

Thermo-Friendly Concept on a double-column machining center

Machining dimensional change over time 1/4



Features

An approach that accepts temperature changes

What is the Thermo-Friendly Concept?

Distortion of machining dimensions from thermal deformation - In the past, the main strategy for combating thermal distortion on machine tools was to limit heat generation to the minimum. The new thinking adopted in the Thermo-Friendly Concept is, as the name indicates, to co-exist with heat rather than fight it. Thermal deformation occurs in complex patterns that make it difficult to predict; however, if thermal distortion is allowed to occur only in predictable shapes, the effects of heat can be effectively canceled through correction. This is done with the use of:

Simplified heat deformation structures

Design technologies to make heat distribution uniform

Highly accurate thermal deformation compensation

With this technology high machining accuracies can be maintained even without large cooling systems or extensive equipment such as temperature-controlled rooms.

Double-column machining centers and other large machine tools have large axis travel, and proportionately more deformation. There is also a tendency for distortion as a result of vertical temperature differences. At the point of machining, such deformation can have effects from several dozen microns to several tenths of a millimeter in size.

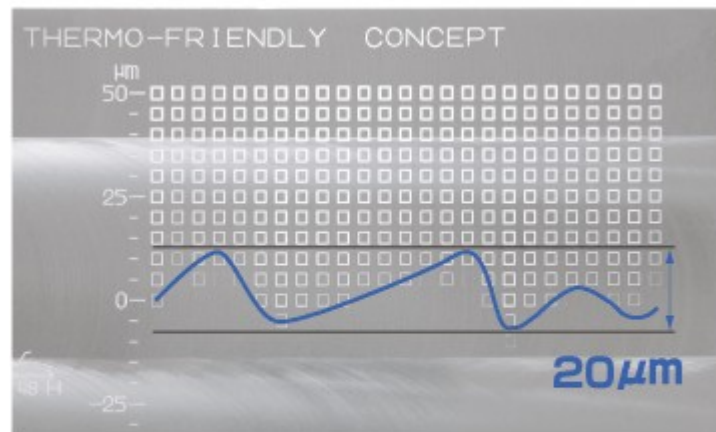
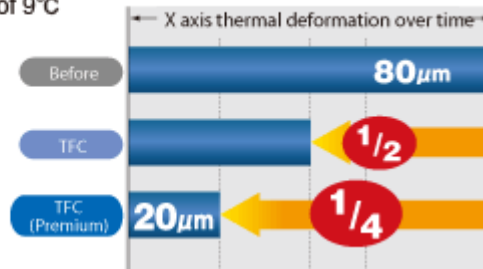
With the use of the Thermo-Friendly Concept on Okuma's double-column machining centers for 5-sided applications, this thermal deformation can be reduced to one-fourth. Warming-up and temperature-controlled rooms are no longer needed, and steps do not appear even with continuous die operation for

long hours with the initial zero offset, no matter where the workpiece is on a large table.

Thermal stability

Machining dimensional change: 20 μm

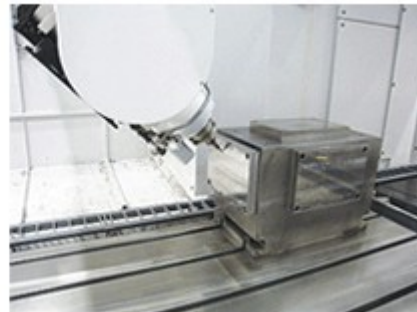
MCR-BII 30 X 50 actual data 20 μm
temperature change of 9°C



[Thermal matrix] X-axis table longitudinal direction

Thermal matrix

Machining dimensional changes reduced 1/4-1/3 compared with earlier machines even with room temperature change of 9°C over 48 hours.

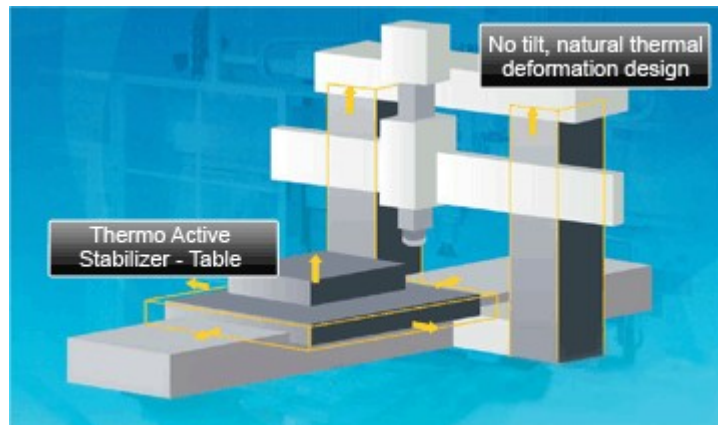


Thermal deformation causes dimensional changes on the micron level that are difficult to see with the naked eye. The

"thermal matrix" is a machining sample that allows you to see these changes.

Machining is normally done under factory environments in which temperature changes (9°C in 48 hours). In the "thermal matrix", a grid in which the machining depth in a flat finished sample becomes 5 µm shallower is scored in vertical columns. Two hours later the same machining is repeated, with the direction shifted to horizontal rows. This machining is continued every 2 hours.

With machine thermal deformation (misalignment of position on X axis) from room temperature changes or other causes, machining traces of the changes between the tool edge and workpiece can be seen. Thermal deformation at the micron level that occurs with actual machining can then be clearly seen with the naked eye. Confirm the high performance of a double-column machining center equipped with the Thermo-Friendly Concept with your own eyes.



■ Thermo-Friendly specifications (optional)

- **Thermo Active Stabilizer – Spindle (TAS-S)**
Highly accurate compensation of spindle thermal deformation
- **Thermo Active Stabilizer – Table (TAS-T)**
Compensation of deformation from table heat expansion

■ Thermo-Friendly premium specifications (optional)

- Thermo Active Stabilizer – Spindle (TAS-S)
- Thermo Active Stabilizer – Construction (TAS-C) for large machines (TAS-C²*)
Optimum control of machine even in changing ambient temperatures to maintain machining accuracy

Note: XYZ axis AbsoScale specifications also required.

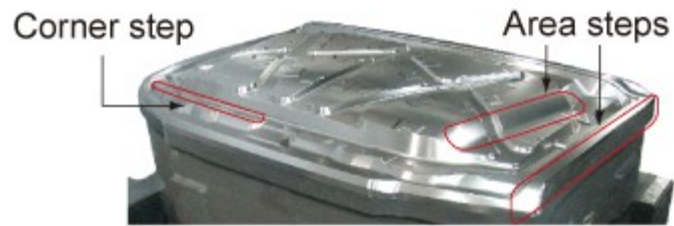
*TAS-C²: TAS-C + TAS-T

Results

Die machining

Manual finishing time 1/3-1/2

by minimizing area and corner steps



Parts machining

Huge reduction in zero offsets

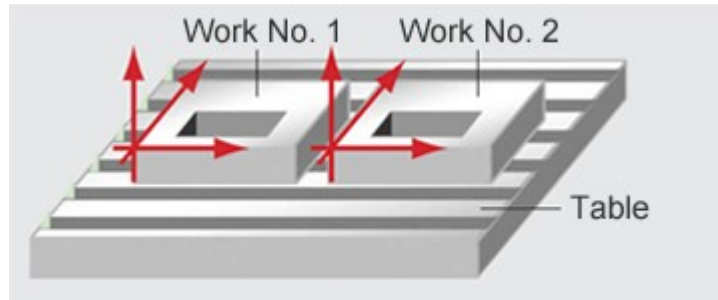
Previous machine

- Must find origin every time before machining multi-quantity parts (misalignment from workpiece origin: 100 μm)



With Thermo-Friendly Premium

- Confirmation only OK! (misalignment from workpiece origin: 20 μm)



Energy savings

- Air conditioned room investment unnecessary!
- Cost reduction approx ¥5 million/year! (US\$ 50,000!)
- CO₂ reduction approx 200 tons/year!

↓
Equivalent of approx.
24,000 beech trees

