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Check valves for sewage pumping stations including fecal matter

Part V. Full and free flow

The selection of the appropriate valve is sometimes of a key importance for the success or failure of a new project of a sewage pumping station. A reliable and certified check valve must be used due to the fact that a certification is frequently required for a sewage pumping unit. There are applicable EU regulations which specify the technical requirements for a specific group of products, which override the national regulations in this area.

A full (unconstrained) passage and a free passage for a check valve for sewage including fecal matter.

In the literature, definitions are used which are frequently erroneously interpreted or intentionally over-interpreted (for marketing purposes).

Firstly, a full passage of the valve is a passage which is not constrained in relation to the nominal passage of the valve, which at the same time should mean that each field of the cross-section flow of the valve for the flow rate ≥ 0.7 m/s is not smaller than its nominal field (Fig. 1).

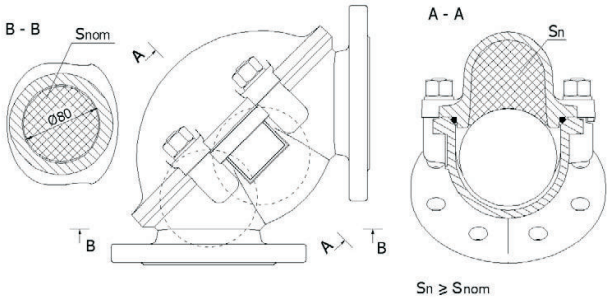

Fig. 1 Elbow check valve, type ESK 11 Dn80

Secondly, a free passage of a valve is a free passage for a ball with the nominal diameter of the valve, which should at the same time mean that in each place of the cross-section of the flow through the valve for the flow rate V ≥0.7 m/s there is free space of the ball diameter being equal or larger than the diameter of the nominal cross-section of the valve passage (Fig. 2).

Thirdly, for sewage including fecal matter, there is one more condition: (a harmonized standard of PN-EN 12050-4) free clearance for solid particles should not be smaller than 80% of the internal diameter of the outlet pipe minus 4 mm (Ds = 0.8 x Di – 4 mm, where Ds: clearance for solid particles in millimeters, Di: the internal diameter of the outflow pipe in mm) – (Fig. 3).

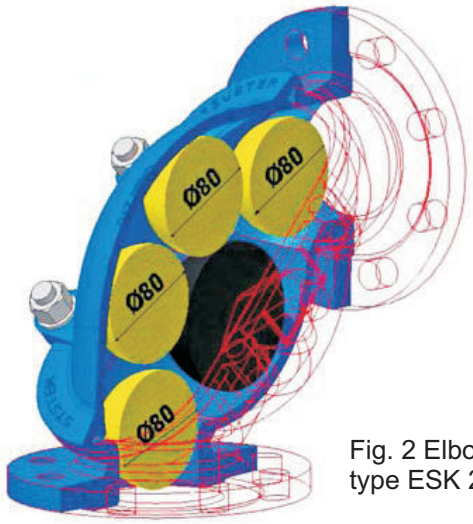

Fig. 2 Elbow check valve, type ESK 21 Dn80

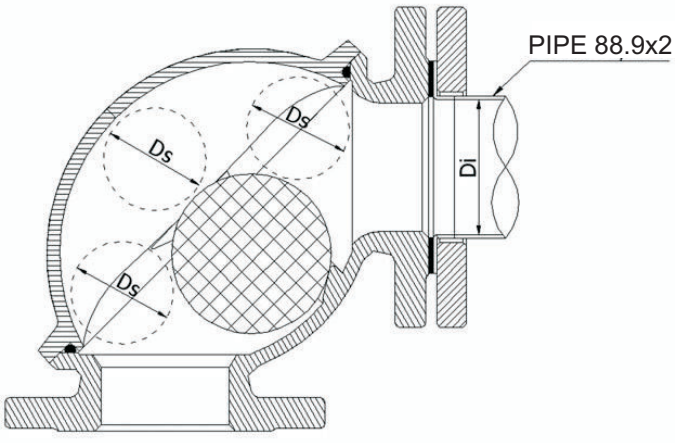

Fig. 3 Elbow check valve, type ESK 11 Dn80

Example: Di = 84.9 mm
Ds.. = (0.8 x Di – 4) = (84.9 x 0.8 – 4) = (68.3 – 4) =

As it becomes evident, no classic check valve, and especially no ball check valve fulfils the abovementioned requirements, and all the more all the requirements at the same time. Talking about classic check valves in the literature and advertising brochures as having a **full passage in the open state** is like singing the song entitled "If I Were a Rich Man" in a new interpretation of "If I were open" (fully) – "I would have a full passage".

SZUSTER system ESK 11 type ball elbow check valve is the one which fulfils the first and third condition. As it was previously described [1], its full opening occurs as early as with the flow rates of liquid V=0.7 m/s and higher. SZUSTER system ESK 21, 22 type ball elbow check valve is the one which fulfills all the three conditions.

The dependences as given in diagrams 1 and 2 speak for themselves.

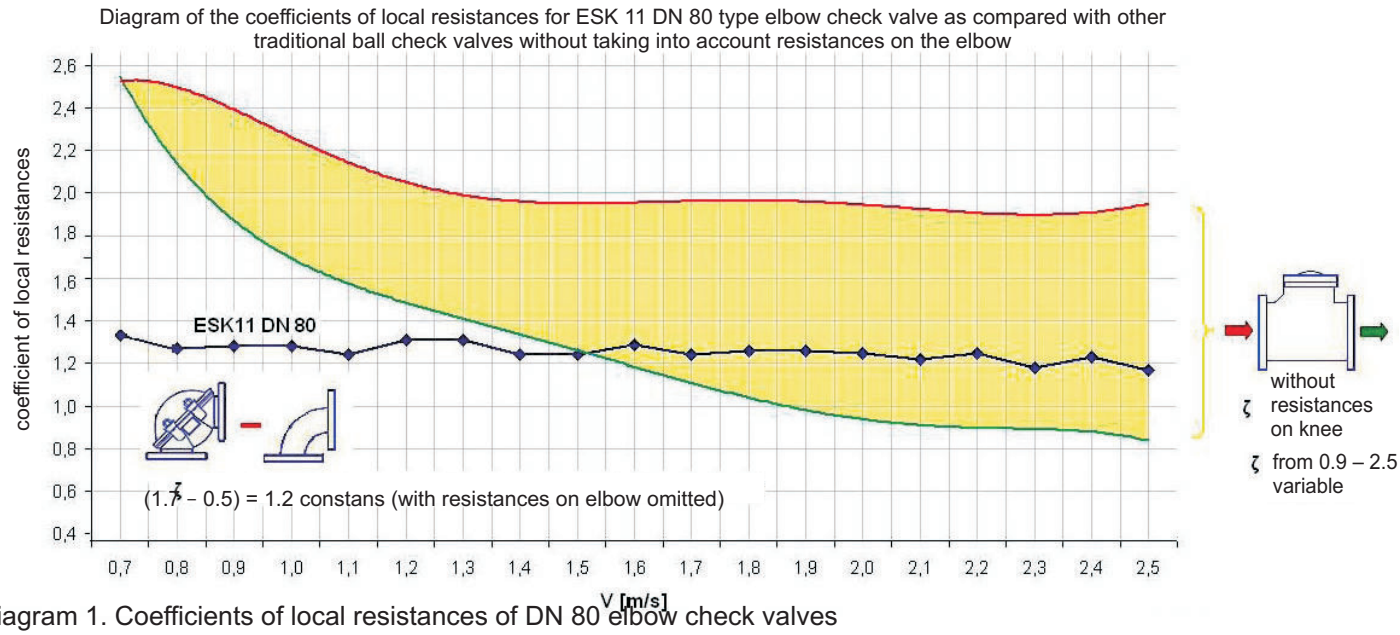

Diagram 1. Coefficients of local resistances of DN 80 elbow check valves

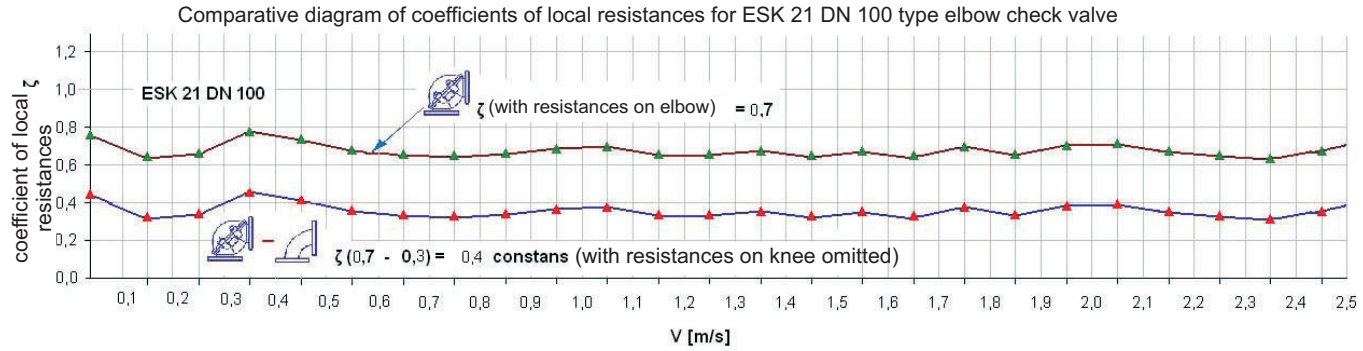

Diagram 2. Coefficients of local resistances of DN 100 elbow check valves

Special constructions

For abrasive media and those including large-sized solid particles, a special elbow check valve with a free passage was designed: ESK 21 type. Its cross-section is shown in Fig. 3. It can be used as an inflow check valve in sewage pumping stations with a separation of solid particles, or in pneumatic sewage pumping stations.

Fig. 4 presents an example of the use of SZUSTER system ESK 21 DN 100 type ball elbow check valve in an EPP pneumatic sewage pumping station. Additionally, this valve has very small flow resistances, which reduces the time required to fill the pneumatic working tanks (displacement tanks) of the EPP pneumatic sewage pumping station,

Fig. 4 Pneumatic pumping station EPP

while the ball, which is moved away from the flow section, is not at the risk of being blocked with solid particles from inflowing sewage. It is interesting to note that owing to the suitable hydraulics of the valve, full opening of the check valve was obtained as early as with the flow (inflow) rate equal to zero. This was achieved owing to the use of a sinking ball instead of a floating ball used in typical check valves.

REFERENCES

1.Check valves for pumping stations for waste including fecal matter part 1 PP1/2006, part 2 PP2/2006, part 3 PP/2006, part 4 PP/2007
2.PN-EN 12050-4 standard
3.Service manual for EPP sewage pumping station

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