START-UP Pre-Rinse Recommendations for Taste/Odor, pH and Corrosivity Control:

When starting up any POU or POE PFAS removal system, it is necessary to rinse the resin and GAC for best performance. Follow the advice of the GAC manufacturer regarding in pre-soak time needed for the GAC. Some GAC manufacturers recommend a soak time of 24 hours followed by rinsing be for putting the system into service.

pH Control:

With ion exchange resins, apart from taste and odor issues perceived by some sensitive consumers, there is the need to pay attention to the pH and corrosivity of the treated water that emanates intiallly on start-up of the system. If the resin is unbuffered, there can be a reduction on the pH of the first volumes of water treated. The treated water pH can initiall be reduced by 1 to 1.5 pH units which can potentially increase the corrosvity of the water which is not desirable. This can last for a day or two, depending on the volume of water consumed during that period. This is a temporary problem and can be resolved if the system is rinsed with about 200 bed volumes of the incoming water after which the pH is expected to go back up the influent water pH and stay so until the resin is changed out. To calculate volume of rinse, use 50 gallons (~200 liters) of water per liter of resin – or about 1.7 hours at 1/2 gpm (2 LPM) flowrate). For 1.5 ft^3 (42 L) of resin use approximately 2200 gallons (8.3m^3) of water – about 4 hours of rinse at 10 gpm flow for 1.5 ft^3 of resin).

Corrosivity:

Corrosivity of the water may be impacted by any changes in the sulfate to chloride ratio of the treated water. This can occur again for the first set of water treated when using an unbuffered resin. After this initial volume of water is treated, the sulfate and chloride levels in the treated water will stabilize and remain at the same levels as in the incoming water. An unbuffered resin must usually treat about about 500 to 2000 bed volumes before sulfate and chloride values stabilize- this will be dependent on the sulfate and chloride levels in the incoming water. For 1 cubic foot of resin, this will require rinsing with about 4000 to 16,000 gallons of water. This water will be PFAS-free and can be sent to drain but it is also possible to use it elsewhere while the system is stabilizing.

Buffered Resin:

The supply of buffered resin may resolve both the initial pH and potential corrosivity issues but will be more costly since the resin must undergo extra processing. The cost will depend on the volume of resin to be supplied and the specific influent water chemistry to be treated as we will need to customize the conditioning of the resin. This is therefore a custom service that must be discussed in well in advance.

Certified to NSF Standard 61

Member of:

NSF/ANSI 61 D040211

American Water Works Association
The Authoritative Resource on Safe Water℠

Water Quality Association

Rural Water Association

For more information
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POE/POU Design Guidelines for OEMs for Removal of PFOS, PFOA, PFNA, PFHxS and PFBS with MetSorb™ PFX - Selective Resin

Objective:

To reduce PFOA, PFOS, PFNA, PFHxS and PFBS from household water supplies to Non-Detect levels.

Commercial installations of our PFX-selective ion exchange resin show excellent capability to reduce PFX (or PFCs) including PFOA, PFOS, PFNA, PFHxS and PFBS to non-detect (ND) levels (where ND can vary from 0.4 to 2 ppt depending on the specific PFAS and the accuracy of the lab used for testing). In such systems, the contact time between the resin and the water typically ranges from as low as 1.5 to 3 minutes of contact time vs the typically recommended 10 to 20 minutes that is recommended by prominent suppliers of granular activated carbon (GAC). While this guidance is primarily for removal of PFOA, PFOS, PFNA, PFHxS and PFBS, our experience shows that PFHpA, PFPeA and PFBA will also be removed but to lesser extents. If these are of interest, we would be happy to discuss.

The relatively short contact time needed for our PFX-selective resins make them ideal for the stopstart operation that is typical of Point-Of-Entry (POE) and Point-of-Use (POU) devices. Please note that some of our general-purpose ion exchange resins may remove PFAS, but removal efficiency will vary and ability to reduce PFAS to non-detect levels for extended time may not be realized. As such, we do not recommend general-purpose resins for PFAS removal in POU/POE systems – these systems are more demanding, requiring frequent stop-start cycling and extremely short contact times between the water and the resin. Contact times for POE devices can be approximately 1.5 minutes while that for POU devices can be as low as 0.5 minute, depending on design.

Our single-use selective resin, MetSorb™ PFX, is currently certified for use in drinking water under NSF/ANSI-61 standard. Guidelines presented here are for OEMs looking to develop entire POU or POE packages. These are guidelines only and performance will depend on the actual system design by the OEM. Since we do not manufacture or operate the treatment device, the onus is on the OEM to properly design and operate such devices to achieve the desired targets.

MetSorb™ PFX selective resin can effectively reduce PFX to nondetectable levels in drinking water supplies, and we find that taste and odor issues are generally not a problem with our resin. Below are our design guidelines showing recommended maximum influent water quality parameters (note - most water supplies will normally have much reduced concentrations than shown):

Influent Water Parameter	Capacity Rating Valid for
PFOA	2000 ppt max. (higher levels will reduce PFAS capacity)
PFOS	2000 ppt max. (higher levels will reduce PFAS capacity)
PFNA	2000 ppt max. (higher levels will reduce PFAS capacity)
PFBS	2000 ppt max. (higher levels will reduce PFAS capacity)
PFHxS	2000 ppt max. (higher levels will reduce PFAS capacity)

Other PFAS compounds	2000 ppt max. (higher levels will reduce PFAS capacity)
Total Organic Carbon (TOC)	1.5 ppm max. (excessive TOC can result in a significant reduction in operating capacity for PFAS removal).
Volatile Organic Carbons (VOCs)	200 ppt max. (will not materially impact resin PFAS capacity but may otherwise to undesirable in drinking water)
Total Dissolved Solids	500 ppm max. (high levels will reduce PFAS capacity)
Sulfate	200 ppm as SO^4 max. (high levels will reduce PFAS capacity)
Nitrate	5 ppm as NO^3 max. (high levels will reduce PFAS capacity)
Chloride	100 ppm max. (high levels will reduce PFAS capacity)
Alkalinity	200 ppm max. (high levels will reduce PFAS capacity)
pH	5 to 9
Temperature	40 to 90°F (5 to 32°C)
Free Chlorine	All oxidants will damage the resin and should be removed before the water contacts the resin. We strongly recommended use of a GAC pre-filter to reduce free chlorine and other oxidants to as low a level as possible – but certainly to no more than 0.1 ppm free chorine.
Suspended Solids	It is mandatory to use a sediment filter ahead of the resin to removed suspended solids – 10 µm filter is usually recommended – this should be changed out based on build-up of suspended solids or increased pressure drop (usually no more than a 5 psi increase across the filter).

Consult us if any of your influent water chemistry parameters exceed those given above.

For POU Design (e.g. under-the sink):

Parameter	Acceptable Range	Comments
Specific flowrate	10 to 60 BV/h (1.25 to 7.5 gpm/ft^3)	Assume a maximum flow of ½ gpm (2 LPM).
Resin Volume per Cartridge	2 liters minimum	Smaller cartridges can be used if installed in series to make up a minimum volume of 2 liters of resin
Flowrate	120 liters per hour (1/2 gpm) maximum for 2 liters of resin	Do not exceed the recommended maximum flowrate. Install flow restrictors as needed.
Oxidant, Taste and Odor Control Measures	Even though the resins are certified for drinking water use under NSF/ANSI-61 standard, some consumers may be more sensitive to mild taste and odor issues when resins are used, such as a fishy or amine odor because of the composition of the resin. Pre and post filtration with GAC are highly recommended to resolve such issues. If oxidants (e.g. chlorine) are present in the incoming water, these will damage the resin if left unprotected and can contribute to taste and odor issues.	We highly recommend good quality drinking water approved GAC (e.g. coconut or lignite based) be installed ahead of and after the resin. The prefilter GAC is intended to reduce oxidants and to protect the resin from any excessive levels of TOC present in the water. The post filter GAC is intended for final taste and odor control. The GAC can be either installed either in separate cartridges before and after the resin, or a GAC/RESIN/GAC "sandwich bed" can be used, all inthe same cartridge. We recommend at least 1 liter of GAC before and 1 liter of GAC after the resin.
Suspended Solids, and Iron and Manganese Control	Control any iron and manganese present in the inlet water at more than 0.3 ppm and 0.05 ppm respectively. Control suspended solids in the feed water to avoid fouling of the resin bed and premature breakthrough.	Pretreat as needed for iron and/or manganese such as with softening resin or manganese greensand. Install a suspended solids filter cartridge ahead of the PFAS unit and replace as needed.
Service Life Estimate	Approx. 4000 liters of water treated (~1000 gallons) or 4 months whichever comes first.	Change out the entire volume of resin (e.g. both cartridges) after 4 months to assure best performance. (Note for certification purposes the system is expected to deliver a capacity of at least 8,000 liters of water based on the influent conditions stated above – so capacity has been de-rated for safety). Our suggestion to change out the resin every 4 months is not necessarily based on exceeding throughput capacity of the resin, since the resin has far greater capacity than indicated here. It is based on the need to get consumers to regularly and periodically change-out the resin, without having to monitor often for PFAS in the treated water. A single test for PFAS can cost as much as $300 per test which can exceed the cost of the service to change out the resin.

For POE Design (Point of Entry – whole household supply):

Resin may only be backwashed once upon initial installation. Any subsequent backwashing will compromise capacity and potentially cause early breakthrough of targeted contaminants. Therefore, good prefiltration upstream is needed using a 10-micron filter cartridge or better and replacing such cartridges when suspended solids build up or the pressure drop across the cartridge increases by more than 5 psi.

For POE Design (e.g. Point-of-Entry household system):

Parameter	Acceptable Range	Comments
Assumed peak flowrate per household	7.5 gpm (28 LPM)	For POE with larger flows, proportion accordingly.
Specific flowrate	20 to 40 BV/h (2.5 to 5 gpm/ft^3) Empty Bed Contact Time (EBCT) of 3 to 1.5 minutes per tank.	Flow will vary and can be as low as 1/2 gpm (~2 LPM) if a single faucet in the house is being used. Therefore, good internal distributor design for the vessel is essential
Number of resin tanks	Minimum of 1 tank – see comment	Preferably 2 tanks in series to give extra protection and to minimize the need for testing of treated water for PFAS which can be relatively expensive
Minimum resin bed depth and volume	32 inches (0.8 m). For example - use 10 x 54 (10 inch diameter x 54 inches sidewall) FRP tank with 1.5 ft^3 (42.4L) of PFX-selective resin	Design can be done using smaller tanks if not targeting 10 gpm flow, but **it is mandatory to keep a minimum bed depth of at least 32 inches (80 cm)**
Suspended Solids, and Iron and Manganese Control	Control any iron and manganese present in the inlet water at more than 0.3 ppm and 0.05 ppm respectively. Control suspended solids in the feed water to avoid fouling of the resin bed and premature breakthrough.	Pretreat as needed for iron and/or manganese such as with softening resin or manganese greensand. Install a suspended solids filter cartridge ahead of the PFAS treatment unit and replace as needed based on increase in pressure drop.
Total Hardness Control	High hardness and alkalinity in the inlet water may cause precipitation of hardness on the resin and degrade the performance of the resin if not pretreated.	Consider installing a softener if the hardness and/or alkalinity in the inlet water exceeds 200 ppm as $CaCO_3$
Oxidant, Taste and Odor Control*	Even though the resins are certified for drinking water use under NSF/ANSI-61 standard, some consumers may be more sensitive to mild taste and odor issues when resins are used, such as a fishy or amine odor because of the composition of the resin*. Pre and post filtration with GAC are highly recommended to resolve such issues. If oxidants (e.g. chlorine) are present in the incoming water, these will damage the resin if left unprotected and can contribute to taste and odor issues.	We highly recommend good quality drinking water approved GAC (e.g. coconut or lignite based) be installed ahead of and after the resin. The GAC can be either installed either in separate vessels before and after the resin, or as a GAC/RESIN/GAC "sandwich" bed. For oxidant and taste and odor control follow the advice of the manufacturer of the GAC but use enough GAC to give a contact time of about 6 minutes (10 BV/h). If installing GAC as a sandwich bed, target a GAC resin depth of at least 12 inches (30 cm) for the pre-filter GAC and 12 inches (30 cm) for the post-filter GAC.
Service Life Estimate	**Approx. 10,000 bed volumes (or 75,000 gallons/ft^3 of resin in the lead vessel)** based on maximum influent water quality shown above. This assumes any incoming oxidant in the water is removed (see above) and that excess TOC (e.g. >1.5 ppm) is removed before the water contacts the resin. **While MetSorb™ PFX-Selective Resin provides excellent removal of PFAS in water, we find that taste and odor issues are generally not a problem.*	When using 1.5 ft^3/42.4 L of PFX-selective resin, we estimate an operating capacity of 112,000 gallons (423.9 m^3) based on 300 gallons (~ 1.1 m^3) usage per day per household. **We recommend that resin in the lead vessel be changed out annually**. (Note for certification purposes, the system is expected to deliver at least 20,000 bed volumes capacity based on the influent conditions stated above – so capacity has been de-rated for safety). Since a single PFAS test can cost as much as $300, it is better to de-rate the system and minimize the number of water tests that must be performed annually. Note: the recommendation for the resin to be changed out in POE household systems once per year is not necessarily based on exceeding the throughput of the resin, since in large commercial practice, capacity will be much higher. The recommendation to do annual change-out means that the resin in the lag vessel will then be moved to the lead position while a fresh charge of resin is placed in the lag position. This means the resin will spend 2 years in service before being changed out. Our opinion is that other mechanical/fouling and microbial potential issues are going to be the main drivers here of resin change-out. There is a strong need to avoid microbial growth on the resin since there is usually no postoxidation step for the water in a POE system (unlike in a municipal or small community water system). Again, since a sample of water can cost as much as $300 per test for PFAS analysis, it makes sense for these reasons to change out the resin annually.