



SABROE

# SABROE INDUSTRY

## Refrigeration technology at its best!

### Special plant: Vacuum ice heat pump

#### Utilizing the latent heat of freezing

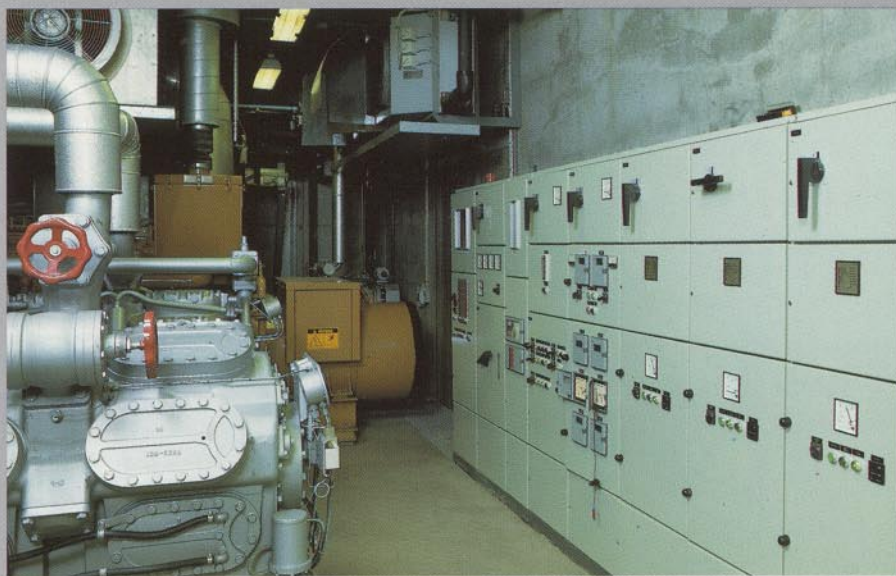
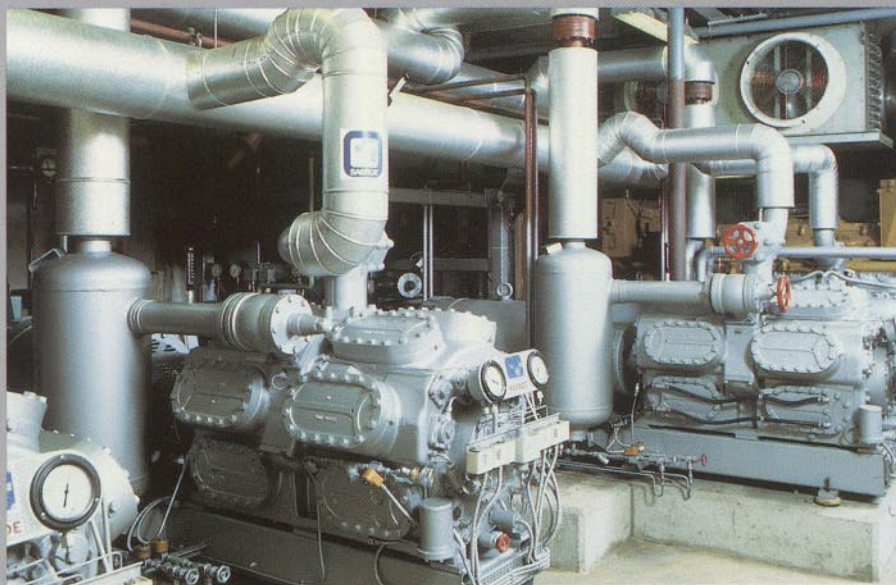
Oil is the primary energy source for heating of the district heating water. And in 1986 the district heating plant in Augustenborg, Denmark, carried through a very advanced project in order to save oil and cut down on the oil consumption.

The plant design is based on a new principle developed by SABROE REFRIGERATION.

The heat is recovered from sea water, which is sprayed into a vacuum tank. Since the vacuum is maintained close to the water's triple point, some of the water freezes to ice immediately. It is this very process that liberates the latent heat, which simultaneously evaporates a corresponding amount of water (the production of 7.5 kg ice evaporates 1 kg water).

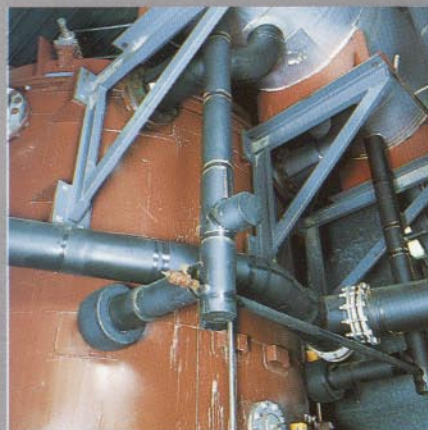
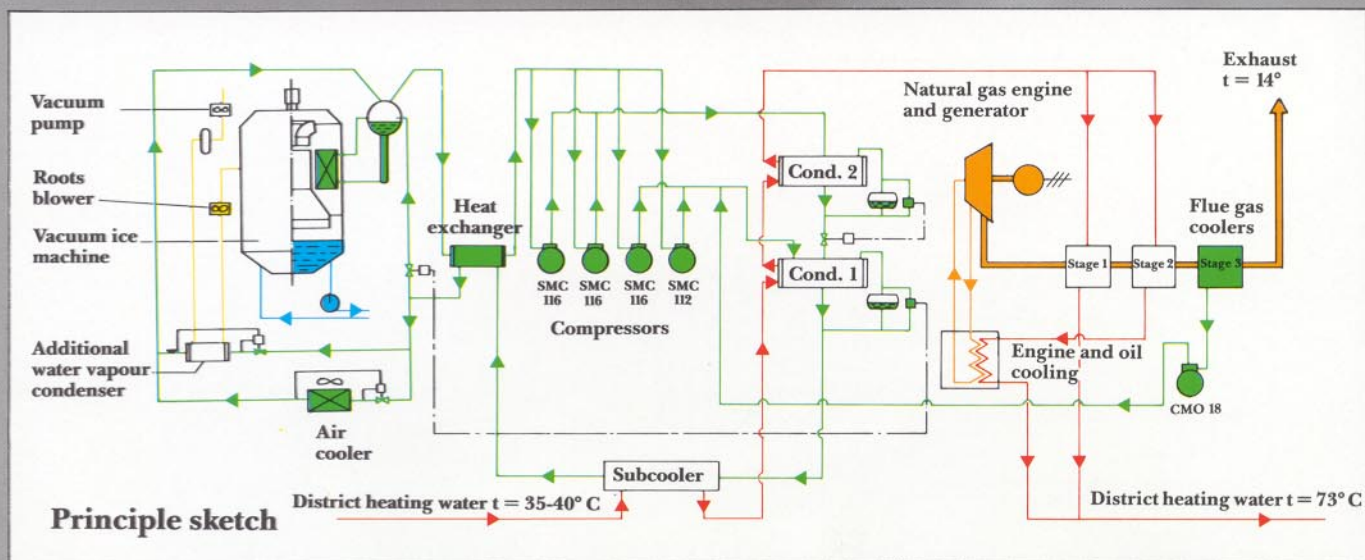
The heat from the evaporation process is contained in the vapour itself. It is recovered in a built-in water vapour condenser and transferred to the refrigerant in a heat pump plant, from where it is utilized for heating of the district heating water.

A combustion engine with generator – driven by natural gas – operates the plant's electric motors, and all heat from the cooling of gas engine, oil and flue gas is recovered for heating of the district heating water.



SABROE's supply comprises:

- Vacuum ice plant with a nominal capacity of 170 t ice/24 hrs.
- Heat pump plant with:
  - 3 reciprocating compressors, type SMC 116
  - 1 reciprocating compressor, type SMC 112
  - 1 reciprocating compressor, type CMO 18
  - complete with condensers, control equipment, etc.



Vacuum tank

The total effect transferred to the district heating water is approx. 2000 kW – with a temperature rise of approx. 30 K and reduction of the exhaust temperature to 14° C.



Heat exchangers for flue gas etc.

The heat pump's coefficient of performance is approx. 3.7, and the plant's total coefficient of performance related to primary energy is approx. 1.6.



Top cover on vacuum tank



Vacuum vapour compressor

SABROE INDUSTRY's expertise is the result of 90 years of experience in the refrigeration business. We offer:

- applied refrigeration technology
- refrigeration control management
- innovative personnel
- application know-how
- tailor-made solutions
- service commitment



SABROE REFRIGERATION A/S  
Industry Division

Chr. X's Vej 201, Aarhus, Denmark

P. O. Box 1810, DK-8270 Højbjerg

Phone: +45 86 27 12 66 · Fax: +45 86 27 12 44

Telex: 6 87 23 · Telegram: SABROE AARHUS