POSITIV 20

Ref. : 20820

1. GENERAL DESCRIPTION

Liquid photo-positive resist based on o-naphto-chinon-diazide and Novolack, used in the production of printed circuit boards.

2. FEATURES

POSITIV 20 is a classic liquid photo-resist that transfers patterns directly onto working materials for processing by etching. The lacquer resists strong acidic etching products however can be easily be removed by solvents (ester, ketone) or aqueous alkalines.

The lacquer is at its most photo-sensitive at close utlra-violet range (UVA). The lacquer should therefore be applied in yellow light or darkened daylight.

3. APPLICATIONS

The main application for POSITIV 20 is the production of printed circuits boards. The transparent positive-pattern from the circuit diagram is accurately transferred. Surfaces impervious to light e.g. the electrical circuits, do remain present after etching.

Other application include photo-lithographics on metal or glass.

4. DIRECTIONS

Directions in producing printed circuits

4.a. Surface preparation

Surfaces must be free of grease and oxide. A water-based cleaning process is available. When preparing metal surfaces manually, household scouring powders are ideal. Solvents are only used when dirty, oily stains have to be removed. The last step in the cleaning process should be rinsing with demineralized water.

At this stage the cleaned surface should be fully wetable and hence no water repellant areas should be left. The cleaned board should be left drying in a dust-free environment.

4.b. Coating

Following the cleaning stage, the horizontally positioned copper plate is coated by spraying (aerosol) from a distance of 20 cm. Best result in getting a uniform coating is obtained by continuously spraying in a zigzag pattern. A typical coat thickness is 6-8µm and has a bluish colour. To overcome discontinuities while spraying, the aerosol can should not be held too tilted.

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The lacquer is sensitive to UV-light and hence exposure to direct sunlight or bright day light should be avoided. Coated materials can be stored in the dark at 25℃ for up to 4 weeks.

4.c. Drying

After application of the film, boards must be dried immediately in the dark. The drying temperature should be increased slowly to 70℃ and kept at that temperature for approximately 15 minutes. Infrared or forced air drying is possible. When air drying at ambient temperature is used (24 hrs minimum), the quality of the film will only allow very simple work. The adhesion is poor and the danger for dust entrapment and pinholes is high.

4.d. Exposure

The transparent circuit diagram must be placed flat and error free on the copper plate. Paper based diagrams can be made transparent using Kontakt Chemie TRANSPARENT 21. The spectral sensitivity for the photo resist POSITIVE 20 lacquer lies in the wave length range 340 to 420 nm, so one can use UV-lamps to expose the film/copper plate. At an exposure strength of 100 mJ/cm² the exposure time will be approximately 10 seconds for a film thickness of 8µm.

In practice the exposure time is between 60 and 120 seconds when lamps are used from a distance of 25-30 cm. It is recommended to allow the lamps to warm-up for approximately 3 minutes.

4.e. Developing

The exposed plate is being developed by immersion in a sodium hydroxide bath (10 g/l sodium hydroxide in water) at ambient temperature for approximately 60 seconds. The exposed lacquer dissolves. The developing process can be assisted by minor bath agitations. After developing, the plates are rinsed thoroughly with water.

4.f. Etching

Etching of copper and brass plates is best done with an iron-3-chloride solution (400 g/l water). The required time is between 30 and 60 minutes. Warming-up the solution to 40℃ plus minor bath movements will assist the etch ing. At the end of the etching process, plates should be rinsed excessively under running water.

4.g. Stripping of remaining lacquer

Following the etching, the remaining lacquer is to be removed from the circuits. This is best done with acetone at ambient temperature.

We do recommend to apply a film of Flux SK10 to the PCB's, in case these are not being processed immediately. The Flux SK10 lacquer protects the circuits from oxidation plus acts at the same time as a highly effective flux during subsequent soldering.

Finished PCB's can be coated with PLASTIK 70 to protect these from environmental humidity.

Possible deficiencies and their cause during application

Bad adhesion, blisters or dot formations

- Product shelve life (18 months) has expired, see date on aerosol can
- Presence of anti-cross linking impurities: cleaning with scouring powder and rinse.
- Summer hot temperature during application: Decreases spray distance.
- Aerosol can too cold, just out of fridge: leave at ambient temperature.
- Too high drying temperature: to not exceed 70°C.

Pin-holes formation

- Insufficient drying: dry at the recommended temperature of 70°C.
- Too fast drying: gradually increase over a period of 15 min. the temperature to 70°C.
- Too long a development time: do not exceed 2 minutes.

Other applications of POSITIV 20

- **Etching of glass**: the lacquer also resists 40% strong hydro fluoro acid hence making it possible to etch glass. The adhesion can be improved by a temperature treatment at approximately 120°C.
- **Production of durable inscriptions or graphics**: A temperature treatment of the lacquer at 190°C will result in durable inscriptions or gra phics having a blackish-brown color.

Safety precautions

While working with the above mentioned chemicals, it is necessary to strictly adhere to the safety and handling instructions. Skin and eye contact are strictly to be avoided. We

recommend the use of protective clothing, gloves and safety spectacles. Use only in well ventilated areas.

A safety data sheet (MSDS) according to EU directive 91/155/EEC and amendments is available for all CRC products.

5. TYPICAL PRODUCT DATA (without propellant)

Color	:	blue, transparent
Flashpoint spray	:	<0°C
Coverage at film thickness of 8µm	:	±1m²/200 ml aerosol
Maximum spectral photo-sensitivity	:	340-420 mm (UV-A)
Shelve life	:	18 months following aerosol production (see aerosol can)

6. PACKAGING

Aerosol: 25 x 100 ml; 12 x 200 ml

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Annex: Do-it-yourself printed circuits made easy

Forget about any problems you have ever had with the production of printed circuits. Use Positiv 20, the photoresist varnish which makes child's play of the production of printed circuits.

With Positiv 20 **you expose directly from the positive without using a negative** and after developing you will obtain **a sharp edged impression of the circuit giving all the advantages of a perfect reproduction copy. Irrespective of size or format,** you can coat the material yourself with a light sensitive photo-varnish "Photoresist". The procedure used is highly practical and inexpensive when preparing single circuits or a small series of circuits. A spray can of 200 ml is normally sufficient for 4 square metres (43 square feet) of copper laminated board. A smaller 75 ml can is normally sufficient for coating approximately 2 square metres (21 square feet).
The following advice will enable technicians and amateurs alike to produce printed circuits without prior experience.

1. Pre-treatment of the Original Material

The surface to be sprayed must **be absolutely grease free**. To ensure this, clean with a good detergent (Vim, ATA or other powdered cleaner). Rub in the detergent with a moist rag so that it brightens the copper surface, removes any oxides and makes the copper layer completely wettable. This can be checked by running the surface under a tap to make sure that there are no water repellent areas left. After rinsing the plate thoroughly, dry it between sheets of absorbent paper taking extreme care to avoid any fingerprints on the board surface.
Abrasive pads or solvents other than good detergents should not be used for cleaning the surface.

2.Application of Layer

A dark room is not required for the application of the photoresist. This must be done however in a subdued light i.e. without sunshine or similar brightness and it is also very important that the work is carried out in a dust-free atmosphere. The board should be placed in a horizontal position and the spray applied from a distance of approximately 20 cm (8") from the board. To give a uniform coverage, application of the spray should be made in serpentine lines commencing at the upper left hand corner. Please note that application of too much spray will result in undesirable edges and coats of varying thicknesses requiring a longer exposure time (see paragraph 5). Whilst spraying, the spray can should be held in a vertical or slightly inclined position and after applications of the spray coating the boards should not be exposed to daylight.

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3. Drying

After application of the sprayed-on coating, boards must be dried immediately in the dark. If necessary, the varnish can be dried at room temperature which will take at least 24 hours. It is safer to accelerate drying in a drying chamber of thermostatically controlled oven. If using for example an electric grill, make sure that all opening are covered and any source of light is shut off. Raise the temperature slowly to 70℃ maxi mum and dry at this temperature for about 20 minutes.

Caution: Any drying temperature exceeding 70℃ is l iable to damage the board!

4. Positive original

The original circuit drawing should be carefully prepared as it will be used as a master (positive) and will be copied onto the board surface. If the circuit is drawn with Indian ink, it is advisable to use transparent paper (tracing paper) of 90g/m2. For the production of high quality printed circuits, use originals **on highly transparent film material only**. Today print-outs on tracing paper or transparencies can be used. Be aware that **the original drawing must be entirely impermeable to light** and that the film of the original must allow ultraviolet rays to pass through.

Originals showing extremely narrow sections of the circuit can be placed upside-down, so that direct copying onto the coating can be done. This will eliminate any side lighting effect with the resulting loss of width. Some trade journals publish circuit diagrams with a scale of 1: 1 on one side. By means of a transparency spray with brand TRANSPARENT 21, developed by KONTAKT CHEMIE, you can make such sides transparent and permeable for ultraviolet light. So, the direct copying out of circuit diagrams from trade journals on plates coated with Positiv 20 is possible. Transparent 21 makes tedious repro works unnecessary. If quality is not so important, you can also make photocopies onto transparencies.
Place the original on top of the board surface. Put a sheet of glass on top of this and clamp them together, so that no light leaks underneath your drawing original.

5. Exposure

Time required for exposure depends on both the thickness of the coating and the intensity of the light source. A wide range of exposure ensures the safety margin required. Since our photoresist varnish Positiv 20 is **sensitive to ultraviolet rays,** ultraviolet lamps e.g. a mercury vapour lamp Philips HPR 125W or sunlamps 300W can be used. **Exposure time depends on the thickness of the coating and will take 60 - 120 seconds at a distance of up to 25 - 30cm. Start with 60 s, if the film (transparent sections) remains cloudy, a longer exposure time (not under 120 seconds) will be necessary.**
Check the film every 15 seconds. It is important that the plates are not exposed to the UV-light before the lamp has reached full intensity normally 2–3 minutes from being switched on.

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In the event that an Ultraviolet lamp is not available, any other lamp can be used that emits sufficiently high amount of effective ultraviolet light, e.g. Xenon lamps or super actinic tubes. Light from punctiform lamps is preferable to light from tubular lamps.The spectral sensitivity for the photoresist Positiv 20 lies between 360 and 410 nm.

6. Developing

Remove the plate from under the glass. Then bring the exposed plate in the developer in a plastic tray and agitate gently. Developing may not be performed in direct light, dark conditions are preferred. To prepare the developer in the correct concentration add **7 grams of caustic soda (NaOH) to one litre of cold water.** Caustic soda is normally obtainable from any chemist's shop or pharmacy.
After a maximum of 2 minutes the image of the conductor should be fully developed. If not the board is under exposed. Normally the exposed section of the photoresist coating are removed in the developer, the original copper is clearly visible. The circuits are now outlined in a different colour compared to the copper. Do not leave the plate in the developer for an overlong time, otherwise it will attack the unexposed parts of the photoresist coating.
In cases of over-exposure and if the ink drawings are not completely opaque, the image of the circuits will appear for a short time but will eventually be removed by the developer.
CAUTION: After developing rinse the board in running cold water. **Also wash your hands thoroughly in water every time you have worked with caustic soda.**

7. Etching

Photoresist varnish Positiv 20 is resistant to acid baths of **ferric chloride, ammonium persulphate, chromic acid and hydrofluoric acid.** The latter two are used for etching glass plates using the usual processing methods. For the etching of copper plates we recommend an etching bath of ferric chloride heated to approximately 45℃ of a density of 35 – 40%.
Using the following mixture modern etching practice allows short etching times.
200 ml hydrochloric acid (HCL 35%)
30 ml hydrogen peroxide (H2O2 30%)
770 ml water (H2O)
This mixture has a pungent smell and produces light vapours. It is essential that it is used with great care.
Avoid any contact with the skin, but if this should occur, the affected area must be washed immediately.
When using it is essential that the eyes be protected. The mixture also attacks clothing and other materials and the extreme care required in handling cannot be over-emphasized.
The solution should be stored in dark bottles – **not closed by airtight stoppers**, because an excess pressure will then be generated inside the bottle by the disintegration of H2O2.

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8. Clearing (removal of the coating)

For removing the photoresist coating acetone or other ketone solvents can be used. After the clearing process we recommend the application of our protective Soldering Varnish SK 10 which effectively protects the circuit's paths from oxidation and also assists the soldering process.

9. Durability (removal of the coating)

Positiv 20 has a limited shelf life until the date indicated (EXP) on the to prim of the aerosol. The product has to be stored cool (optimal between +8 and +12℃
in refrigerator, not in the freezer).

Positiv 20 in an aerosol not only facilitates the production of printed circuits of all sizes, but also allows the production of photoengraving and enables the precise transfer of image elements to materials of many different kinds. Once your board or foil has been printed, it is advisable to safely protect the circuit against environmental effects. This can be done with absolute safety by using Plastik 70 spray which is a transparent protective varnish of acrylic resin giving a clear transparent coating with high quality insulation. A protective film of this type will permit the soldering of metallic surfaces. Place the original on top of the board surface.
The spraying agents are high quality products manufactured by Kontakt Chemie – Europe's leading manufacturer of Electronic Sprays.
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