Believe it or not, it’s now over 10 years since initial heat-shrink systems became commercially available, a fact corroborated by Graham Horwood, managing director of Gewefa UK. “Since we showed our first heat-shrink systems as long ago as the MACH 94 exhibition, the concept has become widely accepted,” he says, “particularly in aerospace machining.”

Gewefa claims it has supplied literally thousands of heat-shrink clamping toolholders into the UK over the past decade. Taking the lion’s share is the aerospace sector, thanks largely to the high gripping forces required to avoid the cutting tool grip ‘slipping’ in the toolholder, which can lead to extremely expensive workpieces being scrapped.

Mr Horwood states proudly that Gewefa has never had a heat-shrink toolholder returned due to cutter failure – testimony to the security of the toolholder/cutter connection. “Gewefa shrink clamp toolholders can comfortably withstand up to 40,000 tool clamping/unclamping movements without loss of grip,” he says. “We work to a 2 micron tolerance between the bore and the tool taper, which means nothing can go wrong – no collets, nuts, screws or seals to fail – while the solid one-piece body also optimises tool balancing.”

Mr Horwood says that heat-shrink systems come into their own where heavy milling is the order of the day in high-speed machining environments. “In addition,” he says, “because the nose of the toolholder is very slim in comparison with other systems, even long-reach toolholders retain their rigidity. Coupled with the security, it is not difficult to see why the concept is so well suited to aerospace machining applications.”

COST-EFFECTIVE INVESTMENT
Heat-shrink systems are also cost effective. After a one-off investment in a bench-mounted heat-shrink clamping machine (heater and cooler), such as the InduTerm G5, Gewefa says toolholders (available in every shank connection) are approximately half the price of a hydraulic chuck. Cooling of the assembly using the InduTerm G5 takes just seconds and is providing benefit to an increasing number of Gewefa customers (see box).

However, Mr Horwood is keen to point out that heat-shrink clamping is not suited to every application. “There are occasions where it is simply too rigid and damping may be necessary,” he says. “A hydraulic chuck is likely to be more satisfactory in these circumstances. In our experience, shrinking is also unsuitable for simple drilling or tapping operations.”
Where it does outperform other systems is in applications requiring high spindle speeds and relatively long overhangs, where minimal run-out and precise balance are called for.

Typical applications are found where deep pockets or cavities need to be machined, often with small diameter tooling. In these applications heat-shrink eliminates the need for any tool clamping mechanism that may reduce the effectiveness of a toolholder.

“Heat-shrink tooling is very much a growth area for us,” says Adrian Fitts, WNT (UK) business development manager, “especially in the mould and die sector where an increasing number of high spindle speed machines are being introduced.”

To capitalise on this growing demand, WNT’s range of heat-shrink toolholders has recently been expanded with a series of tools designed around the HSK shank. These are targeted at users who are looking to achieve high levels of quality and accuracy. Available in HSK-E40 and 50 and HSK-A63 and 100 variants, the range covers tool shank diameters from 3 through to 32 mm with a reach of up to 134 mm, plus the tool length.

The toolholders are manufactured from specialised materials that when subjected to WNT’s heat treatment process are capable of over 50,000 shrinking operations without losing any of their concentricity or clamping force. Clamping force ranges from 24 Nm for a 3 mm diameter toolshank up to 980 Nm for a 32 mm diameter shank.

Given the intended application of these toolholders at elevated spindle speeds, close attention has been paid to the balance of each tool. WNT is, as standard, balancing this range to a level that is one of the highest in the sector: G2.5 at 25,000 rpm.

In general, tooling manufacturers have not been slow to get heat-shrink systems to market, with new product introductions occurring relatively frequently. For instance, Sandvik Coromant has recently launched a new range of heat-shrink toolholders as an extension to its Capto modular toolholding system. Available in shank diameters between 6 and 32 mm, the new range is available for use with Capto sizes C4, C5 and C6.

Elsewhere, Guhring has also introduced new heat-shrink systems: GISS 4000, GISS 2500 and GISS 5000. The first has a maximum setting dimension of 750 mm and is designed specifically for long tools. The latter two models combine measuring, presetting and heat-shrinking in a single system.

Above, Renishaw chose Gewefa’s heat-shrink system; left WNT has introduced a HSK-based system, while Sandvik, right, offers its heat-shrink Capto line.

Turning up the heat

A Gewefa heat-shrink toolholding system installed in the machine shop at metrology equipment manufacturer Renishaw has become an integral part of the company’s process operations following a major machine tool investment programme. This saw the arrival of eight Mazak FJV 250 UHS machining centres with 25,000 rpm HSK spindles.

Renishaw was seeking maximum duty cycles from each machine – in excess of 120 productive hours a week – so consistent toolholder performance was vital to help produce the 5,000 different small precision parts it manufactures every week at its Gloucestershire facility. The company commenced an in-depth assessment of available toolholding systems including heat-shrink, hydraulic and mechanical variants.

Heat-shrink offered a number of advantages. The security and consistency of the cutter in the toolholder was impressive and eliminated the need for collets. In addition, Renishaw engineers decided they could not afford run-out at the speeds involved.

As a result, Renishaw purchased Gewefa’s InduTerm G5 three-phase induction shrink unit, which has a cycle time of less than 10 secs. Once the tool has been gripped, it is placed in a cooling unit containing refrigerated water for approximately 30 secs. The unit is located adjacent to three off-line kitting stations where operators load and unload the RAMTIC (Renishaw’s Automated Milling, Turning and Inspection Centre) fixtures and tooling.

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