CT workstation exaCT® M with Nicola Turrini, application engineer

Case Study: Product quality improvement with industrial Computed Tomography

Holistic analysis of aluminum die-cast parts

The Computed Tomography workstation exaCT® M creates a holistic part analysis based on a single CT-Scan. Conventional analyses of aluminum die-cast parts require a multitude of different measurement and testing procedures. Industrial Computed Tomography reduces the effort involved in testing and increases the quality of measurement results. The foundry Pressofusione Saccense S.r.l. integrated the exaCT Volume-Scanning-Technology for holistic part analysis successfully into their production chain.

Pressofusione Saccense S.r.l. was founded in 1981 as pressure foundry near Padova, Italy. Ever since they have been working constantly on increasing product quality by using the newest technologies in the fields of production and quality assurance. Today numerous international renowned companies are costumers of Pressofusione Saccense. ”With the help of the CT workstation exaCT® M we are able to produce parts with an even higher quality and significantly reduce the time-to-markt. The reason why we have chosen the exaCT® M is simple. The data quality of the scanned parts is crucial for us. The results from WENZEL Volumetrik distinguished significantly from those of other suppliers”, explains managing director Fabio Voltazza the purchase of the CT workstation (figure 1).

It is the intention of the Italian foundry to distinguish itself from their competitors. To achieve this, production processes are constantly optimized and the

casting processes are optimally adjusted for new products. To achieve such a high level of quality and production efficiency, sophisticated inspection methods need to be applied. In the past a number of different inspection techniques were used.

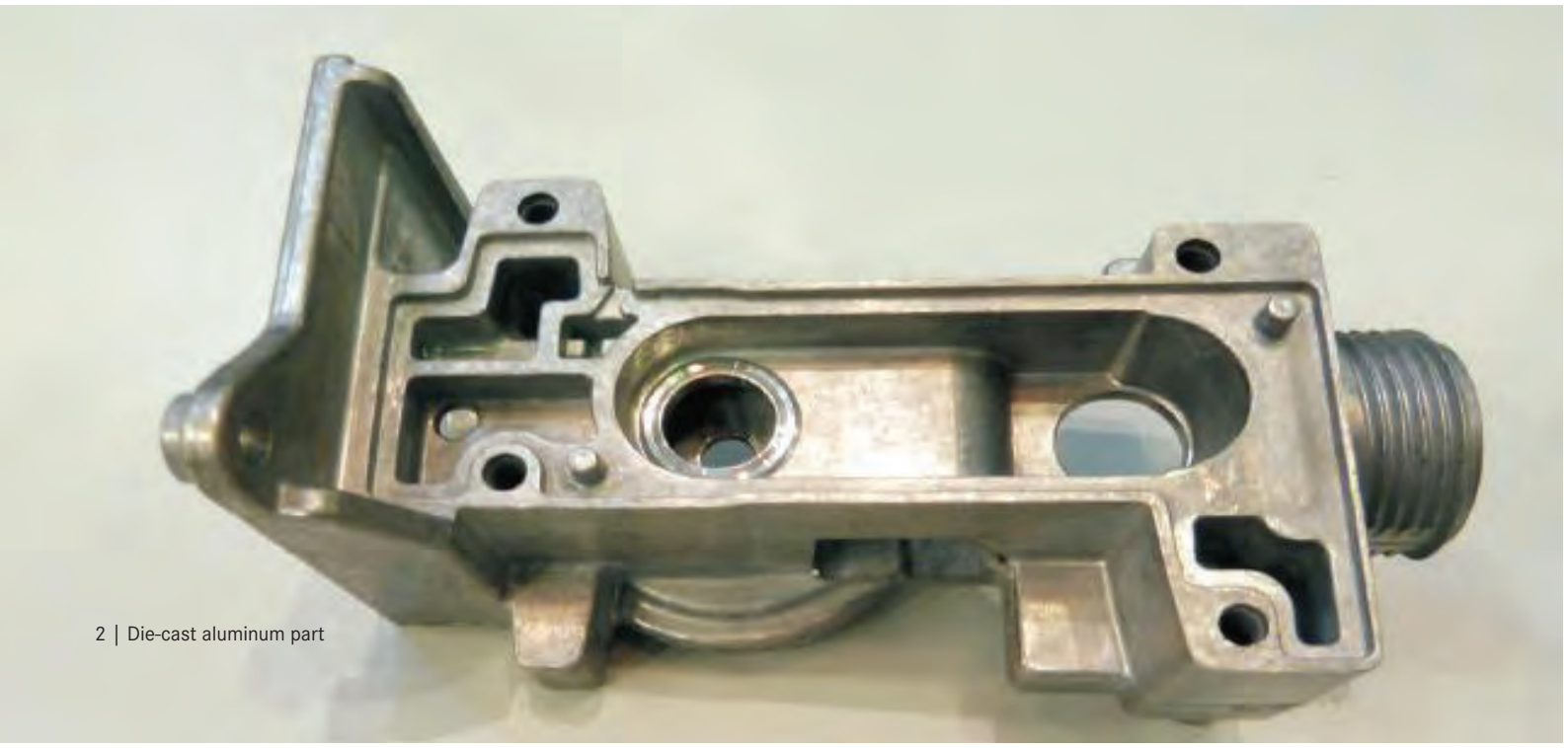
Porosities need to be checked because it may affect the material strength. For the production process porosities are critical if it is located close to surfaces that need to be machined. In such cases, in a very late stage, parts become scrap due to imperfect machined surfaces. Porosities were checked in the past by two different methods: X-Ray radioscopy and visual inspection of sectioned (destroyed) parts. Both methods have strong limitations and drawbacks so that porosity could not be detected adequately.

In the process of approving the accuracy of die castings dimensional measurements need to be performed. It used to be done by 3D coordinate measuring machines (CMM). To measure internal features, the parts needed to be destroyed.

To check aluminum die-cast parts faster, more complete and more cost efficient, Pressofusione Saccense put an industrial Computed Tomography system of the exaCT-line made by WENZEL Volumetrik into operation. With the CT workstation exaCT® M parts with a size up to 200 mm (diameter) x 300 mm (height) are checked. In this case study the analysis of a typical aluminum die-cast part with a size of 110 mm x 70 mm x 65 mm (figure 2) is demonstrated. These parts undergo a material analysis, a dimensional check and a complete nominal-to-actual comparison.

The scanning procedure is set up and carried out with the software exaCT® Control. This software allows the easy definition of scanning parameters. While the part is scanned, the captured data is reconstructed. This parallel mode of operation minimizes the needed time for data processing. At the end of the scanning procedure the reconstructed data is available as voxel (three-dimensional pixel) data as well as surface data (figure 3). This data is the basis for all following analyses.

A comparison of the scanned data and the CAD model is carried out to completely analyze form deviation and deformation of the part. The deviations of the real part to the CAD data are visualized with a color plot. Detailed information about the size of deviations can be displayed with labels. Figure 4 shows the deviations of the die-cast aluminum part with colors.

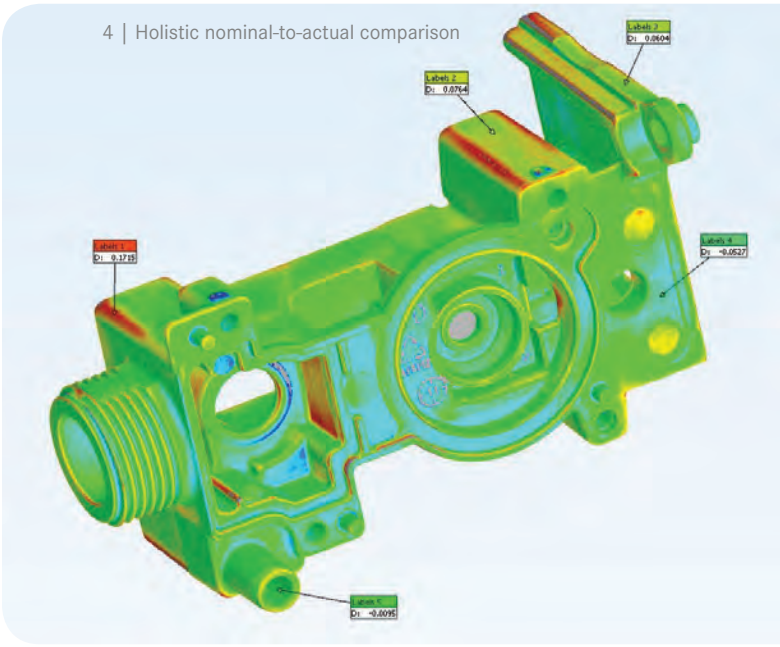


2 | Die-cast aluminum part

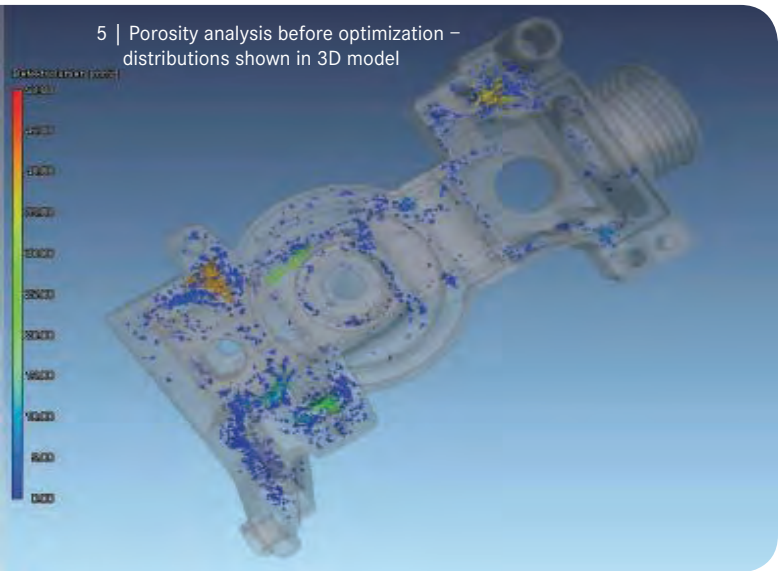
In another work step, porosities are detected and analyzed on the basis of the scanned data. With color coding the pores are categorized by their size. Therefore the distribution of the pores can easily be recognized (figure 5 and 6). When using a conventional testing method the part has to be destroyed. Industrial Computed Tomography allows the non-destructive three-dimensional testing of the part. An important feature is the ability of the CT system to detect very small pores even in large aluminum castings. The proprietary detector technology of WENZEL Volumetrik enables to achieve a very high spatial resolution in combination with a high contrast resolution. Therefore, even small pores or clusters of pores can be detected and evaluated. After the procedure the part is fully functional. The knowledge gained from the results is brought into the casting process and hence the occurrence of porosity minimized.

The dimensional evaluation of the part is carried out with the measuring software Metrosoft QUARTIS. Element capturing, geometrical evaluation and reporting are done within the measuring software (figure 7 and 8). The surface data, captured with the industrial CT, is used for the probing of the measurement points. A once prior written measuring program can be selected and fully executed automatically. With this method even internal and the smallest structures, which cannot be measured by tactile or optical methods, can be dimensionally measured and evaluated.

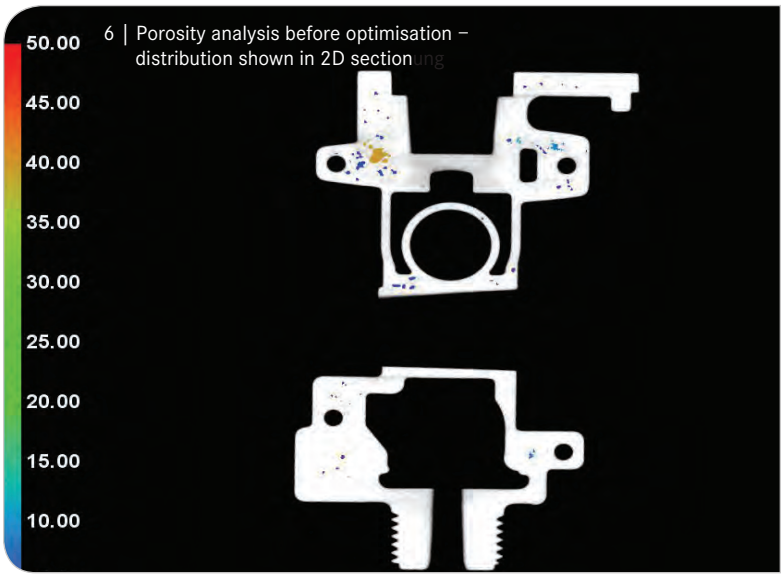
3 | Surface data of the reconstructed part



4 | Holistic nominal-to-actual comparison



5 | Porosity analysis before optimization – distributions shown in 3D model



6 | Porosity analysis before optimisation – distribution shown in 2D section

Inspection Report Metrosoft QUARTIS®

Workpiece:	2 CES617 versione D
Drawing:	34000617
Comment:	COLLAUDO
Measurement:	1 ESEGUITO SU IMP 1
Measure date:	13.05.2011 10:50:25
Inspector:	Volumetrik
Report date:	22.06.2011

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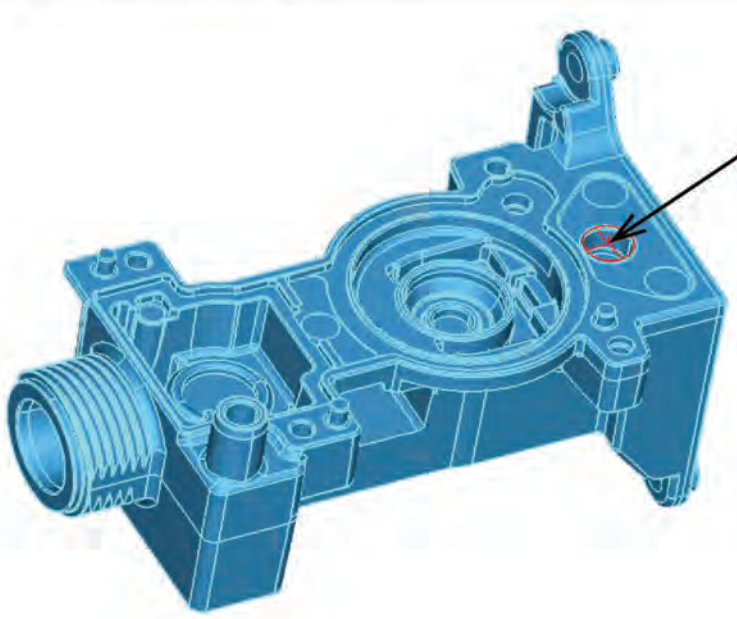

CIR_2		
Circle, Least squares, inside, measurec		
Reference		PLN_1
Probe points		6
Range		0.039
Min. point number		3
Max. point number		4
Min. point residuum		-0.022
Max. point residuum		0.017
Standard deviation		0.016
Date		10.06.2011
Time		10:00:03
Magnification of devia		10
Nominal value		Actual value
x	-26.020	-14.299
y	0.000	0.689
z	-14.700	40.290
ø	7.873	8.023

7 | Graphical Measurement Report

Since the integration of the exaCT® M Pressofusione Saccense was able to convince and win new customers with their remarkable product quality. “The CT technology of WENZEL Volumetrik offers a huge potential of analysis for both material integrity and dimensional accuracy. It definitely helped us to improve our product quality and optimize the production process. We wouldn’t like to miss it” says Nicola Turrini, application engineer at Pressofusione Saccense.

ID		Feature type				Work. length		
	Nominal value	ISO 286	UTol	LTol	Actual value	Dev	%Dev	Graphics
8		Diameter						
ø	3.500		0.100	-0.100	3.532	0.032	32%	
9		Diameter						
ø	4.700		0.100	-0.100	4.724	0.024	24%	
10		Distance plane - plane						
d	16.000		0.100	-0.100	16.018	0.018	18%	
11		Diameter						
ø	3.000		0.050	-0.050	3.012	0.012	23%	
12		Diameter						

8 | Report with measurement results