Quality assurance focus: Prototype parts

Laser scanner operation at automotive supplier Kiekert AG

Cross Scanner lines digitizing a complex door closing part.

The dimensional evaluation of prototype parts is integral to the actual serial production. However, depending on material consistency, traditional tactile measurement cannot provide the necessary integrated overall view of measured components. For this reason, Kiekert AG, the Heiligenhaus-based global leader in vehicle locking systems, primarily relies on digital Cross Scanners for prototype inspection.

BMW, Daimler Benz, VW, Ford, General Motors, Fiat, Renault, Nissan,.... More than fifty international automobile brands favour Kiekert AG's technology for side door locks, lock modules, rear compartment locks and gears. Based in Heiligenhaus near Dusseldorf, the global leader for the supply of automotive locking systems operates in nine countries around the world, with a total of around 5,000 employees. Six of these locations are production centres, six are involved in R&D, and there are three sales & distribution centres.

The inventor of central locking systems

Over the course of its 150-year history, the company has developed and manufactured more than 1.5 billion vehicle locks. With more than 1,200 patents, Kiekert AG is the uncontested leader of innovations in this challenging field of technology. Here at Kiekert AG, central locking and electromotive power servo locking were invented. It is also where engineers are hard at work developing various solutions to make driving even safer and more comfortable in the future. And it's a place where ultra-modern measurement techniques and test procedures are used in quality assurance processes.

Kiekert's prototypes are subjected to extreme life-cycle testing in specially constructed test rigs. During the course of their development, all products have to pass countless load tests reflecting vehicle use under widely differing conditions around the world. The company headquarters in Heiligenhaus are also home to one of the automobile industry's leading acoustic laboratories. Amongst others, it features psychoacoustic measuring devices, a drivable acoustic chamber, high speed cameras and unique technology which is able to simulate specific driving movements.

Kiekert AG's focus lies entirely on future-proof quality. And right at the start of the process chain it's the main center of attention. Because here, Kiekert's QA relies fully on the special abilities of Nikon Metrology's digital Cross Scanners for the metrological qualification of prototype parts.

The critical pre-production phase

As a company which specialises entirely on assembling modules, Kiekert AG is 100% dependent on vendor parts. Particularly in the prototype phase and pre-production runs, this demands meticulous testing and highly precise coordination with the suppliers producing these parts.

Bearing in mind that a side door lock consists of up to 132 individual parts, one can imagine the amount of time, work and energy involved in this process. These individual parts need to perfectly fit and operate together like the workings of a clock.

The complex functionality within this highly restricted space is dependent on absolute adherence to several hundred functional dimensions. These dimensions define bearing locations, for example, or the accurate relative positions of two moving parts. Rarely does engineering tolerance allow deviations of more than 0.05 of a millimetre.

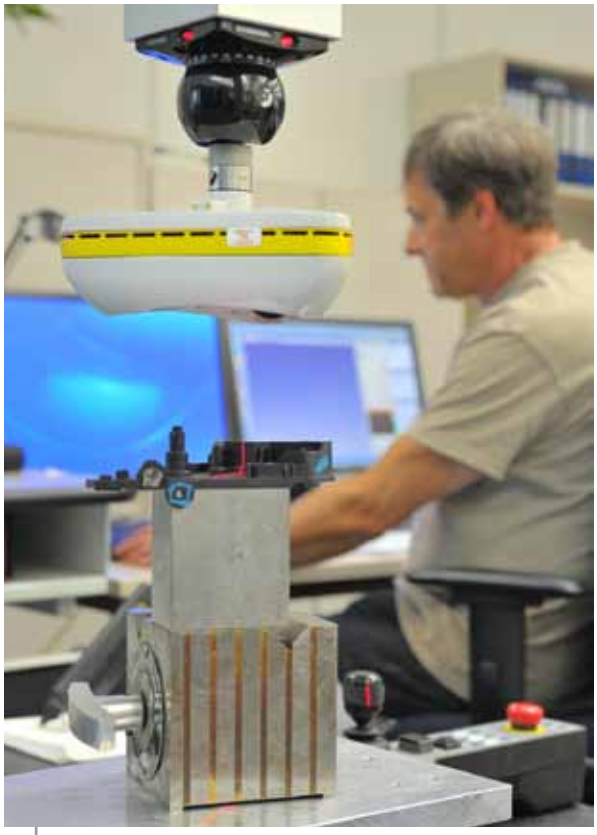
This is a level of precision which can, generally speaking, be measured without problems by tactile coordinate measuring machines. Generally speaking, that is. But not in special cases. And not in Kiekert's special component qualification.

The background: above all, it is the so-called integral parts which have to meet the demand for highly accurate dimensional precision. These are the parts which compose the entire complexity of the door lock module. Primarily, one is talking here about the enclosures of the door lock and central locking modules with their countless bearing locations and moving parts.

Accordingly, Kiekert concentrates intensively on prototype parts. "Prototype parts" is the term used for the first samples produced by suppliers using mass production techniques. During the pre-production phase, these offer important insights, and form the basis of component qualification for the serial produced parts.

The integral overall view is vital

Because plastic components are unavoidably subject to a certain degree of warping, by very nature of the material, it is important



Operators use Focus software to program scan paths and analyze measurement results.

to measure the complete form of the part. Tactile inspection of individual measuring points and feature dimensions provides too limited information. The number of measuring points, being ultimately finite, can never provide a full picture of the part being tested. This is particularly problematic when a part needs to be "mated", or joined, to another part in a later step.

Hence it is absolutely vital for an integral verification to have a complete 3D view of the part which includes all surfaces and all features. Only a complete view enables engineers to draw actual conclusions regarding potential corrections to machine tools. This also provides the right information to determine actual "zero datum points" in the part, taking natural warpage into account - so that for example additional tactile tests can be conducted.

Early on, Kiekert began to distinguish itself from other manufacturers by solving this measuring problem. Kiekert instantly recognised and exploited the potential of non-contact laser measurement systems.

Scanning instead of touching

As soon as laser scanner technology entered the market at the beginning of the millennium, the first systems of this kind were implemented in quality assurance in Heiligenhaus. And it was not long before Nikon Metrology's digital line scanners were used in Kiekert's largest production site in the Czech Republic as well as the production site in Mexico and China.

The digital Cross Scanner features 3 laser lines from different angles to measure complex shapes with a minimal number of PH10 head rotations

At all these locations, the use of non-contact laser scanners in part qualification offered enormous advantages:

- Creation of high-density point clouds for quickly identifying form and features
- Initial and detailed analysis of surfaces and sections considerably simplified due to colour charts
- Fast measurements of free-form surfaces possible
- CAD characteristics tests
- Complete digital copy of parts acquired in just a couple of minutes
- Reduced measuring times, hence increased throughput
- Simplified processing of measuring data to be passed on to existing processing and evaluation software
- Reverse engineering possible
- Determination of ideal alignment points for geometric measurements

With the introduction of the newest evolutionary phase in Nikon's laser technology, the XC65Dx digital Cross Scanner, the evaluation of prototype parts took yet another huge leap forwards in efficiency. Because with these scanners, prototype parts have come into the focus of Kiekert's quality assurance more than ever.

Cross scanning with three laser lines

With its three lasers positioned crosswise to each other, Nikon Metrology's XC65Dx digital Cross Scanner is able to acquire not only surfaces, but also focus on the features of the components, such as round slots, bearing points, holes etc.

In most cases, it is able to do so in a single scan, with the part passing it just once. The field of vision covered by the three laser lines is 65 x 65 mm, whilst the precision level of the sensor is 12 µm.

With its 75,000 laser points per second, the Nikon Metrology Cross Scanner, which is mounted on a bridge-type CMM, generates a high-density 3D point cloud. Thanks to the Part-to-CAD comparison colour display of Nikon Metrology's Focus Inspection software, the inspection results are highly meaningful even at first glance.

Short measuring times, high precision, complete 3D view, simple to operate, fast analysis of results: these advantages alone are convincing arguments in favour of Nikon Metrology's Cross Scanner technology for component qualification. And the advantages don't end there.

Six-fold increase in productivity

Unlike with first-generation analogue scanners, most parts no longer have to be sprayed with matt spray in a time-consuming process to rule out unwanted reflections. The basis for this is the Enhanced Sensor Performance algorithm of Nikon Metrology's digital XC65Dx, that automatically adjusts the laser source intensity per measured point depending on the surface reflectivity. It individually measures up to 75,000 points per second, thus guaranteeing a homogenous, complete point cloud picture without flare.

Adaptations in the testing process, i.e., for different prototypes, are not a problem either. This is because the scanner movements are easy to program and can be generated automatically offline, based on CAD data using Nikon's Focus Scan software. This saves a considerable amount of time. Kiekert calculates that Nikon Metrology's laser Cross Scanners are five or six times more productive than analogue single line scanners. Experience has shown that by using Nikon Metrology's digital cross scanners, a product can be brought to market faster. Due to the early integration of suppliers to determine the ideal alignment points, the number of correction loops when measuring prototype parts is drastically reduced.

Kiekert AG is also fast in another respect: when it comes to sharing new and successfully implemented technology between its international locations. Thus the company's largest production site, which is located in the Czech Republic, is already using Nikon Metrology's cross scanners to put prototype parts from local suppliers in the line of fire. The advantages of digital cross scanners outnumber the benefits of analog laser scanners by far. This means that in the near future the more beneficial digital scanning technology will widely replace existing analog scanning systems.

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