

Manual Contac RS

English, Version 2.0

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Article no. 121237

Information about the manual

It is part of the duty of the care of the machine operator to check that the following points are complied with. It must be ensured that

- **the machine is only used in accordance with its designated use.**
- **the system is only used in a faultless and functioning state. The safety devices in particular must be checked regularly!**
- **All warning signs at the machine are to kept in a legible condition and under no circumstances removed.**
- **this manual is always at hand in a legible state and in its entirety at the place where the system is used**
- **only sufficiently qualified and authorized personnel operates the machine**
- **this personnel is familiar with this manual and in particular the safety instructions contained therein!**

I. Outline

1. Introduction
2. Scope of delivery
3. Safety regulations
4. Description of the system
5. Menus
6. Putting the machine into operation
7. Description of the procedure
8. Maintenance and repair
9. Disposal
10. Appendix

II. Notations

Bold print is used to emphasize important information.

Figures are numbered continuously,
Example: Figure 5

› Actions to be carried out are indicated by an arrow.

Paragraphs in italic print are the reactions resulting from an action.

Words in italic print identify proper names.

Key labels and menu terms are written in **BOLD UPPER CASE**.

III. Information regarding the symbols used



Danger!

This symbol is used for danger to life or health.



Caution!

This symbol is used for dangers that may result in material damage.



Note:

This is used for notes to avoid disruptions to the operating sequence or to improve the operating sequence.

IV. Target group

This manual is intended for persons who have fundamental knowledge of circuit board production **including multi-layer circuit board production** for the electronics sector.

V. Designated use

The LPKF *Contac RS* is used for galvanic through-hole plating of circuit boards. The through boreholes can have a minimum diameter of 0.2 mm and are metallized according to the Black Hole procedure. The system is suitable for the processing of double-sided and multi-layered circuit boards.

The tin-plating option is intended for providing copper surfaces of circuit boards with a surface finish based on chemical tin. The layer of tin is deposited chemically, i.e. without electricity and is intended for protecting the copper surface against corrosion and improving its solderability. This also ensures that it can be processed further after it has been stored for some time.

Any other use is not allowed or requires prior permission by LPKF AG.

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1.0 Introduction

Dear Customer,

We are delighted that you have opted to use the system LPKF *Contac RS* for through-hole plating with the option of tin-plating to build up a surface finish on the basis of chemical tin.

With regard to the number of technological steps and its processes, this system is the easiest-to-use galvanic through-hole plating process with subsequent surface protection on the basis of chemical tin that is known to us on the market. Specialist or galvanic knowledge is not required for operation as the programs to be selected include optimized process settings ex factory.

Nevertheless, as with every galvanization system, it needs to be operated carefully in compliance with the operating manual as otherwise there is a great risk that a bath is completely destroyed or can no longer be prepared ready for use.



We would like to draw your attention to the following error potential based on our experience to date.



- **! PLEASE ENSURE THAT THE AMBIENT TEMPERATURE IS BETWEEN 18° - 25° C (64.4° - 77° F) (FOR EXAMPLE OVERNIGHT)!**
- **Please pay particular attention to careful rinsing. Under no circumstances must chemical liquids from one bath get into the next one. The printed circuit board holder also needs to be carefully rinsed after use.**
- **Do not clean the printed circuit boards with steel wool or similar materials. Even the smallest metal parts can result in the baths being destroyed.**
- **Please keep the baths covered at all times, i.e. as clean as possible. You will be repaid with a long service life.**
- **Please ensure faultless boreholes. Please note the drill parameters.**
- **There must not be any free ammonia or chlorine vapors in the room.**
- **An extraction unit can be installed above the system but there must not be any draft above the baths.**
- **No supply air may be installed above the baths.**
- **Attendance of a basic introduction given by one of our specialists is recommended. During this training, you will also be given tips and know-how for your entire printed circuit boards production.**

If these instructions and the following operating manual are followed precisely, we are sure that you will achieve reliable through-hole plating results and be satisfied with every aspect of the LPKF *Contac RS* system.

2.0 Scope of delivery

The scope of delivery of *Contac RS* includes:

- 4 x phosphated copper anodes
- 2 x holders (1 x with electrical connection, 1 x without electrical connection)
- 4 x covers (1 cover jointly for reservoirs 1, 2 + 3 and a separate one each for reservoirs 4, 5 + 6)
- 1 x measuring cylinder
- 2 Anode bags
- Pan
- Spray bottle
- Stripper
- protective gloves
- Adhesive tape
- Water feed hose
- Hose clamp
- Fuses (8 A /16 A)
- Connecting cable
- This manual

The scope of delivery does not include the following:

- Distilled/deionized water
- Container for the disposal of spent chemicals

2.1 Accessories

The chemicals for the through-hole plating are not included in the scope of delivery but can be supplied as an option.

- 9 l *CLEANER 110*
- 8 l *CLEANER 210*
- 7 l *AKTIVATOR 310*
- 30 l *COPPER PLATER 400*
- 0.5 l *SHINE 400*
- Base chemical for the chemical tin bath:
 - bright tin *SENO 3211* for a total of 9 liters of bath preparation



Note: Please put labels on the canisters of the chemicals supplied and do not remove the existing labels and keep them for the filling of the spent chemicals containers according to each type.

3.0 Safety regulations

In order to be able to guarantee reliable results with the system, the user must have read this manual and in particular the safety instructions given in bold print!



- **Never reach into the running machine!**
- **The product *SENO 3211* is harmful if swallowed!**
- **Avoid any skin contact with the liquids! (In case of skin or eye contact, immediately rinse with plenty of water and consult an eye doctor!)**
- **Never prepare or have meals while working on the system!**
- **Wash your hands after working at the system!**
- **Wear suitable protective clothing when working at the system! (Safety goggles and protective gloves)!**
- **Never drink the liquids!**
- **When handling the system, please ensure that no liquid can leak out!**
- **For modifications carried out on the device by the user himself, the safety of the device can no longer be guaranteed, in addition to forfeiting any warranty claims!**
- **Please note that some materials can generate dangerous gases during processing. Get more information about this from the supplier of your materials.**
- **As a basic principle, work in rooms with ventilation or an extraction unit! (operation with open window)!**
Based on company-internal measurements there is no evidence for an air pollution risk resulting from the operation of a *Contac RS* system.
- **Air change where possible 7-fold**
- **When using chemicals, please note the instructions on the containers and/or the separate safety sheets!**
- **Only use chemicals for their designated purpose.**
- **Ensure that the workplace is tidy.**
- **Read the safety instructions!**

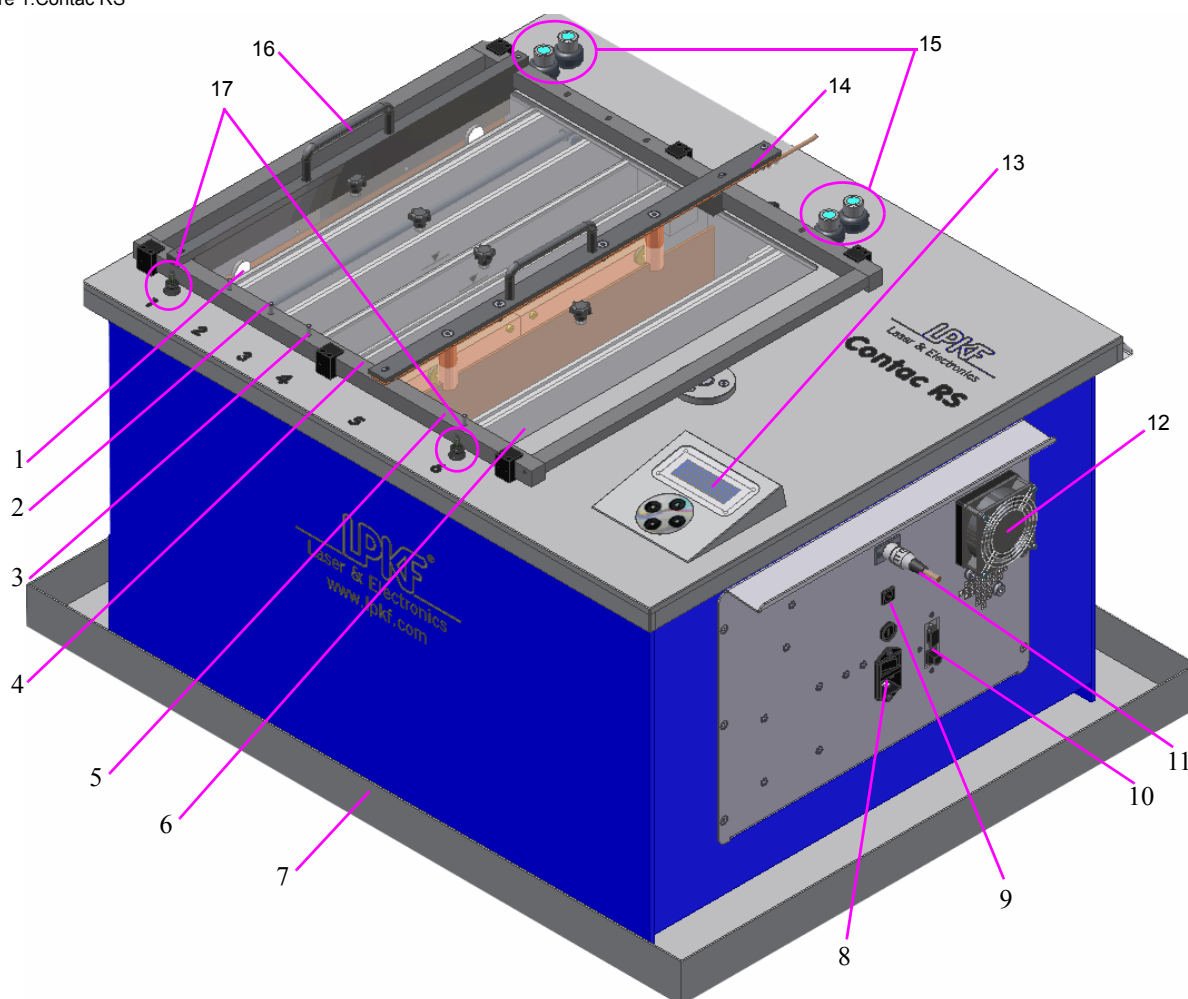
4.0 Description of the system

The system consists of a stable plastic housing containing the working reservoirs for the baths and the appropriate motion device, the operating unit with display and the printed circuit board holders.

The operating unit is located in the top right and the main switch on the right-hand side.

The system has the dimensions: approx. 900 mm x 540 mm x 800 mm (width x height x depth).

Figure 1: Contac RS



- 1-- Reservoir 1
- 2-- Reservoir 2
- 3-- Reservoir 3
- 4-- Reservoir 4
- 5-- Reservoir 5

- 6-- Reservoir 6
- 7- Pan
- 8- Main switch
- 9- Voltage changeover switch

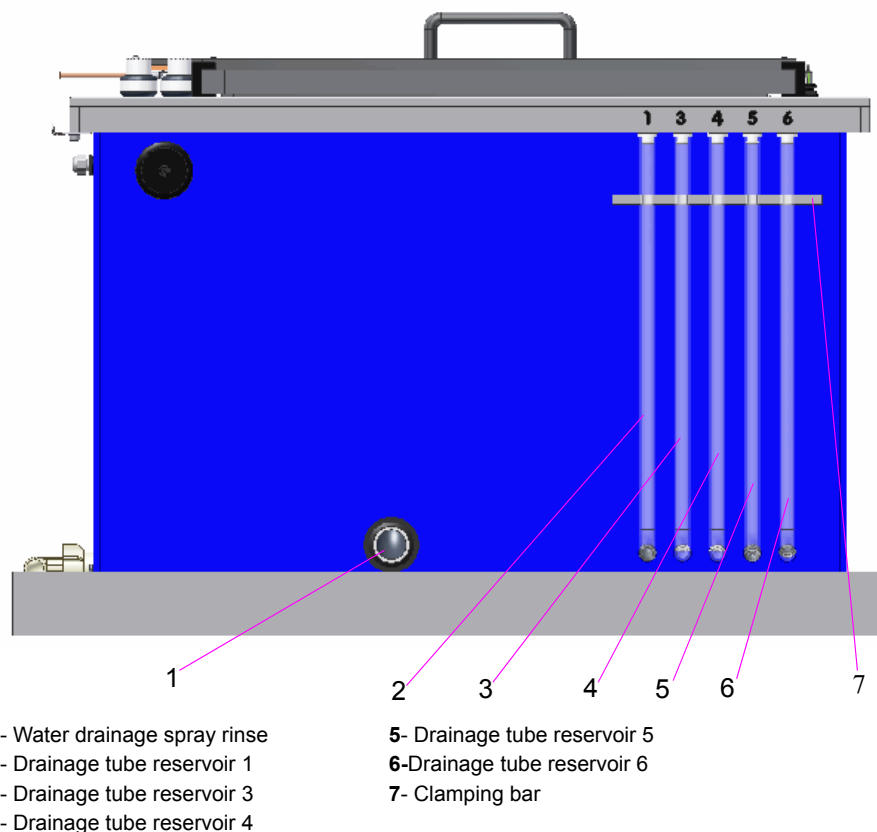
- 10 -Connection Ethernet /RS 232

- 11- Cathode connection
- 12- Fan
- 13- Operating unit
- 14- Printed circuit board holder with electrical connection (cathode)
- 15- Heating rods
- 16- Printed circuit board holder without electrical connection
- 17- Thermometer



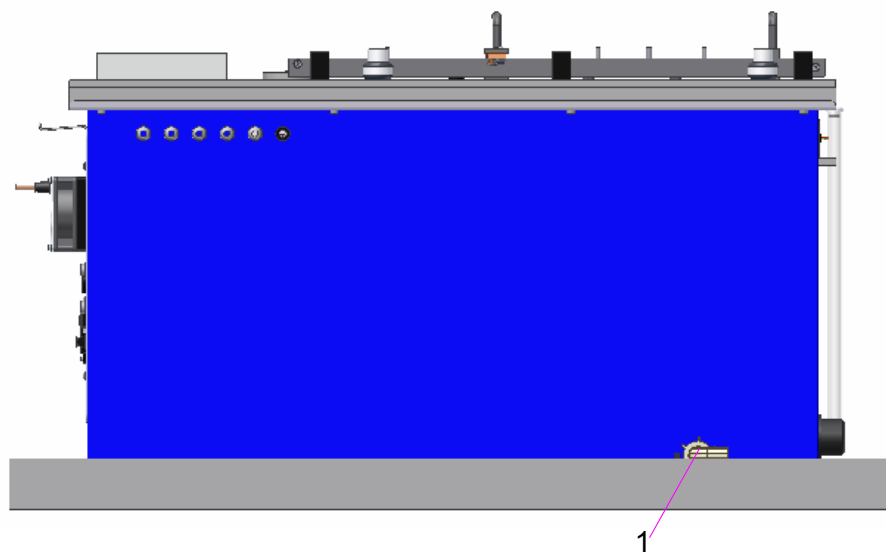
Caution! The printed circuit board holder with electrical connection may only be used for the reservoir containing the *COPPER PLATER*.

Figure 2: Left side view



On the left-hand side, there is a drainage tube and the water drainage for the spray rinse for each of the reservoirs 1,3,4,5 + 6. If liquid should drain from a reservoirs, it will be collected in the pan. In such a case, please contact the LPKF Service.

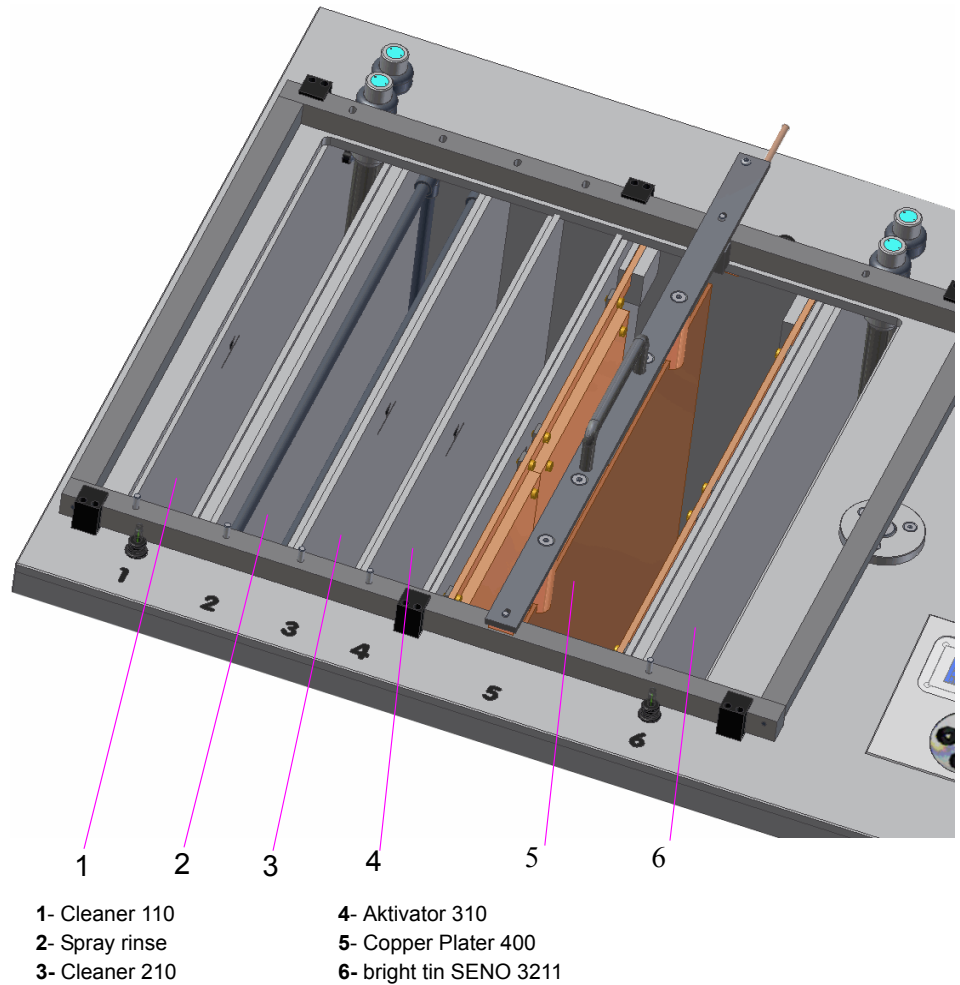
Figure 3: Rear view



On the rear side there is the water supply for the spray rinse (reservoir 2).

4.1 Description of the individual reservoirs

Figure 4: Bath arrangement



Reservoir 1

Degreasing and borehole preparation

Filling:	1 (=CLEANER 110)
Inner dimensions:	approx. 45 mm x 350 mm x 600 mm (width x height x depth)
Chemicals volume:	8.6 liters
Heating:	approx. 55°C
Frame movement:	stroke 12 mm
Emptying:	via drain pipe
Reservoir cover:	yes, together with reservoirs 2 + 3

Reservoir 2

Spray rinse

Dimensions:	approx. 57 mm x 325 mm x 570 mm (width x height x depth)
Emptying:	into the water drainage
Reservoir cover:	yes

For the rinsing of the printed circuit board, two nozzle fittings are installed in the form of drilled pipes on the left and right on the upper edge

Reservoir 3

Preparation

Filling:	3 (=CLEANER 210)
Inner dimensions:	approx. 45 mm x 325 mm x 570 mm (width x height x depth)
Chemicals volume:	7.5 liters
Heating:	no
Frame movement:	stroke 12 mm
Emptying:	via drain pipe
Reservoir cover:	yes, together with reservoirs 1 + 2

Reservoir 4

Activation

Filling:	4 (=AKTIVATOR 310)
Inner dimensions:	approx. 45 mm x 330 mm x 475 mm (width x height x depth)
Chemicals volume:	6.3 liters
Heating:	no
Frame movement:	stroke 12 mm
Emptying:	via drain pipe
Reservoir cover:	yes

Reservoir 5

Copper-plating

Filling:	5 (=Copper Plater 400)
Inner dimensions:	approx. 152 mm x 360 mm x 570 mm (width x height x depth)
Volume:	28.3 liters
Heating:	no
Frame movement:	stroke 12 mm
Emptying:	via drain pipe
Reservoir cover:	yes

There are two copper rails in the reservoir that act as a holder for the four phosphated copper anodes (see „Putting into operation” on page 32).

Reservoir 6

Chemical tin-plating (electro-less tin-plating)

Filling:	6 (=bright tin SENO 3211)
Dimensions:	approx. 45 mm x 350 mm x 600 mm (width x height x depth)
Volume:	approx. 8.6 liters
Frame movement:	stroke 12 mm
Heating:	approx. 35°C
Emptying:	via drain pipe
Reservoir cover:	yes



Note: For all reservoirs, the supplied quantity of chemical is greater than the bath can hold. Consequently, attention needs to be paid to the fill-level of the bath when filling it. The maximum fill-level is indicated by a triangular marking in each reservoir.

4.1.1 Fill-level sensors

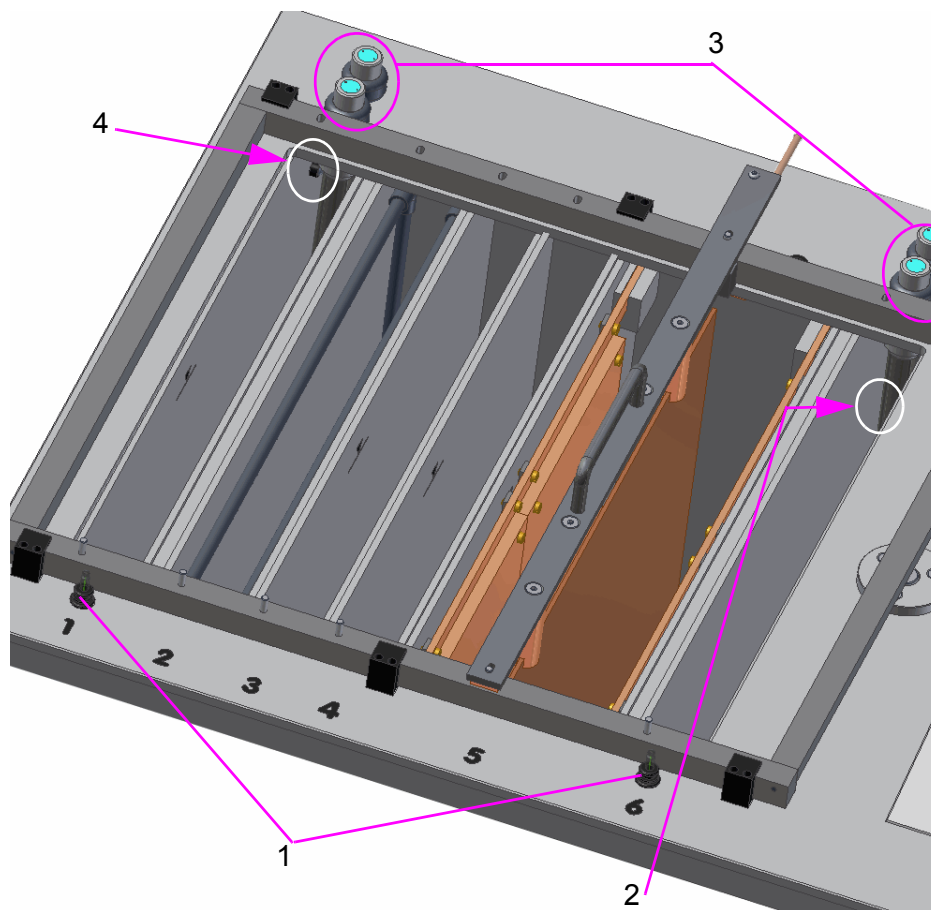
In the reservoirs 1 and 6 there are fill-level sensors for monitoring the fill-level (see figure below). If the sensors are not wetted with liquid when the system is switched on, the heating rods remain switched off. If the sensor in reservoir 1 is wetted with liquid, the heating rod is switched on when the system is switched on and heats up the bath. The temperature is pre-set.



Note: Before beginning work on a circuit board, you need to check using the thermometer in reservoir 1 whether the working temperature of approx. 55°C has been reached.

The sensor in reservoir 1 only reacts when the tin-plating has been activated (see see „Phases“ on page 30.). When the tin-plating is activated, please check using the thermometer in reservoir 6 whether the working temperature of approx. 35°C has been reached.

Figure 5: Fill-level sensor



1- Thermometer

2- Fill-level sensor reservoir 6 (not visible here)

3- Heating rods

4- Fill-level sensor reservoir 1

4.2 Locking into place of the circuit board holder

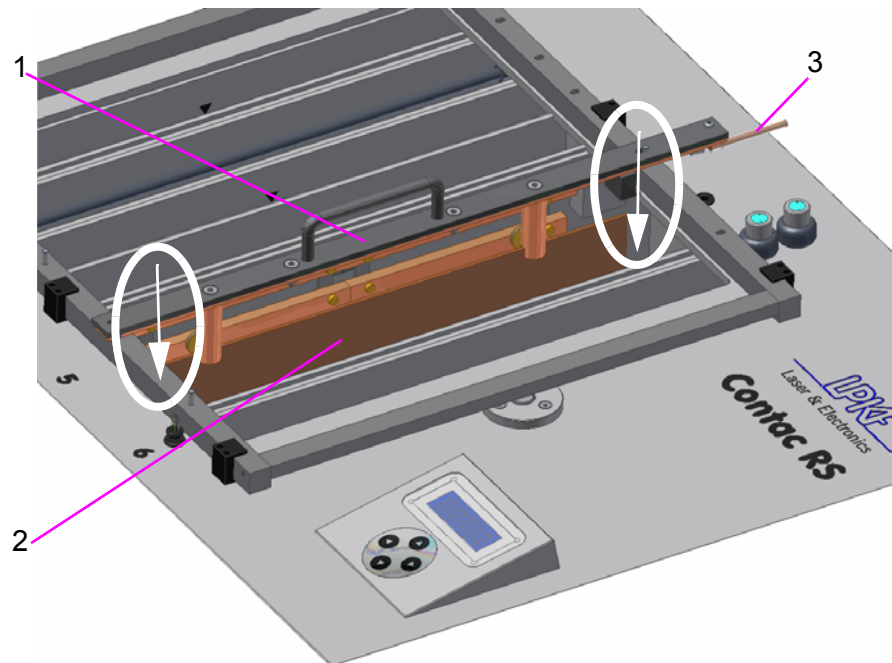
When handling the printed circuit board holder, proceed as follows:



Note: This handling applies to the usual printed circuit board holder and to the printed circuit board holder with cathode connection.

- › Place the holes provided in the printed circuit board holder on the pins at the frame of the reservoir edge (see following figure).

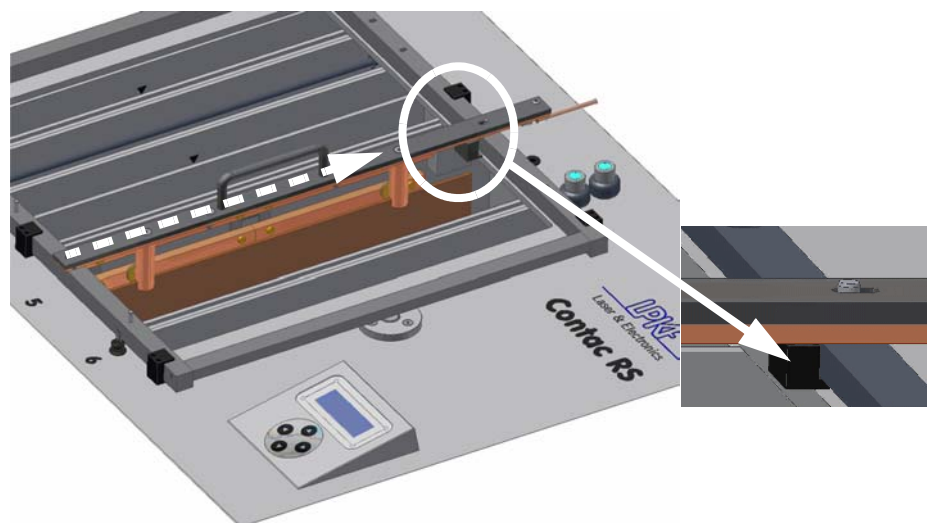
Figure 6:



1- Printed circuit board holder 2- Printed circuit board 3- Plug for cathode holder

- › Then move the printed circuit board holder so that the clamping piece locks into place under the frame (see following figure).

Figure 7:



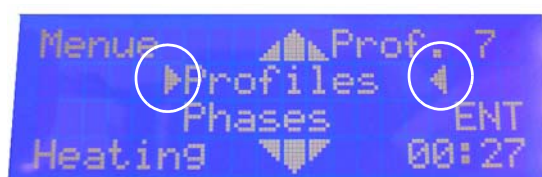
4.3 Operating unit

Figure 8:



After switching on, the following message appears on the display:

Figure 9: Display operating unit





Now the system is in the warm-up phase.





Note: How to set the choice of language is described in „Menu“ on page 31.

The arrows in circles Figure 9 on page 20 indicate the selected menu.

The keys have the following functions:

The menu selection is done via the  and  keys.

Press the  key to go to the next higher level (**ESC**).

Press the  key to activate the selected menu (see Figure 9 on page 20) (**ENT**).

Please see „Menus“ on page 26., this chapter contains the description of all the individual menus.

4.4 Description of the technical environment

Fresh water supply and a waste-water connection is necessary for the operation of the system.



Note: The voltage supply is to be done via a connection (30 mA) fuse-protected with FI.

These connections are to be provided by the user. As splashes of water cannot be ruled out entirely in the area of the system, it is recommended that the system be set up in an area that is insensitive to water.

The connections for the voltage supply are located on the right-hand side of the system (see Figure 1 on page 13). The electrical connection is done via a 230/115 volt connection cable.

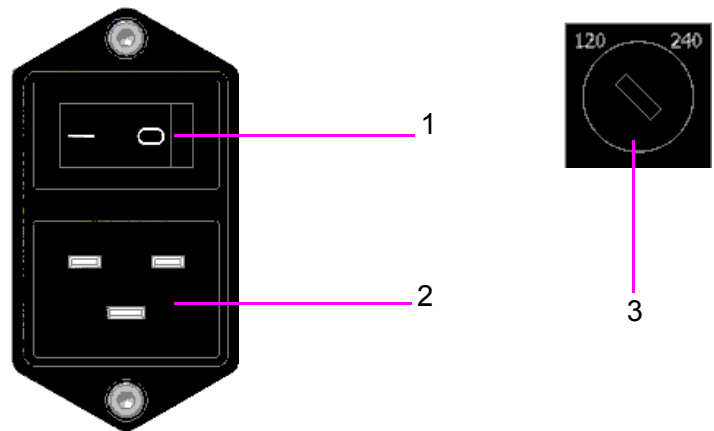
The connections for the water feed are located at the back the system (Figure 3 on page 14). In order to connect the water supply, the system is connected by means of the water feed hose (contained in the delivery) with the lockable water connection provided by customer. Maximum allowable water pressure is 3 bar.

The connection to the waste-water drainage is done at the DN 40 connection on the left-hand side of the system (see Figure 2 on page 14).

4.5 Electrical connections

The system can be operated with approx.. 230 V (+ 15 % / - 30 %) 50 Hz or with 115 V (+ 15 % / - 30 %). The voltage supply is done via a mains cable with earthing contact plug.

Figure 10: Electrical connections / main switch



1- Main switch

2- Connection for mains cable

3- Voltage changeover switch



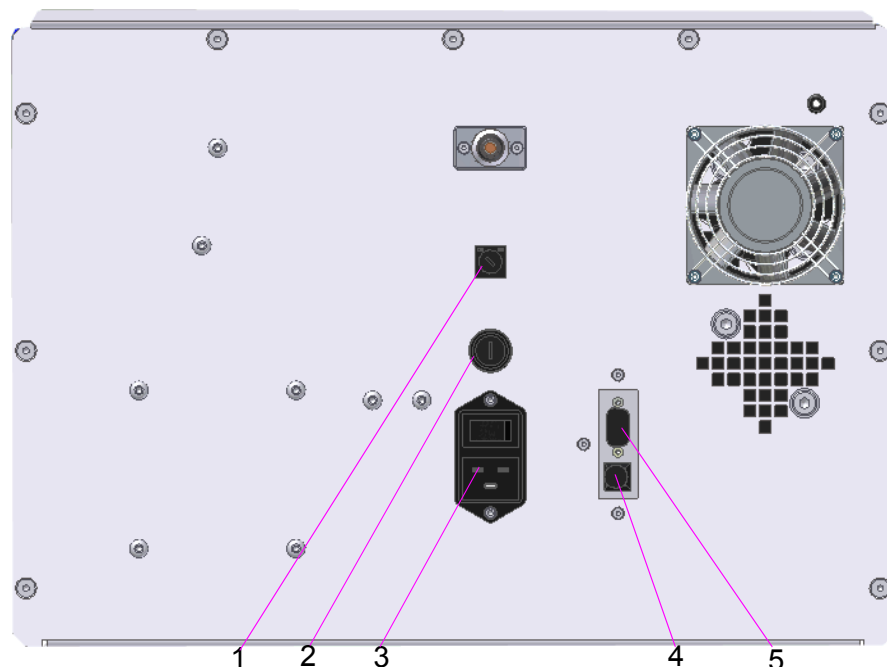
Caution: By all means observe the mains-dependent fuse values:

230 V = 8 AT

115 V = 16 AT

The voltage can be changed over between 110 V -120 V or 220 V - 240 V. To change the voltage over (see figure above), the slot in module (3) must be set carefully with a screwdriver to the desired number of volts.

Figure 11: Contac RS Side view



1- Voltage changeover switch

2- Fuse

3- Main switch

4- Ethernet connection

5- RS 232 connection

Software updates can be effected via the RS 232 connection.

4.6 Technical data

The *Contac RS* is a table device.

Approx. dimensions and connection values

Width	900 mm
Depth	800 mm
Height	540 mm
Weight	approx. 94 kg (without contents of bath)
Voltage	230 V +15% / -30%, 50 - 60 Hz 115 V +15% / -30%, 50 - 60 Hz
Output transformer	1400 W



AMBIENT TEMPERATURE **18 °C - 25 °C (64.4° - 77° F)**

Max. usable base material size	460 mm x 330 mm
Max. printed circuit board size:	approx. 430 mm x 290 mm

4.7 Reverse Pulse Plating

The Reverse Pulse Plating (RPP) is implemented by means of the special LPKF control electronics that monitors the entire through-hole plating process.

With conventional galvanizing, material is increasingly deposited in the corners of the boreholes as a result of the distribution of the field lines. This peripheral beading, called 'bone effect' of the metal deposition occurs in particular with a high aspect ratio (see left half in the following figure).

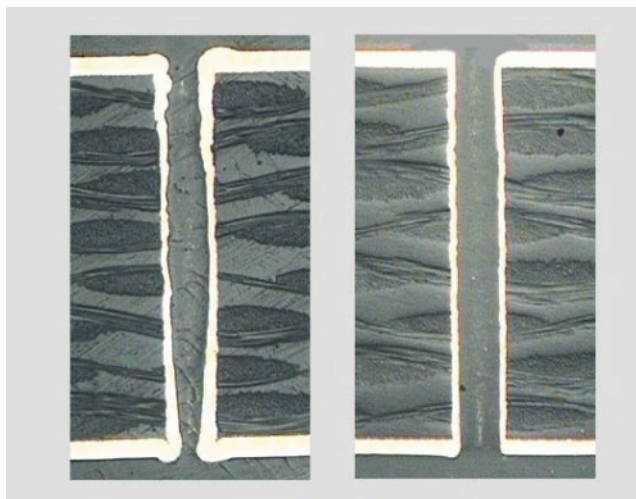


Note: The machine is delivered with the RPP function being disabled (profiles 1 - 6). In order to use the RPP function, it must first be activated in the menu profiles (see „Changing the individual menu items“ on page 27.).



Note: The RPP function is recommended to be used up to a drill-hole diameter of $\leq 0,4$ mm.

Figure 12: Bone effect



With Reverse Pulse Plating, the workpiece is briefly poled anodically by setting reverse pulses. This also briefly removes a part of the material peaks at the increased parts so that the copper build-up runs more evenly overall and the aspect ratio is improved (see right half in the above figure).

Figure 13: Normal galvanizing

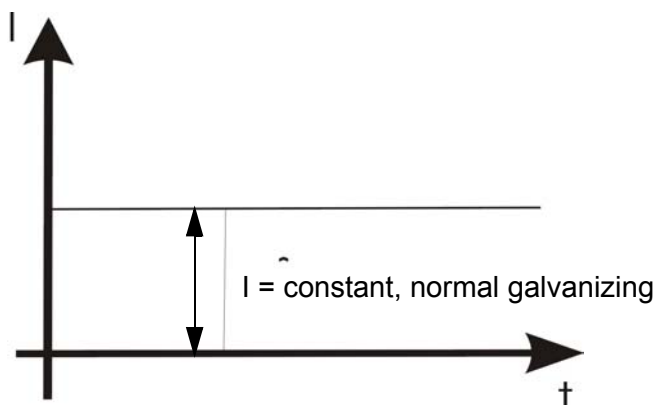
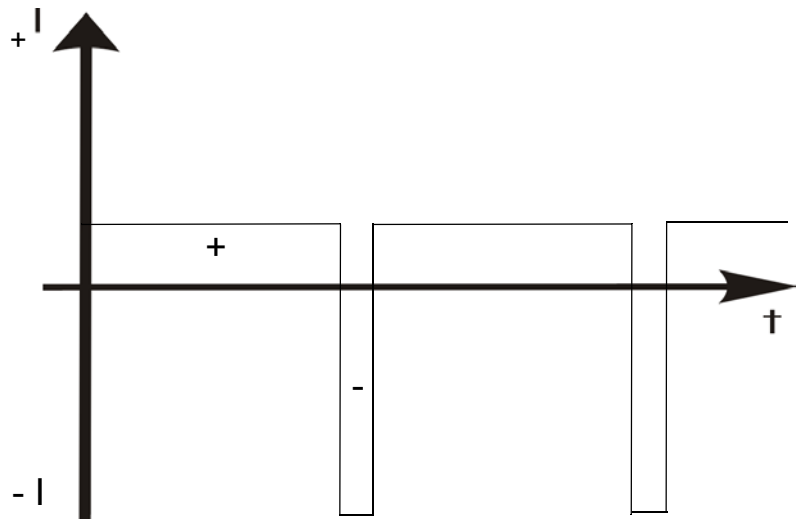


Figure 14: Galvanizing with Reverse Pulse Plating



4.8 Tin-plating

The *Contac RS* has a heatable reservoir (reservoir 6), in which the surface of the copper-plated printed circuit board can also be chemically tin-plated. The option tin-plating can be switched on or off via the menu item Profiles (see „Menu“ on page 28).

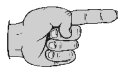
5.0 Menus

The following menus can be selected on the system:

- **PROFILES**
- **PHASES**
- **SETUP**
- **SERVICE**

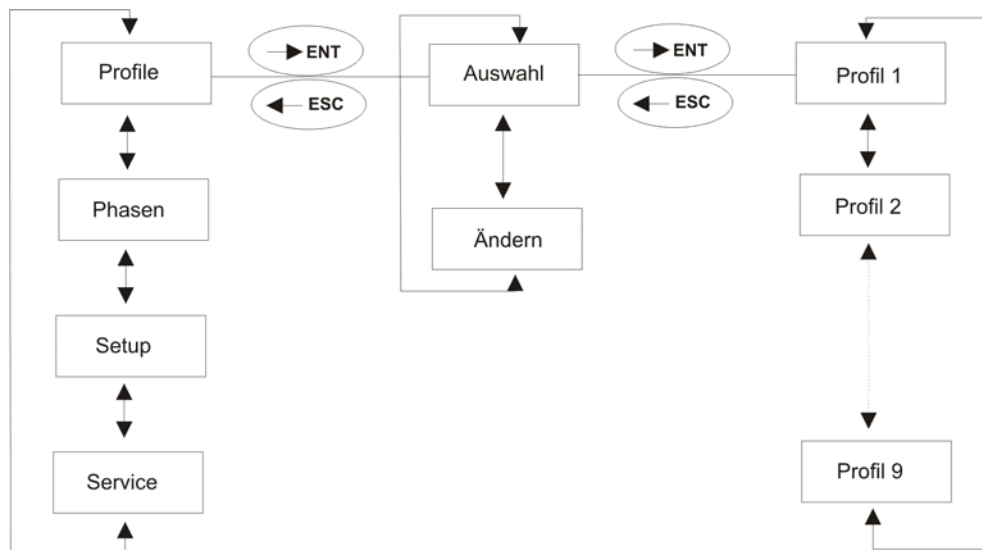
5.1 Menu navigation





Below the menu navigation is explained with reference to an example (**PROFILES** Menu).



Note: The application of this menu navigation applies to all available menus

Figure 15: Menu navigation

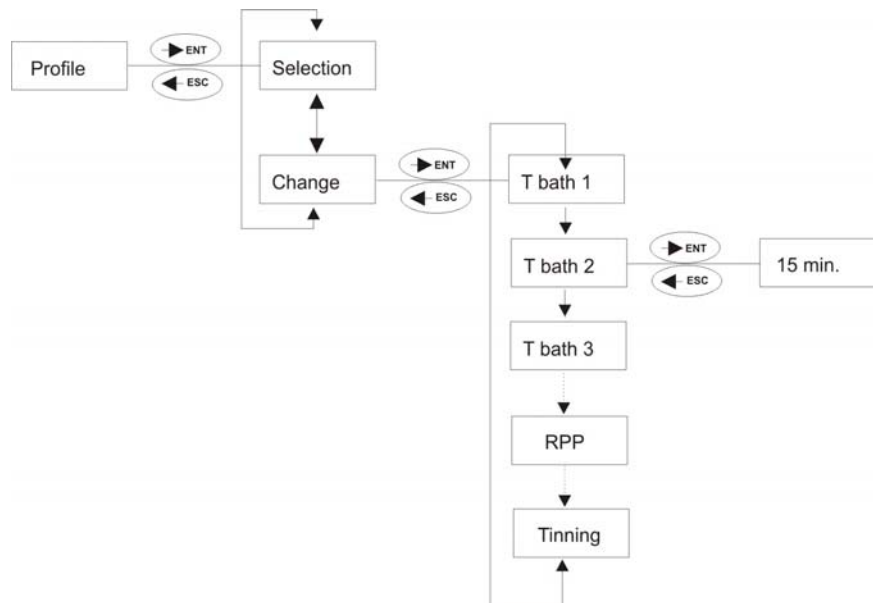


- › Select the desired menu item by pressing the  or  key.
- › Then activate the selected menu item by pressing the  key (**ENT**).
- › To leave the selected menu item, press the  key (**ESC**).




5.2 Changing the individual menu items


To change the individual menu items, proceed as follows (Example: **PROFILES**):


Figure 16:




› Select the menu item to be changed (Example: time bath 3).
Edit the entered time as follows:

- › Select the input position by pressing the  key.
- › To select the numbers, press the  and  keys.

To cancel the input, press the  key (**ESC**).

- › Press the  key up to the last input position (ENT).
The input is applied.

- › After the input, press the  key (**ESC**) as often as necessary to return to the main menu.



Note: Should any problems arise, please contact the LPKF service personnel.

5.3 Profiles Menu

The profiles 1, 3 and 5 have been edited by LPKF for circuit board size 9 " x 12 " and the profiles 2, 4, 6 and 7 for circuit board size 12 " x 18 ". When using different circuit board sizes, the current value must be recalculated and the profile changed accordingly (see „Changing the individual menu items“ on page 27.).

The current value is calculated as follows:

Per 100 cm² of surface area, a value of 1,0 Ampere is required.



Note: For this calculation only the area immersed into the electrolyte must be taken into account.

Example for base material size 12" x 18":

$$420 \text{ mm} \times 300 \text{ mm} \stackrel{\wedge}{=} 1260 \text{ cm}^2 (= 12" \times 18")$$

$$420 \text{ mm} \times 270 \text{ mm} \stackrel{\wedge}{=} 1134 \text{ cm}^2 (= \text{usable area})$$

$$\text{Surface area} = \text{front and rear side } 1134 \text{ cm}^2 \times 2 = 2268 \text{ cm}^2$$

$$2268 \text{ cm}^2 = \frac{2400}{100} \text{ dm}^2 \times 1,0 = 22,68 \text{ A}$$

Current must be set to = 22,7 A

Maximum current to be set = 26 A

The data listed in the table can be changed individually under the menu item **CHANGE** (see „Changing the individual menu items“ on page 27):

Change	Example	Remark
Time bath 1	15 min.	Enter time
Time bath 2	1 min.	Enter time
Time bath 3	10 min.	Enter time
Time bath 4	15 min.	Enter time
Time bath 5	60 min.	Enter time
Current	10 A	Current intensity
RPP	Yes/No	on/off
Time bath 6	30 min.	Enter time
Tin-plating	Yes/No	on/off

To select one of the profiles 1-9, go to the menu item **SELECTION**. If the selection is saved, the selected profile will still be active the next time the system is switched on.



Note: The following information applies to boreholes > 0.4 mm. For bore holes ≤ 0,4 mm the RPP function is to be switched on in the corresponding profile (see „Changing the individual menu items” on page 27).

Profile 1 (Standard DIN A 4 / 9“ x 12“)

Bath 1:	55°C	15 minutes	Pre-cleaning
Bath 2:	Room temperature	1 minute	Rinsing
Bath 3:	Room temperature	5 minutes	Cleaning
Bath 4:	Room temperature	15 minutes	Activation
Bath 5:	Room temperature (<30°C)	90 minutes	Galvanization
Bath 6:	35°C	30 minutes	Tin-plating
Current		11 Ampere	Current intensity
RPP		Yes/ No	on/ off
Tin-plating		Yes/ No	on/ off

Profile 2 (Standard DIN A 3 / 12“ x 18“)

Bath 1:	55°C	15 minutes	Pre-cleaning
Bath 2:	Room temperature	1 minute	Rinsing
Bath 3:	Room temperature	5 minutes	Cleaning
Bath 4:	Room temperature	15 minutes	Activation
Bath 5:	Room temperature (<30°C)	90 minutes	Galvanization
Bath 6:	35°C	30 minutes	Tin-plating
Current		20 Ampere	Current intensity
RPP		Yes/ No	on/ off
Tin-plating		Yes/ No	on/ off

Profile 3 (multi-layer DIN A 4 / 9“ x 12“)

Bath 1:	55°C	30 minutes	Pre-cleaning
Bath 2:	Room temperature	1 minute	Rinsing
Bath 3:	Room temperature	10 minutes	Cleaning
Bath 4:	Room temperature	25 minutes	Activation
Bath 5:	Room temperature (<30°C)	120 minutes	Galvanization
Bath 6:	35°C	30 minutes	Tin-plating
Current		11 Ampere	Current intensity
RPP		Yes/ No	on/ off
Tin-plating		Yes/ No	on/ off

Profile 4 (Multi-layer DIN A 3 / 12“ x 18“)

Bath 1:	55°C	30 minutes	Pre-cleaning
Bath 2:	Room temperature	1 minute	Rinsing
Bath 3:	Room temperature	10 minutes	Cleaning
Bath 4:	Room temperature	25 minutes	Activation
Bath 5:	Room temperature (<30°C)	120 minutes	Galvanization
Bath 6:	35°C	30 minutes	Tin-plating
Current		20 Ampere	Current intensity
RPP		Yes/ No	on/ off
Tin-plating		Yes/ No	on/ off

Profile 5 (flexible printed circuit boards DIN A 4 / 9" x 12")

Bath 1:	55°C	25 minutes	Pre-cleaning
Bath 2:	Room temperature	1 minute	Rinsing
Bath 3:	Room temperature	10 minutes	Cleaning
Bath 4:	Room temperature	20 minutes	Activation
Bath 5:	Room temperature (<30°C)	90 minutes	Galvanization
Bath 6:	35°C	30 minutes	Tin-plating
Current		10 Ampere	Current intensity
RPP		Yes/ No	on/ off
Tin-plating		Yes/ No	on/ off

Profile 6 (flexible printed circuit boards DIN A 3 / 12" x 18")

Bath 1:	55°C	25 minutes	Pre-cleaning
Bath 2:	Room temperature	1 minute	Rinsing
Bath 3:	Room temperature	10 minutes	Cleaning
Bath 4:	Room temperature	20 minutes	Activation
Bath 5:	Room temperature (<30°C)	90 minutes	Galvanization
Bath 6:	35°C	30 minutes	Tin-plating
Current		20 Ampere	Current intensity
RPP		Yes/ No	on/ off
Tin-plating		Yes/ No	on/ off

Profile 7 (initialization for printed circuit boards DIN A 3 / 12" x 18")



Note: This profile must be used when the system is put into operation for the first time.

Profile 8

Can be defined by the user.

Profile 9

Can be defined by the user.

5.4 Phases Menu

The printed circuit board is processed in the order **PHASE 1** through **PHASE 6** (see „“ on page 39.).

Phase	Input	Remark
Phases 1 - 6	Start	Phase is starting
Phases 1 - 6	Pause	Phase is interrupted
Phases 1 - 6	Change	Current data of the phase can be changed! (see „Changing the individual menu items“ on page 27.)
Phases 1 - 6	End	Ending the phase



Note: Data such as time, current intensity, RPP and tin-plating for the current phase can be changed under the menu item **CHANGE**.

5.5 Setup Menu

The following settings have been defined in the **SETUP** menu and can be changed, as described in chapter „Changing the individual menu items” on page 27:

Setting	Input	Remark
Save		Save configuration in the EPROM
Acoustic signal	Yes/No	Beeper on/off
Factory setting		Set factory setting
Message	Yes/No	Message service on/off
Language	German/English	Language selection
Interface	RS232/Ethernet	Interface selection
Version		Display of the firmware version
Chemicals Max. Ah	Number of ampere hours	Entry after how many ampere hours the warning message to supplement the chemicals should appear.
Chemicals Info		Info display how many ampere hours should be used.
Chemicals supplemented	Yes/No	Confirmation whether chemicals were supplemented. Counter is set to 0.

5.6 Service Menu



Note: The **SERVICE** menu is used exclusively by the LPKF service personnel.

6.0 Putting into operation



Caution! The foam rubber packaging material of the heating rod must be removed before the *Contac RS* is put into operation!

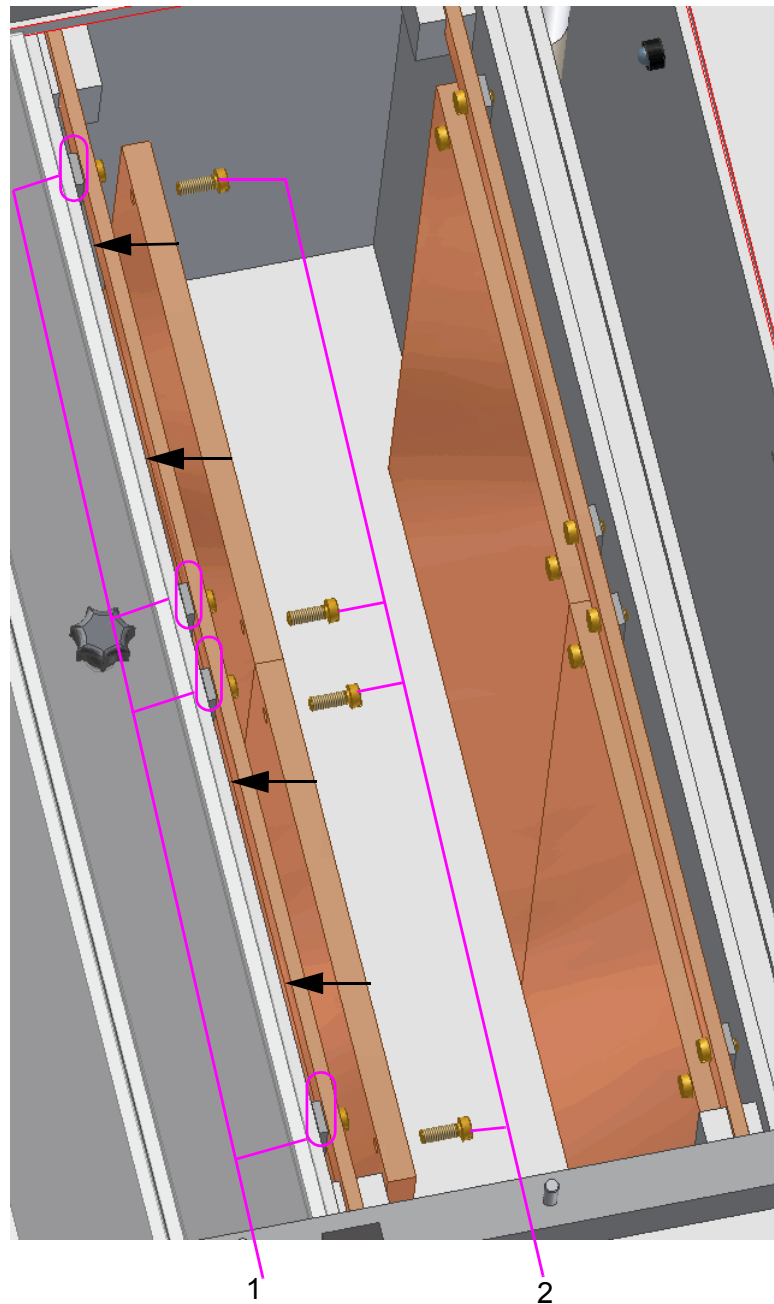


Caution: By all means wear appropriate protective gloves when putting the system into operation in order to avoid contamination of the copper anode boards and the anode bags!

To protect the galvanizing bath from contamination from anode mud, the supplied phosphated copper anodes must be put into the anode bags and mounted in the galvanic reservoir, before putting the system into operation. To do so, proceed as follows:

- › First remove the anode screws (2) from the anode holders (1) in the galvanic reservoir.

Figure 17:



1- Anode holder (4 per reservoir side)

2- Anode holder (4 per reservoir side)

- › Put an about 20 mm thick support into the galvanic reservoir.

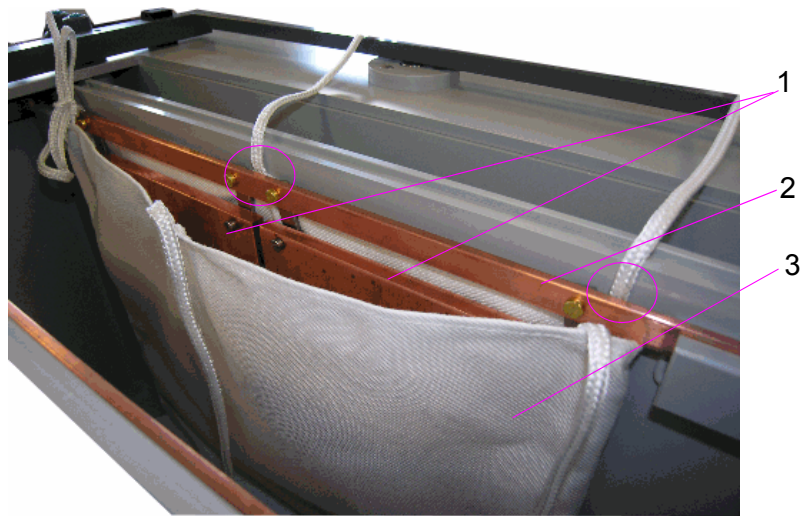


Note: This support is used as installation aid for the copper anode plates and in order to prevent the ground of the galvanic reservoir from being damaged during installation.

- › Remove the packaging of the copper anode plates.

- › Take the anode bag out of the packaging.
- › Put the first copper anode plate into one half of the anode bag.

Figure 18: Anode bags



1- Copper anode plates

2- Copper bars

3- Anode bags

- › Carefully set the first copper anode plate with the bag into the galvanic reservoir onto the support.
- › Pull the strings through underneath the copper bar (see circle in figure above) and around the anode holder.
- › Screw this copper anode plate tight to the anode holders of one side by means of the anode screws.
- › Put the second copper anode plate into the other half of the anode bag.
- › Screw this copper anode plate tight in the same way as the first plate.
- › Tie the strings of the anode bag above the anode plates around the anode holder tighten. Shorten the strings accordingly, the ends should be inside the bag.



Caution: The anode plates and the anode bag must be completely immersed in the bath and must not come into contact with the copper bar, as otherwise unwanted chemical reactions occur!



Note: Proceed in the same way with the third and fourth copper anode plate on the opposite side, as described above.

- › Remove the base from the galvanic reservoir and make sure that no residues remain in the cleaned reservoir.



Note: The anode bags must be exchanged if

- the worn copper anode plates are exchanged.
- the complete chemical fluid in reservoir 5 is exchanged.

The anode bags should not be washed and re-used.



Danger: When filling or emptying the system, it is absolutely necessary to wear suitable protective clothing (safety goggles and protective gloves) as contact with chemicals can result in acid burns!

The reservoirs have already been cleaned and rinsed before delivery; consequently, they can be filled with the through-hole plating chemicals immediately.



Caution! Please be sure that the reservoir 1 is sufficiently filled. If necessary, fill up with deionized water. When the option tin-plating is activated, please also ensure that the reservoir 6 is sufficiently filled and where necessary fill up with deionized water.



Caution! The reservoir 4 for the **ACTIVATOR 310** must be absolutely dry before it is filled and should definitely be filled last.

The maximum fill-level is indicated by a triangular marking in

- reservoir 1 (*CLEANER 110*)
- reservoir 3 (*CLEANER 210*)
- reservoir 4 (*ACTIVATOR 310*)
- reservoir 6 (*SENO 3211*)

The **reservoir 5** (*COPPER PLATER 400*) must be filled in such a way that the chemicals are approx. 5 mm under the copper rails.



Caution! With the *COPPERPLATER 400*, 2 ml of *SHINE 400* per liter of bath volume must be added shortly before commissioning (use the measuring cup supplied for this).



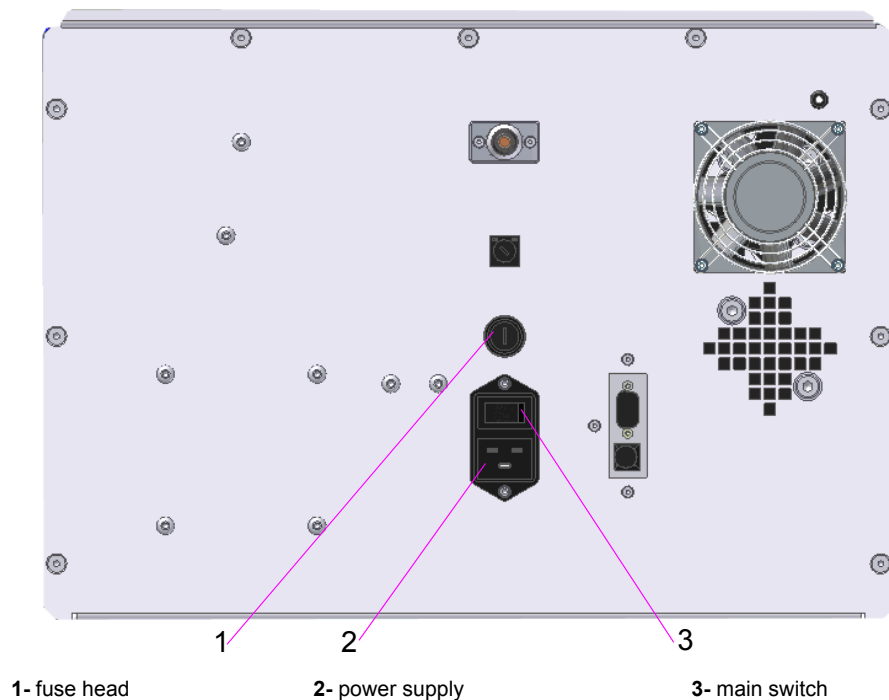
Note: The reservoir 6 (bright tin *SENO 3211*) only needs to be filled if the option tin-plating is used.

After inserting the copper anodes and filling the reservoir, the system can be put into operation. To do so, proceed as follows:

- › Insert the fuse required for your needs into the supplied fuse head (see accessory bag).

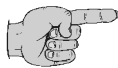
230 V = **8 AT** or 115 V = **16 AT**

Figure 19:



- › Carefully turn the fuse head (1) with the installed fuse (8 AT or 16 AT) into the fuse holder.
- › Connect the device at the power supply (2).
- › Switch on the device at the main switch (3).

The device will start heating up the bath in reservoir 1, which will be shown on the display (see Figure 8 on page 20).



Note: Before beginning work on a printed circuit board, you need to check using the thermometer in reservoir 1 whether the working temperature of approx. 55°C has been reached.

- › Clamp the dummy plate (min. 12" x 18") into the circuit board holder.
- › Then select **PROFILE 7** (see „Menu navigation” on page 26.).



Note: Profile 7 is the initialisation profile. This process takes about 6 hours so that the phosphor layers can build up on the anode plates.

Before the start of the initialisation process the dummy plate must be thoroughly rinsed.

- › To do this, move the printed circuit board into the reservoir 2 (spray rinse).
- › Start **PHASE 2**.

When the time has been counted down to 0, an acoustic signal will sound.

- › Please terminate **PHASE 2**.

› Afterwards, move the dummy plate into the reservoir 1 (CLEANER 110).

› Start **PHASE 1**.

When the time has been counted down to 0, an acoustic signal will sound.

› Please terminate **PHASE 1**.

› Then insert the dummy plate again into reservoir 2.

› Start **PHASE 2**.

When the time has been counted down to 0, an acoustic signal will sound.

› Terminate **PHASE 2**.

› Then put the dummy plate into reservoir 5.

› Start **PHASE 5**.

After 300 minutes an acoustic signal sounds and the plate can be taken out.

› Terminate **PHASE 5**.

› Then put the dummy plate again into container 2.

› Start **PHASE 2**.

When the time has been counted down to 0, an acoustic signal will sound.

› Terminate **PHASE 2**.

The initialisation process is then finished.



Caution! Please be sure to observe the safety data sheets for CLEANER 110, CLEANER 210, ACTIVATOR 310, COPPER PLATER 400, SHINE 400 and bright tin SENO 3211 ! Please fix these securely to the system so that they are clearly visible!



Caution! The printed circuit board holder with electrical connection may only be used for the reservoir 5.

6.1 External preparation of the tin-plating chemicals



Note: The external preparation of the tin-plating chemicals is recommended to achieve a more homogenous solution.

The following work steps need to be carried out for a bath preparation for reservoir 6 outside the *Contac RS*:

- 8.0 liters of deionized water (not supplied with the system, to be kept ready by the user) are heated up to 45°C +/- 5° (e.g. in a 10 l plastic bucket).
- Per liter demineralized water 90 grams of *SENO 3211* must be stirred into the heated water (i.e. 810 grams for 9 liters)
- The solution is stirred until all the salt has dissolved
- The solution is then left to cool down to room temperature
- The reservoir 6 is filled with this solution
- The reservoir is filled up to the marking on the back wall of the reservoir with the deionized water
- Stir entire contents of the bath
- The tin bath is heated up to room temperature using the menu control



Note: Before beginning work on a printed circuit board, you need to check using the thermometer in reservoir 1 whether the working temperature of approx. 35°C has been reached.

- the tin bath is ready for the chemical tin-plating of the printed circuit boards

6.2 Preparation of the tin-plating chemicals in reservoir 6

The following work steps need to be followed when preparing the tin-plating chemicals in reservoir 6:



- Fill reservoir 6 with deionized water up to the fill level (approx. 9 liters)
- After the temperature of 35°C has been reached, stir in 90 grams of *SENO 3211* per liter of water (for 9 liters, this corresponds to 810 grams of *SENO 3211*)
- Continue the stirring process until the salt has been entirely dissolved
- The bath is now ready for the chemical tin-plating of the printed circuit boards

7.0 Description of the procedure

The printed circuit board should only be drilled with carbide drills that are suitable for base materials. In the process, you should comply with the drilling parameters that can be found in the machine manuals or the tool libraries in *BoardMaster*.

Preferably, you should use FR4 with a copper layer of 5 µm or 9 µm (depending on availability). As this material is equipped with a copper foil as protection, it only needs to be rinsed to clean the boreholes. If you are using base material without a protective foil, e.g. FR4 18/18 µm, you need to deburr the drilled board and brush or scrub the surface e.g. with plastic non-woven material (not with steel wool). Thoroughly rinse the printed circuit board, in particular the boreholes.



Caution! Do not clean with compressed air containing oil! Oil residues could destroy the chemicals or have a negative influence on the through-hole plating.

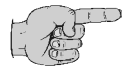


Caution! To produce a multilayer, cover up the outer edge with the adhesive tape included in the delivery in order to prevent contamination with chemicals.



Note: Before beginning work on a printed circuit board, you need to check using the thermometer in reservoir 1 whether the working temperature of approx. 55°C has been reached.

Before starting the actual circuit board processing, select the profile adapted to your requirements. Should you not use circuit board material of the size that the profiles are designed for, then the profiles must be edited to suit your circuit board size (see chapter „Menu“ on page 28).



Note: In the menu item PROFILES / INPUT / RPP, you can select between copper plating or RPP copper plating (see chapter „Reverse Pulse Plating“ on page 24 and „Menu“ on page 28).



Note: In the menu item PROFILES / INPUT / TIN-PLATING you can switch the option tin-plating on or off respectively (see chapter „Menu“ on page 28).



Danger: When filling or emptying the system, it is absolutely necessary to wear suitable protective clothing (safety goggles and protective gloves) as contact with chemicals can result in acid burns!

- › Clamp the base material into the printed circuit board holder.
- › Then move the printed circuit board into the reservoir 2 (spray rinse).



Note: In order to increase the rinsing effect, move the board up and down with the board holder during the whole rinsing time.

- › Now start **PHASE 2**.

When the time has been counted down to 0, an acoustic signal will sound.

- › Please terminate **PHASE 2**.

- › Afterwards move the printed circuit board into the reservoir 1 (*CLEANER 110*).

- › Now start **PHASE 1**.

When the time has been counted down to 0, an acoustic signal sounds and the prompt to rinse appears on the display.

- › Please terminate **PHASE 1**.



Caution: After removal from the *CLEANER 110* bath, the printed circuit board must be rinsed off quickly so that the degreasing chemicals do not dry out. To do this, move the printed circuit board during rinsing in reservoir 2 up and down.



Caution! You should make sure that the printed circuit board fixation is also rinsed to minimize the contamination with chemicals.

- › To do this, move the printed circuit board into the reservoir 2 (spray rinse) again.

- › Now start **PHASE 2**.

When the time has been counted down to 0, an acoustic signal will sound.

- › Please terminate **PHASE 2**.

- › After intensive rinsing, move the printed circuit board into the reservoir 3 (*CLEANER 210*).

- › Now start **PHASE 3**.

When the time has been counted down to 0, an acoustic signal sounds and the prompt to rinse and then dry appears on the display.

- › Please terminate **PHASE 3**.

- › Then remove the printed circuit board and by using the attached spray bottle with deionized water spray down all over and on both sides including the boreholes to rinse off any tap water components that might have a negative effect.

- › Then clean the printed circuit board with oil-free compressed air. This should prevent any water from remaining in the boreholes.

The printed circuit board is then dried completely with warm air.



Caution: No water must get into the activator!

The reservoirs 1, 2 and 3 now need to be covered with a lid to prevent loss through evaporation. Reservoir 5 also needs to be covered with the lid.



Note: The bath containing the **ACTIVATOR** needs to be stirred with a glass-fiber rod or similar before the printed circuit boards are introduced. When the fill level is too low, refill **AKTIVATOR 310** only

› Afterwards move the printed circuit board into the reservoir 4 (**AKTIVATOR 310**).

› Now start **PHASE 4**.

When the time has been counted down to 0, an acoustic signal sounds and the prompt to dry appears on the display.

› Please terminate **PHASE 4** and remove the printed circuit board.

› Strip **AKTIVATOR** from both sides of the surface using the attached stripper so that the residual liquid drops completely back into reservoir 4. .

› Remove the printed circuit board holder.

› Allow the printed circuit board **to dry thoroughly** (e.g. use a hairdryer -temperature < 55°C- or wait for an appropriate period of time) and alternately remove excess activator by carefully tapping it on a soft base.

The drying of the activator can also be done in the drying cabinet at < 55°C.



Please ensure that the boreholes are free of chemical residues.

Caution! Do not clean with compressed air containing oil! Oil residue could destroy the chemicals.

› If you are using FR4 material with copper foil, please remove the latter after the drying.



Caution! To produce a multilayer, cover up the outer edge with the adhesive tape included in the delivery in order to prevent contamination with chemicals.



Note: If you are using base material without a protective foil, you should dab it very carefully with a moist, fiber-free cloth so that the activator is not wiped off the boreholes.

› Clamp the circuit board into the circuit board holder with cathode connection.

› Make sure that the plug has been plugged into the cathode holder.

› It is only now that you can move the printed circuit board into reservoir 5 (**COPPER PLATER 400**).

› Now start **PHASE 5**.

The printed circuit board should be taken out after at least 15-20 minutes in order to check whether all boreholes are coated with copper.



Danger: When filling or emptying the system, it is absolutely necessary to wear suitable protective clothing (safety goggles and protective gloves) as contact with chemicals can result in acid burns!

- › Press **PAUSE** key to interrupt the through-hole plating.
The countdown of the time is interrupted.
- › Remove the printed circuit board and rinse it externally with tap water.
- › Check the printed circuit board.
- › After checking the printed circuit board, put it back in the reservoir and press **START** again. The countdown is continued at the point where it was interrupted.

When the first half has expired, a buzzer will sound, and a prompt will appear asking you to turn the circuit board.

- › Take out the circuit board along with the circuit board holder, turn it by 180° and re-insert it.
- › Press again **START**.
When the time has been counted down to 0, an acoustic signal sounds and the prompt to rinse and then dry appears on the display.
- › Please terminate **PHASE 5**.



Note: Depending on bath temperature, current intensity, printed circuit board size and chemicals quality, approx. 0.1 - 0.2 µm of copper are deposited every minute. Thus, approx. 6 - 12 µm of copper build up in 60 minutes.



Caution! Please note that the values given are approximate values for the achievable copper thickness that can spread with a system for laboratory operation such as the **LPKF Contac RS**.

If you require exact information about the copper thickness in the borehole, we recommend that you through-hole plate some test printed circuit boards and determine the actual wall thickness by means of micrographs. Once you have determined the parameters for the desired wall thickness, you can through-hole plate the actual printed circuit board. We recommend that you use the parameters given by us which enable good through-hole plating.

The galvanization process can be repeated as often as required.

To terminate the process, proceed as follows:

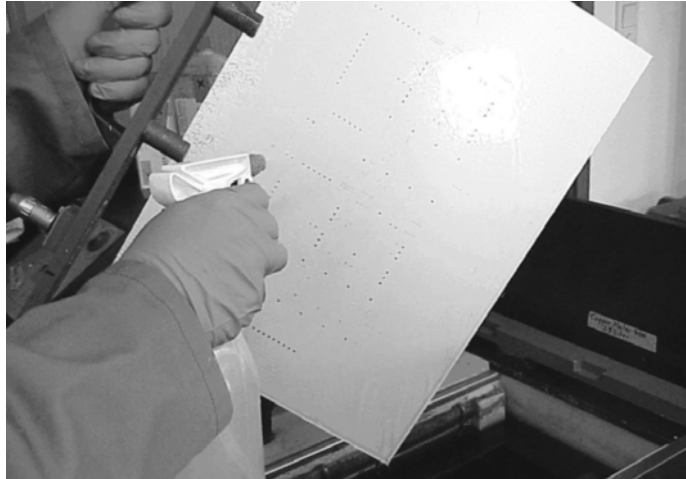
- › Always allow the printed circuit board to finish dripping over the bath.



Note: By allowing the printed circuit board to drip over reservoir 5 (**COPPER PLATER 400**), you save chemicals and at the same time protect the environment.

- › Remove the printed circuit board with its holder out of reservoir 5.
- › Spray the printed circuit board from both sides over reservoir 5 with the attached spray bottle and distilled or deionized water (see figure below).

Figure 20: Spraying of the printed circuit board



- › Allow this water to run back into the bath containing the *COPPER PLATER 400* where it replenishes losses through dripping and evaporation.
- › Then rinse the printed circuit board in reservoir 2 (spray rinse).
- › Move the printed circuit board up and down in the spray rinse (reservoir 2) approximately 10 times or rinse the printed circuit board at least continuously until the water stops.
- › Now dry the printed circuit board, where possible in warm air. This should be carried out as soon as possible to prevent an oxidation of the copper in the boreholes.



Note: If you work with too high a current intensity, the surface of the printed circuit board may be of a poor quality; the life of the chemicals is also reduced.

7.1 Description of the procedure during tin-plating

The tin-plating in the *Contac RS* (reservoir 6) can be used on any processing states of the printed circuit board, depending on user requirements.

- Tin-plating of the unprocessed printed circuit board
- Tin-plating of the through-hole plated, unmilled printed circuit board
- Tin-plating of the through-hole plated printed circuit board milled with the LPKF – *ProtoMat*

Irrespective of the aforementioned processing state, the following technological work steps must be carried out:



Caution! The surface of the printed circuit board must be clean and free of dust, lint and grease.

- › Please wash the copper surfaces of the printed circuit board down with water or use the spray rinse in reservoir 2. Then brush and lightly sand it with plastic non-woven material or use a printed circuit board brushing machine that may be available. The boreholes also must be included as burr or swarf could be deposited here.



Note! The boreholes and other surfaces can be cleaned with oil-free compressed air.

- › Spray the printed circuit board with deionized water.
- › Stir the contents of the bath thoroughly as the active substance tends to settle.



Note! Tests with a mini-pump (aquarium pump) have shown that this prevents sedimentation. The same effect is achieved when a low volume of air is introduced from an existing compressed air cable. However, the air must be free of oil and grease!

- › Only now should you clamp the printed circuit board in the printed circuit board holder and hang it in reservoir 6.



Note: The residence time in the bath can be selected between 5 and 60 minutes; the layer thickness of the deposited tin layer is proportional to the residence time in the chemical tin bath. The standing setting is a residence time of 30 minutes (see „Changing the individual menu items“ on page 27.).

- › Please start **PHASE 6**.

When the time has been counted down to 0, an acoustic signal sounds and the prompt to rinse and then dry appears on the display.

- › Please terminate **PHASE 6**.
- › Remove the printed circuit board and use the spray rinse in reservoir 2.
- › Then rinse off the printed circuit board again with warm water outside the reservoir.
- › Dry the printed circuit board completely with warm air (hairdryer).

8.0 Maintenance and repair

System

The system itself is maintenance-free.

It is important to cover the baths immediately after completing work to avoid contamination. The system needs to be cleaned carefully from time to time, and needs to be kept clean.

Baths

Reservoir 1 De-greasing Product: *CLEANER 110*

In the work breaks, when neither reservoir 1 nor reservoir 3 are in use, cover the reservoirs. Evaporated liquid can be replaced with distilled or deionized water.

(Change chemicals after 3 months or when there has been a clear change in color of the cleaning chemicals.)



Note: Avoid any unnecessary heating up as this affects the life of the chemicals.

Reservoir 2 Spray rinse

Clear the spray nozzles from calcium deposits on a regular basis.

Reservoir 3 Preparation Product: *CLEANER 210*

Cover the reservoirs in the work breaks when neither reservoir 1 nor reservoir 3 is in use. Evaporated liquid can be replaced with distilled or deionized water.

(Change chemicals after 3 months or when there has been a clear change in color of the cleaning chemicals.)

Reservoir 4 Activation Product: *AKTIVATOR 310*

Cover the reservoir in the work breaks. The bath is very sensitive to third-party components and acid ions and therefore requires careful operation.

Residues of *CLEANER 110*, *CLEANER 210*, *COPPER PLATER 400*, tap water, all acid chemicals, chips of ferrous metals, or similar, can result in a malfunction of the bath even after a short time. It is irrelevant for this whether the bath is in use or not. If the bath is not in use, mixing needs to be carried out at least once a week.

Only completely dry printed circuit boards may be introduced into the bath of the activator. Furthermore, water and other liquids must not enter the bath, i.e. clean printed circuit boards with oil-free compressed air, dry oil- and water-free with warm air (hairdryer) at < 55°C.



Note: Filling only with *AKTIVATOR 310*.

After removal from the activator bath, the excess activator liquid is stripped from the surface of the printed circuit board into the bath with the stripper. The boreholes are subsequently dried and blown free; and then an inspection is carried out.

- › Allow the printed circuit board **to dry thoroughly** (e.g. use a hair dryer temperature < 55°C- or wait for an appropriate period of time) and alternately remove excess activator by carefully tapping it on a soft base and only then immerse it in the reservoir 5 (COPPER PLATER 400).

The drying of the activator can also be done in the drying cabinet at < 55°C.



Note: After work breaks (longer than one day), stir the bath well with a glass-fiber rod or similar for 2-3 minutes.

Loss of liquid is compensated by filling up with *AKTIVATOR 310*.



Caution! Never add water to the activator bath as otherwise the through-hole plating will no longer work. The bath needs to be prepared fresh no later than after one year. Makes sure that the dispersion is well mixed.



Caution! Chemicals that have dropped on the unit should not be removed with scouring agents. Instead, they should be removed with a soft cloth. Otherwise, the plastic surface of the system will be scratched and it will be even more difficult to remove the chemicals.

Reservoir 5 Copper-plating Product: *COPPER PLATER 400*



Note! Do not rinse off the black coating on the anodes. It is a necessary requirement of the functioning of the galvanic copper plating.

Cover the reservoir in the work breaks.

The *COPPER PLATER 400* bath must be filtered

- after a long break in production
- after 100 ampere hours (warning message appears in the display).

15 % - 20 % of the bath must be filtered and returned to the *COPPER PLATER 400* bath.

- › To do so, empty the bath (see „Emptying of the individual reservoirs” on page 48) and pour the contents into a can, passing it preferably through several coffee filters fitted into each other.



Note: Should copper particles be deposited on the surface of the printed circuit board or are visible in the copper bath, the *COPPER PLATER 400* bath must be filtered immediately, in which case the entire contents of the bath need to be filtered. The bath container is rinsed out with deionized water and then filled with the filtered *COPPER PLATER 400* again.

Any liquid that has been lost should be filled up with *COPPER PLATER 400*.

An inspection must be carried out on a weekly basis of the reservoir containing *COPPER PLATER 400* to see whether copper sulfate crystals have been deposited on the walls and corners of the reservoir. These crystals must be returned to the bath. Then wipe off the edges and corners of the reservoir with a cloth that has been moistened with deionized water.



Caution! No copper sulfate crystals and residues of the *COPPER PLATER 400* chemicals must be allowed to enter the adjacent activator bath; this would destroy the activator chemicals. Any guarantee claims would expire in this case.

The chemical additive *SHINE 400* is used up as a function of the throughput. The *Contac RS* has an internal ampere hour counter. After 100 ampere hours, a warning message appears in the display that prompts you to add 5 ml of *SHINE 400* to the *COPPER PLATER* bath. After the addition of the chemical, you need to confirm the supplement in the setup menu and the ampere hour counter is reset to 0 (see „Menu“ on page 31).

Reservoir 6 Tin-plating Product: *SENO 3211*

The chemical tin bath *SENO 3211* is maintenance-free. When it is not used for a prolonged period of time, the tin bath should be transferred to a closed canister to avoid an oxidation of the active substance.

With one bath preparation, approx. 30 - 40 printed circuit boards in Euro format can be tin-plated. After that, the bath is exhausted and must be replaced/supplemented.

The period before the bath needs to be replaced is dependent on

- the size of the printed circuit board
- the area of the layers to be tin-plated
- the number and residence time of the printed circuit boards in the chemical tin bath

If the rate of deposition of tin on the surface of the printed circuit board drops, i.e. the time until a closed tin layer has been built up increases, this indicates that the tin bath is depleted.

Then proceed as follows:

- › Prepare bath fresh („External preparation of the tin-plating chemicals“ on page 38)

or

- › Stir in 25 % of the new preparation, i.e. approx. 25 grams of the active substance *SENO 3211* per 1 liter of bath volume.
- › Stir until the active substance *SENO 3211* has completely dissolved.

The bath is ready again for chemical tin-plating

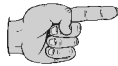
8.1 Emptying of the individual reservoirs



Danger: When filling or emptying the system, it is absolutely necessary to wear suitable protective clothing (safety goggles and protective gloves) as contact with chemicals can result in acid burns!

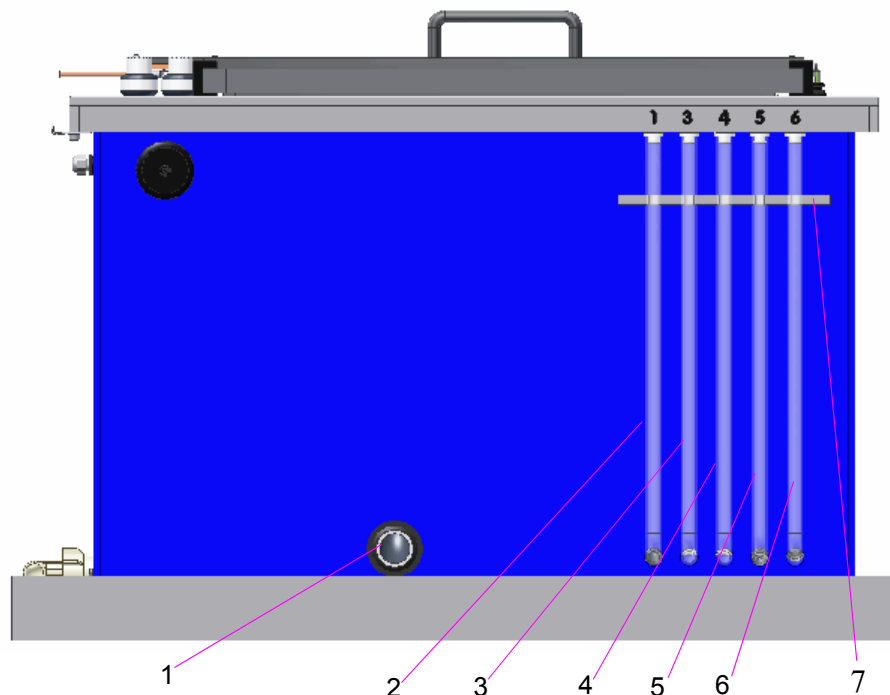


Danger: Never empty spent chemicals into the drain, but instead into the containers provided for waste disposal and dispose of them in an approved chemical processing plant.



Note: The cans of the delivered chemicals must be saved for the bottling of spent chemicals according to type.

Figure 21: Side view



1- Water drainage spray rinse
2- Drainage tube reservoir 1
3- Drainage tube reservoir 3
4- Drainage tube reservoir 4

5- Drainage tube reservoir 5
6- Drainage tube reservoir 6
7- Clamping bar

To empty the reservoirs 1, 3, 4, 5 + 6, proceed as follows:

- › Pull the hose in question out of the clamping rail.
- › Close the hose **completely** by placing the hose clamp included in the scope of delivery above the liquid level.
- › While holding the hose high, pull off the closing plug.
- › Then hold the end of the hose into the corresponding canister and open the hose clamp so that the chemicals can drain out.

9.0 Disposal

- Do not allow spilled chemicals to reach water channels or sewer systems.
- The rinse water from the work process can be disposed of via the waste-water system without hesitation (see Appendix).
- Never empty spent chemicals into the drain, but instead into the containers provided for waste disposal and dispose of them in an approved chemical processing plant.
- For the type of disposal (neutralization, special waste, physico-chemical treatment), please refer to the safety data sheets of the chemicals manufacturer.
- For the waste disposal, the local and national regulations for internal or external disposal must be regularly checked and complied with.
- The local and national regulations always take priority over our recommendations.
- The disposal of the chemical tin residues must be clarified with the manufacturer of the active substance („To be ordered from” on page 54).

10.0 Appendix

10.1 Error codes and troubleshooting

If an error has occurred, it is displayed in the display as an error code. **E** for error and the corresponding error code number appear in the bottom left of the display. The error description appears in the bottom right of the display. At the same time an acoustic signal is emitted.

Error code	Description	Possible cause	Elimination
E01	Interruption to the power supply in the galvanization reservoir	<ul style="list-style-type: none"> Printed circuit board was removed from the galvanization reservoir (5) without the process being put into the pause status beforehand. Blue crystalline material of the galvanization chemicals have been deposited between the copper frame and the anode plates. 	<ul style="list-style-type: none"> Hang the printed circuit board in the reservoir again and press START. Switch off machine. Remove anode plates and copper frame and clean with tap water, rinse with distilled or deionized water, reinstall, switch on machine.
E02	<ul style="list-style-type: none"> Cleaning chemicals in reservoir 1 remain at room temperature, i.e. heating rod does not start 	<ul style="list-style-type: none"> Fill-level in reservoir 1 is insufficient Heating rod is defective 	<ul style="list-style-type: none"> Fill up reservoir 1 with Cleaner 110 until the embossed fill-level mark Switch off machine. Heating rod must be replaced by a service technician.
E03	Failure in operating voltage +12 V.	Electronics defective	Please contact the LPKF Service
E04	Overheating cooling element	The output transistor is defective and is generating too much lost heat	Switch the machine off. Power board must be replaced by a service technician.
E05	Failure in operating voltage 24 V.	Electronics defective	Please contact the LPKF Service
E06	Failure in operating voltage 3 V.	<ul style="list-style-type: none"> Electronics defective Plugs X4, X5 not plugged in 	Please contact the LPKF Service
E07	Fill-level tin-plating reservoir insufficient		Fill up
E08	Temperature sensor defective	Sensor emits unrealistic temperature figures; R too high, T too low, (NTC)	Switch the machine off. Power board must be replaced by a service technician.

Error code	Description	Possible cause	Elimination
E09	Fan error	<ul style="list-style-type: none"> • Internal fan defective • Fan monitoring defective 	Please contact the LPKF Service
E16	Overload motor	<ul style="list-style-type: none"> • Frame has got stuck or runs sluggish • Motor is defective 	<ul style="list-style-type: none"> • Switch off machine. Loosen positioning blocks for the frame and then fix them again so that the frame can be moved easily. • Switch off machine. Motor must be replaced by a service technician.
W01	Warning supplement chemicals	Chemicals in the galvanization reservoir must be supplemented	Supplement chemical and confirm SETUP/ CHEMICALS in the menu
	Machine cannot be switched on	<ul style="list-style-type: none"> • No connection to the power supply • Main fuse defective • Fuse on the electronics board defective 	<ul style="list-style-type: none"> • Check plug-in connection • Replace main fuse, see „Replacing the main fuse“ on page 52., • Replace fuse of the electronics see „Electronics fuse“ on page 53

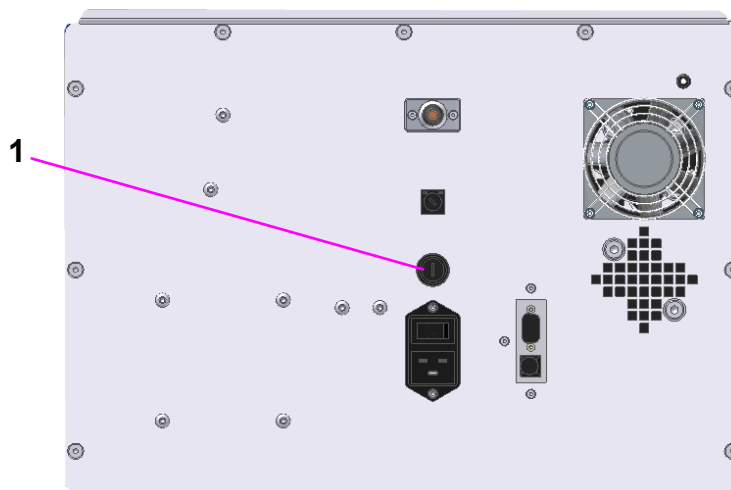
10.2 Replacing the main fuse

The main fuse (1) is a glass fuse (8 AT at 230V or 16 AT at 115V) and is located above the main switch (see figure below).

To replace the fuse, please proceed as follows:

- › Pull out the plug for the power supply.
- › Put the screw driver in the gap on the head of the fuse (1 in the following figure) and carefully twist the fuse head out of the fuse holder.
- › Insert the corresponding fuse or replace it.
- › Then turn the fusehead with the fuse carefully into the fuse holder again.
- › Reattach the mains plug.

Figure 22: Main fuse



1- Main fuse

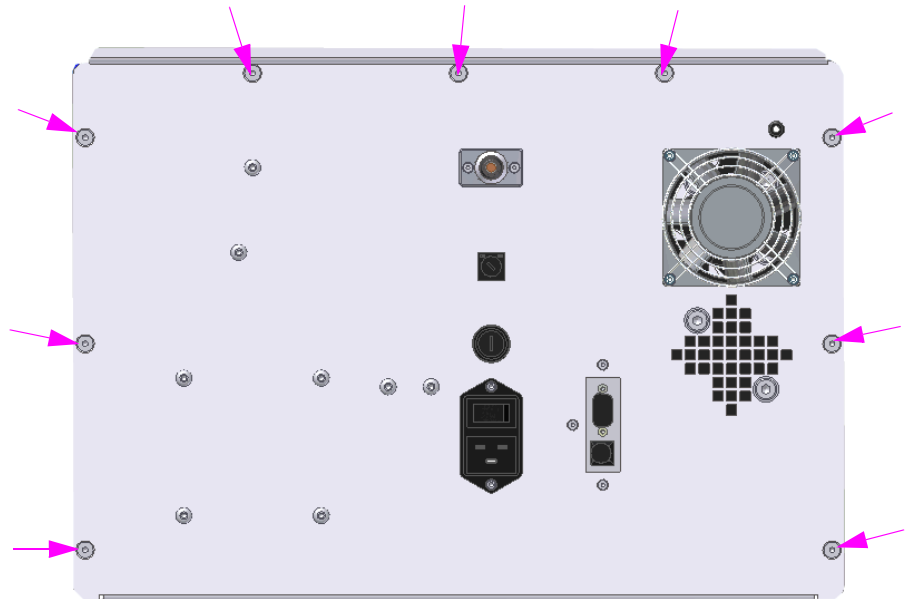
10.3 Electronics fuse

In case of electronics failure and, after having checked the main fuse, the electronics fuse may be defective. This glass fuse (3.15 AT) is on the power board.

To exchange the fuse, proceed as follows:

- › Switch off the *Contac RS* and pull the mains plug.
- › Loosen the screws marked with arrows (see following figure) on the right-hand side of the system.

Figure 23: Access to the fuse



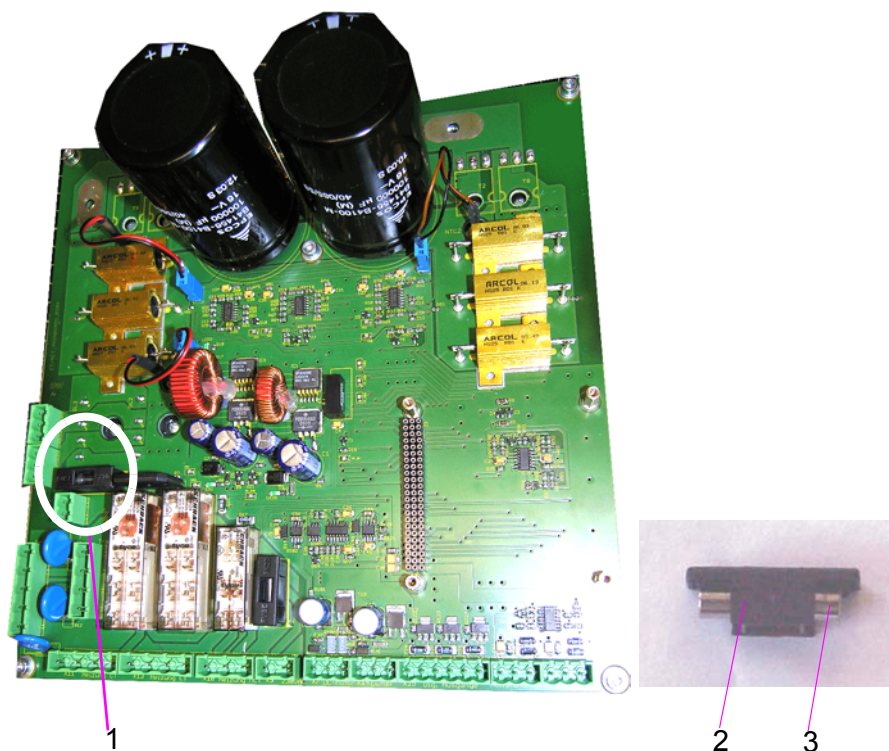
- › Remove the side cover by lifting it slightly and pulling it towards the front.
- › Now place the side cover carefully on the front side.

Figure 24:



- › On the power board, pull off the fuse holder containing the fuse (1) (see following figure)

Figure 25:



1- 'Electronics' fuse on power board

3- Fuse

2- Fuse holder (side view)

- › Exchange the fuse (1).
- › Re-insert the fuse holder (2) containing the new fuse (3).
- › Re-insert the side cover carefully and tighten the screws.
- › Connect the mains plug and switch the machine on again.

10.4 To be ordered from

Product name for the chemical tin bath: *SENO 3211* bright tin extra

To be ordered from: KEPETS GmbH & Co Systemtechnik
Nordstraße 24
D – 35641 Schöffengrund - Laufdorf

10.5 Examination result 1

Seite 2/3
vom 25.10.2004
Prüfauftrags-Nr. 30514-P2C



CHEMISCHES LABOR
DR. WIRTS+PARTNER
SACHVERSTÄNDIGEN GMBH

Prüfergebnisse

Probenkennzeichnung:	Spülwasser Mini- und Contac II / Mini- und Contac III /				
Labor-Nr.:	3 0514 / 1				
Aussehen:					
Farbe:	farblos				
Trübung:	ohne				
Bodensatz:	ohne				
Geruch:	schwach unspezifisch				
Probemenge:	ca. 750 ml				
PARAMETER	PRÜFVERFAHREN:		PRÜFDATUM:	EINHEIT:	PRÜFERGEBNIS:
pH - Wert	DIN 38404 / 5	a	25.04.03		8,1
Meßtemperatur			25.04.03	°C	14,7
elektrische Leitfähigkeit ber. auf 25 °C	DIN EN 27888	a	29.04.03	µS/cm	816
Chlorid	EN ISO 10304-1	a	10.03.03	mg/l	4,21
Sulfat	EN ISO 10304-1	a	10.03.03	mg/l	10,0
Chrom	EN ISO 11885	a	11.03.03	mg/l	< 0,02
Chrom VI	DIN 38405 / 24	a	11.03.03	mg/l	< 0,03
Kupfer	EN ISO 11885	a	28.04.03	mg/l	0,47
Nickel	EN ISO 11885	a	11.03.03	mg/l	< 0,04
Zink	EN ISO 11885	a	11.03.03	mg/l	0,086
Blei	EN ISO 11885	a	11.03.03	mg/l	< 0,1
Cadmium	EN ISO 11885	a	11.03.03	mg/l	< 0,01
Zinn	EN ISO 11885	a	13.03.03	mg/l	< 0,5
DOC - Gehalt	DIN 38409 / 3/1	a	06.03.03	mg/l	1,39

Zeichenerklärung:

u.B. = unter der verfahrensbedingten Bestimmungsgrenze

i.A. = in Anlehnung an

a = Akkreditiertes Verfahren

u = Unterauftrag

Schwermetalle wurden nach Aufschluß mit H₂O₂ / HNO₃ gemessen

10.6 Translation of examination result 1

page 2/3
of June 18, 2003
Test order No. 30514- P2C



CHEMISCHES LABOR
DR. WIRTS + PARTNER
SACHVERSTÄNDIGEN GMBH

Test Results

Sample identification.:	flushing water				
Laboratory No.:	Mini- and Contac II / Mini- and Contac III 3 0514 / 1				
<u>Appearance:</u>					
colour:	colourless				
turbidity:	none				
sediments:	none				
smell:	weakly non-specific				
sample quantity:	0,75 ltr				
PARAMETER	TEST METHOD		TEST DATE	UNIT	TEST RESULT
pH - value	DIN 38404 / 5		April 25, 2003		8,1
measurement temperature			April 25, 2003	°C	14,7
electric conductivity calculated at 25° C	DIN EN 27888		April 29, 2003	µS / cm	816
chloride	EN ISO 10304-1	a	March 10, 2003	mg / ltr	4,21
sulphate	EN ISO 10304-1	a	March 10, 2003	mg / ltr	10,0
chromium	EN ISO 11885	a	March 11, 2003	mg / ltr	< 0,02
chromium IV	DIN 38405	a	March 11, 2003	mg / ltr	< 0,03
copper	EN ISO 11885	a	April 28, 2003	mg / ltr	0,47
nickel	EN ISO 11885	a	March 11, 2003	mg / ltr	< 0,04
zinc	EN ISO 11885	a	March 11, 2003	mg / ltr	0,086
lead	EN ISO 11885	a	March 11, 2003	mg / ltr	< 0,1
cadmium	EN ISO 11885	a	March 11, 2003	mg / ltr	< 0,01
tin	EN ISO 11885	a	March 13, 2003	mg / ltr	< 0,5
DOC contents	DIN 38409 / 3 / 1	a	March 06, 2003	mg / ltr	1,39

Note:

a = accredited method

The samples were analysed after H₂O₂ / HNO₃ digestion

10.7 Examination report

Seite 3/3
vom 25.10.2004
Prüfauftrags-Nr. 3 0514-P2C



CHEMISCHES LABOR
DR. WIRTS + PARTNER
SACHVERSTÄNDIGEN GMBH

Zusammenfassende gutachterliche Stellungnahme zum Prüfbericht Auftrags- Nr. 3 0514-P2C

Die Auftraggeberin vertreibt Kontaktierungsanlagen.

Bei dem Betrieb dieser Kontaktierungsanlage Mini- und Contac II / Mini- und Contac III fällt Wasser zur Entsorgung an.

Zur Klärung, ob das anfallende Spülwasser in die öffentliche Abwasser- Kanalisation eingeleitet werden kann, wurde dem hiesigen Labor eine Abwasserprobe übergeben.

Das Untersuchungsprogramm wurde auf allgemeine Parameter, Säurereste und Schwermetalle abgestellt.

Die im einzelnen erhaltenen Meßergebnisse sind vorstehend aufgeführt.

Die Spülwasserprobe war farblos und klar war. Der pH- Wert lag im neutralen Bereich und die elektrischen Leitfähigkeit war gering. Alle weiteren geprüften Parameter lagen in einer für Abwasser normalen Größenordnung.

Unter Bezug auf die ATV- DVWK- Regelwert A115 „Einleiten von nicht häuslichem Abwasser in eine öffentliche Abwasseranlage“ entsprach das Spülwasser den Abwasser- Anforderungen.

Nach Vorlage dieses Prüfberichtes erteilt die zuständige Behörde die Genehmigung zur Einleitung in den Regen- oder Schmutzwasserkanal.

10.8 Translation of examination report

page 3/3
of June 18, 2003
Test order No. 30514- P2C



CHEMISCHES LABOR
DR. WIRTS + PARTNER
SACHVERSTÄNDIGEN GMBH

Summarised expert comments re. Test Report Order No.3 O514-P2C

The Principal is distributor of a contacting plant.

The operation of this contacting plant Mini- and Contac II / Mini- and Contac III Mini involves the accrual of water which is to be disposed of.

To clarify whether this accruing flushing water can be discharged into the public sewage system, a wastewater sample was handed to the undersigning laboratory.

The analysis programme was aimed at general parameters, residual acids and heavy metals.

The measuring results obtained in detail are itemized hereabove.

The flushing water sample was colourless and clear. The pH-value was in the neutral range and the electric conductivity was low. All the other parameters tested were in a magnitude normal for wastewater.

The flushing water sample met the sewage water requirements, with reference to ATV-DVWK-Regelwert A 115 "Einleiten von nicht häuslichem Abwasser in eine öffentliche Abwasseranlage" (discharge of non-domestic wastewater into a public sewage plant).

On presentation of this Test Report, the authority in charge will grant approval to this discharge into the public rainwater system or drainage system.

10.9 Examination result 2

Seite 2/2
vom 03.07.2003
Prüfauftrags-Nr. 31490-P1C



CHEMISCHES LABOR
DR. WIRTS+PARTNER
SACHVERSTÄNDIGEN GMBH

Prüfergebnisse

Probenkennzeichnung:	Trinkwasser			
Labor-Nr.:	3 1 490 / 1			
Aussehen:	farblos ohne ohne schwach unspezifisch ca. 1000 ml			
Farbe:				
Trübung:				
Bodensatz:				
Geruch:				
Probemenge:				
PARAMETER	PRÜFVERFAHREN:	PRÜFDATUM:	EINHEIT:	PRÜFERGEBNIS:
pH - Wert	DIN 38404 / 5 a	01.07.2003		8,0
Meßtemperatur			°C	14,6
elektrische Leitfähigkeit ber. auf 25 °C	DIN EN 27888 a		µS/cm	852
Kupfer	EN ISO 11885 a	01.07.2003	mg/l	0,023

Zeichenerklärung:

u.B. = unter der verfahrensbedingten Bestimmungsgrenze
i.A. = in Anlehnung an
a = Akkreditiertes Verfahren
u = Unterauftrag

10.10 Translation of examination result 2

page 2/2
 of July 29, 2003
 Test order No. 31490-P2C



CHEMISCHES LABOR
 DR. WIRTS+PARTNER
 SACHVERSTÄNDIGEN GMBH

Test Results

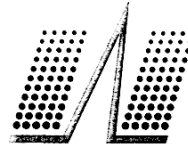
Sample identification:	drinking water			
Laboratory No.:	3 1490 / 1			
Appearance: colour: turbidity: sediments: smell: sample quantity:	colourless none none weakly non-specific 1,0 ltr			
PARAMETER	TEST METHOD	TEST DATE	UNIT	TEST RESULT
pH - value	DIN 38404 / 5 a	July 1, 2003	°C	8,0
measurement temperature		July 1, 2003	°C	14,6
electric conductivity calculated at 25 °C	DIN EN 27888 a	July 1, 2003	µS/cm	852
copper	EN ISO 11885 a	July 1, 2003	mg/ltr	0,023

Note:

a = accredited method

10.11 Examination result 3

Seite 2/4
vom 08.06.2000
Auftrags-Nr. 0 1218-P2C



CHEMISCHES LABOR
DR. WIRTS+PARTNER
SACHVERSTÄNDIGEN GMBH

Probenkennzeichnung:	Cleaner 110, Probe 1			
Labor-Nr.:	0 1218/ 1			
Aussehen: Farbe: Trübung: Bodensatz: Geruch:	farblos klar ohne schwach, unspezifisch			
Folgende Ergebnisse beziehen sich auf die homogenisierte Wasserprobe incl. Bodensatz				
PARAMETER	PRÜFMETHODE:	ANALYSEN-DATUM:	EINHEIT:	PRÜFERGEBNIS:
pH - Wert	DIN 38404/ 5	24.05.00		9,4
Meßtemperatur		24.05.00	°C	13,9
elektrische Leitfähigkeit ber. auf 25 °C	DIN 38404/ 8	24.05.00	µS/cm	57,4
Chrom, gesamt	DIN 38406/ 22	30.05.00	mg/l	< 0,02
Chrom VI	DIN 38405/ 24	30.05.00	mg/l	< 0,03
Kupfer	DIN 38406/ 22	30.05.00	mg/l	0,028
Nickel	DIN 38406/ 22	30.05.00	mg/l	< 0,04
Zink	DIN 38406/ 22	30.05.00	mg/l	< 0,02
Blei	DIN 38406/ 22	30.05.00	mg/l	< 0,1
Cadmium	DIN 38406/ 22	30.05.00	mg/l	< 0,01
Quecksilber	DIN 38406 / 12	07.06.00	mg/l	< 0,0005
Arsen	Graphitrohr-AAS	05.06.00	mg/l	< 0,005
AOX - Gehalt	DIN 38409/ 14	31.05.00	mg/l	< 0,010
TOC - Gehalt	DIN 38409/ 3/1	29.05.00	mg/l	2,42
Mineralöl-Kohlenwasserstoffe	DIN 38409/ 18	26.05.00	mg/l	< 1,6

Zeichenerklärung:

u.B. = unter der verfahrensbedingten Bestimmungsgrenze
i. A. = in Anlehnung an
(Die 16 PAK - Einzelsubstanzen sind nachstehend aufgeführt.)

10.12 Translation of examination result 3

page 2/4
of June 8, 2000
order No. 0 1218-P2C



CHEMISCHES LABOR
DR. WIRTS + PARTNER
SACHVERSTÄNDIGEN GMBH

sample identification:	Cleaner 110, sample 1			
laboratory No.	0 1218/ 1			
appearance	colourless none without slightly non-specific			
colour				
turbidity:				
sediment:				
smell:				
The results itemized herebelow are relating to the homogenized water sample incl. sediment.				
PARAMETER	TEST METHOD	ANALYSIS DAY	UNIT	TEST RESULT
pH value	DIN 38404/ 5	24.05.00	°C µS/cm	9.4
measuring temperature		24.05.00		13.9
electric conductivity at 25°C	DIN 38404/ 8	24.05.00		57.4
chromium, total	DIN 38406/ 22	30.05.00	mg/l	< 0,02
chromium VI	DIN 38405/ 24	30.05.00	mg/l	< 0,03
copper	DIN 38406/ 22	30.05.00	mg/l	0,028
nickel	DIN 38406/ 22	30.05.00	mg/l	< 0,04
zinc	DIN 38406/ 22	30.05.00	mg/l	< 0,02
lead	DIN 38406/ 22	30.05.00	mg/l	< 0,1
cadmium	DIN 38406/ 22	30.05.00	mg/l	< 0,01
mercury	DIN 38406 / 12	07.06.00	mg/l	< 0,0005
arsenic	Graphitrohr-AAS	05.06.00	mg/l	< 0,005
AOX - content	DIN 38409/ 14	31.05.00	mg/l	< 0.010
TOC - content	DIN 38409/ 3/1	29.05.00	mg/l	2.42
mineral oil hydrocarbons	DIN 38409/ 18	26.05.00	mg/l	< 1.6

Zeichenerklärung:

u.B. = below determinability limit set by analysis process
i. A. = leaning on

10.13 Examination result 4

Seite 3/4
vom 08.06.2000
Auftrags-Nr. 0 1218-P2C



CHEMISCHES LABOR
DR. WIRTS+PARTNER
SACHVERSTÄNDIGEN GMBH

Probenkennzeichnung:	Cleaner 210, Probe 2			
Labor-Nr.:	0 1218/ 2			
Aussehen:				
Farbe:	farblos			
Trübung:	klar			
Bodensatz:	ohne			
Geruch:	schwach, unspezifisch			
Folgende Ergebnisse beziehen sich auf die homogenisierte Wasserprobe incl. Bodensatz				
PARAMETER	PRÜFMETHODE:	ANALYSEN-DATUM:	EINHEIT:	PRÜFERGEBNIS:
pH - Wert	DIN 38404/ 5	24.05.00		8,2
Meßtemperatur		24.05.00	°C	13,1
elektrische Leitfähigkeit ber. auf 25 °C	DIN 38404/ 8	24.05.00	µS/cm	28,2
Chrom, gesamt	DIN 38406/ 22	30.05.00	mg/l	< 0,02
Chrom VI	DIN 38405/ 24	30.05.00	mg/l	< 0,03
Kupfer	DIN 38406/ 22	30.05.00	mg/l	0,106
Nickel	DIN 38406/ 22	30.05.00	mg/l	< 0,04
Zink	DIN 38406/ 22	30.05.00	mg/l	< 0,02
Blei	DIN 38406/ 22	30.05.00	mg/l	< 0,1
Cadmium	DIN 38406/ 22	30.05.00	mg/l	< 0,01
Quecksilber	DIN 38406 / 12	07.06.00	mg/l	< 0,0005
Arsen	Graphitrohr-AAS	05.06.00	mg/l	< 0,005
AOX - Gehalt	DIN 38409/ 14	31.05.00	mg/l	< 0,010
TOC - Gehalt	DIN 38409/ 3/1	29.05.00	mg/l	7,65
Mineralöl-Kohlenwasserstoffe	DIN 38409/ 18	26.05.00	mg/l	< 1,6

Zeichenerklärung:

u.B. = unter der verfahrensbedingten Bestimmungsgrenze
i. A. = in Anlehnung an
(Die 16 PAK - Einzelsubstanzen sind nachstehend aufgeführt.)

10.14 Translation of examination result 4

page 3/4
 of June 8, 2000
 order No. 0 1218-P2C



CHEMISCHES LABOR
DR. WIRTS+PARTNER
 SACHVERSTÄNDIGEN GMBH

sample identification:	Cleaner 210, sample 2			
laboratory No.	0 1218/ 2			
appearance colour turbidity: sediment: smell:	colourless none without slightly non-specific			
The results itemized herebelow are relating to the homogenized water sample incl. sediment.				
PARAMETER	TEST METHOD	ANALYSIS DAY	UNIT	TEST RESULT
pH value	DIN 38404/ 5	24.05.00		8.2
measuring temperature		24.05.00	°C	13.1
electric conductivity at 25°C	DIN 38404/ 8	24.05.00	µS/cm	28.2
chromium, total	DIN 38406/ 22	30.05.00	mg/l	< 0.02
chromium VI	DIN 38405/ 24	30.05.00	mg/l	< 0.03
copper	DIN 38406/ 22	30.05.00	mg/l	0.106
nickel	DIN 38406/ 22	30.05.00	mg/l	< 0.04
zinc	DIN 38406/ 22	30.05.00	mg/l	< 0.02
lead	DIN 38406/ 22	30.05.00	mg/l	< 0.1
cadmium	DIN 38406/ 22	30.05.00	mg/l	< 0.01
mercury	DIN 38406 / 12	07.06.00	mg/l	< 0.0005
arsenic	Graphitrohr-AAS	05.06.00	mg/l	< 0.005
AOX - content	DIN 38409/ 14	31.05.00	mg/l	< 0.010
TOC - content	DIN 38409/ 3/1	29.05.00	mg/l	7.65
mineral oil hydrocarbons	DIN 38409/ 18	26.05.00	mg/l	< 1,6

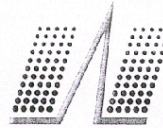
Zeichenerklärung:

u.B. = below determinability limit set by analysis process

i. A. = leaning on

10.15 Examination report

Seite 4/4
vom 08.06.2000
Auftrags-Nr. 0 1218-P2C



CHEMISCHES LABOR
DR. WIRTS+PARTNER
SACHVERSTÄNDIGEN GMBH

Gutachterliche Stellungnahme zum Prüfbericht. Auftrags-Nr. 0 1218-P1C

Bei dem Betrieb einer Kontaktierungsanlage der Auftraggeberin fällt Waschwasser zur Entsorgung bzw. Verwertung an.

Zur Klärung, ob das Waschwasser in eine öffentliche Abwasserkanalisation eingeleitet werden kann, wurden dem hiesigen Labor zwei Proben zur chemischen Untersuchung übergeben.

Die Proben wurden neben allgemeinen Parametern auf Schwermetalle und organische Summenparameter geprüft.

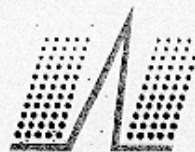
Die im einzelnen erhaltenen Meßergebnisse sind vorstehend aufgeführt.

Bei Auswertung der Meßergebnisse war festzustellen, daß die Waschwasserproben, Labor-Nr. 0 1218/ 1 und 2 (Cleaner 110 und 210), einen leicht alkalischen pH-Wert aufwiesen. Die Schwermetallübersichtsuntersuchung ergab jeweils nur geringe, unkritische Gehalte. Auch die geprüften organischen Summenparameter wiesen nur geringe Werte auf.

Unter Bezug auf das ATV-Regelwerk, Arbeitsblatt A 115 "Einleiten von nicht häuslichem Abwasser in eine öffentliche Abwasseranlage" entsprachen die Proben, Labor-Nr. 0 1218/ 1+2 (Cleaner 110 und 210), den Abwasseranforderungen, so daß eine Einleitung in eine öffentliche Abwasserkanalisation möglich wäre.

10.16 Translation of examination report

page 4/4
of June 8, 2000
order No. 0 1218-P2C



CHEMISCHES LABOR
DR. WIRTS+PARTNER
SACHVERSTÄNDIGEN GMBH

Expert comments re.: Test Report, Order No. 0 1218-P1C

On operation of a Contact Bed Plant of Mandator's, wash water is produced which is either put to waste disposal, or is utilised.

To clarify whether the wash water can be introduced into a Public Sewerage System, two samples were handed over for chemical analysis to the undersigning laboratory.

The samples were analysed – further to general parameters – for heavy metals and for organic summation parameters.

The measuring results obtained in detail are itemised hereabove.

The evaluation of the measuring results proved that the wash water samples, Labor No. 0 1218/ 1 and /2 (Cleaner 110 and 210) had a slightly alkaline pH value. The heavy metals general analysis brought, in each case, no more than slightly non critical contents. The organic summation parameters showed, on examination, no more than slight values.

With reference to the ATV-Regelwerk, Arbeitsblatt A 115 "Einleiten von nicht häuslichem Abwasser in eine öffentliche Abwasseranlage" (Discharge from non-domestic sewage in a public sewage plant) , the samples, Labor-No. 0 1218/ 1+2 (Cleaner 110 and 210) met the waste water requirements, so that an introduction into a Public Sewerage System might be possible.

10.17 Examination result 5

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Arbeitsbereiche und Messergebnisse

Betrieb:	LPKF Laser & Electronics AG, Garbsen
Arbeitsbereich:	Galvanik
Datum:	18.11.2003

Arbeitsbereich / Messpunkt		Stoffe	Datum	Uhrzeit	Dauer (min)	Art der Probe nahme	Faktor für verkürzte Expositi- on	Konzen- tration (mg/m³)	Stoffindex I
Nr.	Bezeichnung								
1	galvanische	Formaldehyd (Gesamtprozess)	18.11.03	10.47	120	o / W	k=1	0,013	0,02
	Durchkontaktia- rung	Formaldehyd (saures Cu-Bad)	18.11.03	12.50	30	o / W	k=1	0,018	0,03
2	Contac-III	Schwefeldioxid (Gesamtprozess)	18.11.03	10.47	120	o / W	k=1	< 0,4	< 0,31
		Schwefeldioxid (saures Cu-Bad)	18.11.03	12.50	30	(K *)		< 1,3 *)	
3		Schwefelsäure (Gesamtprozess)	18.11.03	10.47	120	o / W	k=1	< 0,05	< 0,5
		Schwefelsäure (saures Cu-Bad)	18.11.03	12.50	30	(K *)		< 0,2 *)	
4		Kohlenstoffdioxid	18.11.03	10.47	145	o / W	k=1	741 ppm	0,15

Erläuterungen:

- p = personenbezogen
o = ortsfest
S = Schichtmittelwert
K = Kurzzeitwert
W = Worst-case-Betrachtung
- *) die zur Zeit verfügbaren Analysenverfahren sind aufgrund geringer Nachweisempfindlichkeit bei kurzen Messdauern nicht oder nur bedingt zur Kontrolle des Kurzzeitwertes geeignet

10.18 Translation of examination result 5

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Operating areas and measurement results

works:	LPKF Laser & Electronics AG, Garbsen
operating ranges:	Galvanics
date:	18.11.2003

Working area / measuring point		Substances	Date	Time	Duration (min)	Sampling mode	Factor for shortened exposure	Concen- tration (mg/m³)	Substance index I
No	Designation								
1	<i>galvanic plating through</i>	Formaldehyde (total process)	18.11.03	10.47	120	o / W	k=1	0,013	0,02
		Formaldehyde (sour Cu bath)	18.11.03	12.50	30	o / W	k=1	0,018	0,03
2	Contac-III	Sulfur dioxide (total process)	18.11.03	10.47	120	o / W	k=1	< 0,4	< 0,31
		Sulfur dioxide (sour Cu bath)	18.11.03	12.50	30	(K *)		< 1,3 *)	
3		Sulfuric acid (total process)	18.11.03	10.47	120	o / W	k=1	< 0,05	< 0,5
		Sulfuric acid (sour Cu bath)	18.11.03	12.50	30	(K *)		< 0,2 *)	
4		carbon dioxide	18.11.03	10.47	145	o / W	k=1	741 ppm	0,15

Explanations:

p = relative to a person
o = stationary
S = average shift value
K = short time exposure value
W = worst case viewing

*) the analysis methods
available at the present time
are, by reason of their rather
slight detectability response
at brief measuring durations,
not or only restrictedly
suitable for the control of the
short time value

10.19 Examination report

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Befund

"Arbeitsbereich Galvanik - galvanische Durchkontaktierungsanlage Contac-III":

Die **Grenzwerte** für Formaldehyd, Schwefeldioxid, Schwefelsäure und Kohlenstoffdioxid sind auch unter dem Aspekt einer Worst-case-Betrachtung (konstante Exposition über eine Schichtdauer von 8 Stunden) eingehalten. Üblicherweise beträgt der tatsächliche Aufenthalt an der Anlage etwa 2-3 Stunden pro Schicht. Es ergeben sich folgende Stoffindizes:

Stoff	Stoffindex bei 8-stündiger Exposition	Stoffindex bei 3-stündiger Exposition
Formaldehyd	0,02	< 0,01
Schwefeldioxid	< 0,3	< 0,13
Schwefelsäure	< 0,5	< 0,19
Kohlenstoffdioxid	0,15	(0,06)

Eine Aufsummierung der Stoffindizes wurde aus folgenden Gründen nicht vorgenommen:

Für Schwefeldioxid und Schwefelsäure sind die Grenzwerte erst kürzlich gesenkt worden. Aufgrund nicht ausreichender Empfindlichkeit liegen die Bestimmungsgrenzen der verfügbaren Analyseverfahren bei rd. ein Drittel bzw. der Hälfte des Grenzwertes, so dass eine "einfache" Aufsummierung der Stoffindizes zu einer verfälschten Betrachtung der tatsächlichen Situation führen würde. Eine Analyse des Produktionsablaufs und eine genauere Betrachtung der verwendeten Chemikalienbäder zeigt jedoch, dass unter vorschriftsmäßig eingehaltenen Produktionsbedingungen mit keiner erhöhten Gefahrstoffemission zu rechnen ist. Der Messwert für Kohlenstoffdioxid lag mit 0,074 Volumenprozent deutlich unter dem Innenraumrichtwert von 0,15 Volumenprozent (DIN 1946, Teil 2) und weist auf einen gut belüfteten Raum.

Kurzzeitwerte

Die Kontrolle der Kurzzeitwerte von Schwefeldioxid und Schwefelsäure gestalten sich etwas schwieriger. Grund ist die kürzlich vorgenommene Absenkung der Grenzwerte, wobei zur exakten Überprüfung des 15-Minuten-Intervalls zur Zeit keine ausreichend empfindlichen Messverfahren zur Verfügung stehen.

Schwefeldioxid:

Aufgrund der Gleichartigkeit des Prozesses konnte hier ein "verlängertes" 30-Minuten-Intervall für die Messung herangezogen werden. Der Überschreitungsfaktor ist "1", d.h. die Konzentration soll zu keinem Zeitpunkt höher sein als der Grenzwert. Der Messwert lag unter der Bestimmungsgrenze von 1,3 mg/m³ (Grenzwert 1,3 mg/m³). Damit ist der **Kurzzeitwert** als sicher *eingehalten* zu betrachten.

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Schwefelsäure:

Auch hier konnte aufgrund des konstant gleichartig verlaufenden Prozesses ein 30-Minuten-Intervall für die Messung herangezogen werden. Der Überschreitungsfaktor ist auch hier "1". Der Messwert lag unter der Bestimmungsgrenze von 0,2 mg/m³ (Grenzwert 0,1 mg/m³).

Während der Benutzung des "sauren Cu-Bades" gab es keinerlei Hinweise auf eine Veränderung der Badstabilität. Auch eine geruchliche Belastung der Luft oder Reizwirkungen wurden nicht festgestellt. Somit ist auch hier von einer Einhaltung des Kurzzeitwertes auszugehen.

Bei vorschriftgemäßem Betreiben der Anlage sind die Grenzwerte für die oben genannten Stoffe gut eingehalten.

Eine Betrachtung der Randbedingungen für die Kurzzeitwerte ergibt, dass unter üblichen Betriebsbedingungen auch diese gut eingehalten werden können.

K.-D. Willaschek-Jühne
- Diplomchemiker -

Anlagen:

- Fotodokumentation
- Prüfbericht 32636-P1A
- Prüfbericht 32728-P1A
- Probenahmeprotokolle
- Messprotokoll - CO₂-Messung und Klimadaten
(Kontinuierliche Messung: testo 445 mit CO₂-Fühler und Dreifachsonde (°C; %rF; m/s))

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- sulfur dioxide
- carbon dioxide
- On the principals' request, the parameter list was completed by **formaldehyde**, because the chemical bath in Container 6 is holding formaldehyde in minor percentages.

Findings

“Operating range Galvanics - galvanic plating-through plant Contac III“

The **Limit values** for formaldehyde, sulfur dioxide, sulfuric acid and carbon dioxide **are retained**, too, under the worst case aspect (constant exposure through an eight hour shift duration). Usually, the actual dwell period at the plant will amount to approx. 2 - 3 hours per shift. The following substance indices will result:

Substance	substance index at 8-hour exposure	substance index at 3-hour exposure
Formaldehyde	0,02	< 0,01
Sulfur dioxide	< 0,3	< 0,13
Sulfuric acid	< 0,5	< 0,19
Carbon dioxide	0,15	(0,06)

The substance indices were not summed-up for the following reasons:

Only a short while ago, the limit values for sulfur dioxide and sulfuric acid were lowered. By reason of insufficient sensitivity, the limits of quantitation of the analysis methods available are at around one third respectively one half of the limit value, so that a "simple" summing-up of the substance indices would lead to an adulterated picture of the real and actual situation. An analysis of the production process and a closer observation of the chemical baths used does show, however - production conditions being adhered to strictly - an increased emission of hazardous substances will not have to be taken into account.

The measured value for carbon dioxide was, with a 0.074 volume percentage, distinctly below the indoor standard value of 0.15 volume percent (DIN 1946, Part 2), and does indicate a well-ventilated room.

Short time values

The control of the short time values of sulfur dioxide and sulfuric acid is involving some more difficulties; by reason of the lowering made, a short time ago, of the limit values so that - for an exact checking of the 15-minute interval - at present there are not available measuring procedures which would be sufficiently sensitive.

Sulfur dioxide:

The process homogeneity allowed, in this instance, the use of a "lengthened" 30-minute interval for the measurement. The excess factor is "1", i.e., the concentration shall not, at any time, be higher than the limit value. The measured value was below the limit of quantitation of 1.3 mg/m³ (limit value 1.3 mg/m³). With that

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the short time value is to be regarded as certainly respected.

Sulfuric acid:

Here, too, by reason of the process taking its constantly homogeneous course a 30-minute interval could be used for the measurement. The excess factor here too is "1". The measured value was below the limit of quantitation of 0.2 mg/m³ (limit value 0.1 mg/m³).

Whilst the "sour Cu bath" was being used, there were no indications of an alteration of the bath stability. Neither were there ascertained any smell load in the air nor any irritating influences. Thus there is to be assumed here, too, an adherence to the short time value.

If the plant is operated according to prescription, the limit values for the a.m. substances will be well adhered to.

An observation of the marginal conditions for the short time values shows that these, under usual operating conditions, can also be well kept.

K.-D. Willaschek-Jühne
- Diploma Chemist -

Enclosures:

- Photo documentation
- Test Report 32636-P1A
- Test Report 32728-P1A
- Sampling protocols
- Measuring protocol - CO₂ measurement and climate data (continuous measuring: testo 445 with CO₂ sensor and triple probe (°C; %rF; m/s))

10.21 Konformitätserklärung (German)

EG-Konformitätserklärung nach Maschinenrichtlinie 98/37/EG,
Anhang II A

Der Hersteller / Inverkehrbringer

LPKF Laser & Electronics AG
Osteriede 7

30827 Garbsen

erklärt hiermit, dass folgendes Produkt

Produktbezeichnung: *Contac RS*
Serien-/Typenbezeichnung: Anlage zur Durchkontaktierung von
Leiterplatten

den Bestimmungen der (den) oben gekennzeichneten Richtlinie(n) -
einschließlich deren zum Zeitpunkt der Erklärung geltenden Änderungen
- entspricht.

Folgende harmonisierte Normen wurden angewandt:

- EN 349:1993
Sicherheit von Maschinen - Mindestabstände zur Vermeidung
des Quetschens von Körperteilen
- EN ISO 12100-1
Sicherheit von Maschinen Teil 1
- EN ISO 12100-2
Sicherheit von Maschinen Teil 2
- EN 1050:1996
Sicherheit von Maschinen - Leitsätze zur Risikobeurteilung
- EN 626-1:1994
Sicherheit von Maschinen - Reduzierung des Gesundheitsrisikos
durch Gefahrstoffe, die von Maschinen ausgehen - Teil 1:
Grundsätze und Festlegungen für Maschinenhersteller
- EN 60204-1:1997
Sicherheit von Maschinen - Elektrische Ausrüstung von
Maschinen - Teil 1: Allgemeine Anforderungen
- EN 61000-3-2:2000
Elektromagnetische Verträglichkeit (EMV) - Teil 3-2: Grenzwerte -
Grenzwerte für Oberschwingungsströme (Geräte-Eingangsstrom
bis einschließlich 16 A je Leiter)
- EN 61000-6-2:2001
Elektromagnetische Verträglichkeit (EMV) - Teil 6 -
Fachgrundnormen - Störfestigkeit - Industriebereich
- EN 61000-6-3:2001
Elektromagnetische Verträglichkeit (EMV) - Teil 6-3:
Fachgrundnormen - Fachgrundnorm Störaussendung -
Wohnbereich, Geschäfts- und Gewerbebereiche sowie
Kleinbetriebe

Folgende nationale oder internationale Normen (oder Teile/Klauseln daraus) und Spezifikationen wurden angewandt:

- EN55022 Klasse B
Funkstörspannung, Funkstörstrahlung

Folgende weitere EU-Richtlinien wurden angewandt:

- EMV-Richtlinie 89/336/EWG
- Niederspannungsrichtlinie 2006/95/EG

Ort: Garbsen
Datum: 05.03.2007



Herr Bernd Hackmann (Vorstandsvorsitzender)

10.22 Declaration of conformity

EC Declaration of Conformity in accordance with Machinery Directive 98/37/EC, Appendix II A

The manufacturer/seller

LPKF Laser & Electronics AG
Osteriede 7

D-30827 Garbsen

hereby declares that the following product

Product designation:	<i>Contac RS</i>
Series/type description:	System for Through-Hole Plating of Circuit Boards

conforms to the provisions of the directive(s) identified above - including the modifications effective at the time of this declaration.

The following harmonized standards were applied:

- EN 349:1993
Safety of machinery - Minimum gaps to avoid crushing of body parts
- EN ISO 12100-1
Safety of machines Part 1
- EN ISO 12100-2
Safety of machines Part 2
- EN 1050:1996
Safety of machinery - Principles for risk assessment
- EN 626-1:1994
Safety of machinery - Reduction of risks to health from hazardous substances emitted by machinery - Part 1: Principles and specifications for machinery manufacturers
- EN 60204-1:1997
Safety of machinery - Electrical equipment of machines - Part 1: General requirements
- EN 61000-3-2:2000
Electromagnetic Compatibility (EMC) - Part 3-2: Limits – Limits for harmonic current emissions (Equipment input current up to 16 A per phase)
- EN 61000-6-2:2001
Electromagnetic Compatibility (EMC) - Part 6 - Generic standards - Immunity for industrial environments
- EN 61000-6-3:2001
Electromagnetic Compatibility (EMC) - Part 6-3: Generic standards - Emission standard for residential, commercial and light-industrial environments

The following national and international standards (or parts/clauses thereof) and specifications have been applied:

- EN55022 Class B Radio interference voltage, Radio interference emission

The following additional EU Directives were applied:

- EMC directive 89/336/EEC
- Low Voltage Directive 2006/95/EC

Place: Garbsen
Date: 05.03.2007



Bernd Hackmann (Board chairman)

11.0 Index

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12.0 Safety data sheets

CLEANER 110

CLEANER 210

AKTIVATOR 310

COPPER PLATER 400

SHINE 400

Bright tin SENO 3211

