

## CO<sub>2</sub> flow control for membrane filtration (RO)

### Drinking water re-mineralisation

**Desalination, a process for removing salts and minerals, is used in the Middle East to retrieve drinking water from sea water or brackish water. A major technique in this respect is membrane filtration via reverse osmosis (RO), where membrane filters remove particles, ions and several molecules from the water. But for drinking purposes, the resulting RO water is too pure, in the sense that minerals necessary for humans also have been removed from the original water.**

To this end, minerals such as calcium carbonate have to be 're-introduced' to the RO water. However, when the alkaline level of the water is too high, as expressed in a too high pH, calcium carbonate cannot dissolve and will precipitate. Controlling the pH is essential, and one way to do that is by introducing carbon dioxide (CO<sub>2</sub>) gas in a controlled way. Dissolved in water, carbon dioxide will partially convert into carbonic acid, reducing the pH of the water, thus facilitating the dissolution of calcium carbonate.

A South USA based company involved in systems for water treatment and dry ice production requested Bronkhorst USA to help them finding a solution to accurately measure CO<sub>2</sub> flows for pH control for re-mineralisation in a 'reverse osmosis' desalination plant.



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### Application requirements

The client needs to have a compact solution for the accurate measurement of gaseous carbon dioxide (CO<sub>2</sub>) flows. Furthermore, this measurement solution has to deal with low-pressure gases, and operates preferably at low costs.

### Important topics

- Compact size of the mass flow meter
  - Low pressure drop
  - Accurate and fast response
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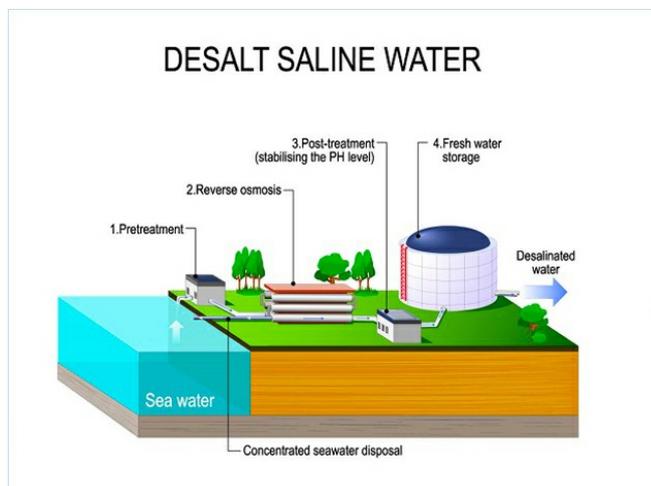
## Process solution

The Bronkhorst solution consists of an IN-FLOW thermal mass flow meter which is used to accurately measure the flow of CO<sub>2</sub>. At the part of the desalination process downstream of the reverse osmosis (RO) stage, a pH analyser measures the pH of the RO water in real-time, and passes this signal through to a PLC (programmable logic controller) which tells the Bronkhorst device how much CO<sub>2</sub> has to be dosed. In effect, the PLC controls a valve to feed gaseous CO<sub>2</sub> into a large 2" water line for pH control. With the current IN-FLOW device, up to 10 kilograms of CO<sub>2</sub> can be supplied per hour, with an accuracy of  $\pm 0.5\%$  of reading plus  $\pm 0.1\%$  of full scale.

The client is satisfied with the much smaller size of the IN-FLOW compared to many of the Coriolis-type flow meters of other makes they have used. The device works right out of the box and only needs a zero calibration. The compact size of the meter is an advantage in the desalination plant, and the fast speed of response allows for a fast feedback of the pH control.

In addition to purchase costs, also the operational costs of the device are reduced compared to other flow meters. This is due to the low pressure drop of the IN-FLOW. Now it is possible to work with lower pressures; the same gas flow rate can be obtained using a lower pressure difference, and hence at lower costs.

Besides the IN-FLOW flow meter for the current application, Bronkhorst also delivered a MASS-STREAM mass flow meter – an instrument based on the direct-through principle - for a comparable application for CO<sub>2</sub> dosing, emphasising the role of Bronkhorst as one supplier for various kinds of mass flow devices.



## Recommended Products



**IN-FLOW F-112AI**

Min. flow 0,8...40 l/min  
Max. flow 1,4...250 l/min  
Drukklasse 100 bar  
Compact IP65-ontwerp  
Hoge nauwkeurigheid



**MASS-STREAM D-6360 MFM**

Min. flow 0,4...20 l/min  
Max. flow 2...200 l/min  
Drukklasse tot 20 bar  
Robuuste sensor en behuizing (IP65)  
Optioneel geïntegreerd TFT display

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