mott *corporation*

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Spargers for pH Control in Chemical Treatment Plants

Application: The customer needed the pH level adjusted in a chemical treatment tank. They wanted to eliminate use of sulphuric acid by using CO_2 instead. There was a restriction on the diameter and length of the sparger to be used.

Mott Product/Solution: After data collection, a sparger was sized based on the pH level, liquid flow rate, and the target time provided by the customer. The Industrial Sparger was chosen to be most efficient for this application. Per customer's specification, a flange-mounted sparger was developed.

Sparger Features/Benefits:

Feature	Benefit
Sintered Metal	Rugged Construction, Reliable in Service
Many Configurations Available	Meet Specific Application Requirements
Available in Wide Variety of Metals & Alloys	Corrosion Resistance (Chemical Compatibility), Temperature Resistance
Large Gas-Liquid Contact Area	More Complete and Rapid Mass Transfer
Precise Control of Bubble Point, Permeability And Uniformity of Permeability	Consistent & Repeatable Performance

Competition:

- Drilled Pipe
  - Poorly Dispersed Gas
  - Large Bubbles
  - Low Surface Area

Competition (continued):

- Mott Sparger
  - Evenly Dispersed Gas
  - Millions of Tiny Bubbles
  - High Surface Area

High efficiency sparging is achieved by fine bubble propagation. The fine bubble propagation will provide maximum surface area for effective "mass transfer".

Note: In addition to the pore size of the media, there are several factors that influence bubble size. These factors are: gas exit velocity – the lower the velocity the smaller the bubbles; and liquid surface tension – the lower the surface tension the smaller the bubbles.

Sizing Procedure for In-Tank or Vessel Sparging:

1. Determine gas flow required in standard cubic feet per minute (SCFM).

2. Determine the liquid pressure at the sparger, in psig (P).
   2.1 For open or vented tanks:
   P (psig) = liquid head (feet) x 0.433 x specific gravity of liquid
   (Specific Gravity of water = 1.0)

   2.2 For closed tanks or vessels with a pressurized head space:
   P (psig) = Head Space Pressure (psig) + Liquid Head Pressure (psig)

3. Determine liquid temperature, °F (T).

4. Determine ACFM, from SCFM using standard gas formula:

$$ACFM = SCFM \times \frac{14.7}{[14.7 + P]} \times \frac{(460 + T)}{520}$$

5. Select Gas Exit Velocity, FPM, using chart:

In-Tank, not agitated:		In-Tank, agitated:	
5-10 FPM	Design	1-5 FPS*	25 FPM Design
25 FPM	Maximum		50 FPM Maximum
		5-10 FPS*	25 FPM Design
			100 FPM Maximum
		> 10 FPS*	50 FPM Design
			150 FPM Maximum

*Calculate agitator tip speed:

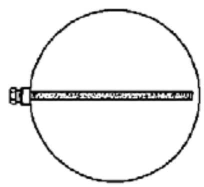
$$\frac{\text{Agitator Diameter (in)} \times \text{RPM}}{229} = \text{FPS}$$

Note: Lower exit velocities will produce smaller bubbles. Exit velocities may be less than the design values given.

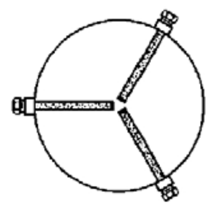
6. Calculate sparger area required, ft^2, (A).
   $$A = \frac{ACFM}{FPM}$$

7. Select appropiate Mott sparger element (or elements), and determine the best in-tank arrangement based on process requirements.

VARIOUS CONFIGURATIONS

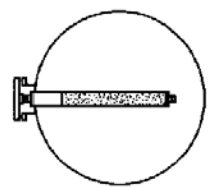


Single Element
Type 6400 Element
Side Mounted



Multiple Elements
Type 6400 Elements
Side Mounted

Single Element
Type CD Element
Dip Leg Mounted



Single Element
Type CD Element
Flanged Side Mounted

Manifolded (Cross)
Type A Elements
Dip Leg Mounted

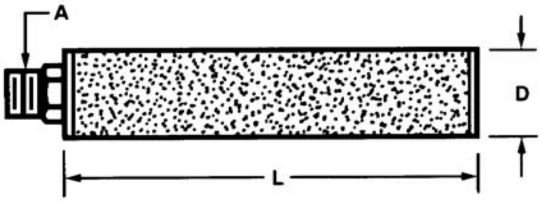
Cross Tank
Type A Elements
Flanged Side Mounted

Mott recommends the use of media grade 2 or general gas sparging.

The use of reinforced or supported elements is also highly recommended.

VARIOUS END FITTINGS

TYPE A HEX NIPPLE
SPARGER ELEMENTS



TYPE G SPARGER ELEMENTS
(FOR WELDING BY OTHERS)