



» Upgrading waste heat from the flue gas cleaning process of Umeå's Dåva power station, with 2 Unitop® 28C heat pumps

Client

Umeå Energi AB
90105 Umeå, Sweden

District heating conquers Umeå

Umeå is an innovative town in the north of Sweden, with 107,000 inhabitants, two universities and an expanding business sector. Approx. 70% of the buildings in Umeå are served with the district heating network. In 2002 alone, 400 private houses were connected. At the same time, district heating has expanded across the city borders. It has to compete mainly with small heat pumps and pellet-fuelled boilers owned by private households.

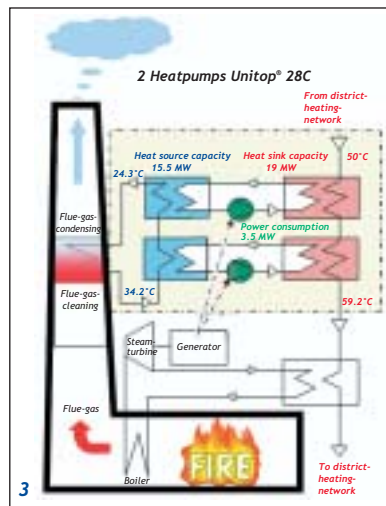
Umeå Energi AB

Operating in the very dynamic energy business, Umeå Energi AB consists of the four business areas: District heating, Electricity Network, Electricity trading, and UmeNet. Deregulation and growing competition are challenging but also open up new opportunities. Expanding operations in all business areas, it is the goal of Umeå Energi AB to remain strong on the domestic market.

Owned by the local municipality, Umeå Energi AB has 260 employees and serves 53,000 customers.

The Dåva heat and power plant

Situated 15 km north-east of Umeå, the Dåva combined heat and power



Energy efficiency of fabulous 107%

Standard calculation of the heating value of any fuel does not consider the energy lost in the flue gas. Thus, the heating capacity gained from partial condensation of the flue gas stream enables a performance factor above 100%. The low temperature energy is transformed into valuable heat with the two heat pumps and fed into the district heating network of Umeå.

The district heating network supplies a capacity of approx. 750 GWh/a. With 350 GWh/a, the Dåva heat & power station covers 46% of the requirements, of which the heat pumps provide around 20%, thus improving the profitability of the plant considerably.

Network temperatures correspond to normal European conditions, i. e. supply temperatures of 70 to 110°C and return temperatures of 40 to 70°C.

The process of flue gas cleaning uses several steps: bag filter, acid scrubber, SO₂-scrubber and finally flue gas condensation, which besides heat also extracts condensate. The condensate is added again to the upstream cleaning stages in the process. Thus, the plant is basically self supporting with respect to process water. The moisture content of the flue gas is reduced from 12 vol-% to 4.3 vol-%.

plant is one of the world's most energy-effective waste-fuelled plants, complying with the most stringent environmental requirements regarding emissions. By converting waste into energy, it creates a valuable additional source of electricity and has enabled Umeå Energi AB to enhance its heat production capacity.

The incineration plant has a capacity of 175,000 tons (20 t/h) of waste per year and incineration of bio fuel is possible simultaneously. Approx. 80 GWh/a of electricity is produced. With heat recovery from flue gas condensation the total energy performance is raised from 94% to 107%.





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Unitop® 28C heat pump

The Unitop® 28C is equipped with shell and tube type heat exchangers for evaporation and condensation of the refrigerant type R134a.

With the electric motor and the oil cooler being water cooled with water from the heat source, the entire energy input to the heat pump system is transferred to the district heating network.

The two heat pumps are connected in series on both, the evaporator side and the condenser side. This supports flexibility and considerably improves the overall COP. With some operating points being at low district heating temperatures, a COP above 5.0 is achieved.

Main features of the Unitop® 28C

- Open-type single stage compressor
- Refrigerants: halocarbon/hydrocarbon
- Integrated planetary type gears
- Tough industrial design with vertically split casing for easy maintenance
- Suited for all drive systems
- High efficiency over the entire range
- Operating temperatures – 40°C/+80°C

- Multiple compressor units available
- Operation in series or in parallel
- Large capacity, small floor space

Plant control system

A SattCon type PLC control system is used for local control and supervision of the heat pump units. It is connected to the central building control system.

Service and maintenance

Specialists of Friotherm are maintaining the two Unitop® 28C and carry out the regular service works.

Legend

- 1 The city of Umeå; 70% of the buildings are connected to district heating. © Umeå Energi
- 2 General view of the environmentally friendly Däva heat and power plant. © Umeå Energi
- 3 Principle of heat recovery from flue gas and temperature upgrading for district heating.
- 4 Rear view of a Unitop® 28C in the works of Friotherm. The condenser on top, below the evaporator and the refrigerant subcooler.
- 5 Front view of the unit; on the right the compressor and the partly visible motor, the electrical control panel on the left and the heat exchangers in the back.

Technical Data

Incineration plant

Incineration capacity	61 MWth
Boiler capacity	55 MWth
Turbine generator	+15 MWeI
Turbine condenser	+40 MWth
Heat pump capacity	+13.7 MWth
Heat pump + utilities	-3.3 MWeI
Total capacity	65.4 MW
Plant efficiency (65.4 / 61)	107 %

Emissions of the incineration plant

Dust	5 mg/Nm ³	NH ₃	5 mg/Nm ³
HCl	5 mg/Nm ³	Cd+Tl	0,05 mg/Nm ³
HF	1 mg/Nm ³	Hg	0,05 mg/Nm ³
SO ₂	25 mg/Nm ³	Dioxin	0,1 mg/Nm ³

2 Heat pumps Unitop® 28C, each

Heating capacity	13,700 kW
Power absorbed	3,360 kW
COP	4.08
Heat source capacity	10,340 kW
Heat source temp. in/out	+38/+28 °C
Heat. water temp. in/out	60/70-75 °C
Capacity control	10-100 %

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