भारतीय मानक **IS 14293 : 2024**

Indian Standard

भूवस्त्रादि — ट्रेपेज़ाइड विदरण बल निर्धारण की विधि

(पहला पुनरीक्षण)

Geotextiles — Method for Determination of Trapezoid Tearing Strength

(First Revision)

ICS 59.080.70

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October 2024 **Price Group 5**

Geosynthetics Sectional Committee, TXD 30

FOREWORD

This Indian Standard (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.

The trapezoid tear method is a test that produces tension along a reasonably defined course such that the tear propagates across the width of the specimen. The trapezoid tearing strength for woven fabrics is determined primarily by the properties of the yarns that are gripped in the clamps. In nonwoven fabrics, because the individual fibers are more or less randomly oriented and capable of some reorientation in the direction of the applied load, the maximum trapezoid tearing strength is reached when the resistance to further reorientation is greater than the force required to rupture one or more fibers simultaneously. The trapezoid tearing strength method is useful for estimating the relative tear resistance of different fabrics or different directions in the same fabric.

This standard was first published in 1995. This revision has been made in the light of experience gained since its publication and to incorporate the following major changes:

a) Title of the standard has been modified;

b) References to Indian Standard have been updated;

c) Scope of the standard has been modified to extend applicability of standard for layered fabrics, knit fabrics, and felts also;

d) Clamp size has been specified for the tensile testing machine and requirement for upper clamp has been specified additionally; and

e) Requirement of trapezoidal template has been made optional.

In this revision, considerable assistance has been derived from ASTM D4533-15 ‘Standard test method for trapezoid tear strength of geotextiles’, 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, is to be rounded off, it shall be done in accordance with IS 2 : 2022 ‘Rules for rounding off numerical values (*second revision*)’.

Indian Standard

GEOTEXTILES — METHOD FOR DETERMINATION OF TRAPEZOID TEARING STRENGTH

(First Revision)

1 SCOPE

1.1 This test method is an index test used to measure the force required to continue or propagate a tear in woven or non-woven geotextiles by the trapezoid method.

1.2 This test method is applicable to most geotextiles that include woven fabrics, nonwoven fabrics, layered fabrics, knit fabrics, and felts that are used for geotextile applications.

1.3 This test method may be used with constant-rate-of-traverse (CRT) or constant-rate-of-extension (CRE) type tension machines. However, there may be no overall correlation between the results obtained with the CRT machine and the CRE machine. Consequently, these two tension testers cannot be used interchangeably. In case of controversy, the CRE machine shall prevail.

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 6359 : 2023	Method for conditioning of textiles (*first revision*)
IS 13321 (Part 1) : 2022	Geosynthetics: Part 1 Terms and definitions (*first revision*)

3 TERMINOLOGY

For the purpose of this standard, definitions given in IS 13321 (Part 1) shall apply.

4 PRINCIPLE

An outline of an isosceles trapezoid is marked on a rectangular specimen cut for the determination of tearing strength (*see* Fig. 1), and the non-parallel sides of the trapezoid marked on the specimen are clamped in parallel jaws of a tensile testing machine. The separation of the jaws is continuously increased so the tear propagates across the specimen. At the same time, the force developed is recorded. The tearing strength, which is the maximum value of the tearing force, is obtained from the autographic force-extension curve (*see* Fig. 2).

5 APPARATUS

5.1 Tensile testing machine, of the constant-rate-of-extension (CRE) or constant-rate-of-traverse (CRT) type with autographic recorder.

5.2 Clamps, having all gripping surfaces parallel, flat, and capable of preventing slipping of the specimen during a test, and measuring 50 mm by no less than 76 mm, with the longer dimension perpendicular to the direction of application of the load.

5.3 Trapezoidal template (optional), having the dimensions as shown in Fig. 1.

6 PREPARATION OF TEST SPECIMEN

6.1 For woven fabrics, take the specimens to be used for the measurement of the tearing strength of machine direction yarns from different sets of machine direction yarns and the specimens to be used for the measurement of the tearing strength of cross-machine direction yarns from different sets of cross-machine direction yarns and, when possible, from fabric woven from different bobbins. In case of non-woven fabrics take the specimens for the measurement of the machine direction tearing strength from different positions across the fabric and for the measurement of the cross-machine direction tearing strength from different positions along the length of the fabric.

6.2 Cut rectangular specimens of 76 mm × 200 mm in such a way that no specimens are taken nearer the selvedge or edge of the fabric than 1/20th of the fabric width or, 150 mm whichever is smaller. Cut the specimens to be used for the measurement of the tearing strength in the machine direction (or warp yarns), with the longer dimension parallel to the machine direction (or warp yarns). Cut the specimens to be used for the measurement of the tearing strength in the cross-machine direction (or weft yarns) with the longer dimension parallel to the cross-machine direction (or weft yarns). Mark each specimen with an isosceles trapezoid template (*see* Fig. 1). Make a preliminary cut 15 mm long at the centre of the 25 mm edge, as shown in Fig. 1.

6.3 The number of specimens shall be as agreed to between the buyer and the seller subject to a minimum of 5 in each direction.

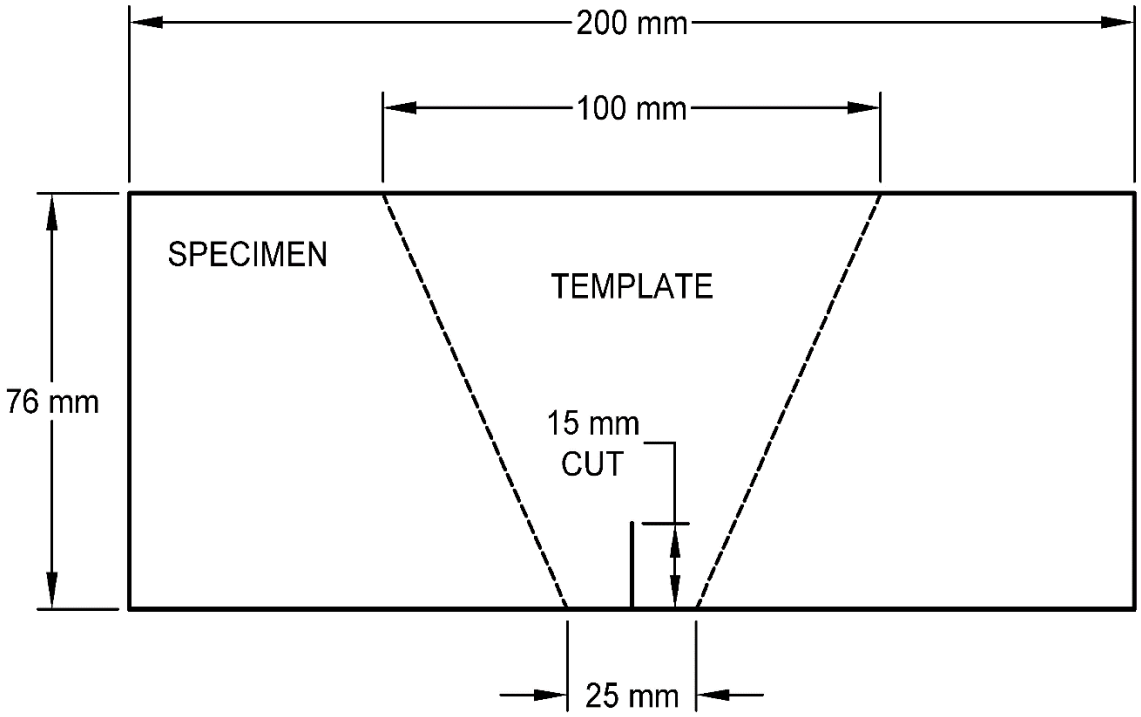
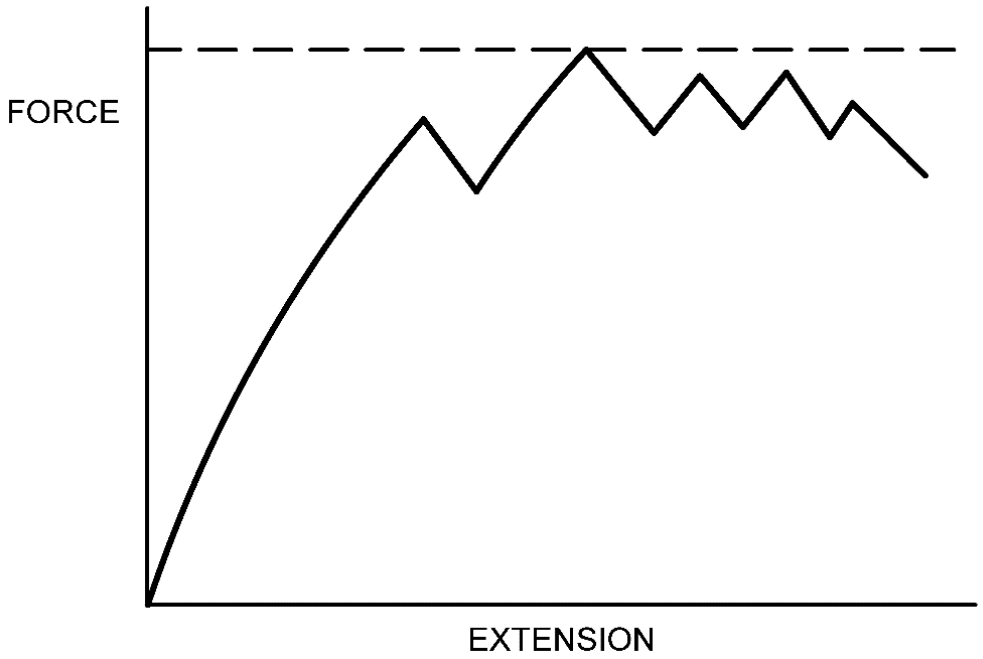
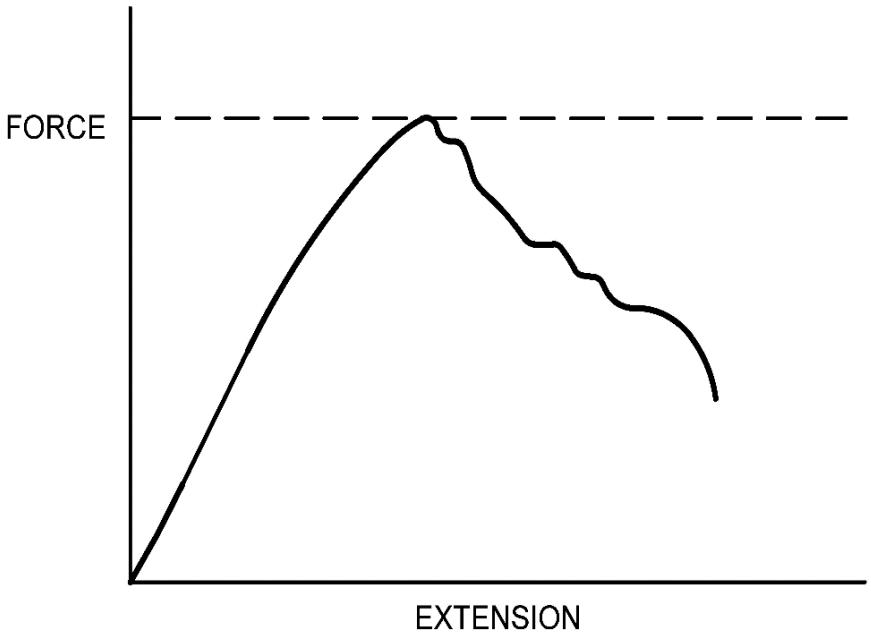


FIG.1 TRAPEZOIDAL TEMPLATE FOR TRAPEZOID TEARING STRENGTH TEST



2A FABRIC EXHIBITING SEVERAL MAXIMA



2B FABRIC EXHIBITING SINGLE MAXIMUM

FIG. 2 TYPICAL TEARING FORCE-EXTENSION CURVES FOR INDIVIDUAL TEST SPICEMENS

7 CONDITIONING

7.1 Bring the specimens to moisture equilibrium in the atmosphere for testing textiles as specified in IS 6359.

7.2 Specimens to be tested in the wet condition shall be immersed in water maintained at a temperature of (27 ± 2) °C. The time of immersion shall be sufficient to wet out the specimens thoroughly; this is indicated by no significant change in strength or elongation following a longer period of immersion, and shall be at least 2 min. To obtain thorough wetting, it may be necessary and advisable to add not more than 0.05 percent of a non-ionic neutral wetting agent to the water.

8 PROCEDURE

8.1 Test the conditioned specimens in the standard atmosphere for testing as defined in IS 6359.

8.2 Test the thoroughly wet specimen in the normal machine setup within 2 min after removal from the water.

8.3 Set the distance between the clamps at the start of the test at (25 ± 1) mm. The upper clamp should be supported by a free swivel or universal joint which will allow the clamp to rotate in the plane of the fabric. Select the load range of the testing machine such that the maximum load occurs between 15 percent and 85 percent of full-scale load. Set the machine to operate at a speed of (300 ± 10) mm/min.

8.4 Secure the test specimen in the machine, clamping along the non-parallel sides of the trapezoid so that the end edges of the clamps are in line with the 25 mm long side of the trapezoid, and the cut is halfway between the clamps. Hold the short edge tight and let the remaining fabric lie in folds.

8.5 Start the machine and record the tearing force on the autographic recorder. The tearing force may not increase to a simple maximum value, but may show several maxima and minima, as shown in Fig. 2A. Record the maximum force obtained in Newtons, as illustrated in Fig. 2A and Fig. 2B.

8.6 If a fabric slips in the jaws or if 25 percent or more of the specimens break at a point within 5 mm of the edge of the jaw, then

a) the jaws may be padded;

b) the fabric may be coated under the jaw face area; or

c) the jaw face may be modified. If any of the modifications listed above are used, state the method of modification in the report.

8.7 If an individual test result deviates 25 percent or more from the average test result of a swatch, it shall

be discarded and an additional specimen tested. Calculate the average excluding outlier values.

9 CALCULATION

Calculate separately the average of the maximum tearing strengths of the machine direction (or warp) specimens and the average of the maximum tearing strengths of the cross-machine direction (or weft) specimens.

10 REPORT

The report shall include the following:

a) State that the tests were performed as directed in this test method. Describe the material(s) or product(s) sampled and the method of sampling used; and

b) Report the following information for each sample:

1) Average of the maximum tearing strengths in Newtons for each direction;

2) Number of specimens tested for each direction;

3) Coefficient of variation of the observed tearing strength of individual specimens, if required; and

4) Condition of the specimens (dry or wet).

ANNEX A

(*Foreword*)

COMMITTEE COMPOSITION

Geosynthetics Sectional Committee, TXD 30

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Amendments Issued Since Publication

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