

AUTOMOTIVE

TURNING THE WHEEL

➤ “Since the mid-1970s, the market for aluminium wheel rims has increased dramatically, going from a niche accessories business for sports fans and high-end cars to a mass business”, explains Horst Schuster. The founders of Dugar + Schuster, a machine building specialist based in Langenfeld, have been familiar with the aluminium wheel market right from the start because its customers include component suppliers to the automotive industry. “A machine can only deliver its full capabilities by working in perfect harmony with the tools”, asserts Schuster. In HORN, he has managed to find a suitable tool partner to supply the original equipment for the lathes he sells. Dugar + Schuster’s experienced directors were both won over by HORN’s expertise and by its sales representative Andreas Manfraß.

*Machine and tool
in perfect harmony*



The RDM 4 series from Dugar + Schuster with specially adapted automation.



Turning the wheel flange with the S29F system.

The partnership between Dugar + Schuster and HORN dates back to 2015. As far as the machine building specialist is concerned, the Tübingen-based precision tool manufacturer is the number one choice of tool supplier. At the customer's request, the specialist from the Rhineland can supply all its machines equipped with HORN tools as original equipment. It also uses HORN tools during machine demonstrations. "The tools are extremely powerful and are specifically tailored to the machining of aluminium. Thanks to the experience and commitment of the sales staff and consultants, we can get our hands on the optimum technology for customer-specific applications", explains Managing Director Frank Schuster. Andreas Manfraß is also keen to sing the praises of the cooperation: "We work very closely together and have already managed to solve several problems and improve day-to-day machining processes for the customer."

Stringent tolerance requirements

There are three basic methods of manufacturing aluminium wheel blanks, depending on quality and price range: flow forming, forging and casting. With all three methods, the blank still has to undergo machining once it has been produced. This is the only way to achieve the necessary hub-to-bolt circle, radial run-out and axial run-out tolerances. Furthermore, the automotive industry imposes strict requirements on surface quality, which is regarded as a designer feature of the wheel.

The blanks produced by each of the three production methods exhibit different properties during machining. Flow form wheels have a tendency to vibrate because the walls of the rim wells are sometimes very thin. To prevent these vibrations, an appropriate cut distribution must be set for the blank. Forged wheels behave very differently from cast wheels during machining. The former tend to produce long chips and because of the nature of the process have a bigger allowance than cast alloys. Forged wheels are also stronger than cast wheels, increasing the amount of power required by the machine and placing greater demands on the tool's cutting edge. In cases where forged wheels also happen to have particularly thin walls, the machining requirements are very high indeed.

Tools are not allowed to limit the machine

"The machine's full capabilities can only be realised if it works in perfect harmony with the tools and fixtures. For this reason, we expect the tools not to limit the machine's performance", states Frank Schuster. HORN has been focusing intensively on tool development for the wheel industry since 2010. The requirements for the inserts are extremely demanding. Long tool life, high surface quality and precision are just a few of the properties that the tools are required to demonstrate during series production. Very long throat depths are sometimes required for rim well and spoke turning operations. As a result, the tool

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The PCD-tipped cutting edges offer long tool life, controlled chip breaking and high surface quality.



Turning the spokes with interrupted cutting.

holder has to offer a very high level of stability. Otherwise, the resulting vibrations will cause premature wear on the cutting edge and lead to poor surface quality. "For process reliability during aluminium wheel machining, the technical limits must be set by the workpiece, not by the machine or the tool", believes Horst Schuster.

The different aluminium alloys call for appropriate cutting materials to ensure process-reliable machining. When designing its tools, HORN relies on the cutting material PCD (polycrystalline diamond). The precision-ground PCD cutting edges achieve high levels of surface quality and are an effective way to stop chips from sticking thanks to the diamond material's low coefficient of friction. In addition, PCD offers considerably longer tool life than carbide because of its high abrasion resistance. Consequently, the workpieces enjoy better long-term dimensional stability. Andreas Manfraß is also keen to emphasise the

benefits of PCD: "The introduction of PCD-tipped cutting inserts has proven to be one of our greatest advances in the area of wheel machining tools. PCD is the only way to achieve long tool life coupled with high surface quality and process reliability in a series production context."

90 per cent diamond

Polycrystalline diamond is a composite material. The diamond particles are randomly oriented in a metal matrix (binder) that can be made from cobalt, nickel or titanium. The matrix makes PCD electrically conductive, meaning that it can also undergo electrical discharge machining. The diamond content of PCD cutting materials is usually somewhere around the 90 per cent mark. Grinding results in high cutting edge quality and makes for minimal chipping of the edge. For optimised chip breaking



A close partnership: Horst Schuster (company founder) in conversation with Frank Schuster (Managing Director) and HORN technical consultant Andreas Manfraß.

and managed chip removal, HORN offers PCD cutting inserts with lasered chip shape geometries.

The machining process for aluminium wheels usually involves the use of special turning centres, although standard ones are sometimes used instead. For their special machinery, wheel manufacturers rely on machines like the ones from Dugar + Schuster. Thanks to the development of its RDM 4 series, the Rhineland-based company is able to offer a lathe for machining wheels in sizes ranging from 12 to 24 inches. At the heart of the machine, there is a specially designed motor spindle with an output of 92 kW. The wheels are attached to this by means of special fixtures. Two vertically arranged turrets – each with eight tool locations – mean that there is enough space available even for demanding machining operations.

A designer piece

Setting function aside for a moment, aluminium wheels are one of the few car components that can be custom selected as styling elements. Automotive manufacturers take advantage of this to position their vehicles in the market and create a specific design look. Since it first began in the 1970s, the market for aluminium wheels has increased dramatically, going from a niche accessories business for sports fans and high-end cars to a mass business. In the beginning, there were many different aluminium wheel manufacturers based mainly in Europe, but these have turned into a relatively homogeneous group of globally active manufacturers. Nevertheless, market niches still allow smaller companies to spring up and survive within this sector.

➤ Dugar + Schuster was established by Janos Dugar and Horst Schuster in 1974. It was a rocky start, with an economic crisis coming hot on the heels of the oil crisis. Thanks to Janos Dugar's experience and Horst Schuster's drive, they managed to get through the crisis and it was soon firmly behind them. When the former retired at the end of the 1970s, Horst Schuster started running the business on his own. Shortly after that, the company relocated to Langenfeld in the Rhineland. The current Managing Director, Frank Schuster, joined the company in 1995. Today, the machine building firm offers an all-round service for machines from its sales portfolio. This even extends to a complete overhaul and automation. By developing the RDM 4 series, Dugar + Schuster is once again demonstrating the expertise in aluminium wheel machining that it has accumulated over a period of 40 years.