REPORT

Tests with the Flame Away

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1. GENERAL

1.1 REPORT

This report describes the tests that were performed with Flame Away on the 16th of August 2023 at the laboratory of Efectis Nederland BV in Bleiswijk, The Netherlands.

1.2 SUBJECT

The tests were performed with Flame Away's, manufactured by Flame Away.

1.3 INVESTIGATION

For the investigation three research questions were formulated:

- Can the Flame Away extinguish a solid material fire with a diameter of 0.5 metres?
- Can the Flame Away extinguish different types of solid material fires (Class A fires)?
- What is the diameter of the liquid, after the use of the Flame Away?

1.4 LIMITATIONS

- This test report may only be read, used and published in its entirety. This report consists of 17 pages;
- The tests were performed without an available test standard, because the product is not covered by the category of portable fire extinguishers;
- This test report only displays the results of the tests performed with the product under test conditions and is therefore not a certificate, type approval or similar statement that guarantees the operation in practice.

2. TEST SPECIMEN

2.1 VERIFICATION OF THE FLAME AWAY

Efectis has executed a verification on ten Flame Away's. These Flame Away's were selected by Efectis from the storage and taken to the laboratory. The verification specimens were then measured and weighed to verify consistency. The obtained data is listed in *Table 1*.

Table 1: Obtained verification data

Verification specimen	Colour	Weight [g]	Height [mm]	Distance from liquid level to cap [mm]	Liquid content [L]
1	Red	1792.8	280	70	-
2*	Red	1802.3	285	-	1.4
4	Red	1822.3	285	55	-
3	Red	1809.9	285	55	-
5	Red	1810.1	290	65	-
6	Blue	1792.0	285	70	-
7	Blue	1784.8	285	72	-
8	Blue	1777.9	280	70	-
9	Blue	1806.3	280	70	-
10	Blue	1807.1	285	65	-
Average		**1800.55**	**284**	**65.8**	

*After unpackaging specimen 2, the glass at the cap was found broken and a little bit of liquid had leaked

The differences in data can be explained by the process of production of the glass part of the Flame Away. The thickness of the glass may vary slightly which causes small differences in the weight of the product. The measured data is within a small range; therefore, it can be concluded that the Flame Away is a consistent product.

3. TESTS

3.1 TESTS PART 1

Tests were performed with the Flame Away at the laboratory of Efectis Nederland BV. For these tests a fire was started on a (flooring) substrate with kerosene. Kerosene was applied with a laboratory flask for a certain number of seconds (amount of fuel) to the substrate in a circle with a certain diameter (see Figure 1 and Figure 2). After this, the kerosene was ignited with a burner. When the fire was developed, so all kerosene was on fire, the Flame Away was ‘dropped’ (thrown without force) into the middle of the fire from a distance of 1 meter from the middle of the fire (see Figure 3). Multiple variables were used for the tests, the used variables and options are described below.

Substrate:

- Laminate flooring;
- Softboard;
- Rug;
- Carpet;
- Bath rug.

Diameter of fuel/fire circle:

- 0.5 meter;
- 1.0 meter.

Amount of fuel

- 10 seconds;
- 20 seconds.

Figure 1: The outlined circle in which the kerosene was spread (left) and after the kerosene was set on fire (right) on the bath rug.

Figure 2: The outlined circle in which the kerosene was spread (left) and after the kerosene was set on fire (right) on the softboard.

Figure 3: Dropping of the Flame Away on the fire

After the test the effectiveness of the extinguishing of the Flame Away was noted. The width and length of the diameter of the liquid that has been released from the Flame Away has been measured and also noted. The width and the length of the diameter is pictured in Figure 4.

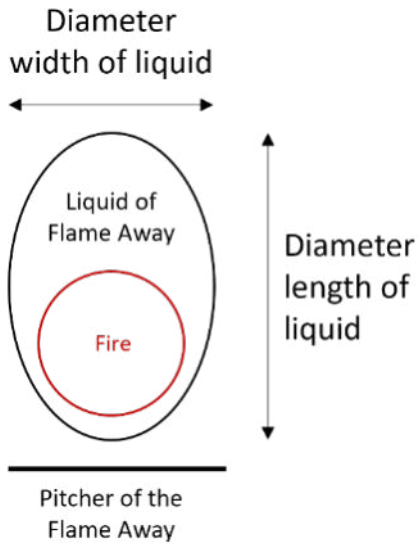

Figure 4: Width and length of the diameter of the liquid of the Flame Away

3.2 TESTS PART 2

3.2.1 General

Additional tests were performed to determine what the results would be of the Flame away in different situations from the (18) standard tests in part 1. An overview of the tests performed in part 2 of the investigation is shown in Table 2.

Table 2: Overview of the tests in part 2

Test	Variable	Used option
19	Orientation softboard	Vertical
20	Orientation softboard	Vertical
21	Throwing force	Throwing hard
22	Throwing force	Throwing hard
23	Substrate	Wood crib
24	Substrate	Wood crib
25	Aiming spot on laminate flooring	Next to the fire
26	Aiming spot on laminate flooring	In front of the fire

3.2.2 Orientation

All tests of part 1 were performed on a horizontal flooring. To investigate the effectiveness of the Flame Away on a vertical surface, two tests were performed on a vertical softboard wall (see Figure 5).

Figure 5: The vertical softboard wall with the outlined circle in which the kerosene was spread (left) and set on fire (right)

3.2.3 Throwing force

The tests in part 1 were performed by dropping the Flame Away (without force) on the horizontal surface. To investigate the influence of the throwing force on the performance of the Flame Away. Two additional tests were performed, where the Flame Away was thrown hard on the horizontal softboard from a distance of 2 meters to the middle of the fire (see Figure 6).

Figure 6: Throwing hard of the Flame Away on the fire

3.2.4 Substrate

To investigate the effectiveness of the Flame Away on an object instead of a flat surface a wood crib was screwed onto a wooden board and set on fire (see Figure 7). After the fire was completely developed the Flame Away was dropped onto the wood crib.

Figure 7: The wood crib screwed on a wooden board and set on fire

3.2.5 Aiming spot

The tests in part 1 were performed by dropping the Flame Away in the middle of the fire. To investigate the influence of dropping the Flame Away next to or in front of the fire two tests were performed. In the first test (test 25) the Flame Away was dropped 0.5 meter on the right side of the middle of the fire (seen from the pitcher). In the second test (test 26) the Flame away was dropped 0.5 meter in front of the middle of the fire (seen from the pitcher).

4. RESULTS OF THE TESTS

4.1 GENERAL

In the next paragraphs the results of the tests will be shown per part of the investigation.

4.2 RESULTS PART 1

4.2.1 Laminate flooring

Table 3: Results of the tests on the laminate flooring substrate

Test	Diameter of kerosene [m]	Amount of kerosene [sec]	Diameter width [m]	Diameter length [m]	Results
1	0,5	10	-	-	Extinguished
2	1	10	-	-	Extinguished
3	1	20	-	-	Extinguished
4	0.5	10	1.4	1.8	Extinguished
5	0.5	10	1.4	1.7	Extinguished

All five fires were extinguished immediately after the Flame Away broke on the surface of the laminate flooring. After dropped, the liquid of the Flame Away resulted in a minimum diameter width of 1.4 meter and length of 1.7 meter.

Figure 8: The result of test 1

4.2.2 Soft board

Table 4: Results of the tests on the soft board substrate

Test	Diameter of kerosene [m]	Amount of kerosene [sec]	Diameter width [m]	Diameter length [m]	Results
6	0.5	10	-	-	Extinguished
7	0.5	10	1.3	1.6	Extinguished
8	0.5	10	1.1	1.5	Extinguished
9	0.5	10	1.5	1.8	Extinguished
10	1	20	1.2	1.6	Extinguished
11	0.5	10	1.2	1.2	Not completely extinguished
12	1	20	1.2	1.6	Extinguished
13	1	20	1.2	1.8	Extinguished

All fires were extinguished immediately after the Flame Away broke on the surface of the soft board except for the fire in test 11. In test 11 the Flame Away was unintentionally thrown a little bit behind/over the middle of the fire. This ensured that not the entire fire was covered with the liquid of the Flame Away. A flame was left burning on the pitcher's side of the circle (see Figure 9). After dropped, the liquid of the Flame Away resulted in a minimum diameter width of 1.1 meter and length of 1.2 meter.

Figure 9: The result of test 11, the fire wasn't completely extinguished

4.2.3 Rug

Table 5: Results on the tests on the rug substrate

Test	Substrate	Diameter of kerosene [m]	Amount of kerosene [sec]	Diameter width [m]	Diameter length [m]	Results
14	Rug	0.5	10	1.8	2.0	Extinguished
15	Carpet	0.5	10	1.5	2.2	Extinguished
16	Carpet	0.5	20	1.5	2.2	Extinguished
17	Bath rug	0.5	10	1.5	1.5	Not completely extinguished
18	Bath rug	0.5	20	-	-	Not completely extinguished

The fires in tests 17 and 18 were not extinguished immediately right after the Flame Away broke on the surface. The little flame that was left in both tests, was on the front side of the circle of the fire (the pitching side) (see Figure 10). The Flame Away was unintentionally dropped a little bit behind the middle of the fire. The liquid of the Flame Away spread to the back side of the circle of the fire and did not cover all the flames in the front. That's why the fire wasn't extinguished completely immediately. At both tests the little flame that was left, extinguished by itself after approximately 30 seconds. It is possible that the liquid of the Flame Away spread in the bath rug and still put out the fire. The fires of test 14-16 were extinguished immediately after the Flame away broke on the surface (see Figure 11). After thrown, the liquid of the Flame Away resulted in a minimum diameter width of 1.5 meter and length of 1.5 meter.

Figure 10: The result of test 17 (left) and test 18 (right)



Figure 11: The result of test 14 (left) and test 16 (right)

4.3 RESULTS PART 2

4.3.1 Overview test results part 2

An overview of the results of the test of part 2 is shown in Table 6.

Table 6: Overview of the results of the tests of part 2

Test	Variable	Used option	Result
19	Orientation softboard	Vertical	Extinguished
20	Orientation softboard	Vertical	Extinguished
21	Throwing force	Throwing hard	Not completely extinguished
22	Throwing force	Throwing hard	Extinguished
23	Substrate	Wood crib	Extinguished
24	Substrate	Wood crib	Not completely extinguished
25	Aiming spot on laminate flooring	Next to the fire	Not completely extinguished
26	Aiming spot on laminate flooring	In front of the fire	Extinguished

4.3.2 Orientation

Tests 19 and 20 were performed on a vertically placed softboard. This was done to simulate a vertical surface in a home that is on fire. The Flame Away was thrown on the fire and extinguished the fire immediately in both tests. The width of the diameter of the liquid was 0.8 meter after both tests. The result of test 19 is shown in Figure 12.

Figure 12: The result of test 19

4.3.3 Throwing force

In tests 21 and 22 the Flame Away was thrown hard into the fire instead of dropping it (without force). During test 21 the flame Away was thrown in the middle of the fire. Because of this the flames in the front of the fire were not extinguished, the liquid of the Flame Away had spread more away from the pitcher and didn't cover the flames the closest to the pitcher (see Figure 13). The width of the liquid diameter was 2.7 meter and the length 3.0 meter.

During the next test (test 22) the Flame Away was not thrown in the middle of the fire but more to the front of the fire. The fire was immediately extinguished (see Figure 14). The width of the liquid diameter was 2.0 meter and the length 3.0 meter.

In both tests the liquid had spread further away from the point of impact but didn't cover all the surface on outer diameter of the liquid. The liquid was more divided in 'splashes' (see Figure 13 and Figure 14), compared to the tests where the Flame away was 'dropped'.

Figure 13: The result of test 21


Figure 14: The result of test 22

4.3.4 Substrate

To simulate an object on fire, a wood crib was set on fire. The Flame Away was thrown on top of the burning wood crib. This was done in test 23 and 24. In test 23 the wood crib was extinguished immediately (see Figure 15) and the diameter width and length were both 1.4 meter. In test 24 the Flame Away didn't land on top of the wood crib. Which resulted in the bottom being extinguished and the top of the wood crib still burning (see Figure 16(left)). After this, a second Flame Away was thrown on the wood crib and the fire was fully extinguished (see Figure 16(right)).


Figure 15: The result of test 23


Figure 16: The result after throwing the first Flame Away (left) and after throwing the second Flame Away (right)

4.3.5 Aiming spot

In test 25, the Flame Away was thrown next to the fire to simulate someone who throws the flame away but misses the middle of the fire. The liquid of the Flame away did spread over the laminate flooring but didn't cover all the fire and a small flame was left burning (see Figure 17).

Figure 17: The result of test 25

In test 26 the Flame Away was thrown in front of the fire to simulate someone who doesn't throw far enough, which makes the Flame Away land in front of the middle of the fire. The fire was completely extinguished after the Flame Away broke on the surface of the laminate flooring.

5. ANALYSIS OF THE TEST RESULTS

The tests of part 1 have been performed on different substrates. These substrates are solid materials on which a fire was started (class A fires) with a diameter of 0.5 or 1 meter. A Flame Away was used on these fires to try to extinguish the fire. In most tests the fires were extinguished completely immediately. In the cases where the fire wasn't extinguished completely, a flame was left burning. In these cases, the Flame away was thrown a little bit too far, so that the liquid of the Flame Away didn't cover all the fire on the front side of the circle. Although the Flame Away didn't extinguish the whole fire, it did reduce the fire substantially. The results of the tests don't show an influence of the substrate on the extinguishment of the fire by the Flame Away, but the aiming spot was an important factor whether a fire was extinguished or not. Aiming not in the middle, but a little bit more to the front of the fire, resulted in better extinguishment of the fire. The liquid of the Flame Away spreads more away from the pitcher than it does towards the pitcher because of the throwing movement of the Flame Away, away from the pitcher. Because of this the liquid might not cover all of the fire when the Flame Away is thrown in the middle of the fire.

After most of the tests the diameter of the liquid of the Flame Away was measured, see Table 7. The average width of the diameter was 1.4 meters and the average length was 1.7 meters, with a minimum width of 1.1 meters and minimum length of 1.2 meters.

Table 7: An overview of the measured diameters of the liquid of the Flame Away

Test	Substrate	Diameter width [m]	Diameter length [m]
4	Laminate flooring	1.4	1.8
5	Laminate flooring	1.4	1.7
7	Softboard	1.3	1.6
8	Softboard	1.1	1.5
9	Softboard	1.5	1.8
10	Softboard	1.2	1.6
11	Softboard	1.2	1.2
12	Softboard	1.2	1.6
13	Softboard	1.2	1.8
14	Rug	1.8	2.0
15	Carpet	1.5	2.2
16	Carpet	1.5	2.2
17	Bath rug	1.5	1.5
23	Wood crib	1.4	1.4
Average		**1.4**	**1.7**
Minimum		**1.1**	**1.2**
Maximum		**1.8**	**2.2**

The tests in part 2 where the Flame Away was thrown hard on the laminate flooring (test 21 and 22), the diameters of the liquid were bigger than the measured diameters in part 1. Although, the liquid on the outer diameter didn't cover the substrate completely and was more divided in splashes. Throwing the Flame Away on the substrate also makes it harder to aim compared to dropping the Flame Away. Test 25 and 26 proved that it is important to aim right for a successful extinguishment. The Flame Away can therefore best be dropped a little bit in front of the middle of the fire rather than throwing the Flame Away hard.

The tests performed on the vertical softboard (test 19 and 20) simulated a vertical surface that's on fire. The Flame away extinguished the fire in both tests immediately. The Flame Away can also be used on vertical surfaces but it is not clear how the Flame Away performs on an uneven surface like a closet or a bookcase.

To simulate an uneven horizontal surface or an object that is on fire, tests 23 and 24 were performed on a wood crib. During test 24 the Flame Away didn't extinguish the fire on the top of the wood crib because de Flame Away broke on the ground and the liquid didn't reach the top part of the wood crib. Whether the Flame Away is able to extinguish an object, depends on geometry of the object and the possibility for the liquid to reach the burning surfaces.

6. CONCLUSIONS

The following research questions were formulated for the investigation:

- Can the Flame Away extinguish a solid material fire with a diameter of 0.5 metres?
- Can the Flame Away extinguish different types of solid material fires (Class A fires)?
- What is the diameter of the liquid, after the use of the Flame Away?

The Flame Away can extinguish a fire with a diameter of 0.5 meter on the tested substrates, when thrown so that the liquid covers the fire completely. When not thrown right, the Flame Away doesn't extinguish the fire completely but still reduces the fire substantially. The right aiming spot is a very important factor for the complete extinguishment of the fire. The liquid of the Flame Away spreads more away from the pitcher than it does towards the pitcher. Throwing the Flame Away not in the middle but more to the front of the fire may lead to a more effective extinguishment.

The flame Away was tested on fires on different types of flooring. The type of substrate (flooring) didn't seem to influence the results of the Flame Away. The Flame Away extinguished the fires on all the used substrates in the tests. The cases where the fires weren't extinguished completely immediately, were caused by the Flame Away not being thrown right and weren't caused by the influence of the substrate.

The average diameter width and length of the liquid, after dropping the Flame Away on different horizontal substrates, was 1.4 and 1.7 meter. The minimum measured diameter width of the liquid was 1.1 meter. The minimum measured diameter of the length of the diameter was 1.2 meter.

7. COMMENTS

- This test report may only be read, used and published in its entirety. This report consists of 17 pages;
- The tests were performed without an available test standard, because the product is not covered by the category of portable fire extinguishers;
- This test report only displays the results of the tests performed with the product under test conditions and is therefore not a certificate, type approval or similar statement that guarantees the operation in practice.

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