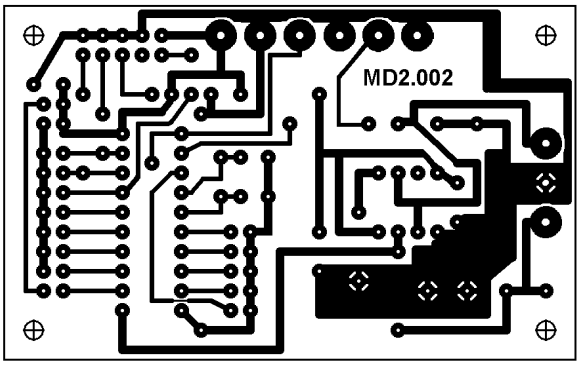
Positiv 20

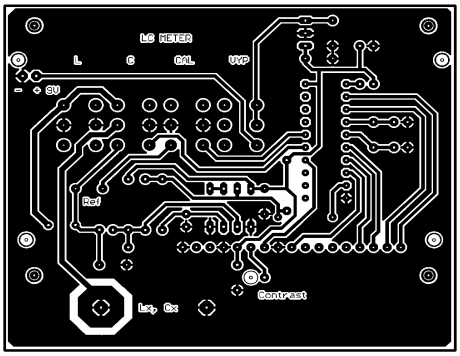
How to make your self Printed Circuit Boards

1. Making your own drawing

It is of utmost importance to use a positive original that is most carefully prepared, as the circuit you make will always be a true image of the original.

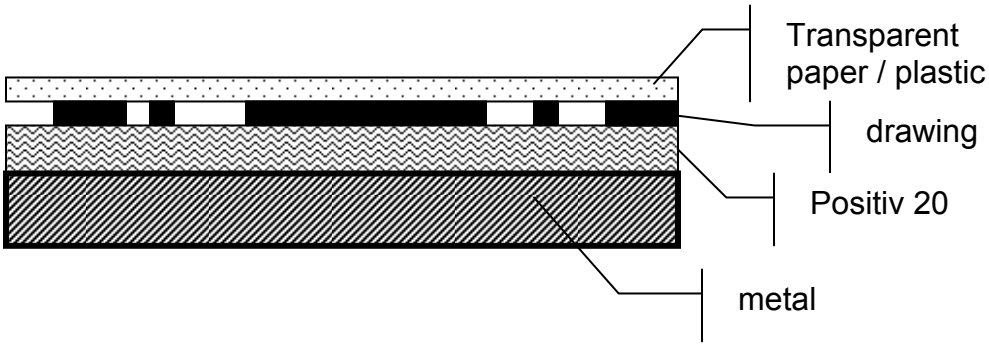


positive original



negative original

- To make your positive drawing, use a fully transparent carrier that does not absorb UV light. The carrier must in no case be yellowed.
- Choice of the transparent:
  - When the drawing is made with “Indian ink” use transparent paper (90 g/m²)
  - Use plastic transparencies when copying from the original on a Xerox machine.
  - Use plastic transparencies when pasting self adhering symbols.
- Make sure the drawing or pasted symbols are on the reverse side of the carrier. This will allow the closest contact between drawing and the photosensitive film.



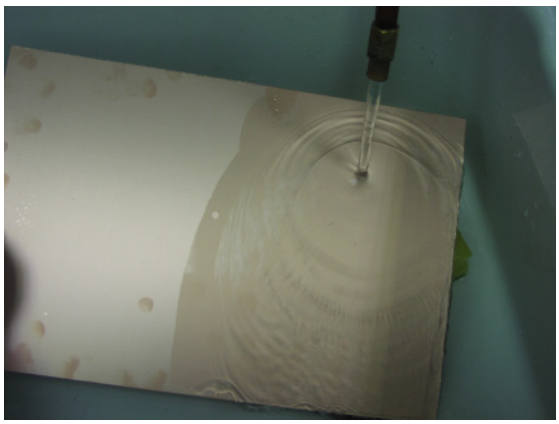
The lines of the drawing must be entirely impervious to light, meaning they should block all light. When Indian ink has been used, make touch ups only after the ink is completely dried.

2. Cleaning the boards

The metal (copper) surface must be absolutely free of grease and dust.

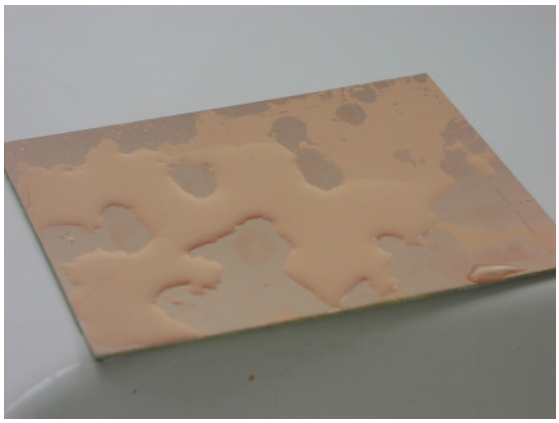
Use an abrasive detergent (VIM, ATA, Cif, …) and rub gently the metal surface to remove any oxides, grease or other impurities. Using an abrasive detergent makes the copper layer fully wetable.
Rinse the metal surface with plenty of clean water.

cleaning

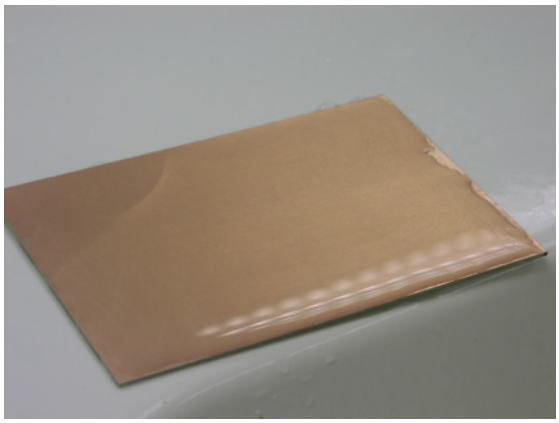


rinsing

Check the wetting ability of the metal surface: the clean rinsing water should wet the complete surface and form an unbroken film. Unwetted spots on the surface do mean: the surface is not entirely clean.



bad wetting

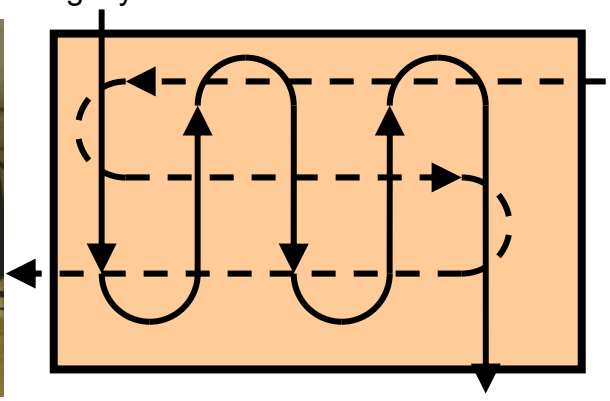


good wetting

Do not use any solvents after the cleaning procedure. Make sure not to touch the surface with your fingers and allow for complete drying on a dust free place.

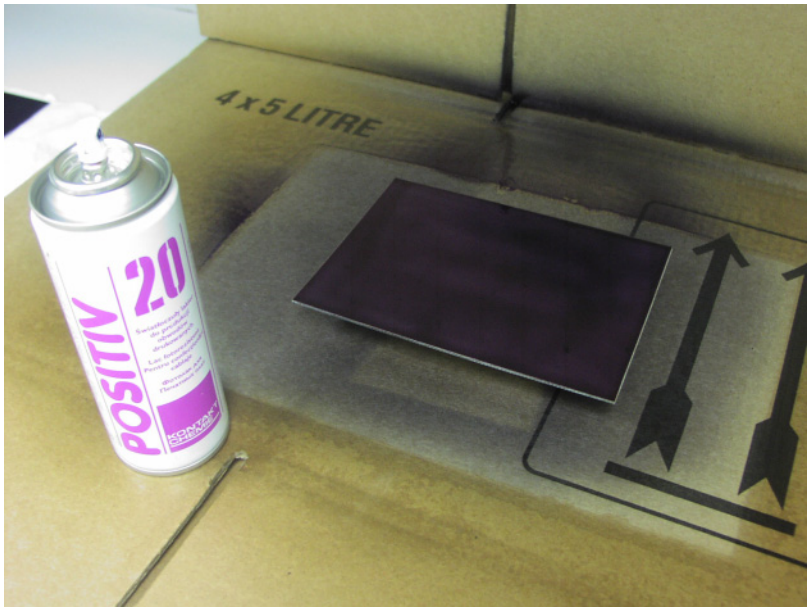
3. Application of Positiv 20

- Leave the Positiv 20 aerosol together with the boards to be treated at room temperature for at least 4 hours prior to application.
- Application of the Positiv 20 should be done in attenuated daylight. A darkroom is not required but sunshine or bright daylight must be avoided.
- Work in an atmosphere free of dust.
- Place the board horizontally or slightly inclined.



- Spray from a distance of 20 à 30 cm in a continuous, serpentine movement.
- Hold the spray can as vertical as possible
- Stop spraying when an effect of “orange peel” occurs

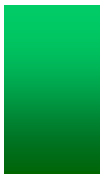
Most important is obtaining an even thick film



When working at elevated temperatures (summer) the spray distance should be shortened to compensate for the faster evaporation of the solvents.

The color of the layer gives an indication for the coat weight:

Light grey-green	=	1 – 4 µ
Dark grey-green	=	4 – 6 µ
Green	=	6 – 8 µ
Dark green	=	> 8 µ



For most purposes we recommend a thickness of 4 – 6µ. Deviation might be needed for special applications.
Depending on the color of the board the aspect might vary (e.g. on copper → blue-green)

4. Drying

The boards must be dried in the dark, prior to further handling.
The drying can be done in a drying cabinet or a thermostatically controlled oven.
Drying procedure:

Start the initial drying at a temperature gradually going up from room temperature to 40°C during a period of 10 minutes. Continuo the final drying by bringing the temperature gradually up to 70°C and leave at that temperature for 20 minutes.

Note that the drying time is relative to the coat weight. This is: the thicker the layer, the longer the drying time
Make sure the coated boards are thoroughly dry, as insufficient drying will cause pin-holes and a loss of adhesion.

5. Exposure

Best results can be reached by UV-lamps, e.g. quartz-lamp or a Philips HPR 125 mercury vapor lamp. You may also use Xenon lamps, or super actinic tubes.
A sufficient high amount of effective UV light ranging from 370 to 440 nm is in any case required.

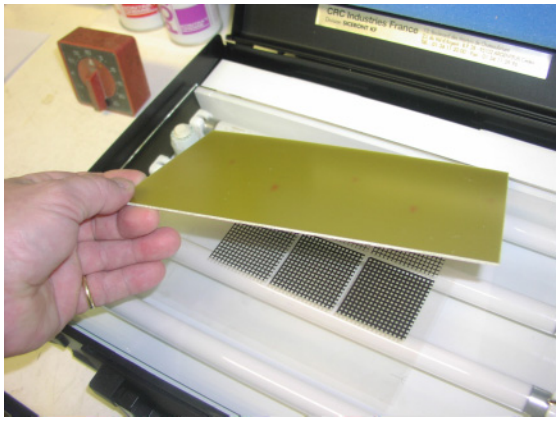
Standard bulbs have only a small share of blue (and so UV) light. One of our customers obtained good results by using a 200 W bulb at a distance of 12 cm and with an exposure time of 15 minutes.

It is the wavelength and not the wattage of the rays that determine the exposure time. The most favorable spectral sensitivity of the photo resist varnish Positiv 20 lies between 370 and 440 nm. Glass plates used for covering can absorb up to 65% of the UV rays. In such cases expose longer or use crystal glass or Plexiglas.

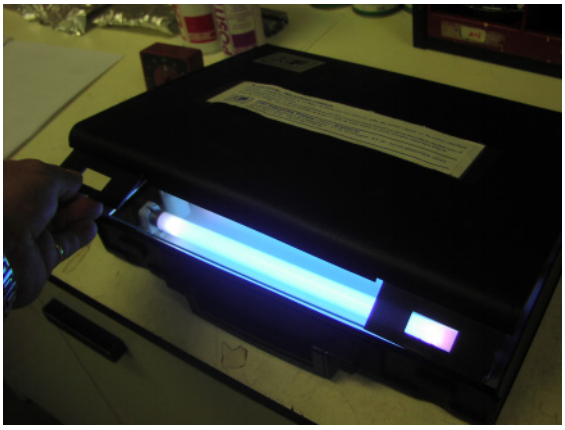
Where thicker varnish layers and the formation of edges are involved, twice the exposure time is required. Older photo resist varnish should be exposed for a longer period.

Some example of exposure time in function of the light source

Source of light	time	distance	notes
Mercury vapour lamp Philips HPR 125	3 min	30 cm	Crystal cover 5 mm
Mercury vapour lamp 1000 Watt	90 sec	50 cm	Crystal cover 5 mm
Mercury vapour lamp 500 Watt	150 sec	50 cm	Crystal cover 5 mm
Quartz lamp 300 Watt	180 to 240 sec	30 cm	Crystal cover 5 mm
Sunlight	5 to 10 min		Crystal cover 5 mm
Osram Vitalux 300 watt	4 to 8 min	40 cm	Crystal cover 8 mm



Positioning drawing & board

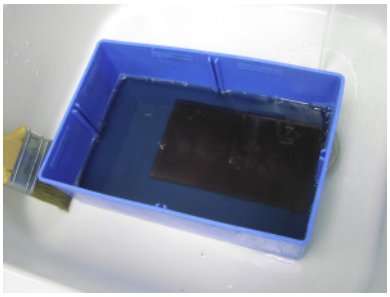


expose

- Position the positive original with the drawing side on the board.
- Assure a good and even contact all over the surface by means of a crystal or Plexiglas plate.

6. Developing

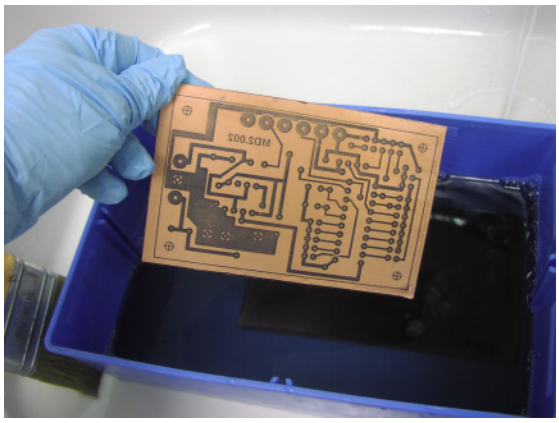
The exposed Positiv 20 layer is developed in normal daylight, without direct sunlight entering the room.



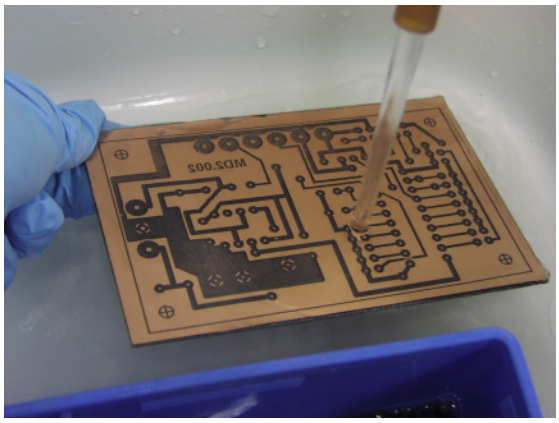
Prepare the developer with a solution of:
7 grams of caustic soda (NaOH)
in one (1) liter of water
in a suitable container (e.g. plastic)

Make sure the developer has a temperature between +20°C and +25°C.

- Submerge the exposed board into the developer. The varnish, exposed to the UV light, will dissolve and render the caustic solution slightly cloudy.
- Exposed layers with a thickness of 4 to 6µ will develop in 30 to 60 seconds. Thicker layers need more time, but do not exceed 2 minutes.
- Take care that the developed circuit diagram is clean and free from any fog. If there is still fog on the surface, continuo with developing.
- After developing, rinse the board with clean water.



end of developing



rinse

Never add new developer to used one. Always use new developer.

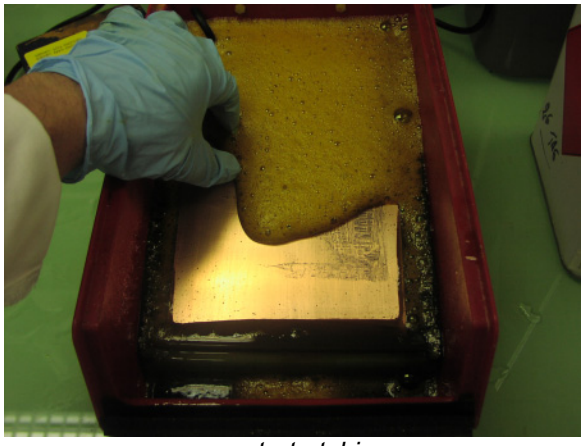
For difficult to etch materials, a post curing of 10 to 30 minutes at 120°C is recommended.

7. Etching

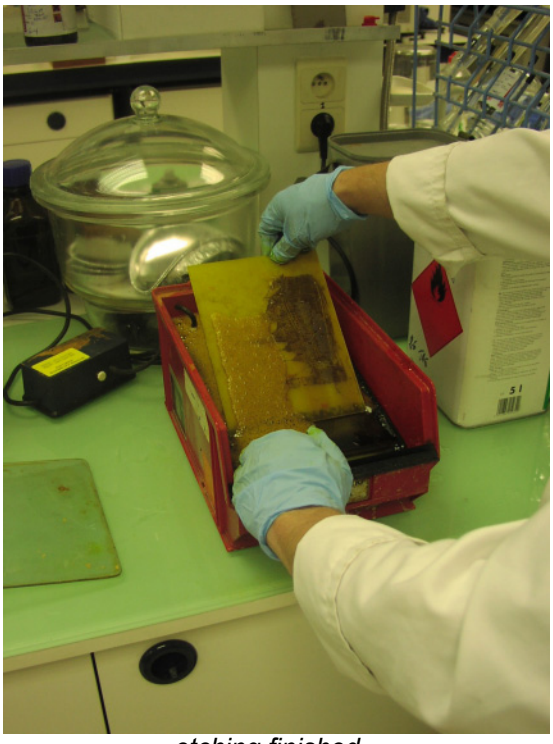
The remaining Positiv 20 film on the boards is resistant to acid baths of:
Ferric chloride
Ammonium persulphate
Chromic acid

Ferric Chloride process (Fe-III-Cl)

- Fe-III-Cl as a solid material is dissolved in water until a saturated solution with a golden yellow color is obtained.
- The etching process lasts from 30 to 60 minutes
- Heating and agitating the solution accelerates the process.
- After the etching process: rinse the board with plenty of clean water.



start etching



etching finished

Ammonium persulphate process $(NH_4)_2S_2O_8$

- Ammonium persulphate, a white crystalline body, is dissolved in water (35 g $(NH_4)_2S_2O_8$ in 65 ml water.
- Bring the etching solution to 40°C and assure the solution will be agitated during the etching process.
- The etching process takes about 10 minutes
- After the etching process: rinse the board with plenty of clean water.

We do not recommend using chromic acid for the etching procedure.

NOTE: treat the chemicals and the prepared solutions according to the rules and legislation for handling, storage, usage,… and take the needed safety precautions.

Dispose used chemicals always according to the local legislation.

8. Removal of remaining varnish

Once the etching process is finished, the remaining varnish must be removed. Use an organic solvent (like Acetone) to clear the board from remaining varnish.

After clearing, be sure to protect the board against corrosion. Plastik 70 is a suitable protective coating that will even allow afterwards soldering.

Reference: Technical Data Sheet: www.crcind.com