What's new in tooling

Tooling is technical. To stay competitive you must be aware of the latest developments – including the variables and good tool management. By James Abbott and David Morr

James Abbott (left) and David Morr

The machinist needs to be aware of all the variables and how to manage tools well. There are so many variables that a machinist needs to be aware of that can lead to problems during the machining process. These include: chip forming and evacuation, tool wear and heat. By smart tool selection, correct tool usage and milling processes, you can manufacture products straight off the machine and increase productivity.

To stay in touch we encourage you to attend industry events. Below is an outline of the technology demonstrated and discussed at a recent Society of Manufacturing Engineers (SME) event.

SECO Tools Australia, a leading supplier of carbide to the manufacturing sector, hosted a technical evening for the Society of Manufacturing Engineers (SME). It focussed on the development of new technologies in metal cutting and was held at the SECO Technical Centre at Huntingwood, NSW.

Challenge Engineering, a leading Sydney CNC machining company, co-ordinated the event, for which more information can be gained by visiting www.challengecnc.com.au. Challenge Engineering has been very active in the manufacturing sector and was responsible for co-ordinating another event on Lean Manufacturing late last year. The company believes in the importance of building awareness in these areas, particularly in such a competitive environment.

CNC machining

Many years ago, an experienced machinist was someone who could grind a HSS tool with the appropriate cutting geometry to suit the material they were machining. Today, an experienced machinist is someone who can apply the appropriate cutting parameters to available tooling to cut any material.

Chip forming and evacuation

Chip forming and evacuation really needs to be fully under control. If not, long chips can cause production stoppages and damage to work pieces, machine tools and cutting tools – as well as operators. Cutting forces acting on the tool need to be completely understood. If control is lost, there is a risk of broken tools, broken cutting edges and vibrations during the operation. All of these will cause production stoppages and a poorly finished product.

Tool wear

Today's machinist needs a solid understanding of chip formation and tool wear. Contrary to popular belief, short 'C' shaped chips are not necessarily desirable. They require an extra 20% of force to produce and reduce tool life. In fact, short spiral chips are more desirable because they do not require as much machine power. To understand tool wear is the key to a safe and predictable machining process as it's an excellent gauge for productivity. But what should you look out for? Tool wear that occurs suddenly like 'breaking' or 'edge chipping' needs to be avoided. As it turns out, flank and crater wear are what you should be striving for in tool wear, because they are measurable.

Example: if you're getting 0.3mm flank wear every hour, or 100 parts, then each time you change that insert on that job, you will get the same amount of tool life and insert wear over and over again. It's measurable, and of all the tool wear variations you can get, 'flank' and 'crater' wear are the most desirable. Whereas, 'plastic deformation' on the other hand is an undesirable tool wear. Basically, you're melting the cobalt binder in the cemented carbide insert as you're placing too much heat into the cutting edge, making it unpredictable.

But without enough heat at the cutting edge, you will have 'built up edge' where friction welds small deposits of metal during the cutting process onto the cutting edge that will deliver an uncontrollable cutting action resulting in poor swarf control and surface finish! This leads us to the topic of heat and temperature.

Heat and temperature

Machining metal generates a lot of heat. If not evacuated by the chips, this heat will concentrate over a period of time in the cutting tool or in the work piece surface, jeopardizing the quality of the finished work piece. The high temperature in the cutting process can cause changes in the cutting properties of the cutting material with loss of tool life as a logical consequence. Heat can make it difficult to finish work pieces with the correct quality in terms of dimensions, shape, surface roughness and surface structure etc.

It's a well known fact that a lot of heat is generated during the cutting process. Heat can be used to our advantage, but temperature is what we need to avoid. Why? It's a function of pressure from the cutting forces on the cutting edge.

However, you don't want to generate too much heat as it will build temperature into the insert and the work piece. Interesting to know is that, under normal machining conditions, if you are machining steel, 80% of heat is evacuated through swarf.

Understanding the cutting process

Are you familiar with the "flow zone"? It is a term that explains the microscopic, deformation of material at the cutting edge. Long chipping materials have a flow zone

Continued on page 62