

Australian Standard®

AS 3706.2—2012

Geotextiles—Methods of test

Method 2: Determination of tensile properties— Wide strip and grab method

1 SCOPE

This Standard sets out the method for determining the tensile properties of geotextiles in both atmospheric and wet conditions.

2 APPLICATION

This method is applicable to all types of geotextiles, but has limitations for high strength materials (i.e. those having a tensile strength in excess of approximately 85 kN/m) due to specimens slipping in the jaws.

3 REFERENCED DOCUMENTS

The following documents are referred to in this Standard:

AS

2193 Calibration and classification of force-measuring systems

3704 Geotextiles—Glossary of terms

3706 Geotextiles—Methods of test

3706.1 Method 1: General requirements, sampling, conditioning, basic physical properties and statistical analysis

BS EN ISO

10319 Geosynthetics. Wide width tensile test

ASTM

D4595 Test method for tensile properties of geotextiles by the wide width strip method

D4632 Standard test method for grab breaching load and elongation of geotextiles

4 PRINCIPLE

The specimen is gripped in the jaws of a tensile testing machine that is operated at a prescribed constant rate of extension. A longitudinal force is applied to the specimen until it ruptures (breaks). Various tensile properties of the test specimen are recorded.

5 DEFINITIONS

For the purpose of this Standard, the definitions given in AS 3704 apply.

6 APPARATUS AND REAGENTS

The following apparatus and reagents are required:

- (a) Constant rate of extension (CRE) tensile testing machine complying with the requirements for a Grade B machine in accordance with AS 2193, and having an extension rate of 20 to 300 mm/min and an autographic recorder with adequate pen response or an interfaced computer to properly record the force extension curve.

For machines with no autographic recorder, appropriate measuring instruments shall be used to allow readings of the applied force and the corresponding extension at a number of points up to failure.

- (b) Clamping devices complying with the following:

- (i) *Wide width tensile strength* The jaws of the device shall be not less than 10 mm wider than the width of the test specimen and shall prevent the test specimen from slipping. The jaws shall not damage the test specimen.

NOTES:

- 1 Flat plate type jaws, often supplemented by small G-clamps placed at X_1 and X_2 , as shown in Figure 1(a), have been found to hold most wide strip specimens satisfactorily.
- 2 Flat plate pneumatic/hydraulic type jaws of appropriate size have also been found to be suitable.
- 3 For higher strength materials, corrugated surfaces may limit slippage (see Figure 2).

- (ii) *Grab tensile strength* The jaws of the device shall be positioned such that the centre-line of the jaws is in line with the applied force, and the front edges are at right angles to the line of applied force and their clamping faces are in the same plane.

The jaw size shall be 25 mm wide by 50 mm long [see Figure 1(b)].

The jaws shall be capable of holding the test specimen without allowing it to slip and designed so that they do not cut or otherwise weaken the test specimen.

The faces of the jaws shall be smooth and flat. For packing purposes, engraved or corrugated jaws may be used to prevent slippage, as flat-faced jaws cannot hold the test specimen satisfactorily. Other auxiliary materials for use with either smooth or corrugated jaws to improve specimen gripping include paper, leather, plastics or rubber.

NOTE: Ensure auxiliary material used to improve gripping does not increase or decrease the total gripping area.

- (c) Area-measuring device, such as an integrating accessory to the tensile testing machine or a planimeter.
- (d) Deionized water and a non-ionic wetting agent.
- (e) Water bath maintained at a temperature of $20 \pm 2^\circ\text{C}$.

7 PREPARATION OF TEST SPECIMENS

7.1 Method A: Wide width tensile strength

7.1.1 Sampling

A minimum of 10 test specimens shall be sampled in accordance with AS 3706.1.

The specimens shall be cut as follows:

- (a) A minimum of five specimens with the larger dimension in the machine direction.
- (b) A minimum of five specimens with the larger dimension in the cross-machine direction.

7.1.2 Size of specimens

7.1.2.1 For atmospherically conditioned testing

Each specimen shall be prepared so that it is 200 mm wide (excluding ravelled edge when applicable). The length of the specimen depends on the type of jaw being used. For all jaw types, the length shall be such that the ends of the specimen shall project not less than 20 mm beyond the jaws.

For woven geotextiles, the 200 mm width of the test specimen shall be obtained by cutting the specimen 220 mm wide and removing or ravelling threads from each side alternately until the removal of one more thread will reduce the width below 200 mm. The width of the cut test specimen shall be obtained by cutting in the machine or cross-machine direction, as appropriate.

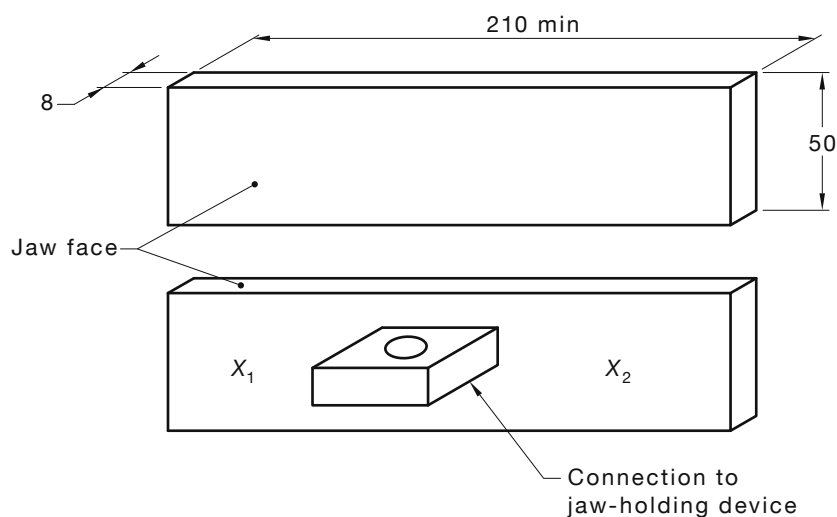
7.1.2.2 For wet-conditioned and atmospherically conditioned testing

Where the tensile properties are required for both wet-conditioned specimens and atmospherically conditioned specimens, each specimen shall be not less than twice as long as required for atmospheric testing (see Clause 7.2.1). Each specimen shall be numbered and cut crosswise into two test specimens of equal length, one for testing the tensile properties of a wet-conditioned specimen, the other for determining the tensile properties of an atmospherically conditioned specimen. Each test specimen shall be numbered so that each pair of tests may be carried out on specimens containing either the same set of yarns (woven materials) or from the same processing area (non-woven materials).

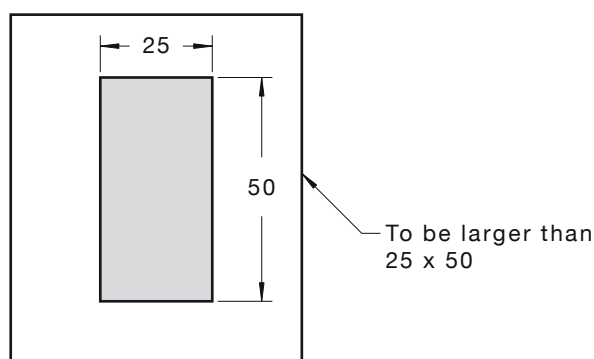
For geotextiles that shrink excessively when wet, the test pieces for wet tensile properties shall be cut longer than those to be tested after conditioning in the atmosphere. No adjustment or allowance shall be made for any change in width on wetting of the test specimen.

7.1.3 Conditioning

The specimens shall be conditioned, either atmospherically or wet, as required, in accordance with AS 3706.1.



(a) Wide width method



(b) Grab method

DIMENSIONS IN MILLIMETRES

FIGURE 1 JAW FACES

7.2 Method B: Grab tensile strength

7.2.1 Sampling

A minimum of 10 test specimens shall be sampled in accordance with AS 3706.1.

The specimens shall be cut as follows:

- (a) A minimum of five specimens with the larger dimension in the machine direction.
- (b) A minimum of five specimens with the larger dimension in the cross-machine direction.

7.2.2 Size of specimens

7.2.2.1 For atmospherically conditioned testing

Each specimen shall be prepared so that it has a width of 100 ± 2 mm and a length of 200 ± 2 mm min. (excluding ravelled edge when applicable).

NOTE: The length of the specimen depends on the type of jaw being used.

For woven geotextiles, the 100 mm width of the test specimen shall be obtained by cutting the specimen 120 mm wide and removing or ravelling threads from each side alternately until the removal of one more thread will reduce the width below 100 mm. The width of the cut test specimen shall be obtained by cutting in the machine or cross-machine direction, as appropriate.

7.2.2.2 *For wet-conditioned and atmospherically conditioned testing*

Where the tensile properties are required for both wet-conditioned specimens and atmospherically conditioned specimens, each specimen shall be not less than twice as long as required for atmospheric testing (see Clause 7.2.2.1). Each specimen shall be numbered and cut crosswise into two test specimens of equal length, one for testing the tensile properties of a wet-conditioned specimen, the other for determining the tensile properties of an atmospherically conditioned specimen. Each test specimen shall be numbered so that each pair of tests may be carried out on specimens containing either the same set of yarns (woven materials) or from the same processing area (non-woven materials).

For geotextiles that shrink excessively when wet, it will be necessary to cut the test pieces for wet tensile properties longer than those to be tested after conditioning in the atmosphere. No adjustment or allowance shall be made for any change in width on wetting of the test specimen.

7.2.3 *Conditioning*

The specimens shall be conditioned, either atmospherically or wet, as required, in accordance with AS 3706.1.

8 TEST CONDITIONS

The test atmosphere shall be in accordance with AS 3706.1.

Wet-conditioned specimens shall be tested in the tensile testing machine within 20 min after their removal from the water bath.

9 PROCEDURE

9.1 Method A: Wide width tensile strength

The procedure shall be as follows:

- (a) Record mass per unit area for each specimen as per AS 3706.1.
- (b) Set up the tensile testing machine as follows:
 - (i) Adjust the distance between the jaws to 100 ± 3 mm. Measure and record the gauge length.
 - (ii) Select the force range of the machine so that the break occurs between 10% and 90% of full scale load.
 - (iii) Set the machine to operate at an extension rate of 20 mm/min.
- (c) Clamp the specimen centrally in the jaws with approximately equal lengths extending beyond the jaws at each end. Take care that the specimen length is parallel to the direction of application of force. Record whether it is a machine direction or cross-machine direction specimen.
- (d) Mark the sample along the upper and lower face of the jaws (for example, with a soft felt pen), ensuring the geotextile sample is not damaged in the process. This will allow the operator to assess whether slippage at the jaws is occurring. Slippage at the jaws will render the result unusable.

- (e) Start the testing machine and the area-measuring device, if used, and continue running the machine to specimen rupture (i.e. break). For machines with no autographic recorder, record the applied force and corresponding extension or elongation at a number of points, up to specimen failure.
- (f) Reject results if any of the following occurs, and for each rejected specimen test another specimen from the same roll (see Note 1):
 - (i) If the specimen slips in the jaws. Test another specimen from the same roll, after adoption of one of the following procedures:
 - (A) Padding the face of the jaws (e.g. with felt, cloth, or excess sample fabric).
 - (B) Coating the specimen under the jaw face area.
 - (C) Modifying the faces of the jaws.
 - (D) Setting up two suitable steel rods of minimum length 210 mm, together with new specimens having their longer dimension in excess of 260 mm, in the tensile testing machine as shown in Figure 2.
 - (E) Using other jaw types such as wedge shaped jaws, roller locked jaws, and jaw faces, with a matched undulating/groove-type profile in accordance with ASTM D4595 and BS EN ISO 10319 (see Note 2).
 - (ii) If three or more of the specimens break within 5 mm of the edge of the jaws.
 - (iii) If a specimen breaks within 5 mm of the edge of the jaws and results in a strength value below 20% of the average of all the other breaks. No other clamp breaks shall be discarded unless the test is known to be faulty.
 - (iv) An abnormal result occurs in accordance with AS 3706.1.

NOTES:

- 1 The decision to reject a test result is based on observation of the specimen during the test and upon the inherent variability of the fabric.
- 2 Care should be used with these jaws to ensure correct specimen alignment and gauge length, minimal specimen pre-tension, and accurate measurement of specimen elongation.
- 3 It is difficult to determine precisely why certain specimens break near the edge of the jaws. If a jaw break is caused by damage to the specimen from the jaws, then the results should be discarded. However, if it is merely due to randomly distributed weak places, it is a legitimate result. In some cases, it may also be caused by a concentration of stress in the area adjacent to the jaws because these prevent the specimen from contracting in width as the load is applied. In these cases, a break near the edge of the jaws is inevitable and acceptable as a characteristic of the particular test conditions.
- 4 Slippage may be detected by checking displacement of the marked line along the internal edge of the upper and lower jaws.