

Chillventa Specialist Forums 2022

Chillventa Fachforen 2022

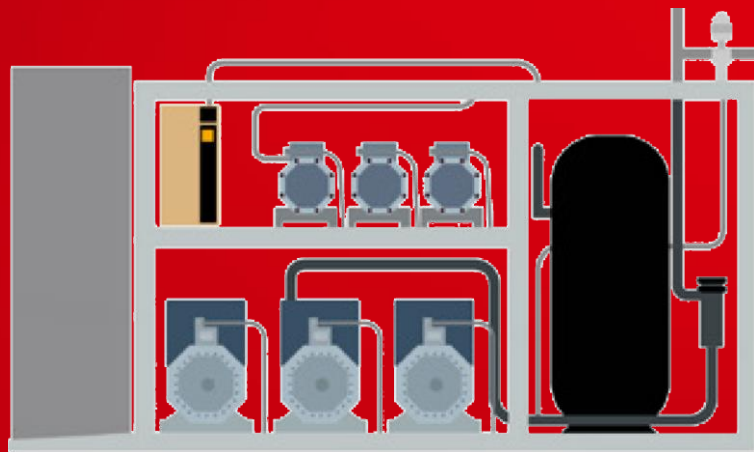
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Danish supermarket cuts heating bill and CO₂ footprint with Danfoss Heat Recovery Unit (HRU)

Mark Sever

Global Applications Expert Food Retail



MENY's Fredericia supermarket in Denmark

- Danish supermarket 1,900 m²
- Instead of letting the heat simply dissipate, as most supermarkets still do, a Danfoss Heat Recovery Unit (HRU) now recover heat from CO₂ refrigeration system.
- Heat provided for heating the store's and plenty of hot tap water year-round.

89.7%

Reduction annual
heating consumption



Heat recovery mode

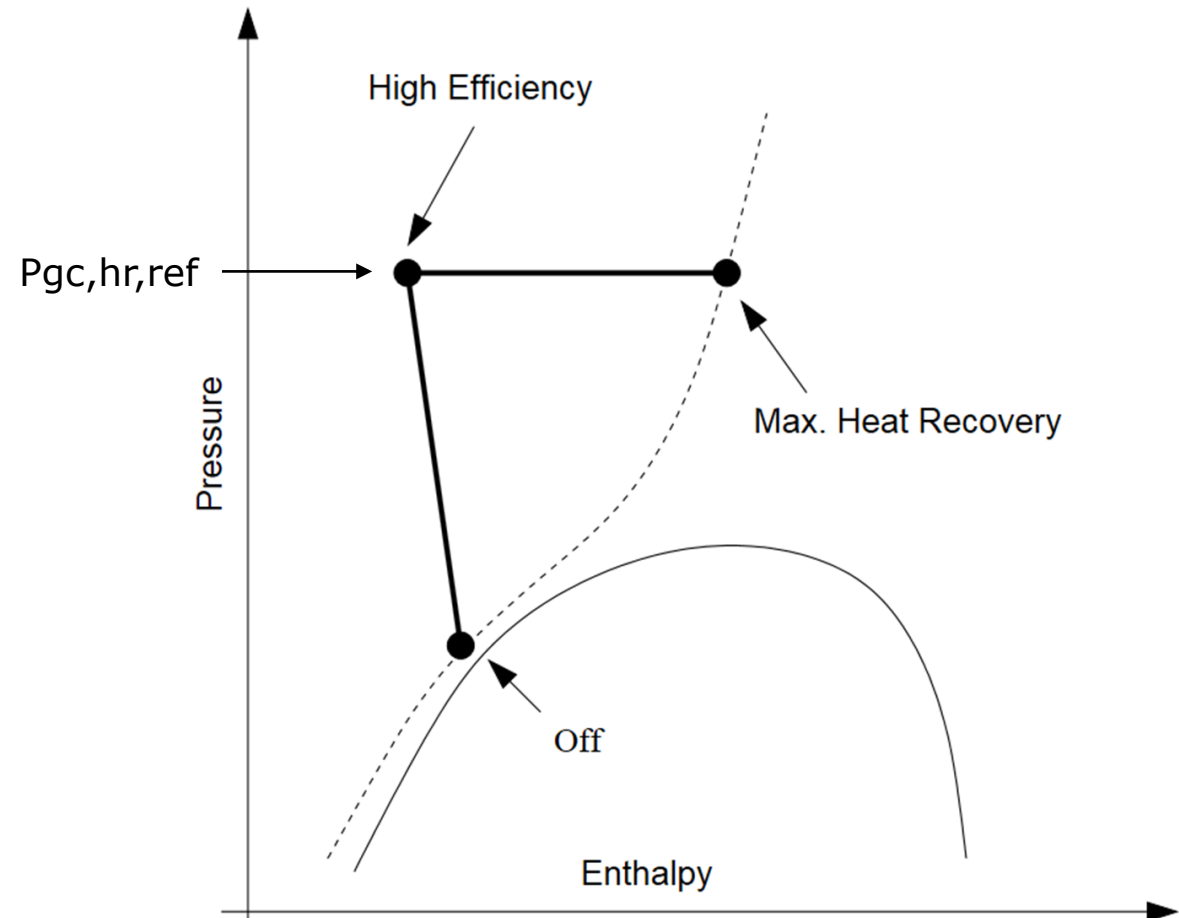
- When **Heat Recovery (HR)** is active, the P_{gc} reference is pushed up to the user set value.

High efficiency mode

- S_{gc} reference is kept above Sc_3 depending on settings in the controller. As low as possible inside the allowed region keeping care on available gas fraction after HPV expansion in the receiver.
- The S_{gc} reference may be changed when necessary (reducing fan capacity). E.g. When the $S_{gc,ref}$ is so low that it might collapse the receiver pressure.

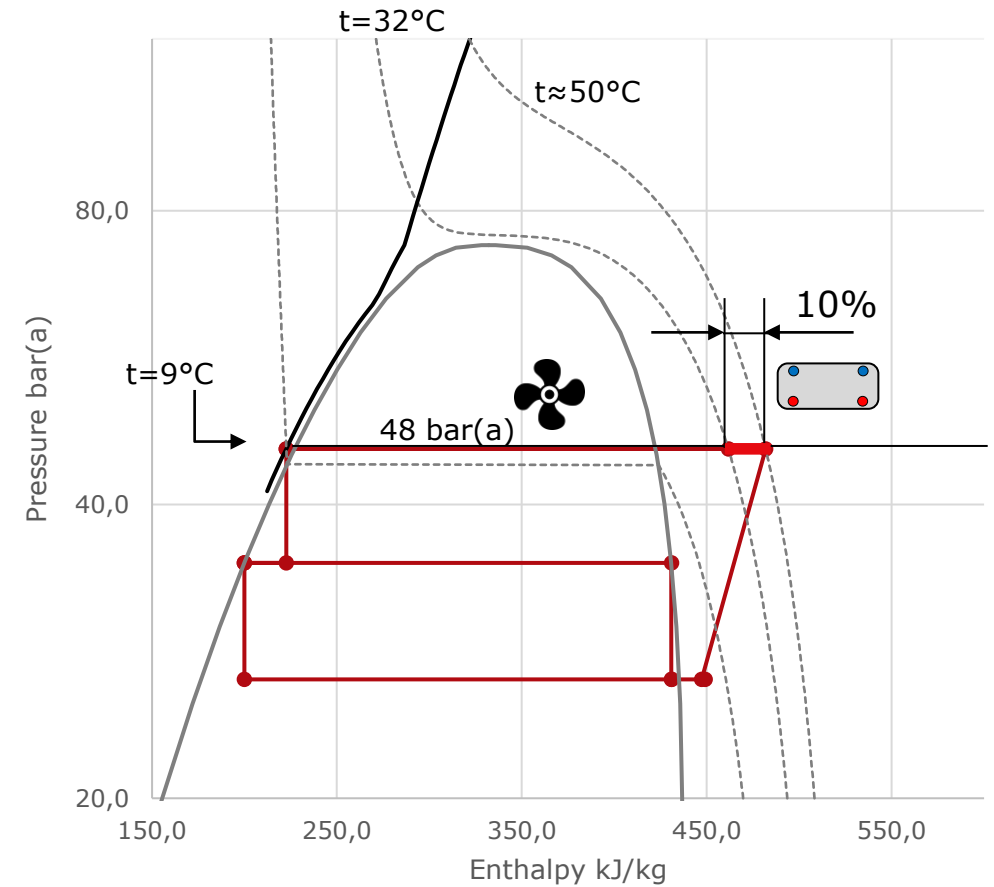
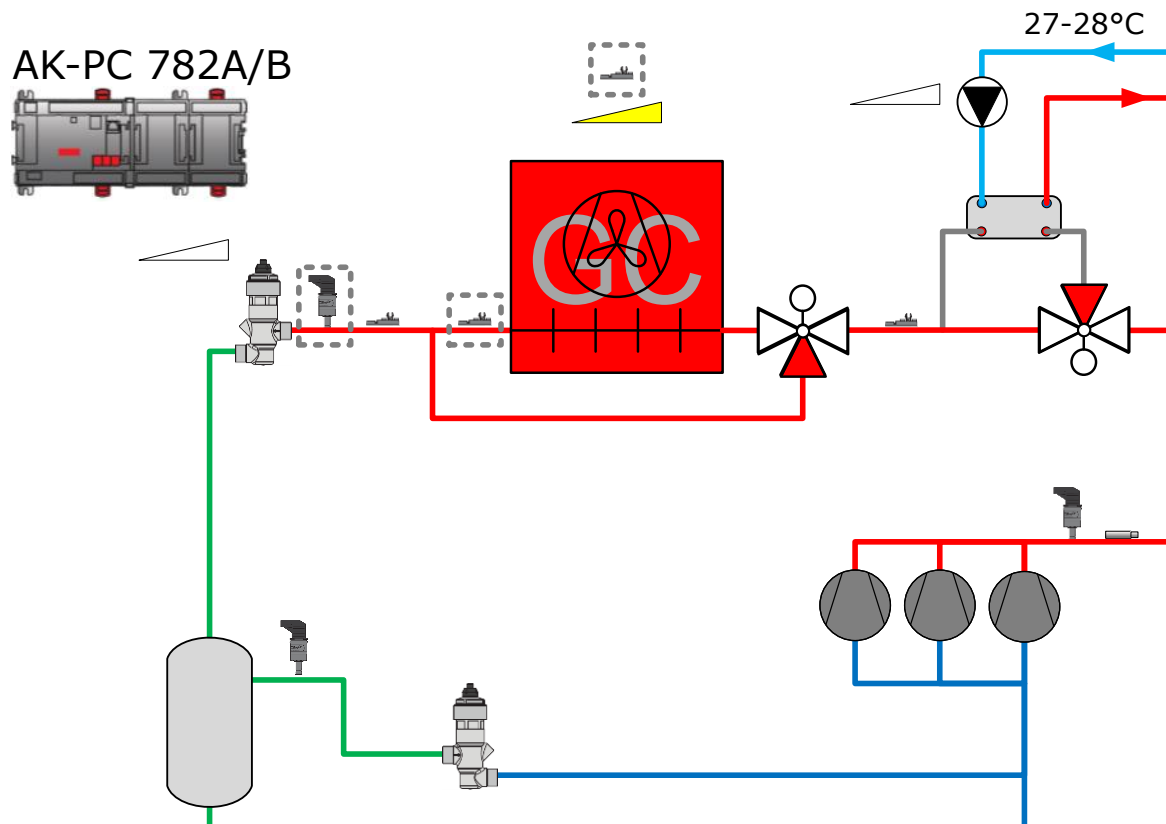
Max heat reclaim mode

- $S_{gc,ref}$ is calculated from the optimal curve.



Heat Recovery operation modes

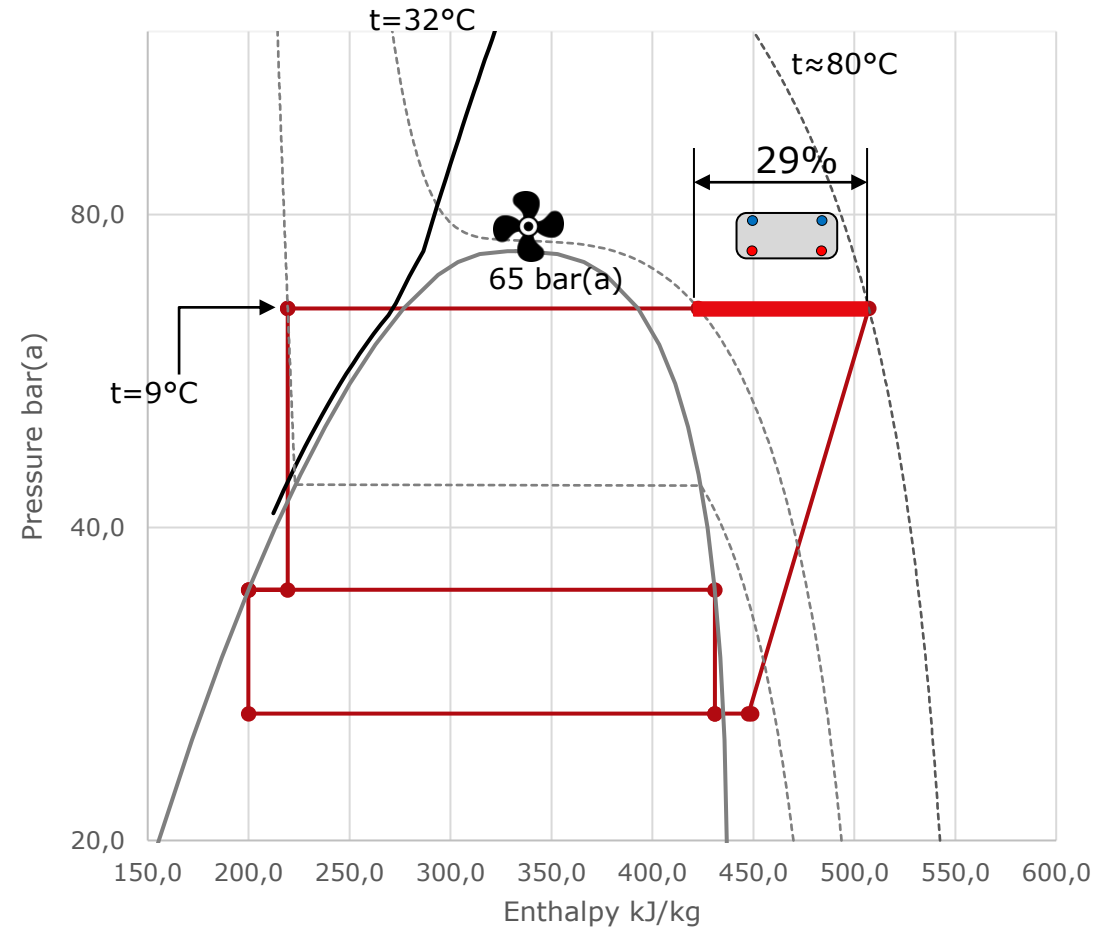
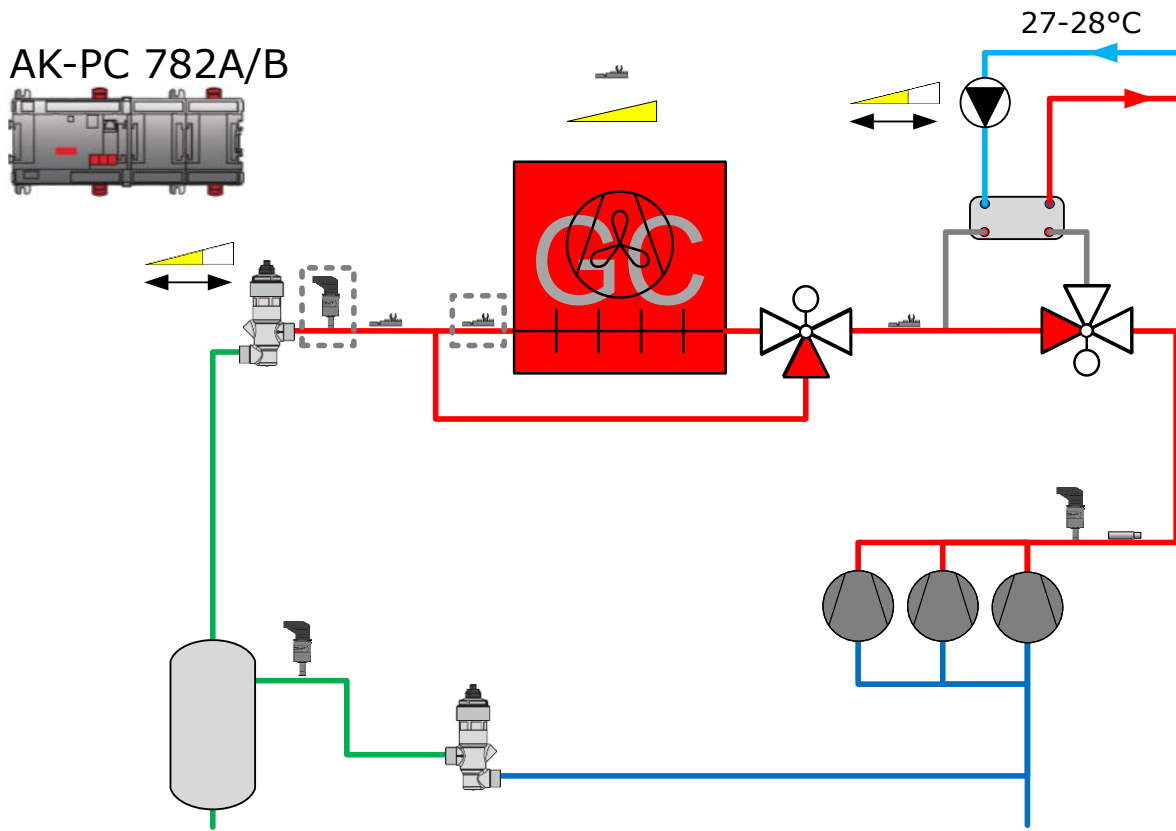
Cooling only and therefore the high pressure is as low as possible. In this case the high pressure is optimized based on ambient temperature.



Heat Recovery operation modes

By increasing the pressure, the part of the heat rejection that can be reclaimed is increasing and at the same time the discharge temperature is increasing.

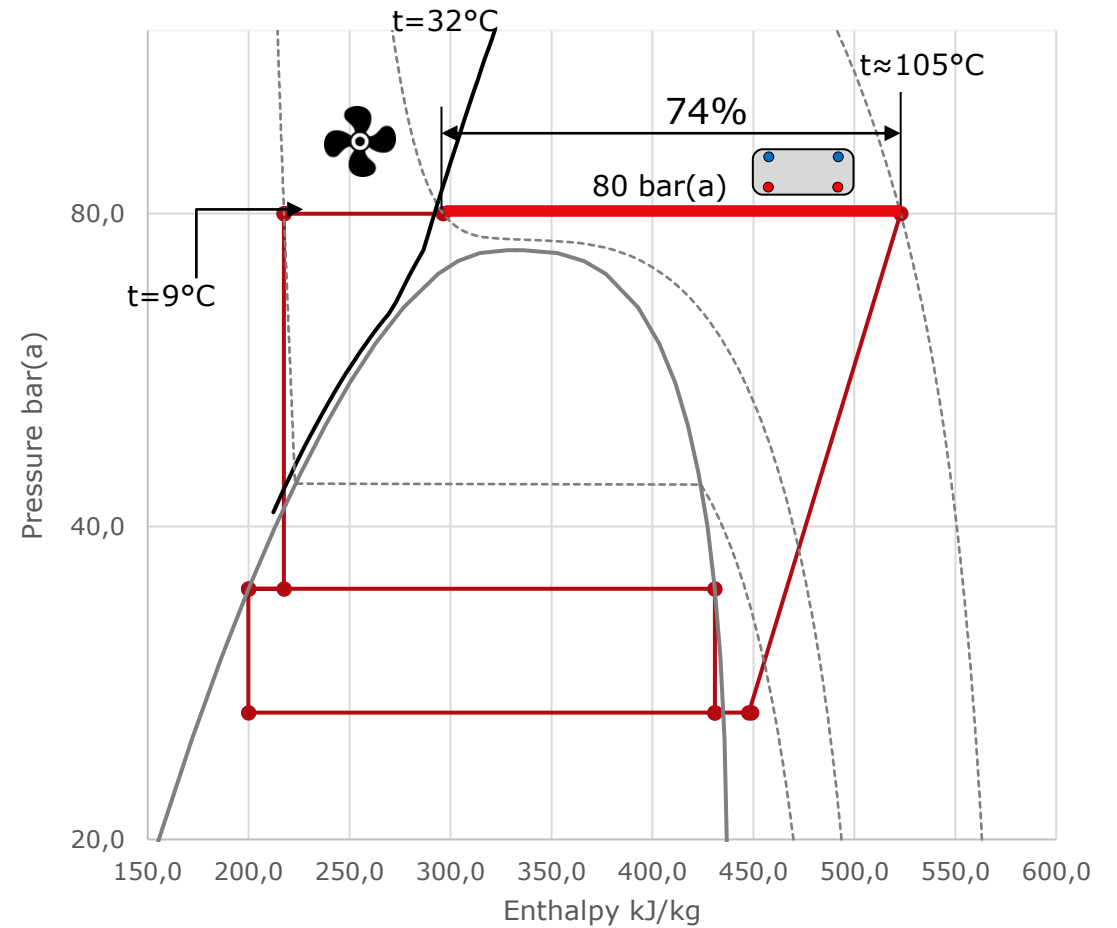
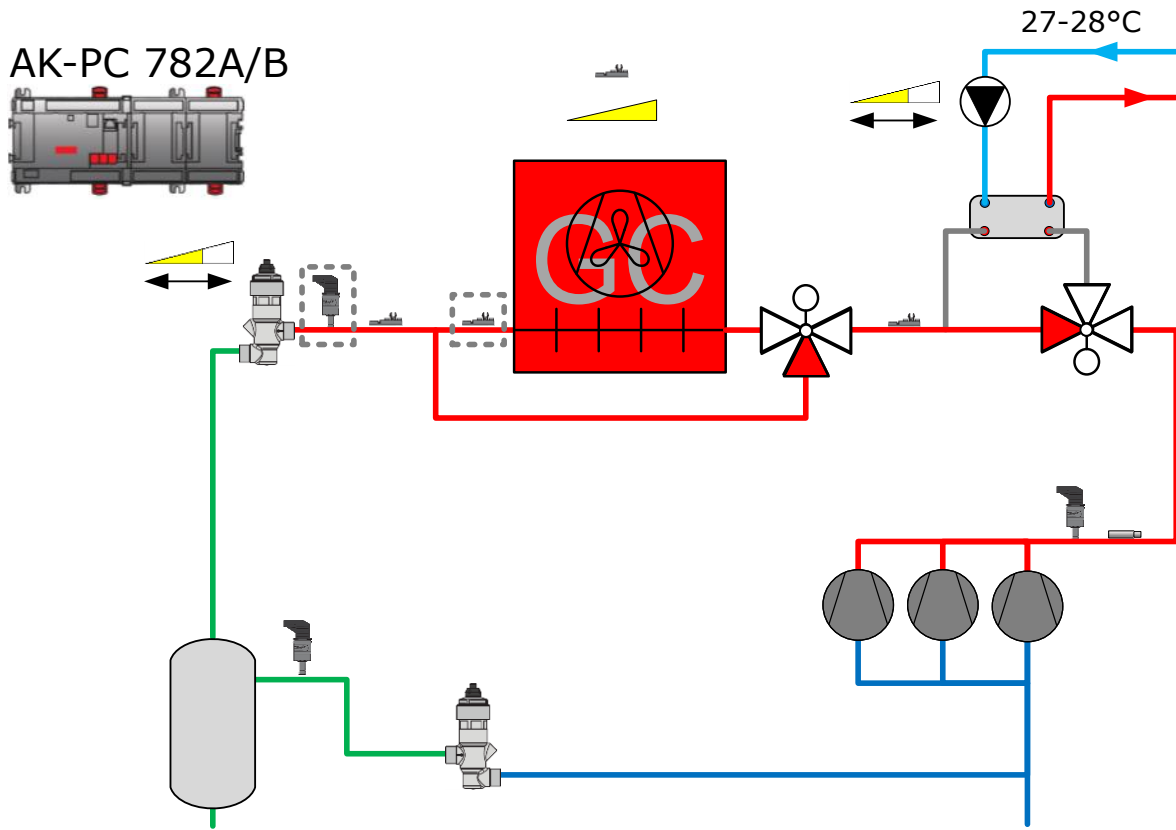
AK-PC 782A/B



Heat Recovery operation modes

Keeping constant temperature out of the gas cooler eg. 9°C, pressure will be increased up to the reference for heat recovery gas cooler pressure eg. 80bar(a).

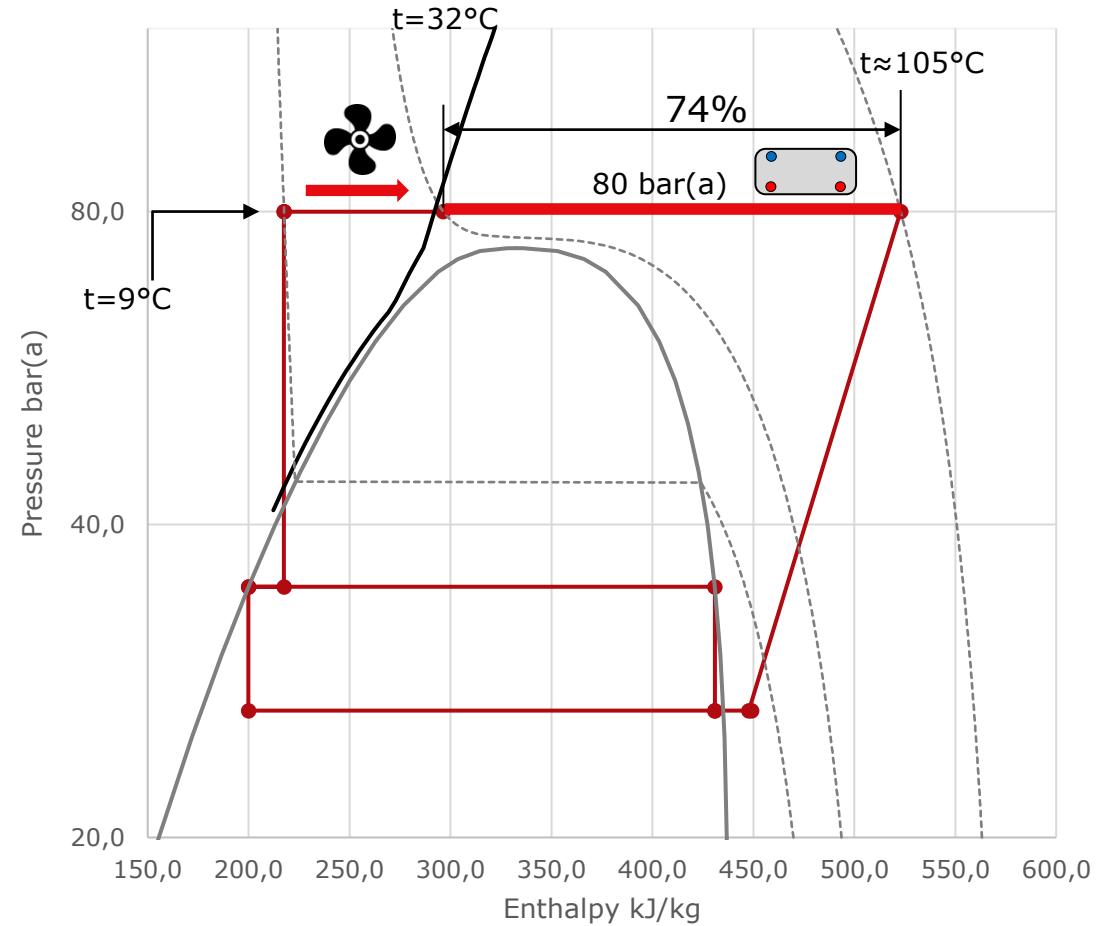
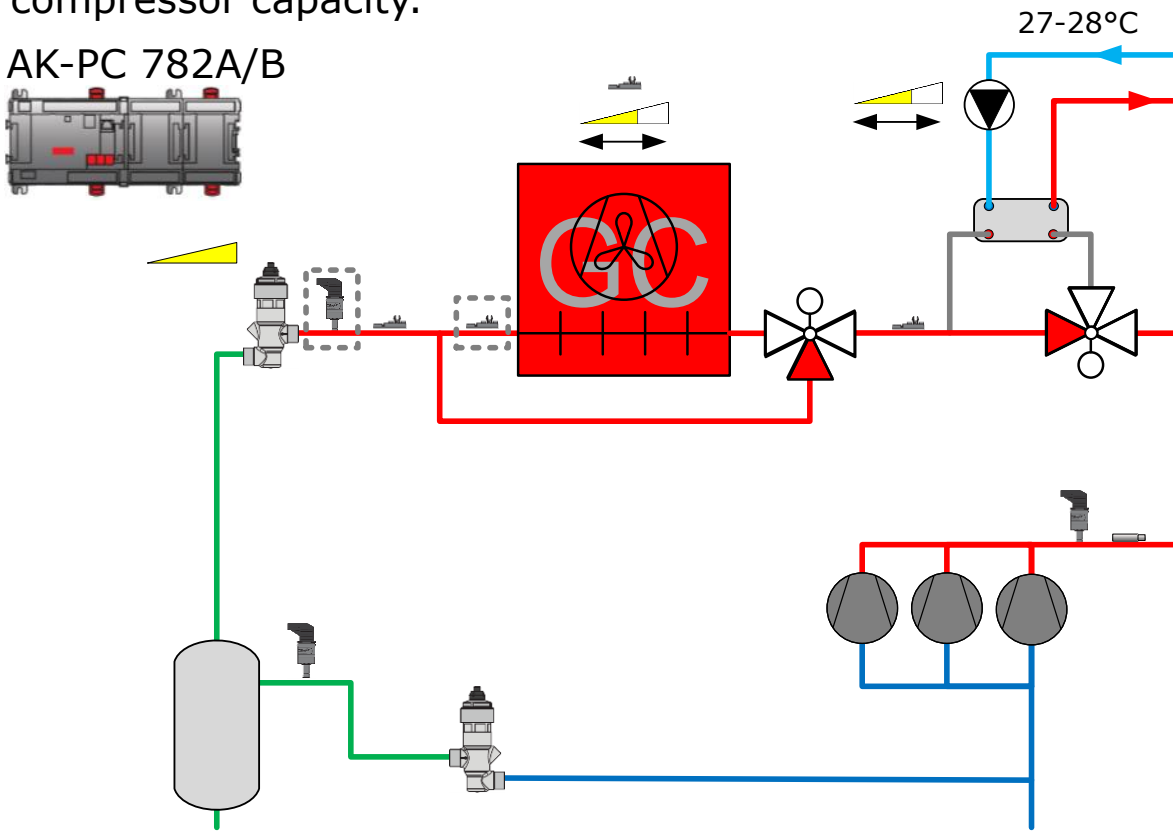
AK-PC 782A/B



Heat Recovery operation modes

Fans capacity is gradually decrease until the fans are stopped. This will result in a loss of cooling capacity, but the system will compensate by putting in more compressor capacity.

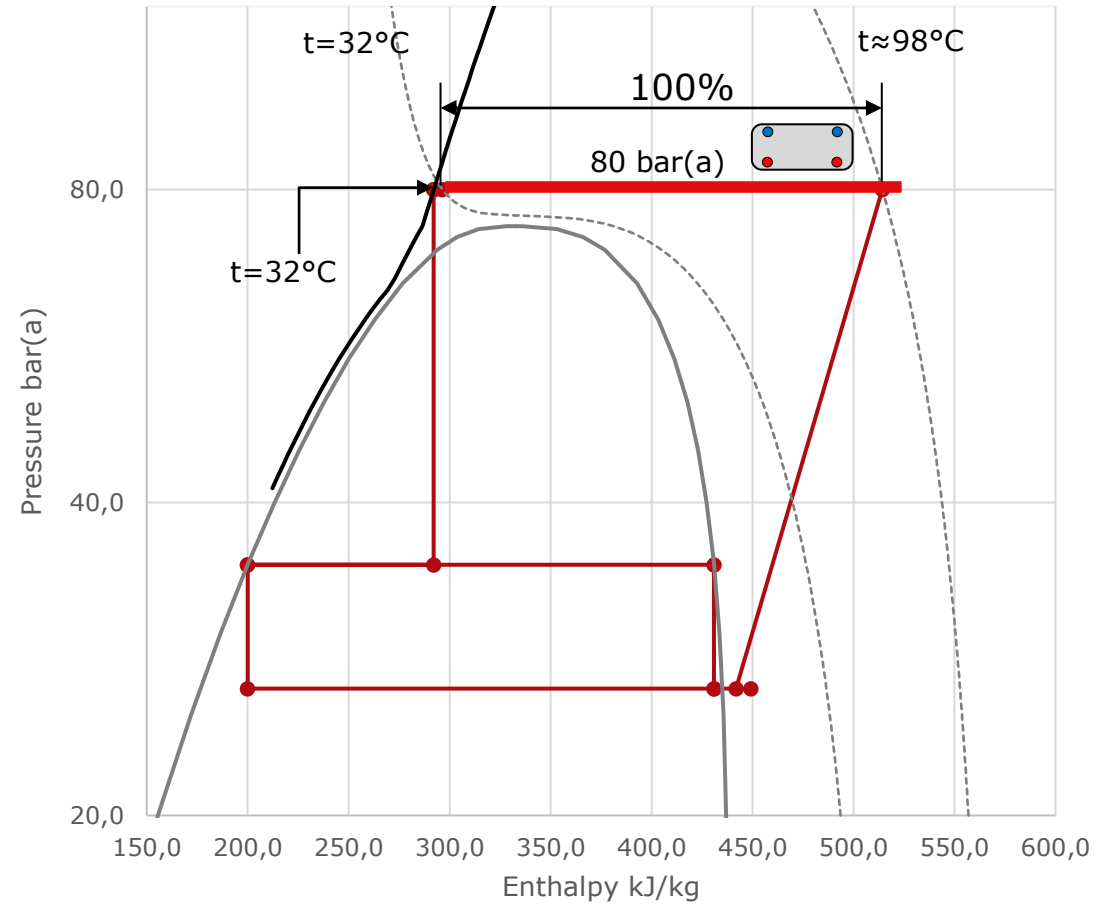
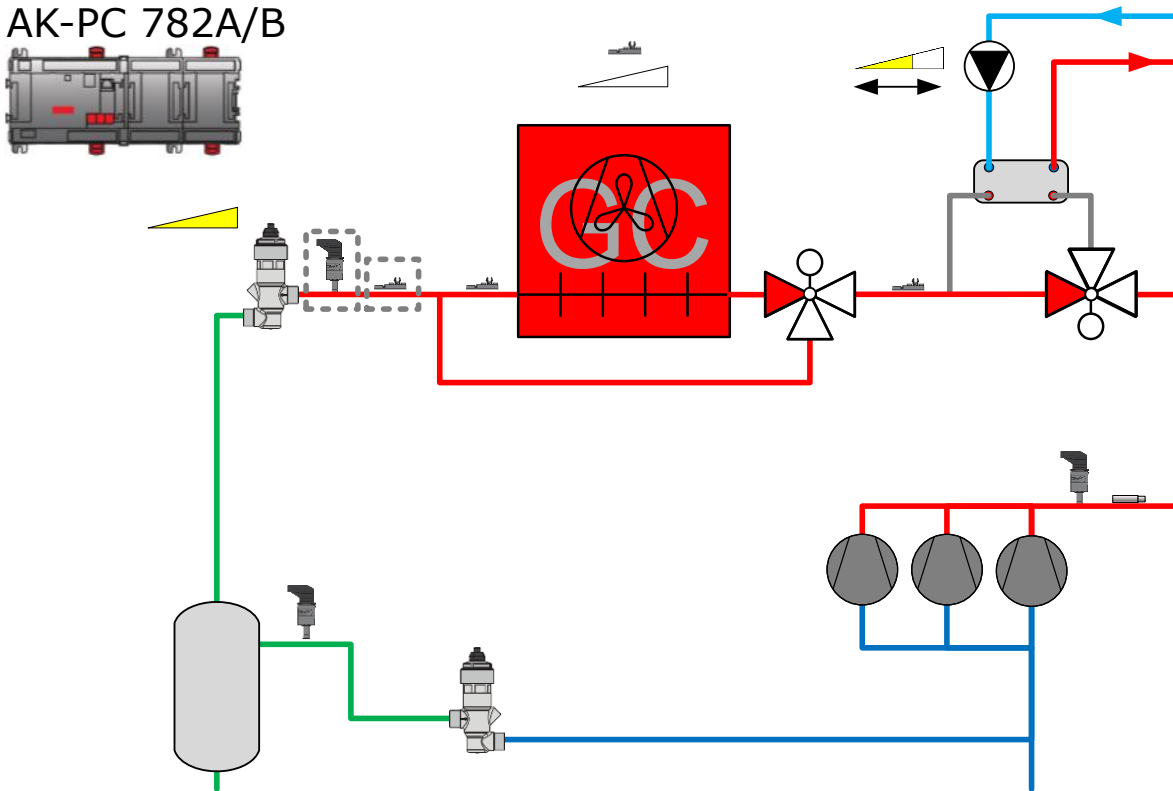
AK-PC 782A/B



Heat Recovery operation modes

Air cooled gas cooler is bypassed to avoid natural convection and thereby heat rejection from this part of the system. System will compensate reduced cooling capacity by putting in more compressor capacity.

AK-PC 782A/B

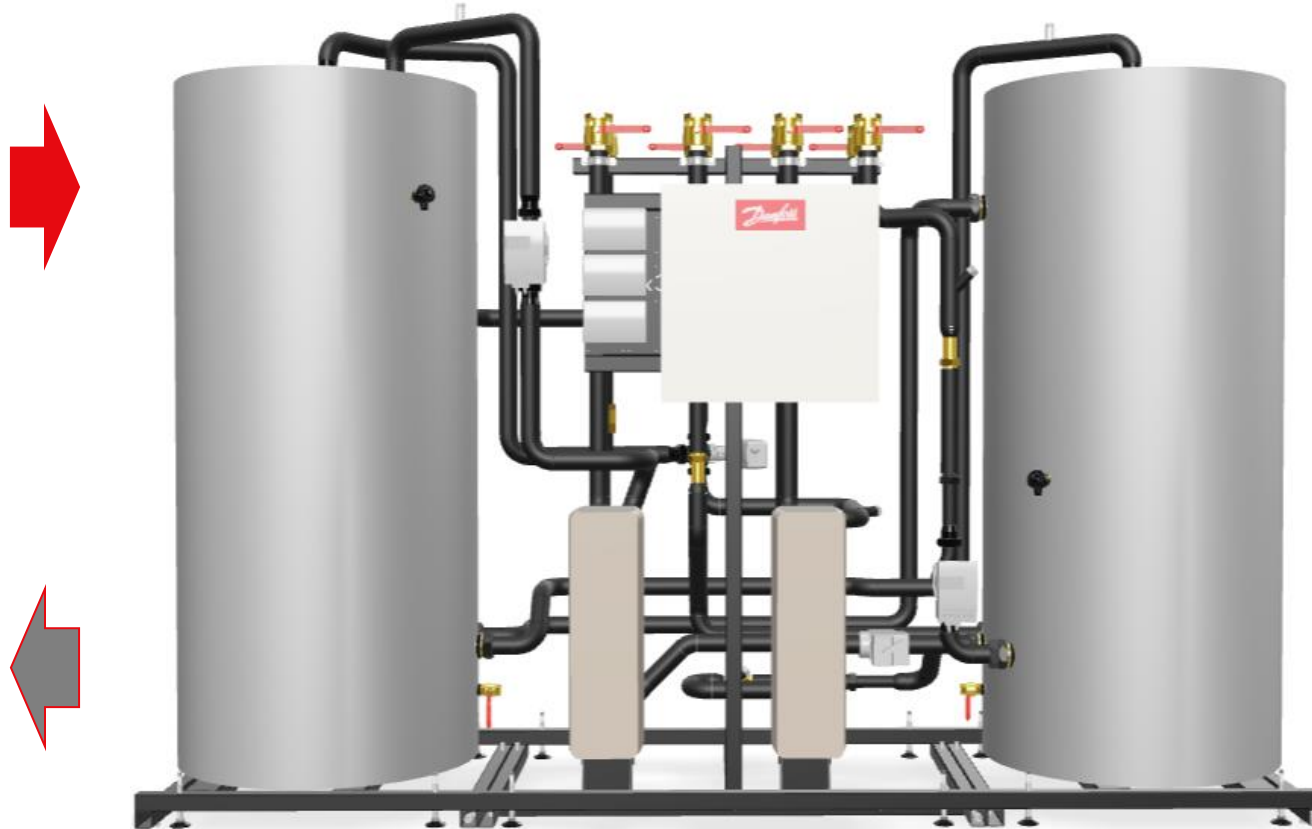


Application options

External Heat source connection:

- Direct
- Indirect

Option:
Heat resale



Heating demand

Heat Recovery
from CO₂
system

Heat Recovery solution

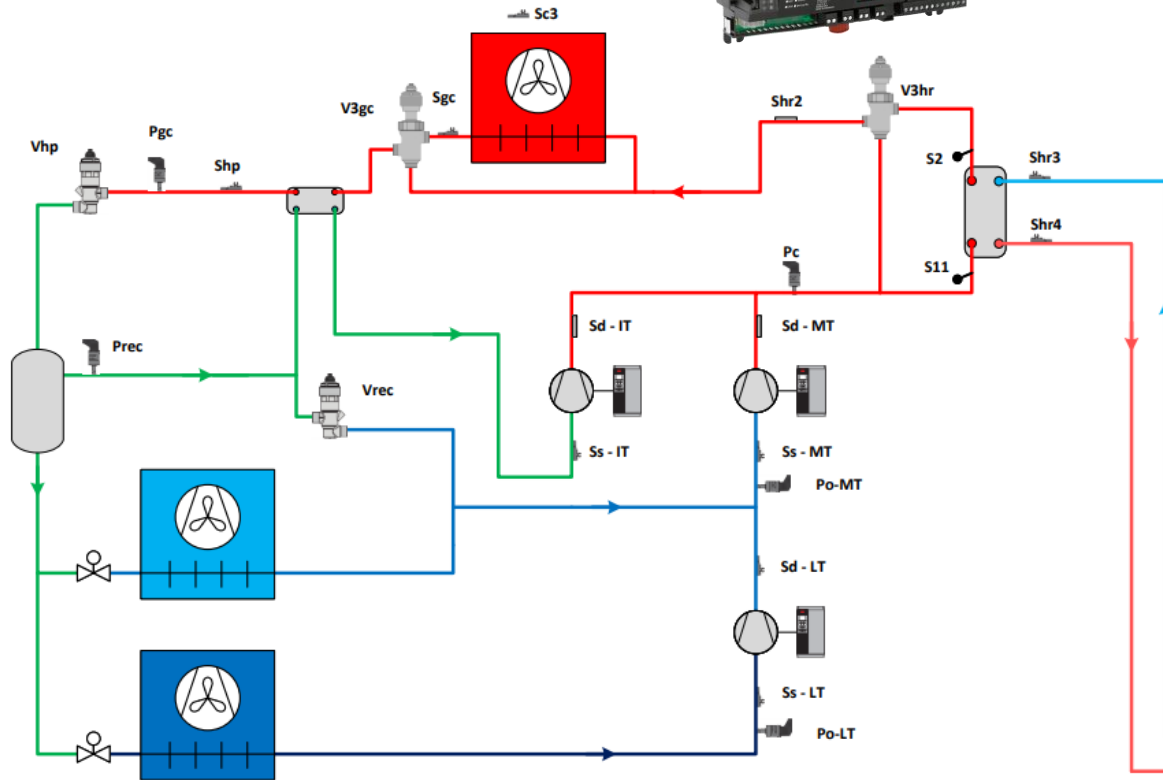
Pack Controller AK-PC 782A/B



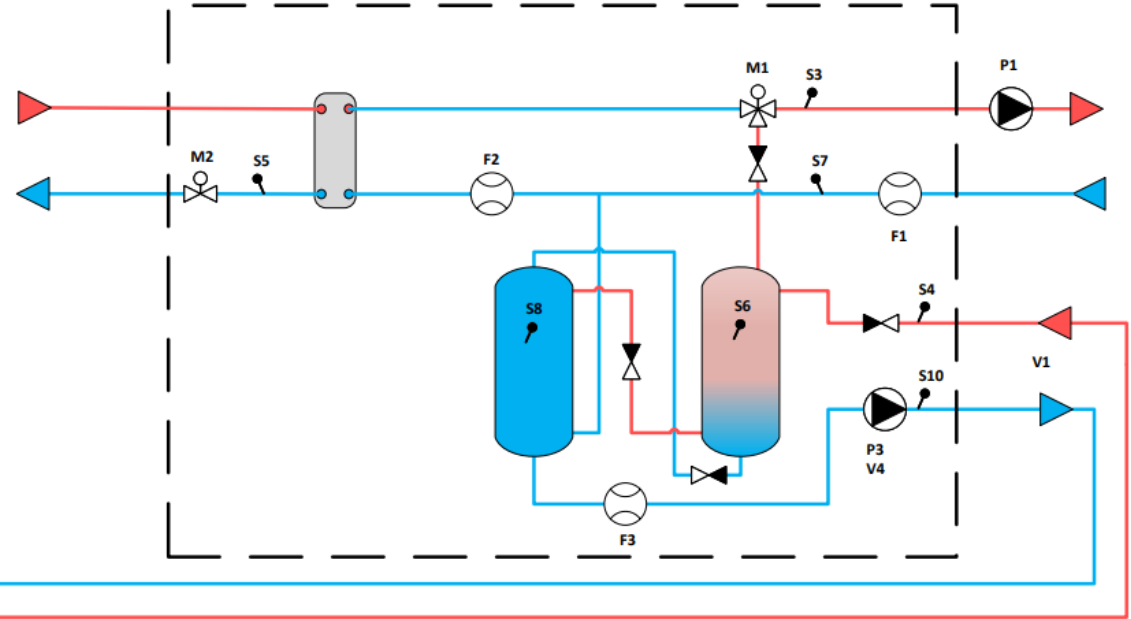
REQUEST



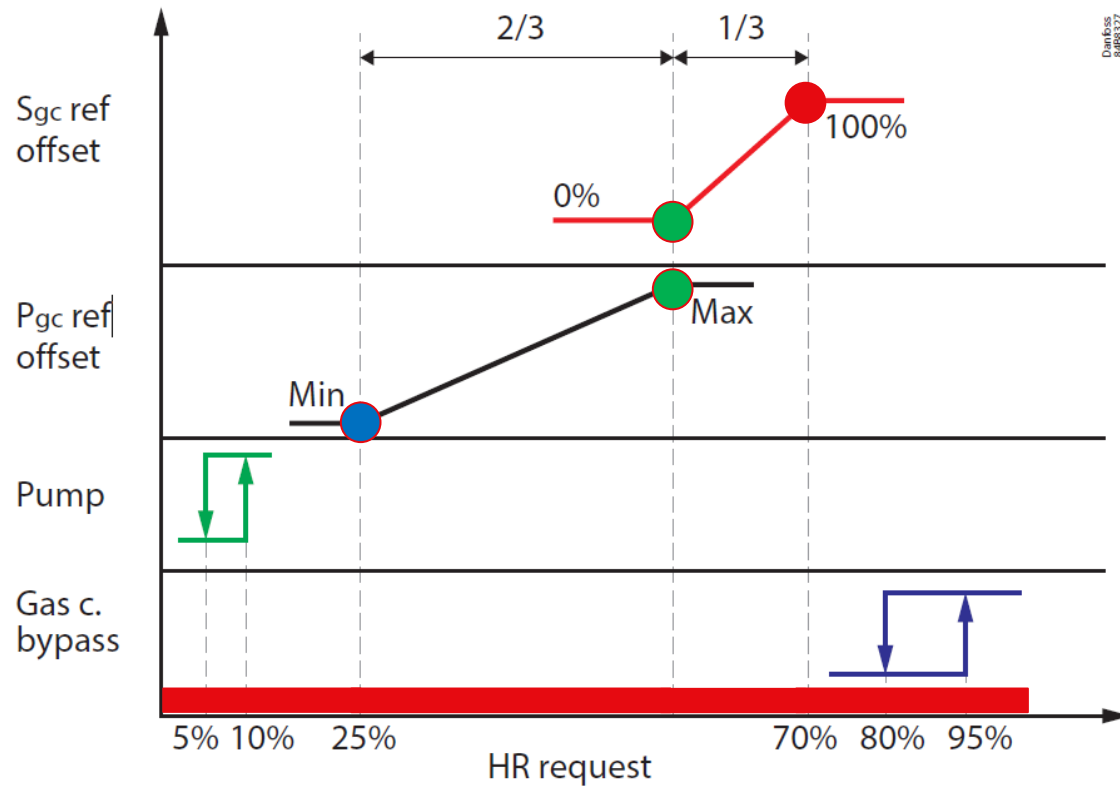
HRU controller ECL



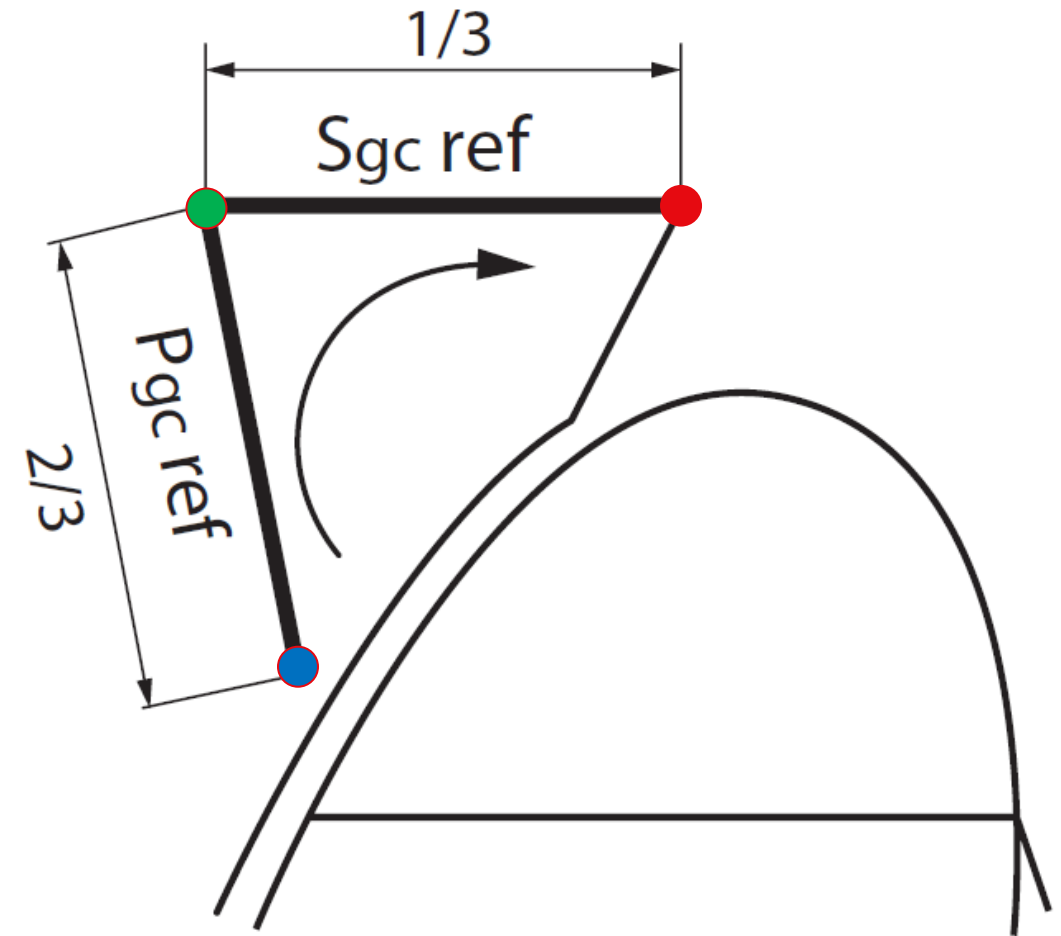
HRU



Maximum Heat Recovery



5%	HR stop limit	70%	Ref offset high
10%	HR start limit	80%	V3gc bypass stop limit
25%	Ref offset low	95%	V3gc bypass start limit

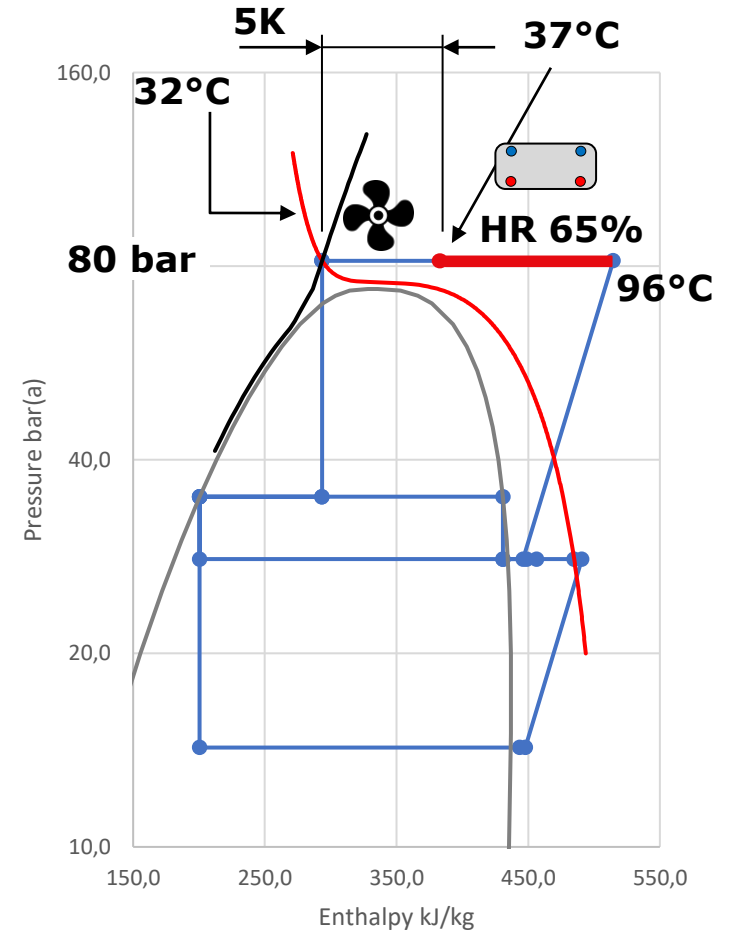
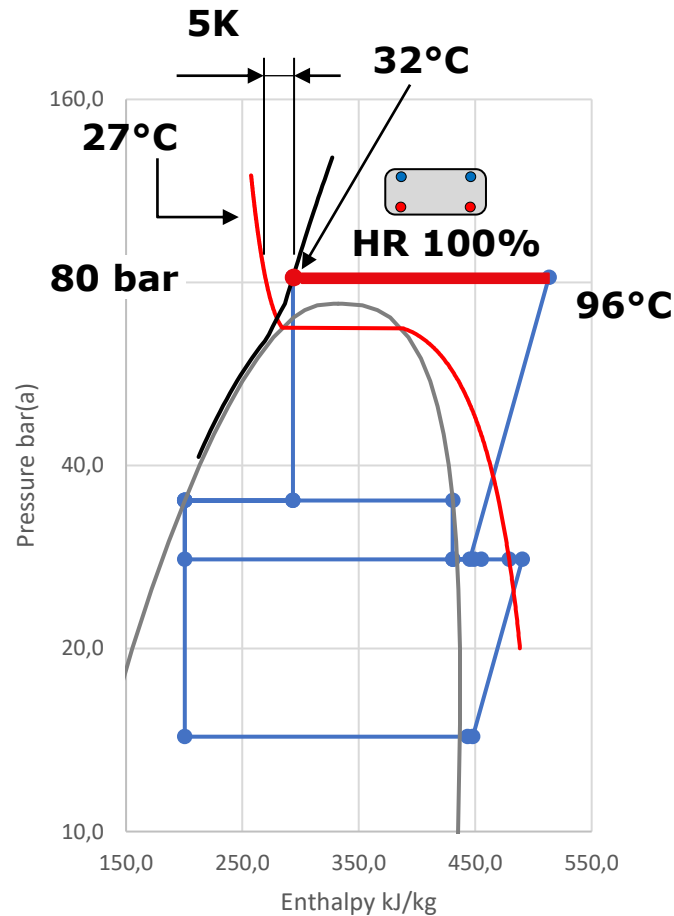


Importance of return water temp limitation

At heat recovery operation mode and common water return temperature of 27°C and with 5K temperature differential between CO₂ exit and water inlet it is possible to completely recover heat from the refrigeration system.

But

If return temperature increase from 27°C to 32°C and with the same 5K temperature differential on CO₂ exit and water inlet it will be possible to recover only 65% of heat recovery potential. Rest of the heat it will be necessary to release via Gas Cooler to the ambient.



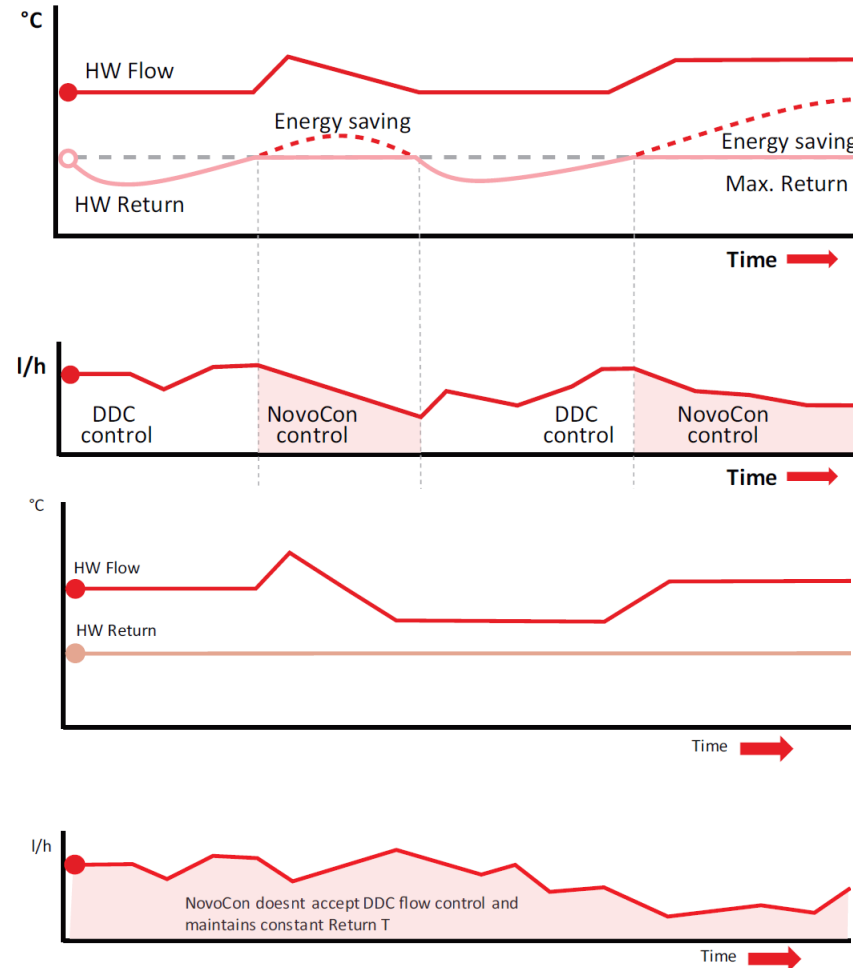
Return temperature control / limitation

ABQM + NovoCon



Return temperature limitation

Set Return temperature control



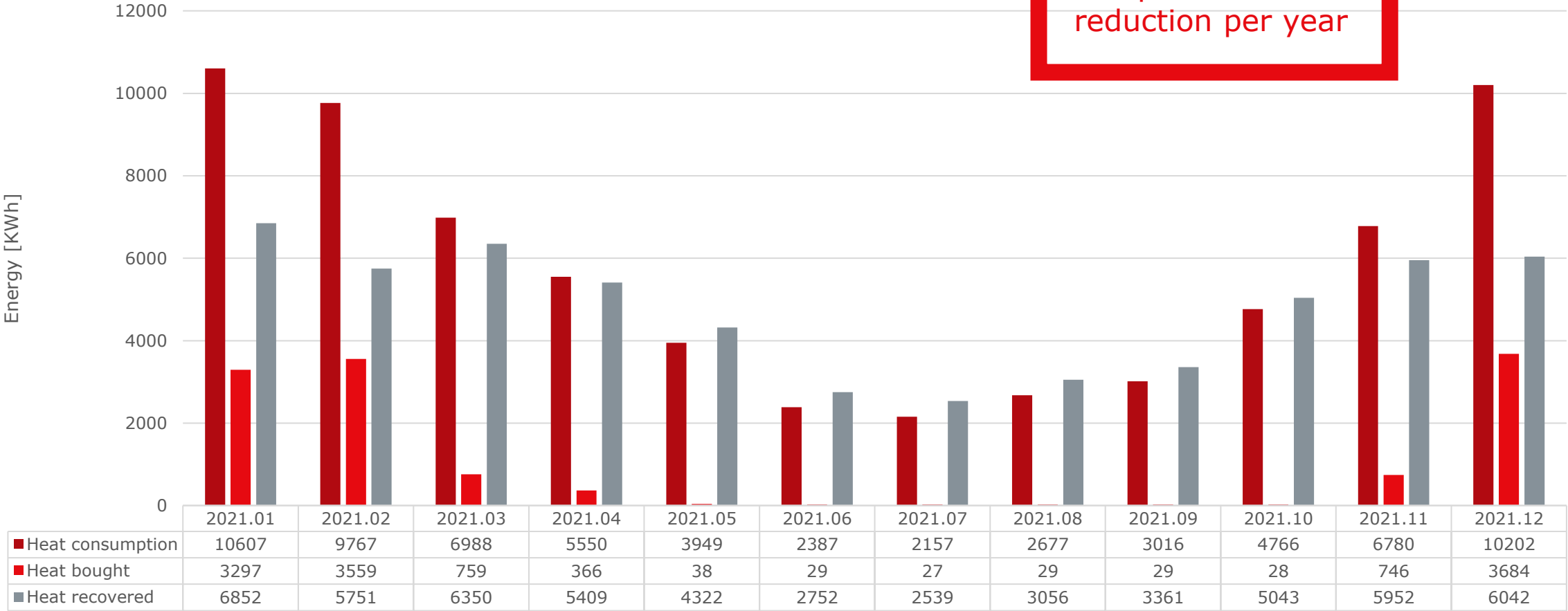
Case study

Measurements for 2021

**6.7 tons
of CO₂**

Footprint
reduction per year

Heat Recovery



Summary - Key take aways

- During the first year, MENY in Fredericia reduced its energy consumption by 135 MWh in total
 - 56 MWh coming directly from the Danfoss Heat Recovery Unit (HRU).
 - 79 MWh through a year-long Danfoss EnergyTrim™ contract.
 - Store reduced its carbon footprint by 6.7 tons of CO₂
 - MENY's experience is a good example of what many supermarkets can expect.
- "We've installed 50 heat recovery units so far with an average payback period of 1 to 3 years."
- Today more than 100 sites is running with a Danfoss HRU in Denmark, Norway, Sweden, Finland, Germany and Baltics.



Q & A



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