Heat pump and domestic hot water legionella protection

Legionella prevention requirements of G12 AS1

G12.3.9: A hot water system must be capable of being controlled to prevent the growth of Legionella Bacteria.

6.14.3 Legionella Bacteria: Irrespective of whether a mixing device is installed, the storage water heater control thermostat shall be set at a temperature of not less than 60°C to prevent the growth of Legionella Bacteria.

6.14.4: The water temperatures within flow and return circulating systems shall be maintained at no less than 60°C.

Comment: Alternative methods of controlling Legionella within hot water circulating or warm water systems may include chlorine disinfection, UV sterilisation, high temperature pasteurisation combined with system flushing as part of a documented maintenance programme.

Historical & typical methods for approval in New Zealand

1. Electrical immersion element permanently set to at least 60°C with permanent power supply. Use of domestic hot water will cause tank temperatures to fluctuate, lower tank temperatures will fall as low as 10–20°C in normal usage with reheat times of around 1–2 hours before the entire tank contents is heated back to 60°C.

2. Electrical immersion element permanently set to at least 60°C with ripple control power supply. Use of domestic hot water will cause tank temperatures to fluctuate, lower tank temperatures will fall as low as 10–20°C in normal usage with reheat times of around 1–2 hours before the entire tank contents is heated back to 60°C. Reheat times can be longer if usage is during peak tariff periods and element is off.
3. Wet back and electrical immersion element, the immersion element will be operated as per one of the 2 options above. The wood fired wetback will contribute to the re-heating of the cylinder and achieve higher temperatures than the element set point (80–90°C).
4. External water heating sources that achieve domestic hot water tank temperatures of 60°C,

typically these would be part of a total building heating system where a circuit is dedicated to the domestic hot water heating. Often these circuits would be managed by a time clock that allows domestic hot water heating to operate in a number of daily time slots in order to not conflict with peak space heating periods.

5. Appliances that instantaneously produce domestic hot water and do not contain storage vessels or recirculation systems do not need to meet the requirements of G12/AS1 6.14.3 & 6.14.4.

Acceptable solution G12/AS2

AS2 covers the requirements of an acceptable solar water heating system for compliance with G12. Solar water heating systems do not offer a consistent output and the temperature in the domestic hot water cylinder cannot be guaranteed.

AS2-3.5.1 contains 3 acceptable methods to prevent Legionella Bacteria growth:

a) Have a continuously energised heating element fitted within 55% of the bottom of the water tank (by volume) and a thermostat set to 60°C or higher, or

b) Be controlled so that the water above the element is heated to 60°C once a day, and the element is in the bottom 20% of the water tank (by volume) and no more than 150mm from the bottom of the tank, or

c) Be controlled so that all of the stored water is heated to 60°C or higher, once a week for not less than 1 hour. The temperature must be measured by a probe in the bottom 20% of the water tank (by volume) and no more than 150mm from the bottom of the water tank. For open loop systems the stored water includes the water in the solar collector and water must be circulated through the collector during the heating period.

Heat pump domestic hot water heating

There are many forms of heat pump domestic hot water heating systems, some can independently comply with G12 6.14.3 as they can achieve domestic hot water temperatures of 60°C. These systems either use more efficient heat exchange systems, operate with high refrigerant temperatures (>65°C), or have integral electrical elements to boost heating or domestic hot water and do not need to be considered any further.

Other systems may be limited to the pre-heating of the domestic hot water to 45–55°C, these systems are not able to comply on their own and need the assistance of an immersion element to achieve the 60°C required. These systems are similar to the solar systems considered in AS2 and therefore the compliance methods (a, b, & c) listed above should be sufficient to achieve compliance with G12.

The purpose of heating domestic hot water with a heat pump is to increase the efficiency of the system, for this reason we would suggest only options b & c above are considered unless very high volumes of hot water are required.

How is this achieved with a Chofu heat pump?

Compliance with G12/AS1-6.14.3 with the Chofu heat pumps is achieved in one of two ways;

1. The heat pump manages the heating of the domestic hot water to 50°C either continuously or in programmed time periods (i.e. outside peak space heating periods). The immersion element installed in the hot water cylinder is located in the bottom port and is run through a time clock set to heat the cylinder to 60°C or higher once a day or once a week as per options b & c from G12/AS2-3.5.1.
2. The heat pump manages the heating of the domestic hot water to 50°C either continuously or in programmed time periods (i.e. outside peak space heating periods). The immersion element installed in the hot water cylinder is located in the bottom port and is controlled by the heat pump as per section 8.2.4 of the Chofu operation manual to heat the tank above 65°C for 10 minutes. If this function is not completed successfully the heat pump will show an error code that will not clear until this function has completed successfully.

Where domestic hot water systems also contain a flow and return circulating system "ring main", compliance with 6.14.4 will also need to be considered. The most common method for this is to ensure the ring main pump is forced on for the boost periods when the element is active, this will ensure the entire volume of the hot water system is heated to above 60°C. The alternative solutions suggested in G12/AS1 6.14.4 are also acceptable however are likely more costly.