

Measuring point

Installation

Measuring task

1

pipeline

monitoring of scrubbing liquid  $K_2CO_3$  and the salt  $KHCO_3$

2

pipeline

real time control of regenerated  $K_2CO_3$  solution

# Benfield Process Scrubber

## Introduction

In many industrial plants, contaminated gas accrues for example in the ammonia synthesis or in an ethylene oxide plant. For quality reasons, the  $CO_2$  enriched gas has to be cleaned. Therefore a well-known approach in the chemical industry is the Benfield synthesis gas scrubber where the acidic components in the gas stream (such as  $CO_2$ ) are absorbed by means of a scrubbing liquid.

In the purification of the gas stream, the focus is to prevent an under- or overdosing of the scrubbing liquid. Inline analyzer are used to prevent insufficient gas cleaning and in case of overdosage the higher material usage and associated costs.

By a continuous measurement directly in the process, an optimum concentration management can be assured.

## Application

A hot potassium carbonate ( $K_2CO_3$ ) solution is used in the Benfield process as a scrubbing liquid. The gas to be cleaned is passed under high pressure in a counterflow through the  $K_2CO_3$  solution in the absorber. The scrubbing solution  $K_2CO_3$  is enriched with  $CO_2$  and reacts partially to potassium bicarbonate  $KHCO_3$ . The purified gas leaves the absorber at the upper end. The temperature range in the absorption process is between 100 °C and 110 °C.

The desorption is carried out by steam and under pressure loss, whereby the captured  $CO_2$  is emitted into the scrubbing liquid. The regenerated  $K_2CO_3$  is then fed back to the absorption cycle.

The LiquiSonic® 40 analyzer allows the optimal response to concentration fluctuations in the scrubbing liquid. Too high  $KHCO_3$  concentration results in foam formation and lesser  $CO_2$  absorption performance. At too low  $K_2CO_3$  concentration, sufficient absorption is not ensured.

## Customer value

LiquiSonic® 40 provides a precise inline concentration measurement of 3-component mixtures with real-time monitoring. This allows an automatic control of the  $K_2CO_3$  concentration in the range of the maximum absorption or the maximum efficiency of the scrubber.

LiquiSonic® enables a reduction of labor cost through the elimination of manual process steps:

- time saving: 1 h per day
- cost per hour: 50 € (60 \$)
- total cost savings: 10.000 € (12,000 \$) per year

Through prevention of under- or overdosing, the operational costs related to their consumption at absorber ( $K_2CO_3$ ) and desorber (steam) are saved:

- steam savings: 0.3 t per hour
- steam costs: 30 € per t (40 \$)
- operating hour: 6000 h per year
- total cost savings: 54.000 € per year (72,000 \$)

Investment: approx. 25.000 € (30,000 \$)

Amortization: approx. 6 month

## Installation

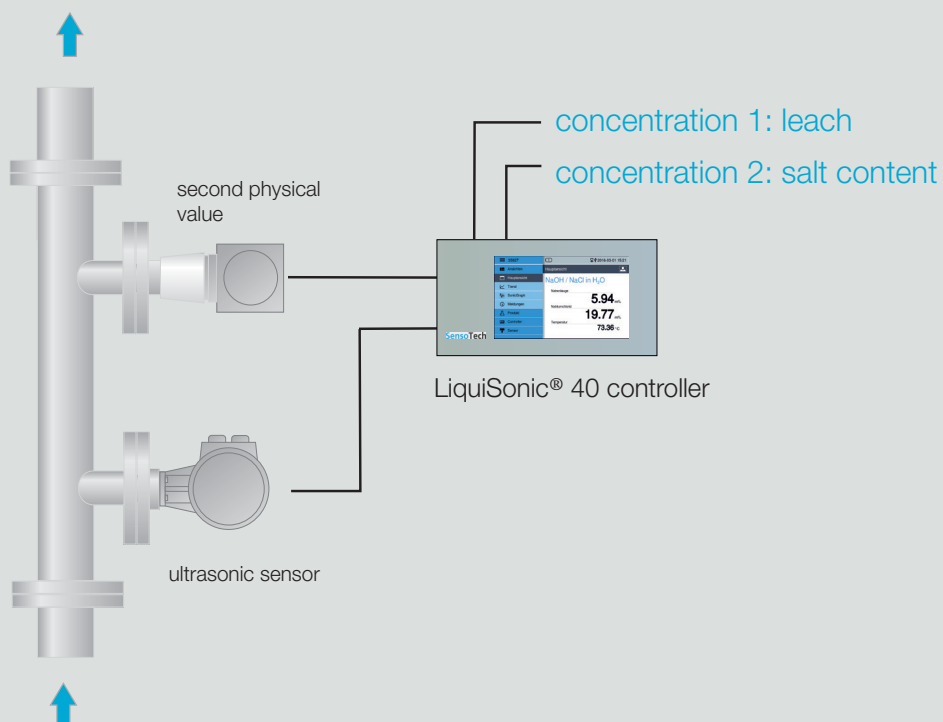
The LiquiSonic® 40 sensors are easily installed in the pipeline (typically DN 80) from the absorber to the desorber and the recirculation.

The robust sensor construction and the optional special materials, like HC2000, promote long process life.

The LiquiSonic® controller 40 is connected to the LiquiSonic® immersion sensor and the device for the second physical value. The controller displays the  $K_2CO_3$  concentration and  $KHCO_3$  - salt content.

Typical measuring range:  
 concentration range  $K_2CO_3$ : 0 to 25 wt%  
 concentration range  $KHCO_3$ : 0 to 25 wt%  
 temperature range: 80 to 110 °C

## Sonic velocity measurement with LiquiSonic® 40



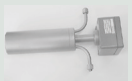
## LiquiSonic® 40



21001411  
LiquiSonic® Controller 40 V10



21010138  
Immersion sensor V10 40-40 Ex FM, ANSI 2", L150, HC2000



21006020  
Density sensor BR, DN15, PN40, Ex i, 1.4571,  $T_{max}=150^{\circ}\text{C}$

BUS

21004435  
BUS connection: Profibus DP



21004449  
Network integration



21004110  
High power sensor electronic



21004202  
Bus cable indoor (100m)



21007846  
Factory acceptance test (FAT) certificate



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