A complete portfolio of CO_2 refrigeration solutions

CO_2 has long proven to be one of the most sustainable natural refrigerants. And for the last 20 years, Danfoss has developed innovative solutions to ensure supermarkets and food retail applications in climates all over the world can take full advantage of CO_2 refrigeration.

Start here

Learn more about
CO_2 solutions for Food Retail

More than
30%
reduction of carbon footprint on store level

CO_2 Refrigeration Systems

Discover the opportunities of CO_2 refrigeration

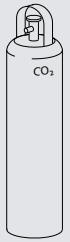
CO_2 has proven itself to be a highly reliable, cost effective, and environmentally friendly natural refrigerant. And transcitical CO_2 refrigeration technology delivers game-changing benefits to supermarkets and small retail stores alike – in cold and warm climates.

Danfoss has pioneered transcritical CO_2 technologies for food retail applications around the world – and because no two systems are the same, there is a complete portfolio to suit any need.

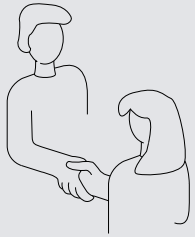
Explore how to take full advantage of the environmentally compliant, efficient, safe, and future-proof benefits of CO_2 refrigeration systems.

Forward
CO_2 Refrigeration Solutions
Naturally

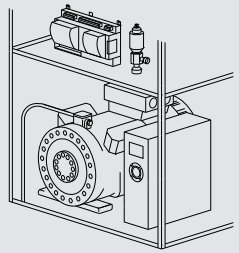
Why choose CO_2 refrigeration?



Danfoss partnership and expertise



A full portfolio of CO_2 solutions



Why choose CO_2 refrigeration?

- Reduced complexity with low and medium temperature compatibility
- Zero ozone depletion and one of the lowest possible Global Warming Potentials (GWP), one.
- Viable and profitable solution even in warmer climates
- Outperforms traditional HFC systems on energy efficiency in all climates

CO_2 is the refrigerant of tomorrow

Since 1850, CO_2 has proven to be one of the most reliable, efficient, and environmentally friendly refrigerants. Now, CO_2 is being used worldwide to provide a sustainable and cost-effective refrigerant solution – one that is compliant with the increased environmental requirements of today – and tomorrow.

CO_2 is a natural, sustainable refrigerant suitable for food retail stores of all sizes, and in all climates.

Superior thermodynamic properties

EXPERIENCE HIGH VOLUMETRIC COOLING CAPACITY

- Small volume – high capacity
- Up to 5 times greater than R404A
- Possible to use smaller pipes and compressors

HIGH PRESSURE REFRIGERANT

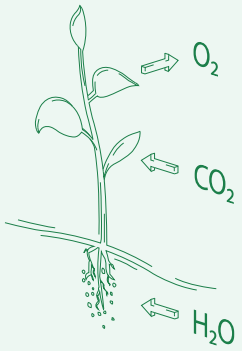
- +30°C - 71 bar
- Very low pipe pressure drop effect

HIGH DENSITY GAS

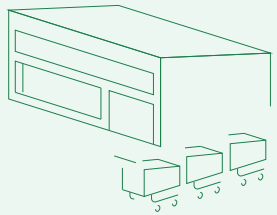
- Increases heat exchanger efficiency
- Greater capacities with smaller surfaces

A wonder of natural efficiency

Environmentally friendly and sustainable, CO_2 is a natural substance that plays an important role in many natural and industrial processes.



CO_2 provides the lowest cost of ownership for end-users because of high volumetric efficiency, low power consumption, and refrigerant charge reduction.



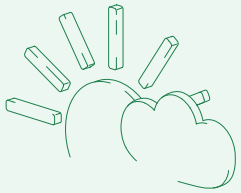
Supermarket systems can easily leak up to **20%** of their refrigerant. Replacing HFCs with CO_2 reduces refrigeration cost and accelerates a positive climate impact.

More than
30%
reduction of carbon footprint on store level

CO_2 HAS
0 ozone depletion
and one of the lowest possible Global warming potentials (GWP) = 1.

A refrigerant accompanied by cool cash

SAVE UP TO
20%
on energy by replacing HFCs with CO_2 in warmer climates.



Transcritical systems provide an efficient, simple, and cost-effective solution
in all climates.

Danfoss partnership and expertise

Our engineers are on the frontline of CO_2 refrigeration, developing the solutions needed for CO_2 transcritical systems – with installations all over the globe.

- Achieve unparalleled energy efficiency while protecting food safety
- An all-in-one solution customized to your need – with expert support and training
- Heat recovery unlocks business-critical efficiency and cost benefits
- CALM™ is a truly optimized CO_2 refrigeration solution for all climates
- Comprehensive portfolio of high-performance sub- and transcritical CO_2 compressors

BOCK® compressors
for food retail

Transcritical CO_2 compressors
Achieve the highest EER/COP values within their range of applications – officially confirmed by ASERCOM (Association of European Refrigeration Component Manufacturers) certification for several displacement stages. Further advantages of reciprocating compressors: Highest reliability and durability due to proven BOCK CO_2 design.

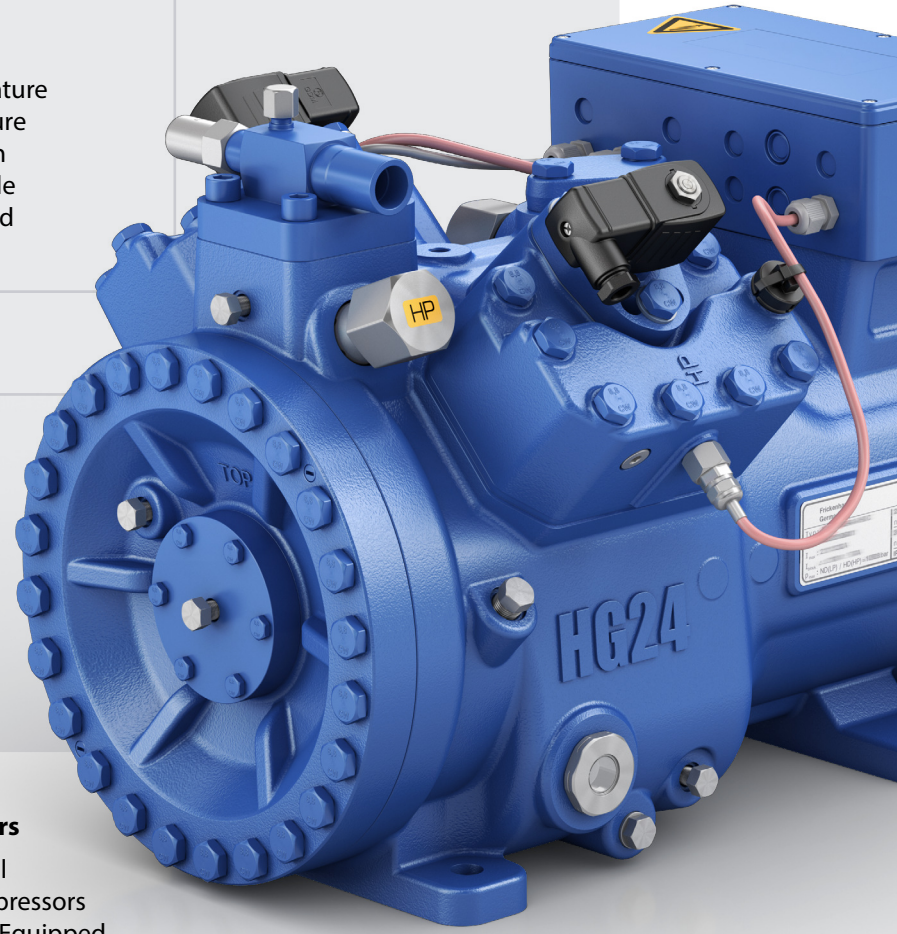
Subcritical CO_2 compressors
The subcritical series for use in low temperature applications is based on the advantages of the proven BOCK compressor technology, which has been holistically optimized to meet the requirements of CO_2 operating conditions. Its wide range of applications enables tailor-made, cost-saving solutions for low temperature applications.

Read more here

Outstanding running comfort
Low noise and vibration, compact and lightweight design and minimal oil carry over rate

Wide range of applications
From low temperature to high-temperature heat pumps – with reliable and flexible partial and full load

Lowest energy and operating costs
Highest efficiency and reliability thanks to more than 30 years of expertise in CO_2 compressor technology



flexxCO_2NTROL – the capacity regulator
BOCK flexxCO_2NTROL technology, the compressor capacity regulator for the almost stepless capacity adjustment of transcritical BOCK CO_2 compressors to the current system requirement.

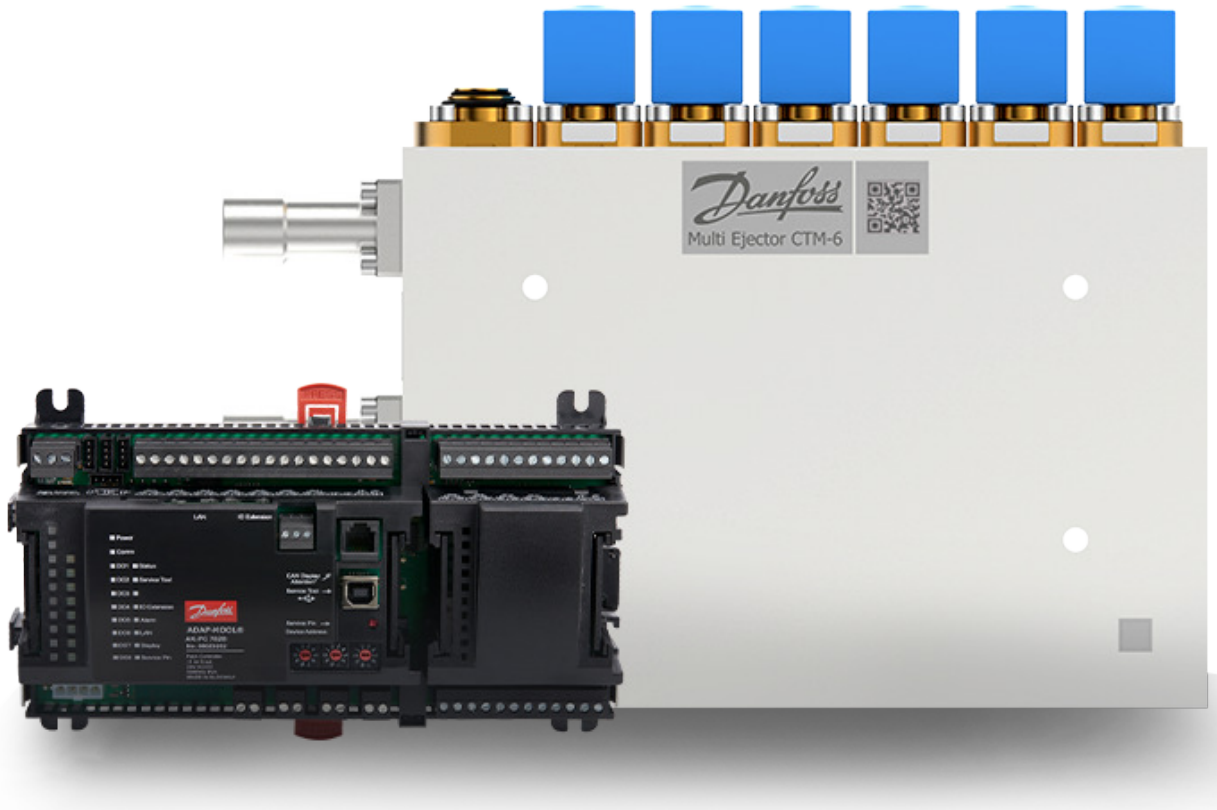
LSPM motors for highest efficiency
New transcritical BOCK CO_2 compressor series, equipped with LSPM motor technology (Line Start Permanent Magnet). Economical system solutions with higher efficiency and a plus in capacity – with lower operating costs at the same time.

UL-recognized CO_2 compressors
The UL-HG CO_2 series includes all transcritical and subcritical compressors in 2-, 4- and 6-cylinder versions. Equipped with all CO_2 relevant features. Approved for US and Canadian saftey standards.

Embrace the power of CO_2 with future-proof technology

Our portfolio of pioneering CO_2 technologies for transcritical refrigeration systems has evolved from more than 20 years of frontline experience – and thousands of installations around the world.

And because there is no one-size-fits-all solution, our adaptive refrigeration technology makes it possible to harness the environmental and energy-saving benefits of CO_2 in food retail stores of all sizes, and in all climates.



The Danfoss Multi Ejector Solution™

With a complete portfolio of Multi Ejector solutions for all store sizes, CO_2 systems, and climates, it's possible to take full advantage of the future-proof technology.

Optimization of compressors

15% – 25% less compressor capacity needed, controlling three suction groups.

High system reliability

Max uptime and reliability with 4–6 redundant ejectors, backup systems, and emergency operations.

One solution for all climates

Apply transcritical CO_2 refrigeration systems in all climates for optimal performance.

Easy installation

Reduced complexity with built-in strainer and connectors for welding and soldering.

Service

Easy service with tools, fast strainer and ejector operation, and an LED plug for troubleshooting.

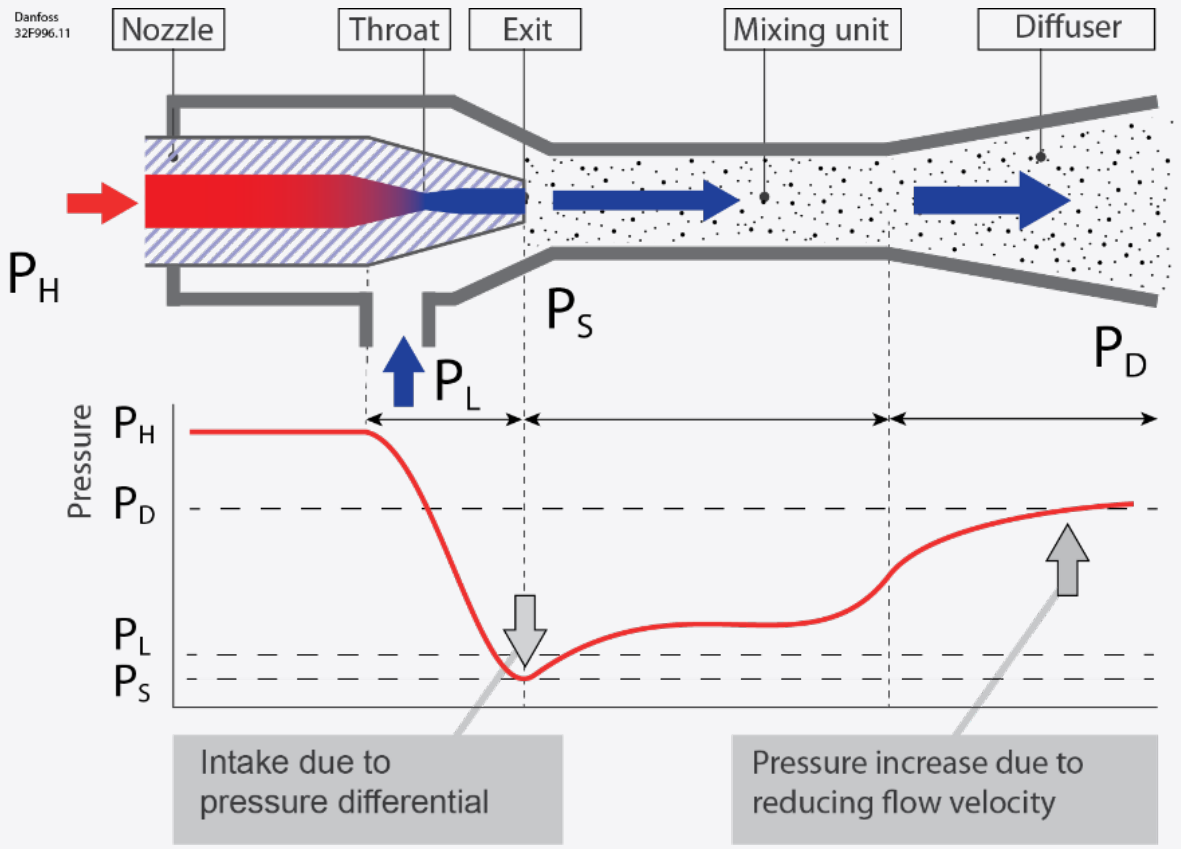
Savings

Gain initial operational savings with easy installation, reduced compressor needs, and lower energy consumption.

How the Multi Ejector Solution™ works

1. CO_2 leaves the gas cooler. Then, the high-pressure CO_2 (PH) enters the motive nozzle where the expansion takes place.
2. At the exit, the speed is very high resulting in low pressure. The low pressure then drags in gas or liquid from the MT suction (PL).
3. The two flows are then combined in the mixing unit where the pressure is higher than at the outlet due to mixing gas from a higher pressure.
4. After mixing, the flow enters the diffuser where it slows down. The shape of the diffuser enables the conversion from kinetic energy (velocity) to potential energy (pressure). From the diffuser, the flow returns to the receiver.

See how the Multi Ejector Solution™ works

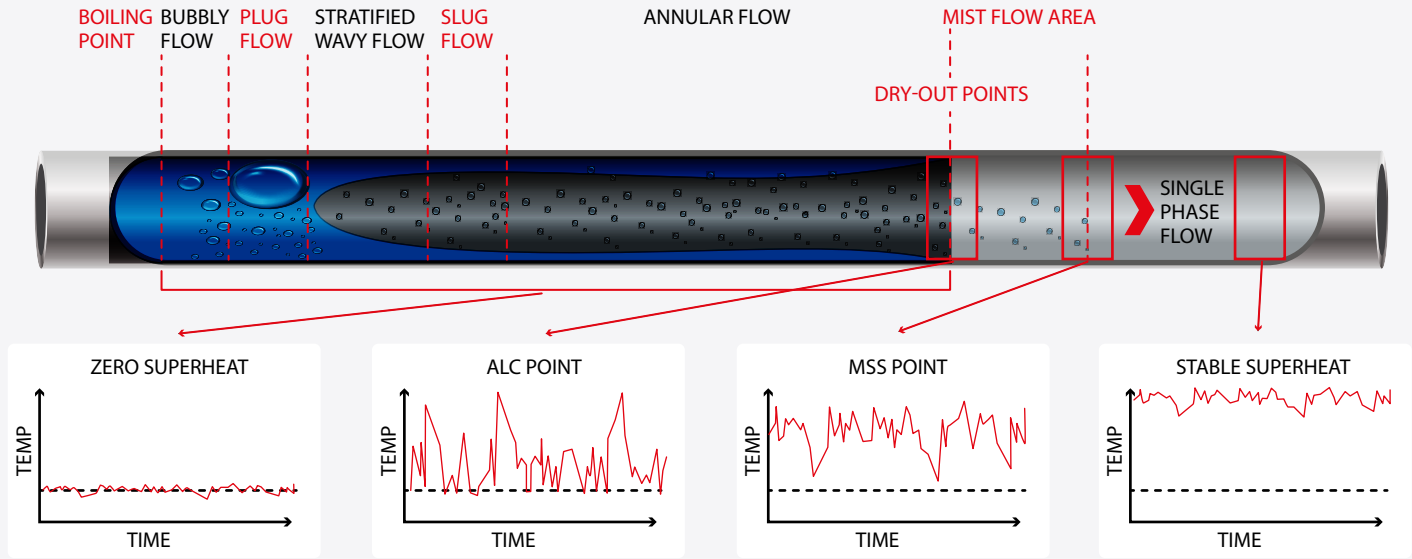


Save energy and enhance food safety with adaptive control algorithms

Adaptive superheat control has proven to be a robust, efficient, and superior solution, saving 8–12% of energy use by ensuring the evaporator is always fully utilized under all conditions. Plus, adaptive controls mean you no longer have to manually adjust system operation for changing conditions – reducing operating and maintenance costs.

Read more here

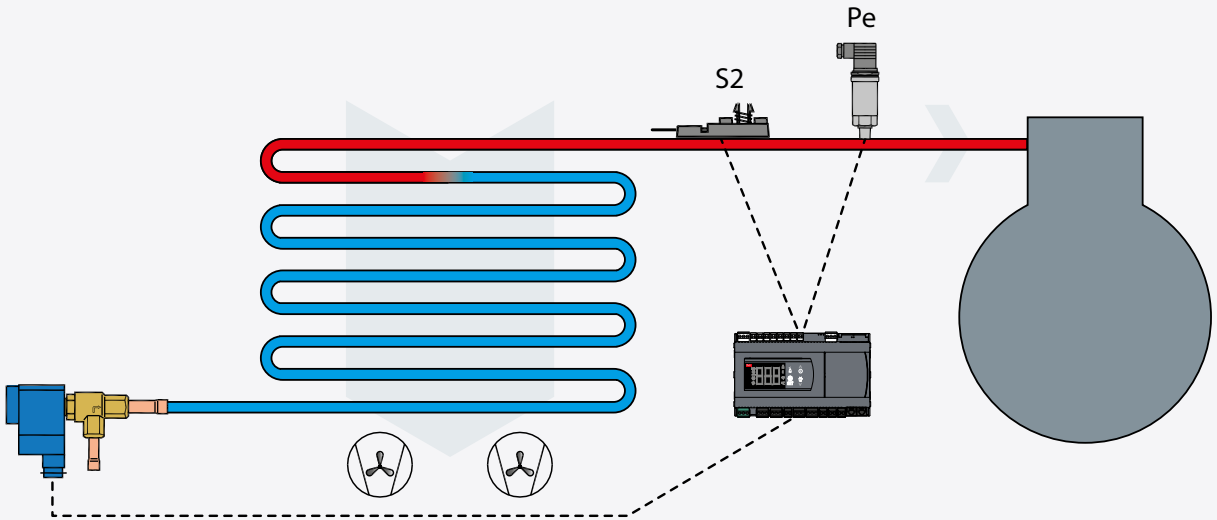
The evaporator illustrated as a tube presenting the evaporation process



Danfoss Adaptive Minimum Stable Superheat Control (MSS)

Utilization of the evaporator surface is maximized while ensuring that no liquid exits the evaporator – safeguarding the compressor and delivering significant energy savings and optimal food safety.

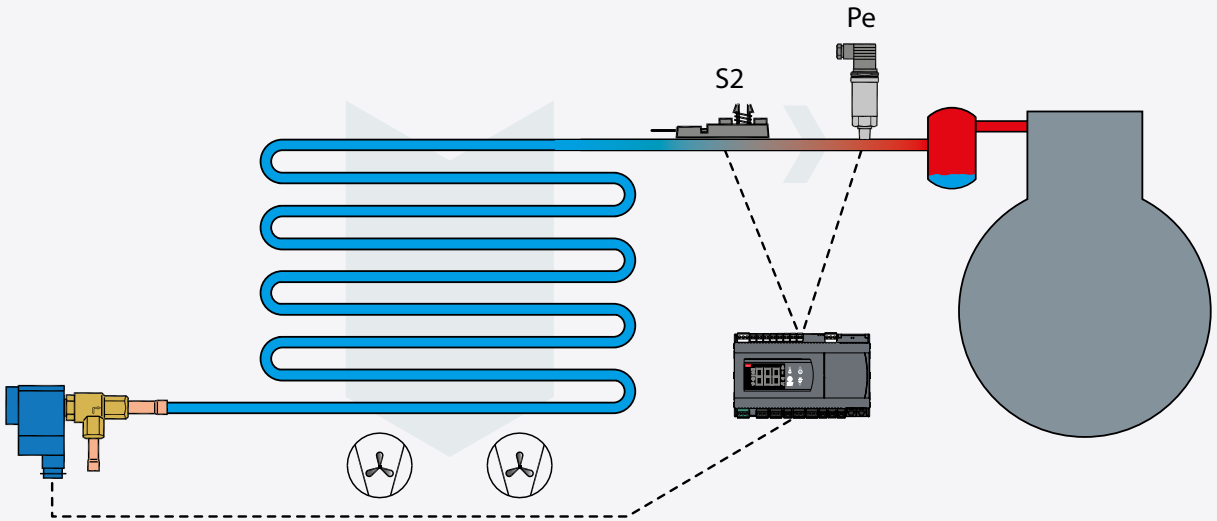
- Maximum system efficiency in systems with dry expansion
- Exceptional precision, stability, reliability, and efficiency
- Minimum energy consumption regardless of fluctuating ambient temperature
- Ensures all liquid is evaporated before reaching the end of the evaporator, optimizing suction pressure while keeping a fully loaded display case at the desired temperature



Danfoss Adaptive Liquid Control (ALC)

Greater amounts of refrigerant are injected into the evaporator, fully utilizing the entire surface – bringing the superheat very close to zero.

- Suitable for systems with a suction accumulator and Liquid Ejector
- Reduced compressor load with high suction pressure
- Significant energy savings with increased evaporation temperature up to 5 Kelvin compared with MSS systems
- Highly precise liquid control ensures limited liquid to be captured in the suction accumulator

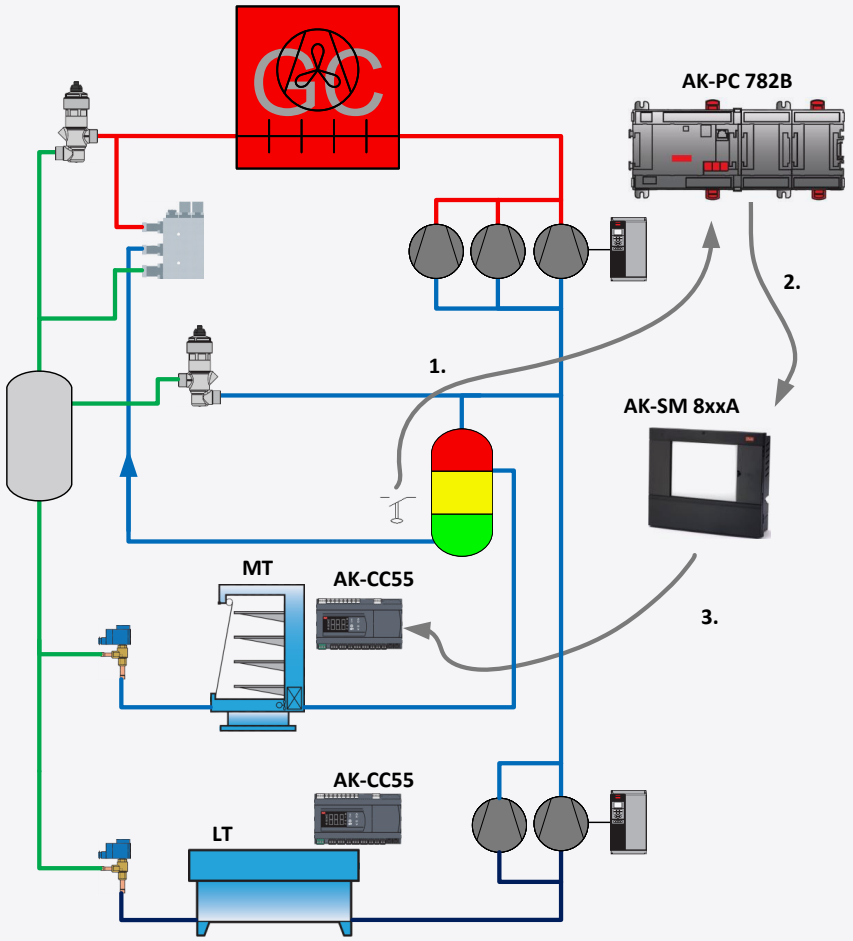


CO_2 Adaptive Liquid Management (CALM™)

CALM™ is a complete solution for the entire system, optimizing all evaporators in a store. This is only possible when all components are optimized to work perfectly together, This is the case for Danfoss AK-CC55, AK-PC 782B, AK-SM 8xxA and Liquid Ejector.

- Globally optimized for any climate, efficient in all ambient temperatures
- Significant energy savings and cost reductions with a reduced risk of first-cost investments
- Liquid Ejector optimizes any transcritical CO_2 booster or parallel compression refrigeration system
- Optimized evaporation effect from refrigerant with superheat controlled close to zero and fully utilized evaporator

Read more here



CALM™ solution:

1. If Liquid Ejectors are unable to take all the liquid collected in the suction accumulator, the liquid level will rise. When the liquid level switch (ideally positioned 1/3 from the bottom of the total height) indicates too high a level, a digital signal triggers AK-PC 782B input.
2. Information about high level is transmitted via a communication line to the System Manager AK-SM 8xxA.
3. By using a communication line to the MT evaporator controllers, superheat control will switch from ALC to MSS (dry SH control) and stop releasing liquid to the MT return line.

Heat reclaim technology maximizes energy efficiency

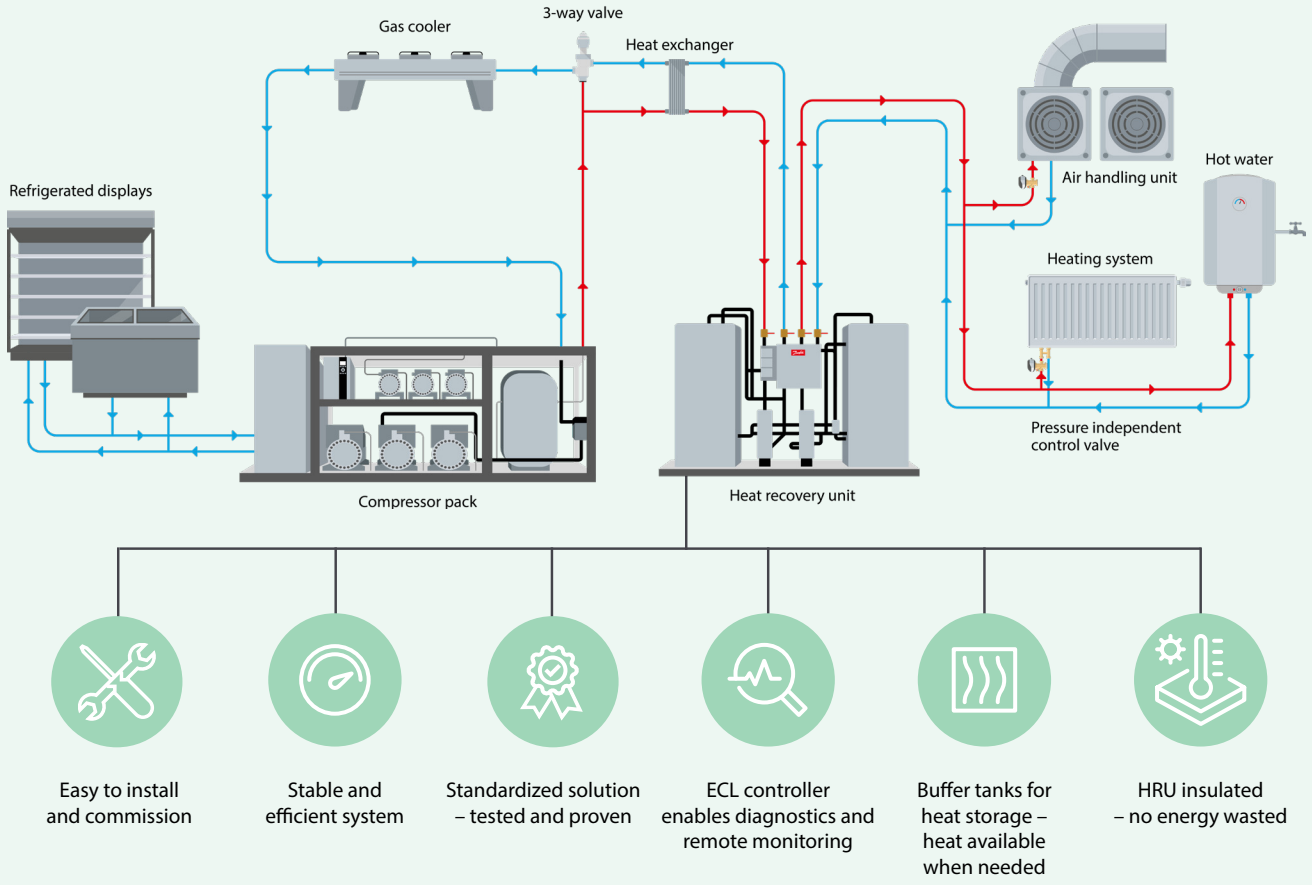
CO_2 is a highly suitable refrigerant for heat reclaim. By closely aligning heating, ventilation, air conditioning, and refrigeration systems, you save money, safeguard stock, and reduce your environmental impact.

The Danfoss Heat Recovery Unit (HRU) helps to eliminate the technical challenges of managing heat recovery. The HRU is an integrated solution managing and buffering the heat from the refrigeration pack – to be reused for space heating, hot tap water, or even sold to neighbors or district heating grids.

- Maximum heat recovered and reused
- Standardized solution – tested and proven
- Easy to install and commission
- Stable and efficient solution
- Eliminates the need for a boiler

Learn more

With an HRU unit, get maximum heat recovered and reused with no or minimum need for additional heat sources.



Case Study

Recycling heat to cut costs and CO_2

A busy Danish supermarket has significantly reduced its annual heating bill and carbon footprint by utilizing the waste heat from its refrigeration system.

- External heat requirement reduced with 89.7%
- Carbon footprint reduced by 6.7 tons
- No operational disruptions

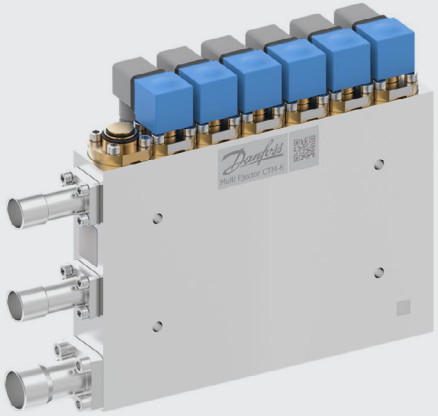
Read more here

Case Study

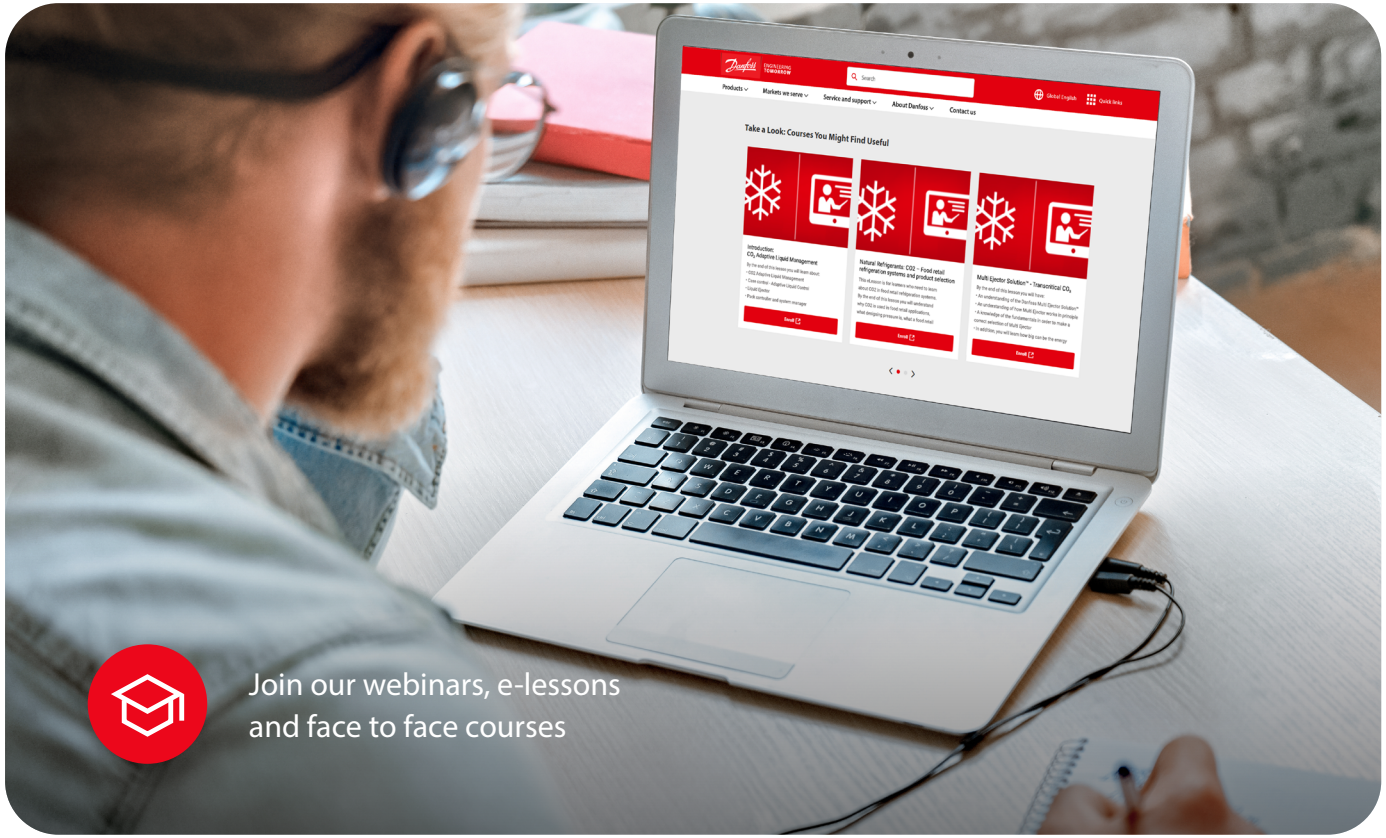
CO_2 technology transforms German supermarket

Danfoss Multi Ejector technology optimizes reliability, efficiency, and sustainability at one of EDEKA's midsized supermarkets in Germany.

- Installation of CO_2 parallel compression system, Multi Ejector technology, and CALM™ system increased reliability and efficiency in various ambient climate conditions
- Multi Ejector Combi HP/LE decreases thermal stress on the MT compressors
- CALM™ system includes Danfoss case controllers that enable MT evaporators to run at maximum by getting superheat control close to zero



Watch the video



Worldwide training in CO_2 refrigeration

Take the next step in CO_2 refrigeration – together.
CO_2 has become industry standard in food retail refrigeration with proven technology and components for transcritical refrigeration readily available today. But, there is no one-size-fits-all solution – which is why our team of CO_2 champions is ready to guide you on your refrigeration journey.

Get industry-leading application support and guidance – and access to a series of e-lessons available through Danfoss Learning:

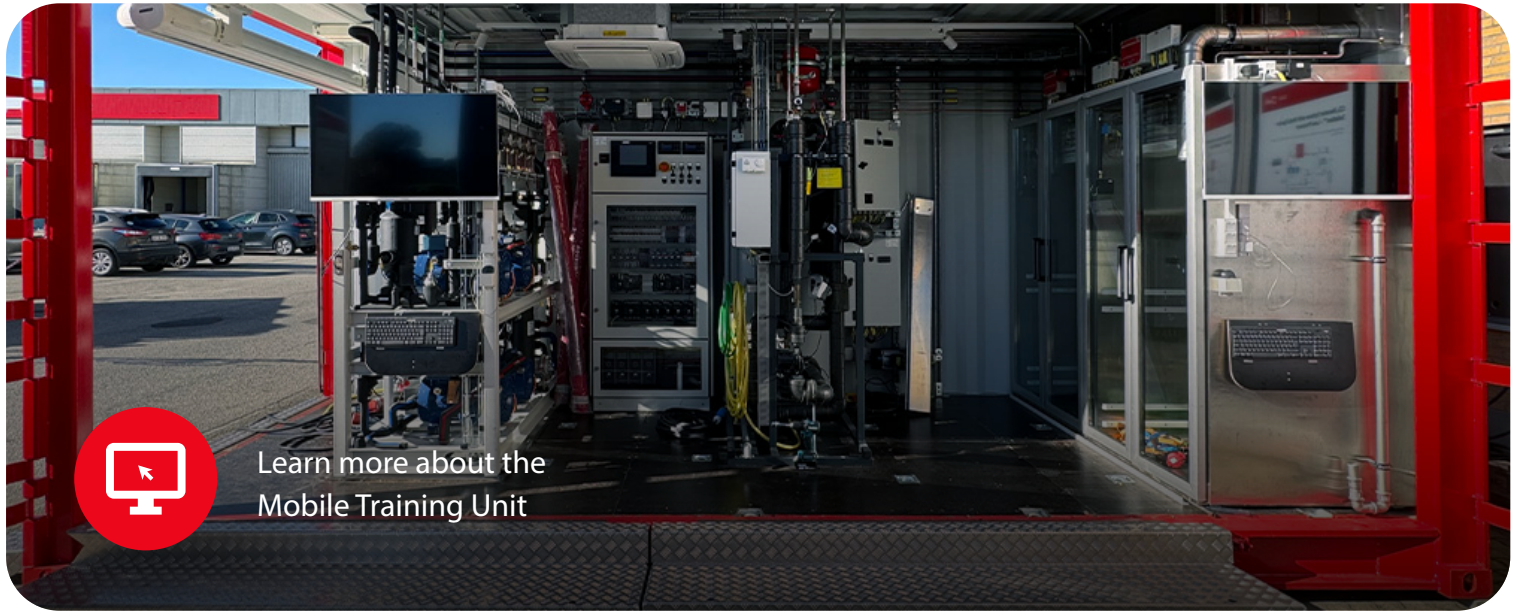
- Introduction to Carbon Dioxide: Properties and Impact
- Advantages of Carbon Dioxide as a Refrigerant
- System Understanding
- Phase Change
- Food Retail Systems and Product Selection

Hands-on CO_2 training is coming your way

The Mobile CO_2 training unit has provided more than 3,000 installers, service technicians, and OEM engineers with hands-on CO_2 training since 2016 – providing easy-to-access, hands-on training on how to take full advantage of the natural refrigerant.

Manned by dedicated Danfoss CO_2 champions, visitors can view demonstrations and experience hands-on training with the latest advancements in CO_2 refrigeration via actual systems and interactive panels.

- Simple booster system
- Parallel compression
- Parallel compression with ejector
- Commissioning of CO_2 systems
- Heat recovery
- Service procedures
- Troubleshooting and correction



A full portfolio of CO_2 solutions

Because no two applications are alike, choose from a full portfolio of CO_2 solutions – tailored to your specific need.

- Small Commercial Cold Room Solutions
- Small Commercial Cold Room Solution – Self-build
- CO_2 MiniPack Solution
- Transcritical Booster Solution
- Transcritical Booster with Parallel Compression Solution
- Multi Ejector Solution™
- Heat Recovery Solution
- Cold Storage Solution
- Comprehensive portfolio of high-performance sub- and transcritical CO_2 compressors

CO_2 solutions for cold rooms – 4.6kW MT

Get a complete CO_2 cold room package with only a few components.

Optyma™ cold room Controller

Optyma™ iCO_2 condensing unit

1.5 to 4.6kW MT, max. 35 dB(A) at 10 meters

Temperature sensor EKS 221

Expansion device TE2 for R744

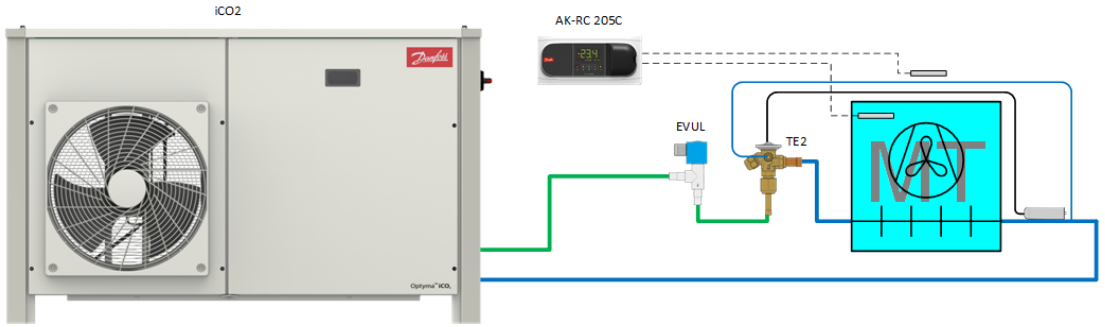
Valve
MWP 90 bar, MOPD 60 bar

Solder adaptor
– without orifice assembly and filter

Orifice assembly
With filter for solder adaptor

Solenoid valves

Solenoid valve EVUL + coil
MWP 90 bar, MOPD 36 bar



Receiver pressure (32-50 bar)
MT suction pressure (22-36 bar)

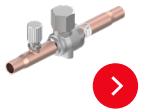
CO_2 solutions for cold rooms – 20kW MT / 10kW LT

CO_2 solutions suitable for small and medium-sized stores.
The condensing units can handle the cooling capacity of multiple display cabinets or cold rooms, and they offer high efficiency and reliable performance for medium/low temperature applications.

System Manager AK-SM 800A
Seamless connectivity from refrigeration, lighting, and HVAC controllers to the cloud

Case Controller AK-CC55
Complete control with excellent flexibility

Condensing unit Optyma™ iCO_2
20kW MT or 10kW LT, max. 46 dB(A) at 10 meters

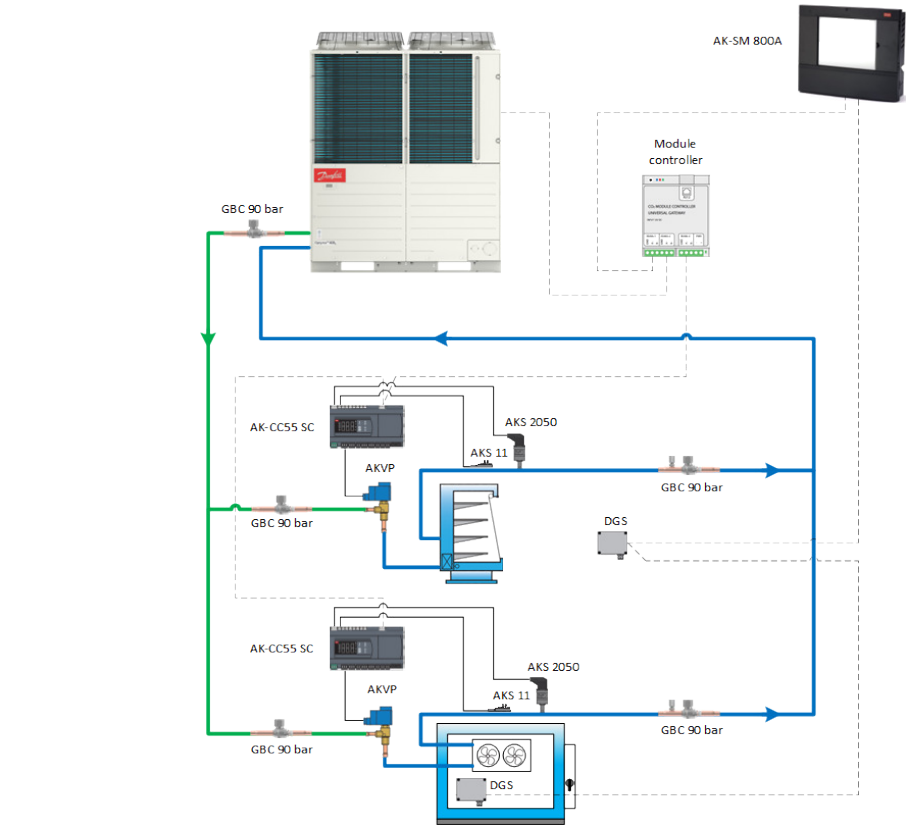


Shut-off Ball Valve GBC 90 bar
For full flow with minimum pressure drop, for 90bar

Electric Expansion Valve AKVP
Precise liquid injection for evaporators

Pressure Transmitter AKS 2050
Reliable, durable, high-performance pressure transmitter

Temperature Sensor AKS 11
Temperature-dependent resistance sensor



Receiver pressure (32-50 bar)
MT suction pressure (22-36 bar)
LT suction pressure (10-16 bar)

CO_2 solutions for cold rooms – Self-build

CO_2 solutions for custom build condensing units suitable for small commercial cold rooms.

Pack Controller AK-PC 572
An all-in-one solution that makes using CO_2 approachable

EKE 1P
Stepper valve driver

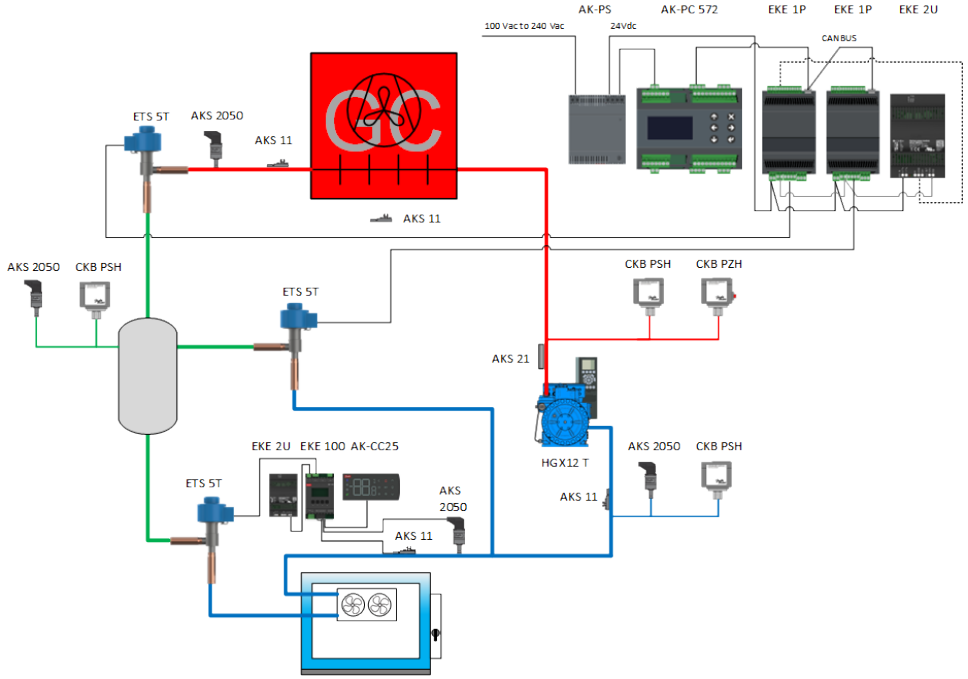
Case controller AK-CC25
Reliable performance and seamless user experience

Superheat controller and valve driver EKE 100
Reliable and precise performance for consistent operation

Electric expansion valve ETS 5T
MWP 140bar, MOPD 120bar

CKB Pressure Switch
CO_2 safety pressure switch to protect compressor and the system against too high pressure

BOCK® Transcritical and subcritical CO_2 compressor
Efficient and reliable CO_2 compressor for all applications



High pressure (50-120 bar)
Receiver pressure (32-50 bar)
MT suction pressure (22-36 bar)
LT suction pressure (10-16 bar)

CO_2 made easy
for small stores

The CO_2 MiniPack solution – from 20-70 kW – empowers owners of small stores to harness the energy efficient, cost-saving benefits of CO_2 refrigeration systems, combining five compatible products into a single solution.

Pack Controller AK-PC 572
An all-in-one solution that makes using CO_2 approachable

Stepper Valve Driver EKE 1P
An extension module for Danfoss controllers

Backup Power Module EKE 2U
Effective energy storage device

Midi Drive VLT FC 280
Flexible and efficient motor control

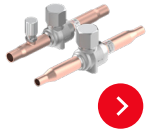
BOCK® Transcritical and subcritical CO_2 compressors
Efficient and reliable CO_2 compressor for all applications

Electric Regulating Valve CCMT Light 3-10
Highly robust and reliable electric valve

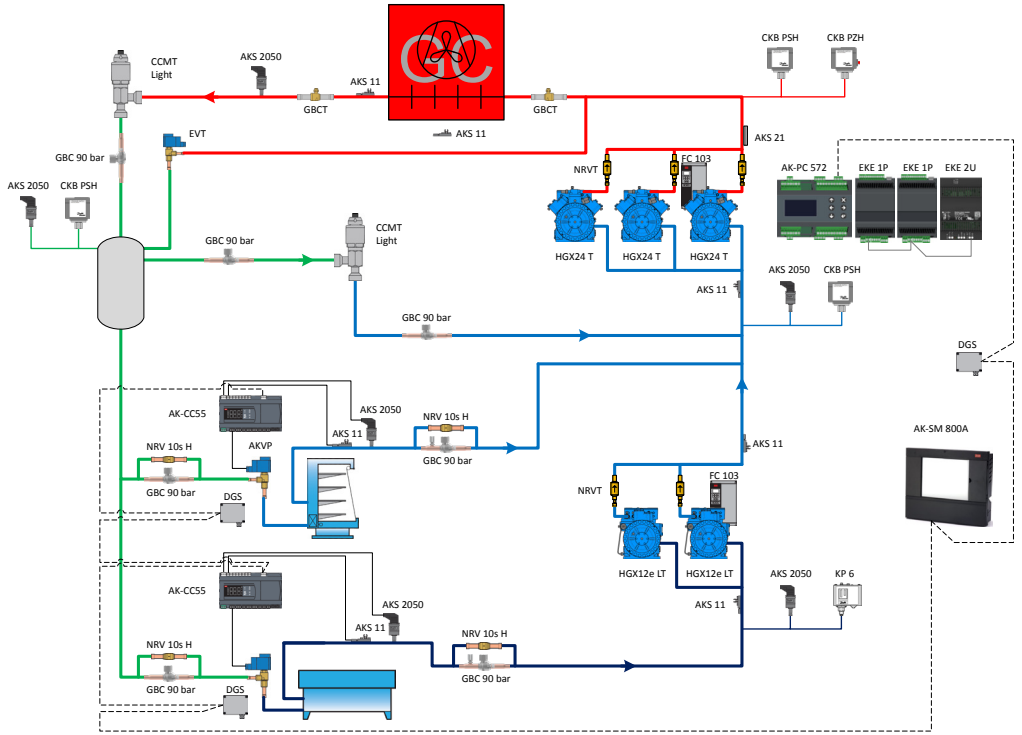
Pressure Transmitter AKS 2050
Reliable, durable, high-performance pressure transmitter

NRVT
Check valve for high pressure CO_2 applications

Temperature sensor AKS 21
For high temperatures



GBC 90 bar
Efficient and reliable shut-off ball valve for CO_2



High pressure (50-120 bar)
Receiver pressure (32-50 bar)
MT suction pressure (22-36 bar)
LT suction pressure (10-16 bar)

Uncomplicated and reliable
CO_2 solution for mild climates

The first generation of transcritical supermarket systems, the simple booster solution – from 40-100 kW – proves the efficiency and simplicity of CO_2 systems in mild and warm climates.

Pack Controller AK-PC 772B
Complete regulating unit for capacity control of compressors and condensers

Gas-Detecting Sensor DGS
Refrigerant gas detection to safeguard buildings

Case Controller AK-CC55
Complete control with excellent flexibility

Shut-off Ball Valve GBCT
Engineered specifically for use with CO_2

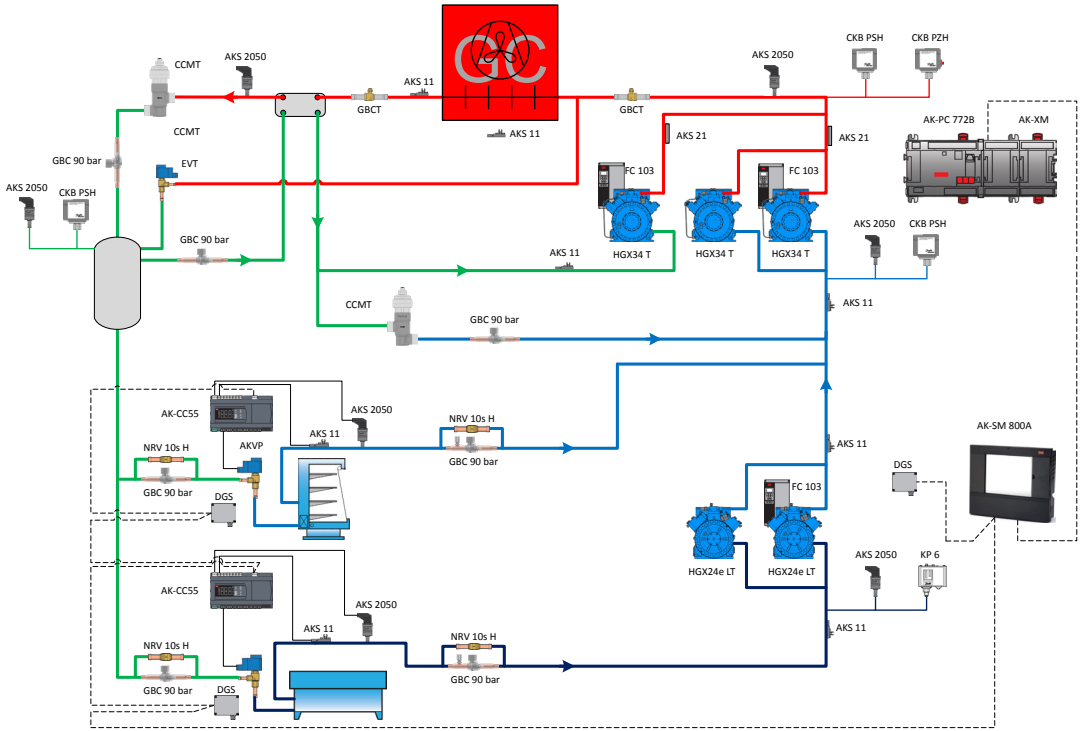
BOCK® Transcritical and subcritical CO_2 compressors
Efficient and reliable CO_2 compressor for all applications

Electric Regulating Valves CCMT 2-8 and CCMT 16-42
Highly reliable electric valve for all CO_2 systems

CKB Pressure Switch
CO_2 safety pressure switch to protect compressor and the system against too high pressure

Solenoid valve EVT
EVT high pressure range is a direct or servo operated solenoid valve specially designed to fit into CO_2 transcritical refrigeration systems.

Electric Expansion Valve AKVP
Precise liquid injection for evaporators



High pressure (50-120 bar)
Receiver pressure (32-50 bar)
MT suction pressure (22-36 bar)
LT suction pressure (10-16 bar)

An industry-leading CO_2 solution for warm climates

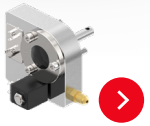
The most common CO_2 solution today, transcritical booster systems – from 100 kW and up – with parallel compression boost efficiency and increase viability in warmer climates.

Pack Controller AK-PC 782B
Scalable control for up to 12 compressors

Case Controller AK-CC55
Complete control with excellent flexibility

Refrigeration Drive VLT FC 103
Simple energy efficiency

BOCK® Transcritical and subcritical CO_2 compressors
Efficient and reliable CO_2 compressor for all applications



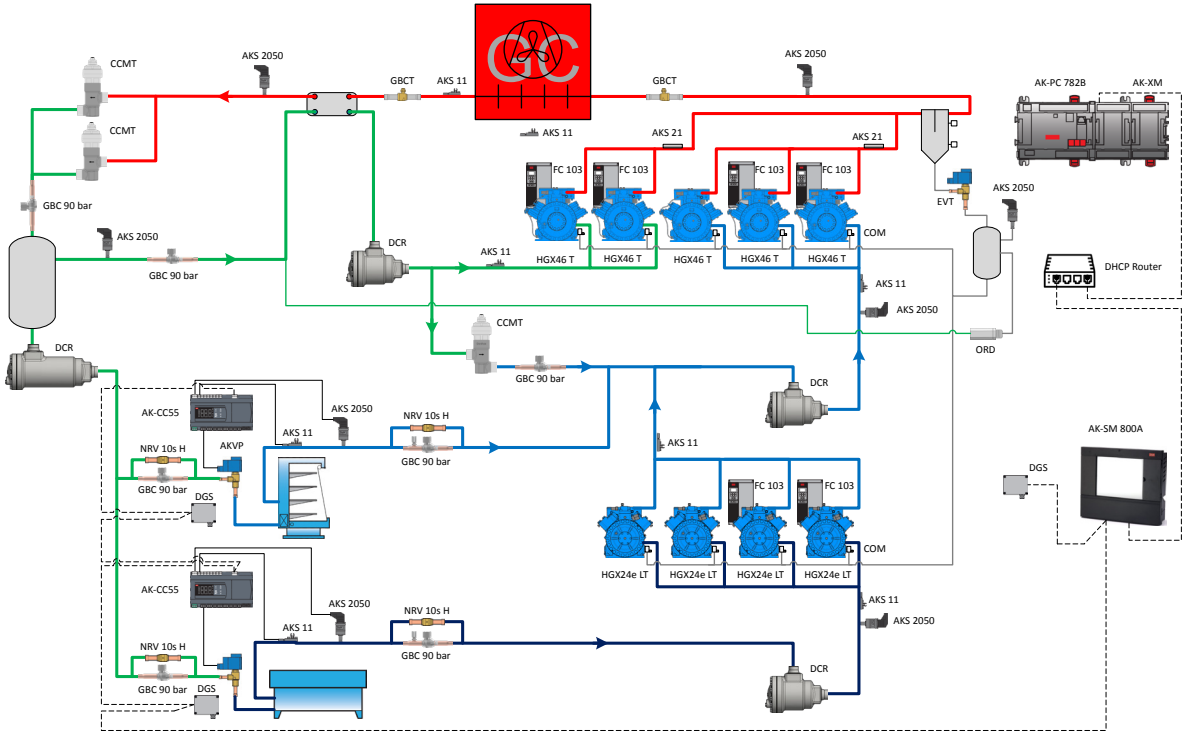
Compressor Oil Management COM
Continuous oil-level control for high system reliability

Electric Regulating Valve CCMT 16-42
Highly reliable electric valve for all CO_2 systems

Electric Expansion Valve AKVP
Precise liquid injection for evaporators

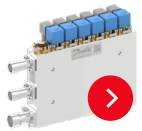
Temperature Sensor AKS 11
Temperature-dependent resistance sensor

DCR filter driers
Reliable, high performance and easy installation



A solution for every size and climate

The complete portfolio of Multi Ejector solutions covers the needs for all store sizes, CO_2 refrigeration systems, and climates.

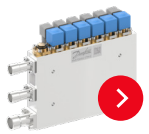


Multi Ejector – CTM High Pressure lift (HP)
Add-on to enhance efficiency in a parallel compression system

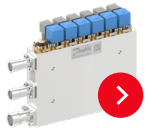
Multi Ejector – CTM Liquid Ejector (LE)
Full evaporator optimization via CALM™

Pack Controller AK-PC 782B
Complete regulating unit for capacity control of compressors and condensers

System Manager AK-SM 800A
Take advantage of the CALM™ solution



Multi Ejector – CTM Low Pressure lift (LP)
Add-on to the booster system improving efficiency during warm ambient conditions



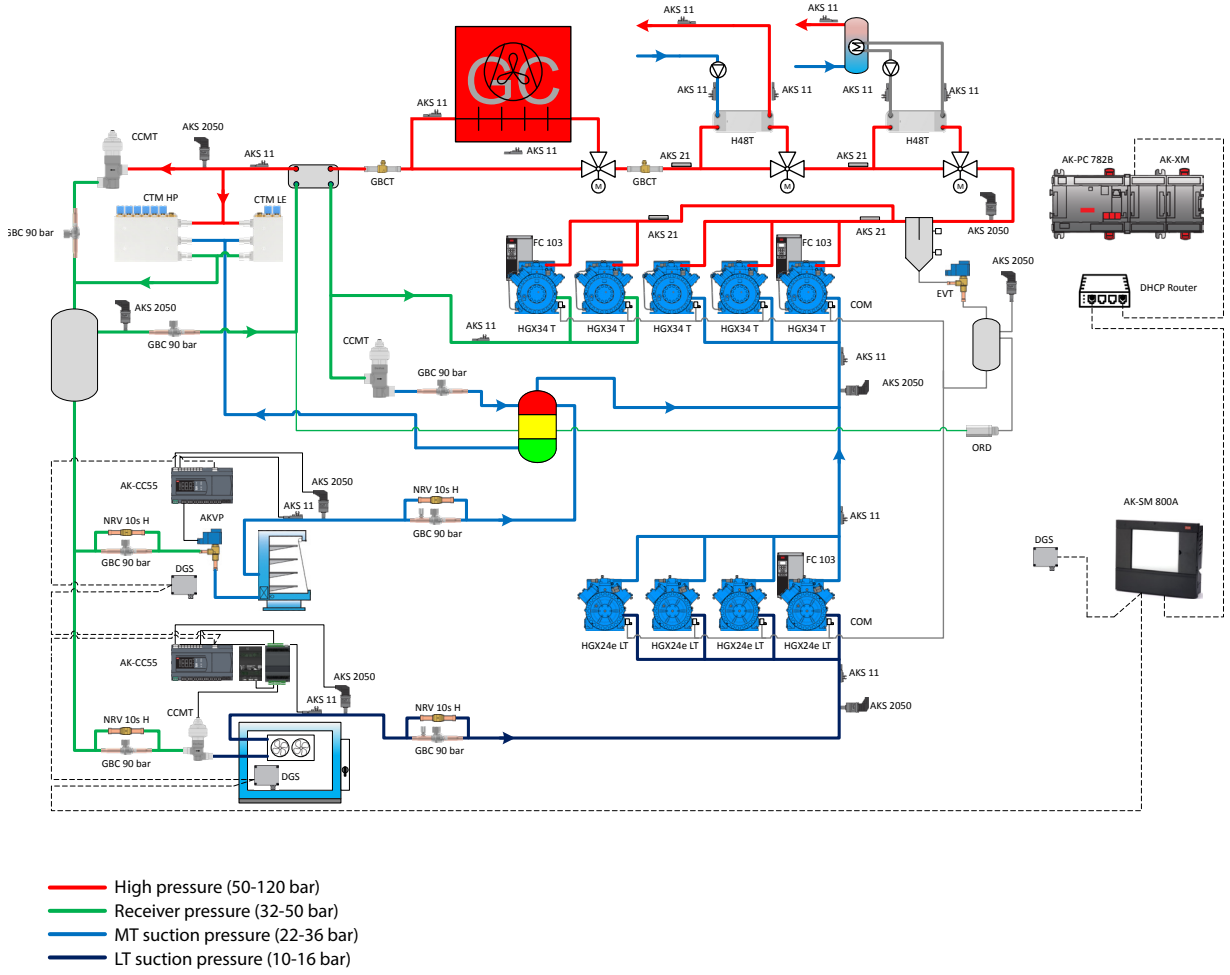
Multi Ejector – CTM Combi HP/LE
The benefits of the High Pressure and Liquid Ejector in one solution

Case Controller AK-CC55
Complete control with excellent flexibility

Electric Regulating Valve CCMT 16-42
EEV for larger cold rooms

BOCK® Transcritical and subcritical CO_2 compressors
Efficient and reliable CO_2 compressor for all applications

How to choose the right Multi Ejector



Efficient and green CO_2 system with Heat Recovery

Unlock Sustainable Savings with Danfoss Heat Recovery Unit.
The cutting-edge solution is designed to harness the excess heat from the cooling system and thereby maximize energy efficiency and reducing the carbon footprint of the store significantly.

Heat Recovery Unit- One tank
Introducing the one tank solution with the perfect capacity for smaller stores

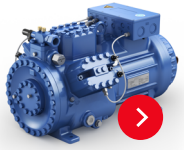
Heat Recovery Unit- Two tank
Two tank solution is the optimal product for heat recovery in bigger mid size stores

Pack Controller AK-PC 782B
Complete regulating unit for capacity control of compressors and condensers

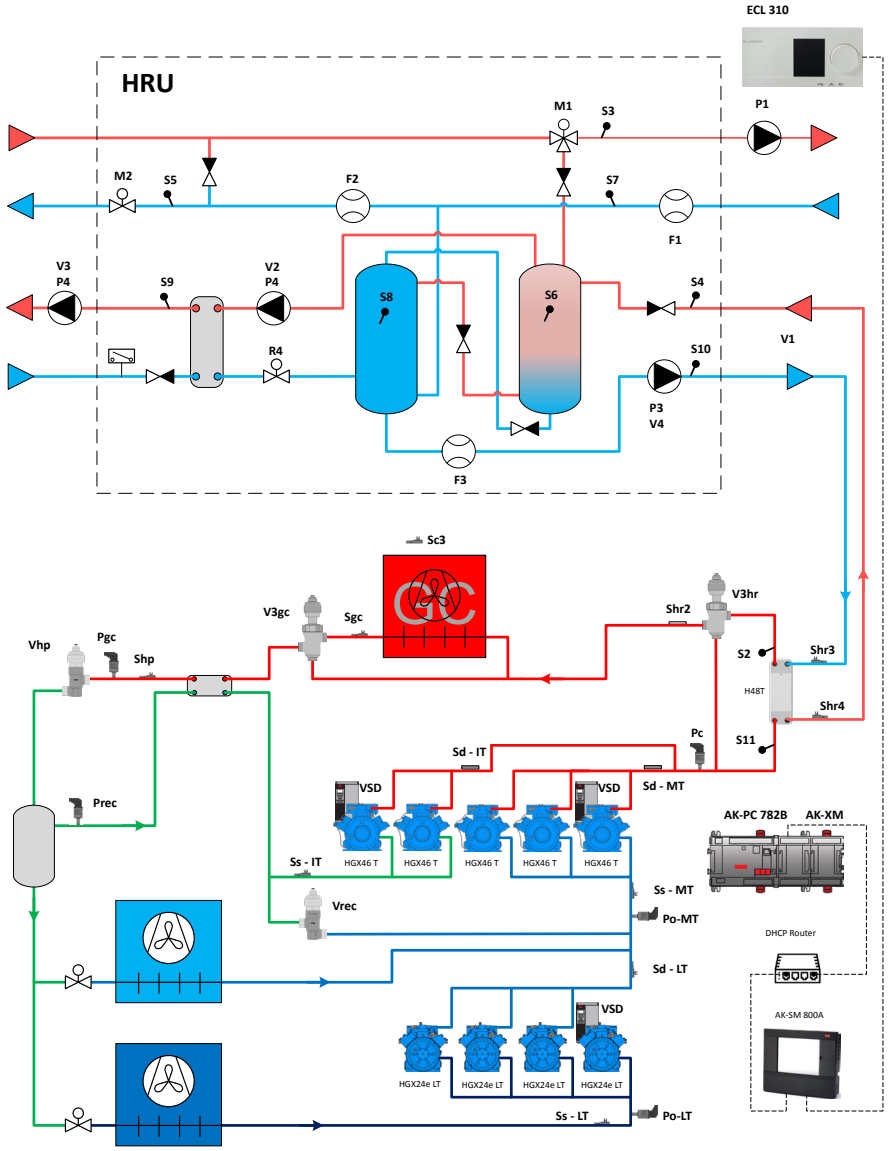
Electric 3-Way Valve CTR
For heat recovery and gas cooler bypass application.

System Manager AK-SM 800A
Take advantage of the CALM™ solution

Pressure Transmitter AKS 2050
Reliable, durable, high-performance pressure transmitter



BOCK® Transcritical and subcritical CO_2 compressors
Efficient and reliable CO_2 compressor for all applications

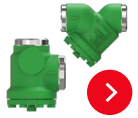


High pressure (50-120 bar)
Receiver pressure (32-50 bar)
MT suction pressure (22-36 bar)
LT suction pressure (10-16 bar)

CO_2 transcritical system with large Industrial components

Use the parts designed for the job. Danfoss' built-for-purpose, built-for-industry, transcritical CO_2 solutions ensure your operation is future-proof. The larger components bring unmatched efficiency and simplicity to large systems. Creating a new industrial standard for transcritical CO_2 systems.

Shut-Off valve SVA-140B
For isolating large components and high differential pressures



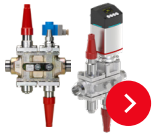
Strainer FIA-140B
Housing with replaceable stainless steel insert

Liquid Level transmitter AKS 4100
Accurate measuring of CO_2 liquid levels in IT and LT vessels

Motor-Operated Valve ICMTS
Regulate the flow of transcritical gas or subcritical liquid

BOCK® Transcritical and subcritical CO_2 compressors
Efficient and reliable CO_2 compressor for all applications

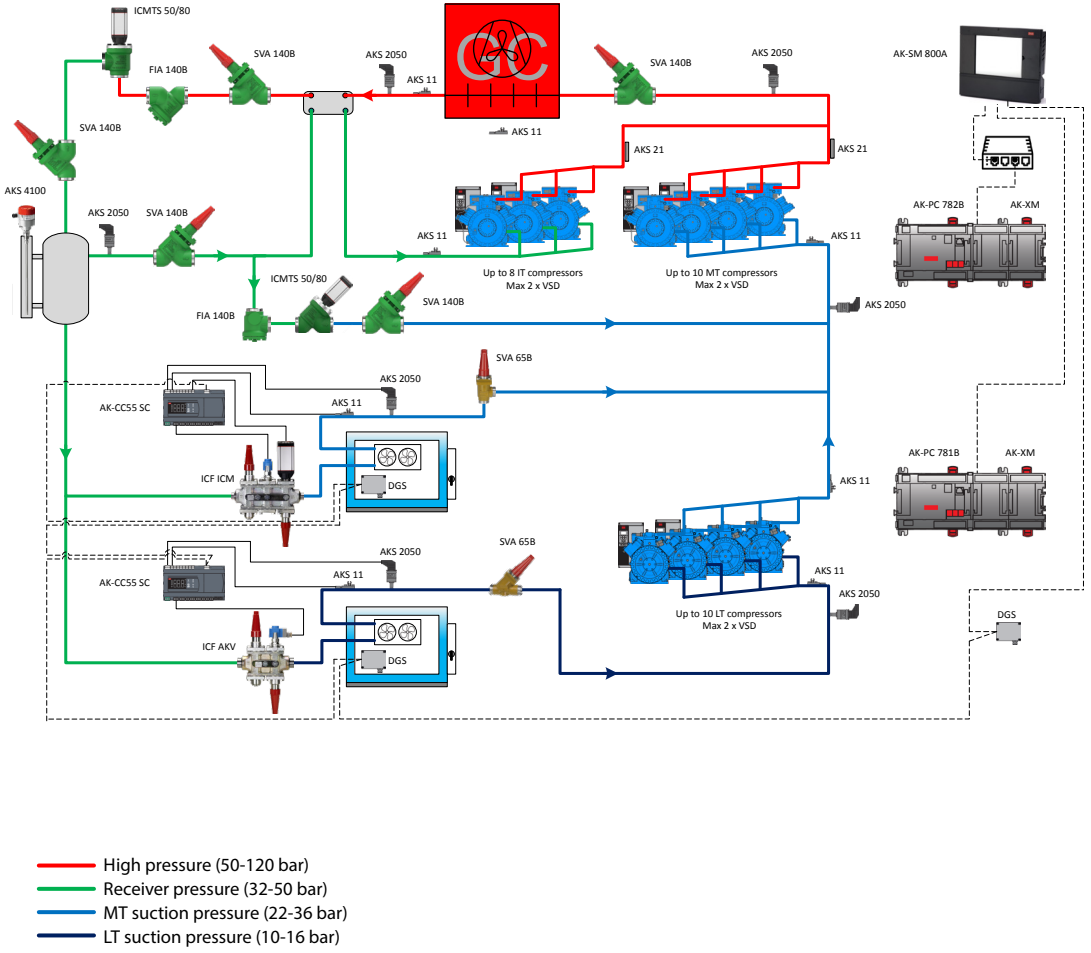
SVL 65 bar Flexline™
Shut-Off, Stop/Check, Check, Regulating valve and strainers in one shared 65 bar valve house



ICF Flexline™ valve station
Replaces individual function and simplifies design, installation, service, and maintenance

Pack Controller AK-PC 782/781B
Scalable control for up to 10 compressors

Discover more about our industrial CO_2 portfolio for cold storage



CO_2 refrigeration is part of the Danfoss Smart Store

Danfoss Smart Store solutions help build the supermarkets of tomorrow by reducing costs, minimizing environmental impact, and creating future-proof advantage – all while maintaining the highest level of food safety.

Installed in more than 50,000 food retail stores worldwide, smart store solutions:

- Use smart refrigeration to reduce operating costs
- Use connectivity to eliminate food waste and reduce service costs
- Provide long-term sustainability
- Integrate systems to gain economies of scale
- Reduce energy prices through optimized demand

Get started today – and prepare for a better tomorrow:
Smartstore.danfoss.com

Tools and support for your CO_2 journey

RefTools
The essential all-in-one app for air conditioning and refrigeration technicians. Get seven powerful tools to support your CO_2 journey all from the palm of your hand.

Download it here

Alsense Food Retail
Our newest cloud solution for supermarkets and food retail applications, offers a sustainable, scalable, and secure portal for optimizing the performance of operations.

Download it here

Coolselector®2
Significantly reduces complexity on the job by running unbiased calculations based on a set of operating conditions to determine the best components for your design.

Download it here

Explore our solutions
danfoss.com

Learn more about
CO_2 solutions for Food Retail

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