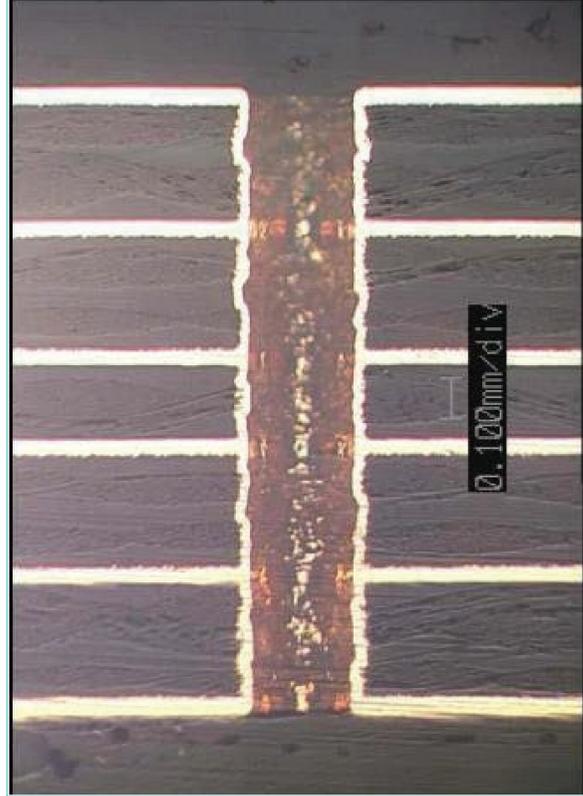
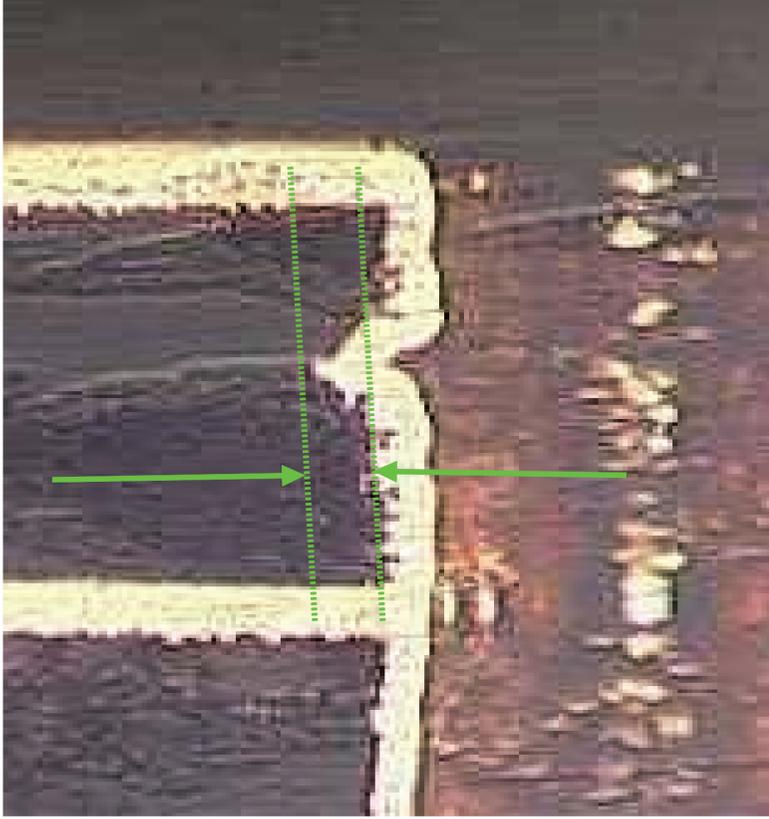




## ROUGHNESS OF HOLE WALL

The below pictures shows some very rough holes caused by drilling. This defect should be controlled to get the desired quality requirements.



FAILURE CAUSE	SYMPTOMS	REMEDIES
Use of improper drill geometry	By using low helix drill, the chips do not evacuate smoothly and leads to cause of roughness or By using standard drills	-Use higher helix drills -Use undercut drill
Flute volume too small	Due to this, chips will get clogged in flutes and cause of roughness	Enlarge chip volume in drill geometry
Flute length too short	Due to this, the chips will get clogged in end of flute and cause of rougher finish	Use suitable flute length as per stack height We recommend stack height < 85% of flute length
Thicker margin width	It will increase area of contact to hole wall and raise temperature during drilling which cause the roughness	Keep appropriate margin width
Excessive repointing amount	It will decrease flute volume as well as flute length which cause chip clogging resulting roughness of holes	Control amount of material removal in each grind ( 0.05 to 0.10mm). Set standard for overall length for each re-sharpening.
Carbide material grade	Improper grade of carbide causes more wear and increase hole roughness	Use suitable carbide grade



FAILURE CAUSE	SYMPTOMS	REMEDIES
Improper cutting parameters	Too high chip load or too low chip load causes the hole roughness. Too high chip load will increase chip volume and make hard to evacuate resulting roughness. Also it can damage cutting edge of drill bit and influence hole finish. Low chip load causes slow chip evacuation and more wearing of tool resulting roughness.	Use proper chip loads or optimize cutting parameters as per the drilling set up
Improper peck drilling	If no. of steps and infeed rate do not match the PWB set-up it will affect chip evacuation and cause roughness problem	Recalculate peck drilling steps and cutting parameters
Thick laminates	Chip evacuation is poor due to large volume of chips and causes poor finish	Use lower chip loads or not use more no. of stacks in case of thicker laminates
High Cu content laminates	Spiral copper chips form block chip evacuation as well more wear of cutting edge, resulting poor hole finish	Use lower chip load and decrease stack height Use peck drilling.
Penetration too deep into back-up	Too deep penetration into back-up generate large particle of swarf causing bird nesting.	Use proper back penetration
Improper Stack Preparation	A gap between the entry and boards causes poor evacuation	Do proper stack of entry and laminates, back-up.
Improper vacuum pressure	It affects the chip evacuation and worsens the hole wall	Keep it into recommended limits. It should be > 80mbar in case of micro drilling
Laminates quality	Improper resin and fiber inter-sections leads to poor hole wall quality	Keep control on the laminate quality
Entry material	By using aluminum entry, the fine roughness can not always be expected. The lubricant type entry offers better comparability for fine hole wall conditions.	Use high quality entry board like attached water soluble resin type, multi layer aluminum type etc.



FAILURE CAUSE	SYMPTOMS	REMEDIES
Improper pressure foot	Wider inner dia of bush causes poor evacuation of chips and roughness of holes	Use small inner diameter bush in case of micro drills
Spindle run-out	More spindle run-out causes more wear of cutting edge and drill wandering leads to poor hole wall quality	Keep it into the specified limits. Recommendation is < 0.005mm for micro drills and < 0.012mm for larger diameters >0.50mm