

भारतीय मानक ब्यूरो
BUREAU OF INDIAN STANDARDS

भारतीय मानक मसौदा

भूवस्त्रादि — परीक्षण की पद्धतियाँ

भाग 2 परा बैंगनी प्रकाश, नमी और ऊष्मा में जीनान आर्क प्रकार के उपकरण द्वारा अनावरण
का प्रतिरोध ज्ञात करना

(पहला पुनरीक्षण)

Draft Indian Standard

GEOTEXTILES — METHODS OF TEST

**PART 2 DETERMINATION OF RESISTANCE TO THE EXPOSURE OF
ULTRAVIOLET LIGHT, MOISTURE AND HEAT (XENON-ARC TYPE APPARATUS)**

(First Revision)

ICS 59.080.70

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FOREWORD

(Formal clauses will be added later)

This standard was first published in 1991. The present revision has been made in the light of experience gained since last revision and to incorporate the following major changes:

- 1) Title of the standard has been modified;
- 2) Scope of the standard has been modified to include the word 'heat';
- 3) References to Indian Standard given in Annex A has been updated;
- 4) The exposure cycle given in the standard has been changed from '102 minutes of light exposure and 18 minutes of water, spray and light exposure' to '90 minutes of light and 30 minutes of light plus water spray exposure' to align the standard with the current practices;
- 5) Procedure of the test has been modified to specify the level of irradiance of UV light;
- 6) Specimen selection template has been provided for the guidance; and
- 7) Calculation and reporting of test result and have been modified.

In the preparation of this standard considerable assistance has been derived from 'ASTM D4355/D4355 M-21 Standard Test Method for Deterioration of Geotextiles by Exposure to Light, Moisture, and Heat in a Xenon Arc-Type Apparatus' issued by the American Society for Testing and Materials, USA.

In reporting the result of a test or analysis made in accordance with this standard, if the final value, observed or calculated, is to be rounded off, it shall be done in accordance with IS 2: 2022 'Rules for rounding off numerical values (first revision)'.

1 SCOPE

1.1 This standard (Part 2) prescribes a method for the determination of resistance of geotextiles to the exposure of ultraviolet light, moisture and heat.

1.2 The light and water exposure apparatus employs a xenon-arc light source.

2 REFERENCES

The standards listed in Annex A contain provisions which through reference in this text, constitute provisions of this standard. At the time of publication, the editions indicated were valid. All standards are subjected to revision, and parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated in Annex A.

3 PRINCIPLE

Specimens of geotextiles for the machine and cross directions are exposed for 0, 150, 300 and 500 hours of ultraviolet exposure in a xenon-arc apparatus. The exposure consists of 120 minute cycles consisting of 90 minutes of light only, followed by 30 minutes of water spray and light. After the exposure, the specimens are subjected to a cut strip tensile test as prescribed in IS 1969 (Part 1) or wide width strip test as prescribed in) IS 16635. The test results are compared to the test results

for unexposed specimens and the deterioration which has taken place due to ultraviolet exposure is assessed. This method will enable the user to develop a degradation curve for the geotextiles being tested to determine the tendency of a geotextile to deteriorate when exposed to ultraviolet light, heat and moisture.

4 ATMOSPHERIC CONDITIONS FOR CONDITIONING AND TESTING

4.1. Condition the test specimens to moisture equilibrium from the dry side in the standard atmosphere of (65 ± 5) percent relative humidity and $(27 \pm 2)^{\circ}\text{C}$ temperature (*see also* IS 6359). When the specimens have been left in such an atmosphere so that both the faces are exposed to the standard atmosphere as far as possible for 24 hours, they shall be deemed to have reached the state of moisture equilibrium.

5 PREPARATION OF TEST SPECIMENS

5.1 Take two pieces each of one square metre from each roll as selected in **9.2**, one from machine direction and the other from cross machine direction.

Note — Since the thickness of a specimen may markedly affect test results, thickness of replicate specimens shall be within ± 10 percent of the nominal dimensions. This is especially important when mechanical properties are being investigated.

5.2 Use the template illustrated in Fig. 1 to identify the potential specimens from which the actual specimens are drawn. To select these actual specimens, randomly draw 20 specimens from both the machine and cross machine directions measuring 50 mm by 150 mm from the 1 m² portion the test pieces obtained in **5.1**.

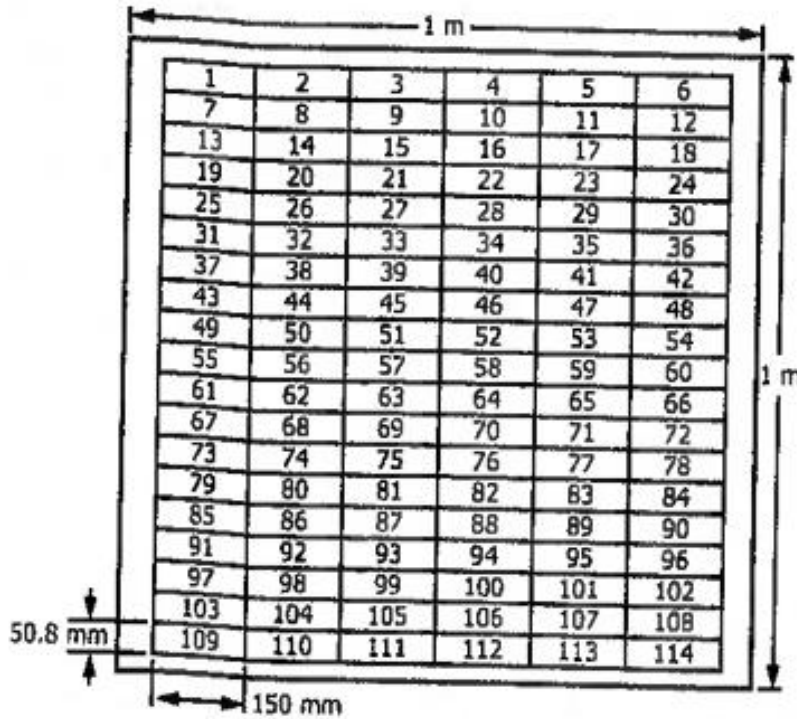


FIG. 1 SPECIMEN SELECTION TEMPLATE

5.3 Specimens from a roll shall be cut from positions evenly distributed over the full width and length of the sample, but not closer than 100 mm or one tenth of width to the selvages, whichever is smaller.

5.4 Specimens shall not contain dirt, irregular spots, creases, holes or other visible faults.

5.5 Any two specimens shall not contain the same longitudinal or transversal position. If it is not possible, it shall be reported.

5.6 Before cutting structured geotextiles exact instructions for cutting shall be laid down, and these shall be followed with great care.

5.7 If the cutting causes fragments of geotextile to loosen influencing the test results and if this cannot be avoided, this fact shall be reported.

5.8 The specimens shall be kept free from dust, dry, kept in dark and protected against chemical and physical damage until the test is performed.

5.9 The top and bottom portion of specimen which goes inside grips should be rolled in weathering device to protect from exposure to the radiation while in weathering device to avoid jaw breaks during tensile testing.

6 APPARATUS

6.1 The working details of Xenon-arc apparatus are described in IS/ISO 105-B02.

6.1.1 The apparatus should be capable of exposing the specimens to cycles of light only, followed by light and moisture water spray and light under controlled atmospheric conditions.

6.1.2 The apparatus should be equipped with an inner and outer borosilicate filter glass as described in IS/ISO B02.

6.2 Tensile strength testing machine as described for cut strip test in IS 1969 and wide width test in IS 16635.

7 PROCEDURE

7.1 Operate the Xenon-arc apparatus as directed in IS/ISO 105-B02 to provide 120 minute cycles as follows:

90 minutes of light only at $(65 \pm 3)^\circ\text{C}$ black panel temperature, and (50 ± 5) percent relative humidity, followed by 30 minutes of light and water spray.

7.1.1 Set the minimum level of irradiance at control point to achieve $0.35 \text{ W/m}^2 \cdot \text{nm}$ at 340 nm (unless otherwise specified) maintained at $0.02 \text{ W/m}^2 \cdot \text{nm}$.

7.1.2 If the UV exposure device does not equipped with irradiance control, device manufacturer's recommendation should follow to produce required irradiance. Equivalent 300 nm to 400 nm or 300 to 800 nm broadband irradiance can also use and tolerance as per instrument manufacturer specification.

7.2 Randomly assign five specimens for each direction from each laboratory sample to each of the following exposure times, zero (unexposed), 150, 300 and 500 hours. Place 30 specimens (15 for each direction) out of the total 40 test specimens in the apparatus, such that the side most likely to be exposed to the effects of ultraviolet light will be exposed in the apparatus.

7.3 Rotate specimen position in chamber accordance with procedure given in IS/ISO 105-B02.

7.4 At the end of each exposure time, remove the appropriate five specimens for each direction for tensile test using cut strip test as given in IS 1969 or wide width strip test as given in IS 16635.

7.5 Select five unexposed specimens (zero exposure time) and five exposed specimens for each exposure time interval and direction, from a laboratory sample as per the method given in IS 1969. Test these specimens for breaking strength on a constant-rate-of-extension (CRE) or a constant rate-of-traverse (CRT) type testing machine by cut strip test, as given in IS 1969 or for wide width test as given in IS 16635. In case of controversy, the CRE method shall prevail.

NOTE —If tested on a CRT machine, the traverse speed shall be 300 ± 15 mm/ min.

8 CALCULATIONS

8.1 Calculate the average breaking strength for all exposed and unexposed (control) specimens for each direction.

8.2 Calculate the percent loss of strength from the unexposed specimens for the average results of each exposure time for each direction.

8.3 For the groups of five specimens from the unexposed specimens and the specimens exposed at various times, calculate the standard deviation and coefficient of variation for the strip tensile strength.

9 SAMPLING

9.1 A random sample shall be selected from the lot. The sample selected should be homogeneous and representative of the lot.

9.2 The number of rolls to be selected from a lot shall be in accordance with the procedure laid down in the relevant material specification or as agreed to between the buyer and the seller.

10 REPORT

The test report shall include the following information:

- a) IS number of the method followed for testing;
- b) Full description of the specimens and their origin;
- b) The average breaking strength for unexposed (control) specimens, and exposed specimens in each direction for each of the exposure period of 150, 300 and 500 hours;
- c) Graph of average breaking strength between exposure time, for each direction;

- d) A listing of the percentage of strength retained for each exposure time for each direction;
- e) Total exposure time alongwith the total radiant exposure (irradiance X time of exposure) at respective clock hour intervals, and the number of cycles as defined in **7.1.2**.
- f) Type and Model of exposure device and light source used;
- g) Type and position of black or white panel thermometer, if used;
- h) Standard deviation and coefficient of variation for the strip tensile strength; and
- j) If required, irradiance in $W/(m^2.nm)$, or radiant exposure in J/m^2 , at the sample plane and wavelength region in which measurements were made.

ANNEX A

(*Clause 2*)

LIST OF REFFRRED STANDARDS

<i>IS No.</i>	<i>Title</i>
IS 6359 : 2023	Method for conditioning of textiles
IS 1969 : Part 1 : 2018	Textiles — Tensile Properties of Fabrics — Part 1 Determination of Maximum force and Elongation at Maximum Force Using the Strip Method
IS 16635 : 2017	Geosynthetics — Wide-Width Tensile Test
IS/ISO B02 :2014	Textiles — Tests for Colour Fastness Part B02 Colour Fastness to Artificial Light : Xenon Arc Fading Lamp Test

