

Non-bypass vs Bypass Filtration-whats the difference?

For simplicity, consider that you start out with a tub of water that contains particles and needs filtering. A no-bypass system delivers 100% filtered water. But it delivers it right back into the tub, where it more or less immediately mixes with unfiltered water. Thus it is no longer 100% filtered, it immediately again contains particles. As the filter operates, the concentration of particles in the tub decreases until eventually the amount of particles in the water is acceptable.

Next, look at the more common bypass filtering method. Water is fed to the pump through both the filter and through footwell filtration inlets where some are plumbed to the filter and some are not plumbed to the filter. The pump thus delivers a mix of filtered water and unfiltered water back to the tub. Just as in the no-bypass case, post-pump water immediately mixes with tub water. Since particles are removed, the concentration of particles in the tub is steadily reduced as the filter system runs, and after some time the concentration of particles is acceptable. It's very similar to the no-bypass case.

If you think about it, both systems mix filtered and unfiltered water. No-bypass mixes filtered and unfiltered water when it returns to the tub. Bypass types mix filtered and unfiltered at the pump inlet.

If the total circulating flow rate was the same, one could argue that a no-bypass scheme would bring the concentration down to acceptable levels quicker than a bypass system. While this is true, this logic fails to account for the fact that most particulate matter tends to float on the surface. This is why the filtration on most tubs is focused on skimming the contaminants from the surface. Since the bulk of contaminants are on the surface, the "time" advantage of no-bypass is negated.

Particles that do not float are still for the most part effectively removed by non-bypass systems. As the water circulates, even non-floating particles eventually find their way into the filter and are removed.

The fact is that most spas use either a 24 hour circulation pump or run the main pumps (higher volume) for between 4 and 8 hours per day. The result of this is that with either system, the concentration of particulates never gets high - no one likes dirty spa water - and the concentration of particulates in either bypass or no-bypass system is basically never allowed to get to unacceptable levels in normal use. With either system, the water is kept very clear.

There are conditions where spa water will contain a high level of matter that needs to be removed by the filter. One is just external contamination - tree pollen particles or whatever - that get into the pool during say, windy conditions or when the cover is left off for long periods of time. These particles for the most part float. Another condition might occur when the spa water becomes cloudy. Often the particles are too small for the filter to remove, and a clarifying agent is added. These agents cause the small particles that are causing the cloudiness to bind together into larger particles that the filter can effectively remove. In such exceptional conditions, a no-bypass system could likely clear the water faster than a bypass type. However, with a bypass system with the pumps run at high speed on the spas preset cycles, it will be possible to clear the water in similar time or possibly even faster.

The disadvantage to a 100% no-bypass system is that as the filters clog, the pump performance is affected. Inlet side pressure drops as the filters accumulate matter. Jet performance can be affected, and very low inlet pressure can result in pump cavitation that can damage or destroy the pump. It is true that designs with a lot of filter surface area (lots of filters) mitigate this effect and thus work fine. The downside is that you have a lot of filters, or large filters that are quite expensive!

Bypass type filtration systems do not have this problem. Pump performance is not significantly affected by the state of the filter, and cavitation is not a threat. But clearly if the filter is poorly maintained the water will not be kept very clean.

I have had both 24 hour circulation pump systems and systems that run a jet pump on low speed during 2, 4, or 6 hour filtration cycles to effect filtration. My 24 hour system automatically cycled the jet pumps on for 5 minutes every so often to stir up particles that had settled, and also to flush water through the plumbing. This system, a bypass type, did a great job. My current spa is also non-bypass, but uses one of the jet pumps on low speed. I run the filtration 2 hours, twice a day (4 hours total) and it also does a very good job. The 24 hour systems have the advantage of running the ozone, if so equipped, constantly rather than just during the filtration cycle. They also generally consume less electricity and in my view tend to keep the water generally a bit more clear of particles.

A key aspect that should be looked at in ANY system is the cost and number of filters. More filters mean more filters to clean. Personally I like to deal with one or two, which can be rinsed every week or two very quickly. More filters mean more work. It's also true that lots of filters may mean that it will be more expensive to replace them, and, like everything else, filters are not cheap. I prefer systems that use, as I said, one or two filters that are generic sizes that I can buy online, inexpensively.

Overall, I like systems with bypass filtration to avoid any potential reduction in pump performance or possible cavitation as the filter(s) gets dirty, one or two filters, 24 hour circulation pump, and cycling the jet pumps on for 5 minutes a few times per day. My experience was that this system was quiet and effective. But really, any of the systems in use work very well so I wouldn't (and didn't) let the filtration make the decision. With either bypass or no bypass, if you keep your filters clean you will have well-filtered water, but if you don't maintain them you will have problems. Most spas are so similar in design and equipment that manufacturers need to have features that differentiate their product to promote sales, and IMO that's the real reason that there is no-bypass filtering. I don't see any significant technical advantage. Implementation of no-bypass is easy, and cheaper to manufacture so if there was a true advantage, it would be in more common use.