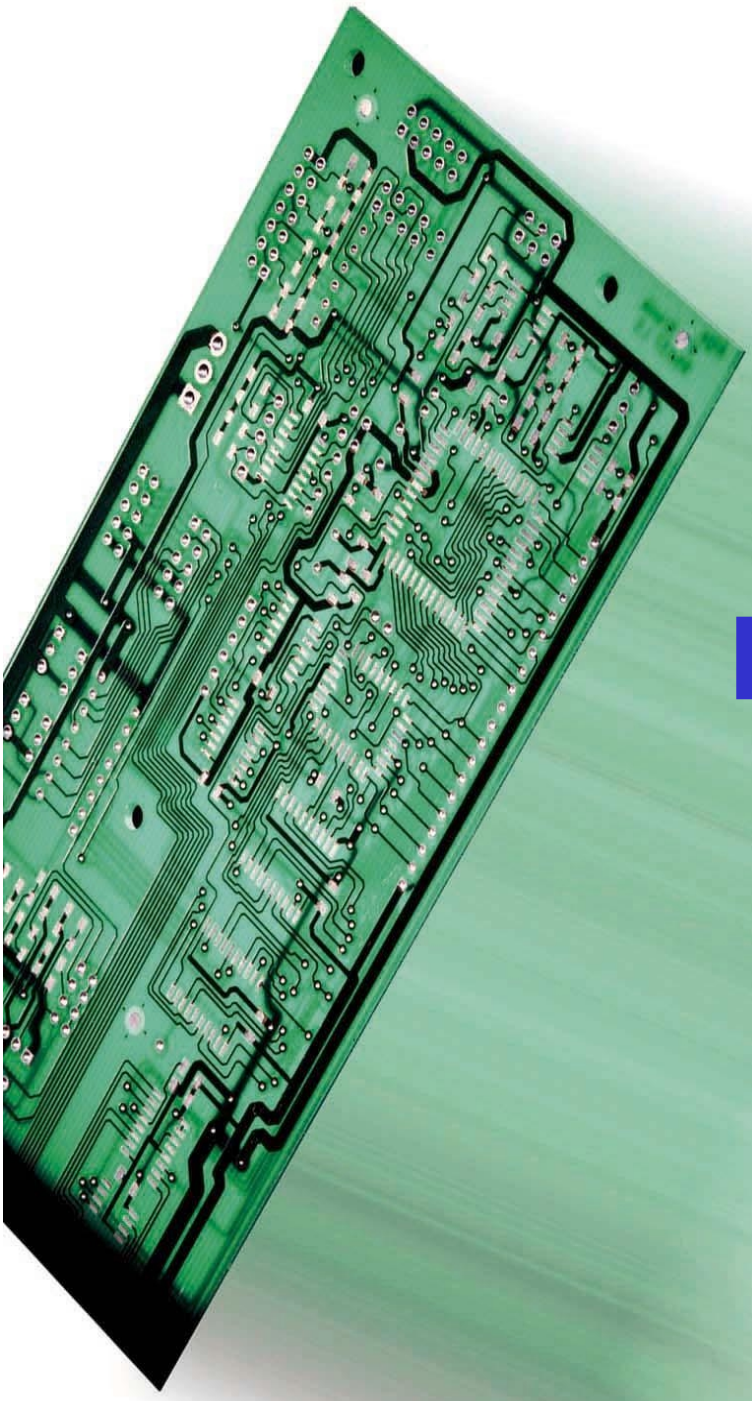
ORMECON™ CSN

Immersion Tin Process with Organic Metal



PROCESS GUIDE

Ormecon Chemie GmbH
Ferdinand-Harten-Str. 7,
D-22949 Ammersbek
Germany
Phone: +49 - (0) 40 - 60 41 06 - 0
Fax: +49 - (0) 40 - 60 41 06 - 51
e-mail: mailbox@ormecon.de
Internet: www.ormecon.de

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Process Description

ORMECON™ CSN is an immersion tin process for copper surfaces.

ORMECON™ CSN meets all requirements of a modern and environmentally friendly PCB surface finish:

- absolutely planar surface for SMD technology
- long storage time of bare boards
- easy to run and to monitor
- Energy and cost reduction compared to HASL
- Environmentally friendly
- suitable for vertical and horizontal processing

Compared to usual other immersion tin processes ORMECON™ CSN additionally offers:

- **significant reduction of diffusion**
- **oxidation protection**
- **extremely higher temperature resistance for lead-free finishing**
- **multiple soldering operations possible, also with intermediate storage**
- **pure tin deposit, even with high copper load of the bath**
- **up to 100% longer shelf-life of the tin bath**

ORMECON™ CSN **offers an extraordinary set of properties and increases the process safety and operating window both in manufacturing and assembling of PCBs**

ORMECON™ CSN **for the first time combines environmentally friendly process chemicals with low process costs and a quality equal to Ni/Au surface finishes..**

Important Remark:

ORMECON™ CSN **is exclusively suitable for processing pure copper surfaces. It is necessary to check case by case if also other metal surfaces can be processed. Non-copper surfaces have to be treated with separate process chemicals, because metal ions could cause a contamination that lead to dark or black tin deposits.**

ORMECON™ CSN **is exclusively suitable for FR4, PTFE and PD base materials. CEM-1 material should not be used under any circumstances, because it leads to irreversible contamination of the tin bath and black deposits. A CEM-1 contaminated tin bath needs to be exchanged. The compatibility base materials other than listed here, need to be checked case by case with separate process chemicals.**

Process Description

ORMECON™ CSN consists of three active components:

1. ETCH 7000

An etching solution for copper based on hydrogen peroxide to remove copper oxides. **ORMECON™ CSN** provides the stabilizer **ETCH 7000 S**.

2. ORMECON™ PCB 7000

An aqueous dispersion of the Organic Metal **ORMECON™**. It is applied to the clean copper surface and ensures an ideal pretreatment for the following immersion tin step. The ultra-thin **ORMECON™** layer (only 0.08 µm) catalyzes a highly crystalline tin deposit which results in an extremely lower tin-into-copper diffusion and a significantly improved oxidation resistance. This unique pretreatment is the key to the superior properties of the **ORMECON™ CSN** surface finish.

3. CSN 7001

An immersion tin bath, which selectively covers the copper surface with a 0.8 - 1.0 µm thin and even tin deposit.
It is especially adapted to the use with **ORMECON™ PCB 7000** and its highly crystalline deposit is the guarantee for the extraordinarily high security and long solderability.

An acid cleaner is recommended prior to the **ORMECON™ CSN** process.
Suitable products (**AC 7000** or **ACE 7000**) with technical data sheets and process guides could also be supplied upon request.

We will be pleased to advise on all aspects of application technology.

Process Scheme

PCB with solder mask

Acid Cleaner AC 7000 / ACE 7000

Rinse

optional

Process Step

1 **Etch 7000** 30°C ; 2 min.

2 **Rinse** 1 min

3 **ORMECON™ PCB 7000** 23°C ; 1 min.

4 **Rinse** 30 sec.

5 **CSN 7001** 60 - 65°C ; 9 - 20 min.

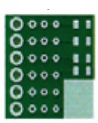
6 **Warm rinse** ***40 - 60°C,*** 1 min.

7 **Rinse** 1 min.

8 **Static rinse** 1 min. **DI water**

9 **Dry**

PCB with solderable surface finish.



Primary Installation
- Vertical Mode -

Prior to Installation

A) Configuration of equipment

PCB 7000 module:

The tank should be equipped with a circulation pump, but with no filter unit. The pump should circulate the entire bath volume at least once an hour. It is necessary to adjust the pump capacity carefully to avoid any turbulence or foam formation, because air (oxygen) sucked into the liquid could affect the bath's stability.

The continuous operation of a circulation pump is important to keep the small particles contained in the bath in a constant state of suspense. This maintains the ideal Organic Metal working concentration at any time because it helps to avoid precipitation and sedimentation.

The PCB 7000 bath should not be filtered at any time, because the bath is not a solution but a dispersion. It contains very small particles of the Organic Metal which would be removed when filtered. The bath would become irreversibly useless and would have to be exchanged.

If the **PCB 7000** module can not be placed in the process sequence as recommended, it is necessary to carefully cover the bath after every use, in order to avoid a contamination with other process chemicals.

Example: If a board is treated with **ETCH 7000** or **CSN 7001** and has to be moved across the PCB 7000 module for rinsing, a dropping of such process chemicals into the PCB 7000 bath should not be allowed. A contamination with these process chemicals or their rinsing water can quickly ruin the entire **PCB 7000** bath volume. So it is highly recommended to either strictly keep the process sequence or to carefully cover the **PCB 7000** bath after every single operation.

CSN 7001 module:

The tin bath needs to be operated at a process temperature of 60 - 65°C. The heater used for this module should not exceed a capacity of 2 W / cm^2. Further more the heater should be made from PTFE or quartz. It should not be made of or expose any metal parts. To avoid local overheating of the **CSN 7001** it is essential to ensure a perfect heat exchange between heater and solution. This can be achieved with a continuous operation of a circulation pump. It is recommended to have the pump outlet very close to the heater so that the solution laps around it all the time.

The pump should circulate the entire bath volume at least 2 - 3 times per hour.

Primary Installation
- Vertical Mode -

Prior to Installation

To maintain the long lifetime of the **CSN 7001** bath it is essential to avoid local overheating. Any immersion tin bath passes through a natural aging process, which is influenced by temperature. On the one hand a high process temperature is necessary to guarantee a perfect deposition reaction, on the other hand this temperature speeds up the aging of the bath, during which decomposition products are formed (for further information see pages 20 - 22). The natural aging process is accelerated by frequent temperature changes (heating / cooling) and local overheating.

It is ideal to keep an immersion tin bath in constant operation, resp. to keep it at process temperature continuously, and to use an optimized equipment. A discontinuously running process requires a careful observation. In this case it is even more important to avoid local overheating. A perfect bath movement not only helps to reduce the risk of local overheating, it also helps gaseous decomposition products to evaporate, so they can not accumulate in the solution and affect the tin deposit.

Like with the **PCB 7000** it is very important that the bath is obviously streaming (streams should be clearly seen on the solution surface) to ensure a perfect circulation of the liquid, but there should be no turbulence or foam formation, because air (oxygen) sucked into the solution would lead to an oxidation of tin salts. These tin oxides (Sn4+) precipitate as white crystals. The formation of a small amount of tin oxides is normal and will be removed by filtration. Any overabundant oxidation should be avoided, because it precipitates active tin from the solution which is intended to be used for the tin deposition. So with strong oxidation processes it is often required to replenish tin to ensure a perfect deposition quality. Such a measure unnecessarily increases process costs and should be avoided.

For the above mentioned reasons a continuous filtration of the **CSN 7001** bath is highly recommended whenever it is heated up to and operated at process temperature (PP 5 - 10 µm). Without filtration tin oxides would accumulate in the solution. They would first make the bath hazy and then affect the quality of the tin deposit.

Besides keeping the circulation pump running continuously, also the filter units need to be checked and exchanged regularly.

Primary Installation
- Vertical Mode -

Prior to Installation

Rinses

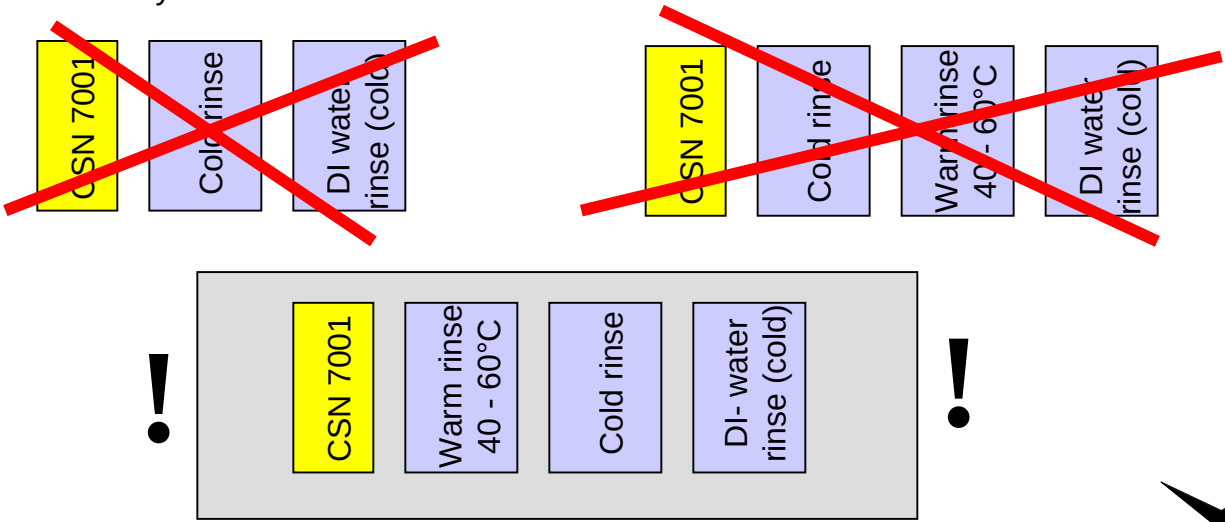
The deposition quality significantly depends on the cleaning (rinsing) quality of the boards between process steps. So the rinsing water has to be kept extremely clean, especially in static rinses. Contamination of rinsing water, e.g. with very high loads of process chemicals, grease or other foreign substances could affect the tin deposit and its solderability. Except for the final rinse all other rinses can be operated with normal city water. Should the city water be loaded with impurities, e.g. a high salt concentration, it is suggested to use DI water for the other rinses as well.

Warm Rinse

It is absolutely essential to have a warm rinse after the **CSN 7001** module. The tin bath contains ingredients which are only soluble in water at higher temperatures (40 - 60°C). It is only possible to perfectly wash off these ingredients with a warm rinse when it is ensuing the tin bath. If a cold rinse is used after **CSN 7001**, these ingredients would precipitate and remain on the board. Once these residues are crystallized they can hardly be removed from the board, not even with a warm rinse. So they should be washed off the board right after the tin treatment when they are still in solution. The residues can affect the quality of the tin deposit and its solderability.

DI water rinse

It is recommended to have a DI water rinse at the end of the process, prior to drying. This guarantees that the board is free from residues caused by salts contained in usual city water. These salts could leave remains on the board that affect not only the visual appearance but also the processability of the board.



Primary Installation
- Vertical Mode -
Prior to Installation

B) Cleaning of the line / equipment

Prior to the installation of **ORMECON™ CSN** it is necessary to properly clean the process equipment, especially when it has been used for other purposes before. All the equipment has to be free from foreign (process) chemistry and its residues. Encrustations have to be removed from tanks, frames and other equipment parts.

A special attention has to be turned to the **PCB 7000** tank, because this process chemistry is very susceptible to chemicals, especially alkaline media.

If an alkaline cleaner has been used for cleaning the tanks there has to be an additional acid rinsing prior to filling the process chemistry in. Also all equipment parts that are in contact with the process chemicals require a final acid cleaning.

The filter unit for the **CSN 7001** bath has to be cleaned properly as well. All residues have to be removed and the filter has to be rinsed with acid DI water prior to its first operation. New filters have to be used (PP 5 - 10 µm).

A proper acid cleaning also applies for every circulation pump.

Primary Installation
- Vertical Mode -

The Installation

For logistic and cleanness reasons it is recommended to keep the following sequence when loading the tanks:

1. CSN 7001
2. ETCH 7000
3. PCB 7000
4. Rinses

1. CSN 7001

The immersion tin tank should be filled first, because the process bath needs to be heated up to a process temperature of 60°C. This requires some time during which the other tanks can be loaded. This procedure also avoids the contamination of other process chemicals.

CSN 7001 is a ready-to-use solution that just has to be poured or pumped from the delivery containers into the tank of the line.

The products tends to foam, so the tank should be loaded carefully to avoid extensive foam formation (e.g. keep the pump (tube) outlet below the liquid surface in the tank all the time). **Attention:** No metal parts should be used.

Temperatures below 10 °C during transport or storage could lead to a precipitation of tin crystals in the delivery containers. This does not affect the quality of the product, but requires a warming up of the entire container to redissolve the crystals prior to taking out the liquid. Do not take out any **CSN 7001** liquid from a container that contains such white crystals, because the removed solution does not contain the specified tin concentration. The solution only meets the specifications again, when all crystals are redissolved. So check **CSN 7001** for white crystals before pouring / pumping it out.

After successfully loading the **CSN 7001** tank, start the circulation pump and filtration. In case the bath is intended to be used the same day (even for test purposes) also the heater must be turned on now.

After the foam has settled the bath has to be clear and yellow. In case of haziness or a different color contact your supplier immediately.

The recommended process temperature is 60 °C.

While the **CSN 7001** bath is heated up, the other tanks can be loaded.

Primary Installation
- Vertical Mode -

The Installation

2. ETCH 7000

First of all the make-up quantities for the given tank volume have to be calculated. Further information are given on page 12 in chapter „*Bath make-up of **ETCH 7000***“.

Fill the tank with 3/4 of the required DI water quantity.

Carefully add the calculated quantity of sulfuric acid (H_2SO_4, 96%). Caution: The reaction with water is strongly exothermic and the bath warms up significantly (temperatures of up to 40°C are possible). Mix properly.

Now add the stabilizer **ETCH 7000 S** and mix properly again.

Afterwards add the corresponding quantity of hydrogen peroxide (H_2O_2, 36%) and mix.

Fill up the bath volume with the remaining DI water and mark the level.

Start the pump and check the bath temperature. If the bath is intended to be used the same day (even for test purposes) turn on the heater. Should the bath have a temperature of > 30°C already due to the blending reaction let the bath cool down and turn on the heater later to keep the bath at the recommended process temperature.

3. PCB 7000

The Organic Metal contained in the **PCB 7000 Concentrate** is susceptible to chemical influences. So the tank needs to be rinsed extremely well with acid DI water again after etching solution and tin bath have been filled in and prior to loading with **PCB 7000**, to remove any scattered **ETCH 7000** and **CSN 7001**.

First of all the make-up quantities for the given tank volume have to be calculated. Further information are given on page 15 in chapter „*Bath make-up of **PCB 7000***“.

Fill the tank with 3/4 of the required DI water quantity.

Add the calculated quantity of **PCB 7000 Buffer** and mix properly. The buffer ensures ideal acid conditions which are necessary for a full functionality of the Organic Metal.

Now the corresponding quantity of **PCB 7000 Concentrate** can be added. Mix properly again.

The product tends to foam. This should be avoided but any foam formed during make-up settles within a few hours.

Primary Installation
- Vertical Mode -

The Installation

Now add the remaining DI water quantity and mark the level. Start the pump and ensure a good movement of the bath. This helps to keep the contained particles in a constant state of suspense and to avoid sedimentation. **Do not filter the bath**, because this would remove the particles. The pump has to be adjusted so that no turbulence is caused. Any air sucked in would lead to additional foam formation and affects the bath stability and deposit quality.

The process bath is operated at room temperature so there is no heater required.

After the foam has settled the tank should be filled with a slightly hazy, dark green liquid. A different color, e.g. blue or yellow brown, is an indication for a chemical interference and it is recommended to contact your supplier.

Also the formation of obvious agglomerates or flocculation indicate an unspecified condition of the process bath and requires technical support.

4. Rinses

If the rinses have not been filled prior or during the installation of the process chemicals, they should be filled (and heated) now after another proper cleaning (to remove scattered process chemicals). Information about the rinse water requirements are given on page 3 and 6.

Test run

As soon as all process baths have reached the recommended operating temperature, some representative test board should be treated with **ORMECON™ CSN**. It is recommended to use regular boards for the test run to get a representative result. Irregular test boards, e.g. without or improperly cured solder mask, can lead to results that are not comparable with serial production conditions.

Besides an optical control of the **ORMECON™ CSN** surface finish, the thickness and solderability of the deposit should be checked. Ormecon Chemie offers these evaluations free of charge once (on specially designed test boards that are available upon request).

An adjustment of process parameters (e.g. bath movement, pump and filter capacity, heater performance, etc.) may be necessary if the plating results do not meet the manufacturer‘s specifications.

Primary Installation
- Horizontal Mode -

The design and equipment of a horizontal line is more complex than a vertical line. The installation of **ORMECON™ CSN** in the horizontal mode should not be made without technical support from Ormecon Chemie and the equipment manufacturer (especially for new lines). So the installation procedure is not described here in further detail.

Like for other wet chemical processes a horizontal mode is preferred for the **ORMECON™ CSN**. The technical equipment of horizontal lines is aimed at a fully automated operation and is usually especially designed for the process. Further more a horizontal treatment of boards is more effective and material saving. The need for process chemicals is almost cut by half for horizontal processes, so the running costs are significantly lower.

Of course a horizontal line first requires financial investment, but it is compensated quickly when operated continuously.

Please contact us any time if you need further information about horizontal processing of if you are interested in purchasing a horizontal line.

ETCH 7000 S

ETCH 7000 S is a stabilizer for an etching solution for copper based on hydrogen peroxide to remove copper oxides. The solution has a smooth etching effect and is an ideal pretreatment for the following **ORMECON™ PCB 7000** process step. Leaving the surface fine and smooth after etching, keeps the surface area small and reduces the risk for oxidation. Besides it makes a tin deposit appear whiter and more glossy.

The etching solution is free from complexing agents and can be regenerated, which reduces the need for disposal.

Make-up of ETCH 7000

For a 100 Liter make-up

	Liter	kg
DI water	81.5	81.5
Sulfuric acid (H_2SO_4, 96%)	10	18.5
ETCH 7000 S (stabilizer)	2	2.2
Hydrogen peroxide (H_2O_2, 35%)	6.5	9.0

Instructions for make-up

Submit 3/4 of the DI water and slowly add sulfuric acid while stirring. Caution: Exothermic reaction causes temperature increase (up to 40°C are possible)! Now add the **ETCH 7000 S** stabilizer. As final component add hydrogen peroxide, mix properly and fill up with the remaining DI water quantity.

Attention:

Please follow precaution measures for handling corrosive substances. During and after blending steps a proper mixing should be ensured.

Do not store or transport the solution blend in tightly closed containers.

ETCH 7000 Process Conditions

General information:

Operating range	H_2O_2 concentration:	40 - 65 ml/ltr.	Nominal value: 65 ml / ltr.
	H_2SO_4 concentration:	85 - 110 ml/ltr.	Nominal value: 100 ml/ltr.
	Copper concentration:	0 - 50 g/ltr.	Nominal value: < 50 g / ltr.
	Color:	green	Nominal value: green

Vertical mode:

Temperature	30°C ± 3 °C
Treatment time	2 minutes
Etching rate	approx. 1.2 µm / min.
Tank material	Plastic, e.g. PVC, Polypropylene (PP), GFK, with a temperature resistance of at least 50°C
Heater	PTFE, porcelain, quartz
Flight bar agitation	is necessary, 0.2 - 0.5 m/min. with 15 - 30 mm stroke
Exhaust system	is recommended

Horizontal mode (data given for a 0.5 m/min line):

Temperature	30°C ± 1 °C
Treatment	Spray technology
Treatment time	34 sec. (treated length in module: 280 mm)
Tank material	PP-S/S
Heater	e.g. 3.15 kW
Filtration	necessary

ORMECON™ PCB 7000

ORMECON™ PCB 7000 is a dispersion of the Organic Metal **ORMECON™** in an aqueous medium. It is applied to the etched copper surface and has an active effect on the following tin deposition. The Organic Metal is the key to the superior quality of the **ORMECON™ CSN** surface finish.

The ultra-thin **ORMECON™** layer (0,08 µm) leads to a defined oxidation of the copper surface and furthermore catalyzes the tin deposition to a highly crystalline structure. This extremely compact tin layer is significantly less sensitive to diffusion and oxidation and offers highly improved solderability properties.

Since this product is not a solution but a dispersion of homogeneously distributed, fine particles of the Organic Metal please, pay attention to the following issues:

- The product tends to form sediments. This is a normal property and the sediment can be easily re-dispersed with powerful stirring or shaking.

- The sediment has to be fully re-dispersed before taking the product out of a container, otherwise the concentration of the Organic Metal is disbalanced, both in the taken portion and the dispersion remaining in the container. This could lead to inconsistencies for analysis and replenishment procedures.

- During operation a continuous bath movement is recommended to avoid sedimentation and agglomeration.

- Do not filter the product because this will remove the Organic Metal particles and the dispersion is irreversibly destroyed.

- **ORMECON™ PCB 7000** contains fine particles, which are hardly visible (50 - 100 nm). In case of agglomeration or flocculation bigger particles are formed. They should vanish after powerful stirring or shaking. If the agglomerates remain, please contact your supplier.

- The product is dark green under normal conditions. Chemical reactions could lead to color changes. A blue or yellowish brown color is an indication for the improper state of the bath, so the color change can be used as a quality control tool.

Bath make-up ORMECON™ PCB 7000

For a 100 Liter make-up

	Liter	kg
DI water	92.5	92.5
ORMECON™ PCB 7000 Buffer	2.5	2.6
ORMECON™ PCB 7000 Concentrate	5.0	5.0

Instructions for make-up:

Submit approx. 70 liters of DI water and add **PCB 7000 Buffer** while stirring. Mix properly. Now add **PCB 7000 Concentrate**, mix properly again and add the remaining quantity of DI water.

Attention:

PCB 7000 Buffer and **PCB 7000 Concentrate** are not compatible in their concentrated form and should therefore not be mixed before one of the components has been diluted with DI water as described above.

It is essential to submit DI water first and mix properly, because otherwise the **ORMECON™** dispersion would flocculate.

Before taking **PCB 7000 Concentrate** out of the container, check for sediments and re-disperse it completely with powerful stirring or shaking.

PCB 7000 Buffer, **PCB 7000 Concentrate** and the blended process bath should never be in contact with alkaline media, because this would immediately cause an irreversible chemical change of the Organic Metal and the products would be made useless.

ORMECON™ PCB 7000 Process Conditions

General information:

Yield	from 1.5 ml (horizontal process) to 7.5 ml (vertical process) of **PCB 7000 Concentrate** per m² panel		
Operating range	Concentration:	70 - 120%	Nominal value: 100%
	pH-value:	1.3 - 2.7	Nominal value: 2.0
	Color:	green (compare with standard)	Nominal value: green

Vertical mode:

Temperature	15 - 30 °C
Treatment time	1 minute
Tank material	Plastic, e.g. PVC, Polypropylene (PP), GFK, with a temperature resistance of at least 30°C

Caution: Do not use metal parts! Do not use filters!

Heater	not necessary in heated rooms
Flight bar agitation	is necessary, 0.2 - 0.5 m/min. with 15 - 30 mm stroke
Exhaust system	not necessary

Horizontal mode (data given for a 0.5 m/min line):

Temperature	15 - 30 °C
Treatment in chamber	Flow technology
Treatment time	50 sec. (treated length in module: 420 mm)
Tank material	PP-S/S
Bath movement	continuously by circulation pump

Caution: Do not use metal parts! Do not use filters!

CSN 7001

CSN 7001 is an immersion tin bath, which selectively covers the copper surface with a 0.8 - 1.0 µm thin and even tin deposit. It is especially adapted to the use with **ORMECON™ PCB 7000** and its highly crystalline deposit is the guarantee for the extraordinarily high security and long solderability.

CSN 7001 is a ready-to-use solution.

Caution:

Temperatures below 10 °C during transport or storage could lead to a precipitation of tin crystals in the delivery containers. This does not affect the quality of the product, but requires a warming up of the entire container to redissolve the crystals prior to taking out the liquid (40 - 60°C).

Do not take out any **CSN 7001** liquid from a container that contains such white crystals, because the removed and remaining solutions do not contain the specified tin concentration. This could lead to inconsistencies in the process and replenishment. The solution only meets the specifications again, when all crystals are redissolved. So check **CSN 7001** for white crystals before pouring / pumping it out.

A storage at room temperature is recommended (15 - 30 °C).

CSN 7001 Process Conditions

General information:

Yield	from 30 ml (horizontal mode) to 150 ml (vertical mode) of **CSN 7001** per m² panel. Regular replenishment with tin concentrate (**CSN 7012 R**) makes it possible to use the bath until a copper concentration of 15 g / ltr. bath volume is reached. This is corresponding to approx. 12.5 m² of panel per liter bath volume. The bath has to be exchanged with copper loads exceeding this mark.	
Operation range	Tin concentration: 18 - 22 g/ltr.	Nominal value: 21.5 g/ltr.
	Copper conc.: 0 - 15 g/ltr.	Nominal value : < 15 g/ltr.
	Density (at 20°C): 1.23 - 1.25 g/ml	Nominal value: 1.24 g/ml
	Acidity: 5 - 7	Nominal value: 6.2

CSN 7001 Process Conditions

Vertical mode:

Temperature	60°C ± 5 °C
Treatment time	20 minutes
Min. distance between boards in rack	15 mm (0.03 m² / ltr.)
Tank material	Plastic, with a minimum temperature resistance of 80°C, preferably PPN.
	Caution: No metal parts!
Heater	PTFE, quartz
Flight bar agitation	is necessary, 0.2 - 0.5 m/min. with 15 - 30 mm stroke
Exhaust system	absolutely necessary
Circulation	2 - 3 times per hour
Filtration	continuously necessary (PP-Filter 5 - 10 µm)

Horizontal mode (data given for a 0.5 m/min line):

Temperature	60 - 70 °C
Treatment	Flow technology
Treatment time	534 sec. (treatment length in module: 4,460 mm)
Tank material	PP, metal parts plastic coated
Bad movement	continuously by circulation filter pump
Exhaust system	absolutely necessary
	Caution: No metal parts!

Replenishment Products

CSN 7012 R

CSN 7012 R is a liquid tin salt concentrate, which is necessary to replenish the tin concentration of **CSN 7001** during operation. It contains a high concentration of tin and should only be used according to the replenishment instructions given in this process guide (pages 37 and 54).

CSN 7012 R is a ready-to-use solution.

Caution:

Temperatures below 10 °C during transport or storage could lead to a precipitation of tin crystals in the delivery containers. This does not affect the quality of the product, but requires a warming up of the entire container to redissolve the crystals prior to taking out the liquid (40 - 60°C).

Do not take out any **CSN 7012 R** liquid from a container that contains such white crystals, because the removed and remaining solution quantities do not contain the specified tin concentration. This could lead to inconsistencies in the process and replenishment. The solution only meets the specifications again, when all crystals are redissolved. So check **CSN 7012 R** for white crystals before pouring / pumping it out.

A storage at room temperature is recommended (15 - 30 °C).

CSN 7020

CSN 7020 R is an aqueous acid solution used for the acidity (pH-value) adjustment of **CSN 7001** during operation. It should only be used according to the replenishment instructions given in this process guide (pages 38 and 39).

CSN 7020 is a ready-to-use solution.

Replenishment Products

CSN 7030 CAT

CSN 7030 CAT is a catalyst to regenerate an aged **CSN 7001** process bath. The product consist of two components, which have to be mixed in a 1:1 ratio prior to addition and a regulating agent to replenish all ingredients lost in the aging process.

General information about aging

Any tin bath is subject to an aging process over time and decomposition products are formed. This is a normal, time and temperature depending process. The decomposition products can be a poison for the tin ingredients and the tin deposit and the result is usually a streaky to dark gray tin deposit and the loss of solderability. Temperature plays an important part in this aging process. High temperature accelerates the natural aging of the bath.

The formation of decomposition products is not obvious. They tend to accumulate in the tin solution, especially in surface spheres. This phenomenon is especially critical for vertical processes. The deposition reaction inside the bath is usually perfect, but by pulling out the boards through the surface spheres of the immersion tin solution where degradation products have accumulated, the deposit immediately turns dark / black. This only applies for the surface layers of the tin deposit (a few nanometers) but it affects the optical appearance and solderability of the board.

Usually the bath is perfectly stable at room temperature. Aging (and degradation) starts at temperatures higher than 40°C. The following conditions could accelerate the aging of **CSN 7001**:

- Storage temperatures of > 40°C over 24 hours and more could lead to a decomposition of the product. So recommended storage and transport conditions should be kept. Gaseous decomposition components can not evaporate out of sealed containers. Even this could lead to a bad deposition quality already after initial make-up.
- A strong local heater (> 2 W/cm²), especially in combination with an insufficient bath circulation, could lead to local overheating of the solution with the result of local formation of degradation products leading to the described effects.
- A bad air circulation (e.g. breakdown of exhaust system) limits the air exchange and keeps gaseous products in solution.

Replenishment Products

CSN 7030 CAT

All these issues should generally not occur when the **ORMECON™ CSN** process chemicals are stored properly and the equipment is perfectly adjusted to the process requirements. Please note that **CSN 7030 CAT** should not be used to compensate an insufficient equipment. If a **CSN 7001** process bath continuously leads to an unspecified deposit, it is necessary to check the equipment and handling procedures carefully. Ormecon Chemie or your local supplier will help you to take all necessary measures to run the process with the best results and to minimize the necessity for the use of **CSN 7030 CAT**.

CSN 7030 CAT can only cure decomposition due to aging processes (as described above) and brings back the tin deposit to a light gray with perfect solderability. Any other reason for a streaky, dark or black deposit, e.g. contamination with metal ions, contamination from solder masks or CEM-1 base material, rough etching, bad or dirty rinses, any other unspecified treatment, etc. are beyond the sphere of the catalyst‘s influence and can not be cured. In this case the bath usually has to be exchanged completely.

Instructions for use

The product consists of two catalytic components **CSN 7030 CAT - A**
CSN 7030 CAT - B
and a regulating component **CSN 7030 R**

Treatment sequence: a) Use the catalyst components first
b) Add regulating component after regeneration is finished

CSN 7030 CAT- A and **CSN 7030 CAT- B** have to be mixed in a ratio of 1:1 only prior to the addition. A blend of the two components has a limited stability and may have only little or no effect when stored for more than 30 minutes. So it is recommended to only mix the required quantity and to use it as soon as possible. Add 3vol% of the ready-to-use **CSN 7030 CAT** mixture to the warm degraded CSN 7001 process bath (usual process temperature). Stir well while adding the catalyst. Stop filtering the bath for the regeneration period but keep the circulation pumps running constantly. Depending on the bath circulation **CSN 7030 CAT** reacts with the entire volume of the process bath within 24 hours. The result is a white precipitation which makes the bath look hazy.

After the regeneration period filter out the precipitation products in order to get the bath back to a clear yellow. Change the filters and clean the pump properly.

Replenishment Products

CSN 7030 CAT

Now add 1.5 % of **CSN 7030 R** to the bath and stir well. This regulating agent will replenish ingredients that have been lost due to degradation. Make a full analysis of the process bath and replenish if necessary (this should not be the case when **CSN 7030 R** is used properly). Now check the tin deposit on sample boards on appearance, thickness and solderability (Ormecon Chemie provides help upon request). The **CSN 7001** process bath should now be back to its normal high quality.

It is recommended to use **CSN 7030 CAT** only 3 times for the same process bath. After that it is recommended to exchange the process bath.

Example:

Volume of an aged CSN 7001 bath:	*100 Liters*
Necessary quantity of ready-to-use CSN 7030 CAT blend:	*3 Liters*
Necessary quantity of CSN 7030 CAT - A:	*1.5 Liters*
Necessary quantity of CSN 7030 CAT - B:	*1.5 Liters*
Necessary quantity of CSN 7030 R:	*1.5 Liters*

Quality Control
- Survey -

During the operation of **ORMECON™ CSN** regular analysis and replenishment procedures are required (the relevant intervals can be found on pages 24, 27 and 36):

		Operating range	Nominal value
ETCH 7000			
	H_2O_2 Concentration:	40 - 65 ml/ltr.	65 ml / ltr.
	H_2SO_4 Concentration:	85 - 110 ml/ltr.	100 ml/ltr.
	Copper concentration:	0 - 50 g/ltr.	< 50 g / ltr.
	Color:	green	green
ORMECON™ PCB 7000			
	Concentration:	70 - 120%	100%
	pH-value:	1.3 - 2.7	2.0
	Color:	green (compare with standard)	green
CSN 7001			
	Tin concentration:	18 - 22 g/ltr.	21,5 g / ltr.
	Copper concentration:	0 - 15 g/ltr.	< 15 g / ltr.
	Density (at 20 °C):	1.23 - 1.25 g/ml	1.24 g / ml
	Acidity:	5 - 7	6.2

The bath needs to be exchanged as soon as the maximum copper concentration of ≥ 15 g/ltr. is reached.

The replenishment instructions for each product given in this process guide need to be kept strictly.

Final finish:

It is highly recommended to check the optical appearance of the surface finish regularly. Contrary to HASL **ORMECON™ CSN** provides a matt, silver white and planar tin layer. The color should be even and homogeneously silver. In case of brown or gray stains on the surface finish, the process conditions need to be carefully checked. (see Troubleshooting, pages 56 - 59).

Solderability, Storability

Also these properties should be checked after every 100 m² or once a week (depending on what come first). It is recommended to process one additional board for quality control purposes with every bath.

Which tests are suitable for solderability evaluation depends on the customer's specification.

Quality Control
- ETCH 7000 -

During the operation of **ETCH 7000** the bath suffers from drag-out and evaporation losses. These losses need to be observed carefully and must be replenished regularly in order to guarantee a full functionality of the **ETCH 7000** process bath.

For a proper replenishment it is necessary to first compensate the evaporation losses by adding DI water. And only then to compensate the chemical losses.

The replenishment must be made two steps:

A) regular replenishments without analysis during operation (e.g. after every small bath)
B) replenishments with careful analysis after every **7 m²** panel / ltr. bath volume.
This applies only when the regular replenishments, as described in A), have been made.

A. Replenishment procedure without analysis

- Addition of DI water until the original level is almost reached. Do not fill up to the original level because there is still some room required for the addition of Hydrogen peroxide, sulfuric acid and **ETCH 7000 S**.

- Addition of **ETCH 7000 S**	3 (1)* ml / m² treated **panel**
- Addition of H_2SO_4	12 (4)* ml / m² treated **panel**
- Addition of H_2O_2	8 (3)* ml / m² treated **panel**

- Fill up to the original level with acidified DI water if necessary

* values given for horizontal processing ( )

B. Replenishment procedure with analysis

A complete analysis of the process bath is required after every 7 m² of treated panel per liter bath volume followed by an adequate replenishment.

1. Add DI water until original level is almost reached
2. Analyze hydrogen peroxide content and replenish properly (40 - 60 ml/ltr.)
3. Add corresponding amount of **ETCH 7000 S** and check color (has to be green)
4. Analyze sulfuric acid and replenish properly (85 - 110 ml/ltr.)
5. Analyze copper content (0 - 50 g/ltr.)

The analysis methods will be described on the following pages.

Quality Control
- ETCH 7000 -

Analysis and replenishment procedure

1. Hydrogen peroxide

Operating range: 40 - 65 ml/ltr. Nominal value = 65 ml/ltr.

Analysis:
- submit 1.0 ml of the **ETCH 7000** process bath to an Erlenmeyer flask
- add 100 ml of DI water
- add 5 ml of 10% sulfuric acid
- add 10 drops of Ferroin indicator solution
- titrate against 0.1 N Cer(IV)-Sulfate from red to blue endpoint

Calculation: Hydrogen peroxide 35% (**W**) [ml/ltr.] = Titration consumption of Cer(IV) [ml] x 5,13

Replenishment: Addition of H_2O_2 (35%) [ml] = (65 - **W** [ml/ltr.]) x bath volume [ltr.]

*(65 - **W**) ml of a 35% H_2O_2 solution need to be added per Liter bath volume.*

2. Stabilizer ETCH 7000 S

Analysis:
- The color of the process bath needs to be (become) green while using. Dark blue solutions either contain too much hydrogen peroxide or not enough stabilizer **ETCH 7000 S**.
- Every addition of hydrogen peroxide requires the addition of **ETCH 7000 S.**

Replenishment: *For every ml of H_2O_2 0.13 ml of **ETCH 7000 S** are required.*

Addition of **ETCH 7000 S** = Addition of H_2O_2 (35%) [ml] x 0,13

Quality Control
- ETCH 7000 -

Analysis and replenishment procedure

3. Sulfuric acid

Operating range: 85 - 110 ml/ltr. Nominal value = 100 ml/ltr.

Analysis:
- submit 2.0 ml of **ETCH 7000** process bath to an Erlenmeyer flask
- add 100 ml of DI water
- add 5 drops of Methyl orange indicator solution
- titrate against 0.5 N Sodium hydroxide (NaOH) from red to yellow endpoint

Calculation: Sulfuric acid content 96% (**S**) [ml/ltr.] = Titration consumption of NaOH [ml] x 6,75

Replenishment: Addition H_2SO_4 (96%) [ml] = (100 - **S** [ml/ltr.]) x bath volume [ltr.]

*(100 - **S**) ml of a 96% H_2SO_4 solution need to be added per Liter bath volume*

4. Copper

The copper concentration in the process bath should be below 50 g/ltr. at all times. A higher copper load could lead to crystal precipitation on the PCB surface. Copper concentrations higher than 30 g / ltr. can be easily determined because copper crystals precipitate when the bath is cooled down to 20°C. But these crystals would again resolve with warming up the bath.

Measure: Take / filter out the copper crystals when the bath is cooling down to 20°C and warm it up again to continue the process. Make a full analysis of ingredients and replenish if necessary prior to using the bath again.

Quality Control
- ORMECON™ PCB 7000 -

Also the **ORMECON™ PCB 7000** process bath suffers from drag-out that needs to be replenished. Due to operating the bath at room temperature there are almost no evaporation losses. Nevertheless regular replenishments are necessary to maintain the full functionality of the **ORMECON™ PCB 7000** process bath.

For a proper replenishment it is necessary to first compensate the evaporation losses by adding DI water. And only then to compensate the chemical losses.

The replenishment must be made two steps:

A) regular replenishments without analysis during operation (e.g. after every small bath)
B) replenishments with careful analysis after every **7 m²** panel / ltr. bath volume.
This applies only when the regular replenishments, as described in A), have been made.

A. Replenishment procedure without analysis

- Addition of DI water until the original level is almost reached. Do not fill up to the original level because there is still some room required for the addition of **PCB 7000 Concentrate** and **Buffer**.

- Addition of **ORMECON™ PCB 7000 Concentrate** 5.0 (1.0)* ml / m² treated **panel**
- Addition of **ORMECON™ PCB 7000 Buffer** 2.5 (0.5)* ml / m² treated **panel**

- Fill up to the original level with acidified DI water if necessary

* values given for horizontal processing ( )

B. Replenishment procedure with analysis

A complete analysis of the process bath is required after every 7 m² of treated panel per liter bath volume followed by an adequate replenishment.

1. Add DI water until original level is almost reached
2. Analyze **ORMECON™** concentration and replenish properly (70 - 120 g/ltr.)
3. Maintain content of **PCB 7000 Buffer**. Check pH (1.3 - 2.7)

The analysis methods will be described on the following pages.

Quality Control
- ORMECON™ PCB 7000 -

Analysis and replenishment procedure

1. ORMECON™ concentration

Operating range: 70 - 120 % Nominal value = 100%

Analysis:

- First of all add DI water and fill up the tank to the original level (prior to sampling). **This is important, otherwise the sample will be too concentrated and the analysis will provide much higher values than there are originally contained in the process bath.**
- Mix process bath thoroughly (stirring) and make sure there is no sediment left in the tank.
- Fill a 1 cm cuvette with a process bath sample

Now there are two ways to analyze the sample:

a) Determination of the optical density by UV-Vis spectroscopy (pages 30 - 33)
b) Determination of the optical density by visual comparison vs. standards (pages 34 - 35)

Further information to both methods are given on the following pages.

Calculation for analysis with UV-Vis spectrum:

$$\textbf{ORMECON}^{TM}\ \text{Concentration (}\textbf{OM}\text{) [\%]} = \frac{(\boldsymbol{A} + \boldsymbol{B})}{2}$$

A = Extinction at 430 nm ***B*** = Extinction at 810 nm

For a visual analysis vs. Standards there if no calculation necessary.

Replenishment:

Addition of **PCB 7000 Concentrate** [ml] = (100 - **%OM**) x 0,5 x bath volume [ltr.]

Addition of **PCB 7000 Buffer** [ml] = $\frac{\text{Addition of PCB 7000 Concentrate}}{2}$

*For every missing % of ORMECON™ per Liter bath volume, 0.5 ml of **PCB 7000 Concentrate** and 0.25 ml of **PCB 7000 Buffer** need to be added.*

Quality Control
- ORMECON™ PCB 7000 -

Analysis and replenishment procedure

2. pH-value

Operating range: 1.3 - 2.7 Nominal value = 2.0

Analysis: Measure the pH at 20°C.

Replenishment: Normally the pH is adjusted by mutual addition of **PCB 7000 Concentrate** and **PCB 7000 Buffer**. So it is usually not required (and not recommended) to add an additional amount of Buffer to the process bath. If the pH of the process bath is still out of spec after proper replenishment, please contact your local supplier for technical support.

3. Color

The process bath has to be dark green at all times. It is necessary to regularly check the color visually vs. a standard. The bath needs to be observed carefully for color changes, haziness or flocculation. A color change from green to blue indicates an increase of the pH > 7. In this case the bath needs to be exchanged.

4. Flocculation / Agglomeration

ORMECON™ PCB 7000 is a dispersion of very fine particles (0.08 µm). It is not a solution. After a down time of 3 days approx. 30% of the particles are precipitated as sediment. This is normal and the particles can be easily re-dispersed by stirring, pumping or shaking. The sediment needs to be re-dispersed prior to every use of the product (PCB 7000 Concentrate and PCB 7000 process bath).

Please do not use filters for PCB 7000, because this would remove the **ORMECON™** particles and the bath would be irreversibly destroyed.

The bath is unstable when flocculates or sediments are formed very shortly after re-dispersing the particles (a few minutes after shaking/stirring). Such a behavior could be caused by contamination with chemicals or foreign particles (e.g. metal particles). In this case the bath needs to be exchanged..

Quality Control
- ORMECON™ PCB 7000 -

Determination of the optical density by UV-Vis spectroscopy

ORMECON™ PCB 7000 is a dispersion and contains very fine particles of the Organic Metal **ORMECON™**. These particles are green and provide an intense green color to the liquid. The intensity of the color is directly dependant on the concentration of the Organic Metal, so the concentration can be determined by measuring the optical density of **PCB 7000**.

This method provides data about the light absorption of the Organic Metal measured in a UV-Vis spectrometer. It is helpful that the Organic Metal provides two very typical extinction peaks at approx. 430 nm and 810 nm. The strength of these extinction peaks can be directly transferred into the **ORMECON™** concentration with the formulas given on page 28.

There are two different types of spectrometers:

a) Spectrometer, which can only measure at one wavelength at a time.

b) Spectrometer, which are able to measure a full UV-Vis spectrum from 200 - 1000 nm at a time.

Prior to measurement

Before starting the measurement please take care of the following issues:

1. Use only 10 mm cuvettes.
2. Use a DI water base line for measurements
3. Fill up the process baths to the original level with DI water prior to taking out a sample for the analysis. Otherwise the bath samples would be too concentrated and would provide results that are not representing the real process bath conditions.

For spectrometers, which are only capable of measuring one wavelength at a time, it is necessary to calibrate with a DI water base line prior to every single measurement.

Quality Control
- ORMECON™ PCB 7000 -

Preparation of a 100% standard of the ORMECON™ PCB 7000 dispersion:

- submit 50 - 70 ml of DI water to a 100 ml Volumetric flask
- add 2.5 ml of **PCB 7000 Buffer** and mix thoroughly
- now add 5 ml of **PCB 7000 Concentrate** and mix thoroughly again
- finally carefully fill up the flask to the 100 ml mark

It is necessary to submit some water first because **PCB 7000 Concentrate** and **Buffer** are not compatible in their concentrated form (the Buffer would destroy the Concentrate and it would irreversibly precipitate).

For diluting the standard

- submit 20 ml of the 100% standard to a new 100 ml Volumetric flask
- fill up to the 100 ml mark with DI water

- Now measure a DI water base line
- Finally measure the extinction of the diluted standard at 430 nm and 810 nm.

The following values should be achieved:	at 430 nm	**0,4 ± 0,05**
	at 810 nm	**0,3 ± 0,05**

These values represent a 100% standard (which has been diluted 20%). Such a dilution is useful because some UV-Vis spectrometer are imprecise at higher extinction values.

If you do not reach the above given values, there may be a sediment in your original **PCB 7000 Concentrate** container that has not been fully re-dispersed. Shake the container again well and make a new standard.

If your measurement still gives different values with the new standard, please contact your supplier for technical support.

Quality Control
- ORMECON™ PCB 7000 -

Now it is finally possible to measure the concentration of the **PCB 7000** process bath (with a dilution similar to the standard of course):

- take 20 ml of the **ORMECON™ PCB 7000** process bath after stirring thoroughly (there should be no sediment left in the tank)
- fill up with 80 ml of DI water
- measure the extinction of your sample at 430 nm and 810 nm using DI water as a blank.
- the measured values again represent a diluted bath (20%). The real extinction values of the process bath can be calculated with the following formula:

Partial Concentration I = Extinction at 430 nm / 0,4 x 100
Partial Concentration II = Extinction at 810 nm / 0,3 x 100

The **ORMECON™** concentration of the process bath is the result of the average of both extinction values:

$$\textbf{ORMECON}^{TM}\text{ concentration} = \frac{(\text{Partial Concentration I} + \text{Partial Concentration II})}{2}$$

A necessary replenishment can be calculated with the following formulas:

$$\text{Addition of } \textbf{PCB 7000 Concentrate [ml]} = \frac{(100 - \text{ORMECON concentration}}{100} \times 0{,}5 \times \text{bath volume [ltr.]}$$

$$\text{Addition of } \textbf{PCB 7000 Buffer [ml]} = \frac{\text{Addition of PCB 7000 Concentrate}}{2}$$

For the replenishment of the process bath add PCB 7000 Buffer first while stirring thoroughly. Only then add the corresponding amount of PCB 7000 Concentrate and mix well again.

Quality Control
- ORMECON™ PCB 7000 -

If you want to check the accuracy of your measurement it is recommended to additionally measure a 50% standard. The procedure is as follows:

- submit 50 ml of the diluted 100% standard to a 100 ml Volumetric flask
- fill up to the 100 ml mark with DI water
- Measure a DI water base line
- Measure the extinction of your sample at 430 nm and 810 nm.

The following values should be achieved:	at 430 nm	**0,2 ± 0,05**
	at 810 nm	**0,15 ± 0,05**

These values represent the 50% standard (with the same dilution rate as the 100% standard).

It is important that the values given for the 50% standard are only half of the values of the 100% standard. If this is the case your measurements are reliable.

If not, it may be possible that the standards are still too concentrated for your spectrometer. In this case you can try to further dilute the standards. Please note that it is important that all samples are diluted similarly.

In case you get appropriate values with a further dilution rate, please use the same dilution factor for the concentration analysis of the process bath sample.

Quality Control
- ORMECON™ PCB 7000 -

Determination of the optical density by visual comparison of standards

Due to the color of **ORMECON™ PCB 7000** and the direct dependence between color intensity and Organic Metal concentration it is also possible to determine the concentration of the process bath by visual comparison. This method requires a trained eye, but can be easily done after some “test runs”.

First of all it is necessary to make at least two fresh standards with different Organic Metal concentrations.:
with 120% - the maximum operating concentration
with 70% - the minimum operating concentration

The concentration of the process bath should be within this tolerance range. With the help of the two benchmark standards it is possible to check if the process bath and / or the replenished process bath meets the concentration specification.

In case the process bath has a lower concentration than the minimum standard, a replenishment is necessary. A visual comparison is less accurate than a UV-Vis measurement and it is impossible to determine the exact concentration of a process bath. So the evaluation of the replenishment procedure is a little bit empiric for this method. But the big specification range leaves enough room for an adequate adjustment of the Organic Metal concentration in the process bath.

It is highly recommended to make fresh standards for every analysis, even though the standards are usually stable for a period of three months. If “old” (not older than 3 months) standards are used, make sure that they are shaken well so that the sediment is fully re-dispersed. Otherwise the concentration of the Organic Metal is distorted.

It is essential for the visual method that all samples (standards and process bath samples) are examined in similar, and more important, small receptacles. It is recommended to use cuvettes or small test tubes. Receptacles with bigger volumes are not suitable, because the liquid of the examined sample would be too opaque to make a color differentiation possible.

A process bath that has a concentration lower than 70% requires a replenishment. The replenishment procedure should be first evaluated with a small portion of the process bath. Add some ml of the **PCB 7000 Buffer** first, shake well and add the corresponding amount of **PCB 7000 Concentrate**. Then check the optical appearance by comparison with the 120% and 70% standard using similar receptacles. Repeat this empiric procedure until the color of the process bath sample is well between the two standards. Finally transfer the replenishment procedure to the entire **PCB 7000** process bath volume.

Quality Control
- ORMECON™ PCB 7000 -

Determination of the optical density by visual comparison of standards

Preparation of standards for the visual evaluation of the optical density of ORMECON PCB 7000 (applied to 1000 ml):

	DI water	PCB 7000 Concentrate	PCB 7000 Buffer
120%	910 ml	60 ml	30 ml
70%	947 ml	35 ml	18 ml

Please note that it is important for the sample preparation to submit DI water first. Only then it is possible to add **PCB 7000 Buffer** and then **PCB 7000 Concentrate**. Please follow the instructions given on page 15.

Quality Control
- CSN 7001 -

Due to the high process temperature the immersion tin bath suffers from high evaporation losses during operation. The tin concentration in the bath is constantly reduced because of the deposition of tin on immersed PCBs. At the same time the copper concentration increases. And of course there is the usual drag-out.

For a proper replenishment it is necessary to first compensate the evaporation losses by adding DI water. And only then to compensate the chemical losses.

The replenishment must be made two steps:

A) regular replenishments without analysis during operation (e.g. after every small bath)
B) replenishments with careful analysis after every **1 m²** panel / ltr. bath volume.
This applies only when the regular replenishments, as described in A), have been made.

A. Replenishment procedure without analysis

- Addition of DI water until the original level is almost reached (compensation of evaporation losses). Do not fill up to the original level because there is still some room required for the addition of **CSN 7001** and **CSN 7012 R**.

Attention: Add water in small portions and mix thoroughly.
It is recommended to acidify DI water with 0.5% **CSN 7020** prior to the addition.
This increases the compatibility with **CSN 7001**.

- Addition of **CSN 7001** 100 (25)* ml / m² treated **panel**
- Addition of **CSN 7012 R** 40 (40)* ml / m² treated **copper area**

- Fill up to the original level with acidified DI water if necessary

* values given for horizontal processing ( )

B. Replenishment procedure with analysis

A complete analysis of the process bath is required after every 1 m² of treated panel per liter bath volume followed by an adequate replenishment.

1. Adjust density with acidified DI water (with 0.5% **CSN 7020**). Add in small portions!!!
2. Adjust tin concentration with **CSN 7012 R** (18 - 22 g/ltr.)
3. Fill up to original level with **CSN 7001** if necessary.
4. Adjust acidity with **CSN 7020** if necessary.

The analysis methods will be described on the following pages.

Quality Control
- CSN 7001 -

Analysis and replenishment procedures

1. Tin concentration

Operating range: 18 - 22 g / ltr. Nominal value = 21,5 g / ltr.

Analysis:
- submit 5.0 ml of **CSN 7001** tin solution to an Erlenmeyer flask
- add 5.0 ml of Hypophosphorus acid (50% H_3PO_2)
- add 20 ml of DI water
- add sodium acetate buffer solution while stirring until reaching pH = 4 (make-up of buffer solution on page 51).
- add 3 drops of Xylenol orange indicator solution (1% in ethanol)
- fill up to 100 ml with DI water
- titrate to a light yellow against 0.1 M EDTA solution. The solution changes its color from red/purple to light yellow during analysis.

Calculation: Tin content (***Sn***) [g/ltr.] = Titration [ml] of 0,1 M EDTA x 2,37

Replenishment: Addition of **CSN 7012R** [ml] = (21,5 - ***Sn*** [ml/ltr.]) x 10 ml x bath volume [ltr.]

*Every missing gram of tin (Sn) requires the addition of 10 ml **CSN 7012 R***

2. Copper

Operating range: up to 15 g / ltr. maximum Nominal value = < 15 g / ltr.

Analysis:
- submit 0.5 ml **CSN 7001** tin solution to a 25 ml beaker
- add 5.0 ml of 25% ammonia solution
- add 0.1 ml hydrogen peroxide (35%)
- filter precipitated tin and transfer the solution to a 1 cm cuvette

Attention: All the equipment (incl. Filters) need to be dry (dry filters in an oven is necessary)
- UV-VIS measurement of 25% ammonia solution as base line:
  - measure extinction at 635 nm (A)
  - measure extinction at 450 nm (B)

Calculation: Copper (***Cu***) [g / ltr.] = $\frac{(A) - (B) - 0{,}025}{0{,}0744}$

Quality Control
- CSN 7001 -
Analysis and replenishment procedures

3. Acidity / pH value

Operating range: 5 - 7 Nominal value: 6,2

Analysis:
- submit 1.0 ml of **CSN 7001** tin solution to an Erlenmeyer flask
- fill up to 100 ml mark
- add 10 drops of Cresol red indicator solution (in ethanol)
- titrate to purple against 1.0 N NaOH

Calculation: Acidity = Titration [ml] of 1.0 N NaOH x Titer of solution

Monitoring: The tin (Sn2+) contained in **CSN 7001** is stable at a pH value <1. If the pH rises above this mark, an increasing amount of Sn4+ develops, which precipitates as SnO_2 and forms white insoluble crystal flakes. The tin oxide affects the tin deposition and can lead to a gray color of the deposit.

The acidity represents the acid content of the tin solution. Under normal conditions the acidity is directly connected to the water content of the solution. The drag-in of a high quantity of rinsing water leads to a drop in acidity (the pH increases), while a high evaporation rate (which is not compensated by water drag-in) leads to an acidity increase (the pH is reduced).

Depending on the process conditions there are two issues possible for the acidity of the CSN 7001 process bath:

A) The process is used rarely, the evaporation rate is very high and can not be compensated by rinse water drag-in, so the acidity of the solution increases (the pH decreases):

An acidity higher than the operating range means that also the density of the solution is higher than specified. Adding DI water brings the density back to normal. This measure also reduces the acidity of the tin solution. So if the density is adjusted, also the acidity of the solution is between 5 and 7.

A brown deposit can be an indication for a too high acidity.

Quality Control
- CSN 7001 -
Analysis and replenishment procedure

B) The process is used continuously, the rinse water drag-in can not be compensated by evaporation, so the bath becomes more and more diluted and the acidity drops (the pH increases):

In this case also the density of the solution is too low. To increase the density (and the acidity) of the solution it is necessary to take out 250 ml / ltr. bath volume and to substitute this quantity with 230 ml / ltr. of fresh **CSN 7001** + 20 ml/ltr. of **CSN 7020**. This solution exchange usually brings back the density and acidity into the operating range.

Since the reason for a low acidity (under normal process conditions) is usually caused by an excessive drag-in of rinse water, it is recommended to avoid the dilution of the process bath by, e.g. optimizing the draining of the boards prior to the immersion tin step, changing the geometry of the **CSN 7001** tank to increase the surface of the tin solution in order to increase the evaporation rate.

A gray deposit can be an indication for a too low acidity.

Process aids

- Analysis sheets, replenishment tables and monitoring records -

The following pages will provide monitoring, analysis and replenishment aids for every single product of the **ORMECON™ CSN** process.

You will find analysis sheets which could be copied and used for your own analysis.

Further more there are replenishment tables, providing information for replenishment quantities corresponding to analysis results. They are related to a bath volume of 100 Liters, but there is room for values related to your own bath volume on the right hand side of the sheet. After converting them once these tables can be used for your own replenishment determination.

Also the examples for bath monitoring records could be copied and used. They were made to document all analysis results and replenishment measures with date and name. The records guarantee a history survey for each process bath.

All these information were put together to simplify the operation and monitoring of the **ORMECON™ CSN** process. Please contact us in case of any further questions regarding the process.

Analysis Equipment

The following equipment and chemicals are required for an analysis of the **ORMECON™ CSN** process baths:

(Glass-) Equipment:

20 ml Graduated cylinder
100 ml Volumetric flask
250 ml Erlenmeyer flask
Pipettes (0,1 ml / 1,0 ml / 5,0 ml)
Titration equipment
Filters
1 cm cuvette
10 mm cuvettes for UV-Vis measurement
UV-Vis measuring unit

General chemicals:

DI water
Sulfuric acid, (10%)
Hypophosphorus acid (50%)
Ammonia, conc. (25%)
Hydrogen peroxide (35%)
Sodium acetate, tri-hydrate
Acetic acid (100%)

Indicators:

Ferroin indicator solution
Methyl orange indicator solution
Xylenol orange indicator solution(1% in ethanol)
Cresol red indicator solution (in ethanol)

Titration solutions:

0.1 N Cer(IV)sulfate
NaOH, c = 1.0 mol/l
NaOH, c = 0.5 mol/l
Titriplex-III-solution (EDTA), c = 0.1 mol/l

ORMECON™ CSN

Analysis Sheet
- Etch 7000 -

Bath volume: _____ Liter

Date of analysis: ____ . _____ . _____

Throughput: _____ m²

Analyzer: _____ (Initials)

Capacity / Liter: _____ m²/ l (Throughput : Bath volume)

Date of installation:_____ ._____ . _____

Signature: _____

Physical data:

	OK	Caution	NOK
Form:	○ watery		○ oily
Color:	○ green	○ blue green ○ green blue	○ blue ○ others
Appearance:	○ clear/slightly opaque	○ opaque / hazy	○ different
Foam formation:	○ no	○ yes	

Analysis procedure:

H_2O_2 Hydrogen peroxide (35%)

Bath sample ETCH 7000	1 ml
DI water	100 ml
Sulfuric acid, diluted (10%)	5 ml
Ferroin indicator solution	10 drops

0.1 N Cer(IV)Sulfate-Titration: X= _____ ml
(Color change from red to blue)

H_2O_2 ,35% (= X*5.13): _____ ml/l (=***W***)

Operating range: 40 - 65 ml / l

Nominal value: 65 ml / l

H_2SO_4 Sulfuric acid (96-98%)

Bath sample ETCH 7000	1 ml
DI water	100 ml
Methyl orange idicator solution	5 drops

0.5 N NaOH: X= _____ ml
(Color change from red to yellow)

H_2SO_4 ,96-98% (= X*6.75): _____ ml/l (=***S***)

Operating range: 85 - 110 ml / l

Nominal value: 100 ml/ l

Copper:

Zero (Minimum ~ 500 nm) _____ = E5

Extinction at 805 nm _____ = E8

Cu^{2+} concentration _____ g / l (E8-E5) : 0.186

Nominal value < 50 g / l

Result:

○ Bath is ok, no replenishment necessary

○ Bad needs to be replenished with ○ **H_2O_2 / Etch 7000 S** ○ **H_2SO_4**

○ Bad needs to be exchanged

Comments_____

Replenishment Table
- Etch 7000 -

H_2O_2 (Hydrogen peroxide)

Example:

100 Liter Bath volume

Values related to your bath volume:

_____ Liter

Analysis result H_2O_2 (35%) (***W***)	Addition of **H_2O_2 (35%)**	Addition of **Etch 7000 S**	Addition of **H_2O_2 (35%)** [ml]	Addition of **Etch 7000 S** [ml]
65 ml / ltr.	---	---	---	----
60 ml / ltr.	500 ml	65 ml		
55 ml / ltr.	1000 ml	130 ml		
50 ml / ltr.	1500 ml	195 ml		
45 ml / ltr.	2000 ml	260 ml		
40 ml / ltr.	2500 ml	325 ml		
35 ml / ltr.	3000 ml	390 ml		
30 ml / ltr.	3500 ml	455 ml		
25 ml / ltr.	4000 ml	520 ml		
20 ml / ltr.	4500 ml	585 ml		
15 ml / ltr.	5000 ml	650 ml		
10 ml / ltr.	5500 ml	715 ml		

Calculation: Addition of H_2O_2 (35%) [ml] = (65 - ***W*** [ml/ltr.]) x Bath volume [ltr.]

Addition of **Etch 7000 S** [ml] = Addition of H_2O_2 (35%) [ml] x 0.13

Replenishment Table
- Etch 7000 -

H_2SO_4 (Sulfuric acid)

Example:

100 Liter Bath volume

Values related to your bath volume:

_____ Liter

Analysis result H_2SO_4 (96%) (***S***)	Addition of **H_2SO_4 (96%)**	Addition of **H_2SO_4 (96%)** [ml]
100 ml / ltr.	---	---
95 ml / ltr.	500 ml	
90 ml / ltr.	1000 ml	
85 ml / ltr.	1500 ml	
80 ml / ltr.	2000 ml	
75 ml / ltr.	2500 ml	
70 ml / ltr.	3000 ml	
65 ml / ltr.	3500 ml	
60 ml / ltr.	4000 ml	
55 ml / ltr.	4500 ml	
50 ml / ltr.	5000 ml	

Calculation: Addition of H_2SO_4 (96%) [ml] = (100 - ***S*** [ml/ltr.]) x Bath volume [ltr.]

Monitoring Record

Bath: Microetch **ETCH 7000**	Bath volume: Liter	New make-up: 81.5 Liter DI water, 10 Liter H_2SO_4 (96%), 2 iter ETCH 7000 S, 6.5 Liter H_2O_2 (35%)	

Date	ANALYSIS RESULT			Analysis Initials	CORRECTIONS		Addition Initials
	H_2O_2 (35%) [ml / l]	H_2SO_4 (96-98%) [ml / l]	Copper [g / l]		Addition per bath volume / New make-up Comments	Initials	
	65 ml / l	100 ml / l	< 50 g / l				

Analysis Sheet

- PCB 7000 -

Bath volume: _____ Liter

Date of analysis: ____ . _____ . _____

Throughput: _____ m²

Analyzer: _____ (Initials)

Capacity / Liter: _____ m²/ l (Throughput : Bath volume)

Date of Installation:_____ ._____ . _____

Signature: _____

Physical data:

	OK	Caution	NOK
Form:	○ liquid		○ oily
Color:	○ dark green	○ blue green ○ yellow green	○ blue ○ others
Appearance:	○ clear/slightly opaque	○ opaque / hazy	○ different
Sediment	○ no	○ little	○ significant
Foam formation after shaking:	○ yes	○ no	
Odor:	○ acetic	○ different	

Analysis result for diluted samples (see description on page 30 - 35):

UV-Vis measurement

		Operating range	Nominal value		
Extinction at 430 nm		0.28 - 0.48	0.4 ± 0.05	○ ok	○ nok
Extinction at 810 nm		0.21 - 0.36	0.3 ± 0.05	○ ok	○ nok
Concentration [%]		70 - 120 %	100 %	○ ok	○ nok
pH-value:		1.3 - 2.7	2	○ ok	○ nok

Result:

○ Bath is ok, no replenishment necessary

○ Bad needs to be replenished with _____ ml of **PCB 7000 Concentrate** and _____ ml of PCB 7000 Puffer

○ Bad needs to be exchanged

Comments_____ _____

_____

_____

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Analysis Procedure
- PCB 7000 -

Bath volume: _____ Liter

Date of analysis: ____ . _____ . _____

Date of sampling: _____ . _____. _____

Analyzer: _____
(Initials)

UV-Vis-Measurement

Sample preparation:

- take out 20 ml of the ORMECON PCB 7000 process bath (no sediment in the tank allowed!)
- fill up with 80 ml of DI water
- measure UV-Vis extinction at 430 nm and 810 nm

Calculation of total ORMECON concentration:

Partial concentration I = $\frac{\text{Extinction at 430 nm}}{0.4} \times 100$

Partial concentration II = $\frac{\text{Extinction at 810 nm}}{0.3} \times 100$

ORMECON Concentration = $\frac{\textbf{Partial conc. I + Partial conc. II}}{\textbf{2}}$

Your calculation:

_____ / 0.4 x 100 = _ _ _ _ _ %

_____ / 0.3 x 100 = _ _ _ _ _ %

_____ / 2 = _ _ _ _ _ %

Replenishment:

Addition of PCB 7000 Concentrate = $\frac{(100 - \text{ORMECON Concentration[\%]})}{100} \times 0{,}5 \times \text{Bath volume [ltr.]}$

_ _ _ _ _ _ _ _ _ _ _ _ _ _ _ **ml** = $\frac{(100 - \_\_\_\_\_\ \%)}{100}$ **x 0,5 x** _ _ _ _ _ _ _ _ **ltr.**

Addition of PCB 7000 Puffer = $\frac{\text{Addition of PCB 7000 Concentrate}}{2}$

_ _ _ _ _ _ _ _ _ _ _ _ _ _ _ **ml** = _____ / **2**

Signature: _____

Replenishment Table
- PCB 7000 -

PCB 7000 Concentrate and Buffer

Example:

100 Liter bath volume

Values related to your bath volume:

_____ Liter

Analysis result ORMECON Conc. **(OM)**	Addition of **PCB 7000 Conc.**	Addition of **PCB 7000 Buffer**	Addition of **PCB 7000 Conc.** [ml]	Addition of **PCB 7000 Buffer** [ml]
95 %	250 ml	125 ml		
90 %	500 ml	250 ml		
85 %	750 ml	375 ml		
80%	1000 ml	500 ml		
75 %	1250 ml	625 ml		
70 %	1500 ml	750 ml		
65 %	1750 ml	875 ml		
60 %	2000 ml	1000 ml		
55 %	2250 ml	1125 ml		
50 %	2500 ml	1250 ml		
45 %	2750 ml	1375 ml		
40%	3000 ml	1500 ml		

The functionality of the bath is critical below an Organic Metal concentration below 40%, even with replenishment. It is recommended to exchange the bath.

Calculation:

Addition of **PCB 7000 Concentrate** [ml] = (100 - **%OM**) x 0,5 x bath volume [ltr.]

Addition of **PCB 7000 Buffer** [ml] = Addition of PCB 7000 Concentrate

Values still within operating range

Monitoring record

Bath: Predip **PCB 7000**	Bath volume Liter	New make-up: 92.5 Liter DI water 5.0 Liter PCB 7000 Concentrate 2.5 Liter PCB 7000 Buffer	

Date	ANALYSIS RESULT			Analysis Initials	CORRECTIONS		Addition Initials
	ORMECON concentration [%]	pH-value	Color		Addition per bath volume / New make-up Comments	Initials	
	70 - 120 %l	1.3 - 2.7	green				

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Analysis Sheet (survey)

- CSN 7001 -

Bath volume: _____ Liter

Date of analysis: ____ . _____ . _____

Throughput: _____ m²

Analyzer: _____ (Initials)

Capacity / Liter: _____ m²/ l (Throughput : Bath volume)

Date of Installation:_____ ._____ . _____

Signature: _____

Physical data:

	OK	Caution	NOK
Form:	○ liquid	○ white precipitate	
Color:	○ yellow	○ others	
Appearance:	○ clear/slightly opaque	○ opaque / hazy	○ different
Foam formation after shaking:	○ yes	○ no	
Odor:	○ fruity to slightly sulfuric		○ **sulfuric**

Analysis results:

		Operating range	Nominal value		
Density		1,23 - 1,25 g/ml	1,24 g/ml	○ ok	○ nok
Tin content		18 - 22 g / ltr.	21,5 g/ltr.	○ ok	○ nok
Copper content		0 - 15 g/ltr.	< 15 g / ltr.	○ ok	○ nok
Acidity		5 - 7	6,2	○ ok	○ nok

Comments: _____

_____

_____

Result:

○ Bad is ok, no replenishment necessary

○ Bad need to be replenished with ○ **CSN 7012 R** ○ **CSN 7001 fresh / CSN 7020**

○ Bad needs to be exchanged

Comments _____

_____

Analysis Procedure I
- CSN 7001 -

Bath volume : _____ Liter

Date of analysis: ____ . _____ . _____

Date of sampling: ____ . ____. _____

Analyzer: _____
(Initials)

Determination of tin content (Titration)

Sample preparation:

- CSN 7001 bath sample	5 ml
- Hypo phosphoric acid (50%)	5 ml
- DI water	90 ml
- Sodium acetate buffer solution*	submit approx.. 20 ml, and add more until pH=4 is reached
- Xylenol orange (1% in ethanol)	3 drops

* Preparation of sodium acetate buffer solution:
- fill a 1000 ml Volumetric flask with approx. 500 ml of DI water
- now solve 334,78 g of sodium acetate tri-hydrate and 140,31 g Acetic acid (100%)
- fill up to the 1000 ml mark with DI water

Mix CSN 7001 process bath sample, hypo phosphoric acid, DI water and approx.. 20 ml of buffer solution. Check pH and add more buffer if necessary to adjust solution to pH=4. Now add indicator and titrate with Titriplex III solution (EDTA) c = 0.1 mol/l from red/purple to yellow. A triple titration is recommended. If the results vary around more than one drop (0.05 ml) more or less, it is recommended to make another two titrations.

Calculation of tin content:

Consumption of EDTA: _____ ml

Consumption of EDTA: _____ ml

Consumption of EDTA: _____ ml

Consumption of EDTA: _____ ml

Consumption of EDTA: _____ ml

Average consumption: _____ ml

Tin content (Sn) [g/ltr.] = Average EDTA consumption x 2.37

Tin content: _____ **g/ltr.**

Signature: _____

Analysis Procedure II
- CSN 7001 -

Bath volume: _____ Liter

Date of analysis: ____ . _____ . _____

Date of sampling: ____ . ____. _____

Analyzer: _____
(Initials)

Determination of copper content (UV-Vis measurement)

Sample preparation:

- CSN 7001 bath sample	0.5 ml
- Ammonia, conc. (25%)	5.0 ml
- Hydrogen peroxide (H_2O_2, 35%)	0.1 ml

Mix process bath sample with ammonia first and add hydrogen peroxide. After stirring properly wait for a few minutes until the hydrogen peroxide reaction has been finished. If the solution stays clear transfer it directly to a 10 mm cuvette and measure it with a UV-Vis unit. If the solution is opaque or hazy a filtration is necessary prior to UV-Vis measurement. Please make sure that all samples are treated with a comparable speed.

An 25% ammonia base line is required.

Calculation of the copper content:

Extinction peak (A) at approx. 635 nm: _____

Extinction valley (B) at approx. 450 nm: _____

Copper content (Cu) [g/ltr.] = $\frac{(A) - (B) - 0.025}{0.0744}$

Copper content: _____ **g/ltr.**

Please note: The values given above are related to measuring the extinction of the sample. If transmission (T) is measured, it is possible to transfer the values with the following formula:

$$\text{Extinction} = \frac{-\log(T\%)}{100}$$

It is possible that the extinction peak and valley are slightly shifted. Please use the maximum and minimum values at these shifted wavelengths.

Signature: _____

Analysis Procedure III
- CSN 7001 -

Bath volume: _____ Liter

Date of analysis: ____ . _____ . _____

Date of sampling: ____ . ____. _____

Analyzer: _____
(Initials)

Determination of acidity (Titration)

Sample preparation:

- CSN 7001bath sample 1 ml
- DI water 75 ml
- Kresol red indicator solution 10 drops

- **Titer NaOH c = 1.0 mol/l** _____

Mix the above mentioned ingredients in an Erlenmeyer flask. Now titrate with NaOH, c = 1.0 mol/l from yellow/orange to purple. The titer of the NaOH solution is important for the following calculation of the acidity and needs to be documented. If the results vary around more than one drop (0.05 ml) more or less, it is recommended to make another two titrations.

Calculation of acidity:

Consumption of NaOH: _____ ml

Consumption of NaOH: _____ ml

Consumption of NaOH: _____ ml

Consumption of NaOH: _____ ml

Consumption of NaOH: _____ ml

Average consumption: _____ ml

Acidity = Average consumption of NaOH x Titer

Acidity: _____

Please note: This formula is only valid for the use of a NaOH solution with c = 1.0 mol/l.

Signature: _____

Replenishment Table

- CSN 7001 -

CSN 7012 R

Example:

100 Liter Bath volume

Values related to your bath volume:

_____ Liter

Analysis result tin content **(Sn)**	Addition of **CSN 7012 R**	Addition of **CSN 7012 R** [ml]
20 g/ltr.	1500 ml	
19.5 g/ltr.	2000 ml	
19 g/ltr.	2500 ml	
18.5 g/ltr.	3000 ml	
18 g/ltr.	3500 ml	
17.5 g/ltr.	4000 ml	
17 g/ltr.	4500 ml	
16.5 g/ltr.	5000 ml	
16 g/ltr.	5500 ml	
15.5 g/ltr.	6000 ml	
15 g/ltr.	6500 ml	
14.5 g/ltr.	7000 ml	
14 g/ltr.	7500 ml	
13.5 g/ltr.	8000 ml	
13 g/ltr.	8500 ml	
12.5 g/ltr.	9000 ml	
12 g/ltr.	9500 ml	

The functionality of the bath is critical below a tin content of 12 g / ltr. bath volume, even with replenishment. So it is recommended to exchange the bath.

Calculation:

Addition of **CSN 7012 R** [ml] = (21,5 - **Sn**) x 10 x bath volume [ltr.]

Values still within operating range

Monitoring Record

Bath: Tin bath **CSN 7001**	Bath volume: Liter		

Date	ANALYSIS RESULTS				Analysis Initials	CORRECTIONS		Addition Initials
	Tin content [g/ltr.]	Copper content	Color	Acidity		Addition per bath volume / New make-up Comments	Initials	
	18 - 22 g/ltr.	< 15 g/ltr.	yellow, clear	5 - 7				

ORMECON™ CSN

Frequently Asked Questions (FAQ) / Troubleshooting

Like every other wet chemical process also the **ORMECON™ CSN** immersion tin process requires a thorough treatment. The process security has been significantly increased with the introduction of the innovative **ORMECON™** pretreatment. Nevertheless regular analyses and replenishments are necessary.

With adequate adjustment and use of the process bath and equipment boards treated with **ORMECON™ CSN** should provide a matt, almost white, silvery surface. If this is not the case there are various reasons why.

Following you will find some of the most frequent problems with and reasons for an unspecified condition of process chemicals and/or tin deposit and possible measures to overcome these problems. If the quality of your process baths or the quality of your tin deposit does not change after these measures, please contact your local supplier for technical support.

Problems with process chemistry

Problem	Possible reasons	Help
Color change of the **ETCH 7000** process bath from green to blue	Hydrogen peroxide concentration too high	Analyze and adjust H_2O_2 concentration and also adjust other ingredients accordingly to re-balance the bath
	Concentration of **ETCH 7000 S** too low	Add **ETCH 7000 S**
Sediment in original **PCB 7000 Concentrate** container	Normal precipitation process of dispersions	Re-disperse sediment by stirring or shaking
PCB 7000 Concentrate contains non-dispersible agglomerates	Probably chemical reaction due to pollution of the bath	Do not filter! Contact local supplier
Color change of **PCB 7000** process bath	Probably chemical reaction due to pollution of the bath	Contact your local supplier
Sediment formation in **PCB 7000** process bath	Normal precipitation process of dispersions	Re-disperse sediment by stirring or shaking

Problems with process chemistry

Problem	Possible reasons	Help
CSN 7001 contains white precipitates	Probably tin oxide formation (Sn4+) due to air in the bath	Filter out precipitate, analyze tin content of solution and replenish if necessary
	Precipitation of tin crystals due to temperature falling below minimum solution temperature (< 10°C)	Heat up bath / container to 60°C and precipitates will redissolve
CSN 7001 contains brown precipitates	Probably formation of decomposition products, e.g. due to local overheating	Small amounts should be filtered out, analyze tin content and replenish if necessary. In case of high amount of brown precipitate contact your local supplier for technical support.
Copper content reaches or exceeds 15 g / ltr.		Exchange bath
		Cool down process bath to room temperature and filter out crystals forming during the cooling process. Analyze tin content and replenish if necessary.

Problems with tin deposit

Problem	Possible reasons	Help
Shiny surface	Temperature of **CSN 7001** too low	Control and adjust process temperature
	Immersion time too short (Caution: Solderability endangered)	Increase immersion time
Surface finish stained	Water stains; final rinse contaminated	Clean rinse
	Water stains; no DI water in final rinse	Optimize rinse
	Improper cleaning of boards after one of the process steps	Clean / optimize rinses
	Copper surface contaminated	Check and optimize etching rate
	Copper surface heavily contaminated	Pre-cleaning of boards prior to microetch (e.g. with acid cleaner)
	Interference with solder mask (e.g. migration of solder mask into **CSN 7001** process bath)	Check solder mask for compatibility with **ORMECON CSN** process, ask your local supplier.
Isolated gray or brown stains at specific areas of the boards (e.g. on the edges)	Remains of **CSN 7001** (“depot”) left on isolated areas of the board. They are not rinsed off (Caution: risk of corrosion)	Optimize rinses
Gray deposit right after **CSN 7001** treatment	Improper rinsing	Check and optimize temperature and cleanness of warm rinse
	Acidity of **CSN 7001** too low	Adjust acidity according to process guide
	Capacity of heater too high (eventually combined with improper bath movement, result is local overheating	Optimize heater and / or tank configuration (contact your local supplier for technical support)

Problems with tin deposit

Problem	Possible reasons	Help
Gray deposit right after **CSN 7001** treatment	Natural aging process of **CSN 7001** due to long process operation or frequent temperature cycles because of discontinuous operation	Use **CSN 7030 CAT**
Dark gray or black deposit	Contamination of CSN 7001 with foreign metal ions (e.g. iron, nickel)	Check bath on metal ion contamination. It may be necessary to exchange the bath.
	Contamination of CSN 7001 with CEM-1 base material	Exchange **CSN 7001** bath.
Interference with solder masks (e.g. undercutting, color change, orange peel, complete peel-off, etc.)	Incompatibility of solder mask with **ORMECON CSN** process parameters	Check solder mask on general compatibility, contact your local supplier for technical support.)
		UV post curing of solder mask
		Reduce **CSN 7001** process temperature as much as acceptable (affects plating time and thickness of deposit)
		Reduce immersion times for **CSN 7001** (affects plating time and thickness of deposit)

Specification and Warranty

Ormecon Chemie GmbH &Co. KG guarantees constant composition of the products, and functionality in accordance with the Technical Information up to the time of delivery and opening of the packages. In its designated state **ORMECON™ CSN** permits surface finish properties for printed circuit boards as defined in this process guide.

This does not relieve the user from the need to conduct his own experiments and tests. No warranty is given with respect to properties of products manufactured using **ORMECON™ CSN**.

The **ORMECON™ CSN** products are supplied on the basis of the ”Delivery Conditions of the Electroplating Industry” and the ”General Delivery Conditions for Products and Services of the Electrical Industry”, and especially on the basis of IPC - A 600 C-D.

The user may assume that if the instructions for use are followed precisely, the properties described in the separate data sheet ”Printed Circuit Board Properties” will result.

Necessary Quality Assurance

The user guarantees that the product **ORMECON™ CSN** will be checked carefully immediately after receipt. Any defects found at this point have to be reported without delay.

Contamination of the baths with impurities must be avoided under any circumstances. Fresh water must be used for rinsing. Circulation water must be treated and must not contain any excessive or unusual impurities.

During production the checks set out in this process guide have to be executed at regular intervals. The treated surface area has to be documented.

All quality control and quality assurance steps and results have to be documented in accordance with DIN ISO 9001.

Product liability

We accept no liability for any use beyond our control.

Product liability shall be accepted if a faulty delivery comes up, which could not be detected with receipt check or quality controls during production and which falls within the responsibility of the supplier Ormecon Chemie. Furthermore it is necessary for acceptance of product liability that it can be proven to the supplier that no deviation from the process rules and quality assurance rules took place during use of the products.