How To Size Chemical Feed Pumps for Polyphospate Water Systems

Polyphosphate Treatment For Water Systems

In order to size a MEC-O-MATIC feed pump for polyphos-phate feeding it is necessary to know:

a) the polyphosphate residual (ppm), and

b) the well pump rate (gpm).

Rule 1: One pound of polyphosphate per 10 gallons water = 12,000 ppm (solution strength)

Rule 2: One pound of polyphosphate typically treats 40,000 gallons of water at a 2 ppm concentration (residual).

Formula: [Well pump rate (gpm) x polyphosphate resid-ual (ppm) x 1440 (conversion factor)] ÷ solution strength = required feed pump output (gpd)

Example :

Well pump rate = 10gpm Polyphosphate residual = 4 ppm (10 x 4 x 1400) ÷ 12,000 = 56,000 ÷ 12,000 = 4.66

feed pump output (gpd), with 10 = well pump rate; 4 = the desired concentration of polyphosphate; 1440 = the conversion factor to change gpm to gpd; 12,000 = the solution strength based on the above Rule 1; and 4.66 = the feed pump output (gpd) based on well pump rate and polyphosphate residual.

It is advisable to slug the system initially at 10 ppm for approximately 30 days to clean out the lines at a faster rate.

Useful Data:

Polyphosphate @ 1 lb/10 gal = 12,000 ppm

5.25% bleach = 52,500 ppm

12.5% bleach = 125,000 ppm

Potassium Permanganate @ 0.25 lbs/gal = 30,000 ppm

- It requires 3 ppm chlorine for each ppm of hydrogen sulfide.
- It requires 1 ppm chlorine for each ppm of iron.
- It requires 0.7 ppm potassium permanganate for each ppm of hydrogen sulfide or iron.
- Do not neglect the residual required for chlorine applications.
- Do not mix potassium permanganate stronger than 0.25 lbs/gal or the maximum solubility will be exceeded.

Sizing Feed Pumps

In sizing feed pumps for iron and hydrogen sulfide removal using chlorine bleach or potassium permanganate, the following formula can be used:

Well pump flow rate in gpm xdosagex Required in ppm (1440)÷ Solution strength in ppm = Feed rate required in ppm

Size the chemical feed pump so that its maximum capacity is double the required feeding.

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How To Size Chemical Feed Pumps

In many water treatment systems, a chemical feed pump is necessary to successfully supply good quality water. Bacterial iron and hydrogen sulfide may require chlorination or potassium permanganate. Clear water iron can be treated in the same manner. Polyphosphate can be used to treat low hardness waters, waters containing low levels of clear water iron, or aggressive waters.

The following formula can be used to size feed pumps for all of these applications:

Well pump output rate (gpm)	x	Required dosagex (ppm)	1440	÷	Solution strength (ppm)
= FEED PUMP OUTPUT IN GPD					

From the formula, it can be seen we need three pieces of information:

1. Well pump output rate
2. The required dosage
3. The solution strength of the compound to be fed

Let's go through each one separately.

WELL PUMP OUTPUT RATE

The well pump output rate can be determined quite easily. Don't confuse this with the flow rate delivered by one or two taps in the home. What is required is how fast the well pump refills the pressure tank – the reason being is that the well pump controls the feed pump and well pump may be filling the pressure tank more rapidly than the water is being used in the home.

To determine the output rate open a tap until the well pump turns on. Immediately turn off the tap and time how long the well pump runs. Then, using a one-gallon container, close the tap and dump the gallon of water down the drain. Continue doing this and counting each gallon until the pump starts again. You now have the information to calculate the well pump output rate.

For Example: The well pump required two minutes to refill the pressure tank and you found it took 21 gallons before the pump started again.

$$\frac{\text{21 gallons}}{\text{2 minutes}} = 10.5 \text{ gpm}$$

DOSAGE REQUIRED

The dosage required can be estimated by the following:

3 ppm of chlorine is required for each ppm of hydrogen sulfide.

1 ppm of chlorine is required for each ppm of iron.

0.7 of potassium permanganate is required for both iron and hydrogen sulfide.

2 to 5 ppm of polyphosphate is required for hardness and clear water iron treatment.

NOTE: Don't neglect the ppm of chlorine residual required in chlorination. For example, treat a supply containing two ppm of iron and four ppm of hydrogen sulfide, a dosage of 15 ppm of chlorine is required.

(2 ppm Fe) (1 ppm Chlorine)
+ (4 ppm H2S) (3 ppm Chlorine)
+ 1 ppm residual
= 15 ppm total Chlorine

SOLUTION STRENGTH

The final piece of information required is the solution strength. Typical concentrations are:

Straight 5.25% bleach is 52,500 ppm

Straight 12.5% bleach is 125,000 ppm

Potassium permanganate dissolved at 1/4 lb per gallon is 30,000 ppm

Polyphosphate dissolved at one lb. per 10 gallons is 12,000 ppm

We are now ready to size the feed pump. Using our exam-ple above, treat the iron and hydrogen sulfide with straight 5.25 % bleach:

(10.5 gpm) (15 ppm) [1440] ÷ (52,500 ppm) = 4.3 gpd

This means we need a feed pump with an output of 4.3 gallons per day. Our PM-16 can pump 20 gpd at its maximum setting, therefore we would set the pump at 2.15.

$$\frac{4.3}{20} \times 10 = 2.15$$

The "10" in the formula above is the maximum dial setting on the PM-16, and "20" is the maximum feed rate of the PM 16.

Now this is a very low setting on the pump. Try to arrive at a feed rate that is near mid-scale on the dial of the pump. This is easily done by adjusting the solution strength of the compound being fed.

For example, we can dilute one gallon of bleach with one gallon of water, double our feed pump setting and still maintain a 15 PPM dosage. We can dilute one gallon of bleach with two gallons of water and triple the feed pump setting. By getting a feed rate near the mid-setting of the pump, we give ourselves room for adjustment.

This method of sizing feed pumps will get you close to the required dosage. However, there is no substitute for actually measuring the residual in the treated water. Slight adjustments in the feed rate setting are normally required.

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