MAKA
CNC-Spezialmaschinen

Aluminum space frame from Alcoa carries new Ferrari “California”

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The new Ferrari California car body will be based on an aluminum space-frame construction. Alcoa Trasformazioni srl in Modena, an independent subsidiary of the Alcoa group, located in close vicinity of the Ferrari headquarters in Modena, were chosen as the component supplier.
For the complete processing of the space frame, machine builder Maka in Nersingen/Germany have developed their MAKA CM 27t X, a CNC machine model which is distinguished by numerous innovative features. An absolute novelty is the possibility to completely rotate the space frame and the clamping facility by 360 degrees in regard to the processing of aluminum on a CNC machine.

In October 2008 the new Ferrari California was officially launched at the "salon de l'automobile" in Paris. The designers of the two-seater convertible were inspired by the philosophy of the legendary classic Ferrari 205 GT Spyder, which was launched in 1957 and which had also been dubbed „California". The Ferrari California is 4,563 m long, 1,902 m wide, 1,308 m high and disposes of a 2,670 m wheel base. The chassis of the Ferrari California consists of an aluminum space-frame, which completely fulfills the demands for stability, rigidity and lightness. The expensive deep-drawing and pressing tools would not be economical for smaller series. Ferrari had given clear requirements for their space-frame production: The part had to be completely machined in one single operation cycle. Space-frames of existing models of varying constructions concepts (front, central and rear engines) developed by either Ferrari or Alcoa should be realized just the same as any other future constructions.

Requirements specification on the machine concept

1. Machining of the space frame from all sides = 6-sided machining is necessary, i.e. the machining procedure needs to realized in one go.
2. Ideal component logistics with reasonable ergonomics and good machining quality have to come up to end customer Ferrari's high demands.
3. Predetermined cycle times have to be met or even undercut.
4. The CNC machine has to be able to efficiently handle volume models as well as exclusive special models up to lot size 1.
5. The machine unit was originally conceived for the production 2 new vehicles; even though it has to be able to handle the largest vehicle model of the product line-up and many other models of the current production. It furthermore has to be capable to produce individual parts and components such as sub-frames from the same material type, cast aluminum parts and the finishing of welded aluminum constructions.
6. The specification requirements comprise all known operation methods of aluminum processing with a 5-axis machine, including thread cutting.
7. Alternate machine loading via two tables to minimize loading and unloading times.

Kompetenz bewirkt viel



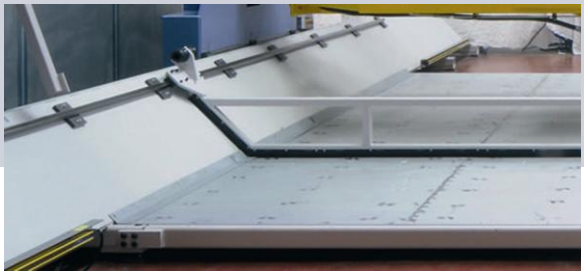
„The decisive factor to opt for us as supplier was the high quality we provide, our attentive projecting and last but not least Alcoa's good experience with MAKA machines", says Rainer Jilge, technical Sales Adviser at MAKA and responsible for the Ferrari project.

Alcoa and MAKA can look back on a long lasting co-operation in the machining of aluminum space-frames. Alcoa had placed their first machining order for an all-aluminum car body of the A8 developed by Audi with the German machine builder in the 90s. This had been the first step into the development of CNC machines for aluminum processing: "The launch of the A 8 was the crucial point to apply ourselves to the processing of car bodies. At that time we had to work on arched, curved-type profiles – a job that other producers were not able to carry out", explains company director Max Mayer. The two companies later kept co-operating on other projects like the "Prowler" – a limited vehicle construction in the space-frame technology, conceived and produced by Alcoa.

Decision-making
Maka have carried out a detailed analysis of the requirements specification handed in by Alcoa and Ferrari including cycle times, machining quality, dimensional stability, surface quality, material to be machined, component sizes, flexibility or envelope sizes to guarantee an accurate realization of this sophisticated project. This was the basis for the development of a completely new machine concept: the CNC machining centre model CM 27t X with total engineering output through to series maturity at customer's works.
Series maturity amongst others comprises a comprehensive production assistance as well as a training of customer's maintenance personnel in German, English or customer's national language. MAKA's services furthermore include response times, technical advice, availability and servicing personnel in customer's national language.

The overall project
To provide optimal accessibility to all important points at highest flexibility, MAKA developed a standard portal machine with two machine tables in tandem arrangement that keep travelling on two guides between on/off loading and working station.
Each table is fitted with modularly mounted clamping devices. Basing on the extremely high machining requirements for the space frames, the project crew realized their idea of rotating the space frames together with the clamping device by 360° during the working procedure. This rotation feature is an absolute innovation in the processing of aluminum parts handled by CNC technology.

The clamping facility, which is also serving as the machine bed, takes up the space frame by its particular RPS points. As soon as the required position is reached, the facility is locked hydraulically and only releases the part after the completed machining procedure. With their modular, highly-flexible construction, coupled by a free span length of 6 meters,



the clamping devices are able to take up various tools at minor set-up efforts – should the car design differ too strongly from the basic design, the clamping facility can be changed completely. Being completely integrated into the machine concept, the particular clamping circuits of the currently installed facility (hydraulics or pneumatics) can be controlled and monitored individually. The routing provides a workable envelope size of X /Y/Z 6.000 x 2.000 x 1.200 mm, in connection with a free trajectory circle diameter of 2.200 mm for the facility including components. (The unit size comprises a surface of 12.000 mm width, 10.500 mm depth and 5.600 mm height). The routing cell with operating area is housed in a sound absorbing cabin. Dimensioning has been effected on the basis of the turning rotator inside the machine and the envelope size to be machined.

A chain-magazine with 51 tool places is fitted outside the working area. The tools are transported to the routing spindle via CNC tool shuttle, which keeps tool changing times as short as possible.
The routing spindle travels to the next machining step; the tool shuttle is able to dock on to it in standing as well as in moving position to carry out the tool change. The organization of the tool magazine is carried out simultaneously with the routing procedure. Saw blades with a maximum diameter of 400 mm, special tools like angular boring and routing heads as well as extremely long tools can be deposited and assorted in a most flexible way. The use of a 3D probe permits machining performances of highest precision.

Longer cycle times can be handled with a highly-flexible "rotary work bench" which allows access to almost every part of the space frame. Finishing jobs thus can be carried out in a most ergonomic way (via hand key, rotatable by 360°). Additional space and the handling of on- and off-clamping procedures for further finishing jobs can be completely left out per each operating cycle. High-capacity lifting gates of 8 m x 3 m coupled with high-dynamic drives permit rapid table changes at highest safety conditions.

Innovative swarf management
MAKA even take new directions in the handling of swarf management. A best-possible interior housing combined with an automatic cleaning system for the entire working area change keeps cleaning times short. Swarf guide plates in the interior cabin part help concentrating the swarf on the planar working area. The surface is automatically cleaned after each table change.
The state-of-the-art machine concept offers first-class flexibility to meet the high demands of the automotive industry. Cleverly thought-out sensor technology, including component identification and plausibility testing allow for reliable, multi-shift operation.

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