CNC Cylindrical Grinder GL4-SⅢ PREMIUM

The GL4-S III PREMIUM is a high accuracy CNC cylindrical grinder optimal for the high accuracy machining of automobile components associated with improved fuel consumption, as well as high precision rolls which manufacture aircraft components and medical components made from difficult-to-cut and new materials, batteries for EV automobiles, and solar panels.

1. Features

1) Stable dimension accuracy that lasts from the initial workpiece
   · Sharp decline in dimensional changes from cold start due to total temperature control of heat generating parts
2) High shape accuracy
   · Improved wheelhead positioning accuracy through fluid film lubrication and full closed loop control
3) High grade grinding
   · Higher grinding surface grade due to low vibration
   · Improved roundness due to higher rigidity

2. Structure

2. 1 Total temperature control of heat generating parts

Heat sources such as the wheel spindle, motor, servo motor, and hydraulic pump exist on a grinder. Temperature changes in these heat sources cause complex thermal displacement to occur at each part of the grinder. Thermal displacement can lead to changes in workpiece machining accuracy.

We have suppressed thermal displacement in this machine to the very minimum by implementing temperature control for seven parts ranging from the static pressure wheel spindle bearing to the motor, and in all nine heat generating parts.

This has achieved suppression of workpiece dimensional changes to ϕ3 μm at continuous 8-hour grinding from cold start (**Fig. 1**).

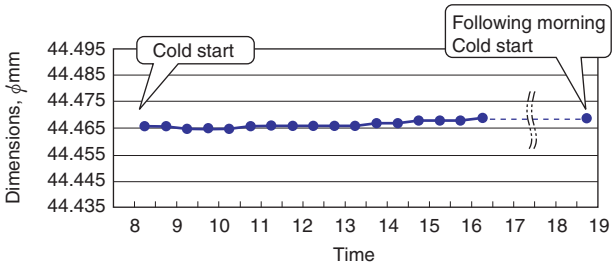

Fig. 1 Results of indirect auto-sizing plunge machining

2. 2 Improvement of wheelhead feed positioning accuracy

The slide surface of the wheelhead employs fluid film lubrication applying the principles of static pressure bearings, enabling long-lasting smooth feed without stick-slip and improving positioning accuracy.

Furthermore, full closed loop control through a linear scale and a low-lead ball screw are utilized for the feed, achieving high positioning accuracy.

Figure 2 is an example of five-step 1 μm (ϕ2 μm) difference grinding on a cylindrical workpiece. All steps were automatically ground using an ordinary grinding program, achieving and step grinding of exactly 1 μm (ϕ2 μm).

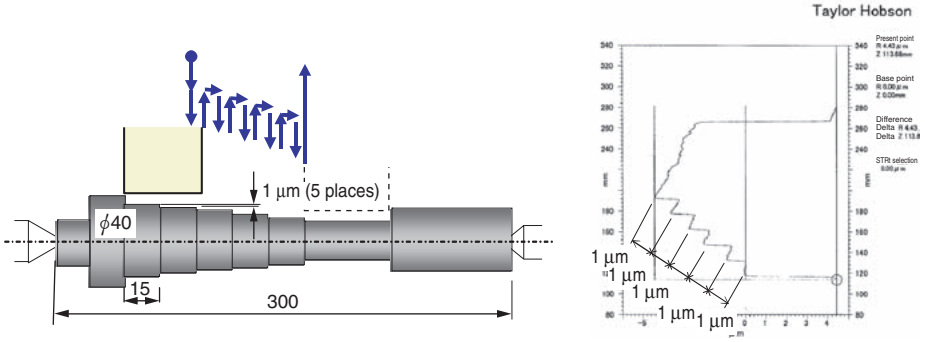

Fig. 2 Fully automatic micro step machining

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Figure 3 shows the grinding of a crowning-shaped workpiece using a wheel with concave R-shape dressing applied through simultaneous 2-axis control.

Generally, when the wheelhead feed direction changes at the crowning peak, shape deformation can easily occur due to backlash. This is called "quadrant protrusion."

The GL4-S III PREMIUM achieves extremely smooth grinding without shape deformation.

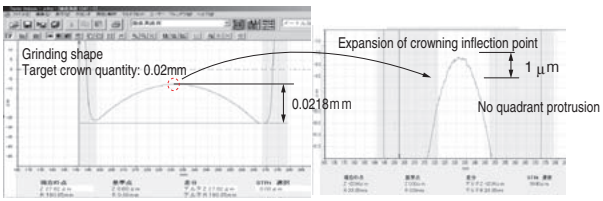


Fig. 3 Simultaneous 2-axis crowning

2. 3 Improved grinding surface grade through low vibration

The relative motion between the wheel and workpiece greatly contributes to workpiece shape generation during machining. Therefore, if vibration occurs within the wheelhead or wheel spindle, it is transferred to the workpiece during machining, causing deterioration of surface quality.

The following measures have been taken against the conventional machine in order to thoroughly eliminate wheelhead vibration within this machine.

(1) Separation of wheel spindle pump and motor (changed to floor type)
(2) Lower center of gravity to inhibit wheel shaking
(3) Low vibration through obtainment of dynamic balance of the wheel spindle motor and drive system

Dynamic balance was thoroughly obtained for each individual component of the wheel spindle motor including the rotor, shaft, and pulley, particularly for the main cause of vibration, listed in (3). Through these measures, wheelhead vibration was reduced to 1/3 that of the conventional machine.

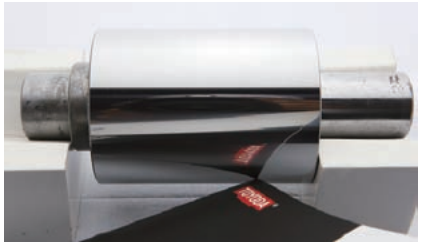
2. 4 High rigidity

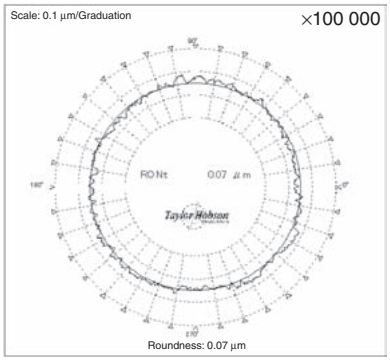
The rigidity of the workhead and footstock of the GL4-S III PREMIUM has been improved considerably over that of the conventional. This has achieved better roundness and high accuracy machining without chattering, as the workpiece is able to be grinded while held more firmly in the grinding center. In addition, the wedge type taper adjusting device mounted on the footstock enables precise cylindricity adjustment.

We have revised the installation mechanism of the wheel dresser to secure over twice the rigidity of the conventional product. This achieves high grade wheel dressing in which neither escape nor hitting of the diamond occur during wheel dressing, improving the quality of the grinding surface.

Figure 4 shows the results of fully automatic mirror finishing.

A roundness of 0.07 μm and surface roughness of 20 nmRa were achieved with wheel grain size #80.





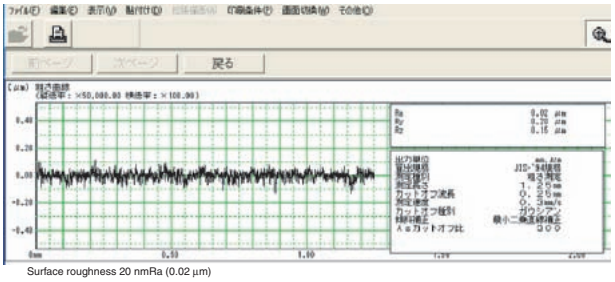


Fig. 4 Fully automatic mirror finishing

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