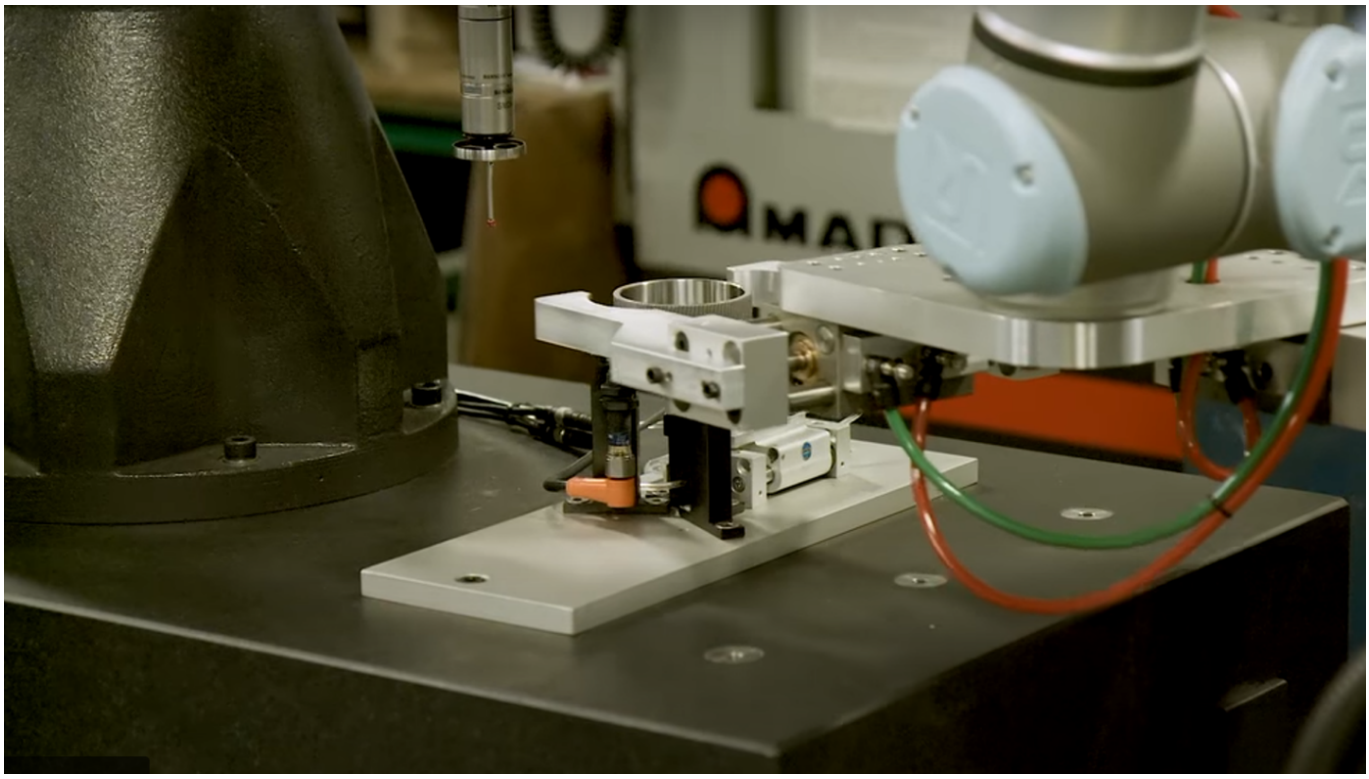

Metrology

ZEROing in on Defects

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In researching the overall topic of this article, it led Mitutoyo to the historical significance of the term Zero Defects, so they felt it necessary to honor the individual who coined the terminology. Mr. Philip Bayard "Phil" Crosby of the Martin Company initiated a zero-defect program in 1964 as a direct response to the quality crisis in early 1970s American manufacturing. His overall response to the crisis was the DRIFT principle, “doing it right the first time” and the performance standard of “zero defects” was one of the four principles.

In this article, Mitutoyo will first define how metrology can address one of the defect categories, Manufacturing Defects. Most quality professionals classify the defects in three categories: minor, major, and critical. The concept of zero defects may suggest to treat all defects as critical. The overall goal of zero defects, of course, is to eliminate all defects.

Using data collection technologies are a proven method to gain insights on dimensional measurement data that leads to actionable decision making that first reduces and eventually eliminates defects. Most modern metrology tools are digital, so data collection is available by any number of methods including traditional cable connection or wireless relay.

Simple and easy-to-use data collection is the preferred method for most operators. With immediate operator feedback and visualization of pass/fail tolerance conditions, for example, throughput is increased dramatically without compromising measurement accuracy.

SPC – The Empowerment of Data-Driven Statistics

For many customers, the achievement of zero defect starts with a simple process but usually requires more complex tools to capture, categorize and characterize product data. The use of Statistical Process Control software platforms has helped quality professionals collect and analyze data as part of the overall TQM platform. Many organizations have adopted these SPC software products to enhance productivity. Mitutoyo offers MeasurLink® with enhanced tools such as the ability to define variable and attribute data, traceability, and multiple evaluation methodologies, to provide a more comprehensive data collection platform.

Watch: What MeasurLink® Can Do For You

Finding the Cause

In many instances, the use of Root Cause Analysis can be applied to the process to identify where, why and how the defect is being generated. There are multiple techniques which are typically part of a Total Quality Management System or TQM. To gain a better understanding of the methods and best practices, Mitutoyo recommends a quick tour of the *American Society for Quality (ASQ) website*.

Correcting the Defects

Once a defect has been defined, the next step is to make changes to the production system. Management typically has the authority to make these changes. Usually a lot of consideration and examination of the root causes are used to affect these changes. In some cases it may be a simple change of a process or material, but in other cases high costs, loss of production time and other factors can slow the process considerably. Fortunately, the elimination of a defect is in everyone's best interest.

Measurement Data Instantly on Your Phone

Using a caliper with wireless data connectivity and a simple phone-based application allows operators to immediately identify and determine dimensional defects. Preparation of the measurement process is simplified using image based step-by-step instructions. Data is transferred via Bluetooth and a simple push of a button on the gage.

There are other more difficult-to-quantify defects. Manufacturers like Mitutoyo are leveraging the power of Artificial Intelligence (AI) in software such as AI Inspect to replicate and surpass the human evaluation of visual defects. This class of defects, typically known as scratches, dents and dings, are highly subjective and usually dependent on operator interpretation. Using high resolution cameras and synchronized lighting integrated into an inspection line, and by using AI to create an inspection model, can offer customers a glimpse of the future of visual defect detection.

AI Inspect is capable of detecting a wide array of defects such as scratches, burs, cracks, dents, inclusions and misprints for many different product types that humans just can't see manually. AI Inspect's training module allows users to develop inspection routines for automated implementation of defect detection using image sets. Importing images is as simple as dragging and dropping images into the normal or defect fields. Easy-to-use defect marking tools then detect defects on the uploaded images. Various image enhancement tool settings can recommend the number of defect images required for high-detection accuracy. Thresholds are set with a graphical interface, allowing the

operator to adjust the pass and fail image scores.

The model can then be imported into the runtime model, which resides on imaging hardware on the factory floor, and does the defect detection. This will become the preferred method of defect detections in the coming years, as it's highly efficient, more effective and faster than manual human inspection, and is easy to use.

While the possibility of zero defects exists in practice, the ultimate achievement of zero defects in a product are difficult to obtain. Time, effort, expenses and resources are the typical prohibitive factors in obtaining the end result.

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