



»SHOT« FOR »SHOT« PERFECT

Automation of die-casting machines

Die-casting, an industrial casting process, is used for the mass production of structural parts made from metals such as aluminium, zinc or magnesium. For the past ten years Oskar Frech GmbH + Co. KG, based in the Swabian town of Schorndorf (Germany), has been using the Bachmann M1 system for the automation of its die-casting machines.

FRECH[®]

Oskar Frech GmbH + Co. KG has around 700 employees at the Schorndorf plant and in 17 branches worldwide.

Oskar Frech GmbH + Co. KG was founded in 1949, and developed in the last six decades to the world's leading supplier of die-casting technologies. In 1959 the first hot chamber die-casting machine was launched on the market, a technology that is used today for the high volume production of housings for

cell phones and notebooks. In 1967 Frech added cold chamber die-casting machines to its product range. The south German manufacturer constructs complete die-casting cells worldwide for the production of very small die-cast parts right through to motor blocks and chassis components for vehicles.

THE AUTOMATION IS CRITICAL

»The automation of a manufacturing process determines its competitiveness,« as Rainer Sautter, head of open and closed-loop technology at Frech, explained. In die-casting the reliability and reproducibility of manufacturing processes are key priorities. This is why Frech has been using Bachmann's M1 controller as the basis of its »DATADIALOG« automation system for several years. »It has now been over ten years since we decided to replace our own outdated system with an OEM solution,« Rainer Sautter recounted the beginnings of the cooperation with Bachmann. After an extensive evaluation of a wide range of industrial controllers, the M1 system was chosen.

»Our casting cells have a highly modular design and comprise melting and metering technology, spraying equipment, heating and cooling devices, die-cast molds and removal devices, in addition to the actual machine,« Rainer Sautter describes the general conditions of the automated systems. A suitable level of flexibility in the automation system and optimum adaptability to the individual requirements of the overall plant were therefore also important selection criteria. »What is more: When it comes to a solution for a new requirement, we still feel today the very close partner-based support of Bachmann,« Rainer Sautter adds. In 2007 Frech took over the die-casting business of Müller Weingarten AG. As a result Frech has become the only supplier worldwide that covers all technologies and closing forces. The machine controllers of the acquired series were later fitted with the DATADIALOG system in some applications.

FAST CYCLE TIMES

Depending on the size of the machine, up to 1,000 shots per hour are possible. »Shot per hour«, as the specialist calls the high-pressure and high-speed die-cast pressing of the molten metal in the mold, is an expression of the productivity of a die-casting machine. Many parameters influence here the optimum casting result, which requires a high level of performance from the control system with the required short cycle times. »For example, with every shot we measure the temperatures at various points in the process, the filling time of the mold, the press speed, absolute pressures and the pressure rise times, as well as monitoring and controlling the periphery and much more,« Rainer Sautter lists the extensive range of closed-loop and open-loop control variables.

The most powerful cold chamber die-casting machines have enormous dimensions: Weighing several hundred tons, they are heavy and reach lengths of over 20 meters, with up to 5 meters in height. »For these kinds of machines we rely on a distributed automation system,« Sautter describes the topology of the control system. The remote units are networked via the optical FASTBUS with the central controller on which all the closed-loop control processes are implemented.



»We feel the very close partner-based support of Bachmann.«

Rainer Sautter

Head of Engineering Control Systems at Frech



◀ **GDK cold chamber die-casting machine from Frech:** Up to 5,000 tons (50,000 kN) closing force. (construction in the assembly plant prior to painting.)

ROBUSTNESS REQUIRED

»The robustness of the entire system structure is critical for our applications,« Rainer Sautter states a further reason for selecting the Bachmann system. The ambient conditions present in a foundry plant are harsh. Heat, dust, vapors, vibrations with pressures of 200 MPa and more also place demanding requirements on the controller. The engineers at Frech therefore appreciate the stable mechanical design of the M1 system. According to Rainer Sautter, the specified operating temperature range up to +60° C provides them with the safety they need.

FLEXIBLE OPERATION ALSO AT DISTANCE

The die-casting machine visualization provided by Frech on Bachmann terminals »is one of the best HMI interfaces in the world,« Rainer Sautter proudly states, »This is due to its highly intuitive operation.« The documentation of all die-casting parameters moreover allows the gap-free monitoring of the production and parts quality. This is critical for the process safety required by the user. Over 55 percent of Frech systems are exported. All of them can be accessed by the service department in Schorndorf via a remote connection, thus enabling the rapid diagnostics

Factbox

DIE-CASTING

In the die-casting process, molten metal such as zinc, magnesium or aluminium is pressed in a mold at high pressure and at very high speed. Specialists talk here of a <shot>. The divided mold is mounted on a moving platen and a fixed platen. Due to the high pressure, the locking forces required in the machine for the mold are enormous and for large parts amount to several thousand tons. On hot chamber die-casting machines, casting vessels and casting pistons are constantly in the molten metal. Alloys with a high melting

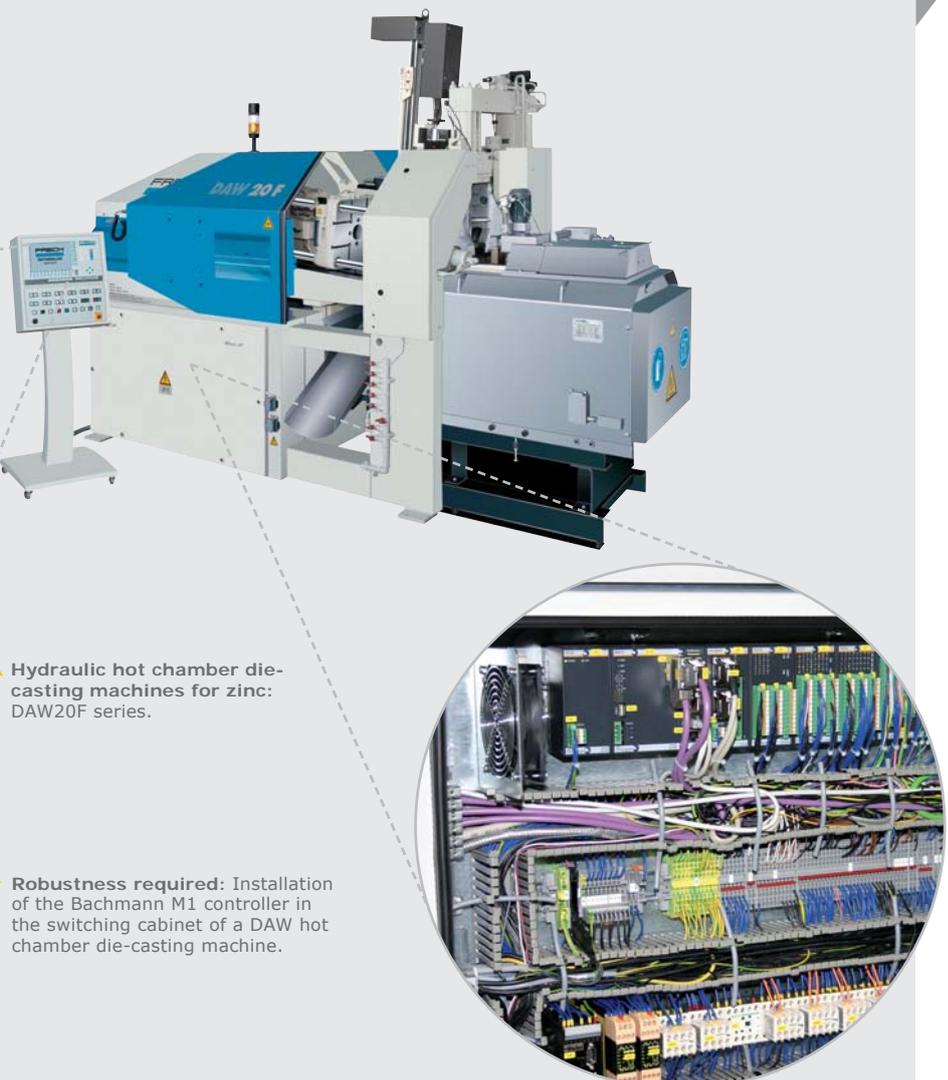
point are cast in the cold chamber die-casting process in which the casting set is located outside of the molten metal. Die-cast parts have smooth surfaces and clean edges, with achievable tolerances of +- 20 µm depending on the alloy used. Wall thicknesses of less than half a millimeter are possible depending on the material used.

and maintenance of installed systems worldwide. »As manufacturers, we consider our fast and reliable support of customers as an indispensable requirement for absolute excellence,« as Rainer Sautter describes Frech's service philosophy.

UNCOMPROMISING QUALITY

There are good reasons for the superior profitability and reliability of Frech die-casting machines: Decades of experience, continuous research and the perfect technical implementation. And towards this end the Bachmann controller makes an important contribution. ■

Hydraulic hot chamber die-casting machines



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01 Legierung	Al	Füllgewicht	300 g	Gießklobendurchm.	80 mm
04 spez. Gießdr. soll	800 bar	Füllzeit soll	20 ms	Anschüttgeschw. soll	120 mm/s
spez. Gießdr. ist	537 bar	Füllzeit ist	31 ms	Anschüttgeschw. ist	34.0 mm/s

Anschüttgeschw. soll	52.1 m/s	Stichtoffdruck Pressen	120 bar
Anschüttgeschw. ist	34.0 m/s	Multi	72 bar
Füllhub	25 mm	Hydraulikdruck soll	90 bar
		Hydraulikdruck ist	0 bar

Gießklobengeschw. soll	1.24 m/s	ist	0.81 m/s	Multiaktordruck soll	213 bar	ist	143 bar
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Qual. kalber, Druck. meter, Gieß. apparat, Halb. angabe, Hydr. Druck, Stichtoff. druck, Füllzeit

▲ **Intuitive and clearly designed:** Visualization of Frech die-casting machines.

▲ **Hydraulic hot chamber die-casting machines for zinc:** DAW20F series.

▶ **Robustness required:** Installation of the Bachmann M1 controller in the switching cabinet of a DAW hot chamber die-casting machine.