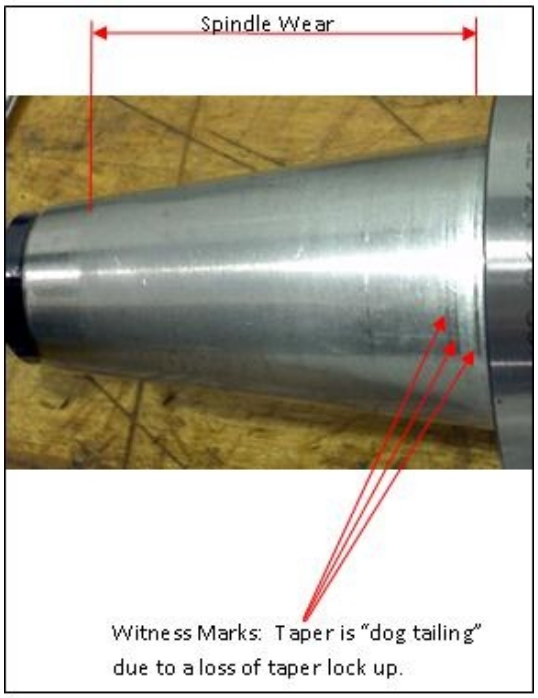
The Truth about Face Contact

Face Contact will improve rigidity, control “Z” draw and provide higher performance from the machining center. The theory is sound. The application of the theory? That, is a completely different story.

In the beginning, HSK (Hollow, Shallow, Kegel) was developed for high speed machining. HSK is unique because it provides face AND taper contact. As the spindle increases in speed, the locking system expands and as it does, the taper of the shank then compensates. It works great.

Then the HSK system came to the US and instead of .040 per pass, we began machining at .100 which generated additional harmonics. Why? Because the shank is designed to be hollow (which reduces its' mass) and designed to flex, when the cutting tool is under a heavy load, T.I.R. and deflection occur. Then, in comes Face Contact Steep Taper Tooling, AKA 'dual contact'.

The theory was a solid taper that goes up into the spindle is better for rigidity and with its' face contact, gains radial support. No expanding taper in this design resulted in a loss of lock-up due to normal tool changer and machining wear as shown in the picture to the right. This loss of lock-up had the effect of 'dog tailing' (e.g., the front of the taper moving under load which results in rings at the top of the taper).



The system was sold on the premise of cost savings. The customers who invest in the system see a decline in the cutting tool life after a short time. Machine dealers who sell this system sometimes don't explain or understand the amount of maintenance involved over time.

Customers approach Face Contact like a standard machine and expect it to run forever. In reality, you must inspect the spindle and tooling a couple of times per year while performing aggressive preventative maintenance, much more than standard CAT tooling. Considering the fit between the face and taper is around 1-2 microns (0.000039/.000079), any dirt, chips or sludge dramatically affects tool life and lock-up..

Many customers believe this system will improve all of their applications. This is unfortunate when you consider that Face Contact only provides a benefit on heavy side load applications. *If you are drilling, tapping, reaming, boring and or finish milling, there is no improvement over premium standard tooling.*

There have been reported savings when running extended or oversized cutters in small machines. These tools normally are exceeding the recommended practices for that size of a machine and accelerated wear is present in the same cutting conditions applied to standard spindles.

Where did Face Contact come from and how was the testing developed? This design was developed in Japan where machining techniques are similar to Europe – high speed, light and many passes. Under US machining conditions, the system requires expensive preventative maintenance, ultimately failing in the long term.

So what changed? *Everything!*

The machines have become smarter, faster and more flexible. The cutters have variable flutes, wiper blades, super nano multi-layered coatings with greatly improved finishes. Considering the patents for Face Contact tooling are almost 20-years old (HSK even older), they have not caught up with the rest of the industry. One of the consequences of all this improved technology is the discovery that “going back to basics” can and will outperform the so-called new “20-year old” holder technology. The standard CAT and

BT tooling today is balanced @ 20,000 RPM and higher with total run outs in the 3 micron range...and all of this, with superb vibration dampening and availability. Too many have learned the hard way, that mixing the two styles not only accelerates the wear but can even void some machine spindle warranties. This means, if you are going to embrace the system, every tool must Face Contact.

Enter “spacer additives”....

In spacer style Face Contact spindle, the same wear issues exist. And the lower quality of low-priced tooling added to spacers creates new wear and fit issues. This causes a higher acceleration in spindle wear and a much smaller cost payback window. The biggest issue we see is customers regrinding spindles because of this tooling. And if you've ever had to do this kind of repair, you already know the repair is never quite as good as the original. And with the change in spindle position, you lose retention strength which in turn, introduces a whole new list of problems.

Draw bar pressure:

If that weren't enough, there is the whole overlooked and often unspoken topic of 'draw bar pressure'. Face contact spindles normally have much higher draw bar pressures than standard spindles. That being said, it isn't all that surprising that when one adapts face contact to low cost machines, the application never performs the same (e.g., consequence of the reduced pressure). A long time veteran of the tooling industry recently equated this to strapping a high performance engine into a used Yugo...they simply weren't meant to go together.

When a customer is finding wear and lock-up issues, chances are that draw bar force is at play. Too many times, we've seen a customer running a 3/4” high feed cutter in a CAT50 machine and then turn around and use the very same cutter in their BT30 machine. Think about it. A BT30 machine has approx 800 pounds of effective draw bar force. CAT/BT40 have anywhere from 1,800-2,800 pounds and CAT50's? 6,000 pounds plus.

Draw bar force is key in preventing holder movement. The pattern we see so often is the lower the machine tool cost, the lower the draw bar force. Unfortunately, cutting tool engineers don't include what the machine requirements are for running the cutter to their specifications. That can be a real problem on the shop floor. High helix cutters create excessive negative Z pressure which will generate movement in the holding systems. The machine and holder must be appropriately paired...it's often overlooked.

But there's still more...

How about the issue of over-tightening retention knobs? If you torque a knob to the point where the taper is expanding at the tail, you are too high. Every machine manual has a recommended tightening torque for that machine...for a reason. The specification must be followed or undue spindle wear and/or damage is going to come looking for you. Why put yourself at risk?
My old boss use to say, “I can line up people from here to the airport that will tell me what's wrong. What I need is a solution”.

Solutions:

1. You can make the system work by purchasing a taper and face gage to check for spindle wear with the opposite gage to check the tooling. Once wear is found, regrind or replace the worn part. And yes, this does increase the already high cost payback formula.
2. You can look at Premium Standard holders (standard holders will fit in Face Contact spindles) to provide the performance and reasonable cost pay back. And as many of you have witnessed first-hand, premium chucks have come a long way since their inception.
3. Assert yourself. When buying your next machine, ask the machine builder to provide a cost payback schedule for YOUR application and tooling.

Most companies want to use Hard Milling data in a performance machine. That's fine. But you owe it to yourself to make sure the data they supply was tested: One - in the machine you are purchasing and Two - with the tooling you are selecting to go with it.

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