

General vision for CO₂ valves

- Short term solution is raising the pressure on existing products to 60 bar
- Long term vision is to have two pressure levels for CO₂. 90 and 140 bar and full program

AKVH – 90 Bar

- 90 bar stand still capability
- 18 bar or 35 bar MOPD depending on coil
- At higher differential pressures than 18 bar the service interval will decrease.



AKVH capacity

R744				AKVH 10		
Valve type	Rated capacity kW		k _v value	Connections		
				Solder ODF		
	Refrigeration 1)	Freezing 2)	m ³ /h	Inlet × outlet in.	Industrial pack 32 valves each	Single pack 1 valve each
					Code no.	Code no.
AKVH 10-0	0.4	0.8	0.003	$\frac{3}{8} \times \frac{1}{2}$	068F4068	068F4078
AKVH 10-1	1.1	2.2	0.010	$\frac{3}{8} \times \frac{1}{2}$	068F4069	068F4079
AKVH 10-2	1.7	3.5	0.017	$\frac{3}{8} \times \frac{1}{2}$	068F4070	068F4080
AKVH 10-3	2.6	5.4	0.025	$\frac{3}{8} \times \frac{1}{2}$	068F4071	068F4081
AKVH 10-4	4.3	8.7	0.046	$\frac{3}{8} \times \frac{1}{2}$	068F4072	068F4082
AKVH 10-5	6.7	13.6	0.064	$\frac{3}{8} \times \frac{1}{2}$	068F4073	068F4083
AKVH 10-6	10.7	21.7	0.114	$\frac{3}{8} \times \frac{1}{2}$	068F4074	068F4084

ICMTS and ICADTS

- Second generation of high pressure control valve for transcritical systems
- New actuator with M12 connectors and build in heater



ICMTS capacity

Table 1

	0 K subcooling in the subcritical mode		
	+15/+5°C [kW]	+30/+5°C [kW]	+38 (100 bar)/ +5°C [kW]
ICMTS 20-A33	16.7	16.1	25
ICMTS 20-A	50	48	75
ICMTS 20-B	291	278	423
ICMTS 20-C	479	454	675

Table 2

	5 K subcooling in the subcritical mode		
	+15/+5°C [kW]	+30/+5°C [kW]	+38 (100 bar)/ +5°C [kW]
ICMTS 20-A33	18.5	23	25
ICMTS 20-A	56	69	75
ICMTS 20-B	325	400	423
ICMTS 20-C	540	655	675

Replacement of ICMT / ICMTS top part.



Diameter of the top part where the ICAD is mounted

The diameter of the top part where the ICAD is mounted is different on the ICMT prototype and the current ICMTS standard valve.

ICMT : Ø30,1 mm

ICMTS : Ø28,1 mm

The inside diameter of the magnet on the ICAD has a diameter that corresponds to the diameter of the ICMT / ICMTS top part.

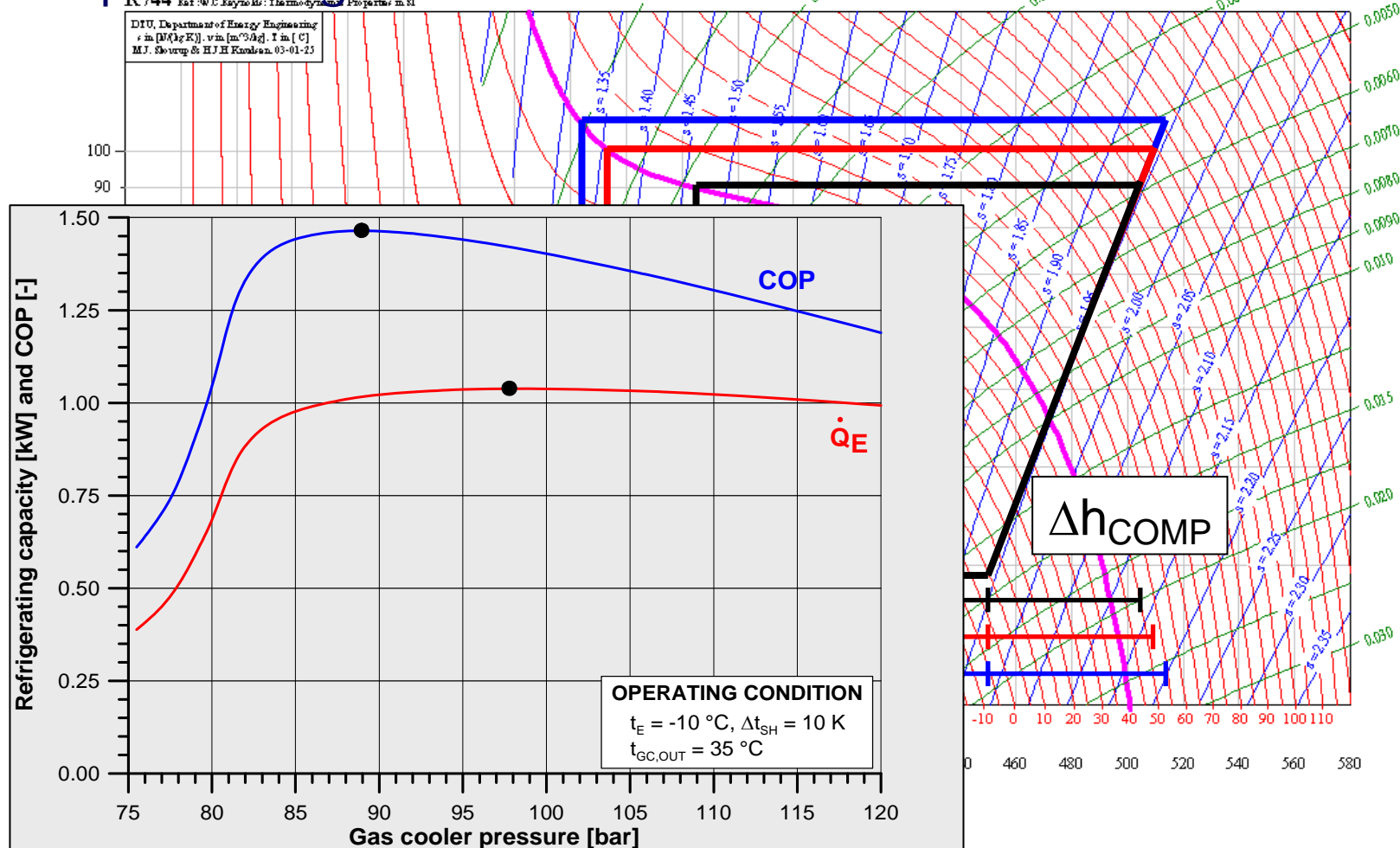
<u>Current top part</u>	<u>Replacement top part</u>	<u>ICAD replacement</u>	<u>Result / Recommendation</u>
ICMT	ICMT	ICAD 600S	OK
ICMT	ICMTS	ICAD 600TS	Not to be recommended, change of ICAD necessary
ICMTS	ICMTS	ICAD 600TS	OK
ICMTS	ICMT	ICAD 600S	Not possible, change of ICAD necessary

Controllers for CO₂

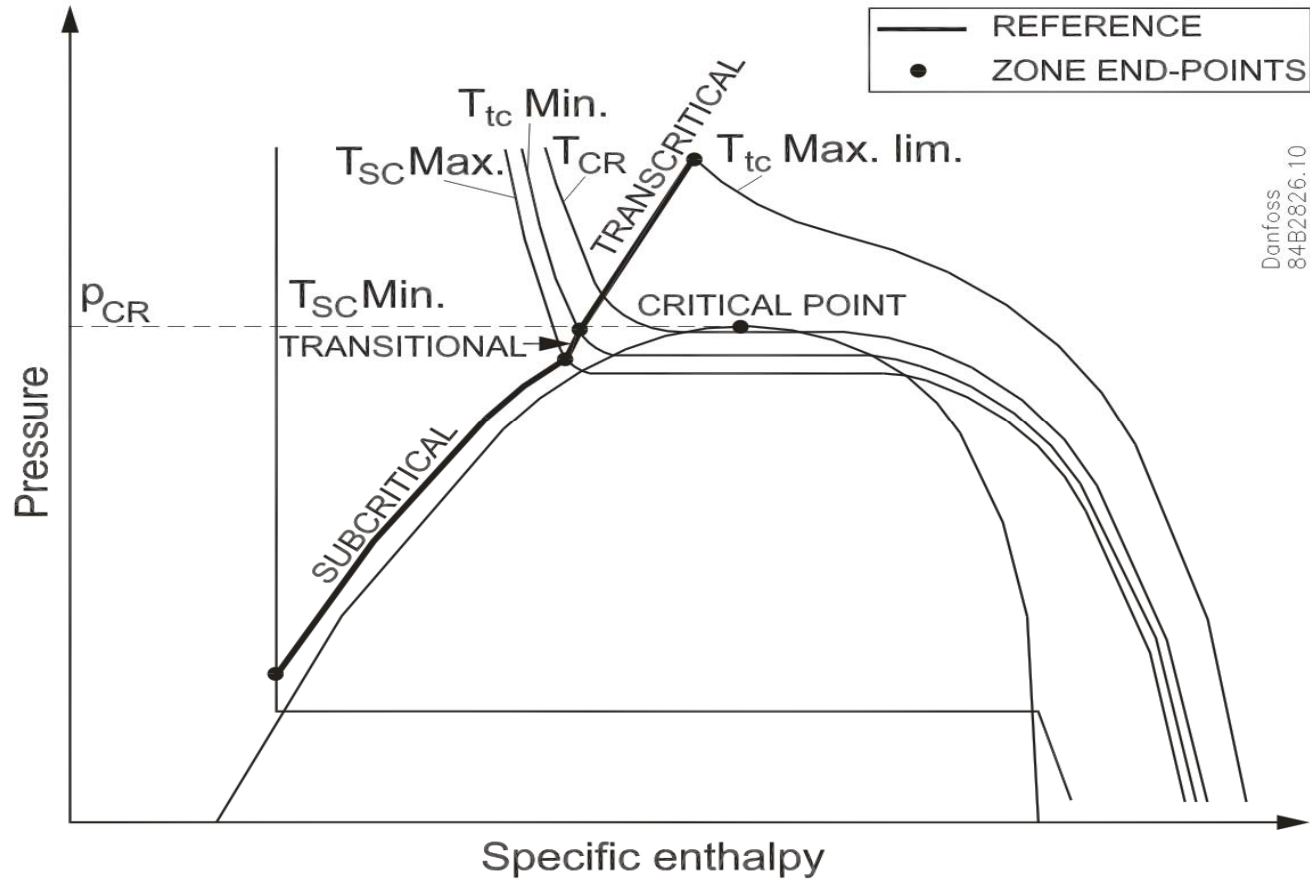
Optimal High Pressure

R 744 Ref. N.C. Kaye: Thermodynamic Properties in SI

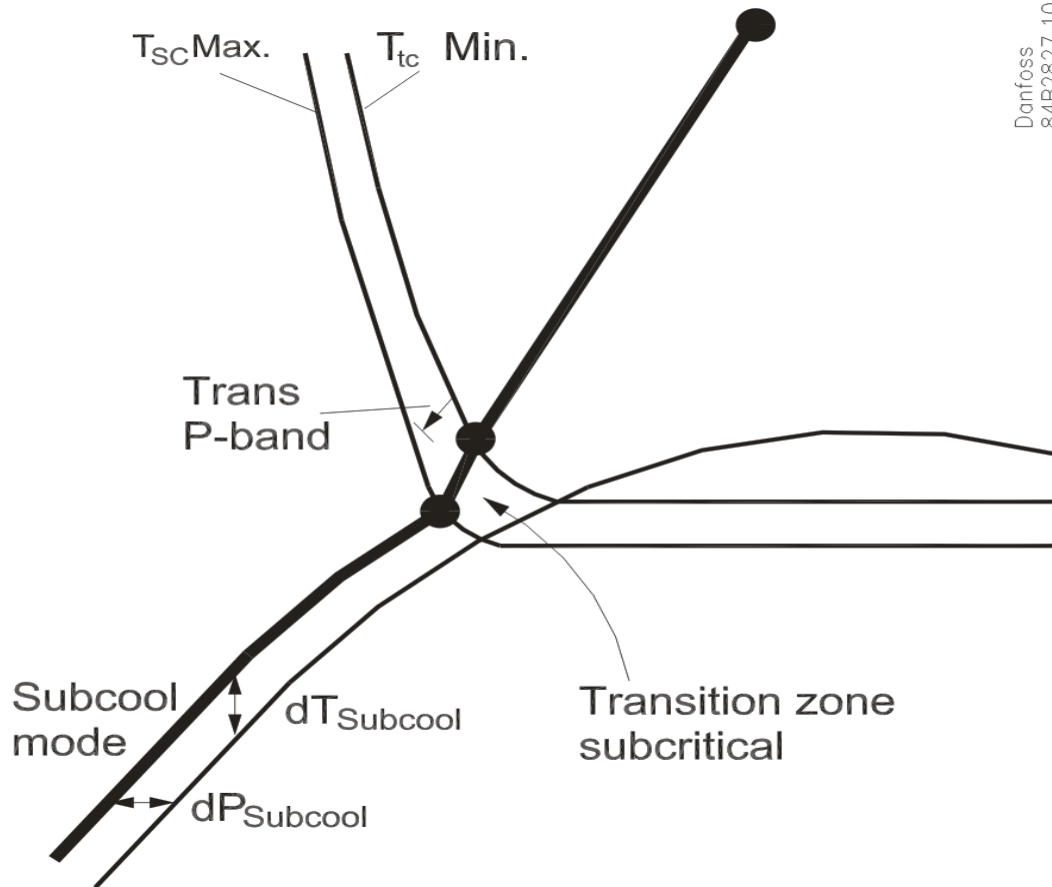
DTU, Department of Energy Engineering
 v in [m³/kgK], v in [m³/kg], T in [°C]
 M.J. Steen & H.J.H. Fausen, 03-01-23



Algorithm



Algorithm



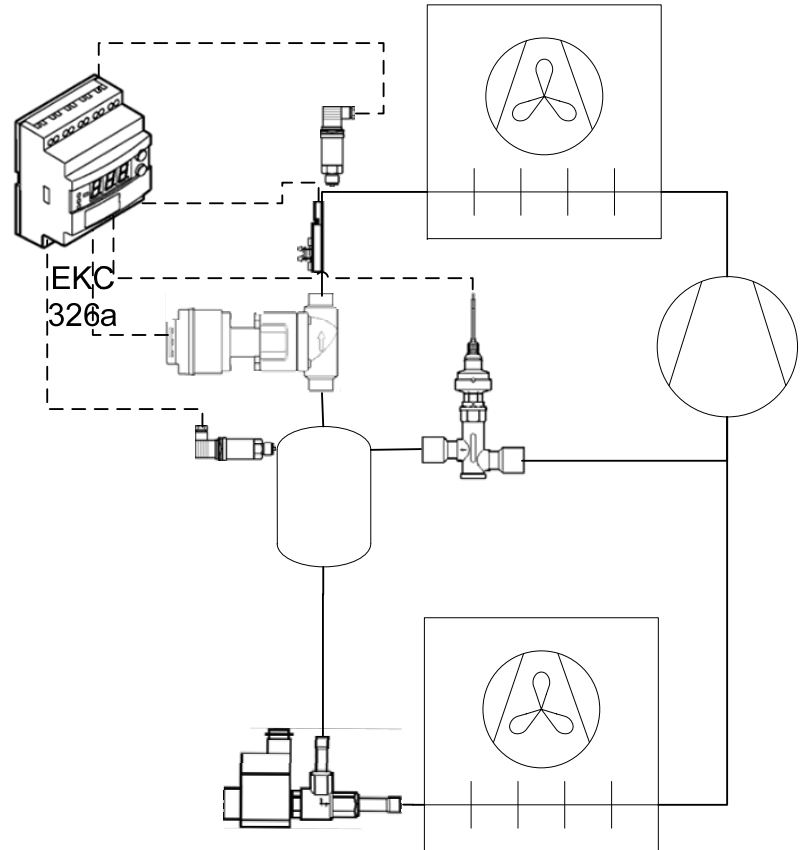
Danfoss
84B2827.10

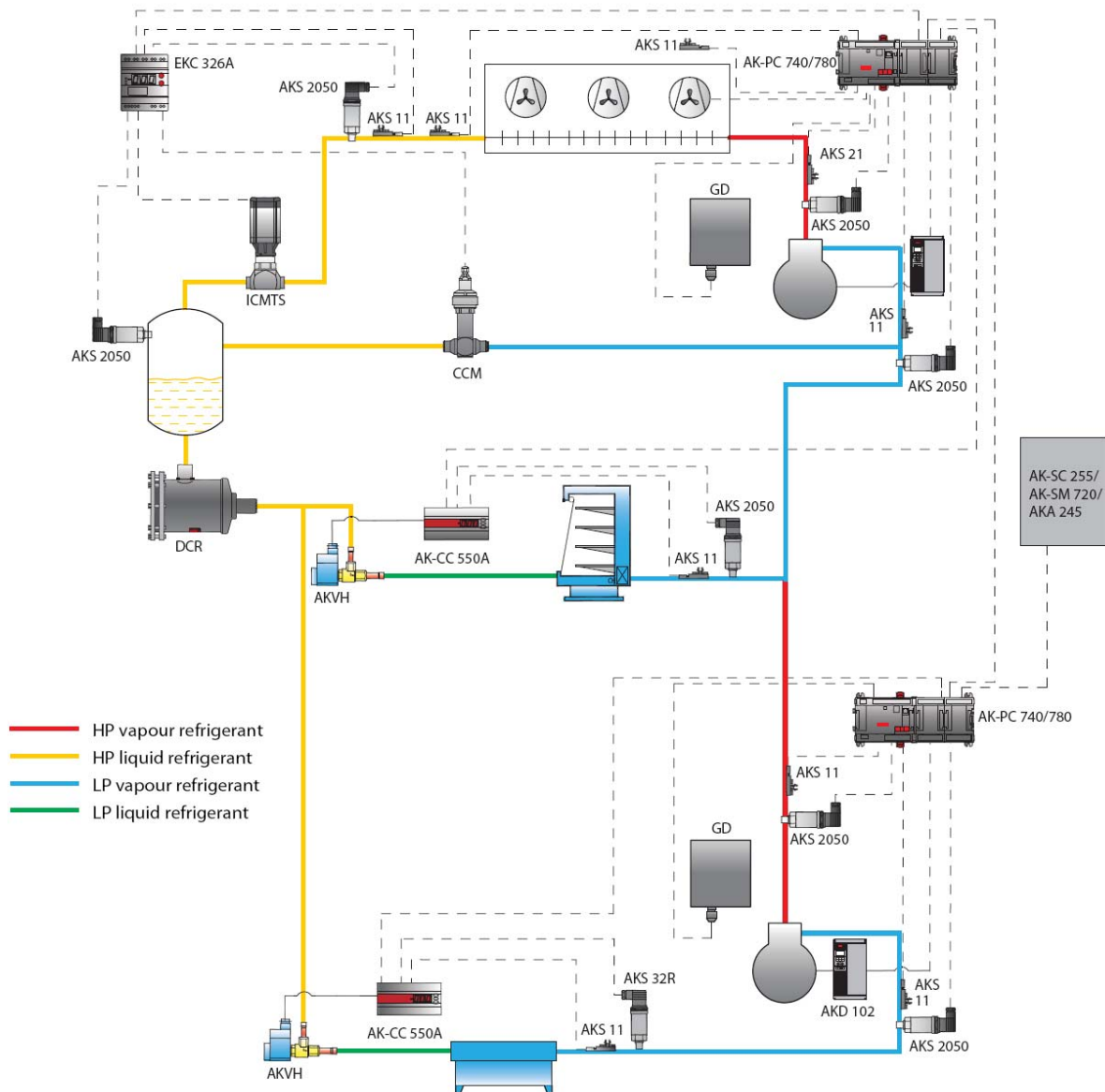
3rd generation gas cooler controller EKC 326a

- Optimum COP gas cooler control (high pressure control)
- Control of receiver pressure together with the ETS or CCM valve
- Heat reclaim with 0-10V signal
- Optimum capacity control via digital signal (approx 5% extra capacity with the same system)
- Use of radiometric pressure transmitters
- Supports 60, 100 and 160 bar pressure transmitters

3rd generation gas cooler controller EKC 326a

- Optimum high pressure control (COP)
- Option to offset the high pressure via digital input to obtain higher capacity at high ambient temperature
- 0-10 V signal offers the possibility to elevate the share of heat reclaim (from approx 10 to 100% depending on conditions)
- Possibility to control the pressure in the receiver (constant pressure)
- In case of low pressure in the receiver the high pressure valve opens to ensure the pressure in the receiver (mainly used in cold climates)





Product Grouping	Product	Product Description	Pressure (bar)	APPLICATION	
				Commercial Refrigeration Incl. Food Retail	Industrial Refrigeration
Transcritical Expansion Valves	ICMTS	Motorized transcritical control valves	140	●	●
Pressure Regulating & Gas-Bypass Valves	ICS with CVP-HP/XP	Mechanical backpressure regulators	52	●	●
	CCM	Standstill capable electronic backpressure regulators	90	●	●
Electronic Expansion Valves	AKVH	Standstill capable pulse width modulating expansion valves	90	●	
	AKV	Pulse width modulating expansion valves	46	●	
	AKVA	Industrial pulse width modulating expansion valves	42		●
	ICM	Industrial motorized expansion valves	52 (65)*	●	●
	CCM	Standstill capable motorized expansion valves	90	●	●
Valve Stations	ICF	Industrial valve stations	52		●
Solenoid Valves	EVR 2-8	Small solenoids	46	●	●
	EVRH 10-40	Large solenoids	46	●	●
	EVR5	Industrial solenoids	50		●
	EVRST	Industrial solenoids capable of opening at 0 differential	50		●
	ICS + EVM	Industrial solenoid valves for large capacities	52 (65)*		●
Line Components	SVA	Stop valves	46/(52)*		●
	SCA	Industrial check valves	46/(52)*		●
	GBC for CO ₂	Ball valves	46	●	
	NRV	Check valves	46	●	
	SG	Sight glasses - inline and socket versions	46	●	
	DCRH	Exchangeable core filter driers	46	●	●
	DML	Filter driers	46	●	
	DMT	Transcritical oil and refrigerant driers	140	●	
	FIA	Filters	52		●
	REG/ REG (SS)	Regulating valves for pump recirculated systems	46/(52)*	●	●
Liquid Level Controls	AKS 4100	Liquid level transducers	100	●	●
	EKC 347	PI controllers		●	●
Safety valves	SFA 15	Safety relief valves	40	●	●
	DSV	Industrial double safety relief valve manifolds	40	●	●
Pressure Switches	RT	Differential pressure switches	47	●	●
	MBS 5000	Transcritical pressure switches	160	●	●
	KP 6	Pressure switches	46	●	●
Pressure Sensors	AKS 2050	Radiometric transcritical pressure transmitters	250	●	●
	AKS 32	Pressure transmitters (0-5V signal)	55	●	●
	AKS 32R	Radiometric pressure transmitters	55	●	●
	AKS 33	Pressure transmitters (4-20mA signal)	55	●	●
Temperature Sensors	AKS 11	Suction side sensor		●	●
	AKS 21A	Discharge side sensor		●	●
Gas Detection	GD	Gas detectors		●	●
Electronic HP Controls	EKC326A	Controllers for transcritical operation and gas bypass		●	
Electronic Case Controllers	AK CC 450	CO ₂ "brine" case controllers		●	
	AK CC 550	Single case controllers		●	
	AK CC 750	Multi-case controllers		●	
Cascade HX controller	EKC 313	CO ₂ /CO ₂ cascade heat exchanger controllers		●	
	EKC 316A	X-refrigerant/CO ₂ expansion valve controllers		●	●
Pack Controllers	AK PC 740	Case controllers (up to 4 compressors)		●	
	AK PC 780	Case controllers (up to 8 compressors)		●	
	XM 205A	8 analog input/ 8 output relay extension module		●	
System Manager	AK SC 255	CO ₂ supermarket system manager		●	
Service Tool	MIMIC	Graphical system monitoring software		●	
	AKM	Service technician software		●	
Variable Frequency Drives	AKD 102	Compressor, pump and fan motor drives		●	