# INDUSTRY FLYER AEROSPACE

TITANIUM ALUMINIUM STAINLESS STEEL NICKEL ALLOY

# DEAR READERS,

Aviation is one of the biggest industries in the machining sector. Safety is the top priority and manufacturing errors have to be avoided at all costs. In light of this, the tools used for each machining operation are subject to extremely stringent requirements.

The materials used for aircraft construction have to be as light as possible while still being able to withstand the maximum possible loads. Typical materials include aluminium, high-tech materials such as titanium, high-strength steels and nickel-based and magnesium alloys. In addition, superalloys are available for high-temperature applications.

In this publication we show you examples of applications realised with our precision tools. If you have production requirements or challenges, feel free to contact our technical and sales teams.

Markus Horn and Matthias Rommel, Managing Directors

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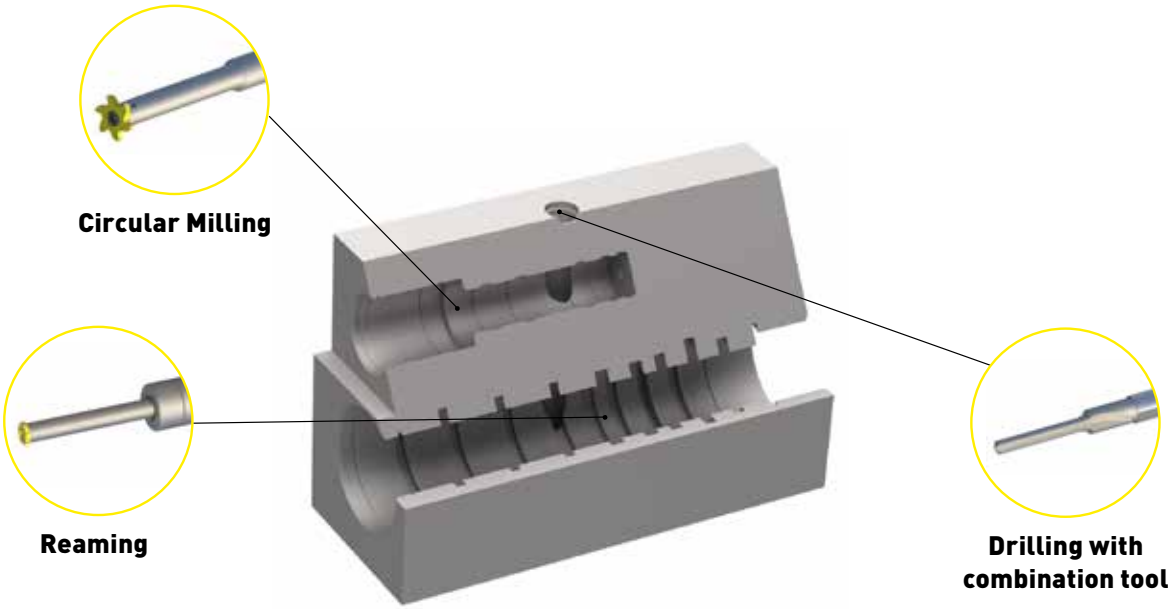
TITANIUM

# PYLON FIXATION


With respect to chip removal, such as when milling or turning titanium, its susceptibility to strain hardening can have a detrimental effect. If, for example, friction on the cutting edge is too great, the onset of strain hardening can cause the tool to quickly become blunt. When milling and turning titanium, sharp tools, the right cutting parameters and optimum chip formation are key parameters.

TITANIUM

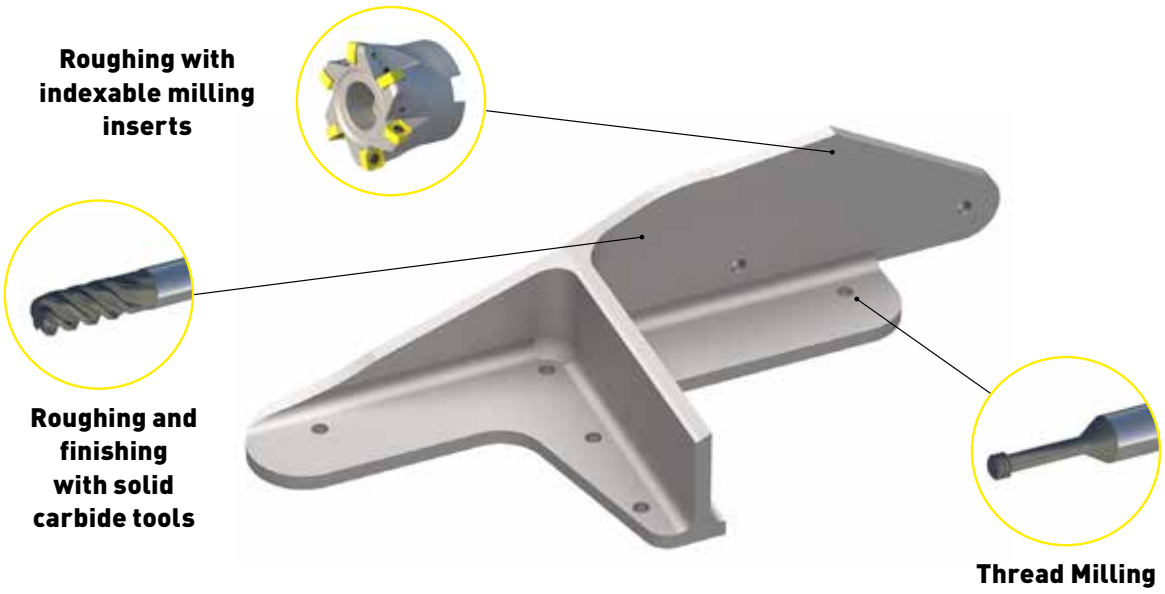
# LANDING SYSTEM HYDRAULIC BLOCK




The hardness of the tools and the heat resistance of their coatings must be suitable for the hardness of the material. The combination of its properties such as elasticity (ductility) and tensile strength also complicate the machining of titanium.

TITANIUM

# FUSELAGE COMPONENT

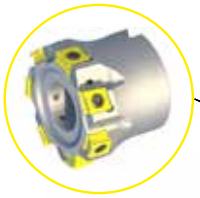



In order to machine titanium materials such as Ti6Al4V, which is in widespread use in the aerospace industry, HORN has developed an impressive portfolio of special tools that are able to overcome the main problems associated with processing titanium thanks to sharp cutting edges, a positive rake angle, a large relief angle and polished cutting edges. For the specific purpose of machining titanium in the aerospace and medical sectors, HORN has developed the cutting material grade TSTK for its solid carbide milling cutters, which boasts good tribological properties, high temperature resistance and low discharge of heat into the substrate – like a kind of heat shield.

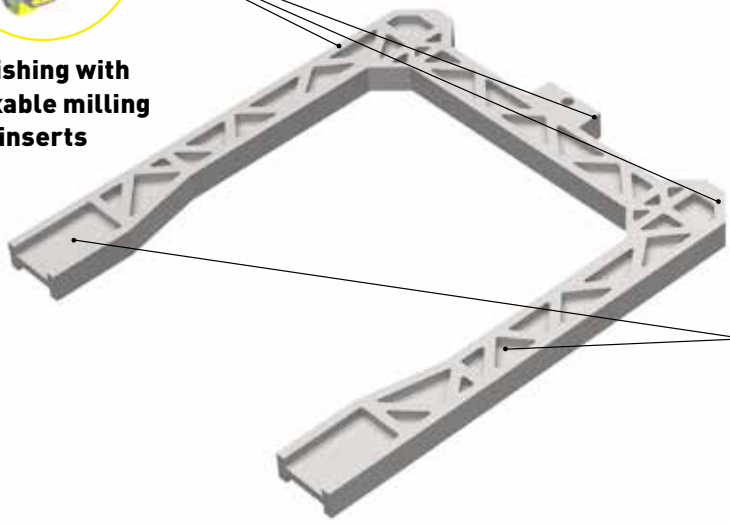
ALUMINIUM

# PYLON FRAME

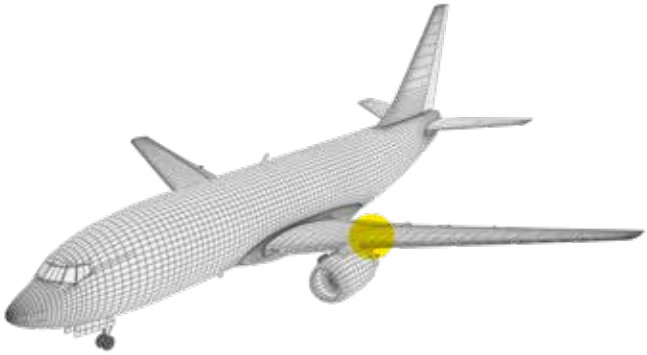
**Roughing with indexable milling inserts**



**Finishing with indexable milling inserts**



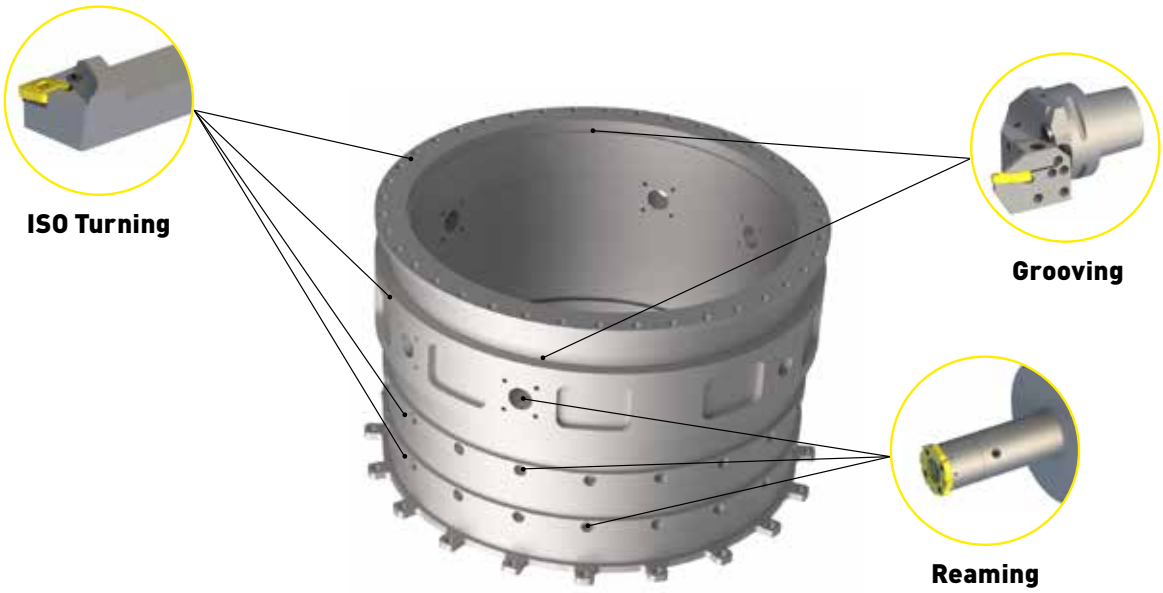
**Roughing and finishing with solid carbide tools**

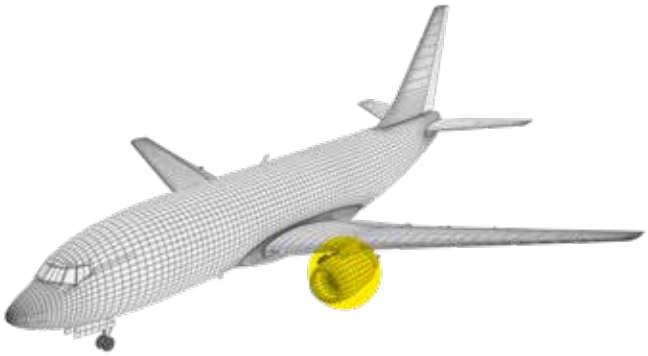


The tensile strength, elongation, hardness and rigidity of aluminium can all be influenced by alloying elements such as silicon, magnesium, copper, zinc and manganese. During machining, the material can become soft due to the heat generated which can cause the cutting tool to stick, with the impaired chip flow even resulting in the tool's destruction. Therefore it is important to ensure that the material and cutting parameters are properly matched to one other. The determining factors are the aluminium alloy, the cutting tool, the feed rate and rotational speed, and the type and quantity of coolant used.

STAINLESS STEEL

# ENGINE HOUSING

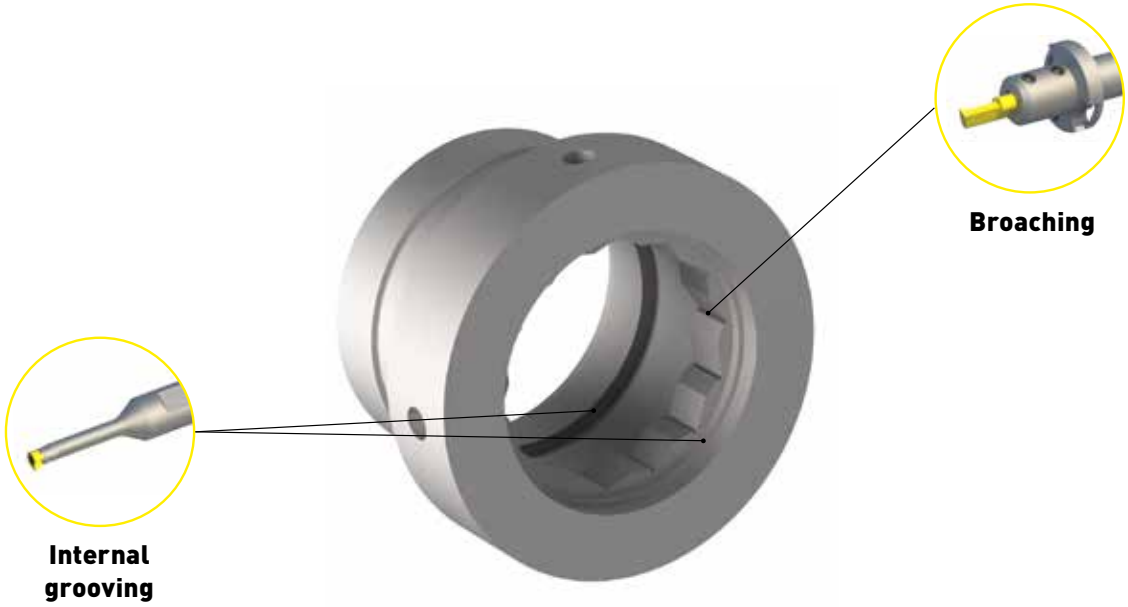


When machining stainless steels, it is essential to know the proportions of the alloying elements. These are decisive for the selection of the cutting geometry and correct grade.

STAINLESS STEEL

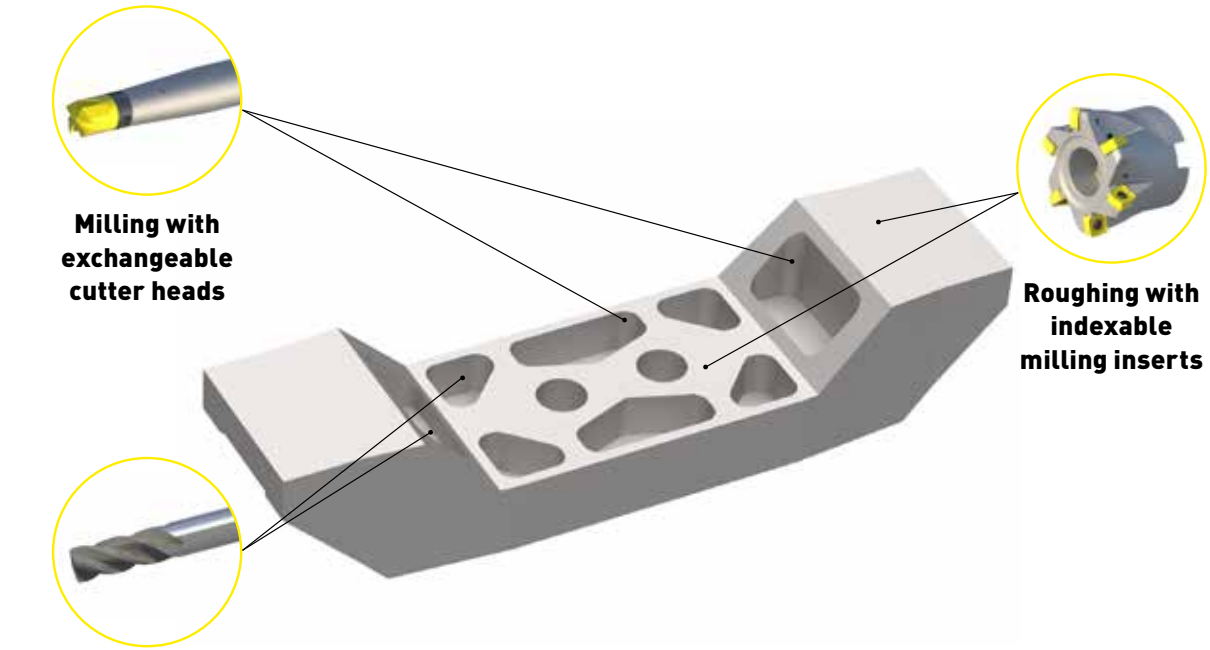
# CONNECTOR

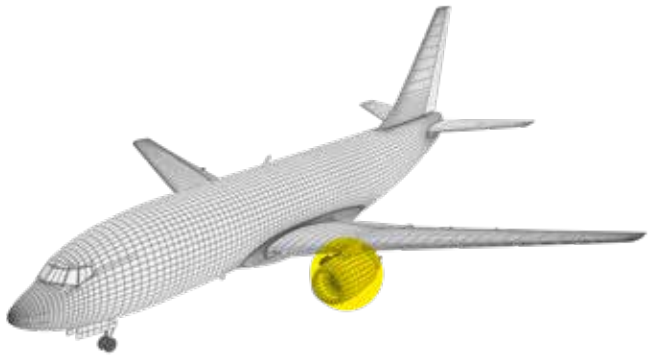



In the demanding machining of stainless steels, which usually have high strength, the high load on the cutting edge and the heat generation that occurs quickly lead to the formation of built-up edges, which are challenge in machining.

NICKEL ALLOY

# PYLON ATTACHMENT SYSTEM

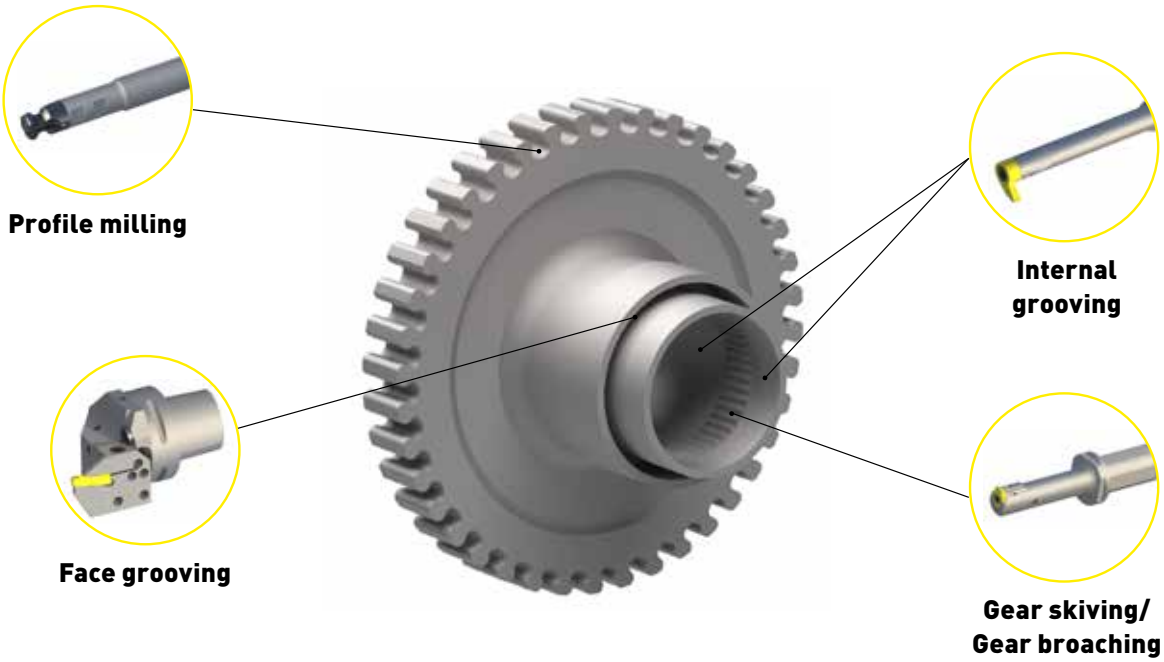


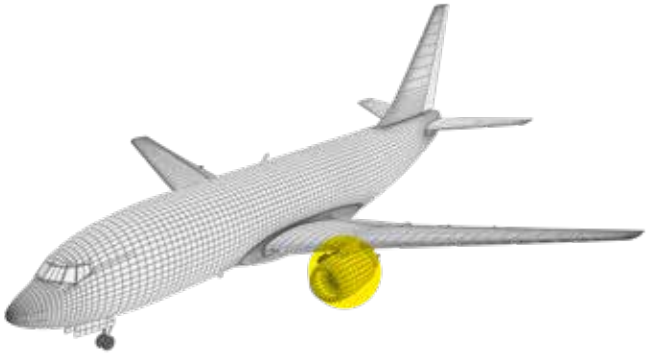



Nickel-based alloys such as Nimonic 90, Inconel 718, René 80 and Hastelloy have particularly low levels of thermal conductivity. In these materials – which are primarily used for turbine manufacture – this property leads to the formation of built-up edges and strain hardening. The resulting vibrations, together with the high strength that the materials demonstrate, exert extreme stress on the cutting edge. A friction-reducing coating provides a remedy and simultaneously satisfies conflicting requirements such as high hardness with low susceptibility to cracking.

NICKEL ALLOY

# TURBINE DISC



The special mechanical, chemical and thermal properties of these materials are often associated with poor machinability, high tool wear and low cutting speeds. The economical machining of these materials sometimes presents users with great challenges. The CBN cutting material for example can be used as a problem solver. Particularly when finishing, it enables shorter machining times, greater precision and higher surface quality. A desire for exceptionally sharp cutting edges and an increase in tool life has led to tool coatings such as the TiAlN-nanostructured thin film with extremely low cutting edge rounding.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with the perfect tool. HORN combines cutting-edge technology
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