

Layup and Startup of Cooling Towers

One of the primary factors that can the increase of the growth of Legionella bacteria is stagnant water. Therefore, it is essential that proper layup and startup procedures be followed to minimize exposure to the stagnant water, and to disinfect it prior to operation.

DuBois best practice for preventing Legionella growth is to perform a dry layup whenever the tower will be stagnant for more than 3 days. However, we realize that often, accounts prefer a wet layup due to time, labor, and monetary constraints.

Below are procedures for both wet and dry layups, as well as for start-up of both dry and wet systems.

Required Products

- Penetrex (Alternate: CW-878L or CW-879L)
- SHS-900 (Alternate: Trexcide 311)
- CW-58L

Tower Layup

For both wet and dry layups:

1. Five days prior to a scheduled shutdown, increase inhibitor feed to 2x the typical target feed rate.
2. Two days prior to shutdown, open blowdown valve (or change conductivity setpoint) to lower cycles to approximately 1.25.
3. Per 1000 gallons of system water, add ¼ pint of Penetrex (CW-878L (10-15 ppm) or CW-879L (50-75 ppm) may also be used in place of Penetrex.) Circulate for 1-2 hours.
4. Shut off all bleed valves and add a chlorine-based biocide* initially at a rate to provide approximately 12 ppm available chlorine to the water. Depending on the demand, chlorine residual may or may not be evident at this point. If this initial dosage does not provide a residual of 5-10 ppm available chlorine, add additional product in 1 ounce per 1000 gallon increments, allowing adequate time for the system circulation to “turn over” between additions. The inhibitor feed should be shut off during this time of no blowdown.
 - a. A chlorine-based biocide can be used. Most commonly used are SHS-900 and Trexcide 311. Make sure the product is registered by the state EPA in which you are feeding the product. Also, some states may require a pesticide license for the person dispensing the biocide. A feed rate of 1.4 oz/1000 gallons system water of SHS-900 provides approximately 1 ppm available chlorine. With Trexcide 311, a feed rate of 1.1 oz/1000 gallons provides 1 ppm available chlorine.
5. Continue to circulate the system, with a target circulation time of at least 4-6 hours. Maintain at least 5 ppm, but not more than 10 ppm, free chlorine residual during this time through periodic product additions when needed. If the system pH is > 8.0, maintain chlorine residual at higher end of this range.

6. Next, drain and thoroughly flush system to remove dirt, silt, sludge, solids, and any organic matter. Continue flushing until water is clean and free of debris.
7. Refill the tower with makeup water. Test chlorine and conductivity levels. They should be similar to the makeup water. If not, repeat Steps 6 and 7 until readings are similar.
8. Perform either a dipslide test or pull a sample for a Total Heterotrophic Plate Count and/or Legionella test. The results will not be known immediately. But, if results come back >1,000 CFU/mL for dipslide/Total bacteria or >0 for Legionella, then this procedure will need to be repeated.
9. Add CW-58L to a level of 220-250 ppm Molybdate in the system and circulate for 6-8 hours. Note: Nominal requirements of CW-58L are 4 gallons per 1,000 system gallons.

Specific Instructions for Wet Layup

Following the above steps, please proceed with the following:

1. Take the equipment offline and drain the outdoor portion of the condenser water system to prevent freezing. Allow the indoor portions of the piping and condenser system to remain wet until maintenance can be performed on the chiller units, or until the condenser tubes are ready to be brushed.
2. If necessary, add a sufficient amount of uninhibited glycol to the system to prevent freezing. Circulate throughout the system.
3. It is advisable to circulate water for a few hours at least once or twice per month during wet storage. Add more CW-58L as necessary to maintain treatment levels. Circulating the water will protect the system from excessive corrosion by passivating metal surfaces, and by avoiding stagnant water conditions, will aid microbiological control.

Specific Instructions for Dry Layup

1. Complete the initial Steps 1-9 above.
2. Drain system of water. Blow dry with air where possible.
3. If possible, place suitable desiccant in plastic trays into heat exchangers and piping and “blank” them off from air.
4. If not possible to close up the system (the cooling tower itself will be exposed), at least close off the tower basin drain, and allow thorough air drying of the rest of the system.

Tower Startup

If starting up a dry tower:

1. Clean all debris, such as leaves and dirt, from the tower.
2. Fill the tower with water. Add corrosion/scale inhibitor at 2x its typical dosage. Operate the condenser pumps but DO NOT turn on the cooling tower fans.
3. Per 1000 gallons of system water, add ¼ pint of Penetrex (CW-878L (10-15 ppm) or CW-879L (50-75 ppm) may also be used in place of Penetrex.) Circulate for 1-2 hours.
4. Add a chlorine-based biocide* initially at a rate to provide approximately 4-5 ppm available chlorine to the water.

* Most commonly used chlorine-based biocides are SHS-900 and Trexcede 311. Make sure the product is registered by the state EPA in which you are feeding the product. Also, some states may require a pesticide license for the person dispensing the biocide. A feed rate of 1.4 oz/1000 gallons system water of SHS-900 provides approximately 1 ppm available chlorine. With Trexcede 311, a feed rate of 1.1 oz/1000 gallons provides 1 ppm available chlorine.

5. Continue to circulate the system, with fans off, for 6 hours. Maintain 4-5 ppm free chlorine for the duration of this disinfection.
6. Perform either a dipslide test or pull a sample for a Total Heterotrophic Plate Count and/or Legionella test. The results will not be known immediately. But, if results come back >1,000 CFU/mL for dipslide/Total bacteria or >0 for Legionella, then this procedure will need to be repeated.
7. Begin typical treatment program (inhibitor and microbiocides).

If starting up a wet tower:

1. If possible, one to week prior to the tower startup, test for bacteria (Dipslide, Total Heterotrophic Plate Count, and/or Legionella).
2. Remove accessible dirt and debris from the tower and any remote storage tanks or sumps.
3. Ensure that the inhibitor concentration is within proper range. (For example, 220-250 ppm Molybdate for CW-58L.)
4. Depending on the results of the biological testing in Step One, perform a Level I or Level II Hyperchlorination. (Note: Level I Hyperchlorination would be the same procedure as Steps 3-6 in the Startup procedure for a dry system.)

If Dipslide or Total Heterotrophic Count is <100,000 CFU/mL, perform a Level I. If > 100,000 CFU/mL, perform a Level II Hyperchlorination

If Legionella counts are <1,000 CFU/mL, perform a Level I Hyperchlorination. If Legionella >1,000 CFU/mL, perform a Level II Hyperchlorination.

5. When performing the hyperchlorination, add the biocide directly to the sump or storage tank. DO NOT circulate water over the tower fill. Pumps should only be turned on if the water can be isolated from the fill through a bypass. Mix the biocide in the sump through manual or Sidestream methods if the fill cannot be bypassed. DO NOT have cooling fans on during this process.

Take care to prevent the creation of aerosol spray of the stagnant water during the disinfection process.

6. Once the stagnant water has been pretreated with biocide as described above, the pumps can be turned on to allow the water to circulate over the fill. Ensure that the chlorine level remains at its recommended dosage over a six hour period.

Once the pumps are turned on, add your typical scale/corrosion inhibitor chemistry to the tower water.

7. After the six hour disinfection is completed, allow the system to bleed until the chlorine residual is approximately 1 ppm. Ensure the inhibitor level is maintained during the bleed. Fans can then be turned on and normal tower operation may begin.
8. Perform either a dipslide test or pull a sample for a Total Heterotrophic Plate Count and/or Legionella test. The results will not be known immediately. But, if results come back >1,000 CFU/mL for dipslide/Total bacteria or >0 for Legionella, then another disinfection will need to be performed.