



# Process optimization and quality monitoring

Increasing tool lifespans through  
improved clamping technology

## Vibrations

**Are the arch nemesis of the machining world. Why?**

Because, at best, they cause damage to the surface of the workpiece and, at worst, they render the workpiece completely unfit for use. Plus they can significantly shorten the lifespan of cutting tools. There are many potential solutions to this problem, including 5-axis vices with integrated elastomer damping such as the X5G-Z from CERATIZIT. The question is do they work? Does the vibration-damping action of the X5G-Z really improve surface quality when used in combination with the latest SilverLine milling cutters and a brand-new heavy duty chuck (HDC)? To find out, we used ToolScope and a sensor integrated in the spindle to monitor the vibration levels and the condition of the tool on the cutting edge throughout the machining process.

CERATIZIT ist eine Hightech-Engineering-Gruppe,  
spezialisiert auf Zerspanungswerkzeuge und  
Hartstofflösungen.

**Tooling a Sustainable Future**

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## Test use-case

To demonstrate the effectiveness of a 5-axis vice with integrated vibration damping and show how it can improve workpiece surface quality, we conducted a test directly comparing two different vices. The basic test conditions were the same for both:

Each was installed with the same adapter plate on a mechanical zero point clamping system in a DMU 75 monoBLOCK 5-axis milling centre from DMG MORI. The adapter and cutting tool were the same and a new tool was used for each milling operation.

The competitor's 5-axis vice was fixed in place with two screws tightened to 100 NM. The 1.2379 steel workpiece was then clamped in position using grip jaws with 40 kN clamping force. The X5G-Z was fitted with just one screw tightened to 140 NM, and the workpiece again clamped in position using grip jaws with 40 kN clamping force. The cutting tool of choice was an end mill (10 mm diameter) from the latest SilverLine series which was clamped with a HSK-63 heavy duty chuck.

The machining parameters were the same for both test set-ups:

$v_c$  155m/min  
 $F_z$  0.1 mm/tooth  
 $a_p$  20 mm  
 $a_e$  2 mm

And the vibration levels were measured using a separate sensor on the spindle, which is usually used for collision monitoring.



The red line on the ToolScope display shows the vibration level, and above and below this are two green tolerance bands. If the red line touches either of the green lines, ToolScope immediately stops the machine. The black line indicates the maximum value. If this level is reached, the machine stops automatically. This maximum value is designed to provide an added safety mechanism as part of a reliable process monitoring system. In the machining test with the X5G-Z, vibrations remained at a consistently low – almost negligible – level. In other words, the process ran very smooth and the vice's integrated elastomer damping worked well.

The differences in the surface quality were clear to see and the roughness measurements backed up this visual observation. In fact, the X5G-Z gave users a significant quality advantage, with the results almost twice as good as those achieved with the competitor vice. The machining process was also gentler on the cutting tools and the tools had longer lifespans – all vital factors in maintaining a consistent machining process and quality end product.

**Simple to extend up to a clamping range of 687 mm**

Fully encapsulated,  
mechanical spindle

**130 mm basic clamping stroke  
without the need for conversion**  
Quick adjustment of clamping range

**Optimised  
against vibrations**

Integrated, internal elastomer  
damping

**5- and 6-sided machining possible**

Integrated pull-down action

No force transmission across the seating surface

## Benefits:

- ▲ Improved surface quality
- ▲ Greater accuracy
- ▲ Longer tool lifespan
- ▲ More flexibility in terms of machining volumes/feed rate/RPM

## Summary:

**There are enormous benefits to reducing vibrations in the machining process**

The workpiece surface quality is improved and the cutting tools last much longer. A well-designed clamping system such as the X5G-Z 5-axis vice with integrated elastomer damping can have a significant impact when it comes to minimising vibrations. To achieve the best results, it's important that all the components – i.e. cutting tool, chuck and vice – are compatible with one another. A process monitoring system like ToolScope also gives added peace of mind, since it keeps a close eye on all the relevant parameters throughout the machining process, and triggers the emergency stop before the tool or workpiece get damaged.



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