



Sliding gate valves optimise light metal die casting and increase the process reliability



Conversion enables early detection of faults in BMW's light metal die casting

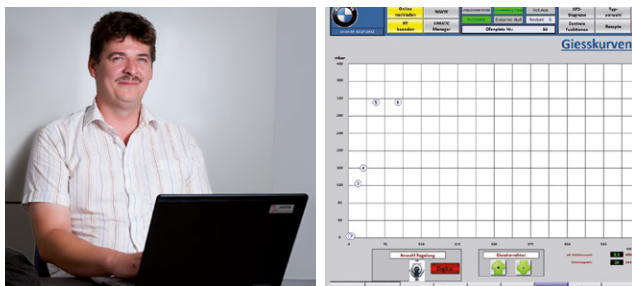
An application report by Josef Gibis and Helmut Ambros

In low pressure die casting, e.g. light metal engine blocks, the casting machines are filled by pressurising the furnaces. This requires highly precise pressure control along defined pressure curves in order to be able to produce a high quality casting and, for example, to prevent the metal pillars from moving around in the mould. In each case, BMW replaced the pressure control previously used for this purpose in its Landshut light metal foundry with a single sliding gate valve from Schubert & Salzer Control Systems. The outstanding control quality and the rapid reactive ability of the sliding gate valves have allowed the pressure head curves to be followed in a precisely reproducible manner. In addition, they offer the possibility of compensating for process influences when furnaces of different sizes are used.

In the low pressure die casting process, the casting furnace is pressurised so that the molten metal flows up a riser tube into the casting machines. To ensure that the complete shape of the part is filled uniformly, it is absolutely essential to have a controlled rise in pressure. The pressure profile is crucial for quality in the casting process.

Sensitively adjustable pressure control is needed in order to reproduce these pressure curves time after time. It not only prevents pressure fluctuations, but also facilitates different mould

Software developer Dipl. Ing. Dietmar Reithmeier



"The valve organs used before were digitally actuated and reacted very quickly. However, due to its special construction, the sliding gate valve now being used not only reacts comparatively quickly, but it also offers the possibility of detecting faults. The equal characteristic gives us additional scope to cater for all sizes of furnace and with just one Kvs value," said Dipl. Ing. Dietmar Reithmeier of HISTA Elektroanlagenbau GmbH in Neutraubling who have been contracted with the control technology.

Mr. Josef Gibis



Casting: double-poured crank case

filling speeds to optimise the filling of castings with different cross sections. BMW has all-round know-how in this area and is achieving a high degree of success in working with precisely defined casting pressure curves for the different versions of the component parts. Previously, a so-called valve organ with 13 digitally actuated valves of different sizes had been used to follow the pressure curve. While this pressure control was precise, there was a problem in that it was not immediately evident when a valve failed. The critical issue here was that the pressure curve was no longer being followed according to the reference data and the operator was not in a position to detect this. Therefore, a valve failure of this type could only be picked up by defects in the finished casting.

Josef Gibis, who has worked at BMW for 25 years and is currently the person responsible in Landshut for process development and design in the area of light metal foundry work, could not rest with this constraint. He searched for a valve solution that offered more process reliability. This would have to

- display a high level of quality with a very rapid control response,
- detect faults itself and flag them up immediately,
- be low on maintenance and
- offer a good price-performance relationship.

The company HISTA Elektroanlagenbau GmbH in Neutraubling, charged with the job of upgrading the foundry operations and

developing new software for the comprehensive control processes, proposed that the 8021 sliding gate valve from Schubert & Salzer Control Systems, used already in other facilities, should be used here.

Flow-related advantages and variable K_{vs} values

The sliding gate valve offers a simple opportunity to modify the valve operating characteristics, which is the K_{vs} values as a function of the valve opening, almost infinitely. This can be done simply and in almost any conceivable number of ways by an appropriate configuration of the shape of the slit in the sliding discs. After just two short project discussions on site, Schubert & Salzer's specialists calculated a K_{vs} value of 1.7 for BMW's foundry in Landshut. However, since different sizes of furnaces ranging from 1,000 to 2,500 kg serve a casting facility interchangeably, making it imperative that any process effects would have to be compensated, the sliding gate valve was selected at a K_{vs} value of 5 on an equal characteristic. As a result, not only does the sliding gate valve make it possible to follow the pressure curves precisely but it also has sufficient capacity with a larger opening to react to leakages, yet still be able to meter to the finest degree possible.

Outstanding rangeability and excellent control quality

The very good response behaviour in particular of the sliding gate valve is crucial for the excellent control quality. Short positioning paths, low moving masses and small actuation forces are the most important parameters for short reaction times with optimal resolution of the stroke position. The sliding gate valve offers all of these features in one package. The typical stroke between "open" and "closed" is a mere 6 to 9 mm.

Sliding gate valves are an economically very efficient solution for a multitude of applications. Since they are available in different materials and in combination with all conventional positioners, they can be used in virtually all industrial areas and applications. Sliding gate valves are manufactured:

- in sizes DN 15 to DN 250
- for pressures up to PN 160 and
- for media temperatures between - 200 °C and + 530 °C.

Sliding gate valves involved in process technology

The sliding gate valve is actuated at BMW by Schubert & Salzer's 8049 digital positioner. This highly accurate, electronic control circuit system was developed for the exact positioning of control valves. Using the configuration software DeviceConfig V7, a vast range of possibilities are available in setting the parameters of the positioner, such as

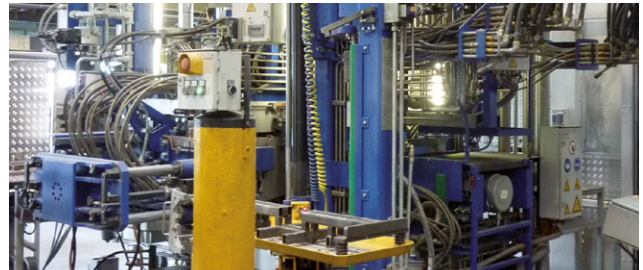
- setpoint signal range,
- custom characteristics for a valve,
- hysteresis control,
- operating direction,
- configuration of the alarm output,
- critical values for the maintenance alarms.

By using this positioner, the sliding gate valves are connected directly to the foundry control system and they issue messages concerning maintenance and diagnostic data as well as faults.

After the successful completion of the trial phase with the sliding gate valve in controlling casting pressures, BMW issued an order for the upgrading of one casting unit. "We are looking for a valve that will fulfil our highest control requirements, that can be used for all sizes of furnaces and, as a result, offers additional scope in compensating for process effects," said Gibis, looking back. "We are amazed at the precision with which these sliding gate valves fulfil these difficult control tasks".

In view of these experiences, BMW recently issued an order to convert the pressure head control for nine further light metal casting units to sliding gate valves. An invitation to tender has been issued for another 16 units.

Casting machine for casting a crank case



Highly accurate pressure control in light metal casting machines is a fundamental prerequisite for quality products. BMW has special know-how and demands the highest level of quality from the pressure control valves in following different pressure curves.

Furnace pressure control valve



The control quality demanded in the conversion of BMW's Landshut casting units to sliding gate valves from Schubert & Salzer Control Systems is assured. In addition, the process reliability is optimised and a very high availability of 99% is assured by the incorporation of the valves into the control system by Hista Elektroanlagenbau GmbH.

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