

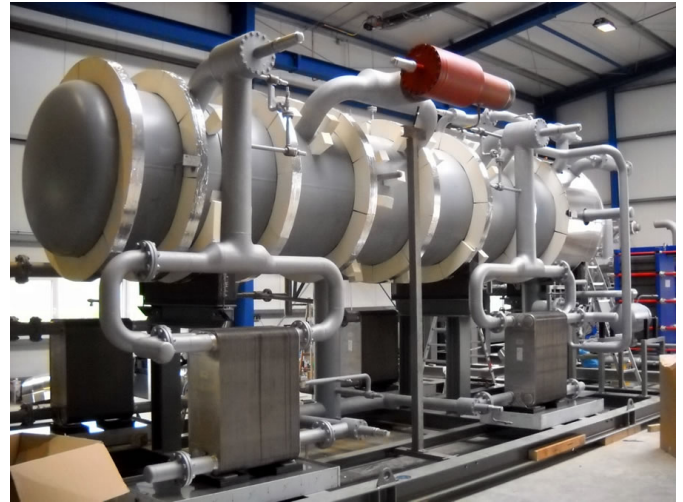
CO₂ / Propylene Cascade Refrigeration System

ARCTOS builds for the Chemical Industry

CO₂ / Propylene Cascade Refrigeration System for Cooling a Synthesis Stream of Organic Solvents.

The cascade refrigeration system enables low temperatures of up to -54°C with the natural refrigerant CO₂. Propylene serves as the refrigerant for the upper cascade stage. With other refrigerants (e.g., Ethane), temperatures of -85°C can be achieved.

ARCTOS Industriekälte AG enables the chemical industry to implement low-temperature applications using natural refrigerants with this concept.



R&I Diagram

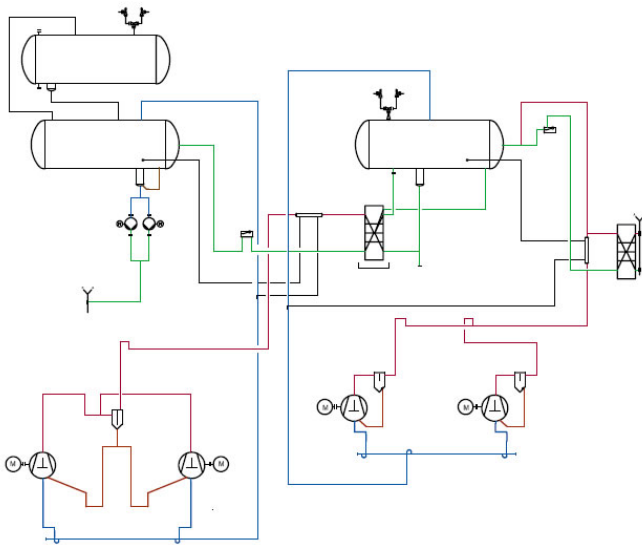
A cascade project implemented in the chemical industry is schematically shown in the process flow diagram displayed on the top right. In this case, a CO₂ / Propylene cascade refrigeration system is used to cool a synthesis stream of organic solvents.

TECHNICAL DESCRIPTION

In the CO₂ / Propylene cascade refrigeration system built by ARCTOS, two refrigeration units are integrated into each cascade stage. The evaporator of the upper cascade stage (Propylene) also serves as the condenser for the lower cascade stage (CO₂). The liquid CO₂ cools the chemical process to -50°C through its evaporation.

TECHNICAL DATA CASCADE

REFRIGERANT	Propylene R1270	CO ₂ R744
Charge	240 kg	1,100 kg
Max Operating Pressure	16/25 bar	25/40 bar
Evaporation Temperature	-10° C	-50° C
Condensation Temperature	+39° C	-7° C
Cooling Capacity	2x 227kW (at -10° C)	2x 124kW (at -50° C)
Compressor Manufacturer	GEA Grasso	GEA Grasso
Compressor Type	Piston compressor 2x Grasso 610	Piston compressor 2x Grasso 45HP
Condenser Power Requirement	2x 298 kW with cooling water t _{IN} +31° C and t _{OUT} +36° C	2x 164 kW with CO ₂ t _{IN} +35° C and t _{OUT} -7° C



Simplified R&I diagram of a CO₂/Propene cascade refrigeration system

WHY CO₂?

The natural refrigerant CO₂ is ecologically and safety-wise an ideal refrigerant that can be excellently used in low-temperature applications.

It is non-toxic, non-flammable, has no ozone depletion potential, is chemically inert, cost-effective, and allows for a compact design due to its low volume flow.

DESIGN

At temperatures of -50°C, the technical components must meet high requirements, and in explosion-proof systems like this one (device category II 2 G (Zone 1, Gas), ignition group II B H₂), high safety measures must be implemented. Only through years of experience is it possible to correctly design all components. The CO₂ high-pressure stage is designed for PN40. To prevent overpressure in the low-temperature stage while at rest, a sufficiently large expansion vessel has been provided. The liquefaction of the upper cascade stage is achieved by cooling water from the operator's central plant network.



Ready-to-ship explosion-proof CO₂ / Propane cascade refrigeration system at the manufacturer's plant in Sörup

Do you have any questions or comments? We are happy to assist you:

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