



DESIGN. BUILD. **GROW.**

“BOLT-ON” RELIABILITY

ENTRUST TOOL & DESIGN CO. NEEDED A HIGH QUALITY, PRECISION DRAWBAR

OTT-JAKOB was able to provide a standardized drawbar that had “bolt-on” reliability, and high-end machine tool performance for their high-speed, multi-purpose machining center for the die-mold industry.

CHALLENGES

Finding a high-quality, precision power drawbar for a heavy-duty, multi-purpose machine with bolt-on reliability.

Entrust selected an OTT-Jakob power drawbar with rotary union and steep taper gripper. The modular ES Series drawbar provided the design flexibility required for their typical customer applications, plus the rigidity of this drawbar had inherent advantages affecting the finish quality of the part being machined.

PROJECT OVERVIEW

Entrust Tool & Design, Menomonee Falls, Wisconsin needed a particular arrangement of components for the cutting mechanism on its new USC50, a 7-axis, 2-spindle deep-hole machining center for heavy-duty mold and diemaking. Since this large-capacity machine tool was being designed for four-sided machining and deep-hole drilling on workpieces up to 40" x 120" on a 25-ton CNC rotary table, a very high degree of accuracy and rigidity would be needed, especially at full extension of the tool tip.

Furthermore, high productivity would be required here, so high precision was necessary even at the maximum speeds of 10 meters per minute (394" per minute). Finally, with a 160mm (6.30") quill and 500mm (19.7") travel, an ANSI 85.50 CAT 50 spindle was designed into the machine to handle the substantial torque, so a power drawbar became an essential element of this machine tool. Lastly, a nearly backlash-free worm gear assembly would be required to accommodate the load and provide the stability and repositioning needed to satisfy the accuracy spec.

Surveying the available suppliers, Entrust sought out a longtime associate, Advanced Machine & Engineering, Rockford, Illinois to assist with these critical components. Entrust required a high-quality, precision power drawbar for this heavy-duty, multi-purpose machine. They were seeking a standard product that featured bolt-on reliability, 80 bar max (1,160 psi) coolant pressure steep taper air-blast at stand still with tool blow-off and standard integral position sensors for feedback. Plus, all the features needed to be configurable



UNISIG USC50 from Entrust Tool & Design, a 7-axis, 2-spindle deep-hole drilling machining center, used for large mold and diemaking.



OTT-Jakob power drawbar, shown with rotary union and steep-taper gripper, had the optimum clamping, air-blast at stand still for tool blow-off and integral standard position sensors this application demanded, according to Entrust engineering.

for their customer needs. Based on some previous automotive experience in the U.S. and Europe, Entrust selected an OTT-Jakob power drawbar with rotary union and steep taper gripper. The modular ES Series drawbar provided the design flexibility required for their typical customer applications, plus the rigidity of this drawbar had inherent advantages affecting the finish quality of the part being machined. It provided the optimum connection between the toolholder and the spindle. Toolholding tolerances on the USC50 were targeted for 0.0002". This factor, combined with the very high rotational speed capability up to 1,500 rpm for the 2KL union with the ES series drawbar, the high pull force of 23kN (5,169 lbs), plus its reputation as a quality product in the world machine tool market, solidified the decision for Entrust engineers to spec the OTT-Jakob power drawbar and related components.

For the worm gear assembly, Entrust again turned to Advanced Machine & Engineering for a solution suggestion. After an examination of the available products, the suggestion was made to utilize the Zahnradfertigung OTT patented worm gear design with a hollow and a shaft worm that are adjusted to minimize backlash. Owing to the nature of the application, a DIN standard Class 3 set of worm gears was required. Advanced supplied,

after testing, Class 2 worm gears at no additional charge to the customer, according to Dan Lapp, VP sales for the company. "A conventional solution would not work here for this precision application and the OTT worm gear set was more appropriate." He explained how the typical machine tool worm gear on the market often has a split worm, springloaded to compensate for backlash errors. In the OTT design, he noted, the backlash can be virtually eliminated. By the positioning of the shaft worm and hollow, the backlash can be changed. Commenting on the process of this machine tool design development, Entrust COO Anthony Fettig noted, "The Unisig engineers worked with Advanced Machine & Engineering as a provider of these critical, precision mechanical components on our USC50 mold machining center. OTT worm gear set, OTT-Jakob power drawbar and Speith components (locknuts, sleeves, bushings) have performed very well in the application and the technical support from Advanced Machine was thorough and usually immediate." Fettig also noted this machine, though entirely designed and built in the U.S., incorporates key mechanical components from suppliers in the U.S., Italy, Germany and Japan. Though still quite new to the market, customer reports on the performance of the USC50 have been excellent, he concluded.



UNISIG USC50 CAD model (left), and machine head (right).



UNISIG USC50 showing the OTT-Jakob toolholder and the drilling spindle.



As the machine uses BTA/STS or inserted gundrill tooling for the highest penetration, the OTT-Jakob drawbar, drilling spindle and toolholder maintain accuracy at full extension.