Coordinate Measuring Machines versus Portable Metrology

How to Choose the Most Effective Measuring Tool

Quality control managers have the delicate task of verifying and guaranteeing that manufactured parts meet customers’ requirements, specifications, and tolerances. While coordinate measuring machines are usually their preferred choice, alternative metrology instruments are now available, enabling them to perform accurate measurements directly on the shop floor during the manufacturing process.

To carry out their mission critical tasks, quality control (QC) managers mainly rely on coordinate measuring machines (CMMs), which are the most precise and accurate metrology equipment available for quality inspection. Systematically choosing the CMM to perform all QCs can, however, affect the manufacturing process, inspection flow, and customer delivery because of its high accuracy, the CMM is widely used and, often, totally loaded by all types of QC. It might cause a bottleneck effect that clogs the manufacturing process. It might not be available to practise critical inspections, such as the first article inspection (FAI). Worst, it might generate critical delays in shipping the manufactured parts to customers. There are now several alternative metrology instruments available, enabling QC managers to unload their CMM and perform accurate measurements directly on the shop floor during the manufacturing process. The measurements obtained with these alternative solutions prove to be insensitive to external instabilities and, most important, very accurate.

Challenges

• Better quality products
  Over the past decades, the market’s interest for quality products has increased significantly. The market now expects better quality products for both high-end markets and popular brands. To meet this demand, manufacturing companies must guarantee their products’ performance and high quality by achieving more QCs and better inspections.
**Tighter tolerances**

Tolerances that must meet QC standards are now increasingly sophisticated and optimized. To meet these tighter tolerances, QC managers need more accurate and better performing equipment.

**More equipment, more resources**

On the one hand, customers require more QCs; on the other hand, industry tolerances have tightened. This has a direct impact on the work of QC teams that experience more pressure because they are being asked to do more complete and accurate inspections in greater numbers and at different stages of the manufacturing process. To meet this demand, QC managers need more metrology equipment and more metrology staff to operate them. These two solutions are feasible in the short or middle term, but they require a large investment of time and money.

Purchasing new metrology equipment, such as a CMM, requires important capital investment. The new equipment will also permanently occupy valuable space in the laboratory, which must be controlled for temperature, humidity, and vibration.

Hiring more qualified personnel to perform more inspections involves time. It is not an easy task to find experienced metrology specialists. Training is, therefore, required to enable new employees to set up and manipulate sophisticated machines.

Although purchasing new equipment and hiring new staff are the ideal solution to more inspections, the reality is different. Companies privilege using equipment to their maximum capacity and adding extra shifts before pausing,
analyzing the situation, and considering different solutions. This reaction may have consequences that will impact the complete QC process.

**Impacts**

- **Bottlenecks**
  Bottlenecks happen when the manufacturing process is clogged by inspections waiting to be completed on the CMM. The major consequences of these bottlenecks are delays in deliveries to customers. To counter this, QC managers may decide to reduce the frequency of the sampling and/or inspections which means that only the minimum inspection is performed. No further investigation will be made to improve the QC process or to proactively identify issues before they occur. This may severely impact the products' quality and increase quality issues.

- **Pressure**
  QC managers might suffer from the pressure exerted by the production team to ship parts without delay. Part inspection must follow production to ship on schedule. Therefore, metrologists might be asked to make compromises in the execution of their work. They might no longer have the flexibility to perform QCs as they are used to. Inspecting parts as soon as they come out of production to ship them to customers immediately is the reality of many QC managers.

**False perceptions**

- **Not all parts on the CMM**
  CMMs have undeniable advantages, but they also have clear limitations. For instance, it is certainly the most accurate measuring instrument available on the market. However, it requires moving the measured part and is often loaded by all types of operations. Therefore, a good way to optimize its key features is to use it specifically for highly accurate measurements, such as the first article and final inspections of critical parts. All other controls that do not require high accuracy do not need to monopolize the CMM. In fact, the high level CMM is an overkill for most intermediate and sporadic controls and for parts with looser tolerances.

  A non-exhaustive study found that from a tolerance of 50µm it is possible to use an alternative solution, such as measuring arms or portable technologies, and reach the level of accuracy required for the part’s inspection.
Solution

Complementing traditional measuring equipment with portable technologies is the solution to increasing QC managers’ productivity. Adding new tools to the common metrology kit gives more possibilities, including better use of the CMM, optimizing its use for more inspections, and allocating it for the most important controls.

Key features:

- Easy to use and simple to setup: Requires less-qualified staff and decreases the required time for every inspection.
- Portable: Gives the flexibility to address specific needs on the shop floor, in the manufacturing area, near or on the production line.
- Insensitive to external instabilities: Tracks any vibrations that could impact the measurement system.
- Flexibility: Enables measurement of different types of parts, materials, and sizes
- Accuracy: Allows multiple inspections with a high level of precision which gives users confidence.

Benefits

Adding new tools to the common metrology kit generates two important benefits: It unloads the CMM and returns to an acceptable workload where all QC standards can be restored, and it lowers the level of expertise required to operate instruments.

Making the right choice

The CMM will always maintain its leading position in metrology labs. It is unquestionably the best and most accurate metrology equipment. This is why it should only be dedicated to specific, important, and accurate controls, such as the first article and final inspections of parts with tight tolerances.

Unloading the CMM by adding portable alternative solutions to the metrology kit should be considered. Since these technologies are specifically engineered to address external instabilities - due to their optical components - more controls on the production floor are possible. In addition, since these measuring instruments are easy to use and to set up, they can be operated by less qualified staff.
Finally, not only can QC standards be restored, but more inspections can be done, enabling the opportunity to improve the QC process, be more productive, and obtain better quality products.

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Bildmaterial:

Creaform_Aufm_InsInt0117

Creaform01_InsInt0117: Evolution: Flush and gap tolerances in automotive

Creaform02_InsInt0117: CMM in action

Creaform03_InsInt0117: A non-exhaustive study found that from a tolerance of 50μm it is possible to use an alternative solution, such as measuring arms or portable technologies, and reach the level of accuracy required for the part and inspection.

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