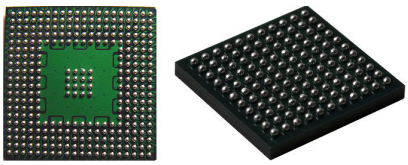
Liquid Flux Tutorial



Whilst this document briefly outlines Xbox specifics and BGA packages, this liquid flux is applicable for all types of PCB soldering rework where '**Rosin free**' and '**No Clean**' applications are required.

The purpose of the flux is to clean surfaces that are going to be joined together to enhance wetting by the solder in its molten state to allow the solder to flow more uniformly. To accomplish this, the flux deoxidizes metal surfaces at high temperatures without decomposing.

All Fluxes contain some form of solvent which is Highly Flammable, keep in a dark dry place and away from naked flames.

Keep out of the reach of children

Always use in a well ventilated area and avoid contact with eyes and skin.

Rosin

Rosin is a collection of naturally occurring acids, chiefly abietic acid and its compounds, which can be combined with solvents and various activators to formulate a solder flux. These types of flux's leave residuals which can be tacky and attract dust which may contain conductive elements that can cause shorts and other electrical failures on the board and subsequently require post solder cleaning.
Rosin fumes given off during soldering will irate nose, throat and the respiratory system and can cause an allergic reaction that could lead to occupational Asthma. Flux fumes can also irritate the skin causing a rash to develop.

Rosin Free

This specially created flux formula contains **NO** natural Rosin thus overcoming Rosin based Flux issues, but utilises a synthetic alternative that leaves very little residue and requires no post solder cleaning procedures.

Ball Grid Array (BGA) Packages

Historically semiconductor integrated circuits (IC'S) utilised external pins or leg's to provide a solder connection to printed circuit boards (PCB's), with ever increasing device complexity, transmission speeds and inherent developed heat, the BGA package overcomes the issues associated with other package types.

BGA's replaced these pins with solder balls which are attached to the underside of package, and directly match the PCB landings when aligned correctly. The circuit board assembly is then heated in a controlled process via infrared or oven system techniques, which causes the balls to melt but keep the package aligned and at the correct separation distance due to surface tension.

BGA Disadvantages

The major disadvantage of BGAs is the lack of flex that can be applied to the package, all electronic systems generate a level of heat, with different materials expanding at different rates and inducing mechanical stress.

Where excessive heat exist, there is an inherent danger that the expansion differences between the PCB and the BGA package can cause micro fractures on the solder joints, which over time will cause bad connections, with intermittent and finally system failure.

Xbox Red Ring of Death (RROD)

Unfortunately the Xbox 360 suffered from both the short comings of the BGA package and transition to 'Lead Free' manufacturing, coupled with cooling issues that have plagued the system and infamously been termed the Red Ring of Death.

With Microsoft initially refusing to acknowledge the magnitude of the problem, frustrated and industrious individuals investigated various methods in an attempt to understanding the issues and resurrection of their consoles.

Whilst various 'Fixes' have been widely documented over the internet, these generally are only short term and whilst they can be initially effective, long term they can potentially cause irreparable system damage. They all get there basis from addressing the interconnection issues by either applying additional pressure or attempting to reflow the solder. Applying additional pressure will cause the solder balls to be malformed and in some circumstances the PCB to warp, Overheating the system when running can cause component failure and in the case of the notorious 'Towel Trick', be extremely dangerous and a potential fire hazard.

The root cause of the interconnection issues is caused by failure of solder joints, reworking or re-balling of the package therefore provides the most effective repair, applying a flux facilitates good solder flow and rejuvenation of the joint.

BGA Rework

A number of professional BGA rework / reflow systems exist that unfortunately can be outside the price range of the average person looking at the attempted reflow repair of individual boards. Various options are available for a 'Home Brew' solution, from improvised hot air / infrared to utilising a conventional oven. The actual methodology and selected rework route is left up to the individual.

Xbox Device Fluxing

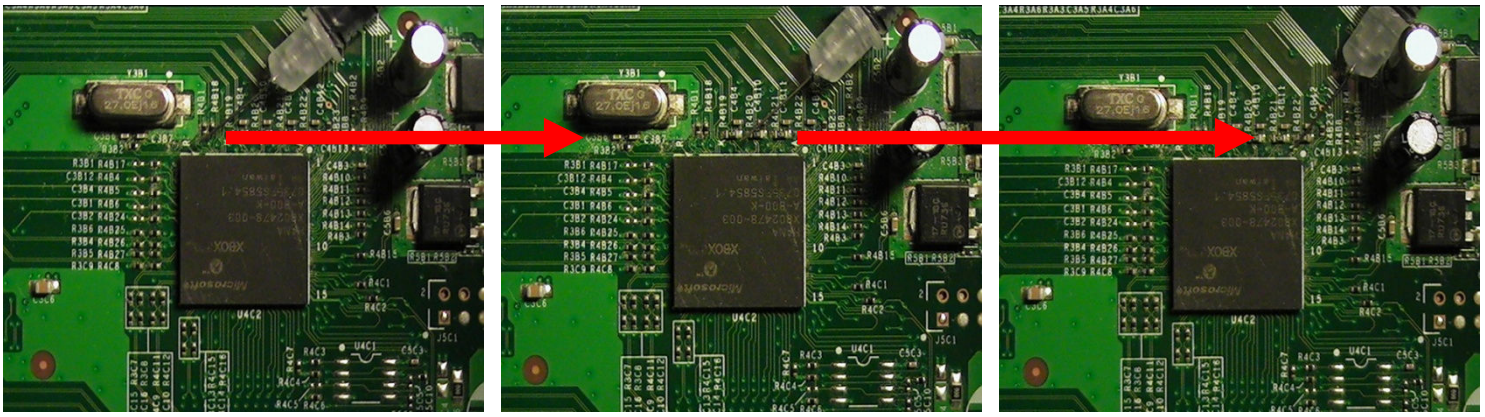
From the combination of displayed error LED's and sub code signatures it can be possible to determine which IC's are potentially causing the fault condition. The following description of how the flux is applied is generic for similar device types and provided as guidance only.

Firstly identify the components that you wish to rework, to allow the flux to flow under the BGA package place the board at an angle so that it's slightly tilted.

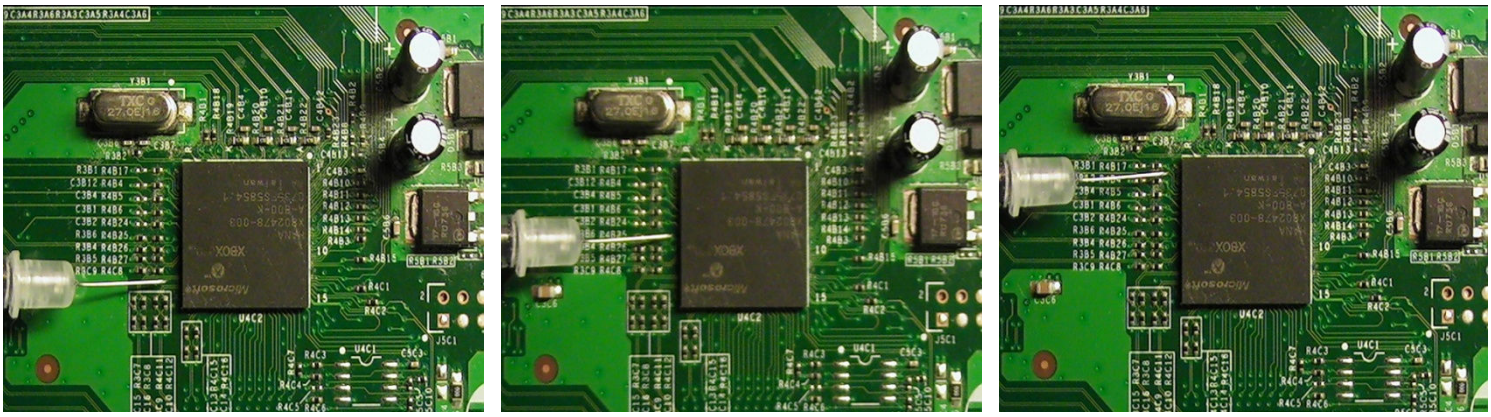
Using the syringe applicator, draw up the liquid flux and working from one corner gently expel the fluid whilst moving along the top edge of the package.

Note : If you are using the needle, take care as this is sharp and insure that you do not press into the PCB or under the device as this could cause damage to either.

Hana



Once you view the liquid flux seeping from the bottom of the package, stop and rotate the PCB though 90 degrees and repeat the process. You will find that only a small amount is required for the 2nd step.

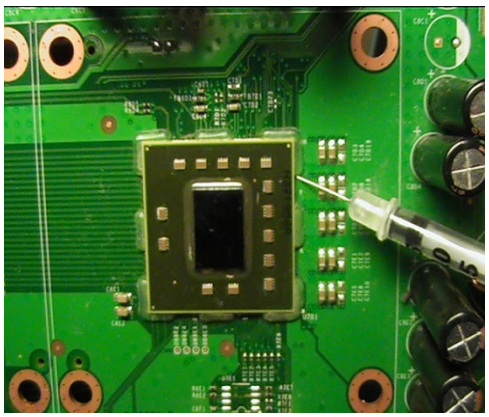
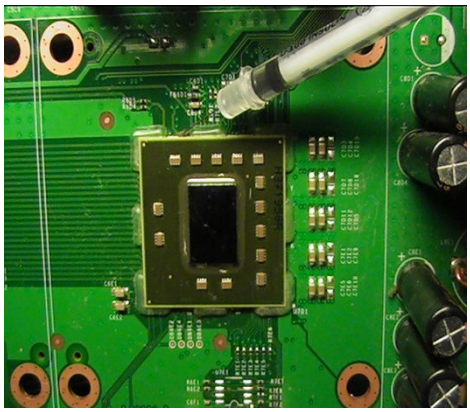
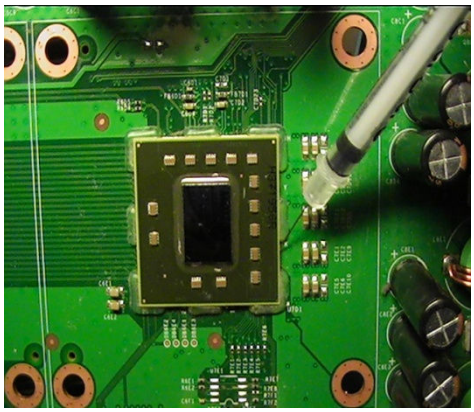


Lift the PCB up and manually rotate the board to spread the flux around the selected device.

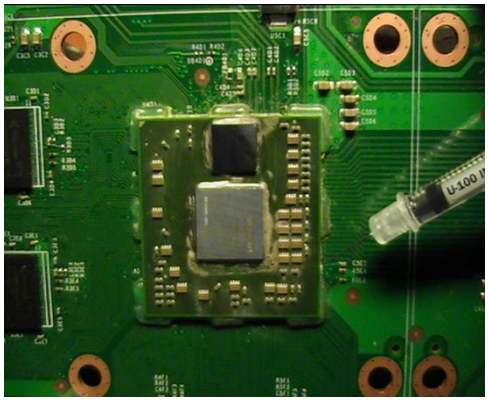
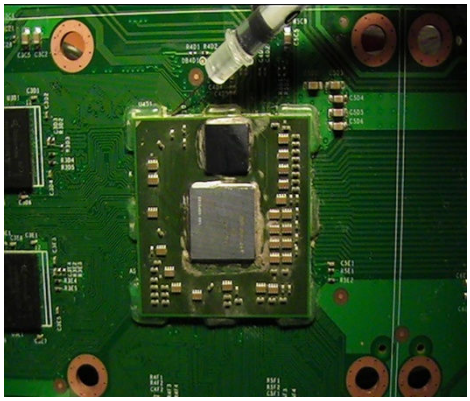
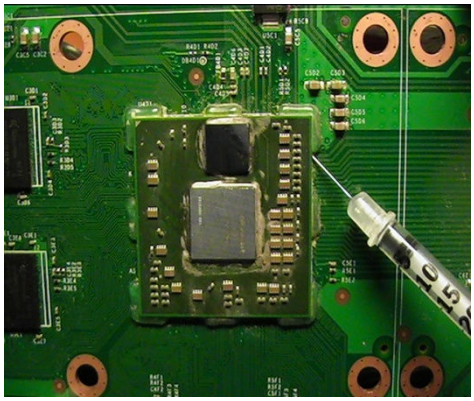
The same process is applicable for the other BGA devices

Depending on the revision of the PCB, for the CPU and GPU devices, you may find these have been fixed in place with a resin, in these cases angle the applicator to ensure the solder balls at the corners of the device are fluxed.

CPU

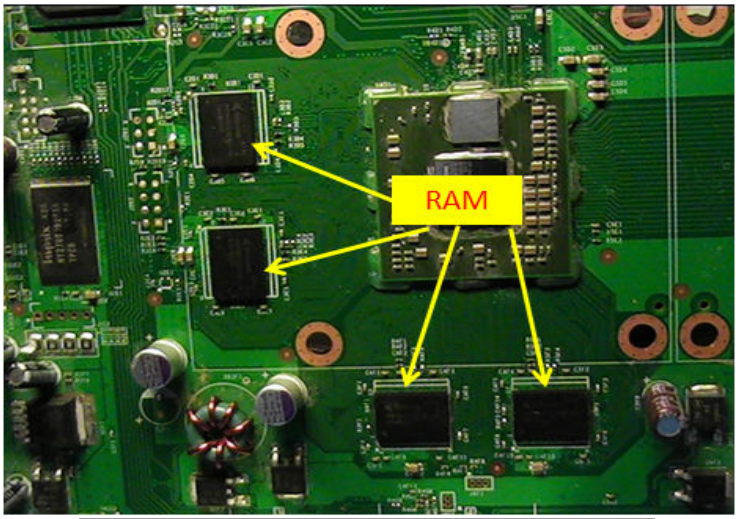
GPU

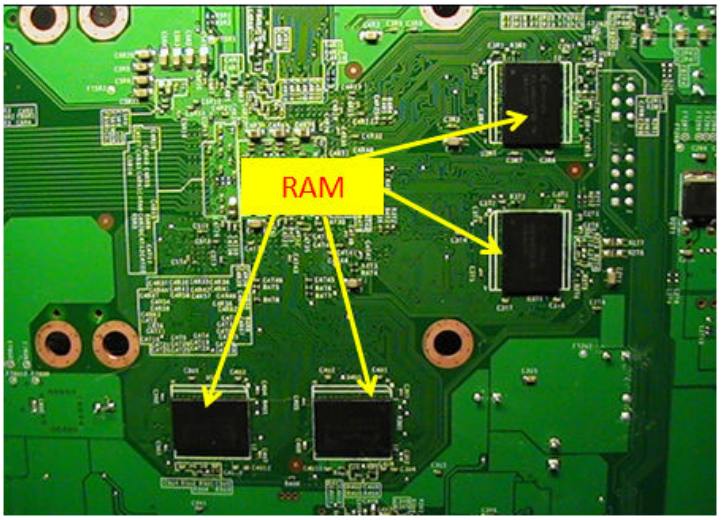
South Bridge



Depending on the revision of the PCB, the number of RAM chips may be 4 or 8, check the underside of the board for additional devices.

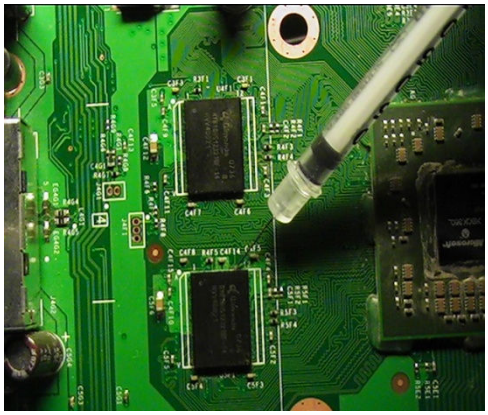


Front side of PCB



Reverse side of PCB

Ram



For other devices including the descretes and passives such as capacitor and resistors, it is simply a case of accurately applying flux to the PCB connections.