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## 1 SCOPE


- 1.1 This method describes procedures for testing matches for compliance with the Hazardous Products (Matches) Regulations (hereafter called the Matches Regulations) and is applicable to item 23 of Part II of Schedule I to the Hazardous Products Act (HPA). This includes safety, strike-anywhere, fireplace and book matches.
- 1.2 The method consists of procedures for visual inspection and tests for determining the:
- (a) disintegration of ignition compound,
  - (b) duration of afterglow of splints,
  - (c) breaking resistance of splints
  - (d) spontaneous ignition of matches, and
  - (e) drop test for strike-anywhere matches (not a regulatory requirement).
- 1.3 This method is provided to facilitate laboratory procedures only. It is the trader's responsibility to ensure that the product is tested according to, and meets the requirements of the HPA and its Regulations.

## 2 APPLICABLE DOCUMENTS

- 2.1 Hazardous Products (Matches) Regulations (attached)
- 2.2 Product Safety Reference Manual: *Book 4 - Flammable Products*
- 2.3 *Standard Operating Procedure for the Test for Breaking Resistance of Splints (F-20, 5.6) Using the Instron*

## 3 DEFINITIONS

- 3.1 *Afterglow*: The glow remaining on a splint of a match after the flame has been extinguished.
- 3.2 *Book matches*: One or more layers of matches that are joined at the base and attached to a cover.
- 3.3 *Break*: The separation of a splint into two or more pieces.
- 3.4 *Collapse*: The permanent bending or deformation of a splint.
- 3.5 *Fracture*: The partial separation of a splint.
- 3.6 *Ignition compound*: The chemical compound used to make the striking tip of a match.

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- 3.7 *Splint*: The part of a match that is wood, paper or other material and that supports the ignition compound.
- 3.8 *Strike-anywhere match*: A match that can be ignited by being struck against any surface.
- 3.9 *Striking surface*: The part of a book, box or other immediate container of matches that is designed for igniting matches.
- 3.10 *Wood matches*: Matches that have splints of wood but does not include matches if they are attached to a common base.

#### 4 APPARATUS

- 4.1 A draft free test box (air velocity of less than 0.3 m/s), 300 mm deep, 480 mm long and 600 mm high.
- 4.2 A 100 mm high stand-off. An aluminum block with dimensions of 100 x 80 x 60 mm has been found satisfactory.
- 4.3 Heat sensitive paper that is at least 215 x 215 mm.<sup>1</sup>
- 4.4 Test holders for the Spontaneous Ignition Test, one made of metal or other fire-resistant material that is 20 ± 2 mm thick and has, at its centre, a hole 25 ± 2 mm in diameter and another made of wood that is 22 ± 2 mm thick and 50 ± 2 mm square and that has a hole 25 ± 2 mm in diameter.
- 4.5 A convection oven capable of maintaining temperatures of 90±1 °C and of 40±1 °C (two different ovens can be used also).
- 4.6 A stopwatch or a similar timing device capable of measuring an interval of time of 0.2 seconds or better.
- 4.7 Apparatus for determining the breaking resistance of splints: a device capable of holding a match splint solidly (e.g. a clamp), a knife edge perpendicular to the initial position of the splint, and an instrument capable of measuring the load applied to the match with an interval of 0.5 grams-force or better at any given moment. Either the device holding the splint or the knife edge must be mobile in the direction perpendicular to the initial position of the splint.
- 4.8 A device capable of measuring an interval of length of 0.1 mm or better.

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<sup>1</sup> Product number C13610 from Chromatographic Specialties (1-800-267-8103) or equivalent.

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## 5 PROCEDURE

### 5.1 Label Review

Verify the label requirements as per Section 4 of the Matches Regulations.

### 5.2 Visual Inspection

Visually inspect the matches to determine compliance with sections 5(1)(a), 5(1)(b), 5(2), 6 and 7 of the Matches Regulations.

### 5.3 Sample Preparation

Select evenly, from all the boxes or matchbooks received, at least 160 matches (and at least 50 more for matches that are not round, not made of wood and for which the cross section of the splint is not square) and condition them along with their striking surfaces in an oven at 40°C for 1.5 hours and then at 21±3°C and 40±10% R.H. for at least 2 hours but less than 48 hours (if this period is exceeded, recondition the matches). Conditioned matches are required for the tests described in 5.4, 5.5 and 5.6.

### 5.4 Test for Disintegration of Ignition Compound

5.4.1 Randomly select 50 of the conditioned matches.

5.4.2 Place a sheet of unmarked heat-sensitive paper on the bottom of the test box.

5.4.3 Position the striking surface vertically on the stand so that its bottom edge is 100 mm above the centre of the paper.

5.4.4 Ignite the match by striking it downwards so that the match head does not travel more than 50 mm below the bottom edge of the striking surface.


5.4.5 Record if the match caused at least one mark with the longest dimension being 1.0 mm or greater on the heat-sensitive paper or if the match caused at least one hole in the heat-sensitive paper.

5.4.6 Repeat steps 5.4.2 to 5.4.5 for each of the other selected matches.


### 5.5 Test for Duration of Afterglow

5.5.1 Randomly select 50 of the conditioned matches.

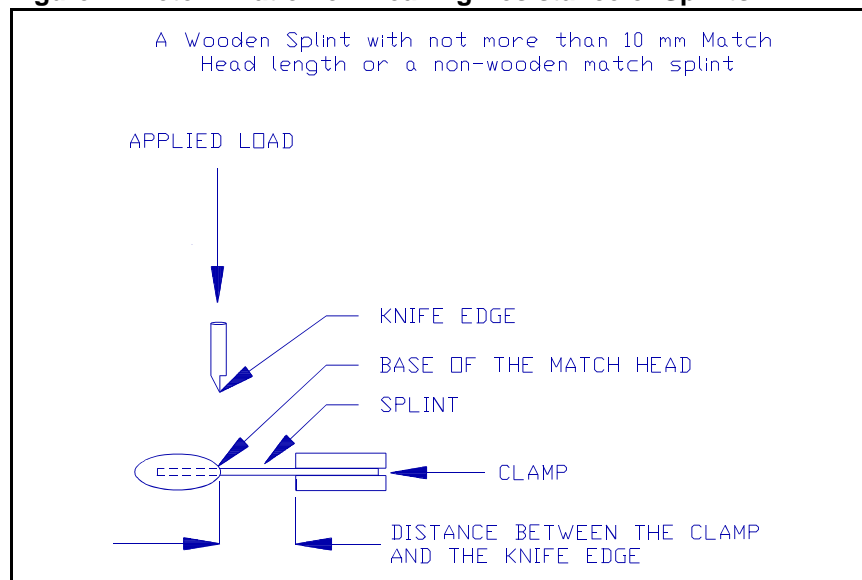
5.5.2 Mark the mid-point of their splints or a point 50 mm from the base of the match head if the splint is 100 mm or longer.

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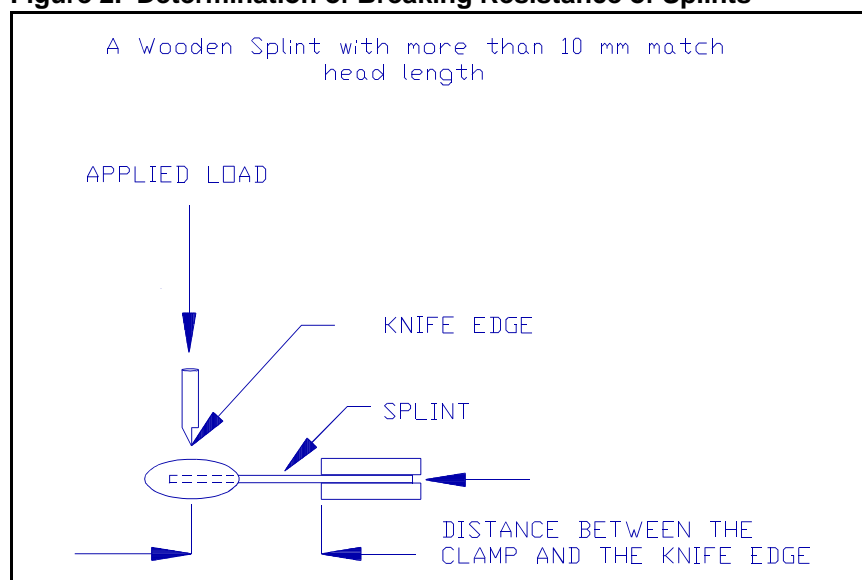
- 5.5.3 Ignite a match inside the test box by striking it on the striking surface and hold it horizontally.
- 5.5.4 Let the match burn to the mark on the splint, gently blow out the flame and start timing.
- 5.5.5 Record the duration of afterglow on the portion of the splint not covered by ignition compound. Also record if the head of the match being tested falls off.
- 5.5.6 Repeat steps 5.5.2 to 5.5.5 for each of the other selected matches.
- 5.6 Test for Breaking Resistance of Splints
  - 5.6.1 Randomly select 50 of the conditioned matches (100 matches in the case of matches not made of wood and which are not round — test 50 matches placed flat and 50 matches placed on their edge).
  - 5.6.2 Insert the match to be tested in the test apparatus in accordance with one of the following instructions, as applicable:
    - 5.6.2.1 If the splint is made of wood and has a match head that is not more than 10 mm in length, clamp the match 20 mm from the base of the match head and apply the knife edge at the base of the match head (see Figure 1 below);
    - 5.6.2.2 If the splint is made of wood and has a match head of more than 10 mm in length, clamp the match 25 mm from the tip of the match head and apply the knife edge 5 mm from the tip of the match head (see Figure 2 below);  
or
    - 5.6.2.3 If the splint is not made of wood, clamp the match 15 mm from the base of the match head and apply the knife edge at the base of the match head.
  - 5.6.3 Increase the load applied to the match until the match breaks, fractures or collapses. The rate at which the load is applied should permit an adequate data acquisition which in turn will allow the desired precision of the result. As a guideline, the mobile part of the apparatus should be moving at a rate between 15 and 50 mm/min.
  - 5.6.4 Record the maximum force required to break, fracture or collapse the splint.
  - 5.6.5 Repeat steps 5.6.2 to 5.6.4 for each of the other selected matches.


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**Figure 1. Determination of Breaking Resistance of Splints**



**Figure 2. Determination of Breaking Resistance of Splints**



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## 5.7 Spontaneous Ignition Test<sup>2</sup>

- 5.7.1 Fill the hole in the test holder with matches, their heads pointing up.
- 5.7.2 Place the holder in a convection oven at 90±1°C for 2 hours.
- 5.7.3 Record any evidence of spontaneous ignition, such as charring of the match heads.

## 5.8 Drop Test for Strike-anywhere Matches (not a regulatory requirement)

- 5.8.1 Condition three containers of matches in an oven at 40°C for 1.5 hours and then at 21±3°C and 40±10% R.H. for at least 2 hours but less than 48 hours.
- 5.8.2 Drop a closed container of matches four times from a height of 2 m onto a concrete floor, in random orientations.
- 5.8.3 Record any evidence of ignition of the strike-anywhere matches, such as smoke or flames.
- 5.8.4 Repeat the last two steps for the remaining two containers.

## 6 QUALITY ASSURANCE/QUALITY CONTROL PROCEDURES


- 6.1 The area used for the Test for Disintegration of the Ignition Compound and Test for Duration of Afterglow must be draft free (air velocity less than 0.3 m/s).
- 6.2 The drop height has to be measured to the nearest centimetre.
- 6.3 The Quality Control section of the test method is under development and, when completed, will be added in a revised issue.

## 7 TEST REPORT

See Test Report Format in the Appendix.

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<sup>2</sup>For this test, use the metal holder. If the matches ignite during the test, repeat with the wooden holder. Only the results obtained with the wooden holder need to be reported. The reason for using the metal holder is that the wooden one (which is the one referred to in the regulations) degenerates with use.


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## 8 PRECISION AND BIAS

- 8.1 Precision - This section of the test method is under development and will be added in a revised issue when completed.
- 8.2 Bias - No justifiable statement can be made on the bias of this test method since there is no accepted referee test method for testing matches.

## 9 SAMPLING

The sample should come from only one lot and should consist of a sufficient number of matches so that it can provide fifty matches for each of the following tests: (i) Disintegration of Ignition Compound, (ii) Duration of Afterglow and (iii) Breaking Resistance of Splints (50 more matches are required for this test if they are not round, not made of wood and if the cross section of their splints is not square). In addition, the sample should provide enough matches to fill the test holder used for the Spontaneous Ignition Test. The matches should be selected evenly from all of the containers received. Three additional containers of matches are required for the Drop Test for strike-anywhere matches.

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## APPENDIX

### STANDARD REPORT FORMAT

#### 1. Visual Inspection

(Section 4, Paragraphs 5(1)(a) and (b), Subsection 5(2), Sections 6 and 7)

Label:


Scan label and put here

The name and mailing address of the manufacturer/importer/distributor/wholesaler were shown in a clear and legible manner on the book/box/container that immediately covered/enclosed the matches	YES-NO
The identification number of the manufacturer was clearly shown in close proximity to the name and mailing address of the wholesaler	YES-NO N/A

All matches were inspected.

Number of matches for which the ignition compound was not uniformly applied to the end of the splint	##
Number of matches having the striking tip split, chipped, cracked or crumbling	##
Number of occurrences of two or more matches adhering to one another at the striking tip	##
Number of match splints broken, split or crushed (wood matches only)	## - N/A
Number of books not having all of the match heads covered when they are closed	## - N/A
Number of books having their striking surface pierced or loosened by the fastening wire used to secure the cover to the common base of the matches	## - N/A



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Number of books having friction paint present on the inside of the cover within 1 inch of the match heads	## - N/A
The striking surface of the books was on the side that opens	Yes-No N/A

## 2. Test for Disintegration of Ignition Compound

(Paragraph 5(1)(c))

Fifty matches were randomly selected and tested.

Number of matches that left at least one mark with its longest dimension being 1.0 mm or greater on the heat-sensitive paper or burned at least one hole in the heat-sensitive paper	##
--	----

## 3. Test for Duration of Afterglow

(Paragraph 5(1)(d))

Fifty matches were randomly selected and tested.


Number of matches exhibiting an afterglow on the match splint not covered by the ignition compound lasting longer than 15 seconds	##
Number of matches exhibiting an afterglow on the match splint not covered by the ignition compound for a period of > 3 seconds but ≤ 15 seconds	##
List of duration of afterglow periods for matches exhibiting an afterglow on the match splint not covered by the ignition compound lasting longer than 15 seconds	## s, ## s, ## s, ## s, ## s

## 4. Test for Breaking Resistance of Splints

(Paragraph 5(1)(e))

Fifty [One hundred] matches were randomly selected and tested.

Number of matches breaking under a moment of 300 gcm or less when placed on the edge	## - N/A
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Number of matches breaking under a moment of 700 gcm/100 gcm or less [when placed flat]	##
List of maximum moments required to break the splint of the matches enumerated above	
For matches placed on the edge The results have an error of [1%]	N/A - ## gcm, ## gcm, ## gcm, ## gcm
For matches placed flat/wooden matches/round matches The results have an error of [1%]	## gcm, ## gcm, ## gcm

**5. Spontaneous Ignition Test**  
(Paragraph 3(b))

The matches ignited	Yes - No
---------------------	----------

**6. Drop Test for Strike-anywhere Matches**  
(non-regulated)

Three boxes of strike-anywhere matches were selected and tested.

The matches ignited	Yes - No N/A
If yes, box and drop #	Box # Drop #