▶ BY PREBEN HANSEN

Solid Contact

The advantages of dual- and triple-contact toolholding systems for high-speed machining.

A significant development in maintaining a complete interface between the machine tool's spindle and the toolholder is the dual-contact, 7/24 taper system (7" of taper per 24" of length). Available from various manufacturers, the dual-contact system incorporates standard CAT and BT 40- and 50-taper tooling, but allows simultaneous contact on both the toolholder's flange and taper when machining at high speeds.

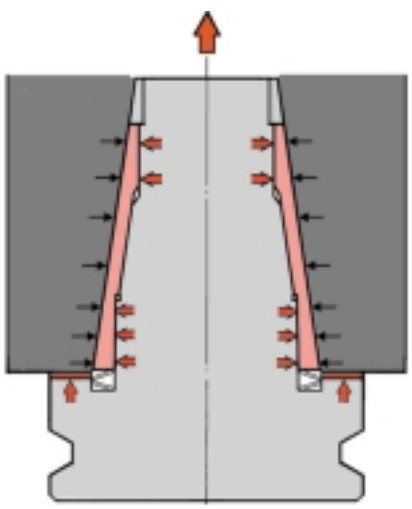
This simultaneous contact is achieved by the machine tool builder extending the spindle nose 1mm for a 40-taper holder and 2mm for a 50-taper holder. In addition, the manufacturer of dual-contact toolholders adds 1mm to a 40-taper holder's flange and 2mm to a 50-taper holder's flange.

The dual-contact spindle must have a qualified relationship between the taper and flange, while the toolholder must likewise exhibit this characteristic. In other words, the tapered interface between the spindle and toolholder has a tighter tolerance than the standard spindle-tooling interface.

Dual-contact tooling offers many advantages over traditional types of toolholders. The most obvious advantage, when compared to standard CAT tooling, is the added rigidity of the flange contact. This added stability significantly increases cutter life, while allowing machine tools to operate effectively at much heavier feed rates. However, to realize this advantage, dual-contact tooling must be used with either a machine tool built with a dual-contact spindle or a machine that's been retrofitted by adding a spacer onto the spindle face.

The dual-contact system can be especially beneficial for high-speed machining. Typical HSM applications include precision die and mold making, and medical and aerospace parts production. At spindle speeds of 20,000 rpm or higher, it's common for conventional CAT V-flange tooling to be sucked into the spindle, because centrifugal forces cause the spindle to expand minutely. This is known as "spindle growth." The toolholder's taper cannot expand with the spindle, causing the toolholder to separate from the spindle surface. Overcoming this problem was the driving force behind the development of HSK toolholders, with their hollow-shank design.

With the development of dual-contact, CAT-style tooling, the problem of tools being forced farther into the spindle has been virtually eliminated. The new toolholder allows operators of high-speed machines to realize the benefits of a hollow-shank toolholder, but with a solid-mass design. The additional mass, in combination with the simultaneous flange contact, demonstrably increases productivity. This is most evident on extreme applications, such as machining with long gage-line extensions and when applying very large, heavy cutting tools.



All images: HPI (Heartech Precision Inc.)

A triple-contact system, with its inner, expanding sleeve, maintains uniform contact between the machine tool spindle and the toolholder's top taper, bottom taper and flange—regardless of the spindle speed.

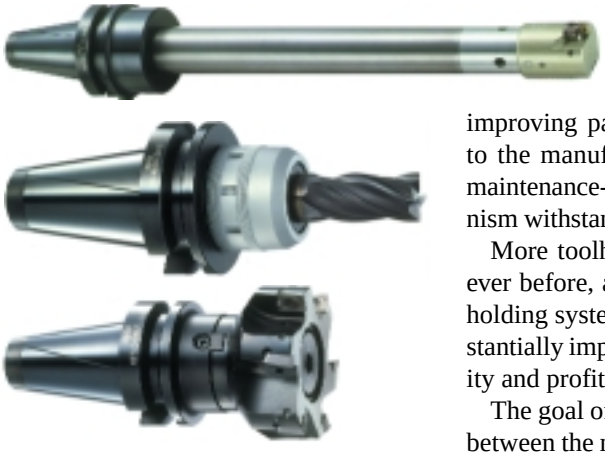
From a cost standpoint, the dual-contact toolholder shouldn't cost more than standard CAT tooling, while providing more toolholder-purchasing flexibility. Standard CAT-style toolholders could still be used in applications where a rigid flange contact is not needed, such as simple drilling operations.

Triple Contact

One additional design feature, which is available from a few toolholder manufacturers, incorporates an inner, expanding sleeve, which functions particularly well at high spindle speeds. As centrifugal forces cause the spindle to grow, the toolholder's spring mechanism forces the split-cone sleeve to expand proportionally with the spindle.

Also called a "triple-contact" system, it improves rigidity and stability on any dual-contact, 40- or 50-taper machine tool spindle by maintaining the interface between the spindle and the toolholder's top taper, bottom taper and flange. The expanding sleeve also acts as a vibration-dampening device. This design functions in a similar fashion regardless of whether it's used on a boxway or linear-guide machining center.

The expanding sleeve extends tool life three to five times, on average, by virtually eliminating vibration. And a vibration-free interface between the tool and workpiece provides smoother cutting of aluminum alloys, tool steels or other metal alloys.



Various types of triple-contact toolholders for double-contact spindles are available, including (from top to bottom): an extended boring bar, a conventional milling chuck and a facemill arbor.

The triple-contact system also performs well with extra-long tools used on horizontal machining centers, because the "floating" inner sleeve minimizes Z-axis deflection to maintain concentricity. While somewhat more expensive, these toolholders pay for themselves by extending cutter life and improving part production. According to the manufacturer, the toolholder is maintenance-free and its spring mechanism withstands 1 million tool changes.

More toolholding options exist than ever before, and finding the right toolholding system for the job at hand substantially impacts any shop's productivity and profitability.

The goal of maintaining total contact between the machine tool's spindle and the toolholder's top taper, bottom taper and flange, while eliminating vibration, is being achieved by those who understand the unique conditions of today's high-speed and high-accuracy machining needs.

About the Author

Preben Hansen is national sales manager for HPI (Heartech Precision Inc.), Elk Grove Village, Ill. For additional information about HPI, call (847) 593-6000, or visit www.hpi-heartech.com.