Technical Report for MS9000SAN Rework Machine.

The Best Heating System for Reworking.

Optimal Heating System.

The rework machine must heat only specific parts, thus, in that case, the board may warp by heating. Since, the best heating system is required that it is peculiar function as follows.

*The board cannot warp easily.

*Only the target parts can be heated.

*Does not heat on any parts other than the target.

*A temperature profile can be specified correctly. And also it is repeatable.

The best heating system for reworking is must clear those conditions.

MS9000SAN Rework Station

The Heating System of MS9000SAN.

MS9000SAN is used of the heating sys that the top heating is by Hot Gas and the bottom heating is by IR with wide area. It is the system developed by the many experience and long research from 1980.

The foundation policy is combination heating by the top and bottom side. And the bottom heating mainly prevents warp of the board, and top is partial heating. However, **combination heating** of the both is very important. And it is our one of the know-how.

Why the top heater is by hot gas?

We are specialist for reworking, and the rework system was made before BGA appended. It was a lead type package such as QFP at the time. In this case, the top heater mainly has to heat to lead of the package. Hot gas heating was the best for it, and also at partial heating.

Therefore, field heating like IR was completely unsuitable.

And hot gas heating is suitable to BGA than IR heating. That is because heating of MS9000SAN is a combination style.
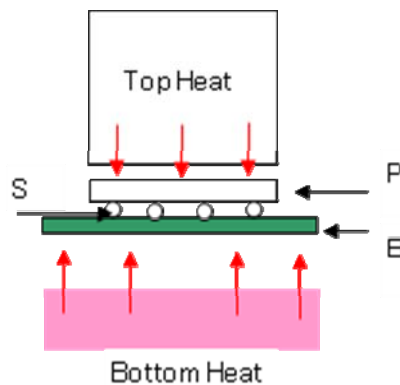
S=solder ball / **P**=package / **B**=board

The temperature of "**S**" is important, and the temperature for "**S"** is made from **conduction heat** from the top and bottom. It was made by combination heating of the top and the bottom.

The temperature of "S" is never made from the flow of hot gas only.

When the package is QFP, the heating flow of hot gas should be made more than BGA. In this case, heating to the package of the QFP will soften. (see next picture)

Top Heat

Bottom Heat
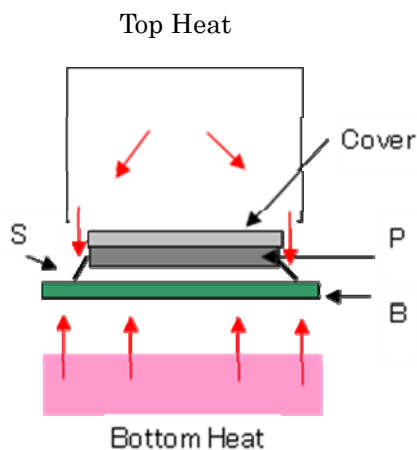
Cover= holds of the package.

The package is lead type such as QFP, the flow of hot gas is heating to the lead of the QFP. "P" will be protected from the heating by the cover of nozzle.

In this case, It is used for fine pitch QFP such as 0.4mm lead pitchs. If the lead pitch is 0.5mm or more, heating can be same as BGA.

The combination heater of MS9000SAN is provided of optimal temperature to the "S". And the optimal temperature of "S" often becomes 240 degree centigrade. However, it is only the portion heated at the top heater. Therefore, the portion "C"

and "T" will be no melted solder.
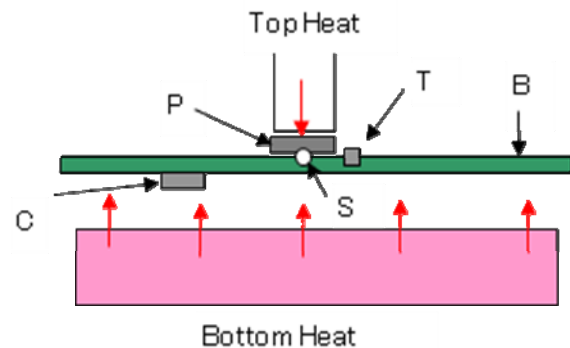
However, if "T" adjoins the "P", the solder of "T" may also melt. It wills no moves of "T". It is because, since heating to "S" is by the conduction heat.

Usually, the solder will not be melted if "T" separates from the "P" is 1.5mm or more.

Hot gas system can be use N2 gas, it is very important for Read free soldering. The system can be use for the air and also N2 gas.

Why the bottom heater is by wide IR?

MS9000SAN has wide area IR heating system. And it is created of the temperature profile in collaboration with the top heating system.

The warp of the board will be smallest when heating is the same temperature in the large range.

The combination heating system of MS9000SAN is always auto-controlled to become best condition of the temp of under the board, such as "C". The parts under the board never fall.

The combination heating system is

controlled by the coefficient obtained from the data by the long experience know-how.

If the parts under the board are overheated, the data of "Hb" should be made low, and then the controller is automatically controlled "Ht", in this case "S" is always same.

If the temperature of the package "S" is overheated, the data of "Hb" should be raises, and then to controller is automatically controlled "Ht", and the temperature of "P" will be made low.

Intelligence Thermal Trace System.

MS9000SAN has a function of ITTS; it creates the optimal temperature profile automatically. It is possible by original combination heating system.
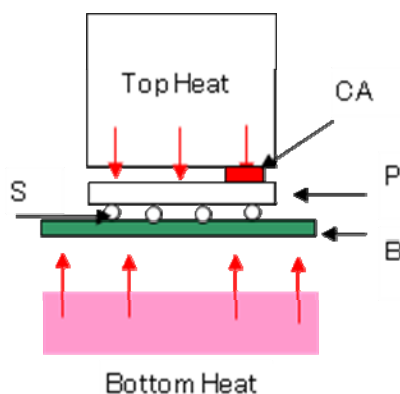
"**CA**"= the control sensor for ITTS.

ITTS is operated that the temperature of the "P" and "S" may become the same. Therefore, the control sensor is setting on the surface of the "P" and it is very easy and detection temperature is obtained correctly. That is because heating to the "S" is conduction heating.

Generally, the temperature control is by the temperature of the "S". In the case, the temperature of the "P" is ignored, thus the accident such as overheated of the "P" will be often occurs. Probably, it will be difficult to connect a sensor to the "S" correctly in the actually. Reworking will go wrong, if setting of a sensor is inaccurate.

Why not the Top Heating by IR?

The IR hearting is by light source, in the case; correctly temperature control is very difficult. It is because, In that case, the sensor should be setting at the position "S". Probably, it will be very difficult when such as the CSP of fine pitch. And also sometimes used of the sensor of the type of the non-contacting radiation thermometer when IR controls system, In this case, probably, detection of a still more exact temperature will be difficult.

And, IR heating system cannot heat only specific parts. Thus, it must heat protect cover to the other parts. Furthermore, probably, a package overheats in reworking of the parts of lead type, such as QFP.
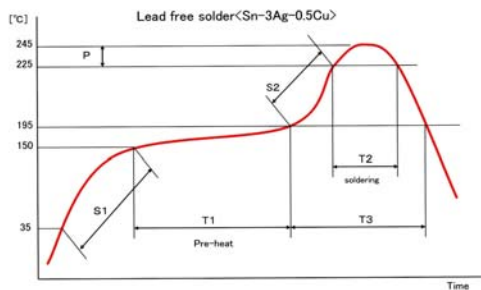
In the case of BGA etc, the solder ball is heated by the heat conduction from the package (P), and the board (B). It is same as "Hot gas" and "IR."

If heating from the board (Hb) is stronger from the package (Ht) the temperature of the solder ball (Hs) will

be higher than the package "P")".
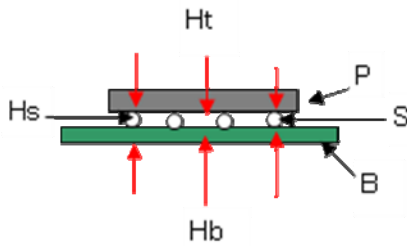
If it is reverse, the temperature of solder (Hs) will become lower than the package "P".

Recommendable Profile for Read free solders

T1= Pre-heat zone up to 160 sec.

T2=Soldering Zone 225 to 245 degrees

T3=Total soldering time up to 115 sec.

P=Soldering Temperature 225to245 degrees

S1=Inclination of Temperature up to 5/sec

S2=Inclination of Temperature up to 3/sec.

In the case of Read Free solder ball, the dissolution temperature will be about 225 to 240 degrees; however, the temperature of the package must be lower than 250 degrees. So, ITTS of MS9000SAN is controlled by the temperature of the package "P". And the combination controller of MS9000SAN is operated so that "Ht" and "Hs" may always become equal. In the case of IR heating, it will not be able to detect temperature of the package "P" correctly, it is because, IR heating is too rapid and cannot measure the conduction heat of the package "P" correctly. It is the best way that low thermal conductivity heating system as "Hot Gas".

In MS9000SAN can be reworking all most all SMD, if nozzle is exchanged. It is without considering the influence of the surrounding parts on others. And, heating balance to a large size package is also good, it is because, it is conductive heating.

MS9000SAN fulfills all heating conditions required for reworking. It is by the technical know-how acquired by the long experience from 1980.

The hot gas system for top heating, the wide IR system for bottom heating and also the exchangeable nozzle of the top heater head, All of they are for rational and exact heating in the reworking.