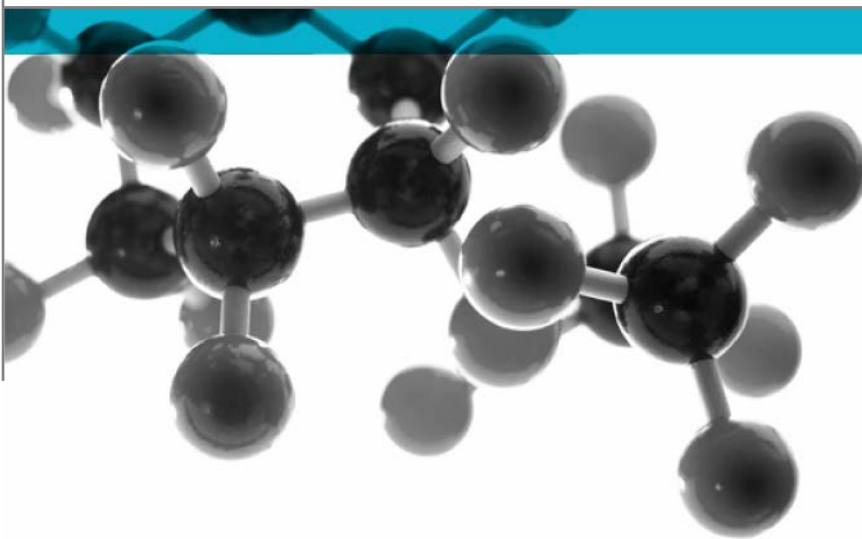


# UL 94: 2013 ANSI/UL 94: 2018



## Vertical Burning Test For Classifying Materials V-0, V-1 Or V-2

A Report To: Photocentric Ltd

Document Reference: 537704

Date: 22 November 2023

Issue: 1

Page 1



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## Executive Summary

**Objective** To determine the performance of the following material when tested in accordance with Section 8 - "50W (20mm) Vertical Burning Test for Classifying Materials V-0, V-1 or V-2" of UL 94: 2013 ANSI/UL 94: 2018 - 'Test for Flammability of Plastics Materials for Parts in Devices and Appliances'.

| Generic Description   | Product reference | Thickness | Density               |
|---|-------------------|-----------|-----------------------|
| (Meth)acrylate based 3D printable photocurable resin  | "Rigid DLFR"      | 3mm       | 1.18g/cm <sup>3</sup> |
| <b>Please see page 5 of this test report for the full description of the product tested</b> |                   |           |                       |


**Test Sponsor** Photocentric Ltd, Titan House, 20 Titan Drive, Peterborough, PE1 5XN

**Test Results:** When the test results are assessed using the test criteria specified in the Standard, the material, when tested at a nominal thickness of 3mm, is classified as "V-0".


An uncertainty of measurement estimation has been conducted in relation to the duration of flaming and glowing. The findings are as detailed in Test Results section of this report.

**Date of Test** 02 November 2023

## Signatories



Responsible Officer  
D. Roberts \*  
Testing Officer



Authorised  
C. Jacques \*  
Senior Technical Officer

\* For and on behalf of [Warringtonfire](#).

Report Issued: 22 November 2023

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## Test Details

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|                                    |  |
|------------------------------------|--|
| <b>Purpose of test</b>             | To determine the flammability of a plastics material when it is tested in accordance with the test procedure specified in Section 8 – “50W (20mm) Vertical Burning Test for Classifying Materials V-0, V-1 or V-2” of UL 94: 2013 ANSI/UL 94: 2018 - ‘Test for Flammability of Plastics Materials for Parts in Devices and Appliances’.  |
| <b>Scope of test</b>               | <p>The requirements of UL 94: 2013 ANSI/UL 94: 2018 cover plastics materials and are intended to serve as a preliminary indication of their suitability with respect to flammability for a particular application. The requirements may be applied to other non-metallic materials, if found to be appropriate.</p> <p>The final acceptance of a material by the Underwriter's Laboratories Inc. is dependent upon its use in complete equipment which conforms with the Standards applicable to such equipment.</p> |
| <b>Fire test study group/EGOLF</b> | Certain aspects of some fire test specifications are open to different interpretations. The Fire Test Study Group and EGOLF have identified a number of such areas and has agreed Resolutions which define common agreement of interpretations between fire test laboratories which are members of the Groups. Where such Resolutions are applicable to this test they have been followed.   |
| <b>Instruction to test</b>         | The test was conducted on the 02 November 2023 at the request of Photocentric Ltd, the sponsor of the test.  |
| <b>Provision of test specimens</b> | The specimens were supplied by the sponsor of the test. <a href="#">Warringtonfire</a> was not involved in any selection or sampling procedure. The results stated in this report apply to the sample as received.   |
| <b>Conditioning of specimens</b>   | <p>The specimens were received on the 10 October 2023.</p> <p>Five specimens were conditioned for at least 48 hours at a temperature of <math>23 \pm 2^{\circ}\text{C}</math> and a relative humidity of <math>50 \pm 5\%</math> prior to testing.</p> <p>Five specimens were conditioned in a circulating air oven for 168 hours at <math>70 \pm 1^{\circ}\text{C}</math> and were then cooled in a desiccator, over anhydrous calcium chloride, for at least four hours at room temperature prior to testing.</p>  |

## Description of Test Specimens

The description of the test specimens is detailed in below. Prior to conducting the test, Warringtonfire verified the conformity of the test specimens with the description of the test specimens provided by the sponsor. This verification consisted of the following:

1. Where possible, the construction of the test specimens was checked to ensure that it matched the description of the test specimens provided by the sponsor.
2. Where possible, the thickness, weight per unit area and density measurements of the test specimens were checked to ensure that they matched the description of the test specimens provided by the sponsor. Warringtonfire ensured that the measurements were within the manufacturing tolerances stated by the sponsor or within a tolerance of  $\pm 10\%$  in the absence of a manufacturing tolerance.

Any areas of discrepancy identified by Warringtonfire during the verification process were resolved with the sponsor prior to starting the test.

Unless otherwise specified:

- The information including measurements was provided by the test sponsor.
- All measurements taken by Warringtonfire or the sub-contract laboratory as part of the verification process are clearly identified.
- Where a measurement is listed without a verification measurement by Warringtonfire or sub-contract laboratory, this indicates that it was not possible for that measurement to be verified and the information supplied by the sponsor has to be relied on.

|  |  |
|--|--|
| Generic type                               | (Meth)acrylate based 3D printable photocurable resin   |
| Product reference                          | "Rigid DLFR"   |
| Name of manufacturer                       | Photocentric Ltd   |
| Thickness                                  | 3mm (stated by sponsor)<br>2.84mm (determined by Warringtonfire)   |
| Density                                    | 1.18 g/cm <sup>3</sup> (stated by sponsor)<br>1.34g/cm <sup>3</sup> (determined by Warringtonfire)   |
| Colour                                     | Black  |
| Flame retardant details                    | <b>See Note 1 below</b>  |
| Brief description of manufacturing process | The resin is added into either our 3D printer or a 3 <sup>rd</sup> part 3D printer and printed using the required settings. Following this, the parts were post processed by washing in suitable solvent and post curing in a heated UV system (Cure L2) for at least 2 hours. |

**Note 1: The sponsor of the test has provided this information but at the specific request of the sponsor, these details have been omitted from the report and are instead held on the confidential file relating to this investigation.**

## Test Results

**Test procedure** Each specimen was tested in accordance with the test method specified in the Standard and the following points were observed and recorded for each specimen.

- A - Duration of flaming after first flame application ( $\pm 0.6$  seconds).
- B - Duration of flaming after second flame application ( $\pm 0.8$  seconds).
- C - Duration of glowing after second flame application ( $\pm 0.8$  seconds).
- D - Whether or not the specimens burn up to the holding clamp.
- E - Whether or not the specimens drip flaming particles which ignite cotton swatch.

**Results** The following results were recorded for the ten specimens tested. The letters correspond with those listed under 'Test Procedure'.

The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor  $k=2$ , providing a coverage probability of approximately 95%. The uncertainty evaluation has been carried out in accordance with UKAS requirements.

**Specimens conditioned at a temperature of  $23 \pm 2^\circ\text{C}$  and a relative humidity of  $50 \pm 5\%$ .**

| Specimen No. | A   | B   | C   | D  | E  |
|--------------|-----|-----|-----|----|----|
| 1            | Nil | 1   | Nil | No | No |
| 2            | Nil | Nil | Nil | No | No |
| 3            | Nil | 1   | Nil | No | No |
| 4            | 1   | Nil | Nil | No | No |
| 5            | Nil | Nil | Nil | No | No |

**Specimens conditioned at a temperature of  $70 \pm 1^\circ\text{C}$  for 168 hours.**

| Specimen No. | A   | B   | C   | D  | E  |
|--------------|-----|-----|-----|----|----|
| 1            | Nil | 1   | Nil | No | No |
| 2            | Nil | Nil | Nil | No | No |
| 3            | Nil | Nil | Nil | No | No |
| 4            | Nil | Nil | Nil | No | No |
| 5            | Nil | Nil | Nil | No | No |

## Conclusion

When the test results are assessed using the test criteria specified in the Standard, the material, when tested at a nominal thickness of 3mm, is classified as “V-0”.

An uncertainty of measurement estimation has been conducted in relation to the duration of flaming and glowing. The findings are as detailed in Test Results section of this report.

The classification requirements can be found in Appendix 1.

## Applicability of test results

The test results relate only to the behaviour of the test specimens of the product under the particular conditions of test; they are not intended to be the sole criterion for assessing the potential fire hazard of the product in use.

The test results relate only to the specimens of the product in the form in which they were tested. Small differences in the composition or thickness of the product may significantly affect the performance during the test and may therefore invalidate the test results. Care should be taken to ensure that any product which is supplied or used is fully represented by the specimens which were tested.

## Validity

The specification and interpretation of fire test methods are the subject of ongoing development and refinement. Changes in associated legislation may also occur. For these reasons it is recommended that the relevance of test reports over five years old should be considered by the user. The laboratory that issued the report will be able to offer, on behalf of the legal owner, a review of the procedures adopted for a particular test to ensure that they are consistent with current practices, and if required may endorse the test report.

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## Appendix 1 – Classification Criteria

| Criteria conditions  | V-0  | V-1   | V-2   |
|--|------|-------|-------|
| Afterflame time for each specimen $t_1$ or $t_2$   | ≤10s | ≤30s  | ≤30s  |
| Total afterflame time for any condition set ( $t_1$ plus $t_2$ for the 5 specimens)                          | ≤50s | ≤250s | ≤250s |
| Afterflame plus afterglow time for each individual specimen after the second flame application ( $t_2+t_3$ ) | ≤30s | ≤60s  | ≤60s  |
| Afterflame or afterglow of any specimen up to the holding clamp  | No   | No    | No    |
| Cotton indicator ignited by flaming particles or drops   | No   | No    | Yes   |

If only one specimen from a set of five specimens does not comply with the requirements, another set of five specimens is to be tested. In the case of the total number of seconds of flaming, an additional set of five specimens is to be tested if the totals are in the range of 51-55 seconds for V-0 and 251-255 seconds for V-1 and V-2. All specimens from this second set shall comply with the appropriate requirements in order for the material in that thickness to be classified V-0, V-1 or V-2.



## Revision History

|                      |                |
|----------------------|----------------|
| Issue No:            | Re-issue Date: |
| Revised By:          | Approved By:   |
| Reason for Revision: |                |

|                      |                |
|----------------------|----------------|
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| Reason for Revision: |                |