

GESTRA Information A 1.2

Automatic Drainage of Steam and Condensate Systems During Start-Up and Shut-Down

During the start-up of a steam-heated plant the steam condenses rather rapidly, while the pressure is building up slowly. This implies that at the beginning of the process relatively large amounts of condensate are formed, the steam trap is, however, not yet in a position to discharge all the condensate without banking-up. The start-up process is therefore retarded; thermal waterhammer may result. (The subject "Waterhammer and How to Avoid It" is treated in GESTRA Information A 1.3 leaflet which we shall send you on request.)

When shutting down the steam system the remaining steam condenses. The pressure in the system drops, and even a vacuum may be formed. This might affect the systems as follows:

- Deformation of heating surfaces by the formation of vacuum
- Increased corrosion and the danger of freezing of the remaining condensate during winter
- Dynamic waterhammer during start-up

(On the subject "Freezing of Equipment in Steam and Condensate Systems" we have also published the special GESTRA Information A 1.5)

Remedy

Fitting of a device, in addition to the steam trap, to assist condensate discharge during start-up, and both draining the system and air admission during shut-down. This device can either be a manually operated valve or better still an automatic GESTRA condensate drain valve type AK 45.

Automatic drainage compared to manual drainage offers several advantages:

- saves personnel
- excludes human error
- prevents steam losses through manual valves whose closure was overlooked
- eliminates waterhammer and frost damage
- reduces the danger of accidents in places not readily accessible
- makes the installation of an air-inlet valve unnecessary

The valve plug of the RHOMBUSline condensate drain valve type AK 45 is controlled by the system pressure. When there is no pressure, the AK 45 is held in the open position by the integral spring. At start-up the condensate formed in the system is discharged without any problem. As soon as the steam pressure has built up to



the closing pressure to which the AK 45 has been adjusted, the valve closes automatically. The closing pressure is set at our works to 0.8 bar. When the pressure in the system drops again, the valve opens at approximately the same pressure required to close the valve, i. e. opening pressure ≈ closing pressure.

The hand-purging knob provided on the AK 45 permits purging under pressure to clear any dirt accumulations.

The pipework leading to the AK 45 should be arranged so that the condensate is free to fall towards the valve and the system can drain by gravity when shut down.

For further technical details refer to the data sheet AK 45 which we shall send you on request.

The following schematic layouts give a few typical installations of the RHOMBUSline AK 45.

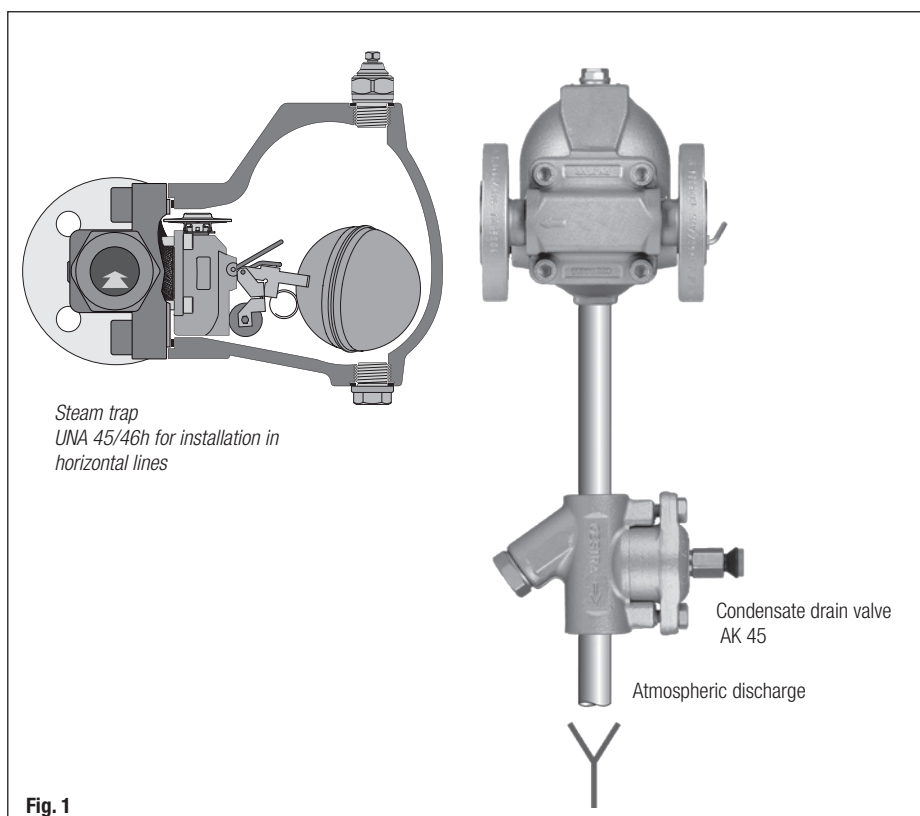


Fig. 1

Fig. 1:
Drainage of float traps

Float traps operate with an internal water level. In times of frost the condensate remaining in the trap might freeze when the plant is shut down. An AK 45 fitted downstream of the float trap solves this problem.

Fig. 2:
Start-up drainage of a rising steam line

When starting up a rising steam line (e.g. long distance steam line) the total condensate formed cannot immediately be discharged by the steam trap. Due to phase friction the passing steam will entrain the cold condensate and convey it into the rising part of pipework. Pulsating flow and thermal waterhammer may result. In this case, too, the installation of an AK 45 is an ideal solution.

Fig. 3:
Drainage of water pockets

Water pockets cannot always be avoided in a plant (e.g. in expansion loops or pipe bends). The installation of an AK 45 at the lowest point of the line ensures correct drainage during start-up, prevents waterhammer and provides direct drainage at shut-down of the system, so that freezing cannot occur.

Fig. 4:
Condensate discharge into an elevated condensate-return line

If condensate is to be discharged into an elevated condensate-return line (e.g. condensate from steam lines, steam mains or heat exchangers) drainage of the condensate by the steam trap is not possible unless a sufficient differential pressure has built up. At shut-down of the system condensate accumulates in the line, a vacuum might be formed and the condensate can freeze. In addition waterhammer might result during start-up. The AK 45 ensures free condensate discharge during start-up. The valve remains open until the pressure in the system has reached its closing pressure which is then sufficient for the steam trap to discharge the condensate into the condensate-return line. At shutdown the system is drained and air admitted so that frost damage, waterhammer and deformation of the heat exchanger are prevented. Corrosion is reduced.

Fig. 5:
Optimum start-up and shut-down for batch operation

Heat exchangers used for batch operation (e.g. boiling pans, evaporators, autoclaves) require rapid start-up and shut-down for each batch. The AK 45 permits rapid start-up as large amounts of condensate are freely discharged. Waterhammer can no longer occur. At shut-down of the system the AK 45 ensures drainage of the remaining condensate, so that freezing in winter and deformation due to vacuum formation are prevented and corrosion is reduced.

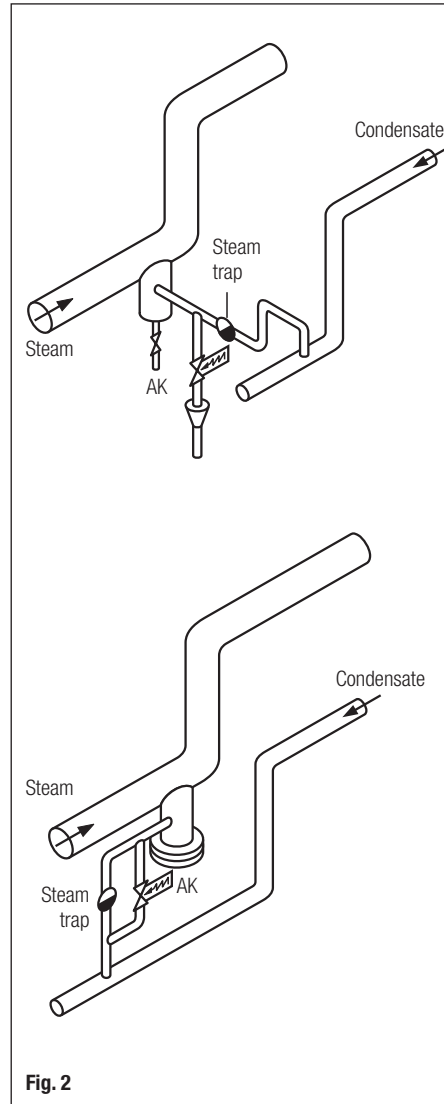


Fig. 2

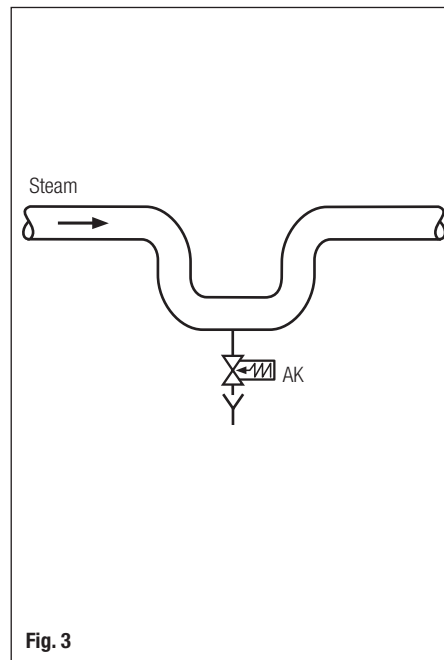


Fig. 3

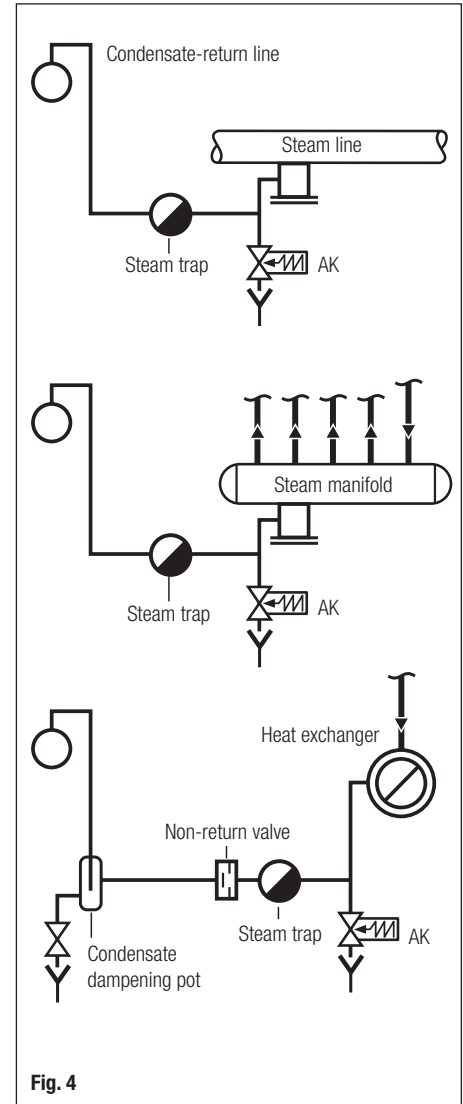


Fig. 4

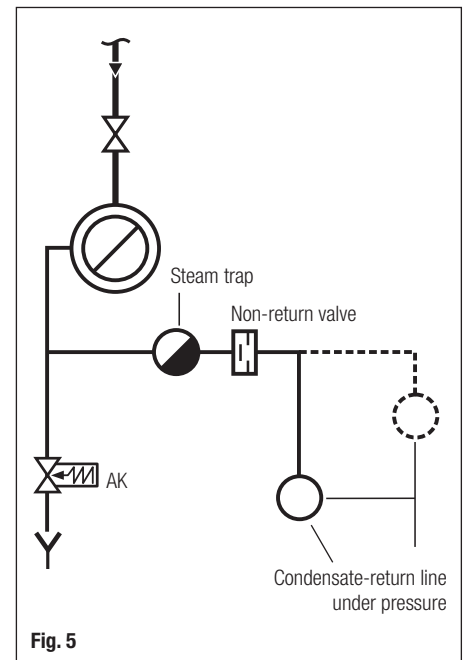


Fig. 5

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