Most valves expand your refrigerant
EcoFlow™ expands your options

25% COP
boost possible
with silent defrost.

1+ SEER
energy savings
Reduce energy consumption and increase efficiency in residential air conditioning systems.

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Innovative thinking, a revolutionary design and patented technologies have solved one of the main challenges within air conditioning: achieving balanced distribution of refrigerant in air conditioning systems and avoiding maldistribution in evaporator circuits.

Conventional mechanical or electronic expansion valves and distributors can not equally distribute refrigerant throughout the evaporator, resulting in less than optimal performance. This results in an efficiency drop between 20-40%, compared to the total potential of the evaporator.

With EcoFlow refrigerant imbalance and maldistribution is a thing of the past. The solution is adaptive distribution. The technology is based on advanced algorithms and simple laws of physics. The EcoFlow expansion system increases the SEER/EER ratings of today's systems, is prepared for tomorrow's microchannel systems and enables efficiency improvements without impacting the environment.

EcoFlow-developed, designed and produced in Denmark
The challenge:
Existing expansion technology

Stable evaporator performance with low superheat depends on a balanced distribution of refrigerant. Hunting phenomena by the expansion valve is well known when trying to lower the overall superheat in an unbalanced state and leads to a need for a higher superheat to avoid liquid in the compressor. High superheat also makes it difficult to improve SEER/EER ratings, as the evaporator is not fully utilized.

Although greatly improved in recent years, the combination of expansion valves and distributors has still not adequately solved common issues within evaporators.

- Irregular mass flow rate to all circuits
- Unequal pressure drop across circuits
- Unequal heat resistance in circuits
- Uneven air flow over the evaporator
- Refrigerant imbalance

The solution is here:
EcoFlow™ adaptive distribution

Using advanced algorithms the EcoFlow system continuously monitors and optimizes the performance of the evaporator. The data retrieved and calculated enables EcoFlow to create a hypothesis about the refrigerant flow in the individual circuits, and then distribute the exact amount of refrigerant necessary for each circuit to perform optimally.

The result is a consistent, low superheat level in each circuit, which enables near-perfect performance throughout the entire evaporator. In addition the EcoFlow is equally applicable in systems ranging between 1 and 7 tons capacity.

Immediate advantages with EcoFlow™
- Continuous monitoring and optimization
- Control via one superheat sensor mounted at the evaporator outlet
- Eliminates maldistribution
- Insensitive to variations in air flow over the evaporator
- Optimal superheat performance
- Increased efficiency of evaporator
- Enables higher SEER/EER rating of existing systems
- One EcoFlow expansion system for a wide evaporator range
Innovation

The EcoFlow applies several innovations within controls, materials and design. The combined effect of new technology and simpler design solves problems that have challenged the refrigeration and air conditioning industry for years.

- One sensor to monitor the performance of all circuits
- Advanced control algorithms enabling precise refrigerant flow
- Refrigerant is distributed to each circuit independently
- Unique distribution method to independent circuits
- Simplified design with fewer brazed joints
- Works with all common refrigerants
- Internal ceramic orifice disk designed for long lifetime (15Y+)
- Only one rotating part

Intelligent system monitoring and control

Advanced algorithms enable optimised flow with lowest possible superheat. The EcoFlow system measures the performance of the evaporator and distributes the optimal amount of refrigerant to each circuit independently, tracking changes continuously.

This method of adaptive distribution works as a result of the non-linear behaviour of the superheat of the refrigerant, which temperature at the beginning of the dry-zone increases rapidly, and slowly increases towards the air-inlet temperature.

Continuous calculations form the basis of a hypothesis about the refrigerant level in each circuit. The EcoFlow tests the hypothesis by adding slightly more refrigerant to one circuit, while reducing the amount to the others.

If the superheat measured in the manifold drops, then it is concluded that the dry zone has been reduced and less refrigerant is added to the circuit on the next cycle. On the other hand, if the resulting superheat increases, it is an indication that the circuit that received more refrigerant had a larger dry-zone. The valve will then distribute more refrigerant to this circuit until the superheat reduces. The valve then repeats the action to track changes, and then starts the process again in a continuous cycle.
Improve the A/C energy efficiency in homes with the Ecoflow expansion system that not only increases the SEER ratings of today’s residential air conditioning systems, but is prepared for tomorrow’s microchannel systems.
Tested in real-life applications, EcoFlow has also proved to be extremely efficient in systems fitted with microchannel heat exchangers. Although well on their way to being the new standard within heat exchangers, microchannel systems are known to suffer from significant refrigerant imbalance.

With EcoFlow, refrigerant maldistribution is a thing of the past. As the system continuously monitors the performance of the evaporator and instantly equalizes the flow of refrigerant, the true potential of the evaporator is unharnessed, thereby increasing both evaporator and overall system efficiency.

By using an infrared camera, we have been able to monitor the flow of refrigerant in the evaporator in real-time. As documented by the large image, an EcoFlow distributor clearly increases the performance of the evaporator, as the refrigerant levels are consistently high in all circuits.

By comparison, the flow of refrigerant in an evaporator controlled by a TXV valve and mechanical distributor, is far from optimal with visibly irregular refrigerant levels in the single circuits.

**Efficiency improvement**
- 15+% interlaced fin and tube evaporators
- 25+% face split fin and tube evaporators
- 30+% microchannel evaporators

**Production advantage**
- Refrigerant independent solution
- Smaller unit footprint due to smaller coils
- Main evaporator control components in a packaged solution (EEV + distributor + fEESer tubes)

**Efficiency benefits**
- Increased COP in all conditions
- Increased system capacity
- Reduction in evaporator size possible
- Refrigerant balanced in MC evaporators

**System opportunities**
- Dehumidification possible by controlling suction pressure
- Load matching from ultra low capacity to maximum
- Diagnostic capability (e.g. compressor protection, flash-gas detection, charge loss)
- Defrost of the evaporator by disabling one segment at a time

**Environmental benefits**
- Increased SEER/EER rating of existing systems
- Energy savings from one million EcoFlow valves amount to 110 mill US$ per year, or the electricity production of 85 wind turbines
- One EcoFlow reduces CO$_2$ emissions by 1430 lbs per year, equivalent to a single car’s CO$_2$ emissions after driving 1600 miles
The solution: Silent defrost
The EcoFlow valve employs a principle we call silent defrost to remove ice from evaporator segments.
By opening or closing evaporator segments independently it is possible to defrost evaporators segment by segment, allowing the remaining segments to function normally.

When an evaporator segment is shut off for a period, the ambient air above the frost will melt that what has built up on this segment. The segment is then re-opened while the next segment is closed for defrosting.
The Danfoss product range for innovative efficiency

Danfoss is a worldwide manufacturer with a leading position in industrial, commercial and supermarket refrigeration as well as air conditioning and climate solutions.

We focus on our core business of making quality products, components and systems that enhance performance and reduce total life cycle costs – the key to major savings.

We offer a single source for one of the widest ranges of innovative components and systems in the world. And, we back technical solutions with business solutions to help your company reduce costs, streamline processes and achieve your business goals.

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