

1 HYDRAULIC SEPARATOR

The hydraulic separator is used to make the primary and secondary circuit independent, to prevent interferences and mutual disruptions, especially when the flow rates on the circuits are different.

The separator cannot replace the inertial buffer tank unless it has an adequate volume (Paragraph 2 p. 2).

The hydraulic separator should have the following features:

- ▶ Maximum water speed in the separator 0,1 m/s
- ▶ Maximum inlet/outlet water speed 0,9 m/s
- ▶ Branch connections for circuits at higher temperature upwards (for heating applications)
- ▶ In case of several deliveries at the same temperature use a single branch connection and create a distribution manifold

Sizing must be carried out on the basis of the maximum flow rate between primary and secondary.

For optimal sizing it is recommended to follow the so-called "3 D" rule, shown in Figure 1.1 p. 1.

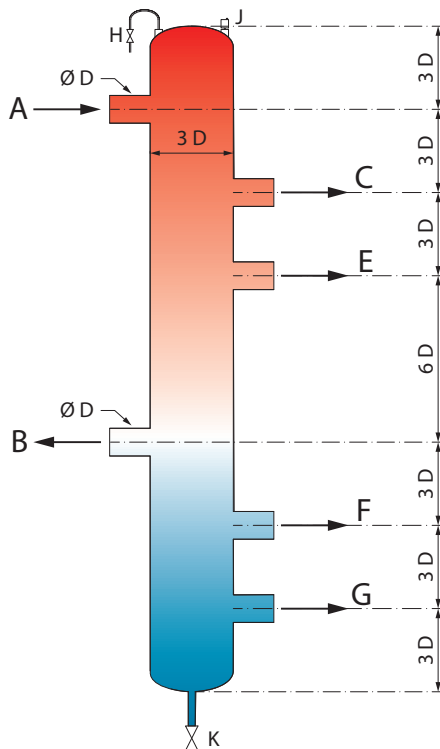
This is based on the diameter D of the hydraulic separator's connections to define the dimensional features and position of the branch connections, based on multiples of the diameter.

Figure 1.1 p. 1 shows the use for heating applications.

For conditioning applications, the inlet of the primary circuit should be at the bottom, so that natural circulation does not trigger parasitic mixing phenomena.

Similarly, for conditioning applications, branch connections at lower temperature must be at the bottom and those at higher temperature must be at the top.

Figure 1.1 6-connection hydraulic separator

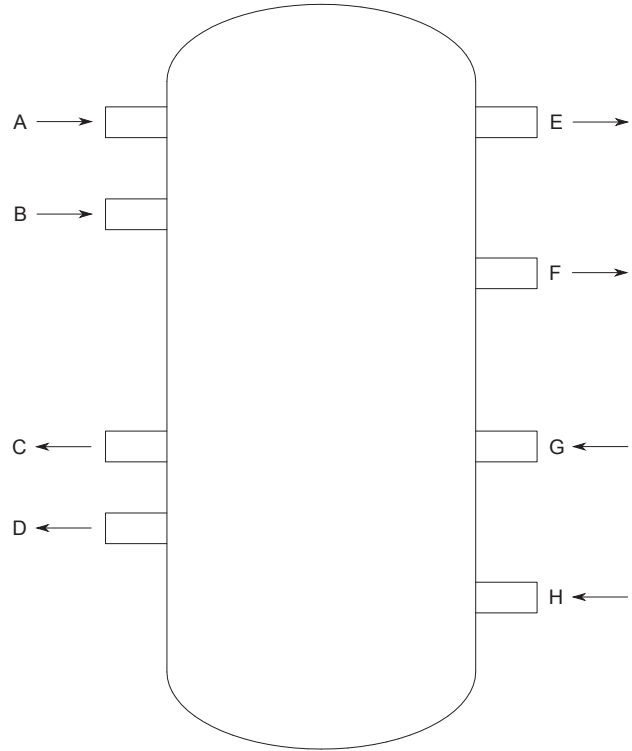


- | | |
|---|---|
| A Heating primary circuit outlet | F High temperature secondary circuit return |
| B Hot primary circuit return | G Low temperature secondary circuit return |
| C High temperature secondary circuit outlet | H Manual air vent |
| D Hydraulic connections diameter | J Automatic air vent |
| E Low temperature secondary circuit outlet | K Sludge purge |

If different types of generators are installed on the primary circuit, connected to the same separator, one should refer to Picture 1.2 p. 1, related to heating applications.

Branch connections at higher temperature, on inlet or outlet, must be positioned higher, in order to prevent excessively hot water reaches the heat pumps from the boilers.

Figure 1.2 8-connection hydraulic separator



- | | |
|---|---|
| A Boiler primary circuit delivery | F Low temperature secondary circuit outlet |
| B GAHP primary circuit delivery | G High temperature secondary circuit return |
| C Boiler primary circuit return | H Low temperature secondary circuit return |
| D GAHP primary circuit return | |
| E High temperature secondary circuit outlet | |

2 BUFFER TANK

The buffer tank has the purpose of providing thermal inertia to the system, especially in low load conditions, thus reducing the number of heat generators ON/OFF, particularly significant for the system general efficiency.

In the appropriate plumbing configuration, it may also be used as a hydraulic separator (Paragraph 1 p. 1).

The buffer tank may also be used for disposing of thermal and cooling power during unit switching off, in order to prevent the water temperature to rise or drop excessively.

i The heating or cooling energy accumulated during normal operation of the system, which also depends on the buffer tank capacity, can only be exploited effectively with a control system which, on the basis of the secondary temperature, switches off the generation system and relevant circulating pumps and chokes the water flow on the secondary circuit, for example by means of mixing valves.

Failing this type of control system, the buffer tank is unable to prevent the units from switching off, regardless of the buffer tank size, as soon as the set-point temperature is reached, without being able to store energy hence running the risk of triggering a high number of switching ON/OFF especially in the event of low load.

For more information on Robur control systems, see Section C01.11.

Buffer tanks are divided into:

- ▶ in line (2 connections) (Paragraph 2.1 p. 2)
- ▶ with hydraulic separation (3 or 4 connections) (Paragraph 2.2 p. 2)

When used with chilled water, special versions of the buffer tanks must be provided (Paragraph 2.3 p. 3).

A minimum volume of water in the primary circuit equal to at least 70 litres for each GAHP/GA module must be provided, both on the heating/cooling circuit and on the renewable source circuit (only for systems with GAHP GS/WS), in order to absorb the energy (thermal or cooling) supplied by the unit during the switch-off phase.

The recommended dimensions for optimising efficiency by reducing the number of ON/OFF switching are however greater:

- ▶ single unit: 300 to 500 litres
- ▶ several units: 500 to 1000 litres total

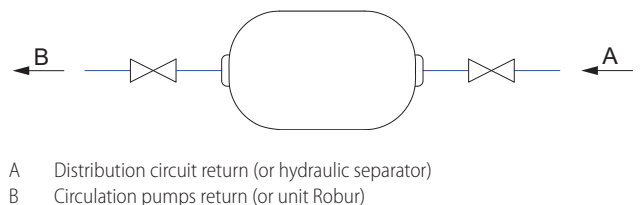
2.1 IN LINE BUFFER TANK

The in line buffer tank, or 2-connection buffer tank, only has the purpose of storing the heating and/or cooling energy.

It must be installed on return to the units, preferably before the circulation pumps.

Figure 2.1 p. 2 schematically shows an in line buffer tank with 2 connections.

Figure 2.1 2-connection inertial buffer tank



2.2 BUFFER TANK WITH HYDRAULIC SEPARATION

The buffer tank with hydraulic separation performs both functions of thermal buffer tank and hydraulic separator.

There are two types:

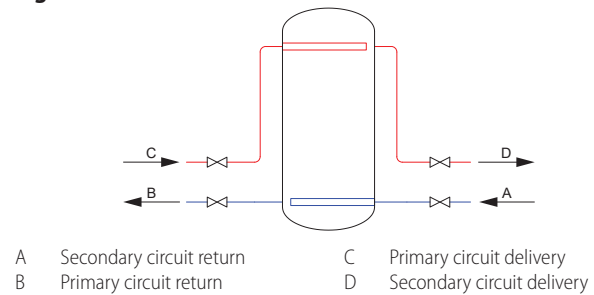
- ▶ 4 connections
- ▶ 3 connections

2.2.1 4 connections

The 4-connection buffer tank represents the most typical case of buffer tank with hydraulic separation functions.

Figure 2.2 p. 2 shows an example of 4-connection buffer tank installation.

Figure 2.2 4-connection inertial buffer tank



One should ensure the selected buffer tank includes certain measures to reduce mixing the water flows inside the tank, consequently altering the temperatures and undermining comfort and efficiency:

- ▶ correct sizing (in particular the ratio of height to diameter)
- ▶ installation of anti-mixing devices

The main types of anti-mixing devices are:

- ▶ anti-mixing baffles (Figure 2.3 p. 2)
- ▶ conveying pipes (Figure 2.4 p. 2)
- ▶ diffuser pipes (Figure 2.5 p. 3)

Figure 2.3 Tank with dividing baffles



Figure 2.4 Tank with conveying pipes



Figure 2.5 Tank with diffuser pipes



2.2.2 3 connections

The 3-connection buffer tank is actually identical to the more popular 4-connection one, except for the water connection. A section of pipe, indicated with D in Figure 2.6 p. 3, with a large cross-section area (and consequently minimum pressure drop), in which the water can flow alternately in both directions, is realised.

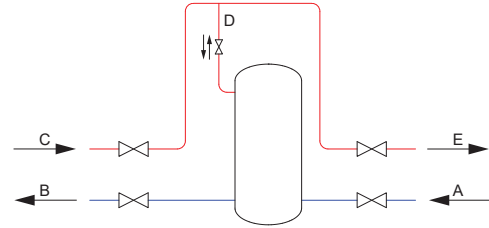
The water flow is:

- ▶ towards the inlet of the buffer tank if the primary flow is higher than the secondary flow
- ▶ out of the buffer tank if the primary flow is lower than the secondary flow



In order for the buffer tank to also act as a hydraulic separator, it is essential not to close the shut-off valve provided on pipe D, which should only be closed for maintenance operations on the tank itself or to check the temperature arriving at the manifold in the absence of the buffer tank.

Figure 2.6 3-connection inertial buffer tank



- | | | | |
|---|--------------------------|---|---|
| A | Secondary circuit return | D | Pipe performing hydraulic separation, with shut-off valve |
| B | Primary circuit return | E | Secondary circuit delivery |
| C | Primary circuit delivery | | |

The significant advantage of this configuration, compared to the more popular 4-connection one, lies in the fact that when there are balanced flow rates the water flow is directly transferred from primary to secondary circuit, without mixing inside the buffer tank.

This is particularly useful in high temperature systems, where it is important to reduce temperature drops in order not to undermine the energy efficiency of heat pumps.

This configuration is also possible in cooling, provided the C, D, E sections are positioned at the bottom to better exploit thermal stratification.

2.3 BUFFER TANKS FOR CHILLED WATER

If the buffer tank (of any type) is also to be used for chilled water, it should be checked that it is suitable for this type of use, in order to prevent condensate formation leading to a deterioration of the buffer tank in a short time.