

Advantages of ReFreeX™ System

1. Content

1. Content
2. Reliability
 - 2.1. Centralized digital control
 - 2.2. Software replaces hardware
 - 2.3. Safe hot gas replaces electric defrost and heating
 - 2.4. No mechanical regulation
 - 2.5. Remote monitoring
 - 2.6. Less refrigerant and oil means better reliability
 - 2.7. Master – slave architecture
3. Total cost of ownership
 - 3.1. Proper regulation means lower electrical consumption
 - 3.2. Better winter operation leads to lower electrical consumption
 - 3.3. Digital control means lower management cost
 - 3.4. Refrigerant charge under 6 kg leads to lower management cost
4. The Environment
 - 4.1. The greenhouse effect
 - 4.2. The oil impact
5. Flexibility
 - 5.1. Migration to new refrigerants
 - 5.2. Working at low and normal temperature
 - 5.3. Free heating and dehumidification

2. Reliability

2.1. Centralized digital control

All the analog and digital signals of the refrigeration plant are collected by a dedicated electronic controller with a microprocessor, named master controller and located inside the electric board. The master controller has all the information about the refrigeration plant, so it is able to attain the optimum regulation and to take the best action in every operating condition.

For instance, a standard refrigeration plant can have several pressure switches, and use just their open/closed contact status; the ReFreeX system instead reads once the pressure, translates it to a numerical format suitable for the microprocessor and then acts.

The evaporator feeding system of ReFreeX, replacing the traditional thermostatic/expansion valve, is integrated inside the master controller to optimize performances and reliability, while even the most modern plants, with electronic expansion valve, have separate devices not integrated with plant control.

2.2. Software replaces hardware

The ReFreeX system employs the software and the system integration to reduce at the minimum the number of components: it does not have thermostatic valve, liquid receiver, Kriwan INT 69 module, oil pressure switches, capillaries nor devices with flare nuts.

Being able to perform the same control with a reduced number of components, the reliability is increased.

2.3. Safe hot gas replaces electric defrost and heating

The defrost and heating function is performed by an intrinsically safe hot gas system.

No third pipe is required, because the hot gas is injected in the engine room into the liquid line, passing then through the evaporator distributor and so avoiding any possible liquid return at the compressor during defrost and heating.

Just a dedicated solenoid valve – with no other control – is required to substitute the heating elements.

Heating elements are a well known source of trouble in the long run; their substitution leads to improved reliability.

2.4. No mechanical regulation

No device in the ReFreeX system can be regulated by mechanical tools: screwdrivers and like.

This means that all the regulations – named setting parameters – are safely stored inside the master controller microprocessor EEPROM.

The regulations are set during the project stage, before production beginning, and set at the factory, leaving no room for error.

The regulations are transparent to the user, during all the working life of the plant; they can be checked and eventually restored by electronic means.

2.5. Remote monitoring

The lack of manual regulation means that everything can be set using a local PC.

The control is easily extended to a remote PC, eventually several thousand kilometres away; so the manufacturer, the installation company and the end user can have maximum profit from all the instruments offered in the internet era.

2.6. Less refrigerant and oil means better reliability

The ReFreeX system requires 80% less refrigerant than a traditional plant, for instance 2 kg of refrigerant Vs. 10 kg.

The lubricating oil – required by the motorcompressor – mixes with the refrigerant and travels all along the circuit piping.

For this reason smaller quantity of refrigerant means also smaller quantity of oil.

One of the biggest risk of fault for a refrigeration plant is the stroke in the compressor piston, due to excessive oil or liquid refrigerant.

A reduced amount of refrigerant and oil means better reliability.

2.7. Master – slave architecture

The master electronic controller of the ReFreeX system is safely put inside the electric board.

The operator interacts through a second controller – named slave controller – put near to the operational area.

The slave controller is just an interface used to protect the master control from day to day mechanical stress or impact.

In case of fault of the slave controller, the master controller is unaffected and continues to work properly.

This kind of architecture is named master-slave and ensures the maximum reliability.

In a similar way, the local pc – when installed – is a kind of interface towards all the refrigeration plant installed in the area. In case of fault of the PC, all the refrigeration plants continue to work properly.

3. Total cost of ownership

3.1. Proper regulation means lower electrical consumption

More than 80% of installations do not perform as expected by the project, having performance loss between 10% and 30%. This incredible state of affair, perceived by empirical experience, has been confirmed by rigorous study of Mr. Klas Berglöf, MoSc, MD ClimaCheck Sweden AB, klas@climacheck.com: “The survey based on 164 documented performance inspections on air-conditioning, refrigeration and heatpump systems [in Sweden] showed that only 13% of the systems operated with the specified performance.”.

Unsurprisingly the most common cause of bad performance is shown to be linked to the expansion valve and to the refrigerant charge. The management of refrigeration plants, not assisted by proper software and control, is particularly prone to performance losses.

A proper regulation, performed by a centralized controller as in the ReFreeX system, improves performances and reduces electrical consumption.

3.2. Better winter operation leads to lower electrical consumption

Traditional refrigeration plants do not perform at maximum efficiency during the winter, due to the *orifice* of the mechanical thermostatic valve that requires operating the compressor at higher pressure on the discharge side.

Lower pressure would reduce consumption because the compressor would require lesser work to “pump against the high pressure side”. We experience something similar manually inflating a bicycle wheel, that becomes harder when the wheel pressure increases.

The ReFreeX system has no *orifice*, so in the winter operation can benefit from favourable environment, reducing the pressure at the compressor and so reducing the electrical consumption.

3.3. Digital control means lower management cost

The digital control of the ReFreeX system allows simpler management by local and remote PC, reducing the cost of periodical inspection by repairmen, and so reducing the total cost of ownership.

3.4. Refrigerant charge under 6 kg leads to lower management cost

The regulation EC 842/2006 mandates periodical leakage searches on hermetically sealed plant containing more than 6 kg of fluorinated refrigerant gases: R404A, R507, R134a The frequency of inspections depends on the quantity of refrigerant contained in the refrigeration plant.

The lower quantity of refrigerant of the ReFreeX system leads to lower management cost and sometimes to leakage search exemption, when the refrigerant quantity is less than 6 kg.

4. The Environment

4.1. The greenhouse effect

The greenhouse effect of our planet is due to our atmosphere reflecting back the heat radiated from the earth. This effect causes global warming and climate modification.

The main contributor is the CO₂ – carbon dioxide – risen to higher concentration than in the past time. However several other gases have equivalent effect, among them the fluorinated refrigerants.

One kilogram of R404A in the atmosphere has the same effect of about 3600 kg of CO₂. To have an idea of the damage caused by it, travelling ideally around the earth equator for about 40,000 km, using a small efficient car, the CO₂ emission is equivalent to about one kg of R404A.

The ReFreeX system reduces by 80% the refrigerant charge and so reduces the environment impact.

Having better winter performance, the ReFreeX system reduces the electricity consumption and so the environment impact to produce the energy.

4.2. The oil impact

The lubricating oil is essential for the correct operation of the motorcompressor. The oil is not bound inside the compressor, but travels in all the circuit blending with the refrigerant.

The compressors come from the factory already equipped with the right oil quantity, however often it is necessary to integrate the quantity of oil, due to the mixing with refrigerant.

The ReFreeX™ refrigeration system, having less quantity of refrigerant requires less or no oil addition, so reducing the environmental impact of the oil.

5. Flexibility

5.1. Migration to new refrigerants

The ReFreeX system has no thermostatic valve, so it can be used with different kind of refrigerants, without modifying any hardware device.

5.2. Working at low and normal temperature

The ReFreeX system, thanks to clever algorithms, is able to work in a wide range of temperatures. For instance a normal cold room for -25°C can be operated at 0°C, without modifying any hardware device, including the condenser.

5.3. Free heating and dehumidification

The logic of the ReFreeX system is not hardwired inside the electric board, as happens for traditional plants. The same plant can perform for free also heating and dehumidification, if required.