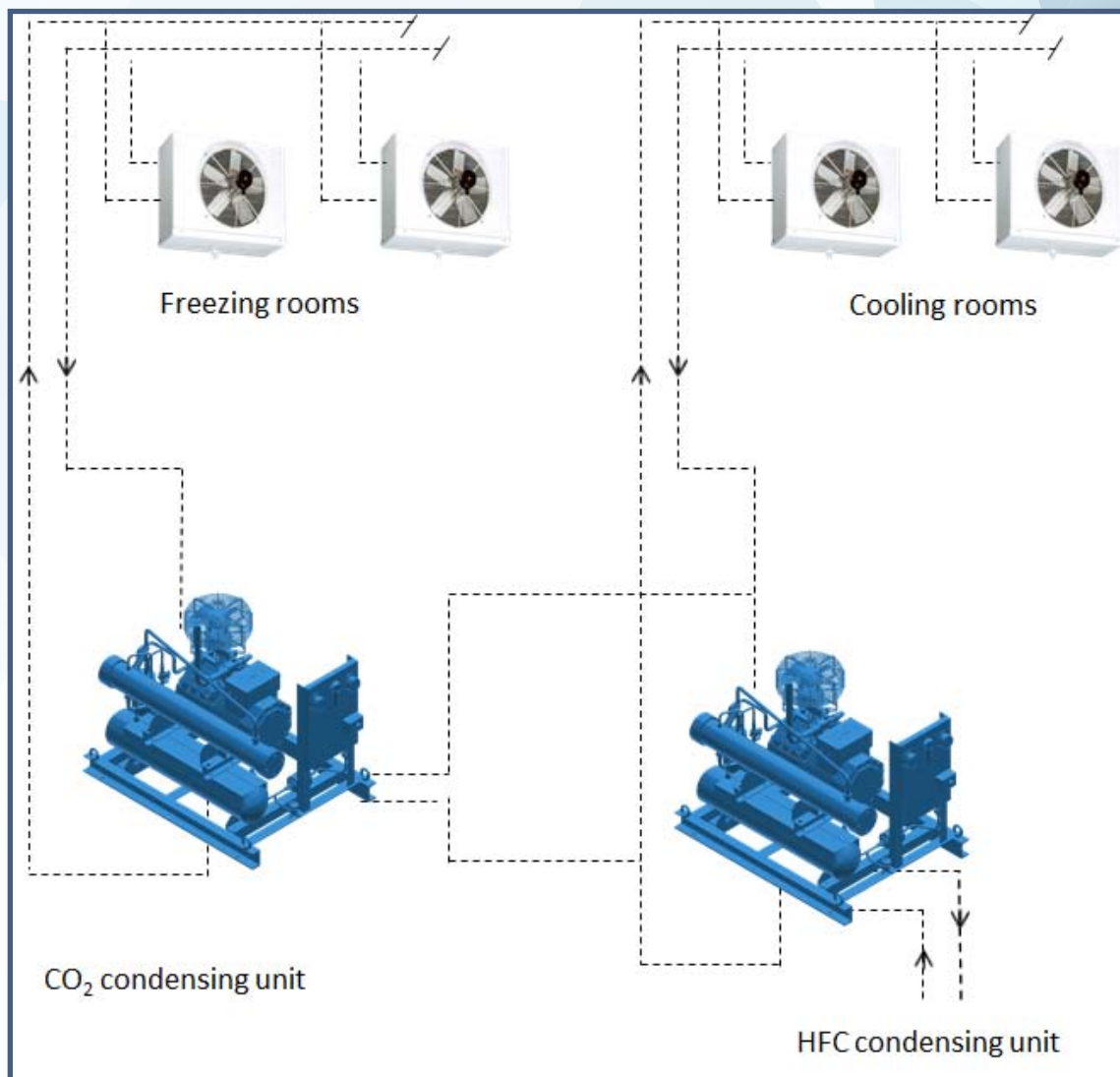


Provision Room Refrigeration CO₂ - HFC Cascade System



Heating



Ventilation



Air Conditioning



Refrigeration

CO2 as a refrigerant

Within refrigeration technology, carbon dioxide (CO₂) is recognized by the name R-744 and has a long history. It is a colourless gas which liquefies under pressure, and has a slightly acidic smell and taste. Carbon dioxide has no ozone depletion potential (ODP=0) and a negligible direct effect on global warming (GWP=1) when used as a refrigerant in closed systems. It is not combustible, is chemically inactive and heavier than air.

Carbon dioxide is available naturally in large quantities.

CO2 in a provision refrigeration plant

CO₂ is also known for high pressures and low critical point which requires special measures when used onboard a ship as well as for general installations. For a typical provision plant, the refrigeration system will be designed as a so-called 2-stage cascade system. A cascade system will include minimum one compressor for the freezing (low temp.) rooms using CO₂ as refrigerant, while the cooling (high temp.) rooms need minimum one designated compressor which may use an ordinary HFC refrigerant, typical R-134a.

The CO₂ low temperature compressor will be cooled by high temperature compressor via a so-called cascade heat exchanger. This arrangement will give an improved plant efficiency (COP) compared with a traditional single stage arrangement.

The complete plant will operate with positive (over) pressures for both low- and high temperature side while the highest environmental standards of the classification societies will be achieved.

CO₂ is preferably to be used in larger provision systems, typical for cruise- and ferry vessels.

Features for CO2/HFC cascade plant :

- Reduced power consumption
- Reduced overall global warming impact
- Environmentally friendly installation
- Reduced components dimensions
- Low temperature capacities from 10 kW and up

COP – Coefficient Of Performance comparison with some typical refrigerants

CO ₂ /R-134a, cascade TE/TM/TC	: -35/-8/45 ⁰ C	semi. reciprocating compressor	COP : 1,5
R-134a, single stage TE/TC	: -35/45 ⁰ C	semi. reciprocating compressor	COP : 0,8
R-134a, single stage TE/TC	: -35/45 ⁰ C	open screw compressor, eco	COP : 1,25
R-404A, single stage TE/TC	: -35/45 ⁰ C	reciprocating compressor	COP : 1,0
R-404A, single stage TE/TC	: -35/45 ⁰ C	open screw compressor, eco	COP : 1,2