

45° Flame Test
ASTM D1230-94

Standard test Method for Flammability of Apparel Textiles

What this test is used for:

This test is used to measure and describe the properties of natural or synthetic fabrics in response to heat and flame under controlled lab conditions. Most any textile material can be evaluated using this test with the following exceptions: children's sleepwear, protective clothing, hats/gloves, footwear, and interlining fabrics. Two factors are measured:

1. Ease of ignition (how fast the sample catches on fire).
2. Flame spread time (the time it takes for the flame to spread a certain distance).

How this test works:

Samples are mounted in a frame and held in a special apparatus at an angle of 45°. A standardized flame is applied to the surface near the lower end for specified amount of time. The flame travels up the length of the fabric to a trigger string, which drops a weight to stop the timer when burned through. The time required for the flame travel the length of the fabric and break the trigger string is recorded, as well as the fabric's physical reaction(s) at the ignition point.

Scientific Testing Requirements:

Condition according to ASTM D1776-98

For this exercise each student will need the following equipment:

45° Flammability Tester
Pre-cut fabric sample(s)
Sample frame with four clips
Brushing device (for piled or napped fabrics only)
50/3 mercerized sewing thread
Double-sided tape (for slippery fabrics only)
Sparker

Procedure

Sample Preparation

1. a) Launderable / Dry-cleanable Fabrics:
Cut 12, 6.5" x 2" samples (per group)
 - 6 from the original fabric: (3 in warp direction - 3 in weft direction)
 - 6 from the laundered / dry-cleaned fabric: (3 in warp direction - 3 in weft direction)
- b) Non-Launderable / Non-Dry-cleanable Fabrics:
Cut 6, 6.5" x 2" samples (per group) (3 in warp direction - 3 in weft direction)
2. All fabrics are oven dried for 30min.at 105°C
3. All fabrics should then be placed in desiccator for at least 15min. before testing
4. Secure samples into frame using two clips on each side
5. Piled or napped fabric should be brushed at this time with brushing device to raise the surface fibers

Preparing the Flammability Tester

1. Main power switch is OFF (left side of front panel).
2. Timer is set at zero.
3. Move rack to right, using lever arm located in front panel. Place sample holder in instrument sample rack so that the longest frame is on top.
4. Using the lever, slide the rack to the left until the sample comes in contact with the L - shaped locating arm. The burner tip now remains $\frac{5}{16}$ " away from the face of the specimen.
6. Fill the glass U - shaped manometer with water to a convenient level (located on the left side of the chamber).
7. Stop cord of 50/3 mercerized cotton sewing thread is threaded through instrument.

Performing the Test

1. Turn ON main power switch.

2. Select time of Auto Impingement (1, 5, 10sec, or manual). For the purpose of this class we will use the time of 5 sec.
3. Press start button. Impingement is automatic and the flame is applied for a period of 5 sec.
4. Timer will start automatically. Starting upon application of the flame and ending when the weight is released by the burning of the stop cord.
5. Record results
6. When testing is done, switch power OFF. Turn off gas supply.

Results:**Calculations**

1. Calculate the arithmetic mean flame-spread time of the six (or twelve) specimens. Add all the times together and then divide by six (or twelve).
2. If the mean time is less than 3.5 seconds, or any of the specimens do not burn, test six (or twelve) additional specimens.
3. Calculate the arithmetic mean flame-spread time for all six (or twelve) specimens. Add all six (or twelve) specimens together and divide by six (or twelve).
4. The time of flame spread is the average time for all the specimens of that sample material tested.

Interpretation of Results

The following three classes are used by the Consumer Product Safety Commission to interpret results for a similar test:

Class I: These textiles are considered by the trade to be generally acceptable for apparel and are limited to the following:

1. Textiles that do not have a raised fiber surface but have an average time of flame spread in the test of 3.5 seconds or more.
2. Textiles having a raised fiber surface that have an average time of flame spread in the test of more than 7 seconds or that burn with a surface flash (in less than 7 seconds) in which the base fabric is not affected by the flame.
3. Textiles for which no specimen ignites.

Class II: These textiles are considered by the trade to have flammability characteristics for apparel intermediate between Class I and Class III fabrics are limited to the following:

1. Textiles having a raised fiber surface that have an average time of flame spread in the test of 4 to 7 seconds and in which the base fabric is ignited, charred, or melted.

Class III: These textiles are considered by the trade to be unsuitable for apparel and are limited to the following:

1. Textiles that do not have a raised fiber surface that have an average time of flame spread in the test of less than 3.5 seconds.
2. Textiles having a raised fiber surface that have an average time of flame spread in the test of less than 4 seconds in which the base is ignited, charred, or melted.

Report:

1. Report that the specimens were tested as directed in ASTM Test Method D1230.
2. Describe the materials or products tested and the method of sampling used.
3. Report the average time in seconds of flame spread for the fabric specimens that did ignite. If no specimens ignite, report DNI (did not ignite).
4. For raised surface fabrics, report the number of fabric specimens for which the base fabric ignited, charred, or melted.
5. Report the number of specimens tested of each fabric.
6. Determine the classification of each fabric as defined above.
7. If fabric was laundered, report the information for the laundered samples and the non-laundered samples separately.