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DINO CONDENS-*IT PROFILER*

The perfect method to solder SMD-components at the highest solder quality

Preliminary Owner's Manual

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Mini Vapor Phase – Reflow – Soldering Machine

Ideal for Hobbyist, Laboratory, single pieces, proto-types and small quantities

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The *DINO-CONDENS-IT* Owner's Manual

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Table of Contents

1. Introduction

Thank you for purchasing our IMDES **DINO-CONDENS-*IT*,** the compact reflow soldering machine.

This compact device is sufficient for most reflow solder purposes and is able to accept PCB´s up to double Euro Card size.

Please read the entire instruction manual, before operating the unit safely and optimally.

The operation is basically very simple, but one shall always work with trained people or people who are familiar with this machine.

With careful maintenance and proper operations you will be able to enjoy the benefits of this machine for many years.

The system is intended for the soldering of printed circuit boards or ceramic substrates with leadless components (SMD) up to a temperature of 240 °C (464 °F).

Other applications are not permitted.
The operating safety of **DINO-CONDENS-*IT*** supplied is guaranteed only when used as directed.
The limits specified in the technical data shall NOT be exceeded under any circumstances.

1.1 Technical Data:-

Power Supply	Single phase 220-240 Volt / 50-60 Hz
Power Connector	Three Prong Power Connector
Max. heating capacity	2500 Watt (ca. 12 A)
Dimensions.	**840 x 640 x 460 mm *(L x W x H)***
max. solder product format	**580 x 460 x 20 mm** (***L x Wx H)***
Standard cycle time	15-25 Minutes ***(including heating up & cooling down***)
Standard Reflow Time (*TAL Time Above Liquids)*	3 – 50 Seconds ***(max 70 Seconds)***
Process temperature **(depends on medium type)**	150 °C up to 240 °C = 302 °F up to 464° F
Weight	12 kg
Solder Profiles	Adjustable temperature profiles in the pre-heating zone(CVPRS*)
TAL Time Above Liquid	Adjustable TAL Time Above Liquid
ATS	Anti Tomb Stone modus (ATS)
Micro USB interface	for the transfer of solder profile data to PC
Cooling	Forced Air cooling down to 70°C = 158°F
Storage Temperature	-1°C to +70 °C 30,2 °F to 158°F
Heat Transfer Medium	GALDEN LS with the boiling temperature as needed (max. 240 °C max. 464 ° F)
Medium basic filling quantity	ca. 1648 ml (1.65 Liter) 3 Kg GALDEN

1.2 Scope of the DINO-CONDENS-*IT* :

- Soldering of single pieces and small numbers of SMD PCB's.
- Safe and high quality (lead-free) soldering of SMD prototypes PCB's.
- Quality control printed circuit boards and solder pastes.
- Repair (de-soldering and soldering) of SMD components (large).

1.3 Introduction to Condensation soldering:

Condensation soldering also known as "Vapor Phase Reflow Soldering" is the use of hot vapor, submitted by a special heat transfer medium, to transfer heat using the condensation principle on to a PCB with SMD components, which then will be reflowed

Condensation soldering is a known technique that was first applied in the early eighties when the SMD technique was introduced.
The heat transfer medium applied in those days had many disadvantages, mainly the chemical used were harmful to health and the environment.

As a result, the condensation soldering lost popularity and infrared soldering became the standard.

By the arrival of **Perfluorpolyeter *,** the condensation soldering was rediscovered as an alternative to the infrared "reflow" soldering.

Perfluorpolyeter * is manufactured and marketed by the company Solvay Solexis under the trade name **Galden**.

1.4 HOW DOES IT WORK?

The heat transfer medium is the chemical and electrical neutral liquid **Perfluorpolyeter *.**
In a closed space is a chemically inert and electrically neutral liquid heated to the boiling point.

When the liquid temperature exceeds the boiling point, it starts to evaporate and forms a saturated vapour above the liquid with practically the same temperature as the boiling liquid.

When the assembled printed circuit boards is brought into this space, the vapor will condense on the surface, because the circuit board has a lower temperature than the saturated vapor, and transfer the vapor's temperature to the PCB. This will happen until the entire surface of the circuit board will have the same temperature as the vapor.

After that, the covering hot liquid will evaporate again. This is the same principle as if someone with glasses from the cold outside air enters a warm room. At first the glasses will be covered by condensation than drops gradually will evaporate.

The soldering alloys which have a lower melting temperature than the temperature of the vapor will melt and then become entirely liquid.

When the heat transfer medium cools down, the solder solidifies, and then circuit board can be removed carefully from the process chamber.

******Perfluorpolyeter** * liquid polymers, which are exclusively built of carbon (C), Fluor (F) and oxygen (O) atoms.
The connections present in the molecules are very stable. They belong to the most stable connections in the realm of carbon chemistry.

1.5 Features:

- High temperature resistance.
- Under normal circumstances, inert to all chemicals, and does not react with acids alkaline or strong oxidizers (substances that cause oxidation).
- Tolerates all known plastics, metals and elastomers.
- Highly resistant to reactive chemicals.
- The Fluor atoms bound in the polymer chain in the framework of the display helps protect sensitive C-C connections against chemical and thermal attack.
- Good dielectric properties.
- Low vapor pressure.
- No flash point.

- High vapor density.
- Excellent heat transfer coefficient.
- Low surface tension.
- Good wetting properties (film adhesion).
- There will be no harmful substances released during the process.
- No chemical activity (perfluoriert, i.e. no H-or CI-Atom).
- During the heating of the heat transfer medium under normal atmospheric pressure, all types Galden are thermally stable.
- Does not damage the ozone layer.

1.6 Why condensation soldering?

For contemporary complex BGA, FPGA and the new generation complex to solder SMD components, this solder method is the only method which is relatively simple, even for the amateur and hobbyist to achieve **perfect** solder results

Moreover, one can also easy remove, without damaging, major components such as FPGA's using simple auxiliary tools.

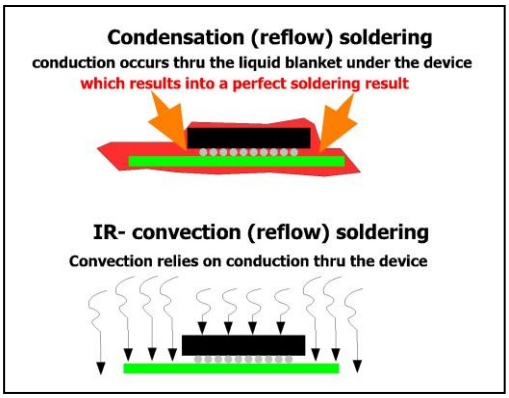
Reflow Soldering (called reflow technique) of Printed Circuit Boards with SMD components are/were mostly done in an infrared oven, possibly, with nitrogen as shielding gas to prevent oxidization of solder joints.

On the introduction of lead-free soldering, it was found that this infrared soldering was sensitive to the occurrence of defects at the connection between the components and the PCB.

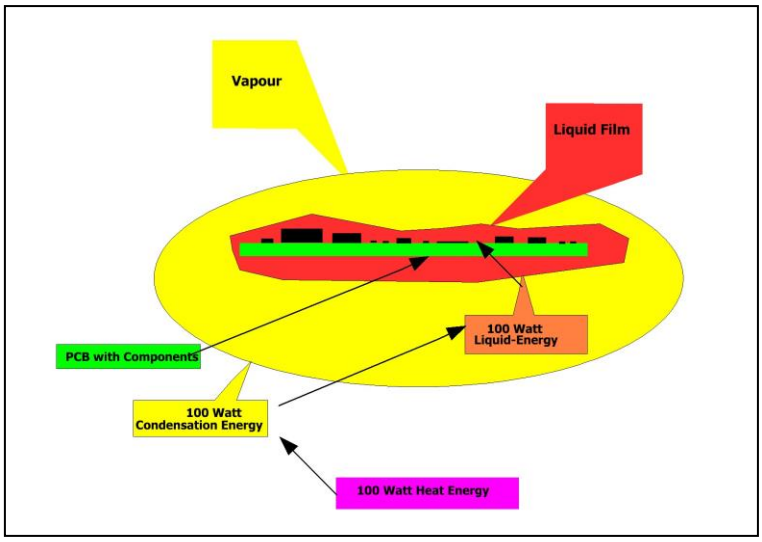
Due the increasing requirements for higher quality and reliability of circuit boards, search was launched for better solder methods and the "vapour phase" condensation soldering was rediscovered as an alternative method to the infrared "reflow" soldering.

1.7 Benefits of condensation soldering

Soldering takes place in a space filled with inert gas, so no oxygen or other gases will be coming in contact with the soldering surfaces and components. This is why a shielding gas such as nitrogen is no longer needed. The heat transfer takes place by a fluid film, which is much more direct and more effective than radiation or air heating.



This creates an extremely high efficiency. Overheating is impossible because the temperature of the vapour will never exceed the boiling point of the liquid, which is fixed by the chemical composition of the liquid.



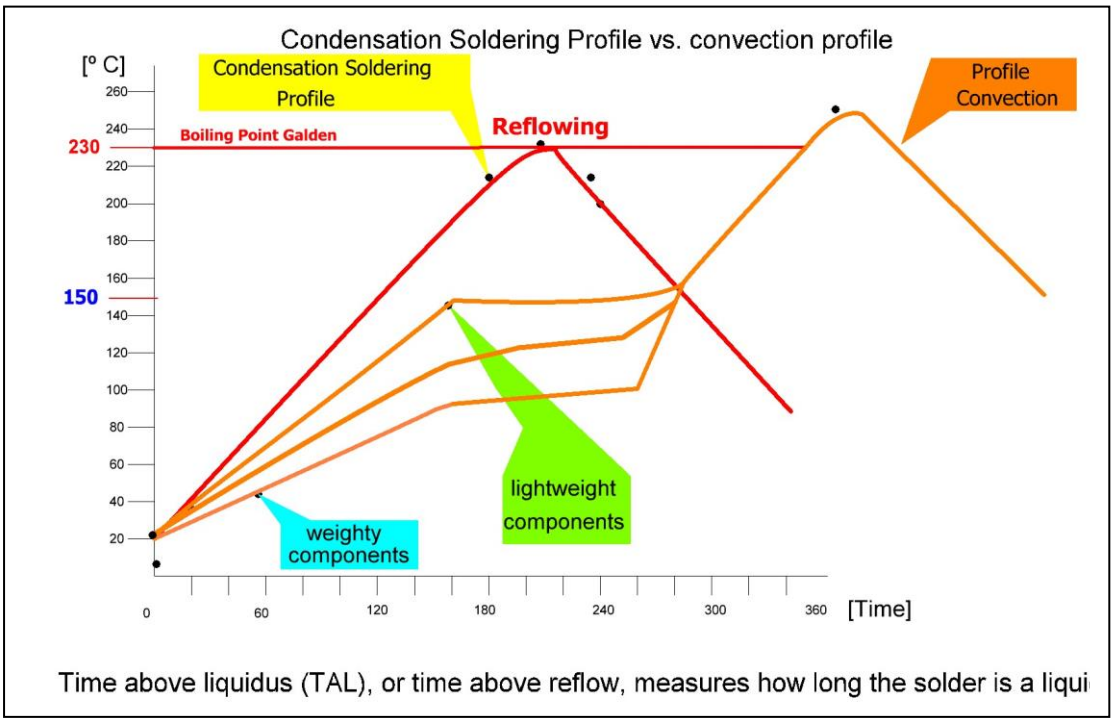
Extremely high efficiency
100 Watt heat energy from heating elements

Will generate:

- 100 watt condensation energy (vapor)
- 100 watt condensation liquid (liquid film during condensation)

1.8 The advantages at a glance:

- Environmentally friendly process.
- Repeatable soldering process conditions.
- No overheating of the PCB and its components.
- Uniform warming of the PCB regardless of the shape or colour.
- Absolute uniform heating of the PCB.
- Condensation vapour causes a thin liquid film that penetrates to the smallest openings resulting in reliable soldering of BGAs and FBGAs.
- Good reproducible temperature profiles.
- No oxide formation.
- No protective gases required.
- No more labour-intensive procedures to determine the desired temperature profiles.

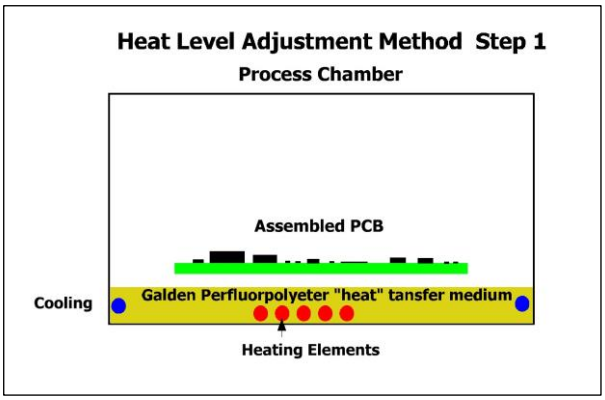


1.9 HEAT LEVEL ADJUSTMENT METHOD

The above described procedure of the **JUMBO-CONDENS-*IT*** condensation soldering machine works according to the "HEAT LEVEL ADJUSTMENT METHOD".
Refer the picture below.

Step 1

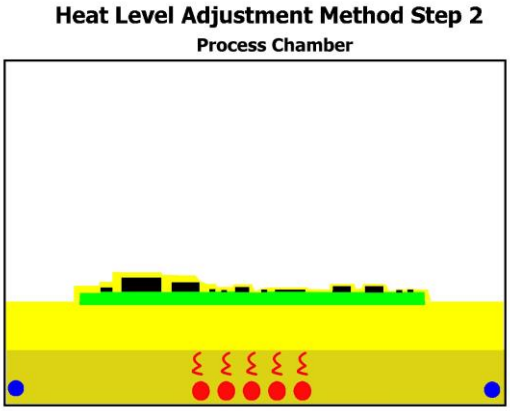
The heat transfer fluid (Galden) is not active.



1) The circuit boards are in the process chamber, a few centimetres above the heat transfer liquid at the bottom of the process chamber.
2) Transfer liquid is heated to the boiling point.

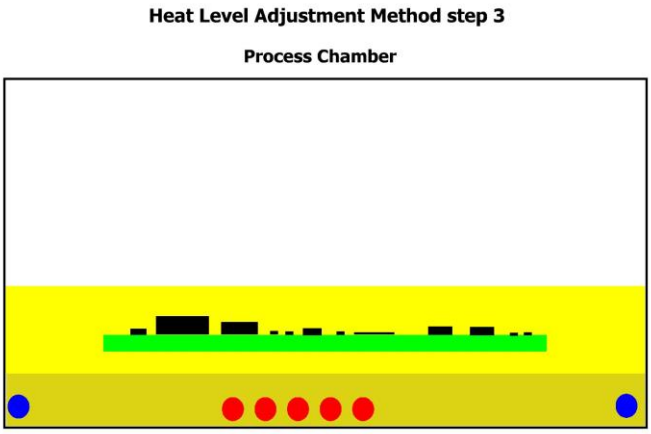
Step 2

The heat transfer liquid (Galden) is active.
It boils at 230 °C and is in active phase.
PCB with components is in the condensation vapour at 230 ° C.
(Galden LS 230 boils at 230 ° C for lead-free applications.)



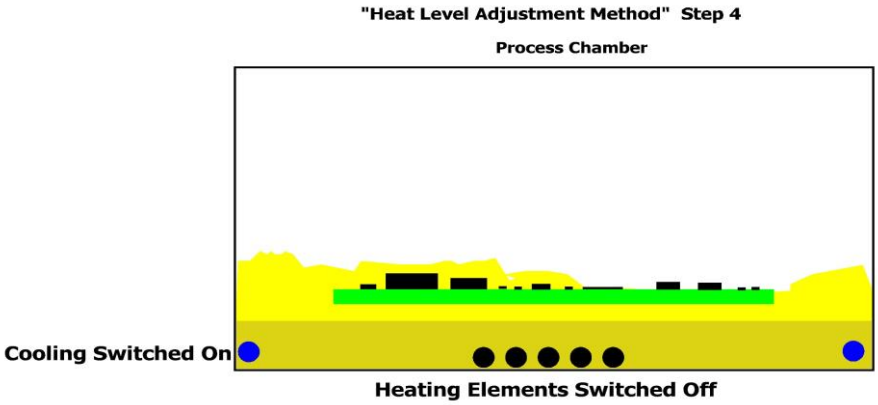
1) The liquid starts to evaporate and the vapour starts to rise to the assembled PCB.
2) The PCB surface will condense the vapour, because it has a lower temperature than the vapour.
3) Once the PCB temperature equals that of the vapour, the reflow process will take place.
4) The reflow soldering time will take between 60 to 90 seconds and the total cycle time including loading, processing, cooling and unloading will be approx. 10 minutes.

Step 3



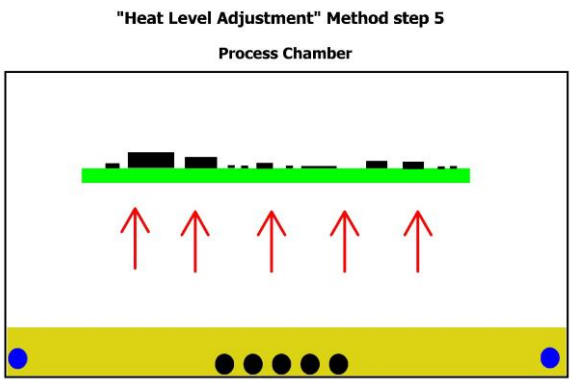
1) Temperature of the assembled PCB reaches temperature of the transfer fluid.PCB temp. =Vapour temp.
2) Vapour starts to rise again.

Step 4



1) Reflow process will be terminated by switching off the heating elements.
2) Blowers placed under the process chamber will start to cool the process chamber and its transfer medium

Step 5



1) After the cooling process, the PCB can be removed

1.10 System Description DINO-CONDENS-*IT*.

The **DINO-CONDENS-*IT*** is intended to use for reflow soldering printed circuit boards on a smaller scale, i.e. for individual pieces, prototypes and small series run.

It is specially designed to use for soldering of prototype PCB's using BGAs, LGA's components and stacked arrays.

Due the small footprint of the **DINO-CONDENS-*IT***, forced air cooling and single phase power, you will able to use the unit at almost any that place.

After proper installation and operation, **DINO-CONDENS-*IT*** will give high quality solder joints at all times.

Appropriate frequent checks and maintenance are required, due to the low GALDEN capacity.

Other applications than those described in this manual are not allowed!

1.12 safety Features:

1.12.1 Process chamber cover sensor.

A micro switch monitors if the process chamber cover is present and closed.

If you open the cover before the end of the process, the system is switched off.

When the there is no cover on to the process chamber, it is not possible to start the process.

1.12.2 Temperature Vapor/ ceiling height sensor.

The height of the vapor in the process chamber is controlled by a thermal sensor K-Element (T1) and a digital controller.
When the vapor maximum height is reached, the sensor automatically switches off the heater and automatically starts the cooling process.
The end of the cooling process is reached when the fans have stopped.

1.12.3 Over heating sensor of heating surface temperature (fail safe)

A sensor/switch is mounted underneath the bottom of the process chamber to prevent overheating when there is no heat transfer medium (fluid) at the bottom of the process chamber.

Caution!
In case of over temperature you must wait until the switch is closed again. Then you may fill the process chamber with the transfer medium.

1.12.4 Cooling:

There is **ONE** large fan below the process chamber to cool the PCB and liquid in the chamber.

1.12.5 Transport of the DINO-CONDENS-*IT*

The system must not be tilted during transport.

If the **DINO-CONDENS-*IT*** will be transported over greater distances, **and it filled with Galden**, it should be secured on a pallet or similar platform to prevent slipping or tripping over and losing the expensive Galden.

Caution: May be transported only in the cold state!

1.13 Inspection, Unpacking, Installation & Commissioning

1.13.1 Unpacking and inspection for transport damage.

Please check the system on delivery for transport damage.

For Visible transport damage, immediately inform your carrier and **make a note on the delivery note of your carrier.**

Later, hidden transport damages must immediately put in writing to the freight forwarder and us.

Contents of the Carton

Inside the carton you should find the following items:

Table 1: Contents of Carton for each* DINO-CONDENS-*IT

"**DINO-CONDENS-*IT*,**-"	1 no.
Lid/Cover with glass window	1 no.
This owner`s manual	1 no.
AC Power cable	1 no.
Dipstick to measure the Galden Level in the process chamber	1 no.
Pump = 100 ml large hypodermic syringe for emptying	1 no.
Initial filling GALDEN (minimum quantity ca. 1648 ml 1.65 Liter)= 3 Kg GALDEN	1648 ml**.**
Gloves	1 set.

(Other items may be included that are not listed above. See the packing list in the carton for all the items in the carton).

1.13.2 Installation and commissioning

The **DINO-CONDENS-*IT*** should be stored in place and operated where no excessive or condensing humidity is present and the ambient temperature should never be below freezing point.

As the unit is air cooled, a higher ambient temperature will lead to a reduced cooling capacity and thus extend the cooling time.

The **DINO-CONDENS-*IT*** must have a free space of at least 30 cm on both sides (ventilation slits side) to aid sufficient air circulation.

Be warned that at the left and right side of the device are ventilation slits, where for a short time (immediately at the end of a solder process) up to **140 °C 284 °F** warm air can be blown out!

The device should be operated only on horizontal surfaces which are firm and non-slippery.

Chose a solid (working) table top with good lighting conditions and near a window which can be opened for optimal ventilation, because heated solder paste will create pungent fumes.

The 4 rubber feet under the unit aid in exchange of air underneath the **DINO-CONDENS-*IT***.

1.13.3 The stainless steel lid with glass observation window

GALDEN is an expensive liquid, and hence we have optimized the **DINO-CONDENS-*IT*** to have the lowest possible evaporation loss.

This includes also proper handling!

-Open the lid only after the blower has been stopped after the cooling stage.

-Opening the **DINO-CONDENS-*IT*** at reflow temperature will increase the loss of GALDEN, as GALDEN steam could escape from the chamber.

The lid is made of a stainless steel and has an integrated heat resistance glass window (up to 700 °C =1292 °F) to observe the reflow process.

1.14 Handling tips:

Keep the stainless lid with glass observation window vertical above the tank, with a corner down, so the GALDEN condensate left will flow back, in drops, in the process chamber.

- A piece of cleaning paper or kitchen roll is a wonderful resource and should be always kept at hand to wipe drops right away.

1.14.1 Handling of the DINO CONDENS-*IT*

With the construction of **DINO-CONDENS-*IT*** great attention was given to a simple reliable and straightforward design for ease of handling and low cost of ownership.

1.14.2. General operating instructions

When loading the **product carrier**, care should be taken that the maximum dimensions and weight of the PCB or device are not exceeded.

The PCB/ Device may not stick out over or under the **product carrier.**

The **DINO-CONDENS*-IT*** stainless steel lid should be opened only to insert or remove a PCB to prevent unnecessary loss of Galden.

The minimum level of the process medium must be monitored by the operator with the help of the Dipstick (brass tube).

1.15 safety instructions

Please read carefully the safety instructions, to avoid damage to humans and DINO-CONDENS-IT.

- Prior to operate the **DINO-CONDENS-*IT*** you **MUST** be read the **Owner's Manual**.
  All information/operating instructions must be read carefully.
- Never try to access the hot system or open the unit lid when the system is in operation.
  The vapor is invisible and can cause serious burns.
- Do not operate **DINO-CONDENS-*IT*** without process media.
- The lid of the **DINO-CONDENS-*IT*** must always remain closed during operation.
- Use the supplied cotton gloves to remove the soldering material.
- The PCB´s and work piece carrier are still not completely cooled to temperature after the cooling has been stopped!!
- **DINO-CONDENS-*IT*** must be operated only as mentioned in this manual!
- Installation, operation, maintenance must be carried out only by qualified and trained personnel.
- Untrained persons, mentally handicapped and children must not operate the **DINO-CONDENS-*IT*** !
- Comply with the electrical requirements!
- The workpiece carrier and the PCB´s that comes out of the **DINO-CONDENS-*IT*** will still be hot.
  Caution: burning risk! *(Use the cotton hand shoes delivered with the machine)*
- **Never use** the DINO CONDENS-IT in case of machine failures, errors and or defects these must be first
- Eliminated before running the machine for production.
- Immediately switch off the **DINO-CONDENS-*IT*** from the line voltage in case of faulty operation and damage and secure the main switch against uncontrolled restart!
- Open the system only after complete cooling.
- Disconnect the **DINO-CONDENS-*IT*** from the power during maintenance work.
- **NEVER** by-pass, Modify, Change or manipulate the protection devices.
- The **JUMBO-CONDENS-*IT*** must not be modified or altered in any way without prior consultation with IMDES CREATIVE SOLUTIONS.
- Use personal protection while operating the system.
- Observe all applicable national regulations and safety regulations for accident prevention and environmental protection.
- Operate the system only with completely enclosed area and not in the open.
- Electrical components are NOT protected against splashing water, appropriate protection measures must be taken by the operator.
- Do not operate the unit with a lid with broken glass Window.
- There is danger of cutting on broken glass of the lid. Wear suitable protective gloves when handling broken pieces of glass.
- The Safety manager has to instruct the operator on the risk of injury if he operates the machine with a damaged or broken window.
- Use only approved heat transfer mediums which are approved by IMDES CREATIVE SOLUTIONS
- Process mediums, substances and materials must be investigated prior to use on their process capability.
- Be aware of slipping danger by accidental leaking of reflow medium on the ground.
- Cordon off the affected area and ensure that leaked medium is absorbed with a suitable bonding agent and removed, or cleaned up.
- Hot medium has a high risk for burns, the operator must, therefore, let the media cool down.
- **DO NOT Touch hot medium** in any case. Allow the **DINO-CONDENS-*IT*** to cool down completely before removing it from the system.
- Wear sealed protective clothing and gloves during cleaning and provide adequate ventilation and exhaust.
- Read and follow the safety instructions and regulations of the used cleaner and the used medium.
- To drain the used medium USE suitable containers. Ensure that the used medium dumped into the drain or into open field.
- Read the safety and disposal instructions from the manufacturers of soldering pastes, PCB´s and component.
- Eating, drinking and smoking during operating near the **DINO-CONDENS-*IT*** is not permitted.
- Wash your hands after working with the system thoroughly with Soap and water.
- If the system should be scrapped, the process fluids have to be drained and disposed of as per regulations.
- Filter materials must be disposed as hazardous waste.

1.15.1 Filling with GALDEN

Take off the stainless steel /glass lid of **DINO-CONDENS-*IT***.

Fill the stainless process chamber until the middle of the bottom the stainless process chamber is completely covered with approx. **1.65 liter Galden = 3 kg** such that there is at least **8- 10 mm= 0.31"-0.39"** of Galden in the bottom.

Use the supplied dipstick (brass or aluminum tube)

Never fill the process chamber if the temperature of the liquid is above 100 °C. 212 °F

1.15.2 Effect of adding large quantity of Galden to the process chamber:

A larger capacity leads to slower heating and cooling and this results in higher energy consumption, but otherwise has no adverse effect on the soldering process.

1.15.3 Effect of adding too small quantity of Galden to the process chamber: DANGEROUS!!!.

As the bottom of the process chamber, when heaters are present, sometimes bulges out into the chamber, it may occur, that at some point of time these bulges will rise above the liquid level and cause the temperature to rise above 300°C. This may result in damaged heaters and release of dangerous fumes due the Galden **See Message below.**

Warning!

GALDEN decomposes when heated above 295 °C =563 °F into harmful components!
The DINO-CONDENS-*IT* does NOT check automatically if there is sufficient level of GALDEN in the process chamber.
Therefor you have to check the GALDEN level on a regular and conscientious basis with the Supplied dipstick (brass tube/aluminium).

If you notice low level of Galden during the soldering process, press **stop/cooling** button, leave the glass lid closed, and keep a distance from the unit and ensure good ventilation. This will lower its temperature as quickly as possible.
When the machine has **cooled down to less 100 °C = 212 °F** , you can refill GALDEN

1.15.4 Open the lid

The lid of the **DINO-CONDENS-*IT*** is an important part of the safety, and should always be closed if no manipulation in the process chamber (inserting/removing of boards, cleaning) are required.

Due the built-in micro switch the soldering process could be only be started when the lid is closed!

The other advantage of the glass in the lid is to minimize the escape of GALDEN vapor while allowing observation of the soldering process, without breathing the ascending vapors.

Never open the lid during the process of soldering! The GALDEN vapor escaping out of the chamber is extremely hot and can cause severe burns! (In case of an emergency exercise great caution while opening the lid in mid process.)

If you open the lid or move during an ongoing process of soldering the soldering process will be interrupted and the heating system switched off!

1.15.5 Removing Soldered parts:

The lid may be removed when the fans have stopped at the end of the cooling process; the soldered parts on the **product carrier** are cooled down to about 70 °C. – 158 ° F
As the soldered parts and **product carrier** are not at room temperature, use cotton gloves supplied to remove the soldered part and product carrier.

We strongly discourage the use of pliers, tweezers or similar tools to remove the soldered parts as they may slip from the tool and fall into the liquid Galden.

In case the soldered part falls into the liquid Galden, do not try to "Save" the soldered part fallen in to the GALDEN. The result for such actions will be burns.

As the liquid GALDEN has now cooled on a non-critical components temperature of 160°C=320°F (or less), the components on the circuit board will suffer no thermal damage.

Simply turn off the **DINO-CONDENS-*IT*** and wait until the machine has completely cooled off.
No you can safely remove the soldered part.

1.15.6 Control panel

2.0 Operating the DINO-CONDENS-*IT*

2.1 The proceedings at the IMDES CONDENS-IT Profiler

1. Turn on the main switch.
2. Blue LED at the front of the machine will turn on after switching on and the green LED at the control panel will start to glow a few seconds later if the lid is in place on top of process Chamber.
3. Open the cover of the system, and then place the work piece onto the **product carrier**.
4. Close the cover lid.
5. Press the **Start switch** Green Button to execute the "reflow process".
6. **Yellow** and **RED** LED Start to Burn
7. **When the RED LED does not start to burn the LID is not good closed micro switch is not activated and the heater will not switched in**
8. System heats up the applied "heat transfer" liquid to its boiling point. The resulting vapour rises up and condenses on the surface of the work piece to be soldered and transfers its thermal energy to the work piece.
9. The solder Oxidation is avoided as vapour is chemically inert and no oxygen present in this zone. The work piece surface is heated to the temperature of the boiling liquid vapour. The temperature of the vapor is determined by the temperature of the boiling point of liquid and will not exceed.
10. After reaching the boiling temperature (= the vapour temperature) of the liquid, vapour rises until it reaches the vapour temperature sensor and the heating elements are turned off.
11. The cooling fans start cooling process chamber and as the temperature of the vapours come down, it starts to condense to liquid form and collects at the bottom of the process chamber. The remaining condensate remains on the work piece and will evaporate by the own heat of the work piece.
12. When the blowers are stopped the cooling procedure comes to an end.
13. Next open the lid of the system and **remove the soldered work piece** from the **product carrier**.

The entire procedure takes approximately 10 to 15 minutes.

The consumption of the Galden medium is minimal, especially if the work piece is adequately cooled after reflowing and the lid remains closed during the process.

In the **DINO-CONDENS-*IT*** is a micro switch built into the top of the unit so the "reflow process" can only be started up if the lid is closed.

Basically no harmful vapours are generated during the reflow process other than the flux fumes during the reflow process, which can be exhausted out.

2.2 Programming and modifying the Soldering Profiles

Your **CONDENS- IT Profiler** reflow soldering machine is from the factory pre-programmed for use with Galden **230** lead-free applications.
If you have ordered the machine for for lead containing solder alloys, the machine is pre-programmed for Galden **200** or Galden **210**.

- **The "default" Preheat heater temperature** is set to: **150 °c (**Galden **230** lead-free applications)

- **Preheat heating "Default Time"** is set to: 30 seconds (Galden **230** lead-free applications)

- "**Default boiling Time" TAL** "Time Above Liquid" is set to: 30 seconds.

- "**Default value"** AntiTombStTime + menu (not activated) and is set to 0 Sec but you can activate it by changing the time span from 0 Seconds to for example into 30 seconds

- **"Default value"** of the tomb Temp + 200 ° C (for lead-free application)
  "Default value" of the tomb Temp + 160 ° C (for leaded applications

2.3 OPERATING & PROGRAMMING THE MACHINE

Power up the Machine by activating the Black Switch on the left side at front of the machine
The **Blue LED** under the main power switch will be **illuminated** now!
On the display appears :
IMDES CREATIVE SOLUITIONS
Copy right Paul Keizer Ver. 1.15 ***(or an other Ver. = Version release No.)***

Gal 230 ° Pht 150
Prof 30s GrB=ok

When pressing the **green key**, the soldering process starts with the last saved profile in Eeprom and starts to warm up the machine to go through the entire solder and cooling process.
If you want to have a different solder profile.
You need to **press the RED key!**
Then appears in the display
Galden boiling point = (boiling point Galden)
PLEASE NOTE!!! ***This will be determined by the type of Galden you want to use:***

LS 200	Maximum solder temperature 200°C	for lead containing solder alloys
LS 210	Maximum solder temperature 210°C	for lead containing solder alloys
LS 215	Maximum solder temperature 215°C	for lead containing solder alloys
LS 230	Maximum solder temperature 230°C	for lead free solder (SnCuAg)
XS 235	Maximum solder temperature 235°C	for lead free solder (z.B. Sn100C,SnCu)
HS 240	Maximum solder temperature 240°C	for lead free solder (z.B. SnCu)
HS 260	Maximum solder temperature 260°C	for lead free solder (special lead free product)

2.4 Attention!

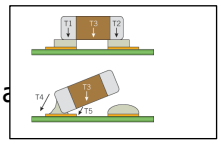
If you have entered the new values, you want in the menu, you **must press** the **green** and **red key simultaneously** to confirm and entering in to the next menu.

If you **do not want to change anything in a menu,** you must **also press the green** and **red key simultaneously** to skip and entering into the next menu.

The last saved values in the EEPROM are indicated in the display.
For example:

GaldenBoilingPt+ 230 °C	GaldenBoilingPt the boiling point of the Galden to be This can be changed by using the **green** and **red key** *(in steps of 5 degrees from 200 °c <-> 260 °c)* • **Green Key** for lower value • **Red key** for a higher value
Profilechoice + 0 sec -	**Profile Choice** Sets the preheating time of the solder profile in steps of 30 seconds of entry (0 seconds is a lineair profile)
PreheatTemp + 150 °C -	**PreheatTemp** PreheatTemp in this menu you can change the preheating temperature in steps1 degree.
BoilingTime + 30 sec -	**BoilingTime** ***(=this is time above liquid)*** In this menu you are able to enter the boiling Time Above Liquid (TAL) in steps of 1 second when the galden vapor has reached its boiling temperature (for example 230 degrees)

2.5 The **Anti-Tombstone** mode **(ATS)** is not activated by default!



(ATS) can be activated if he tombstone effect occurs during the solder reflow process

If you do not want to change anything in the menu AntiTombStTime you need to press the **green** a simultaneously to enter the next menu.

If you want to **activate the Anti-tombstone mode**, you must enter **values** into the *AntiTombStTime"* **Menu**

AntiTombStTime + 54 sec -

You have to enter a value > then 0 Seconds.

The total "*AntiTombStTime"* must be entered in increments of 1 Second

Then press **green** and **red key** simultaneously and you come into the menu

AntiTomb Temp + 200 ° C -

AntiTomb Temp Default values in the menu are already entered:**:**

AntiTomb Temp + 200 ° C *(for lead free solder alloys)*

AntiTomb Temp + 160 ° C *(for lead containing solder alloys)*

If you do not want to change anything in a menu, you must press the **green** and **red keys** simultaneously to enter the next menu.

Write to Eeprom? Red button= Yes	If all data is entered correctly, you can save the data in EEPROM by pressing the **Redbutton**

The machine will then automatically switch to the Reflowsolder mode according to the parameters you have entered.

If you do not wish this

Press the **black RESET** button the machine will restart.

The display then displays the boot menu showing the last saved data (for example).

Gal 230 ° Pht 150
Prof 60s GrB=ok

By pressing the Green key the reflow process will start using the saved data in EEPROM.

2.6 Handcontrol Mode

When the **AUTOMATIC reflow process is running** you can go over from automatic mode in to hand control mode.
By pushing the **green button** the machine will go automatically in the cooling modus and the blowers will switch on and will cool down the machine.
IF you press the **red button** the the machine will be switching over in the lineair reflow solder mode and switch off to cooldown at 230 C degrees or 220, 210, 230 degrees depending which value was stored in EEPROM.

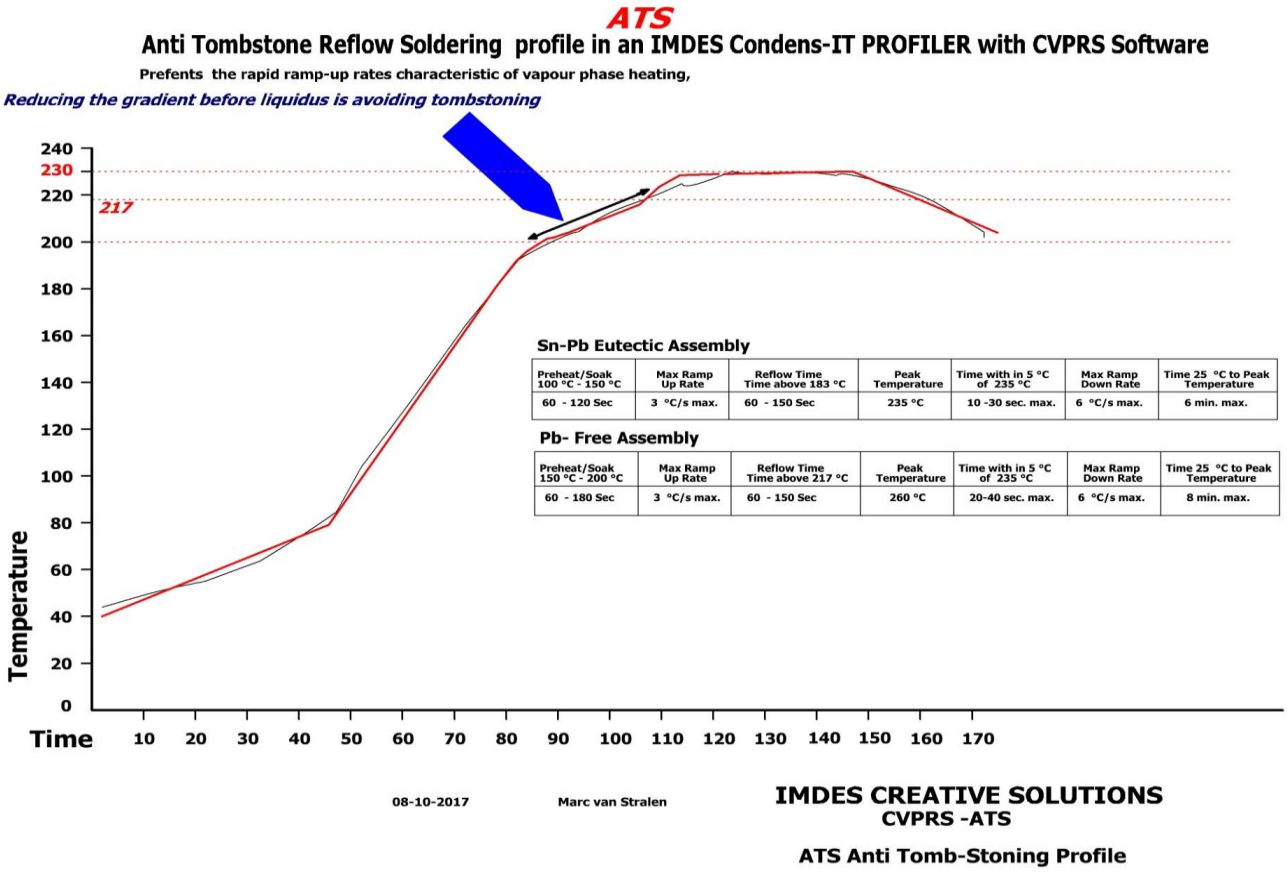
4.0 Overheat protection

During the relflow modus the machine is continually sensing the Galden Temperature and automatically switch of de heaters and starting the cool down if the Galden temperature exceeds its limits

ANTI TOMBSTONE REFLOWING PROFILER WITH

CVPRS

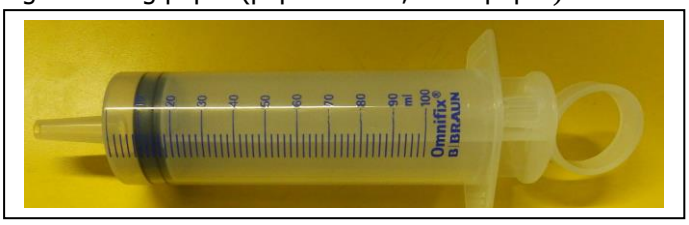
Creative Vapor Phase Reflow Software



2.7 Procedure to drain Galden and clean medium with filters:

Preparatory steps:

The **DINO-CONDENS-*IT***,-must be cooled to room temperature.
You need a bucket, for the GALDEN with a capacity of approx. 0.5 liters, (not delivered with the machine). An old cheap plastic bottle will do.
You will also need enough cleaning paper (paper towels, toilet paper).



2.7.1 How to proceed:

1. Switch the **DINO-CONDENS-*IT***, to off with the main switch.
2. Remove the power cable to the **DINO-CONDENS-*IT***, to avoid damaging the connector during draining.
3. Remove the product carrier from a stainless process chamber.
4. Tilt the **DINO-CONDENS-*IT*** by placing some flat objects (like books or blocks of wood) under one side of the machine such all the Galden liquid flows to one side of the chamber.
5. Push the piston of the large syringe (100 ml) all the way in.
6. Place the syringe on to bottom of the process chamber so it touch is the lowest point of the process chamber bottom, where the GALDEN has been flowed together.
7. Now pull the plunger of the syringe. The GALDEN is thereby sucked in and stored in the syringe.
8. Empty the syringe into the empty bucket/bottle by pressing the plunger of the syringe.
9. Repeat the procedure until process chamber is empty
10. When the process chamber is empty, place the **DINO-CONDENS-*IT*** in horizontal position.
11. The **DINO-CONDENS-*IT*** process chamber which is now empty, can wiped clean with cleaning paper.

2.7.2 .<u>Medium filtration</u>

You can reuse the used Galden in the bucket/bottle by filtering it by passing it through the cheap coffee filter paper.
After the passing through the filter into a suitable container, you can put the Galden back into the system.
If you prefer you can, of course, discard the Galden.

2.7.3 Cleaning the inside of the process chamber:

For the cleaning of process chamber you will need appropriate solvents which are capable of dissolving the solder paste flux residues and other dirt and to be able to wipe it out.
Never use never aggressive detergents. Use Isopropyl alcohol (rubbing alcohol, abbreviated IPA) or alcohol.
Empty some solvent in the tank and use a brush to wash the process chamber walls. Be careful with the process temperature sensor.
Avoid bending the temperature sensor if you need to clean below this! Pull a thin rough cloth between tank side and sensor several times, avoiding touching the sensor. If necessary, let it soak in for a few minutes and repeat the cleaning.
Do not close the lid on the tank immediately. Allow the solvents used to evaporate out of the process chamber completely before replacing the lid, as there may be a risk of explosion if is there is solvent present in the process chamber.

2.8 Care of the Cabinet

For the cleaning and care of the housing, use a Microfiber cloth, moistened with a little soapy water or only water. Do not use dripping wet clothes or sponge, it could water to penetrate into the **DINO-CONDENS-*IT*** electronics.

2.9 Model variants

In addition to the **DINO -CONDENS-*IT***, there's also the smaller **MINI-CONDENS-*IT* & JUMBO-CONDENS-*IT*** available.
Please contact us for any further details.

3.0 warranty

The warranty for the soldering system is 12 months from the delivery date.
The warranty is void if:

- -The machine is not operated as per the procedure detailed here in and/or operated without the liquid Galden filled in the process chamber.
- - If any modification are carried out on the machine without the written consent of IMDES CREATIVE SOLUTIONS.
- If the machine is used for any other purpose than what is described in this operating manual.

The general business conditions apply of **Condensation Soldering Machines**
Of the company IMDES CREATIVE SOLUTIONS
For purchased parts the warranty conditions of the manufacturer/supplier are valid.
Location for guarantee / warranty is exclusively at our business location in
Bad Bentheim, Germany.

During warranty claims the machine has to be sent to our business location well cleaned and empty. The freight to and from our works will be **on the expenses of the buyer/customer**.

3.1 Lead-free soldering

With conventional soldering technologies there are substantial problems when using lead-free solder alloys in the production for lead-free SMD products. Although neither the handling nor the use of lead-free pastes is the actual problem. Any bad wetting behavior may be counteracted by installing suitable inert gas equipment and by using suitable fluxes. However, the components, potting compounds, printed circuit boards, plastics, etc., simply do not meet any more the required conditions for a lead-free soldering process. All boundary parameters are infringed upon, i.e. maximum temperature, time above liquids, maximum dwell times in the oven, etc. With convection machines all the process limits have been reached. The air temperatures may not be increased further because this would exceed the maximum temperatures and the temperature differences on the printed circuit board. Neither may the machines be lengthened further as this would increase the times above flow point temperature and the maximum dwell times. Even an increase in the speed of the air-flow is out of question as this will displace the components. Thus, in mass production one may be forced – if one maintains the present soldering technology, to tailor any critical materials to the process. However, from today's point of view this results in enormous complications and overhead. Contrary to the costs of the pastes, which represent only a fraction of the costs of the assembly – a doubling of the costs of the components increases the actual production costs enormously. This, consequently, will create a substantial problem in earning capacity. It is here where the vapor-phase - as the only soldering system - offers the inestimable advantage to continue using all hereto known and processed materials. The costs of the machines are comparable and in some cases even lower than those of well-known convection systems. Therefore, the vapor-phase offers enormous competitive advantages in the production of lead-free products.

Profile of paste containing lead. 200 °C end temperature
Profile of paste without lead. 230 °C end temperature

3.2 Void-free soldering

A critical property of solder-joints - from certain sizes onwards, is to form voids, which may lead to functional problems and questions as to their durability. E.g. the solder-joints of high-capacity processors may not dissipate their waste-heat correctly any more. Often only a fraction of the capacity of high capacity thyristors may be used. Yet, the trend continues towards even higher integrated circuits with power components on the printed circuit boards. All this requires furthering reducing the formation of voids. The vapor-phase process offers inestimable possibilities to reduce drastically the formation of voids. Studies have verified that assemblies, which have been processed in a vapor-phase system, produce only a fraction of voids -compared to infrared or convection processed boards. The reason for the small amount of voids is the absolutely oxygen-free vapor-phase soldering process. As soon as there is an oxide film on the molten alloy, it is like a skin which inhibits the escape of the voids out of to the solder-joint. This void behavior is problematic and particularly so with lead-free soldering. Due to the bad wetting of the pastes the voids are not able to escape the soldering alloy. However, when soldering in a vapor-phase system voids the behavior that corresponds to that of convection soldering with lead containing pastes. Generally, lead-free pastes are inclined to produce very high amounts of voids in standard convection machines.

4.0 Tips for reflow soldering.

4.1 Soldering errors

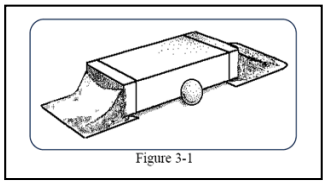
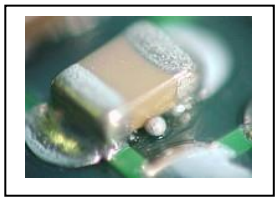


Figure 3-1

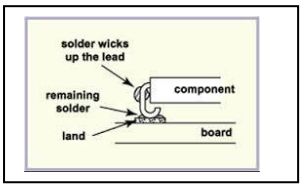


Random Solder Balls

4.1.1 Solder Balls The causes for solder balls are different:

- The temperature gradient in pre-heating is too high, which causes the solvent in the paste to evaporate violently, ripping out solder paste balls from the print of the paste.
- The paste print rests on the solder resist. (Wrong pressure or mask too large). Good results are obtained if the print of the paste is reduced by approx. 10 to 15 %).
- The applied solder paste is too old or of bad or unsuitable quality.
- The bottom side of the stencil or the screen is not clean, thus depositing paste residues on the assembly surface.
- Due to a bad wetting of the pad or component the wetting is incomplete. Some paste remains on the assembly in the form of balls.
- The amount of paste relative to the available pad size is too high. Generally, due to the careful heating with **vapor-phase soldering the solder ball formation is greatly reduced.**

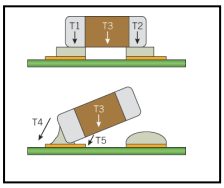
4.1.2 Wicking-Effect



The wicking effect is the rise of the molten solder on component leads. This disrupts the soldering to the contact pad below. The wicking effect is known mostly with infrared or convection machines with very high pre-heating speeds. Lately it is found rather frequently with backplane SMD connectors, due to an extremely large amount of energy flowing across the pin-area into the metal. Thus the pins reach soldering temperature much faster than the pad below.

1. The wicking effect is mostly caused by bad solder ability of the contact pads on the assembly.
2. The component leads reach the flow point temperature much faster than the metallization of the substrate. This causes the paste to melt and to rise along the leads. In this case, the so-called 'top heat' is too high. The formation of the wicking effect may be controlled via the machine technology by lowering the temperature gradient starting at approx. 150° C. **With vapor-phase soldering the wicking effect is practically unknown, because of the negligible temperature differences on the printed circuit boards and the components.**

4.1.3 Tombstone-Effect



The tombstone effect occurs if - under certain circumstances during the reflowing process of the solder paste and its unilateral influence on the surface tension of the solder - the small bi-polar components start to lift (e.g. SMD capacitors and resistors). The most important reasons for the rising of the components are:

1. The layout of the printed circuit board does not, or only badly suits the component geometry.
2. The applied solder paste is bad or unsuitable.
3. The solder paste print is uneven and/or badly positioned.
4. The amount of solder paste is too high. (Optimum approx. 0.15 mm thickness of the mask and pressure reduction from 15 to 20 % with critical components of the size 08/05 and smaller).
5. The size of the stencil is not reduced. (Optimum is 10 to 15% reduction).
6. The mounting displacement is too high.
7. The metallization of the components and the contact pad is insufficient.
8. The components have 'balled'contact pads.
9. The solder resist is higher than the pad surface. It sometimes happens – should the solder paste have not or only insufficiently dried - that the solvent evaporates violently during soldering. These small 'explosions' may lift the components. However, this will not occur if the dwell-times are correctly set and suitable solder pastes are used. But the most frequent reason for the lifting is unsuitable pad geometry relative to its component geometry as well as too big a solder paste quantity.

1. The pads must not be too far apart - to prevent the surface tension of the solder to pull the component to one side. This will make it impossible to produce a solder contact on its other side, due to an insufficient contact area. The pads may, however, be positioned only to a certain degree under the components as they must still produce a good solder contact (meniscus). The further the solder-joint lies below the component, the more difficult it is to check its quality subsequently.
2. A further role, when designing pad geometry, is played by the metallization's of the solder areas on the components. Contrary to the SMD resistors, the SMD condensers possess metallization´s along the sides and fronts. Due to the wetting forces additionally acting at these side areas, there is a certain compensation of the unilaterally lifting force on the front side. Thus, tombstoning does not affect the condensers as much as the resistors.

Regretfully, there are at rare occurrences of tombstones in assemblies which meet all the above conditions. The cause may be temperature differences in the printed circuit board itself. These temperature differences lead to an uneven reflowing of the two pads. Even if one pad is reflow-soldered only marginally earlier, the forces of the molten solder may pull the component vertical. Until now it has been generally recommended to improve pre-heating.

Yet, this frequent advice to better pre-heating does not eliminate the temperature differences at the reflow point temperature.

However, since the introduction of the variable temperature gradients in the vapor-phase process, these are reflow-soldered homogeneously.

Another possibility to reduce the tombstone effect is to use solder pastes with a low wetting potential. An elegant approach is also to use pastes which - instead of having an exactly defined melting point - feature a melting range of approx. 5 K.

4.1.4 Tombstoning comparing IR/Convection with/without N2/ Vapor-phase

A phenomenon often observed with tombstones is that they become more frequent the more the quality of the soldering atmosphere improves. Analyzing this failure behavior of the assemblies in a typical production batch, the tombstone effect is unknown with IR soldering. However, with convection soldering with good N2 atmosphere it occurs quite frequently and in the vapor-phase machine most often. As all parameters i.e. print, pastes, mounting, etc., of the respective assembly are the same there must be another reason. The reason for this differing tombstone behavior lies in the different degree of oxidation of the solder-joint when reaching the flowing point of the paste. With reduced oxidation on the solder-joint, the wetting force increases in the meniscus. As the geometrical ratios in the solder-joint remain the same, a higher surface tension in the solder causes an increasing lifting moment and thus a tombstone. This oxidation influence may be well observed in convection machines. Switching-off the nitrogen supply is a frequently used trick to eliminate tombstoning with known failure-prone assemblies.
Without nitrogen the oxidation increases and consequently the surface tension – thus reducing the lifting moment. Therefore, the paste volume must always be reduced to minimize the lever-effect in the solder-joint (responsible for the lifting- moment).

4.1.5 Bridging = short circuits (bridges between pads)

Definition: Solder connecting, in most cases, misconnecting two or more adjacent pads that come into contact to form a conductive path.

Possible Reasons:

- Excessive solder paste slump.
- Reflow profile not suitable i.e. Initial ramp rates too steep.
- Soldering pads too big relative to gap between pads.
- Too much solder on the pads due to incorrect stencil preparation.
- Solder paste not active enough.
- Bad seal between the stencil and the board during printing.
- Mismatch between the stencil and PCB.
- Poor component placement or poor component leg to PCB pad size relationship.

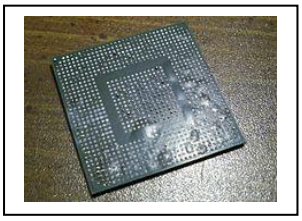
4.1.6 Solder Beads

Caused by solder paste being present underneath the components prior to reflow

Possible reasons:

- Reflow profile not suitable, initial ramp too steep.
- Too much solder on the pads caused by incorrect stencil specification.
- Excessive solder paste slump.
- Excessive placement pressure.
- Incorrect print registration.

4.1.7 Pop corning



Pop corning is when the housing of a component delaminates as a result of heated fluid that if steam is blown out of the housing.
The moisture can reside in: Housing material, between different materials in the housing of the component.

The popcorn effect can occur when moisture-sensitive electronic components are stored for a longer period without moisture protective packaging they slowly absorb moisture from the ambient air.

The storage of moisture sensitive components is regulated in IPC/JEDEC J-STD-020D (MSL classes, English moisture sensitive level).

Through In the reflow oven evaporates the moisture due to the rapid rise in temperature, resulting in a volume expansion.
Consequences are: cracks in the casing and the delamination of the substrate.
The dangerous of the popcorn effect is that it is not immediately detected as it occurs under the device, for example are BGAs.

Vapor phase soldering significantly reduces this error probability.

4.1.8 Poor Wetting

The primary root cause of poor wetting is excessive oxidation of solder powder, component leads, and the PCB pads prior to the reflow. If the overall heat input is too high, and the solder paste has a limited oxidation tolerance, the flux activity of the solder paste will be weakened and lead to poor wetting. In this case the reflow profile should be adjusted more toward a standard type to reduce the overall heat input.

4.1.9 Voiding

The root cause of the solder voiding is primarily due to the entrapment of flux during the reflow stage. Formation of solder voids increases with the oxidation level of both solder paste and the PCB pads. Un-wetted spots on the pads, or un-digested solder oxide particles from solder paste in the bulk of molten solder will entrap small amounts of flux. This in turn will expand/explode into a void at the solidification stage. A lower overall heat input and higher activity of flux will help in this situation.

5.0 Double-sided printed circuit boards

There is no difference in the vapor-phase processing of assemblies mounted on both sides to that of the conventional soldering processes, i.e. radiation or convection. Heavy components with unfavorable mass-solder-surface ratios have to be glued - if they are on the bottom side of the assembly. This glue-process may be avoided, as long as sufficient attention is paid during the layout phase and all the heavy components are placed on the top side. Generally, in the vapor-phase, significantly heavier components stay in place without additional adhesive than in a convection process. Because in vapor-phase no oxidation occurs on the solder-joint and the surface tension of the solder is highest so that even big components stay in place held only by the wetting force. If heavy components must be glued, there are SMD adhesives, which cure at the process temperatures of the vapor-phase. This results in enormous savings as it does away with an additional adhesive curing process when soldering SMD‘s on both sides of an assembly.

Documents to these adhesives are available with IMDES creative solutions.

More information regarding **DUAL SIDED SMD SOLDERING you will find on the pages 28, 29, 30 and 31.**

5.1 Curing of adhesives

Curing SMD adhesives in the vapor-phase is straight forward. Due to its careful and steady energy supply, as well as its totally oxygen-free environment, the adhesive agents may be cured under the same conditions as solder pastes may be reflowed.
This leads to the following advantages:

- Shorter dwell-times in the hot zones for curing, resulting in positive effects relative to the longevity of the components.
- Curing the adhesive and soldering is one process step. There is no other in-series curing process, thus saving costs.
- As the adhesives are cured without oxygen no oxides will form on the printed circuit boards - which results in improved solder quality.
- Advantage of having a single profile to cure adhesive and to solder is an added advantage.

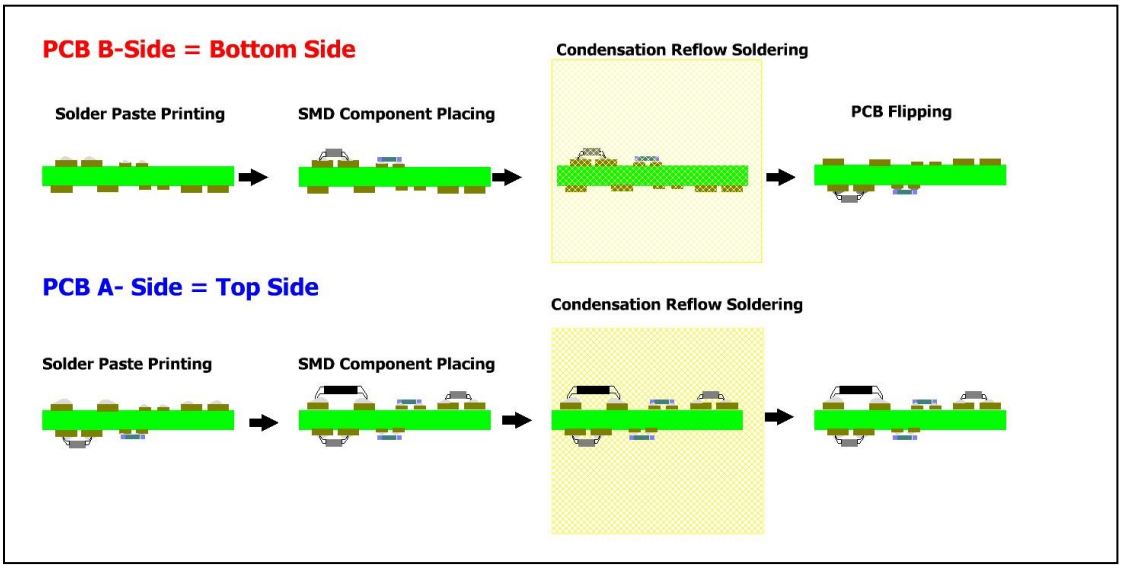
6.0 Cleaning and cleanliness of the printed circuit board

Using the mildest activated or no-clean pastes, the cleaning of the printed circuit boards is, in most cases no longer necessary. Certain products, e.g. those according to MIL or ESA specifications, electrically tested assemblies, etc., must be cleaned. However, printed circuit boards soldered in a vapor-phase system may easily be cleaned off their flux residues with normal cleaning processes, as the flux residues are not burnt and their chemical structure is not altered. In future, the cleanliness of the printed circuit boards after soldering will become more important. Particularly with edge connectors, LED´s, switches, potentiometers, any flux contaminations or outgassing from the printed circuit board will become more problematic and undesired. Especially in these cases it is the vapor-phase process, which offers enormous advantages. In difference to the convection machines - in which the whole surface of the printed circuit board is always exposed to some contamination by the circulating air, the vapor-phase processes the boards in a very clean environment. The vapor-phase is actually a distillation column and thus always extremely clean - due its physical properties. Consequently and independently of the machine‘s contaminated condition, no foreign particles are deposited on the printed circuit boards during the condensation of the vapor,. Outgassing of the paste or of the printed circuit boards escape immediately from the vapor-zone, due to their lower specific gravity. Any solid matter which might accrue during the soldering process, e.g. solder balls, flux residues, will be transported into the sump of the machine where they will be filtered. As no oxygen is present during the heating process, pastes with lowest and mild fluxing contents may be used. Consequently, the contamination of the solder pads by flux residues, after the solder-joints solidified, is minimal.

7.0 DUAL SIDED SMD SOLDERING

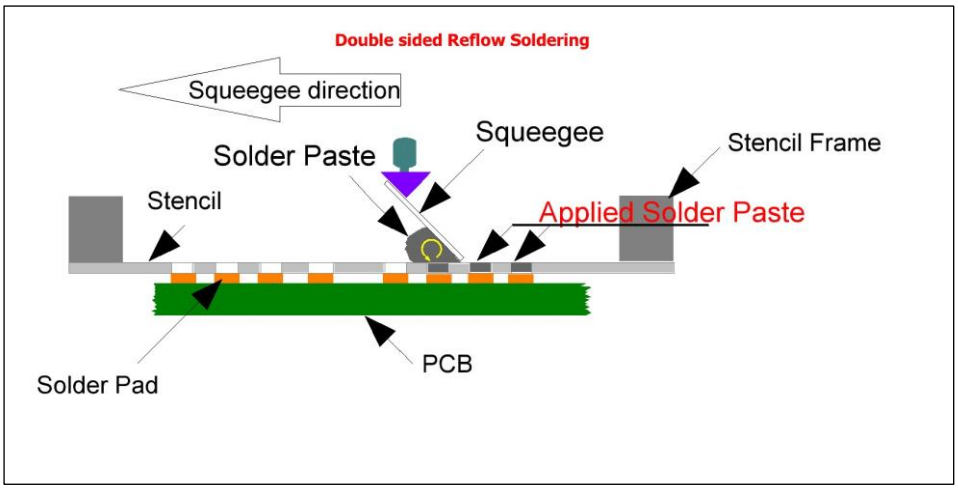
7.1 Assembly, Reflow & Soldering steps

The A side (TOP side) of a double sided PCB is mainly laid out (designed) with large IC's components.
The B side (Bottom) of a dual sided PCB is mainly laid out (designed) with small chips.



7.2 Step 1

We start with Screen printing the **B** side of the double side PCB with smallest components.



Placing the components
Reflowing PCB Side B with the components

7.3 STEP 2

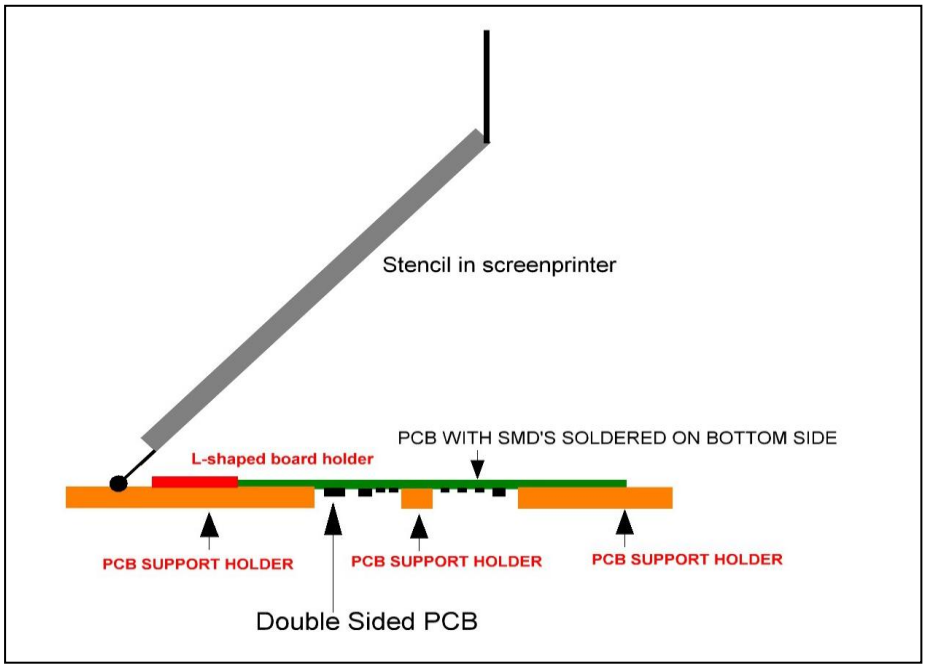
Board side A.

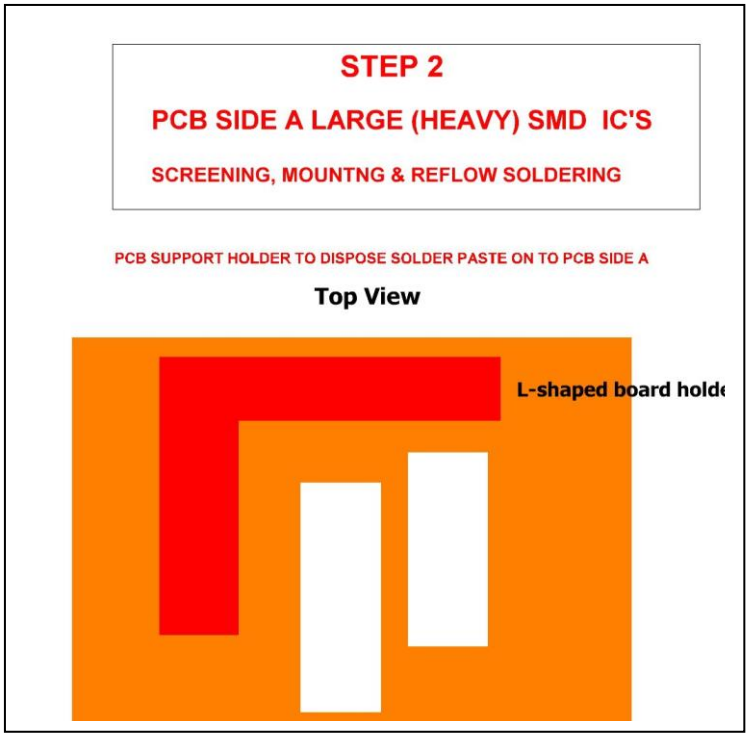
After populating and reflowing the **B** side with the smallest components, repeat the process on the **A** side with the larger SMT parts.
This sequence will keep the largest and heavier parts from hanging upside down during reflow, reducing the possibility that they would fall off.
Molten solder has very high surface energy and can hold most SMT parts even upside down.

7.4 Screen printing of the A side with large components

To screen the A side of the PCB you need to use a PCB support holder

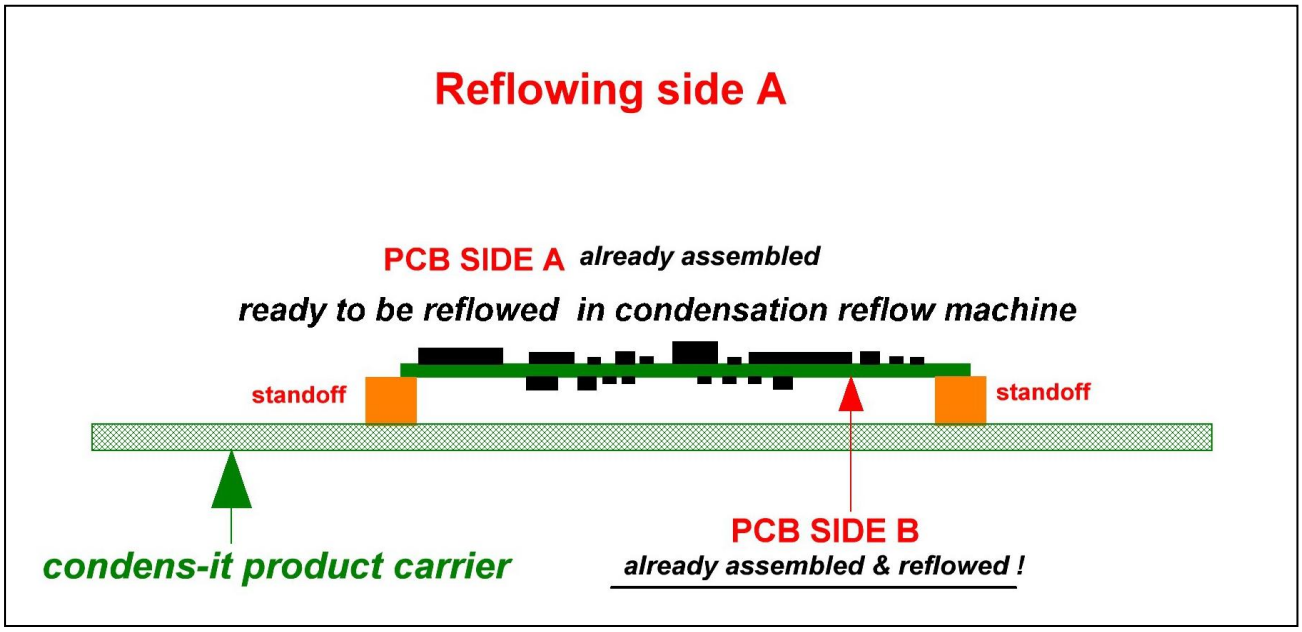
Use for the PCB support holder material that is thicker than the populated PCB and thick enough to function as a support for the screening
The PCB support holder should be cut out to clear the SMT components from the first reflow.
Make sure all work surfaces are ESD safe or grounded.
Use epoxy or wood.





7.5 Reflowing side A

When you want to reflow the second side of the PCB, the whole assembly **has to be held above JUMBO-CONDENS-*IT* product carrier with standoffs**. (See Fig. below)
You'll damage the SMT solder joints from the first reflow if you lay the board directly on the product carrier.



Standoffs

You can use any material that can withstand the condensation reflow oven temperature to create stand offs to hold the board. The best is scrap of FR4 material.
You probably have some old board scraps lying around,
But, if not, just prop the assembly up on a couple of pieces of metal or anything that is not going to be affected by the heat of the **CONDENS-*IT*.**
You can also use large metal binder clips.

7.6 DUAL SIDED MIXED (SMD THT) ASSEMBLY & SOLDERING