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Special valves for steam systems



Robust segment disc valves also contribute significantly to availability of industrial power plants

An application report by Burkhard Hinsch and Mirko Pietrzik

At its production site in Stade, the US-American company Dow Chemical Company ("Dow") operates a state-of-the-art gas and steam turbine power plant which produces not only power but also thermal energy which is necessary for operating the chemical plants. Due to power/heat-cogeneration, efficiency rates of more than 80% can be reached. A fuel mix based of hydrogen and natural gas is used in order to generate power and steam. The hydrogen is a by-product of the electrolysis system at the plant and combusts in a fully climate-neutral manner as it is CO₂ free when it is burned. In the field of steam distribution, Dow uses the extremely robust segment disc valve from Schubert & Salzer (Fig. 1). This special valve is characterised by excellent control precision, extremely economical long-term tightness and almost complete no-wear attributes.

The significant advantages of this series are:

- Space saving design compared to other valves – even at large nominal sizes
- High level of control precision over a wide flow range
- Robust design
- Bi-directional flow control is possible
- Can be used for media contaminated by particles
- Long-term tightness



Figure 1 Schubert & Salzer Segment Disc Valve with pneumatic actuator Type 5020



Figure 2 The heart of the segment disc valves are two segment discs that glide and seal against each other.

The design principle of segment disc valves

The central throttle device of this control valve is two discs with segmented openings which slide on one another and seal against each other (**Fig. 2**). The segment discs are positioned vertically in the valve housing, facing the direction of flow. A moving disc is placed upon a rotationally fixed segment disc, the geometry of which determines the throughput capacity and characteristic curve. These two discs have the same number of segments and the moving disc is rotated via a push rod which is tangentially inserted. Consequently, the cross-section surface of the free segment passage changes when a control intervention is made.

Irrespective of the pending pressure differential, the moving segment disc is pressed onto the fixed disc via a spring package. This ensures that the direction of flow is variable and that the valve can be installed in any desired location. Due to the fact that there are no metal seats with ring-shaped contact surfaces, no grooves will occur which can rapidly lead to leaks in traditional steam valves. Leakage ratios amounting to $< 0.001\%$ of the K_{vs} value are constantly achieved with the significantly less vulnerable surface seal.

Thanks to this special design, segment disc valves are one of the few valves that are able to combine control precision and a high level of tightness, even in extreme conditions and which also experience hardly any wear.

The standard segment disc valves are available in finely graduated intervals of between DN 25 and DN 300 – and go up to DN 800 where necessary – in an intermediate flange design for nominal pressures up to PN 25. They can be used for media temperatures ranging between -60°C and $+220^{\circ}\text{C}$ (higher temperatures and nominal pressures are available on request). The robust valves have a rangeability of 60:1.

Steam system reliably controlled for many years

The compact design, the comparatively low weight and the therefore easier handling as well as the minimised space requirements, even when dealing with large nominal sizes were, in addition to the high control precision and the high long-term tightness, the primary reasons for installing these valves at Dow in Stade. The segment disc valve as illustrated in **Figure 3** has been in continuous operation at the industrial power plant in Stade since 2004. This valve protects a 2.5 bar low pressure steam line against excess pressure by safely discharging the steam into the atmosphere. The silencer ensures that the permissible noise pressure level is not exceeded.

In recent years, the only part which needed to be replaced was a gland packing. According to information provided by the operator, the valve is still completely leak-tight, even after several years of operation.

Exclusive segment disc valves and sliding gate valves

Following the takeover of the valve company, Damko in 2015, Schubert & Salzer is the sole European valve manufacturer that develops and manufactures this special valve technology. With their outstanding advantages the segment disc valves and the sliding gate valves can be used equally to control and shut off fluids as well as gases and steam, these valves are not only used in power plants; the wide range of application also includes the construction materials industry as well as the fields of chemistry, pipes, water supply and disposal as well as ship building.



Figure 3 This insulated segment disc valve has a nominal size of 500 and is operated as an end valve with attached silencer and is operated here in a nominal size of 800.



Figure 4 The authors, Burkhard Hinsch (Dow; right) and Mirko Pietrzik (Schubert & Salzer; left)

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