Den-on Rework Reference Process for Desktop platform and new Intel Socket LGA-1156 using the Den-on BGA rework station RD-500II and III

*This document shows the whole process on how to repair the Intel socket LGA 1156 using the system associating all the tooling needed to complete the process. All the reflow tools used in the process and recommended from Den-on must be used. Substitutes will alter the process.

Process Steps:

1. PCB loading on the machine PCB holder
2. Removal Process and used tooling
3. PCB solder Pad clean up recommendations’ tool
4. Ball printing process and Alignment
5. Placement
6. Profile used during placement removal process
7. Kit and tooling required for implementation
1. **PCB loading on the machine PCB holder**

The picture above shows PCB loaded on the machine XY tables, using all kind of knob to align fix and reduce tension on the PCB.

*The picture above shows PCB loaded on the machine XY tables, using all kind of knob to align fix and reduce tension on the PCB.*
2. **Removal Process and used tooling**

Since the parameter of the reflow profile recommended by Intel are nearly a linear profile we did use the same profile during placement and removal. The socket can be removed automatically using a standard vacuum pad, eventually there is no need to use any tooling to remove the socket however during removal the plastic cover on the socket may be lifted living the socket on the PCB so to prevent this issue from happening we do advise to use the removal jig clench as described in the pictures below.

![Removal Jig to lift the whole socket automatically](image1)

![Large Vacuum pad 70](image2)

The whole socket is removed automatically
Using the SMT Cleaner SC-200/300

The ideal time to clean up the excess solder from the PCB is just after removing the component when the solder and PCB are still at an elevated temperature. Using the RD-500 cleaning mode on the software. When this button is clicked it changes the Reflow time into 60s and the temperature of the top heater to $0^\circ$C keeping the bottom heater on, this will allow to clean the lands of the removed component while the board is still in the RD-500III board holder, use the SC-200 or SC-300 to remove the excess solder.

CAUTION: The Nozzle in the RD-500III will still be very hot. Use caution when working in this area. If you prefer to remove the PCB before removing the excess solder, be sure to use gloves as the PCB will be hot after the rework cycle.

While wicking solder off of pads:(Using solder wick with solder iron):

- Always clip off the used portion of the wick; it behaves as a heat sink.
- Apply liquid flux to the wick, to minimize sticking of the wick to the pads.
- Place the soldering iron on the solder wick off to the edge of the pads being soldered, to heat iron tip and wick prior to desoldering.
- Do not let solder iron or wick freeze on pads, to prevent pad lift.
- Do not lift the wick up and down on the pads.
- Apply very light pressure, similar to writing with a pencil. Soldering is achieved by temperature difference, not by tip pressure.
- Apply heat for 2 to 3 seconds after solder melts. Total contact time may be 6-7 seconds. Excess heating causes solder brittleness and may lift pads.
- Pb-free hand solder may require soldering iron tips hotter than used for SnPb rework.
- Hotter tips allow rework at a pace similar to SnPb rework.
- Without hotter tips, desoldering and resoldering is slower.
- However, with hotter tips, caution must be used to prevent pad lift.
4. Ball printing process and Alignment

- Ball Printing Process

The jig is inverted once more, the lock cover is removed the part is removed by the rework machine’s vacuum pick for placement from the optics arm.

**Precautions:**

- Never use paste directly from the refrigerator, it takes time for the solder paste to come to working temperature when previously refrigerated see 4hrs for 250g of solder paste.
- Never stir solder paste with screw driver this may cause solder spitting during reflow process because of the air transferred into the paste.
- Always check the date of the manufacturer, depending on solder paste manufacturer the date should be between 6 to 12 months of manufacture.
- The solder paste is frequently used in rework than in screen printer line so a regular check is advised.
Alignment

After the printing process is finished the printing jig is loaded on the optics arm then pick up automatically by the vacuum pad.

Using the zoom function then the up and down heater you can align the component.
5. Placement

- Height between PCB/nozzle around 2 to 3 mm. The height is adjusted using the up/down heater. You can also set up an automatic height when developing a profile, it is very important since the profile parameters can change depending on the height of the nozzle.

- Nozzle used during placement/removal 44x44mm or 46 x 46mm.
• Warpage is a big issue with such PCBs so Insight Bottom heater nozzle underneath BGA board area, Den-on machine has a focal heating system from top and bottom so the most heated area could be easily warped so the insight nozzle board support has the function to support this area to prevent warpage.

• PCB board support to prevent the PCB from warping, in addition of this the IR heaters have a primordial function to keep a uniform temperature on the PCB and the PCB varying between $120^\circ\text{C} \leq \text{PCB temperature} \leq 160^\circ\text{C}$ to prevent warpage.

• Initial Board temperature function it is very important to use the initial board temperature feature on the software this will allow a preheating of the whole PCB to create a uniform expansion temperature and a stable repeatable profile before starting the reflow process, also recommended by Intel.
6. **Profile used during placement removal process**

**Intel Recommended thermocouples location:**

<table>
<thead>
<tr>
<th>T/C#</th>
<th>Pad</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>B3</td>
</tr>
<tr>
<td>2</td>
<td>B39</td>
</tr>
<tr>
<td>3</td>
<td>AW38</td>
</tr>
<tr>
<td>4</td>
<td>AW2</td>
</tr>
<tr>
<td>5</td>
<td>M8</td>
</tr>
<tr>
<td>6</td>
<td>AB3</td>
</tr>
</tbody>
</table>

It is recommended that the Leaded Free LGA1156 socket be thermocoupled at the specific locations in order to ensure an accurate reflow profile.
Thermocouples plugged on different corners of the socket.
a. Slope measured in the 5 target point of the socket: $1.8^\circ\text{c/s} \leq \text{slope average} \leq 4.4^\circ\text{c/s}$

b. Soak time/temperature: $53\text{s} \leq \text{Time} \leq 85\text{s}$, $150^\circ\text{c} \leq \text{Temperature} \leq 217^\circ\text{c}$ (Using the solder paste...using a different solder paste need a different profile)

c. Heat time (time above liquidus 217°C): $82\text{s} \leq \text{TAL} \leq 109\text{s}$

d. Peak temperature: $236^\circ\text{c} \leq \text{PT} \leq 248^\circ\text{c}$

e. The $1^\circ\text{c} \leq \Delta t \leq 12^\circ\text{c}$ between the 5 target point of the socket

**Important:** it is very important to use the initial board temperature feature on the software this will allow a preheating of the whole PCB to create a uniform expansion temperature and a stable repeatable profile before starting the reflow process, also recommended by Intel.
**BGA & Socket Rework: Intel Reference Process- Parameter table**

<table>
<thead>
<tr>
<th>Rework Part Type</th>
<th>BGAs (and other area packages)</th>
<th>Process Socket</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Sn/4Ag/0.5Cu and Sn/3.5Ag Ball alloys, PCB</td>
<td></td>
</tr>
<tr>
<td></td>
<td>nominal thickness 0.062-0.093&quot; (1.6-2.4mm) [LGA sockets: Validated only 0.062&quot; PCBs]</td>
<td></td>
</tr>
<tr>
<td>Process parameters based on</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Peak Temperature Range</td>
<td>230-245 °C</td>
<td>230-250 °C</td>
</tr>
<tr>
<td>Time above 217 °C (TA217)</td>
<td>40-120 seconds</td>
<td>40-180 seconds</td>
</tr>
<tr>
<td>Maximum Body Temp and Time</td>
<td>Not to exceed component supplier max specification</td>
<td></td>
</tr>
<tr>
<td>Delta-T (temp difference) across joints on part while above 217 °C</td>
<td>≤10 °C</td>
<td>≤15 °C</td>
</tr>
<tr>
<td></td>
<td>Except for body temps, all temperatures are measured at</td>
<td></td>
</tr>
<tr>
<td>Soak Time, from 150 °C to 217 °C</td>
<td>≤100 sec (Soak time &amp; temp vary with solder paste selection)</td>
<td></td>
</tr>
<tr>
<td>Rising Ramp Rate below 205 °C</td>
<td>0.5-2.5 °C/sec</td>
<td></td>
</tr>
<tr>
<td>Critical Rising Ramp Rate between 205 °C and 215 °C</td>
<td>0.35-0.75 °C/sec</td>
<td></td>
</tr>
<tr>
<td>Falling Ramp Rate</td>
<td>0.5-2.0 °C/sec</td>
<td></td>
</tr>
<tr>
<td>Flux applied to Solder paste application</td>
<td>Pads on board</td>
<td></td>
</tr>
<tr>
<td>Solder paste</td>
<td>Same as used at SMT</td>
<td></td>
</tr>
<tr>
<td>Hot air rework machine</td>
<td>Den-on RD-500III</td>
<td></td>
</tr>
</tbody>
</table>
7. **Kit and tooling required for implementation**

1. BNZ 44 x 44 or BNZ 46 x 46 reference n: BNZ-xx

2. Laser Process Stencil, Any size, For BP-500 reference n: 61-03-03-01 (the ball printing kit come standard with the machine) Thickness 0.15mm Aperture 0.522mm

3. Insight Bottom Nozzle board support reference n: 61-71-03


5. SC-200/300 SMT Cleaner to clean the solder residue after removal

6. Solder paste used LFM-48U TM-H8 from Almit

7. LGA socket removal tool
Note: All the information in this document has been used to get the job done; changing the material may change the way to proceed on repairing the socket.

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Used equipment RD-500III

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