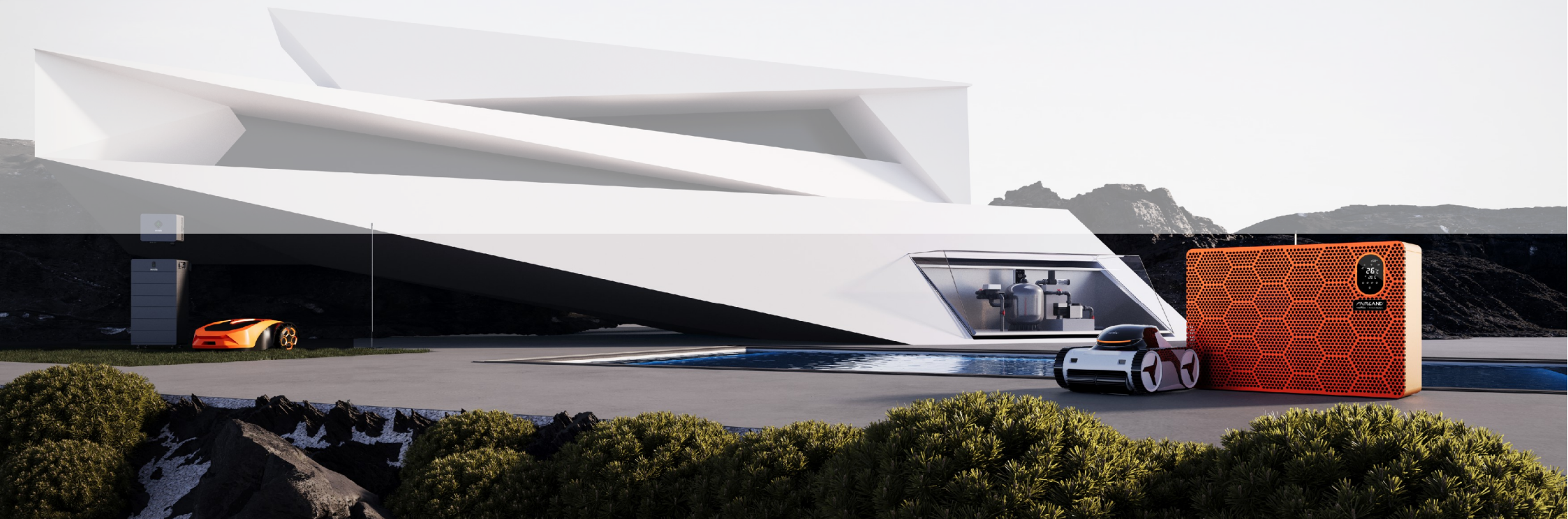


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Anti-freeze protection





Anti-freeze protection

Why is freeze protection necessary?

- ① **The expansion caused by water freezing can directly damage plate heat exchanger.** In plate heat exchangers, the flow channels are narrow; even slight ice formation can lead to blockage, while continuous expansion may directly cause the plates and copper tubes to crack. Since the refrigerant and water are in direct contact, if water enters the compressor, it can result in immediate failure of the compressor, with repair costs becoming extremely high.
- ② **When the outdoor ambient temperature is extremely low, the water circuit is highly susceptible to freezing due to heat loss.** If no heating is required during nighttime, and the unit remains powered off in standby mode for an extended period—resulting in the water circuit remaining stationary and without flow—the system is most prone to cracking from freezing.
- ③ **Relying solely on insulation is insufficient to prevent freezing.** Insulation foam can only slow down the rate of temperature decline but cannot lock the temperature; when the unit is shut down and the pump stops rotating, the water in the pipeline remains stationary, allowing heat to continue dissipating, which can cause the temperature to drop rapidly to the freezing point in low-temperature environments.

Anti-freeze protection basic logic

When the water temperature within the system drops below the set value, the anti-freezing protection function activates.

The unit will heat the water using a heat pump, a backup heater, or an auxiliary heat source to prevent freezing of the water-side plate-type heat exchanger.

The anti-freeze protection function will only cease operation once the water temperature rises again.



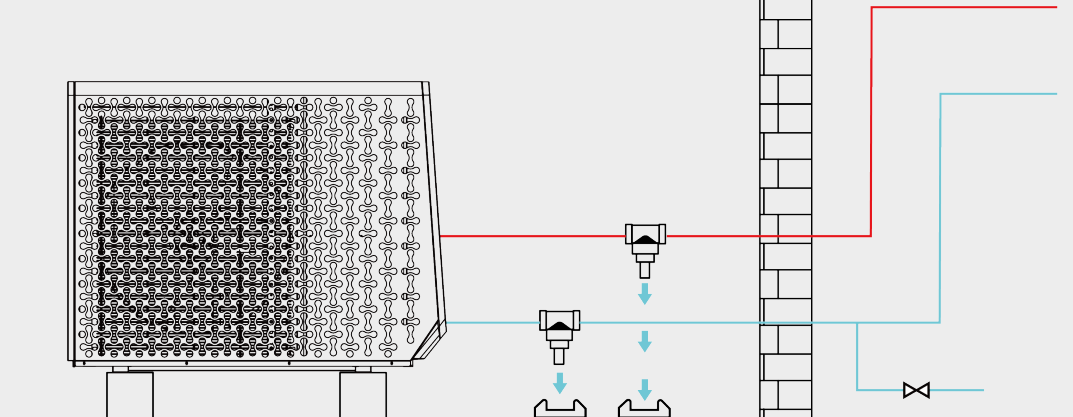
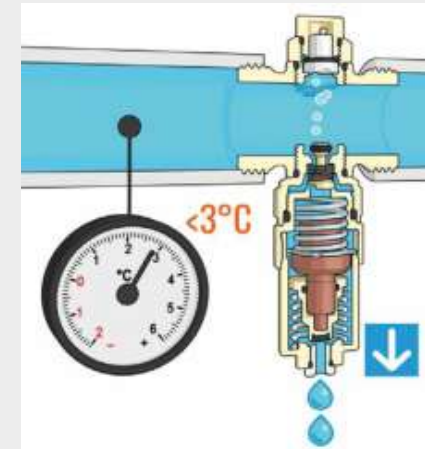
Anti-freeze protection

frost valve

When a heat pump loses power, a freeze protection valve must be installed to provide frost protection.

The frost valve function is designed to prevent the heat exchanger or piping from being damaged due to freezing or expansion during power outages, thereby ensuring the safe operation of the heat pump system. When the freeze protection valve automatically detects that the water temperature falls below 3°C, the valve opens to drain any accumulated water; once the water temperature rises again, the valve closes automatically.

Anti-freeze valve brand: ACOL





Anti-freeze protection

anti-freeze fluid

In addition to using a frost valve, you can also add antifreeze to the water circuit for protection.

Using antifreeze can affect the hydraulic resistance of the heat pumps water circuit, as well as its flow rate and heat transfer capacity.

Table 3-3.1: Ethylene Glycol

Concentration of ethylene glycol (%)	Modification coefficient				Minimum outdoor temperature(°C)
	Cooling capacity modification	Power input modification	Water resistance	Water flow modification	
0	1.000	1.000	1.000	1.000	0
10	0.984	0.998	1.118	1.019	-5
20	0.973	0.995	1.268	1.051	-15
30	0.965	0.992	1.482	1.092	-25

Table 3-3.2: Propylene Glycol

Concentration of propylene glycol (%)	Modification coefficient				Minimum outdoor temperature(°C)
	Cooling capacity modification	Power input modification	Water resistance	Water flow modification	
0	1.000	1.000	1.000	1.000	0
10	0.976	0.996	1.071	1.000	-4
20	0.961	0.992	1.189	1.016	-12
30	0.948	0.988	1.380	1.034	-20

* The degree of impact is for reference only.

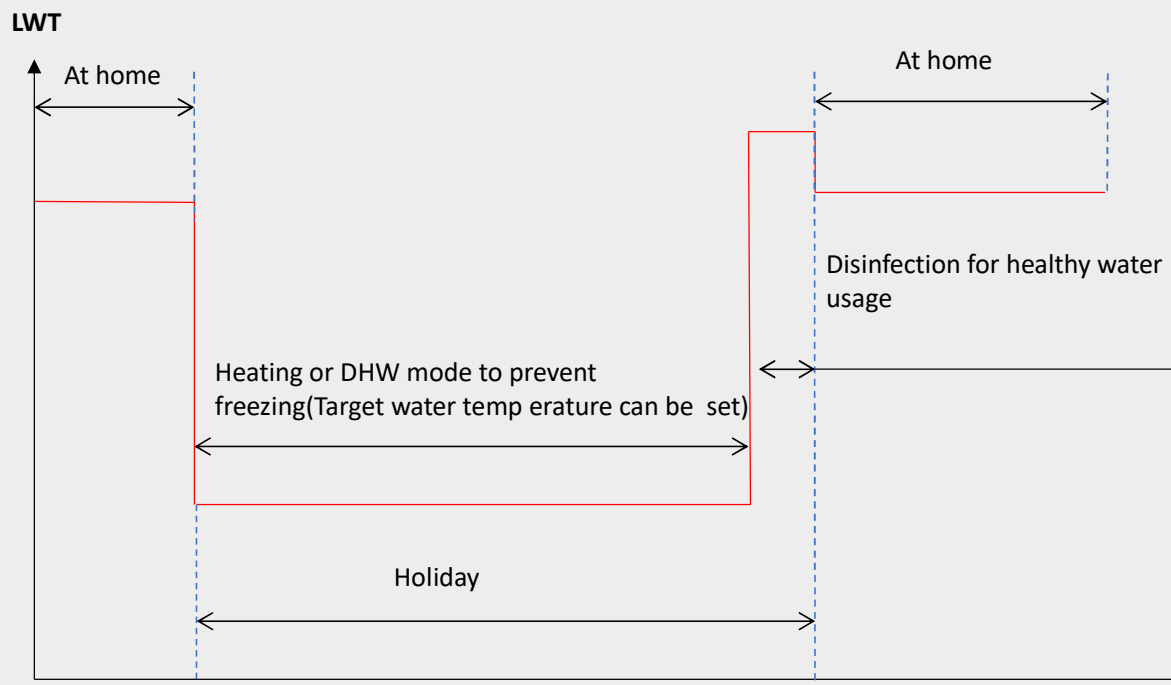


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Anti-freeze protection

Holiday Away Mode

When users are on vacation, the "Holiday Away Mode" can be enabled to protect the heatpump from frost damage based on weather conditions. Once this mode is activated, the heatpump will operate at a low set temperature in either the heating or DHW mode during the specified time period.



< Holiday Away

Function Enable	Disable
START	19 - 11 - 2025
END	26 - 11 - 2025
Heating Mode Enable	Enable
DHW Mode Enable	Enable
Disinfection Enable	Enable



Anti-freeze protection

Three-stage Anti-freeze Protection

Three-stage Anti-freeze protection:

- **Standby mode :**

When the equipment is in standby mode and the ambient temperature (TA) $< [\text{Atfr. enter. T}] = 7^\circ\text{C}$

① If the outlet water temperature $\leq [\text{Atfr. pump T}] = 18^\circ\text{C}$, the system will only start the main circulation pump;

② If the outlet water temperature $\leq [\text{Atfr. Heat T}] = 12^\circ\text{C}$, activate the electric heater;

③ If the outlet water temperature $\leq [\text{Atfr comp. T}] = 10^\circ\text{C}$, the equipment enters the heating/DHW mode.

- **Cooling Mode:**

If the hot pump outlet water temperature is $< [\text{Air cool low}] = 4^\circ\text{C}$, the heat pump will stop operating;

If the outlet water temperature $> [\text{Air cool low}] + [\text{Exit T. diff}] + 2^\circ\text{C} = 11^\circ\text{C}$, the heat pump will resume normal operation.

Default :

Atfr. enter. T = 7°C
[Atfr. pump T] = 18°C
[Atfr. Heat T] = 12°C
[Atfr. comp. T] = 10°C

Default :

[Air cool low] = 4°C
[Exit T. diff] = 5°C

When anti-freeze protection is enabled, the wired controller  icon will illuminate.



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Anti-freeze protection

Cascade anti-freeze protection

Anti-freeze protection: if any of the parallel units enters anti-freeze protection mode, all other units will enter anti-freeze response mode.

For example: when units 0#,1#, and 2# are in operation, if unit 0# meets the anti-freezing conditions, unit 0# will execute the standby anti-freezing procedure; based on the anti-freezing conditions, units 0#,1#, and 2# will start the water pump, electric auxiliary heater, or compressor; the wired controller will display the anti-freezing icon  continuously lit.



Anti-freeze protection

Note

To enable the anti-freezing protection function, the unit must remain powered at all times; in the event of a power outage, this function will be unable to effectively prevent the equipment from icing.

Therefore, during extended periods of unattended operation, no need to leave the unit powered on continuously. It is recommended to drain all accumulated water from the system or add antifreeze to the water system. Based on the expected minimum outdoor temperature, ensure that the antifreeze concentration in the water system complies with the specified requirements. Adding antifreeze may affect the performance of the unit.