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Episode 30 Are You Cheating Enough?

The Cheat Sheets can be found on the Urbans Aqua Website – Mike-o-Pedia.

#1 Tanks – Typical Volume Data

This is the keystone chart. Use this chart in conjunction with others. Manufacturers' specifications give a range of service flow and backwash rates in square feet (ft^2), not cubic foot (ft^3). This chart has the surface area of the commonly used tanks. (If you want to understand the calculations it in more detail, we suggest you read this article. Numbers Don't Lie - A Water Math Tutorial.)

#2 Backwash Volume Data Chart

The specifications will indicate a range, rather than a single rate. For example, activated carbon is backwashed at a rate of 8-10 minutes per square foot. Warm water is less dense than cold water, so you need more water, 10 gpm/ ft^2, to lift and expand the bed. For cooler water we use 8 gpm/ ft^2 to backwash a 10" diameter tank.

When sizing a system be careful to calculate the backwash rate and the service rate. Sometimes the backwash flow rate is twice the service flow rate. The service rate of GreensandPlus or Pyrolox Advantage is 5 to 7gpm whereas the backwash rate is 12 to 15 gpm.

- Backwash rates, the backwash volume, and – for media and resin per square foot.
    - Don't confuse softener resins with anion resin
    - Cation ~52 lbs/ ft^3 vs. Anion ~45 lbs./ ft^3 – lower backwash rate for anion

#3 Empty Bed Contact Time

Empty bed contact time is the time required for the carbon to react with the contaminant you're trying to remove.

- Chlorine is very easy to remove – 2 minutes
- Chloramine – using catalytic carbon – 4 minutes
- Hydrogen Sulfide – using catalytic carbon - 4 minutes
- VOC's – (carbon type TBD) – 7 minutes
- PFAS/PFOA – (carbon type TBD) – 10 minutes

In cases where the EBCT dictates a large system, 5 – 10 cubic feet, we cheat a little. We put 3-1/2 ft^3 in one tank and 3-1/2 ft^3 in the other and operate lead-lag. In commercial operations water flow usually is consistent. In a home the empty bed contact time may be 7 minutes in the morning at shower time, but it might be 4 hours during the day when no one is home. That contaminant is hanging inside that carbon for half a day. This needs to be considered when sizing the system for VOC removal.

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#4 Softener & Filter Technical Data

#4 is handy for water softeners or multi-media filter design/rebed. Urbans prefers FilterAg Plus over multi-media but that's a different podcast. Handy information includes:

- Quantity of gravel support bed required in a softener.
  - Suggested size – 1/4 x 1/8 or 1/8 x 1/16"
  - How much – depends on the distribution system you - hub and lateral takes a little less than coffee can type distributors. Rule of thumb, add one or two inches of gravel above your hub and lateral.
  - Gravel helps the dispersion path in your bed. Don't use it in a vortex style tank or a Clack plated tank because the distribution plate does it for you.
- Number of cubic feet of resin in the tank.
- Maximum softening capacity, excluding high efficiency softeners.
  - 10 pounds per cubic foot on this chart.
- Quantities of gravel, garnet, sand, anthracite that go into various size multi-media filters.

#5 Filter Media Operation Guidelines

#5 combines filtration media in one place! No need to find the manufacturer's specifications.

This includes calcite, which is the limestone used to buffer the pH. Filter-Ag, Filter-Ag Plus, GreensandPlus and KDF, which we don't suggest because the backwash rate for KDF is 30 gpm/ ft^2.

- You will note that the service rate may exceed the backwash rate.
  - Consider using multiple skinny tanks.
  - This is where you finesse to these charts
    - Example - Tank volume data for the backwash rate per square foot exceeds the well pump rate. What do I do? Consider using three 8" tanks instead of one 13" tank. Multiples rather than single and divide the flow with the manifold among three tanks. You're going to obtain the service rate, and this is how you get the backwash rate.
  - Remember temperature will affect backwash rate.
- Uniformity Coefficient (UC) is a measure of the uniformity of the mesh size. A UC of 6 or less is generally acceptable. This is commonly included in municipal specifications and in the AWWA standards.

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- pH range and temperature
    - Cation resin can take high temperatures. You will damage the tank and internals before you destroy the resin. Type 2 anion is very temperature sensitive. Excessive temperatures will reduce capacity.
    - pH range – Cation and Anion can tolerate pH highs & lows but for household applications the pH should stay within potable water range.
    - When you're oxidizing, you want a higher pH – 7.5-8.2.
        - Contaminants come out of solution with a higher pH. Oxidizing – like Birm or Katalox perform better at a higher pH.
        - Oxidating medias like GreensandPlus and Pyrolox Advantage -manufacturers state it will work at 6.5 pH. We suggest 7 pH or higher because your performance is sluggish at 6.5.
        - EBCT is a factor as well. You might be able to run it a little faster if you bump your pH up.

Again, there is a little finessing of these numbers. Don't take them as gospel, **use them as guidelines to avoid performance issues.**

#6 Brine Tank Capacity & Area Chart

While not used too often this chart is important when sizing up commercial/industrial softeners.

- It takes approximately 4-6 hours to make up saturated bine.
- Saturated brine is how many pounds of salt dissolves in a gallon of water.
- If you spray water over the salt, it will dissolve instantly, then turn into a brick!
- There are a lot of brine fill first valves, which is a dry brine.
    - Before regeneration begins the brine tank is filled with water.
    - At a set time the softener will regenerate. If done properly the system should regenerate 4 hours later, especially if you are trying to remove iron with the softener.
    - Unfortunately, in a home this may be unrealistic. If the brine fill is set for 2am, it won't regenerate until 6am, when people are starting the day. These systems can be used effectively in vacation homes where it's desirable to have dry salt rather than brine which turns into a brick due to lack of use.

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