The Industrial Internet of Things

Achieving Industry 4.0 in Pre-machining Processes (Part II: Execution)

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In the last article, Haimer looked at how improved process reliability is essential for achieving Industry 4.0 and listed four pre-machining best practices that make this possible. In this article, Haimer looks at each element and examines exactly how it pertains to process efficiency and reliability.

1. Pre-machining Tool Inspection

The most common inhibitors in properly detailing dimensions such as gage length, tool stick out, diameter, runout and insert height are: the time it takes to measure, accuracy in measurements taken and errors in transferring offsets accurately to the machine controls. Each dimension can be measured any number of ways. However, using a ***presetter*** for such processes is the ideal methodology, as it saves significant time during the set-up process, helps to eliminate errors and improves repeatability of machining operations. A presetter that has the high degree of accuracy necessary to attain precise measurements is fundamental, but also look for one that has a stable construction that limits temperature variances that can affect repeatable accuracy. RFID or post-processing technology is also another important consideration to enable automated data transfer from presetter to machine control. These features eliminate possible errors in manual data transfer, such as mis-typed keystrokes at the control. Lastly, ease of use for presetting machines cannot be understated. Machines with complex software and operating instructions often garner less than full adoption by users, thereby becoming very expensive paperweights over time.

2. Runout

Runout accuracy is a quality that every shop knows is fundamental to any machining operation. Precise runout accuracy dictates outputs including dimensional part accuracy, surface finish, tool life and ultimately, metal removal rates. A facet of runout often overlooked, however, is the ability to maintain TIR repeatedly over the course of a week, month or year. To ensure runout is precise and repeatable, look to employ toolholding solutions with as few wearable components as possible. For example, collet chuck systems employ a series of elements that must be put together to form the assembly. External variables like dirt, chips and natural collet wear caused by over-tightening all lead to degradation of runout accuracy over time. In contrast, solutions like ***shrink fit holders*** offer the same or better precision versus this and other mechanical chucks, but lack the wearable components that impact TIR over time. With no moving or wearable mechanical parts, shrink fit is an ideal solution to achieve long-term repeatable runout accuracy, regardless of the operator or tool room attendant.

3. Balance

Balance of tooling assemblies is critical in maintaining consistent and stable finishes, tool life, part accuracy, spindle life and productivity. Often when unbalance is present, cutting speeds are reduced to compensate for a myriad of issues created by the subsequent vibration. And while purchasing "balanced" toolholders is a good start, there are still too many variables that can affect the final balance when holders are fully assembled. The factory of the future will need to integrate ***balance inspection technology*** as part of their pre-machining inspection processes. Unbalance simply leads to a multitude of different potential problems, all of which affect the repeatability of any given machining operation. Inspecting assemblies prior to placement in the machine can reduce variances in the machining process by as much as 50%.

4. Tool Security

Tool security seems like perhaps the most obvious of attributes needed to maintain process reliability during machining. However, all too often things like slow metal removal rates, poor tool life and tool breakage are often blamed on the cutting tool instead of the true source of the problem. With newer and more aggressive machining tool path strategies being employed every day, in combination with more advanced milling machines and cutting tools, the issue of micro-creep is becoming more and more prevalent in today's machining environments. Instead of older side lock technology, look to newer anti-pullout solutions like ***Safe-Lock***™ to garner total process security without sacrificing balance and runout accuracy.

To achieve the factory of the future and be competitive in the global market, emphasis on technology that streamlines processes and provides repeatable outputs in machining operations is paramount. Without process reliability, things like automation and data-driven intelligence will remain uphill battles.

To read part one of this series click here.

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