

Benefits of Vapor Phase

Vapor phase soldering provides an innovative method for SMT, which the following will illustrate:

At atmospheric pressure, the temperature of the vapor will be the same as that of the boiling liquid.

Fluctuations in temperature are much less than if infra red or laser heat is used because, even if power is increased, the rate of vapor production will increase but the temperature remains the same.

Primary fluids are available in a wide temperature range, (155°C to 260°C)

Due to the high vapor density of most fluids, soldering takes place in an inert atmosphere, thereby removing the added cost incurred from the use of inert gases such as nitrogen in other types of soldering systems.

The process is extremely fast and efficient since the heat transfer coefficient of vapor condensation is about ten times (10x) faster than hot air and about eight times (8x) faster than infra red heat.

Vapor Phase is independent of size, shape or geometry with the maximum surface area exposed and every component part seeing precisely the same temperature.

The process is clean as the components only come in contact with distilled vapors. Furthermore, the inertness of most fluid does not present a compatibility problem with these components. Also, because of their low heat of vaporization, most fluids evaporate quickly from the hot surface resulting in rapid, residue free drying of the parts.

Most fluids exhibit high chemical and thermal stability and are safe to use up to 290°C.

For more information on fluids, check with 3M or Galden.

3M Customer Service (651) 733 4317 or (651) 736 6191
Galden Customer Service (800) 221 0553

[SEE COMPARISON STUDY BELOW](#)

Comparison study of reflow methods

Here are the results of a comparison study of conveyORIZED reflow machines conducted by a Centech customer in Singapore, published by **3M** in 1990.

Comparison factor	Features	Vapor Phase	Lamp IR	Panel IR	Panel IR/ Forced air
Theoretical performance	Belt speed (ipm)	48	36	25	48
	Total process time (min.)	3.5	3.2	3.4	4.1
	Board size	7" x 6"	7" x 6"	7" x 6"	7" x 6"
	Boards per hour	1,234	309	214	411
Expected performance	Utilization rate	50%	50%	80%	80%
	Boards per hour	617	154	171	329
Investment usage cost	Cost of machine with options	\$95,450	\$73,675	\$79,050	\$74,000
	Productive hours per year (2 shifts)	3,650	3,650	3,650	3,650
	Number of boards per year	2,252,050	565,750	624,150	1,200,850
	Investment cost per board	\$0.0085	\$0.0260	0.0253	\$0.0123
Electricity usage cost	Electricity usage cost per board	\$0.0023	\$0.0078	\$0.0047	\$0.0106
FC-70 fluid usage cost	Rate per pound	\$40.00	--	--	--
	FC-70 usage per hour (lb/hr)	0.12	--	--	--
	FC-70 usage cost per board	\$0.0078	--	--	--
Factory cost floor space requirement	Space for machine (sq. meter)	0.05	6.73	5.19	6.63
	Space required cost per board	\$0.0002	\$0.0007	\$0.0005	\$0.0003
Preventive maintenance	Preventive maintenance cost per board	\$0.0020	0.0049	\$0.0045	\$0.0023
Total cost per board		\$0.0207	\$0.0394	\$0.0349	\$0.0255

Other benefits:

- Q Controlled pre-heat minimizes difficulties related to thermal shock damage.
- Q The inert atmosphere simplifies cleaning procedures.

Fluorinert liquids are exempt from VOC classification

The EPA has added four classes of perfluorocarbon compounds to the list of negligibly reactive organic compounds. These compounds may be exempted from state implementation plans (SIPs) to attain the National Ambient Air Quality Standards (NAAQAS) for the ozone layer.

The classes of perfluorocarbon compounds listed include Fluorinert liquids and 3M Secondary Fluids for condensation reflow soldering systems. As a result, the Fluorinert liquids have been exempt by the EPA from classification as VOCs.(1990) Most local Air Quality Management Districts have accepted EPAs new definition of VOCs.

Vapor phase condensation reflow inert atmosphere yields superior results

By John Brennan
Manager, Surface Mount Operations

(Continued Below)

ETMA, Inc.
Redmond, WA

(Editor's note: ETMA, Inc. , a contract assembly house, was faced with a challenging project: mounting a flex circuit to a bare FR4 stiffener. Mounted on the circuitry were 16 gullwing flatpack components with the additional challenge of bare copper component pads.)

“We tried IR reflow, but the results weren't satisfactory. The time and temperature necessary to achieve good soldering results on the copper pads, and to heat the assembly for proper reflow to take place, caused the flex circuit material to become brittle and crack. Also, the need to incorporate nitrogen into the IR process was not cost effective.

Condensation reflow yields great results because it provides an inert atmosphere and keeps the process temperature constant. In addition, we did not have to undergo costly equipment retrofit, nor did we have to ask our client to make a design change, such as tinning the pads, to accommodate us.”

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