
**Textiles — Tests for colour fastness —
Part G01:
Colour fastness to nitrogen oxides**

Textiles — Essais de solidité des teintures —

Partie G01: Solidité des teintures aux oxydes d'azote

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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.

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).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

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 third edition cancels and replaces the second edition (ISO 105-G01:1993), which has been technically revised. It also incorporates the Technical Corrigendum ISO 105-G01:1993/Cor 1:1995. The main technical changes are the following:

- a) the test-control fabric dyed with Disperse Blue 3 was deleted;
- b) the test-control fabric dyed with Disperse Violet 1 and the test-control fabric dyed with Disperse Blue 56 were added.

ISO 105 consists of 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.

Textiles — Tests for colour fastness —

Part G01: Colour fastness to nitrogen oxides

1 Scope

This part of ISO 105 specifies two methods for determining the resistance of the colour of textiles of all kinds and in all forms to the action of nitrogen oxides produced during combustion of gas, coal, oil, etc., and when air is passed over heated filaments.

The two tests differ in severity; one or both of them are used, depending on the result obtained (7.2.4).

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-F02, *Textiles — Tests for colour fastness — Part F02: Specification for cotton and viscose adjacent fabrics*

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

ISO 3696, *Water for analytical laboratory use — Specification and test methods*

3 Principle

Specimens of textiles are exposed to nitrogen oxides in a closed container until either one or three test-control fabrics exposed simultaneously with the test specimens have changed in colour to a predetermined extent. The change in colour of each specimen is assessed with the grey scale.

4 Apparatus and materials

4.1 **Exposure chamber**, see [Annex A](#).

4.2 **Nitric oxide**, from a commercially supplied cylinder or a generator (see [Annex B](#)).

WARNING — Nitric oxide is toxic. The maximum concentration in a working room should not exceed 6,7 mg/m³.

4.3 **Sulfuric acid**, containing 1 100 g/l of H₂SO₄ (relative density 1,603).

4.4 **Sodium nitrite (NaNO₂)**, saturated solution in grade 3 water ([4.13](#)).

4.5 **Sodium hydroxide**, dilute solution (approximately 100 g/l of NaOH).

4.6 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 dihydrate ($\text{NaH}_2\text{PO}_4 \cdot 2\text{H}_2\text{O}$) and 2,5 g/l of disodium hydrogen orthophosphate dodecahydrate ($\text{Na}_2\text{HPO}_4 \cdot 12\text{H}_2\text{O}$), and containing 0,1 g/l or less of a rapid-wetting surface-active agent, for example, sodium dioctyl sulfosuccinate.

4.7 Test-control fabric

4.7.1 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) CI 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 nitric oxide should not be varied between the new lots. The supplier should confirm the performance of the new lot.¹⁾

4.7.2 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 nitric oxide should not be varied between the new lots. The supplier should confirm the performance of the new lot.²⁾

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4.8 Standard of fading

4.8.1 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 (4.7.1), dyed to match an average of faded test-control fabric.³⁾

4.8.2 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 (4.7.2) is observed to have a contrast equal to grade 3-4 on the grey scale.

4.9 Syringe, for injecting oxide into the exposure chamber (4.1).

A medical syringe is best suited to the injection of the nitric oxide. For a larger exposure chamber, the gas can also be measured and transferred from the nitric oxide reservoir to the exposure chamber by means of a gas burette.

4.10 Undyed fabric, of the same kind(s) of fibre as the test specimen.

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.

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

4.12 Means for providing the standard atmosphere for testing, specified in [Clause 5](#).

4.13 Grade 3 water, according to ISO 3696.

5 Conditioning and testing atmosphere

The standard temperate atmosphere for testing textiles (see ISO 139), i.e. a relative humidity of $(65 \pm 4) \%$ and temperature of $(20 \pm 2) ^\circ\text{C}$, shall be used for conditioning and testing.

6 Test specimens

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

6.2 If the textile to be tested is yarn, knit it into fabric and use a piece measuring 40 mm × 100 mm or wind it closely round a frame of rigid inert material measuring 40 mm × 100 mm to form, on each side, a layer having only the thickness of the yarn.

6.3 If the textile to be tested is loose fibre, comb and compress enough of it to form a sheet measuring 40 mm × 100 mm and sew the sheet on a piece of cotton adjacent fabric complying with ISO 105-F02 to support the fibre.

6.4 Cut a test specimen measuring 40 mm × 100 mm from the test-control fabric ([4.7.1](#) or [4.7.2](#)) and cut test specimens measuring 40 mm × 100 mm from the undyed fabric ([4.10](#)).

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7 Procedure

7.1 Preliminary operations

7.1.1 Mount each test specimen by fastening the shorter side to a radial arm of the frame of the apparatus (see [Figure A.1](#)) by means of an adhesive or clips. When an adhesive is used, this shall be allowed to dry properly.

7.1.2 Up to 12 test specimens, each measuring 40 mm × 100 mm, may be mounted in this way for one test. If fewer test specimens are to be tested, fill up with cuttings of undyed fabric of the same kind to the total number of 12. The test-control fabric is fastened to the holder. Condition the test specimens and test-control fabric for at least 12 h in the atmosphere specified in [Clause 5](#).

7.1.3 Place the frame with the test specimens inside the glass cylinder and then place the bell-jar on top; put the holder with the test-control fabric through the top plug-hole.

7.1.4 Adjust the rotational frequency of the fan to 200 min⁻¹ to 300 min⁻¹ and shield the apparatus from bright light.

7.1.5 Inject 0,65 ml of nitric oxide ([4.2](#)) for each litre of exposure chamber capacity into the bell-jar.

7.2 One-cycle test

7.2.1 Observe the test-control fabric and, when it has faded to the extent shown by the standard of fading ([4.8.1](#) or [4.8.2](#)), lift the bell-jar immediately and plunge the exposed test specimens and the

exposed test-control fabric into the buffered urea solution (4.6) together with unexposed portions of the textile from which each test specimen was taken.

7.2.2 After immersion for 5 min, squeeze, rinse and dry the test specimens and unexposed portions by hanging them in air at a temperature not exceeding 60 °C.

7.2.3 Check that the test-control fabric has faded to the extent shown by the standard of fading (4.8.1 or 4.8.2) and, if so, assess the change in colour of each test specimen against the appropriate unexposed portion which has been immersed in the buffer solution, using the grey scale (4.11).

7.2.4 If a test specimen shows a contrast greater than grade 4, this one-cycle result shall be reported (see Clause 8) and the test completed. If the contrast is not greater than grade 4, the preliminary operations described in 7.1 shall be carried out on fresh test specimens, followed by the three-cycle test procedure described in 7.3.

7.3 Three-cycle test

7.3.1 Observe the test-control fabric and, when it has faded to the extent shown by the standard of fading (4.8.1 or 4.8.2), plunge test-control fabric into the buffered urea solution (4.6), replace it with another test-control fabric and inject an additional 0,2 ml of nitric oxide for each litre of exposure chamber capacity. When the second test-control fabric has faded to the extent shown by the standard of fading, plunge test-control fabric into the buffered urea solution (4.6), replace it with a third test-control fabric, and again add 0,2 ml of nitric oxide for each litre of exposure chamber capacity. When the third test-control fabric has faded to the extent shown by the standard of fading, lift the bell-jar immediately and plunge the exposed test specimens and the exposed test-control fabric into the buffered urea solution (4.6) together with unexposed portions of the textile from which each test specimen was taken.

7.3.2 After immersion for 5 min, squeeze, rinse and dry the test specimens and unexposed portions by hanging them in air at a temperature not exceeding 60 °C.

7.3.3 Check that each of the three test-control fabric has faded to the extent shown by the standard of fading and, if so, assess the change in colour of each test specimen against the appropriate unexposed portion which has been immersed in the buffer solution, using the grey scale (4.11).

7.3.4 This three-cycle result shall be reported (see Clause 8) and the test completed.

7.4 Conditioning

The test shall be conducted in the standard atmosphere for testing as specified in Clause 5. If no conditioning room is available in which the complete test can be carried out, the test specimen may be conditioned in the standard atmosphere for testing in a suitable apparatus and tested at room temperature. In this case, conditioned air (20 °C, 65 % relative humidity) shall be aspirated through the chamber for 15 min before introducing the nitric oxide. The conditioned air can be provided by passing air through a wash bottle containing a saturated solution of ammonium nitrate (NH₄NO₃) in contact with the solid phase at 20 °C. The inlet and outlet are closed during the test.

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-G01:2016;
- 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 (one or three).

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