CHILLVENTA

Chillventa Specialist Forums 2024
Chillventa Fachforen 2024

CONNECTING EXPERTS.

ENGINEERING
TOMORROW

NeoCharge®

The new game changer

LA

Danfoss NeoCharge®

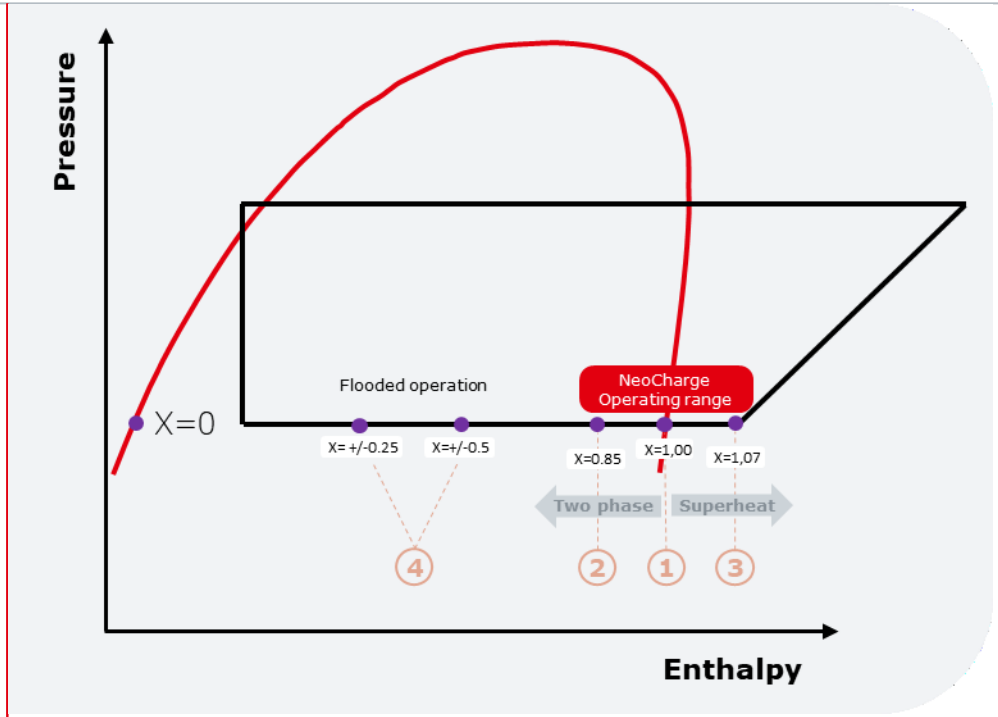
Simple and unique technology enabling NH_3 DX system running without superheat (WDX) and reducing the **recirculation** in traditional flooded system to the **lowest possible rate keeping high performance** (CCR)

The new
game changer

Danfoss NeoCharge
What does it do?

Take the shortcut to **low-charge**

NeoCharge
The new game changer



NH_3 recirculated evaporators

It controls the circulation rate in evaporators (air coolers)

- The circulation rate will be reduced from high to almost no circulation rate, e.g. from point 4 to point 2
- **NH_3 charge reduced by up to 45%**
- **Efficiency gain**

NH_3 DX evaporators

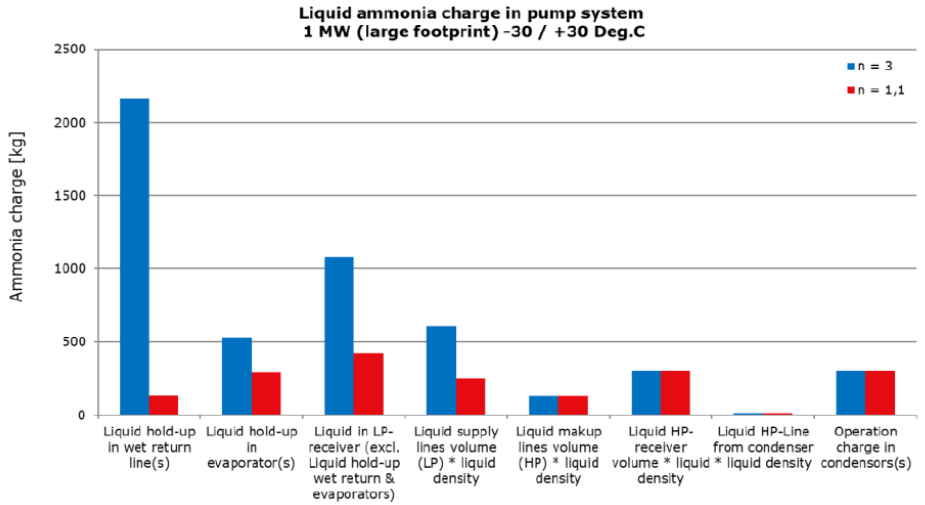
It generates ultra low superheat in evaporators (air coolers)

- Superheat will be reduced from standard to very low, e.g. from point 3 to point 1
- **Efficiency gain up to 15%**

Principle elements of NeoCharge solution

- Traditional superheat measurement
- **Danfoss Heated Sensor**
- **Danfoss NeoCharge controller**
- Control valves (stepper motor or PWM)

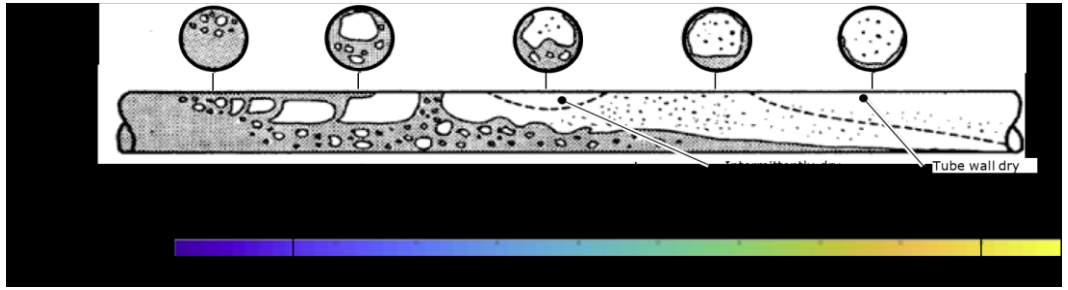
Danfoss NeoCharge feeds each evaporator with the **right charge** required



Danfoss NeoCharge
Control principle

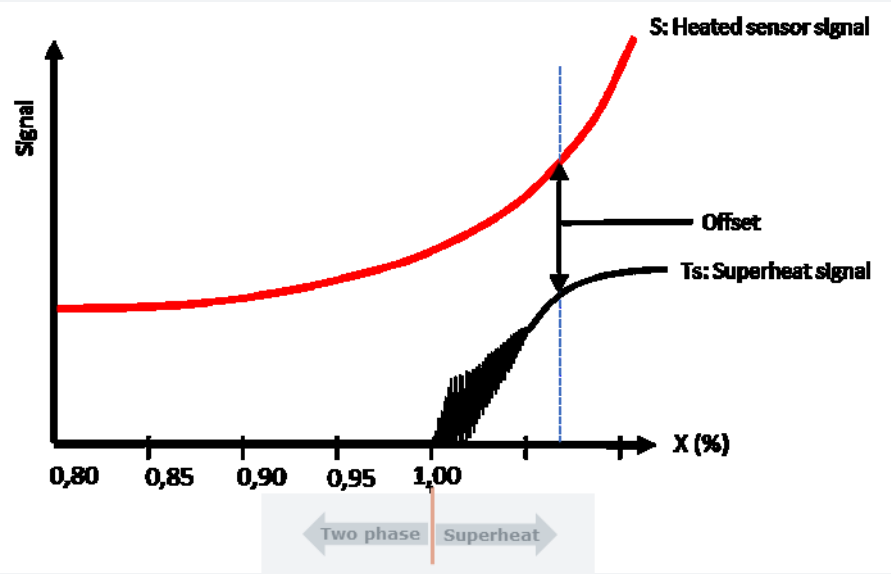
Take the shortcut to **low-charge**

NeoCharge
The new game changer



<- DX ->

<- flooded ->

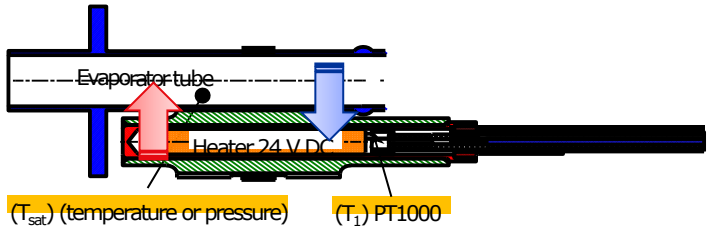


How to measure the liquid amount in the evaporator outlet?

- Capacitance — Difference in dielectric permittivity of gas/liquid
- Radar — Difference in dielectric permittivity of gas/liquid

Danfoss Heated Sensor

- Measures the difference in heat transfer coefficient between liquid and gas
- The Danfoss Heated Sensor produces a "heat assisted superheat signal", which is a function of the liquid inside the evaporator tube.

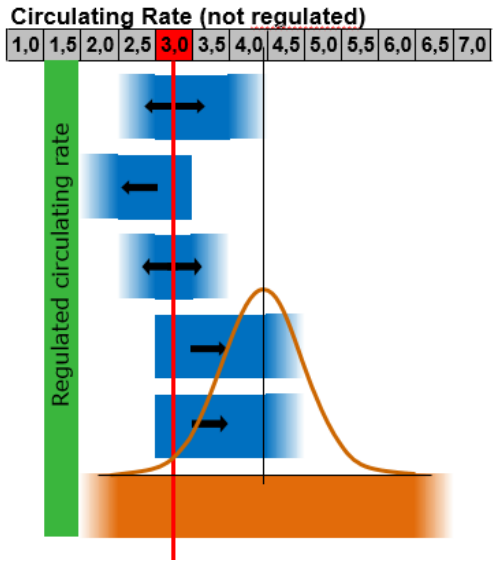


During evaporator filling (initial startup)

- Look at standard superheat signal (temperature sensor – pressure transmitter)
- Find required power to heating element
- Calculate offset and setpoint
- Run slightly flooded…

Recirculated evaporators
(Pump systems)

Uncontrolled Recirculated evaporator feed



1 - Tolerance of adjusted circulating rate.
Higher circulating rates are selected to ensure sufficient capacity

2 - Effect of high load (e.g. hot goods entering the freezing room)

3 - Effect of temperature variation within the temperature band (e.g. ± 1,5°C)

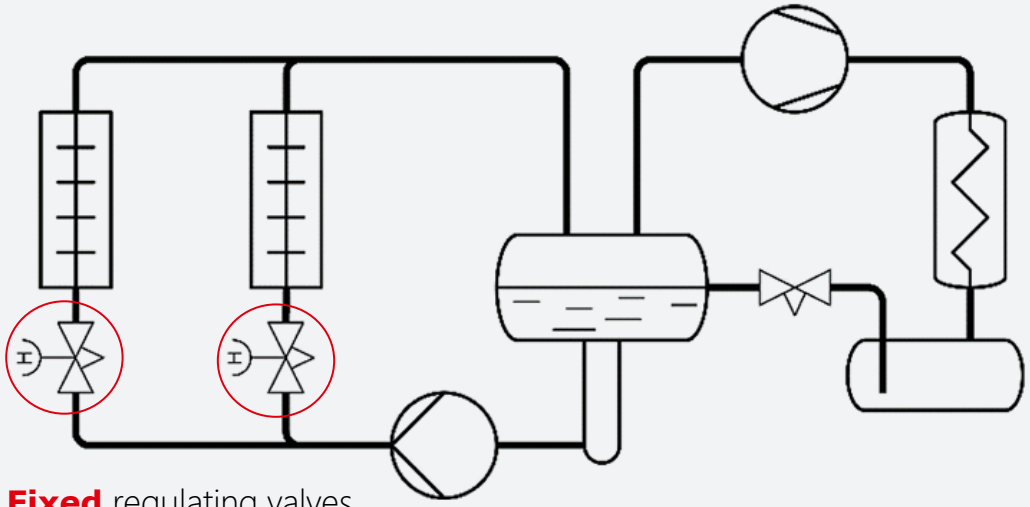
4 - Effect of pressure variation due to parallel evaporators on the same pump are off / defrosted

5 - Effect of capacity reduction due to ice formation on evaporator surface

6 - Estimated accumolated circulation rate variation
Note: VFD not included

- Pump systems with **uncontrolled circulation rate**, tend to run with **higher circulation rates** as designed
- This will negatively impact the NH_3 charge of the system
- This will negatively impact the efficiency of the system

Principle **uncontrolled** circulating rate



Fixed regulating valves

- Fixed regulating valves can’ t adjust system dynamics
- **Over time**, the circulation rates will **increase up** higher then the design operation

NH_3 100 kW -35°C	Design r=3	Actual r=4,65	Controlled r=1,5	Saving
Evaporator V=100 l	**23 kg**	**27 kg**	**16 kg**	**11 kg**
Wet suction pipe DN100 10 m	**13 kg**	**17 kg**	**7 kg**	**10 kg**
Tot	**36 kg**	**44 kg**	**23 kg**	**21 kg**

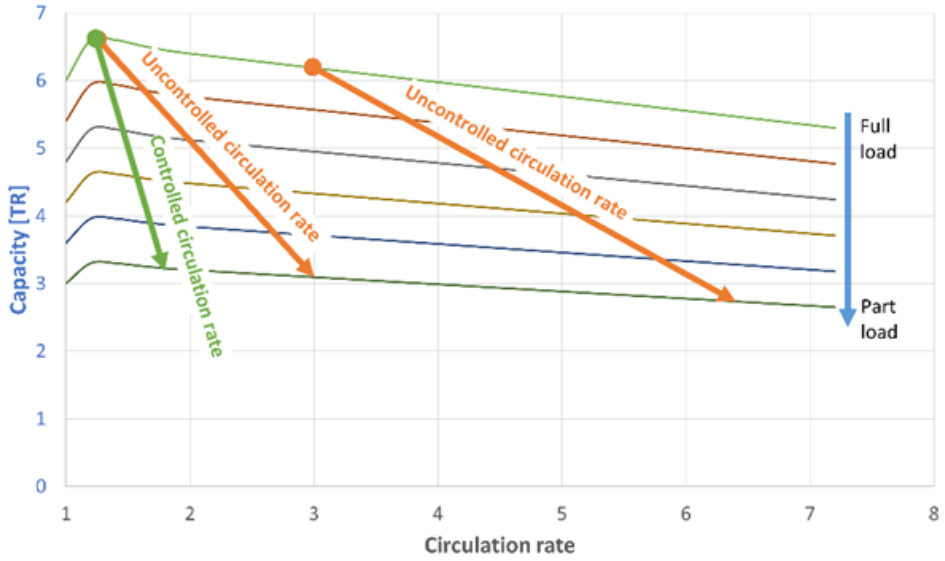
Calculation performed with Zivi void fraction equations

Controlled recirculated evaporator feed With Danfoss NeoCharge

Take the shortcut to **low-charge**

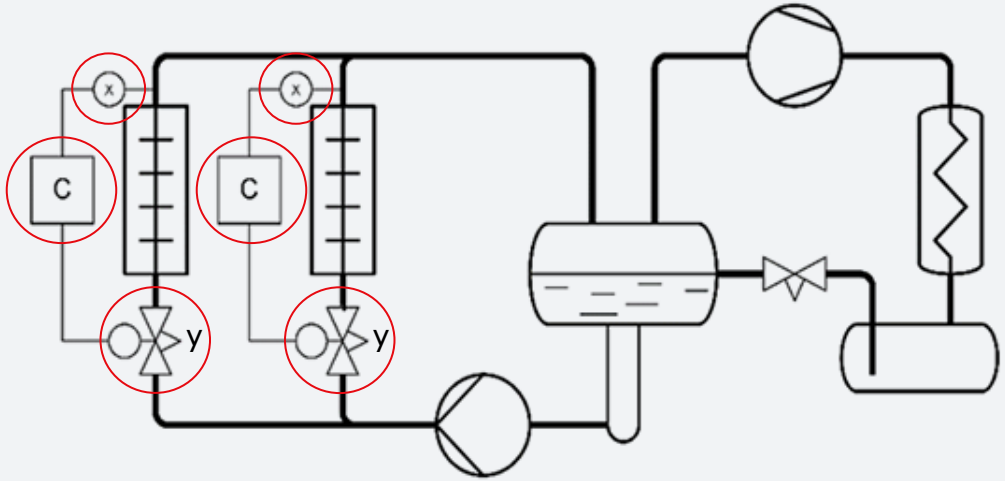
NeoCharge
The new game changer

Bottom feed evaporator. Evaporating temperature = -22°F/-30°C



- Pump systems with **controlled circulation rate**, tend to run with **Lower** circulation rates
- This requires **less NH_3 charge**
- Power consumption **drops**

Principle **controlled** circulation rate



x **Sensors**

- Standard superheat measurement (pressure transmitter + temp. sensor)
- **Danfoss Heated Sensor**

C **Danfoss NeoCharge** controllers

y **Danfoss Control valves**

Danfoss NeoCharge for **controlled** recirculated evaporators feed

Main features

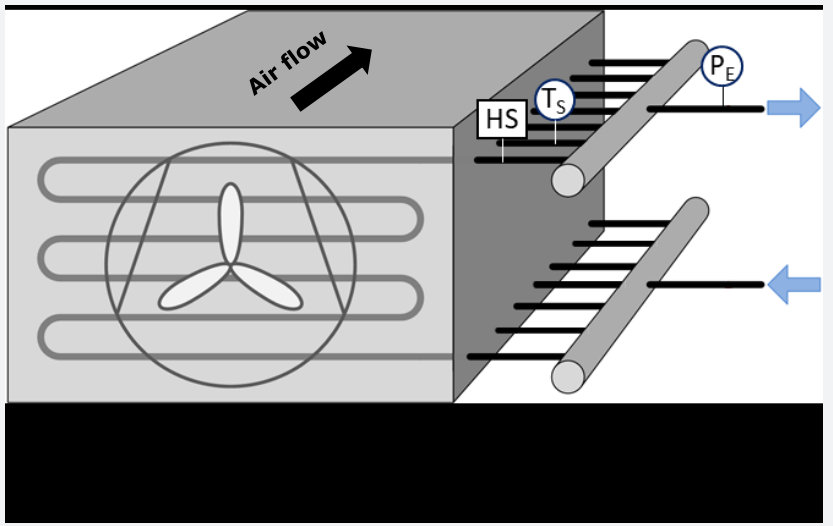
Take the shortcut to **low-charge**

NeoCharge
The new game changer

- NH3 **charge reduction**
  - Less refrigerant in circulation
  - Smaller system footprint required
  - Smaller liquid separator and piping
- **Stable** and controlled recirculation rate **continuously** over the operation of the evaporator.
- **Lower** pump & compressor **energy consumption**
- **Technology**
  - **Self adaptive**
  - Safety mode
  - Plug & play
  - **Easy to mount** Danfoss **Heated Sensor** (outside evaporator tube)

- Suitable for **New and Existing** plants
- **NH_3 charge reduction up to 45%**
  - Existing installations can **expand** capacity with the **same ammonia charge**
- Liquid feed modulation is possible with
  - Danfoss ICM and the New ICADB
  - Danfoss PWM valves

  Both in combination with Danfoss **ICF** valve stations or Danfoss **stand alone valves**

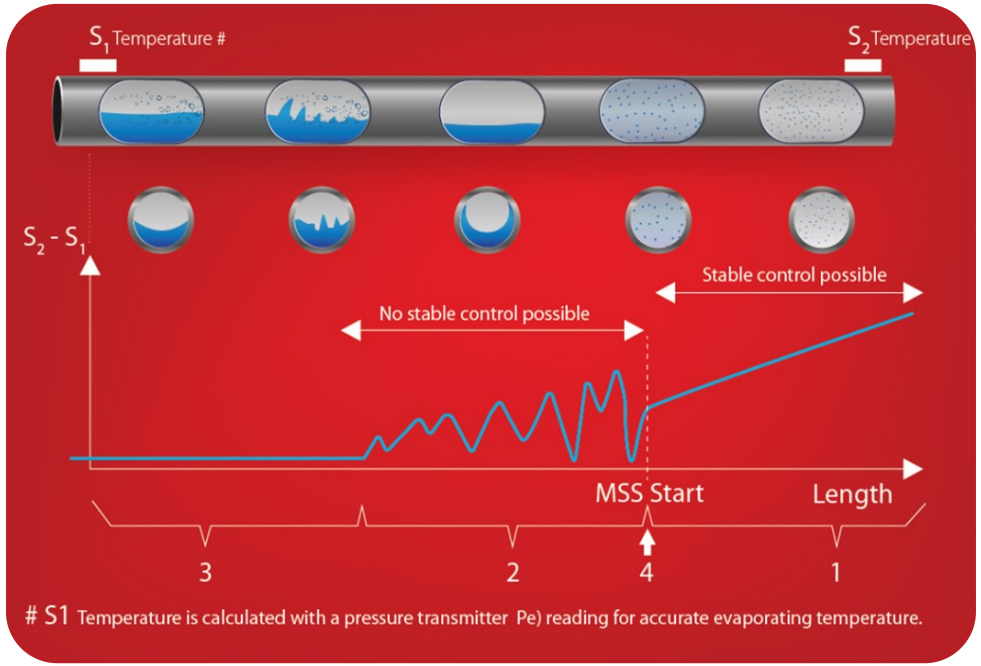


Recirculated (flooded) evaporators (bottom feed)

- Recommended **position of sensors**
  - Danfoss Heated Sensor (HS) on "most loaded pipe"
  - Temperature sensor (TS) on "next" pipe

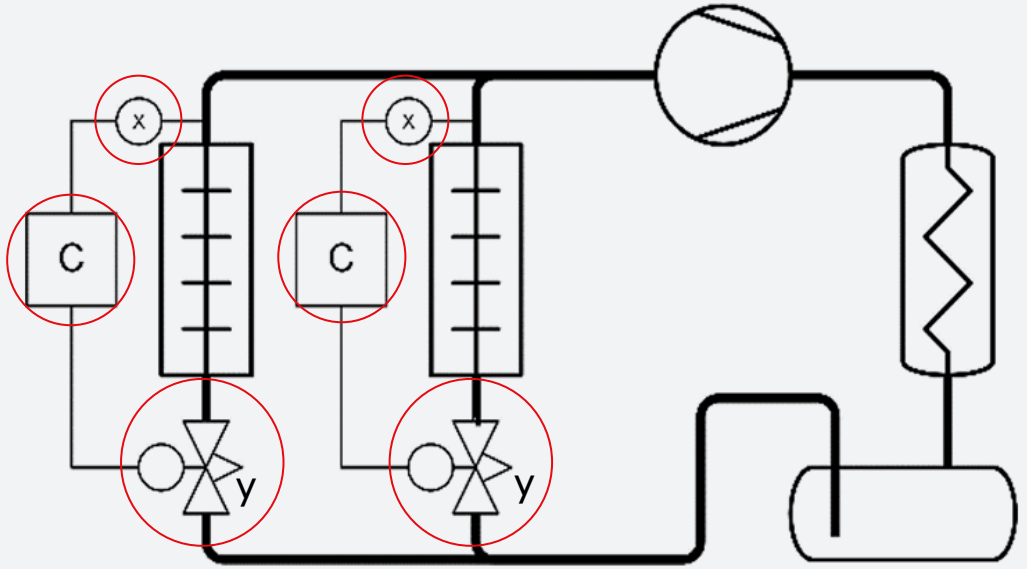
Direct expansion (DX) evaporators

Traditional Danfoss direct expansion evaporator feed



- The minimum stable superheat allows for the system to perform well.
- Superheat however, requires the evaporating temperature to be lower to compensate.
- It results in a ~ 5 to 15% higher energy consumption

Principle **traditional direct expansion control**

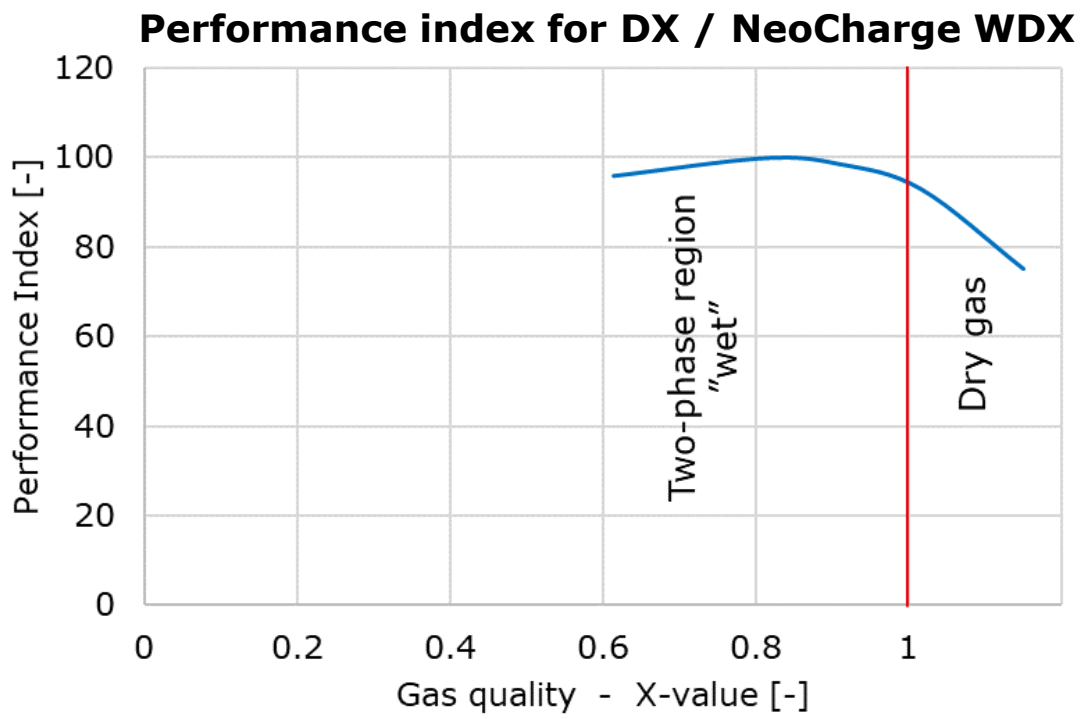


x Standard superheat measurement (pressure transmitter + temp. sensor)

c Standard superheat control

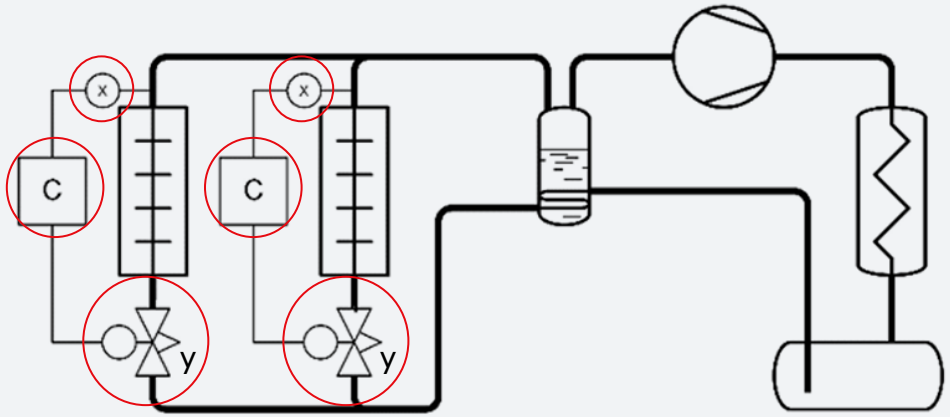
y (Electronic) Expansion valves

From DX to Danfoss NeoCharge



- Danfoss Neocharge reduces gas quality around 1
- Danfoss Neocharge lowers power consumption

Principle direct expansion with **Danfoss NeoCharge**



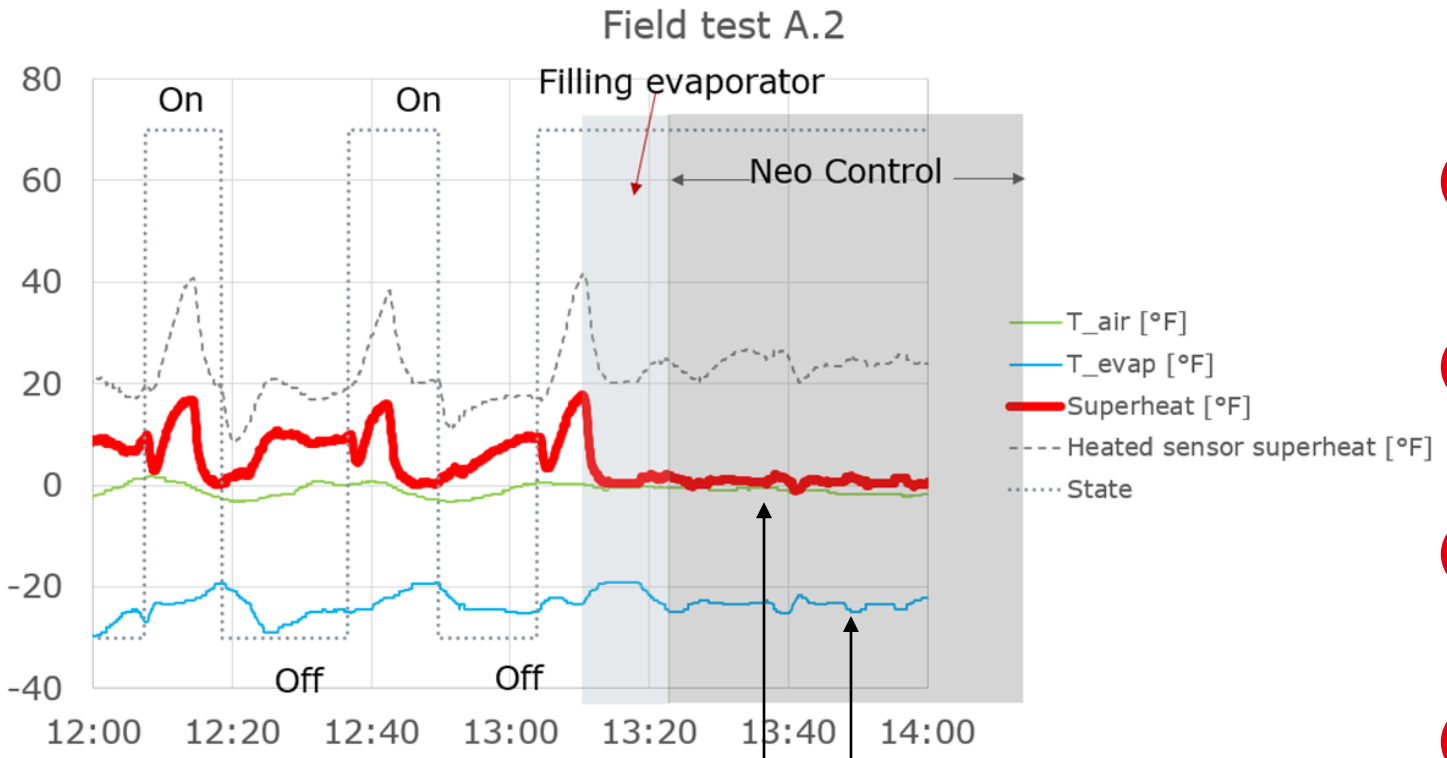
x **Sensors**

- Standard superheat measurement (pressure transmitter + temp. sensor)
- Danfoss **Heated Sensor**

c Danfoss **NeoCharge controller**

y Danfoss **new NeoCharge Control valve**

From DX to Danfoss NeoCharge



- Danfoss NeoCharge enabled
- Superheat temperature level
- Evaporating temperature level

- DX control switching to Danfoss NeoCharge control
- Superheat slowly drops and is varying around 0K
- The air temperature seems to become more stable
- The evaporating temperature gradually moves up to a higher and more stable level
- This reduces the system power consumption

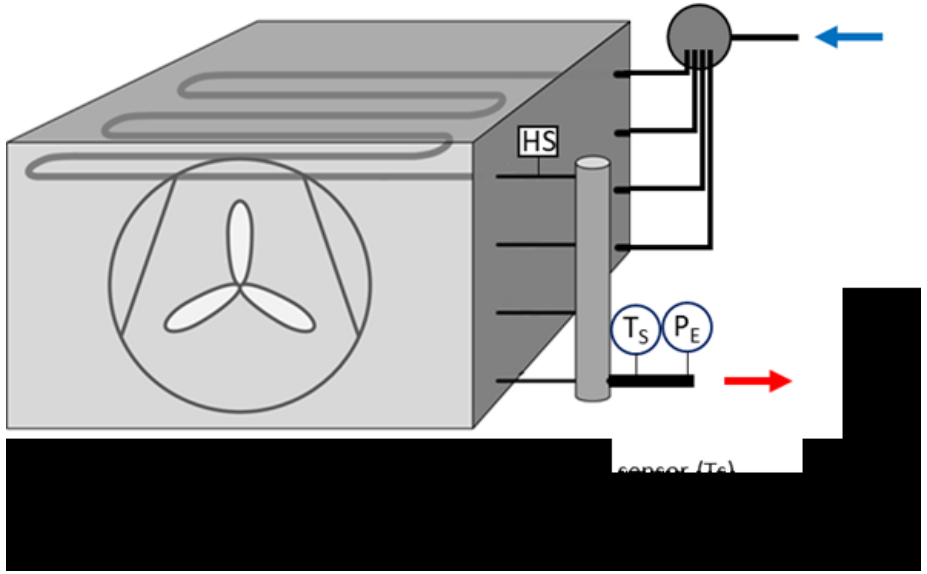
From DX to Danfoss NeoCharge
Main features

Take the shortcut to **low-charge**

NeoCharge
The new game changer

- **Stable** and controlled **superheat**
  - Lower superheat
  - Higher evaporating temperature
  - Better evaporator performance
- **Direct** expansion systems **can reduce system charge up to 50%** compared to recirculated (pumped) systems.
- Liquid feed control with the **New Danfoss NeoCharge direct expansion valve** in ICF valve stations

- 5 to 15% lower energy consumption compared to standard DX.
- **Technology**
  - **Self adaptive**
  - Safety mode
  - Plug & play
  - **Easy to mount** Danfoss **Heated Sensor**



Direct Expansion (DX) evaporators

- Recommended **position of sensors**
  - Heated Sensor (HS) on “least loaded pipe”
  - Temperature sensor (TS) on common outlet

NeoCharge Solution

Take the shortcut to **low-charge**

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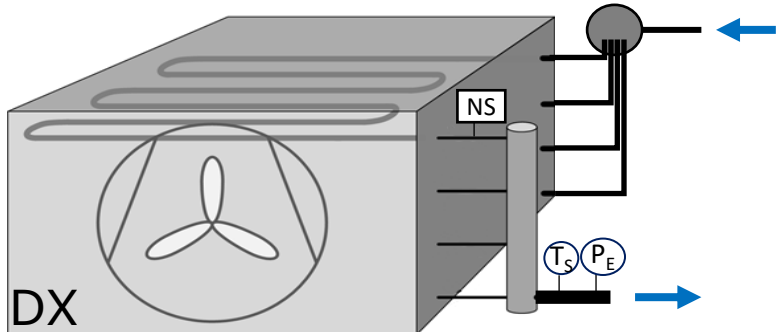
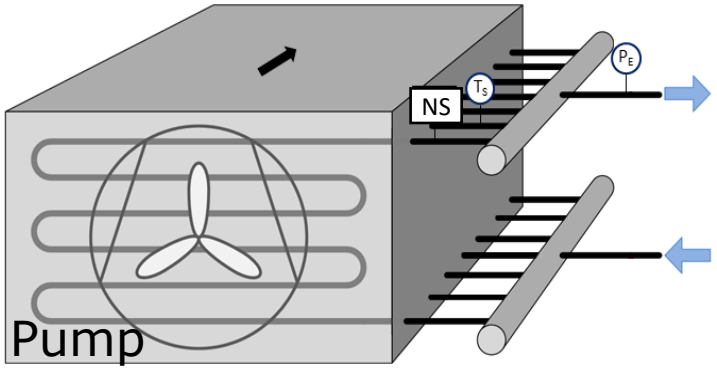
The new game changer





- **Simple and unique technology** enabling NH_3 DX system running without superheat (WDX) and reducing the **recirculation** in traditional flooded system to the **lowest possible rate keeping high performance** (CCR)

- › **Plug & play solution**
- › All kind of air coolers: DX – Pump
  All refrigerants: NH3 – CO2 – R....
  All conditions: active control
  Ideal for retrofit

NeoCharge Controller

NeoCharge Sensor

Temperature Sensor

Pressure Sensor
(can be shared with multiple evaporators)

NeoCharge test reference

Take the shortcut to **low-charge**

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Lab test 2020-22

		Achievements
DK NH_3	DTI Laboratory test	Technology release for horizontal pipe 10-22 mm WDX 0 K superheat - CCR 1,5

Field test on single evaporators 2023-24

DE NH_3	WDX retrofit 1 evaporator 02-2023	Stable 0K superheat in any load condition
IT NH_3	CCR retrofit 1 evaporator 150 kW 09-2023	Stable CR no lack of performance
IT NH_3	CCR retrofit 1 evaporator 28 kW 02-2024	Same capacity with reduced CR
IT NH_3	CCR retrofit 2 evaporators 30 kW 03-2024	27 mm pipe galvanize steel top feeded OK

Pilot test on complete system 2024

DE NH_3	CCR new system LT 4 evap. 50 kW March	Same capacity with fixed CR
DK CO_2	WDX DTI air/water HP 465kW 4 evap. May	Stable 0K superheat any load condition
CN NH_3	CCR new LT 64 evap. 65/80/100 kW September	Reducing charge to 8 t
FR NH_3	CCR retrofit LT 9 evap. 35/77/101 kW October	Expand capacity with the same charge
FR NH_3	CCR retrofit LT 3+2 evap. 90/175kW December	Expand capacity with the same charge
ES NH_3	CCR freezing tunnel retrofit 3 110kW evap. October	Increase evaporating pressure reducing dp
CA NH_3	WDX retrofit 2 evap. 290 kW September + 11 evap.	0 K superheat increase efficiency & stability
US NH_3	WDX retrofit 2 evap. 90 kW October + 23 evap.	0 K superheat increase efficiency & stability
NL R600a	WDX Air to water HP copper pipe 2 evap. October	0 K superheat increase efficiency & stability
RS NH_3	CCR 2 new spiral freezing tunnels December	Reduce charge

Project 2025

DE NH_3	WDX new LT log. platform 13 evap. 153 kW Jan. 25	0 K superheat increase efficiency & stability

We invite you to learn more about NeoCharge at
Chillventa
in Nuremberg from 8th – 10th of October.
Visit us at Hall 7, booth 251.

Hall 7A

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