



CLEANING GUIDELINES



Synder Elements

These guidelines are presented with the idea of clearing up any misconceptions about cleaning Synder Filtration's spiral e-coat elements as well as provide direction for more efficient system operation and longer [useful] membrane life.

The single most common problem with restoring the permeate rate with spiral e-coat membranes, is the amount of time spent in cleaning the elements. The time spent cleaning is often due to the degree the permeate rate declined prior to cleaning. In many cases, the initial permeate rate is allowed to decline sixty five percent (65%) or more, before the element is cleaned.

Spiral elements should be cleaned when the permeate rate has declined between twenty and thirty percent (20%-30%) from the steady state permeate rate that was recorded when either the element was installed initially or last cleaned.

The steady state permeate rate is that permeate rate you record about fifteen to twenty (15-20) minutes after the element is initially put on paint, when installed new **OR** the permeate rate recorded after the element has been cleaned and is back on paint for about fifteen to twenty (15-20) minutes.

When initially cleaning an element, you should flush the paint from the element (preferably back to the paint tank) with UF permeate. If your system is large enough, and time permits, do this two (2) or more times, as time permits. This helps with the cleaning process and helps recover as much paint as possible.

If you cannot use UF permeate, make up a solution of artificial permeate using DI or RO water and acetic acid. Adjust the pH of this solution to the pH of the paint. For example, if the paint pH range is pH 5.6 to 6.0, adjust the pH to about 5.6 to 5.8. Heat this solution to the temperature of the paint. If your paint tank temperature is 90⁰ F, heat this solution to that temperature. This is important when flushing the paint from the element.

If you flush the paint from the element with cold DI or RO water, you can "set" the paint on the element surface, making it more difficult to clean it.

After flushing the paint from the element, flush the element to drain. Start with a full, heated cleaning tank of DI or RO water, pH adjusted to the pH of the paint. Once you have started flushing the element to drain, open the DI/RO water fill valve to the cleaning tank to maintain the level in the cleaning tank. This will allow you to thoroughly flush the element to drain, while gradually lowering the temperature of the flush water. When the flush water is reasonably clean from the element (provided you can see it), slowly close the cleaning pump discharge valve and stop the pump.

There are many cleaning formulas available for cleaning spiral elements. Many of them were developed in the early days of cathodic paints when the paints were formulated with lead, solvents and higher solids. These formulas were very effective for those paints. And, while they still work, they are not as effective with today's low solvent and no solvent, low lead and no lead paints.

Synder Filtration has formulated a concentrated cleaning product for use with our membranes and other's spiral elements. The concentrate ratio is 1:99. It does not require the use of any solvents; uses muriatic acid (acetic and formic acid may be substituted for muriatic) and is usually effective in 60 minutes or less. The key to it's success is cleaning at a pH of 2.0 to pH 2.2, maintaining the temperature between 100⁰ F and 110⁰ F, and cleaning before the permeate rate has declined too far.

There are circumstances when repeatedly cleaning with Synder's **Power Flux Concentrate** is necessary. These may include instances where there is a bacteria problem; drag-in problems; the elements have sat in paint due to a pump failure; the plant lost power; the permeate rate has declined forty (40%) or more; and / or there are undetected paint conditions that may be fouling the membrane(s) while not effecting the quality of the finish on the parts being coated.

In circumstances of severe paint fouling, very aggressive cleaning may be required before the permeate rate can be restored. And, there are times when it is impossible to restore the element permeate rate, regardless of what is done to try and clean the membrane.

The next page contains a list of cleaning formula's that may be used if the end user chooses not to use Synder's **Power Flux Concentrate**.

Cleaning Formulations

PPG/Chemfil 39C - follow the manufacturer's dilution directions. Do not exceed 110⁰ F or go below pH 2.0. If the temperature is between 110⁰ and 125⁰ F, the pH should not be allowed to go below pH 4.5. This is a pre-blended formulation used in place of the old Abcor CPC-1 formula. It does not contain any surfactant (Additive Z).

PPG/Chemfil 39F - this is used in place of 39C and some people find it more effective. It too is a pre-blended cleaning formulation based on the old Abcor CPC-5 formula. It does not contain any surfactant (Additive Z). The temperature and pH conditions and limitations listed above for 39C apply with when using this formula too.

CPC - 6 this formulation consists of:
1% Dowenol PM (replaces butyl cellosolve)
2% Dowenol PMA (replaces cellosolve acetate)
3% formic acid
0.5% surfactant (Triton X-100 or equivalent membrane surfactant)
for the last 30 - 45 minutes of the cleaning.

This formula is for normal to severe paint fouling. It is as effective as the CPC - 5 formula, but it is less toxic.

When cleaning with any of the above formulas, it is imperative that the operator maintains the pH above 2.0, for temperatures up to 110⁰ F and above pH 4.5 for temperatures between 110⁰ F and 125⁰ F.

It is important to thoroughly flush the element to drain at the end of the cleaning cycle. Start with a clean tank of RO or DI water, heated to the cleaning solution temperature used when the element was cleaned. Once you have started to flush the element to drain, open the RO or DI water valve to the cleaning tank to maintain the water level in the tank. Throttle the pump discharge as necessary to maintain the level in the tank. Direct the permeate to drain as well.

As the element is flushed to drain, the temperature will slowly come down to the ambient temperature of the plant water. Check the pH of the permeate. When it is close to the supply water, you can stop flushing.

At this point, the cleaning tank should be filled with clean RO or DI water. When it is full, start circulating it through the element, back to the cleaning tank. Direct the permeate to the cleaning tank as well.

Write down the cleaning water temperature, permeate rate and if equipped with pressure gauges on the cleaning feed and return piping, the cleaning inlet and outlet pressure to the element.

After measuring the permeate rate of the element on water you can put the element back on paint. Record the element permeate rate after the element has been put back on paint for 15 - 20 minutes. This should be recorded on the UF System Log Sheet.



CLEANING GUIDELINES



Biological Fouling of Spiral E-Coat Elements

There are times when your spiral e-coat elements will become fouled or blinded due to bacteria from either the post rinses or the e-coat tank. This fouling occurs whether the bacteria are dead or alive. It cannot be removed with a standard cleaning.

The following procedures describe the steps to take to clean your elements when you know or suspect biological / bacteria fouling.

1. Clean the element or system using your standard cleaning procedures. Follow Synder's standard "Cleaning Guidelines".
2. Thoroughly flush the element with clean DI water after cleaning the element as detailed above.
3. Fill the cleaning tank with clean DI water. Circulate through the element with all valves 100% open. Record the inlet and outlet pressures, if your system is supplied with pressure gauges; the permeate rate, and the water temperature.
4. After recording the permeate rate above, stop circulating the water through the element. Start to circulate through the pump back to the tank to heat it up to 100° F.
5. While that water is heating up, calculate the amount of hydrogen peroxide you will need to add to the tank. You want to make up a 500-ppm solution of hydrogen peroxide. The formula to follow is:

The volume of the cleaning tank plus 5 gallons for the holdup volume of the element times 0.0005 (500 ppm) divided by the percent solution of hydrogen peroxide you are using

Example: the volume of the cleaning tank is 35 gallons, holdup volume is 5 gallons and you are using a 35% hydrogen peroxide solution

35 gallons +5 gallons = 40 gallons for the solution

40 gallons X 0.0005 = 0.02 gallons

0.02 gallons / 0.35 (35% H₂O₂ solution) = 0.057 gallons (round to 0.06) of hydrogen peroxide. Multiply 0.06 X 128 ounces = 7.68 ounces of hydrogen peroxide to add to the cleaning tank.
Round it to 8 ounces.

6. When the water is up to temperature, start to circulate it through the element again. Once this is done, add the correct amount of hydrogen peroxide to the cleaning tank.
7. If there is bacteria fouling your element(s), you will see a steady increase in the permeate rate. You will circulate this solution through the element for 20 - 30 minutes.

If you see the permeate rate increasing, add the same amount of hydrogen peroxide to the cleaning tank again, after the first 10 - 15 minutes.

8. At the end of the cleaning time, stop the pump. Drain the system and flush the element to drain for 5 minutes or so.
9. Refill the cleaning tank with clean DI water and measure the permeate rate on water once more. Record the operating conditions as you did in Step 3 above. Compare the results to determine the effectiveness of the cleaning.



E-Coat Membrane Technology

CLEANING GUIDELINES



*Power Flux Concentrate*TM

*Power Flux Concentrate*TM is Synder Filtration's proprietary formulation developed for cleaning e-coat spiral membranes. It is an environmentally and user-friendly product. It is biodegradable and uses no solvents!

*Power Flux Concentrate*TM also provides the advantage of being effective in one hour or less. This means that you can clean more elements per shift if cleaning individual elements or taking less time to clean an entire system.

*Power Flux Concentrate*TM is available in one, five and fifty-five gallon containers from Synder Filtration's Vacaville facility.

To obtain additional information or to place an order, call Synder Filtration at the either of the numbers listed below.

Synder Customer Service

Tel: 707-451-6060

Fax: 707-451-6064

Vacaville, CA

CLEANING GUIDELINES

Standard Cathodic E-Coat Cleaning Procedure

While the mechanics of the cleaning procedure is generally the same for most E-Coat Systems and membranes, the following procedure is specific to the **Power Flux Concentrate™** cleaner chemistry. The procedure is based on cleaning **one** eight inch, **one** six inch or **one** four inch cartridge at a time. **IF** your cleaning tank size **and pump** will support cleaning more than one cartridge at a time, then adjust the formula to the **volume** of your cleaning tank.

1. Isolate the cartridge to be cleaned. Close the cartridge paint inlet and outlet valves. Close the paint permeate valve while opening the cleaning permeate valve.
2. Fill the cleaning tank with UF permeate. Make sure the cleaning (CIP) pump discharge valve is closed. Start the CIP pump. Slowly open the CIP pump discharge valve and pressurize the cleaning line to the element.
3. At the element, slowly open the **PAINT** outlet line on the element. Immediately slowly open the **CLEANING** inlet valve. Flush the paint out of the element through the paint return line.
4. When the level in the CIP Tank is approaching about 1/3rd full, slowly close the **PAINT** outlet valve on the element. Immediately close the cleaning inlet valve.
5. Open the cleaning outlet valve from the element. Slowly open the cleaning inlet valve.
6. If time permits, fill the cleaning tank with UF permeate and circulate that for 30 minutes. If not, then circulate the remaining permeate in the CIP Tank through the element for 10 minutes.
7. After 10 minutes, slowly close the CIP Pump discharge valve and stop the pump. Drain the CIP Tank and cleaning piping. Rinse any paint out of the bottom of the cleaning tank with DI water.
8. Fill the cleaning tank with clean DI water. When filled, start the cleaning pump. Slowly open the cleaning pump discharge valve and start circulating the water through the element back to the cleaning tank. Record the water temperature; permeate rate, inlet and outlet pressure to the element, if pressure gauges are on the system. You will use this data after cleaning the element to determine how effective was the cleaning.
9. Fill the CIP Tank with clean DI water. Circulate the water with the CIP Pump to bring the temperature up to the paint tank temperature. When that has been done, add the **Power Flux Concentrate™** to the CIP Tank. Remember that the dilution ratio is 1:99, e.g. 1 part **Power Flux Concentrate™** to 99 parts DI water.
10. Adjust the pH of the cleaning solution with **Muriatic** (hydrochloric) acid (preferred) or formic acid to a pH of 2.0 to pH 2.2. **Do not go below pH 2.0.** Raise the temperature to 100⁰ F. Glacial acetic may be used if the acids referenced above

When the pH of the cleaning solution is adjusted and the temperature is 100⁰ F, start circulating the cleaning solution through the element.

After 5 minutes or so, check the pH of the cleaning solution. You may have to add more acid if you find the pH increasing. This is due to the buffering action of the paint as it is removed from the element surface.

11. Maintain the temperature of the cleaning solution between 100⁰ F and 110⁰ F. Do not exceed 110⁰ F with the pH between pH 2.0 and pH 2.2. Circulate the cleaning solution for 60 minutes.
12. After circulating the cleaning solution for 60 minutes, slowly close the cleaning pump discharge valve, and then stop the pump. Drain the cleaning tank and as much of the cleaning system as possible.
13. Flush the cartridge thoroughly to drain with clean DI water for at least 10 minutes. Check the pH of the permeate. When it is the same or close to the pH of the DI water, you can stop flushing the element.
14. Fill the cleaning tank with clean DI water. Circulate it through the element back to the cleaning tank. Record the permeate rate, the water temperature, pressure in and pressure out of the element. Compare this to the data you recorded before cleaning the element. Typically, you should see a permeate rate increase of 2-4 times the initial permeate rate. This all depends on what the permeate rate was before cleaning and how much the permeate rate had been allowed to drop from the initial start up permeate rate or from the previous cleaning.

The permeate rate should never drop more than 30% before an element is cleaned. Many customers clean when the permeate rate drops between 20% and 25%. They report better success with cleaning versus allowing the permeate rate to drop 30% or more.