NANBA

Freon Keeper

Refrigerant Leakage Detection System　Freon Keeper

FK-TOP-3

IoT transformation for refrigeration equipment
Electricity cost reduction using a refrigerant leakage management system

This product received an Excellence Award of the 37th Honors on Excellent Energy-Saving Facilities

Organized by the Japan Association of Refrigeration and Air-conditioning Contractors (JARAC)
Cooperated with the Energy Conservation Center, Japan (ECCJ)

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Refrigerant Leakage Detection System　Freon Keeper

Freon Keeper is a leakage detection system designed to detect refrigerant leakage quickly.
Early detection of refrigerant leakage provides you with three significant benefits.

Three Significant Benefits

1 Cost saving

2 Reduced amounts of leakage

3 Stable operation of equipment

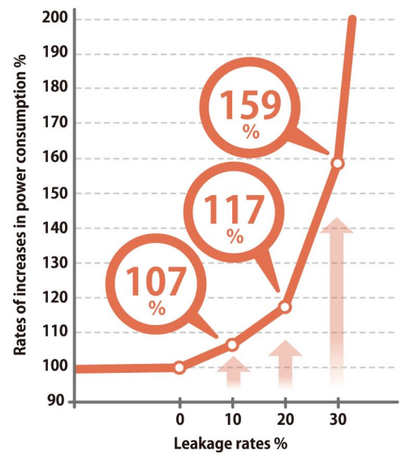
1 Cost saving

Freon Keeper can save power consumption by up to 37.2%※

※ This value varies depending on the operating environment, use conditions, the refrigerant type and refrigeration equipment used.

Separate-type showcases, which are often used in supermarkets and the like, leaks approximately 16% of refrigerant per year on average. If the refrigeration equipment is continuously operated with over 30% of its refrigerant leaked, a shortage of its cooling capacity results in longer running time and an increase of 59% power consumption on average. Using refrigeration equipment with its refrigerant leaked not only reduces the operating efficiency of the equipment but also increases the risk of compressor problems.

Relationship between the amounts of refrigerant leakage and the increases in power consumption



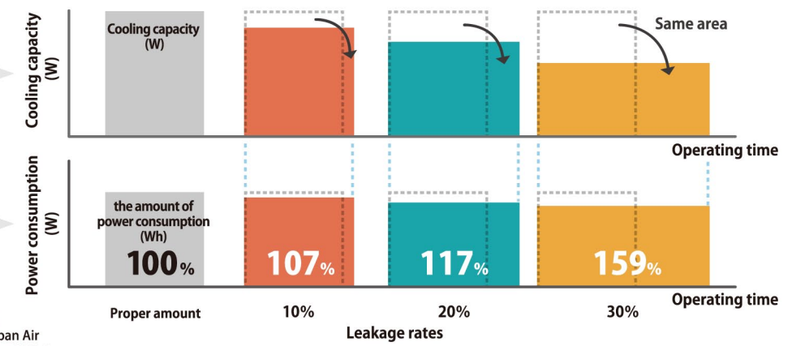
Particularly sensitive to refrigerant leakage is the increase in the power consumption of refrigerating and air-conditioning equipment. The Japan Refrigeration and Air Conditioning Industry Association and the Japan Air Conditioning and Refrigeration Testing Laboratory conducted "A test to measure the power consumption of refrigeration equipment with varying top-up amounts of refrigerant," using commercially available integrated scroll-type refrigeration equipment (with a cooling capacity of 6.3kW and using R-404A as refrigerant) and a dummy load device. According to the test results, when the refrigerant leakage rate on the horizontal axis increased from 10% to 20% and 30%, the rate of increase in power consumption on the vertical axis increased from 7% to 17% and 59%, respectively. Because refrigerant leaks very slowly in many cases, you will be consuming an excessive amount of power (up to 59%) until you realize that a leak is happening. Even the most of professional vendors do not recognize this fact. Freon Keeper can detect as small as about-10% of reduction in the amount of refrigerant and save power consumption by early detection of refrigerant leakage.

Source: Based on data from the Japan Refrigeration and Air Conditioning Industry Association and the Japan Air Conditioning and Refrigeration Testing Laboratory (2018)

Impacts of reduced amounts of refrigerant on cooling capacity and power consumption

Due to reduced cooling capacity, the operating time to reach the set temperature will increase.

Due to the increased operating time, the amount of power consumption (Wh) will also increase.



Source: Based on data from the Japan Refrigeration and Air Conditioning Industry Association and the Japan Air Conditioning and Refrigeration Testing Laboratory (2018)

2 Reduced amounts of leakage

Freon Keeper can reduce refrigerant leakage by detecting an about-10% of leakage in the amount of refrigerant

3 Stable operation of equipment

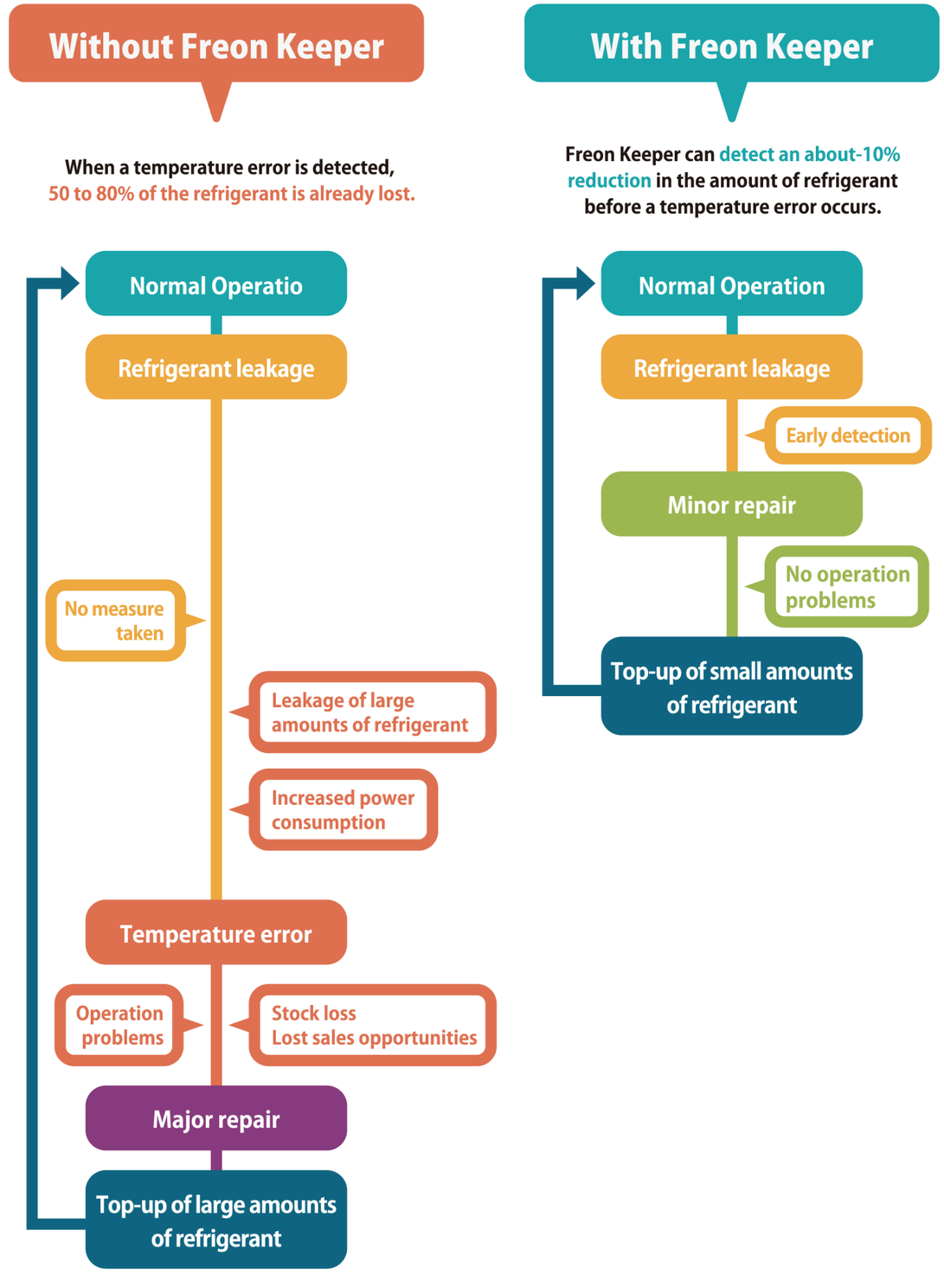
Stable operation of refrigeration equipment will prevent the loss of product stock and sales opportunities, and it will help extend the lifetime of the equipment.

Typically, refrigerant leakage is detected when a temperature error occurs in freezing and refrigeration equipment and 50 to 80% of the refrigerant is already lost in this stage. The rise in refrigeration temperature affects the quality of product stock and sale, which not only impairs business profitability but also requires urgent large-scale repair. However, by monitoring the rate of flash gas generation※ in real time, Freon Keeper can detect about 10% of leakage in the amount of refrigerant and prevent profit loss, such as the loss of product stock and sales opportunities. At the same time, Freon Keeper allows you to take systematic and appropriate measures for improvements of the refrigeration equipment at proper costs.

※ Flash gas refers to bubbles that appear in the liquid refrigerant pipe when the amount of refrigerant decreases. The generation of large amounts of flash gas deteriorates the refrigerant effect.

※ The generation rate of flash gas refers to an index that represents the frequency of flash gas generation per minute.

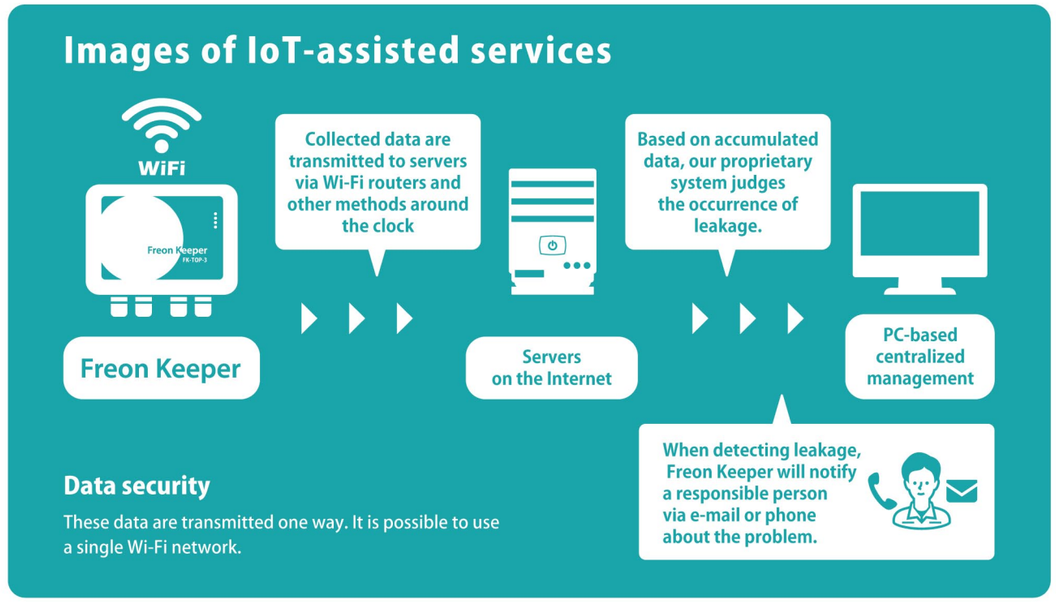
Freon Keeper: Comparison of damage to refrigeration equipment



IoT transformation for refrigeration equipment

By installing Freon Keeper, you can transform your refrigeration equipment into IoT-assisted equipment. Our proprietary system judges the occurrence of leakage by collecting, measuring, and monitoring various data such as ambient temperature, liquid refrigerant temperature, output temperature, input temperature, and power consumption (current) around the clock. This operation is like an experienced technician monitoring refrigeration equipment around the clock but Freon Keeper demonstrates even more reliable and higher accuracy than the technician. Collected data are automatically transmitted to servers every ten minutes, making it possible to manage refrigeration equipment installed in many stores in an integrated manner through the web without going to the sites. When detecting leakage, Freon Keeper will automatically send an e-mail to a responsible person to notify them of the problem.

Images of IoT-assisted services



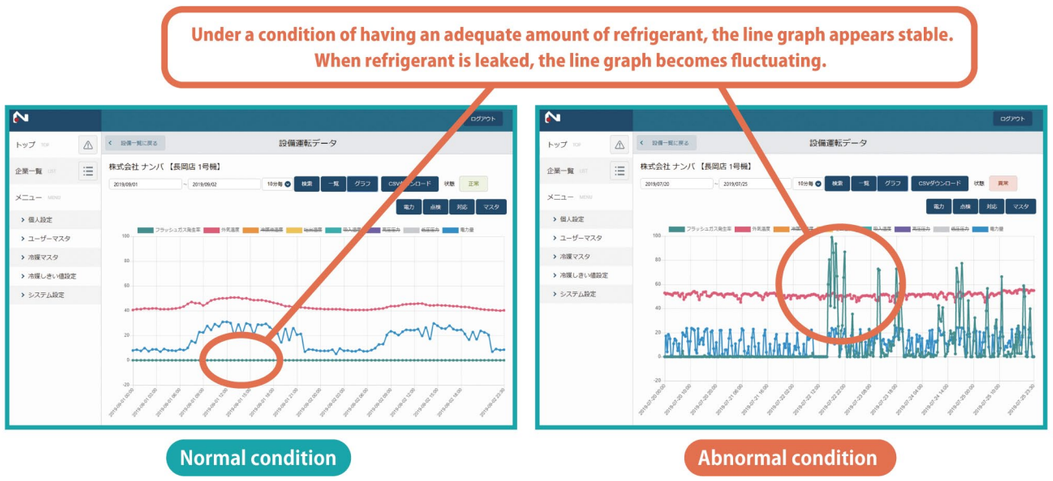
Data security

These data are transmitted one way. It is possible to use a single Wi-Fi network.

WEB management screen

※ The appearance of this screen may change without prior notice due to continual improvements.

You can display and manage collected data of equipment operation, such as ambient temperature and liquid refrigerant temperature, using tables and charts. It is also possible to download CSV data.



A mechanism for early leakage detection

Freon Keeper detects refrigerant leakage instantaneously utilizing ultrasonic waves.

When refrigerant leaks, the liquid-state refrigerant circulating within the refrigeration equipment cannot be condensed completely, generating very small bubbles which are quite difficult for human eyes to perceive. With a Freon Keeper sensor attached to the liquid refrigerant pipe, Freon Keeper can detect these small bubbles instantaneously by ultrasonic waves, enabling to detect refrigerant leakage earlier than a temperature alarm does.

The sensor is simply attached to the outside of the pipe. For this reason, you can install the sensors without stopping the operation of the refrigeration equipment.

※You can see these bubbles through the sight glass (a glass window through which you can see the condition in the refrigerant pipe).

Appearance of the sight glass in normal and abnormal conditions

A
Normal refrigeration performance

No leakage

This is the appearance of the sight glass when there is no leakage. Bubbles are not generated.

B
Normal refrigeration performance

Small amounts of leakage

Although even an experienced technician would have difficulty detecting it, there is a bubble in the sight glass, which is evidence of the presence of small amounts of leakage. Freon Keeper can detect the leakage as early as at this stage.

C
Abnormal refrigeration performance

Large amounts of leakage

Due to large amounts of bubbles, the sight glass is turbid. In this case, about 50% of the refrigerant is leaked.

Main specification FK-TOP-3	
Input voltage	DC5V
Consumption current	500mA
Power consumption	1W
Operating temperature	0℃ to 60℃
Controller display	LCD panel
Sensor input	Temperature sensor ×4 Pressure sensor ×2 Ultrasonic sensor ×2
CT College Transformer	MAX200A
Communication	WiFi ※The customer needs to make a Wi-Fi service contract.
Detectable refrigerants	R22 R134a R404A R410A R407C R507F R12 R502 R407F R507A R32 R744 ※R410A and R32 can be detectable only for refrigeration equipment. ※There are some conditions attached to specifications for refrigeration equipment using R744 ※This product is not applicable to hydrocarbon refrigerants ※R448A, R449A, and R463A will be verified in the future

Temperature sensor	
Operating temperature range	−55℃ to 125℃

Ultrasonic sensor	
Input voltage	DC5V
Service life	Approximately 10 years

Pipe diameters	※Other materials, pipe diameters, and wall thicknesses should be discussed separately
Copper pipes	φ9.52 to φ28.58※
STPG pipes	15A to 50A（Sch40）※
SUS pipes	15A to 50A（Sch40）※

Supplied accessories

Power adapter, current sensor, ultrasonic sensor, and temperature sensor

Optional accessories

Pressure sensor

NANBA

Nanba Co., Ltd.

633-1 Mishimashinbo, Nagaoka-shi,
Niigata 940-2311, Japan
Phone (+81) 258-42-2211　Fax (+81) 258-42-2089

Head Office: Nagaoka
Sales Office: Niigata, Jyoetsu, Tokyo

https://nanba1.jp/