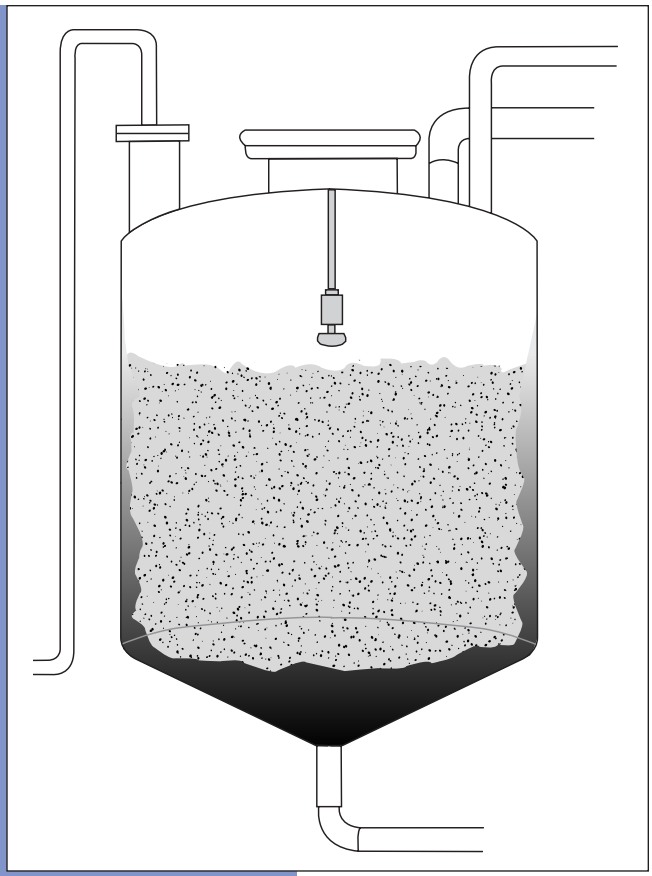
Summer 2001

Chemical Industry Application Notes

Engineering to help you optimize nozzle applications

Sizing tank washers: How much is enough?



Analyzing a tank washing application has to begin with a study of what it is you're washing out. The nature of the cleaning process and the difficulty of removing the soil will dictate what kind of tank washing nozzle you use and the amount of liquid.

One of the questions we deal with regularly when discussing tank washer selections with customers is, "How much liquid flow is required to clean a tank?" That's not an easy question and in the same league with "How many horsepower does a car need?" As in many situations, the answer is, it depends. While you will ultimately need to be the judge for your specific applications, the following guidelines should be helpful.

- How big is the tank? You know the volume, but think in terms of interior surface area and distance between the walls. If you compare a spherical tank and a tall "silo" tank of the same capacity, you could come up with substantially different answers. Begin your analysis by calculating the interior surface area (it doesn't have to be very precise for elliptical tank heads, etc.) and the longest distance that the nozzle will have to spray from its mounting position.

- What is the nature of the cleaning function? Think about what you're trying to wash out of the tank. Is it simply a liquid residue that has to be rinsed away? Is there solid material that has to be knocked off the walls? Are there mineral deposits? Some residues are more difficult than others.

- What is the chemical action of the cleaning solution? Water may be fine for washing out molasses, but it probably won't do the job for something oily. Alkali cleaners will help with many products, but won't help with mineral deposits. The cleaner should soften, dissolve or otherwise break down the soil in the tank to move the process along.

- How congested is the interior? A mixer with large internal blades and paddles will require a much different approach than a clear space.

Once you've answered those questions, you can begin to make some determinations.

First, when designing CIP systems for relatively easy cleaning tasks, most experts size tank washing nozzles and pump capacity to deliver 0.15 to 0.30 gallons per minute per square foot of internal surface area. Simple tanks with uncluttered interiors can stay around the lower figure. Complex shapes may need the higher end. Difficult applications may require 0.50 gpm per square foot.

Second, choose an operating pressure that is appropriate for the nozzle. Higher pressure is not always better. Many free spinning tank washers work best (throw liquid the farthest with the most impact) when running at 20-30 psi. Others can take advantage of higher pressures. If you're not sure, do some experimenting or discuss it with the manufacturer.

Third, determine how long the unit needs to run. The simple answer is until the tank is clean, but sometimes figuring out when that is can be tricky. In some cases, a visual check may be enough. In critical cases, there are specific validation methods using swabs or tracer substances which can quantify the process. Tank washers with standard nozzle heads or fixed spray balls wash the whole interior almost constantly. Gear driven mechanical units need a specific period of time to complete enough rotations to sweep the entire tank interior. This information should be available from the manufacturer.

Fourth, make sure your chemical cleaner is suited to the task. Cleaning with the right chemical and temperature can drastically improve the process and shorten the time and liquid required. There are a number of manufacturers in this field (Ecolab for example) who can assist you in choosing the proper solution for your various installations.

These are only guidelines. Your situation will require specific analysis since your needs are unique. We produced a paper entitled "Choosing a Tank Washer, Key to an Uncontaminated Process" for a trade show presentation. This goes into greater depth on the topic and the whole issue of the cleaning process. Ask for a free copy.

Fortunately, Lechler offers a very wide range of tank washing nozzles so we can help you find something appropriate for just about any application. Whether it's a tiny 5 gpm unit for barrel washing or 200 gpm for 30 foot storage tank, we can help you make the best selection.

Nozzle layout for headers, Part 2: Covering a large area evenly

In our last issue we discussed the process of laying out headers using flat fan nozzles. (If you didn't receive it, ask for a copy.) These are especially useful when trying to spray a moving target such as something carried on a conveyor.

There are other types of applications where it is necessary to cover a large area without either the nozzles or the target moving. Examples could be distributing liquid over packing in a tower or washing mist eliminator panels. These applications call for a large array of full cone nozzles distributed over the surface. If you spend a few minutes making a sketch of the installation and doing a few calculations, you can generate a nozzle layout that will make the liquid distribution very consistent over the surface.
Looking at the two diagrams, you will see that there are two typical layouts, the square and offset. Either method works, but they have their own characteristics.

Square is easiest with minimal overlap. If coverage is not highly critical, this can be the most cost effective approach. However, if the nozzles are too narrow or the header is too low, the intersections at the corners can open into voids. If the opposite is the case, the corners can become heavy spots with overlap from four nozzles.

Offset requires a few more nozzles, but is frequently preferred as more forgiving of slight variations in nozzle spray angle and header height position. There is little chance that holes can form in the spray and the maximum possible layering at any point is three. This security also comes at the cost of about 15% more headers.

Full cone nozzles are available in both narrow and wide spray angles. When impact is not a major concern, using the widest spray angle possible, 120°, will minimize the number of nozzles and headers. However, droplets at the edges of the individual spray circles hit the target at only 30° above horizontal. If a more perpendicular spray is required, a narrower nozzle will accomplish that. Unfortunately, that will increase the number of nozzles and headers.

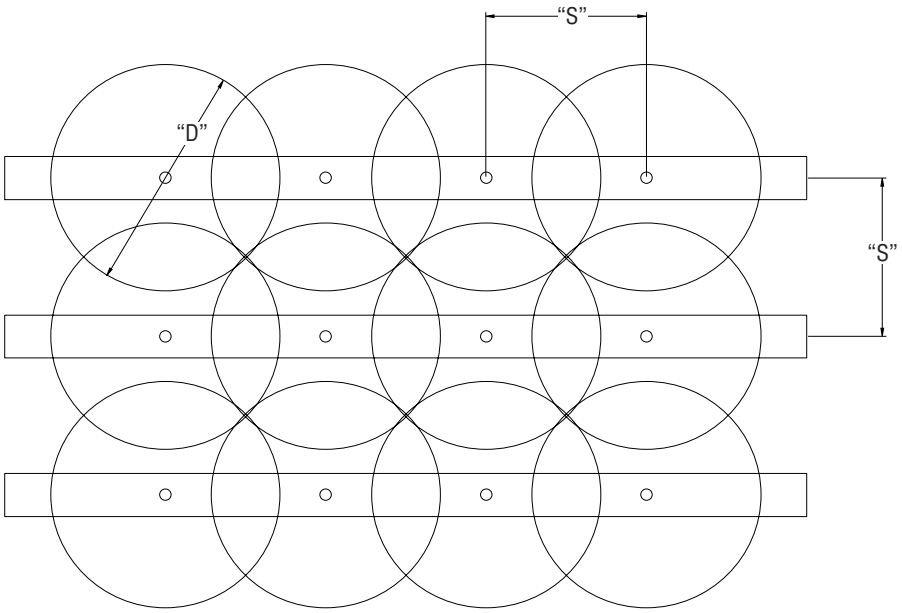
Making the position calculation is not complicated. Once you have chosen the spray angle nozzle that you want to use, calculate the diameter of the spray circle at the appropriate distance.
For square arrangements, multiply the circle diameter by 0.7 which will give 30%

overlap between the sprays. This measure then becomes the distance between the nozzles on the headers and the distance between the header center lines.

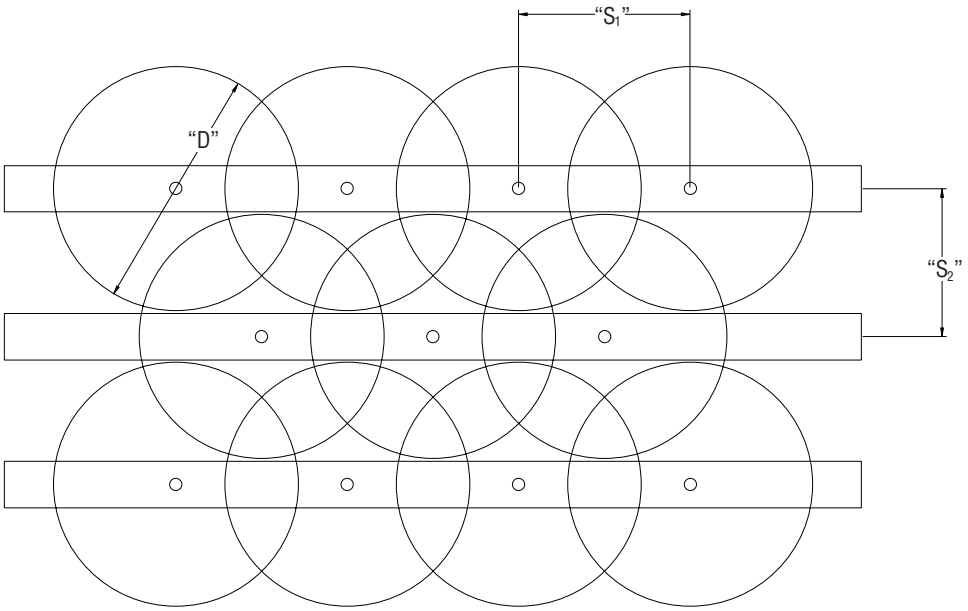
For offset arrangements, use the same calculation for the distance between the nozzles on the header, however the headers need to be closer together and offset by half the distance between the nozzles. Multiply the nozzle spacing distance by 0.85 for the header spacing.

These calculations are easier using our handy Spray Nozzle Calculator. This FREE slide chart is available at your request. See the back cover for details.

In addition to making individual nozzles, Lechler can design and build headers for many applications. Give us your dimensions, flow rates and so forth, and we can lay out the configuration for whatever spray attributes you need. Just ask for help.



Square S = D x 0.7



Offset $S_1 = D \times 0.7$ $S_2 = S_1 \times 0.85$

Come see us in New York

Booth 1218

2001 chem show

It's not too soon to start planning for the Chem Show. We'll be exhibiting and would like to see you there. Ask us for a VIP invitation for reduced admission.

FREE Spray Nozzle Calculator

Ask for one of our handy calculators. It can help you make many quick calculations and conversions related to spray nozzles and liquid flow:

- Spray coverage vs. distance
- Flow rate vs. pressure
- PSI vs. bar
- Gallons vs. liters
- Pipe flow and sizing

Check the box below and get your copy!

Do you want future issues of this newsletter?

You probably don't think about nozzles every day. Unless you work for a company like ours, there are other things on your mind. But, when the topic comes up, you need to know where to turn for help. These papers contain technical information, application tips and ideas for nozzle applications specifically for the chemical and pharmaceutical industries.

If you want future issues (four each year) and our most current catalog information, fax this page back to us with the YES box checked. If there is someone else who might like it, send his or her name too. Make sure we can read your address label.

If you don't, check the NO box. It will save paper, printing and postage if you aren't really interested.

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- ❑ Send me your previous issue too. I missed it.
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