



## smartSCAN

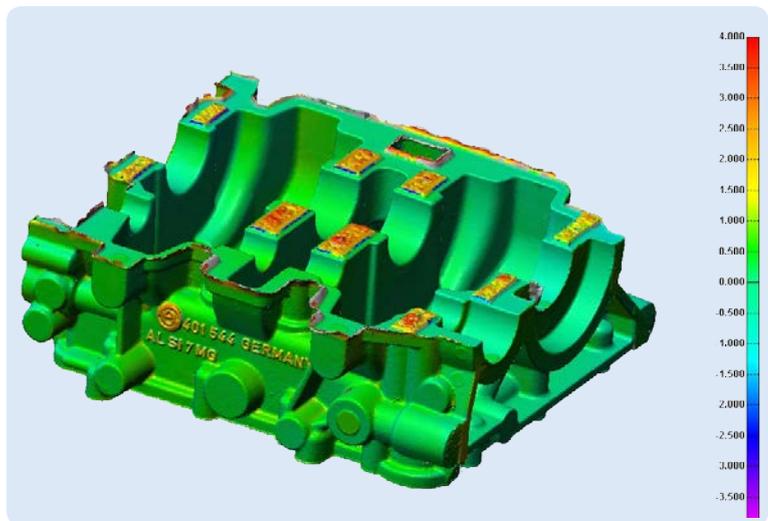
### 3D quality inspection of crankcases for four-stroke engines

Highly complex engine crankcases containing components rotating up to 10.000 revolutions per minute (rpm): This is where precision down to the millimeter is required!

Weber Motor GmbH in Markdorf (Germany) is member of the Weber Group and for more than 40 years has been a competent and reliable partner for their global customers for the development and production of engine components, engine systems, complete engines as well as fiber reinforced composite components. Quality is considered a key factor for the competitiveness and success of the company, which is why the entire production process has to comply with very high quality standards. In connection with the production of aluminum cast parts used for the manufacturing of Weber's powerful four-stroke engine, the exact adherence to these quality requirements can be verified by CAD comparison with the help of the flexible digitization and measuring system, the smartSCAN.

#### Objective and measuring object

The crankcase to be measured in this particular project has been manufactured using the sand casting method and fulfills a number of various functions: It is here where the crankshaft and the balance shaft are plain bearings and are being subjected to the ignition forces of the combustion engine (axial and radial).



—→ Deviation of the inspected crankcase from its target values (3D false color comparison)



—→ The smartSCAN with a small field of view

Furthermore, the crankcase accommodates the oil pressure pump with the pressure relief valve and it is here where the compressed oil is channelled to the relevant bearing points. Finally, it also serves as a cover for the timing driveshaft and gears. The cast aluminum crankcase therefore constitutes an important category 'A' component; depending on the application, the internal engine components contained in a crankcase can reach rpm ranges of up to 10.000 rpm. Because of the increased likelihood of possible shape deviations as a result of the chosen casting method, it is vital that the crankcases are measured and examined with regard to any potential deviations from the specified requirements.

Given the complex geometry of the unfinished parts, the surface acquisition carried out by means of a coordinate measuring machine has proven to be rather time-consuming and labour-intensive: In addition to comprehensive programming tasks, also significantly more time for the generation of the drawing as well as the documentation has to be accounted for. A variance comparison based on the precise three-dimensional data sets generated by the area measuring system smartSCAN therefore provides the perfect time and resource saving alternative.

#### Measuring system and setup

The inspection of the unfinished components is carried out with the measuring system smartSCAN, in this case configured with a small field of view. In order to achieve a partially automated data capturing process, the measuring setup also employs a turntable.

## Workflow

With the aid of the AICON software OPTOCAT, the scanning process firstly produces individual data recordings of the crankcase, thereafter aligns them and joins them to a homogeneous triangulated mesh. In a second step, the generated data sets are evaluated with the aid of a special inspection software (in this case PolyWorks | Inspector™ by InnovMetric Software Inc.), in order to assess the geometry.

Area measuring optical sensors using only standard triangulation angles are often not able to capture deep serration textures at the required level of precision. The flexible sensor configuration of the smartSCAN product series enables scanning procedures at triangulation angles of 30°, 20° and 10°, thus allowing even very difficult accessible object areas to be measured at a high degree of detail and accuracy.

## Conclusion

The high-precision data of the smartSCAN provides Weber Motor GmbH with the necessary support to ensure compliance with their demanding quality standards. In order to perform conclusive inspections of the crankcase production, the caster has access to a 3D data set which within a certain shape deviation tolerance complies with the respective DIN 1680 GTA guidelines.

After the casting process is completed, the crankcase is digitized with the smartSCAN system and compared against the CAD reference data. The time consuming procedure with the tactile measuring sensor of a coordinate measuring machine is no longer necessary; not only can every smallest shape deviation be identified faster, easier and at higher accuracy, also the overall digitization process together with the subsequent data comparison gives valuable time and cost savings.

The measuring results are instantaneously interpretable and immediately channeled into the optimization of the process parameters. In doing so, the smartSCAN serves to support and to ensure the consistent efficiency required by the Weber Motor production department in order to manufacture top quality crankcases.



—→ Radial measurement (2D cross section)



—→ Exploded view of combustion engine components including the crankcase to be inspected

## Contact / Link

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