Sliding gate valves optimise airport‘s power plant

Retrofit in power generation reduces fuel consumption and improves performance

An application report by Josef Halder and Helmut Ambros

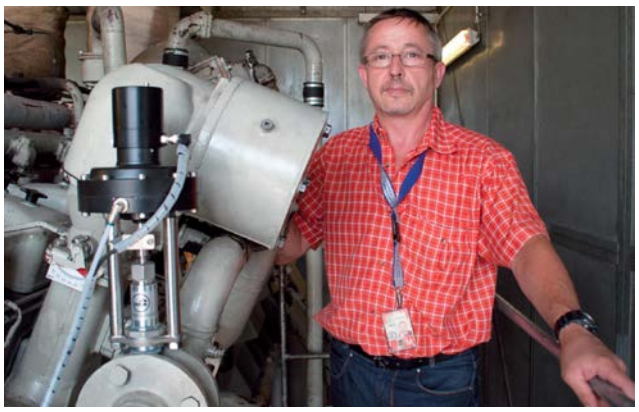
Sliding gate valves have excellent control characteristics. Munich Airport‘s power plant now also benefits from these inherent advantages, as the existing gas flow butterfly valves of two diesel gas pilot ignition (duel fuel) engines were replaced by sliding gate valves. This retrofit minimises the gas consumed by the power generators. Thanks to using a combination of sliding gate valves with digital positioners, the operating performance could also be improved.

Munich‘s main airport electrical power requirement is covered about 44 percent through the grid. The remaining 56 percent, about 122,000 MWh p.a., is produced at the airport by 9 power generators. As combined power / heating / cooling machines, the 7 duel fuel engines and 2 spark ignition gas engines used for this purpose, operate not only for power generation: The released heat is also being used for the central-heating during the winter period, whereas in summertime the air conditioning benefits from the lost heat due to the employment of absorption cooling machines.

During the warming up phase, which lasts for a few minutes, duel fuel engines operate solely on diesel fuel. After this, a natural gas / air mixture is fed into the engine which is ignited by the diesel fuel element, its proportion now reduced to 10 percent. As a result, the power generators can be operated more efficiently. Sliding gate valves with digital positioners have recently been installed on the first two power generators to regulate the natural gas / air mixture.

Inherent control performance

The maximum stroke of a sliding gate valve is a mere 9 mm. This facilitates extremely short opening and closing times (optionally up to < 10 msec) for the complete stroke. Through a resolution of 0.1% of the stroke position, a very dynamic response is reached which not only improves the control quality but forms the basis for control circuits with very short reaction times. This proves to be the defining key to highly efficient and precise control operations.



Josef Halder, manager of the mechanical engineering workshop at Munich Airport: “Our technicians are constantly searching for optimised solutions offering benefits in operating reliability and efficiency.”

With its special design based on two slotted discs sliding against each other and forming a seal, sliding gate valves are the only valves that combine high control accuracy with the lowest leakage rate. Also the throttling element - the slotted discs that slide against each other - suffers scarcely any wear so that long service lives can also be achieved under extreme conditions, an inherent feature of the system design.

Sliding gate valves therefore offer a very economical solution in different fields of application. Produced in alternative material versions and in combination with all conventional positioners, they can be used in practically every industry and for different applications. Accordingly, they are produced

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

Schubert & Salzer Control Systems offer a positioner range in 11 different versions for the sliding gate valves. All versions can be configured via a PC interface by means of “DeviceConfig” graphic configuration software and are therefore easily adaptable to the particular application case.

Sliding gate valves provide significant economic advantages

As a result of retrofitting to sliding gate valves with digital positioners, the engines in the generating plant at the airport can be operated directly from the control room at maximum efficiency. The exhaust gas temperatures are measured continuously to optimise the combustion control of the natural gas / diesel / air mixture and the sliding gate valves accurately adjust the quantity of natural gas needed. Thus, the high control precision of the sliding gate valves minimises the consumption of natural gas as well as the ammonia used in cleaning the exhaust gas.

The adaptability, now highly simplified in controlling the amount of gas, increases the specific energy yield. At the same time, the optimised operation of the engines is prolonging their service lives and is providing better protection from overheating of the catalytic converters. One indicator for the control precision achieved with sliding gate valves is the difference of the exhaust gas temperature measured between the two cylinder banks of the V16 engines. Before, when the butterfly valves were still being used, this temperature difference was up to 15 K. After retrofitting with sliding gate valves the temperature difference dropped to only 1 K.

Alongside optimisation of consumption and less stress in the operation of the power generators, the substantially higher control and operating performance represent a further outstanding advantage of this retrofit. Beforehand, the natural gas supply was controlled by butterfly valves with a mechanical stop. These could only be adjusted in the engine room. Thanks to the sliding gate valves with positioners, the amount of gas / exhaust temperature of the power generators can be precisely controlled and corrected if necessary from the control centre.

Since at least four of the seven power generators have to run continuously, the employees in the power supply section in Munich Airport have to be on call around the clock. Thanks to the retrofitting, especially trained employees can now operate the sliding gate valves with positioners also remotely from home.

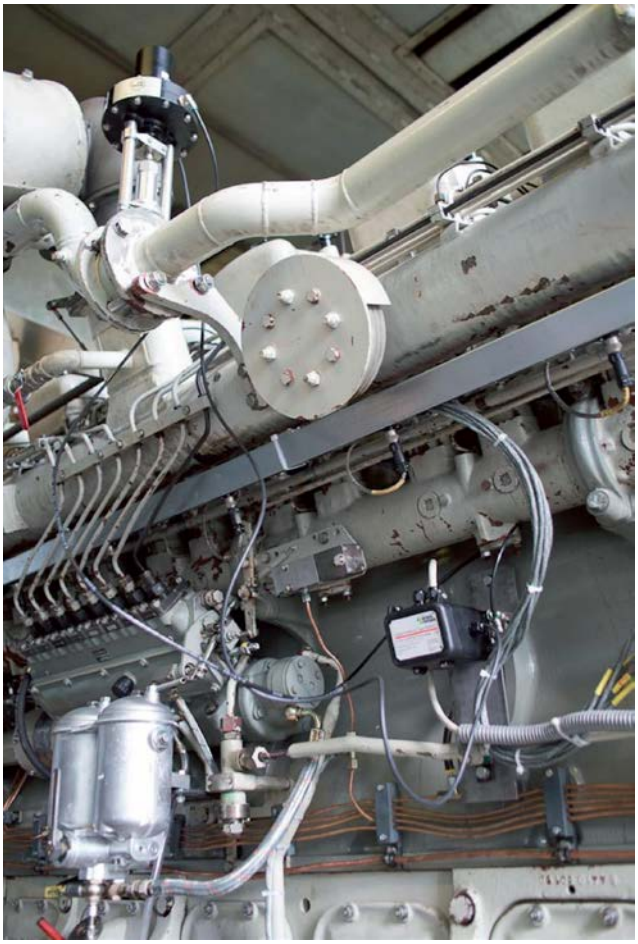
Retrofitting made easy

In each power generator, two butterfly valves were replaced by sliding gate valves. Since the dimensions of both valves are identical, only marginal mechanical adaptations were necessary.

When the duel fuel engines operate on diesel only, the use of the digital positioners guarantee a high degree of operational reliability. It is essential in this operating state that no natural gas is being supplied. The positioner software enables the triggering of a system alarm when there is an attempt to interfere with the local valve control. Therefore, if there is any unauthorized manual interference at the newly installed gas flow control valves, an alarm is set off immediately in the control room at Munich Airport.

Also, if operating under emergency power which is on diesel fuel only, the control valve must close very quickly to ensure a smooth control performance when switching over to diesel operation.

The excellent experience in the use of sliding gate valves to control the gas flow in the first two duel fuel engines is providing the basis for the retrofitting of the five remaining power generators.



One of the 1.58 MW power generators (MWM) at Munich Airport with Schubert & Salzer Control Systems‘ sliding gate valve (upper left) and, lower right, the digital positioner which is mounted separately to protect it from vibration.

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