

Chillventa Specialist Forums 2024

Chillventa Fachforen 2024

**CONNECTING
EXPERTS.**





Shift your perspective

**Danfoss Electric Expansion Valve
technologies and controller portfolio
for natural refrigerants**

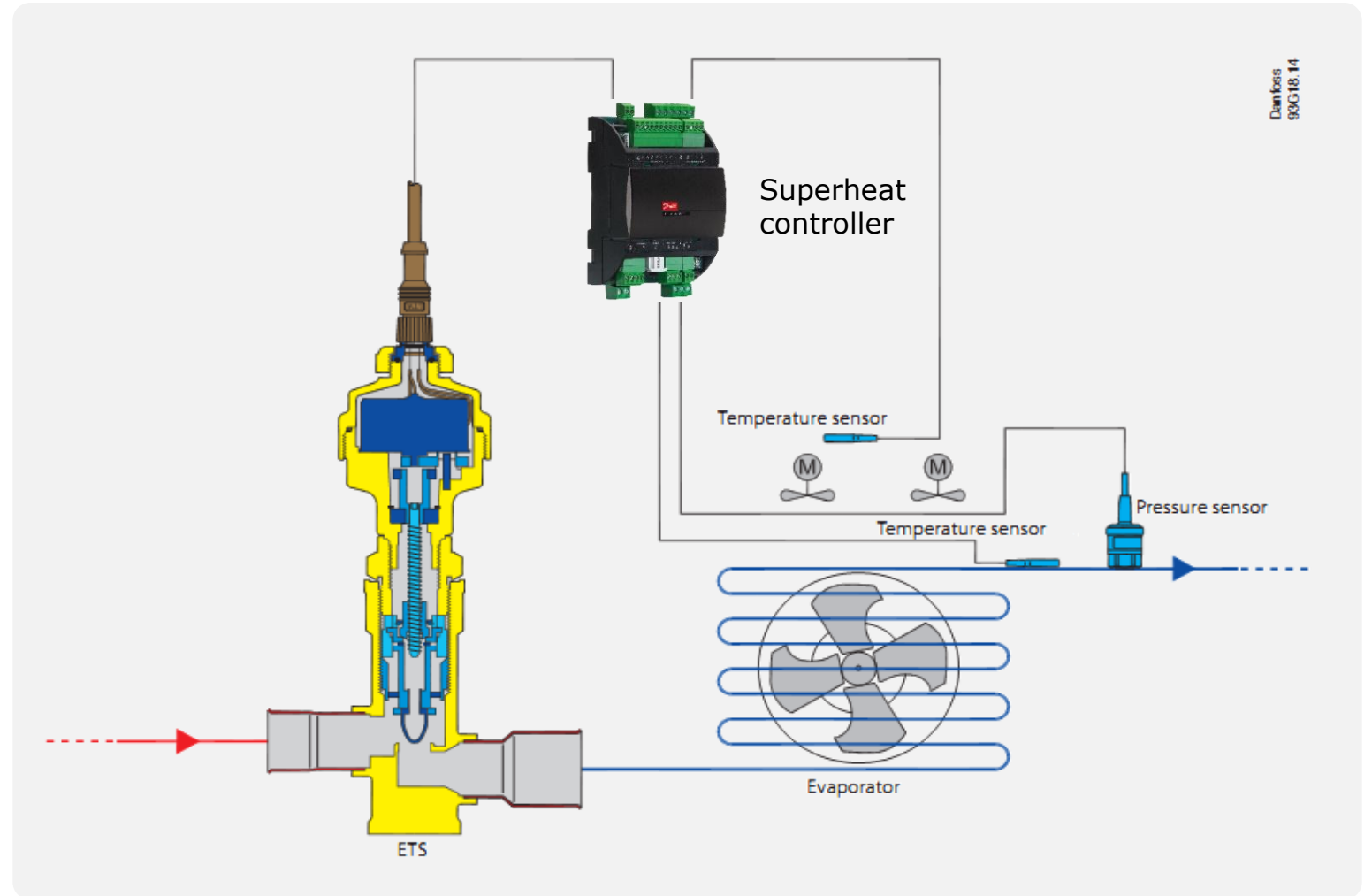


Jörg Saar

Electric Expansion Valve System

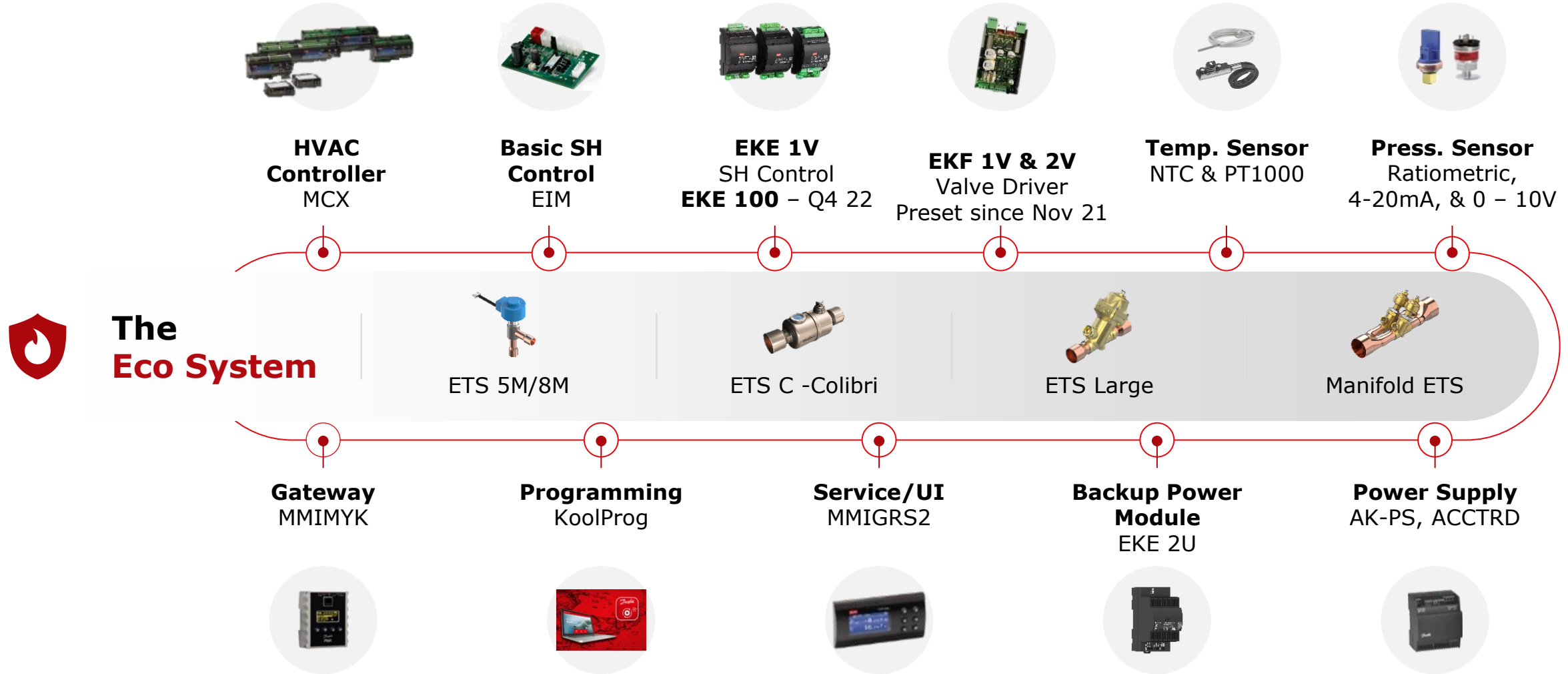
The electric expansion valve system consists of :

- ✓ Sensors
(pressure, temperature)
- ✓ Electronic controller
- ✓ Valve incl actuator



Electric Expansion Valves

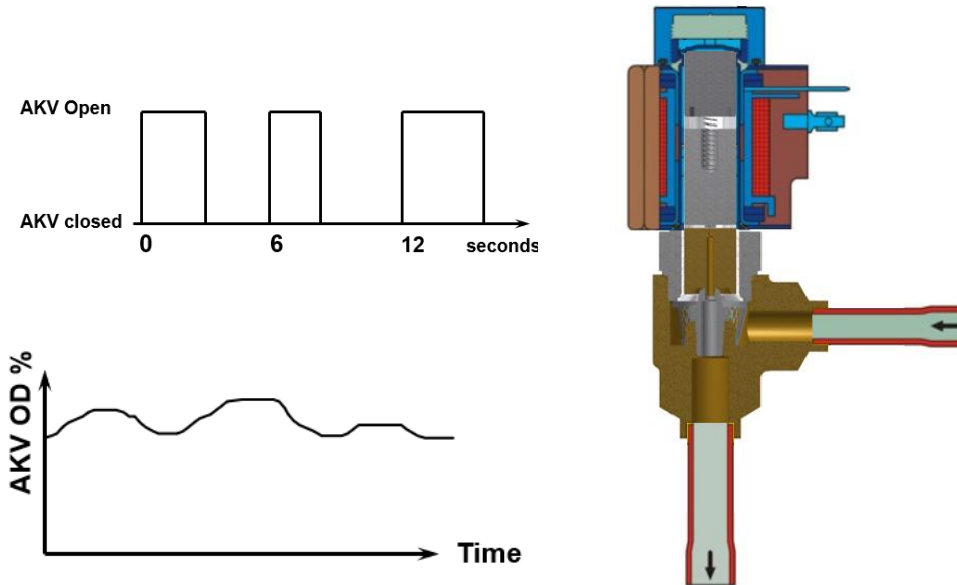
Danfoss Ecosystem



Electric Expansion Valve System

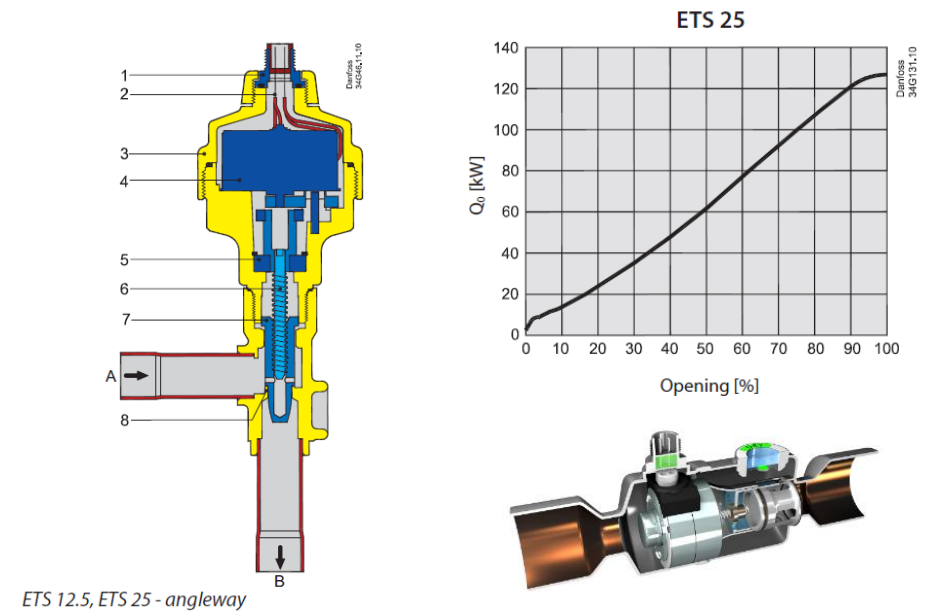
2 electric expansion valve concepts

Pulse Width Modulating (PWM)



✓ Danfoss AKV(P) family

Stepper motor driven



✓ Danfoss CCM(T), ICMTS, ETS families

Pulse Width Modulating (PWM) vs. Stepper Motor Valve Differences

Legend

+

Good

(+)

OK

-

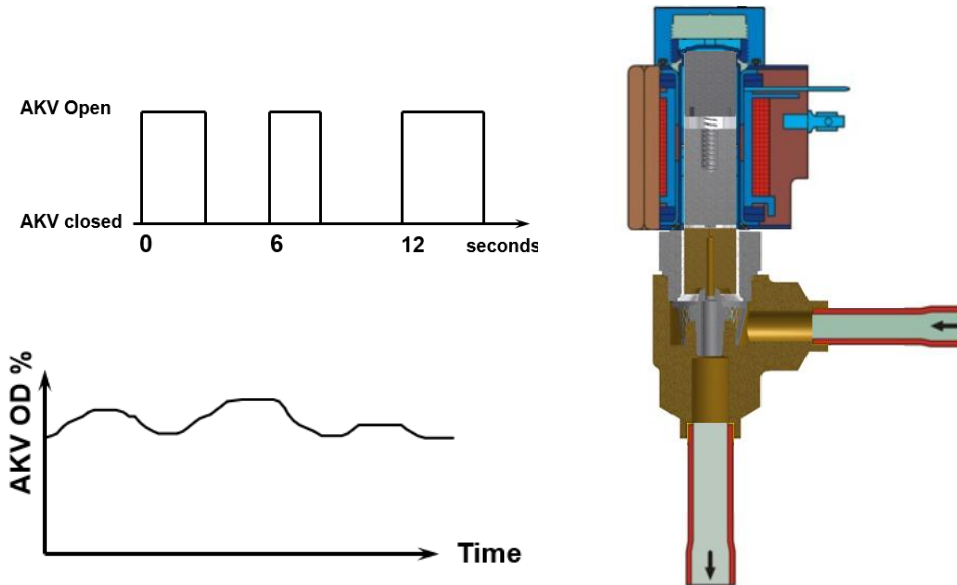
Not good

Criteria	AKV (PWM)	ETS (Stepper)	Remarks
Simple electrical signal	+	(+)	AKV : on / off. Stepper motor : more complex signal changes.
Single evaporator systems	-	+	PWM operation generates pressure fluctuations.
Multi evaporator systems	+	+	More evaporators even out fluctuations of PWM operation.
Failsafe closure after power loss	+	-	Stepper motor needs backup power to close . AKV is a NC valve (normally closed = closed without power).

Electric Expansion Valve System

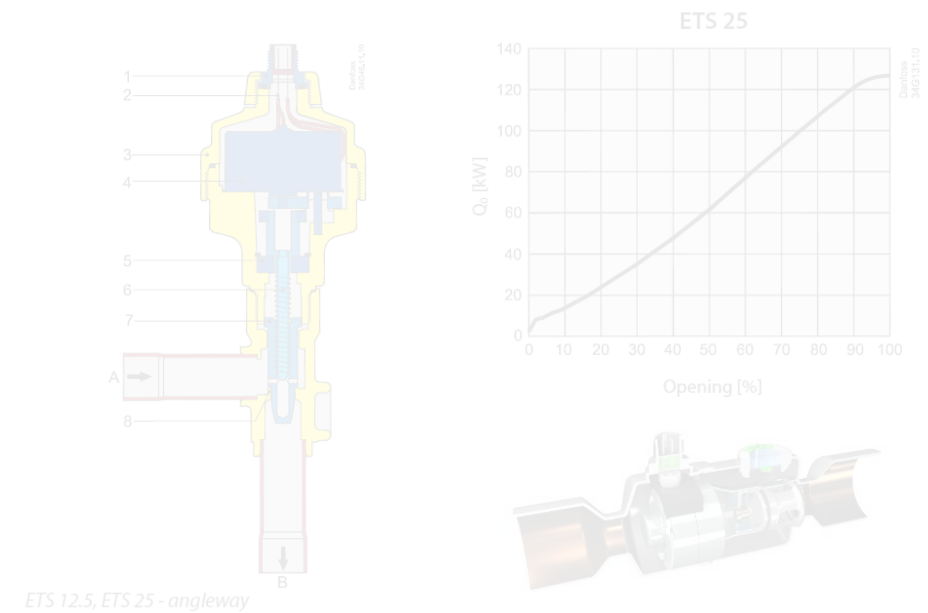
2 electric expansion valve concepts

Pulse Width Modulating (PWM)



✓ Danfoss AKV(P) family

Stepper motor driven



✓ Danfoss CCM(T), ICMTS, ETS families

ADAP-KOOL[®] expansion valves

Pulse Width Modulating valves CO₂ and HFCs

AKV family

Capacities :

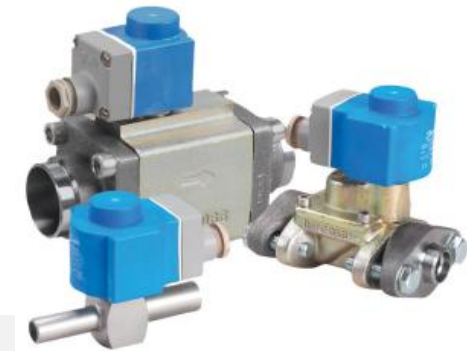
HC : 0,3 kW - 25 kW

HFC : 0,3 kW - 500 kW

CO₂ : 0,4 kW - 1150 kW

NH₃ (Ammonia)

Capacities : 4 kW to 3150 kW



Introducing **soft pulse technology** for PWM valves

Reduced pipe movement



Reduced risk of straight liquid hammer



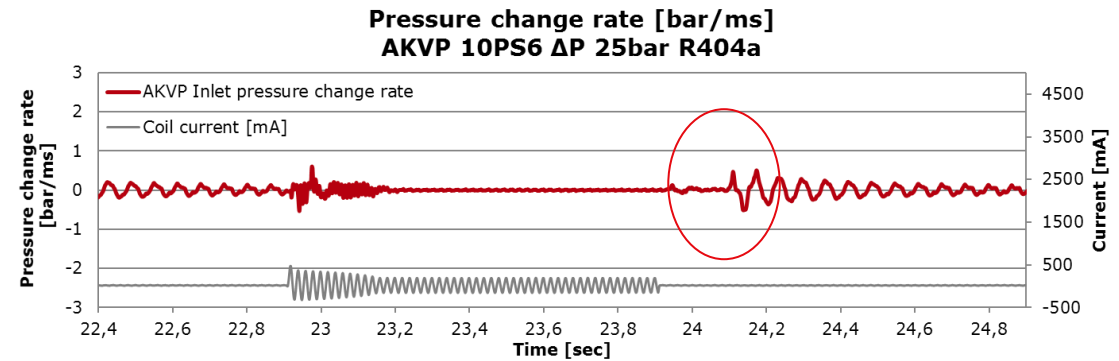
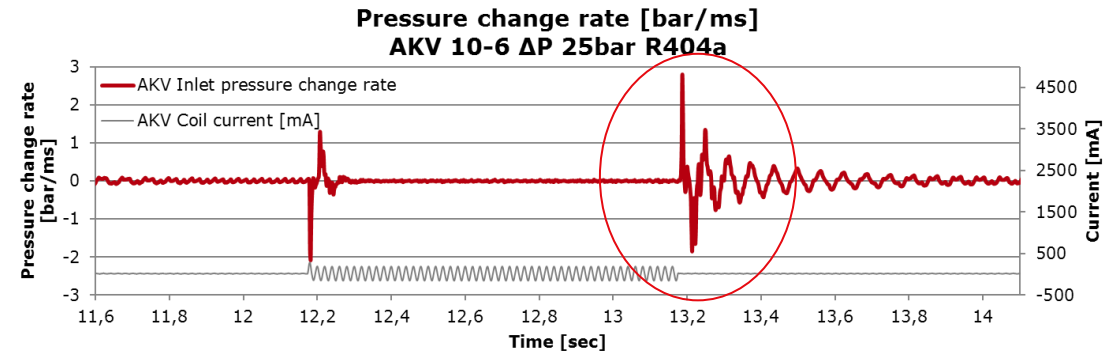
Reduced audibility



AKV 10-6 and AKV 10PS6
Comparison



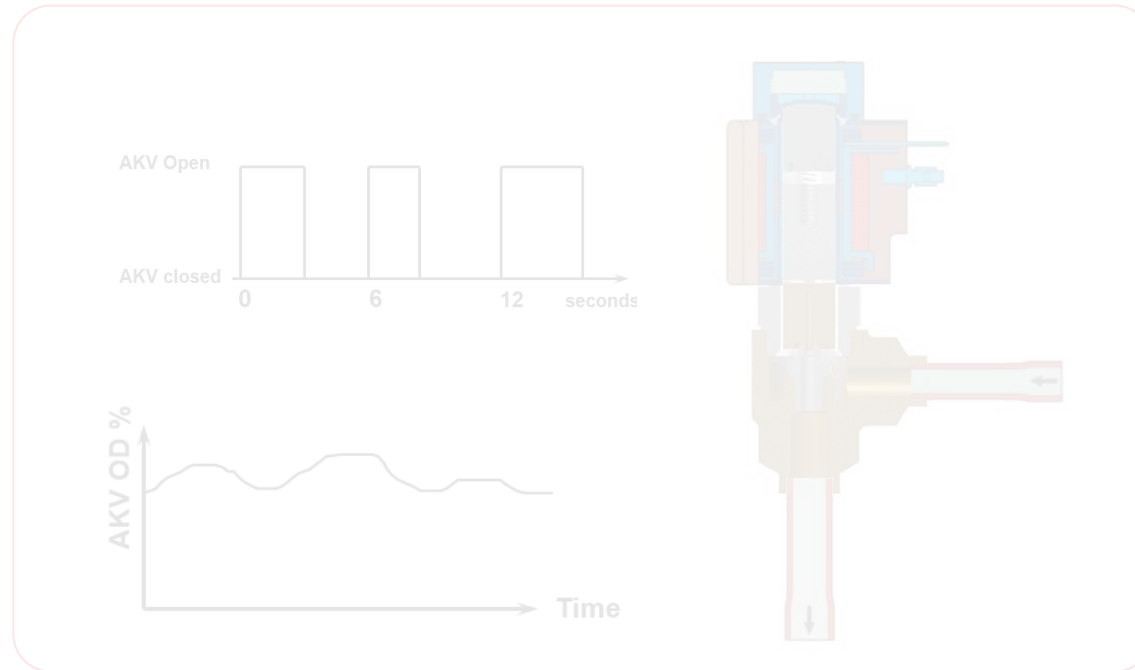
Pressure change rate in
4m/14ft straight liquid-line



Electric Expansion Valve System

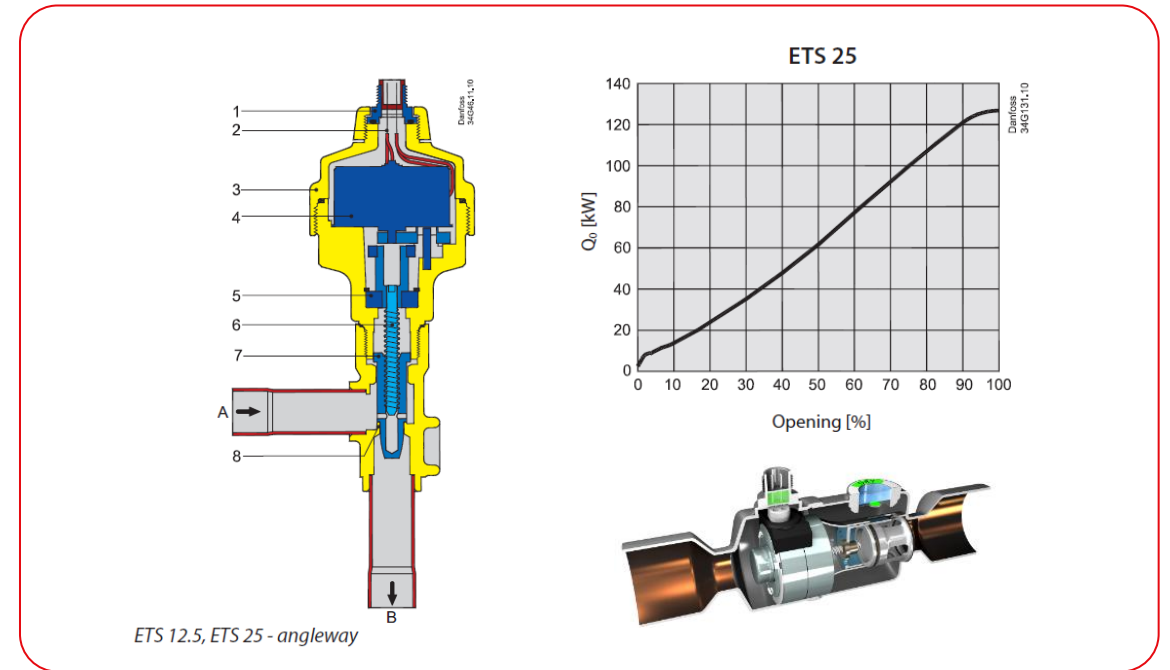
2 electric expansion valve concepts

Pulse Width Modulating (PWM)



✓ Danfoss AKV(P) family

Stepper motor driven



✓ Danfoss CCM(T), ICMTS, ETS families

Stepper motor operated valves for CO₂ and NH₃



Up to 700 kW

CCMT & CCM

CO₂



CO₂ : up to 5.300 kW

NH₃ : up to 18.000 kW

ICMTS 20 - 80

CO₂ and NH₃

Capacity

Stepper motor operated valve ICMTS with ICAD Actuator

- ✓ Approved for NH₃ and CO₂
- ✓ Max working pressure 140 bar
- ✓ Max opening pressure differential 90 bar
- ✓ Magnet coupling



Stepper Motor valves

Hydrocarbons



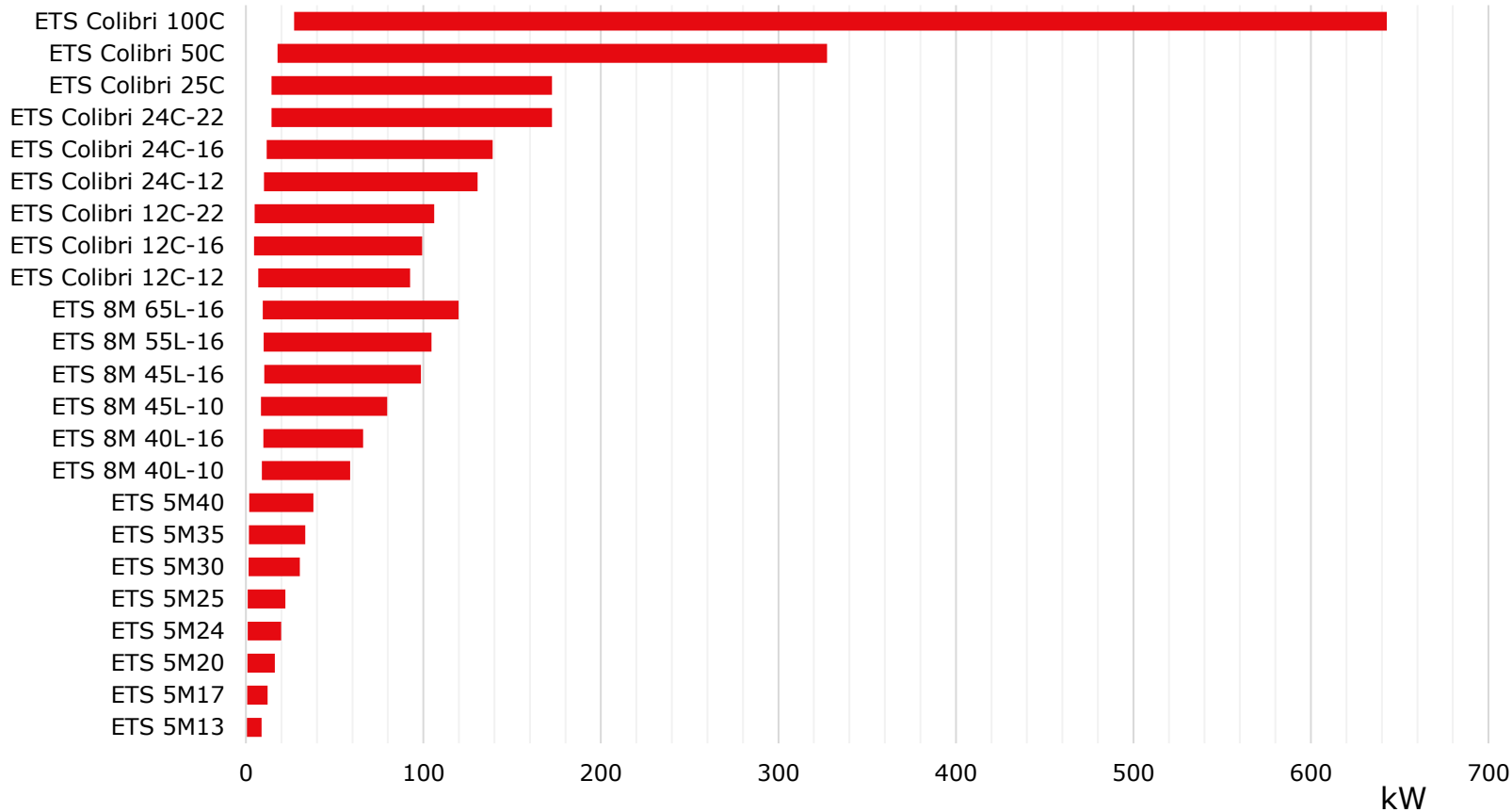
ETS Colibri



ETS 8M



ETS 5M



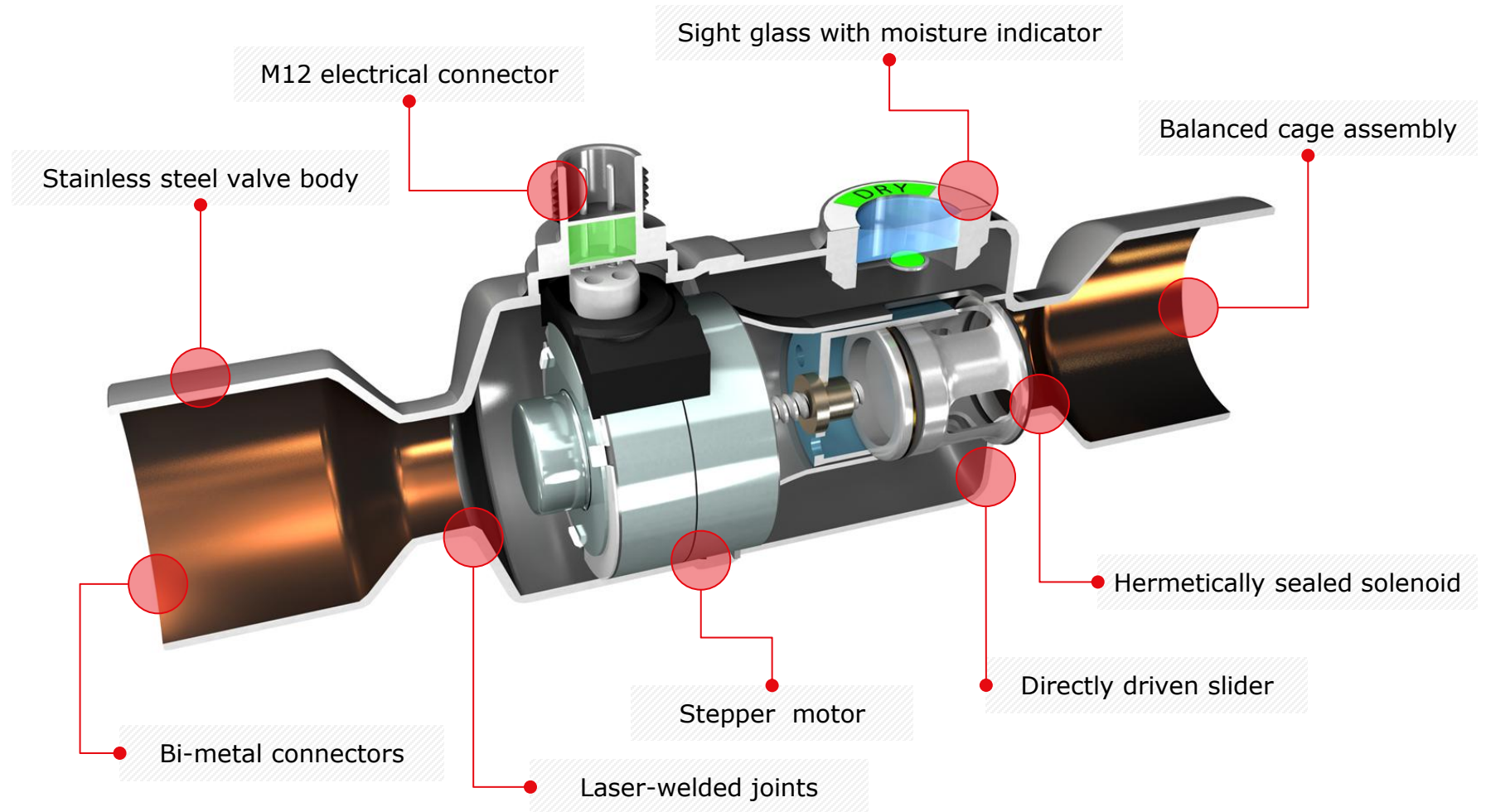
Ratings: R290 | Evap 5°C | Condensing 50°C | SH 10K | SC: 0K

Stepper Motor valves

ETC-C (Colibri)

✓ Fully hermetic design

✓ No gasket leak paths

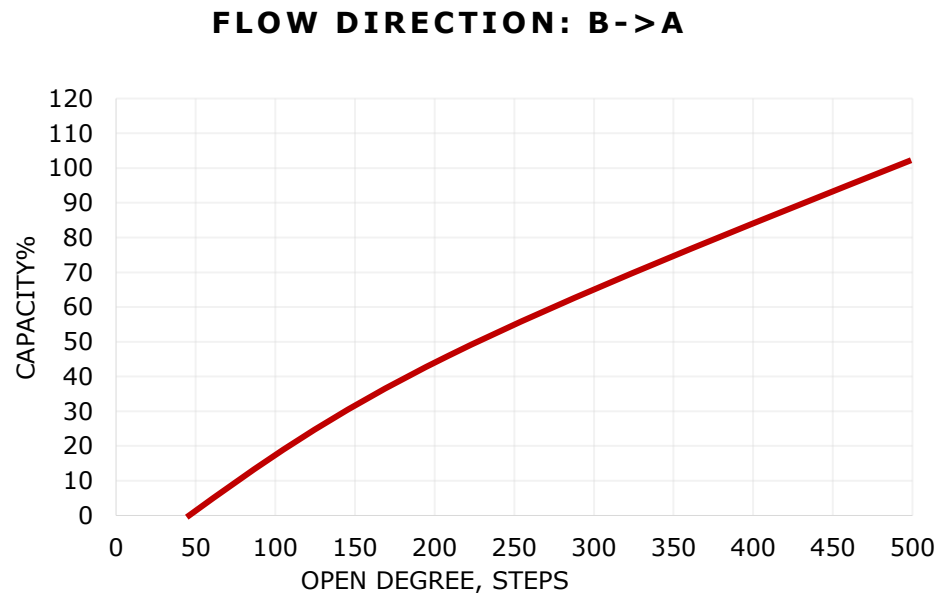


Stepper Motor valves

Flow curves

Linear curve

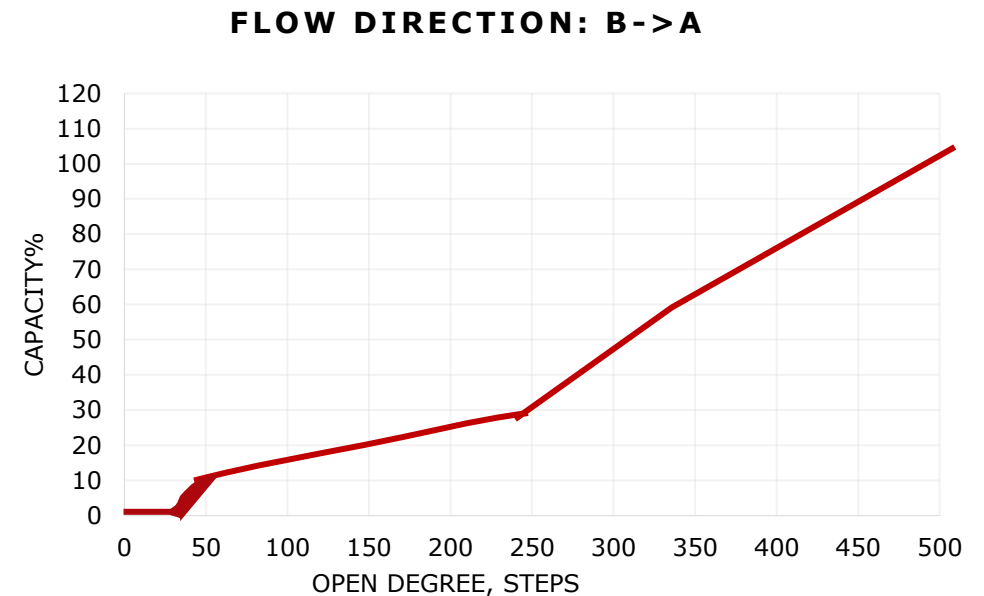
e.g. in modular chillers



- ✓ Simple control logic possible

S curve (Polyline)

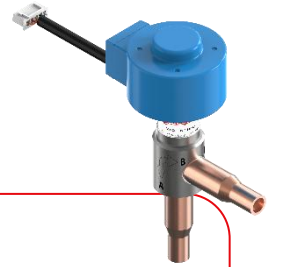
e.g. in commercial heat pumps



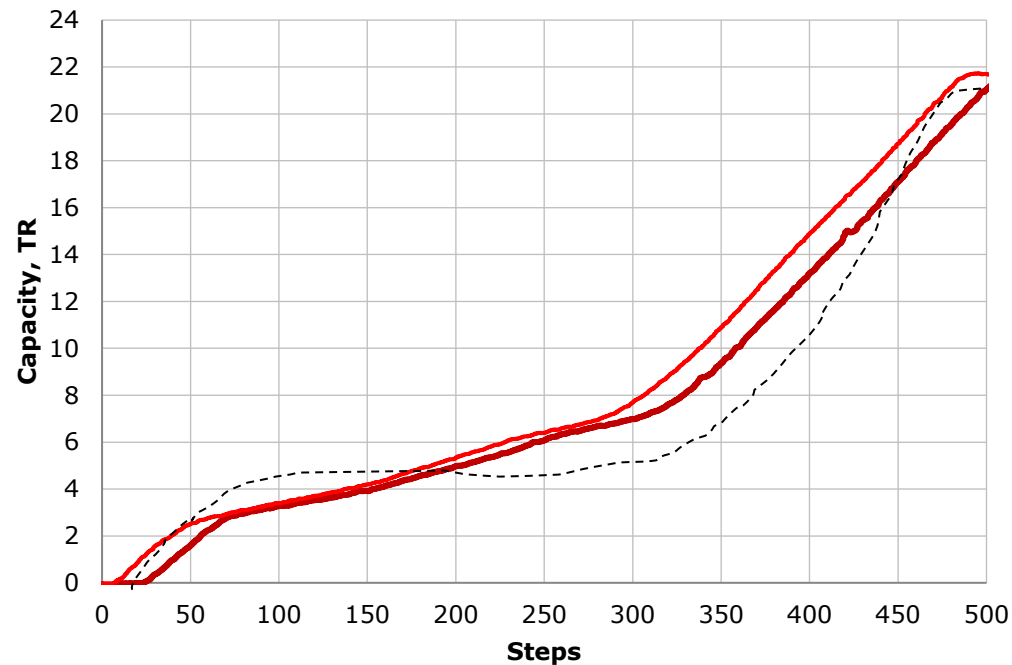
- ✓ Better control at lower capacities possible
(e.g. A/W – HP low ambient, high water supply temp)

Stepper Motor valves

Flow curve hysteresis – measured example S-curve

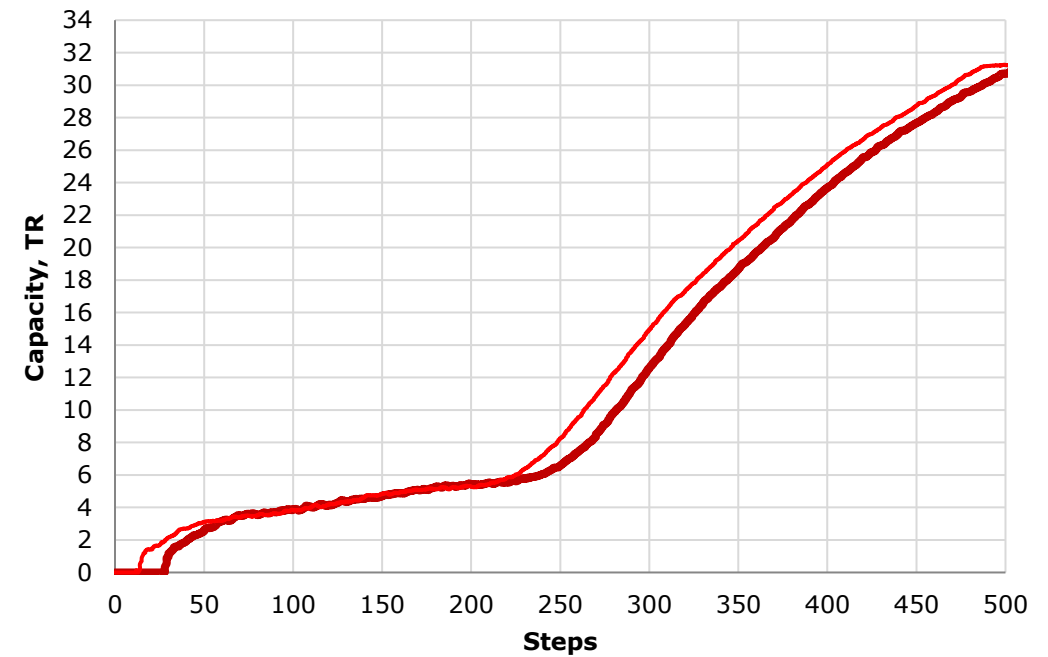


ETS 8, Orifice 4.0



— Opening curve — Closing curve
- - - Would not be good

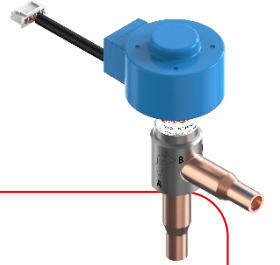
ETS 8, Orifice 5.5



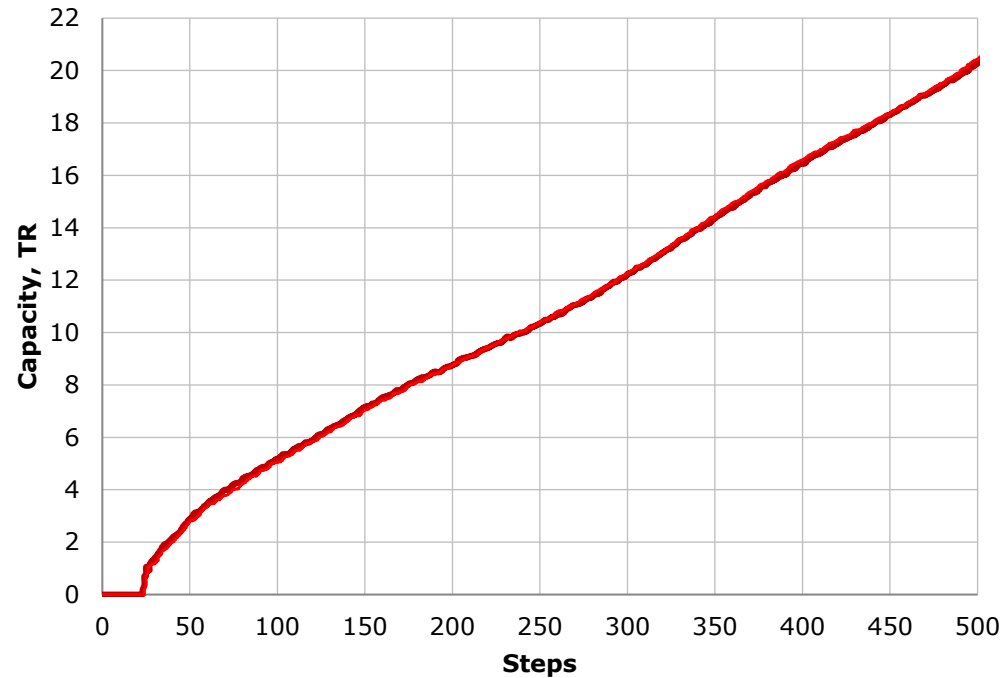
— Opening curve — Closing curve

Stepper Motor valves

Flow curves hysteresis – measured example linear curve

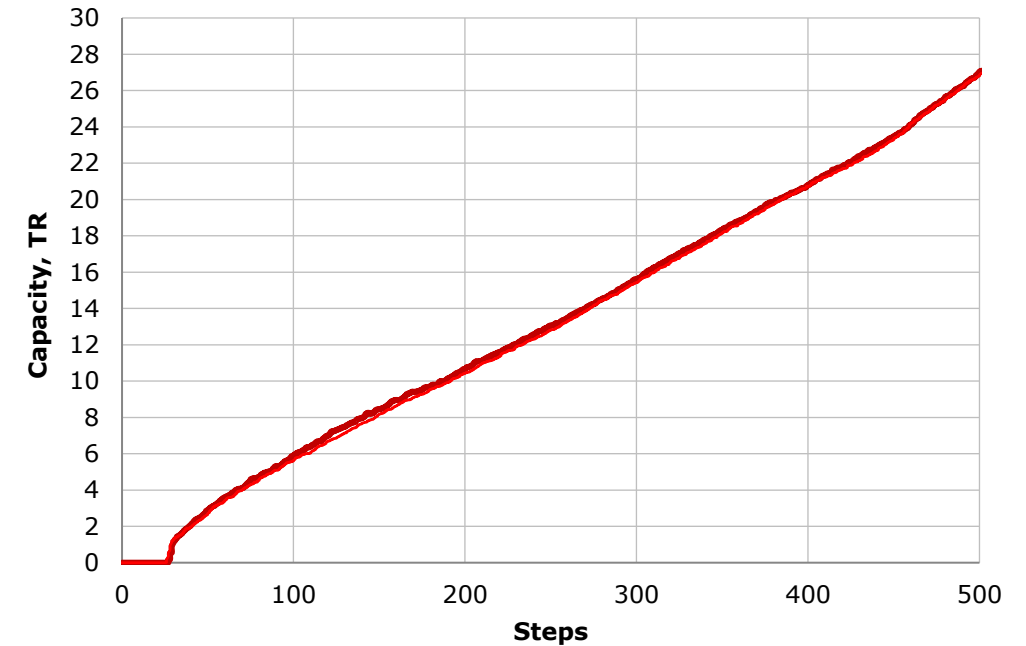


ETS 8, Orifice 4.0



— Opening curve — Closing curve

ETS 8, Orifice 4.5



— Opening curve — Closing curve



Superheat Controller

Controllers for Stepper Motor valves

EKE family



Main applications

*Small Heat Pumps, IT cooling,
Modular chiller, Ice maker*

*Heat Pumps, Chillers,
Food Retail applications*



Controllers for Pulse Width Modulating valves

ADAP-KOOL® Case controllers



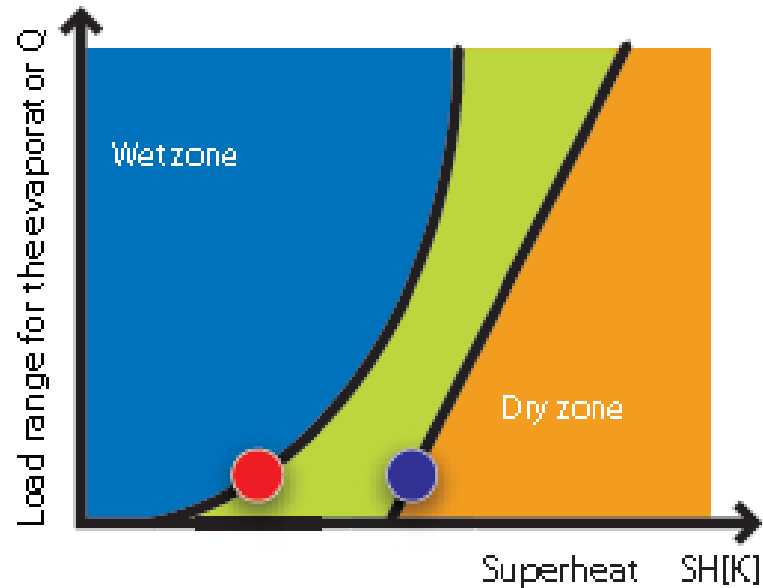
	AK-CC55 Compact	AK-CC55 Single Coil	AK-CC55 Single Coil UI	AK-CC55 Multi Coil
	Conventional EEV Case controller	Flexible EEV Case controller		
Expansion Device	AKV (Appl. 5-9)	AKV	AKV	3 x AKV
Control Principle	MSS Superheat / ALC Control	MSS Superheat/ ALC Control	MSS Superheat/ ALC Control	MSS Superheat/ ALC Control
Communication	Modbus built-in	Modbus built-in, LON option module	Modbus built-in, LON option module	Modbus built-in, LON option module
Remote Displays / User Interfaces	1	2	1	2
Bluetooth Connection to AK-CC55 Connect APP*	✓	✓	✓	✓

*AK-UI55 Bluetooth display is required

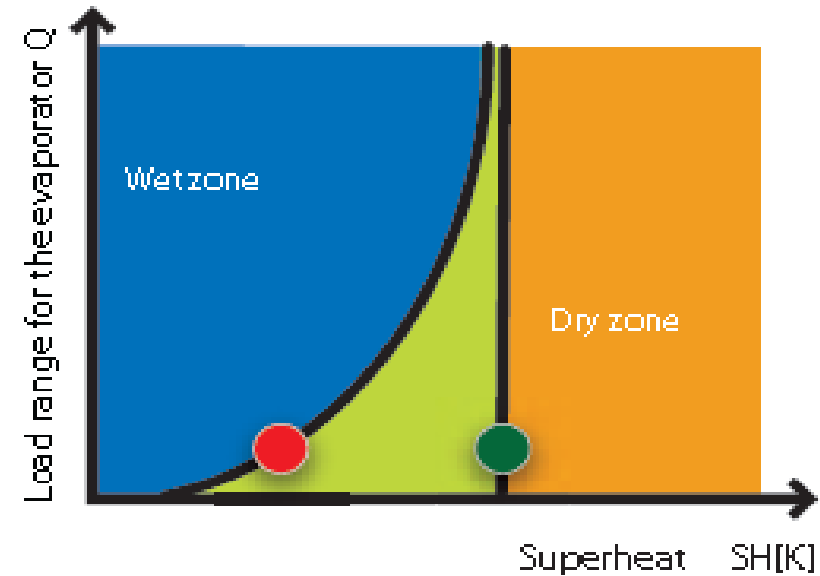
Controller: Superheat algorithms

Example: **MSS**

MSS Algorithm



Fixed superheat



Energy savings due to reduced superheat at lower loads

CoolSelector: your 24/7 software to select Components and applications

The screenshot displays the CoolSelector2 software interface, titled "CoolSelector2 - Untitled.cspj". The interface includes a menu bar (File, Options, Tools, Help, About) and a toolbar (Selections, Report, Bill of Materials). The left sidebar contains a tree view with categories: VALVES AND LINE COMPONENTS, COMPONENTS IN SERIES, COMMERCIAL APPLICATIONS (highlighted), INDUSTRIAL APPLICATIONS, COMPRESSORS, CONDENSING UNITS, ELECTRONIC CONTROLS, SENSORS AND SWITCHES, and CUSTOM APPLICATIONS. The main workspace shows a refrigeration system diagram with components labeled: Cold room, Transcritical high pressure side, Retrofit tool, Heat recovery unit, and Riser. A "Components" panel on the right lists various parts under "VALVES AND LINE COMPONENTS", including Control and regulating valves, Solenoid valves, Check valves, Stop and shut off valves, JCF valve station, Safety relief valves, Water valves, Electronic expansion valves, Thermostatic expansion valves, Manual expansion valves, Float expansion valves, Transcritical high pressure valves, Transcritical gas bypass valves, Multi ejectors, Filters and strainers, Filter driers, Burnout filters, Sight glasses, Piping, Internal heat exchangers, and Service valves. An "Applications" panel on the right shows a "Cold Room - Step 1 of 3: Load Wizard" dialog box. The wizard includes fields for Dimensions (Length: 6.00 m, Width: 5.00 m, Height: 3.60 m), Room surroundings (Temperature of surroundings: 28.0 °C, Relative humidity: 55 %, Temperature below floor: 10.0 °C), and a checkbox for "Floor is insulated". The wizard also has "Cancel" and "Next >" buttons.



ENGINEERING **TOMORROW**

Thank you for your attention!
Let's meet at the **Danfoss Booth Hall 7, booth 251**