Managing Excess Heat in a Nested-based CNC Application

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Some topics are worth discussing on a regular basis, particularly those concerning safety and potential property damage. A CNC router in a nested-based application, has the potential to generate enough heat to start a fire and everyone needs to understand how it can happen and how to avoid it.

Any woodworking tool… router bits, saw blades and drill bits… spin fast enough to generate heat quickly, just like rubbing two sticks together, but much more quickly! Even using basic power tools, we have all seen the telltale brown tool marks when the wood jams or the tool doesn't move along as intended. Or worse, we've seen smoke rising from the tool and smelled the burning. Proper tool feed rate and RPM will cut the material efficiently, preventing excessive heat buildup and providing a nice finish on the workpiece.

On a nested-based CNC router, the clues that something is amiss aren't easy to detect and it's possible for a situation to go from bad to worse to disastrous in a hurry. Why is it so difficult to know if a tool is generating too much heat on a CNC? The tool in operation cannot be seen beneath the dust collection shroud. If material is smoldering, airflow from the vacuum system will pull any smoke downward through the MDF. This same airflow also fuels the fire. Not until the vacuum is released will any smoke be visible. Even then, the dust system may pull the smoke away from the machine. The flashpoint is typically between the panels being cut, away from the edge of the table, making it difficult to see.

How is this excess heat generated?

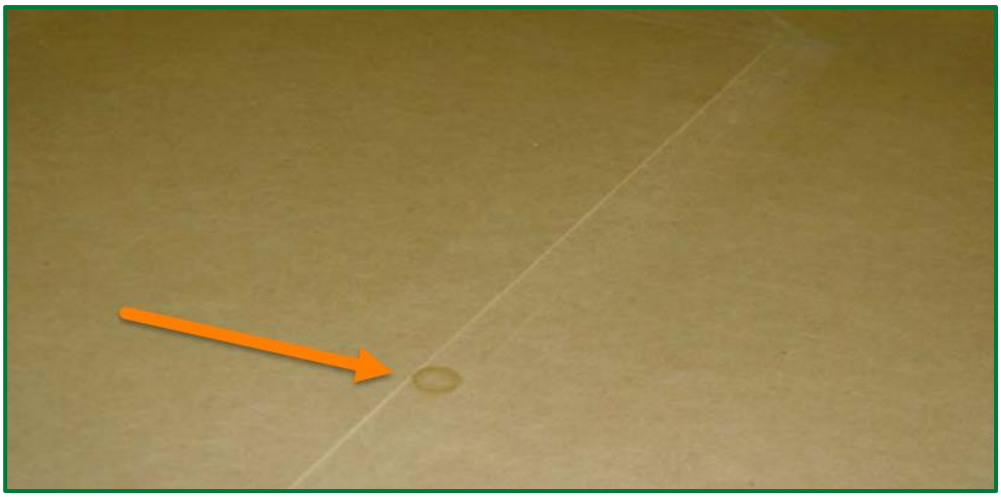
#1: Feed rate too slow…way too slow. This usually happens when the operator uses the feed rate override to test a program. Overriding the feed rate will cause the machine to slow dramatically in the corners, where machines typically slow the feed rate automatically.

#2: Using tooling that is not designed to plunge. A tool that can't cut with its bottom edge can push a "plug" of material through the board and get red hot almost instantly. If this plug of material is trapped between the tool and the spoilboard, smoldering will begin and the airflow from the vacuum pump will fuel it. Always use a router bit designed to plunge vertically.

#3: Incorrect lead-ins in the CNC program Even with a tool designed to plunge, the lead-in length needs to be 3 to 4 times the diameter of the tool. In your programming software, find whatever parameter controls the lead-in length and verify it is creating the proper lead-in.

Dull tooling can make any of these conditions worse.

In addition to managing these conditions, also keep an eye on the spoilboard itself. If you see brown circles on it, as shown in the picture, that's an indication that the cutting tool is not moving fast enough and heating up. These brown circles are a warning that one or more of the conditions above are present and **needs to be corrected**. Always seek out and follow the tooling manufacturer's recommendation for feed rate and RPM for the material you are cutting.



Whether your CNC has a phenolic or aluminum table, you need to be diligent about managing excessive heat. If you don't, then damage to your machine is the least of the problems that can occur. The big issue that must be avoided is embers getting pulled into the dust system resulting in a fire that can destroy everything.