

How iGarden R290 ASHP achieves COP Up to 7.0

1. COP 7 comes from system balance

To achieve a high COP, a heat pump needs to:

- Absorb more heat from the environment
- Transfer heat more efficiently
- Consume less electrical energy

Therefore, high COP is not determined by one individual component.

A heat pump consists of three major systems:

- Refrigerant system
- Water system
- Electrical and control system

The refrigerant system transfers energy, the water system delivers heating output, and the control system coordinates all components to work together.

The real challenge is not only selecting high-performance components, but making all components work together at the optimal point under different operating conditions.

This system balance is the key to achieving COP up to 7.0.

And the technology that enables this balance is Fairland self-developed and self-manufactured intelligent control system.

2. Self-developed intelligent control system: the brain that coordinates the entire system

The control system is the brain of the heat pump.

Many manufacturers use third-party control systems.

The problem is:

They may have good compressors, good valves, and good heat exchangers, but these components are controlled separately.

Because **Fairland develops and manufactures our own PCB and control system**, we understand every component and can optimize the interaction between:

- compressor frequency
- refrigerant flow
- fan speed
- water flow
- temperature and pressure feedback

This precise coordination is the foundation for achieving higher COP.

3. Intelligent EEV control: precise refrigerant management

The refrigerant cycle is the core of heat pump performance. To achieve high efficiency, the system needs to maintain the optimal refrigerant balance under different operating conditions.

Too much or too little refrigerant can reduce heat transfer efficiency, affect COP, and impact system reliability.

Therefore, precise refrigerant management is essential for maximizing system performance.

The Electronic Expansion Valve (EEV) controls the refrigerant flow into the evaporator and is a key component affecting heat transfer efficiency and COP.

With Fairland's self-developed intelligent control system continuously adjusts the EEV opening. Compared with conventional systems, iGarden's control logic delivers 5–10 times higher control precision, enabling faster and more accurate refrigerant regulation.

This enables:

- More precise refrigerant control
- Faster response to load changes
- Improved heat absorption efficiency

As a result, the refrigerant cycle stays closer to its optimal operating condition, improving heat transfer performance and COP.

4. Intelligent startup control: reaching optimal operation faster

The startup stage is critical for establishing a stable refrigerant cycle. Improper refrigerant control during startup can lead to longer stabilization time, higher energy consumption, and reduced efficiency.

iGarden's intelligent control system automatically calculates the optimal initial EEV opening based on operating conditions and continuously adjusts the performance curve through real-time monitoring.

With over **20 levels of superheat control** and **100 precise startup adjustment steps** (compared with conventional systems typically using 3–5 superheat control levels and around 20 startup steps), iGarden achieves more accurate refrigerant regulation from startup.

Benefits include:

- Faster refrigerant cycle stabilization
- Smoother startup
- Reduced startup energy loss
- Higher efficiency and system stability

By reaching optimal operating conditions faster, intelligent startup control improves heat transfer efficiency and contributes to COP up to 7.0.

5. Optimized low-frequency operation: achieving COP 7

COP is not a fixed value. It changes depending on operating conditions, including outdoor temperature, water temperature, and compressor frequency.

In real applications, heat pumps operate most of the time under partial load conditions, rather than at maximum capacity.

Under partial load operation, the compressor runs at a lower frequency, which helps to:

- Reduce energy consumption
- Lower compressor losses
- Improve overall system efficiency

However, simply reducing compressor frequency is not enough. The entire system needs to be accurately coordinated to maintain the optimal operating condition.

With Fairland's self-developed intelligent control system, the heat pump can intelligently adjust according to actual heating demand and operating conditions. This allows iGarden R290 ATW heat pump to operate continuously in its high-efficiency range under optimized low-frequency conditions, achieving COP up to 7.0.

8. Conclusion

COP 7 is the result of system engineering, not a single technology. It comes from high-efficiency hardware, self-developed control system, precise EEV and superheat management, and optimized partial-load operation.