Tensile Testing of Textile Fabrics in Accordance with ASTM D 5034

Application Report

Introduction

ASTM D 5034 'Standard Test Method for Breaking Strength and Elongation of Textile Fabrics (Grab Test)', is used to determine the breaking strength and elongation of woven, non-woven and felted fabrics. Typically, these fabrics exhibit less than 10% elongation. A modified form of this grab test may be used for some woven fabrics.

The aim of this report is to recommend an Instron® test configuration that would best suit this application. Further, useful testing techniques and typical data and results will also be discussed.

Test Configuration and Sample Preparation

A 1-yard square fabric sample was obtained to evaluate strength and elongation using the grab test method. The first step in specimen preparation was to cut several 4 in x 8 in rectangular sections. Each section is then marked as shown in Figure 1. 1 inch-wide parallel lines define the position of the grip faces for a 4 in gauge length. Slits are made on each side the specimen such that the test is performed on a 1 inch-wide segment of the fabric only.

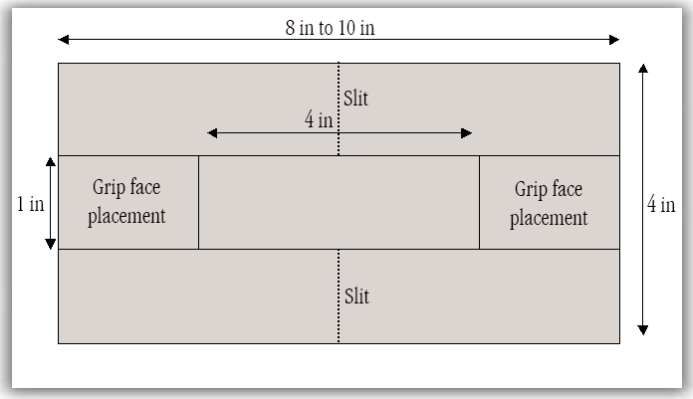

Figure 1: Specimen preparation template.

A 5544 model universal testing machine, 1 kN pneumatic side action grips with 1 in x 1 in rubber-coated faces and a 500 N load cell were used to test this material. After setting the proper grip separation, the first specimen was loaded into the grips using the specimen markings to ensure proper alignment. This configuration is shown in Figure 2. The test speed was set for 12 in/min and the specimen was tested to failure as shown in Figure 3. A total of three specimens were tested and results for breaking force and percent elongation were reported.

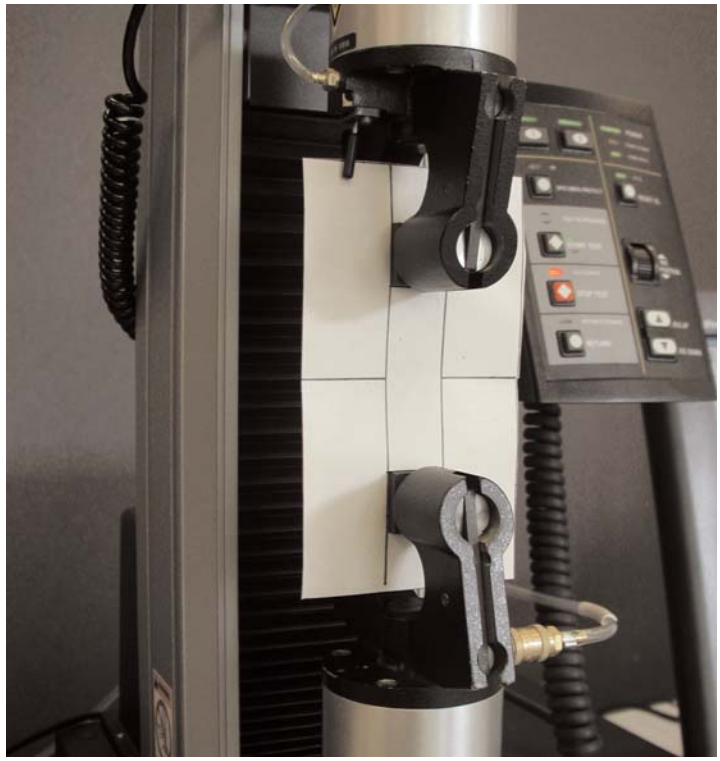

Figure 2: Fabric specimen loaded into the 1 kN grips with 1 in x 1 in rubber-coated faces.

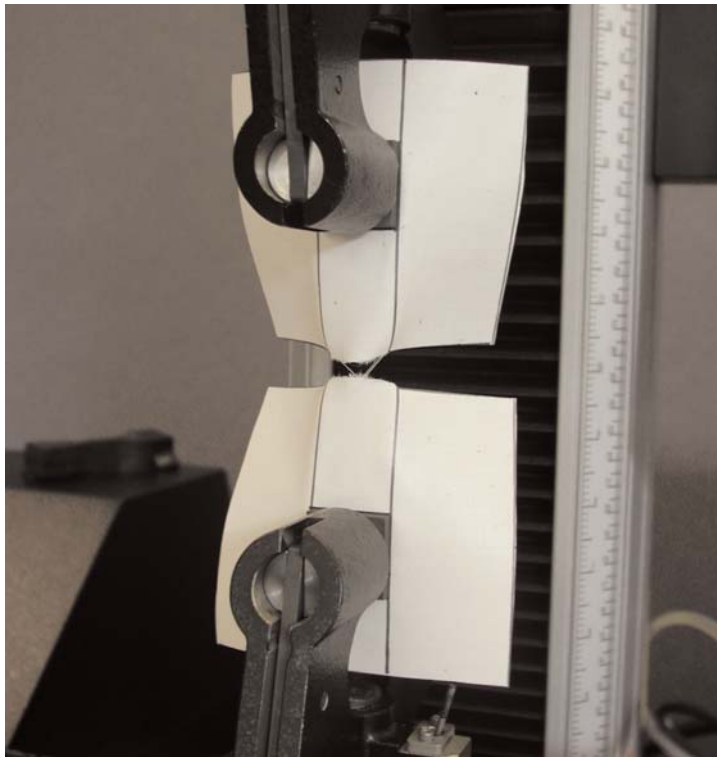

Figure 3: Examination of the specimen after failure shows a successful test based on location of the failure and lack of evidence for slipping or tearing at the grip faces.

Tensile Testing of Textile Fabrics in Accordance with ASTM D 5034

Application Report

Results

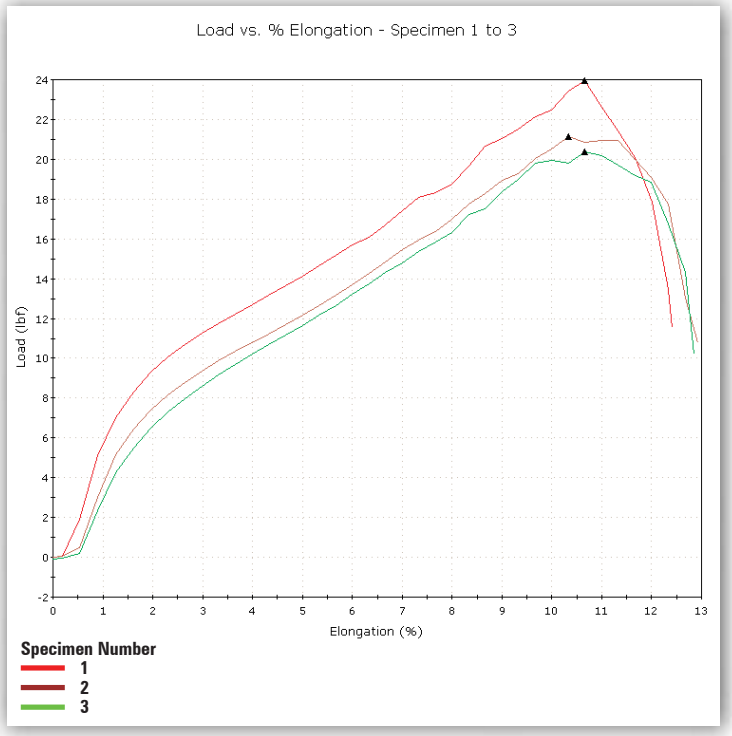

Figure 4: Load versus elongation results for three specimens tested to failure using the grab test method. The breaking load (maximum load) is marked for all specimens.

Specimen #	Breaking Force (lbf)	Apparent Elongation (%)
1	23.953	10.667
2	21.157	10.333
3	20.358	10.667
Mean	21.822	10.556
S.D	1.888	0.193

Table 1: Results for breaking force and elongation for three specimens.

Conclusions

Examination of the specimens after testing shows that the tests were successful in determining breaking force and percentage elongation of the fabric. This conclusion is based on the location of the failure and a lack of evidence for slipping or tearing at the grip faces.

In cases where some slipping of the specimen occurs, 1 in x 1.5 in or 1 in x 2 in faces may be used to increase the surface area along the length of the specimen in the direction of the applied load. Another technique that may assist in specimen loading and alignment is to use a back grip face that is larger than the front grip face.

Lastly, it is important to note that careful specimen preparation is extremely important in acquiring accurate and repeatable results. Alignment of the line of force and the fiber stitch should consistently be in the same direction, as different machine directions of the fabric will lead to a difference in breaking force and elongation. Further, when cutting the fabric to acquire the 1 inch-wide section, it may be necessary in high strength fabrics to count the number of fibers in the section. Some test results have shown that a single fiber can significantly affect the reliability and repeatability of the results.

Suggested Configuration

Configuration Options	Description	Catalog Number
Frame	Single column frame	5544
Load cell	500 N (100 lb) load cell	2530-416
Fixtures	1 kN (200 lb) pneumatic side action grips	2712-003
	25 mm x 25 mm (1 in x 1 in) rubber-coated faces	2702-107
Software	Bluehill™ software	2410-270K1
	Tension application	2410-270C1

INSTRON

Corporate Headquarters
825 University Avenue, Norwood, Massachusetts 02062-2643, USA
Tel: +1 800 564 8378 or +1 781 575 5000 Fax: +1 781 575 5725

European Headquarters
Coronation Road, High Wycombe, Bucks HP12 3SY, United Kingdom
Tel: +44 1494 464646 Fax: +44 1494 456123

Instron Industrial Products
900 Liberty Street, Grove City, PA 16127-9969, USA
Tel: +1 724 458 9610 Fax: +1 724 478 9614

www.instron.com