

## Different signals, one result

### Complete testing of sheet metal blanks with combined thickness/ linear measurement system

If flexibly rolled or welded sheet metal blanks do not meet the given specifications and this is only recognized during further processing in forming technology, this is not only annoying, but sometimes also costly. One automotive supplier shows that there is another way and uses a special solution to inspect complete sheet metal blanks as early as the incoming goods stage.

The GEDIA Automotive Group develops and produces structural parts and assemblies for lightweight automotive body construction, as well as chassis components for the automotive industry. With more than 3,300 employees worldwide, the company achieved a turnover of via 480 million euros in 2015. "Among other things, we also process 'tailored rolled or welded blanks', i.e. flexibly rolled or welded sheet metal blanks that we receive from suppliers according to our specifications," explains Marc Witzmann, Quality Technician at Gedia Gebrüder Dingerkus GmbH.

#### Complete component made from one sheet

Flexible rolled blanks have different material thicknesses in different segments. These blanks are used in hot forming or press hardening. Hot forming is currently the technology that plays a straightforward role in lightweight automotive construction. It enables a significant reduction in the weight of certain vehicle components while at the same time maximizing component strength. "Hot forming has established itself as a highly efficient process with which a complete component can be produced from a single flexibly rolled sheet metal blank," says Witzmann.

#### Time-consuming and incomplete control

For all their advantages, however, such production processes also have their pitfalls. If the material thicknesses specified for a sheet metal blank are outside the permissible tolerances and this is only commented on during production, NOK parts are produced. In the worst-case scenario, this can lead to tool breakage, but in any case, delays in production planning.

Problems and risks that cannot be decisively controlled with conventional quality inspection methods, as Gedia's quality technician knows from experience: "In the past, we used to check individual sheet metal blanks from different delivery batches with manual measuring devices. Of course, we couldn't check the entire blank for the correct material thicknesses, but could only determine individual measured values from different sheet segments by random sampling. This procedure was not only time-consuming, but also incomplete, as it is not possible to recognize the transitions between different sheet thicknesses of a blank with the naked eye.

### Efficient testing with low tolerances

Many reasons to give serious thought to a real alternative in the form of a specific inspection device. Marc Witzmann specifies some of the necessary requirements for the desired solution from his specifications: "The device should enable efficient, continuous inspection of individual sheet metal blanks as early as the incoming goods stage based on combined thickness and linear measurement. The device would have to be able to accommodate sheets with a maximum length of 2,200 mm, with the material thicknesses to be inspected ranging between 0.5 and 4 mm. Common tolerated material thicknesses for rolled sheets and blanks are  $\pm 0.03 - 0.05$  mm.

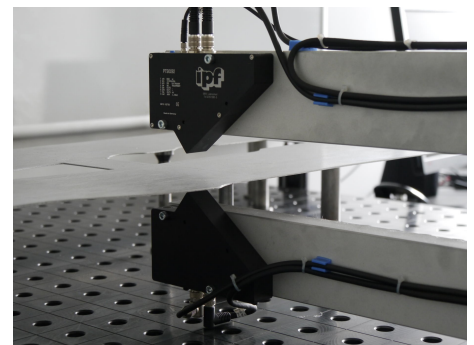
The solution was finally realized by a special machine manufacturer in accordance with these and other parameters. The testing device consists of a base table for holding the sheet metal blanks and various support points. Some of these support points serve as limit stops. The measuring system is mounted on the base table and can be moved manually along the entire length of the table. The thickness measurement must be carried out as a function of the distance traveled by the measuring system. The distance is measured via the incremental distance measuring system **MW100405** from ipf electronic.

### Flexibly selectable starting position for high-precision linear measurement

With the absolutely wear-free magnetic position measuring system, the sensor **MW100405** is moved contactless at a distance of 0.1 to 2mm via the magnetic tape (scale) **AM000049** is moved. Due to the four-edge evaluation (rising and falling edge track A and, 90° out of phase, rising and falling edge track B) of the sensor signals, a very high repeat accuracy of  $\pm 0.1$ mm is achieved. The starting position of the sensor via the belt for linear measurement can be flexibly selected so that measurements can be taken from both the right and left side of a sheet metal blank. The guide speed is not relevant when moving the system manually, as it is well below the maximum approved values.



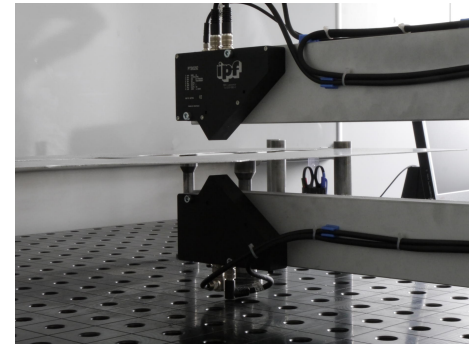
Flexible magnetic support points ensure reliable fixing of the sheet metal blanks on the base table.



The absolutely wear-free magnetic position measuring system consisting of the sensor **MW100405** and the magnetic tape **AM000049** has an operating distance of 0.1 to 2 mm and a repeat accuracy of  $\pm 0.1$  mm.

**Very accurate thickness measurement with laser light**

A master-slave system from ipf electronic is used for thickness measurement of the sheet metal blanks, specifically the **PTSIO292** as master and the **PTSIO274** as slave, which are mounted facing each other on a C-shaped clip via the test table. At the same time, this clip also holds the sensor **MW100405** sensor. The master-slave systems from ipf electronic consist of two mechanically identical laser distance sensors with a measuring range of 4mm (measuring range start 35mm, measuring range end 39mm). The master used in the specific application at Gedia **PTSIO292** with analog output (4...20mA) is the current variant of the master **PTSIO273** (0...10V). After the one-off software-supported parameterization of the overall system, the master and slave operate autonomously as a stand-alone solution. The devices use the triangulation method to indirectly determine the distance to the sheet metal plate from one side via the angle of incidence of the laser light beam reflected by the sheet metal surface. The design of the distance sensors ensures that the measured values are not influenced by any differences in the reflectivity of the surface. The thickness or material thickness of a blank in the current measurement sector can be determined from the two distance information and the distance between the laser sensors. The master-slave systems from ipf electronic have a very high resolution of 1µm, so that even very thin, non-transparent materials, e.g. plastic or metal foils, can be measured.



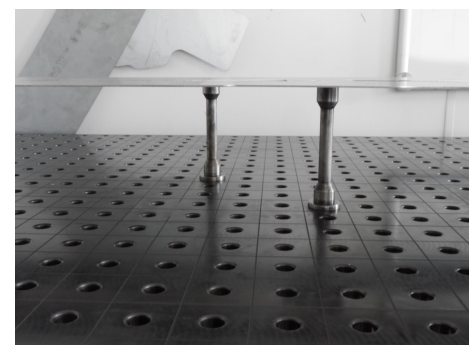
The master (top) and slave are mounted on a C-shaped metal bracket that can be moved manually via a circuit board. The master takes over the straight signal processing and provides an analog signal proportional to the material thickness for continuous evaluation.

**Master provides overall information on material thickness**

The straight evaluation and signal processing takes place directly in the master, which is connected to the slave via a line for this purpose. As the master has access to both its own measured values and those of the slave, it can determine the overall information on the thickness of a sheet metal blank segment and immediately provide an analog signal proportional to the material thickness for continuous evaluation. Marc Witzmann explains: "The master is connected to a host computer via its active PC interface, which contains special QA software for analyzing the combined thickness and linear measurement. The software converts the analogue signals of the master-slave system as well as the incremental TTL signals of the displacement measuring system and synchronizes them to produce uniform output results."

**Meaningful results for the entire circuit board**

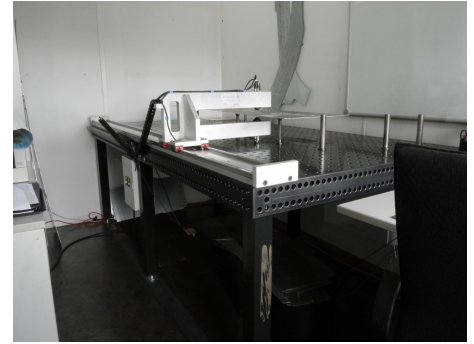
These results are compared in the QA software with the references previously stored for a sheet metal blank. Along with the output of the measurement results, the program also visualizes the measurement process in a graph during an inspection. "Deviations from the approved tolerances are instantly recognizable thanks to the meaningful results," explains the quality technician. The self-test measurement takes a maximum of one minute, after which all the test results are available."



Marc Witzmann, quality technician at Gedia: "Deviations from our parameters can now be identified in a maximum of one minute via the entire length of the sheet metal blank thanks to the meaningful results."

**Problems and risks sustainably reduced**

In view of this minimal procedure, Marc Witzmann is fully convinced by the testing device that went into operation in spring 2016. Instead of cumbersome, random checks with manual measuring devices, a sheet metal blank from a delivery batch is now certified for the various material thicknesses within a few minutes at the incoming goods department. "If deviations from our parameters are detected, we can now take instant action to prevent a faulty delivery from reaching production in the first place. As we also have certain lead times between delivery and production, we have enough time to complain about defective delivery batches, which allows us to minimize further problems in the long term, e.g. delays in production planning or production or even production downtimes."



In use since spring 2016: The special testing device is used to check the material thickness of sheet metal blanks throughout.