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Room to Breathe

The CPAP generators used to provide newborns with a reliable air supply must be sealed as tightly as possible. The producer whr Hossinger Kunststofftechnik uses three different measuring strategies to ensure the precise manufacture of CPAP generators: contact, optical as well as via a chromatic white light sensor. Since the plastics processing company – located in northern Bavaria (Germany) – introduced the latest generation of the ZEISS O-INSPECT multisensor measuring machine, the company has not just been able to increase the precision of its in-house measurements. It has also shortened measuring times and will need to outsource fewer measurements in the future.

Christian Bindl, Quality Management Supervisor

Armin Hossinger, Managing Director

Every tenth baby is born prematurely, many of them weighing less than 1 kg. The chances of survival and the health of these newborns largely depends on consummate breathing support and, if necessary, an increased level of oxygen. This is where the CPAP generators from whr Hossinger Kunststofftechnik GmbH come into play. “Our generators can save lives starting at the 24th week of pregnancy or at a birth weight of 400 grams,” explains Armin Hossinger, the Managing Director. “This is something we're very proud of.” The abbreviation CPAP stands for 'Continuous Positive Airway Pressure.' The principle of the CPAP generator is as follows: oxygen-enriched air is delivered to the particular baby via a tube and is administered with a slight positive pressure as CPAP. This CPAP helps the baby breathe on its own and stimulates lung development. The positive pressure is created within the plastic housing of the CPAP generator. The oxygen must be transferred, without leakage, to the patient's nasopharyngeal zone by means of a silicon prong or a silicon mask. In order to burden the baby as little as possible, whr Hossinger Kunststofftechnik connects the individual plastic components of its product by using a connector system instead of an adhesive. Yet a CPAP generator is only airtight when the components have been manufactured with absolute precision. Quality Inspection is tasked with ensuring accuracy – and with over 100,000 CPAP generators being produced every year, this is a laborious undertaking.

Challenges in the measuring lab

Christian Bindl, Quality Management Supervisor at whr Hossinger, lists the challenges he faces when measuring components for the CPAP generators: “Wall thickness of just three tenths of a millimeter, tolerances of just a few hundredths of a millimeter, freeform components with a complex shape, different product colors...” Thus it can be quite time-consuming, e.g. to capture

the complex geometry of the freeform components because this step must be performed from different angles. Thin wall thicknesses also make contact measuring difficult, and certain product colors require illumination which must be appropriately adjusted for optical measurement. Moreover, the advances in medicine require increasingly precise products. In past years, all these requirements made quality inspection difficult, protracted and sometimes costly with the optical measuring machine this mid-sized company had available. Measurements sometimes had to be outsourced. The detour via an external service provider not only meant additional costs, but also had a negative effect on the throughput times of this family-owned company. Moreover, there was no space on the company's optical measuring machine for other products which this manufacturer produces for the medical technology and the automotive industries.

Three in one

In 2014 Hossinger and Bindl began looking for a new measurement strategy as well as an expansion for the existing optical measuring machine. In the future they wanted to measure more products in-house – and do so more accurately and quickly. Their search quickly brought

The individual components of the CPAP generators must meet the highest quality standards.

Brief Profile

whr Hossinger

Located in Roding (Germany), whr Hossinger Kunststofftechnik GmbH has 60 employees and develops, designs and manufactures technical plastics systems for the medical technology and the automotive industries, amongst others. The family-run company was founded in 1925 and today covers the entire process chain for plastic injection molding. This includes design and engineering, tool making, the manufacture of plastic parts as well as assembly and customer-specific packaging, delivery and logistics strategies. As an employer, whr Hossinger distinguishes itself through personalized work time models, e.g. there are no set shifts in the assembly area. This enables the company, located in the economically prosperous Cham district of Bavaria, to attract workers who would otherwise have a difficult time balancing work and family.

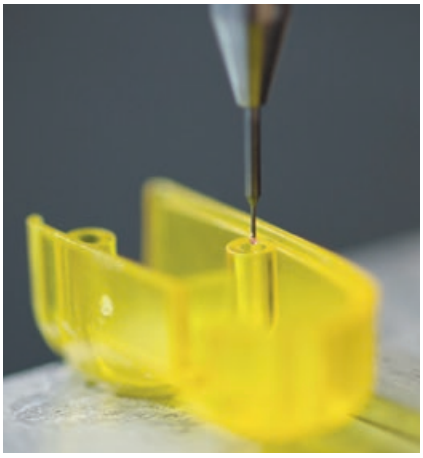
them to the ZEISS O-INSPECT multi-sensor measuring machine because it combines three measurement principles in a single machine: a contact sensor, a camera sensor and a chromatic white light sensor complement each other. In addition to greater precision, the machine promised new opportunities to increase efficiency. There was just one problem: the machine's measuring range (400 x 400 x 200 mm) was too small for the large workpieces manufactured at whr Hossinger.

According to Bindl, measuring machines from other manufacturers were out of the running because e.g. they did not have a chromatic white light sensor. What now? Hossinger and Bindl got in touch with ZEISS. A short time later they signed a contract as a pilot customer. The family-owned company agreed to support ZEISS in getting the latest generation of the multisensor measuring machine ready for market. In return, whr Hossinger had the opportunity – as the first market player – to benefit from the enhanced machine, which differs from the previous ZEISS O-INSPECT product family. For example: it has a larger measuring range (500 x 400 x 300 mm). This was an essential feature for whr Hossinger and meant the company's final requirement for the new machine was now fulfilled.

Freedom to choose

The company began working with the machine several months ago, and Bindl is satisfied: "Contact, optical, white light sensors: the way these three measuring methods interact is unbeatable because these make us highly efficient." He demonstrates these new capabilities using one of the half casings for the CPAP generator. These will later form the hollow space where the CPAP pressure is generated. whr Hossinger measures these halves at the start and end of production as well as for random sampling. The goal is to identify the weak components during manufacture so that, ideally, no reject is found during the concluding function test of all CPAP generators in the cleanroom. The random sampling of the half casing on the multisensor measuring machine in the measuring lab consists of three phases. In the first step, the ZEISS O-INSPECT performs a contact scan of the workpiece. This takes about a minute. During this time, the contact sensor captures the location of the positioning holes for the pins which will connect the two halves with each other after assembly. The position and diameter of the sealant shell, to which the tube adapter for administering oxygen is attached, are also defined using contact measuring. This requires that tolerances between one and two hundredths of a millimeter be maintained to prevent the component from leaking or fracturing.
In the second step, the measuring machine automatically switches from contact to optical measuring. Within about 1.5 minutes, the camera sensor measures the receiving contour for the tube adapter. The translucent half housing – yellow in this version – is illuminated in blue, accentuating the

The optimal sensor for every measuring task



Tiny stylus tip diameters for filigree structures

Christian Bindl programming in CALYPSO

structure. The ZEISS O-INSPECT offers the operator the choice between blue and red illumination which, depending on the color of the workpiece, creates different levels of contrast. The sensor is able to image wall structures elevated by just two or three tenths of a millimeter. These are used later to modify the CPAP generator to fit the shape of the particular patient's nose. Optical measuring with the camera is best-suited for this task because it images geometric elements quickly and flexibly.
The process then moves seamlessly to the third step. The chromatic white light sensor (see box) captures the workpiece topography at record speed: with great precision, it captures a point cloud consisting of 3,000 characteristics in just 15 seconds. These characteristics identify the sealing contour of the half casing for the matching part. The chromatic white light sensor is ideal for this task because the wall thicknesses of three tenths of a millimeter are very thin and a multitude of characteristics need to be captured.

Doubled precision, shortened measuring time

Bindl is pleased: "The multisensor measuring machine affords the metrologist a lot of freedom to decide which sensor to use and for what. If the program is already set up, it is even possible to switch from one method to the other without any fuss." This is where the CALYPSO software comes in. Bindl and his other colleague program all measuring programs using CALYPSO, no matter which of the three sensors they're using. This makes programming and switching methods easy.

Yet CALYPSO is not only used with different sensors, but also with different machines. This means that the two colleagues only needed to get used to one kind of software although they also introduced a ZEISS CONTURA coordinate measuring machine in addition to the multisensor measuring machine. The contact measuring programs for the one machine can also be used on the other machine and vice-versa. They can even exchange the data captured by their service provider on the computer tomograph with the data from the other measuring machines. "This makes us very flexible when choosing our measuring methods," says Bindl.

The acquisition of the multisensor measuring machine has paid off for whr Hossinger because of its great flexibility, accuracy and speed. Not only does the company outsource fewer measurements, but, with the ZEISS O-INSPECT, Bindl and his colleague can now also conduct an abundance of measuring tasks with a high degree of accuracy and repeatability. Otherwise, they would require three different measuring machines. The Quality Manager says that "we have doubled the precision in comparison to our previous measuring machine. And our measurements would also be a lot more time-consuming without the white light sensor." According to Bindl, the ZEISS O-INSPECT has given the metrologists at whr Hossinger Kunststofftechnik "room to breathe."

How does the white light sensor function?

Chromatic white light or focus sensors capture the topography of workpieces quickly and without contact. This makes them the preferred means when sensitive, reflective or low-contrast surfaces pose a challenge to probes and camera sensors. A sophisticated technology makes this possible: the workpiece is illuminated with bundled white light. A special optic with chromatic aberration in the probe head splits the light into its spectral colors. Since light refraction depends on the color, there is a different focal plane for each spectral color. A spectrometer analyzes the reflected light and determines for which color its intensity is the greatest. The measuring machine can then determine the distance between the sensor and the surface – and uses this information to derive the exact topography of the component.