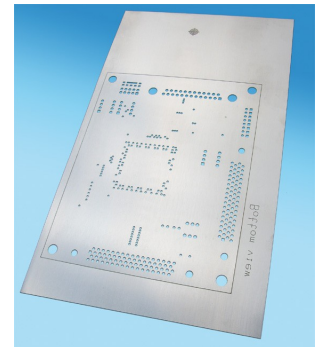


Bungard company offers for your model building or stencil production base material made of brass or German silver.

German silver we provide in the format 280 x 1000 and in thicknesses of 0.1 mm, 0.15 mm, 0.2 mm, 0.3 mm. We also supply brass in the format 500 x 1000 and in thicknesses of 0.2 mm, 0.3 mm, 0.5 mm.

Both materials are coated on both sides with a high resolution photoresist with 5µm thickness according our own recipe.

Upon request, we coat the plates with a negative-laminate. The processing of negative-coated plates is not covered here.



Working material

you need:

- Work area with subdued light or yellow light
- Exposure unit (e.g. Bungard [Hellas](#))
- developing tray
- Spray etching machine (e.g. Bungard [Jet](#), [Splash](#), [Splash-Center](#) or [DL 500](#))
- 1 litre of water (20°C)
- 1 bag of special developer
- Water for rinsing
- Paper towels to dry the plates
- 2 Film templates

Safety instructions



Wear safety goggles



Wear protective gloves

When handling chemicals, always wear protective equipment such as gloves and eye protection.

Avoid contact of chemicals with skin, eyes and mucous membranes.

Contaminated clothing should be changed immediately.

Keep the chemicals out of reach of children.

If developing solution has been swallowed, immediately consult a doctor with reference to a 1% caustic solution.

You will receive our special developer in sealed bags with tear notch. Always loosen the entire content of one bag in 1 litre of water. Have your opened bags not lie around. The solution may be stored in a sealed, clearly marked container made of glass, polyethylene or PVC.

For Safety instructions for handling corrosive liquids please ask the respective suppliers. On request we can send you material safety data sheets for all chemicals that you purchase from us.

Making of the layout

The artwork must have good contrast and coverage. The best results are achieved, if you draw the design on the computer and plot it with our laser plotter film star on a transparent photographic film. Alternatively, you can also operate with a high resolution ink jet or laser printer.

Make sure that the "ink" or "black" side of the film lies directly on the plate. This will reduce the exposure by diagonal light rays (so called under radiation) during exposure. If necessary you need to mirror the layout.

If your template is from a laser printer and does not have enough contrast, you can rework the template with our [Blackout Spray](#).

Setting up developer

Set up the developer as follows:

Solve a bag of special developer completely in one litre of water (approximately 20°C). Stir if necessary. You can store the fresh solution in a closed and labelled container. One litre of developer is enough for approx. 0.5 m² base material.

For your own safety please pay attention to the safety instructions.

Exposure

Prior to exposure your layouts needs to be registered to your brass board.

Since the miniature etching parts are normally etched from both sides, both layouts must lie accurately fitting on both sides.

There are two possible ways to transfer the layout onto the pcb:

The first and maybe simpler is to combine the two sides of you layout to a so called film bag.

First you need to make an angle in the same thickness and length and width of your future miniature etching part. Then attach the layout for the bottom to the bottom side of the angle and on the top side of the angle the layout for the top. Make sure that the printed side comes to rest on the plate so that the layout is not twisted/turned in a wrong manner and that the top and bottom are exactly matching each other.

For the second possibility you have to print/plot your layouts with registration marks, which lie outside the actual design. These registration marks need to be punched into the layout (e.g. with the Bungard [FilmPunch](#) and drilled into your panel (we offer a registration hole function with our CAD-Cam software [IsoCam](#). IsoCam will also create a reference hole drill file, which will enable you to drill the reference holes with the Bungard [CCD](#)).

Or attach the upper layout e.g. with masking tape to the plate and then drill with a precision drill (e.g. Bungard [Variodrill](#)) the registration marks through layout **and** plate. Now having reference holes on your board for top and bottom side, you can secure the layout with fixing rivets, so bottom and top side of your layout will match automatically.

The photoresist reproduces positive. It has its maximum spectral sensitivity at 400 nm. Exposure time depends on the number, the power and the spectrum of the light sources you have and their distance to the plate. With the Bungard [HELLAS](#) exposure time is approx. 120 s. Overexposure is not critical with a good layout, underexposure makes developing of the plate difficult or impossible! A hint for underexposure is, when the colour of the developer changes to brown-reddish colour.

The optimal exposure time can be determined as follows:

Remove a narrow strip of tape from the plate. Place the template on the exposure unit and expose the plate for 20 seconds. Remove another strip of foil and repeat the process n-times. This way you get a board, whose final strip is exposed for 20 seconds, the first strip however was exposed n x 20 seconds was exposed. If now the fifth strip perfectly develops within a minute, the perfect exposure time for your exposure unit is 5 x 20 seconds = 100 s. A safety margin of 1 level added, the result is an optimum at 120 seconds.

Developing

Fill the clean bowl with as much fresh developer, so that the plates are just covered.

Let the exposed plate slide into the bowl. With double-sided boards, make sure that sufficient developer touches the bottom side and no dirt particles cause mechanical damage.

Immediately after immersion into the developer a clear contrast between exposed and unexposed portions of the plate shows up. Enhance the development process by moving the plate in the dish slightly up and down. Please do not rub over the plate, as this could cause damage.

If there is no longer resist coming off the plate and the copper surfaces appear metallic bright, the plate is fully developed. This usually takes less than 60 seconds. The unexposed photo-coat is approximately over 5 minutes resistant against the developer solution. The risk of damage due to long development is minimal. Of course, the above times are based on the correct use of our specialized developer.

After development, rinse the plate please thoroughly under cold running water.

The developer solution loses its effect with time and progressive saturation. Used solution hinders the development process considerably. Previously used developer should not be poured back to fresh solution.

You should therefore set up only so much developer as needed for the job, and replace the contents of the bowl at the latest, if you cannot recognize the board in the liquid.

Better results are obtained with our spray developing machines ([Jet34d](#), [Splash](#) or [DL500](#)), as there is always fresh developer solution sprayed onto the board. Instead of the etchant solution, simply fill in developer into the machine. If necessary a defamer should be added to reduce the development of foam when sprayed.

Etching

The photo-coat is resistant to most available acidic etching media. Also, alkaline etching is possible provided that a pH of 9.5 is not exceeded and the plate was not exposed to daylight or any other kind of UV-light.

The resolution of the photo-coat is in the range of a few micrometers. Due to the unavoidable under-etching effect, the maximum resolution with a copper surface of 35 µm is about 70 µm.

Special influence on the etching result, of course, have the etchant and the type of etching machine. A fast etching will always give a better result with a finer line resolution. The spray etching technique with its fast media exchange and the energy of the beam that impinges perpendicularly on the surface, increases both the speed and precision of the result. We recommend a double-sided etching machine for model building parts, as the under etching effect is stronger with a single sided machine.

Our [Splash](#) e.g. achieves in fresh, warm ferric(III)chloride an etching rate of approx. 25 microns / minute, which means that a 150 µm German silver will need an etching time of 3 minutes (two-sided etching, 3 times 25 microns!) with a resolution better than 100 microns.

The use of sodium or ammonium persulfate, however, is out of date and under the Special Waste Avoidance bid even illegal. After etching, you should rinse the panels thoroughly and dry with paper towels or air.

Stripping

After etching, the photo-coat can remain on the model building part. You can solder through the coat.

If you want to surface treat your board (tinning, protective varnish or colour paint), then the photoresist needs to be removed. You can use acetone or alcohol.

Another, very gentle and economical way is to expose and develop the plate again.

The fact that the photoresist can be exposed and developed several times, enables selective etching, e.g. if you want to etch part of your model completely, where as others parts of the same board should get only a certain surface patterns.

Disposal

The developer of photo-coated boards is not a photographic developer and contains neither heavy nor precious metals. A characteristic feature is the content of lye, similar to waste water from dishwashers.

According to our non-binding knowledge of the current applicable law, it is therefore permitted to dispose of small quantities of spent developer solution into public sewers, if the pH-value does not exceed 8.5. The disposal regulations are country specific. Ask for valid and binding information your local relevant Office of Waste Management. This Office is also obliged to provide information to you, about who is approved for the disposal of the spent etchant.

Trouble shooting

Exposure

Too short exposure time can cause that the photoresist cannot be developed completely.

You can see this from the reddish-brown colour change of the exposed areas in the developer, which then can only be removed very difficult and impede the etching or even make it impossible.

When you expose too long and your template/layout is not black enough, you will lose the fine lines or at least have interruptions on them.

Nevertheless, it is better to expose rather too long than too short.

If you have poorly black templates it is possible to expose as short as possible and develop with stronger developer, e.g. with a developer twice as strong as recommended.

With a little experience, you can get even good results using normal printing paper.

You can increase coverage and contrast of your layout with our [Blackout](#) spray.

If you use a laser printer to create the layouts, you better use tracing paper instead of polyester film. The picture is distorted less and toner distribution is better.

A complete image loss may occur if the printed or emulsion side of the layout did not have contact to the plate, but was overturned (stray light will then diagonally expose under the black areas of the layout) or film contact to the plate was insufficient.

Develop

Decisive influence in the developing process have the correct concentration and temperature of the developer. However, the processing latitude in our photo-resist is so high that development is one of the rare sources of error. Low temperature, low concentration and consumed developer will slow down the process. Too high temperature and too high concentration of the developer lead to interruptions and holes in your plate. You also get a bad result if air bubbles got caught underneath the board.

Etching

When etching with acid etching media errors are usually caused already in the previous steps like creating layout, exposure and developing. Thus, a diamond-shaped pattern on the free areas of the plate as usually an indication of underexposure. For further details on the etching process, please consult the manufacturer of your etching machine.

Copyright

Technical specifications are subject to change.

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