Case Study

R404A to Klea® 407A supermarket conversion with HAUSER

Fig. 1: Hofer supermarket in Dauphine Street, Linz, Austria

"Regulation (EU) No 517/2014 of the European Parliament and the Council on fluorinated greenhouse gases" (F gas regulation) provides for the allocation of quotas for HFC refrigerants and specific prohibitions of use. The widely used refrigerants R-404A and R-507 are particularly affected due to their very high GWP values. In addition to the overall pressure from the quota mechanism, systems containing these refrigerants cannot be serviced with virgin refrigerant from 2020.

It is, therefore, advisable to stop using these refrigerants now, in particular as a proven alternative is available with Klea® 407A. The direct emission of greenhouse gases by a refrigerating plant can be reduced by almost 50% by using Klea® 407A.

Klea® 407A is also well suited for the conversion of R-404A plant. Numerous changeovers from R-404A to Klea® 407A have been carried out successfully in Europe in cool climatic zones (Great Britain) as well as in warmer regions (Spain).

Klea® 407A has also been used to retrofit supermarket systems extensively across the USA.

The Hofer supermarket in Linz changed over from R-404A to Klea® 407A at the end of 2013 through a collaboration between Hofer (operator), HAUSER (refrigeration specialist) and Agatex/Mexichem (refrigerant supplier).

Mexichem
Refrigerants

Description of the plant

The converted plant is a multipack plant for the refrigeration of dairy products and meat which was taken into operation in 2008 using R-404A. The main elements of the plant are:

Normal cooling (Medium temperature refrigeration)

- 6 open refrigerated wall units, HAUSER make, type Regius URP-T-H, length 3.75 m each. (2 units for meat, 4 units for dairy products and milk).
- A cold room (HAUSER) for dairy products for 12 Euro pallets
- Compound system with 3 Bock type compressors
- Air cooled condenser
- Refrigerant subcooler
- Thermostatic expansion valves, Danfoss make
- Refrigerant R-404A
- Refrigerating capacity 50 kW

Deep freezing (Low temperature refrigeration)

- One freezer room (HAUSER) for 9 Euro pallets
- Deep freeze booster with scroll compressor
- Thermostatic expansion valve, Danfoss make
- Refrigerant R-404A
- Refrigerating capacity 4.5 kW

Fig. 2: Compound system with 3 Bock compressors

Refrigerated display cabinet

REGIUS URP-T-H

Technical Data (mm)	
Shelf heights	195 (LF) ; 295; 395 mm
Module lengths	1.250; 1.875; 2.500; 3.750 mm
Depth	1.180 mm
Height	2.220 mm
Average temperatures of produce space	0-2°C; 2-4°C; ...
Crown heads (295)	1.875; 2.270; 2.500 mm

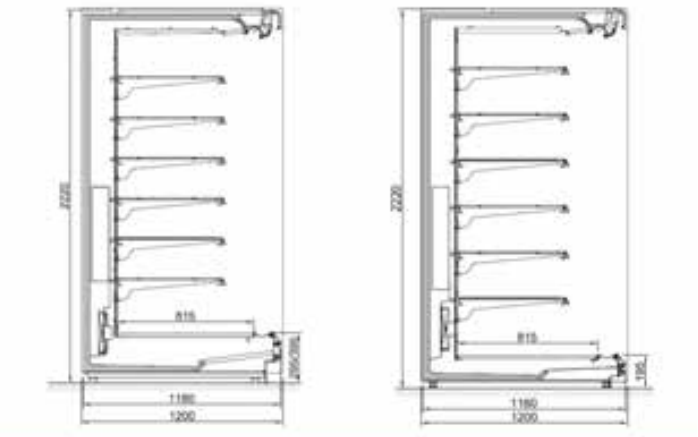

Fig. 3: Refrigerated display cabinets for dairy products and meat

Fig. 4: Copeland scroll compressor for deep freezing

Implementation

The conversion followed guidance provided by Mexichem and was carried out overnight so that customers were not affected. After the normal closing time of 8 o'clock, the produce was removed from the refrigerated cabinets and cold stores and stored in a refrigerated lorry during the conversion.

As a first step, all seals were checked for integrity. This was done to exclude the possibility that any leaks which were present before conversion would be attributed to the conversion to the new refrigerant KLEA® 407A. Following this, the superheat was measured at the individual refrigerating points to be able to determine changes in behaviour before and after conversion.

Once the measurements were complete, the R-404A refrigerant was removed and collected in the recovery cylinders provided. An oil change was carried out on all compressors, even though this was not required. Finally, a fresh dryer was installed and the plant was then evacuated.

In the meantime, the controller for the compound system, the evaporator and condenser pressure regulators (Danfoss KVP and KVR) as well as the pressure switches were set for the refrigerant Klea® 407A. The thermostatic Danfoss expansion valves were closed two turns before refilling to avoid water hammer in the compressors.

Then the plant was filled with Klea® 407A. The quantity was the same as the original R-404A charge.

After fine adjustment of the superheat at all valves, all regulators and pressure switches were checked again for the correct setting. The compression end temperatures were monitored by means of measurements to ensure that the limits specified for the compressors were observed. The compression end temperatures were within the permitted range with a condensation temperature of +50°C at the duty point as well.

It has to be remembered for the regulator settings that they have to be set correctly for the dew and bubble points. After about 3 hours of operation, the superheat of the expansion valves was checked again and adjusted for almost all cooling points. All R-404A stickers were removed and the plant was marked with R-407A labels.

Fig. 5: Applying the labels

All conversion work was completed at 4 o'clock in the morning and the produce could be replaced in the units. The supermarket opened at the normal time of 8 o'clock and the customers were not aware that the conversion had been carried out.

The units were checked for leaks after an operating time of about 8 hours and again after about 72 hours. No leaks were found. The plant has been running without problems since conversion.

Fig. 6: In front of the converted refrigeration unit (from left): Kevin Prinz (HAUSER), Karsten Schwennesen (Mexichem), Andreas Reichl (Agatex).

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