Drilling Techniques for Back Panel

By
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1. Introduction

The demand of back panels has been increasing for telecommunication board as well as mobile phone base station.
The characteristic of back panels is generally thicker board and larger size like over 30 inches and planning 70 inches future size, comparing with standard P.C.B size 21 x 24 inches.
To drill back panels has lots of difficulty and less productivity in comparison with standard panel drilling.
This article explains the basic drilling concept on back panels and specific functions of the machines to be added for proper drilling.

2. Back Panel Trend

The trend of back panels is shown in figure 1.
Main characteristic points are the below. These should be also paid to a special attention on actual drilling process.
1) The board thickness is getting thicker.
2) The weight is heavier.
3) The panel size is larger and longer.

<table>
<thead>
<tr>
<th>Panel Size [Inch]</th>
<th>Current</th>
<th>Future</th>
</tr>
</thead>
<tbody>
<tr>
<td>24&quot;x27&quot;</td>
<td>24&quot;x42&quot;</td>
<td>30&quot;x36&quot;</td>
</tr>
<tr>
<td>24&quot;x31&quot;</td>
<td>24&quot;x54&quot;</td>
<td>30&quot;x48&quot;</td>
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<tr>
<td>24&quot;x36&quot;</td>
<td>30&quot;x54&quot;</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>24&quot;x70&quot;</td>
</tr>
<tr>
<td>Thickness [mm]</td>
<td>0.125&quot; -- 0.420&quot;</td>
<td>*1 0.5&quot;</td>
</tr>
<tr>
<td></td>
<td>(3.175mm -- 10.7mm)</td>
<td>(12.7mm)</td>
</tr>
<tr>
<td>Weight [kg]</td>
<td>10</td>
<td>15</td>
</tr>
<tr>
<td></td>
<td>11</td>
<td>19</td>
</tr>
<tr>
<td></td>
<td>13</td>
<td>24</td>
</tr>
<tr>
<td></td>
<td></td>
<td>29</td>
</tr>
</tbody>
</table>

*1: It is necessary to use long flute drill.

Figure 1: Back Panel Trend
3. Drill Bit for Thicker Panel

Although board thickness of the basis back panel board is 6 mm or more, it has recently been produced for 9-10 mm board thickness as a product. 1/2” (12.7mm) or more is also examined in the near future.

The special drill, of which flute length is 14-15 mm, is needed, too.

(ref. Figure 2.)

4. Tool Change System for Thicker Panel Drilling

Regarding thick panel drilling, the following items should be considered from the point of machine design.

1) Movable stroke of pressure foot to hold panel is longer.
2) There is a function to confirm whether the spindle equips drill bits for a thicker panel without fail.
3) In case that the spindle equips a specially flute length drill, drill chucking system should be flexible as the height of drill tip is changed by the flute length.

(ref. Figure 3)
5. Solution of High Aspect Ratio Drilling

It is technically important how to reduce the drill bend as long flute drill bits are used, and also how to keep good conditions of inner wall in the holes, smoothly discharging drill dust which comes from drilling process.

As there happens an unsuitable case for one shot drilling due to board thickness, required drilling accuracy and hole quality, Step Feed Drilling process must be taken, even if productivity is somehow sacrificed.

Each manufacturer has adopting different step feed drilling systems in the machine.

Hitachi Via Mechanics, Ltd. have developed its own system which adopt sophisticated feeding and have long experience in actual thicker panel drilling process.

(ref. figure 4)
The examples of the 9 mm and the 12.7 mm of board thickness who processed using step feed drilling are shown in Figure 5 and 6. An accuracy distribution is the accuracy of the bottom side of a thick board. The step number of times is three times in 9 mm of board thickness and six times in 12.7 mm of board thickness. The step number of times is to increase or decrease due to required processing accuracy.

**Accuracy Result, Bottom Side**

- **Drill:** f 0.85mm
- **Thickness:** 9.0mm
- **Step Feed:** 3 times
- **Speed:** 100km/min⁻¹
- **Infeed:** 1.78m/min.

**Figure 5: Drilled Hole Accuracy(1)**
5. Special Machine for Back Panel

A drilling machine for exclusive use of the back panels is introduced in Figure 7. This ND-J series have specific function for thicker and larger panels drilling and at the same time, high accurate drilling is perfectly kept as well as spindle alignment accuracy, even two spindles drilling for larger size panels.

As back panels takes a very long time to finish drilling, operation rate of drilling machines is dramatically down if drilling works for standard size panels are made at the same machine. Specific machines likes ND-J series are recommendable to produce back panels.

Also it is explained about the specific function to be utilized for large sized and heavier back panels in machine.
6. Panel Set Up & Transportation

Weight of back panels is light one from about 10kg to heavy about 20kg, but in the near future it will become around 30kg or over.

It is very difficult for operators to handle these heavy weight panels.

The machine equipped with “panel lifter” in the above Figure 8 is absolutely needed to avoid manual handling works in setting up heavier panels on the machine.

This type machine adopt the Roller in the front cover fixed portion to smoothly slide panels on the table from the machine front side.
In addition to panel lifter, the specific Loading Cart in the above Figure 9 is prepared to carry on panels to the machine.

Especially, if the panel becomes 70 inches size, 30kg weight, it is difficult to transport them from previous process to drilling process.

This Loading Cart turns larger and heavier panels to the same level of the machine from vertical standing position.

In this case, special assist bar is additionally equipped to the machine side. Panels are drilled half and half as in Figure 8.

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