



Figure 1: Dependence of the casted part quality

## VACUUM DIE CASTING PRODUCTION: QUALITY AND DATA COLLECTION

The correct controls and measurements of the vacuum process and its right interpretations are the key of efficient production improvements. The data collection is the way to ensure optimal analysis of that vacuum process.

### INTRODUCTION

Today, vacuum technology plays a key role in the production of complex high-quality casted parts, as well as for structural components.

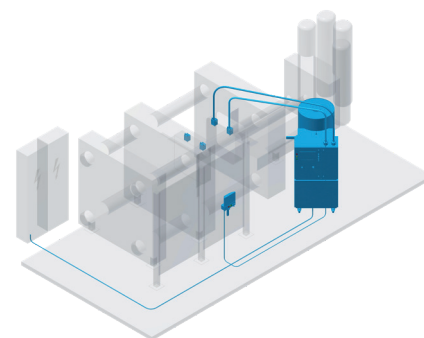
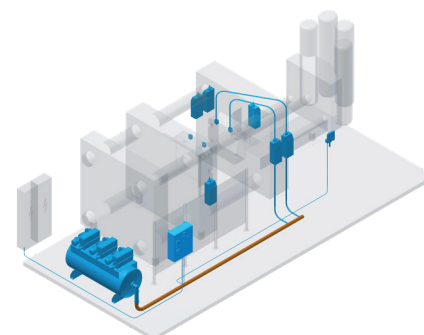
Nevertheless, in order to guarantee an efficient vacuum process, Fondarex aims at taking into consideration the complete die casting process. The quality of the casted part will depend upon the mold tightness and precision, the alloy quality, the lubrication and thermoregulation technologies, the tightness between piston and shot sleeve, the die casting machine parameters and efficiency, as well as the adequate vacuum system (figure 1).

Vacuum die casting requires complete mastery of both the pressure die casting process and the vacuum technology. Any deviation such as leakage, incorrect parameter settings, or even inappropriate dimensioning or integration of the vacuum system can have major effects on the quality of the casted part.

Each project starts with the analysis of the mold. Fondarex, as the specialist in vacuum application studies, will provide recommendations on:

- The gating system design
- The vacuum channels layout
- The vacuum devices, such as vacuum valves or chill blocks, according to the project and the customer needs
- The vacuum system according to the casted part and the technical requirements

In terms of the investment perspective, we believe that it is important to consider which strategy is more adequate for the setup. Both, the mobile vacuum system (figure 2) or the cell vacuum system (figure 3) might be fitting, but depending on the factory layout, the die casting machine size range and the casted part range, Fondarex will accompany the customer by recommending the best cost efficient solution.

Figure 2:  
Fondarex Mobile vacuum systemFigure 3:  
Fondarex Cell vacuum system

## ADVANTAGES OF VACUUM

The vacuum technology has demonstrated over the years on many high end products the need to achieve efficient production (figure 4). Vacuum is not a new technology anymore, but is still one of the knowhow continuously improving and positively influencing the casting process and the casted parts quality simultaneously.

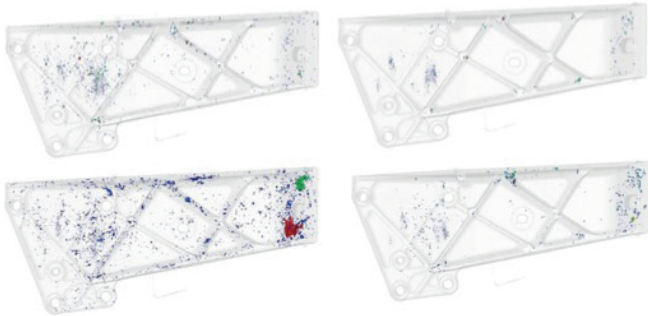


Figure 4: Top left: without vacuum, without heat treatment; top right: with vacuum, without heat treatment; bottom left: without vacuum, with heat treatment; bottom right: with vacuum, with heat treatment. Research by the Austrian Foundry Institute (ÖGI)

The largest pores are removed thanks to the vacuum technology (figure 5), which is leading to a better heat management without blistering of the casted parts, even at high treatment temperatures.

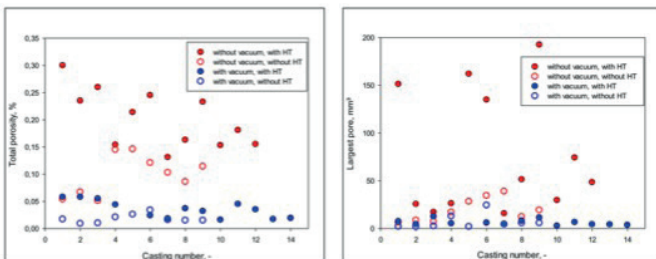


Figure 5: Porosity content in the casted parts as shown in figure 2; with and without vacuum, with and without heat treatment. Research of the Austrian Foundry Institute (ÖGI)

## VACUUM PROCESS CONTROL

Fondarex attaches great importance on enhanced, reliable control of the vacuum process (figure 6). The aim is to provide adequate control of the vacuum method and do the right interpretation of the measured values. Fondarex offers following main process controls:

- Continuous measurement of the vacuum in the mold (inside the vacuum valve or on the top of the chill block) (figure 7)
- Control of the real-time vacuum parameter to reach the optimal vacuum curve related to the project
- Continuous measurement of the vacuum in the tank

- Continuous measurement of the filter pollution
- Continuous measurement of the chill block profile
- Continuous air flow control per each vacuum channel
- Measurement of the evacuated air volume per shot
- Continuous quality control of the evacuated air
- Control of the evacuated air humidity
- Control of the mold tightness
- Control of the compressed air consumption
- Control of the electrical power consumption
- Control of the vacuum pump performance



Figure 6: Overview of the Fondarex Modular control panel showing the main control points of the vacuum process

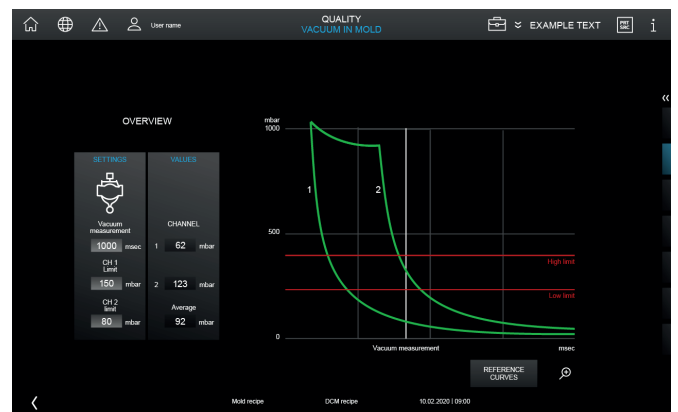


Figure 7: Continuous vacuum measurement, independently for each channel, incl. real time vacuum regulation

## DATA COLLECTION OF THE VACUUM PROCESS

Fondarex manages the data of the vacuum process on different levels. First of all, the data and measurement curves are registered in the Siemens automation system of the vacuum system (figure 8).

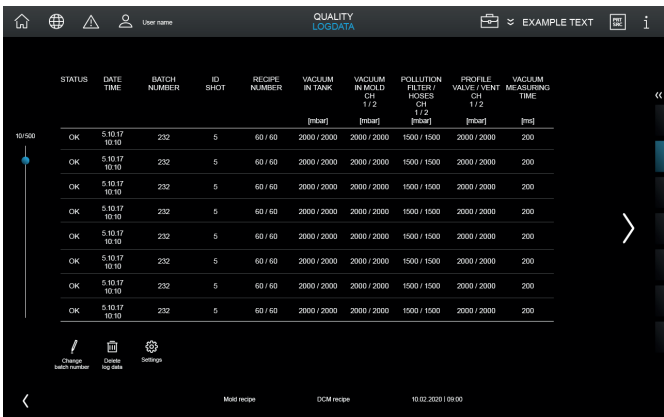


Figure 8: Log data of the vacuum process

From there, Fondarex provides the option to transfer the data and measurement curves to a computer or to the die casting machine through Profinet, Profibus or Ethernet communication interfaces. In order to use the vacuum system in the easiest way, Fondarex has integrated the control of the vacuum process on several die casting machine brands (figure 9 and 10).

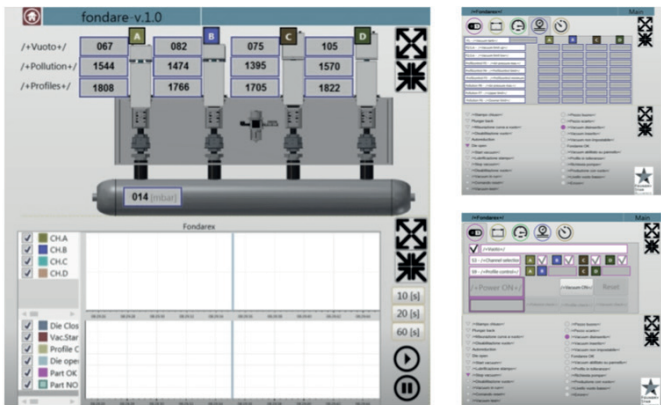


Figure 9: Integration of the Fondarex vacuum system in the Idra die casting machine control panel

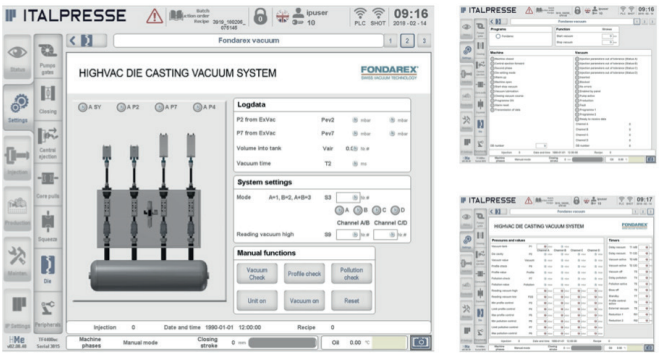


Figure 10: Integration of the Fondarex vacuum system in the Norican-Italtipresse die casting machine control panel

Those technical possibilities in combination with the experience of the Fondarex staff leads to a continuous improvement of the control and the analysis of the vacuum die casting process (Figure 11). Building on this expertise, Fondarex presents as its next equipment the "Industry 4.0", thus giving the possibility to evaluate the stability and the performance of the vacuum die casting process and qualify the quality of the casted part. Fondarex attaches great importance on the collection of the data, but actually even more prominence on the correct interpretation of those data in order to provide in future a condensed production report which will include the quality of the casted part.

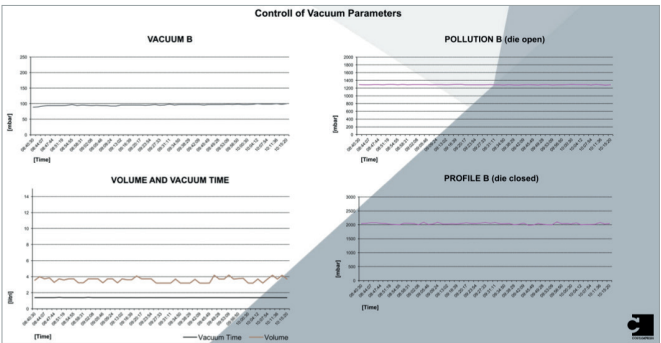


Figure 11: Analysis of the vacuum process and its variations. Analysis at Costampress, Italy

CONCLUSION

The Fondarex vacuum technology has the capacity to achieve high flexibility with regards to the integration in the die casting cell. Furthermore the Fondarex units are compatible with all die casting machines and adaptable to each project, providing a complete analysis of the vacuum process and ultimately proposing modern data transfer possibilities.

If you would like to get more information contact our team members at [sales@fondarex.com](mailto:sales@fondarex.com) or contact your local representative