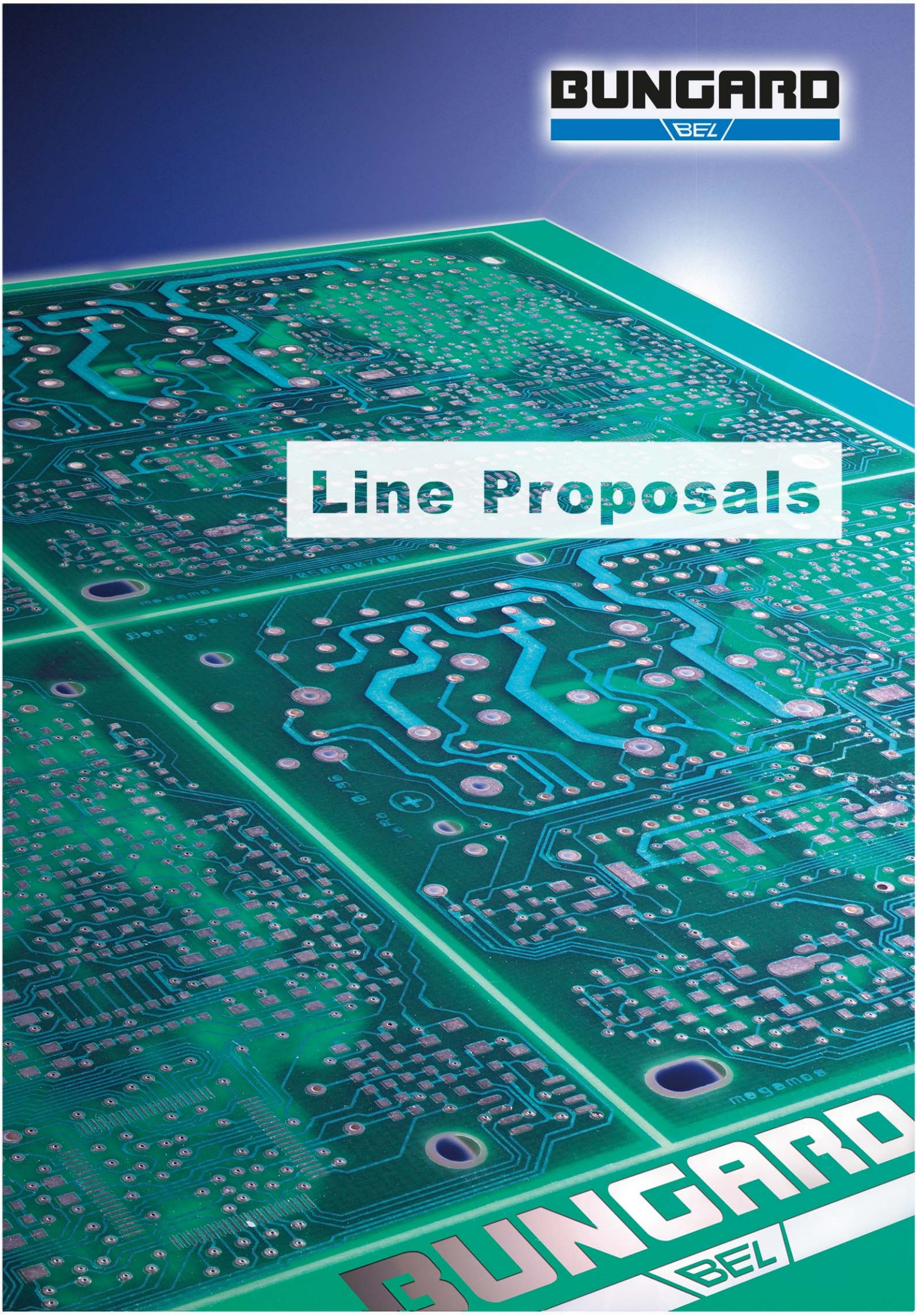
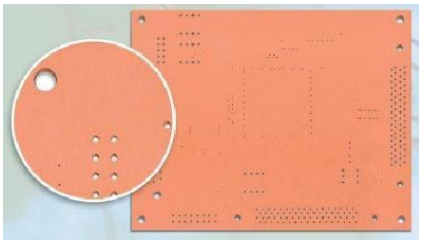

BUNGARD
BEL
Line Proposals
megamos
BUNGARD
BEL

Isolationline Level 1

Printed circuit board production with mechanical through-hole plating



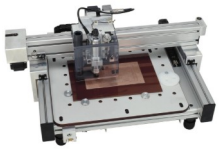
Preparation of the design data
(IsoCam)

↓

Purchase of raw material blanks
Alternatively:
Cut with Bungard CCD
Alternative:
Cutting with plate shears Bungard Ne-Cut

↓

CNC drilling and milling
(BUNGARD CCD/2)

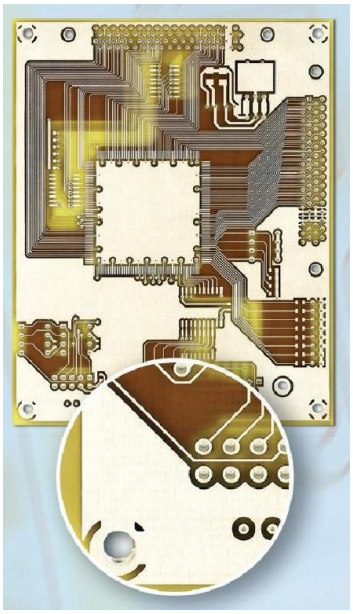


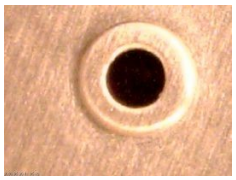
↓

mechanical through-hole plating
(FAVORIT)

↓

chemical tinning
(EG 01)



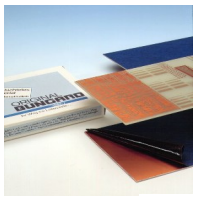


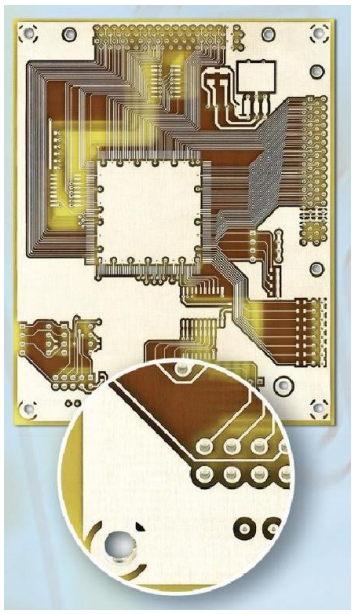
System properties:

- Fine-line technology without solder resist mask
- Resolution better 150 µm
- Film production with laser printer / inkjet printer or externally
- Modularly upgradeable at any time to base line level 1, 2 + 3, multilayer, film production, wastewater or surface package
- Total process time: 60 to 120 min on average (depending on the number of vias, trace length, and channel widths).
- Maximum capacity: 1 m² / 8 h
- Maximum plate format: 270 x 325 mm (CCD/2) or 325 x 495 (CCD/MTC)
- **ISOLATIONLINE includes: 2 machine**

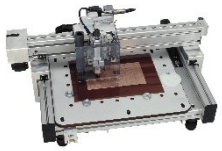
Basisline Level 1

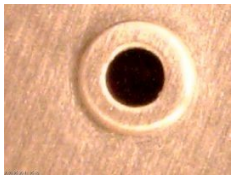
PCB production with mechanical through hole





Original Bungard
positiv presensitized boards
⬇
CNC-drilling and contour routing
(BUNGARD CCD/2)
⬇
vacuum exposure
(HELLAS LED)
⬇
dip developing +
rinsing +
sprayetching +
chemical tinning +
drying
(all in Splash CENTER)
⬇
mechanical PTH
(FAVORIT)



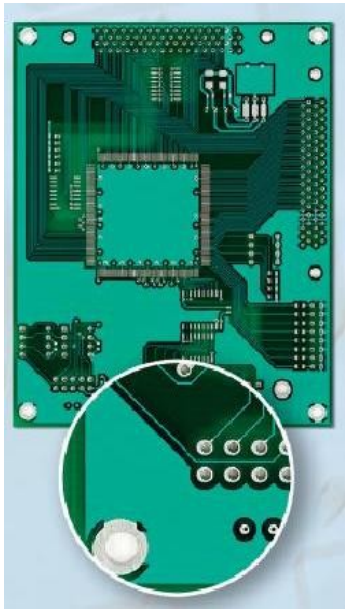


<u>System features:</u>

- Fine-line technology PCBs without soldermask
- Modular upgradeable to all Basic Line steps including multilayer, waste water treatment, artwork production or surface finishing set at any time!
- Track resolution: better 100 µm!
- Film production with laser printer or bubble jet or local film supplier
- over all process time: 10 to 60 min depending on number of holes
- maximum throughput: 10m² / 8h
- maximum usable size: 210 x 300 mm
- **Basic package: 4 machines**

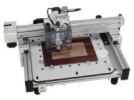
Basisline Level 2

PCBs like in Level 1
plus green solder mask and blue components printing



Original Bungard
positiv presensitized boards

↓
CNC-drilling and contour routing
(BUNGARD CCD/2)
↓
vacuum exposure
(HELLAS LED)



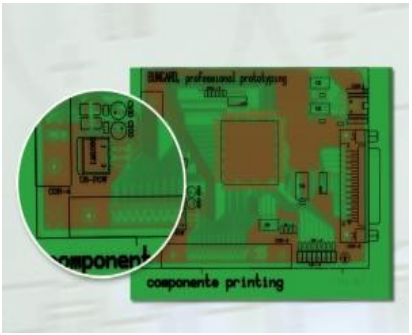
↓
dip developing +
rinsing +
sprayetching +
chemical tinning +
drying
(all in SPLASH CENTER)

↓
mechanical PTH
(FAVORIT)

↓
lamination of solder mask
(RLM 419p)

↓
vacuum exposure of solder mask
(HELLAS LED)
↓
spraydeveloping of solder mask
(SPLASH D)

↓
curing of solder mask
(HELLAS LED oder Heißluftofen)

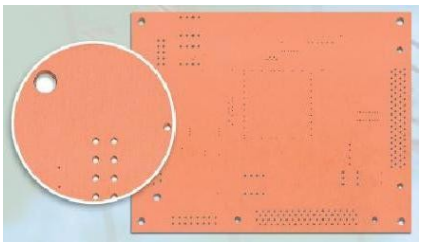


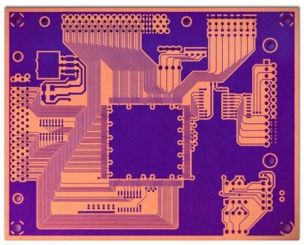
<u>System features:</u>

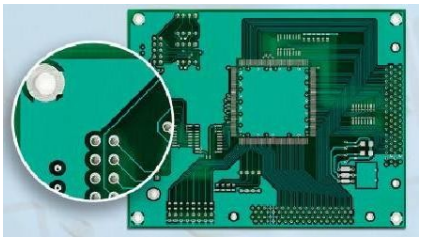
- Like in Level 1, but in addition:
- Laminator for laminating solder mask and SPLASH D for developing (2 additional machines)
- Components printing: repeat Laminating, exposure and developing with blue tenting resist.
- over all process time: 50 to 120 min depending on number of holes
- maximum throughput: 6 m² / 8 h!

Basisline Level 3

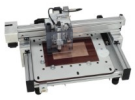
PCBs like in Level 2
jedoch im Negativverfahren mit galvanischer Durchkontaktierung







raw material cut to size (Ne-Cut)



↓

CNC-drilling and contour routing
(BUNGARD CCD/2)

↓

brushcleaning (RBM 300)

↓

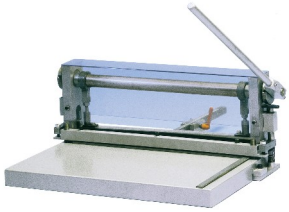
galvanic plating through hole (COMPACTA 30)

↓

brushcleaning
(RBM 300)

↓

lamination of tenting resist
(RLM 419p)



↓

vacuum exposure
(HELLAS LED)

↓

spray developing
(SPLASH D)

↓

spray etching
stripping of tenting resist
(SPLASH CENTER)

↓

brushcleaning
(RBM 300)

↓

chemical tinning
(SPLASH CENTER)

↓

laminating of solder mask
(RLM 419p)

↓

exposure of solder mask
(HELLAS LED)

↓

spray developing
(SPLASH D)

↓

curing of solder mask
(HELLAS LED or hot air oven)

↓

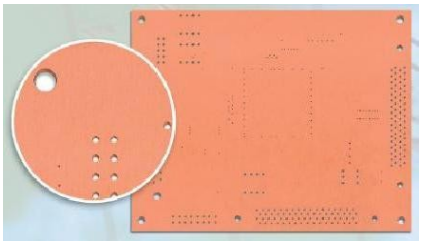
CNC-V-Cut or contour routing
(Bungard CCD/2)

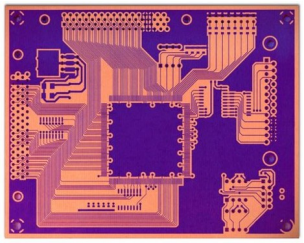
<u>System features</u>:

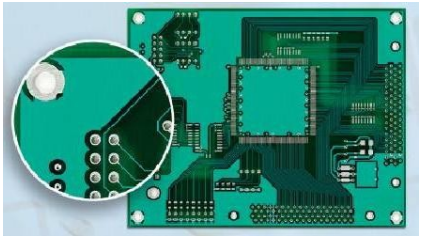
- Fine-line technology in <u>industrial quality</u> with green solder mask and blue components printing!
- (To make components printing repeat the steps laminating, exposure and developing with blue tenting resist!)
- Modular upgradeable to multilayer, artwork production, waste water treatment or surface finishing set at any time!
- Track resolution: better 150 µm!
- Film production with laser printer or bubble jet or local film supplier.
- maximum throughput: 0,8 m² / 8h
- maximum usable size: 210 x 300 mm
- Processing time: approx. 4 hours
- 3 more machines than Level 2: Ne-Cut for board cutting, RBM 300 for cleaning and roughening and COMPACTA 30 for galvanic through hole plating (PTH)

Comfortline Level 3

PCB production with negative resist, galvanic through hole plating (PTH), green solder mask and blue components printing
like Basisline Level 3, but optimized on through put!







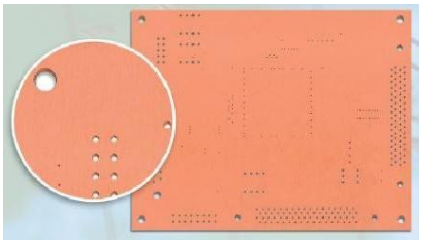
raw material cut to size
(Ne-Cut)
↓
CNC-drilling and contour routing
(BUNGARD CCD/ATC)
↓
brushcleaning
(RBM 300)
↓
lamination of tenting resist
(COMPACTA 30 2CU)
↓
brushcleaning
(RBM 300)
↓
spray developing
(RLM 419p #1)
↓
vacuum exposure
(HELLAS LED)
↓
spray developing
(SPLASH D)
↓
spray etching
stripping of tenting resist
(both SPLASH CENTER)
↓
brushcleaning
(RBM 300)
↓
chemical tinning
(SPLASH CENTER)
↓
laminating of solder mask
(RLM 419p #2)
↓
exposure of solder mask
(HELLAS LED)
↓
spray developing
(SPLASH D)
↓
curing of solder mask
(HELLAS LED or hot air oven)
↓
CNC-V-cut or contour routing
(Bungard CCD/ATC)

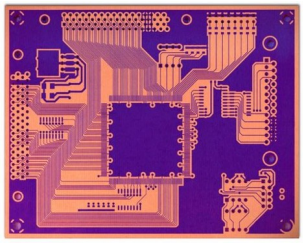
<u>System features</u>:

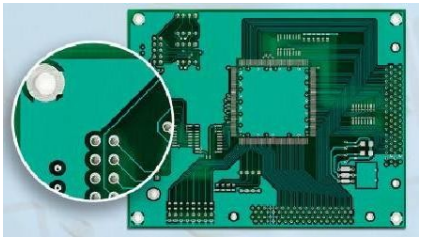
- CCD/ATC for enhanced drilling, COMPACTA 30 2 CU doubles galvanic throughput, a second laminator RLM 419p avoids changing rolls between the steps!
- Fine-line technology in industrial quality with green solder mask and blue components printing!
- (To make components printing repeat again from laminating but with RLM 419p #1 and blue tenting resist)
- Modular upgradeable to multilayer, artwork production, waste water treatment or surface finishing set at any time!
- Track resolution: better 150 µm!
- Film production with laser printer or bubble jet or local film supplier
- maximum throughput: 2,0 m² / 8 h – more than twice the volume of Basisline 3!
- maximum usable size: 210 x 300 mm
- Processing time: approx. 2 hours

Comfortline XL Level 3

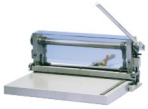
PCB production with negative resist, galvanic through hole plating (PTH), green solder mask and blue components printing
like Basisline Level 3, but optimized on through put for board size 300 x 400mm







raw material cut to size
(Ne-Cut)
↓
CNC-drilling and contour routing
(BUNGARD CCD/ATC)
↓
brushcleaning
(RBM 300)
↓
galvanic plating through hole
(COMPACTA 40 2CU)
↓
brushcleaning
(RBM 300)
↓
lamination of tenting resist
(RLM 419p #1)
↓
vacuum exposure
(HELLAS LED)
↓
spray developing
(SPLASH XL)
↓
spray etching
stripping of tenting resist
(both SPLASH CENTER XL)
↓
brushcleaning
(RBM 300)
↓
chemical tinning
(SPLASH CENTER XL)
↓
laminating of solder mask
(RLM 419p #2)
↓
exposure of solder mask
(HELLAS LED)
↓
spray developing
(SPLASH XL)
↓
curing of solder mask
(HELLAS LED or hot air oven)
↓
CNC-V-cut or contour routing
(Bungard CCD/ATC)

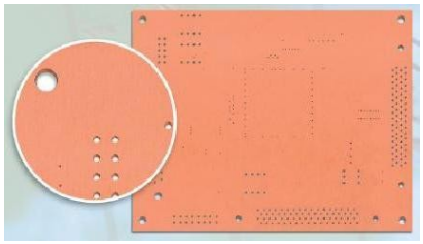


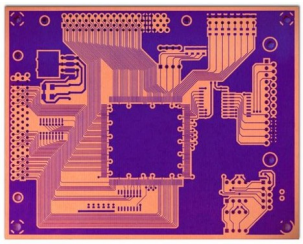
System features:

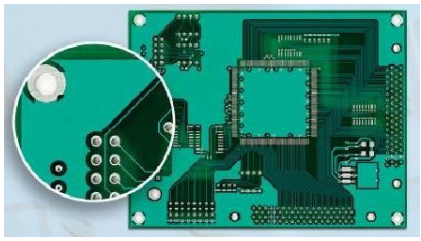
- CCD/ATC for enhanced drilling, COMPACTA 40 2 CU doubles galvanic throughput, a second laminator RLM 419p avoids changing rolls between the steps!
- maximum usable size: 300 x 400 mm because of COMPACTA 40 2CU, SPLASH XL and SPLASH CENTER XL!
- Fine-line technology in industrial quality with green solder mask and blue components printing!
- (To make components printing repeat again from laminating but with RLM 419p #1 and blue tenting resist)
- Modular upgradeable to multilayer, artwork production, waste water treatment or surface finishing set at any time!
- Track resolution: better 150 µm!
- Film production with laser printer or bubble jet or local film supplier.
- maximum throughput: 3,0 m² / 8h – approx. three times the volume of Basisline 3!
- Processing time: approx. 2 hours

Bungard Profiline Level 3

**PCB production with negative resist,
galvanic through hole plating (PTH),
green solder mask and blue components printing**







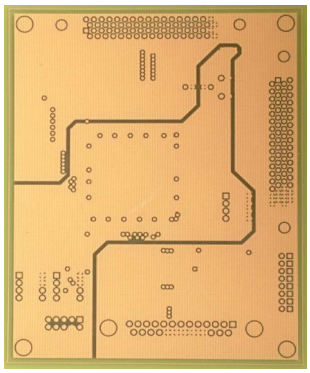
raw material cut to size
(Ne-Cut #1)
↓
CNC-drilling and contour routing
(BUNGARD CCD/ATC #2)
↓
brushcleaning
(RBM402KF #3)
↓
galvanic plating through hole
(COMPACTA 40 2CU #4)
↓
brushcleaning
(RBM 402KF #3)
↓
lamination of tenting resist
(RLM 419p #5)
↓
vacuum exposure
(EXP 3040 LED #6)
↓
spray developing
(DL 500 D #7)
↓
spray etching
(DL 500 #8)
↓
stripping of tenting resist
(DL 500S #9)
↓
brushcleaning
(RBM 402KF #3)
↓
laminating of solder mask
(RLM 419p #10)
↓
spray developing
(EXP 3040 LED #6)
↓
Sprühentwickeln
(DL 500 D #7)
↓
curing of solder mask
(EXP 3040 LED #6)
↓
CNC-V-cut or contour routing
(BUNGARD CCD/ATC #2)

System features:

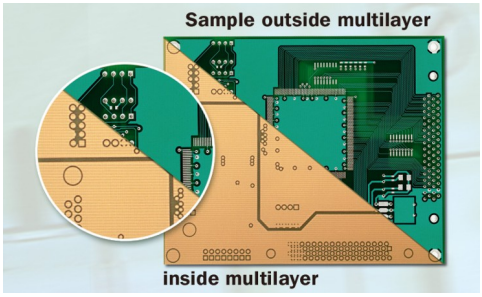
- Fine-line technology in industrial quality with green solder mask and blue components printing!
- (To make components printing repeat again from laminating but with RLM 419p #1 and blue tenting resist)
- Modular upgradeable to multilayer set, artwork production, waste water treatment or surface finishing at any time!
- Track resolution: better 150 µm!
- Film production with laser printer or bubble jet or local film supplier.
- Processing time: approx. 1,5 hours!
- maximum throughput: 4,5 m² / 8 h!
- Full scope: 10 machines
  Expandable at any time for own film production, multilayer, waste water treatment or surface package!

Upgrade Multilayer

Production of inner layer and multilayer press lamination



raw material cut t to size
(Ne-Cut)
↓
CNC-drilling of reference holes of
inner layers + prepregs + top/bottom layers
(BUNGARD CCD)
↓
brushcleaning of inner layers
(RBM 402KF/RBM300)
↓
laminating of etch resist
(RLM 419p)
↓
vacuumexposure
(EXP 3040 LED /HELLAS LED)
↓
spraydeveloping
(DL 500 D/SPLASH D)
↓
stripping of etchresist
(DL 500/SPLASH CENTER)
↓
Strippen des Ätzresist
(DL 500S/SPLASH CENTER)
↓
brushcleaning
(RBM 402KF/RBM 300)
↓
insert reference pins
(FAVORIT)
↓
mulitlayer press lamination
(RMP 210)









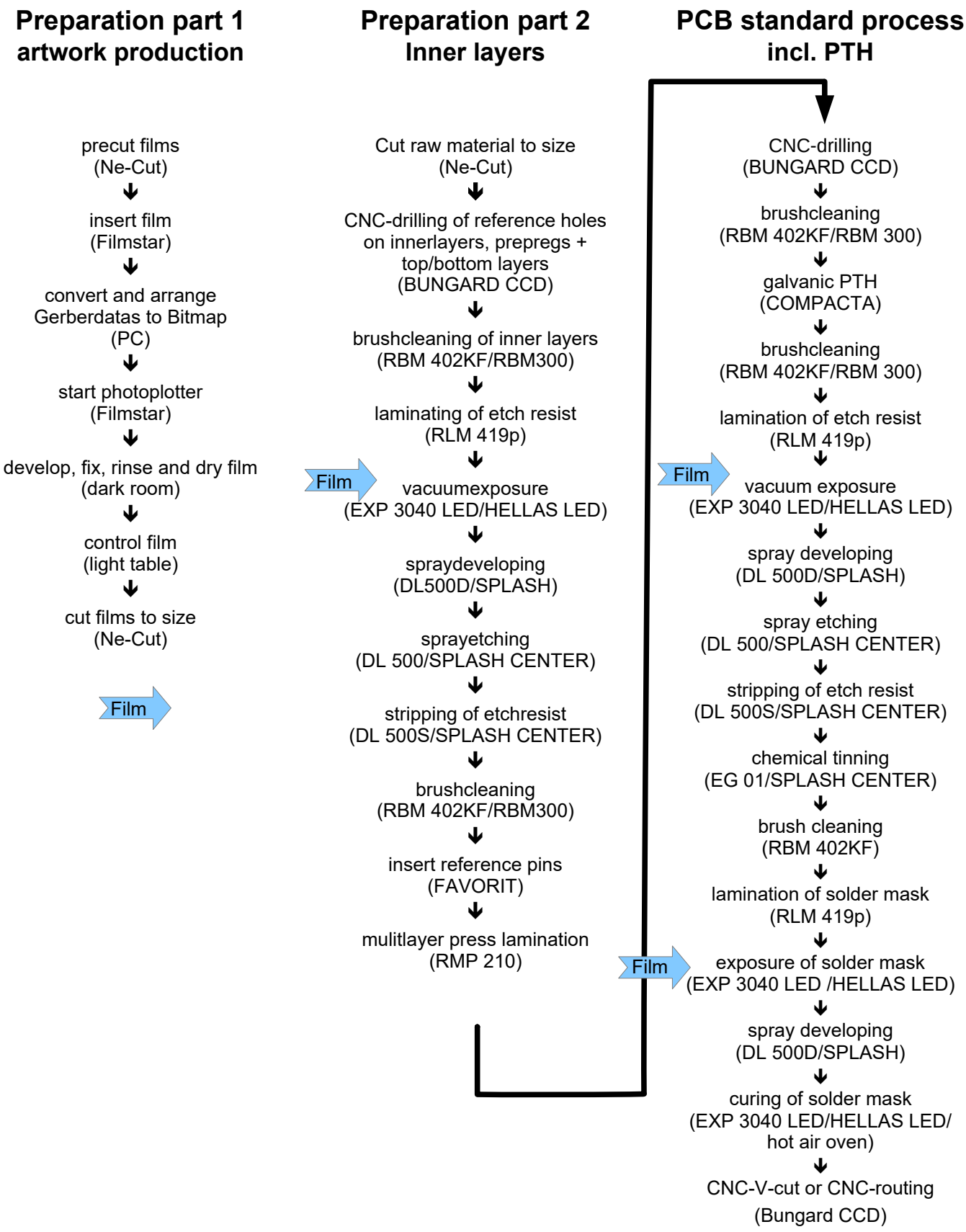




System features:

- Like Level 3, but in addition: Production of inner layers and multilayer press lamination!
- track resolution: better than 150 µm!
- Processing time: depending on type of prepreg and type of line – approx. 4,5 h
- maximum throughput: depending on type of prepreg and type of line – max. 0,8m² / 8 h
- maximum board size: 210 x 300 mm
- Only two more machines!!
- Modular upgradable to artwork production, surface finishing or waste water treatment package at any time!

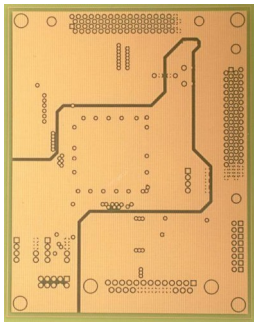
Flow chart Multilayer complete

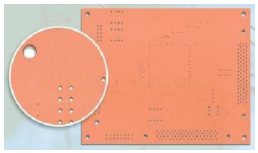


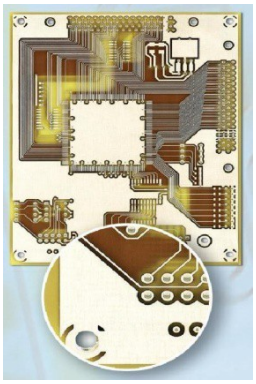
Bungard Elektronik GmbH & Co. KG, Rilkestrase 1, 51570 Windeck – Germany
Tel.: +49 (0) 2292/9 28 28 - 0, Fax: +49 (0) 2292/9 28 28 - 29, E-mail: support@bungard.de

Multilayer production in combination of insulation milling and laser direct exposure (LDI) of the inner layers

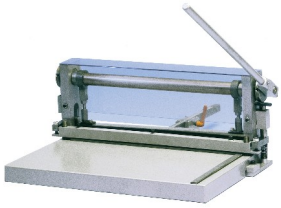
Production of inner layers in etching technology, combined with UV laser direct exposure Multilayer pressing with commercially available prepregs (without air inclusions) Cover layers in CNC insulation milling technology







Original Bungard
positive photo coated base material
↓
CNC drilling of the reference holes
of the inner layers and the top layers
(BUNGARD CCD)
↓
Laser Direct Exposure
of the inner layers with UV laser attachment
(BUNGARD CCD/LDI)
↓
Developing and spray etching
(SPLASH CENTER)
↓
Removing the etching resist
(SPLASH CENTER)
↓
Pinning the multilayer
(FAVORIT)
↓
Grouting of the Mulitlayer
(RMP 210)
↓
CNC drilling of multilayer printed circuit board
(BUNGARD CCD)
↓
Through-hole plating
(COMPACTA 30)
↓
CNC isolation milling of the top and bottom sides
(BUNGARD CCD)
↓
Chemical Tinning
(SPLASH CENTER)
↓
MULTILAYER

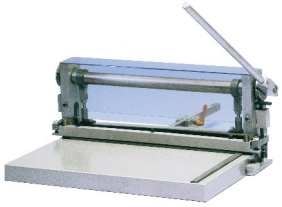


System Features:

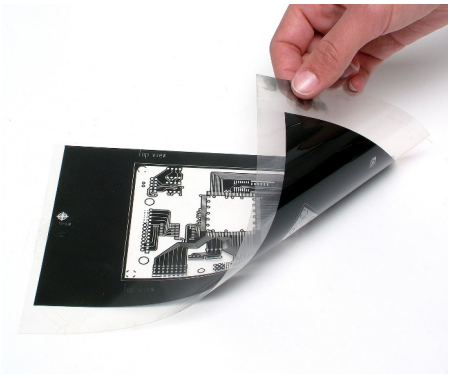
- Production of multilayer printed circuit boards (multilayers) with commercially available prepregs, WITHOUT air inclusions, as is usual in pure insulation milling due to the system
- Conductor paths below 150 µm possible
- Production purely in-house possible, without necessary film production
- Throughput time approx. 2 - 4 hours depending on structures and depending on the pressing parameters of the multilayer materials.
- Net useful size: 210 x 300 mm
- System can be retrofitted modularly at any time (to Bungard Profiline/Basisline) and thus up to 4 m² / 8 h

Bungard Artwork Production

precut films
(Ne-Cut)
⬇
insert film
(Filmstar)

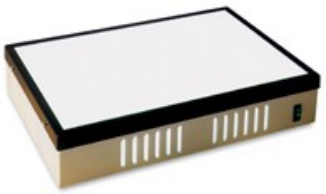


⬇
convert and arrange Gerberdatas to Bitmap
(PC)
⬇



start photoplotter
(Filmstar)
⬇
develop, fix,
rinse and dry film
(dark room)
⬇

control film
(light table)
⬇
cut films to size
(Ne-Cut)



System features:

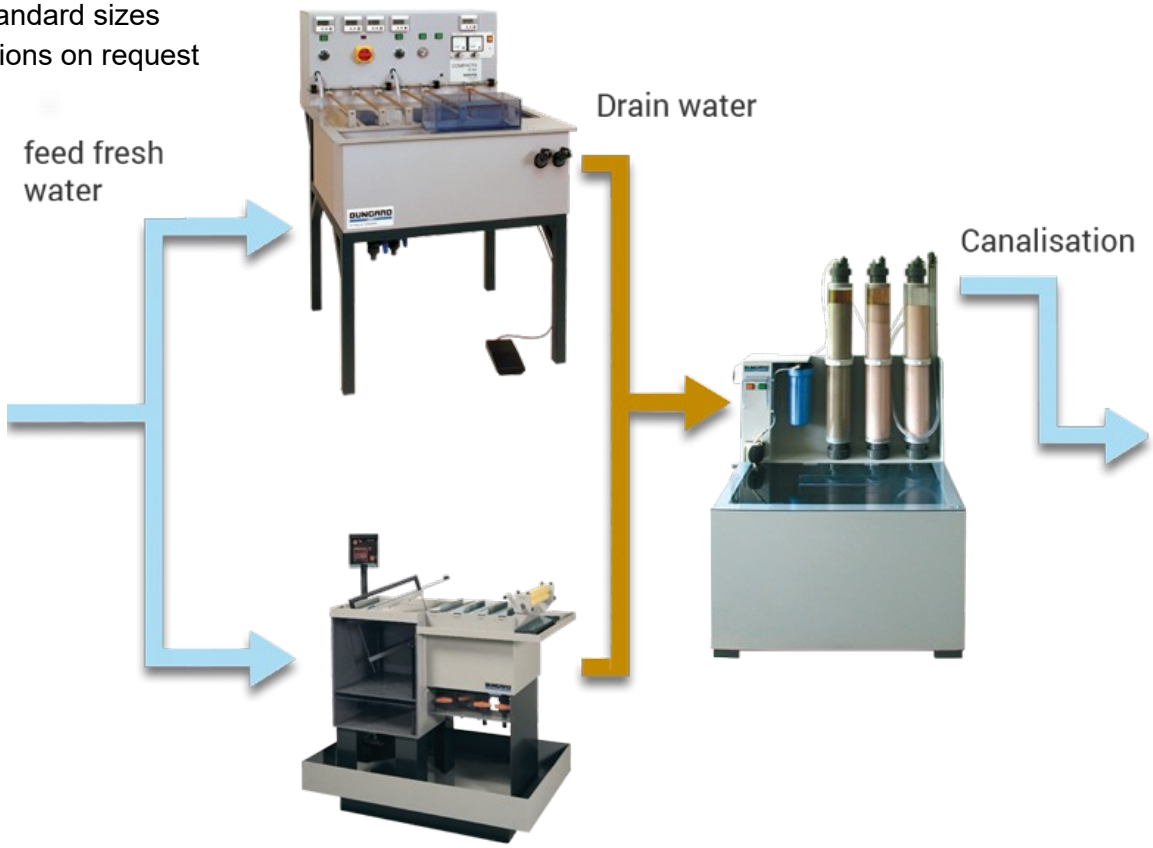
- Like in level 3, but in addition: produce your own artwork with only one more machine!!
- Modular upgradable to surface finishing or waste water treatment package at any time!
- Perfect opacity because of photo processing technique!
- Resolution better than 20 µm!
- Maximum film size 320 x 400 mm
- Light table and film punch as option.
- Darkroom facility required.
- Required software is included!

Upgrade Waste Water Treatment

Solution 1: IONEX A or B

Flow-through version with discharge into canalisation

- Removal of solids and all heavy metals → waste water regulations can be met!
- Decrease of chemical oxygen demand
- PH neutralization by minerals
- For post treatment of etch and galvanic rinse water
- Lower and upper sump level control switch
- 2 different standard sizes
- Special solutions on request

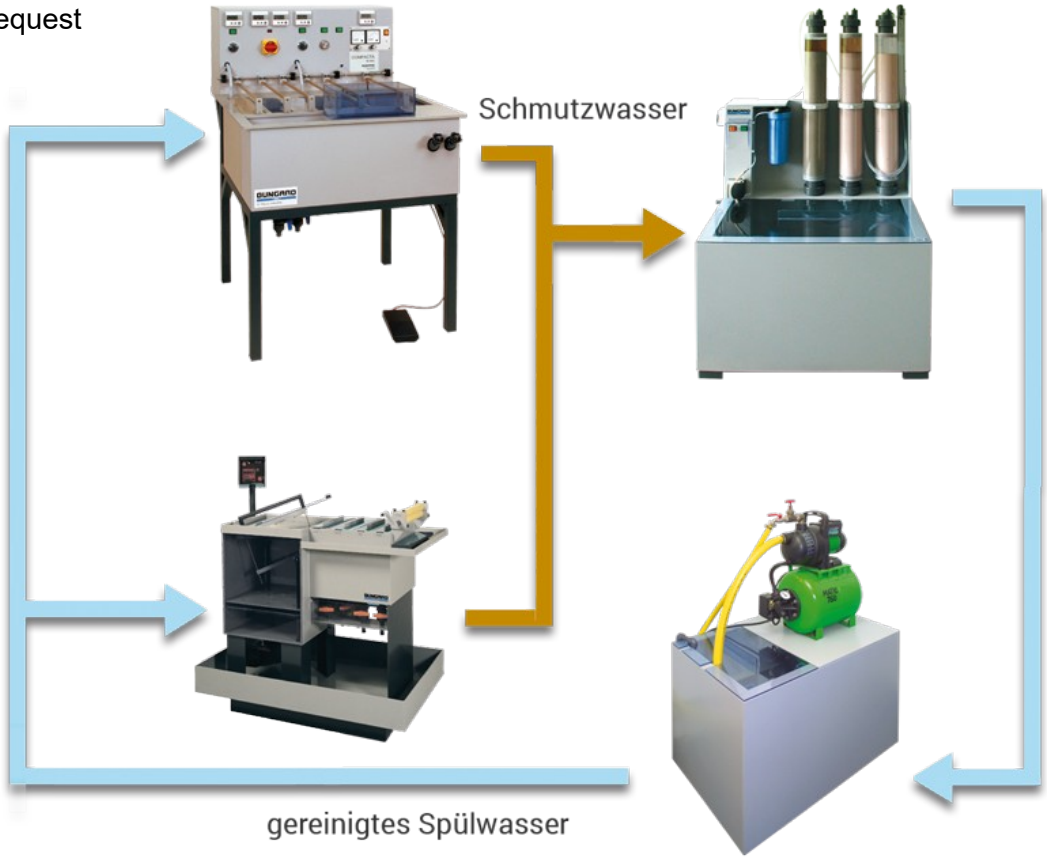


- Machine is connected to etch-, developer- or PTH-machine
- Waste water from these plants is collected in the IONEX
- Tank capacity: max. 110 l (max. 220 l IONEX B)
- Cleaning capacity: approx. 100 (200 IONEX B) Eurocards or 1000 (2000 IONEX B) prerinsed Eurocards
- Water throughput: 10 l/h (15 l/h IONEX B)
- Consumption of neutralizing agent: approx. 100ml on 100l waste water
- 4 cleaning steps
  - coarse filter
  - cotton micro filter
  - 2 cation exchanger columns to remove heavy metal ions
  - neutralisation column to adjust ph-value
- Cleaned rinsing water is discharged into the canalisation

Solution 2: IONEX KA or KB

Self regenerating circuit version

- closed loop water circuit → no need for fresh water or connection to canalisation!
- Removal of solids and all heavy metals → waste water regulations can be met!
- Decrease of chemical oxygen demand
- For post treatment of etch and galvanic rinse water
- Lower and upper sump level control switch
- 2 different standard sizes
- Special solutions on request



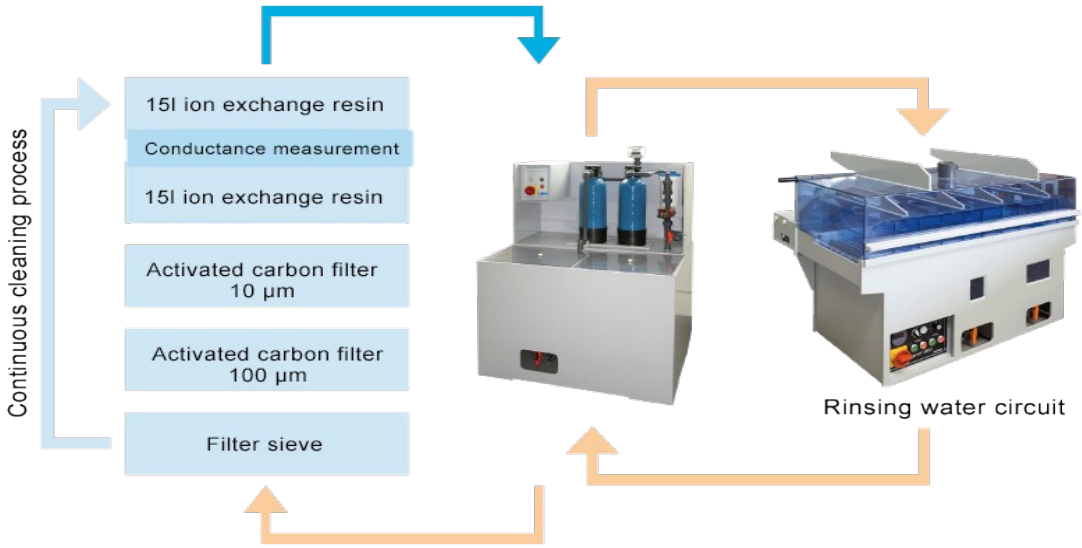
- Machine is connected to etch-, developer- or PTH-machine
- Waste water from these plants is collected in the IONEX
- Tank capacity: max. 110 l (max. 220 l IONEX B)
- Cleaning capacity: approx. 100 (200 IONEX B) Eurocards or 1000 (2000 IONEX B) prerinsed Eurocards
- Water throughput: 10 l/h (15 l/h IONEX B)
- Consumption of neutralizing agent: approx. 100 ml on 100 l waste water
- 4 cleaning steps:
  - coarse filter
  - active coal micro filter
  - 1 cation exchanger columns to remove heavy metal ions
  - 2 anion exchanger columns for neutralisation

Regenerated rinsing water flows into the tank of the pressure unit and is pumped back to the rinsing zones of the tank.

Upgrade wastewater treatment 3 AquaPur 1000

Recirculating version without fresh water requirement and without sewer connection

- Closed water circuit → no fresh water consumption
- Removes heavy metals and solids
- Reduces the chemical oxygen demand
- For the post-treatment of etching and electroplating rinse waters
- Special models on request



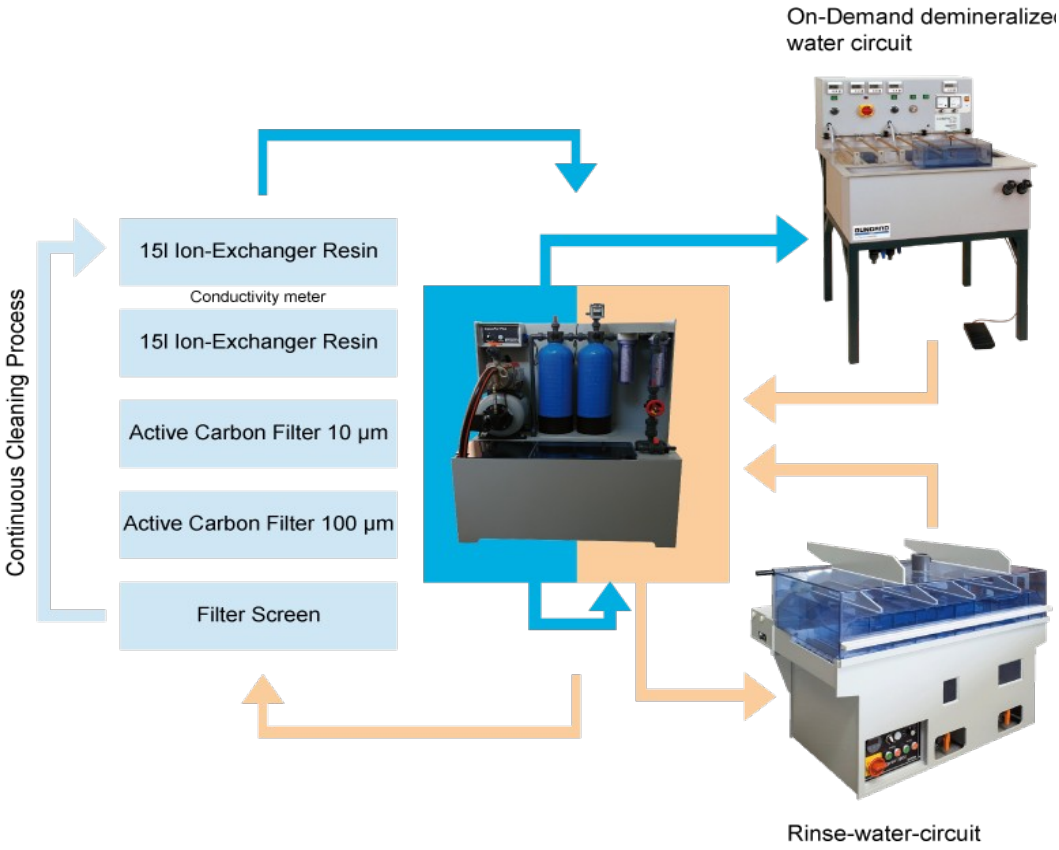
- Machine is connected to etching, developing or through-hole plating unit
- Rinsing water from the plants is collected in AquaPur
- Filling capacity: max. 250 l
- Capacity: approx. 400 Eurocards or 4000 pre-dipped Eurocards
- Delivery rate ion exchanger 250 l / h
- Delivery rate flushing pump approx. 3000 l / h
- 5 cleaning stages:
  - Filter sieve
  - Activated carbon filter 100 µm
  - Activated carbon filter 10 µm
  - First ion exchange column with mixed bed resin for cat and anions
  - Conductance meter
- Second ion exchange column with mixed bed resin for cat and anions
- Continuous cleaning process inby-pass-loop of the main pump. Main quantity is pumped back to the rinse zone of the etching or plating through-hole-machine

In planning - available soon:

Upgrade Wastewater Treatment 4 AquaPur 1000 Plus

Advantages of the Bungard AquaPur 1000 and Advantages of the Ionex KB plus

- **Pressurized water tank united in one machine**
- **Circuit version without fresh water requirement and without sewer connection**
- **Rinsing water circuit for continuous etching systems**
- **On Demand VE-Water Supply for Galavanic or Vertical Etching Systems**



Properties as before Additionally:

- Pressurized water supply for demineralized water for Through-hole or vertical etching systems
- 17 l pressure vessel, max. 3000 l / flow rate theoretically possible (limited by ion damper)
- Continuous cleaning in the bypass. The main volume is pumped back to the rinsing zone of the etching or through-hole plating machine.
- VE-water tank for galva- nic plants overflows to the mixed water tank for continuous etching plants
- Capacity and cleaning stages as before.

Upgrade Bungard Pick&Place SMT 3000 Line 1 Prototypes

Step 1 **Dispensing of adhesives and solder paste with Bungard SMT 3000 BASIC or SMT 3000 PLUS (integrated dispensing function)**

Step 2 **Placement of components with Bungard SMT 3000 BASIC or SMT 3000 PLUS**

Step 3 **Reflow soldering with Bungard Reflow Oven HotAir06**

Max. substrate size:	300 mm x 370 mm
Max. placement area:	245 mm x 350 mm
Max. thickness of pcb:	0,5 mm bis ~ 4 mm
Height below pcb::	min. 39 mm, max. 50 mm
Components:	Chip 0201 bis QFP 0,65 mm Pitch
Max. Component height:	ca. 16 mm
Preheating temperature:	60-260°C
Reflow timet:	0-999 Sekunden
Reflow temperature:	90-300°C

Upgrade Bungard Pick&Place SMT 3000 Linie 2

Step 1 **Dispensing adhesives and solder paste with StenPrint 3000 and Bungard SMD stencil sheets**

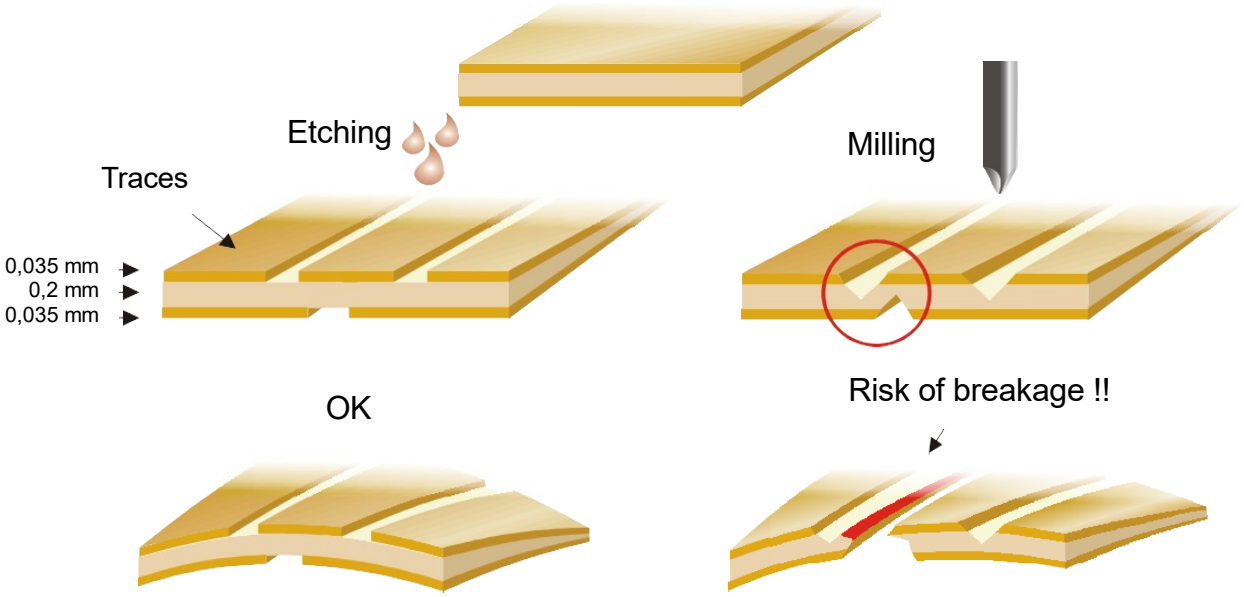
Step 2 **Placement of components with Bungard SMT 3000 BASIC Light or SMT 3000 PLUS Light (without dosing function)**

Step 3 **Reflow soldering with Bungard Reflow Oven HotAir06**

Max. substrate size:	300 mm x 370 mm
Max. placement area:	245 mm x 350 mm
Max. thickness of pcb:	0,5 mm bis ~ 4 mm
Height below pcb::	min. 39 mm, max. 50 mm
Components:	Chip 0201 bis QFP 0,65 mm Pitch
Max. Component height:	ca. 16 mm
Preheating temperature:	60-260°C
Reflow timet:	0-999 Sekunden
Reflow temperature:	90-300°C

Etching or milling (1): Application: Thin FR4 PCBs

Construction : 0 .035 mm copper, double-sided, with 0.1 mm or 0.2 mm FR4 carrier

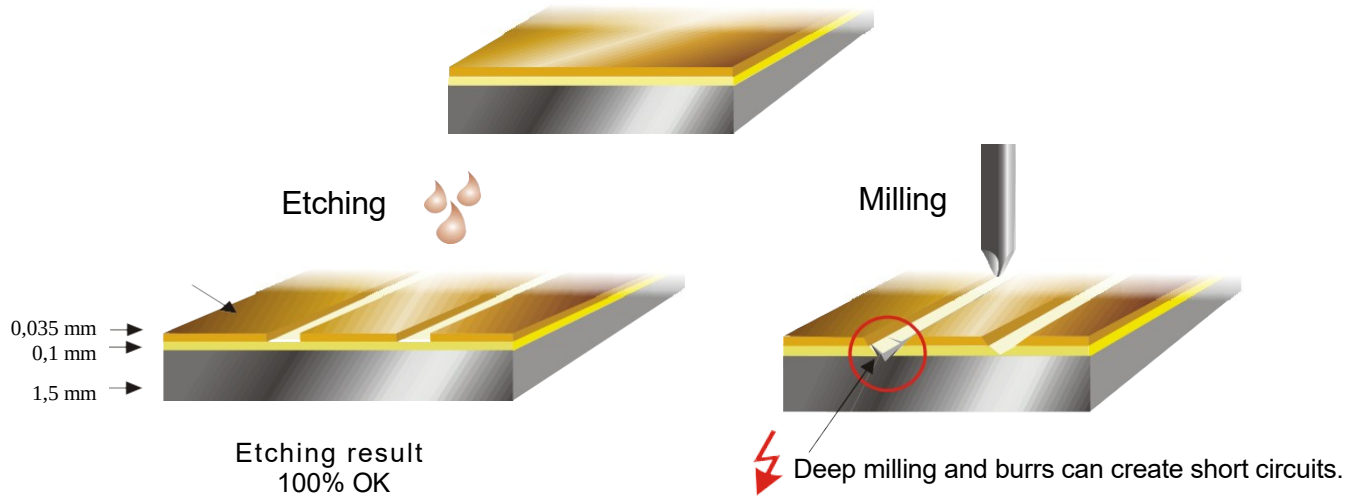


Problem: when milling, insulation channels must not lie on top of each other. Otherwise there is an extreme risk of breakage (V-scoring).
Etching always ends automatically at the FR4 carrier - as in large-scale production - and is therefore much less critical.

Etching or milling (2):
Application: Cotherm(TM) printed circuit boards for LED applications

Copper coated aluminum carrier plates with thin insulation layer of FR4, used especially in LED applications where high heat is to be dissipated.

Typical construction : 0 .035 mm copper plus 0.1 mm FR4 adhesive foil plus 1.5 mm aluminum carrier.

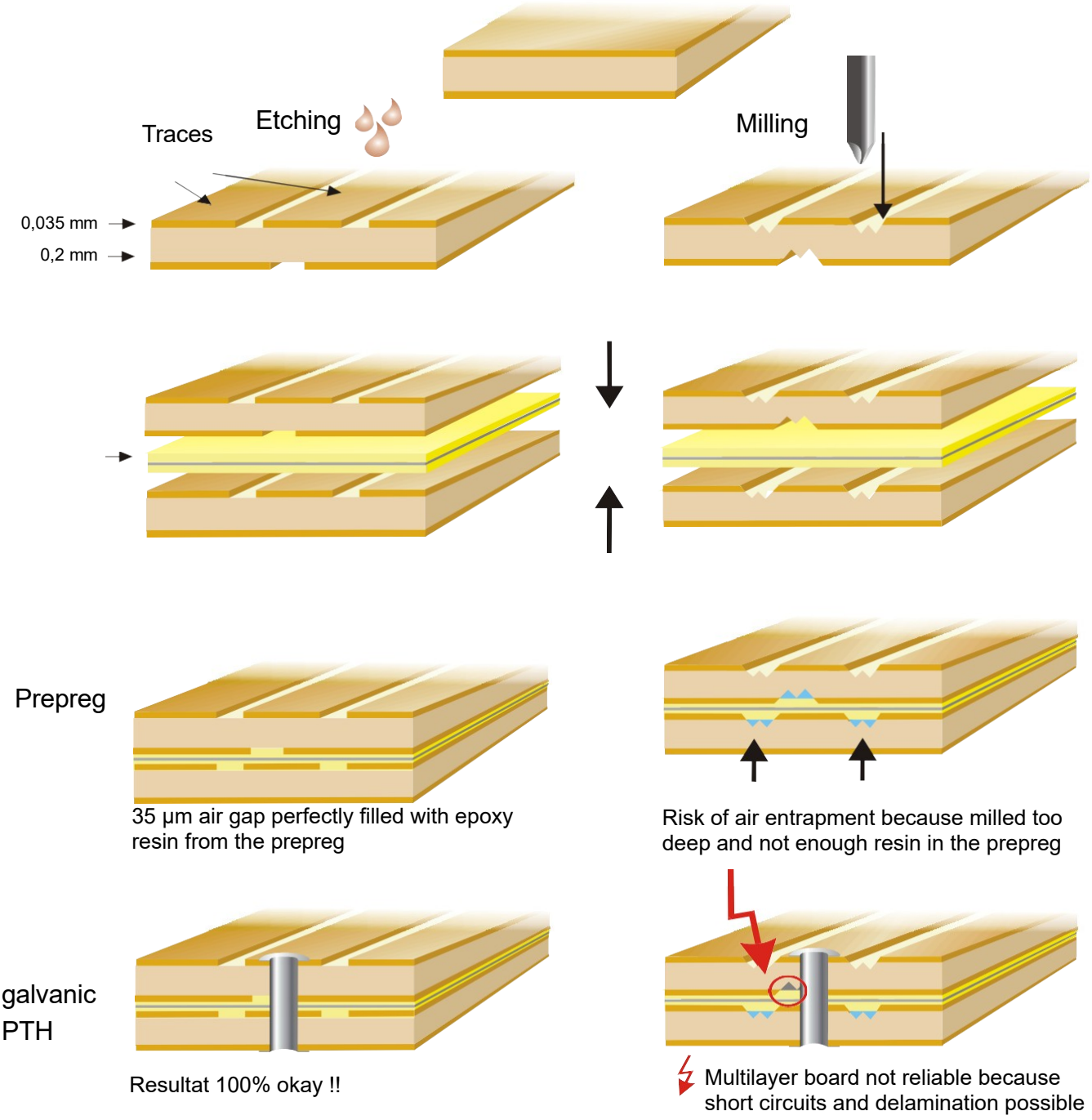


Milling problem: Too deep milling and burr formation during milling can lead to short circuits.
Uncritical for etching. There, only the back and edges must be covered so as not to etch there.

Etching or milling (3):

Application: Multilayer boards with standard prepreg adhesive films

Construction: 0.035 mm copper 0.2 mm inner layer plus 0.1 mm adhesive foil (prepreg)



The problem with milling is that prepregs are produced worldwide only for normal copper thicknesses. They can therefore fill 35µm copper height well, but not deep insulation channels under certain circumstances. There is a considerable manufacturing risk here, because cavities can be enclosed that lead to short circuits when drilled through. If air pockets remain, there is a risk of delamination, for example during reflow soldering, due to the air bubbles expanding under heat.
Etching should remain the method of choice here! You can use a professional alternative here with a laser imagesetter, which combines the advantages of both techniques.