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Application News

AGS-X Precision Universal Tester

Fabric Tearing Test (ASTM D4533 Trapezoid Method)

Yuki Kamei

User Benefits

◆ The tearing strength of fabrics can be measured in accordance with ASTM D4533.

■ Introduction

Every day, we change into various clothes according to the season, time of day, situation, and scene. For example, in the summer during the day we wear a T-shirt that breathes well, and in the cold winter a down jacket that keeps us warm. Also, if we work in the field, we should wear work clothes that are sturdy and easy to move in. Depending on what values are prioritized, such as comfort, functionality, and design, different performance is required for clothing, and new products are produced every day.

As clothing is a product, it requires strength evaluation to ensure a certain level of quality. ASTM D4355 describes methods for measuring the tearing strength of woven and non-woven geotextiles that are essential to our daily lives.

This article presents an example of trapezoid tear testing of fabrics in accordance with the ASTM D4533.

■ Measurement System

Table 1 shows the test configuration. For this test, an AGS-X precision universal tester and a screw type flat grip were used. Table 2 shows the test conditions.

Fig. 1 shows a schematic diagram of trapezoid tearing test specimen. Specimens for ASTM D4533 were prepared by cutting out a specimen of approx. 76 mm × 200 mm, and then marking an isosceles trapezoid template as shown by the dashed lines in Fig. 1(a), then making a 15-mm slit on the short side of the trapezoid previously marked on the specimen. The specimen was gripped so that long side of the grip face and the lateral sides of the trapezoid were matching. In addition, a hexagonal specimen as shown in Fig. 1 (b) was also introduced as an optional template. By gripping the side indicated by the red arrow and the grip face in parallel, the test can be performed without marking the specimen with an isosceles trapezoid. In this case, the strength of four kinds of specimen was evaluated in the warp and weft directions.

Fig. 2 shows a photo of the test. Although ASTM D4533 requires the use of grip faces with a width of no less than 76.2 mm and a length of 50.8 mm, this test was conducted with grip faces with a width of 150 mm and a length of 20 mm. When first placed in the grips, the fabric on the longer side of the trapezoid was loose (Fig. 2-1) and the test was conducted until the specimen tore in two pieces from the 15-mm slit (Fig. 2-2, 2-3, and 2-4).

Table 1 Test Configuration

Universal Testing Machine:	AGS-X
Load Cell:	5 kN
Grips:	Screw type flat grip (5 kN)
Grip Faces:	Single file teeth grip faces Width 150 mm by Length 20 mm (The length was shorter than specified in the standard.)
Software:	TRAPEZIUM™ X (Single)

Table 2 Test Conditions

Test Speed:	300 mm/min
Gauge Length:	25 mm
Specimen Dimensions:	Width 76 mm × Length 200 mm 15-mm slit placed at a right angle to the specimen edge, in the center of the narrow side of the trapezoid
Kinds of Specimen:	(1) Gingham fabric (2) Sheeting fabric (3) Costume satin fabric (4) _Japanese pattern fabric
Number of Specimens:	n = 3

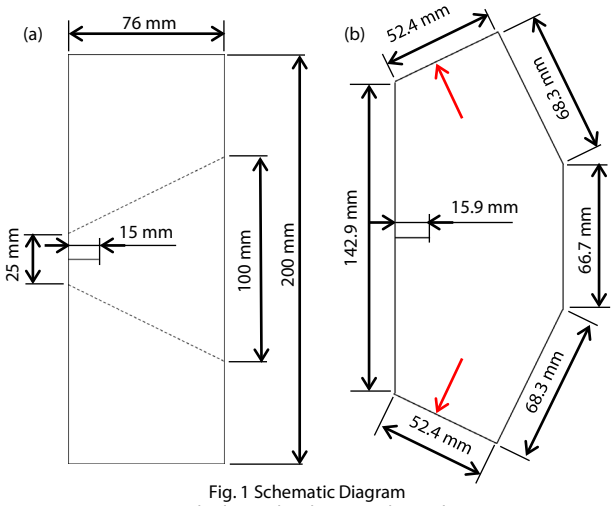

Fig. 1 Schematic Diagram
a:Standard Template b:Optional Template

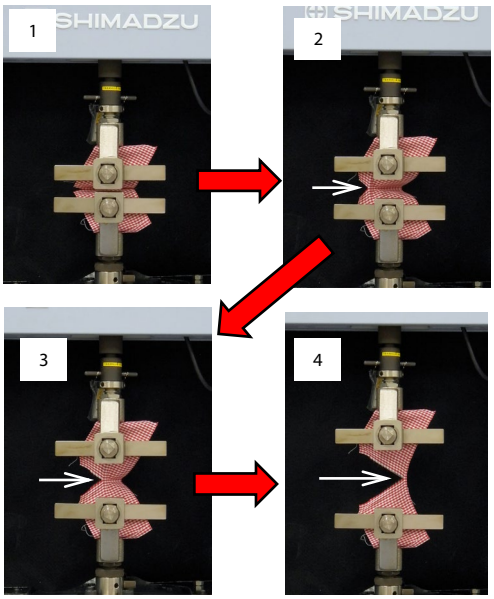

Fig. 2 Photo of the Test

■ Test Results

In ASTM D4533, the maximum test force during the test is the tearing strength. Fig. 3 shows the test results. The test could be conducted smoothly preventing slippage of any specimen. Table 3 summarizes the test results. The results showed a large difference of tearing strength between warp and weft directions for specimens (1) and (3), but it was small for specimens (2) and (4).

Table 3 Summary of the Test (Mean Strength of n=3)

Specimen	Direction	Strength (N)
(1) Gingham fabric	Warp	19.9
	Weft	11.2
(2) Sheeting fabric	Warp	17.8
	Weft	16.2
(3) Costume satin fabric	Warp	173
	Weft	53.2
(4) Japanese pattern fabric	Warp	18.5
	Weft	17.9

■ Conclusion

A table-top type universal testing instrument was used to perform a fabric tearing test (trapezoid method) that conformed to ASTM D4533. This Shimadzu test system can be used to evaluate fabric strength.

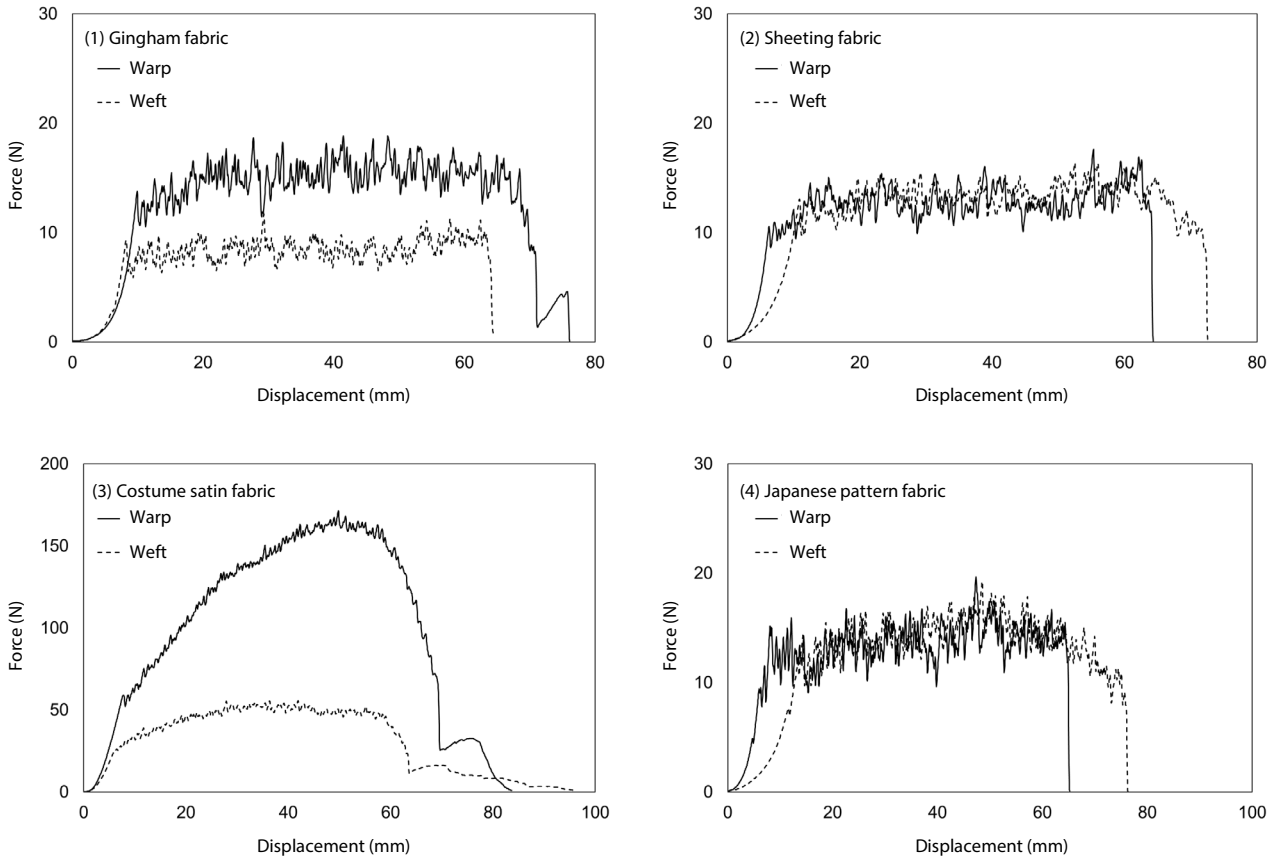

Fig. 3 Test Results

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