

Vertical Flame Chamber

ASTM D6413-94

What This Test is Used For

This test method measures the vertical flame resistance of textiles in general, but does not describe or evaluate the fire risk or fire hazard of those materials.

How the Test Works

Samples cut from fabric to be tested are mounted in a frame that hangs vertically from inside the flame chamber. A controlled flame is exposed to the sample for a specified period of time. After-flame time, the length of time the material continues to burn after removal of the burner, and after-glow time, the length of time the material glows after the flame extinguishes, are both recorded. Finally, the specimen is torn by use of weights and the char length, the distance from the edge of the fabric that was exposed to the flame to the end of the area affected by the flame, is measured.

Scientific Testing Requirements

Condition according to ASTM D1776

Vertical flame chamber

Burner with pilot light

Sample holders with clamps

Stop watch

Ruler

Metal hooks and weights

Samples

Set up and Preparation

Sample Preparation

1. When cutting samples, avoid wrinkles, folds, or creases.
2. If the specimen has a pattern, be sure to get samples representative of all areas.
3. Cut samples so that each represents different warp and weft threads.
4. Cut five lengthwise specimens that measure 3 inches by 12 inches. The 12-inch sides should run along the warp yarns. Label "L" for lengthwise with a pen in a corner.
5. Cut five widthwise specimens that measure 3 inches by 12 inches. The 12-inch sides should run along the filling yarns. Label "W" for widthwise with a pen in a corner.

Specimen Holders

1. Clamp samples one at a time, as they are being used.
2. Position so that the "W" or "L" is at a top corner.
3. Line up the bottom edge of the specimen clamps with the edge of the fabric.
4. Use at least four clamps: two at the bottom and two at the top.

Flame Adjustment

1. Hang an empty specimen holder in the flame chamber.
2. Light pilot light and adjust so flame height is about (inches) 3mm.
3. Adjust the gas burner until the flame is 1-1/2 inches (mm) high.
4. The specimen holder should hang so that the bottom edge is $\frac{3}{4}$ of an inch (mm) above the burner's top.

Timer

1. Use the stop watch to monitor the length of time the flame is exposed to the sample.

Operation Sequence

1. Be sure the hood ventilation system is off.
2. Hang the specimen from the U-shaped bar inside the top of the flame chamber.
3. Position the burner directly below the sample and expose it to flame for 12 seconds.
4. Observe the specimen for melting or dripping and record any observations while the sample is exposed to the flame.
5. Immediately after the flame is removed, start the stopwatch to record the length of after-flame and after-glow. Record each time within 0.2 seconds.
6. Do NOT extinguish the flame or the after-glow because of the effect it may have on the char length.
7. Remove specimen from chamber and place in ventilation hood. Turn on ventilation system.
8. Allow specimen to cool.
9. Measure char length.
10. Fold the specimen in half lengthwise.
11. Puncture with a hook about $\frac{1}{4}$ of an inch from the side and bottom of the specimen.
12. Hang the appropriate weight on the hook to provide sufficient tearing force, according to Table 1.

| Fabric Basis Weight | | Total Tearing Force | |
|---------------------|-----------------|---------------------|--------|
| Grams/sq. Meter | Ounces/sq. Yard | Grams | Ounces |
| 68 to 203 | 2 to 6 | 100 | 4 |
| Over 203 to 504 | Over 6 to 15 | 200 | 8 |
| Over 504 to 780 | Over 15 to 23 | 300 | 12 |
| Over 780 | Over 23 | 475 | 16 |

13. Apply tearing force as follows:
 - a. Hold the sample at the corner opposite the hook and weights.
 - b. Raise the specimen up in a smooth, continuous motion until all the weight is supported solely by the specimen.
 - c. Note any tears in the charred area of the fabric.
 - d. Mark the end of the tear with a line across the width of the sample and perpendicular to the foldline.
14. Measure the char length along the undamaged edges of the specimen to the nearest 3mm.

Total System Shut Down

1. Turn off gas supply.
2. Run ventilation system until hood is cleared of smoke and fumes.

Report

1. State that the samples were tested as directed in ASTM Test Method D6413.
2. Describe the materials or products tested.
3. Report the following fabric lengthwise and widthwise information for individual specimens and an average for each group.
 - a. After-flame time within .5 seconds.
 - b. After-glow time within .5 seconds.
 - c. Char length within 3mm (inches).
 - d. Occurrence of melting or dripping, if any.

Flammability Testing for Children's Sleepwear **CPSC 16 CFR 161**

Standard for the Flammability of Children's Sleepwear: Sizes 0 Through 6X

What This Test is Used For

This standard provides a test method to determine the flammability of children's sleepwear, meaning any product of wearing apparel up to and including size 6X, such as nightgowns, pajamas, or similar or related items, such as robes, intended to be worn primarily for sleeping or activities related to sleeping, except for diapers/underwear, "infant garments" and "tight-fitting garments."

"Infant garment" refers to those garments sized 9 months or smaller that fits within certain total length measurements. "Tight-fitting garments" are those in which the garment does not exceed maximum dimensions specified for each size at the chest, waist, seat, upper arm, thigh, wrist or ankle. They also cannot have trims that extend more than ¼ inch (6 mm) off the surface of the garment.

Garments that are considered tight-fitting must be designated by hangtags (or a statement on packaged garments) with specific requirements of size, font, and color. In addition, these items must have the words "Wear Snug-fitting, Not Flame Resistant" on the front of the center back care tag.

How the Test Works

Five specimens (which comprise one sample) are suspended one at a time vertically in holders in a prescribed cabinet and subjected to a standard flame along their bottom edge for a specified time under controlled conditions. The char length, or distance from the lower edge of the specimen exposed to the flame to the end of the tear in the charred, burned or damaged area, is measured. To pass, the average char length of the five specimens cannot exceed 7 inches (17.8 cm). In addition, none of the individual specimens can have a char length of 10 inches (25.4 cm).

Scientific Testing Requirements

For this test method, specimens are to be mounted before conditioning to minimize the time that they are exposed to an uncontrolled environment immediately before testing. (See Sample Preparation, below.) The mounted specimens must be exposed to freely circulating air in the oven in room 263 for 30 minutes at 105 degrees Celcius (221 degrees Fahrenheit). After this period is up, the mounted specimens are moved from the oven into a desiccator for 30 to 60 minutes to cool. No more than five specimens should be in the desiccator at one time.

In addition, specimens representing garments that will be washed and dried by the end consumer must be laundered before testing. The specimens should be tested after one washing and after 50 typical home launderings. Items that do not withstand 50 washings may be tested at the end of the useful service life. Those items that are not to be laundered must be dry cleaned before testing. For more information, see CPSC 16 CFR 1615.

For this exercise, you will need the following equipment:

Vertical Flame Chamber
Specimen holder and clamps for each specimen (tape is allowed if needed)
Burner with pilot light connected to a gas system of at least 97% pure methane
Hooks and weights for measuring char lengths
Stopwatch for timing exposure to flame and afterglow time
Ruler for measuring char lengths
Circulating air oven (in room 263)
Desiccator

Set up and Preparation

Sample Preparation

1. In this case, each sample consists of five individual specimens.
2. Each sample should consist of two specimens that run parallel to one machine direction (warp or weft) and three specimens that run parallel to the other.
3. When cutting specimens, use care to avoid dirt, grease, wrinkles, etc.
4. Try to cut specimens so that each represents different warp and weft yarns.
5. Cut specimens to measure 3.5 inches by 10 inches (8.9 cm by 25.4 cm).
6. If fabrics to be tested are multi-layered, they must be hemmed to about one inch at the lower edge using a suitable thread and stitch.

Mounting Specimens

1. The bottom edge of the specimen must be even with the bottom of the specimen holder.
2. Keep the specimen as flat as possible when mounting.
3. The sides of the specimen holder must cover $\frac{3}{4}$ inch (1.9 cm) on the long sides of the specimen. This will leave 2 inches (5.1 cm) of the center of the specimen exposed.
4. Clamp and/or tape the sides of the specimen so that the specimen will not shift during conditioning and testing.
5. At this point, condition the specimens according to the directions above.

Flame Adjustment

1. Perform these steps with the hood fan turned off.
2. Use the needle valve to adjust the flame height of the burner to 1-1/2 inches (3.8 cm).

Testing

1. Remove one mounted specimen from the desiccator and suspend it in the cabinet for testing.
2. Start the stop watch and move the flame under the specimen simultaneously.
3. Close the cabinet door.
4. Expose the specimen to the flame for 3 +/- 0.2 seconds. To stop the flame, turn off the gas supply.
5. Allow the specimen to continue burning. When the visible flame has extinguished, remove the specimen holder from the cabinet and lean it against the wall inside the ventilation hood. DO NOT put out the after-

glow.

6. When the after-glow has ceased, remove the specimen from the hood and holder and place it on a clean flat surface.

7. After testing all specimens, vent the hood and cabinet to remove the smoke and/or toxic gases.

Specimen Tearing

1. Fold the specimen lengthwise along a line through the highest peak of the charred or melted area.
2. Crease the specimen firmly by hand.
3. Unfold the specimen and insert the hook with the correct weight in the specimen on one side of the charred area $\frac{1}{4}$ inch (6.4mm) from the lower edge.
4. Tear the specimen by grasping the other lower corner of the fabric and gently raising the specimen and weight clear of the supporting surface.
5. Measure the char length as the distance from the end of the tear to the edge of the specimen exposed to the flame.

Report

1. Report the char length for each specimen.
2. Figure and give the average char length for the five specimens.

Acceptance or Rejection of Specimens

Fabric Production Unit: any quantity of finished fabric up to 5000 linear yards. One sample is taken from the beginning of the piece, one sample from the end.

Accept if: Both samples meet all test criteria.

Reject if:

1. Either or both samples fail the 7 inch (17.8 cm) average char length criterion.
2. Two or more of the individual specimens from the 10 selected specimens fail the 10 inch (25.4 cm) char length.

Additional Testing Required if only one individual specimen from the 10 selected specimens fails the 10 inch (25.4 cm) char length. Select five more specimens from the same end in which the specimen fails. Pass the sample if all the specimens meet all the criteria. Reject it if any specimens fail any part of the testing.

Garment Production Unit: any quantity of finished garments up to 500 dozen which have a specific identity that remains unchanged throughout the unit except for size, trim, findings, color, and print patterns.

The garment sampling plan consists of two parts: prototype testing, which takes place prior to production to assure that the design characteristics of the garments are acceptable, and production testing, which ensure the produced design is the approved prototype design.

For prototype testing, both seams and trim types must be tested.

Seams: make three samples (15 specimens) using the longest seam type and three samples (15 specimens) using each other seam type 10 inches or longer that is to be included in the garment.

Accept the seam design if:

1. All three samples meet all the test criteria.
2. If only one of the individual specimen from the 15 selected specimens fails the 10 inch (25.4 cm) char length.

Reject if:

1. One or more of the three samples fail the 7 inch (17.8 cm) average char length criterion.
2. Three or more of the individual specimens from the 15 selected specimens fail the 10 inch (25.4 cm) char length.

Additional testing required if two of the individual specimen from the 15 selected specimens fail the 10 inch (25.4 cm) char length. In this case, select 3 more samples and test again.

Trim: make three samples (15 specimens from each type of trim to be included in the garment. For trim used only in a horizontal configuration on the garment, specimens shall be prepared by sewing or attaching the trim horizontally to the bottom edge of an appropriate section of untrimmed fabric. Horizontal trim should be attached the full width (smaller dimension) of the trim. For trim used in other than a horizontal configuration, specimens shall be prepared by sewing or attaching the trim to the center of the vertical axis of an appropriate section of untrimmed fabric, beginning the sewing or attachment at the lower edge of each specimen. Trim used in other than the horizontal configuration should be sewn or fastened the entire length (longer dimension) of the specimen. This should be done with thread or fastening material of the same composition and size to be used for this purpose in the garment and using the same stitching or seam type.

Select and accept or reject trim samples on the same basis as seam type samples. A type of trim that is accepted when tested in a vertical configuration may be used in a horizontal configuration without additional testing.

Production samples are only tested for seam type. From each unit select at random sufficient garments and cut three samples (15 specimens) from the longest seam type. No more than five specimens may be cut from a single garment. All specimens cut from a single garment must be in the same sample. Specific instructions are provided for instances in which a garment does not provide large enough specimens for testing.

Accept if :

1. All three samples meet all the test criteria.
2. Three or less of the individual specimens from the 15 selected specimens fail the 10 inch (25.4 cm) char length.

Reject if:

1. One or more of the three samples fails the 7 inch (17.8 cm) average char length.
 2. If four or more of the individual specimens from the 15 selected specimens fail the 10 inch (25.4 cm) char length.
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