

# MAG3 5-Axis Machining Center

## Makino Milling Machine Co., Ltd.

The MAG3 5-Axis Horizontal Machining Center was developed in order to facilitate the high-efficiency machining of large, thin aluminum alloy structural parts for aircraft and boost productivity. In order to reduce aircraft weight, there is a continuous need to make parts more consolidated, larger and more complicated, and larger, more efficient and more precise machine tools are required to produce these parts. Makino has developed a compact high-Power spindle, high-precision high-speed feed axes, A/C axes capable of high-speed rotation, and unique control technology that allows high-speed high-precision simultaneous 5-axis machining. The main features of the MAG3 series are outlined in this paper.

The well-balanced HSK-F63 has been adopted for the high-speed high-Power cartridge type spindle, achieving a rotation speed of 30,000 rpm and maximum Power of 60 kW. In addition, a rotation speed of 33,000 rpm and maximum Power of 80 kW with the HSK-F80 enable deep machining with long tools to be performed.

The axis can be swiveled  $\pm 110^\circ$ , enabling machining from virtually any direction. The C axis for which there are no limitations for rotation commands is an indispensable function for 5-axis contour machining, and enables high-speed and high-precision, for being easy to program. These rotating axes can be moved at a high speed of 7200°/min and high acceleration to synchronize the movement of the linear axes.

Twin ball screws are used for all of the linear axes, enabling a high feed rate of 25.4 m/min. and acceleration of 0.5G. Core cooling for the ball screws is used for all axes in order to minimize the influence of thermal deformation, maintaining high precision and high rigidity even when machining is performed for an extended period of time. Grease is automatically supplied to the linear motion guides and ball screws in order to reduce maintenance requirements. Furthermore, a 0.1-micron high-speed high-precision scale feedback system is provided as a standard feature.

The Professional5 control system features high processing capability, enhances easy operating function with Windows-based screen operation and boasts a wide range of unique machine control functions. Furthermore, SGI.4 is a unique Makino control technology used to drive the machine, allowing high-speed high-precision control when simultaneous 5-axis machining is performed.

The MAG3 features a stroke of 3 meters (4 meters) for the X axis, 1.5 meters for the Y axis and 1 meter for the Z axis, and holds large thin parts upright when machining is performed. Chips generated between the spindle and parts fall onto a large chip disposal conveyor directly. It is very simple so that it can process a large volume of chips.

A pallet changer is provided as a standard feature, and automatically changing pallets that hold parts boosts the operation efficiency of the machine dramatically. Furthermore, the provision of a tilting workpiece setup station (WSS), multi-pallet stocker and other such equipments enable to create a system for reducing setup time, for facilitating machining for a long period of time, and for allowing easy scheduling. As result it increases the operation efficiency of the machine.

Machining time is dramatically reduced by the spindle, the feed axes, these control functions. The superior chip disposal structure and automation of workpiece handling substantially decrease the no-machining time (non-cutting time). A reduction of between 1/3 and 1/5 in the lead-time has also won high acclaim from customers.

The aircraft production industry has recently been experiencing a boom. Many of the major manufacturers around the world have introduced the MAG3, and we understand that it is making a significant contribution to enhancing productivity. We are currently receiving a very large number of inquiries for the MAG3 as a core production unit from manufacturers around the world who are in the process of increasing aircraft production capability. We have received

repeat orders from ten or so different customers, and understand that many more customers intend to place repeat orders in the future. We believe this is a result of the high level of productivity and reliability of MAG3.

First shipment: August 2003

Machines shipped worldwide as of April 2006: 45

Fig. 1 Sample Structural Aircraft Part



Fig. 2 Spindle and A/C Axes

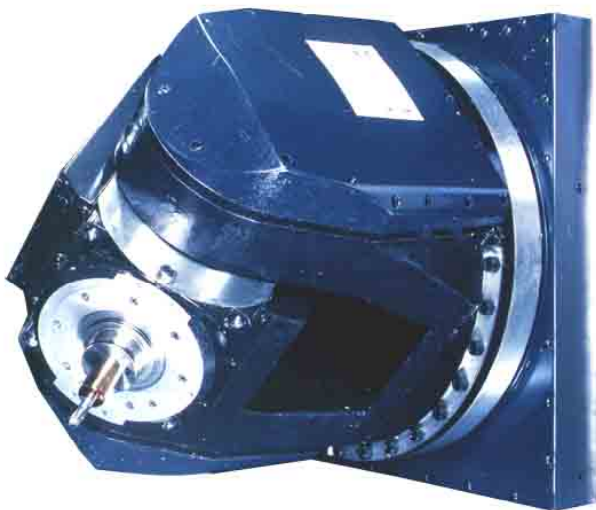


Fig. 3 Outline View

