



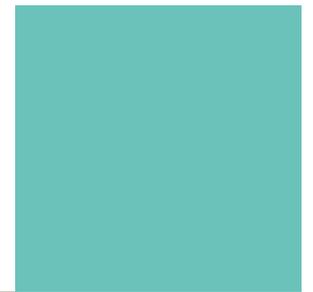
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# Technical Training

## Standards Alliance Conference

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# ASTM D 5587

## Tearing Strength of Fabric by Trapezoid Procedure

# ASTM D 5587 Tearing Strength of Fabric by Trapezoid Procedure

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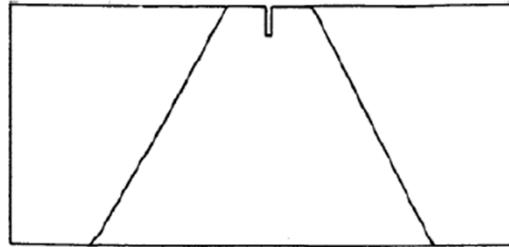


- Scope - this test method describes the determination of the tearing strength of fabrics by the TRAPEZOID procedure
- This test method applies to most types of woven, non-woven and knit fabrics
- Tear strength as determined in this test method requires that the tear be initiated before testing
- Tear strength may be reported either as the single-peak force or the average of the five highest peaks

# Summary of Test Method



- An outline of an isosceles trapezoid is marked on a rectangular specimen and slit at the center of a side



- The non parallel sides of the marked trapezoid are clamped in the jaws of a tensile tester
- The test is initiated and the separation of the jaws, propagating the tear
- At the same time the tear force is developed
- The test is continued through a determined distance

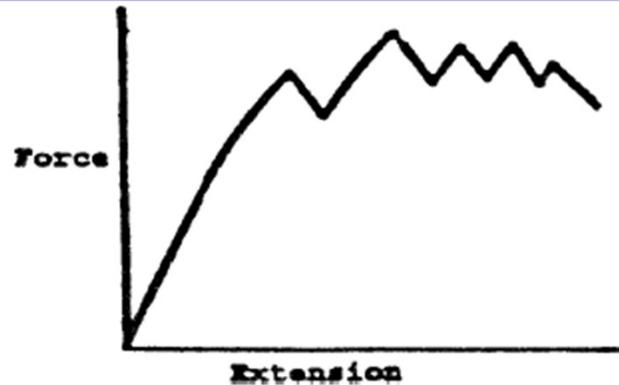
# Significance and Use

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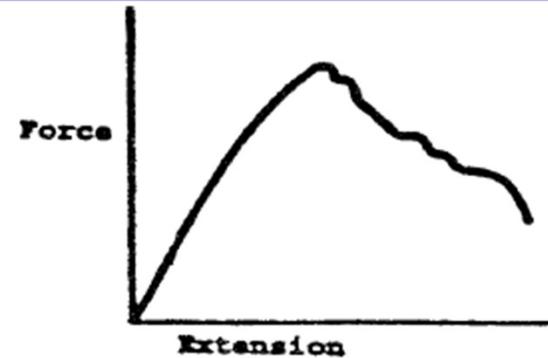


- This test method is satisfactory for acceptance testing
- The force registered in a tear test is irregular and empirical methods have been developed to obtain tear strength. The reported values reflect comparative performance of similar fabrics tested in the same way. No known procedure is available that can be used with all fabrics to determine the minimum breaking strength

# Result detail



(a) Fabric Exhibiting Several Maxima



(b) Fabric Exhibiting Single Maxima

Depending on the nature of the fabric, the data recording device will show the tear force in the form of a peak or peaks referred to as a “saw-tooth” diagram. The high peaks appear to reflect the strength of yarn components either individually or in combination needed to stop a tear in the fabric

# Apparatus

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- Tensile testing machine, preferably CRE type with automatic recording device
- Clamps having all gripping surfaces flat and parallel capable of preventing slipping of the specimen
- Clamp jaws measuring at least 50X75mm with the longer dimension perpendicular to the direction of application of force. The jaw surfaces may be coated or serrated to minimize slippage

# Sampling and Test Specimens

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- Select the number of items from the lot as stated in the material specification. From the lot sample, take a 1 meter swatch or garments as the lab sample.
- From each lab sample unit take five specimens from each of the warp and filling directions
- Cut rectangular specimens 75X150mm with the long dimension as the direction of the test
- Make a preliminary cut 15mm long in the center of the long direction of the specimen

# Preparation of Test Equipment

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- Verify the calibration of the test instrument as directed by the equipment manufacturer
- Set the distance between the clamps at  $25 \pm 1$  mm
- Set the force range of the tester so that the maximum force occurs between 15 & 85% of full scale
- Set the test speed as agreed on between the two parties, usually  $300 \pm 10$  mm/min. Other speeds may be used by agreement.

# Procedure

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- Condition the specimens and test in the standard conditions
- Secure the test specimen in the tester by clamping along the non-parallel sides of the trapezoid in each clamping jaw. The specimen may lie in folds.
- Start the test and record the tearing force as the tear moves for 75 mm through the specimen.
- The tear force may show as a single maxima or show several maxima.

# Calculation and Report

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- For specimens exhibiting five peaks or more, after the initial peak, average the five highest peaks unless otherwise stated in the specification as the tearing force
- For specimens exhibiting less than five peaks, record the highest peak as the tearing force
- Report the tearing force for each direction of the specimens



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# ASTM D 3786

## Bursting Strength, Diaphragm Method

# ASTM D3786

## Bursting Strength, Diaphragm Method

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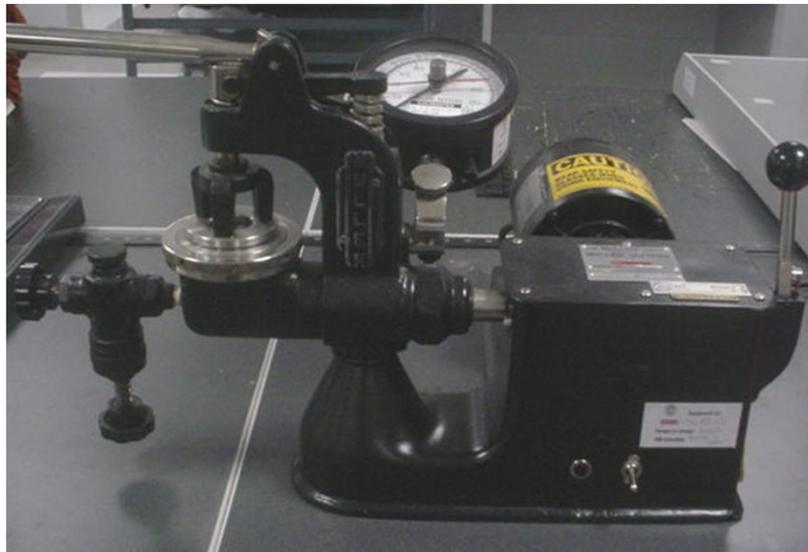


- Scope - this method describes the determination of the bursting resistance of a wide variety of textile fabrics using a hydraulic or pneumatic diaphragm type tester
- Summary of Method- a fabric (woven or knit) is clamped over an expandable diaphragm. The diaphragm is expanded by either fluid (liquid or air) to the point of specimen rupture
- Burst strength is reported either as total pressure to rupture minus the tare pressure required to inflate the diaphragm

# Apparatus and Material



- Inflatable diaphragm bursting tester consisting of clamps to firmly hold the specimen; natural or synthetic rubber diaphragms; Bourdon type pressure gage with accuracy of 1% of capacity and will hold pressure until released; pressure application system either hydraulic or pneumatic; hydraulic fluid if this system is used, either 96% glycerin or ethylene glycol



# Equipment Calibration

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- Aluminum sheets for verifying performance of tester. Use sheets applicable to the type of tester
- Periodically verify the calibration status of the machine by bursting 5 specimens of standard aluminum foil recommended by manufacturer. Record the average burst strength of the foil in the instrument verification log
- The Bourdon pressure gage must be under calibration control. If an electronic pressure gage is used it too shall be under calibration control

# Sampling and Conditioning

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- Select a lot sample as directed by material specification or test method. From each lot sample cut a full width fabric swatch or use a specified number of textile products to be used as lab sample
- From each unit of the lab sample, cut test specimens at least 125 mm<sup>2</sup> or 5 in<sup>2</sup>. The specimens may be either circular or square
- Condition and test the lab specimens as described by the material specification or test method

# Procedure



- Zero the pressure gage or electronic unit. If a pneumatic type tester is used, adjust the control valve so that the burst occurs within  $20 \pm 5$  sec. Determine tare pressure of the diaphragm by inflating without fabric specimen
- Place a lab specimen between the instrument clamps and secure as directed by operation manual
- Initiate the tester and continue applying pressure until the specimen bursts. When burst occurs immediate terminate the application of pressure

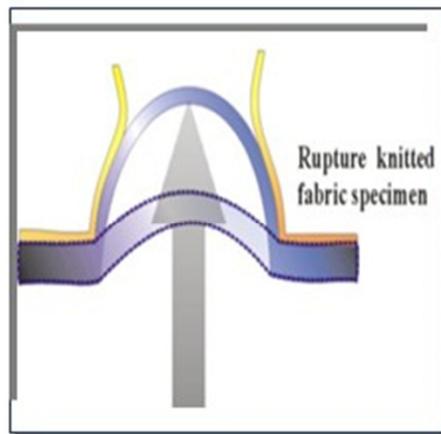


# Calculation and Reporting

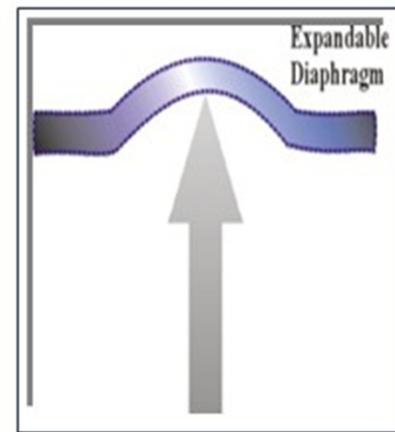


- Record the burst pressure as burst strength
- Calculate the burst pressure of each test specimen by subtracting the tare pressure from the total pressure recorded by the pressure gage or electronic device

**Bursting Strength = Total Pressure - Tare Pressure**



**Total Pressure**



**Tare Pressure**

# Calculation and Reporting

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- Report the average burst pressure of all specimens tested as the burst strength
- Report which type of bursting tester used, hydraulic or pneumatic



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# ASTM D 5034

## Breaking Strength/Elongation Grab Method

# D5034

## Breaking Strength/Elongation Grab Method

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- Scope: This method covers the breaking strength and elongation determined by the grab procedure
- This method is applicable to woven, nonwoven and felted fabrics. It is not recommended for glass or knit fabrics
- The grab method is a strength/elongation test in which the central part of the width of a specimen is gripped in the clamp for example- a specimen is 100 mm wide with a 25 mm clamp placed in the middle of the fabric. This determines “effective strength and elongation”; that is the strength of the yarns in a specific test width with the assistance of adjacent yarns. This cannot be used for direct comparison with yarn strength determinations

# Summary of Test Method, Significance and Use

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- A 100 mm wide fabric specimen is mounted centrally in clamps of a tensile tester and a force is applied until specimen rupture
- The grab method for the determining the breaking strength and elongation is considered satisfactory for acceptance test
- Comparison of results from tensile testers of different operating principles, i.e. Constant Rate of Extension and Constant Rate of Traverse, is not recommended

# Equipment



- Tensile testing machine with working range of fabric strengths capable of operating at a speed of  $300 \pm 10$  mm/min.



# Equipment

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- Clamps and jaw faces - the front jaw measures  $25 \pm 1$  perpendicular to the direction of force application and not less than  $25 \pm 1$  mm or more than  $50 \pm 1$  mm parallel to the direction of force application. The back jaw shall be at least as large as its mate. Use of a larger back jaw reduces the problem of front jaw alignment and slippage. Modified jaw surfaces may be used to minimize slippage.
- An indicator for recording force and elongation. An interfaced computer program from the manufacturer to drive the tester and record results is recommended.



# Preparation of Samples

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- From the lab sample, cut 5 specimens in each of the warp and filling directions. Cut the warp specimens with the long dimension in the warp direction and filling specimens long dimension in filling direction
- Cut each specimen  $100\text{mm} \pm 1\text{ mm}$  wide X at least  $150\text{mm} \pm 1\text{mm}$  long. The length of the specimen depends on the type of clamp used
- Draw a line 37mm from the edge in the long direction of the specimen to align within clamps

# Preparation and Equipment Set-Up

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- Prepare the tester as directed by the manufacturer's instructions and verify the calibration of the tester
- Set the distance between the clamps to  $75 \pm 1$  mm.
- Select the force range of the tester for the break to occur between 10 and 90% of capacity
- Set the load rate (speed) to  $300 \pm 10$  mm/min
- Check the jaw flatness and parallel- make a 4 ply sandwich of white paper and soft carbon papers. Place this between the clamps and close. The impression must show uniform impression

# Procedure and Report

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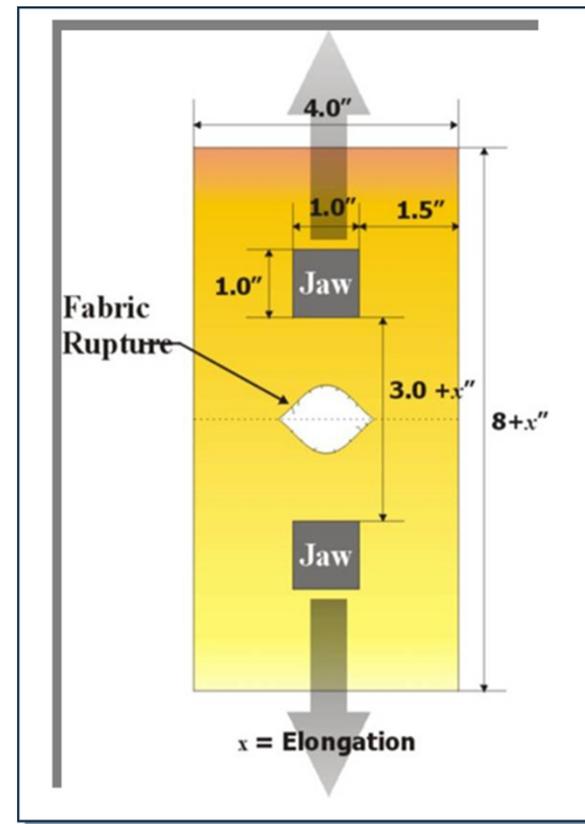


- Mount the specimen between the top and bottom clamp jaw surfaces. Adjust the parallel drawn line to the outside of the clamp jaw and close the clamps. If pretension is required close the top clamp, add the pretension and close the bottom clamp
- Mark the specimen at the front inner edge of the jaw and observe during testing to check for slippage

# Procedure and Report



- Operate the tester until specimen breaks
- Report the average force required to break and elongation at the break for the 5 specimens





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# ASTM D 5035

## Breaking Strength/Elongation Strip Method

# D5035

## Breaking Strength/Elongation Strip Method

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- Scope: This method covers the breaking strength and elongation determined by the cut or reel strip procedure.
- This method is applicable to woven, nonwoven and felted fabrics. It is not recommended for glass or knit fabrics.
- The strip method is a strength/elongation test in which the entire specimen width is tested.
- Summary of Test Method - A test specimen is clamped in a tensile testing machine and a force is applied until the specimen breaks. The breaking force and elongation are recorded. From these data, tensile strength, force/unit width, may be determined.

# Summary of Test Method, Significance and Use

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- A specific width of fabric (specimen) is mounted in clamps of a tensile tester and a force is applied until the specimen ruptures.
- The strip method for the determining the breaking strength and elongation is considered satisfactory for acceptance test.
- Comparison of results from tensile testers of different operating principles, i.e. Constant Rate of Extension and Constant Rate of Traverse, is not recommended.

# Apparatus

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- Tensile testing machine with working range of fabric strengths capable of operating at a speed of  $300 \pm 10$  mm/min.
- Clamps and jaw faces – each jaw face shall be at least 10 mm wider than the specimen being tested and at least 25 mm in the direction of application of force.
- An indicator for recording force and elongation. An interfaced computer program from the manufacturer to drive the tester and record results is recommended.



# Preparation of Samples

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- From the lab sample, cut 5 specimens in each of the warp and filling directions. Cut the warp specimens with the long dimension in the warp direction and filling specimens long dimension in filling direction.
- Cut each specimen width as directed by the material specification. If the specimen is to be raveled, cut the specimen at least 20 yarns wider than the test width. Ravel equal number of yarns from each side.

# Preparation and Equipment Set-Up

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- Prepare the tester as directed by the manufacturer's instructions and verify the calibration of the tester.
- Set the distance between the clamps to  $75 \pm 1$  mm.
- Select the force range of the tester for the break to occur between 10 and 90% of capacity.
- Set the load rate (speed) to  $300 \pm 10$  mm/min.
- Check the jaw flatness and parallel- make a 4 ply sandwich of white paper and soft carbon papers. Place this between the clamps and close. The impression must show uniform impression.

# Procedure and Report



- Mount the specimen between the top and bottom clamp jaw surfaces. If pretension is required close the top clamp, add the pretension and close the bottom clamp

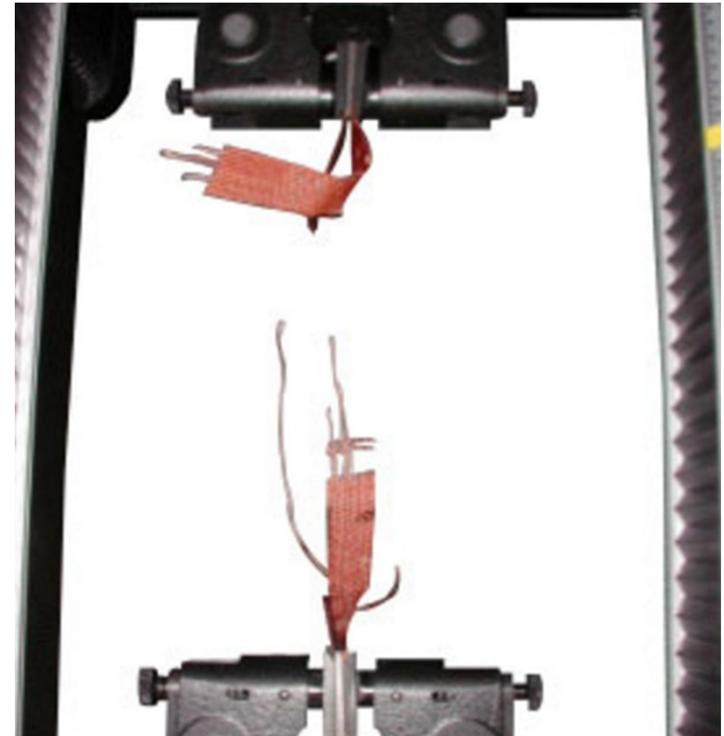


# Procedure and Report

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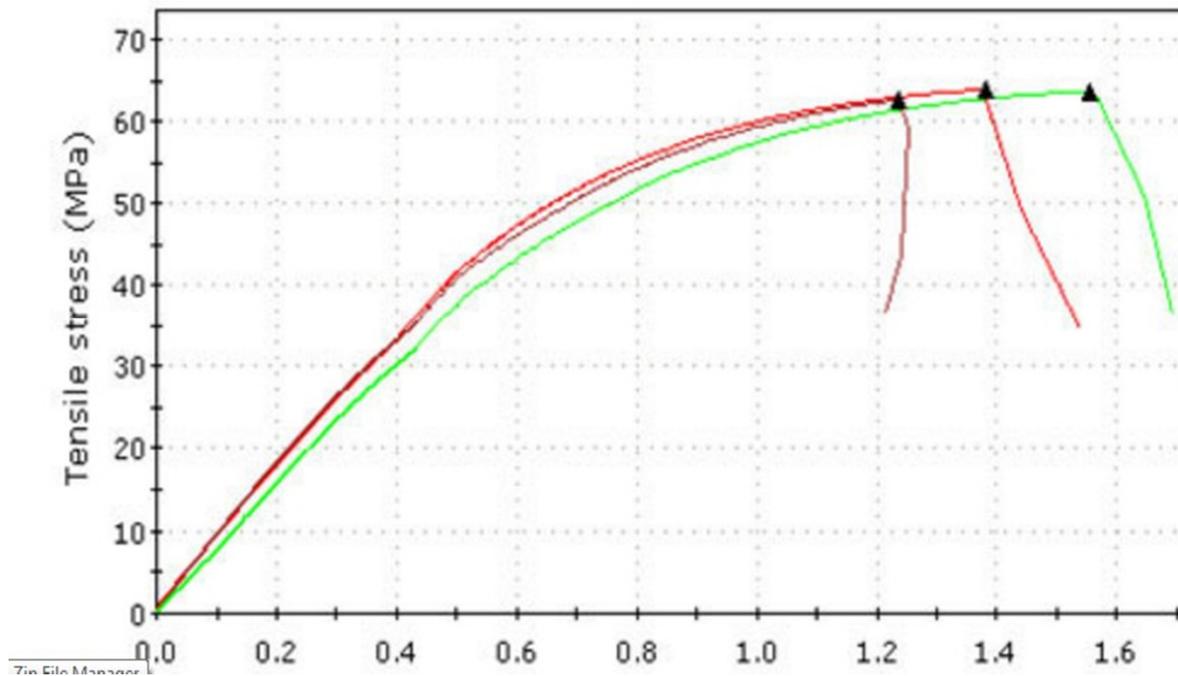
- Mark the specimen at the front inner edge of the jaw and observe during testing to check for slippage
- Operate the tester until specimen breaks



# Procedure and Report



- Report the average force required to break and elongation at the break for the 5 specimens





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Questions?

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Thank You!

