International Standard 105/G

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION•МЕЖДУНАРОДНАЯ ОРГАНИЗАЦИЯ ПО СТАНДАРТИЗАЦИИ•ORGANISATION INTERNATIONALE DE NORMALISATION

Textiles — Tests for colour fastness — Part G: Colour fastness to atmospheric contaminants

Textiles — Essais de solidité des teintures — Partie G: Solidité des teintures aux agents atmosphériques de dégradation

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Descriptors : textiles, dyes, tests, colour fastness, visual inspection, chemical tests, nitrogen oxides, burning gases, butane, smoke, ozone.

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards institutes (ISO member bodies). The work of developing International Standards is carried out through ISO technical committees. Every member body interested in a subject for which a technical committee has been set up 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.

Draft International Standards adopted by the technical committees are circulated to the member bodies for approval before their acceptance as International Standards by the ISO Council.

International Standard ISO 105/G was developed by Technical Committee ISO/TC 38, *Textiles*.

It was submitted directly to the ISO Council, in accordance with sub-clause 5.10.1 of part 1 of the Directives for the technical work of ISO.

This part of ISO 105 cancels and replaces group G of ISO 105-1978, originally published as part 5 of International Standard ISO 105/VI-1972, and part 1 of International Standard ISO 105/VII-1975.

NOTE — International Standard ISO 105 is presented in the form of parts. Each of these parts corresponds to a group and is split up into its different component sections. This form facilitates the replacement of existing sections by successive editions as necessary.

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Textiles — Tests for colour fastness

G01 Colour fastness to nitrogen oxides

1 SCOPE AND FIELD OF APPLICATION

1.1 This method is intended 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.

1.2 Two tests differing in severity are provided; one or both of them may be used depending on the requirement.

2 PRINCIPLE

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

3 REFERENCES

ISO 105 :

Section A01, *General principles of testing.*

Section A02, *Grey scale for assessing change in colour.*

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

4 APPARATUS AND REAGENTS

4.1 Exposure chamber (see 9.3).

4.2 Nitric oxide, from a commercially supplied cylinder or a generator (see 9.4).

CAUTION — Nitric oxide and other nitrogen oxides are toxic. The maximum concentration in a working room must not exceed 5 parts per million.

4.3 Sulphuric acid containing 1 100 g of H_2SO_4 per litre (relative density 1,603).

4.4 Sodium nitrite ($NaNO_2$), saturated solution in distilled water.

4.5 Sodium hydroxide, dilute solution (approximately 100 g of NaOH per litre).

4.6 Urea solution, containing, per litre, 10 g of urea ($NH_2.CO.NH_2$), buffered to pH 7 by the addition of 0,4 g of sodium dihydrogen orthophosphate dihydrate ($NaH_2PO_4.2H_2O$) and 2,5 g of disodium hydrogen orthophosphate dodecahydrate ($Na_2HPO_4.12H_2O$), and containing 0,1 g or less of a rapid wetting surface-active agent, for example sodium dioctyl sulphosuccinate.

4.7 Test control (see 9.1).

4.8 Standard of fading (see 9.2).

4.9 Syringe, for injection (see 9.5).

4.10 Undyed cloth of the same kind of fibres as the specimen.

4.11 Grey scale for assessing change in colour (see clause 3).

4.12 Means for providing the standard atmosphere for testing specified in clause 5.

5 CONDITIONING AND TESTING ATMOSPHERE

The standard atmosphere for testing textiles (see clause 3), i.e. a relative humidity of 65 ± 2 % and temperature of 20 ± 2 °C, shall be used for conditioning and testing.

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Descriptors : textiles, dyes, tests, colour fastness, visual inspection, chemical tests, nitrogen oxides.

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Disapproved by member body of : Belgium.

6 TEST SPECIMEN

6.1 If the textile to be tested is fabric, use a specimen 10 cm × 4 cm.

6.2 If the textile to be tested is yarn, knit it into fabric and use a piece 10 cm × 4 cm or wind it closely round a frame of rigid inert material measuring 10 cm × 4 cm to form a layer having only the thickness of the yarn, on each side.

6.3 If the textile to be tested is loose fibre, comb and compress enough of it to form a sheet 10 cm × 4 cm and sew the sheet on a piece of cotton adjacent fabric to support the fibre.

6.4 Cut a specimen 10 cm × 4 cm of the test control (4.7) and cut specimens 10 cm × 4 cm of the undyed cloth (4.10).

7 PROCEDURE

7.1 Mount each specimen by fastening the shorter side to a radial arm of the frame of the apparatus (see 9.3 and figure 1) by means of an adhesive or clips. When an adhesive is used, this must be allowed to dry properly.

7.2 Up to 12 specimens, each 10 cm × 4 cm, may be mounted in this way for one test. If fewer 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 specimen is fastened to the test-control holder. Condition the specimens and test-control specimen for at least 12 h in the atmosphere specified in clause 5.

7.3 Place the frame with the specimens inside the glass cylinder and then place the bell-jar in top; put the holder with the test-control specimen through the top plug hole at the side and adjust the propeller as described in 9.3.

7.4 Adjust the rotational frequency of the propeller to 200 to 300 min^{-1} and shield the apparatus from bright light.

7.5 Inject 0,65 ml of nitric oxide (4.2) for each litre of exposure chamber capacity into the bell-jar (see 9.4).

7.6 One-cycle test

7.6.1 Observe the test-control specimen, and when it has faded to the extent shown by the standard of fading (see 9.2), lift the bell-jar immediately and plunge the treated specimens and the treated test-control specimen into the buffered urea solution (4.6) together with untreated portions of each specimen.

7.6.2 After immersion for 5 min, squeeze, rinse and dry the specimen and untreated portions by hanging them in air at a temperature not exceeding 60 °C.

7.6.3 Check that the test-control specimen has faded to the extent shown by the standard of fading (see 9.2) and, if so, assess the change in colour of each specimen against the appropriate untreated portion which has been immersed in the buffer solution, using the grey scale.

7.6.4 If a specimen shows a contrast greater than grade 4, this one-cycle result should be reported (see clause 8) and the test completed. If the contrast is not greater than grade 4, the test procedure described in 7.1 to 7.5 shall be carried out on fresh specimens followed by the three-cycle test procedure described in 7.7.

7.7 Three-cycle test

7.7.1 Observe the test-control specimen, and when it has faded to the extent shown by the standard of fading (see 9.2), plunge it into the buffered urea solution (4.6), replace it with another and inject an additional 0,2 ml of nitric oxide for each litre of exposure chamber capacity. When the second test-control specimen has faded to the extent shown by the standard of fading (see 9.2), plunge it into the buffered urea solution (4.6), replace it with a third, and again add 0,2 ml of nitric oxide for each litre of exposure chamber capacity. When the third test-control specimen has faded to the extent shown by the standard of fading (see 9.2), lift the bell-jar immediately and plunge the treated specimens and the treated test-control specimens into the buffered urea solution (4.6) together with untreated portions of each specimen.

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

7.7.3 Check that each of the three test-control specimens has faded to the extent shown by the standard of fading (see 9.2) and, if so, assess the change in colour of each specimen against the appropriate untreated portion which has been immersed in the buffer solution, using the grey scale.

7.8 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 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 nitrogen oxide. The conditioned air can be provided by passing air through a wash bottle containing a saturated solution of ammonium nitrate (NH_4NO_3) in contact with the solid phase at 20 °C. The inlet and outlet are closed during the test.

8 TEST REPORT

Report the numerical rating for the change in colour of the specimen and state the number of cycles of exposure, one or three.

9 NOTES

9.1 Test control

Acetate is 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 co-ordinates of this dyeing are $x = 0{,}198\ 8$, $y = 0{,}190\ 4$, $Y = 23{,}20$ using Illuminant C.

The tolerance may be 2,2 CIE LAB units maximum.

9.2 Standard of fading

This 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 the national standards organizations.

9.3 Testing apparatus

Suitable testing apparatus is shown in figures 1 and 2 and consists of a 15 litre capacity bell-jar having two plug-holes on the top and one plug-hole near the bottom. Inside the bell-jar are placed a glass cylinder, 165 mm in diameter and 225 mm in height, standing on three supports made of inert material (for example, silicone rubber or glass), and a stainless steel frame for suspending the specimens. Through one of the top plug-holes passes a spindle bearing a stainless steel or plastics propeller, 140 mm in diameter, adjusted so that its lower edge is approximately 20 mm from the upper rim inside the cylinder. A stainless steel rod is let through the other top plug-hole and holds the test-control specimen. This holder is located between the glass cylinder and the bell-jar. A ground stainless steel stopper is inserted in the bottom plug-hole and contains a screwed insert within which a silicone rubber membrane is fitted, the gas being introduced through this membrane.

Any other apparatus yielding the same results can also be used. Care must be taken to carry out the test under identical conditions, i.e. the ratio between number of specimens, space in the test chamber and amount of gas must always be the same.

9.4 CAUTION — The filling, emptying, dismantling and cleaning of the apparatus must be carried out with great care under an exhaust hood or out-of-doors, and with the hands and eyes suitably protected against the concentrated acid.

Suitable apparatus for the generation of nitric oxide is shown in figure 3. Nitric oxide gas is generated by slowly running a cold saturated solution of sodium nitrite (4.4) from a dropping funnel with discharge tube into sulphuric acid (4.3), contained in a double-necked glass flask of 1 000 ml capacity. The gas from either the generator or a commercial cylinder is conveyed into a triple-necked glass flask equipped with a displacement vessel (gas reservoir) after having passed over dilute sodium hydroxide solution (4.5) in a safety trap flask. Gas is taken from the reservoir by means of a medical syringe, the needle of which is passed through a silicone rubber membrane located in a stainless steel stopper; the needle is then passed through the silicone rubber membrane in the bottom plug-hole of the bell-jar (see 7.5). The apparatus is operated as follows.

9.4.1 *Starting up the apparatus* (Replacement of the air in the apparatus by nitric oxide)

Fill up the gas reservoir with water. Pour about 300 ml of sulphuric acid (4.3) into the gas generator. Pour 100 ml of saturated sodium nitrite solution (4.4) into the dropping funnel and approximately 100 ml of dilute sodium hydroxide solution (4.5) into the safety trap flask. Close cock 2, open cock 1, and allow the sodium nitrite solution to flow slowly and dropwise through cock 1, at the same time letting the gas formed escape through the discharge tube with cock 5 open. After about 30 s, open cocks 2, 3 and 4, close cock 5, and fill the gas reservoir to about 75 % with gas. Close cock 1, re-open cock 5, and again allow the gas to escape. This procedure shall be repeated five times to ensure that the nitric oxide is free of air.

9.4.2 *Continuous operation*

After the gas reservoir has been filled and emptied five times, it shall be filled with gas to only 50 % of its capacity, whereupon cocks 1 and 3 are closed, while cocks 4 and 5 are left open in order to prevent excess pressure in the generator. The gas may now be taken. Further gas is supplied to the reservoir by allowing a few more drops of sodium nitrite solution to react. It is permissible to fill the gas reservoir up to 90 % of its capacity only when a further supply of gas is prevented by closing cock 3, but the gas generator must then be kept open to the atmosphere via cocks 5 and 2.

9.4.3 *Refilling the gas generator*

9.4.3.1 The pressure in the gas generator is released by closing cock 3 and opening cock 5, so that it can then be dismantled, cleaned and refilled.

9.4.3.2 After re-assembly and re-stocking with sodium nitrite solution and sulphuric acid, the procedure described under 9.4.1 is repeated.

9.5 Transfer of nitric oxide

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 gas reservoir to the exposure chamber by means of a gas burette.

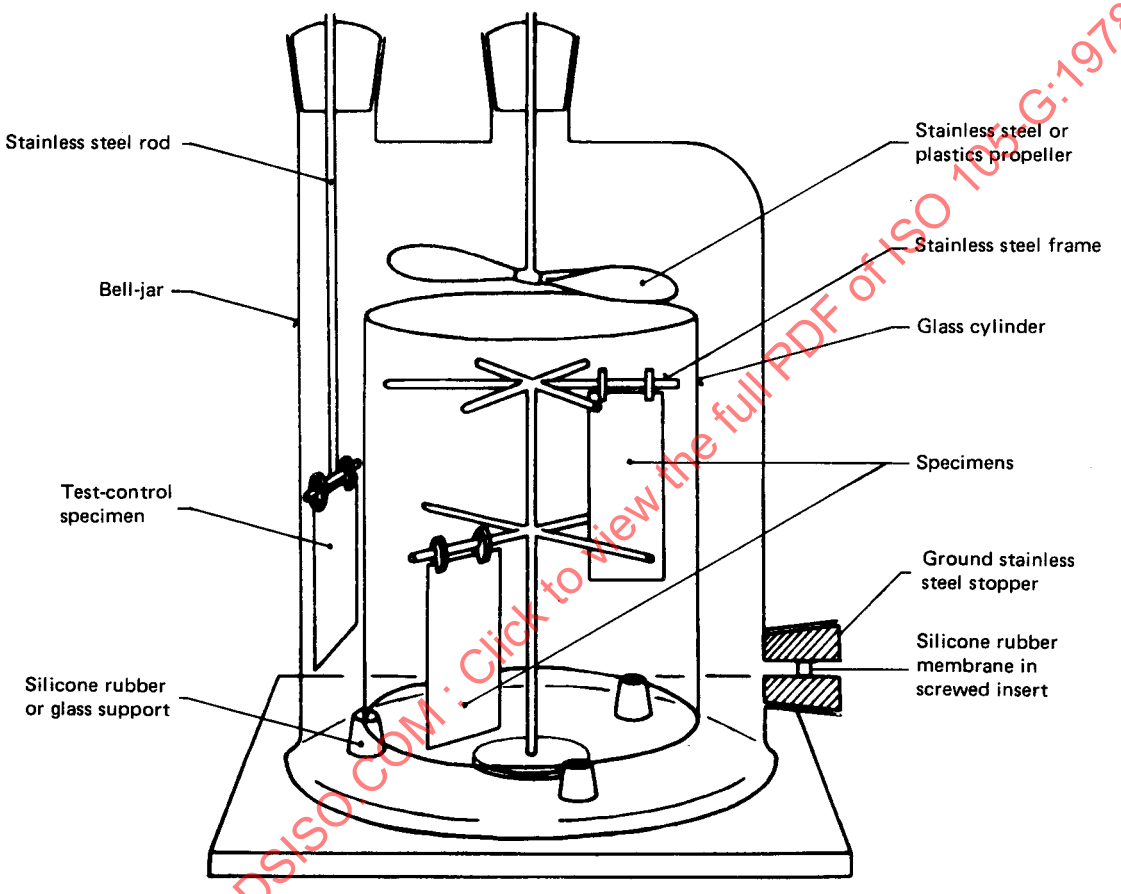

FIGURE 1 – **Exposure chamber**

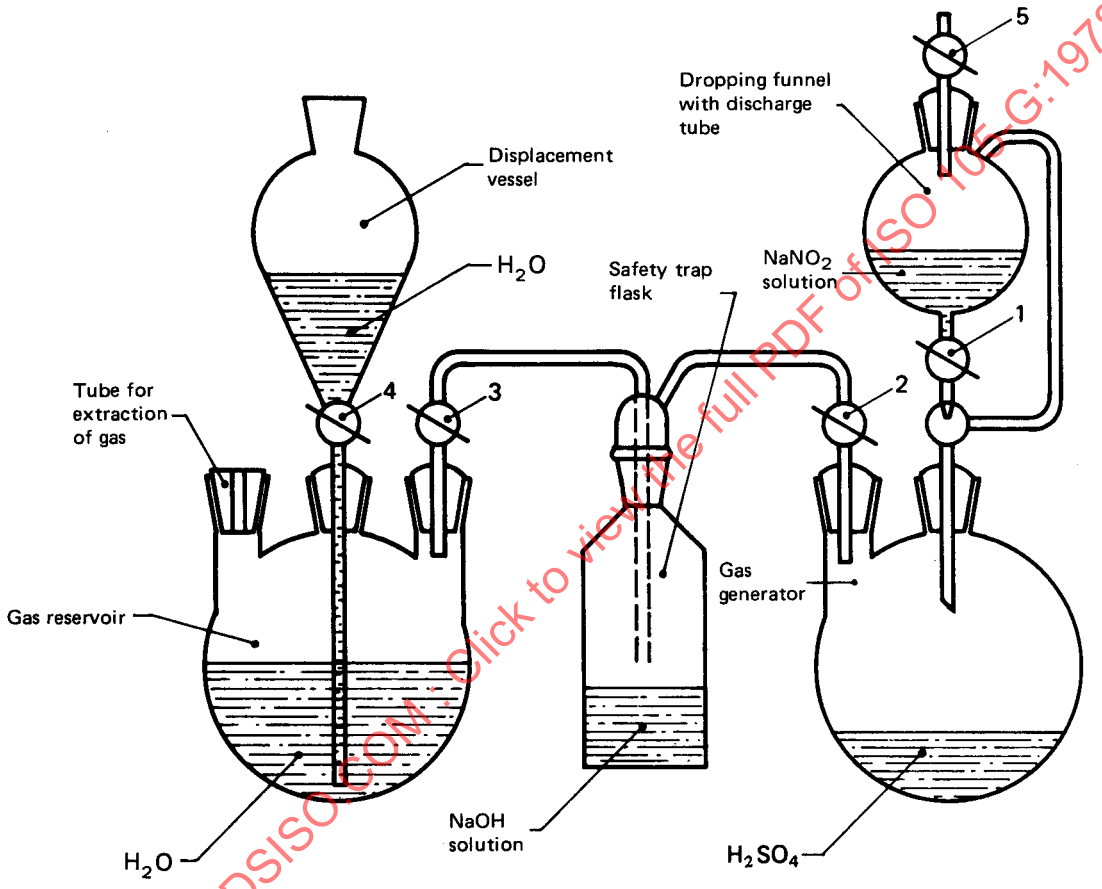

FIGURE 3 – **Nitric oxide generator**

Textiles — Tests for colour fastness

G02 Colour fastness to burnt gas fumes

1 SCOPE AND FIELD OF APPLICATION

1.1 This method is intended for determining the resistance of the colour of textiles of all kinds and in all forms except loose fibres, when exposed to atmospheric oxides of nitrogen as derived from the combustion of butane (C.P.) gas.

1.2 This method may be used for rating 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 PRINCIPLE

A specimen of the textile and the 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 the 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.

3 REFERENCES

ISO 105 :

Section A01, *General principles of testing.*

Section A02, *Grey scale for assessing change in colour.*

Section D01, *Colour fastness to dry-cleaning.*

4 APPARATUS AND REAGENTS

4.1 Exposure chamber (see 9.1).

4.2 Test control (see 9.2).

4.3 Standard of fading (see 9.2).

4.4 Grey scale for assessing change in colour (see clause 3).

4.5 Butane (C.P.) gas (see 9.3).

4.6 Urea solution (see 9.4).

4.7 If required, **perchloroethylene, Stoddard solvent**, or **trichloroethylene** (see 5.4 and 9.5).

4.8 If required, **standard detergent** (see 5.5 and 9.6).

5 TEST SPECIMEN

5.1 If the textile to be tested is a fabric, use a specimen 10 cm × 4 cm.

5.2 If the textile to be tested is yarn, knit it into fabric and use a specimen 10 cm × 4 cm.

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 9.5), use the method specified in section D01. Immerse one specimen in cold perchloroethylene for 10 min, squeeze and allow it to dry in the air. If desired, 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 9.5), unless a specific wash-test is specified, wash the test specimen in a detergent solution (see 9.6) (containing 5 g of AATCC standard detergent WOB per litre of water of approximately zero hardness) for 10 min at 40 °C, rinse in warm water and allow it to dy in the air. Retain a specimen after washing and before testing to compare with the tested specimen.

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Disapproved by member bodies of : Czechoslovakia; France; Germany, F.R.

6 PROCEDURE

6.1 Freely suspend the specimen and a piece of the test control in the test chamber so that they are not in contact with each other and do not come into direct contact with any hot metallic surface. Light the gas burner (see 9.3) and adjust the flame and ventilating equipment so that the temperature in the chamber does not exceed 60 °C (see 9.7 or 9.8). Keep the specimens in the chamber until the test control shows a change in colour corresponding with that of the standard of fading, when compared in daylight or equivalent artificial illumination (see section A01, clause 13).

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

6.3 Those specimens showing a colour change, a piece of each of their original specimens, and the test control shall, without delay, be plunged into the buffered urea solution (see 9.4) 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 of colour of the specimen against the portion of the original textile which has been treated with buffered urea solution, with 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 are not treated with the buffered urea solution, along with a fresh piece of the test control, and continue the test until the second test control shows a change in colour corresponding to that of the standard of fading.

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

7 EVALUATION AND CLASSIFICATION

7.1 Repeat the procedure as often as necessary or desired to disclose the number of exposure periods (cycles) required to produce an appreciable alteration of shade. After each exposure period, remove the specimens from the chamber and immediately compare them with the respective originals.

7.2 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.

8 TEST REPORT

Report the numerical rating for the change in colour of each specimen and the number of cycles to which it was exposed. Report the average temperature employed and, if humidity was increased, report the method employed.

9 NOTES

9.1 Exposure chamber

9.1.1 The exposure chamber may be of variable construction but must provide an enclosure in which specimens can be exposed in an atmosphere of air which has passed over the burner and contains the by-products of combustion from a lighted gas burner. The apparatus shall be equipped with a suitable means of supporting the specimens so that there is a free circulation of the atmosphere around them and so that only a minimum amount of the specimen at the point of its 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 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.

9.1.2 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, N.C. 27709, U.S.A.

9.1.3 The US Testing Co., 1415 Park Ave., Hoboken, N.J., U.S.A., in co-operation with AATCC, has developed a gas-fading apparatus which is suitable for large-scale testing and is available for purchase. The unit collects the fumes from a safety-type Electrolux burner which is located in a lower chamber as shown in the figure. 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 to 16 h.

9.2 Test control and standard of fading

9.2.1 The test control fabric is 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 co-ordinates 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.

9.2.2 Pieces of the original lot of control fabric were hung in air in three separate places in Southern New Jersey, U.S.A., 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.

9.2.3 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.

9.2.4 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 the national standards organizations.

9.2.5 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.

9.2.6 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.

9.2.7 A sealed unit of test control fabric comprising 18,3 m of ribbon 25,4 mm wide with a specific lot number indicated and a specimen of the standard of fading for that lot of control fabric is available as Control Sample No. 1 from Test Fabrics Inc., P.O. Box 53, 200 Blackford Ave., Middlesex, N.J. 08846, U.S.A.

9.3 Gas

Use butane (C.P.) gas to supply the 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 formation of soot. A wire screen placed above the flame at a distance which causes it to be heated somewhere between a red and white heat will increase the percentage of oxides of nitrogen and will thereby accelerate the fading of the test control and samples. Brass, iron, Monel alloy and stainless steel screens give practically the same results.

9.4 Urea solution

Use a solution containing, per litre, 10 g of urea ($NH_2.CO.NH_2$), buffered to pH 7 by the addition of 0,4 g of sodium dihydrogen orthophosphate dihydrate ($NaH_2PO_4.2H_2O$) 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 sulphosuccinate.

9.5 Dry-cleaning and washing test specimens

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 (if 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.

9.6 Detergent

AATCC standard detergent WOB with the following composition is available from AATCC, P.O. Box 12215, Research Triangle Park, N.C. 27709, U.S.A. :

General characteristics :

Low sudsing laundry detergent

Anionic with added non-ionic

Bio-degradable

Fully built solution pH 10

High density granule (5 oz/cup = 0,6 g/ml)

Nominal composition :	% (*m*/*m*)
Linear alkylate sulphonate — sodium salt (LAS)	14,0
Alcohol ethoxylate	2,3
Soap — high molecular mass	2,5
Sodium tripolyphosphate	48,0
Sodium silicate ($SiO_2/Na_2O = 2,0$)	9,7
Sodium sulphate	15,4
CMC (carboxy methyl cellulose)	0,25
Moisture	7,85
	100,00

LAS – Sodium salt :

Made from linear alkylate with the following characteristics :

Approximate alkylate chain length distribution

C_{10} – 10 %

C_{11} – 35 %

C_{12} – 30 % Average C = 11,8

C_{13} – 20 %

C_{14} – 5 %

2-phenyl isomer distribution – 30 % approximately

Approximate relative molecular mass – 244

Ethoxylated fatty alcohol :

Made from linear alcohol with the following characteristics :

Approximate chain length distribution

C_{10} – trace

C_{12} – 66 %

C_{14} – 26 % Average hydroxyl value = 285

C_{16} – 7 %

C_{18} – trace

Ethoxylated to give $RO(C_2H_4O)_nH$

$n = 6$ average

Hydroxyl value = 122 approximately

9.7 Temperature for testing

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 to 12 h at 60 °C may cause as much colour destruction as exposure for 96 h at 21 to 27 °C. Apart from this, the temperature may vary somewhat in different parts of the exposure chamber from time to time.

9.8 Humidity for testing

The fading of dyes by oxides of nitrogen on acetate, triacetate and polyester 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 is to place containers of water on the floor surface of the chamber. If the humidity is raised by this or any other procedure, this shall be noted in the test report.

9.9 Heat by ironing

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.

FIGURE — **Gas-fading apparatus for large-scale testing** (see 9.1.3)