

Genetron Performax® LT



**Sustainability and energy efficiency,
hallmarks of R407F**

Honeywell

Tewis

“After this laboratory test, we are convinced that R407F will contribute decisively in obtaining maximum savings at a minimum cost in refrigeration systems that have been using R404A until now.”

Javier Atencia, Tewis Smart Solutions International



Background, context and issues

Industrial and commercial installations of all types must comply with increasingly strict standards of sustainability, environmental impact and energy efficiency.

In the majority of the more developed countries in the world - regulation, legislation and the potential application of fines involved, result in constant adaptation on the part of these installations to meet these high standards.

Furthermore, industry itself is gradually taking on a commitment to reduce possible harmful effects to the environment, such as by establishing green or sustainable agendas that set goals to reduce the impact of their activity.

There is one clear strategic factor in this scenario that fully affects refrigeration systems, which are vital, in preserving dairy, fresh and frozen products in supermarkets, as well as in many other sectors. The efficient operation of a refrigeration system largely depends on the properties of the refrigerant used.

The characteristics of this fluid, essential for maintaining a variety of perishable products in perfect condition, are being increasingly valued by businesses in the industry. Hence, some firms like Honeywell have research and development departments that are continuously working on replacing refrigerant gases that have been used until now with others that are safer, harmless to the environment and efficient; and other companies, such as Tewis Smart Solutions International, are focusing their technological research on designs and systems that result in the lowest possible TEWI (Total Environmental Warming Impact) through savings in energy consumption and environmental properties. It is in this context that Tewis has undertaken this test for the purpose of estimating the energy saving potential of the refrigerant R407F (Genetron Performax® LT).



An optimal refrigeration system largely depends on the properties of the refrigerant used”

Tewis Smart Solutions International: committed to energy efficiency

Tewis Smart Solutions International, one of the leading energy consulting firms with operations in five countries on three continents, decided to undertake a rigorous and meticulous comparative assessment of the properties of the refrigerant R407F (Genetron Performax® LT) compared to other gases that it could substitute (R404A, in this case).

Tewis has focused its business on continuous development and concern for research and identification of new solutions and controls for refrigeration, directed toward the implementation of more efficient, less energy consuming systems. This goal has led them to open their own laboratory at their Valencia facilities, a pioneering step in this field in Spain.



A conclusive trial with an added seal of accuracy

The Tewis team has set up a controlled laboratory trial with a well-defined objective: to analyse the energy consumption of a medium temperature refrigeration installation with two different refrigerants – R407F and R404A – under similar weather conditions and with a short time difference.

The data resulting from the study must allow evaluation of possible energy savings based on the use of refrigerant R407F in comparison with its predecessor, R404A, with the same compatibility characteristics for the existing installation as with the former (an additional added value for Genetron Performax® LT).

To provide the greatest possible accuracy, consistency and reliability for the entire trial, which was conducted in the Tewis laboratory, certification and monitoring by the *Instituto Tecnológico de la Energía* (ITE) of Valencia (Spain) was required.

The ITE is a support centre for innovation and business competitiveness created 15 years ago by the Generalitat Valenciana (Spanish Regional Government). It is primarily devoted to supporting projects of companies in the energy sector.

In this particular case, **the ITE supervised and confirmed the protocols and calibration of all components, equipment and systems installed**, certifying the validity and accuracy of the results obtained.

After two 70-hour operational cycles of a compressor pack connected to a series of refrigerated display cases, each using one of the two refrigerants for comparison, the results demonstrated the energy saving potential of R407F.

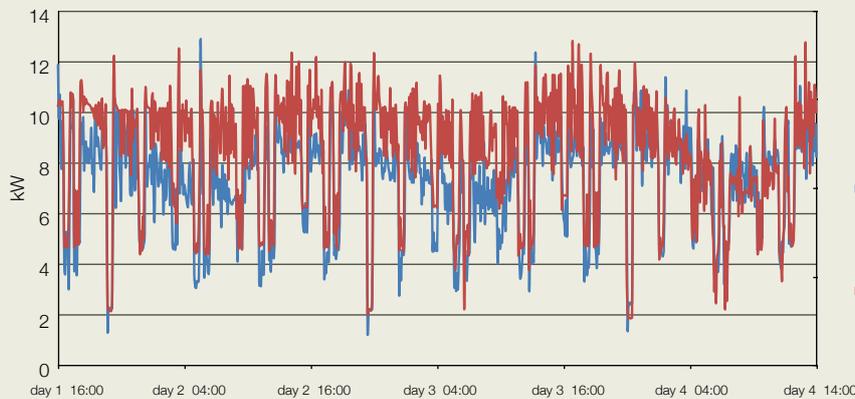
The new refrigerant developed by Honeywell showed a reduction in energy consumption of about 8% kilowatts/

hour than when the system ran on R404A. It should be noted that the initial trial indicators showed an even greater saving in favour of Genetron Performax® LT – specifically, 11% - but given that there was a slight variation in the outside temperature (less than one degree) in the two periods during which the tests were run, a correction factor was applied that provides even greater precision in the final results.

The conclusion is that the potential for reduction in energy consumption that R407F provides, combined with the improved capacity and with lower CO₂ emissions compared with its competitors, makes it the most suitable replacement for the more common refrigerants used in Commercial Refrigeration today. The potential for improving overall profitability of operations involving refrigeration makes it a key product for increasingly sustainable industries.

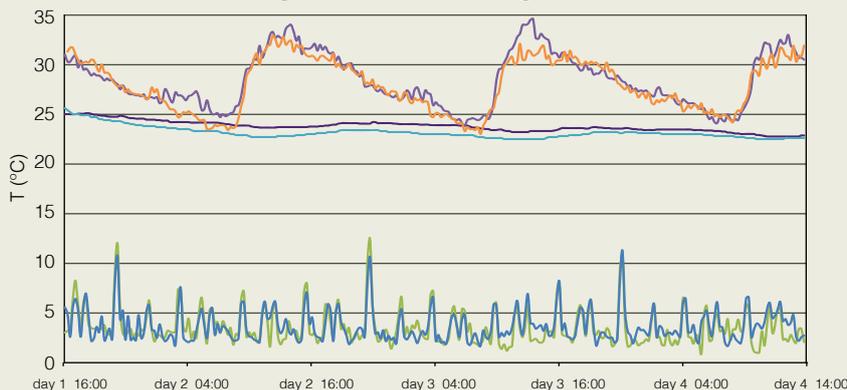


Energy consumption

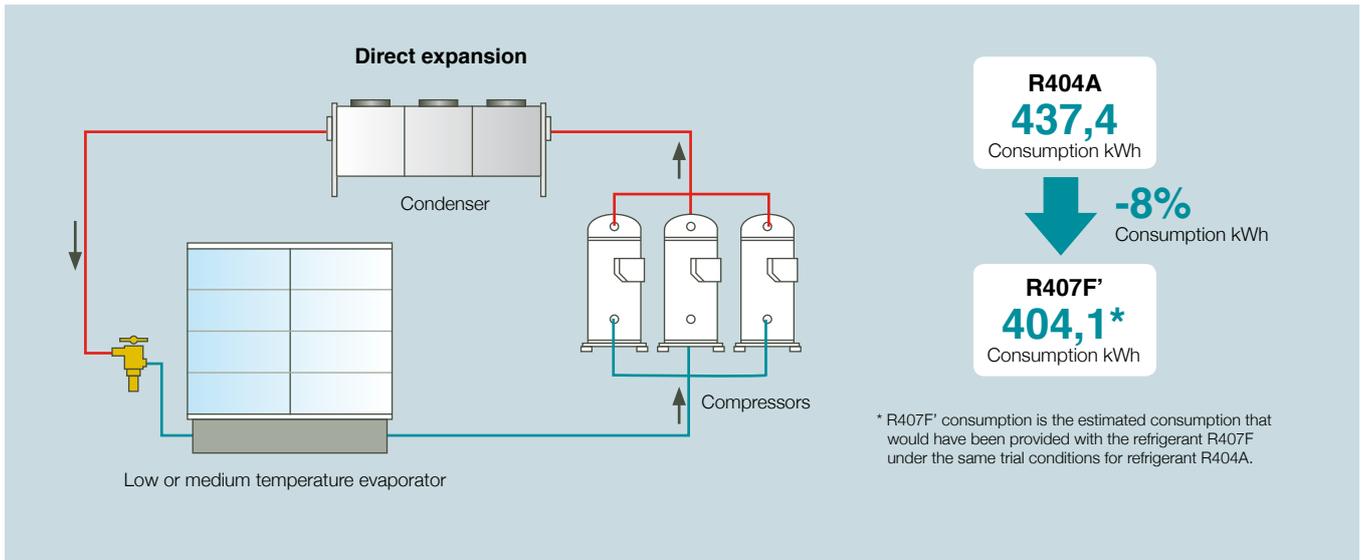


- R407F energy consumption (kW). Average during 70 hours from 17 to 19 July 2013.
- R404A energy consumption (kW). Average during 70 hours from 24 to 26 July 2013.

Temperatures during the trial



- R404A: outside temperature (°C)
- R407F: outside temperature (°C)
- R404A: laboratory temperature (°C)
- R407F: laboratory temperature (°C)
- R404A: temperature in the cases (°C)
- R407F: temperature in the cases (°C)



The solid advantages of R407F:

1. Reduction of carbon emissions.

Previously conducted tests have already made it possible to establish the better performance of R407F gas compared with other gases that it is gradually replacing, such as R404A and R407A; its global warming potential (1,824) is about 50% less than refrigerant R404A (3,922), and lower than any other alternative used in commercial refrigeration.

2. Savings on energy bills. In terms of energy consumption, the 8% savings indicated in the Tewis trial (savings due strictly to the refrigerant and under the worst conditions and with very restrictive criteria regarding the influence of differences in ambient temperature) confirms the savings in other field trials performed by Honeywell with savings of up to 15% compared to systems operating on R404A.

3. Application in already existing installations.

There is no need to replace refrigeration systems in order to use R407F. With a series of minor adjustments, Genetron Performax® LT or R407F can be used with no problem in existing systems. In this way, the necessary remodelling of gas refrigeration installation groups that commercial and industrial establishments face has a major ally in this new refrigerant.

4. Approved by major manufacturers of components, and can be handled by technicians and installers.

R407F is approved by major manufacturers of compressors, valves and other components, and there is no significant difference in its handling for regular technicians and contractors, so that it can be handled safely and with no major changes.

A rigorous methodology endorsed by the ITE (Energy Technological Institute, Valencia, Spain)

- The refrigeration system in the Tewis laboratory was charged with 80 kg of R407F refrigerant and run uninterruptedly for 70 hours from July 17 to 19, 2013.
- The same schedule was repeated a week later (from July 24 to 26) with R404A.
- The key parameters were recorded in both cases: average power (every 5 minutes); outdoor ambient temperature (every 15 minutes); temperature in the refrigerated cases (every 15 minutes) and laboratory temperature (every 15 minutes).
- The main parameter, electricity consumption in the compressor pack, was measured with a calibrated network analyser owned by ITE.
- The tested parameters were measured for the average time of both tests (48 hours) to eliminate transients effects in the system. The two tests were conducted during two consecutive weeks so temperature conditions were practically the same. As the temperature was not exactly the same despite all efforts, a series of corrections were applied based on the thermal difference between the temperatures of the refrigerated case and the outside.
- The conditions for the regulation and operation of the installation were as follows for both tests:
 - Compressor suction setting: **-10°C**
 - Compressor discharge setting: **40°C**
 - Temperature setting at cases: **1°C**
 - Case loading: **Operating empty (without foodproducts)**

Component	Brand	Model
Compressors	Frascold	S 7 33Y
Condensers	Siarco	CN 523H
MT refrigerated cases	Frost-Trol	HMC-4/3750/465
Electronic control	Eliwell	EWCM9100 eo
Individual electronic control	Eliwell	ID985/E LX
Expansion valves	Eliwell	PXVB0AR8000
Network analyser	Darnetz Power Xplorer	Serial no. PX502A510

Methodology used to correct the effect of variation in the external temperature

Bearing in mind that the two testing periods were conducted with a sufficiently close time period, linear and proportional performance of energy consumption in relation to temperature is assumed; the thermal jump existing between the case and the ambient temperature within the laboratory where the test was conducted was considered the variable key of reference. This thermal difference could be considered, in a simplified manner, proportional to the heat extracted by the unit.

In this way, ITE considered the increase in this thermal difference, as a simplified approximation, to be proportional to the increase in energy consumption*.

By establishing a simple formula, it is, hence possible to even more rigorously establish the power consumption measured with R407F under the temperature conditions that the refrigerant R404A was tested with.

$$\text{Consumption}_{R407F'} = \frac{\Delta T_{R407F'}}{\Delta T_{R407F}} \cdot \text{Consumption}_{R407F}$$

Refrigerant	Consumption (kWh)	Temperature gradient (°C)	Laboratory Temp. (°C)	Case Temp. (°C)
R-407F	388,8	19,4	23,0	3,6
R-407F'	404,1	20,2	23,7	3,5

* This approximation may be considered to be excessively rigorous, as the thermal difference is less than one degree and this difference could be within the tolerance of the temperature measuring devices.

A considerable saving

Regarding the increase in regulatory control mentioned, the economic impact resulting from the new tax in Spain on fluorinated greenhouse gases that will become effective in January 2014 on all industries that use commercial refrigeration (supermarkets, hypermarkets, convenience stores, the food industry, vending machines, etc.) should be noted.

This tax sets a new rate for industry, with the new amount to be determined by the type of refrigerant or blend, the charge and the global warming potential (GWP) of the gas used in each case. The tax seeks to stimulate the use of gases with lower environmental impact, levied especially on those with higher GWP.

In this context, the suitability of Genetron Performax® LT is even more obvious. This refrigerant has potential global warming credentials that make it an option that is difficult to beat: its GWP is 53% lower than R404A, the gas that it will be replacing in most cases, and less than any other alternative used in commercial refrigeration. The potential for reduction of direct and indirect emissions that R407F (Performax) provides, aside from its environmental benefits, economic advantages that are far from insignificant.

	GWP*	2014 - €/kg	2015 - €/kg	2016 - €/kg
R-134a	1,300	8,58	17,16	26,00
R-407C	1,653	10,91	21,81	33,05
R-407F	1,705	11,25	22,51	34,10
R-442A	1,793	11,83	23,67	35,86
R-410A	1,975	13,04	26,07	39,50
R-407A	1,990	13,13	26,27	39,80
R-438A	2,151	14,20	28,40	43,03
R-422D	2,623	17,31	34,62	52,46
R-507	3,850	25,41	50,82	77,00
R-404A	3,784	24,97	49,95	75,68

* Global Warming Potential according to the IPCC (International Panel of Climate Change), revision 3.

More information about R407F

You can find all the information about Genetron Performax® LT at:

<http://www.honeywell-refrigerants.com/europe/applications/commercial-refrigeration-supermarkets/>

More information about Tewis

www.tewis.com

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Download the free software from Honeywell Genetron Properties Suite at:

<https://www.honeywell-refrigerants.com>

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