



METAL CASTINGS FOR AUTOMOTIVE

FANUC for MAATSURA

Task Premium manufacturer BBS Motorsport needed to find a solution that enabled it to shorten processing times but also guarantee superb surfaces on the wheels it makes for Formula 1 racing cars and other high-performance vehicles

Solution Fitted to BBS' Matsuura MAM72-63V machining centres, Fanuc Series 30i-A CNCs provide the sophisticated level of control required to achieve extremely high levels of accuracy from high-speed (HSC) and 5 axis machines

Result Machining is not only very fast, but the CNC also contains a number of software features that have been specifically designed to get the most from 5 axis machining and fully utilise the machine's potential

Pole Position in Machining

BBS Motorsport relies on Fanuc-controlled turning and milling centres

When machining cast and forged blanks into wheels for Formula 1 racers and other racing vehicles, it's a race against the clock. The premium manufacturer BBS Motorsport achieves superb results with machinery that includes Matsuura machining centres. The preferred control and drive technology comes from world market leader Fanuc.

It is not difficult to notice that Roman Müller, Managing Director of BBS Motorsport GmbH, has a passion for motor sport. He speaks with enthusiasm about light-alloy wheels that his company develops and produces, and about the successes that have been attained on

"Working together with the leading racing teams, we want to develop the world's best light-alloy wheels that will provide that decisive edge of 1/100th of a second."



BBS wheels for 40 years in every racing sport class. One example: All the world championships that Michael Schumacher achieved for Ferrari occurred on BBS wheels.

It's thus no surprise that Roman Müller has such high standards for himself and his experienced team:

For 40 years, a successful partner of automotive racing sport

The company's history is marked by numerous development highlights. As early as 1972, BBS (established in 1970) produced three-piece wheels, consisting of a central hub, as well as an outer and inner rim. Whilst the latter are available in various sizes in inventory, the pre-fitted hub is adjusted on short notice to the particular vehicles. By means of the modular system, many versions with respect to width, rim offset and diameter can be created. "Such an individual wheel is completed within one week", says Roman Müller, "and the customer can drive his sport vehicle on the racetrack".

Three-piece wheels remain popular, yet today there are predominantly one-piece light-alloy wheels that are cast or forged in one solid piece. They combine the light weight of special alloys with utmost stability – without any weak points, as Roman Müller points out. In order to guarantee this, they are put through multiple production inspections at BBS Motorsport – for the first time prior to machining, in order to ensure that the material quality conforms to the standards. This is followed by in-process measurements on machine tools and finally a three-dimensional 100%



inspection in the measurement room.

With respect to weight, rigidity and durability, BBS set a milestone with the development of the magnesium forged wheel. For Roman Müller it was a great success: "At beginning of the 90s, Ferrari was the first racing team to use our forged magnesium wheels for the Formula 1. Today those wheels have become a standard, and unfortunately we are no longer the sole producers."

Yet not merely in terms of materials, BBS Motorsport excels through innovations that have set new standards on the machining side. For example, the ratio between weight and stability can be optimised by milling the spokes. In doing so, parts of the wheel are removed that are not relevant for rigidity and therefore unnecessary ballast. A technology originally developed by BBS which is emulated by many others today.

Ahead of the field in machining as well

In order to perform such difficult machining procedures economically, the wheel manufacturer must be perfectly equipped in the production department. For machining, Roman Müller has relied on two essential suppliers: Mori Seiki delivers the turning machines, and Matsuura supplies the milling machines. What the company's owner appreciates most about these suppliers is the high long-term quality. The racing supplier also praises the Matsuura machining centres for their speed: "When we started out with high-speed machining in 1999, we tested the centres of various manufacturers. For our requirements in light-alloy machining, the FX70 from Matsuura achieved the best results by far."

At that time, BBS typically received the unfinished blanks pre-forged close to the final contours, so that only minor milling and drilling routines were required. In order to produce the so-called near net shape blanks, it was necessary to invest in very expensive forging tools – which was actually only feasible with

higher unit numbers, which in turn are rare in car racing.

Thus Roman Müller's team searched for an alternative and found it in the high-speed machining of blanks forged as a wheel disk. By means of turning and milling machinery, they could be turned into any desired contour – customer specific with own style elements. Roman Müller explains: "if you invest in an expensive forging die, you are tied up for years. With our 5-axis milling machine, we've gained flexibility and can implement ideas within 2 weeks and present them to the customer."

CNC and drive technology from the world market leader

Over the years that followed, BBS Motorsport has remained loyal to the manufacturer Matsuura.

"Production manager Francisco Serrano recalls: "For years we have been using machine tools with control and drive technology from Fanuc, and we have had the best experiences with it. The products are of exceptional quality, which means that in all those years, we've never had any problems. In addition, the menu structure of the CNC is very simple".

"In 2007, we decided to order Matsuura machines with the Fanuc Series 30i-A CNC." He also points out an advantage that results from the consistency of the

CNC manufacturer in his production: Skilled workers who are familiar with Fanuc can be easily assigned to



other machines without any additional training. What's more, the reduced variety of controls avoids training costs and errors.

The machine operators are primarily responsible for the NC programs. They are supported by work schedulers who use an external CAD/CAM system, in particular for design elements with sophisticated shapes. For this, the worker receives completed subroutines that he combines with his own drilling and turning cycles to assemble main programs. In addition, he integrates the necessary measurement programs for in-process inspection. That sounds complicated, but with the Fanuc workshop programming software Manual Guide *i*, it is easy to manage. The software, in essence, combines two programming worlds by enabling convenient dialogue programming on the one hand, and supporting programming in DIN ISO or with macros on the other. Thus each user – depending upon the requirement and individual knowledge – can choose the optimal programming method. What's more, the various methods can be readily combined amongst themselves. Existing DIN ISO programs can be easily inserted and further edited.

Helpful CNC Functions

When machining its wheels, BBS Motorsport seeks to find the optimal compromise between short processing time and high-quality surface finish.

Support is provided by the Fanuc CNC of the Series 30i-A, with which the Matsuura MAM72-63V machining centres are equipped and which is optimally designed for high-speed (HSC) and five-axis machining. This means it is not only very fast, but it also makes a number of software functions available for five-axis machining, in order to optimally utilise the existing potential of the machine. For HSC use, it offers the automatic feed control system AICC. Under this term – AICC stands for Artificial Intelligence Contour Control – Fanuc has bundled functions that optimise the acceleration and braking routines, and which can automatically adjust speeds for corner machining or segments of a circle. Thus the AICC functionality to a certain extent takes over advance control, ensuring that the tool can follow the prescribed path with a high degree of contour accuracy.

This is an advantage, for example, when working with design studies that are difficult to implement, as production manager Francisco Serrano explains:

“We recently had to follow the path of bore holes, the diameter of which started at 0.4 mm and grew increasingly larger. Even for the very small radii, the edges had to be razor-sharp, which in turn required intricate machining during milling. We were able to achieve perfect success with the Fanuc-controlled Matsuura”.

Generally the BBS manufacturing team tries to utilise rev speeds of up to 27,000 min⁻¹ when machining light



alloys. For aluminium, the system uses feed rates of 8 to 10 m/s, for magnesium 12 to 14 m/s – for an infeed of 5 mm. For easy parameter setting, BBS uses the Machining LevelCondition Function provided by the Fanuc CNC 30i-A, which enables the user to weight the factors of precision, speed and surface finish. The control then independently puts together the optimal parameter set. In doing so, it also harnesses the capability of the control to process splines and to optimise the surface finish quality by means of the Nano Smoothing 2 function. Francisco Serrano: "Together with the application technicians from Matsuura, we define the desired cutting data and surface finishes and, with the help of this function, set them up on all the machines. This ensures consistently good machining results."

He also appreciates the extremely high availability of all Fanuc components: "Over the past 12 years, we have only required a total of four Fanuc customer service calls. Of these, one was our own fault, two were caused by material wear, and only one due to a defective access card". The production manager finally summarises as follows: "Ultimately, whilst the machines and their performance

Wheels for international racing sport

Whether it be Formula One, the IndyCar series, 24-hour Race, rally racing or brand trophy series – numerous racing teams rely on the over 40 years of experience in development and production of high-end wheel models, made of aluminium or magnesium, that BBS Motorsport has to offer. The specialists, located as of recently in Haslach i. K., deliver completely forged or multi-part wheels that always pursue the objective of being utmost aerodynamic, at a minimum weight and offering ideal rigidity. The company, currently 26 employees strong, represents an annual capacity of some 12,000 light-alloy wheels. In addition to the racing teams, private motorists are among the most important customers. In all, some 40% of all orders come from this clientele. After an economically challenging period following the insolvency of the original parent company, the successful BBS Motorsport team gained a fresh start as a German „GmbH“, or Ltd company, in 2012. The main shareholder is a Japanese company that for years has brought BBS forged wheels onto the roads of Asia.

are decisive, we have had such great experiences with Fanuc controls and drives, that these components are co-determining factors in our decision to purchase a machine tool."