THE SPRAY NOZZLE PEOPLE

SNP NOZZLE KNOWLEDGE DOWNLOADS

TANK CLEANING SYSTEMS FREQUENTLY ASKED QUESTIONS

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TANK CLEANING FAQ'S

Q1. WILL I NEED TO CHANGE MY PUMP?

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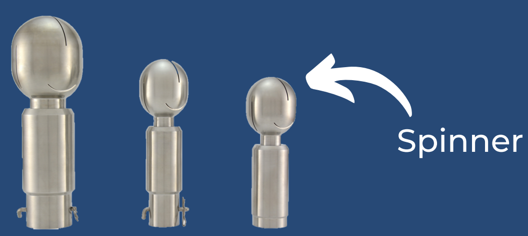
Will I need to change my pump? This is a question we get asked a lot and this is the first in a series of FAQ's answering common questions about tank cleaning and changing tank cleaning systems. The short answer to whether you will need a new pump for your CIP system is possibly.

There are two limiting factors for a pump: the maximum pressure it can deliver and the maximum flow rate it can deliver. And this is what needs to be considered when looking at changing tank cleaning systems.

Generally speaking, if the newly proposed tank cleaning system is lower in both required pressure and flow rate, then the existing pump will be fine and it won't need to changed. If the required or ideal new pressure for the new tank cleaning system is higher or the flow rate is higher, then there will be a possibility that the pump needs changing. However, this is not always the case.

Normally, when moving from a spray ball or to a spinner, (upgrading from a static spray ball to a spinning spray ball), the optimal pressures will be roughly the same. Whether or not the pump can operate at high pressure doesn't need to be considered because it won't need to; both these systems run at roughly the same pressure. When moving from spray balls to spinners, the overall flow rate for the spinner is, in almost all cases - and this is one of the reasons why we make that move - lower than in the spray ball.



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Overall, moving from spray balls to spinners means that the existing pump is going to be fine. If, for whatever reason, it is the other way round and you're downgrading in effect from a spinning spray ball to a static spray ball, then the flow rate of the new spray ball system needs to be looked at because if that's higher than the existing pump can deliver, you may need to change the pump to a higher capacity pump.

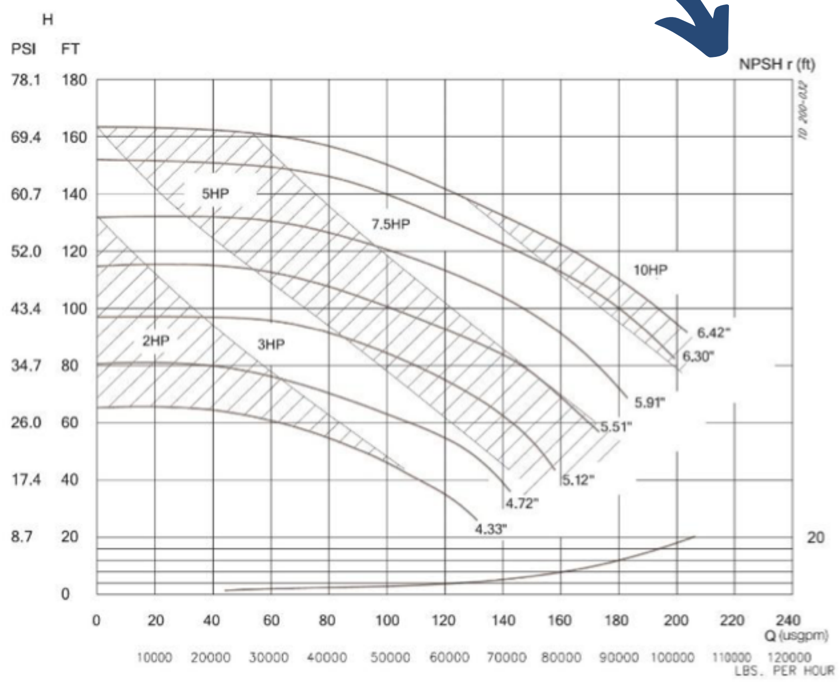
When moving from spinners and spray balls to rotary jet cleaners, it becomes more complex. Typically, these rotary jet cleaners work most efficiently at pressures above approximately six bar. Ideally, it needs to be kept within the eight to ten bar fluid pressure range. This is quite a lot higher than the two to three bar that is optimal for spinners and spray balls. Therefore, it is vital to ensure that the pump can actually deliver the required pressure. Flow rates again, typically will go down when moving from spray balls to rotary jet cleaners.

Rotary jet cleaner

The flow rate capacity of the pump is not the main concern here. Normally, this would be fine, but that higher maximum pressure the pump can deliver is a worry; if it cannot deliver the required pressure, the pump will need upgrading.

However, things become more difficult when looking at certain pumps such as centrifugal pumps. This is because centrifugal pumps will deliver variable pressure depending on what the pipe system actually sees; moving from a spinner running at three bar to a rotary jet cleaner that wants to run at six bar, if the flow rate for the rotary jet cleaner is considerably lower, that centrifugal pump may equalise at a higher pressure and a lower flow rate. A typical example would be moving from a spray ball, running at three bar using 250 litres a minute, and imagine the rotary jet cleaner that you're proposing wants to run at six bar at 125 litres a minute, that same pump may well be able to do that.

At this stage, the pump curve needs to be checked to see whether it can cope with the lower flow rate, higher pressure scenario.



If it can't, then the pump will need upgrading. But it's important to remember that gravitational and frictional pressure loss as well. The pressure right at the pump is going to be different to the one delivered actually at the cleaning head. If you're moving to a high pressure jet cleaning system, you're almost certainly going to need a new pump. High pressure tank cleaning systems need between 50 and two hundred bar.

That almost always requires a change of pump and especially a specialist high pressure pump. The pipework is also likely to be in need of an upgrade, in all likelihood, to high pressure pipework.

TO RECAP:

- You're not going to need to change your pump if the required pressure and flow rate on the new tank cleaning system are both lower in the new system than the old system.
- You probably won't need to change your pump by moving from spray balls to spinners.
- You may well need to upgrade your pump to be able to deliver the higher maximum pressure when upgrading from spinners or spray balls to jet cleaners but you might get away with it if the flow rate is reduced and the pump naturally can settle into that high pressure regime.
- You will definitely need to change your pump when moving to a high pressure system and probably your pipework as well.

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Q2. HOW LONG DOES IT TAKE A CIP SYSTEM TO CLEAN A PROCESSING OR STORAGE TANK?

How long does it take to clean a processing or storage vessel? It is a key question and can be one of the most important in terms of operational efficiency. When they're being cleaned, any tanks are not being used for whatever they're normally being used for.

Effectively, what we have is operational downtime when the tanks are being cleaned. The time it takes to clean a tank can actually be the most important thing for many customers, and improving on tank cleaning times is a key thing we get asked to address.

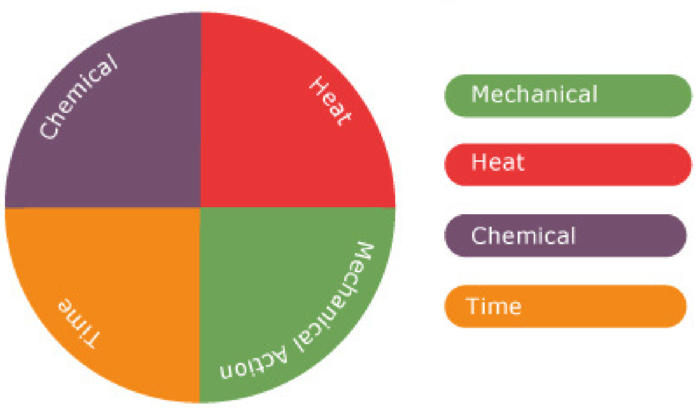
It's impossible to actually answer the question because each residue and each tank are different, so rather than talking about absolute terms i.e. for this residue, it will take this long to clean this tank, we talk about it in relative terms, i.e. comparing the different time periods different styles of tank cleaners will take.

The length of time any tank cleaning or any cleaning operation needs to run depends on four main things:

1. Time
2. Mechanical action
3. Chemical action
4. Heat

Each of these factors combine to give an overall cleaning effectiveness.

Sinner Diagram



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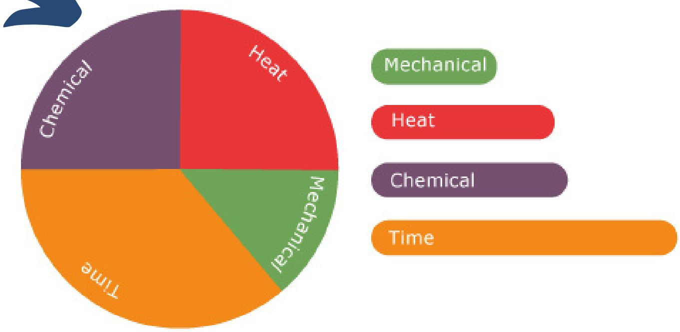
To reduce one of these four factors, one of the others needs to be increased and vice versa.
When answering the question, how long will it take to clean the tank, the other three factors need to be made clear.
To help answer this tricky question, the mechanical action component can be looked at because this is the key difference between the different styles of tank cleaners.

We'll assume for the purpose of this exercise that the chemical action and heat will be kept. The focus will be on the varying mechanical action components of the different styles of tank cleaners.

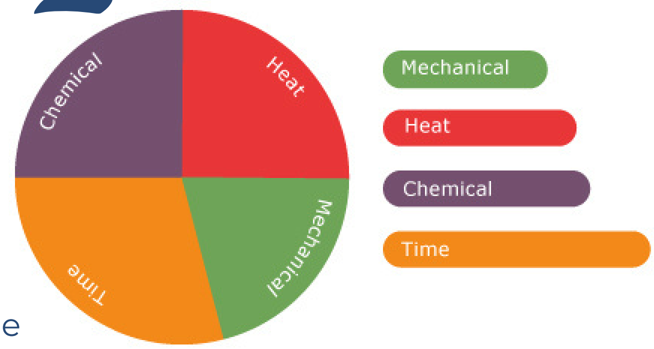
Spray balls have a very low mechanical action, and so all other things being equal, they will need longer to clean any tank.

Spray Ball



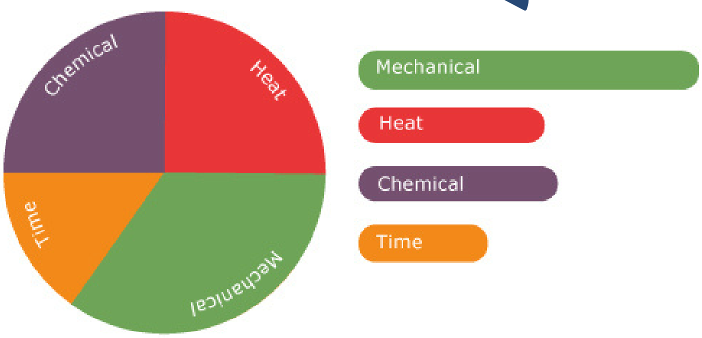
If the mechanical action is increased by upgrading the spray balls to spinners, the mechanical action of the cleaning system is improved and so can reduce the time it takes. **It's hard to estimate by how much, but roughly the same level of cleaning in about 50 to 75% of the time is expected, so a 20 minute clean would be reduced to between ten and 15 minutes.**

Spinner



By upgrading further to rotary jet cleaners, the mechanical action is increased even more dramatically and even bigger reductions in time can be seen.

Rotary Jet



The same level of cleaning can be delivered in perhaps 25% of the time. **So that same 20 minute cleaning for a spray ball will be reduced to perhaps five minutes with a rotary jet cleaner.**

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However, there's one big caveat with this. The jet cleaner must be able to complete its full cleaning cycle to ensure that the jets reach all areas of the tank. Otherwise, parts of the tank simply won't be cleaned. So there's a hard limit on the time savings that can be achieved i.e. you can't reduce the cleaning time below that overall cycle time.

Thus, with very light residues in small tanks that are cleaned well by a single spray ball in five minutes, you're going to struggle to improve the cleaning time even with rotary jet cleaners; most cleaning cycles of most jet cleaners are more than five minutes. You can still improve on overall water consumption by making that upgrade, and the jet cleaner may well do the same job with less water over that five minute period, but from a purely time perspective, improvement is unlikely to be achievable with those kind of light residues in small tanks. However, if the spray ball wash was taking, say, 30 minutes, then it's a completely different story and the rotary jet cleaners will likely produce significant time reductions.

To conclude, the absolute answer is difficult to give because it's very much dependent on the residue in the tank in question, but the relative answers given here can help you make some sensible decisions when choosing the style of tank cleaning that you want for your CIP system.

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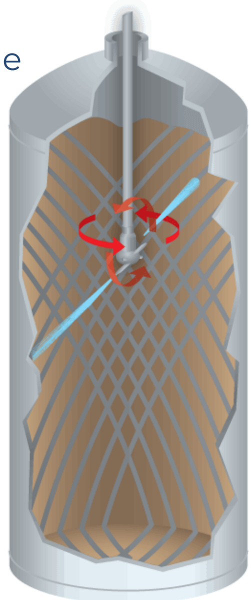
Q3. WHAT IS THE OPTIMAL POSITION FOR A TANK CLEANING HEAD?

As a general rule of thumb, all tank cleaners need to be positioned on the centre line of the tank.

In a common cylindrical tank for example, **the tank cleaner needs to be positioned on the centre line towards the top, about one third of the way down the tank** from the top of the tank.

This general rule applies for all styles of tank cleaners, and it generally gets the best results. The reason for this is gravity is our friend in tank cleaning; the lower parts of the tank will naturally receive all of the washed down water that is used in the cleaning operations for the higher part of the tank.



One third of the way down on the centre line is the optimal position, but there are some complications. The first thing to be considered is product line. **If the product line is normally above two thirds of the way up the tank, then it's often advisable to raise the tank cleaner above this line.** It may be suboptimal for cleaning, but having the tank cleaning head covered with the product in normal operation can cause more problems. This depends very much on the product, and in many cases, it's fine to have the tank cleaning head submerged but it does need to be considered.

The next thing to think about is internal obstructions. Central agitators or other tank internals may mean it's impossible to have the tank cleaning head on the centre line.

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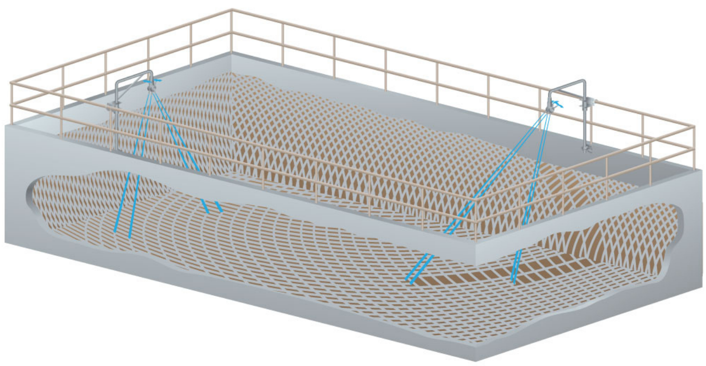
Furthermore, these **obstructions will cause shadowing and block the path of the tank cleaning fluid, meaning some parts of the tank wall are not cleaned**. In this situation, we need to **position the tank cleaner away from the centre line** because it's not possible to put it on the centre line. If we are only using one tank cleaner and shadowing isn't of concern, then getting it as close to the centre line and that optimal position as possible is a good idea. **If two tank cleaners were being used to overcome the shadowing effects from internals or the central agitators, then having them equidistant from the centre is best practice**.

Effectively, what you want to **consider is dividing the tank into two half-cylinders or two virtual tanks and then have each tank cleaning head positioned optimally for that half-cylinder**, i.e. the centre line of that half-cylinder and each tank cleaning head is now responsible for cleaning half the tank.

There will be large parts of the tank cleaning action from each virtual tank that will spill over into the other tank, and that's bonus cleaning. But if the system is designed so that each half tank can be cleaned by a single tank cleaner and that's positioned optimally, then that's going to be best practice.



What about odd shaped and large tanks? Things get a little bit more complicated here when moving away from the standard cylindrical shaped tanks. **Some general rules of thumb for any shaped tank - one third of the way down the tank is still a good general rule from the top.**

The basic principle wanted is to have as much of the tank as equidistant from the actual tank cleaning head as possible. This is often not possible in odd-shaped tanks.

In long tanks or cylindrical tanks on their side, for example, in order to get equal coverage and equal cleaning, a couple of tank cleaners at each end of the cylinder would suffice.

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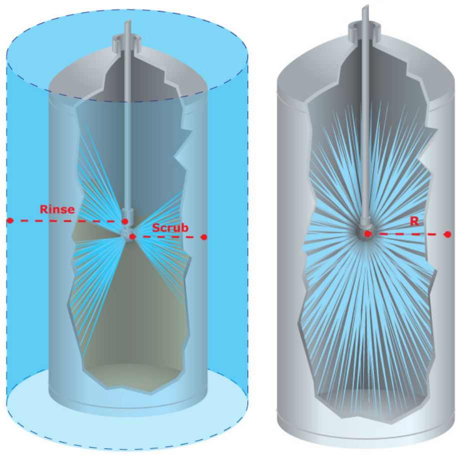
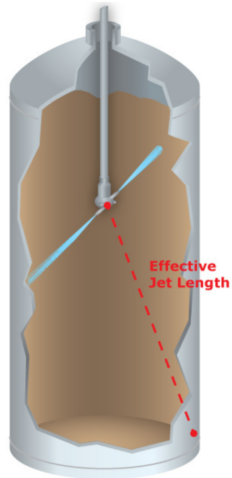
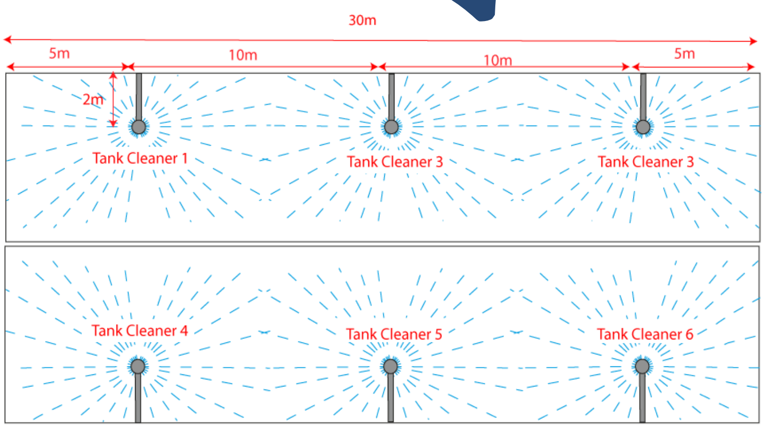
When looking at the maximum cleaning distances of any tank cleaner, the worst-case scenario needs to be considered, i.e. what's the furthest point that needs to be cleaned by the tank cleaner? **For spinners and spray balls, this distance should be the maximum horizontal distance from the cleaning head to the wall.**



This should be kept below the scrubbing distance indicated on the data sheet. **For rotary jet and high pressure cleaners, the best practice is to measure the distance from the cleaning head to the furthest point that needs to be cleaned.** In most tanks, this will be the bottom edge of the tank. This distance can be calculated using Pythagoras theorem. The distance should be less than the rated effective cleaning jet length on the data sheet. It is sometimes, however, acceptable to use the same basic horizontal distance calculation to the tank wall when sizing and positioning jet cleaners. Typically for lighter residues, this is fine.



For odd shaped tanks that require multiple tank cleaners, it's best to divide the tank into virtual sub tanks again and then position a tank cleaning head in each of these virtual sub tanks using the same rules as if they were separate tanks and they were only being cleaned by that one tank cleaner. Any of the overspray outside of these virtual tanks into the next adjacent virtual tank is just bonus cleaning. But if you stick to the rule that you're cleaning a virtual tank with one tank cleaner, you're not going to go far wrong.



So these are the principles that we apply when designing tank cleaning systems with regards to optimal positioning of tank cleaning heads. Please do not hesitate to contact us with any questions you may have.

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Q4. WHAT'S THE BEST WAY TO MOUNT A TANK CLEANING SYSTEM?

The tank cleaner for optimal results has been selected and now it needs to be positioned in the tank for optimal results. So, how is it now mounted in the tank? There are a number of general rules to apply when considering a suitable mounting system. Firstly, with any mounting systems, careful thought needs to be given to how the tank cleaner will be removed from the tank.

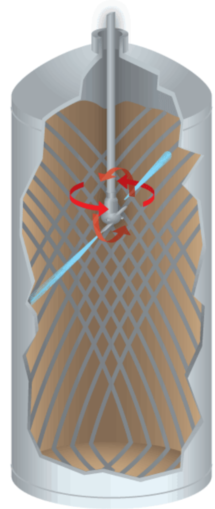
Tank cleaners will need to be maintained from time to time, so any such system needs to be easily removeable and this needs to be designed into the system. The second consideration is hygiene; many tank cleaning systems need to be highly hygienic, particularly in food processing and in the pharmaceutical industry. It is vital to ensure that all of the connections that connect the tank cleaner to the mounting system and then connect the fluid supply to the mounting system outside the tank, are hygienic connections as well.

Tri-clamps or something similar may be the answer to ensure a complete end to end hygienic design.

The third general consideration is how to get the tank cleaner in the optimal position in the tank.

How can the mounting system be designed so that it can get the tank cleaner where it goes/where it needs to be?

By far the most common, is top mounting/roof mounting. This is a simple, centrally mounted down pipe in the roof of the tank that positions the tank cleaner in the ideal position, and this can be fixed to the tank roof via a wall or a tri-clamp connector and the tank cleaner can be removed through the flange for maintenance.



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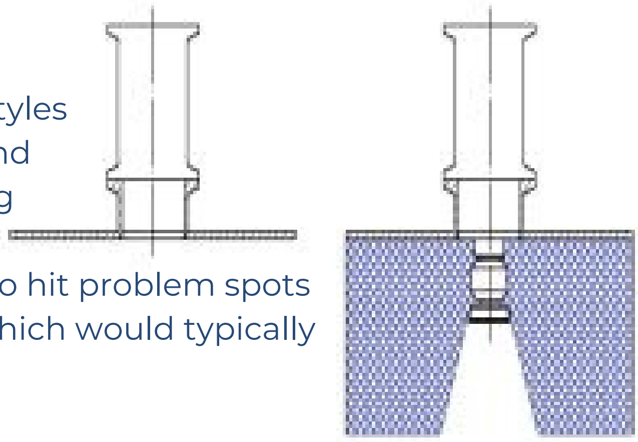
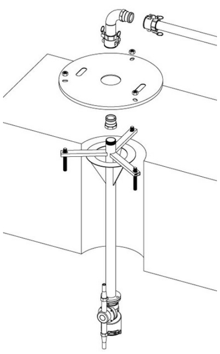
In some cases, an angled position pipework may be advisable to get the tank cleaner into the correct optimal position. If there isn't a suitable opening in the tank roof that's directly on the centre line, a slightly kinked pipe that will position the tank cleaner on the centre line may be advisable, but how this will be removed also needs to be considered.

The other option, if roof mounting isn't suitable for whatever reason, is side mounting. It is possible to come through the wall of the tank on a horizontal pipe and position the tank cleaner in the correct position. A 90 degree bend is needed at the end of that pipe so the tank cleaner can be positioned in its normal downward facing position and then due to the extended profile of that set up, how it will be removed again needs to be considered - it can be problematic but side mounting is an option.



Another option for certain styles of tank cleaners are wall mounted or through-the-wall and this is different to side mounting. Certain styles of tank are designed to sit flush with the wall and pop into the tank to perform their tank cleaning operation. These pop-up nozzles are generally secondary tank cleaners and are used to used to hit problem spots that won't be hit by the primary tank cleaner which would typically be positioned at the top of the tank.

So wall mounting is an option. What happens with these systems is, they're designed to sit very flush with the wall, so it just looks like a normal tank wall there when the tank is being used. When the cleaning cycle begins with the tanks empty, the nozzle pops through the wall under the fluid pressure and starts to spin or spray, hits its specific target and then pops back again once the fluid pressure has gone off, so that's a handy option for those spot cleaning applications.



Looking at bigger tanks, another option is what we call roof mounting. And this is different to the top mounting because what we're talking about here is very large tanks with perhaps concrete roofs that people can walk over e.g. on a stormwater attenuation tank, for example. In these situations, a down pipe up is inserted through a manhole cover and then the whole assembly can be lifted through the roof for maintenance.

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The important design consideration here is to ensure the weight of the overall downpipe assembly and tank cleaner are below the minimum health and safety weight for a single person lift. Otherwise, two people will be needed to take the tank cleaner out each time and that can be problematic. So keeping weight down in the design is an important consideration in that instance.

For very large open tanks again, like storm attenuation tanks, you obviously cannot roof mount tank cleaners. What happens in this situation? They can be mounted from the side and, typically, they are mounted on swing arms. 180 degree downward tank cleaners are used in these situations because, otherwise, using a 360° one without a roof will result in the fluid flying all over the place. Mounting them on a swing arm prevents this and could go two or three metres into the tank. This offers good positioning of the tank cleaner inside the tank.

When it comes to maintenance, the arm swings back to the side of the tank and the tank cleaner can be removed easily for maintenance.

This article outlines the most common options but please contact SNP if you wish to discuss a mounting solution that falls outside any of those mentioned.

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Q5. AT WHAT PRESSURE SHOULD WE RUN OUR TANK CLEANERS?

At what pressure should we run our tank cleaners? And is higher pressure more efficient, more effective?

This is an interesting question that we get asked an awful lot at the Spray Nozzle People when sizing in new or upgrading tank cleaning systems. And there are some counterintuitive and somewhat surprising answers to this question.

Let's have a look at each type of tank cleaner in sequence. **For spray balls and other static non-moving tank cleaners, the general rule is not to go much above three bar in fluid pressure and not really anything below one bar.**

The sweet spot of around two/two and a half bar is about right, but the pressure shouldn't be increased any further. This may seem surprising and counterintuitive; it is often assumed that if the fluid pressure is increased, the bigger the impact and the better the clean. But this is not the case.

Spray balls have very poor nozzles in them - they are effectively a sphere with multiple holes drilled in and those holes act as multiple nozzles. But they're very poor nozzles and they're just a hole in a sheet of metal.

The jets that come out of these don't have very good integrity. As the pressure and velocity increases, they tend to break up and atomise quite easily because it's a poor quality jet coming out of it. So, by increasing beyond that three bar pressure threshold, all that is being achieved is the fluid getting atomised more and any extra impact that might have been attained by the increased pressure is being destroyed. This is a waste of energy and there is no real point in spraying them much above three bar.

For spinning spray balls and rotary nozzles, the situation is quite similar.

Anything above the three bar pressure range will cause them to spin faster and the water to be thrown around quickly and atomised more.

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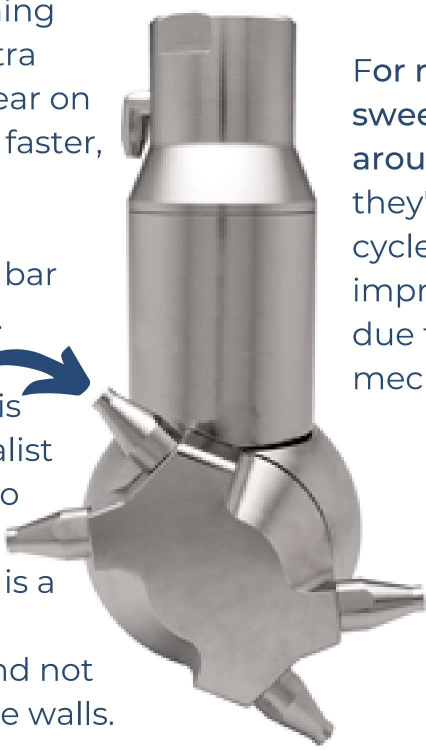
So again, **there's a sweet spot of around two and a half to three bar**, maybe a little bit more than that, where you can get the optimal cleaning out of them. Anything much above that will result in no extra impact. This will also increase the wear on these spinners because as they spin faster, they start to wear more easily.

Keep the pressure around the three bar mark and not much more than that.

For rotary jet cleaners, the situation is different. These cleaners have specialist nozzles on them that are designed to keep their jets in laminar flow, even at relatively high pressures, so there is a coherent jet coming out of these jet cleaners designed to stay laminar and not break apart and deliver impact to the walls.



That's the whole point of these tank cleaners. They're going to give good, stable jets at pressures, for most models, up to about ten bar. Increasing pressure from two to six to ten bar will improve both the jet length and the impact and also improve the overall efficiency of the tank cleaning head. The reason for that is they rotate through their cleaning cycle quicker and quicker as the pressure is increased and the decrease in the time it takes to complete its cleaning cycle more than offsets the additional flow rate obtained at the higher pressure. The result is the overall liquid used per cleaning cycle on any given tank cleaner, comes down as pressure is increased.

For rotary jets then, the sweet spot is normally around eight to ten bar so they'll use less per cleaning cycle and they'll have an improved cleaning action due to the improved mechanical action of the jets.

So, what about high-pressure tank cleaners? These are those that run at above 50 bar and often a lot higher than that.

These high-integrity nozzles produce needle-like laminar flow jets, even at very high pressures. But because the pressure is so high and the resulting velocity of those jets is so high, this laminar flow can't be maintained for as long as in the lower pressure 10 bar rotary jet cleaner styles. The effective jet lengths are reduced and this is because they're typically very low flow rate running at very high pressures and so very high speeds and much beyond a couple of metres from the tank cleaning nozzle.

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That atomisation effect comes into play again which makes them unsuitable for very large tanks where a jet length of four, five, six, seven or eight metres is required.

A high-pressure nozzle like this wouldn't be used in that situation because even though they have the higher pressure, the jet lengths just aren't effective at those ranges due to that atomisation effect. They can, however, be used on bigger tanks if multiple-stage cleans can be facilitated to effectively move the high-pressure cleaner into different parts of the tank. This will enable it to clean each bit within that relatively short range of its cleaning jets.

To recap, the general rules are:

- For spray balls and other static nozzles, to keep the pressure around two to three bar for optimum results. Any more than that is normally just a waste
- For spinners, the same rules apply - so around about that three bar and anything more than this pressure is going to be a waste
- For rotary jet cleaners, efficiency is improved as the pressure climbs and the sweet spot on those is normally about eight to ten bar. Running them at those pressures will likely produce optimal results
- For high-pressure jet cleaners, run them at the manufacturer's recommended pressures. But bear in mind that because these jets are moving so fast they do tend to atomise a relatively short distance from the jet. These wouldn't be suitable to use if a jet length of more than two or three metres is required.

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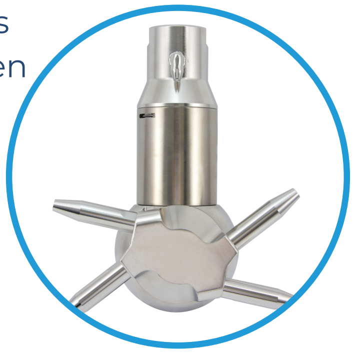
Q6. HOW MUCH DOES A TANK CLEANING SYSTEM COST?

What is the difference in price between the different styles of tank cleaning head?

The short answer is as follows: for standard static spray balls expect to pay anywhere between £50 and £300 per spray ball depending on the size - the bigger the spray ball, the more expensive they are. This assumes a standard 316 stainless base material. You can expect to pay a lot more for Hastelloys and, for other specialist materials, the prices increase.

For spinners, (the spinning style spray balls), expect to pay between £150 and up to roughly £500 per spinner for a decent brand. There are a lot of inferior brands out there, and it is really worth buying a good one that is going to last. In the grand scheme of things, a few hundred pounds is neither here nor there when compared to the cost of contaminated batches or poor cleaning from a shoddily made spinner.

Our advice is to buy a good brand and expect to pay £250 to £500, depending on the size of it.



For rotary jet cleaners expect to pay between around £2,000 to £3,500 for a decent brand. Again, there are plenty of clones that aren't so decent out there.

Some of the brands we come across and rate as good brands, (apart from our own ones, of course, which are manufactured by Dasic Marine here in the UK), are Alfa Laval, Spraying Systems, Lechler and GEA. They are all much of a muchness in terms of price so expect to pay within the £2,000 to £3,500 price bracket for a rotary jet cleaner.

There are equivalent cloned models from fairly random manufacturers from around the world in the £1,000 price range. These are likely to be poor quality and not a sensible choice.

For high pressure cleaners, expect to pay anywhere between £2,000 and £5,000, maybe a little bit more for a decent brand. High pressure cleaners are the ones that are running at roughly 50 bar plus. The same rules apply about buying quality from reputable brands. There are cheaper copies available, but it's not a great idea given the potential cost of failure now. That's the simple answer to the question of cost.

For a slightly more nuanced answer, the overall cost of the system needs to be looked at. Spinners and spray balls have the advantage of being low-pressure systems operating optimally around two to three bar fluid pressure. This means lower operating costs, low fitting costs and low pipework costs.

The downside is they have a much higher cost of running because they're not very water efficient; they're very inefficient in terms of water consumption compared to jet cleaners for example. The overall lower infrastructure costs and the cost of the hardware itself in many cases, in fact, often is outstripped by the additional cost of water and disposal of that water over the year or two year period.

They also take considerably longer to clean tanks in most situations than rotary jet cleaners.

There isan opportunity cost associated with this longer tank cleaning cycle and all the while the tank is being cleaned, it can't be used. So what's the opportunity cost of having a tank inoperable whilst it is being cleaned?

What is the cost of an extra two or three hours a week, if that's what the differential between using spray balls and rotary jet cleaners would be? What's that differential cost?

Rotary jet cleaners cost more for the hardware, as we've seen, but they also may need an increase in the pump capacity to accommodate the higher pressures that they want to run at. So that needs to be factored in as well. But as noted above, they are a lot more water-efficient than spinners and spray balls. So what we often find is despite the additional cost of the hardware and despite the additional cost of maybe an upgraded pump over the long period, over the course of the year, they actually save an awful lot of money because of efficiency gains.

For high-pressure cleaners, high-pressure pumps and pipework are needed because it's a whole different ballgame running something at about ten bar, which is the optimal pressure for standard rotary jet cleaners. Moving up to 50 or 100 bar will then require the change to high-pressure pipework. Some high-pressure pumps will be needed and the wear and tear must be factored in with all of the additional health and safety considerations that go with running them in a high-pressure fluid system.

All of this is going to increase the overall cost. To balance these large additional infrastructure costs, they may well be more fluid efficient per cleaning cycle and, in fact, often they will be so we need to have a balancing consideration between those much larger infrastructure costs and the benefits of having a more water-efficient tank cleaning system.

To recap the short answer, for static spray balls, expect to pay between £50 to £100 for a standard 316 stainless spray ball.

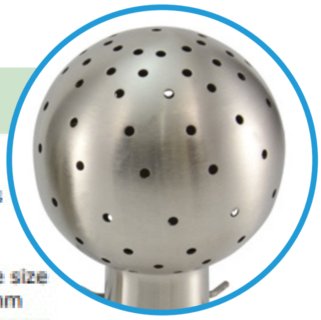
For spinners from decent manufacturers expect to pay between £150 and £500 for the spinner, depending on the size of it. There are a lot of cheap knock-offs out there, but avoid those because the cost of failure is so high.

Decent rotary jet cleaners from the good manufacturers cost between £2,000 and £3,500 and then high pressure cleaners are going to be more expensive than that at £2,500 to £5,000.

Q7. HOW FAR DOES A TANK CLEANER CLEAN?

On tank cleaning data sheets, you'll typically see one or two figures reported with regards to reach or cleaning length. On spray balls or other static cleaners you'll typically see a rinse diameter or radius reported - sometimes called the washing radius.

(Bar)	Rinse diame-ter at (1 bar)	Dimensions		
3.5		A mm	H mm	Hole size mm
495.8	6.8m	90	150	2.5
286.9	5m	65	94	2.5
96.7	6.4m	50	91	1.6
43.7	4.4m	28	65	1.3
396.0	4.4m	90	150	2.5
271.3	4.4m	65	94	2.5
93.5	6m	50	91	1.6



On spinners, you'll typically see two figures reported, and this will be a rinse radius like with the spray ball and then also a scrub radius, which will be lower than the rinse radius.

Pressure in Bar										
1			1.5			2			3	
Scrub Diam (m)	Wet Diam (m)	Flow rate l/min	Scrub Diam (m)	Wet Diam (m)	Flow rate l/min	Scrub Diam (m)	Wet Diam (m)	Flow rate l/min	Scrub Diam (m)	Wet Diam (m)
0.8	4.3	20.3	1.1	4.8	25.5	1.2	5.0	31.0	1.4	5.4
0.8	4.3	36.8	1.1	4.8	46.5	1.2	5.0	58.3	1.4	5.4
1.8	5.2	50.0	1.9	5.3	58.3	2.0	5.2	68.3	1.8	4.9
1.8	5.2	79.2	1.9	5.3	91.7	2.0	5.2	110.0	1.8	4.9

And then on rotary jet cleaners what we see is an effective cleaning jet length or scrub radius reported, and not typically the wetting radius.

BAR	4x4.2mm			4x5mm			4x6mm			4x7mm			4x8mm		
	Flow rate l/min	Jet length Mtr	Cycle Time Min	Flow rate l/min	Jet length Mtr	Cycle Time Min	Flow rate l/min	Jet length Mtr	Cycle Time Min	Flow rate l/min	Jet length Mtr	Cycle Time Min	Flow rate l/min	Jet length Mtr	Cycle Time Min
3	80	2.9	11	112	4	13	138	5.3	15.5	217	6.5	20.1	250	7.2	15.5
4	100	3	9.3	137	4.2	10.8	170	5.7	12.9	252	7.1	15.2	293	8	12.9
5	115	3.5	7.9	155	4.7	9.4	200	6.2	11	283	7.7	14.9	333	9	11
6	127	4	6.9	173	5.2	8	220	7	9.5	310	8.5	13	367	9.9	9.5
7	138	5	6.3	185	6.3	7.3	240	8	8.4	333	9.4	11.7	395	10.6	8.5
8	147	6.2	5.8	195	7.5	6.8	257	9.4	7.6	350	10.3	10.4	418	11.2	7.8
9	153	7.1	5.6	202	8.5	6.5	270	10.3	7	367	11.2	9.3	438	12.2	7
10	157	7.8	5.5	207	9	6.4	282	11.2	6.9	380	12	8.9	458	13	6.9

So why on some tank cleaners are both figures reported? And why on others are only one of those figures reported and what do they mean in terms of when it comes to sizing up tank cleaners? In order to understand that, it's important to look at how tank cleaners actually perform their cleaning.

There are two primary ways in which tank cleaners deliver cleaning. The first is mechanical action. This is the actual impact of the fluid on the side of the tanks to dislodge any residue that may be there.

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The second important effect is effectively chemical action. This relies on a cascading of the liquid down the walls of the tank to dissolve residues over time.

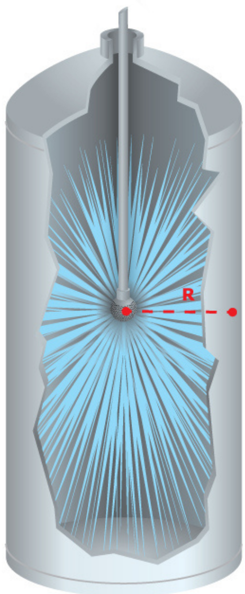
So there are two primary mechanisms: mechanical action and chemical action.

For completeness, any cleaning action also has a heat element and a time element, but these don't need exploring at this stage.

Different tank cleaners have a different primacy on one of those two actions - some deliver cleaning primarily through mechanical action and some through this cascade effect. For spray balls, almost all of the tank cleaning is performed by this cascading solvent effect of the wash liquid running down the walls. So spray balls have very little impact and very little mechanical action when it comes to cleaning.

The rinse radius of the spray ball represents the horizontal distance at which the spray ball will deliver water well to the wall of a cylindrical tank.

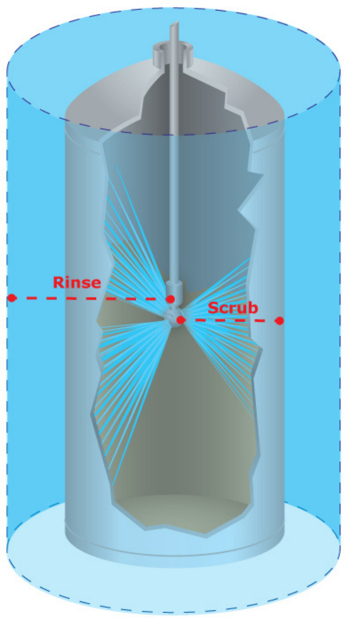
If a scrub radius is reported, it will be some distance below that, but it's not common to have scrub radiuses on spray balls. So when judging a spray ball's effectiveness it is vital to ensure that the horizontal distance from the tank wall to the spray ball is at least within the rinse radius.



Otherwise, liquid is not going to reach the wall to perform that cascading down effect, which is the primary cleaning action of a spray ball.

As long as a decent amount of liquid is on the wall, it's going to work adequately. We don't need to have every part of the tank within that rinse radius, so particularly the lower parts of the tank. They're not going to be within that rinse radius, but that won't matter because as long as it's getting onto the walls further up in the tank and it's flowing down, it's going to perform cleaning well over time.

When moving on to spinners, both the scrub and the rinse r
reported.



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If a light rinse is wanted and it is a fairly easy residue to get off, then a good proportion of the water onto the walls is needed in the same way as a spray ball. The rinse radius can be used for this in exactly the same way as a spray ball.

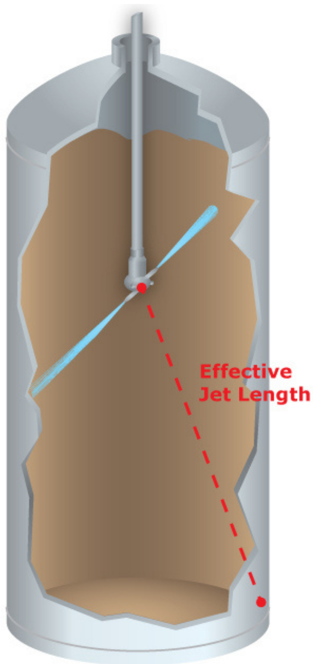
However, to utilise the spinners, improve mechanical action and drive efficiencies in tank cleaning through that, because increased mechanical action also means increased efficiency, the distance from the spinner to the tank wall needs to be kept within the scrub radius that's reported. Again, this is a judgment call as to whether a decent amount of mechanical action is delivered.

This will result in the tank cleaning efficiency being improved. To get the most out of the spinners, keep them within the scrub radius and not the wetting radius.

With rotary jet cleaners, only the effective jet lengths or scrub radius of that cleaner tends to be reported. The reason for that is that, for these cleaners, their primary mode of action and cleaning is mechanical action. The cascade effect is still important, but it's a secondary effect. So this being the case, all of the tank parts being cleaned within that jet length need to be kept. The horizontal distance between the tank cleaner and the wall won't be measured here. Instead, it will be from the tank cleaner to the furthest point of the tank that needs to be cleaned.

Normally, that's the bottom corner of the tank. The distance needs to be kept within the effective jet length or scrub radius of the tank cleaner. And that way sufficient impact will be achieved on every single part of the tank. The cascade effect will also be obtained. The goal is to get good impact on all parts of the tank to have really effective cleaning and get the most out of these tank cleaners.

With very large tanks or very tall tanks, it may not be possible to get to the bottom corner within that jet length, and that's ok as long as the residue isn't too tough. This shouldn't be an issue because all of that cascade effect down the wall is still being obtained.



But to get the most out of them, try and keep every part of the tank within that jet length, if possible.

For high pressure cleaners - tank cleaners running at sort of 50 to 100 bar even or even more - those effective jet lengths come down quite a lot.

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For mid-range rotary jet cleaners, the effective jet length goes up with pressure. Running it at 3 bar, it will maybe have a jet length of five metres and running it at ten bar, it may be twelve metres or so. But when it comes to very high-pressure rotary cleaners, the actual jet length comes down. This is somewhat counterintuitive. And the reason for that is because they're running at such high pressures and because typically they're running at very low flow rates (which is the whole point of these tank cleaners) they produce very thin, fast-moving needle-like jets and, after a few metres, they start to break up and atomise because they keep moving so fast.

It needs to be noted that those high-pressure rotary jet cleaners that run at 50, 100 or 150 bar are not suitable for those very big tanks with long clean distances because their effective jet lengths actually come down despite the high pressure.

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Q8. WHAT FILTRATION DO I NEED FOR MY TANK CLEANING/CIP SYSTEM?

The answer to this question depends heavily on the tank cleaning head being used. The first question to ask is why would you need filtration at all? Isn't clean, filtered water being used for cleaning tanks and in the final rinse? The answer is yes. Not a lot of filtration will be required for the final stage of the clean. For the majority of the other tank clean stages, recirculated water will be used to save on water.

In those situations, the particulates from the previous tank clean, from pips and stalks and whatever else is in that tank for example, often find their way into the wash system. Therefore, it is vital to ensure that the water is filtered before it gets to the tank cleaning head otherwise clogging and problems can occur.

So, what level is required? What kind of particulate content can the different types of tank cleaners handle/enable to pass through them?

Standard spherical spray balls will typically have holes between 1 mm and 2.5 mm in diameter. Any particulate entering the system that's bigger than 1 mm is going to get trapped within the spray balls and build up over time and cause clogging.

Upstream filtration that is significantly smaller than the orifice sizes (the hole sizes on the spray balls), would be recommended here to prevent such an issue from occurring.

A 50 mesh filtration would normally be the choice as it has 0.3 mm holes in the filter which would eliminate any clogging - even with 1 mm holes in smaller spray balls.

Moving on to bigger spray balls with 2 mm or 2.5 mm holes in them, a 25 mesh which is 0.7 mm for filtration, would more than likely suffice.

Clog resistant alternatives such as non-moving static tank cleaning heads are also available.

Other alternatives to the traditional spray ball that require even less filtration are another option.

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Very wide angle spiral nozzles can have a spray pattern of up to 270 degrees and are naturally clog resistant.

They were originally designed to spray slurries and typically have a free passage of around 3 mm to 5 mm. Particles between 3 mm and 5 mm could technically pass through these nozzles fine.

Something a bit smaller would still be recommended in terms of filtration, just to be on the safe side. But a 10 mesh or 2 mm filtration would be sufficient to filter out any large pieces of material such as stalks etc.

The smaller ones can pass happily through the filter and the spiral nozzle.

Another design that recently came onto the market is the HydroClaw from BETE Fog Nozzle. This is a unique, patented tank washing nozzle that is specifically designed to be clog resistant.

The design has a huge free passage of around 7 mm, meaning it can pass objects about three to four times bigger than that of a standard spray ball. In most cases, the very large objects that may find their way into the wash system, just need to be filtered. So a 10 mesh or 2 mm filtration is more than adequate for a nozzle of this size. In most cases, having no filtration at all can also be a possibility.

Next up are spinning spray balls.

The slots on the spinners are reasonably large, especially in comparison to the holes in spray balls. This can make it seem like these types of tank cleaner are more clog resistant than spray balls. The reality is, they're not. This is because they run on a ball bearing system as they spin.

That's all exposed to the wash fluid.

Any particulate can get into that ball bearing system and gum it up and stop it spinning.

50 mesh filtration or better would be advised for these spinners because they can gum up quite easily; small bits of grit can build up in the workings and stop them from spinning over time. So 50 mesh or 0.3 mm filtration and any objects above 0.3 mm will be filtered out as a result.

For rotary jet cleaners, it's a similar story.

The jet orifices themselves are rather large (ranging between 23 mm and anything up to 12 mm or 14 mm for the extra large ones in diameter), and should be able to pass through bits of grit and sand quite easily. However, the wash fluid itself comes into contact with the internal gears within these tank cleaners and it's necessary to clean the gears and keep the internals of the tank cleaner self-lubricating and self-cleaning. The filtration needs to be considered very carefully on these systems, despite the larger nozzle size. So, 50 mesh filtration or better would be advised here to remove particles much above the 0.3 mm size. This will stop the gears from gumming up over time.

It is very common for tank cleaners to stop working due to stuff working its way into the mechanisms because they're open to the wash fluid. However, there is a clog-resistant version of these available on the market.

These standard jet cleaners have greased internal gearboxes, which are not exposed to the wash fluid, and this means they can't be a truly hygienic tank cleaning system. Because of this, they wouldn't be suitable for use in food processing, etc.

But for industrial, non-hygienic tank cleaning processes, they're absolutely fine.

We sell a lot of them into the storm tank cleaning market, for example. And because the gears and internals are no longer coming into direct contact with the washer, fluid, grit and sand, and even small bits of rock, can pass through the internals of the nozzle quite easily.

The goal is to filter out the large stuff to prevent sticks and algae from getting in and messing the system up over time.

10 mesh, 2 mm filtration is more than adequate for most of these styles of tank cleaners. Filtration does not need to be a big concern as long as the big stuff is being removed.

Q9. WHICH CIP SYSTEM IS MOST WATER EFFICIENT?

Water saving is a big concern for most businesses and especially for those that are involved in tank cleaning.

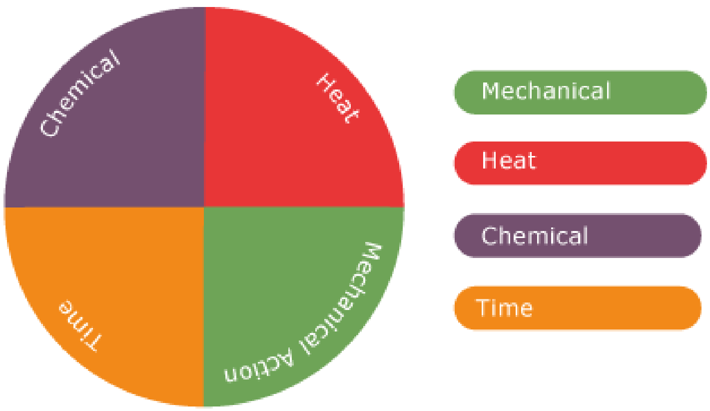
Water can be quite a significant cost. It needs to be bought, pumped, heated and disposed of. Disposal of contaminated water from tank washes can be costly. So much so, that in some water intensive industries such as dairy, it can be one of the most significant overheads. Saving water is a good thing. So which type of tank cleaner is most water efficient?

There's a short answer to this question, which is **high-impact tank cleaners.** Generally, the higher the impact of the tank cleaner, the more water efficient it is going to be. However, there are some nuances to this.

First of all, what makes up a clean?

Any cleaning action or cleaning operation is made up of 4 key components:

1. **Mechanical Action:** the physical scrubbing action of the cleaners scrubbing off the residue.
2. **Heat:** the hotter the cleaning fluid, the better it will break down residues.
3. **Time:** the longer the clean, the more cleaning it's going to get.
4. **Chemical Action:** the solvent quality of the chemicals being used in the clean/the solvent action of breaking down the residue.



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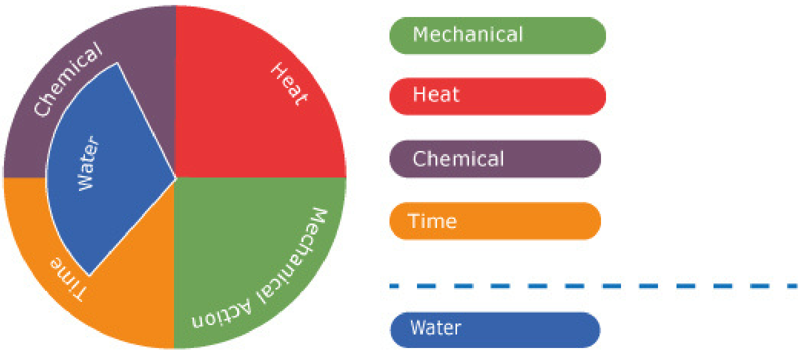
Any cleaning operation will be a combination of these 4 elements. If one part or more than one part is reduced, the other parts must be increased to compensate and this will ensure that the overall clean is still effective.

It is important to note that water isn't one of those components. So where does water come into this? Water is used in almost every cleaning action. So where does the water consumption fit into that 4 part model? There are 2 components that it fits into.

Firstly, water is the main solvent used in almost all cleaning actions. Sometimes water isn't thought of as a solvent, but in actual fact, it's known as the universal solvent. More things dissolve in water than any other chemical, and it is by far the most common solvent used in any cleaning action.

Solvents may sometimes be added to get water to improve the cleaning action, but nevertheless, the chemical action component of most cleaning operations is largely made up of water. Therefore, the chemical action component is definitely part of water consumption.

The other part of the 4 components that makes up water, is time. All cleaning systems when they are on, especially tank cleaning systems, are using water. They're water driven and are using water as the cleaning medium to deliver the other solvents to the tank wall.



Water consumption is essentially a function of the chemical action component of the clean and the time component of the clean.

To reduce water consumption, the chemical action and time require reducing. And to keep the clean effective, heat and/or mechanical action need to increase.

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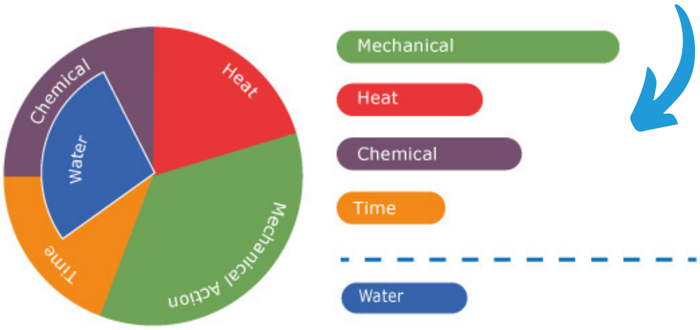
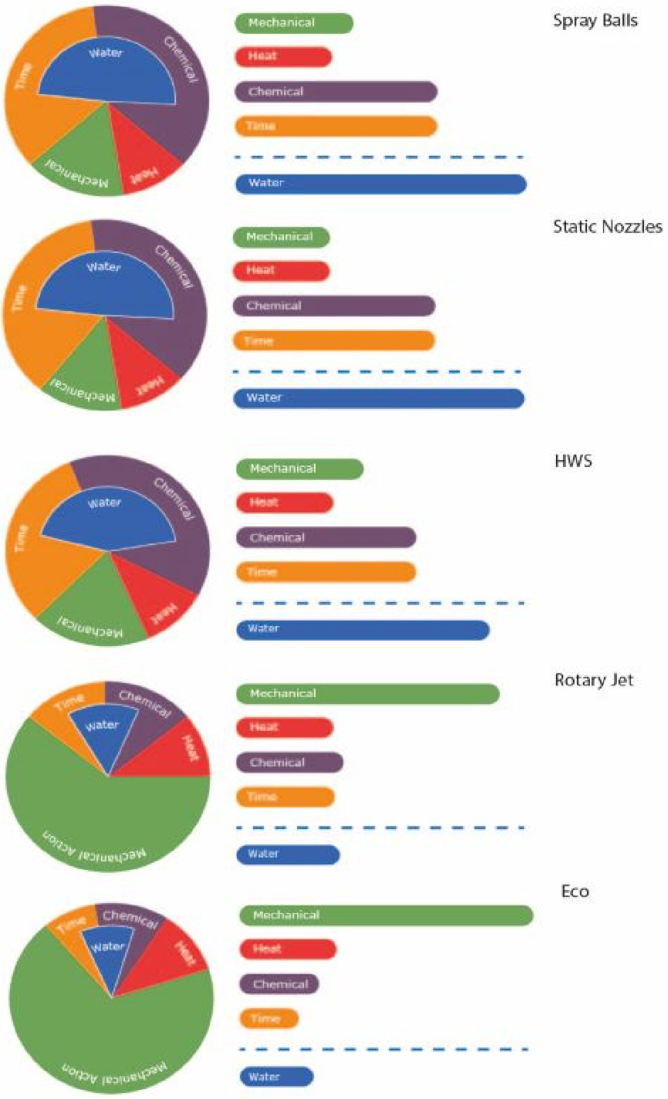
Putting heat aside for one moment as its own separate entity being kept stable, you get left with mechanical action.

In order to reduce water, the mechanical action needs to be increased. This is why the general rule is that high mechanical action tank cleaning devices are more water efficient. But there are some exceptions.

Rotary jet cleaners, which are the high mechanical action jet cleaners, must go through a set cleaning cycle in order to deliver their cleaning action to every part of the tank. This is unlike spray balls and spinners, which are low mechanical action tank cleaners and so inherently less efficient.





If the residue is very light, the spinners and spray balls will provide instantaneous coverage to the whole tank. And if that residue only takes a couple of minutes to come off, then the rotary jet cleaner in the same tank, even though it may be more water efficient overall, still has to go through a 5-10 minute cleaning cycle just to get its cleaning through every part of the tank. Therefore, it's going to be less efficient overall because it has to go through that set cleaning cycle, unlike the spray balls and the spinners so there is an exception there.

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High-pressure cleaners running at 100 or so bar as opposed to the mid-range rotary jet cleaners running at 10 bar, tend to have quite short range cleaning jets. So when looking at very large tanks, these high-pressure jet cleaners may need to be moved around within the tank and they have to go through their set cleaning cycle in each stage of the clean.

Apart from the hassle of having to move the cleaners around inside a large tank so that their relatively short jets can actually reach each part of it, the cleaning cycle time needs to be doubled up and this is the time component which is a key component in water consumption.

In very large tanks, it can often be the case that the very high pressure 100 bar jet cleaners are less water efficient than the 10 bar rotary jet cleaners running at medium pressures. This is precisely because multiple cleaning cycles are required to move them around within the tank to get an overall effective clean. Any water saving that's achieved by increasing the mechanical action through having superior tank cleaners, needs to be offset against the additional energy needs and hardware associated with running those higher pressure/high mechanical action systems.

This is particularly true when it comes to the high 100 bar pressure systems, because they're going to need expensive pumps and expensive pipework, etc. For the mid-range pressure rotary jet cleaners, it is vital to consider those additional hardware and piping costs when compared to spinners; even though the overall water savings are going to be there in terms of clean water use per cycle, that may be offset by the additional hardware costs as well.

SNP NOZZLE KNOWLEDGE DOWNLOADS

If you have more questions or would like to discuss your individual tank cleaning system needs with SNP, please get in touch for no-obligation, intelligent advice and recommendations.