

NO TOOLS?



ITS INVOLVEMENT IN MAJOR HOBGING, SHAPING, AND SHAVING OPERATIONS HAS PROVIDED EMUGE WITH INSIGHTS LEADING TO A NEW LINE OF “TOOL-LESS” QUICK CHANGE WORKHOLDING DEVICES. By David E. Jones

NO PROBLEM.

Over the past few years we have seen several trends in the gear-manufacturing industry, to which we supply our line of precision workholding devices. A good portion of these trends are driven directly by the end user, and for all intents and purposes they always seem to point to the fact that “time is money.”

In the volume manufacturing—or even the precision component—industries, the manufacturers want to produce a quality component while maintaining the most cost-effective manner in which to do so. It is no secret that being cost effective is one of the keys to success, but achieving this goal is not always an easy task.

One of the current trends that we are seeing is no different, and it is certainly directly related to the “time is money” adage. This current trend is for quick-change precision clamping devices. This concept differs from a clamping device that has interchangeable components for a particular part family. In a device that has interchangeable components, there is a basic body that will accept different components for the next workpiece. This concept requires that the basic body be, for lack of a better description, torn down from one workpiece and built up for the next. In the case of quick change, the entire device is changed out, minimizing the amount of time that it takes to change from one workpiece to the next. Normally, most people would think this quick-change concept would only be valid for part families where the workpieces were very close in size and shape, but in most cases the workpieces only need to be close as far as the operation that machine is set up to perform. This may be a hobbing operation, or it may be a shaving or shaping operation, but in most cases the workpieces can be accommodated on a single machine.

In one of the more recent applications, our end user requested not just quick-change clamping devices, but “tool-less” quick-change clamping devices. This seems to be one of the next steps in the evolution of precision workholding.

Tool-less quick change devices mean just that: The personnel responsible for changing the machine over from one workpiece to the next would not even need a simple wrench to perform their duties of changing the clamping device. There may be some other areas of the machine changeover that need to be attended to, as far as tooling or

operational changes are concerned, but for the clamping device itself there is a niche trend toward no tools being required.

There are many challenges involved in building such a clamping device, but the reward comes when the end user can state that the changeover from one device to the next only takes 15 minutes. This is 15 minutes for a planned changeover in a preventative maintenance schedule, or a planned changeover from one workpiece to the next, but perhaps more importantly for an unforeseen changeover due to a dreaded machine crash where the clamping device may have gotten damaged and should be pulled off the machine for a full inspection. Being able to quickly change the clamping device with a tool-less machine connection can certainly get the line up and running much faster, as opposed to a normal bolt to the spindle type of connection.

A design of this type also allows the end user to strategically plan any preventative maintenance on a clamping device. Say you’ve been on a long run for a particular workpiece. Instead of waiting to see a marginal workpiece come off a normally perfect operation due to swarf from the long run—and instead of trying to quickly clean the clamping device inside the machine—a scheduled changeover to an already waiting device can be performed with minimal downtime. The device that was in the machine can then be properly cleaned and maintained off of the machine, without having extended downtime.

The process of changing over from one device to the next relies on the design of the machine, and the design concept of the clamping device itself. For discussion purposes there is generally a machine adapter that, once mounted to the machine, stays mounted to the machine. The adapter can be considered the heart of the system and allows all the different clamping devices to be readily mounted to the same machine.

Once the adapter is on the machine, its purpose is to accommodate the precision alignment of the introduced clamping device to the machine spindle. It cannot be stressed enough how important this machine adapter is to the overall performance of the workholding. Think of how the majority of clamping devices are directly mounted to

the machine spindle, generally by a flange requiring screws, and now you are introducing an intermediate component but still requiring the same accuracy in runout and repeatability. This is not an easy task; tolerances add up, and any lost micron is a lost micron. Accuracy is the key for this adapter, both to the spindle of the machine and the incoming mounted clamping device.

With a tool-less system, mounting—or the pre-clamped position of the individual clamping device to the machine/adaptor—can be easily achieved.

There are several ways this can be accomplished,

but we will discuss a very common and relatively simple design.

Once the clamping device is introduced to the machine adapter, it is rotated into the pre-clamped position and can now be physically released by the installation personnel, as the machine adapter that

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FIGURE 1— Emuge hobbing arbor for a Mitsubishi GND10A dry hobbing machine.

is mounted to the spindle is now supporting the clamping device. As stated, this pre-clamped position can be achieved in several different configurations, but the general concept is accommodated by at least a pair of mounting ears that are fed through a mating

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FIGURE 2— Emuge shaving arbor for a Mitsubishi FS30A synchronized shaving machine.

geometry in the machine adapter. Then, with slight rotation of the clamping device, it is now safely seated into the pre-clamped position. The design can also incorporate internal stops located in the machine adapter that would give the operator a positive feel when the clamping device is safely in the pre-clamped position.

From that point the machine takes over and pulls the clamping device firmly onto the machine connection. This is generally achieved by a type of collet in the machine spindle that pulls back on a stud located on the clamping device. Once this action is completed, the clamping device is now mounted in the spindle.

As in all precision elements of a manufacturing process, cleanliness is also important, and all elements must be properly cleaned and lightly lubricated prior to assembly. This will aid not only in the installation process, but also the disassembly process, as well as assuring that there is no debris present that may affect the precision of the operation, and ultimately the precision of the operation/completed workpiece.

The advantages that a quick-change tool-less system of this type can provide are clear, decreasing the time required to change a clamping device out of a machine while at the same time maintaining the accuracy and repeatability of a direct spindle connection. 

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