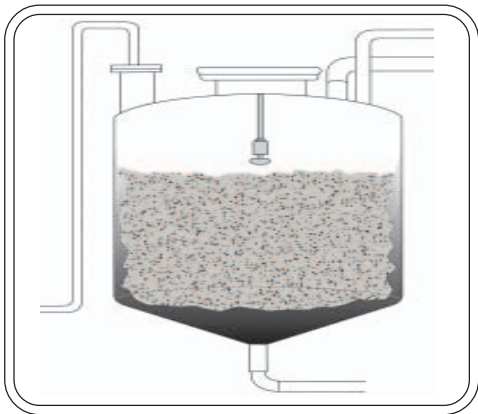




## How to Select Nozzles for Tank Cleaning Applications

### 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 0.10 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

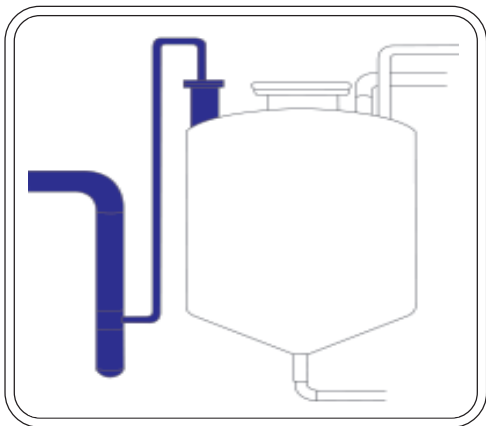
interior. This information should be available from the manufacturer.

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.

#### Piping for tank washing: Hints from the experts



*This tank washing piping (shaded in blue) will give no end of headaches with mixed pipe sizes, sections that won't drain, a dead leg and a long spud. These should be cleaned up for better operation.*

At some point, manual tank washing gets to be a chore. Even when you're using an effective nozzle just for the purpose (such as a Lechler ACCU-Clean™ or Whirling Nozzle) the process of opening the cover, making the hose connection and climbing up the ladder can get old.

The real advantage for tank washing is the ability to leave the nozzle mounted in place so the whole pro-

cess can be done with the turn of a valve. Systems that use this technology are called CIP for "clean in place" and use combinations of tank washing nozzles, cleaning solution storage tanks, cleaning solution injectors and controls to automate the process completely. The dairy industry developed the approach given their need for very thorough and consistent sanitation of all their process equipment. Pharmaceutical manufacturers soon followed for the same reasons.

While you may not need to build a complete CIP system, there are some tips you can learn from these designers that will make your job easier for simple permanent installations:

- **Size the tank washer properly.** For most cleaning, the rule is 0.1 to 0.3 gallons per minute per square foot of interior surface. To Avoid interior shadows, make sure you have enough tank washers positioned throughout the interior that will clean around internal obstructions such as mixing vanes.
- **Avoid piping dead legs.** This is good advice at any time, but especially with cleaning systems. Otherwise product can be contaminated with cleaning solutions.
- **Keep tank spuds short.** Long spuds are no better than dead legs and are difficult to clean.
- **Make sure gravity will drain every thing.** Once the cleaning sequence is finished, the whole system should drain easily on its own. That means properly pitched piping.
- **Watch out for pipe T's.** T's that point down can accumulate sediment. T's that point up can trap gas. It's best to point them horizontally.
- **Keep the solution moving.** Cleaning solutions should move through pipes quickly, 4 to 5 feet per second, to ensure that nothing can settle out and air cannot be trapped.
- **Keep the solution clean.** Your tank washing nozzle should not be the "system strainer." With its orifices, it can trap any debris in the line which will hurt its effectiveness. Make sure you have a more effective way to do that.

These suggestions are just the beginning, but they should give you some ideas. Automated cleaning setups are not difficult to configure, don't have to cost a lot of money and can save a huge amount of time and effort.

#### Preventing contamination: Nozzles in the product pathway

There are frequent situations where a nozzle, especially a tank washing device, is mounted in process equipment where it can come into contact with product or feedstocks. That nozzle could become a source of contamination, but it does not have to if you follow

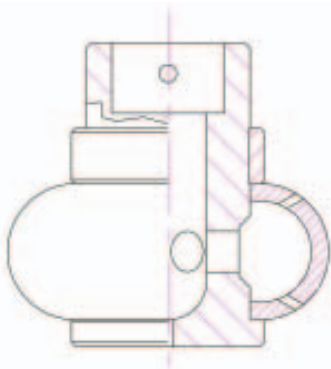
some basic practices that will minimize such problems. The easiest example to consider is a tank washing nozzle mounted inside a tank. If it's part of a CIP system or left in the tank for accessibility reasons, it probably stays in place through all product cycles. During cleaning periods, it sprays washing chemicals and rinses. While the system is operating, it can be splashed with product or even immersed completely. The key is to keep it from accumulating materials that could ultimately become contaminants.

Depending on your products, you must determine how easily they can be contaminated. For illustration purposes, let's look at an extreme case common to the pharmaceutical or food industry. They have developed specific protocols for handling these situations which you might find very informative.

**Illustration 1** below shows a tank washer in a tank where it is immersed in the product. Just a few minutes ago, it could have been spraying a bactericide which we don't want mixed with the current contents.



**Illustration 2** below shows a close-up of the tank washer designed specifically to work in critical situations. Here are some of the features it has to minimize contamination potential.



**Inlet** - The nozzle attaches to the feed pipe using a pin but no threads. This fitting allows a portion of the sprayed liquid to escape through the neck and around the pin. This flushes the connection and makes sure

no material builds up in that area. Threaded inlets are not normally allowed in sanitary applications.

**Self Draining** - When mounted vertically, the unit is designed with internal channels and holes that will allow all the liquid to drain by gravity alone. When combined with properly installed piping (see the previous article) all the liquid used will drain from the pipe and nozzle with no dead areas where it can accumulate.

**Self Flushing** - While the nozzle is spraying, all the moving parts are lubricated and flushed with the liquid. This keeps the internal sections from trapping any deposits.

**Surface Finish** - All internal and external surfaces are very smooth and free from pockets or crevices. Even internal corners have a radius. Any places where contamination could accumulate need to be minimized.

**Material** - The actual material of construction has to be appropriate for the application and one that does not contribute to the development of contaminants.

These concepts cover many of the requirements for such critical applications and apply to nozzles for other applications as well. In some cases specific feedstocks may be added through a fixed nozzle. The same points could apply to that.

For your particular application, you need to determine how critical each element is. If contamination is not very likely, you may be able to relax some of the issues.

One of the best documents on the topic is available from IAFIS, who administers the 3-A Sanitary Standards Program.\* Their document "3-A Sanitary Standards for Spray Cleaning Devices to Remain in Place, No. 78-00," is one of the most concise guides for high sanitation applications available.

Lechler manufactures tank washing nozzles that have been granted the 3-A® Symbol for use in strict sanitary environments such as dairy and food manufacturing. These tank washers meet the requirements of 3-A Standard 78-00. These nozzles, when used in conjunction with appropriate mounting, piping and operational practices, provide the means to deliver reliable cleaning with minimal contamination potential.

\*IAFIS; 1401 Dolley Madison Blvd; McLean, VA 22101  
703-761-2600 or [www.3-A.org](http://www.3-A.org)

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