GESTRA Steam Systems

GESTRA Information A 2.6

Sizing and Installation of Check (Non-Return) Valves

Sizing

Check valves are generally sized in accordance with the pipe diameter, the size of the pump-outlet socket or any other existing pipe socket. In most cases, however, operating conditions and the possible consequences are not considered, viz. whether there is a sufficient volume flow to ensure complete valve opening or not.

As the opening angle of a check valve depends on the volume flow, problems might arise if this point is neglected. Thus, for instance, a check valve which, due to reduced volume flowrate cannot reach a stable completely open position, might clatter during operation and even be subject to increased wear.

The cause for clatter and the possibilities of avoiding it will be treated in some detail in the following text.

A counterweight or spring-loaded check valve commences to open as soon as a certain static differential pressure (pressure upstream minus pressure downstream of valve) has been established. This produces an opening force (differential pressure x cross-sectional area of valve) acting against the closing force produced by the spring or the counterweight. When the opening force outbalances the closing force, the valve is opened. This differential pressure is also called opening pressure or cracking pressure. It depends on the spring tension or the torque of the counterweight, the installation position and the size of the check valve.

Depending on the volume flow the check valve opens either completely or only partly. Clatter will only occur during partial opening, i.e. at a reduced volume flowrate.

At start-up of a plant, for example, first a static pressure is built up between pressure generator and check valve. Once the opening pressure is marginally exceeded, the volume flow starts. Due to the volume flow during this phase, the pressure upstream of the valve drops slightly, so that the closing force again outbalances the opening force. The valve closes.

This process will repeat itself until the volume flow due to the additional dynamic pressure differential is large enough to overcome the closing force. The valve will then stay open.

Clatter is produced by the impact of the valve disc or flap onto the seat, spring retainer, or stop. Sometimes the sequence is so rapid that it is no longer possible to identify the clatter, just a high humming tone can be heard. An incessant noise is a sure sign of an oversized check valve. This kind of disturbance cannot be attributed to the valve itself, it is always the result of wrong sizing.

There are several possibilities of stopping the noise: The surest, but also most expensive, means is to exchange the check valve for a smaller one. This is, however, no longer possible if the pressure drop at full load would become too high. There is another possibility of solving this problem, in particular if the noise appears only during start-up or shut-down or at partial load. This is by reducing the closing force, for example by using a weaker spring or a reduced counterweight.

If the check valve is installed in a vertical line with upward flow, it is even possible to use the valve without spring altogether, closing being then effected by the weight of the valve disc or flap.

If the valves are used without spring in large-sized systems there might be the danger of waterhammer.

In cases of doubt consult our technical department.

The pressure drop chart in **Fig. 1** shows that a check valve is not completely open, unless the volume flow intersects the pressure drop curve in its linear part. Below the completely open point **C** clatter is possible.

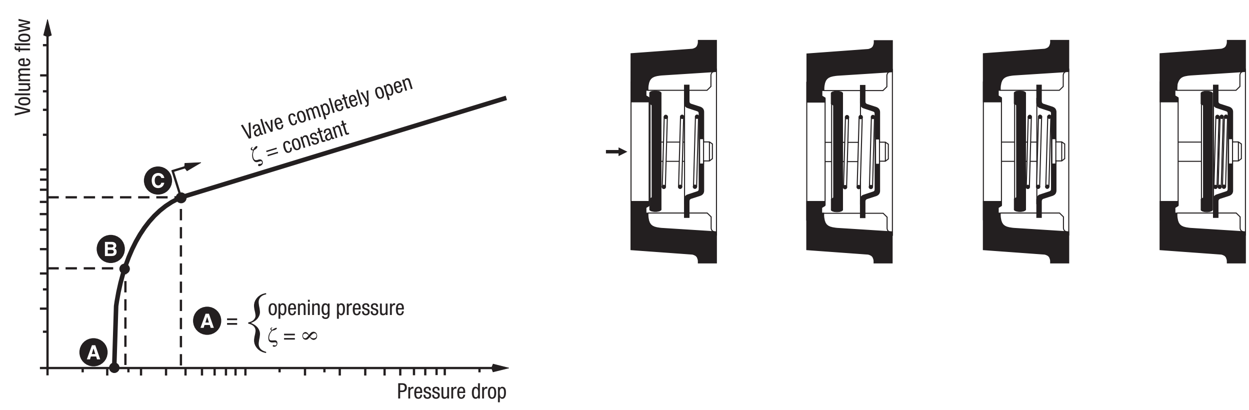

Fig. 1 *Degree of opening of a spring-loaded check valve as a function of volume flow.*

Installation

We know from experience that, besides sizing of a check valve, the exact installation also plays an important part. Depending on the check valve type used (non-return valve, swing or dual-plate check valve) there are more or less favourable dispositions with regard to place and position of installation which we shall describe in the following.

Non-return valves RK

Valves of this wafer design **(Fig. 2, Fig. 3)** can be installed without any problem wherever required.

Provided they are completely open, they are also unaffected by turbulence as might for example occur on the pump-discharge side. They can therefore be directly fitted downstream of a pump **(Fig. 4)** or only with a short extension piece.

The valves can be installed in any plane if they are provided with a spring. Installation without spring is only possible in vertical lines with upward flow.

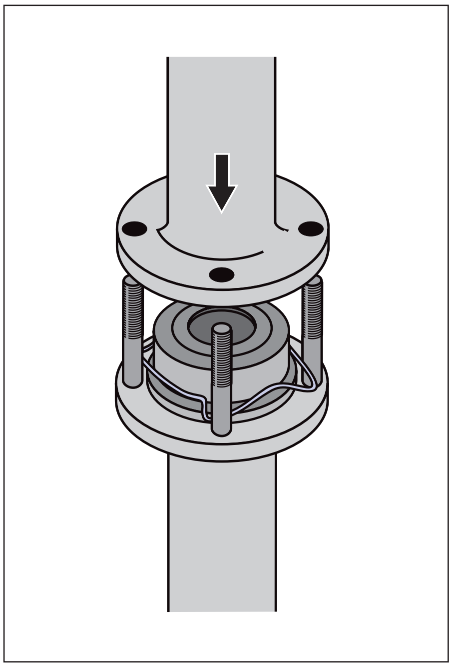

Fig. 2 *GESTRA Non-return valve with spiral centering ring, DN 15 – DN 100*

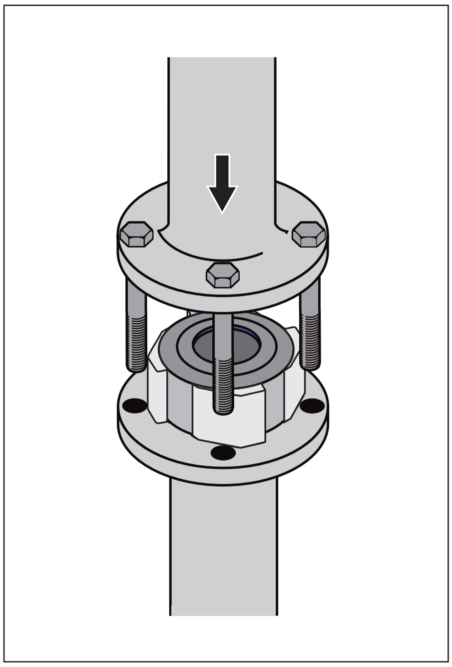

Fig. 3 *GESTRA Non-return valve with self-centering body, DN 15 – DN 100*

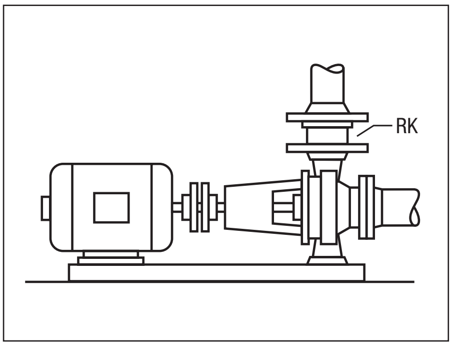

Fig. 4 *Fitting of RK valve directly to pump*

Check valves

Our product range includes DISCOCHECK dual plate check valves and DISCO swing check valves.

Dual plate check valves BB

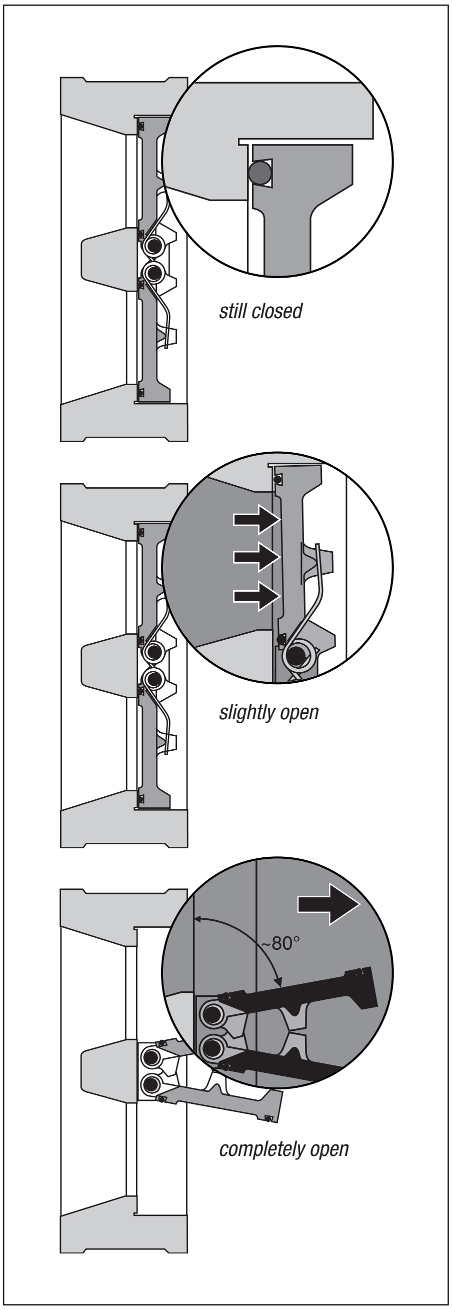

Fig. 5 *GESTRA Dual plate check valve BB*

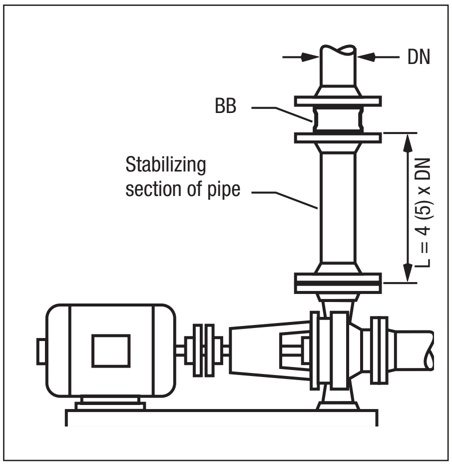

Fig. 6 *Installation example BB*

Spring-loaded dual plate check valves as per **Fig. 5** can be installed in horizontal lines with eyebolt on top to ensure that the hinge pins are vertical, or in vertical lines with upward flow. Installation in vertical lines with downward flow is only possible with stronger springs.

If a dual plate check valve is installed immediately downstream of a pump, it is recommended to provide a stabilizing section between pump and check valve having a length of 4 to 5 times the nominal size (DN) of the valve (see **Fig. 6**).

By this means, the check valve is not subjected to significant turbulent flow at the pump discharge side, so that premature wear is precluded. This mode of installation will normally position the valve within piping of increased diameter with the consequent advantage of a lower pressure drop when compared against a smaller-sized valve to suit the pump discharge connection.

Swing check valves CB

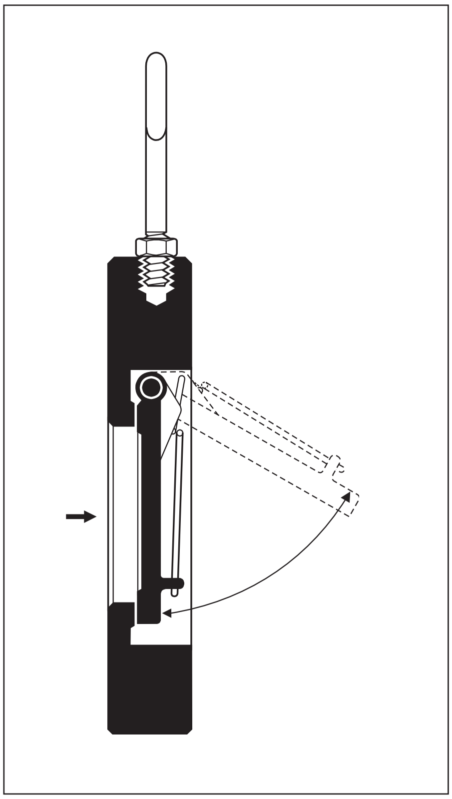

Fig. 7 *GESTRA DISCO swing check valve CB*

The CB swing check valves **(Fig. 7 and Fig. 8)** can be installed in horizontal lines (eyebolt on top), or in vertical lines with upward flow.

Fig. 8 *GESTRA DISCO swing check valves CB*

When fitting these valves directly downstream of a pump, the orientation of the valve is of the utmost importance to obtain a trouble-free operation (see below).

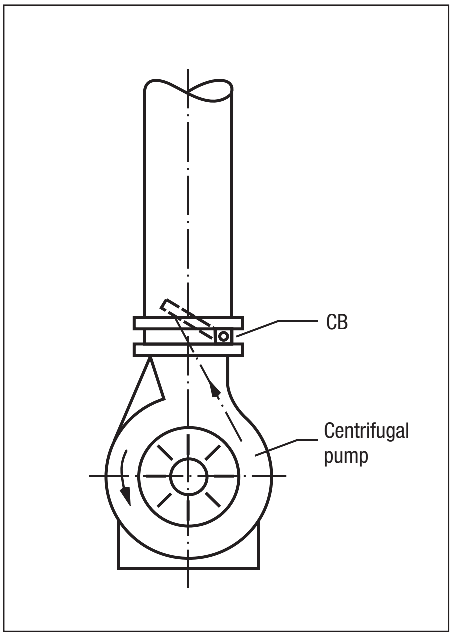

Fig. 9 *Correct valve position*

Flow tests have proved that the optimum installation position is obtained if the flow is directed towards the flap (see **Fig. 9**) or mainly in this direction **(Fig. 10)**. In this case, the flap is always positioned calmly in the flow and reaches its completely open position even at a low flowrate.

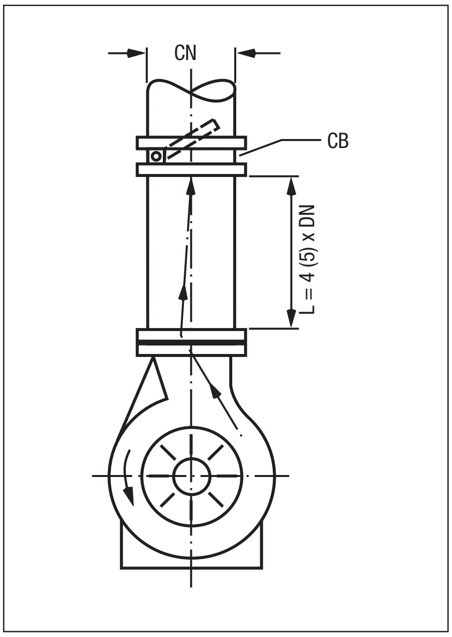

Fig. 10 *Favourable valve position*

The installation position illustrated in **Fig. 11** is the most unfavourable because the flow is directed towards the flap shaft.

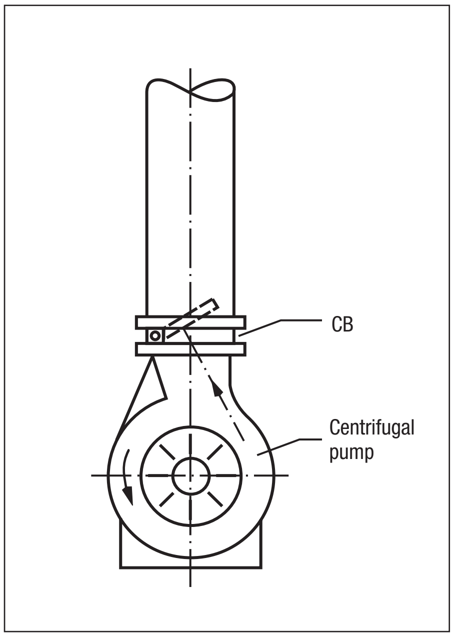

Fig. 11 *Unfavourable valve position*

As flow on the pump-discharge side is in most cases rather turbulent, it is recommended to provide a stabilizing section of L = 4 to 5 x DN between pump and valve **(Fig. 10)**.

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