Living Water™ Treatment System (LWTS™)

Alum Addition Option

Operating Instructions

The Alum Addition Option for the Living Water™ Treatment System (LWTS™) improves the filtration efficiency if needed. The need for improved filtration efficiency is determined by the clarity of the treated water. If the water leaving the system is turbid, then Alum addition is required. Alum addition utilizes the chemical Aluminum Sulfate, commonly referred to as Alum. When added at the proper dose, it can significantly improve the filtration efficiency and hence the clarity of the treated water.

Operation of the Alum Addition Option is discussed in the following sections:

1. Water Flowrate Adjustment

The Alum Addition Manifold is used to inject a concentrated solution of alum into the raw water. The amount of alum injected increases as the flowrate of raw water through the manifold increases. The raw water flowrate through the Venturi is controlled by adjusting valve AV1, shown in Figures 1 and 2. The raw water flowrate through the Venturi increases as AV1 is closed (see Figure 1), and decreases as AV1 is opened (see Figure 2). The amount of alum injected into the raw water increases as the raw water flowrate increases, and decreases as the raw water flowrate decreases. Thus, the amount of alum injected into the raw water increases as AV1 is closed, and decreases as AV1 is opened. Control of the alum solution flowrate is discussed in Section 2.

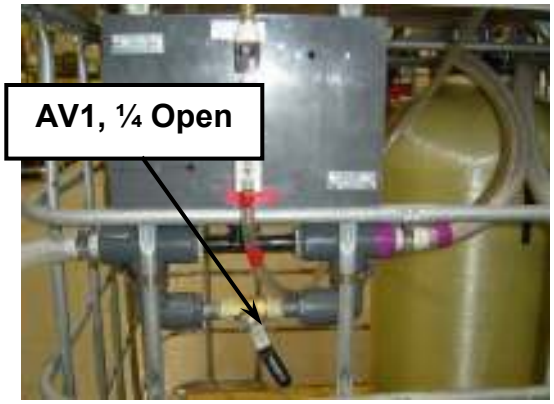

Figure 1: Alum Bypass Valve, ¼ Open

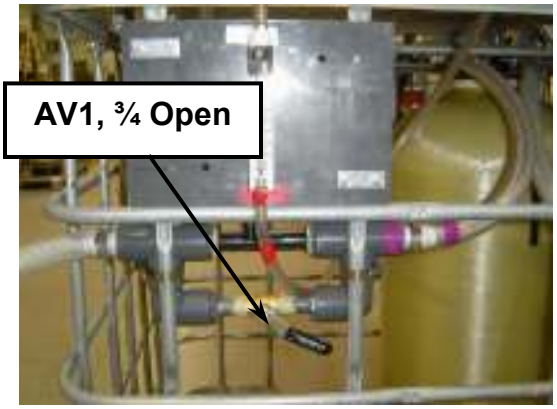

Figure 2: Alum Bypass Valve, ¾ Open

Set AV1 as follows:

1. Adjust AV1 to full open.
2. Start up the LWTS™ and adjust the treated water flowrate to 10 gallons/min.
3. Fill a 5-gallon bucket with treated water.
4. Remove the tubing from the 10-liter Alum Concentrate Feed Tank and place it in the bucket.
5. Adjust the Flowmeter Valve on the Alum Flow Control Manifold (see Figure 3) until it is fully open (open the valve).
6. Slowly close valve AV1 until the Flowmeter indicates the highest reading.

7. Adjust the Flowmeter Valve on the Alum Flow Control Manifold until the flowrate decreases to zero (close the valve).

8. Re-insert the tubing into the Alum Concentrate Feed Tank.

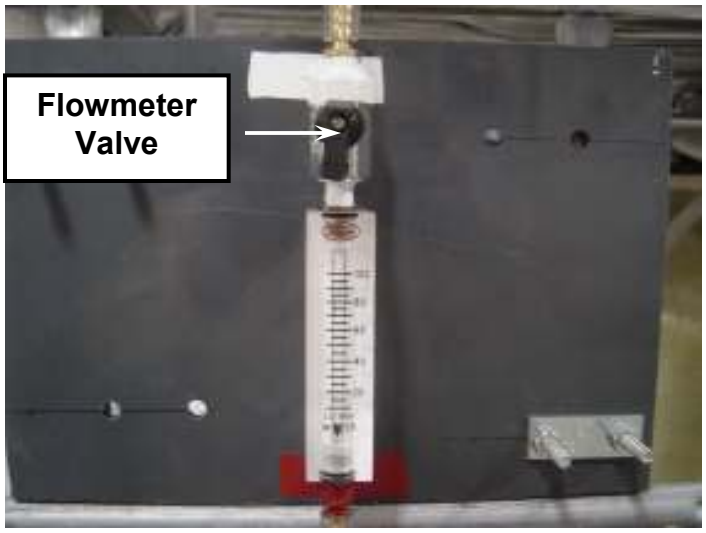

Figure 3: Flowmeter Valve on Alum Flow Control Manifold

Valve AV1 is now correctly set. During operation, minor adjustments to AV1 may be required to increase or decrease the raw water flowrate through the Venturi in order to obtain a constant and steady flow reading on the Alum Flow Control Manifold Flowmeter. Note however that when AV1 if fully closed, the pump draws more electricity resulting in higher operating costs. For this reason, AV1 should be closed just enough to obtain a steady and constant reading on the Flowmeter.

2. Alum Addition

After flowing through the Alum Addition Manifold where alum is injected, the raw water flows into the Flocculation Tank where the alum reacts with the very small particles of suspended contaminants to encourage them to bond loosely together to form larger particles which can be more easily separated from the water by the filters. At a raw water flowrate of 10 gallons/minute (gpm), the volume of the Flocculation Tank provides sufficient residence time for these reactions to take place. The raw water with the larger particles of suspended contaminants flows from the Flocculation Tank to the filters where the suspended contaminants are removed.

The Alum Addition Option uses a 3.8 wt% alum solution which is prepared as follows:

1. Measure 380 grams of alum using the marked measuring container found in the Alum Parts Box.

2. Fill the Alum Concentrate Feed Tank to the 10 L mark with treated water.

3. Pour the 380 grams of alum in to the Alum Concentrate Feed Tank.

4. Shake vigorously until all of the alum is dissolved.

This procedure is summarized in Table 1:

Table 1: 3.8 wt% Alum Preparation Procedure

Chemical	Treated Water	Granulated Alum	Directions
Aluminum Sulfate	10 L	380 gm	1. Add the water to the Alum Concentrate Feed Tank 2. Add the alum to the Tank 3. Shake until dissolved

To feed the Alum Concentrate into the system, insert the tube from the Flowmeter in to the top of the Alum Concentrate Feed Tank and place the Tank on the Alum Concentrate Feed Tank Stand as shown in Figure 4. The Alum Concentrate will then flow from the Tank through the tube into the Alum Flow Control Manifold, and from there into the Alum Addition Manifold where it is injected into the raw water.

Figure 4: Alum Concentrate Feed Tank and Tank Stand

The Flowmeter Valve on the Alum Flow Control Manifold (shown in Figure 3) is used to adjust the alum concentrate injection flowrate. Open the valve to increase the injection flowrate, and hence increase the alum concentration in the raw water. Conversely, close the valve to decrease the injection flowrate, and hence decrease the alum concentration in the raw water. Read the flowrate at the middle of the ball in the sight glass.

The Alum Concentrate flowrate should be adjusted so that the alum concentration in the raw water is approximately 30 parts/million (ppm or mg/L). The numbers on the sight glass correlate directly to ppm when the raw water flowrate is 10 gpm. Therefore, a reading of 30 on the sight glass would represent an alum concentration of 30 ppm in the raw water at a raw water flowrate of 10 gpm. (Note: This correlation is valid only when the Alum Concentrate is 3.8 wt% and the raw water flowrate is 10 gpm.)

Visual observation of the clarity of the treated water can be used to determine the optimum Alum Concentrate flowrate. It takes approximately 15 minutes before the effect of the alum addition can be seen. Therefore, wait at least 15 minutes after adjusting the Alum Concentrate flowrate before observing the clarity of the treated water.

If, after 15 minutes, the clarity of the treated water is not satisfactory (Turbidity < 5 ntu), adjust the Alum Concentrate flowrate. Make adjustments in small increments, ± 5 ppm, allowing at least 15 minutes between each adjustment. Too much alum will have a negative effect on the clarity of the treated water, so it may be necessary to decrease the alum concentration to achieve optimum filtration efficiency. The optimum concentration is determined on a case by case basis by trial and error.