Ventilation systems with ejectors using the example of a hotel

Translated from German
Article published in HLH, Heft 3/2017 under the heading "Lüftungsanlagen mit Strahlpumpen am Beispiel eines Hotels"

The comparison of technically different ventilation systems using the example of a renowned hotel at the Gendarmenmarkt in Berlin conclusively shows the diverse advantages resulting from the use of ejector technology.

Controlled ejectors are versatile in their use for controlling heating, ventilation and air-conditioning systems in industry or in building automation and control, where they have been operating reliably for many years. Controlled Baelz ejectors have been used very successfully in ventilation systems for over 40 years. Ejector technology brings major advantages when it comes to saving energy and resources and minimizing wear on equipment. System hydraulics are simplified and system availability is improved thanks to the low-maintenance, durable ejectors.

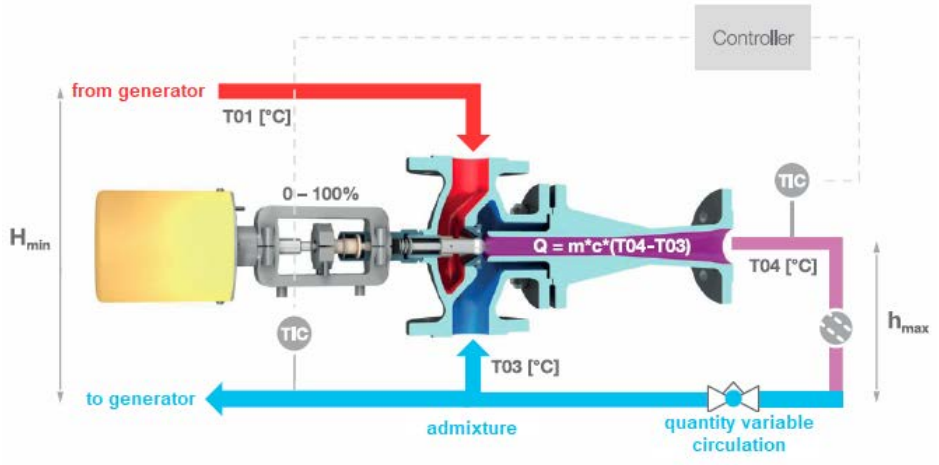

Figure 1 *Cross section of an ejector in a heating system*

The controllable ejector (three-way injector valve or jet pump) replaces the control valve and circulating pump. The idea is to utilize the differential pressure in the heat network by using controlled ejectors. This eliminates the need for electric circulating pumps and check valves in the consumer circuits. Differential pressure regulators are also rendered unnecessary. The hydraulics of the overall system become less complex and significantly more stable. The hydrodynamic system technology with its ejector technology generates considerable financial advantages for

W. Baelz & Sohn GmbH & Co. · Koepffstraße 5 · 74076 Heilbronn · Germany
Tel +49 7131 1500-0 · www.baelz.de · mail@baelz.de

investments, maintenance and in ongoing operation when it comes to economic efficiency. Ejectors are available with both flange and socket connections. They can be installed individually in heating systems (figure 1) or in mixed systems or fulfil their task in compact, complete stations.

Comparison of ventilation systems in a hotel in Berlin

This study comparing the economic efficiency of two types of ventilation system was carried out to the latest technical standards. Systems with high-efficiency pumps and electrodynamic water heat distribution with three-way valves (figure 2) were compared with Baelz-hydrodynamic®, the hydrodynamic water heat distribution system (figure 3).

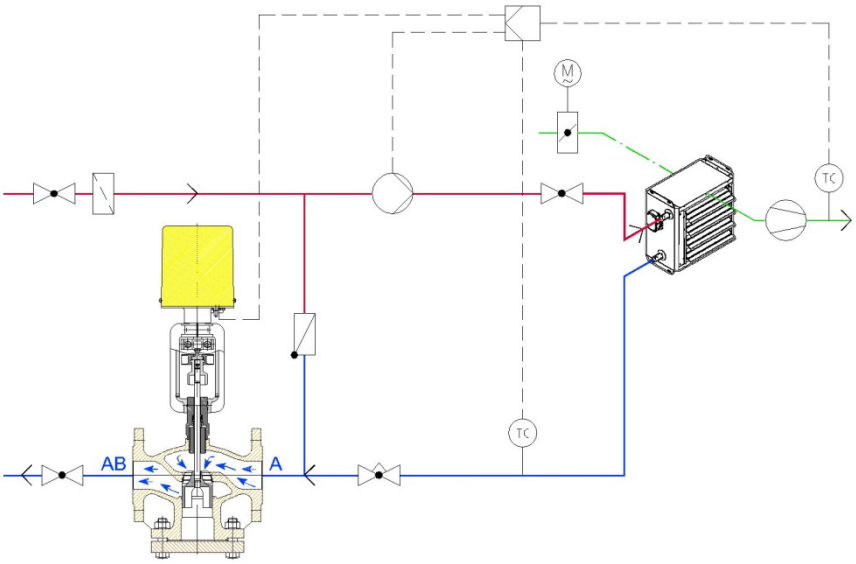

Figure 2 *System with circulating pump*

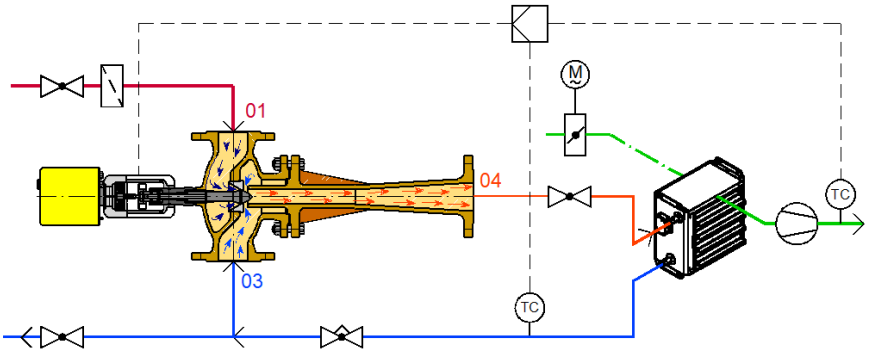

Figure 3 *System with ejector*

W. Baelz & Sohn GmbH & Co. · Koepffstraße 5 · 74076 Heilbronn · Germany
Tel +49 7131 1500-0 · www.baelz.de · mail@baelz.de

Comparison of economic efficiency

Ejectors were first installed in this hotel in 1989, building automation and control were later integrated in 2007 when only the actuators needed to be replaced. The ejectors themselves had been in operation without problem for almost 30 years.

Comparison of the two ventilation variants reveals enormous potential for savings through ejector technology (table 1). Even in the procurement stage approx. 46% savings resulted, as the existing differential pressure normal in any water distribution system from the main pump means that ejector technology can be applied and hence circulating pumps with conventional control valve, wiring and switch cabinet components are no longer needed. The resulting simplified planning cost 52% less, with further costs for maintenance or replacement eliminated thanks to the durability and low maintenance requirements of the ejectors. Longer service lives and reduced maintenance both lead to improved availability of systems. Depending on utilization times, enormous sums can be saved for a calculated system service life of 10 years - cf. table 1 and figure 4.

	With circulating pumps	With ejectors	Savings in €	Savings in %
Investment costs in €	26,792.53 €	14,514.00 €	12,278.53 €	46%
Planning costs in €	6,808.00 €	3,289.00 €	3,519.00 €	52%
Maintenance costs replacement in €	15,192.53 €	12,514.00 €	2,678.53 €	18%

	With circulating pumps	With ejectors	Savings in €	Savings in %
Maintenance p.a. in €	1,108.61 €	303.21 €	805.40 €	73%
Energy costs p.a. in €	1,533.31 €	868.85 €	664.45 €	43%
Life cycle costs in € – 10 years	71,994.80 €	33,256.96 €	38,737.85 €	54%

Table 1 *Economic efficiency consideration in comparison to corresponding systems – in relation to 12 heating circuits or ejectors*

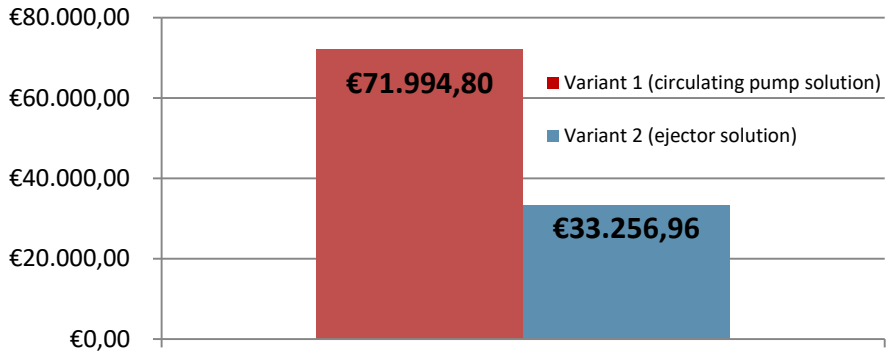

Figure 4 *Life cycle costs over 10 years – comparison with conventional technology - ejector technology*

W. Baelz & Sohn GmbH & Co. · Koepffstraße 5 · 74076 Heilbronn · Germany
Tel +49 7131 1500-0 · www.baelz.de · mail@baelz.de

Structure of ventilation systems with ejectors

The room air or exhaust air is regulated using a PI cascade control system and the supply temperature as an auxiliary control variable. To prevent draughts, a continuous supply air limitation is set to the minimum value. An ejector with electric actuator is shown. If the air-end frost protection thermostat responds (interlock), this causes the ventilators to switch off, the air flaps to close and the ejector to open.

The return cooler, which is installed directly after the air register (figure 5), has three functions: Thermal switching / start-up control, continuous return air temperature monitoring (for cooling) and permanent frost monitoring.

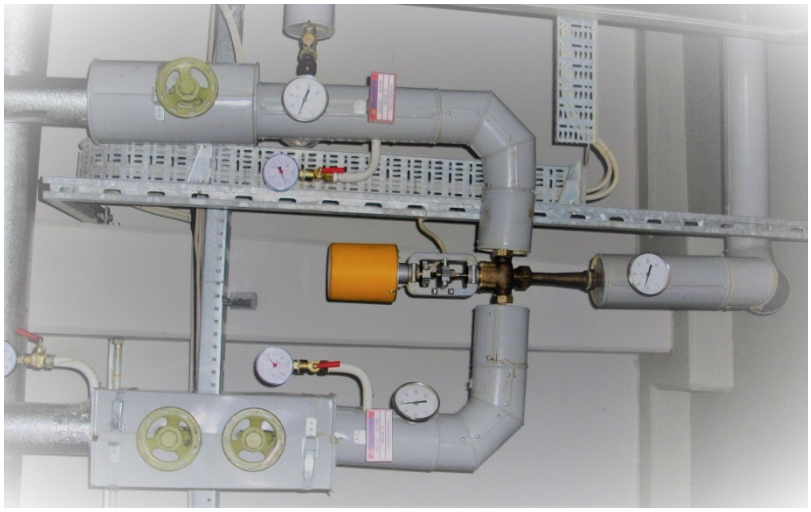

Figure 5 *Ejector with air register in the example*

Temperature switch: Only the ejector is started up when the ventilation system is switched on (figure 6). The ventilation system is not started up until the return cooler measures the desired temperature, e.g. 50°C.

Continuous return air temperature monitoring: The return cooler monitors set and actual values of air temperature (e.g. 35°C).

Continuous, water-end frost monitoring: If the return cooler measures falling temperatures, the ejector should open continuously from 12°C in order to prevent air-end frost monitors from responding. At 8°C for instance the ejector is then fully open.

W. Baelz & Sohn GmbH & Co. · Koepffstraße 5 · 74076 Heilbronn · Germany
Tel +49 7131 1500-0 · www.baelz.de · mail@baelz.de

Air register with ejector for HVAC systems

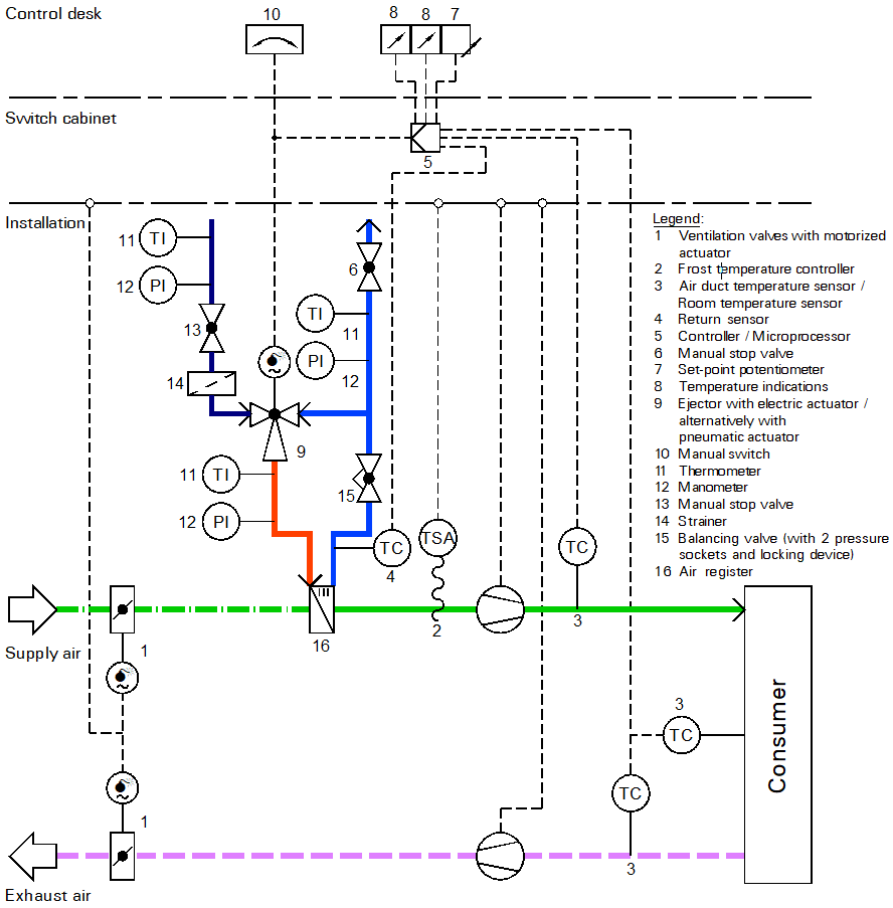

Figure 6 *Graphic representation of a ventilation system with ejector*

Conclusion

For ventilation systems too, it is apparent that ejector technology is far superior to conventional methods in many respects. This becomes clear as early as the investment and planning costs, likewise in ongoing operation for energy and maintenance costs. The long service life and low maintenance of ejectors also contributes towards better availability of systems.

Authors

Marc Gebauer, Master of Business Marketing, W. Baelz & Sohn GmbH & Co., Berlin
Dr. Renate Kilpper, Specialist Journalist at W. Baelz & Sohn GmbH & Co., Heilbronn