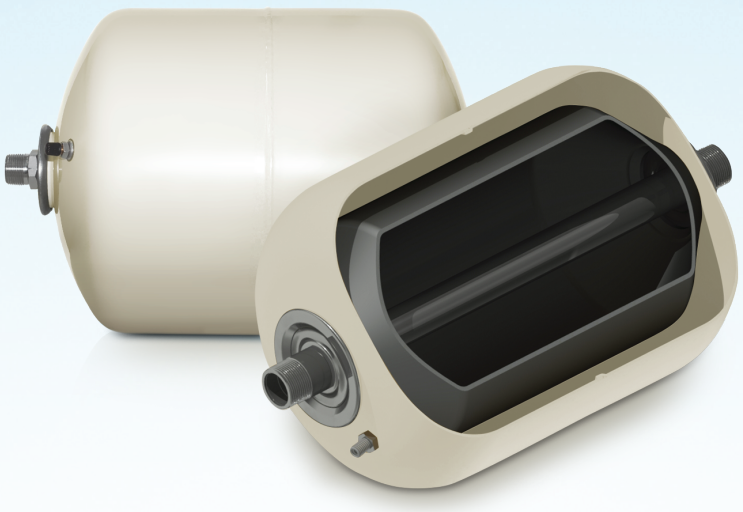
CALEFACTIO

QUALITY INNOVATION RELIABILITY

THE LEGIONELLA BACTERIA THREAT

How to Provide for Thermal Expansion and Minimize Legionella Bacteria Growth



By Ron George, CPD, President, Plumb-Tech Design & Consulting Services LLC.

Legionellosis is commonly known as Legionnaire's disease or Pontiac fever. The disease and the bacterium was named after an outbreak in 1976, when over 200 people who attended an American Legion convention in Philadelphia got sick with a mysterious flu-like lung infection which caused pneumonia and many deaths.

As of 1997, up to 18,000 people needed hospital care and were diagnosed with Legionnaires' disease each year. It is estimated that each year in the United States many cases go undetected and are misdiagnosed as the Flu or Pneumonia. Legionellosis can be contracted by inhaling water droplets or a water mist containing legionella bacteria from a contaminated water source. Legionella grows naturally in Lakes and streams. Legionella can survive in plumbing systems and be transmitted to humans by any aerosolized water source. The common source in plumbing systems is the mist from a shower head or any other source of water spray. The bacteria travel from the plumbing system to the infected person inside tiny water droplets that are inhaled and then settle in the warm, moist lining of the victim's lungs, leading to growth and infection. The symptoms typically include pneumonia and other flu-like symptoms. Legionella most often occurs to people who have a suppressed immune system, although some cases have been recorded in otherwise healthy people. If treatment is delayed, it can cause vital organs to shut down and the disease can be fatal.

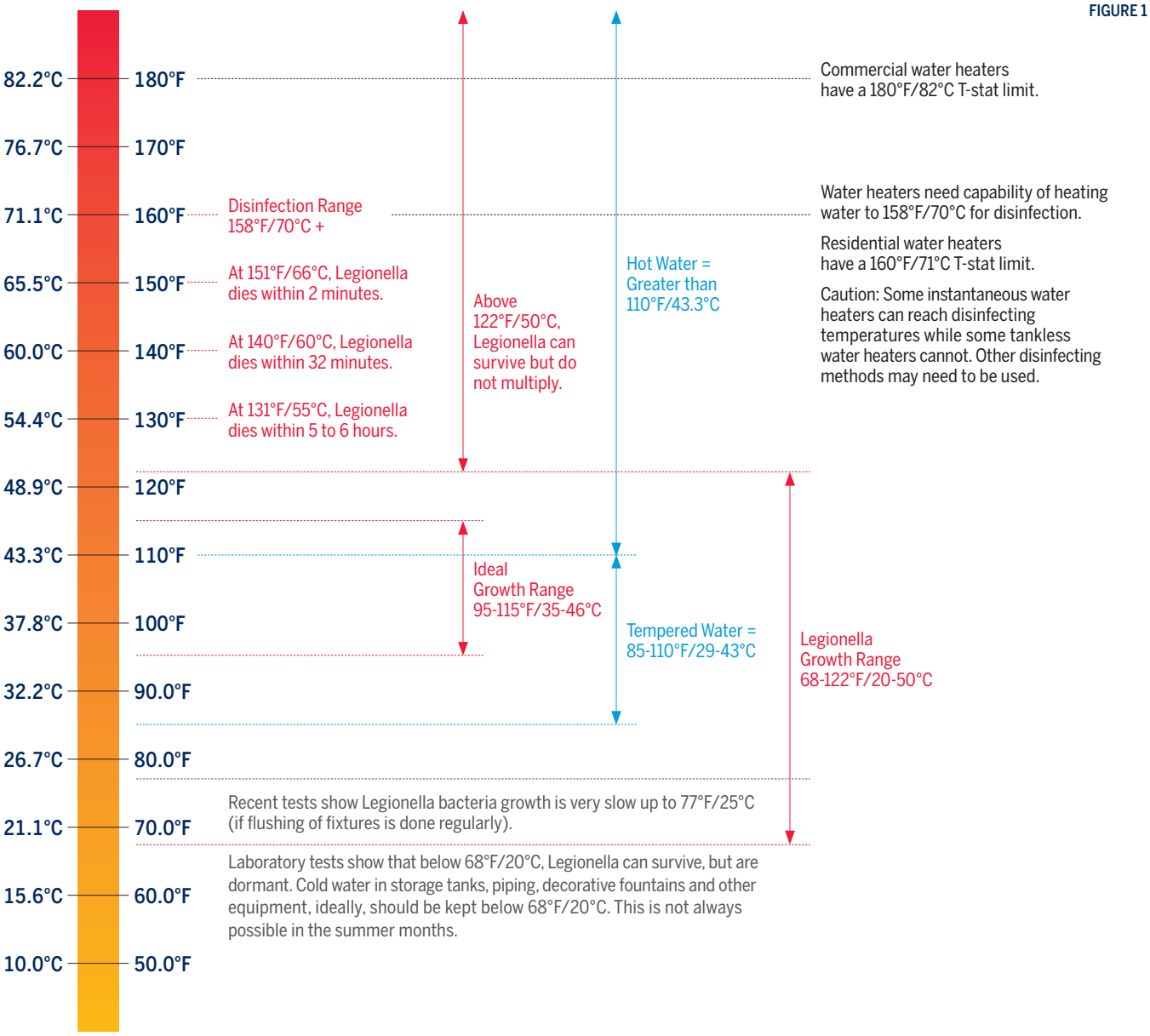
Conditions that promote growth of Legionella bacteria include heat, sediment, scale, and a food source or organisms that including algae, amoebae, and other bacteria that will provide nutrients and an environment favorable to survival & growth. Other conditions that promote Legionella growth are stagnation (which allows dissipation of water treatment chemicals such as chlorine or mono-chlorines) and a pH level between 5.0 and 8.5. Laboratory tests have shown that Legionella bacteria can grow in biofilms in stagnant water or where water velocities are low enough to allow a biofilm to grow. Most domestic water systems sit idle with no flow for the majority of the time.

Legionella will grow between 68°F and 122°F (20°C and 50°C). The ideal growth range where Legionella bacteria grows and multiplies at a more rapid pace is between 95°F - 115°F (35°C - 46°C). Legionella Bacteria can survive, but will not multiply in cold water below 68°F (20°C) and in water temperatures above 122°F (50°C) and up to 131°F (55°C). Legionella bacteria will die in 5 to 6 hours at 131°F (55°C), in 32 minutes at 140°F (60°C) and instantly at 158°F (68.3°C) and above.

With many of these Legionella growth temperature conditions being common in domestic hot water systems, it is important to protect against dead leg piping in older style thermal expansion tanks with a single pipe connection. Dead-end thermal expansion tanks can promote the colonization of the bacteria. To address this issue, Calefactio has a new series of flow-through thermal expansion tanks designed to eliminate stagnant water that is

TEMPERATURE VS LEGIONELLA GROWTH CHART

FIGURE 1



common in older style, dead-end thermal expansion tanks. This new design will help control Legionella bacteria growth. The following chart shows the Legionella growth temperature range and temperatures that will control legionella bacteria growth.

THE PROBLEM

Thermal expansion tanks are hydro-pneumatic tanks. This means the tank has a bladder with air on one side of a bladder and water can expand into the other side of the bladder to absorb thermal expansion.

When installing a potable water expansion tank or thermal expansion tank, the tank pressure must match the cold water supply pressure. If the tank's pressure is not adjusted and ends up being less than the inlet pressure, the tank will accumulate a certain amount of water which will stay stagnant and stuck in the older style of dead-end or single-pipe-connection thermal expansion tanks. The new style of flow-through thermal expansion tanks will not have stagnant water, but still should have the pre-charge pressure match the system working pressure. The pre-charge pressure determines if there will be a volume of stagnant water stored in the thermal expansion tank. The amount of water that flows into dead-end expansion tanks is determined by the pressure differential.

Many buildings and homes are required by codes or ordinances to have a backflow preventer, a check valve or a pressure reducing valve on the water service to a building. These devices create a closed system. When a water heater is installed in a closed system, a method to relieve thermal expansion, such as a thermal expansion tank, should be included to relieve excess pressure during heating periods. If the Temperature & Pressure (T&P) relief valve on the water heater is allowed to discharge, system pressures will far exceed 80 PSI code limitations and minerals in the discharge from the T&P valve could cause the relief valve to scale-up and not operate. This could create an explosive condition. Thermal expansion tanks are the solution. The expansion tank pre-charge air pressure must match the system static pressure. In a system where the inlet pressure is 60 pounds per square inch (PSI) and where the thermal expansion tank has a factory pre-charge of 40 PSI, the pressure differential is 20 PSI and a volume of water will flow into the thermal expansion tank until the air side of the thermal expansion tank bladder increases to 60 PSI this will cause water to always be present in an older-style expansion tank. (See Figure 2).

For a differential pressure of 20 pounds per square inch the manufacturer's literature indicates that the acceptance factor is 0.268 percent (pre-charge pressure at 40 PSI, city inlet pressure at 60 PSI). A 2.1 gallon expansion tank, it will contain 0.56 gallons of stagnant water (2.1 × 0.628 = 0.56 gal). Therefore, the pre-charge pressure should match or slightly exceed the normal system static pressure by a pound or two. When the incoming water is heated by the water heater, it expands. If there is no flow from faucets during the heating cycle, the increased volume created by the thermal expansion process will increase the system pressure and cause flow into the thermal expansion tank where the air in the thermal expansion tank compresses and absorbs the thermal expansion, thus protecting the system from a pressure rise that could damage the piping, plumbing fixtures and other system components.

Calefactio has a series of flow-through thermal expansion tanks designed to eliminate stagnant water which will minimize Legionella bacteria growth.

The thermal expansion tank should be connected to the cold water pipe ahead of the water heater so the water expanding into the thermal expansion tank is not hot water. This will extend the life of the thermal expansion tank bladder. (See Figures 2-5).

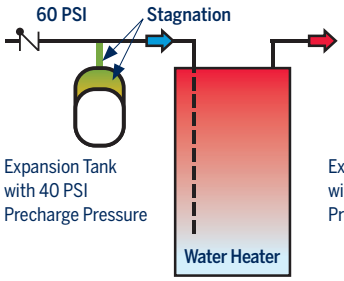


FIGURE 2
Older Style, Dead-end Thermal Expansion Tank with Pre-Charge Less Than System Pressure – Allows Stagnant Water Storage.

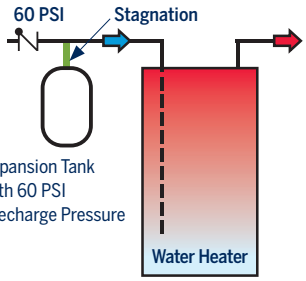


FIGURE 3
Older Style, Dead-end Thermal Expansion Tank with Pre-Charge Equal-To or Slightly Greater than System Pressure – Stagnant Water in Branch.

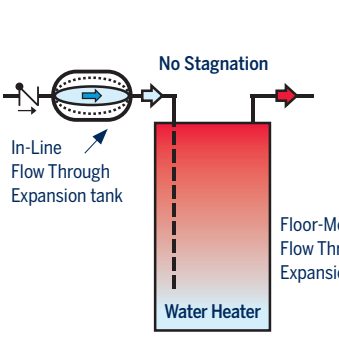


FIGURE 4
In-Line, Flow-Through Thermal Expansion Tank

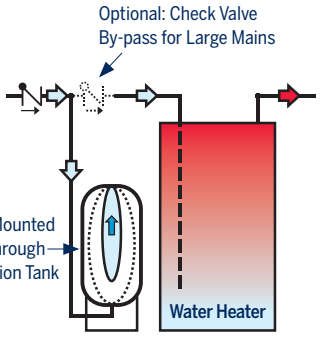


FIGURE 5
Floor Mounted, Flow-Through Thermal Expansion Tank

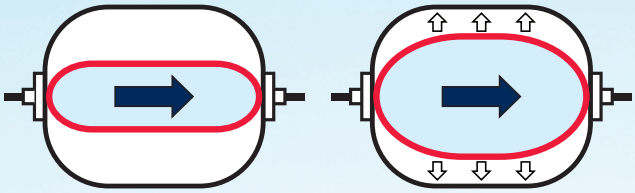


FIGURE 6
New In-Line, Flow-Through Thermal Expansion Tank.

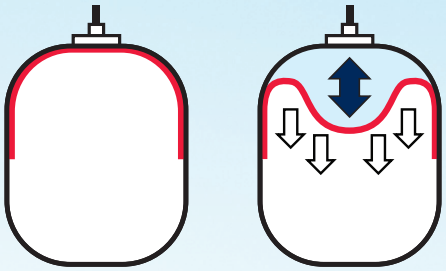


FIGURE 7
Older Style, Thermal Expansion Tank.

THE SOLUTION

One means to counter the propagation of bacteria is to eliminate the stagnant water in the tank with a Calefactio flow-through tank. The flow of water through the tank carries water treatment chemicals to control bacteria growth.

The new Calefactio flow-through expansion tank for potable water systems avoids stagnant water in the bladder since its design allows continuous flow-through the device. It operates as an expansion tank as the flow-through bladder accommodates the expansion of the water minimizing the pressure increases associated with the heating of water. The design of the Calefactio flow-through expansion tank ensures that the system water flows through the tank which allows municipal water treatment chemicals to control legionella bacteria.

Courtesy of RON GEORGE, President
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For more information on flow-through expansion tanks, visit our website:
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