

SURVEY REPORT

Lackwerke Peters GmbH + Co KG Hooghe Weg 13, 47906 Kempen Internet: www.peters.de E-Mail: peters@peters.de

Ein Unternehmen der PETERS-Gruppe

Telefon (0 21 52) 20 09-0 Telefax (0 21 52) 20 09-70

Group 2

Circuit printing lacquers

This survey report gives a comprehensive overview of product group 2. For further information please refer to the technical reports (TR) and application information sheets (AI), in which the mentioned products are described in detail.

For more extensive advice, our application technology department (ATD) is at your disposal at any time.

The first column of this survey corresponds to the order in which our technical reports (TR) are filed in the report manual and/or supplements and new technical reports are to be added. Thus this survey also serves as a table of contents of product group 2.

= registered trademark of Lackwerke Peters GmbH + Co KG for photoimageable lacquers

N = registered trademark of **N** Underwriters Laboratories Inc.; Northbrook, Illinois 60062.

Table of contents

- 1.
- 2.
- 3.
- Via hole fillers 4 4.
- 1-pack solder resists5 5. 6. Conventional and photoimageable 2pack solder resists5

7.	Marking inks	9
8.	Thick film fillers 1	0
9.	Heatsink paste 1	1
10.	Plugging pastes 1	1
11.	Carbon-conductive inks 1	2
12.	Peelable solder masks1	2

1. Application information sheets

Application Information sheets (AI) apply to various lacquers/lacquer series' and supplement the Technical Reports on these lacquers by giving detailed explanations of possible application procedures and individual process steps plus offering numerous practical tips and advice to safeguard the optimum processing of our products.

The associated Technical Reports provide - in a concise and clear manner - numerous characteristics and processing data in transparent diagrams, graphics and tables.

Currently the following application information sheet for group 2 is available:

AI 2/1 "Processing information for the photoimageable solder resists of the series' ELPEMER[®] 2467, ELPEMER[®] 2469 and ELPEMER[®] 2463 FLEX".

2. Etch and plating resists

2.1 General characteristics

- high definition enables the representation of fine conductors
- UV and thermal curing
- excellent adhesion and high surface hardness
- the flake strippable etch and plating resists (index FS) offer the advantage that the flakes can be removed from the stripper medium by means of filters so that the waste water contamination is reduced and the service life of the stripping solution increased.

2.2 Special characteristics of the liquid ELPEMER[®] photoresists

- owing to their outstanding resolution, even ultra-fine conductors < 50 μm can be represented with the photoimageable resists of the series ELPEMER®
- particularly suited for the production of multilayer inner layers.

Product (series)	Special properties
Etch and plating resist	application by screen printing
SD 2050 UV , blue	• UV curing (index UV)
	 suited for 150 µm technology
	 can be used to etch 400 µm copper
	• resistant up to pH 9
	very easily stripped in alkaline media
Etch and plating resist	application by screen printing
SD 2051 UV-AL-FS, blue	• UV curing (index UV)
	 suited for 150 μm technology
	resistant to acid etching and plating baths
	• very easily stripped in al kaline media (index AL)
	• index FS = flake strippable
Etch resists of the series	application by screen printing
SD 2052 AL	air and oven drying
SD 2042 AL, black SD 2052 AL, blue	resistant up to pH 9.5
	• easily stripped in al kaline media (index AL)

2.3 Product-specific characteristics

Product (series)	Special properties
Etch and plating resist	application by screen printing
SD 2053 UV-AL, blue	• UV curing (index UV)
	 suited for 150 µm technology
	 can be used to etch 400 μm copper
	 resistant to acid etching and plating baths
Se a second second	very easily stripped in al kaline media (index AL)
1-pack photoresist	 application by roller coating (index RC), curtain coating, dipping, spray coating
	photoimageable etch resist
	 no fillers and pigments, thus high productivity and no disturbing sediment in developer, thus little cleaning work required
	 fast drying and very low exposure energy
	 significant colour change during exposure from colourless to blue- violet ensures good visual control
	 excellent resolution (< 50 μm, index HR = high resolution)
	aqueous-alkaline developable
	resistant to acid etching baths
	strippable in small, easily filtered flakes
1-pack photoresists of the se- ries SD 2054	application by screen printing
SD 2054, blue transparent	photoimageable etch and plating resist
SD 2054 I, colourless/blue-violet	• similar to RC 2054 HR , but applied by screen printing
	SD 2054 I contains a colour indicator (index I): colour change from colourless to blue-violet during exposure
Etch resist SD 2057 UV, blue	application by screen printing
	• UV curing (index UV)
	 suited for 150 μm technology
	resistant up to pH 9.5
	fast curing and strippability
	strippable in alkaline media
Etch resists of the series	application by screen printing
SD 2058 UV-FS SD 2058 UV-FS, blue	 available in various viscosity adjustments (index HV = highly viscous, index SHV = very highly viscous)
SD 2058 UV-FS-HV, blue SD 2058 UV-FS-SHV, blue	• UV curing (index UV)
,	 suited for 150 μm technology
	resistant to acid etching baths
	fast curing and strippability
	strippable in alkaline media
	 index FS = flake strippable
Etch and plating resists of the	application by screen printing
series SD 2059 UV-AL	• UV curing (index UV)
SD 2059 UV-AL, blue SD 2059 UV-AL-T, blue	 suited for 150 μm technology
	 resistant to pH 9.5
	 very easily stripped in alkaline media (index AL)
	• index $T = thixotropic$

Product (series)	Special properties
Etch and plating resist	application by screen printing
SD 2150 UV-AL-FS, blue	• UV curing (index UV)
	 enables representation of fine conductors up to 250 µm
	perfectly suited for flexible circuits and for roll-to-roll application
	resistant to acid etching and plating baths
	• very easily stripped in al kaline media (index AL)
	• index FS = f lake s trippable
Wepelan plating resist	application by screen printing
SD 2154 E , blue	air or oven drying
	outstanding resistance over the entire pH range
	very good resistance to cyanide baths
	• index E = elastic
	strippable in esters, ketones and chlorinated hydrocarbons
Etch and plating resist	application by screen printing
SD 2155 AL, blue transparent	 suited for 150 μm technology
	resistant to acid etching and plating baths
	suited for electroplating ceramics
	• very easily stripped in al kaline media (index AL)

3. 1- and 2-pack ELPELECT[®] dielectrics

3.1 General characteristics

- insulating layer in the sequential fabrication of multilayer circuits (SBU = sequential build-up technology)
- suited for laser ablation with CO2, Nd-YAG and Eximer lasers
- finest structures can be represented without any problems
- very good adhesion of the subsequent metal plating (> 10 N/cm).

3.2 Product-specific characteristics

Product (series)	Special properties
1-pack dielectric ELPELECT[®] GL 2230 LA, dark-red transparent	 application by curtain coating laser-ablatable (index LA) free of halogenated flame retardants corresponds to best flame class V-0 acc. to UL 94
2-pack dielectric ELPELECT [®] SD 2230 LA, dark-red transparent	• same as GL 2230 LA , but applied by screen printing

4. Via hole fillers

4.1 General characteristics

- prevent the penetration of solder to the component side and the settling of flux residues in the holes
- ensure the sealing of via holes for vacuum adaption during in-circuit testing.

See also section 10 "Plugging pastes".

4.2 Product-specific characteristics

Product (series)	Special properties
Via hole fillers of the series SD 2361	application by screen printing
	safe closing of via holes
SD 2361, green SD 2361 T, green	100 % solids content means practically no volume shrinkage
	 the thixotropic adjustment (index T) is suited for larger holes (> 0.5 mm)

5. 1-pack solder resists

5.1 General characteristics

- UV curing, high curing speed
- 100 % solids content, thus no drying on screen
- easy to print; can thus be processed at high squeegee/printing speeds
- low odour.

5.2 Product-specific characteristics

Product (series)	Special properties
1-pack solder resists of the	application by screen printing
series SD 2368 UV, transparent	• UV curing (index UV)
SD 2308 UV-SM, colourless SD 2358 UV-SM, blue	 for copper conductors of up to 70 μm
SD 2368 UV-SG, green	transparent
SD 2368 UV-SM, green SD 2368 UV-SG-DG, dark-	 perfect curing even in thicker layers
green	suited for the Hot-Air Levelling process
SD 2368 UV-SM-DG, dark- green	 No. File E 80315
SD 2368 UV-HFG, green	 indices: SM = silk-mat; SG = silk-glossy; DG = dark-green; HFG = halogen-free green
1-pack touch-up lacquer	application by screen printing or brush
SD 2369 UV-ABL, yellow-green transparent	• UV curing (index UV)
	 transparent lacquer for eliminating minor mechanical defects (index ABL = touch-up lacquer)
	 especially suited for all yellow-green solder resists of the series' ELPEMER[®] 2467 and ELPEMER[®] 2469

6. Conventional and photoimageable 2-pack solder resists

6.1 General characteristics

- excellent printing properties, even in the case of high conductors
- enable so called mass soldering and selective soldering at the same time
- absolutely non-bleeding
- for rigid and flexible circuits
- low solvent content (low VOC; VOC = Volatile Organic Compound), high solids content
- excellent adhesive strength.

6.2 Special characteristics of the ELPEMER[®] photoimageable solder resists

- virtually vertical sidewalls enable the representation of finest structures, for instance 50 μm solder dams between SMD pads
- very short processing times
- very high processing reliability
- very low exposure energy
- aqueous-alkaline or polyalcohol developable
- **R** approval: best flame class V-0 acc. to UL 94, Approbation No. File E 80315
- meet IPC-SM-840 C and Bellcore GR 78 CORE specifications
- mould-resistant in accordance with IPC-SM-840 C, item 3.4.6, and DIN IEC 60068-2-10.

Please read the advice in our Application Information AI 2/1 (see also section 1).

6.3 Product-specific characteristics

Product (series)	Special properties
2-pack solder resist	application by screen printing
SD 2444 NB-M, black	excellent adhesive strength and resistance to soldering processes
	Alignment of the set of the
	 no light reflection, therefore especially suited for use in optoelectron- ics
	 index NB = no bleeding; M = mat
2-pack solder resists of the	application by screen printing
series SD 2457, halo-	photoimageable
gen-free SD 2457 SM, blue,	aqueous-alkaline developable
SD 2457 SM, blue, SD 2467 SM-GG, green	All approval: best flame class V-0 acc. to UL 94
	 halogen-free per JPCA-ES-01-1999, residual halogen content < 500 ppm
	 indices: SM = silk-mat; GG = grass-green
2-pack solder resist	application by screen printing
SD 2460 FLEX, green	 can already be cured at 80 °C
	 excellent adhesion to polyimide and polyester films (index FLEX = for flexible circuits)
2-pack solder resists of the	application by screen printing
series SD 2460/201 UV-FLEX	• UV curing (index UV)
SD 2450/201 UV-FLEX, blue SD 2460/201 UV-FLEX, green	resistant to Hot-Air Levelling
	 excellent adhesion to polymide, polycarbonate and polyester films (index FLEX = for flexible circuits)
	suited for cross-over technology
	• N approval for SD 2460/201 UV-FLEX: best flame class V-0 acc. to UL 94, Approbation No. File E 80315

	Special properties
	application by screen printing
series SD 2462 NB and SD 2462 NB-M	outstanding definition and excellent edge coverage
	 outstandingly high adhesive strength
	 on account of its excellent adhesive strength SD 2462 NB-M is par- ticularly suitable as a "top coat" in thick-copper technology (e.g. 400 µm technology) and offers highest safety for this technology (see also section 8 "thick film fillers")
SD 2442 NB-M, black	excellent chemical resistance
SD 2452 NB-M, blue SD 2462 NB-M, green SD 2462 NB-M-YG, yellow-	 partially N approval: best flame class V-0 acc. to UL 94, Appro- bation No. File E 80315
	 indices: NB = no bleeding; T = thixotropic; M = mat; YG = yellow- green; 550 = viscosity 550 dPas (highly viscous)
	application by screen printing
SD 2423 FLEX, amber	 highly flexible, thus particularly suited for printing on flexible base materials (FLEX = for flexible circuits)
SD 2463 FLEX, green	photoimageable
	aqueous-alkaline developable
	All approval: best flame class V-0 acc. to UL 94
AS 2467 XM-XG, extra dark- green	 for horizontal and vertical spraying processes (index AS = air spray) photoimageable aqueous-alkaline developable
	 A approval: best flame class V-0 acc. to UL 94
	 indices: XM = extra-mat; XG = extra dark-green
	 application by curtain coating or spraying
	photoimageable
GL 2467 SG-DG GL 2467 SG-GG	aqueous-alkaline developable
	 N approval: best flame class V-0 acc. to UL 94
GL 2467 SM-DG GL 2467 SM-GG GL 2467 SM-YG	 indices: SG = silk-glossy; SM = silk-mat; DG = dark-green; GG = grass-green; YG = yellow-green
	application by screen printing
	photoimageable
SD 2467 SG-DG SD 2467 SG-GG	aqueous-alkaline developable
	 Nu approval: best flame class V-0 acc. to UL 94
SD 2467 SM-DG	 available special colours: colourless, yellow, amber, red, black, blue, white
SD 2467 SM-GG SD 2467 SM-YG SD 2467 SM-XG SD 2467 XM-DG	 indices: SG = silk-glossy; SM = silk-mat; XM = extra-mat; DG = dark-green; GG = grass-green; YG = yellow-green; XG = extra dark- green
	application by curtain coating
GL 2467 MM-YG	photoimageable
	 aqueous-alkaline or polyalcohol developable
	 A approval: best flame class V-0 acc. to UL 94
	 indices: MM = medium-mat; YG = yellow-green

Product (series)	Special properties
2-pack solder resist	application by screen printing
	photoimageable
	aqueous-alkaline or polyalcohol developable
	 N approval: best flame class V-0 acc. to UL 94
	 indices: MM = medium-mat; YG = yellow-green
2-pack via hole fillers of the series VF 2467	application by screen printing
VF 2467 DG	• photoimageable via hole filler (index VF = via hole filler)
VF 2467 LYG	aqueous-alkaline developable
	 N approval: best flame class V-0 acc. to UL 94
	 indices: VF = via hole filler; DG = dark-green; LYG = light-yellow- green
2-pack touch-up lacquer	application by brush
AL 2468 YG	 yellow-green transparent lacquer for eliminating minor mechanical defects (index AL = touch-up lacquer)
	• based on the 2-pack solder resists of the series SD 2468 NB
	• index YG = y ellow- g reen
2-pack solder resists of the	application by screen printing
series SD 2468 NB and SD 2468 NB-M	available in various colour adjustments
	 partially N approval: best flame class V-0 acc. to UL 94, Appro- bation No. File E 80315
	SD 2468 NB-M-HV/50 is specially suited for coating backpanels
	 indices: NB = no bleeding; M = mat
	We also draw your attention to the newer series SD 2462 NB and SD 2462 NB-M .
2-pack solder resists of the	application by screen printing
series SD 2468 NB-M/21	 very good adhesion to metals such as Sn, Pb/Sn and Ni
	 excellent printing properties, for instance over high conductors (70 µm) and in tight conductor spaces
	available in various colour adjustments
	 partially N approval: best flame class V-0 acc. to UL 94, Appro- bation No. File E 80315
	 indices: NB = no bleeding; M = mat
2-pack solder resist 繩 👘	application by curtain coating or spraying
GL 2469 SM, yellow-green	photoimageable
	developable in polyalcohols, preferably butylcarbitol or carbitol
	Approval: best flame class V-0 acc. to UL 94
	• index SM = silk-mat
2-pack solder resist	application by screen printing
SD 2469 SM, yellow-green	photoimageable
	developable in polyalcohols, preferably butylcarbitol or carbitol
	All approval: best flame class V-0 acc. to UL 94
	• index SM = silk-mat

Product (series)	Special properties
2-pack solder resist SD 2494 NB-SM, white	 application by screen printing excellent adhesive strength
	 owing to excellent resistance to yellowing and good light reflection application in optoelectronics and automobile electronics (instrument panels)
	• N approval: best flame class V-0 acc. to UL 94, Approbation No. File E 80315
	 indices: NB = no bleeding; SM = silk-mat

7. Marking inks

7.1 General characteristics

- excellent definition
- high solids content
- outstanding covering power
- very good adhesive strength
- solder bath resistant.

7.2 Special characteristics of the ELPEMER[®] photoimageable marking inks

- the excellent resolution of the photoimageable ELPEMER[®] marking inks enable the representation of finest details
- no time- and cost-consuming fabrication of screen stencils
- aqueous-alkaline developable
- excellent colour stability even after the soldering process.

7.3 Product-specific characteristics of the 1-pack marking inks

Product (series)	Special properties
1-pack marking inks of the	application by screen printing
series SD 2513 UV SD 2513 UV, yellow	• UV curing (index UV)
SD 2543 UV, black	100 % solids content
SD 2593 UV, white	short curing times
	high colour stability

7.4 Product-specific characteristics of the 2-pack marking inks

Special properties
 application by screen printing available in various thixotropic adjustments: T = thixotropic; HT = highly thixotropic free of lead chromate fast curing excellent chemical resistance very good adhesive strength

Survey report group 2

Product (series)	Special properties
2-pack marking inks of the series SD 2617 SD 2617, yellow SD 2617 HV, yellow SD 2617 SF, reddish-yellow	application by screen printing
	free of lead chromate and amine
	 long pot life / processing time (at least 1 month)
	 indices: HV = highly viscous; SF = stronger colour
2-pack marking inks SD 2618 and SD 2698 SD 2618, yellow SD 2698, white	application by screen printing
	photoimageable
	free of lead chromate
	 particularly suited for pilot and low-volume series' since no need for expensive screen stencils
	 exposure energy 400-600 mJ/cm²
	 representation of finest details (50 μm)
	aqueous-alkaline developable
2-pack marking inks of the	application by screen printing
series SD 2692 T SD 2622 T, orange SD 2632 T, red SD 2642 T, black SD 2652 T, blue SD 2692 T, white SD 2612 T-K, yellow SD 2642 T-K, black SD 2662 T-K, green SD 2692 T-K, white	 free of lead chromate (except SD 2622 T)
	 long pot life / processing time (at least 6 weeks)
	 the catalysed adjustments (index K) only have a pot life of 32 hours, but boast a shorter curing time and a considerably improved adhe- sive strength
	 excellent definition owing to the high thixotropy (index T)
	SD 2692 is not thixotropic and thus suited for overprinting closely spaced conductors
SD 2692, white	excellent chemical resistance

8. Thick film fillers

8.1 General characteristics

- to fill the spaces between high traces in thick copper technology (for instance 400 µm technology)
- solvent-free
- ideal basis for the subsequent solder resist coating
- very good solder bath resistance
- flexible, thus suited for use on so-called "static flex" circuit boards (printed circuit boards that are subjected to just one or very few bending stresses, for instance during installation).

8.2 Product-specific characteristics

Product (series)	Special properties
Thick film filler DSF 2706 UV , colourless	application by screen or stencil printing
	• UV curing (index UV)
	 corresponds to best flame class V-0 acc. to UL 94; UL approbation has been applied for under project no. 02ME23571
	free of halogenated flame retardants
	 proven to be the ideal "top coat" in thick-copper technology: 2-pack solder resist SD 2462 NB-M (see also page 7)

9. Heatsink paste

9.1 General characteristics

- highly thermally conductive system for the thermal management of printed circuit boards and assemblies
- low-cost alternative to conventional heatsinks; problem-free application with existing screen printing technology
- enables the flexible configuration of varying heatsink geometries.

9.2 Product-specific characteristics

Product (series)	Special properties
1-pack heatsink paste HSP 2741, black	application by screen printing
	100 % solids content
	high dielectric strength, thus no need for electrical insulation layer between pcb and heatsink
	Approval: best flame class V-0 acc. to UL 94, Approbation No. File E 80315
	German patent already granted, international patents pending

10. Plugging pastes

10.1 General characteristics

- · suited for the creation of blister-free, smooth hole fillings in buried vias
- enable the application of smooth insulating layers in SBU technology
- 100 % solids content
- low coefficient of thermal expansion, no cracking or delamination of the layers applied
- metallisable
- **PP 2795-SD** for screen printing and **PP 2795** for roller coating have been awarded the best flame class V-0 in accordance with UL 94, Approbation No. File E 80315
- the plugging pastes PP 2795-SD and PP 2795 are suitable for use in space electronics. These
 products are listed as approved materials in the NASA specification D-8208 "Spacecraft Design
 and Fabrication Requirements for Electronic Packaging and Cabling; Section 3.6, Printed Wiring
 Boards; Table 3.6-5: Acceptable Via Hole-Fill Material"
- the pluggable diameter depends on the "aspect ratio" of the plated-through holes to be filled (ratio between material thickness and via hole diameter); see also section 10.2 "Product-specific characteristics".

10.2 Product-specific characteristics

Product (series)	Special properties
Plugging pastes of the series PP 2795, white PP 2795 PP 2795 HV	application by roller coating
	 plugging of via holes with an aspect ratio of 12
	 with the highly viscous adjustment (index HV) aspect ratios up to approx. 17 can be filled

Product (series)	Special properties
Plugging pastes of the series PP 2795-SD	 application by screen printing (index SD = screen printing) plugging of via holes with an aspect ratio of 12
PP 2765-SD, green PP 2795-SD, light-grey	

11. Carbon-conductive inks

11.1 General characteristics

- excellent definition owing to high thixotropy
- also suited for flexible base material
- excellent adhesive strength and mechanical stability
- resistant to Hot-Air Levelling
- high chemical resistance
- stable electrical resistance even after temperature and moisture stress.

11.2 Product-specific characteristics

Product (series)	Special properties
1-pack carbon conductive ink <mark>SD 2841 HAL-IR</mark> , black, mat, 14-20 Ω/□*	application by screen printing
	 very smooth surface, thus suited for sliding contacts
	 particularly suited for IR drying (index IR = infrared-curable)
	hot-air levelling resistant (index HAL)
	• can be mixed with 1-pack insulating paste SD 2801 HAL , grey, to increase resistance
1-pack carbon-conductive ink SD 2843 HAL, black, mat, 13-20 Ω/□*	application by screen printing
	hot-air levelling resistant (index HAL)
	high chemical and thermal resistance
	particularly long shelf life: 6 months

* resistance related to a square area at a layer thickness of about 25 μ m

12. Peelable solder masks

12.1 General characteristics

- for the partial coverage of printed circuit boards as protection from direct contact with solder baths and as protection in plating processes
- very high elasticity and tear resistance
- residue-free removal before and/or after the soldering process.

Please also observe the notes in our **Technical Information sheet TI 15/7** "Selection criteria and processing advice for peelable solder resists (solder masks) of the series SD 2950" In our report manual this technical information sheet is filed under group 15.

12.2 Product-specific characteristics

Product (series)	Special properties
Peelable solder masks of the series SD 2950 SD 2950, blue SD 2950 T, blue SD 2952, blue SD 2952, blue SD 2953, blue SD 2953, blue SD 2962 P, green SD 2962 P/300, green SD 2990 T, white	application by screen printing
	unlimited pot life, as solvent-free
	easy to process
	• SD 2950/SD 2950 T : particularly suited for the Hot-Air Levelling process; cannot be peeled until after soldering
	• SD 2990 T: for covering carbon-conductive ink or larger holes
	 SD 2962 P; SD 2962 P/300:suited as masks in electroplating and other metallising processes
	• SD 2952; SD 2952 HV : suited for standard soldering processes, not for overprinting carbon-conductive ink
	• SD 2953: same as SD 2952, but with a higher thixotropy
	 indices: T = thixotropic; HV = highly viscous; 300 = viscosity of 300 dPas; P = pigmented
Peelable solder mask SD 2954, blue transparent	application by screen printing
	peelable before and after soldering
	 very high thermal stability, multiple soldering possible
	 particularly suited for use in reflow soldering (SMD technology)

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