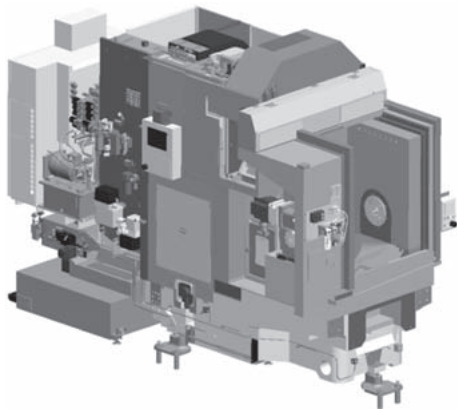


i-TOPCENTER Horizontal Spindle Machining Center



The TOPCENTER series has been highly evaluated as mass production machining equipment for domestic and overseas automobile components, with over 2 000 units installed and operating at customer production sites.

Recently, customer demands such as ① high equipment efficiency, ② improved operational availability (high reliability) and ③ improved space productivity have been increasing. The i-TOPCENTER Horizontal Spindle Machining Center responds to the needs of customers and reduces initial costs through standardization (package) suited for automobile engine machining.

1. Features

- (1) Support for high efficiency machining
 - To support high-load machining, spindle tool clamp force was strengthened to maintain tool chucking force, and feed rigidity was raised to ensure machining accuracy.
 - (2) Improved reliability
 - High reliability (MTBF*¹ 13 000 H: trial calculation) and stronger maintainability maintenance forecast were obtained by the thorough analysis of operation and maintenance information for conventional production lines.
 - A side filter system (filter with a structure that is not easily damaged) was employed and activities to raise MTBF were conducted in order to reduce valve clogging caused by filtration accuracy defects in the coolant supply unit and machining defects caused by clogged piping.
 - A forecast function was added to notify about replacement periods of component parts, etc. before equipment breakage occurs, and actions were taken to raise MTBF (using the JTEKT CNC unit MC70).
- *1 MTBF: Mean Time Between Failure
- (3) Space-saving
 - To increase space productivity, the installation area was minimized to the smallest level for class #40 machines by optimizing equipment layout at the machine rear side.

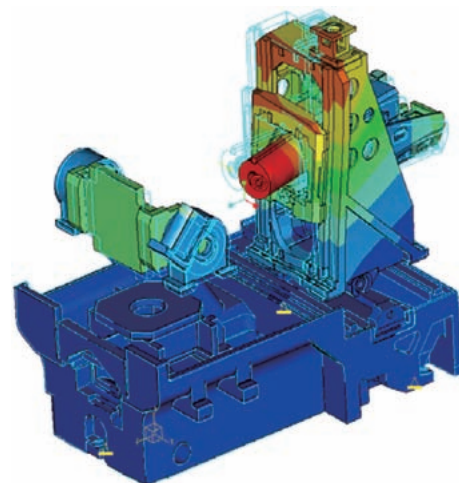
2. Structure

2. 1 Spindle

Cylinder block processes were integrated, and a high-output spindle was developed which supports high-load machining.

2. 2 Base unit (column, slider)

Cast material wall thickness and rib arrangement of the main machine component parts (column, slider) were optimized using CAE, ensuring sufficient rigidity for machining loads. The linear guide used is the same roller type used in conventional models, which has high rigidity and high damping performance. The ball screw selected has a screw diameter able to maintain sufficient rigidity against machining loads at 60 m/min. This combination has enabled the integration of cylinder block processes.



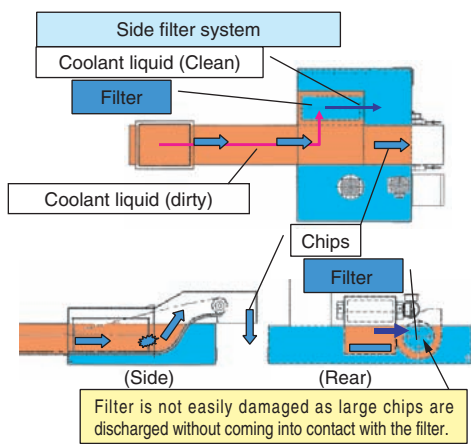
Analysis diagram

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2.3 Reliability

(1) As a result of the knowledge obtained through production line information analysis and “MAST·ZERO”^{*2} activities at production sites, the filter layout has been changed from a center drum system to a side filter system as a drastic measure for the coolant unit. Whereas the filter in the center drum system is easily damaged by passing chips, the side filter system allows no contact between the chips and filter, giving the filter a structure that is not easily damaged.

*2 “MAST·ZERO” activities: Activities based in production lines at customer plants which aim to eliminate machine stops by raising the rate of operation.



Side filter

Preventative maintenance function

Gives notification for inspection if values exceed those forecasted prior to reaching abnormal values
Lamp lights up if set value is reached

Forecast function for component replacement periods

Integrates usage performance of components with life expectancies and gives notification of estimated component replacement period
Displays warning when set value is reached

Air pressure lower forecast

NC warning

Forecast

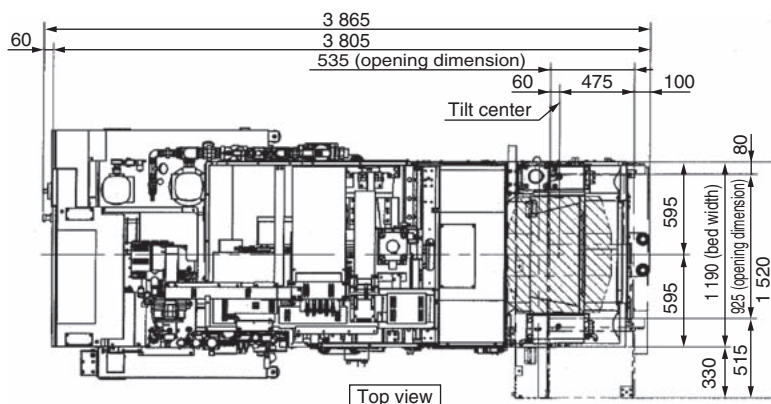
(2) In addition to the visualization of the SFC^{*3} and other parts through the installation of a JTEKT CNC unit (MC70), a forecast function effective in preventative and scheduled maintenance has been adopted as part of the efforts to improve MTBF^{*1}. This function enables notification for component replacements by monitoring the functional decline, number of operations, and time on the machine.

*3 SFC: Sequential Function Chart: Visualization of electric circuits using a flow chart

2.4 Space-saving

Minimum space usage in device layout was achieved by amassing the hydraulic and pneumatic hoses and cable routing on the rear part of the machine together at the top part, thus securing space for filter and coolant pump maintenance.

This resulted in a shorter total machine length and the smallest layout area in class #40 machines.



Top view

Layout

(Machine Tools Development Dept., Machine Tools & Mechatronics Operations Headquarters)

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