

Flame Retardants for Textiles

Description of test methods and their application

German-Standards

- DIN 4102; 1981
- DIN 53438 Part 2; 1984
- DIN 53438 Part 3; 1984
- DIN 54332; 1975
- DIN 54333 Part 1; 1981
- DIN 54335; 1977
- DIN 54336; 1986
- DIN 66080; 1976
- DIN 66081; 1976
- DIN 66082; 1980
- DIN 66083; 1997
- DIN 66084; 1989
- DIN 75200; 1980

Flame Retardants for Textiles

Description of test methods and their application

DIN 4102; 1981

1. Scope:

For the textiles within this scope the classification of building material B1 and B2 is to be applied (except fabrics of glass fibre or similar).

2. Test procedure:

Test procedure acc. to DIN 53438 Part 2 and 3 Brandschacht test

3. Assessment:

Classification B1: -Application of the FR agent with the PA-III mark acc. to the conditions specified in the test procedures
-Brandschacht test
-passing the burning test acc. to DIN 4102 B2 (test procedure acc. to DIN 53438 Part 2 and 3 after reaching K2 and F2)

Classification B2: -Passing the burning test acc. to DIN 4102 B2 (test procedure acc. to DIN 53438 Part 2 and 3 after reaching K2 and F2)

Flame Retardants for Textiles

Description of test methods and their application

DIN 53438 Part 2 & 3; 1984

Part 2: Edge ignition; Method K

1. Scope:

Methods for assessing the behaviour of material after edge ignition

2. Preparation of specimens:

10 specimens each of 190 mm x 90 mm in warp and weft direction Place a measuring mark in a distance of 150 mm from the bottom edge

3. Test procedure:

- mount specimen in a vertical position
- 20 mm flame height to be adjusted
- burner inclined at 45°
- 15 sec edge ignition
- measure the time that it takes the tip of the flame to progress to the point of the upper measuring mark, or after the flame has extinguished

4. Apparatus:

cabinet acc. to DIN 50050 burner acc. to DIN 50051 with propane gas

5. Assessment:

- * thickness of test specimen
- * duration of flaming
- * duration of afterglow
- * fire concomitant

Flame Retardants for Textiles

Description of test methods and their application

DIN 53438 Part 2 & 3; 1984

Part 2: Edge ignition; Method K

Standard for test procedure without resistance requirements, but with classification criteria:

- * classification K1/...mm, if the tip of the flame of the burning specimen does not reach the measuring mark or if the flame has extinguished
- * classification K2/...mm, if the tip of the flame of the burning specimen reaches the measuring mark within 20 s or more
- * classification K3/...mm, if the tip of the flame of the burning specimen reaches the measuring mark within less than 20 sec

-note the average of the thickness of the test specimen behind the back slash of the classification type

Flame Retardants for Textiles

Description of test methods and their application

DIN 53438 Part 2 & 3: 1984

Part 3: Face ignition; Method F

1. Scope:

Methods for assessing the behaviour of material during face ignition

2. Preparation of specimens:

10 specimen each 230 mm x 90 mm in warp and weft direction Place measuring marks with a distance of 40 mm (lower mark) and 190 mm (upper mark) from the bottom edge of the specimen

3. Test procedure:

- place specimen in a vertical position
- 20 mm flame height to be adjusted
- burner inclined at 45°
- 15 sec face ignition at the lower measuring mark
- measuring of time from the beginning of ignition until the tip of the flame of the burning test specimen reaches the upper measuring mark or after the flame has extinguished

4. Apparatus:

flame test cabinet acc. to DIN 50050 burner acc. to DIN 50051 with propane gas

5. Assessment:

- thickness of material
- burning time
- glow time
- fire concomitant

Flame Retardants for Textiles

Description of test methods and their application

DIN 53438 Part 2 & 3; 1984

Part 3: Face ignition; Method F

Standard for test procedure without resistance requirements, but with classification criteria:

-classification F1/....mm, if the tip of the flame of the burning specimen does not reach the measuring mark or the flame has extinguished

-classification F2/....mm, if the tip of the flame of the burning specimen reaches the upper measuring mark within 20 sec or more

-classification F3/....mm, if the tip of the flame of the burning specimen reaches the upper measuring mark within less than 20 sec

-note the average of the thickness of the test specimen behind the slash of the classification type

Flame Retardants for Textiles

Description of test methods and their application

DIN 54332; 1975

1. Scope:

Methods for assessing the flaming and the glowing time as well as the damaged area after flame application on textile floor coverings: – on floor coverings with or without pile layer – on certain felt products – on textile fabrics other than floor coverings

2. Preparation of specimens:

10 specimens each of 340 mm x 104 mm in warp direction Place specimen on a piece of Eternit in a vertical position fitted with a CO thread weight down and spaced 250 mm from the bottom edge

3. Test procedure:

- 20 mm flame height to be adjusted
- burner inclined at 45°
- 15 sec face ignition, adjust the flame 40 mm from the bottom edge of the specimen
- if specimen is completely burnt repeat face ignition during 5 sec

4. Apparatus:

- flame test cabinet acc. to 50050
- burner acc. to 50051 with propane gas

5. Assessment:

- gas burn time –burning times until the CO– thread burns through
- glowing time
- damaged area by stating the longest length and width of the damaged area
- flaming of the pile or the back
- special burning behaviour
- standards of test procedures without resistance requirements and criteria of classification

Flame Retardants for Textiles

Description of test methods and their application

DIN 54333 Part 1; 1981

1. Scope:

Methods for assessing the burning behaviour of woven fabrics, braidings, knitgoods or other textile fabrics which may be coated, bonded, laminated or flocked, or combined and/or fused with other material such as foam material or sheet stock reinforced laminates.

2. Preparation of specimens:

5 specimens each of 340 mm x 70 mm in warp and weft direction weight down CO sewing yarn as marker threads, 40 mm (mark 1), 165 mm (mark 2) and 290 mm (mark 3) away from the edge to be subjected to the test flame.

3. Test procedure:

- place specimen in a horizontal position
- 40 mm flame height to be adjusted
- perpendicular burner adjustment
- 15 sec edge ignition
- flame application 20 mm above the lower edge
- measuring of the burning time from mark 1 until reaching mark 2 or 3 or until the flame extinguishes

4. Apparatus:

flame test cabinet acc. to DIN 50050 burner acc. to DIN 50051 with propane gas

5. Assessment:

- afterflame time
- burning length
- flame spread time in mm/min as quotient of the burning length and the burning time
- standards of test procedures without resistance requirements and criteria of classification – glowing time
- permissible length of char

Flame Retardants for Textiles

Description of test methods and their application

DIN 54335; 1977

1. Scope:

Methods for assessing the behaviour of the burning times and flame spread times on fabrics, braidings, knitgoods or textile of other fibres– also bonded, coated, laminated or flocked.

2. Preparation of specimens:

- 5 specimens each of 640 mm x 100 mm in warp and weft direction specimen inclined at 45° and fitted with CO marker threads weight down and spaced 50 mm (mark 1), 300 mm (mark 2) and 550 mm (mark 3) from the bottom edge :
- * distance between mark 1 and mark 2 = measured distance 1
 - * the distance between mark 2 and mark 3 = measured distance 2

3. Test procedure:

- 40 mm flame height to be adjusted
- perpendicular burner adjustment
- 15 sec edge ignition
- flame application 20 mm above the lower edge

4. Apparatus:

flame test cabinet acc. to DIN 50050 burner acc. to DIN 50051 with propane gas

5. Assessment:

- flaming time
- flame spread time (as quotient of the burning length in mm and the burning time in sec = mm/sec mean of measuring distance 1 and 2)
- standards of test procedures without resistance requirements and criteria of classification distance until the flame has extinguished
- glowing time / melting behaviour
- permissible length of char
- fire concomitant / flaming debris

Flame Retardants for Textiles

Description of test methods and their application

DIN 54336; 1986

(is replaced by DIN EN ISO 6941; 1995)

1. Scope:

Methods for assessing the burning behaviour of fabrics, braidings, knit-goods or any other textile fabric of fibrous material, either coated, bonded, laminated or flocked. Not applicable to textile floor and wall coverings.

2. Preparation of specimens:

10 specimens each of 430 mm x 100 mm in warp and weft direction

3. Test procedure:

- place specimen in a vertical position
- 40 mm flame height to be adjusted
- burner inclined at 60°
- 3 and 15 sec edge ignition

4. Apparatus:

flame test cabinet acc. to DIN 50050 burner acc. to DIN 50051 with propane gas

5. Assessment:

- afterflame time
- afterglow time
- burn length
- flame spread time
- fire concomitant
- permissible length of char
- standards of test procedures without resistance requirements and criteria of classification

Flame Retardants for Textiles

Description of test methods and their application

DIN 54336; 1986

(is replaced by DIN EN ISO 6941; 1995)

Differences between DIN 54336 and DIN EN ISO 6941

DIN EN ISO 6941: 3 specimens each of 560 mm x 170 mm (warp and weft) 5 and 15 sec ignition edge and surface ignition butane gas can be used burner is using a different flame stabilizer burning cabinet is not requested the degree of destruction (tear length) is not requested use of marker threads for classification

Flame Retardants for Textiles

Description of test methods and their application

DIN 66080; 1976

Classification of the burning behaviour of textile goods

1. Scope:

Basis for the standards to classify the burning behaviour of textile goods, to assess the test results and define their classification code

<u>End-use:</u>	<u>Code:</u>
-Upholstered composites	P
-Protective clothing and workwear	S
-Textile floor-covering including carpets	T
-Curtain fabrics and drapes	V

Codes for the classification to be completed by small letters
(a,b,c)

Flame Retardants for Textiles

Description of test methods and their application

DIN 66081; 1976

Classification of the burning behaviour of textile material:

Textile Floor Coverings

1. Scope:

Methods for assessing the classification of the burning behaviour of textile floor coverings

1. Test procedure:

2. Assessment:

– Class T-a: After an ignition time of 15 sec the CO thread across the specimen, fixed 250 mm above the ignition source must not be severed. After removal of the ignition source the duration of flaming and afterglowing must not exceed 5 sec.

– Class T-b: After an ignition time of 15 sec the CO thread of none of the specimens must be severed earlier than 25 sec after the beginning of the ignition time.

If this requirement is not met, the igniting flame is applied on 5 specimens for a duration of 5 sec each.

If the CO thread is not severed earlier than 30 sec after the beginning of ignition, record a pass result.

– Class T-c: After an ignition time von 5 sec the CO thread of none of the specimens must be severed earlier than 10 sec after the beginning of the ignition.

Flame Retardants for Textiles

Description of test methods and their application

DIN 66081; 1976

Classification of the burning behaviour of textile material:

Textile Floor Coverings

ignition time	flaming time	thread severed		classification
		yes	no	
15 sec.	≤ 20 sec.		+	T - a
15 sec.	> 20 sec.		+	T - b
15 sec.	≥ 25 sec	+		
5 sec.	≥ 5 sec.		+	
5 sec.	≥ 30 sec.	+		
5 sec.	≥ 10 sec	+		T - c

Flame Retardants for Textiles

Description of test methods and their application

DIN 66082; 1980

Classification of the burning behaviour of textile material:

Curtain and Furnishing Fabrics

1. Scope:

Methods for assessing the classification of the burning behaviour of curtain and furnishing fabrics

2. Test procedure:

Testing acc. to DIN 54336 and DIN 4102 Part 1

3. Assessment:

- Class V-a: Curtain and furnishing fabrics which meet the requirements of fire tests on building materials of class A2 acc. to DIN 4102 Part 1 (can only be reached with mineral fibres, but not with organic fibres).
- Class V-b: Curtain and furnishing fabrics which meet the test requirements of the building materials test of class B1 acc. to DIN 4102 Part 1.
- Class V-c: Curtain and furnishing fabrics which stop flaming after the flame application time acc. to DIN 54336 or which continue to flame up to 25 sec after the ignition source has been removed.
The maximum damaged length must be less than 250 mm.
- Class V-d: Curtain and furnishing fabrics which do not stop flaming after the flame application time acc. to DIN 54336 and where the flame spread time is less than 25 mm/sec.
- Class V-e: Curtain and furnishing fabrics which do not stop flaming after the flame application time acc. to DIN 54336 and where the flame spread time lies between 25 – 60 mm/sec

Flame Retardants for Textiles

Description of test methods and their application

DIN 66083; 1997

Classification of the burning behaviour of textile materials:

Textile Fabrics for Workwear and Protective Clothing

1. Scope:

Methods for assessing the classification of the burning behaviour of textile fabrics for workwear and protective clothing

3. Test procedure:

Testing acc. to DIN EN ISO 6941 (5 specimen)

5. Assessment:

- Class S-a: Afterflame time: max. 2 sec
Afterglow time: max. 5 sec
Melting: no
Molten debris: no
Destruction: marking thread at 200mm must not be destroyed
Flame spread: no requirement

- Class S-b: Afterflame time: max. 3 sec
Afterglow time: max. 25 sec
Melting: no
Molten debris: no
Destruction: marking thread at 200 mm must not be destroyed
Flame spread: no requirement

- Class S-c: Afterflame time: max. 20 sec
Afterglow time: no requirement
Melting: no requirement
Molten debris: no
Destruction: marking thread at 350 mm must not be destroyed
Flame spread: no requirement

Flame Retardants for Textiles

Description of test methods and their application

DIN 66083; 1997

Classification of the burning behaviour of textile materials:

Textile Fabrics for Workwear and Protective Clothing

- Class S-d: Afterflame time: no requirement
Afterglow time: no requirement
Melting: no requirement
Molten debris: no requirement
Destruction: no requirement
Flame spread: max. 30 mm/sec

- Class S-e: Afterflame time: no requirement

Assessment into burning classes does normally happen in the original stage. Requirements concerning resistance to washing or dry cleaning have to be considered, but they are not a part of this standard

Flame Retardants for Textiles

Description of test methods and their application

DIN 66084

Classification of the burning behaviour of textile material:

Upholstered composites

1. Scope:

Methods for assessing the classification of the burning behaviour of upholstered composites

2. Test procedure:

testing acc. to DIN 54341: Ignition source = paper pad (100 g) testing acc. to DIN 54342 part 1: Ignition source = smouldering cigarette testing acc. to DIN 54342 part 2: Ignition source = propane gas flame
simulating a burning match

3. Assessment:

- Class P-a: Class P-a comprises of upholstered composites which are resistant to a burning paper pad (100 g) acc. to DIN 54341. The upholstered composites must withstand the following effects within the three test phases:
 - flaming must have ceased within the test duration of 15 min
 - the maximum flame height, measured from the top of the seat back, must remain below 45 cm
 - decreasing tendency of burning after the fifth minute of testing at the latest
 - the flame must not reach the edges of the upholstered composites

- Class P-b: Class P-b comprises of upholstered composites for which, for each single test – under the influence of a flame acc. to DIN 54342 part 2, the limits must not fall below the following ratings:

Flame Retardants for Textiles

Description of test methods and their application

DIN 66084

Classification of the burning behaviour of textile material:

Upholstered composites

2 min after removal of the ignition source, the flame must extinguish. During the testing time the flame must not reach the front margin or either side of the specimen. Any smouldering or glowing must not continue for more than 60 min and propagate more than 100 mm in any direction apart from the position of the source. The specimen must not smoulder until it is consumed within the test duration.

- Class P-c: Class P-c comprises of upholstered composites for which, for each single test acc. to DIN 54342 part, neither flaming nor progressive smouldering should be observed under the influence of a smouldering cigarette for a total of up to 60 min.

Flame Retardants for Textiles

Description of test methods and their application

DIN 75200; 1980

1. Scope:

Methods for assessing the flammability of interior materials in passenger cars, multipurpose passenger vehicles, trucks and busses.

2. Preparation of specimens:

5 specimens each of 356 mm x 100 mm in warp and weft direction fasten the measuring marks at a distance of 38 mm (mark 1), 165 mm (mark 2) and 292 mm (mark 3) from the edge of the specimen to be exposed to the flame

3. Test procedure:

- place specimen in a horizontal position
- 38 mm flame height to be adjusted
- perpendicular burner adjustment
- 15 sec gas burn time
- measure the burning time from the measuring mark 1 to the point where flaming stops or the time that the flame takes to reach mark 3

4. Apparatus:

5. Assessment:

acc. to 75200 with propane gas

- burn rate in mm/min as quotient of length the flame travels and time in seconds for the flame to travel
- conditions of test procedure without requirements to resistance or criteria of classification