

Specified Requirements of Flame-Resistant Textiles

Document No. FTTS-FA-015

Version: 1.0

1. Purpose and Scope

This criterion is applicable to the evaluation and testing of flame-resistant ability for general clothing, children's sleepwear, home furnishing, curtain, and camp.

2. Terminology

2.1 Ignition time: The time for which the igniting flame is applied to the test specimen.

2.2 After-flame time: The length of time which a material continues to flame, under specified test conditions, after the ignition source has been removed.

2.3 After-glow time: The time for which a material continues to glow, under specified test conditions, after cessation of flaming or after removal of the ignition source, ignoring glowing debris.

2.4 Duration of burning: The length of time which a material continues burning, under specified test conditions, after the ignition source has been removed.

2.5 Char area: The area which the specimen has been burned into char.

2.6 Char length: The longest length of char area.

3. Performance Specification

Others* represent all other objects excluding general clothing and children's sleepwear; # means the mass loss during the test shall be measured.

Table 1. Grade of general clothing.

Type	Grade	Average burning speed	
		Plain surface	Raised-fiber surface
I General clothing textile	1	4 s or above	Above 7 s; or 0~7 s without flame and melting on base
	2	---	4~7 s and with flame and melting on base

Refer to CPSC 16 CFR Part 1610

Table 2. Grade of children's sleepwear.

Type	Grade	Char length	
		Individual	Average
II Children's sleepwear	Qualify	All below 25.4 cm (10 in); or only one of additional samples equal to 25.4 cm (10 in)	Below 17.8 cm (7.0 in)

Refer to CPSC 16 CFR Part 1615/1616

Revise Date:

Publish Date: Mar/11/2005

Table 3. Grade of all others*/ Republic of China (A-1).

Type	Grade	Fabric weight below 450g/m ² (method A-1)							
		Ignition time: 1 min				3 s after ignited			
		Char area (cm ²)	After flame time (s)	After glow time (s)	Char distance (cm)	Char area (cm ²)	After flame time (s)	After Glow time (s)	Char length (cm)
III (Others*/Republic of China)	1	Below 30	Below	Below	Below 20	Below 30	Below 3	Below 5	Below 20
	2	Below 45	3	5	Above 20	Below 45	Below 10	Below 15	Above 20

Refer to CNS 10285 L3196 method A-1

Table 4. Grade of all others*/ Republic of China (A-2).

Type	Grade	Fabric weight above 450g/m ² (method A-2)							
		Ignition time: 2 min				6 s after ignited			
		Char area (cm ²)	After flame time (s)	After glow time (s)	Char distance (cm)	Char area (cm ²)	After flame time (s)	After Glow time (s)	Char length (cm)
III (Others*/Republic of China)	1	Below 40	Below	Below	Below 20	Below 40	Below 5	Below 20	Below 20
	2	Below 60	5	20	Above 20	Below 60	Below 20	Below 30	Above 20

Refer to CNS 10285 L3196 method A-2

Revise Date:

Publish Date: Mar/11/2005

Specified Requirements of Flame-Resistant Textiles

Document No. FTTS-FA-015

Version: 1.0

Table 5. Grade of all others*/ United States of America.

Type	Grade	Fabric weight (g/m ²)	Individual fame time (s)	Average flame time (s)	Individual char length (mm)	Average char length (mm) (mass loss)
IV (Others*/United States of America)	Qualify	Above 340	4	2	255	115
		270-340			255	140
		200-270			255	165
		135-200			255	190
		50-135 (below 100#)			255#	215# (below 5%)
		Below 50#			255#	230# (below 5%)

Refer to CPAI-84 Sec. 6

Table 6. Grade of all others*/ Europe or international.

Type	Grade	Flame spread rate (mm/s)	After flame time (s)	After glow time (s)	Char length (mm)	Melting
V (Others*/Europe or international)	Qualify	0	Before washing: below 3; after washing: below 20	Below 25	Below 150	None

Refer to EN 1103 (Apparel only), ISO 6941 and Brennbarkeitsverordnung, BrbV 817.043.1

4. Test Method

4.1 General clothing textiles

Determination of burning speed, the test angle is 45 degree. Refer to CPSC 16 CFR Part 1610.

4.1.1 Durability: Wash 20 times according to AATCC 135(1)(III)(A)iii.

4.1.2 Preparation of test specimen: Five specimens, each measuring 50 mm×150 mm (2 in×6 in), are required for each test. The test direction and surface of specimen should be that in which the burn most rapidly in preliminary test. If the specimens in the preliminary test do not ignite or are very slow burning, or have a fire retarding finish, then sample need to be subjected to the dry cleaning and washing procedures. The cleaning apparatus, a cylinder, is filled with 1 gallon perchlorethylene to which is added 270 mL of dry-cleaning soap. Make a total dry load of swatches of 1 pound and operate the cylinder for 25 minutes. Pour out the solution and refill with fresh perchlorethylene without soap, then operate the apparatus for another 5 minutes.

Revise Date:

Publish Date: Mar/11/2005

Specified Requirements of Flame-Resistant Textiles

Document No. FTTS-FA-015

Version: 1.0

Repeat this last operation three times. The swatches are permitted to dry at room temperature, then shall be immersed and worked gently for 5 minutes in a bath of soft water in which 0.5% neutral chip soap has been dissolved. The volume of the bath shall be 30 times the weight of the swatches and the temperature shall be between 35-37°C. The swatches shall then be rinsed twice in water at 27°C, extracted, and dried.

4.1.3 Testing procedure:

- (1) Each specimen having a raised-fiber surface, in its original condition or after dry cleaning and washing, is placed on the brushing device carriage and drawn under the brush once against the lay of the raised-fiber surface. Other specimens do not require brushing. All specimens are clamped individually in the specimen holders of the flammability tester. The specimens then are dried in an oven for 30 minutes at 105 ± 2 °C, removed from the oven, and placed in a desiccator until cool, but for not less than 15 minutes.
- (2) Adjust the flame to a length of 16 mm (5/8 in).
- (3) Remove the mounted specimen from the desiccators and place it in a position on the rack in the chamber of the apparatus. The stop cord (No.50 cotton sewing thread) is strung through of this section. Bring the starting lever over to the extreme right and release it. This starts the timing mechanism and applies the flame to the specimen for a period of 1 second. This should be done within 45 seconds of the time the specimen was removed form the desiccator. Timing is automatic, starting upon application of the flame and ending when the weight is released by the burning of the stop cord. If the time of flame spread is less than 4 seconds or if the specimens do not burn, test 5 additional specimens.

4.1.4 The time of flame spread is then taken to be the average time except the specimen did not burn or the flame distinguish before reach the stop cord.

4.2 Children's sleepwear

A vertical flammability test. Refer to CPSC 16 CFR Part 1615/1616.

4.2.1 Durability : Wash 50 times according to AATCC 124 at 60°C (B).

4.2.2 Preparation of test specimen: Totally 10 specimens in original and after durability wash states. Specimen size : 89 mm × 254 mm. Original state : cut 2 (or 3) specimens in length and 3 (or 2) specimens in width direction from the beginning and the end of fabric respectively. After durability wash: cut 2 (or 3) specimens in length and 3 (or 2) specimens in width direction from the beginning and the end of fabric respectively.

4.2.3 Testing procedure:

- (1) Put the specimen into an oven for 30 minutes at 105 ± 2 °C, removed from the oven, and placed in a desiccator to cool for 30-60 minutes.

Revise Date:

Publish Date: Mar/11/2005

- (2) Adjust the flame (at least 97% pure methane) to a length of 38 mm.
- (3) Remove the specimens from the desiccator and suspended in the cabinet for testing. The burner flame impinged on the bottom edge of the specimen for 3.0±0.2 seconds. When flame impingement, remove the specimen from the cabinet and holder. Insert a hook with the correct weight as shown in table 7 in the specimen on one side of the charred area. Tear the specimen by grasping the other lower corner of the fabric and gently raising the specimen and weight clear of the supporting surface. Measure the char length as the distance from the end of the tear to the edge of the specimen exposed to the flame. Five additional specimen should be tested from the same end of fabric if only one specimen char length equal to 25.4 cm.

Table 7. Dead weight for different fabric weight.

Fabric weight	Dead weight
Less than 101 g/m ² (3 oz/yd ²)	54.4 g (0.12 lb)
101-207 g/m ² (3-6 oz/yd ²)	113.4 g (0.25 lb)
207-338 g/m ² (6-10 oz/yd ²)	226.8 g (0.50 lb)
Greater than 338 g/m ² (10 oz/yd ²)	340.2 g (0.75 lb)

4.2.4 Report the value of char length for each specimen, as well as the average char length for each set of five specimens.

4.3 Other textile fabric/ROC

Test angle is 45 degree. Refer to CNS 10285 L3196 A-1 or A-2 (depend on fabric weight) and Non-inflammable Property Testing Standard of Ministry of the Interior.

4.3.1 Durability : Depend on the needs, wash 5 cycles of 60±2 °C for 15 minutes according to CNS 8038 method F2; or dry clean 5 cycles of 40±2 °C for 15 minutes using a cylinder apparatus.

4.3.2 Preparation of test specimen: Cut enough specimens from original and /or washed samples both in warp (length) and weft (width) directions. Size: 350 mm × 250 mm.

4.3.3 Testing procedure:

- (1) Put the specimen into an oven for 24 hours at 50±2 °C, removed from the oven, and placed in a desiccator to cool for 2 hours.
- (2) Adjust the flame (mainly butane and butene) to a length of 45 mm for A-1, 65 mm for A-2.
- (3) Three steps :
 - (a) Step 1: Flame application time 1 minute for A-1 or 2 minutes for A-2, measure after-flame time, after-glow time, and char area, take 3 specimens both in warp (length) and weft (width) directions.
 - (b) Step 2 (with ignited): Flame application time 3 seconds for A-1 or 6 seconds for A-2 after ignited, measure after-flame time, after-glow time, and char area, take 2 specimens both in warp (length) and weft (width) directions.

Revise Date:

Publish Date: Mar/11/2005

Specified Requirements of Flame-Resistant Textiles

Document No. FTTS-FA-015

Version: 1.0

(c) Step 3 (with melting): Make the specimen in 5% more loose, repeat step 1 and 2, measure after-flame time, after-glow time, char area and char length.

4.3.4 Report the maximum value of after-flame time, after-glow time, char area and char length.

4.4 Other textile fabric/US

A vertical flammability test. Refer to CPAI-84 Section 6.

4.4.1 Durability: The specimens shall be immersed in water for 72 hours then air-dried. The water shall be changed by a continuous flow or by emptying and refilling every 12 hours.

4.4.2 Preparation of test specimen: Cut 4 specimens from original and /or washed samples both in warp (length) and weft (width) directions. Size: 70 mm × 300 mm.

4.4.3 Testing procedure:

- (1) Condition the test specimen in the standard atmosphere.
- (2) Adjust the flame (at least 97% pure methane) to a length of 38 mm.
- (3) Removed the specimen from the standard atmosphere and mounted in sample holder, then suspended vertically in the cabinet. The burner flame applied for 12 seconds. After flaming and glowing have ceased, removed the tested specimen from cabinet, Insert a hook with the correct weight as shown in below table in the specimen on one side of the charred area. Tear the specimen by grasping the other lower corner of the fabric and gently raising the specimen and weight clear of the supporting surface. Measure the char length as the distance from the end of the tear to the edge of the specimen exposed to the flame.

Table 8. Dead weight for different fabric weight.

Fabric weight	Dead weight
Less than 100 g/m ²	50 g
100-200 g/m ²	100 g
200-340 g/m ²	200 g
Greater than 340 g/m ²	350 g

* CPAI-84 Sec.6

4.4.4 Report the after-flame time and char length in individual and average results. Mass loss percentage should be reported as well for fabric weight less than 100 g/m².

4.5 Other textile fabric/ EN or ISO

A vertical flammability test. Refer to EN 1103 (Apparel only) and ISO 6941.

4.5.1 Durability : Cleaning procedure should according to the given care label, if no cleansing procedure is prescribed, washing condition 6A (40°C × 6 minutes) of EN 26330 (ISO 6330-1984) should be used. Wash 20 times for Apparel; 5 times for others, and no wash for do not wash.

Revise Date:

Publish Date: Mar/11/2005

Specified Requirements of Flame-Resistant Textiles

Document No. FTTS-FA-015

Version: 1.0

4.5.2 Preparation of test specimen : Cut 3 specimens from original and /or washed samples both in warp (length) and weft (width) directions. Size : 560 mm × 170 mm. Wash once for un-washed garment according the given care label, if no cleansing procedure is prescribed, washing condition 6A (40 °C × 6 minutes) of EN 26330 (ISO 6330-1984) should be used.

4.5.3 Testing procedure:

- (1) Condition the test specimen at least 24 hours in the standard atmosphere.
- (2) Adjust the flame (propane) to a length of 40 mm.
- (3) Flame application time is 10 seconds. Ignite position :
 - (a) Apparel textile - ignite on the surface of specimen.
 - (b) Curtains and drapes - ignite on the surface of specimen. If cannot ignite, to ignite the bottom edge of specimen.
 - (c) Campers - ignite the bottom edge of specimen.

4.5.4 Report the follows:

- (1) The time from the start of the application of the test flame until the severance of the 1st and 3rd marker thread.
- (2) Record the time from the severance of the 1st to the 3rd marker thread to obtain the burning speed; record the after-flame time and after-glow time if the 3rd marker thread did not burnout.

5. Mark

As 3.

6. Reference

CPSC 16 CFR Part 1610 Flammability of clothing textiles

CPSC 16 CFR Part 1615/1616 Flammability of children's sleepwear

AATCC 135 Dimensional changes in home launderings

AATCC 124 Appearance of fabrics after repeated home launderings

CNS 10285 L3196 Method of test for flammability of testiles

Non-inflammable Property Testing Standard (Ministry of the Interior R.O.C.)

CNS 8038 L3138 Method of test for shrinkage percentage of woven fabrics

CPAI-84 A Specification for flame-resistant materials used in camping tentage

EN 1103 Detailed procedure to determine the burning behavior of fabrics for apparel

ISO 6941 Measurement of flame spread properties of vertically oriented specimens

EN 26330 (ISO 6330-1984) Domestic washing and drying procedures for textile testing

Swiss official regulation Brennbarkeitsverordnung, BrbV 817.043.1

Revise Date:

Publish Date: Mar/11/2005