IS 14739 (1999): Geotextiles - Method for Determination of Creep [TXD 30: Geotextiles and Industrial Fabrics]

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भारतीय मानक

भूवस्त्रादि — विसर्पण (क्रीप) ज्ञात करने की पद्धति

Indian Standard

GEOTEXTILES — METHOD FOR DETERMINATION OF CREEP

ICS 59.080.70

BUREAU OF INDIAN STANDARDS
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NEW DELHI 110002

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Price Group 2

FOREWORD

This Indian Standard was adopted by the Bureau of Indian Standards, after the draft finalized by the Geotextiles and Industrial Fabrics Sectional Committee had been approved by the Textile Division Council.

Geotextiles are being used increasingly in the reinforcement of soil structures and earthworks. An important characteristic of these materials, as of all plastics, is that their elongation under a constant load is a function of time, that is they exhibit marked creep characteristics, in that the application of load may lead ultimately to rupture. These characteristics are also affected by environmental factors, in particular, temperature. Information on creep is thus essential for selection of geotextiles as reinforcement.

This standard is based on BS 6906 : Part 5 : 1991 Methods of test for geotextiles—Part 5 : Determination of creep.

In reporting the results 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 2:1960 'Rules for rounding off numerical values (*revised*)'.

Indian Standard

GEOTEXTILES–METHOD FOR DETERMINATION OF CREEP

1 SCOPE

This standard describes a method for determining the load-strain-time relationship of geotextiles at a given temperature from a series of constant load tests.

2 REFERENCES

The following standards contain provisions which through reference in the text, constitute provision 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 editions of the standards indicated below:

IS No.	*Title*
SP 45 : 1988	Handbook on glossary of textiles terms
13162 (Part 5) : 1992	Geotextiles—Methods of test: Part 5 Determination of tensile properties using a wide width strip
6359 : 1971	Method for conditioning of textiles

3 TERMINOLOGY

For the purpose of this standard, definitions as given in SP 45 and as given below shall apply.

3.1 Decade of Time

The interval between the specified time and its multiple often, for example, between 100 hours and 1000 hours.

3.2 Isochronous Curve

A curve which indicates the strain of a material under load for a specified time, plotted as load against strain.

NOTE — Curves for a range of times are generally plotted on the same diagram.

3.3 Load

The load in newtons per metre width applied to the specimen, including a pre-tension which is applied at commencement of the test.

4 PRINCIPLE

A test specimen is clamped by jaws at either end across its width. A constant load is applied to the specimen. Strain is measured at specified time intervals.

NOTE — The time to rupture may also be determined.

5 NUMBER OF TESTS

Creep tests shall be carried out at loads of 20 percent, 30 percent, 40 percent and 60 percent of the maximum load per unit width for the material determined in accordance with IS 13162 (Part 5). Tests at additional loads may be appropriate for some materials.

6 APPARATUS

6.1 Loading Apparatus

It consists of a loading frame sufficiently strong so as not to deform or vibrate when in use. It shall provide access for the specimen to be mounted, the load to be correctly applied, and strain monitored. The connections between jaws and loading apparatus shall have sufficient freedom (for example, universal joints) to ensure that the load is applied uniformly across the width of the specimen. The jaws shall grip the specimen with sufficient firmness to allow minimum slippage. They shall not cause damage nor produce areas of weakness outside the gauge length.

Throughout the test, the load shall be known and maintained constant to within ± 1 percent. Where the load is applied by means of weights, with or without a lever, no load cell is necessary provided that the weights and lever ratio have been calibrated previously and that the lever has been balanced with the associated jaw in place.

The pre-tension shall be 1.0 ± 0.2 percent of the maximum load per unit width determined in accordance with IS 13162 (Part 5). A simple loading device is shown in Fig. 1.

NOTES

1 In designing lever type apparatus particular attention should be paid to the limits on lever movement necessary to maintain this tolerance.

2 This apparatus has been selected as a simple means of establishing zero strain although it is recognized as not ideal.

6.2 Extensometer(s)

Strain of the geotextile under load shall be measured between two lines drawn across the width of the specimen, parallel to each other and to the jaws and at a minimum spacing of 100 mm. If the mass of the extensometer equipment exceeds 1 percent of the applied load an appropriate correction shall be made to the load. In general, two extensometers are necessary

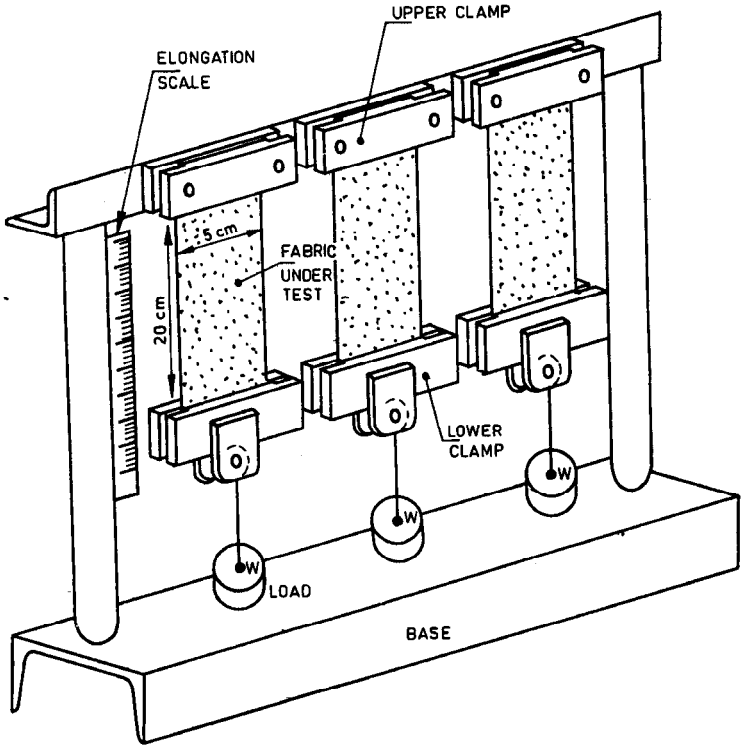

FIG. 1 CREEP TESTER

on opposite sides and ends of the specimen, from which the average reading shall compensate for alignment errors. The extensometer shall allow for a resolution of 0.000 2 (0.02 percent) strain, and its range shall be so selected that it will accommodate material extension during at least the first hour of testing without exceeding its limits of calibration and without adjustment.

NOTE—In place of extensometer a simple arrangement as shown in Fig. 1 may also be used.

7 CONDITIONING AND TESTING ATMOSPHERE

Unless otherwise specified, the test specimens shall be conditioned, and the test conducted in the standard atmosphere for testing textiles as defined in IS 6359.

Any departure from these conditions, for example due to power failure, shall be noted in the final report.

NOTES

1 The requirement for a specified relative humidity may be relaxed or omitted, if it can be shown that the material is not sensitive to humidity.

2 Testing at other temperatures will often be required. Recommended additional temperature are 10 ± 2°C, 40 ± 2°C and 60 ± 2°C.

8 TEST SPECIMENS

For geotextile fabrics, take specimens at random from different positions across the width of the laboratory sample. Unless otherwise specified, take no specimens nearer than 100 mm from the selvedge or edge of the geotextile. Cut specimens parallel to the warp (or machine direction) of the geotextile.

Test specimen shall be 50 mm wide, and sufficiently long to allow a separation of 200 mm between the jaws.

NOTE—For woven geotextiles that fray, cut each specimen 10 mm wider than the final width and then remove an equal number of threads from each side to obtain the finished dimension. This helps maintain the specimen integrity during the test.

For geomeshes or geogrids choose a specimen width that contains a whole number of ribs and at least one row of nodes or cross-members within the gauge length.

Where appropriate, draw four parallel lines running the full width of the specimen, perpendicular to the length dimension, the inner two separated by 100 mm and the outer two by 200 mm.

Examine specimens for any signs of damage or imperfections. If any specimens are rejected, this shall be noted.

Condition each test specimen for at least 48 hours in the test environment (*see* 7). Do not subject the specimen to any stress or strain which could affect its subsequent performance.

9 PROCEDURE

9.1 Setting Up

The apparatus, including the mass of the jaws, shall be balanced before the specimen is mounted. Mount the test specimen centrally in the jaws with the jaws parallel. Where appropriate, do this by having the outer two lines, which were previously drawn 200 mm apart across the width of the specimen, positioned as close as possible adjacent to the inside edges of the upper and lower jaw. Take care that the specimen length in the machine direction is parallel to the direction of application of force. Attach the apparatus for measuring strain.

9.2 Application of Pre-tension

Apply the pre-tension which includes any load due to the mass of the jaws. If possible, record the strain before application of the pre-tension but do not include it in the overall value of strain.

9.3 Measurement of Dimensions

Carry out measurements after application of the pre-tension. Determine the specimen width from the average of three measurements, each made at different positions in the gauge length of the mounted specimen with a resolution of 0.5 mm. Determine the specimen width of a geogrid from the number of ribs under load multiplied by the average rib spacing as determined from three measurements at separate positions on the roll.

Determine the gauge length from the average of two measurements between the inner two lines drawn on the specimen, to which are attached the extensometer clamps. Make measurements at opposite ends and sides of the specimen, correct to the 0.5 mm.

9.4 Application of Load

Apply the load smoothly but rapidly to the specimen at a rate which will not cause any rebound. This may be checked either by monitoring strain or by a load cell mounted in series with the end of the specimen. The loading time excluding any pre-tension shall be between 2 seconds and 60 seconds and shall be recorded.

NOTES

1 Particular attention should be paid to adjusting the mechanism to maintain levers within their calibrated limits (*see* **5.1**) and to avoid any undue load on or distortion of the specimen when making such adjustments.

2 Starting time is the moment at which the full load is first applied to the specimen.

With certain jaws such as roller grips the specimen will slip during loading. If this slippage is seen to be uneven across the width of the specimen, for example by curvature of one of the outer two lines, abandon the test.

9.5 Measurement of Strain

Measure strain and time continuously, or at intervals as given below, after the load is applied. Record the time of loading. After an elapse of 10 X the period of loading, take not less than the following number of measurements :

Four within the first 0.1 hours;

Four more within the first 1 hour;

Four more within the next 10 hours;

Four more within the next 100 hours;

Four more within the next 1 000 hours; and

Four more within the next 10 000 hours.

Take additional readings if there is any possibility of a change in conditions, such as temperature or humidity variations or adjustments to the apparatus.

Unless otherwise specified, the duration of testing shall be not less than 100 hours. However, beyond this time the test can be terminated at any point if there is no change in creep between two successive readings.

Readjust any extensometer that reaches its limit of measurement or limit of accuracy as rapidly as possible and make a corresponding correction to further readings.

Evaluate the results at regular intervals and inspect the specimen for signs of damage or failure.

NOTE — It may be necessary to establish a failure criterion which is indicative of unserviceability other than total separation of the specimen.

Terminate a test either when the specimen has failed, or at the end of the specified period. If the specimen has failed, note the nature of the failure. If it has not failed, note its width, and any signs of local strain or damage before removing it.

10 RESULTS

10.1 Evaluation

Evaluate the results in the following manner :

a) Load : express in kilonewtons per metre (or for strip elements in kilonewtons);

b) Strain: express in percent or in absolute terms taking the specimen with the pre-tension applied as corresponding to zero strain; and

c) Time: express in hours.

10.2 Graphical Presentation

Plot the results as strain against the logarithm of time. Given sufficient clarity, plot the results from tests at a range of loads on the same diagram (*see* Fig. 2).

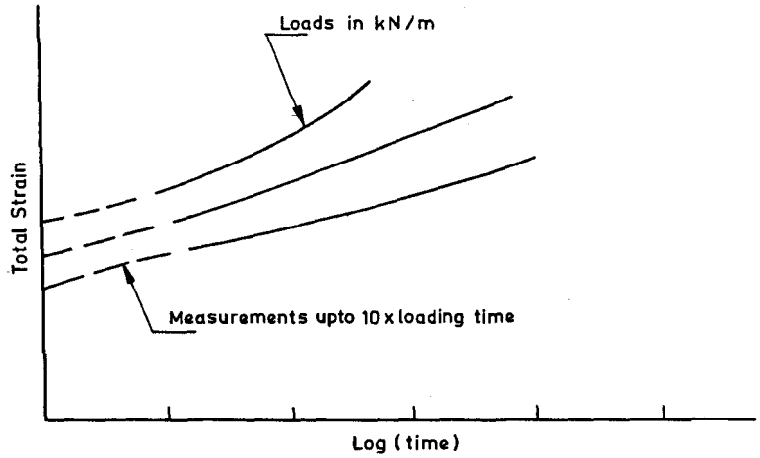

FIG. 2 STRAIN/TIME RELATIONSHIP

11 TEST REPORT

11.1 The test report shall include the following particulars:

a) Number and year of Indian Standard;

b) Identification of the sample tested;

c) Load used;

d) Test environment;

e) Temporary departures from environmental or load specifications;

f) Details of the clamping arrangement;

g) Pre-tension and corresponding strain, if measured;

h) Loading time;

j) Readings of strain against time;

NOTES

1 These may be tabulated or plotted.

2 Presentation of isochronous curves for 1 hour, 10 hours, 100 hours and further decades, if available is also recommended.

k) Details of tensile or short-term creep tests carried out on adjacent specimens;

m) Time to any failure and the nature of failure; and

n) Gauge length and width tested.

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BIS is a statutory institution established under the *Bureau of Indian Standards Act*, 1986 to promote harmonious development of the activities of stardardization, marking and quality certification of goods and attending to connected matters in the country.

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 latest issue of 'BIS Handbook' and 'Standards: Monthly Additions'.

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Amendments Issued Since Publication

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