CASE STUDY

RS-20 (R-480A) replacing R-407A and R-134a in industrial meat drying chambers

Introduction

In the current context of transitioning to more sustainable refrigerants, GRIT has introduced an innovative solution for maintaining industrial meat drying equipment: the RS-20 (R-480A).

This success case was applied to industrial sausage drying chambers. These chambers were originally designed and installed with R-22. However, years ago, the gas was replaced with R-407A, and recently, some were converted to R-134a. Upon verifying that the requirements of these drying chambers were compatible with medium and high-temperature refrigerants, the switch to RS-20 (R-480A) became a reliable option.

The newly developed refrigerant RS-20 (R-480A), with a GWP=291, is designed as a R-134a drop-in replacement with a lower GWP. Its thermodynamic properties are very similar to R-134a, making it suitable for use in drying chambers. Thus, this solution ensures the optimal performance and high efficiency of the drying chambers while contributing to carbon footprint reduction and improving long-term profitability.

RS-20 Main Features

0	291	A1	POE
ODP	GWP	Safety Classification	Compatible Lubricants

Temperature Range: High and Medium

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Drying Chamber Details

The drying plant has 30 drying chambers, each with an independent refrigeration unit, most of them currently operating with R-407A, except one that uses R-134a. In order to carry the comparison out, chambers with the same equipment models were selected.

The chamber where the RS-20 was replaced was previously operating with R-407A. It includes a unit with a semi-hermetic piston compressor and two condensers: one internal for dehumidification and one external for heat removal during the cooling process (dehumidifier + cooler). Only one condenser operates at a time, depending on whether temperature keeping or cooling is required. The unit features a CAREL EVD Evolution electronic expansion valve and a frequency inverter to regulate external fans.

Both systems had high superheat to prevent liquid slugging in the compressor when switching condensers.

Refrigerant Replacement

To replace the refrigerant, these steps were followed:

1) R-407A refrigerant gas removal
2) RS-20 (R-480A) charge
3) System Adjustments: as the unit operated with an electronic valve, the thermodynamic data of the RS-20 (R-480A) were entered into the valve control without any additional equipment changes.

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System Performance with RS-20

The operating conditions of the unit were analyzed before and after the refrigerant change, with the following results. Data from another chamber operating with R-134a was also used in the comparison.

Chamber 1 (EEV).	RS-20	R-134a	R-407A
High Pressure (bar)	7.7	10	17
Low Pressure (bar)	1.5	1.7	2.4
Avg. Evaporation Temperature (ºC)	-1.3	-1.4	-13
Compressor Outlet Temperature (ºC)	63	70	82
Condensation Temperature (ºC)	22	22	22
Drying Chamber Temperature (ºC)	14	14	14
Superheat (ºC)	7.6	10.9	14.5
Cooling Capacity (kW)	1.29	1.38	0.94
Avg. Power Consumption (A)	13.8	14.6	17

Conclusions

Using the new RS-20 (R-480A), the system successfully met the performance needs of the drying chamber. The unit performed smoothly and efficiently, reducing by 17% the power consumption vs R-407A and by 3% vs R-134a. Additionally, it was observed that the unit runs "less often", contributing to further energy savings due to the lower compressor compression ratio.

Moreover, overpressure issues that occasionally were appearing with R-407A, especially during Summer; but did not while performing with RS-20 (R-480A). The cooling capacity improved by 30% due to more suitable conditions for dehumidification. These results prove a better performance with the RS-20, a great and reliable option for this application.

More Information

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