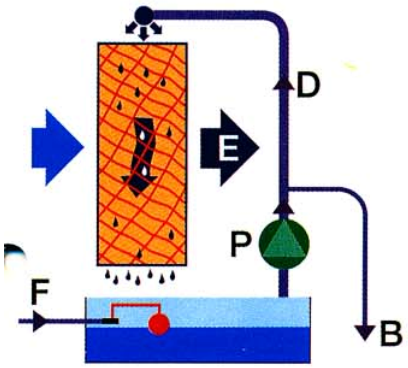
Design Guide - water

How to calculate fresh water consumption and pump capacity

In the water distribution system, there are five different water flows, which are defined in the illustration below.



E = Evaporation B = Bleed-off
F = Fresh water D = Distribution
P = Pump capacity

5. Calculate the bleed-off rate B

To calculate the bleed-off rate B, you need an analysis of your fresh water. If your water quality is unknown, we can help you with the analyse. Send a small sample of your water to our local representative. Depending on the water quality, a so-called bleed-off constant c_B can be found in the water quality graph below.

Example

Assume that our water analysis shows:

pH value of fresh water	7.1
Bicarbonate concentration:	
HCO_3^-	200 mg/l
Calcium concentration:	
Ca^{2+}	20 mg/l

Using the water quality graph, the bleed-off constant c_B=0.2

Then the bleed-off rate B is calculated as:

$B = c_B \cdot E$ **l/min**

B = 0.2 • 99 = 20 l/min

6. Calculate the fresh water consumption F

The fresh water consumption F is calculated as:

F = E + B **l/min**

Our example gives:

F = 99 + 20 = 119 l/min

7. Calculate the distribution flow rate D

To get sufficient wetting and optimal performance, a minimum specific water flow per m² top surface of the pad is needed. The specific water flow c_D for different CELdek® types are:

Pad type	Specific water flow, c_D per m² top surface
7060-15	60 l/min
7090-15	60 l/min
5090-15	90 l/min

The distribution flow rate D to the total length of the pads is calculated as follows:

$D = c_D \cdot L \cdot D$ **l/min**

Our example with a CELdek® pad 7090-15, L = 100 m and D = 0.1 m gives:

D = 60 • 100 • 0.1 = 600 l/min

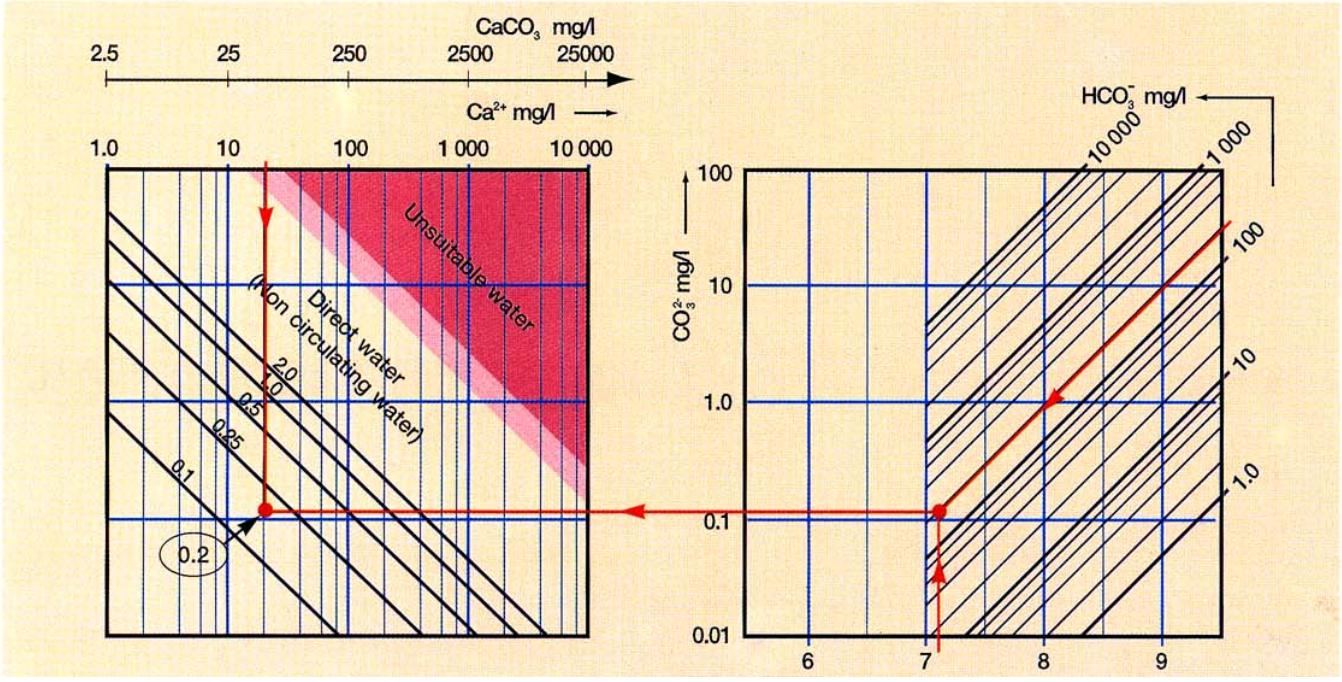
8. Calculate the pump capacity P

The pump capacity P is calculated as:

P = D + B **l/min**

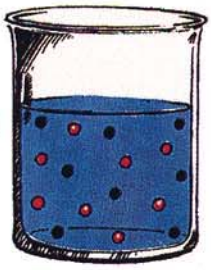
Our example gives:

P = 600 + 20 = 620 l/min



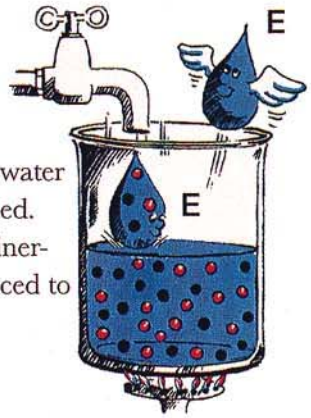
Why bleed-off?

1. Water always contains a certain amount of dissolved minerals.

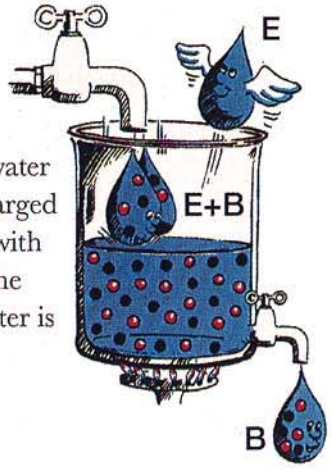


2. When water evaporates, the mineral concentration in the recirculated water will increase.

3. In order to compensate for the evaporated water E, fresh water must be supplied. Then more minerals are introduced to the system.



4. To avoid a built-up of insoluble minerals on the pad surface (scaling), causing an increase in pressure drop, some of the recirculating water must be discharged and replaced with fresh water. The discharged water is called the bleed-off B.



The importance of bleed-off

The bleed-off rate is the water flow that needs to constantly be drained off to keep the mineral concentration in the water to an optimal level. Too little bleed-off means too much scaling and clogging, and you have to change pads too often. Too much bleed-off results in high water costs but also presoftening as well as a changing of the pads more often than with an optimal bleed-off rate.

It is therefore important to calculate the optimal bleed-off rate to get a long lasting pad with high performance.