

Conformal coatings of the series **ELPEGUARD® SL 1307**

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Base: modified acrylate resins

- excellent protection against corrosion (for example e-corrosion and migration) for assembled pcbs/flat packs
- **tested according to IPC-CC-830B**
- very high tracking resistance (CTI > 600)
- very fast physical drying
- can be soldered-through for repair purposes or washed off with the help of thinner **V 1307**
- UL approval for **SL 1307 FLZ/25** as permanent coatings acc. to UL 94



This technical report is valid for the following adjustments:

- **SL 1307**, colourless transparent
- **SL 1307 FLZ**, colourless transparent, fluorescent
- **SL 1307 FLZ/23**, colourless transparent, fluorescent
- **SL 1307 FLZ/25**, colourless transparent, fluorescent
- **SL 1307 MS**, colourless transparent
- **SL 1337**, red transparent
- **SL 1367**, green transparent
- **SL 1367 MS-FLZ-FE/22**, green transparent, fluorescent

Indices: **SL** = conformal coating
FLZ = fluorescent
/23 = viscosity 23 s acc. to DIN 53 211, likewise /25 and /22
MS = moderate boiling solvent (delayed drying), see item 3)
FE = fungicide adjustment

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Please read this technical report, the material safety data sheet according to directive 1991/155/EEC and the Application Information sheet AI 1/1 (see Item 7) carefully before using the product.

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1. General information

The conformal coatings of the series **ELPEGUARD® SL 1307** are physically drying 1-pack conformal coatings based on modified acrylate resins.

All symbols that are used in this technical data sheet and on our containers, such as , are explained on our website www.peters.de in the section “Service – Symbols on labels”.

2. Application

The conformal coatings of the series **ELPEGUARD® SL 1307**

- protect assembled pcbs even under increased climatic stress against moisture, especially against the effects of condensation
- insulate electrical equipment, connections, switch panels, terminal boards, etc.
- can be soldered-through at soldering iron temperature for repair purposes or removed with the help of **V 1307** and subsequently reapplied.


The conformal coatings of the series **ELPEGUARD® SL 1307** are used to protect assembled pcbs that have to fulfil high requirements regarding quality and service life. This is especially valid for pcbs or flat packs for:

- performance electronics
- the automotive industry
- household appliances (hobby tools, washing machines and others)
- electronic/electrical measuring and control units
- electrical appliances equipped with electronic controls (industrial scales, medical appliances, industrial robots, etc.)
- the military sector
- shipbuilding and off-shore technology
- aerospace technology
- explosion-protected equipment
- appliances for telecommunications.

3. Special notes

The independent test laboratory Trace Laboratories-East in the USA has performed tests according to IPC-CC-830B (substituting MIL-I-46058) on the colourless transparent, fluorescent adjustments of the **ELPEGUARD® SL 1307** series as representatives for the whole **ELPEGUARD® SL 1307** series and confirmed that the conformal coatings meet the requirements. Corresponding test certificates can be accessed in the “Service – Certificates” section on our report manual CD and on our website.

The fluorescent adjustments of the series **ELPEGUARD® SL 1307** (index **FLZ**) are mould resistant according to IPC-CC-830B, **ELPEGUARD® SL 1367 MS-FLZ-FE/22** (index FE = fungicide adjustment) is mould resistant according to the US military standard for conformal coatings MIL-STD-810E.

The colourless, fluorescent adjustments of the conformal coatings of the series **ELPEGUARD® SL 1307** have been approved as permanent coatings according to UL 94 (for further information please see Approbation no. file E 80315, registered trade mark of  Underwriters Laboratories Inc., Northbrook, Illinois 60062).

The lacquer layers that are achieved with the conformal coatings of the series **ELPEGUARD® SL 1307** have a very good tracking resistance. Even in the case of pcbs that are made of base materials with tracking resistance values of approx. CTI 200/250 or also in the case of solder resist surfaces with values of CTI 300/400 tracking resistance values of CTI > 600 can be achieved by applying the conformal coatings of the series **ELPEGUARD® SL 1307**.

The conformal coatings of the series **ELPEGUARD® SL 1307** are suitable for use over a permanent temperature load (DIN EN 60216; 20,000 h) from -40 to +125 °C [-40 to +257 °F], although at the lower as well as at the upper ends of this range the behaviour and performance of the material might be

negatively impaired in some applications. Additional tests are recommended. **ELPEGUARD® SL 1307 MS** is particularly suitable for dipping due to its modified solvent composition (Index MS = moderate boiling solvent) which increases the flowability and considerably prolongs the surface drying process.

3.1 Special viscosity adjustments

The conformal coatings with the index **/22**, **/23**, and **/25** are adjusted to a viscosity of 22, 23 and 25 s flow time respectively (measured per DIN 53 211/4 mm flow cup/20 °C [68 °F]) and are thus particularly suitable for selective coating units and for dip coating. An adjustment to the individual equipment technology is recommended. Nevertheless, corresponding pre-trials are mandatory.

4. Safety recommendations

- Please read our material safety data sheet according to directive 1991/155/EEC 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.
- Please also pay attention to national guidelines or directives concerning the handling of flammable liquids as for example the German TRbF (technical regulations for flammable liquids) or European directives.

5. Characteristics

	SL 1307	SL 1307 FLZ	SL 1307 FLZ/23*	SL 1307 FLZ/25*
Colour/appearance	colourless transp.	colourless transp., fluorescent	colourless transp., fluorescent	colourless transp., fluorescent
Solids content, ISO 3251 1 h, 125 °C [257 °F], 1 g weighed quantity	31 ± 3 % by weight	30 ± 3 % by weight	25 ± 2 % by weight	27 ± 3 % by weight
Viscosity at 20 °C [68 °F] flow time acc. to DIN 53211 4 mm DIN flow cup	60 ± 6 s	55 ± 5 s	23 ± 2 s	25 ± 2 s
Viscosity at 20 °C [68 °F] flow time acc. to ISO 2431 6 mm ISO flow cup	41 ± 4 s	-	-	-
5 mm ISO flow cup	-	75 ± 7 s	-	-
4 mm ISO flow cup	-	-	60 ± 5 s	70 ± 7 s
Density at 20 °C [68 °F] ISO 2811-1	0.96 ± 0.02 g/cm ³	0.96 ± 0.02 g/cm ³	0.95 ± 0.02 g/cm ³	0.95 ± 0.02 g/cm ³
	SL 1307 MS	SL 1337	SL 1367	SL 1367 MS-FLZ-FE/22*
Colour/appearance	colourless transp.	red transp.	green transp.	green transp., fluorescent
Solids content, ISO 3251 1 h, 125 °C [257 °F], 1 g weighed quantity	28 ± 3 % by weight	31 ± 3 % by weight	31 ± 3 % by weight	22 ± 2 % by weight
Viscosity at 20 °C [68 °F] flow time acc. to DIN 53211 4 mm DIN flow cup	60 ± 6 s	60 ± 6 s	60 ± 6 s	22 ± 2 s
Viscosity at 20 °C [68 °F] flow time acc. to ISO 2431 6 mm ISO flow cup	41 ± 4 s	41 ± 4 s	41 ± 4 s	-
4 mm ISO flow cup	-	-	-	55 ± 5 s
Density at 20 °C [68 °F] ISO 2811-1	0.92 ± 0.02 g/cm ³	0.96 ± 0.02 g/cm ³	0.96 ± 0.02 g/cm ³	0.95 ± 0.02 g/cm ³

* The DIN 53211 has been replaced by the international norm ISO 2431. However, on account of the widespread usage of the 4 mm DIN flow cup we continue indicating the viscosity acc. to DIN 53211 just as we continue with the product name with the index /22, /23 and /25 that indicates the flow time measured with the 4 mm flow cup.

6. Properties

The conformal coatings of the series **ELPEGUARD® SL 1307** are distinguished in particular by the following properties:

6.1 General properties

- do not contain substances listed in the RoHS directive 2002/95/EC, EU End-Of-Life Vehicle directive 2000/53/EC and WEEE directive 2002/96/EC
- virtually no risk of incipient dissolution of components and marking inks due to the special solvent composition
- after application a very good flow results and after curing an even, closely pored film is obtained
- very fast physical drying at room temperature
- with the fluorescent adjustments (Index FLZ) the coating can be easily controlled under UV light (black light with a UV-A impulse at 350-375 nm), the green and red transparent adjustments can be easily controlled on account of the contrast to the substrate
- good surface hardness of the dried film with simultaneous high elasticity
- suitable for flexible circuits
- very good ageing and yellowing resistance
- excellent protection against corrosion on account of the very good resistance to moisture, particularly condensation
- very good **TCT** (thermal cycling test) resistance: -40 to +150 °C [-40 to +302 °F]
- **tested** by Trace Laboratories-East **acc. to IPC-CC-830B** (see item 3)
- **ELPEGUARD® SL 1307 FLZ, SL 1307 FLZ/23 and SL 1307 FLZ/25** are mould resistant acc. to IPC-CC-830B, **ELPEGUARD® SL 1367 MS-FLZ-FE/22** is mould resistant acc. to MIL-STD-810 E
- can be soldered-through at soldering iron temperature for repair purposes or completely removed with the help of thinner **V 1307, V 1307 FLZ or V 1307 MS**
- UL approval of the colourless, fluorescent adjustments as permanent coatings acc. to UL 94.

6.2 Physical and mechanical properties

Property	Test method	Result
Cross hatch	ISO 2409 on copper on FR4 base material	Gt 0 Gt 0
Flexibility	IPC-CC-830B, 3.5.5	passed
Glass transition temperature Tg	thermo mechanical analysis	approx. -4 °C [24.8°F]
Coefficient of thermal expansion (CTE)	thermo mechanical analysis	160 ppm/°C ≤ RT

6.3 Electrical properties

These values are reached after 7 days' storage at room temperature.

Property	Test method	Result
Dielectric strength	IPC-TM-650, 2.5.6.1 DIN EN 60243-1	60 kV/mm
Dielectric strength	IPC-CC-830B, 3.6.1	passed
Specific volume resistivity	VDE 0303, part 30 DIN IEC 60093	1.5×10^{15} Ohm x cm
Surface resistance	VDE 0303, part 30 DIN IEC 60093	2×10^{14} Ohm
Moisture and insulation resistance	IPC-CC-830B, 3.7.1 (65 °C [149 °F]/90 % r. h.)	5×10^{10} Ohm class A and B
Moisture and insulation resistance	85/85 test; ramp formed storage at high air moisture and high temperature, amongst others 3 days at 85 °C [185 °F] and 85 % r. h.	1×10^9 Ohm
Thermal shock	IPC-CC-830B, 3.7.3	class 3 passed
Hydrolytic stability	IPC-CC-830B, 3.7.3	passed
Comparative Tracking Index (CTI, tracking resistance)	DIN EN 60112 on FR4 base material with CTI 275 CTI 600	CTI > 600 CTI > 600
Resistance to condensation	based on DIN 50 017 (BIAS 12 V, 40 °C [104 °F], 100% r. h.)	$> 10^{10}$ Ohm
Dielectric constant ϵ	VDE 0303, part 4	50 Hz: 3.8 1 MHz: 3.2
Dielectric loss factor $\tan \delta$	VDE 0303, part 4	50 Hz: 0.052 1 MHz: 0.036
TI (temperature index)	DIN EN 60216 (IEC 60216) issue 2001	125 °C [257 °F] (20 000 h)* 150 °C [302 °F] (5 000 h)*



Depending upon the layer thickness the lacquer film will take longer to achieve its maximum property values.

Check the property values according to DIN 46 449 "Conformal coatings/test methods" no earlier than 96 hours after tack-free stage has been reached (see also Item 8 "Drying/curing").

* Limit values for classification were a 25 % loss in mass and/or dielectric strength in comparison to the appropriate reference values.

7. Processing

→ Please read our **Application Information sheet AI 1/1** "Processing instructions for the conformal coatings of the series' ELPEGUARD® SL 1300 to SL 1309 N and SL 1400" where you will find detailed advice on processing. In our report manual the Application Information sheet AI 1/1 is filed under group 1. On our report manual CD and on our website you will find application information sheets in the "Service" section.

The conformal coatings of the series **ELPEGUARD® SL 1307** can be applied by brushing, spraying or by means of automatic selective coating units. Owing to the modified solvent composition and the delayed curing of **ELPEGUARD® SL 1307 MS** (index MS = moderate boiling solvent) it is particularly suitable for application by dipping.



Since the many different permutations make it impossible to evaluate the whole spectrum (parameters, reactions with materials used, chemical processes and machines) of processes and subsequent processes in all their variations, the parameters we recommend are to be viewed as guidelines only. We advise you to determine the exact process limitations within your production environment, in particular as regards compatibility with your specific follow-up processes, in order to ensure a stable fabrication process and products of the highest possible quality.

The product data specified in the technical reports is based upon standard processing/test conditions of the mentioned norms and must be verified observing suitable test conditions on processed printed circuit boards.

Feel free to contact us if you have any questions or for a consultation with our application technology department.

7.1 Adjustment of viscosity

→ Adjust the processing viscosity for each application process by means of the appropriate thinner (see item 3.1 of the Application Information sheet AI 1/1 “Adjustment of the processing viscosity”) and observe the recommended processing temperature.

to be thinned with thinner V 1307: SL 1307
SL 1337
SL 1367

DIL

to be thinned with thinner V 1307 FLZ: SL 1307 FLZ
SL 1307 FLZ/23
SL 1307 FLZ/25

to be thinned with thinner V 1307 MS: SL 1307 MS
SL 1367 MS-FLZ-FE/22

When processing the conformal coatings of the series ELPEGUARD® SL 1307 by means of compressed air **different to the advice given in the Application Information sheet AI 1/1** we recommend a processing viscosity of 25 – 35 s (the lacquer viscosity to be adjusted also depends on the spray nozzle diameter used, see also item 5.4 of the **Application Information sheet AI 1/1**. The viscosity must be adjusted to the spray nozzle diameter used.)

The following diagram shows the relationship between lacquer viscosity and quantity of thinner to be added (related to the viscosity in the condition supplied).

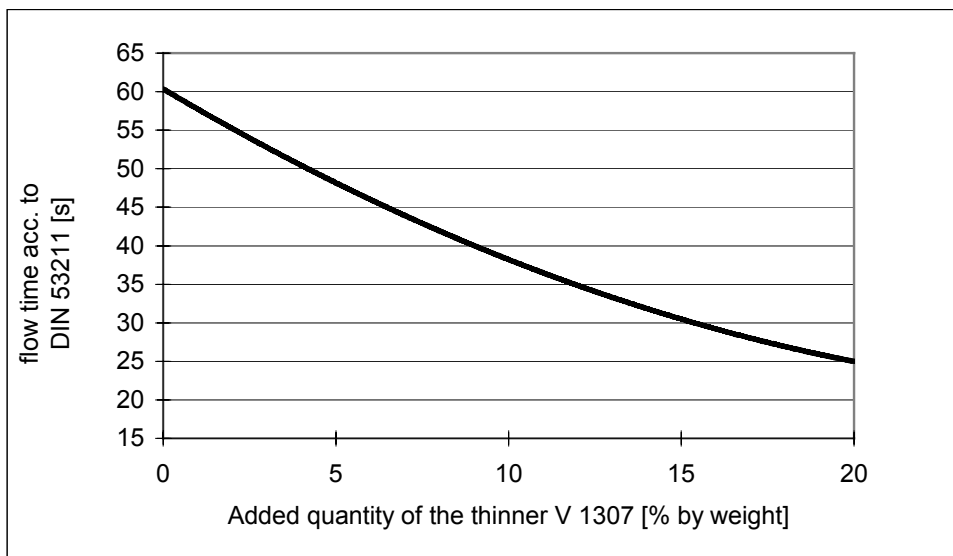


Fig. 1: Dependency of the viscosity on the added quantity of thinner for the conformal coating ELPEGUARD® SL 1307 at 20 °C [68 °F]

7.2 Auxiliary products

- **Thinner**

The conformal coating can be removed for repair purposes with the help of **V 1307**, **V 1307 FLZ** or **V 1307 MS**

- **Cleaning agent R 5817**

For cleaning work place and tools we recommend our cleaning agent **R 5817**.



Do not use the cleaning agent to clean hands. Solvents extract the natural grease from the skin.

- **Peelable protective skin EH 13.150 AQ-T**

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.

Special technical reports on these products are available upon request. In our report manual these technical reports are filed under group 5 and 13. On our report manual CD you will find technical reports in the "Products" section.

7.3 Duplicate coating

The conformal coatings of the series **ELPEGUARD® SL 1307** are not suitable for duplicate coating since they are dissolved by the solvent contained in the lacquer.

8. Drying/curing

Drying can be effected directly after coating at room temperature or in hot-air drying units. Drying is finished after complete evaporation of the solvents.

→ Observe the advice given in Section 7 of the **Application Information sheet AI 1/1 "Drying/Curing"**.

The time required for curing depends, among others, on the geometry of the assemblies, the population and ink layer thickness. In case of oven drying it depends on the oven loading etc. The following data serves as a guideline:

- **Drying at room temperature**

	Drying at room temperature (tack-free) acc. to DIN EN 60464 (IEC 60464)	Drying time until packaging
SL 1307 SL 1307 FLZ SL 1307 FLZ/23 SL 1307 FLZ/25 SL 1337 SL 1367	15 – 20 min	1 h
SL 1307 MS SL 1367 MS-FLZ-FE/22	1 h	2 h

- **Drying in circulating hot-air units**

Curing can be accelerated in circulating hot-air units.

→ Cure the conformal coatings of the series **ELPEGUARD® SL 1307** for **5 – 20 min at 50 – 80 °C [122 – 176 °F]**

→ Consider the temperature resistance of the assembly and the components.

→ Check the electrical properties of the coating (see Item 6.3) to ensure curing is completed.

→ Pack the assemblies only after they have cooled down to room temperature.

9. Standard packaging

The conformal coatings of the series **ELPEGUARD® SL 1307** are packed for delivery as follows:

	Packaging	Selling unit
SL 1307 SL 1307 FLZ SL 1307 FLZ/23 SL 1307 FLZ/25 SL 1307 MS SL 1337 SL 1367 SL 1367 MS-FLZ-FE/22	Can of 25 kg	25 kg
V 1307 V 1307 FLZ V 1307 MS	Can of 23,5 kg	23.5 kg

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

10. Shelf life and storage conditions

Labels on containers show shelf life and storage conditions.



Shelf life: In sealed original containers at least 18 months



Storage conditions: +5 °C to +25 °C [+41 °F to +77 °F]

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.

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 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.

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