Spray Etching Device

The spray etching devices extend the range of our etching machines to a device for professional use. Unlike the basic etching machine 1 and 2, the etching liquid is sprayed by spray pipes directly to the board. This achieve a very fast and precise etching. Thus, the device is particularly suitable for laboratory and small batch production.

The device consist of a frame which fix three acrylic glass cuvettes. Each cuvette is emptied individually. The different cuvettes are provides for the single work steps „Developing - Rinsing - Etching“ of making PCB boards.

For power the DC motors and for control the heater, a separate control box is mounted at the rear side of the device.

Due to clear acrylic cuvettes, the etching is always under control.

- Three independent cuvettes for the work steps „Developing - Rinsing - Etching“
- Self-lance motors (DC-motor) for optimum etching
- Acrylic glass tanks, each of them is emptied individually by drain tabs
- Adjustable heating element (glass heater), temperature range +36°C - +48°C
- Adjustable plate holder of plastic rails for receiving the printed circuit boards
- Control box with power supply for DC-motors at rear side
- Drip pan mode of PVC plastic, and glass thermometer

Technical data

<table>
<thead>
<tr>
<th>Item no.</th>
<th>141070 0000</th>
<th>141071 0000</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dimension (WxDxH)</td>
<td>600 x 330 x 420 mm</td>
<td></td>
</tr>
<tr>
<td>Amount of fluid:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cuvette 1</td>
<td>approx. 5 l</td>
<td>approx. 5 l</td>
</tr>
<tr>
<td>Cuvette 2</td>
<td>approx. 5 l</td>
<td>approx. 5 l</td>
</tr>
<tr>
<td>Etching cuvette</td>
<td>approx. 4 l</td>
<td>approx. 4 l</td>
</tr>
<tr>
<td>Requirement Sodium</td>
<td>approx. 1000g in 4 liter of water</td>
<td>approx. 20 g in 1 liter of water</td>
</tr>
<tr>
<td>Sodium hydroxide</td>
<td>approx. 380 x 200 mm</td>
<td></td>
</tr>
<tr>
<td>PCB dimension max.</td>
<td>150 W (glass heater)</td>
<td></td>
</tr>
<tr>
<td>Heating element</td>
<td>approx. 30 min</td>
<td></td>
</tr>
<tr>
<td>Heating time</td>
<td>approx. 30 min</td>
<td></td>
</tr>
<tr>
<td>Power supply</td>
<td>6V / 25VA</td>
<td>6V / 40VA</td>
</tr>
<tr>
<td>Self-lance motors</td>
<td>2x 7W</td>
<td>4x 7W</td>
</tr>
<tr>
<td>Net weight</td>
<td>ca. 11.5 kg</td>
<td>ca. 12.0 kg</td>
</tr>
<tr>
<td>Total weight</td>
<td>ca. 30 kg</td>
<td>ca. 30 kg</td>
</tr>
</tbody>
</table>
1. Start-up
1.1 Placement
The spray etching device is mounted completely by Gie-Tec. Only the top plates has to be mount.
Place the spray etching device into the catch basin. Place the device on a horizontal, stable and acid-proof table.

The working area should be ventilatable and well illuminated!

1.3 Mounting the top plates

1.3 Handling of the board holder
For adjust different board sizes, loosen the screws of the board holder below the handle strip (8).
In case of single-side boards, you can double the holding capacity by clamping the boards back-to-back (by using device #141070 0000).

If you do not tighten the screws, you can shift the strips easily without need a tool.
For larger boards, remove the middle strip.
1.4 Power supply of Spray Etching Machine
For power supply the self-lance motors (DC-motor) a primary switched power supply is mounted at the rear side of the device. The plastic housing of the power supply includes further 3x switches and a fuse (primary voltage).

Function of the switches:
1. Power switch of the self-lance motors
2. „Start“ switch for starting the DC motors.
3. Power switch of the glass heater
4. Main fuse

1.5.1 Etching bath
For etching, we recommend only our sodium persulfate. This etching medium is odorless, clear, and pollutes the device only insignificantly. Further sodium persulfate has the positive feature to get blue if solution is saturated. It achieves etching times of 6-8 minutes at 40-45°C. The etching speed is between 4 to 7µm/min with a copper reception of approx.: 30g/l.

Preparing the etching solution:
- Fill the cuvette with water (about 4 liter)
- Add the etching granulate (1000g Sodium persulfate) slowly and stir in the water.

The etching device is not suitable for ferrous chloride as an etchant!
In case of using other etching chemicals, we can not take over any guarantee for the function of the device since these chemicals may dissolve the glue of the glass cuvette and let damage the cuvette.

The level of the etching liquids has to be about 10mm above the plastic plate inside the cuvette, at every time.

Make sure, that the glass heater is always below the liquid level. Otherwise the glass heater may burst.

1.5.2 Developer bath
A solution of 50g of sodium hydroxide (etching sodium bicarbonate) is needed for development in 5 liters of water. Store the prepared solution until the granulate has been completely dissolved. The prepared solution is a soda lye of approx. 1%.

The bath is useless, if a development time of more than 7 minutes is needed, it has to be renewed.
1.6 Adjustment of the temperature of the etching bath

The temperature control of the heating element mounted inside the etching cuvette is adjusted at about 45°C. Make sure, that the liquide level always is higher than the plastice plate and by this the glass heater. If you need to change the temperature of the glass heater, you have to emptied the cuvette first. Than please demount the top plate of the device and take out the plastic plate on which the glass heater is mounted.

To adjust the temperature please turn the knob to maximum (+). While the temperature of the etchant is rising, check the temperature of the etchant.

2. Etching

2.1 Expose the PCB

1. Place the film (layout) on the glass plate of the exposure box (e.g. Gie-Tec #140007), the film shows upwards (avoiding of underexposure).

2. Remove the protection foil from the basic material and place the plate with the photosensitive coated side on the film.

3. Align the board and the film and shut the lid of the exposure box.

4. Start the timer of the exposure box by press the turning knob and wait until the timer is count down to zero. The exposure time is between 1 and 5 minutes (depending on the sensitivity of the photosensitive coating).

2.3 Developing

For developing the exposed PCB, clamp the board into the board holder and hang in the developer bath (1% soday lye bath). The bath temperature should have a temperature of 20-25°C. You can observe well that the photo-sensitive coating, destroyed by the UV-light, is removed. If you want to accelerate the development, you can move the board at times or work on with a brush. The development procedure is concluted if the exposed areas stand out with the copper brigthly shining (the layout is still covered by the photosensitive coating).
2.3 Rinsing
Hang the board holder in the middle cuvette with water in and rinse the board by moving the holder shortly forth and back.

2.4 Etching
The removing of the copper is performed by using sodium persulfate. The etching fluid is sprayed to the surface of the boards by spray-pipes. Thus a short and precise etching result is given.

The optimum temperature of the etching bath is about 45°C. To heat up the bath, please shut the slot of the top plate of the cuvette and switch the DC motors of the spray-pipes ON and then the glass heater too. Check whether the liquid level is higher then the plastic plate inside the etching cuvette!

As far the bath temperature is reached hang the board holder with circuit boards into the etching cuvette.

You can interrupt the etching process by switching the DC-motors OFF.

With a layer thickness of 35µm and fresh etching bath the removing of the copper lasts approx.: 5 to 10 minutes. Then take the PCB from the bath and rinse thoroughly in the middle cuvette with water.

2.5 Further handling of the board
1. Clean the produced boards of the remaining photo-sensitive coating. Therefore you can use a removal solution, 50g of sodium hydroxide per liter of water, or a solvent for this (spirit, acetone etc), or rub it off mechanically using a pot cleaner or a abrasive paper (grain size 240).
2. Rinsing the PCB under flowing water.
3. Finally you can use water-based immersing lacquer to protect the board against corrosion. Further you are able to protect the board against corrosion in an immersing process using chemial tin or chemical silver.

3.1 Sewage treatment of developer solution
Neutralize the sewage with developer remainders by adding sodium-persulfate solution (200g/l). Originally, the ph value of the developer solution is 13. By acidification to ph 11-12 and subsequent separation of their precipitation up to 90% of dissolved organic material of the consumed developer can be removed.

3.2 Sewage treatment of etching solution
The most effective operation for copper precipitation:
1. Pour the consumed etching medium into a plastic container that takes about four and a half times the amount of consumed solution.
2. Then, prepare a soda lye (40g of sodium hydroxide/liter of water). Per liter of consumed etching solution about three liters of soda lye are needed.
3. Mix the soda lye slowly with the consumed etching solution until a ph value of 11 is attained.
4. After about 2 hours rest time, the resulting deposited black mud and can be filtered using a suitable filter (e. g. coffee filter).

The mud that stays behind the filter paper (copper hydroxide) has be treated as special waste.
5. Spare parts

- Glass heater, (150W)
  Item no.: 411186

- Glas-Thermometer (0 - 50°C)
  Item no.: 411179

- PCB holder
  Item no.: 149170 1000

- Drain tab
  Item no.: 411199

- Acrylic cuvette (small)
  Item no.: 141070 1001

- Acrylic cuvette (big)
  Item no.: 141070 1002

- Self-lance with Dc-motor
  Item no.: 141070 1015

- Trip tray (PVC)
  Item no.: 149199

4. Maintenance and cleaning

- According to the application frequency, you should regularly clean the etching device in order to guarantee a perfect working. This specially affects the part pump, connecting tube, board holder etc.

- If necessary, remove chemicals residues following each use.

- After a cuvette discharge, clean also the intrenal walls in order to keep the transparency of the device.

- Before using the device check the liquid level of the etching bath.

- For cleaning the cuvette you can use a wooden or PVC strip with a foam stripe on top (eg. Tesa Moll).

5. Conclusion

The described production of printed circuit boards and the handling of the chemicals corresponds to our best knowledge and should serve for your consultation.

Since both the proper handling of the device and the handling of the chemicals is not subject to our influence, we can not take over any responsibility for resulting damages.

According the Machinery Directive (2006/42/EU), this device is a machine.

Any change of the device has be done according the rules of the directive.
6. Declaration of conformity

EC Declaration of Conformity in accordance with Machinery Directive 2006/42/EU

Manufacturer: Gie-Tec GmbH
An der Schlierbach 18
36132 Eiterfeld

Spray Etching Machine 1
Part no. 141070 0000

Spray Etching Machine 2
Part no. 141071 0000

Product designation:

conforms with the requirements of the directive(s)- including any amendments valid at the time of declaration

- Low Voltage Directive (2006/95/EG)
- EN 60204-1 2006 Safety of machinery - Electrical equipment of machines

ISO 9001:2008

Quality Systeme:

The following harmonized standards were used:

Eiterfeld, den 05.01.2015

Place, Date

Rainer Giebel, Managing Director, Gie-Tec GmbH

Safety and risk!

Safety:
Switch ON the DC-motors of the spray pipes only, when the unit is fixed in the top plate by the four mounting screws.

Rotating spray lances can lead to injury!

Switch ON the DC-motors of the spray pipes only after the top plate of the spray etching machine is mounted and the cuvette is closed.

Etchant may escape from the etching tank and will be sprayed into eyes or skin or clothes.