

TR TECHNICAL REPORT

2-pack solder resists
 of the series

ELPEMER® 2467



- suitable for all common application processes
- photoimageable
- highest resolution even of finest details (e.g. 50 µm)
- aqueous-alkaline developable
- thermal cycling resistance:
 -65 up to +125 °C [-85 up to 257 °F]
- excellent resistance to galvanic and electroless nickel/gold (ENiG), palladium, silver, tin baths and OSP processes (Organic Solderability Preservative)
- compatible with lead-free soldering processes
- fulfils/exceeds among others
 UL 94 V-0, Approbation No. File E 80315
 IPC-SM-840 C, Class H and T
 Siemens SN 57030
 Bosch Y 273 R80 029
 Bellcore GR-78-CORE
 NASA outgassing test acc. to ASTM E595

ELPEMER® = registered trade mark of Lackwerke Peters GmbH + Co KG

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Please read this technical report and the material safety data sheet according to EEC 91/155, the process data sheet as well as the application information sheet AI 2/1 (see Item 3) carefully before using the product.



1. General information

The solder resists of the series **ELPEMER® 2467** enable so-called mass soldering (DIN 40 804, terms) and selective soldering at the same time; see also VDI/VDE 3710, Sheet 4: "Fabrication of printed circuit boards; print technology processes".

The photoimageable 2-pack solder resists of the series **ELPEMER® 2467** are suitable for all common application processes and developed in aqueous-alkaline solutions.

This report is valid for the following adjustments:

AS 2467	application by means of spray coating (horizontal and vertical)
ES 2467	application by means of electrostatic spray coating
GL 2467	application by means of curtain coating
SD 2467	application by means of screen printing, also by means of double-sided vertical screen printing

Indices: **AS = air spray**
 ES = electrostatic spray
 GL = curtain coating
 SD = screen printing

The photoimageable, aqueous-alkaline developable via hole fillers of the series **ELPEMER® VF 2467** are also compatible with the 2-pack solder resists of the series **ELPEMER® 2467**. After application of the via hole filler the further processing – predrying, exposure, developing and final curing – is executed together with the solder resist.

As polyalcohol developable solder resists the 2-pack solder resists of the series **ELPEMER® 2469 SM** are available, for the coating of flexible pcbs by means of screen printing the highly flexible, photoimageable, aqueous-alkaline developable 2-pack solder resists of the series **ELPEMER® SD 2463 FLEX-HF** are available. Special reports on these products are available upon request. In our report manual these reports are filed under group 2. On our report manual CD, technical reports can be accessed in the "Products" section.

2. Application

On account of their high resolution alongside their excellent dielectric properties the 2-pack solder resists of the series **ELPEMER® 2467** are used as insulating coatings for pcbs in fine and super-fine line technology, SMD technology as well as for multilayers.

3. Special notes / application information

To complement this technical report you will find product-specific data such as characteristics and recommendations for process parameters in the process data sheets (PD) of each solder resist. Further and detailed general information and notes that need to be observed to achieve an optimum processing result are indicated 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 website you will find application information sheets in the "Service" section. The process data will be supplied together with your initial order.

As an all-round supplier of lacquers for the production of pcbs our product range contains numerous conformal/permanent coatings that boast approvals from UL and the automotive industry. Naturally they are also compatible with our **ELPEMER®** solder resists as well as our other solder resist systems. By subsequently applying coating materials from our product range your high-quality assemblies can fulfil even higher requirements as regards reliable functioning, service life and quality even under increased climatic stress (moisture, condensation, temperature).

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

On account of the different application processes for the solder resists the characteristics vary and are thus indicated in the product-specific process data sheets. We will gladly provide you with the process data sheets upon request.

6. Properties

The photoimageable solder resists of the series **ELPEMER® 2467** are distinguished by the following properties:

6.1 General properties

- suitable for all common application processes, as for instance, conventional and electrostatic spraying, curtain coating and screen printing
- high productivity due to short processing times
- a high solids content and an optimum thixotropy enable an excellent edge coverage at a low wet ink weight as well as a favourable ratio of lacquer to pad height
- broad processing window in the process step “pre-drying“
- low exposure energy, thus short exposure times
- highest resolution: virtually vertical side walls enable the representation of finest details. e.g. 50 µm ink dams between SMD pads
- no holding time after exposure required, therefore suitable for in-line production
- high pencil hardness and excellent scratch resistance protect against mechanical damage during handling
- excellent resistance to galvanic and electroless nickel/gold (ENiG), palladium, silver, tin baths and OSP processes (Organic Solderability Preservative)
- excellent compatibility with no-clean and water-thinnable fluxing agents
- strongly solder-repellent ink surface thus minimum solder ball adhesion
- with a solder bath resistance of 20 s at 288 °C [550.4 °F] acc. to UL 94 fulfil the required temperature resistance for lead-free soldering
- very low ionic contamination values after HAL
- excellent adhesion of subsequent coatings (marking inks, carbon-conductive inks, conformal/permanent coatings and others)
- suitable for laser ablation by means of CO₂ lasers, e.g. to apply AOI legible markings (for instance, data matrix, barcodes), no solder adhesion to ablated areas
- thermal cycling resistance: -65 up to +125 °C [-85 up to 257 °F] (100 cycles)
- best flame class UL 94 V-0 for all colour and appearance adjustments, Approbation No. File E 80315; registered trademark of  Underwriters Laboratories Inc.; Northbrook, Illinois 60062
- free of halogenated flame retardants
- do not contain any substances listed in the **RoHS** directive 2002/95 EG on the **Restriction of the use of certain Hazardous Substances** in electrical and electronic equipment [lead, mercury, cadmium, hexavalent chromium, polybrominated biphenyl (PBB) or polybrominated diphenyl-ether (PBDE)]

- fulfil, among others, the specifications IPC-SM-840 C, Bellcore GR-78-CORE, Bosch Y 273 R80 029 and Siemens SN 57030 with respect to electro corrosion
- various adjustments of the **ELPEMER® 2467** series fulfil the NASA Outgassing Test acc. to ASTM E595 (for detailed information please see the outgassing certificates in the “Service” section of our website at www.peters.de or visit www.nasa.gov)
- mould resistant acc. to IPC-SM-840 C and DIN IEC 60068-2-10 (see also Item 6.2 “Physical and mechanical properties”)
- partially halogen-free acc. to JPCA-ES-01-1999
- compatible with the photoimageable, aqueous-alkaline developable via hole fillers of the series **ELPEMER® VF 2467**.

6.2 Physical and mechanical properties

Due to the various colour and appearance adjustments slight differences in the indicated values may result.

Property	Test method	Result
Adhesion	IPC-SM-840 C, 3.5.2.1	class H and T
Cross hatch	EN ISO 2409, ISO 2409 on copper on FR 4	Gt 0 Gt 0
Pencil hardness	IPC-SM-840 C, 3.5.1 acc. to Wolff-Wilborn	6 – 8 H 6 – 8 H
Scratch hardness	Simex scratch resistance test device type RH 3, scoring needle with ball tip (1 mm diameter)	weight load: 1500 – 2000 g
Resistance to solvents/ cleaning agents	IPC-SM-840 C, 3.6.1 Isopropanol Isopropanol : water (75 : 25) D-Limonene 10% alkaline cleaning agents Monoethanolamine Deionized water	passed passed passed passed passed passed
Resistance to solvents	test boards, dipped in dichloromethane (30 min at room temperature)	no swelling
Hydrolytic stability	IPC-SM-840 C, 3.6.2 28 days/+97 ± 2 °C [+206.6 ± 35.6 °F] 90 to 98 % rel. humidity	passed
Solder bath resistance	IPC-SM-840 C, 3.7.2 MIL - P 55 110 D UL 94*	20 s at 265 °C [509 °F] 10 s at 288 °C [550.4 °F] 20 s at 288 °C [550.4 °F]
Thermal shock	IPC-SM-840 C, 3.9.3 100 cycles 15 min/-65 °C [-85 °F] or -40 °C [-40 °F] 15 min/+125 °C [257 °F]	class H and T
Thermal class	based on DIN IEC 60 085	F = 155 °C [311 °F]
Mould resistance	IPC-SM-840 C DIN IEC 60068-2-10	passed** passed**

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

** Representative of the solder resists of the series **ELPEMER® 2467** the mould resistance of the curtain coating adjustment **ELPEMER® GL 2467 SM-DG** was tested in accordance with the above mentioned test methods in an accredited laboratory. We would gladly supply a copy of the test certificate upon request.

6.3 Electrical properties

Due to the various colour and appearance adjustments slight differences in the indicated values may result.

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	10^{16} Ohm x cm
Insulation resistance	Bellcore GR-78-CORE	passed
Moisture and insulation resistance	IPC-SM-840 C, 3.9.1	class H and T
Electromigration	IPC-SM-840 C, 3.9.2 85 °C [185 °F], 85 % r. h., 168 h, 10 V DC	class H and T
Electrocorrosion	Siemens Norm SN 57 030 40 °C [104 °F], 95 % r.h., 21 d, 100 V DC	passed
Comparative Tracking Index (CTI, Tracking resistance)	DIN IEC 60 112, in connection with VDE 0110, part 3 on FR 4 base material with CTI 250 with CTI 600	CTI 275* CTI 600*
Dielectric constant ϵ_r	based on IPC 4101 A at 1 MHz	3.7
Dissipation factor $\tan \delta$	based on IPC 4101 A 1 – 100 MHz	0.029 ± 0.003

* The CTI value of the coating also depends on the tracking resistance values of the base material, etc. The CTI value of the base material is usually maintained when the 2-pack solder resists of the series **ELPEMER 2467** are used.

Note: Optimum electrical insulation values can only be achieved when all flux residues are removed thoroughly from the printed circuit boards after HAL.

7. Processing

Please observe the product-specific processing parameters recommended in the corresponding process data sheets for each solder resist as well as 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**".

7.1 Auxiliary products

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

- **Cleaning and deoxidising agent HP 5625 for conveyorised 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%

- **Touch-up lacquer SD 2369 UV-ABL**

yellow-green transparent lacquer to touch up small mechanical damages, application by means of screen printing or brushing, UV curing.

- **Peelable protective skin EH 13.150 AQ**

blue transparent, solvent-free, water-borne 1-pack system for the protection of smooth surfaces, e.g. of lacquer coating machines and scales, against soiling from ink splashes or other contaminations. After drying, a highly elastic and tear resistant film results that can be peeled-off and renewed as required.

- **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.

8. Drying/curing

There are 3 drying steps in the standard processing of **ELPEMER®** of the **series 2467**:

- Pre-drying – prior to exposure and developing
- Drying of the pcb after developing and rinsing
- Curing as the final process step.

Further information regarding the above mentioned steps can be found in the corresponding process data sheets of each solder resist.

9. Standard packaging

ELPIMER® of the series 2467 are packed for delivery as follows:

	Component A	Component B	Selling unit [kg]
AS 2467	1 bucket of 7.2 kg	1 top container of 1.8 kg	9
ES 2467	1 bucket of 8 kg	1 top container of 2 kg	10
GL 2467	1 bucket of 8 kg	1 top container of 2 kg	10
SD 2467	10 buckets of 4.8 kg	10 tins of 1.2 kg	60
	10 tins of 0.8 kg	10 tins of 0.2 kg	10

The corresponding thinner is available in cans of 25 kg or barrels of 160 kg.

Partial lots of the selling units 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 technical report. However, it is ensured that our products have **at least** two-thirds of their shelf life remaining when they leave our company.

In accordance with EN 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 against sun and daylight since it is a light-sensitive system.

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

We boast a wide range of **conformal/permanent coatings, thick film lacquers, silicone gels, casting compounds, casting resins, electro pastes, insulating lacquers, impregnating varnishes, adhesive lacquers and auxiliary products for electronics.**

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.

Lackwerke Peters GmbH + Co KG
Hooghe Weg 13, 47906 Kempen

Internet: www.peters.de

E-Mail: peters@peters.de

Phone: 0049-21 52-20 09-0

Fax: 0049-21 52-20 09-70