

PTR **PRELIMINARY
 TECHNICAL
 REPORT**

2-pack via hole fillers
 of the series

ELPEMER® VF 2467



Basis: Novolak epoxy photo polymer

- application by means of screen printing
- photoimageable
- aqueous-alkaline developable
- compatible with solder resists of the ELPEMER® 2467 series
- after printing of the via hole filler and a flash-off phase the subsequent processing is effected together with the solder resist
- best flame class UL 94 V-0, Approbation No. File E 80315, registered trade mark of Underwriters Laboratories Inc., Northbrook, Illinois

This preliminary technical report is valid for the following adjustments:

- **VF 2467 DG**
- **VF 2467 LYG**

Indices: **VF** = via hole filler
DG = dark-green
LYG = light-yellow-green

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Please read this preliminary technical report and the material safety data sheet according to EEC 91/155 carefully before using the product.

1. General information

The photoimageable via hole fillers of the series **ELPEMER® VF 2467** are applied by means of screen printing to close via holes. The photoimageable solder resist is applied directly after a flash-off time. There is a good compatibility with our aqueous-alkaline developable solder resists of the **ELPEMER® 2467** series. The further processing – pre-drying, exposure, development and final curing is effected together with the solder resist.

2. Application

The photoimageable via hole fillers of the series **ELPEMER® VF 2467** are used in order to

- fill via holes and thus avoid solder seeping through to the component side
- ensure via holes are sealed for vacuum adaptation during incircuit testing
- avoid flux residues settling in the holes and forming critical microclimates in the holes and/or under components.

The advantage of a photoimageable via hole filler is that there is no impairment of the resolution even in case of a high integration density. It is possible to fill a via hole that is very close to the soldering area (e.g. SMD pad). The application of the solder resists of the **ELPEMER® 2467** series without prior drying of the via hole fillers of the series **ELPEMER® VF 2467** and the excellent compatibility of both systems prevent the occurrence of a nail head due to exuding via hole filler.

When optimally processed, particularly as regards curing (see also Item 8 “Drying/curing”), via holes can be reliably filled with the via hole fillers of the series **ELPEMER® VF 2467** as their high solids content prevents the risk of solvent inclusions or incompletely filled via holes due to very high volume shrinkage.

3. Special notes

To complement the process parameters indicated in this preliminary technical report you will find further and detailed information and notes that need to be observed to achieve an optimum processing result in the **Application Information** sheet **AI 2/1** “Processing information for the photoimageable solder resists of the series **ELPEMER® 2467**, **ELPEMER® 2469** and **ELPEMER® 2463 FLEX**“. In our report manual the **Application Information** sheet **AI 2/1** is filed under group 2. On our report manual CD and on our web-site you will find application information sheets in the “Service” section.

The via hole fillers of the series **ELPEMER® VF 2467** can be used within a temperature range of -40 up to +155 °C [-40 up to 311 °F] while in the case of some applications the material's performance can be negatively affected at the lower and upper ends of this range. In these instances, additional pre-trials and tests are necessary. The maximum hole diameter of the via holes to be filled is approx. 0.5 mm.

To create very plane, metallisable hole fillings, as for instance for SBU technology, plugging pastes are available that can be applied by means of screen printing (**PP 2795-SD**) or roller coating (**PP 2795**). They are solvent-free 1-pack systems that can be processed bubble-free and are distinguished by a good adhesion, grindability and metallisability.

Special technical reports on these products are available upon request. In our report manual these technical data sheets are filed under group 2. On our report manual CD you will find technical reports in the “Products” section.

4. Safety recommendations

- Please read our material safety data sheet according to EEC 91/155 where you will find detailed specifications of safety precautions, environmental protection, waste disposal, storage, handling, transport as well as other characteristics.
- When using chemicals, the common precautions should be carefully noted.

5. Characteristics


	VF 2467 DG	VF 2467 LYG
Solids content , ISO 3251 (1 h/125 °C [257 °F], 1 g weighed quantity)	74 ± 2% by weight	78 ± 2% by weight
Viscosity of mixture at 20 °C [68 °F] ISO 3219	23 000 ± 2 000 mPas	25 000 ± 2 000 mPas
Density 20 °C [68 °F] , ISO 2811-1 Component A Component B Mixture	1.43 ± 0.05 g/cm ³ 1.24 ± 0.05 g/cm ³ 1.39 ± 0.05 g/cm ³	1.43 ± 0.05 g/cm ³ 1.24 ± 0.05 g/cm ³ 1.39 ± 0.05 g/cm ³
Pot life of mixture (at room temperature; approx. 18 – 23 °C [64.4 – 73.4 °F]; avoid solar and light radiation, yellow light or yellow filters are recommended)	at least 72 hours	at least 72 hours

* measured Haake RV 20, PK1/1°, D = 50 s⁻¹,
viscosity measuring unit supplied by:
Thermo Electron (Karlsruhe) GmbH (formerly Haake-Messtechnik GmbH + Co)
Dieselstraße 4, 76227 Karlsruhe, Germany
Phone +49 (0) 721 - 40 94 - 0
Fax +49 (0) 721 - 40 94 - 300
www.thermo.com

6. Properties

The via hole fillers of the series **ELPEMER® VF 2467** are distinguished by the following properties:

6.1 General properties

- high productivity due to short process times, since further processing can be executed together with the solder resist
- safe filling of plated-through holes
- their high solids content and slight thixotropy ensure optimum printing properties
- very good resistance to galvanic and electroless Nickel/Gold and electroless tin processes
- with a solder bath resistance of 20 s at 288 °C [550.4 °F] acc. to UL 94 fulfil the required temperature resistance during lead-free soldering processes
- excellent permanent temperature resistance at 150 °C [302 °F]
- best flame class UL 94 V-0, Approbation No. File E 80315; registered trade mark of  Underwriters Laboratories Inc.; Northbrook, Illinois 60062
- free of halogenated flame retardants
- do not contain any substances listed in the RoHS directive 2002/95/EC on the Restriction of the use of certain Hazardous Substances in electrical and electronic equipment [lead, mercury, cadmium, hexavalent chromium, polybrominated biphenyl (PBB) and/or polybrominated diphenylether (PBDE)].

6.2 Physical and mechanical properties

The following values refer to **ELPEMER® VF 2467 LYG**. The values of the other adjustment are almost in the same range.

Property	Test method	Result
Adhesion	IPC-SM-840 C, 3.5.2.1	class H and T
Resistance to solvents/cleaning agents	IPC-SM-840 C, 3.6.1 Isopropanol Isopropanol : water (75 : 25)	passed passed
Resistance to solvents	test boards, dipped in methylene chloride (dichloromethane), 30 min at room temperature	No swelling
Solder bath resistance	IPC-SM-840 C, 3.7.2 MIL - P 55 110 D UL 94	passed: 10 s at 265 °C [509 °F] passed: 10 s at 288 °C [550.4 °F] passed: 20 s at 288 °C [550.4 °F]
Thermal class	based on DIN IEC 60 085	F = 155 °C [311 °F]

* With a solder bath resistance of 20 s at 288 °C [550.4 °F] the via hole fillers of the series **ELPEMER® VF 2467** fulfil the required temperature resistance for lead-free soldering.

6.3 Electrical properties

The following values refer to **ELPEMER® VF 2467 LYG**. The values of the other adjustment are almost in the same range.

Property	Test method	Result
Dielectric strength	VDE 0303, part 21 IPC-TM-650, 2.5.6.1	160 - 190 kV/mm
Surface resistance	VDE 0303, part 30 DIN IEC 93	2×10^{14} Ohm
Volume resistivity	VDE 0303, part 30 DIN IEC 93	6×10^{15} Ohm x cm
Moisture and insulation resistance	IPC-SM-840 C, 3.9.1	class H and T
Comparative Tracking Index (CTI)	DIN IEC 60 112, in connection with VDE 0110, part 3 on base material with CTI 250	CTI 250*

* Among others, the CTI value of the coating also depends on the tracking resistance of the base material. The CTI value of the base material is maintained with the 2-pack via hole fillers of the series **ELPEMER® VF 2467**.

Note:

Optimum electrical insulation values can only be achieved when all flux residues are removed thoroughly from the pcb after HAL.

7. Processing

The via hole fillers of the series **ELPEMER® VF 2467** are applied by means of screen printing.

7.1 Mixing

The components are mixed together in the following ratio:

Component A : Component B = 4 : 1 (parts by weight).

Both components are already packed in the correct mixing ratio. The volume of the container of component A is sufficiently large to accommodate the entire quantity of component B and allow for perfect mixing.

→ Mix both components in the indicated mixing ratio.

For stirring we recommend mechanical stirring tools. For more detailed information on correct mixing please read our **Technical Information** sheet **TI 15/10 "Processing of 2-pack systems"**. We will gladly provide you with this technical information sheet upon request. In our report manual, this Technical Information sheet is filed under group 15. On our report manual CD and on our website you will find technical information sheets in the "Service" section.

7.2 Adjustment of viscosity

The 2-pack via hole fillers of the series **ELPEMER® VF 2467** are adjusted in such a manner that they can normally be processed in the condition supplied. If necessary, their viscosity can be reduced for processing purposes by adding the thinner **V 2467-SD**.

7.3 Auxiliary products

We recommend the following auxiliary products for the **ELPEMER®** process:

- **Cleaning and deoxidising agent HP 5625 for conveyerised spraying units**
for the pre-treatment of Cu pcbs prior to ink/resist application, deoxidises and degreases without copper degradation; minimum foaming.
- **Screen opener HP 5200**
The screen opener **HP 5200** is a highly active spray for dissolving dried screen printing inks immediately and safely from clogged screens. **HP 5200** is silicone-free and does not contain oils or oily substances, so that no smearing occurs.
- **Anti-Static Spray HP 5500**
The anti-static spray **HP 5500** prevents and eliminates any static charge that occurs during screen printing. **HP 5500** is silicone- and grease-free.
- **Special stripper HP 5707**
in its concentrated form **HP 5707** can be used to remove exposed and possibly cured photoimageable solder resists (e.g. in case of mis-exposures); diluted with water it is also suitable for cleaning ink developer and resist stripping units.
- **Defoamant HP 5911**
for fast and safe defoaming of aqueous-alkaline developing media, silicone-free, completely biologically degradable, quantity to be added 0.02 up to 0.05%
- **Cleaning agents R 5899, R 5821 and R 5817**
The cleaning agent **R 5899** does not have to be marked according to German dangerous goods regulations and can be handled simply and safely. Owing to its high flash point ($> 100\text{ °C}$ [$> 212\text{ °F}$]) it is especially suitable for use in screen washing equipment. The cleaning agent **R 5899** is particularly distinguished by a low vapour pressure ($< 0.1\text{ hPa}$ at 20 °C [68 °F]) and thus is not affected by the EU-VOC regulation 1999/13/EG which judges solvents by their percentage of volatile organic compounds (VOC = volatile organic compounds).
Furthermore, the cleaning agent **R 5821** is available which, owing to its high flash point of $+32\text{ °C}$ [89.6 °F], is also suitable for use in screen washing equipment as well as for cleaning work tools. For the manual cleaning of screens and tools we recommend our cleaning agent **R 5817** with its fast and thorough cleaning properties.



Do not use cleaning agent as a thinner or for washing hands since solvents remove the natural grease from skin.

Special technical reports for these products are available upon request. Further information regarding the content and consequences of the EU-VOC regulation can be found in our **technical information sheet TI 15/110 E "EU-VOC regulations – Content and consequences for the PCB industry"**. In our report manual these technical publications are filed under group 5 and 15. On our report manual CD you will find technical reports in the "Products" section and technical information sheets in the "Service" section.

7.4 Screen printing

→ Ensure that the via hole fillers of the series **ELPEMER® VF 2467** are printed into clean, dry, grease- and oxide-free via holes.

Recommended screen printing parameters

Screen fabric	steel fabric: - 224/100 (80 mesh standard screen) - 245/65 - 265/50 for initial orientation tests a 35 – 43 T polyester screen is also acceptable
Screen printing stencil	voids in the fabric > hole diameter (about 0.1 – 0.2 mm larger, depending on size of the printing format) A high stencil build-up is not necessary because the ink should be printed into the drill holes only. As a rule it is sufficient to close the screen mesh with a thin coat of emulsion or a thin capillary film.
Snap-off	as low as possible
Flooding squeegee	rubber squeegee
Squeegee	75 Shore A, squeegee profile: 30-45°
Squeegee angle	90°
Squeegee pressure	4 bar
Printing speed	as slow as possible
Printing underlay	thickness of approx. 3 mm, base material that was drilled with the same drill program but where the diameters of the holes are five times the size of the actual via holes. (The printing underlay enables the filling of the holes since there are no air resistances under the holes.) An undergrid would also be acceptable provided it does not permit the printing substrate to spring.

8. Drying/curing

8.1 Flash-off

After printing of the via hole fillers of the series **ELPEMER® VF 2467** and a flash-off time of max. 10 min at room temperature the photoimageable solder resist must be applied **directly**.

8.2 Curing

The further processing and final curing is effected together with the solder resist. The curing conditions also depend upon the applied quantity of via hole filler.

→ Perform pre-trials to determine the optimum curing parameters. If possible adjust a ramp-formed curing curve in order to expel any entrapped solvent residues, e.g.:

1 - 3 h at 110°C [230 °F], followed by the standard final curing of 1 h at 150°C [302 °F] (object holding time*).

* object holding time: The curing time is measured from the point when panels reach the curing temperature.

9. Standard packaging

The via hole fillers of the series **ELPEMER® VF 2467** are packed for delivery as follows:

	Component A	Component B	Selling unit
VF 2467 DG	10 buckets of 4.8 kg	10 tins of 1.2 kg	60 kg
	10 buckets of 0.8 kg	10 tins 0.2 kg	10 kg
VF 2467 LYG	10 tins of 0.8 kg	10 tins of 0.2 kg	10 kg

The thinner **V 2467-SD** is available in cans of 25 kg.

Partial lots of a selling unit may be ordered but will entail surcharges to cover repackaging costs.

10. Storage

In a cool dry place sealed original containers can be stored for at least 9 months. For warehousing reasons, isolated cases may occur where the shelf life upon shipment is less than the shelf life indicated in this preliminary technical report. However, it is ensured that our products have **at least** two-thirds of their shelf life when they leave our company.

In accordance with ISO 9001, labels on containers show expiry dates.



Storage temperatures below +5 °C [41 °F] and above +25 °C [77 °F] as well as moisture and frost affect the storage stability. Protect the open containers from solar and light radiation since these are light-sensitive systems.

11. Further literature/ Technical publications

In addition to the recommendations given in this technical report, we can provide technical papers and information sheets written and compiled by members of our staff. A list of the technical publications available can be found in **TI 15/101 E** (technical papers) and **TI 15/100 E** (technical information sheets).

In our report manual all technical information sheets (**TI's**) are filed under group 15. Alternatively, visit our website at <http://www.peters.de> or click on the "Service" section on our report manual CD.

12. Further products for the production of pcbs

We offer a wide range of **etch resists (photoimageable, UV curing, conventional curing), plating resists, solder resists (photoimageable, UV curing, conventional curing) as well as peelable solder masks, marking inks (photoimageable, UV curing, conventional curing), carbon-conductive inks, via hole fillers (purely thermal curing), thick film fillers, plugging pastes, heatsink pastes, special strippers for solder resists and further auxiliary products for screen printing (e. g. cleaning agents, thinners).**

Special technical reports are also available for these products and can be provided on request. On our report manual CD you will find technical reports in the "Products" section.

13. Further products for the electronics/ electrical engineering industries

For the production and processing of assembled printed circuit boards and for electrical engineering we recommend the following products:

- **ELPEGUARD conformal/permanent coatings**
Protective lacquers for assembled PCBs on the basis of polyurethane, polyacrylic, epoxy and silicone resins, water-thinnable, fluorescent and lead-free adjustments available, selected products UL-approved as conformal or permanent coatings.
- **ELPEGUARD TWIN-CURE® thick film lacquers**
Solvent-free 1-pack systems with the resistance of 2-pack systems for thick film applications, short processing times on account of ideally synchronised curing processes: fast UV curing and progressive cross-linking in shaded areas by reaction with atmospheric humidity, can be handled directly after UV cure, excellent edge coverage.
- **ELPEGUARD silicone thick film lacquers**
Solvent-free 1-pack systems with a high chemical and thermal resistance, cold and/or thermo curing, on account of their high elasticity particularly suitable to cover delicate components and components that are sensitive to mechanical stress.

- **Silicone gels**

Addition cross-linking, thermo curing 1-pack system, extremely flexible, consequently only low thermo-mechanical tensions and thus recommendable for the permanent sealing and embedding of very delicate, sensitive electronics and hybrids.

- **Casting compounds**

Cold and thermo curing casting compounds for potting assembled PCBs, print and mini transformers, transformers and solenoids on the basis of epoxy, polyurethane and silicone-rubber, selected products with UL approval.

- **Casting resins**

For impregnating and insulating all kinds of coil shells, particularly for high-revolution mini rotors.

- **Electro pastes**

Cementing compounds for coil shells and solenoids, also anchor and electro adhesives for the mechanical engineering industry.

- **Insulating varnishes**

For use in the electrical engineering industry to insulate impregnated coils and windings.

- **Impregnating varnishes**

Impregnating varnishes for all kinds of coil shells, particularly for transformer coils.

- **Adhesives and adhesive lacquers**

For numerous adhesion techniques in the electronics and electrical engineering industries.

- **Auxiliary products for electronics**

Chipping lacquers, sealing agents, mould-release agents, cleaning agents, etc.

Special technical reports are also available for these products and can be provided on request. On our report manual CD you will find technical reports in the "Products" section.

Any questions?

We would be pleased to offer you advice and assistance in solving your problems. Free samples and technical literature are available upon request.

The above information as well as advice given by our Application Technology Department whether in verbal or written form or during product evaluations is provided to the best of our knowledge, but must be regarded as non-binding recommendations, also with respect to possible third-party proprietary rights.

The products are exclusively intended for the applications indicated in the corresponding technical data sheets.

The advisory service does not exempt you from performing your own assessments, in particular of our material safety data sheets and technical information sheets, and of our products as regards their suitability for the applications intended. The application, use and processing of our products and of the products manufactured by you based on the advice given by our Application Technology Department are beyond our control and thus entirely your responsibility. The sale of our products is effected in accordance with our current terms of sale and delivery.

ATTENTION!

For new products, according to preliminary technical reports, adequate practical results are not always available which would permit a comprehensive assessment of such a product. It is therefore imperative to exercise particular care in the testing of such products with regard to the application intended!

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