

HVAC upgrades with 2342 QCV zone valves in the GENO-Haus building in Stuttgart

Business as usual during energy-saving upgrades for induction units



Main entrance to the GENO-Haus building on Heilbronner Strasse opposite the new European quarter and Stuttgart 21 railway station



Photos (above and below): Isabell Munck

The 17-storey GENO-Haus building is an office and administrative building with approximately 60,000 m² net floor area. A few years ago, work began on renovating, converting and optimising the whole buildings energy usage to meet today's demands. Since 2008, the various climate control systems in the building have been fitted with energy-efficient technology section by section. The technical control centres as well as the units in the individual office rooms, server rooms and conference rooms have been converted.

Approximately 1200 induction units in the GENO-Haus building in Stuttgart have been replaced with newer models and both the cold water and hot water circuits in them have been fitted with 2342 tight-seal QCV (Quick Compact Valve) zone valves from Belimo. The building, which was constructed in 1970, was converted on a storey-by-storey basis so as to keep disruption in the workplaces affected to a minimum.

The reason for this upgrade project were the two approximately 40-year-old air handling units, which have a combined output of 110,000 m³/h. They needed to be replaced in order to comply with VDI (Association of German Engineers) Guideline 6022 and additionally fitted with a heat recovery system based on EnEV (German Energy Saving Ordinance)

2009. Two energy-efficient units, each with an output of 39,000 m³/h, have already been installed during ongoing operations with a third to follow in Autumn 2014. In addition to energy efficiency, one of the crucial goals in the planning process was that the building had to be as flexible as possible.

The objective: precise water flow control

Type of building	Office building
Project	Renovation
Trade	HVAC
Belimo products	2342 zone valves (QCV)
Commissioning	2014

Consultations with control companies and project partners revealed that these have different opening positions under the same control conditions and are pushed open again by the pumps during unfavourable conditions. It seemed that safe, cost-effective and error-free operation could not be realised with these valves. Instead, GENO-Haus decided on the Quick Compact Valve (QCV) from Belimo based on its long-term leak-tightness, precise controllability and excellent energy balance.

Constant operation 365 days a year

Due to the building layout, the north side of the building often needs to be heated whilst the south side is being cooled. In the existing system with a constant air volume of 80 m³/h per induction unit, the cold water and hot water supply runs constantly 365 days a year. The heating/cooling control on the induction units has been achieved by covering and uncovering the heat exchangers with pneumatically operated dampers. Water-side control was not available.

Efficiency-focused system specifications

GENO-Haus tested various systems, valves and control concepts over several weeks in two sample rooms so as to be able to make the decision on the optimum system and the right components before performing the upgrade. They evaluated the flow behaviour, the acoustics, the comfort level, the control quality and paid particular attention to the inevitable fluctuations in volumes and pressure over the course of the conversion. A significant practical aspect was that replacing the units was a quick process thanks to the simple installation of pre-assembled modular elements. Even in this early project stage, it became clear that using short stroke globe valves in combination with electro-thermal actuators was not the sensible solution for the heating/cooling control in terms of energy.

Energy sustainable solution

The new LTG induction units with needs-based ventilation (type HFVsf), like previous units, function in a four-pipe system. The variable and significantly reduced air volume of 30–50 m³/h is now, regulated via nozzles, which are adjusted by a space-saving linear actuator (CH 24-SC-R40) developed specifically by Belimo for this application. At the same time, the cold water and hot water intake is now controlled precisely by the motorised, compact and energy-dense QCVs.



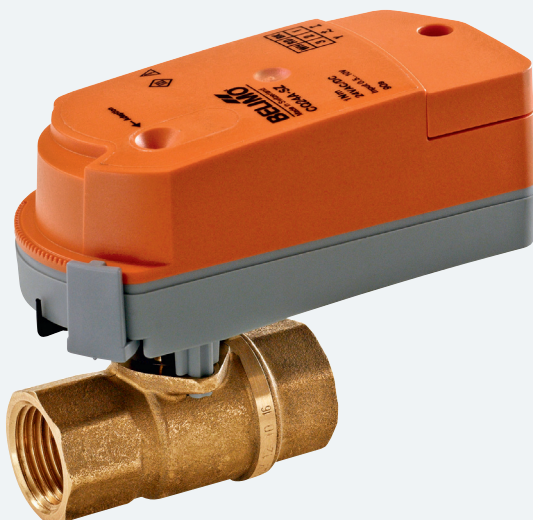
New BMS head end in the technical control centre for the cold/hot water supply

Conversion during ongoing operations

The induction units in the offices were replaced on a storey-by-storey and zone-by-zone basis on Thursdays, Fridays and Saturdays. The old units were dismantled on Thursdays whilst the pipes for the new units were being prepared. It was business as usual on Fridays in the offices concerned but the AHU only supplied primary air. Once the office closed, the technicians then strengthened the insulation (cellular glass) that was already installed on the parapet and installed the new C215Q 2-way characterised control valves from Belimo along with the new electrical connections. Finally, on Saturdays, the new units were installed and fitted with the appropriate terminal box (master or slave unit). The CQ24A-SZ-T electrical actuators were already pre-assembled (k_{vs} value, cable with plug, actuators marked in red or blue) and were simply clicked onto the ball valve and plugged into the terminal box. Once they had been cleaned, the offices were ready for use again after 6 a.m. on Mondays. This approach guaranteed that the installation time would be very short but, more importantly, error-free.

The proven standard Belimo globe valve actuators are also used with the flange valves of the new air handling units in the GENO-Haus building.

Belimo ZoneTight™ – room & zone applications with space-saving QCV (Quick Compact Valve)



The QCV sets new standards for room and zone solutions:

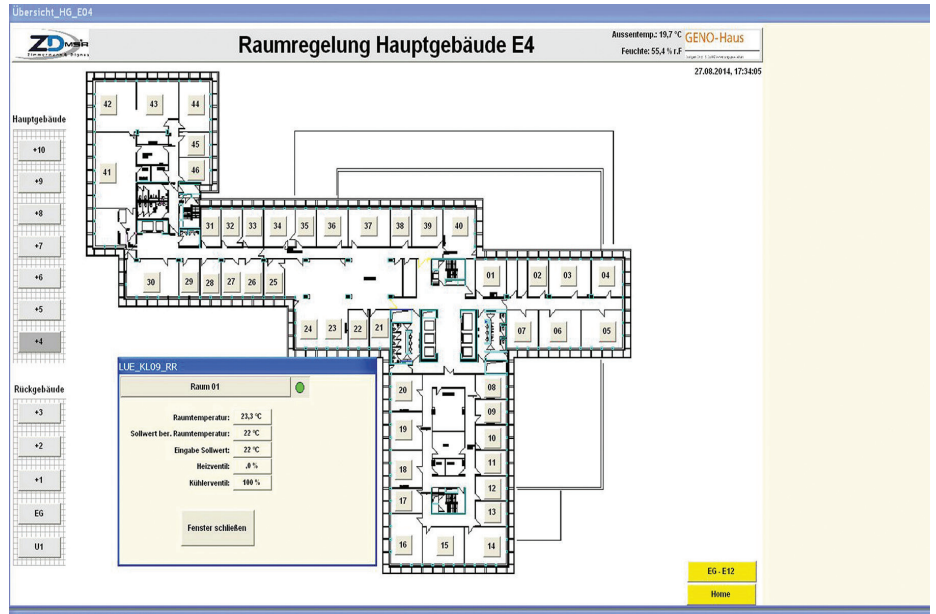
- 2-way characterised control valve (DN 15) with electro-mechanical rotary actuator (as of second quarter of 2015, also available with DN 20)
- No energy losses thanks to air bubble tight-closing valves in accordance with EN 12266-1
- Lightning-fast manually adjustable k_{vs} value from 0.4 to 4.8
- Rotary valve resistant to soiling and sticking
- Attachable, handy and self-adapting actuator
- Exceptionally compact overall structure
- Facilitates monitoring and maintenance with communicative MP actuators

Modulating actuator with protected terminal (CQ24A-SZ-T)

The solution: Quick Compact Valve



Markus Baumann (head of utilities and building technology) is now able to supervise and monitor all rooms in the building via the process control technology system. Once the upgrade was completed successfully, he explained: "Everything that we wanted to achieve in the conversion has been realised in full. There weren't any frictional losses or interface problems. Now I have less water in circulation and it's also only where I need it to be."



Low pressure instead of high pressure

High pressure losses and the mixing of hot and cold water are now a thing of the past in the GENO-Haus building. The new induction units now control the Belimo characterised control valves on the water side. This system is significantly more efficient than the old solution that featured pneumatically operated air damper actuators: now only the heating and cooling energy that is actually required is provided. Therefore, new frequency-controlled and energy-efficient pumps also work in the background. As the new air handling units also significantly reduce the air volume, GENO-Haus was able to convert the existing high-pressure induction units to low-pressure models.

Energy-efficient control strategy

Working with the companies Zimmermann & Dignas MSR (system integrator) and LTG, GENO-Haus developed a control strategy for the new HVAC system. This strategy allows for a flexible room arrangement allowing changes in use at any time. Today, with a

primary air flow between 30 and 50 m³/h, approx. 250 m³/h conditioned air circulates in the room. The individual employee can set the temperature setpoint between 19 and 25°C on the room control unit. CO₂ and/or presence detector controls were intentionally not included as the reduced fresh air sufficiently flushes each room with oxygen.

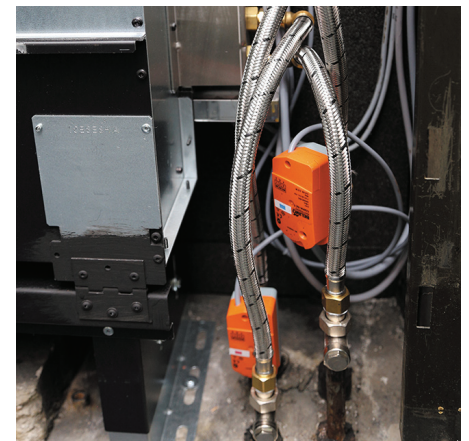
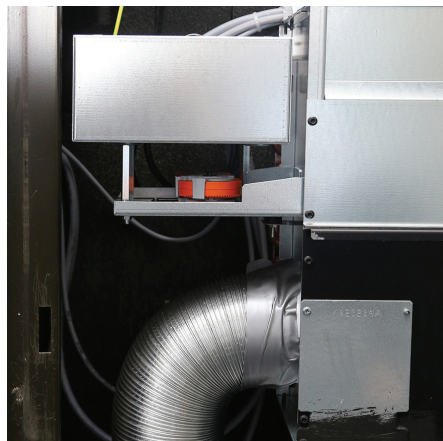
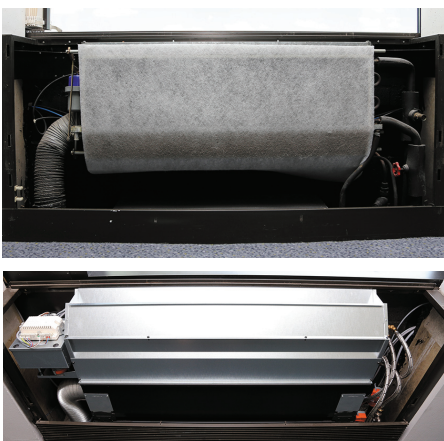
Comfort-based primary air

In the summer, a maximum cooling output of 140 watts is brought into the room via the primary air. At 16°C, the cold water flow provides an additional cooling output of 470 watts. The flow temperature of 45°C creates a heating output of 600 watts. The ideal air flow pattern and water supply is selected by opening air nozzles or the cold water and hot water characterised control valves from Belimo. If the room temperature specified by the user is not reached, the setpoint for the modulating control of the heating or cooling valve is increased in the first stage so that the valve opens further.

If the characterised control valve reaches an opening angle of 85%, the modular control of the linear actuator increases in the second stage. This makes it possible to use a larger nozzle diameter, meaning that the primary air flow can increase from 30 m³/h to 50 m³/h.

Flexible in the event of changes in use

Each master induction unit is fitted with a Saia PCD7 single room controller and is connected to a Saia PCD3 head station in the technical control centre via floor distributors and an S bus. There are approximately 12,000 data points that are connected via Ethernet to the existing building control technology. On each induction unit, up to 10 slave units can be connected to a terminal box via plugs. This concept allows flexible and optimum handling and avoids having to modify the building management technology or reprogram the unit if there are changes in use.



Top left: Old unit. The new units (here as the master) are now regulated on the primary air and water side by the Belimo actuators.

The QCV from the operator's perspective



Dipl.-Ing. Uwe Peters, managing director of GENO-Haus Stuttgart GmbH & Co. KG

When it comes to room climate, employee satisfaction is our top priority. So on this basis, the only logical choice was to fit the 1171 induction units with Belimo actuators and characterised control valves:

- The actuators are very quiet during operation, the ball lock prevents whistling noises whilst closing and the valve flow noises are also very low in the intermediate positions.
- The excellent control accuracy stops one induction unit from cooling whilst the second heats at the same time.

“The QCV from Belimo was the only logical choice.”

The ball lock is also much more resistant to rust particles and soiling than the “normal” short stroke straight-way valve. Another advantage in terms of energy is that it only uses power when changing state. And we require the adjustable k_{vs} value for the hydraulic balancing of the whole system. After a year, it was clear that we had made the right decision in installing the quality products from Belimo. The excellent functional safety reduces user complaints and, as a result, the operating expenses and costs.

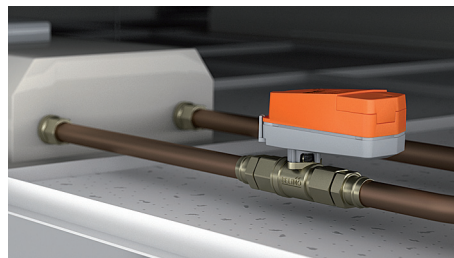
Measurable success

Those responsible for the project in the GENO-Haus building decided on the seal-tight and wear-resistant QCV because the rooms are only provided with the amount of heating or cooling energy required and energy losses resulting from leakages are effectively and permanently prevented. The actuators reduce the electrical energy consumption and allow the user to set the desired k_{vs} value precisely. Energy meters were integrated into all of the new installations so that the efficiency of the energy saving measures can be proven. The measured values are sent to an energy monitoring system and once the conversion is completed in 2015, a complete economic efficiency calculation will be performed for the first time. Even now it is clear that these upgrade measures have provided a significant reduction in cooling and heating energy as well as power consumption. The compressed air station which was previously required for pneumatic actuators can be dismantled and completely removed at a later date. The initial reaction from every single employee has been positive: “We've not had such a good room climate in 25 years.” This has allowed the GENO-Haus building to secure its position as an attractive office and administrative building with state-of-the-art facilities that will also continue to meet the increasing comfort and efficiency requirements as we move into the future.

Quick Compact Valve (QCV) Robust, flexibel, tight

Versatile fields of application

- Fan coils
- Chilled ceilings
- Zone air heaters/air coolers
- Floor heaters
- Radiators
- etc.



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