INTERNATIONAL STANDARD

**ISO 105-G03**

Second edition
1993-10-01

# Textiles — Tests for colour fastness —

## Part G03:
## Colour fastness to ozone in the atmosphere

*Textiles — Essais de solidité des teintures —*
*Partie G03: Solidité des teintures à l'ozone dans l'atmosphère*



Reference number
ISO 105-G03:1993(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-G03 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.

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. Annex C is for information only.



International Organization for Standardization
Case Postale 56 • CH-1211 Genève 20 • Switzerland
Printed in Switzerland

# Textiles — Tests for colour fastness —

# Part G03:
Colour fastness to ozone in the atmosphere

## 1 Scope

This part of ISO 105 specifies a method for determining the resistance of the colour of textiles of all kinds and in all forms to the action of ozone in the atmosphere, both at ambient room temperatures with relative humidities not exceeding 65 % and at elevated temperatures with relative humidities above 80 %.

NOTE 1 If a sample shows sensitivity to this test, it should also be tested for sensitivity to the tests specified in ISO 105-G01 (colour fastness to nitrogen oxides) and ISO 105-G02 (colour fastness to burnt-gas fumes).

## 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-F:1985, *Textiles — Tests for colour fastness — Part F: Standard adjacent fabrics.*

## 3 Principle

**3.1** A specimen and a swatch of test-control fabric are simultaneously exposed to ozone, in an atmosphere at ambient room temperature and a relative humidity not exceeding 65 %, until the test control shows a colour change corresponding to that of a standard of fading. This exposure period constitutes one cycle. The cycles are repeated until the specimen shows a definite colour change or for a prescribed number of cycles.

**3.2** A specimen and a swatch of test-control fabric are simultaneously exposed to ozone in an atmosphere which is maintained at (85 ± 5) % relative humidity and a temperature of 40 °C ± 5 °C until the test control shows a colour change corresponding to that of a standard of fading. The cycle is repeated until the specimen shows a definite colour change or for a prescribed number of cycles.

NOTE 2 The fading of dyes on certain fibres does not readily take place at humidities below 80 %. The test at high humidity is therefore required to produce a colour change that predicts service fading under warm, humid conditions.

## 4 Apparatus and materials

**4.1 Ozone exposure chamber** for ambient room temperatures and relative humidities not exceeding 65 % (see A.1).

**4.2 Ozone exposure chamber** for elevated temperatures and relative humidities above 80 % (see clause A.2).

**4.3 Test-control fabric** for relative humidities not exceeding 65 % (see annex B).

**4.4 Standard of fading** for relative humidities not exceeding 65 % (see annex B).

**4.5 Test-control fabric** for high humidities (see annex B).

**4.6 Standard of fading** for high humidity (see annex B).

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

## 5 Test specimens

**5.1** If the textile to be tested is fabric, use a specimen measuring 60 mm × 100 mm.

**5.2** If the textile to be tested is yarn, knit it into fabric and use a piece measuring 60 mm × 100 mm or wind it closely round a piece of cardboard measuring 60 mm × 100 mm to form a layer having only the thickness of the yarn.

**5.3** If the textile to be tested is loose fibre, comb and compress enough of it to form a sheet measuring 60 mm × 100 mm and sew the sheet on a piece of cotton adjacent fabric, complying with ISO 105-F, section F02, to support the fibre.

**5.4** For subsequent colour comparison, the unexposed sample shall be kept in an airtight container away from light to avoid further shade change.

## 6 Procedure

### 6.1 At relative humidities not exceeding 65 %

**6.1.1** Suspend each specimen and a swatch of the test-control fabric (4.3) in the exposure chamber (4.1) so that each piece hangs separately. The test shall be conducted with the chamber in a room in which the ambient air temperature is 18 °C to 28 °C and the relative humidity does not exceed 65 %. Ozone shall be present in concentrations which produce one cycle if fading in 1,5 h to 6 h of test.

**6.1.2** Compare the colour of the control swatch with that of the standard of fading (4.4) periodically in daylight ranging from average to slightly bluish North Sky light, or equivalent artificial light. When they match, the specimens have been exposed for one cycle and each shall then be compared with a specimen of the untreated material.

**6.1.3** Remove those specimens which exhibit a colour change at the end of one cycle. One cycle will generally produce a measurable colour change in samples which are ozone-sensitive.

**6.1.4** Suspend a fresh swatch of the test-control fabric and continue exposure of any remaining specimens for a second cycle.

**6.1.5** Run additional similar cycles as necessary.

**6.1.6** At the end of each cycle, immediately compare those specimens which are removed from the exposure chamber with the preserved original samples from which they were drawn.

**6.1.7** Assess the change in colour of the specimens, after any specified number of cycles, with the grey scale (4.7).

### 6.2 At high relative humidity

**6.2.1** Suspend each specimen and a piece of the test-control fabric (4.5) in the exposure chamber (4.2) which is maintained at (85 ± 5) % relative humidity and a temperature of 40 °C ± 5 °C. Ozone shall be present in concentrations ranging from 10 pphm to 35 pphm, which should produce one cycle of fading in 6 h to 24 h of test.

**6.2.2** Compare the colour of the control swatch with that of the standard of fading (4.6) periodically in daylight ranging from average to slightly bluish North Sky light, or equivalent artificial light. When they match, the specimens have been exposed for one cycle and each shall then be compared with a specimen of the untreated material.

**6.2.3** Remove those specimens which exhibit a colour change at the end of one cycle. One cycle will generally produce a measurable colour change in samples which are ozone-sensitive.

**6.2.4** Suspend a fresh swatch of the control sample and continue exposure of any remaining specimens for a second cycle.

**6.2.5** Run additional similar cycles as necessary.

**6.2.6** At the end of each cycle, immediately compare those specimens which are removed from the exposure chamber with the preserved original samples from which they were drawn.

**6.2.7** Assess the change in colour of the specimens, after any specified number of cycles, with the grey scale (4.7).

## 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-G03:1993;

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

c) the numerical rating for the change in colour of each specimen;

d) the number of cycles run and the temperature and relative humidity at which the test was performed.

# Annex A
(normative)

## Ozone exposure chambers

**A.1** The ozone exposure chamber for ambient room temperatures and relative humidities not exceeding 65 % consists of an ozone generator, fan, baffle system, specimen rack and housing. Any form of ozone generator may be used to produce the required concentration; however, ultraviolet light from mercury-bulb generators or from spark-gap generators shall be prevented from reaching the specimens on the rack by a suitable shield.

One form of generator makes use of a high-voltage transformer discharge through a grid. The generator is placed in front of a low-velocity fan which ejects the ozone through a baffle system into the exposure chamber. The specimen rack consists of individual clamps mounted on wire travellers to accommodate specimens of various sizes.

The ozone exposure chamber should be operated in a well ventilated and normally heated room, as ozone is toxic.

**CAUTION — To protect the eyes, do not look at the ozone generator while it is operating. Ozone in high concentrations is injurious to health.**

**A.2** The ozone exposure chamber for elevated temperatures and relative humidities above 80 % may be of any suitable construction as long as it meets the conditions of (85 ± 5) % relative humidity and 40 °C ± 5 °C temperature, and contains an ozone concentration in the range of 10 pphm to 35 pphm (see annex C).

**A.3** A typical example of a test apparatus is illustrated in figure A.1.

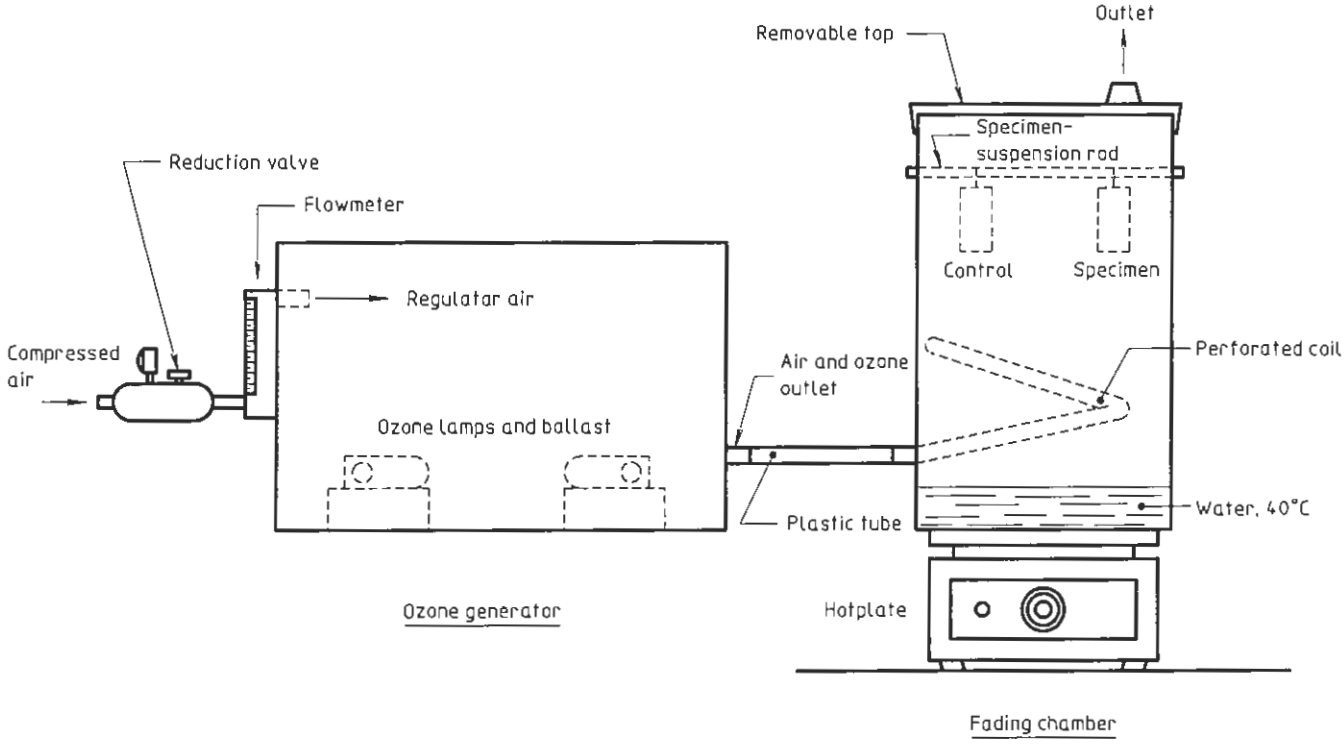


**Figure A.1 — Typical test arrangement**

# Annex B
(normative)

## Test-control fabrics and standards of fading

**B.1** The test-control fabric for tests made at ambient room temperatures with relative humidities not exceeding 65 % consists of a tertiary shade of medium grey prepared by dyeing a spun triacetate fabric with CI Disperse Blue 27 (Colour Index, 3rd Edition), CI Disperse Red 35 (Colour Index, 3rd Edition) and CI Disperse Yellow 42 (Colour Index, 3rd Edition). This fabric is exposed until a colour change, which is mainly loss of blue, to that of the standard of fading is obtained.

**B.2** The standard of fading for tests made at ambient room temperature with relative humidities not exceeding 65 % is a spun viscose fabric dyed with CI Direct Blue 78 (Colour Index, 3rd Edition), CI Direct Red 79 (Colour Index, 3rd Edition) and CI Direct Yellow 106 (Colour Index, 3rd Edition).

**B.3** The test-control fabric for tests conducted at elevated temperatures and relative humidities above 80 % is a tertiary shade, avocado, prepared by dyeing a knitted sleeve containing 2 900 dtex nylon 6 filament yarn with CI Disperse Yellow 3 (Colour Index, 3rd Edition), CI Disperse Blue 3 (Colour Index, 3rd Edition) and CI Disperse Red 4 (Colour Index, 3rd Edition).

**B.4** The standard of fading for tests made at elevated temperatures and relative humidities above 80 % is a dyeing, prepared on the same type of nylon 6 sleeve as in clause B.3 with CI Acid Yellow 79 (Colour Index, 3rd Edition), CI Acid Blue 277 (Colour Index, 3rd Edition) and CI Acid Red 260 (Colour Index, 3rd Edition).

**CAUTION — Both the test-control fabrics and the standards of fading must be kept in airtight containers to prevent colour change encountered in normal atmospheres. In addition, the control fabrics are sensitive to other atmospheric contaminants such as oxides of nitrogen. Their fading rates will vary considerably at different humidities and temperatures and their use in natural 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, the temperature and the humidity variations, and not just the effects of exposure to ozone.**

# Annex C
(informative)

# Bibliography

For information regarding the measurement of ozone concentration, see the following references:

[1] SCHULZE, F. "Versatile combination ozone and sulphur dioxide analyzer", *Analytical Chemistry*, **38**, 748-752, May 1966.

[2] "Selected methods of the measurement of air pollutants", Public Health Service Publication No. 999-AP-11, May 1965, Office of Technical Information and Publication (OTIP), Air Pollution Control Office, Environmental Protection Agency, P.O. Box 12055, Research Triangle Park, North Carolina 27709, USA.

**UDC 677.06.474:535.684.4:546.214**

**Descriptors:** textiles, dyes, tests, environmental tests, determination, colour fastness, ozone, air pollution.

Price based on 6 pages