DL 500

Etching Machine

Instructions for Use

1. Preface

With the this instruction we would like to give an overview about structure, function and operation of the conveyor spray etching machine DL500.. Please read the following text carefully and particularly consider the references to job safety and set-up. Deposit this instruction at a safe place. It contains information on maintenance or cleaning, which you will need later on as well.

If you encounter a problem which is not answered by this manual, please contact us by phone or by mail. This will enable us to give specific advice and analyse malfunction if this ever occurs.

The machines are manufactured by Bungard Elektronik, Rilkestraße 1, D-51570 Windeck and brought into circulation in the EEC-MEMBER countries by the respective retailers/contracting parties.

Operational areas:

aqueous-alkaline or sour etching of printed circuit boards.

Developing of positive or negatively working, aqueous-alkalinely processable fotoresists or laminates (if necessary add antifoaming agents).

Alkaline resist stripping (additional filtration unit necessarily).

2. Safety Instructions

The machines are intended for the chemico-physical treatment of printed circuit boards.

The machines are not intended to be integrated or connected with other machines or plants. They may be operated only in appropriate areas and run only by qualified technical personnel. Children and domestic animals are to be kept away!

Electric

The machine is manufactured using certified parts according to the usual guidelines for electrical security. This does not release the user however of its duty to exercise diligence while handling electrically operated devices.

Before all maintenance work on the machine (filling, emptying, cleaning etc.) switch off the machine and pull power supply plugs.

Etching Machine

Instructions for Use

Pay increased attention to electrical defects because of the conductivity of etching solution containing metal salts. In this a case pull the plug of the machine and replug only after professional repair. This is also valid for spilled etching agent.

There are parts under voltage in the cable channel and in the control unit. The cable to the pump motor may carry bracing from the condenser. Wait for retension before touching these parts.

Personal protection equipment

While handling etching agents, thus in particular when filling and emptying the machine, wear usual protection equipment, like apron, gloves and eye protection.

Temperature

The machine may be switched on only with filled etching agent chamber. The quartz glow bar must be always sufficiently covered with etching agent! **Uncovered glow bar may cause destruction of machine!** Fill the etching chamber up to 1 cm under the cover of the medium container.

The electronic thermostat is secured against break and short-circuit by the thermo sensor. This does not release the operator however of the obligation to supervise the temperature of the etching agent: Perhaps exothermic chemical reactions can lead to overheating of the etching agent. The maximally permissible operating temperature of the machine amounts to 50° C.

*If the etching agent is prepared by release from salts or mixing liquids, this must always take place **outside** of the machine! Pay attention to the safety references of the chemical manufacturer as well.*

Before use of etching agents, whose chemical reaction behavior is or might be exothermic, please coordinate additional measures against overheating with us.

If despite all precautionary measures an overheating of the etching agent should arise, the heating must be switched off at first. The etching agent pump must remain however switched on, so that the etching agent is cooled by the circulation.

Place of assembly

Requirement according to WHG and/or supervision of trade: In order to prevent the penetration of etching agent into the ground, the machine must be installed a) in a sufficiently large area with chemical-firm, waterproof ground lining (no tiles, no concrete!) or b) in a chemical resistance, waterproof collecting tray, which seizes the entire volume of the etching liquid. We offer such a tray as an option.

Personal security

(1)

The DL 500 is equipped with a protective switch mounted to the cover (1). This will turn off the pump as soon as the cover is lifted. You should temporarily check the function of this switch: Close the valve of the feeding tube from the medium container to the etching zone completely (!). Switch in the pump. When you lift the hood for more than 3 mm the pump must switch off.

Exhaust air

We recommend to install an exhaust above the machine for eventual etching steams. This recommendation is however purely precautionary. Leakage of aggressive steams could not be proven in two independent investigations. (water vapour escapes, the salts of the etching agent remains in the solution).

The machine possesses at the back of the rinsing compartment a pipe socket, which can be connected to the exhaust air system of the building. The ventilating outlet is consciously not arranged at the etching zone, in order to prevent that except steams also liquid etching agent can arrive into the exhaust air system.

DL 500

Etching Machine

Instructions for Use

Environmental protection

Used up etching agent is special refuse. It must be handed over to certified disposal enterprises under indication of the waste key number. Pay attention to the refuse laws and regulations of your country. We are not authorized to redemption.

Waste water

Prior to operating the machine, be informed on all applying environmental protection legislation of your country. Used etching liquid contains copper and must be treated as special waste. In most countries, this applies also for the rinse water. We recommend that you collect dirty rinse water and use it to set up fresh etching liquid. In accordance to anti pollution laws, the final cleaning of the boards normally requires a cascade rinsing unit, or further wet process steps, like chem. tinning or resist stripping. Any attempt to neutralize the etchant or the rinse water is NOT recommendable to other than approved chemists.

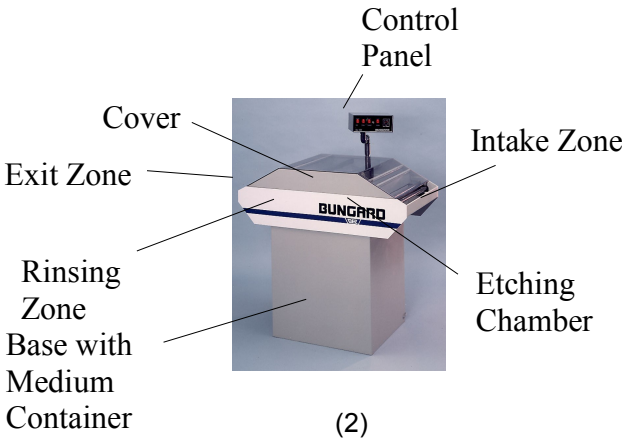
We recommend to use the rinsing unit of the DL500 either in a closed cycle or have the rinse water run over a waste water treatment like the Bungard IONEX.

3. Technical Data

Electrical connection:	220 V~, 50 Hz, ca. 1.5 kW
Dimensions	ca. 110 X 100 x 60 cm (BxHxT)
Max Board Size:	510 mm x endless
Fill Quantity:	ca. 55 l Etching Agent
Weight:	ca. 100 kg
Material:	PVC, PP, Titan
Width of the board gap	510 mm
Conveyor speed	Stepless adjustable 0 - 1.5 m/min
Pump	Centrifugal pump delivery rate ca. 200 l/min, spray pressure stepless adjustable by valve
Heating	1000W Quarz glow bar
Speed of Etching	ca. 35µm in 90 s

Technical changes reserved.

4. Construction



(2)

The machine body is made from PVC. It is divided into infeed-, etching-, rinsing- and outfeed-zone. The removable media tank is located in the pedestal of the machine (2).

The cover is made from grey and transparent PVC. It carries housings to fix the removable partition walls.

The media tank is easy to access and can be entirely removed from the machine (3). The top cover of the tank carries the pump. This is a submersion centrifugal pump which propels with

highpressure the etching medium to the 4 manifolds, each of them equipped with 14 flat spray nozzles. The liquid returns to the tank via 2 PVC drain pipes of big diameter. The tank carries a 1000 W heater element and the temperature sensor.

The conveyor system is made from 13 pairs of PVC covered rollers and of one infeed and outfeed roller at each end of the machine (4). The squeegee rollers are covered with a sponge cloth each. Using an endless belt, the rollers are directly coupled to a gear motor.

(4)

The water access to the rinsing compartment is controlled by both a magnetic and a manual operated valve. The magnetic valve opens only when the etching pump is operating. A circuit rinse or a downstream rinsing water treatment are as an option available (5).

(5)

The control unit is mounted on top of the machine (6). To permit easy access from each side of the machine, it can be turned into almost any position. The front panel carries illuminated switches for the main supply, pump, conveyor and heating circuits as well as a potentiometer for conveyor speed adjustment and the digital-reed-out thermostat.

(6)

5. Setting Up

Observe please the order of the steps to start-up exactly and attach the machine only after filling to electricity mains. Consider also the safety references.

1. Check it for any damage immediately after reception and if damages are discovered contact us and the transport agent to state the facts of damage.
2. The machine is fixed to the transport container or to the palette by plastic tapes. Remove all packing material and tapes from the cover, the control unit and the medium tank.
3. To avoid damage, do not move the machine on the ground. With the help of at least one other person, carry it to the desired location. The best possibility to handle the machine is to hold it at the left and right side walls on each end.
4. The location must fit the labour protection requirements for etching machines, i. e. ventilation, sealed floor etc. It must further offer power and water installation close-by.
5. The place must be straight and even. It must carry the entire bottom of the machine (no palettes!). With respect to an easy feeding and a good access also to the back side of the machine, there should be a free area of about 2m x 2m.
6. The boards are passing the machine from the right to the left, if seen from the closed side of the pedestal (front side).
7. Make sure that the drain valve for the etching agent is closed (7). Install the drain and the supply hose for the rinsing zone. The inlet is from the rear seen left.

(7)

5.1 First Filling

As a check for tightness and function you should operate the machine first only with water. After successful test run the water is replaced by etching agents. If the medium container was demounted for transport, put it back into its position, bolt the connections of the two gutter-pipes and the tubing and connect the plug contacts for thermostat, heating staff and engine (plug are permutation implemented). You can give the water through the opening in the cover (filling height is approx. 1 cm under cover of the medium container).

5.2 Check

Before connecting the machine to the power supply, please check:

The conveyor belt must run parallel to the side walls of the machine. All upper rollers must lay close on the lower ones.

If the cover has been taken off the machine, the intermediate walls and the cover must be remounted. Take care to mount the cover in a way that it sits well all on the machine body and that the security switch is closed.

Check if all fittings are well attached and if all appropriate valves are closed. If necessary, tighten the fittings manually.

With respect to the built-in stoppers, move the control unit to the desired position.

5.3 Electrical connection

Switch off all the switches on the front panel. Turn the adjustment knobs of the conveyor belt and the thermostat to zero position. Connect the power plug to a splash water-protected wall socket. The machine's power consumption (with the heater running) is about 1.9 kW on 220 V, 50 Hz. We assume that an appropriate fuse has been installed to the in-house power circuit.

Now turn on the main switch. It will be lit.

5.4 Test Run

Referring to the description in chapter 4, check in the below given sequence the function of the conveyor, the heater, the pump and the rinse. Pay special attention to the following topics:

Conveyor

The belt and the rollers must move in a steady and uniform way. At position 1 on the scale, the conveyor must just transport a board through the machine.

Pump

When running the pump, have a close look on the fittings and the cover. No leaking should be obvious.

There is a valve in the mounting pipe fed by the pump (8). This valve can be used to reduce spray pressure, if necessary. A very low pressure also permits to see if all nozzles are operating and spray in the right direction. See chapter 8.5 for details on how to adjust the manifolds.

(8)

Heater

If any 'abnormal' temperature read-out appears on the thermostat, check the cable connector to the sensor.

When the heater is on the quartz tube will shine in a red to orange colour and the switch at the control panel will be lit.

Rinse compartment

Check if there is sufficient, but not too much water. Pressure is good if the lower jets almost reach the cover. See if the descent to the drain is sufficient. If not, the water floods the rinsing compartment and exits into the etching zone.

5.5 Discharging

Empty now the machine completely and pull the power supply plug. In order to replace the filled in water by etching agents, empty the medium container: Fasten a short piece of hose to the ball valve of the medium container, the other end of the hose should end in a plastic bucket. Open the ball valve and let the air escape from the hose. Hold the filled hose then into the bucket. With this `principle of the communicating tubes you can empty the medium container so far, that you can move the container from its position without spilling and then empty it completely. Do not forget to loosen the fittings and the electrical connections before moving.

5.6 Fill with etching agent

The machine can be filled alternatively through the hand hole of the medium container or after removing the hood, from above via the etching zone (in that case do not forget to firmly close the tube fittings). Make sure before filling that the drain cock of the medium container is closed. This is the case, if the handle stands perpendicularly to the sleeve. The correct filling level is about 1 cm under the cover of the medium container with the pump switched off. A too small amount of filling can lead to damages and must be avoided. After some operation refilling of etching agent can be necessary by the hand hole in the cover of the medium container. After you filled in the finished and cooled down etching agent and the possibly dismounted parts are reassembled the machine is ready for use.

5.7 Trouble

If there were problems coming up during this first test, which are not described in this manual, please contact us immediately.

6. Operating

6.1 Control Panel

All electric functions of the DL 500 are controlled from the front panel of this unit (9). From the left to the right, there are: The switches for the main supply, for the pump motor, the heater and the conveyor.

(9)

Next is the button for speed control of the conveyor. All to the right, there is the thermostat unit.

The main switch turns off all other switches and circuits. This permits an instant stop of the machine under any circumstances.

6.2 Etching circuit

The second switch from the left being turned on and the cover being closed, the etching pump will start. It propels the liquid to the nozzle-equipped manifolds. The flow capacity and the pressure can be set manually by a valve located in the liquid mounting pipe. The liquid returns to the tank via two fitting connected PVC pipes.

The tank capacity is about 55 litres. The correct filling level is about 1 cm below the tank cover plate. A too little filling level will cause the pump to suck air, which can be heard as a specific sound.

If the filling level should be lower than the pump inlet level, the heater element could run free. This would most certainly lead to a damage to the machine. It is though necessary to control the level periodically. To fill up, switch the pump off and add water or etching medium until the liquid level is 1 cm below the tank cover.

6.3 Conveyor

The boards to be etched are inserted into the machine at it's right end, seen from the front. Boards are put onto the first roller and carefully moved forward until they are attached by the next roller

pair. It may be necessary to support very long boards manually until they have completely entered the machine.

If you did not install a trap table at the machine's left end, you must take off the etched boards from the machine manually. Otherwise they might fall down and get damaged.

Speed can be varied using the button right to the conveyor switch. At a reading of 1 on the button scale, the conveyor will run at it's minimum

speed. Actual speed setting depends on temperature, saturation and type of the etching medium as well as on copper thickness and spray pressure. For fresh warm ferric chloride at about 45°C, a speed setting of about 3 will do.

It might be a good idea to keep a once found setting for 35µm also if boards with 70µm copper are etched: Just have the board pass the machine twice.

The speed adjustment is at it's optimum if there are only very few rests of copper remaining on the board at the moment that it reaches the last roller pair in the etching compartment. A board which was incompletely etched may be processed again at a high speed setting. A too little speed will cause severe under-cut.

6.4 Heater and thermostat

Important: The heater circuit may only be activated with the tank filled!

The control switch being lit, the heater circuit is enabled. The switch relates to the thermostat located on the right. The themostat first makes a self test and after some seconds the present temperature of the etching liquid is shown.

The temperature of the therrmostat is preset to 42°C. You should only changes this value, if your etching liquid **compellingly** requires another tem

perature. You can change the value by pressing 2 times the SET-key. With the arrow-keys you can move up or down to the desired temperature. Press SET again. On the display appears the word “Set” and above the display the orange “OUT”-LED goes on. After some seconds the present temperature of the liquid is shown again.

The temperature setting depends on the type of etching medium to be used. For ferric chloride and sodium persulfate, 45°C is best. For chloric acid (copper chloride) and ammonia based media, 30 to 40°C are recommended. Ask your chemistry dealer for details.

Although the thermostat range is up to 60°C, a temperature setting of more than 50°C is not permitted. Please note that certain etching media produce heat when used. In this case, the temperature setting must be reduced in advance. Do not feed the machine with boards until it has cooled down. We supply a cooling tank as an option (10+11)

(10)

(11)

6.5 Rinse

The rinse compartment can either be used with fresh water or, with an optional tank and pump, as a closed loop rinse.

For fresh water rinse, there must be a pressure resistant hose installed between the wall-mounted valve and the machine. In addition, the flow capacity can be manually set by a valve located below the rinsing compartment.

Attention: A too high flow rate might cause the water to mount in the compartment instead of passing into the drain!

When the etching pump has stopped, the magnetic valve also interrupts the rinse. When you have finished work, close the wall-mounted valve to prevent excessive stress to the hose.

If the optional closed-loop rinse system is installed, the valve below the rinse compartment should always be fully opened. There is a separate instruction for the additional circuit rinse or the treatment rinse. See remarks in chapter 2 Waste Water.

7. Mounting / Demounting

Note! Before all maintenance work on the machine switch off the machine and pull the plug. Consider also the safety references.

Note: The arrangement of the partition walls, transportation rolls and blast connections is not symmetrical. Therefore with cleaning or maintenance work the arrangement of the parts must be noted and considered when assembling.

7.1 Cover

Before the cover can be lift off the machine, the control unit must be turned out of the way. Two persons take the cover at it's lateral ends and lift it simultaneously.

As soon as the separating walls come free, turn over the cover in a way that rest of liquid can not drop. This also prevents any separating walls sticking to the cover from falling down.

Before remounting the cover, remove all rests of liquid. For ease of handling, set the separation walls into their housings in the machine body prior to mounting the cover.

Important: The security switch key must be carefully inserted into it's housing. Be sure that the cover sits well all on the machine body. If it does not, the machine will leak. This problem may occur mainly if the floor at the machine's location is uneven. In this case, put some rest stripes of PCBs under the outer corners of the pedestal to level the machine.

7.2 Machine body

The complete disassembly of the machine's interior components is possible without special tools. It is though only necessary if special maintenance, such as changing the transport belt, is required. You will have to make notes or to sign the parts during disassembly. If not otherwise noted, the assembly of the parts is done in inverse order to disassembly.

7.3.1 Upper walls

The different sections in the machine are separated by each an upper and a lower PVC wall. The upper walls can be pulled off vertically after the cover has been removed. Be sure to identify the proper location of each wall.

7.3.2 Upper rollers

The upper rollers can easily be lift off from their bearing housings. Take care not to drop the small plastic bearings at each roller's ends. Collect the bearings in a box.

Pay respect to the position and orientation, especially of the squeegee rollers.

7.3.3 Lower rollers

You can try to pull the lower rollers out from their bearing housings, but we recommend you to loosen the belt first. To do so, pull back horizontally the last roller's left end so that it comes free from the bearing housing and then pull out the roller's teeth end from underneath the belt.

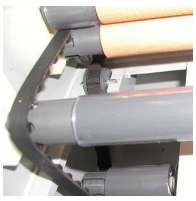
The belt is kept down on the rollers by some small `pressure aids' made from titanium and PVC. These can be pulled out of their housings only with the belt loosened.

Important: The first and the last roller each have six instead of five teeth. It is important that they are not interchanged with other rollers. Otherwise, the conveyor will not run steadily.

(12)

There are some more guiding aids for the belt mounted in the infeed and the outfeed zone of the machine (12+13).

Carefully collect them so that they can not get lost. Pay attention to reassemble them in the right manner.



(13)

7.3.4 Lower walls

All lower separation walls can be vertically pulled out from the machine body. Prior to doing so, all upper rollers must have been removed and the belt must have been loosened.

7.3.5 Gear Belt

Easing the gear belt and demounting the downholder were already discussed in 7.3.3 (lower transportation rolls). Here now the description of the remaining tasks to do to remove the belt completely. After demounting the lower walls, the slit pipe, in which the gear belt runs, can be pressed from the lateral mounting plates to the center of the machine. Particularly consider when re-installing the pipe that it must lie with the slit side downward, in order to prevent leaking of etching agent into the rinsing zone. In the discharge zone the gear belt runs in a loop by two recesses of a cover plate. The cover plate is levered off, if necessary with help of a screwdriver, upward and removed. Under the cover one sees the connection to the gear motor. To remove the gear belt, loosen two attachments screws of the gear motor. Move the gear motor until you can take out the gear belt.

(14)

Caution! Do not bend the axis of the gear motor. The engine must be fastened right after removing the gear belt again.

The gear belt together with the slit pipe can now be taken out of the machine (14). In order to remove it from the pipe, expand the pipe by hand at an end a little slit the pipe between two teeth of the gear belt. The condition of the gear belt should be examined with each cleaning or disassembly of the machine. Possible etching agent deposits must be removed, since they can effect the operation smoothness.

The gear belt tension changes normally only slightly. A sudden, larger change of the belts tension points possibly to a wrong assembly of the transportation rolls or the downholder. The two first clamp blocks in the feeding zone of the machine possess adjusting screws for stretching the belt. The screws must be adjusted parallel. A loose gear belt is likely to slip over the rolls. This becomes apparent in clear crack noises and leads to uneven etching results and increased wear of the drive components. A sufficient tension of the belt is given, if the first transport roles are slightly movable in longitudinal direction. Avoid a too high tension of the belt.

If the gear belt is properly adjusted and still not all roles run evenly, check first if the fleeces are clamped and if all upper rolls lie on the lower roles. In the second step examine the free movement of the downholders. If necessary the pressure of the downholders on the gear belt can be varied adjusting the grub screws on top of the holders.

7.4 Manifolds

Important: The upper and lower manifolds have different length and nozzle equipment. They must under no circumstances be interchanged. The manifolds are fixed in snap-in brackets. To remove them, pull them forward until they come free from the fitting connectors and then carefully lift them from the brackets. The nozzles are fixed to the manifold tubes also by a simple snap-in system. You may use a pair of pliers to carefully turn and twist the nozzles off.

Do not use screw drivers or similar! Damage would result.

To reassemble the manifolds, insert the nozzles manually. You may put them one by one on a table with the flat side down and then press the manifold tube on the nozzle until it snaps in. The nozzle slots must all be aligned parallel to the manifold tube axis.

The middle row of nozzles must point point perpendicular up or down.

To do the adjustment, turn off the pump and take off the cover. Wear long sleeve protective gloves. It may be necessary to remove two or three transport roles to adjust the lower nozzles.

To adjust reduce the spray pressure by slightly closing the valve of the feeding tube, so that the lower nozzles just spray as far as the height of the upper nozzles. This simplifies the optical control.

To adjust the upper nozzles put in a broad board and turn of the conveyor. Now the lower nozzles do not interfere with the upper nozzles. When finished do not forget to readjust the valve of the feeding tube.

Except for the (here missing) nozzles, the manifolds in the rinse compartment are handled the same way.

7.2 Tank

The electrical connectors between the tank and the machine body are located under a cover each at the tank and at the inner left side of the pedestal. Disconnect the machine from the power supply prior to opening this cover. To access the connectors, proceed as follows:

Slide the horizontal, U-shaped cover at the tank to the right so that there is space to seize it at it's open end. Pull it off from the tank wall. Locate the opening in the vertically mounted second cover and pull it away from the pedestal. To completely remove the cover, it may be necessary to slightly lift and twist it.

Open the metal locks on the connectors and pull. The connectors can be identified by size and location and are not interchangeable.

Before you can pull the tank out of the pedestal, you will have to loosen the liquid tubes' screw fittings. You will need the assistance of one more person to safely carry the tank.The pump is fixed to the tank cover by four screws. It can be lift off from the tank together with the cover.

The assembly is done in inverse order. Be sure to have the gaskets in place when tightening the screw fittings. The cable covers will snap into their holdings when pressed on.

8. Service and maintenance

The machine requires almost no maintenance. The main service labour is the periodical exchange of the etching medium and a thorough cleaning of the machine. When doing such service, you may easily check the conveyor system for wear or use.

The pump, the heater and the rinse compartment are maintenance-free.

8.1 Cleaning

Except for the transparent cover, all PVC parts of the machine can be cleaned using liquid abrasive products known from the household. If ferric chloride was used with the machine, we recommend to use our special `spotkiller'.

A thorough rinsing of the appropriate parts is necessary after each cleaning process.

To clean the tank, remove it from the pedestal, as described above. To have better access, you may remove the heater element by unscrewing it's fitting.

If you use flowing water, be careful not to moisten electric parts. Remember your anti-pollution responsibility!

The nozzles can be removed from the manifolds for cleaning. Just rinse them and blow them out with compressed air.

The sponge cloths on the squeegee rollers must be treated carefully. Just wash them without rubbing them. You can wring them by rolling them on

a piece of carton. Damaged sponge cloths should be replaced by new ones. You may have such spare cloths together with a special adhesive from us.

The sifter of the suction zone of the motor can be mechanically cleaned when mounted.

8.2 Cleaning of the machine in use of FeCl3:

Equipment:

Apron, eye protector, (Latex) gloves, 2 plastic scrapers, 2 plastic sponges, 2 buckets, paper cleaning cloths, plastic foil, container from plastic for used etching agent

Chemicals:

Hydrochloric acid HCl technically, concentration approx. 15%, quantity approx.: DL500 55l, stain remover RX3

Proceed:

Cut the plastic foil in the double size of the utility space of the machine. Put on protective clothing. Discharge etching agents from the machine into suitable container. Take up existing sludges with scraper mechanically and give it to the etching agent. Lift the machine and set it on the foil. If you do not have an exhaust move the machine to proper ventilated room or outside.

Fill the machine with 15%iger HCl. Close the cover. Run the machine with heating switched on for several hours. Repeat if necessary the cleaning run the next day.

To Clean from the outside give warm water into a bucket. Add stain remover on a wet sponge and use it like abrasive powder Let the paste act on the surface, if necessary moisten again with sponge. Repeat this procedure, until the marks are faded. Particularly persistent deposits carefully dab with HCl. To clear rinse thoroughly wipe of machine with a not dripping sponge and clean this sponge in a second bucket.

Discharge HCl from the machine and store to reuse it again. Close drain valve. If the machine is not filled again, wipe off the inside of the machine beginning from the top and working your way down. Clean sponge in second buck. Do not touch the uncleaned parts of the machines, wear long sleeved gloves if necessary. Give the contents of the second bucket to the used up etching agent. Alternatively clean the inside by making a test run with water.

Return the machine to its location. Examine whether the glow bare is intact (do not switch on, only visual check.) If necessary remove the electric case and pull back the rubber seal of the glow bare to check for any penetrated liquid. In this case you have to exchange the glow bare. Fill the machine with water for a test run and after that replace the water with fresh FeCl3.

The hydrochloric acid can be used later, in order to dissolve Sludge sediments in etching agent. Give HCl in portions of approx. 0.5l to the dirtily brown etching agent and let the machine run briefly. Do this so long, until the solution is to a large extent clear again. But: NEVER give Hydrochloric acid to fresh iron-III-chloride ! Dispose possible surplus of HCl with used etching agent.

This guidance represents only the fundamental procedure in standard situations. Mistake and change reserved. Handling the chemicals takes at one`s own risk. Regard safety regulations!

Against FeCl3 marks on clothes, smooth and porous surfaces we supply a highly effective stain remover on organic basis.

Drain the dirty rinse water from floor drain of the rinsing zone. The waste laws demand economical handling of rinse water. We advise to collect the water from the first rinse a) To compensate evaporation losses and b) for new FeCl3 solution! After discharging the water sediment remains in the basins. Take up mechanically and give these it to the used up etching agent. Dispose surplus rinse water together with the used up etching agent.

DL 500

Etching Machine

Instructions for Use

Motor protection:

we recommend to regularly inspect the the radial sealing shaft of the PVC-flange or to change this shaft every second year. On request we supply a detailed instruction on how to change this ring.

1. Guarantee

All machines are submitted before distribution to examination on tightness, function and continuous operation firmness. On the machine we grant a work warranty of 12 months to our customers starting from purchase date on accuracy in material and processing. We warrant at our choice by exchange of incorrect parts or by repair of the machine in our house. Old parts change into our possession.

2. Disclaimer of Warranty

All parts subjected to wear and the heater element are excluded from this warranty. Any direct or indirect damage resulting from over-heat or chemical reaction shall void all warranty claims.

This also applies to defects to the machine caused by non-observance of this manual or of parts of it.

We cannot accept subsequent claims from damage or destruction of workpieces worked on in the machine, because we have no knowledge or control over the operating conditions at your site. This is valid in a general manner also for requirements from damage to articles, buildings and persons as well as the environment.

We do not warrant that the function of the machine will meet the customer's requirements or that the operation of the machine will to this regard be error free.

In no event will we be liable to the customer for any incidental, consequential, or indirect damages of any kind, including loss of profit and prosecution for environmental pollution, even if we could have been aware of the possibility of such damages.

All information was arranged with great care. We reserve ourselves however mistake and technical changes without previous announcement.

3. Copyright