

## FREEDOM NANO PLUS

OPUS Nano Freedom Plus is a point-of-use drinking water system that produces great tasting water that is free of chlorine, lead, heavy metals, MTBE, VOCs and contaminants, while maintaining pH (alkalinity) and dissolved minerals. The system features triple activated carbon (granulated and advanced carbon block), 3 pounds of KDF media, a high capacity pleated 1 micron carbon filter, and .5 micron microfiltration technology that removes 99.5% of mercury, lead, and giardia, cryptosporidium, entamoeba, and toxoplasma cysts to ensure contaminant-free water.

A special feature of this system is the 0.01 micron nanofiltration filter, which blocks protozoa, (cryptosporidium, giardia), bacteria (campylobacter, salmonella, shigella, E. coli), viruses (enteric, hepatitis A, norovirus, rotavirus), and over 85% of tested pharmaceutical drugs.



**OPUS Healthy Water Systems**

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OPUS Freedom Nano Plus uses five advanced filtration components to provide seven filtration stages, using three 10" vertical filters and two horizontally mounted inline filters. Tubing, a designer faucet, a John Guest quick connect for the faucet and a John Guest ball valve to allow easy water shut off for filter flushing and future filter changes are all included. The system is rated for up to 5 gallons per day, or 1825 gallons per year.

### Included Components:

1. Triple filter wall mount housing that can be installed under a sink or in a basement with the 5 micron carbon block sediment filter (Stage 1) and nanofiltration filter (Stage 7) horizontally mounted on the metal frame.
2. Inline horizontally mounted 5 micron carbon block sediment filter. (Stage 1)
3. 10" 1 Micron Pleated Carbon High Capacity Sediment, Chlorine, Taste, Odor (Stage 2)
4. 10" 3 lb KDF media / .6 lb granulated activated carbon filter. (Stage 3 & 4)
5. 10" 0.5 micron carbon block microfiltration filter that removes MTBE, VOCs and chlorine, with up to 99.5% removal of lead and mercury. (Stage 5 & 6)
6. Inline horizontally mounted nanofiltration filter (Stage 7)
7. Brushed nickel lead-free ceramic disk designer faucet with normal sink installation components, including a John Guest quick connect that is screwed onto the end of the faucet for fast and easy connection of the blue tubing from the output of the system.
8. Quick connects throughout for all ¼" tubing connections, including on the beautiful brushed nickel ceramic disk designer faucet.
9. Two 5 foot lengths of flexible LLDPE ¼" BPA free tubing.
10. John Guest ball valve shut-off valve, to make it easy to shut off water to the system for initial filter flushing and future filter changes, connected to the water input of the horizontally mounted 5 micron sediment filter. A filter wrench is included to enable easy opening of the filter housings for filter changes.

**FILTRATION UNIT DESCRIPTION:**

**Stage 1 – Horizontally Mounted 5 Micron Sediment Filter.** This is an inline carbon block filter horizontally mounted, attached to the Stage 7 Nanofiltration Filter with two plastic clips. Under normal use, this filter should last six months to one year; however, depending on the quantity of water purified and the level of sediment in your water, it may require changing more often. Replace this filter if the water pressure drops to an unacceptable level, but at minimum it must be changed annually with the other filters.

- This filter is labeled **Stage 1 – 5 Micron Carbon Block Sediment Filter.**

**Stage 2 – 1 Micron High Capacity Pleated Carbon Filter.** This filter is installed in the left vertical stage of the three vertically mounted filters. This filter is designed to remove chlorine, while improving taste and removing odors.

- The metal frame above this filter is labeled **Stage 2 – High Capacity Pleated Carbon**

**Stage 3 & 4 – 3 lb KDF Media / .6 lb GAC.** This filter is installed in the middle, or centre vertical stage of the unit. This filter consists of two components (two stages), with 3 pounds of KDF media and over half a pound of granulated activated carbon (GAC). KDF media is a copper-zinc formulation that combines electrochemical and catalytic technology to remove chlorine, lead, mercury, iron, aluminum, arsenic, chromium, copper, manganese, nickel, chloroform, trichloroethane, lindane, and hydrogen sulfide from water. KDF media has a mild antibacterial, algacidal, and fungicidal effect and may reduce the accumulation of lime scale. Replace this filter annually.

- The metal frame above this filter is labeled **STAGE 3 & 4 – 3 lb KDF/GAC.**

**Stage 5 & 6 – .5 Micron MTBE/VOC/lead/mercury microfilter.** This is the right vertical stage of the unit, and consists of a .5 micron carbon microfiltration filter with multiple functions described below. Replace this filter annually.

- Traps carbon and KDF media particles from the KDF/GAC filter in Stage 3 & 4. (Stage 5)
- Removes chlorine, odors, dissolved and particulate lead, mercury (99.5% removal rate for lead and mercury), cysts, giardia, cryptosporidium, entamoeba and toxoplasma cysts. A unique feature of this filter is the filtration of MTBE and VOCs – contaminants that very few filtration systems can remove. (Stage 6)
- The metal frame above this filter is labeled **Stage 5 & 6 – 0.5 Micron MTBE/VOC Filter.**

**Stage 7 – .01 Micron Inline Nanofiltration Filter.** Mounted horizontally on the unit with two plastic clip, this filter blocks protozoa, (cryptosporidium, giardia), bacteria (campylobacter, salmonella, shigella, E. coli), viruses (enteric, hepatitis A, norovirus, rotavirus), and over 85% of tested pharmaceutical drugs. This filter is an excellent low cost alternative to germicidal ultraviolet radiation, and will provide peace of mind should the municipal water supply fail to provide sterilization. This filter does not affect the mineral content in water, maintaining the pH of the incoming water.

### **NOTE ABOUT QUICK CONNECTS:**

*All OPUS water purification systems utilize quick connects for all tubing connections, including the connection to the John Guest ball valve (shutoff valve), faucet (there is a small gray piece with the quick connect supplied with the faucet) and input and output of the water filtration system. The quick connect allows easy insertion and removal of 1/4" tubing. To remove the tubing, you must hold in the "ring" or collar that is on the outside of the tubing (the ring or collar surrounds the tubing and is part of the quick connect). When you hold in the ring (sometimes you need a flathead screwdriver, but usually your finger will do) the tubing will easily slide out. If you try to pull out the tubing without holding in the ring, you can damage the quick connect fitting.*

## **INSTALLATION INSTRUCTIONS**

**Step 1 – INSTALL THE SUPPLIED FAUCET TO YOUR SINK.** Drill 5/8" hole if required.

If your sink or countertop doesn't have a hole for the supplied faucet, a 5/8" hole must be drilled to allow faucet installation. After the faucet has been installed, mount the unit under your sink or in a location that provides easy access for future filter changes.

Note 1: Most plumbers cannot drill into quartz, granite, or similar solid countertops for faucet installation. If you have a solid countertop, check with your installer to ensure he can drill into your countertop without risking damage. It's usually best to contact the countertop supplier or manufacturer to drill the 5/8" hole required for faucet installation if you have a solid countertop.

Note 2: Your installer must provide a connection to your cold water source. SharkBite U362 1/2" TEE for the cold water connection, and a Dahl straight shut-off ball valve 1/2" PEX 1/4" OD) are recommended. These are included if you choose an Aviva recommended plumber. If you choose to use your own plumber, these parts are available for \$42.00 plus tax.

The 5 foot length of 1/4" red tubing is used to connect the cold water source to the Nano water input, which is the blue and white John Guest shut-off valve that is inserted into the water input on the right side of the horizontally mounted 5 micron carbon block sediment filter.

The 5 foot length of 1/4" blue tubing connects to the quick connect output on the right side of the Nano unit during the filter flushing process, and to the quick connect on the faucet. After the filters have been flushed, the 1/4" blue tubing that is connected to the faucet will be removed from the right side of the unit, and connected to the output (left side) of the nanofiltration filter, and the small piece of tubing that is connected to the input of the nanofiltration filter is connected to the output on the right side of the unit.

### **Important Note Regarding Filter Flushing**

**Prior to flushing the system, it is critical that for the duration of the flushing process that the output tubing that connects to the faucet be temporarily connected to the right side of the unit, bypassing the final Stage 7 Nanofiltration filter. The unit is shipped with the small 1/4" piece of tubing that connects the right side of the system to the final nanofiltration filter disconnected. Once all the filters are flushed, this tube should be re-connected to the final nanofiltration filter.**

The Stage 5 & 6 half (0.5) micron microfiltration VOC/MTBE carbon filter must be removed from the right vertical filter container after receiving the system and re-installed after proper flushing of the Stage 3 & 4 KDF/GAC filter, as described below. Failure to flush the system properly will result in damage to the 0.5 Micron filter (Stage 5 & 6).

**STEP 2 – REMOVE THE FILTER FROM THE RIGHT VERTICAL FILTER HOUSING, WHICH IS THE STAGE 5 & 6 (RIGHT SUMP) FILTER.**

Using the supplied filter wrench, turn the white filter housing to the left to open, and remove the filter. The filter is labeled *Stage 5 & 6* on the metal frame above the filter housings. Labels and plastic should be removed from the filters when you receive the unit, but if there are labels or plastic wrapping on the filter, remove them prior to re-installing as described below.

After removing the filter, replace the empty filter housing by turning to the right. Ensure the O-ring is visible in the groove in the filter container (sump) before screwing back onto the system. To begin filter flushing, only the Stage 2 (1 Micron High Capacity Pleated Carbon), and Stage 3 & 4 (KDF/GAC) should be installed. The filter container (sump) on the right side must be empty.

**STEP 3 – FLUSH THE KDF/GAC FILTER (STAGE 3 & 4)**

1. Make sure you have removed the 0.5 micron VOC/MTBE carbon block filter from the right filter container. Only the 1 micron pleated carbon high capacity chlorine, taste and odor filter (Stage 2) and the KDF/GAC filter (Stage 3 & 4) filter should be installed in the left and middle vertical containers for initial flushing..
2. The red ¼" tubing should be connected to the cold water supply and to the John Guest ball valve connected to the horizontally mounted Stage 1 sediment filter on the top of the system.
3. The blue ¼" tubing is connected to the right side of the unit (Stage 5 & 6), and to the supplied faucet.
4. Open the John Guest ball valve to allow water to flow into the system, and turn the handle on the faucet downwards to allow water to pass through the faucet. Water will enter the horizontally mounted 5 micron sediment filter, through the high capacity pleated carbon chlorine, taste and odor filter installed in the first vertical stage, and through the Stage 3 & 4 KDF/GAC Filter (the right sump must be empty). Run water through the system for a minimum of 15 minutes. Pour some filtered water in a white glass and confirm it is crystal clear before going to the next step.

**STEP 4 – INSTALL THE 0.5 MICRON MICROFILTRATION FILTER IN POSITION 3, THE RIGHT VERTICAL FILTER CHAMBER (STAGE 5 & 6)**

1. After you have flushed the KDF/GAC filter as described in Step 3, turn off the water to the system by closing the John Guest ball valve installed in the Stage 1 horizontally mounted sediment filter. Keep the faucet open to ensure no water is flowing through the unit.
2. Unscrew the Stage 5 & 6 right vertical filter container using the supplied filter wrench and install the 0.5 micron MTBE/VOC carbon block microfiltration filter (Stage 5 & 6, white in color with green rings on each end). Make sure you remove any plastic wrapping (if present) before installation.

You can install this filter in either direction as there are rubber washers on both sides. Remember to install the KDF/GAC filter with the rubber washer facing upwards.

3. Turn on the water to the system by opening the John Guest ball valve. Check for leaks. Run water through the system for 10 minutes.

**Step 5 – Turn off the water** using the John Guest Ball valve, leaving the faucet open to ensure no water if flowing through the unit.

**Step 6 – Move the Blue Output Tubing to the Output of the Stage 7 Filter:** Pull out the blue tubing that connects to the faucet from the right side of the system and connect it to the left side (output) of the nanofiltration filter.

**Step 7 – Connect the output on right side of unit to the input of the Nanofiltration Filter:** Connect the short ¼" piece of tubing from the horizontally mounted Stage 7 nanofiltration filter to the right side of the system. The water should now flow from the Stage 1 filter through all seven filter stages (all five filters).

**Step 8 – Run water through the system for 5 minutes.-** You can now enjoy great tasting water, rich in minerals, and free of a wide range of chemicals, chlorine, VOCs, etc. Sometimes there is some dissolved oxygen in the water when filters are new which could make the water appear cloudy for up to two weeks, but this will dissipate as the water stands.

**Options for the OPUS Freedom Nano Plus:**

- Upgrade to 11" ceramic NSF certified designer water filtration faucet - \$60.00
- John Guest Union “T” to allow connection to a refrigerator or second tap - \$5.00.
- Note: Additional ¼" tubing @ \$1.00 per foot is required for a second water connection.

**Freedom Nano Plus Description**

PLU	Model	Height	Width	Depth	Flow Rate	Description	Price
25735	OPUS FREEDOM NANO PLUS	17"	17"	6"	2 - 4 Litres Per Minute	5 filter, 7 stage water purification system, with .5 micron micro-filtration, chlorine, heavy metal, VOC, MTBE, viruses, protozoa, bacteria, and major contaminant and chemical filtration, with final 0.01 Nanofiltration filter.	\$599.99

**Filter Change Information**

PLU	Model	Stage	Location	Function	Change Every	Price
23788	OPUS Inline Sediment	1	Top Horizontal	5 Micron Sediment Filtration	6 – 12 Months	\$40.00
22491	10" High Capacity Pleated Carbon	2	Left Vertical	High Capacity 1 Micron Chlorine, Taste and Odor (CTO)	1 Year	\$40.00
9395	3 lb. KDF / 0.6 lb. GAC	3 & 4	Centre Vertical	Chlorine, Heavy Metals, THMs	1 Year	\$120.00
14256	0.5 Micron Carbon, MTBE & VOC Removal	5&6	Right Vertical	Chlorine, Lead, Mercury, MTBE, VOC, microfiltration to 0.5 microns	1 Year	\$50.00
19761	0.01 Nanofiltration Filter	7	Top Horizontal	Viruses, Bacteria, Protozoa, Drugs	1 Year	\$100.00
<b>25736</b>	<b>Annual Filter Change</b>	<b>All</b>	<b>All</b>	<b>Annual Kit with all 5 Filters</b>	<b>1 Year</b>	<b>\$350.00</b>

**Winnipeg Installation Options**

11852	¼" John Guest Union “T” to allow two outputs from one input, to allow connection to a refrigerator, second tap, etc.	\$5.00
	¼" BPA Free Linear Low Density Polyethylene Tubing (LLDPE), per foot (White (9678), Blue (9679), or Red (9680))	\$1.00

ANNUAL COST OF OPERATION: APPROXIMATELY \$350.00

MONTHLY COST OF OPERATION: \$29.17

WEEKLY COST OF OPERATION: \$6.73

DAILY COST OF OPERATION: \$0.96

COST PER GALLON BASED ON 5 GALLONS PER DAY: \$0.19

COST PER LITRE: \$.042 CENTS

5 YEAR LIMITED WARRANTY IF FILTERS ARE CHANGED ANNUALLY

**Designed, Engineered, and Tested by Nathan Zassman, President  
OPUS Water Purification Systems**

## Rejection of pharmaceuticals in nanofiltration membrane drinking water treatment.

[Radienović J](#), [Petrović M](#), [Ventura F](#), [Barceló D](#).

### Abstract

This paper investigates the removal of a broad range of pharmaceuticals using nanofiltration (NF) applied in a full-scale drinking water treatment plant (DWTP) using groundwater.

Pharmaceutical residues detected in groundwater used as feed water in all five sampling campaigns were analgesics and anti-inflammatory drugs such as ketoprofen, diclofenac, acetaminophen and propyphenazone, beta-blockers sotalol and metoprolol, an antiepileptic drug carbamazepine, the antibiotic sulfamethoxazole, a lipid regulator gemfibrozil and a diuretic hydrochlorothiazide.

The highest concentrations in groundwater were recorded for hydrochlorothiazide (58.6-2548ngL(-1)), ketoprofen (<MQL-314ngL(-1)), diclofenac (60.2-219.4ngL(-1)), propyphenazone (51.5-295.8ngL(-1)) and carbamazepine (8.7-166.5ngL(-1)).

Excellent overall performance of NF was noted, with high rejection percentages for almost all of the pharmaceuticals investigated (>85%). Deteriorations in retentions on NF membrane was observed for acetaminophen (44.8-73 %), gemfibrozil (50-70 %) and mefenamic acid (30-50%).  
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