Success Story

Direct Drive Index Tables for Machine Tools

Sales Challenge

A leading international machine tool manufacturer recently recognized that existing gear-driven index tables used throughout the industry cannot provide the positional accuracy required for highly demanding applications. Designing a direct drive brushless motor into the index table offers many benefits and differentiates this solution from competing products.

Traditional machine tool index tables use standard rotary motors coupled to right angle gearboxes. Backlash in the geartrain causes an inherent level of inaccuracy when positioning the work-piece for precision machining. This can be especially important for complicated processes such as jig grinding or 4-axis and 5-axis interpolated machining. Because gears wear, the limited positioning accuracy initially achieved with a traditional geared table degrades over time. Many tables must be serviced and gears must be replaced every 18-24 months, depending on the frequency and type of usage.

Key Customer Requirements

The table motor must be compatible with existing standard drive controls typically found on most of today's machine tools. Danaher Motion worked closely with the customer's engineers to design a custom brushless motor solution into available frame space.

Application

The customer wanted to introduce a breakthrough direct drive index table to the machine tool market that features previously unachievable positional accuracy and no wearing parts that require frequent maintenance.

Danaher Motion Solution

Danaher Motion's custom direct drive motor solution provides greater overall package density and higher pole count. The result is higher continuous torque capacity and cooler operating temperature in a significantly smaller footprint. Custom electromagnetics provide exceptionally low cogging and harmonic distortion, resulting in very smooth motion and low ripple. To optimize these benefits, the motor armature was pre-installed into the customer's table housing using an interference fit and an encapsulation process that provides a rugged package and high thermal conductivity. The customer housing includes an integral liquid cooling circuit for extreme applications where high continuous torque is needed.

When tested with industry standard machine tool controls and a high resolution encoder, the custom motor accelerated the highest specified inertia load 5 times faster than required. Positional accuracy test results show an order-of-magnitude improvement over gear driven systems, with repeatability data in the range of a few arc seconds. This initial accuracy capability does not change or degrade over the working life of the direct drive index table. The only wearing parts in the table design are a large capacity crossed-roller bearing, which offers long service-free life, and optional shaft seals that can be replaced externally with no table disassembly. Elimination of the gearbox space on the side of the table provides a much smaller footprint than competing products with similar torque ratings.