

## Introduction

### Condensation soldering:

The use of hot vapour, 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 also known as "Vapour Phase Reflow Soldering", is a known technique that at was applied in beginning of Eighties when the SMD technology was introduced.

The heat transfer medium applied in those days used substances that were harmful to health and the environment. As a result, the condensation soldering lost popularity and Infrared soldering became the standard.

The arrival of **Perfluoropolyeter** \* heralded the rebirth of Vapour Phase Reflow soldering technique. Perfluoropolyeter \* is manufactured and marketed by the company Solvay Solexis under the trade name **Galden**.

### HOW DOES IT WORKS?

The chemically inert and electrically neutral liquid, **Perfluoropolyeter** \*, is heated to it's boiling point in a closed space.

On heating, a saturated vapour above the liquid occurs with practically the same temperature as the boiling liquid. If assembled printed circuit board is introduced in this space, the vapour condense on the PCB surface as the circuit board has a lower temperature than the vapour. This happens until the entire surface of the circuit board reached the same temperature as the vapour. After that, the precipitated liquid evaporates again. The is principal is same as the process where in if someone with glasses enters a warm room from a cold outside, the lenses will be covered with the condensed water vapour and after some time, after the lenses attain room temperature, they will become clear again.

The soldering alloy, which have a lower melting temperature than the temperature of the vapours, will liquefy and form a solder joint. As the process chamber is cooled down, the temperature reduces and the solder solidifies and the PCB can be removed from the chamber.

\*\*\*\***Perfluoropolyeter** \* liquid polymers, which are exclusively built up of atoms of carbon (C), Fluor (F) and oxygen (O<sub>2</sub>).

The bonds between these are very stable. They belong to the most stable connections in the realm of carbon chemistry.

### 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 fluoro 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 vapour pressure.
- No flash point (does not catch fire).
- High vapour density.
- Excellent heat transfer coefficient.
- Low surface tension.
- Good wetting properties (film adhesion).
- There will be no harmful substances are released.
- No chemical activity (perfluoriert, i.e. no H-or Cl-Atom).
- During the heat transfer, medium under normal atmospheric pressure, all types Galden thermally stable.
- Does not damage the ozone layer.

## 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.

Moreover, one can also, repair and rework, by using a simple auxiliary tools, major components such as FPGA's without damage.

PCBs with SMD components are/were soldered mostly in an infrared oven, possibly with nitrogen as oxidizer shielding, (called reflow technique).

With the introduction of lead-free solder, it became more sensitive to the occurrence of defects at the connection between the components and the PCB. In addition to this, the higher standards were set for the quality and reliability of the circuit boards. To address this higher demands on solder, the "Vapour Phase Reflow Soldering " was rediscovered as an alternative to the infrared "reflow" soldering.

## Benefits of condensation soldering

Soldering takes place in a space filled with inert gas so no oxygen or other gases come into contact with the solder. That is why a shielding gas such as nitrogen, is no longer needed. The soldering media being a gas can enter below BGAs and small SMD components and directly transfer the heat to the solder point. This property avoids the shadowing effect that is seen in the IR reflow soldering. This translates into much reliable solder joint. There is no worry of over heating of the components as the temperature of the vapour is not higher than the boiling temperature of the liquid, which is fixed because of it's chemical composition.

## The advantages at a glance:

- Environmentally friendly process.
- Reproducible soldering process conditions.
- No overheating of PCB and its components.
- Global warming print regardless of the shape or color of component.
- Absolute uniform heating of the PCB.
- Condensation vapour causes a thin liquid film that penetrates to the smallest openings like under the BGAs, FPBGA's giving a reliable solder joint.
- Good reproducible temperature profiles.
- No oxidation formation.
- No protective gases required.
- No more labour-intensive procedures to determine the desired temperature profiles.