

New Multi-Function Sizing Centre (MFC)

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Abstract

This lecture introduces new press, adapter and control concepts to size multi-level sintered components. The essential thing here is that the advantages of the multi-plate technology have been applied to the sizing adapter concept. Thus, the new concept meets the demands for a modern P/M manufacture and offers sufficient potential to size any future, complex sintered components such as synchronizer hubs, oil pump wheels and VCT parts with highest precision. Furthermore, it outlines a new flexible concept for the parts transfer, including feeding, orientation and lubrication while responding to the high demands on process stability and short change-over times.

Keywords : Sizing process, multi-level sintered components, hydraulic press, multi-plate design

1. Background

Over the past few years, considerable progress has been made in the field of pressing complex, multi-level sintered components. New developments in the press, adapter and control technology plainly increased the efficiency, precision and process safety in the forming technology. Due to the constantly growing demands for accuracy and capacity, it has turned out that also in the sizing technology new concepts are inevitable to be able to comply with such requirements in the future. Till now these requirements could not be met with the previously used concepts, because only simple presses or adapters respectively with only a few possibilities to influence the sizing process were available. For this reason, the parts manufacturers were forced to develop quite complex and cost-intensive tool constructions for multi-level parts. An adjustment of the different levels in the parts was mostly only possible with distance plates, a procedure which is very time-consuming. Therefore, we have seen the need for a new approach in the field of sizing multi-level sintered components.

2. System description

a. Overall system

Philosophy: Establishment of a standardized system that allows the sizing of complex sintered parts with most different geometries without the necessity of using special designs. LAUFFER has developed an overall centre consisting of individual components that are in optimum tune to one another. The said centre is in modular design so that any additional functions can be easily integrated in the sizing process.

Basically, the centre consists of a hydraulic press, a multi-plate adapter and a 3-axes rail transfer plus optical orientation (vision) system. Additional modules that may be

integrated are e. g. adapter change-over systems, parts lubrication systems, chamfering systems, measuring and sorting units. These individual features were optimized in such a way that new standards could be achieved with regard to output, adapter standstill times upon tool change as well as delicate parts handling. Another important point have been the increasing demands of the automotive industry with regard to process safety and process documentation which have been taken care of by the integration of respective data recording and monitoring systems.

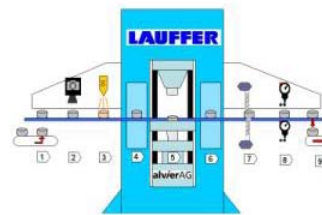


Fig. 1. Schematic Diagram of the Multi Function sizing Centre

b. Press

The press is a hydraulic sizing press in frame design with a stiff shield-type press frame, massive press bolster and press ram. The parts transport is effected across the press for which the press itself is provided with openings on side. As a standard, the upper piston is equipped with a motorically adjustable mechanical stop being advantageous to achieve highest possible speeds.



Fig. 2. Multi Function Sizing Centre with two 300 ton presses

Alternatively, the press can be operated with a servo-valve closed-loop controlled upper piston. In both cases, any tool and process parameters are stored in the control and can be called-up again immediately after re-commissioning. Furthermore, fundamental functions such as ejection, spring-back and withdrawal are already backed in the control and just need to be selected when running in a Pressed part.

c. Adapter

When developing the adapter special attention was paid to establish a standardized system that allows the sizing of complex sintered parts with most different geometries without needing special designs. Furthermore, an important point is that the adapter concept is based on the ejection principle e. g. the part will be ejected out of the matrix in its whole and then the individual lower punches will be released so that even delicate, complex sintered parts such as aluminium components or pre-sintered P/M parts can be processed.

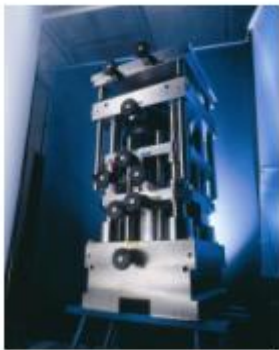


Fig. 3. 400 to Sizing Adapter in Multi-plate Design

d. Transfer

In order to transport the P/M parts to the individual stations at high speeds, a proven rail transfer system has been chosen which is of completely new design aimed to suit the needs in various key sectors. The individual axes are driven by electronic servo-motors and can therefore be freely programmed making a quick and flexible set-up for

the most different parts geometries possible. A safe and damage-free transport even of the most delicate parts is guaranteed by gripping and lifting from below.

Thus, a clamping of the parts can be avoided so that neither the parts' roundness nor their surfaces may get damaged.

e. Additional stations/options

The system, however, does not only include the sizing of P/M parts but moreover a series of further process steps handled in individual stations which are integrated in the press leading to a maximum of productivity and process safety. The individual stations are in modular design and include optical parts orientation, parts deburring in chamfering station, precise parts and/or die lubrication, measuring and logging of process parameters etc.

3. Current applications

The current applications include complex, multi-level parts such as synchronizer hubs, belt pulleys, timing gears and variable camshaft timing systems etc. Furthermore, pump components, helical gear components as well as components made out of aluminium. One of the presses that was recently delivered is being used for complex parts made out of aluminium for the first time at all. This application constitutes a big potential for the P/M industry as a whole with the multi-function sizing centre as one major process step to guarantee the quality and function of such complex aluminium components.

4. Outlook

Forced by the immense cost pressure, P/M suppliers have been contemplating to avoid the sizing of P/M parts. However, at the same time the requirements with regard to complexity and tolerances of sintered parts have increased making further operations after the sintering process inevitable. The sizing process still is the most favourable alternative to these further operations. Because of the increased output and the fact that further working steps can be integrated in the MFC a strong move forward towards efficiency and competitiveness is offered.