**Mastering processes: grooving**

**When Paul Horn introduced the type 312 indexable insert to the public in 1972, it was a small revolution in the grooving process. Horn was the first manufacturer ever to develop a tool system with a vertically mounted, three edged carbide insert for grooving. Today, the grooving process with indexable inserts is indispensable in modern manufacturing. Radial grooving, parting-off, face grooving and internal grooving to µ-precision are now part of everyday life in the machining industry. Paul Horn's incentive at the outset was for the technical perfection of his products and the Horn company continues to set similar standards in tool technology for this machining process.**

The 312 insert is still popular with users today. Horn has not stopped developing and optimising successful product families. At the same time, Horn has completely integrated the value creation for its entire product range into its own production. The possible applications of the tool have grown considerably after the insert was originally used almost exclusively in the automotive industry. The "312" is intended for external machining and is used, among other things, for producing workpieces in the medical industry, in the manufacture of hydraulic components and for making everyday objects such as jewellery or ballpoint pens. However, it is not only the type 312 insert that has made the precision tool manufacturer known as a specialist for machining between the flanks. Numerous other tool systems followed the idea from 1972, which are now successfully used for grooving worldwide.

Basically, the grooving process involves a narrow cutting edge that penetrates the workpiece in a radial or axial direction. The art of grooving is, among other things, controlling the chip flow. Chip sticking, jamming or long, stringy swarf must be avoided in practice, as they have a negative influence on process reliability and can lead to tool breakage and damaged flanks. Depending on the material to be machined and the type of machining, Horn has developed different chipbreaker geometries that ensure reliable chip formation, control and breakage. Another important point for economical grooving is a sufficient supply of coolant. Where in the past cooling was external with the classic flood coolant, today modern tool carriers are used, mostly with an internal coolant supply. This ensures effective cooling of the shear zone between the tool cutting edge and the workpiece. For parting-off, Horn also offers a type S100 insert, which supplies the contact zone with coolant at high pressure directly through the insert. Tools are exposed to high loads during parting-off. The quality of the carbides used, the quality of the cutting edge and the insert coating also play an important role in reliable and economical parting-off.

**Grooving in practice**

A user produces a wide and deep groove in an aerospace component using the trochoidal grooving method. It is very well suited to the production of of deep, wide grooves where high metal removal rate must be generated.The machinists produce the component from 1.4548 (X5CrNiCuNb17-4-4), a steel with high corrosion resistance, strength and toughness. Roughing is carried out using a full radius Grooving insert S229 with a radius of 2 mm. The grooving process is designed as follows: The 30 mm wide and 15 mm deep (incremental) recess is trochoidally roughed using the full radius indexable insert with a cutting speed of vc = 140 m/min at a cutting depth of ap = 1 mm The programmed feed rate is fn = 0.25 mm -1. The finishing allowance is 0.2 mm. Finishing also involves using a cutting insert from the S229 system. The finishing operation is carried out from two sides with a 3 mm wide grooving insert. The corner radius is 0.2 mm. The totalproduction time to complete the groove is less than two minutes.

**Face grooving in the medical sector**

For the production of a thin-walled valve cover made of titanium for a cerebrospinal fluid shunt system, the Supermini system type 105 is used. On one hand, the customer uses a tool for the face grooves and, on the other, a special tool for finishing the lid fit. For the narrow fit on the lid with a length of 0.5 mm, Horn had to design the Supermini tool with a corner radius of 0.05 mm. The difficulty in machining titanium always arises from the dissipation of heat as well as the control of chips. For use as an implant, the user has strict criteria regarding the surface quality and the absence of burrs on the component. By optimising the cutting paths with a CAM system, the experienced colleagues in the machining department were able to double the tool life from 1,000 to 2,000 components.

Although Horn's tool portfolio has expanded considerably, not only in the area of grooving but for all applications in the field of demanding machining tasks, grooving and thus machining between two flanks is still considered the supreme discipline. Looking ahead to the AMB 2022 trade fair in Stuttgart and IMTS 2022 in Chicago, Horn is presenting innovations and expansions in the area of grooving.

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BU: Horn has numerous tool systems in its portfolio for grooving.

Source: HORN/Sauermann



BU: Trochoidal grooving is very well suited to the production of deep, wide

grooves.

Source: HORN/Sauermann



BU: Face grooving of the medical component with the Supermini Type 105 system.

Source: HORN/Sauermann



BU: Horn was the first manufacturer ever to develop a tool system with a vertically mounted, three edged carbide insert for grooving.

Source: Horn/Sauermann