Technical Datasheet

Rigid UVFR

UV Resin

Photocentric

Rigid UVFR

UL 94 V-0 (2mm) certification

HDT (Low – High)

100%

Compatible Printers

UV LCD & DLP 3D Printers

Liquid Crystal OPUS

Colour

Black

Available in 1kg bottles

Industrial IEC 3phase plug housing

Rigid UVFR is Photocentric's first UV Flame Retardant resin with UL 94 V-0 certification, even showing self-extinguishing properties in the green state. Combined with an exceptionally high HDT and high tensile modulus, it is ideal for 3D parts in industries such as aerospace, automotive and railway. Rigid UVFR is halogen free, has an excellent smoke gas toxicity rating and it is easy to print and process due to its low viscosity. Printed parts exhibit a high level of detail and dimensional accuracy, making it the perfect choice for connectors and fittings for both consumer and industrial applications.

Optimised for:

- Electrical and electronic enclosures and connectors
- Battery housings
- High power electrical applications
- Suitable for interior parts in industries like automotive, aerospace, railway, appliances, medical and furniture.

Revision 1
19/03/2024

Unique features:

- UL 94 V-0 (2mm) V-1 (1.5mm)
- Incredible heat resistance HDT >250°C
- Low viscosity
- Superior level of detail and dimensional accuracy
- Halogen free with an excellent smoke and toxicity rating
- TPO Free

Rigid UVFR Properties

Tensile Properties	Green	UV*	UV + Anneal**	Standard
Tensile Modulus	1090 MPa	4170 MPa	4440 MPa	ASTM D638
Ultimate Tensile Strength	32.1 MPa	74.7 MPa	75.5 MPa	ASTM D638
Elongation at break	16%	2.3%	2.1%	ASTM D638
Flexural Properties		**Typical Values (UV*)**		**Standard**
Flexural Modulus		3400 MPa		ASTM D790
Flexural Strength		115 MPa		ASTM D790
Impact Properties		**Typical Values (UV*)**		**Standard**
Impact Strength Notched Izod		22 J/m		ASTM D256
Unnotched Izod (23°C)		176 J/m		ASTM D256
Notched Charpy (Machined, 23°C)		0.9 kJ/m2		ISO 179-1
Thermal Properties		**UV***	**UV + Anneal****	**Standard**
Heat Deflection Temperature (@ 0.45 MPa)		255°C	280°C	ASTM D648
Heat Deflection Temperature (@ 1.82 MPa)		86°C	152°C	ASTM D648
Glass Transition Temperature (DMA, tan(d))		175°C	-	ASTM D4065
Degradation Temperature (TGA, 5% mass loss, air)		330°C	-	ISO 11358
Fire, Smoke, Toxicity (FST) Properties				**Standard**
Flammability		V-0 (3.0 mm) V-0 (2.5 mm) V-0 (2.0 mm) V-1 (1.5 mm)		UL 94
Fire Classification Railway (R22)		Compliant to HL1 (2.0 mm, 2.5 mm)		DIN EN 45545-2
Fire Classification Railway (R23, R24)		Compliant to HL1 (2.0 mm, 2.5 mm)		DIN EN 45545-2
Smoke Generation and Density		Ds (4) < 600 VOF4 < 1200 D_s (max) < 600 (2.0 mm, 2.5 mm)		ISO 5659-2
Limiting Oxygen Index		LOI ≥ 28.0		ISO 4589-2
Smoke Gas Toxicity		CITNLP: 0.36		NF X70-100
Glow-wire Test		GWIT: 825 °C GWIF: 960 °C		IEC 60695-2-12/-13 (2.1mm)

* Post cured for 2 hrs at 60 °C in Photocentric Cure M+.
**Some mechanical and thermal properties can get improved by thermal annealing. Post cured for 2 hrs at 60 °C in Photocentric Cure M+, thermally annealed for 3h at 150 °C.

We are constantly reviewing and improving our range of high-performance materials.
For the very latest information, please visit the Photocentric website

Advanced Thermal Properties	Typical Values (UV*)	Standard
C.T.E (-40 °C to 0 °C)	49 µm/(m·K)	ASTM E831
C.T.E (0 °C to 50 °C)	81 µm/(m·K)	ASTM E831
C.T.E (50 °C to 100 °C)	137 µm/(m·K)	ASTM E831
C.T.E (100 °C to 150 °C)	111 µm/(m·K)	ASTM E831
Dielectric/Electric Properties	**Typical Values (UV*)**	**Standard**
Electrical Strength	31 kV/mm	DIN EN 60243-1
Volume Resistivity	2.20E+13 Ωcm	DIN EN 62631-3-1
Surface Resistivity	4.50E+13 Ω	DIN EN 62631-3-2
Comparative Tracking Index, CTI)	600 V	DIN EN 60112
Other	**Typical Values (UV*)**	**Standard**
Shore Hardness	92 Shore D	ASTM D2240
Water Absorption, Short Term (24 hours)	0.43 %	ASTM D570
Water Absorption, Medium Term (72 hours)	0.75 %	ASTM D570
Water Absorption, Long Term (168 hours)	1.22 %	ASTM D570
Viscosity	680 cPs	At 25°C Brookfield spindle 3
Liquid Density	1.21 g/cm3	Internal
Printed Part Density	1.32 g/cm3	Internal
Storage	10<T>50°C	

* Post cured for 2 hrs at 60 °C in Photocentric Cure M+.
**Post cured for 2 hrs at 60 °C in Photocentric Cure M+, thermally annealed for 3h at 150 °C.

Test Report

BASF SE, PMD/EX - H202, D-67056 Ludwigshafen

Tester: Miriam Miedreich	Phone: 0621-60-41868	Date of order: 2023-10-24
Order no.: 0 -E039/GK	SAP: 40357409	AVS no.: 2304644
	Preparation: Anlief.	PDF no.: 379

Flame testing
Flammability V acc. to UL 94 : 2023

Information about test procedure and test specimens

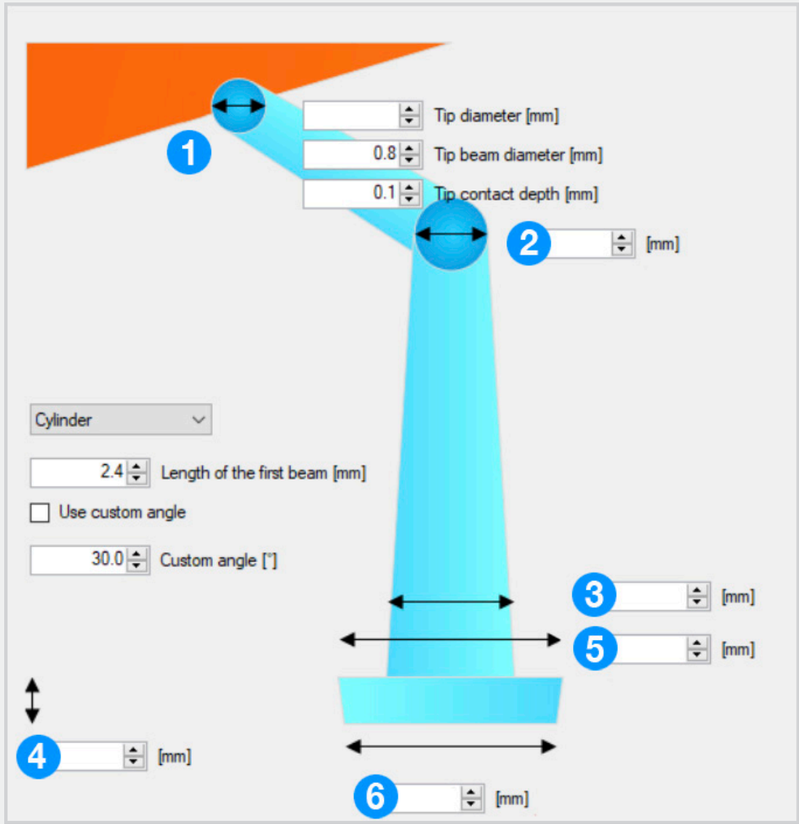
M 0 0324			Measurements & observations										
			1st flame application, 10 s				2nd flame application, 10 s						Classification
Dimensions of test specimens 127 * 12,7 * d mm³			After flame time t1s	Cotton indicator ignited	Burning up to holding clamp?	Obser-vations	After flame time t2(s)	Cotton indicator ignited	Burning up to holding clamp?	Obser-vations	Afterflame & Afterglow time t2 + t3 (s)	Total Afterflame time t1 + t2 (s)	
Requirements			≤ 10 ≤ 30 ≤ 30	no no yes	no no no	- - -	≤ 10 ≤ 30 ≤ 30	no no yes	no no no	- - -	≤ 30 ≤ 60 ≤ 60	≤ 50 ≤ 250 ≤ 250	= V-0 = V-1 = V-2
Pre-conditioning	Spec n°.	Thickn (mm)	Abbrev.: A=dripping parts, K=edge-burning, T=dripping parts, R=rolls up										
Conditioning chamber (2d / 23° / 50%)	1 2 3 4 5	2.01 1.99 2.00 2.00 1.96	10 1 2 1 0	No No No No No	No No No No No		1 4 4 3 5	No No No No No	No No No No No		1 4 4 3 5	31	V-0
			First test: 2022-05-10 16:07 - 2022-05-10 16:12										
Drying oven (7d / 70°C)	1 2 3 4 5	2.01 1.99 2.01 1.98 2.01	1 1 1 11 1	No No No No No	No No No No No		4 2 1 4 4	No No No No No	No No No No No		4 2 1 4 4	30	V-1
			First test: 2022-05-16 10:12 - 2022-05-16 10:19										
Conditioning chamber (2d / 23° / 50%)	1 2 3 4 5												
			Repeated test										
Drying oven (7d / 70°C)	1 2 3 4 5	2.05 1.98 2.10 1.99 1.98	1 1 1 1 1	No No No No No	No No No No No		3 3 2 3 3	No No No No No	No No No No No		3 3 2 3 3	19	V-0
			Repeated test: 2023-11-02 14:46 - 2023-11-02 14:51										V-0 @ 2.0 mm

Design & Print Orientation Consideration Parameters

Printed on Photocentric LC Opus (100 µm layer height)

Properties	Parameters
Minimum feature size (pins)	0.5 mm
Minimum hole diameter	0.8 mm
Minimum slot thickness	0.6 mm
Minimum wall thickness	0.4 mm
Overhangs	Successful for overhangs < 60°
Delamination (unsupported)	Not visible for overhangs ≤ 2 mm
Delamination (between walls)	Not visible for overhangs ≤ 4 mm

Recommended Support Parameters & Orientation



These are recommended support settings in relation to a UV LCD printer with 81µm XY resolution.

	Large Models		Small Models	
Diagram Ref. Nr	Parameters	Values	Parameters	Values
-	Density (%)	70	Density (%)	70
1	Tip Diameter (mm)	0.8	Tip Diameter (mm)	0.8
-	Critical Build Angle (°)	47	Critical Build Angle (°)	47
2	Pole Diameter (mm)	2	Pole Diameter (mm)	2
3	Pole Widening Factor	1.5	Pole Widening Factor	1.5
-	Model Height from Base (mm)	10	Model Height from Base (mm)	10
4	Height of Support Foot (mm)	2	Height of Support Foot (mm)	2
5	Top of Foot Diameter (mm)	7	Top of Foot Diameter (mm)	7
6	Bottom of Foot Diameter (mm)	5	Bottom of Foot Diameter (mm)	5

Recommended orientation around all axes is 45 °.

Printer and Resin Profilling

Photocentric UV Printers

To print with Photocentric UV printers, choose 'Rigid UVFR' and the desired layer thickness when preparing your print file in Photocentric Studio.

3rd Party UV Printers

- Photocentric UV high-performance resins have been formulated to be compatible with a wide range of 3rd Party Printers. This list is continually updated, for the most up-to-date information, please visit our UV Resin Compatibility Page. All resins are functional at a wavelength of 385-405 nm.
- Please see below instruction on how to calculate appropriate exposure time with regards to your 3rd party UV printer and purchased resin

Layer Exposure Guidelines

This guide will assist you in establishing a layer exposure time for a desired resin and layer thickness based on the characteristics of Photocentric's UV Resin range and your UV 3D printer.

Each resin requires a specific energy (Ec) to cure a certain layer thickness (Dp). 'Energy' is defined by multiplying 'light output intensity' of your printer and a 'given time of exposure'. The equation below simply explains the matter.

Energy [mJ/cm²]= Light Output Intensity [mW/cm²] x Exposure Time [s]

Your UV 3D printer manufacturer will provide you with light output intensity value.

Layer Thickness (µm)	25	50	100
A UV 3D printer with 5mW/cm2 light output intensity	-	-	4 sec
Ec (mJ/cm2)	19		
Dp (µm)	140		

Bear in mind the exposure time vs energy is not a linear trend, and this data is intended strictly as a guideline. Settings may need to be further optimised to suit each printer.

Pre-Print Instructions

1. To print on Photocentric LC Opus, choose 'Rigid UVFR' and the desired layer thickness when preparing the print file in Photocentric Studio.
2. Warm the resin to 60 °C for 5 hours, or until the resin is fully liquified in the bottle. Failure to do so prior to printing may lead to the resin crystalising, resulting in print failures.
3. Shake the resin bottle for up to 2 minutes before pouring into the printer vat.

Post-Print Instructions

1. It is recommended to drain and clean the vat after printing if ambient temperatures are below 23 °C.
2. Place the platform into the Photocentric Wash 15 unit, and wash printed parts for up to 10 minutes in Photocentric Resin Cleaner 30.
3. Rinse printed parts thoroughly in warm water for up to 2 minutes.
4. Dry well with compressed air to remove any remaining water. Alternatively, leave to dry naturally until no water is present.
5. Cure for 2 hours at 60 °C in Cure M+.
6. Parts can be thermally shocked from the platform using very cold water when the platform is still warm from the curing process.

Thermal Annealing

To thermally anneal printed parts, place them on a suitable tray in a thermal oven using the following procedure:

	Thermal Oven	
Ramp-up Phase	2 hours	30°C to 150°C (1°C/min)
Holding Phase	3 hours	150°C
Ramp-down Phase	2 hours	150°C to 30°C (1°C/min)

Photocentric

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