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PERFORMANCE OF FIRE BLANKET MATERIALS

by

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SUMMARY

Fire tests involving AVGAS, vegetable oil and clothing have been carried out in accordance with the general procedures in FR Note 1057, to evaluate different types of material for fire blankets, as compared with asbestos.

The materials ranged from glass fibre to treated and untreated wool. Of the six tested, three are currently available as fire blankets, two are standard cloths being produced for other purposes and one is an experimental cloth made up as a fire blanket.

The performance of these materials covered a wide range and has shown the value in the careful selection of materials for adequate performance.

Fire Research Notes cease publication

Fire Research Notes, which have been produced by the Fire Research Station for nearly 30 years, are to cease publication, No.1079 being the final Note. The decision to end this series is part of a programme of rationalisation of publications by the Building Research Establishment. Information which, until now would have been published in Fire Research Note form will be published in appropriate journals or in the well-established BRE Current Paper series. You will continue to receive any of the latter which deal with fire topics if your name is included on the present Fire Research Note mailing list.

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1. INTRODUCTION

An assessment of the performance of asbestos fire blankets on AVGAS, white spirit, cooking oil, wood and clothing fires has been made and described in Fire Research Note 1057¹.

As a result of this work a range of commercial materials were selected for fire blankets and used on a series of fire tests to obtain their relative ratings as compared with an asbestos blanket of the same size.

Only AVGAS, chip pan and clothing tests were carried out, as it was felt that these three test methods would give the necessary information in judging the materials' performances. The two remaining tests, ie white spirit and wood, would supply little additional information on their performance.

The results of this work are presented in tabular form and to assist comparisons to be made between the materials and asbestos a summary of the results is also shown in the form of a table.

2. EXPERIMENTAL

Full experimental details of the test methods are given in Fire Research Note 1057¹; only brief details and modifications where appropriate are given in this note.

2.1. Clothing

The ability of the blankets to extinguish clothing fires was tested using a burning cotton cloth (160 to 170 g/m²) over a simulated torso.

On igniting the cloth with a match at 2 points diametrically opposite to one another, a preburn time of 20 seconds was allowed before applying the blanket. It was wrapped around the drum and the flames beaten out, at the end of a further 20 seconds (40 seconds after ignition) it was removed. Extinction was defined as the absence of flames when the blanket was removed. Glowing and smouldering of the cotton was permitted for an extended period.

2.2. AVGAS

The AVGAS fires had a preburn time of 1 minute and a blanket application period of 2 minutes. Extinction was defined as no flames to be visible after the 2 minutes, adjustment of the blanket being allowed during this period. The rating of a blanket was obtained by carrying out an appropriate number of fire tests (with up to 3 experiments per tray size). The largest tray extinguished in 2 out of the 3 attempts was recorded as the blanket rating.

2.3. Chip pan

In the original test method, the oil was heated slowly with self-ignition taking place at an arbitrary time between $1\frac{1}{2}$ - $2\frac{1}{2}$ hours.

For this series of tests attempts were made to revise this method and reduce the heating period.

In order to speed up the self-ignition of the oil, the rate of heating was increased. Although the oil self-ignited in $\frac{1}{2}$ hour a more fiercely burning fire was produced, with the oil bubbling up and over the top of the pan, which made extinction with even an asbestos blanket impossible.

Following this it was decided to monitor the oil temperature during heating, ignite the oil with a lighted match and note the temperature at which this was possible. It was found that the oil could be consistently lit at 350°C and the time taken to reach this temperature was $1-1\frac{1}{2}$ hours.

During the development of the new test method two different types of vegetable oil were used (obtained from supermarkets). This appeared to make no appreciable difference to the resultant fire. It must not, however, be assumed that all vegetable oils show the same fire characteristics.

Igniting the oil at 350°C proved to be a more reproducible method of test and was therefore adopted for this series of tests. It must not be assumed that the method represents the most severe fire which can occur with burning vegetable oil.

A 5B tray size was used for these tests as it was the maximum size tested previously with the asbestos blankets.

The method adopted was as follows:

Fresh vegetable oil was heated so that 5 litres reached a temperature of 350°C in 1-1½ hours. At this temperature, the heating supply was disconnected and the oil was ignited with a match and allowed to burn for 1 minute before application of the blanket. The blanket was removed after a further 5 minutes. Extinction was defined by the absence of any visible flames on removal of the blanket. Adjustment of the blanket was allowed during the 5 minutes.

The heat was supplied by means of a gas ring situated beneath the tray and adjusted so that no flames came around the tray edge.

This revised test method was used with an asbestos blanket as a check, and then with the remaining blankets. An asbestos blanket was also applied to an 8B chip pan using this method.

The treated wool blanket was also tried on an 8B chip pan because, as shown later, it achieved the same ratings as the asbestos blanket in all other tests.

3. MATERIALS USED

3.1. Blankets

Details of the blanket materials are given in the table below.

Manufacturer	Blanket material	1.22 m x 1.22 m size (a) typical weight (g)	0.91 m x 0.91 m size (b) typical weight (g)
A	Texturized glass	720	400
B	Texturized glass	620	350
C	Smooth glass	720	420
D	Non-melt nylon	570	350
E	Wool	960	540
F	Treated wool	1340	750
A	Asbestos	2620	1460

(a) AVGAS and clothing fires

(b) Chip pan fire

3.2. Fire trays

Full details of the fire tray sizes are given in Fire Research Note 1057¹.
Some information on those used in this series of tests is given below:

3B - 3 litres of fuel in a tray 100 mm deep, 346 mm diameter
5B - 5 " " " " " 447 mm "
8B - 8 " " " " " 566 mm "

NB New fuel and blanket used for each test rating.

A water base was used for each AVGAS fire.

4. RESULTS

The results from this work are presented in table form. Each individual experiment is given a pass/fail rating and observations made during the tests are given beneath each table, together with the overall rating of the blanket in the case of the AVGAS fires.

It should be noted that the table showing the results for an asbestos blanket on AVGAS fires, has been extracted from Fire Research Note 1057¹.

Clothing fire

Blanket 1.22 m x 1.22 m	Test No.		
	1	2	3
Texturized glass (manufac A)	P	P	
Texturized glass (manufac B)	P	P	
Smooth glass	P	P	
Non-melt nylon	P	F*	P
Wool	P	P	
Treated wool	P	P	

P - Pass

F - Fail

Following all the successful tests (P) the cloth was smouldering on removal of the blanket, but it was difficult to fan into flaming combustion.

* - Cloth flaming at bottom edge when blanket removed.

AVGAS fire

Texturized glass blanket Manufacturer A

Test No.	Tray size						
	1B	2B	3B	5B	8B	13B	21B
1			P	F			
2			F	F			
3			P				

1.22 m x 1.22 m blanket rating - 3B

Observation: Updraught from fire lifted blanket, delaying application of the blanket to the fire.

Texturized glass blanket Manufacturer B

Test No.	Tray size						
	1B	2B	3B	5B	8B	13B	21B
1			F	F			
2			F	F			
3			F				

1.22 m x 1.22 m blanket rating - < 3B

Observation: After application of blanket, flames visible from folds of blanket around tray edge.

Smooth glass blanket

Test No.	Tray size						
	1B	2B	3B	5B	8B	13B	21B
1			F	F			
2			P	F			
3			P				

1.22 m x 1.22 m blanket rating - 3B

Observation: Updraught from fire lifted blanket delaying application of the blanket to the fire

Non-melt nylon blanket

Test No.	Tray size						
	1B	2B	3B	5B	8B	13B	21B
1			F	F			
2			F	F			
3							

1.22 m x 1.22 m blanket rating - < 3B

Observation: After application of blanket, flames visible from folds of blanket around tray edge.

Wool blanket

Test No.	Tray size						
	1B	2B	3B	5B	8B	13B	21B
1			P	F			
2			P	F			
3							

1.22 m x 1.22 m blanket rating - 3B

Observation: Updraught from fire lifted blanket, delaying application of the blanket to the fire

Treated wool blanket

Test No.	Tray size						
	1B	2B	3B	5B	8B	13B	21B
1			P*	P	F		
2				P	F		
3							

1.22 m x 1.22 m blanket rating - 5B

*Transient flames across surface which were easily extinguished

Asbestos blanket¹

Test No.	Tray size						
	1B	2B	3B	5B	8B	13B	21B
1				P	F		
2				F	F		
3				P			

1.22 m x 1.22 m blanket rating - 5B

Chip pan fire

Blanket 0.91 m x 0.91 m	Tray size	
	5B	8B
Texturized glass (manufac A)	P	-
" " (manufac B)	P	-
Smooth glass	P	-
Non-melt nylon	P	-
Wool*	F*	-
Treated wool	P	F(ii)
Asbestos	P	P(i)

P - Pass

F - Fail

Following all the successful tests (P), on the 5B size the oil re-ignited on removal of the blanket (after being covered for 5 minutes).

*Blanket charred through around rim of tray and sagged into the oil, which re-ignited 1 m 53 s after application of the blanket. Two further tests were carried out, in one test the blanket passed and in the other it failed again.

(i) Oil did not re-ignite on removal of the blanket. This size of fire took 2 hr 05 min to reach 350°C and it was only just possible to achieve success with this size of blanket.

(ii) Application of the blanket extinguished the fire, but the blanket charred around the tray rim. The centre of the blanket then dropped into the oil and re-ignition of the oil took place, approx. 2 min from application of the blanket.

5. SUMMARY OF RESULTS

In order to assist in the comparison between the materials and asbestos, a summary of the results has been compiled in the form of a table (shown below).

Blanket	Type of fire		
	Clothing	AVGAS	5B Chip pan
Texturized glass (manufac A)	P	3B	P
Texturized glass (manufac B)	P	< 3B	P
Smooth glass	P	3B	P
Non-melt nylon	P	< 3B	P
Wool	P	3B	F
Treated wool	P	5B	P(i)
Asbestos	P*	5B*	P(ii)

*See reference (1)

(i) Failed on 8B chip pan

(ii) Passed on 8B chip pan

6. DISCUSSION AND CONCLUSIONS

The three types of fire selected for this series of tests, have shown themselves to form an effective basis for comparing the general performance of fire blanket materials.

During this work however, specific points emerged from the different experimental fires, which are discussed below.

6.1. Tests

Clothing All the blankets were tested on clothing material of burning characteristics similar to that used with the asbestos blankets. It was however noticed that the conditioning of the clothing material was very important in determining its burning characteristics. Careful consideration should therefore be given to this fact if this test is to form part of any standardisation procedure.

AVGAS On applying the blankets to AVGAS fires a range of results were obtained. A contributory factor to this being the differences in weight and thickness of the materials.

A lightweight material was caught in the updraught from the flames making it difficult to place over the fire. A thick material on the other hand, when placed over the fire, did not drape well and allowed flames to escape around the tray edges.

These two points highlight how important it is to carefully select the material for a fire blanket in order to obtain the optimum results.

Chip pan The modified chip pan fire eliminated the irregularity of the time taken for the oil to self-ignite, it did however produce a less fiercely burning fire.

The new method was first used with an asbestos blanket on a 5B fire to confirm that its performance was satisfactory, the other six materials were then tried on the 5B fire.

All except the woollen material were successful, this failed in 2 out of 3 attempts. The hot tray rim penetrated the cloth causing the centre of the cloth to fall into the oil.

The heating process of the oil although reduced was still lengthy and the fumes evolved necessitated suitable extraction being used. If a vegetable oil fire is to be used for any standardisation purposes, further work may be necessary in developing a suitable test method.

6.2. Blanket performance

All the materials passed the clothing fire and all except the woollen cloth were successful on a 5 B chip pan fire*. In the case of the AVGAS fires the material ratings ranged from < 3B up to 5B.

The 2 texturized glass materials had different ratings, one was successful on a 3B AVGAS fire, the other failed. The woollen materials also produce different results, the treated wool was successful on a 5B AVGAS, the untreated wool could only manage a 3B.

This test method has proved to be very effective in not only establishing the relative performance of fire blanket material, but in differentiating between blankets of the same material with different methods of construct

*The asbestos blanket was also successful on an 8B chip pan; the treated wool blanket failed this test.

7. ACKNOWLEDGEMENTS

The author would like to acknowledge the help of Mr S Wilson and Mr R C Bishop (Yarsley Testing Laboratories) for carrying out the experimental part of this work.

8. REFERENCE

1. WOOLLEY, W D and ROGERS, S P, Mrs. The performance of asbestos fire blankets. Fire Research Note No.1057, 1976.