Legionella bacteria in evaporative cooling systems
Disclaimer:

W-Tech suggestion serves as a general template which should ensure that the risk of Legionella is controlled. What W-Tech suggests must be part of a routine maintenance, which should include a detailed maintenance schedule, listing the various time intervals when the system plant and water should be checked, inspected and cleaned. This must be performed by a qualified water treatment company who shall ensure that an effective treatment regime is in place.
In this document, W-Tech provides general information on the control/prevention of Legionella bacteria in evaporative cooling systems, with the intent to emphasize key-points concisely. The recommendations/suggestions provided in this document should not be interpreted to guarantee the absence of Legionella bacteria or any other particular pathogen.

**What is Legionnaires’ disease?**

Legionnaires’ disease is a severe form of pneumonia (lung infection). It’s caused by the bacterium *Legionella pneumophila*, commonly found in aquatic environment.

**What are the sources?**

Documented sources of bacterium *Legionella pneumophila* and related bacteria are:

1. Natural water sources such as rivers, lakes and reservoirs
2. Purpose-built water systems such as evaporative cooling towers and condensers, hot and cold water systems and spa pools.

**What factors favour the growth of legionella?**

1. Temperature: legionella can survive and multiply between 25-45°C with an optimal temperature between 32-42°C;
2. Formation of biofilms: layer of micro-organisms contained in a matrix that may form a thin layer of slime on surfaces in contact with water;
3. Microorganisms: algae, amoebae, other bacteria can host legionella and protect the Legionella bacteria from external stressors such as disinfectants;
4. Scale and corrosion: will increase the available surface area and encourage the formation of biofilms;
5. Natural organic compounds: rubber gaskets and hoses provide a good nutritional source for bacteria/other microorganisms to grow.

**What are the actions to undertake for preventing the presence of legionella?**

1. Preventing the growth of biofilms
2. Maintaining water temperatures under 20°C and over 50°C;
3. Keeping permanent water streaming and avoiding low flow – stagnation can encourage the growth of biofilm;
4. Avoiding the use of materials such as rubber washers and hoses;
5. Maintaining the cleanliness of the system;
6. Using water treatment techniques to control Legionella population;
7. Ensuring the correct system operation and a well maintenance.

**How are Legionella bacteria spread in evaporative cooling towers/condensers?**

Evaporative cooling towers/condensers are used to cool water and dissipate heat to the atmosphere through water evaporation. They contain large amounts of water, and because of their mode of operation they are potential breeding grounds for Legionella bacteria.

**How are W-Tech accomplishments to prevent and control the Legionella in its systems?**

By paying close attention to the mechanical design of the equipment and providing chemical treatment to maintain good water quality and system cleanliness. W-Tech cooling systems are designed and constructed hence to minimize the release of water droplets and be easily and safely accessible for all essential maintenance tasks, allowing inspection, cleaning and disinfection of all wetted surfaces.
What are W-Tech systems peculiarities against the risk of Legionaries’ disease?

1. **W-Tech systems are entirely made of corrosion-resistant materials.** Standard units are manufactured with galvanized steel Sendzimir type (superficial protection of 300g/m² of zinc) and protected with W-COAT coating which ensures a greater protection than higher grade galvanized zinc steel. Units can be manufactured in stainless steel. Fill pack and drift eliminators are made of PVC or PP, to comply with the most restrictive standards, such as the CTI rule 136 and the ASTM E-84, and presenting many advantages as a major resistance to the majority of chemicals and biological aggression. The heat exchange coils in evaporative condensers and closed-circuit cooling towers are made of galvanized steel and stainless steel as well as all fixing elements, in order to avoid any possible formation of biofilm.

2. **W-Tech employs high-efficient, well-designed and well-fitted drift eliminators,** which greatly eliminate water loss and potential aerosols drift (otherwise easily inhaled), in order to prevent escape of entrained water droplets that might contain Legionella bacteria from the tower. The employed drift eliminators - with the air velocity range of 1 - 4 m/s, allows a passage of drops equal to 0.001% of the droplets present at the entrance. Important W-Tech design features include also easy access-sections to drift eliminators for visual inspection and periodic maintenance.

3. **W-tech systems are fully enclosed to prevent direct sunlight onto the water and eliminate potential drift.** The air inlet louvers, made of PVC, are placed above the water basin and ensure a proper air quantity on all four sides. The design of the louvers also prevents the sun light to enter into the unit avoiding the proliferation of micro-organisms. W-Tech can also manufacture the basin section in stainless steel.

4. **W-Tech basin surface is sloped** to permit complete drainage, emptying during maintenance and avoiding water stagnation, preventing then the growth of bacteria. Basin configuration permits also water volume reduction and a lower weight during operation.
5. **W-Tech fill pack selection** are based on expected water quality, to minimize fouling and poor water distribution of water that might encourage Legionella propagation.

6. **W-Tech recommends detailed water chemistry characteristics** in order to properly manage the control of corrosion and scale.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>300 gr/m² Galvanized steel</th>
<th>AISI 304 Stainless Steel</th>
<th>AISI 316 Stainless steel</th>
</tr>
</thead>
<tbody>
<tr>
<td>pH</td>
<td>7,0 – 9</td>
<td>6,0 – 9,5</td>
<td>6,0 – 9,5</td>
</tr>
<tr>
<td>Total suspended solids (ppm)</td>
<td>&lt; 25</td>
<td>&lt; 25</td>
<td>&lt; 25</td>
</tr>
<tr>
<td>Conductivity (micro-Siemens/cm)</td>
<td>&lt; 2,400</td>
<td>&lt; 4,000</td>
<td>&lt; 5,000</td>
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<tr>
<td>Alcalinity CaCO₃ (ppm)</td>
<td>75 – 600</td>
<td>&lt; 600</td>
<td>&lt; 600</td>
</tr>
<tr>
<td>Hardness CaCO₃ (ppm)</td>
<td>50 – 750</td>
<td>&lt; 600</td>
<td>&lt; 600</td>
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<tr>
<td>Silica SiO₂ (ppm)</td>
<td>&lt; 150</td>
<td>&lt; 150</td>
<td>&lt; 150</td>
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<tr>
<td>Chlorides Cl⁻ (ppm)</td>
<td>&lt; 400</td>
<td>&lt; 400</td>
<td>&lt; 2000</td>
</tr>
<tr>
<td>Bacterial (cfu/ml)</td>
<td>&lt; 10,000</td>
<td>&lt; 10,000</td>
<td>&lt; 10,000</td>
</tr>
<tr>
<td>Sulphates SO₄²⁻ (ppm)</td>
<td>&lt; 400</td>
<td>&lt; 400</td>
<td>&lt; 400</td>
</tr>
</tbody>
</table>
7. **W-Tech provides water treatment skids (Basic/Advanced)** to ensure scale and biocide protection. These systems are capable of ensuring a bivalent protection by using a single antiscale/anticorrosive & biocide product (Basic) and manage the draining of water inside the evaporative system through the use of a digital conductivity (Advanced). In particular the advanced skid manages the dosing of antiscale/anticorrosive proportionally to the water consumption and the dosing of biocide by shock with programmable intervals.

*What does W-Tech suggest to maintain these systems?*

1. **Cleanliness of the system** especially on all wetted parts such as: internal surfaces on the tower, drift eliminator, water distribution system and fill pack.
2. **Regular check of conditions of the water** (Hardness control; Corrosion control; Total dissolved solids control; Microbiological control).
3. **A proper water treatment program**, under the supervision of a competent water treatment specialist.
4. **Control of the operating water level** by a mechanical float-operated valve, in order to prevent overflow or splash-out, which can affect treatment chemical levels and also result in the release of aerosols.
5. **Check of the condition and operation of the conductivity sensor.**
6. **Ensure that towers, condensers and associated pipework are drained down**, at least every 6 months.