measurement cycle is repeated until the test specimen shows a definite colour change or for a prescribed number of cycles.

4 Apparatus and reagents

4.1 Exposure chamber, see Annex A.

4.2 Test-control fabric

4.2.1 Test-control fabric dyed with Disperse Violet 1

A woven filament acetate is uniformly dyed in an open-width dyeing machine with 0,4 % (on mass of fabric) Cl Disperse Violet 1 (Colour Index, Third Edition) in a dye-bath containing 1 g/l of a dispersing agent at a liquor ratio of 10:1.

The fabric construction has both a taffeta and a satin side; for this test procedure, only the taffeta side will be considered.

The resistance of the test-control fabric to the action of nitrogen oxides should not be varied between the new lots. The supplier should confirm the performance of the new lot.[1)]

4.2.2 Test-control fabric dyed with Disperse Blue 56

A woven filament acetate is uniformly dyed in an open-width dyeing machine with 0,8 % (on mass of fabric) CI Disperse Blue 56 (Colour Index, Third Edition) in a dye-bath containing 0,5 ml/l of a dispersing agent at a liquor ratio of 42:1.

The fabric construction has both a taffeta and a satin side; for this test procedure, only the taffeta side will be considered.

The resistance of the test-control fabric to the action of nitrogen oxide should not be varied between the new lots. The supplier should confirm the performance of the new lot.[2)]

4.3 Standard of fading

4.3.1 Standard fading fabric for test-control fabric dyed with Disperse Violet 1

The regenerated cellulose woven taffeta is a fabric of similar appearance to the test-control fabric (4.2.1), dyed to match an average of faded test-control fabric.[3)]

4.3.2 Standard of fading for test-control fabric dyed with Disperse Blue 56

It is considered that the standard of fading is completed when a faded test-control fabric (4.2.2) is observed to have a contrast equal to grade 3-4 on the in grey scale.

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

4.5 Nitrogen oxide

Use bottled gas which contains approximately 1 % nitrogen dioxide in nitrogen, in cylinders equipped with the proper reducing valves. For safety, chain the cylinders to a wall so that they cannot fall or be knocked down.

WARNING — Nitrogen oxide in high concentrations are injurious to health and should be exhausted to the atmosphere or trapped in water and neutralized with a 10 % (m/m) solution of sodium hydroxide or sodium hydrogen carbonate. The maximum concentration in a work area should not exceed 9,57 mg/m^3.

4.6 Urea after treatment

The use of this treatment is optional.

Experience has shown that colour change after removal of test specimens from the exposure chamber is negligible. The urea treatment itself will often cause a colour change in test specimens. Therefore, if

1) Test-control fabric dyed with Disperse Violet 1 is commercially available from Testfabrics, Inc. This information is given for the convenience of users of this document and does not constitute an endorsement by ISO this product.

2) Test-control fabric dyed with Disperse Blue 56 is commercially available from the Japanese Standards Association.. This information is given for the convenience of users of this document and does not constitute an endorsement by ISO this product.

3) The standard fading fabric is commercially available from Testfabrics, Inc. This information is given for the convenience of users of this document and does not constitute an endorsement by ISO this product.

this procedure is used, it is essential that both the exposed and unexposed test-control fabric be treated in an identical manner.

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

5 Conditioning

The standard temperate atmosphere for testing textiles (see ISO 139), i.e. a relative humidity of (65 ± 4) % and temperature of (20 ± 2) °C, shall be used for conditioning.

6 Test specimens

Cut out test specimens measuring at least 60 mm × 60 mm. For subsequent colour comparison, the unexposed sample shall be kept in an airtight container away from light to avoid further colour changes

If the test involves the effect of nitrogen oxide on laundered or dry-cleaned material, use laundered or dry-cleaned material for both the control and test exposure. For the preparation of test specimens for testing after laundering or dry cleaning, follow the procedures described in ISO 105-C10 and/or ISO 105-D01. While laundering or dry-cleaning before testing, the size of the test specimens also meets at least 60 mm × 60 mm.

7 Procedure

7.1 Suspend the test specimens and piece of test-control fabric (4.2.1 or 4.2.2) in the exposure chamber (4.1) which should produce a cycle of fade within 5 h to 15 h of exposure.

7.2 Examine the test-control fabric periodically until its colour corresponds to that of the standard of fading. This constitutes one cycle. An alternative method of determining one cycle of fade is to terminate the exposure cycle when the test-control fabric exhibits a colour change of (16,5 ± 1,5) CIELAB units (see ISO 105-J01).

7.3 Remove those test specimens which exhibit a noticeable colour change at the end of one cycle. One cycle will generally produce a measurable colour change in samples which are sensitive to nitrogen oxide.

7.4 Suspend a fresh piece of test-control fabric (4.2.1 or 4.2.2) for each additional cycle of fade until the required number of cycles has been completed.

Test specimens exposed to nitrogen oxide may continue to change colour after removal from the test chamber. The colour may be stabilized by plunging them into a buffered urea solution (see 4.6) for 5 min, squeezing them out, thoroughly rinsing them in clean water and drying them in air at a temperature not above 60 °C. Do not treat with the urea solution any test specimen that is to be returned to the test chamber for additional exposure.

7.5 At the end of each cycle, immediately assess the change in colour of the test specimen using the grey scale for assessing change in colour (4.4).

7.6 Classify the effect on colour of test specimens after the specified number of cycles, using the grey scale for assessing change in colour (4.4).

8 Test report

The test report shall include the following:

a) the date of test;

b) the number and year of publication of this part of ISO 105, i.e. ISO 105-G04:2016;

c) all details necessary for the identification of the test specimen tested;

d) the type of the test-control fabric used;

e) the numerical rating for the change in colour of each test specimen using the grey scale;

f) the number of cycles of exposure;

g) the temperature and relative humidity at which the test was performed.

9 Notes on humidity for testing

The fading of dyes by nitrogen oxide on some fibres, such as polyamide and acetate, is altered greatly by relatively small variations in relative humidity at high humidities. Therefore, to achieve reproducibility and good interlaboratory correlation in test results, close control of temperature and relative humidity is required.

Annex A
(normative)

Test apparatus

Suitable test apparatus is shown in Figure A.1 and consists of a 15 l capacity bell-jar having five plug-holes on the top and a thermostatic water bath.

The exposure chamber is made of stainless steel which is coated on the inside with a resistant coating, capable of maintaining an atmosphere having a relative humidity of (87,5 ± 2,5) % at a temperature (40 ± 1) °C and containing nitrogen dioxide at a concentration by volume of 8,96 mg/m^3.

Inside the bell-jar are placed a glass cylinder, 165 mm ± 2 mm in diameter and 225 mm ± 1 mm in height, standing on three supports made of inert material (for example, silicone rubber or glass), a temperature and humidity sensor, two evaporating dishes and a stainless-steel frame for suspending the test specimens.

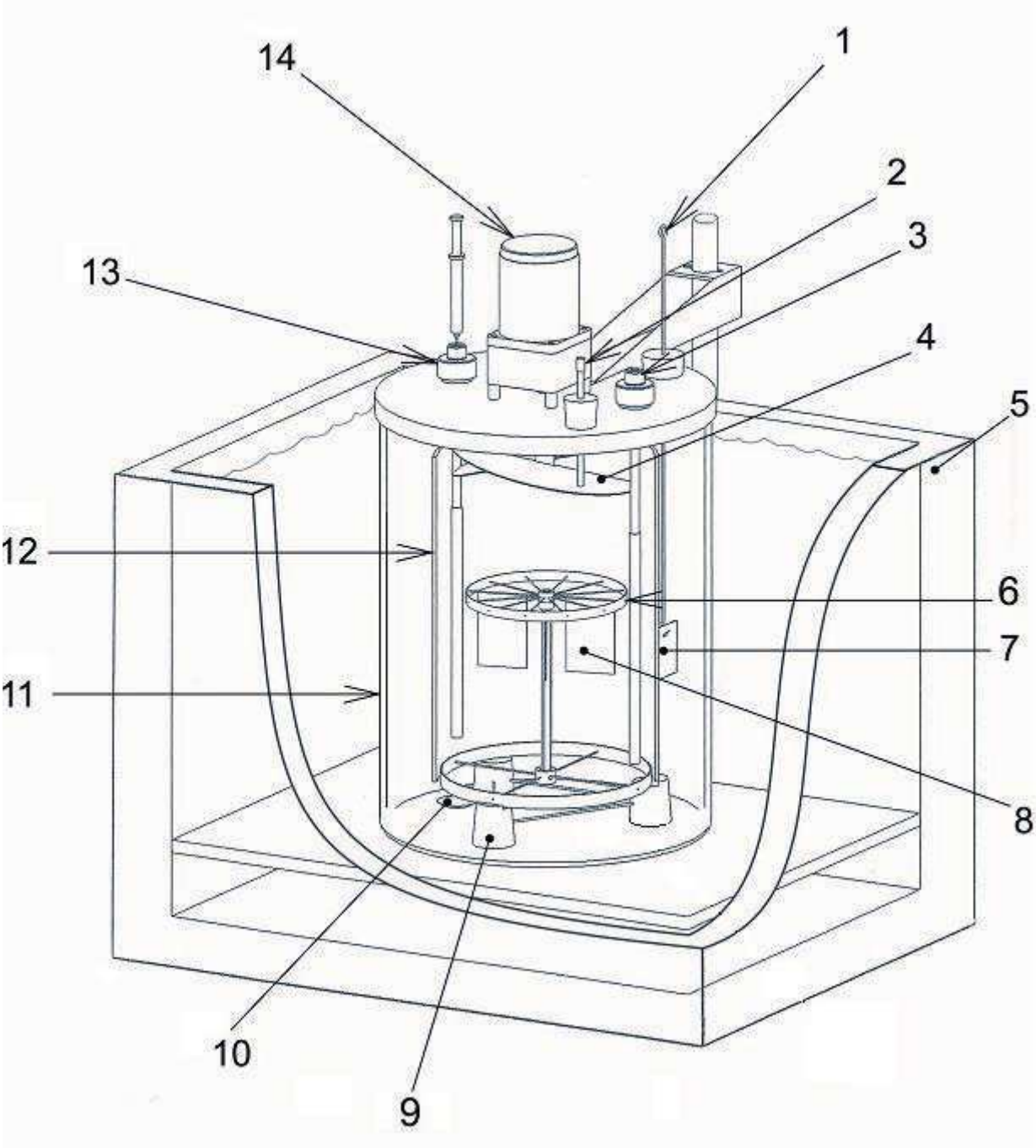
Through one of the top plug-holes passes a spindle bearing a stainless-steel or plastics fan, 145 mm ± 5 mm in diameter, adjusted so that its lower edge is approximately 20 mm from the upper rim inside the glass cylinder.

A stainless-steel rod is let through the other top plug-hole and holds the test-control fabric. This holder is located between the glass cylinder and the bell-jar.

And also inside the bell-jar are placed two evaporating dishes and a temperature and humidity sensor.

Any other apparatus yielding the same results can also be used.

Care shall be taken to carry out the test under identical conditions, i.e. the ratio between number of test specimens, space in the test chamber and amount of gas shall always be the same.



Key

1	stainless steel rod	8	test specimen
2	temperature and humidity sensor	9	supports
3	gas inlet	10	evaporating dishes (for pure water)
4	fan	11	bell-jar
5	thermostatic water bath	12	glass cylinder
6	stainless-steel frame	13	pure water inlet
7	test-control fabric	14	motor

Figure A.1 — Exposure chamber

Bibliography

[1] ISO 105-G01, *Textiles — Tests for colour fastness — Part G01: Colour fastness to nitrogen oxide*

[2] ISO 105-J01, *Textiles — Tests for colour fastness — Part J01: General principles for measurement of surface colour*

[3] Colour Index Revised Third Edition

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