भारतीय मानक **IS 13162 (Part 2) : 2024**

Indian Standard

भूवस्त्रादि — परीक्षण की पद्धतियाँ

भाग 2 पराबैंगनी प्रकाश, नमी और ऊष्मा में अनावरण का प्रतिरोध ज्ञात करना (जीनान आर्क प्रकार के उपकरण द्वारा)

(पहला पुनरीक्षण)

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

भारतीय मानक ब्यूरो
BUREAU OF INDIAN STANDARDS
मानक भवन, 9 बहादुर शाह ज़फर मार्ग, नई दिल्ली - 110002
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI - 110002
www.bis.gov.in www.standardsbis.in

November 2024 **Price Group 4**

Geosynthetics Sectional Committee, TXD 30

FOREWORD

This Indian Standard (Part 2) (First Revision) was adopted by the Bureau of Indian Standards, after the draft finalized by the Geosynthetics Sectional Committee had been approved by the Textile Division Council.

Geotextiles are manufactured using a variety of processes and formulations of polymers and each geotextile varies in its sensitivity to ultraviolet radiation. Ultraviolet radiation from the sun varies with duration of exposure, angle of inclination of the sun, atmospheric conditions, topography, and geography. This method is intended to induce property changes associated with end use conditions, including the effects of solar radiation, moisture and heat. However, this method does not account for the deterioration caused by localized weather phenomena such as atmospheric pollution, biological attack, and salt water exposure. The correlation between time to failure in an exposure conducted in accordance with this test method, and service life in a specific outdoor environment requires determination of an acceleration factor. The acceleration factor is material-dependent and is only valid if it is based on data from a sufficient number of separate exterior and laboratory-accelerated exposures so that the results used to relate times to failure in each exposure can be analyzed using statistical methods.

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

a) Title of the standard has been modified;

b) Scope of the standard has been modified to include the word ‘heat’;

c) References to Indian Standard have been updated;

d) The exposure cycle given in the standard has been changed from ‘102 min of light exposure and 18 min of water, spray and light exposure’ to ‘90 min of light and 30 min of light plus water spray exposure’ to align the standard with the current practices;

e) Procedure of the test has been modified to specify the level of irradiance of UV light;

f) Specimen selection template has been provided for the guidance; and

g) Calculation and reporting of test result and have been modified.

In this revision, considerable assistance has been derived from ASTM D 4355-21 ‘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.

The composition of the Committee responsible for the formulation of this standard is given in Annex A.

In reporting the result of a test or analysis made in accordance with this standard, if the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS 2 : 2022 ‘Rules for rounding off numerical values (*second revision*)’.

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)

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 employ a xenon-arc light source.

2 REFERENCES

The standards given below 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 subject to revision, and parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent edition of these standards:

IS No.	*Title*
IS/ISO 105 (Part B02) : 2014	Textiles — Tests for colour fastness: Part B02 Colour fastness to artificial light : Xenon arc fading lamp test
IS 1969 (Part 1) : 2018/ISO 13934 -1 : 2013	Textiles — Tensile properties of fabrics: Part 1 Determination of maximum force and elongation at maximum force using the strip method (*fourth revision*)
IS 6359 : 2023	Method for conditioning of textiles (*first revision*)
IS 16635 : 2017	Geosynthetics — Wide-width tensile test

3 PRINCIPLE

Specimens of geotextiles for the machine and cross directions are exposed for 0 h, 150 h, 300 h and 500 h of ultraviolet exposure in a xenon-arc apparatus. The exposure consists of 120 min cycles consisting of 90 min of light only, followed by 30 min 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

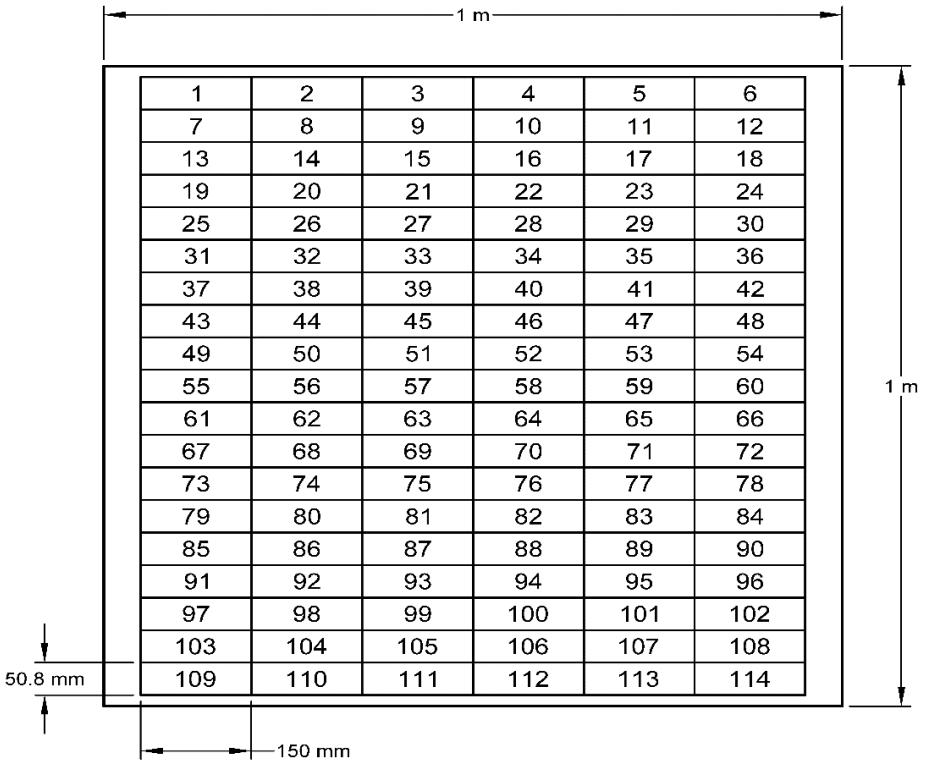
Condition the test specimens to moisture equilibrium from the dry side in the standard atmosphere of (65 ± 5) percent relative humidity and (27 ± 2) °C temperature (*see* IS 6359). When the specimens have been left in such an atmosphere so that both the faces are exposed to the standard atmosphere as far as possible for 24 h, 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 50.8 mm by 150 mm from the 1 m^2 portion the test pieces obtained in 5.1.



1	2	3	4	5	6
7	8	9	10	11	12
13	14	15	16	17	18
19	20	21	22	23	24
25	26	27	28	29	30
31	32	33	34	35	36
37	38	39	40	41	42
43	44	45	46	47	48
49	50	51	52	53	54
55	56	57	58	59	60
61	62	63	64	65	66
67	68	69	70	71	72
73	74	75	76	77	78
79	80	81	82	83	84
85	86	87	88	89	90
91	92	93	94	95	96
97	98	99	100	101	102
103	104	105	106	107	108
109	110	111	112	113	114

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 selvedges, 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 (Part 1) 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 min cycles as follows:

a) 90 min of light only at (65 ± 3) °C black panel temperature, and (50 ± 5) percent relative humidity, followed by 30 min of light and water spray.

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

7.1.2 If the UV exposure device is not equipped with irradiance control, device manufacturer's recommendation should follow to produce required irradiance. Equivalent 300 nm to 400 nm or 300 nm 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 h, 300 h and 500 h. 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 (Part 1) 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 (Part 1). 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 (Part 1) 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;

c) The average breaking strength for unexposed (control) specimens, and exposed specimens in each direction for each of the exposure period of 150 h, 300 h and 500 h;

d) Graph of average breaking strength between exposure time, for each direction;

e) A listing of the percentage of strength retained for each exposure time for each direction;

f) Total exposure time along with the total radiant exposure (irradiance × time of exposure) at respective clock hour intervals, and the number of cycles as defined in 7.1.1.

g) Type and model of exposure device and light source used;

h) Type and position of black or white panel thermometer, if used;

j) Standard deviation and coefficient of variation for the strip tensile strength; and

k) 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

(*Foreword*)

COMMITTEE COMPOSITION

Geosynthetics Sectional Committee, TXD 30

Organization	*Representative(s)*
The South India Textile Research Association Council, Coimbatore	DR A. N. DESAI **(*Chairperson*)**
Ahmedabad Textile Industry's Research Association, Ahmedabad	SHRIMATI DEEPALI PLAWAT SHRI JIGAR DAVE (*Alternate*)
Andhra University, Visakhapatnam	PROF K. RAJAGOPAL
Best Geotechnics Pvt Ltd, Mumbai	SHRI SATISH NAIK
Central Coir Research Institute, Alappuzha	DR SHANMUGASUNDARAM O. L. SHRIMATI SUMY SEBASTIAN (*Alternate*)
Central Road Research Institute, New Delhi	DR P. S. PRASAD DR PARVATI G. S. (*Alternate*)
Central Soil and Materials Research Station, New Delhi	DR R. CHITRA DR MANISH GUPTA (*Alternate*)
Charankattu Coir Mfg. Co. (Pvt) Ltd, Shertallai	SHRI C. R. DEVRAJ SHRI C. D. ATHUL RAJ (*Alternate*)
Department of Jute and Fibre Technology, Kolkata	DR SWAPAN GHOSH DR A. K. SINGHO (*Alternate*)
DKTE Centre of Excellence in Nonwovens, Ichalkaranji	DR SHIRISH KUMAR VHANBATTE
Ganga Flood Control Commission, Patna	SHRI S. K. RAJAN SHRI N. N. SHANKAR (*Alternate*)
Garware Technical Fibers Ltd, Pune	SHRI TIRUMAL KULKARNI SHRI RAJENDRA GHADGE (*Alternate*)
Geosynthetics Testing Services Pvt Ltd, Ahmedabad	SHRI RAVIKANT SHARMA
ICAR- National Institute of Natural Fibre Engineering & Technology, Kolkata	DR SANJOY DEBNATH DR KARTICK SAMANTA (*Alternate*)
Indian Geotechnical Society, New Delhi	DR BAPPADITYA MANNA DR DEBAYAN BHATTACHARYA (*Alternate*)
Indian Institute of Technology, Gandhinagar	PROF AMIT PRASHANT DR G. V. RAO (*Alternate*)
Indian Institute of Technology, Madras	PROF DALLI NAIDU ARNEPALLI
Indian Jute Industries' Research Association, Kolkata	DR MAHUYA GHOSH SHRI PALASH PAUL (*Alternate*)
Indian Jute Mills Association, Kolkata	SHRI S. K. CHANDRA SHRI J. K. BEHERA (*Alternate*)
Indian Technical Textile Association, Mumbai	DR ANUP RAKSHIT SHRIMATI RUCHITA GUPTA (*Alternate*)

Organization	*Representative(s)*
International Geosynthetics Society, India Chapter, New Delhi	PROF G. L. SIVAKUMAR BABU SHRIMATI DOLA ROYCHOWDHURY (*Alternate*)
Kusumgar Corporates, Mumbai	SHRI Y. K. KUSUMGAR DR M. K. TALUKDAR (*Alternate*)
Landmark Material Testing and Research Laboratory Pvt Ltd, Jaipur	DR ANIL DIXIT SHRI HARSH KUMAR CHITTORA (*Alternate*)
Maccaferri Environmental Solutions Pvt Ltd, Navi Mumbai	DR RATNAKAR MAHAJAN SHRIMATI MINIMOL KORULLA (*Alternate*)
National Jute Board, Kolkata	SHRI M. DUTTA
Office of the Jute Commissioner, Kolkata	SHRI SOUMYADIPTA DATTA
Office of the Textile Commissioner, Mumbai	SHRI SIVAKUMAR S. SHRI SANJAY CHARAK (*Alternate*)
Premier Polyfilms Ltd, Ghaziabad	SHRI AMITAABH GOENKA SHRI PRAVEEN KUMAR (*Alternate*)
Rajadhani Institute of Engineering & Technology, Trivandrum	DR K. BALAN
RDSO, Lucknow	SHRI SANJAY KUMAR AWASTHI SHRI SANTOSH KUMAR OJHA (*Alternate*)
Reliance Industries Ltd, New Delhi	SHRI V. RAVIKANTH SHRI RAJENDREN SUBRAMANIAN (*Alternate*)
Sahastra Engineers Pvt Ltd, Noida	SHRI VENKATA MAYUR
Strata Geosystems (I) Pvt Ltd, Mumbai	SHRI NARENDRA DALMIA SHRI SHAHROKH BAGLI (*Alternate*)
Techfab India, Mumbai	SHRI ANANT KANOI SHRI SAURABH VYAS (*Alternate*)
The Bombay Textile Research Association, Mumbai	DR SREEKUMAR DR PRASANTA KUMAR PANDA (*Alternate*)
The Synthetics & Art Silk Mills Research, Association, Mumbai	DR MANISHA MATHUR SHRIMATI ASHWINI SUDAM (*Alternate*)
In Personal Capacity [*104, Kanchanban, A. W. Vartak Marg, Vile Parle (East), Mumbai - 400057*]	SHRI V. N. GORE
In Personal Capacity (*37/1 Satyen Park, Thakurpukur, Kolkata - 700104*)	SHRI P. K. CHOUDHARY
BIS Directorate General	SHRI J. K. GUPTA, SCIENTIST 'E'/DIRECTOR AND HEAD (TEXTILES) [REPRESENTING DIRECTOR GENERAL (*Ex-officio*)]

Member Secretary
SHRI HIMANSHU SHUKLA
SCIENTIST 'B'/ASSISTANT DIRECTOR
(TEXTILES), BIS

Bureau of Indian Standards

BIS is a statutory institution established under the *Bureau of Indian Standards Act*, 2016 to promote harmonious development of the activities of standardization, marking and quality certification of goods and attending to connected matters in the country.

Copyright

Review of Indian Standards

Amendments are issued to standards as the need arises on the basis of comments. Standards are also reviewed periodically; a standard along with amendments is reaffirmed when such review indicates that no changes are needed; if the review indicates that changes are needed, it is taken up for revision. Users of Indian Standards should ascertain that they are in possession of the latest amendments or edition by referring to the website-www.bis.gov.in or www.standardsbis.in.

This Indian Standard has been developed from Doc No.: TXD 30 (25136).

Amendments Issued Since Publication

Amend No.	Date of Issue	Text Affected

BUREAU OF INDIAN STANDARDS

Headquarters:

Manak Bhavan, 9 Bahadur Shah Zafar Marg, New Delhi 110002
Telephones: 2323 0131, 2323 3375, 2323 9402 *Website*: www.bis.gov.in

Regional Offices:		*Telephones*
Central	: 601/A, Konnectus Tower -1, 6th Floor, DMRC Building, Bhavbhuti Marg, New Delhi 110002	2323 7617
Eastern	: 8th Floor, Plot No 7/7 & 7/8, CP Block, Sector V, Salt Lake, Kolkata, West Bengal 700091	2367 0012 2320 9474
Northern	: Plot No. 4-A, Sector 27-B, Madhya Marg, Chandigarh 160019	265 9930
Southern	: C.I.T. Campus, IV Cross Road, Taramani, Chennai 600113	2254 1442 2254 1216
Western	: 5th Floor/MTNL CETTM Technology Street, Hiranandani Gardens, Powai, Mumbai - 400076	283 25838

Branches : AHMEDABAD, BENGALURU, BHOPAL, BHUBANESHWAR, CHANDIGARH, CHENNAI, COIMBATORE, DEHRADUN, DELHI, FARIDABAD, GHAZIABAD, GUWAHATI, HARYANA (CHANDIGARH), HUBLI, HYDERABAD, JAIPUR, JAMMU, JAMSHEDPUR, KOCHI, KOLKATA, LUCKNOW, MADURAI, MUMBAI, NAGPUR, NOIDA, PARWANOO, PATNA, PUNE, RAIPUR, RAJKOT, SURAT, VIJAYAWADA.

Published by BIS, New Delhi