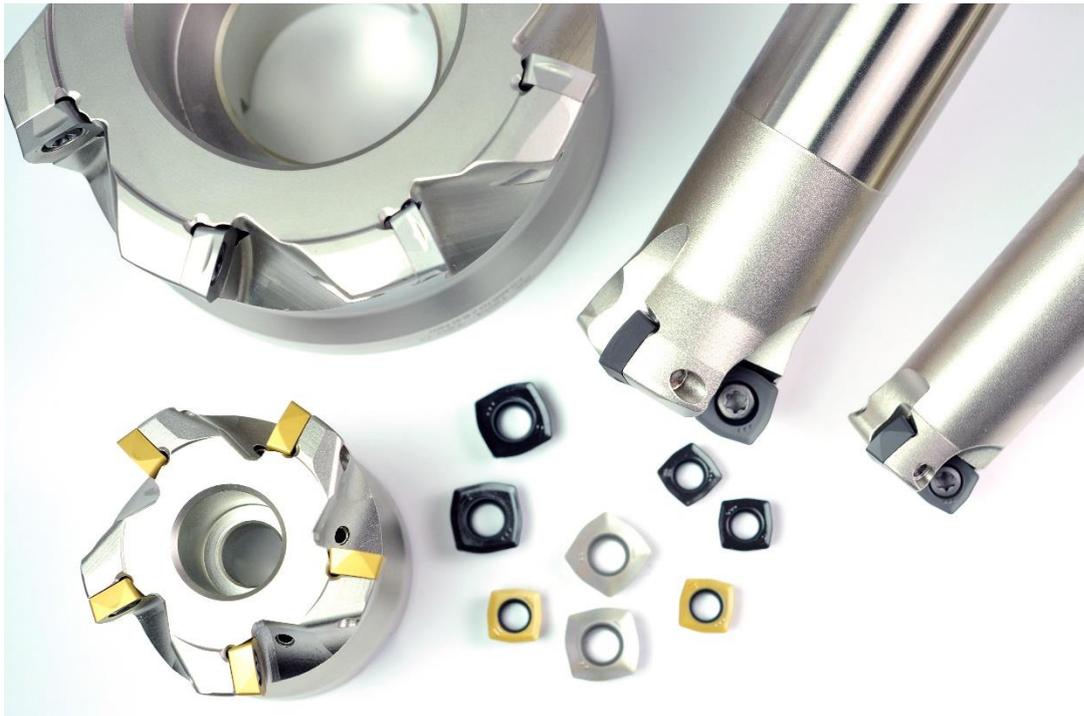


## TECHNICAL ARTICLE

Smart technologies for tool procurement

### High-feed milling: From the digital twin directly to the machine



*Efficient online procurement: OSG's PHC product line in the Tool-Arena*

*High-feed milling cutters are used when difficult-to-machine materials place high demands on machining. Low cutting depths and high tooth feeds maximize the quality of the workpiece. An example from OSG shows how smart functions on tool-arena.com check the compatibility between milling cutter and machine and thus simplify procurement.*

Stainless steel, titanium or hardened steel: materials that are difficult to machine do not allow large cutting depths and can therefore lead to complications in HPC (High Performance Cutting) milling. The large wrap-around not only results in vibrations, but heat

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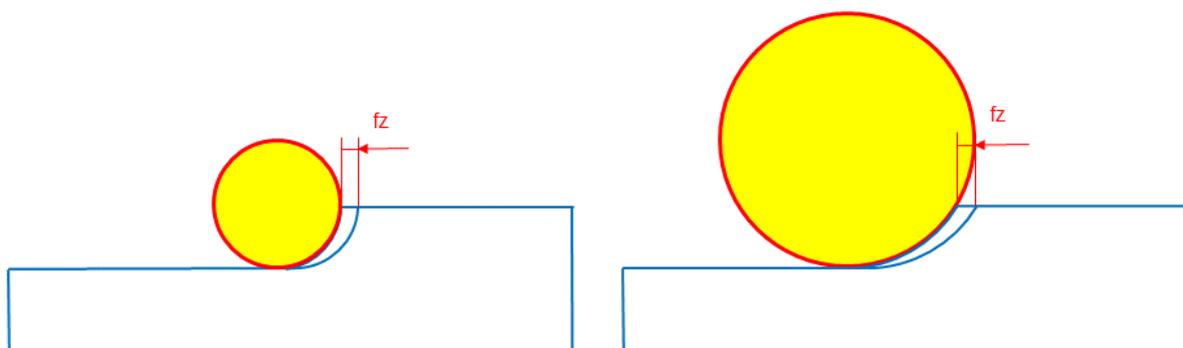
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and high cutting forces also develop. Although the machining process can be implemented at low cutting speeds, it is clearly inferior to other production processes in terms of economic efficiency.

In order to still be able to machine titanium and co. with a large metal removal rate, HSC milling (high-speed cutting) offers a sensible alternative. HSC milling is characterized by low cutting depths and high feed rates. The cutting forces are thus significantly lower and the heat development is also at a very moderate level. The basic principle of HSC milling is based on generating thin chips in order to increase the tooth feeds.

### Relevant parameters for HSC milling

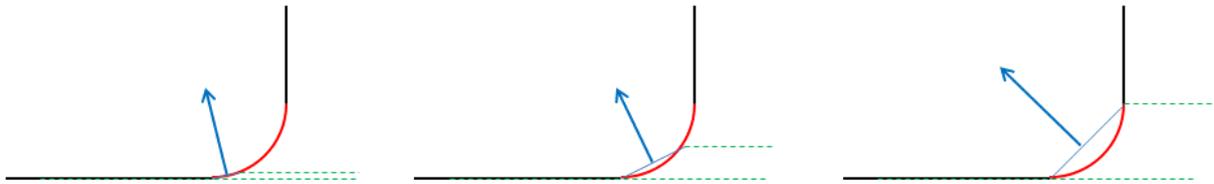
When milling with a torus cutter (cutter with corner radius), the size of the corner radius and the possible cutting depths are directly related. They influence the chip thickness and thus the tooth feeds that can be implemented. Figure 1 makes this clear. With the same depth of cut and the same tooth feed, a thinner chip is produced with a larger corner radius.



Picture 1

As a consequence, it makes sense to use the largest possible corner radius to get the chip as thin as possible. This allows the tooth feed to be increased again, which leads to corresponding metal removal rates. A positive side effect of the large corner radii is that the radial forces are lower than with small corner radii and the same cutting depth.

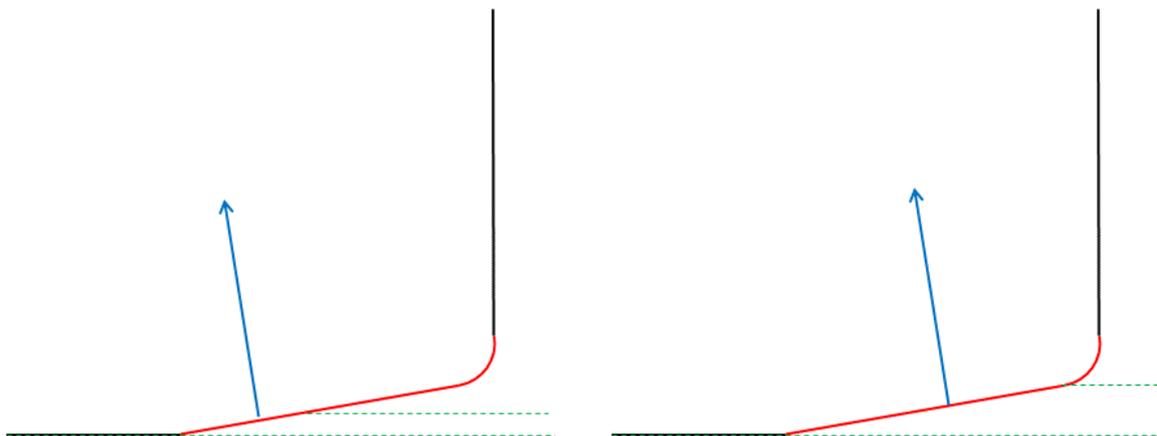
Picture 2 shows the relationship between cutting depth and radial force. It can be clearly seen that with increasing depth, the resulting force changes more and more in the radial direction. As a result, the lateral displacement of the tool increases, which leads to vibrations and consequently poor surfaces and tool life.



Picture 2

### HSC milling cutter: Face cutting instead of large corner radiates

High feed cutters have a decisive advantage: They do not have a large corner radius, but a face cutting edge that is arranged at an angle of approximately ten degrees. As long as the cutting depth does not exceed the height of the face cutting edge, the direction of the cutting force always remains the same: perpendicular to the cutting edge, pointing towards the tool spindle.



Picture 3



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Only low radial forces are generated, which is why the production process is not negatively influenced by vibration. This means that the tool can also be used for large overhang lengths. The flat angle of the face cutting edge creates a chip thinning. As a result, the tooth feeds can be raised considerably. The supposedly low cutting depth is compensated for by increased feed rates.

OSG is known for its shank tools. But the Japanese company with its German headquarters in Göppingen in Baden-Württemberg has also established itself in the field of indexable insert tools. One example of HSC machining is the "PHC" milling cutter series. This is characterized by indexable inserts in different sizes and for different materials. Here, the face cutting edge was set at about ten degrees. The resulting thin chips enable high feed rates and generate only low radial forces, which benefits the surface quality of the workpiece and the tool life.

### **Find, filter, plan: Tool search in the Tool-Arena**

To simplify the search for suitable products, OSG is represented in the Tool-Arena. Numerous smart technologies are available to users via the online marketplace. For example, they can assemble virtual assemblies across all available manufacturers and view them all around in 3D with a 360° view. Registration and use in the Tool-Arena are completely free of charge.

In the 3D configurator, Tool-Arena users select suitable adapters or cutting inserts for their milling cutter. The creation of digital twins is ideal for planning complete tool systems. With the help of these functions, purchasing saves time-consuming enquiries about drawings and 3D models or compatibility with interfaces. Last but not least, the Tool-Arena facilitates the procurement process, as products from numerous manufacturers can be ordered centrally via the platform – for example directly from OSG, without intermediate suppliers.

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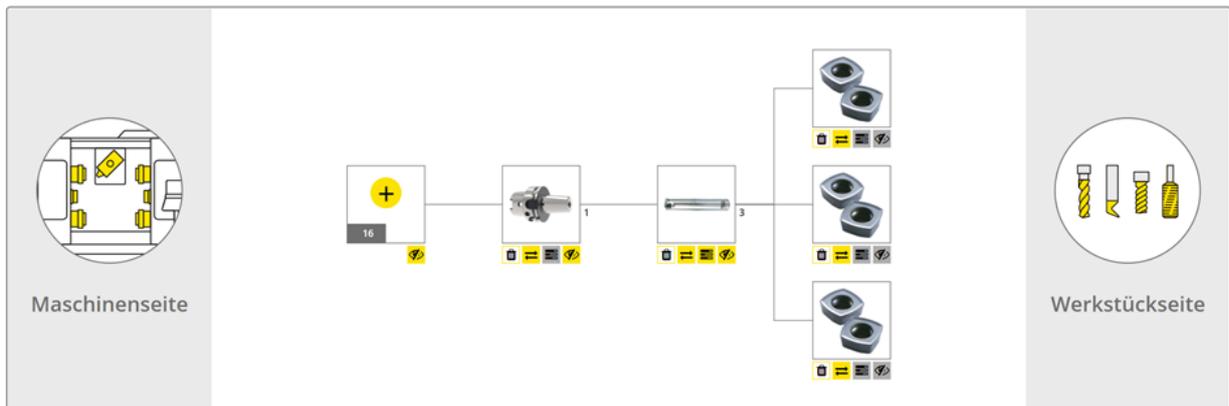
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Picture 4: Virtualisation in the Tool-Arena: In this 3D assembly, OSG tools from the PHC Bore / PHC Inserts series were combined with a matching i-tec shrink fit chuck from KELCH.



Picture 5: On tool-arena.com, users can see all the parts of their assemblies in detail and order them directly from the manufacturer - centrally via one platform.

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For future projects, 3D plans can be saved on tool-arena.com or downloaded directly into the CAD/CAM system for future projects. The data export optimizes programming, minimizes the risk of collisions and makes the workflow faster and easier.

### **Insert milling cutters from OSG: more performance, safe for breakouts**

Almost 16,000 OSG products are available in the Tool-Arena. OSG also demonstrates special expertise in the field of inserts. The PHC insert milling cutter is designed with a special geometry on the cutting edges that counteract scour wear, which is widespread in HSC milling cutters.

If extreme tooth feeds are used, there is a lot of chip flow on the cutting edge. This favors scour wear – a washout on the rake face. To minimize wear, OSG has geometrically adapted the plate in the area where the chip flows off (picture 6, marking 1).



Picture 6



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OSG has also provided for the worst case: it can happen that a cutting edge breaks out due to the high pressure. Then an indexable insert often breaks through completely. OSG has shaped this edge in such a way that only a part will chip off if damage occurs (picture 6, marking 2). The three remaining cutting edges can still be used.

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### **About Tool-Arena**

The software start-up Tool-Arena GmbH, based in Uhingen near Stuttgart, is a wholly owned subsidiary of the EWS Group. The Tool-Arena online marketplace of the same name went live in September 2019 – three years after the company was founded. Tool-Arena's mission is to connect customers, dealers and manufacturers in the machining industry on one platform and to make the procurement process technology-driven and efficient.

Further information: [tool-arena.com](https://www.tool-arena.com)

### **About OSG**

OSG is a manufacturer of cutting tools with a wide variety of products and as such specializes in the production of threading tools, milling cutters, drills and thread rolling dies. In its core business of threads, OSG is currently the world market leader. Since the company was founded in 1938, its primary goal has always been to offer products of the highest quality. OSG is No. 1 in the Japanese cutting tool market and is also in the top ranking internationally. OSG is active in 33 countries worldwide.

Further information: [tool-arena.com/brand/OSG/products](https://www.tool-arena.com/brand/OSG/products)

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