

Comparing energy consumption of industrial size refrigeration systems


Thomas Lund
Danfoss A/S, Kolding, Denmark

Klik på ikonet for at tilføje et billede

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Noise

airconditionanlæg - Op til 85 m²



Pris **5.499,00**

★★★★★ 4,5 (4)

Midlertidig udsolgt (Læs mere)

Få besked, når varen er på lager

Indtast e-mail

Få besked


Se alt i [Ventilatorer & aircondition](#)

KUN TIL TIRSDAG!

FRI FRAGT
på alt i bolig-butikken

Gælder i.o.m. 6/8 - så længe lager haves

Andre kunder købte



airconditionanlæg - PAC N77

Tilbudspris **2.875,00**

Spar **1.624,00**

Normalpris **4.499,00**

Eeese tårnventilator - Air Cooler 1000

Egnet til rum op til 25 m² - Med timerfunktion og

Medlemspris **1.399,00**

Specifikationer

Mærke	
Maks. arbejdsområde i m²	34
Maks. arbejdsområde i m³	85
Anbefalet til følgende rum	Alle rum
Køleeffekt	9.800
Effektforbrug i watt pr. time	2,6
Affugtning i liter pr. døgn	34,0
Arbejdsinterval, temperatur i °C	19-35
Luftgennemstrømning i m³/time	350
Hastigheder	3
Timer-indstilling	Ja
Fjernbetjening	Ja
Afledningslange i meter	1,2
Kategori	A
Lydniveau i dB(A)	64
Vægt i kg	30,0

Økologisk og energibesparende klimaanlæg
PAC N90 køler, affugter og renser luften og sørger dermed for et friskt og sundt indeklima i din bolig. Den gør det endda med et meget lavt støjniveau og lavt støjniveau.

Anlægget er økologisk, idet den bruger det miljøvenlige kølemiddelgæs R410A.

airconditionanlæg - Datablad

aircon - Brugsanvisning

The system is organic, as it uses the environmentally friendly refrigerant R410A

The Purpose of this exercise

Comparing the efficiency/energy consumption of various system types

Our aim

- Levelling the playing field
- 'Rule based' selection of components
- Using real component performance or complex models
- Investigate effect of location (ambient) and size

Comparing existing plants

- Design considerations – price or efficiency?
- Actual construction
- State of maintenance – function and contamination

The Purpose of this exercise

LT is defined as -25°C air temperature, MT as -2°C air temperature

In 4 different sizes (LT / MT cooling load)

- 50 / 150 kW
- 150 / 450 kW
- 300 / 900 kW
- 900 / 2700 kW

Examining a variety of systems:

- R744 transcritical, DX operation
- R744 transcritical, flooded operation
- Two stage R717, flooded operation
- R744/R717 cascade, flooded operation
- Two stage R507, flooded operation

All system types investigated in a 'standard' and an 'optimized' execution

Evaluated in 3 different locations: Oslo, Frankfurt and Rome

Simulation software

'Pack Calculation Pro' from IPU

Contains

- Many system models
- Commercial compressors
- Heat exchanger models
- Ambient data

Industrial compressors
added by authors

Calculates a year
hour by hour

Case A 1 CO2 DX standard Rome.packprj - Pack Calculation Pro Personal

1) CO2 TC DX (reference)

Systemkonfiguration | Sugeseide | Afgangside

Referencesystem

Et-trins | To et-trins | Kaskade | To-trins | Varmepumpe

Totrins-transkritisk To trins transkritisk, parallel kompression

To-trins åben mellemkøler To-trins lukket mellemkøler

To-trins væskeindsprøjtning

MT valg

Oversvømmet fordampere

LT valgmuligheder:

Oversvømmet fordampere

1) CO2 TC DX, MT

Kølemiddel: R744

Vælg kompressorer fra database...

Kompressorer:

- Bitzer 4FTC-30K (SC)
- Bitzer 4CTC-30K (SC)
- Bitzer 4CTC-30K
- Bitzer 4CTC-30K

Samlet kapacitet Qe/Qc: 299,7 kW / 399,1 kW

Ved Custom, MBP (Te/Pgc = -12,0 °C / 65,0 bar)

1) CO2 TC DX, LT

Kølemiddel: R744

Vælg kompressorer fra database...

Kompressorer:

- Bitzer 4FSL-7K (SC)
- Bitzer 4FSL-7K
- Bitzer 4FSL-7K

Samlet kapacitet Qe/Qc: 82,3 kW / 96,9 kW

Ved Custom, LBP (Te/Tc = -35,0 / -12,0 °C)

'Standard' system

R744 transcritical systems – simple booster units

Dry gas coolers

No parallel compression

No ejectors

Two stage R717 and R507 systems – simple two stage systems

Open intercoolers

No economizers

R744/R717 cascade

Cascade dT 5K

No economizers

'Standard' system results

Yearly total COP - includes compressor, fan and pump power

COP	Load	R744 TC DX	R744 TC FL	R717 2ST	R744/R717	R507 2ST
Rome	50/150	2,24	2,49	3,50	3,28	3,38
	150/450	2,53	2,70	3,50	3,18	3,30
	300/900	2,51	2,68	3,64	3,34	3,35
	900/2700	2,50	2,64	3,69	3,35	3,35
Frankfurt	50/150	2,86	3,12	3,91	3,61	3,81
	150/450	3,24	3,52	3,91	3,53	3,82
	300/900	3,22	3,45	4,08	3,73	3,86
	900/2700	3,21	3,39	4,15	3,76	3,86
Oslo	50/150	3,22	3,46	4,09	3,78	3,99
	150/450	3,67	4,00	4,09	3,67	4,04
	300/900	3,64	3,93	4,28	3,90	4,08
	900/2700	3,63	3,86	4,35	3,92	4,35

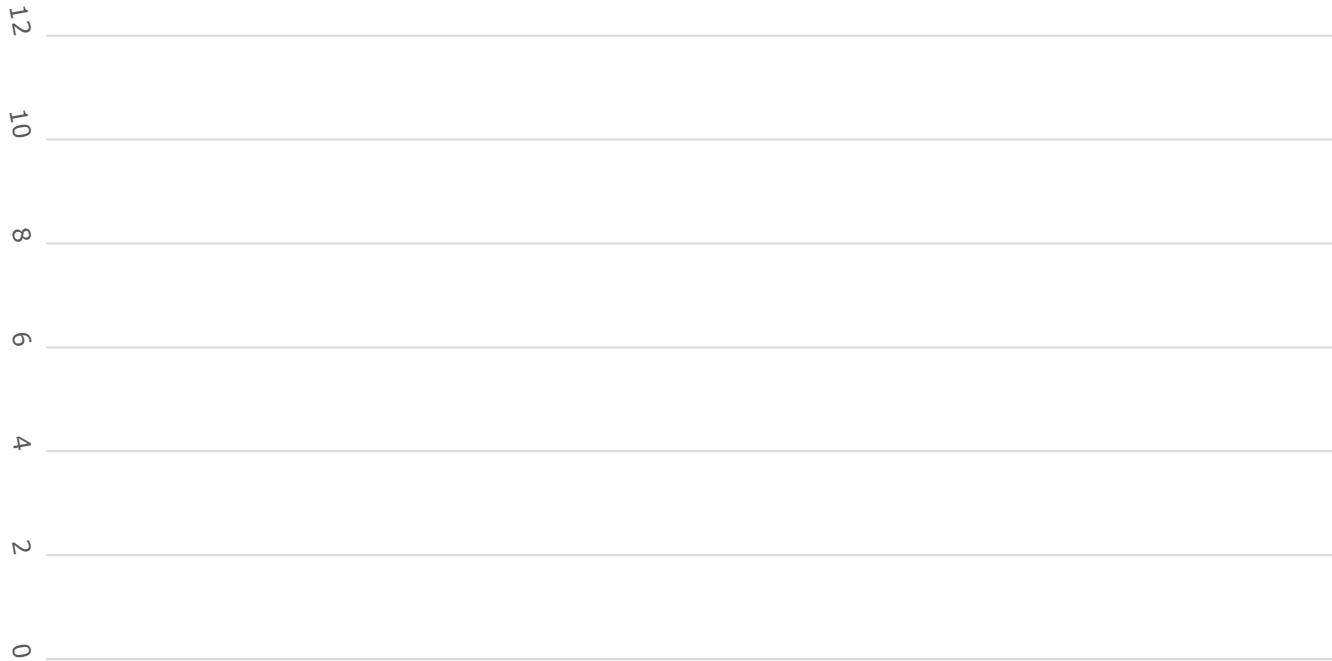
Conclusion 1: Except smallest R744 TC systems, COP for a system type does not depend significantly on size

Small trend towards better COP for larger sizes

Subsequent calculation focus on the 300/900kW systems to reduce workload and increase clarity

'Standard' system results #2

Year total power consumption relative to two stage R717



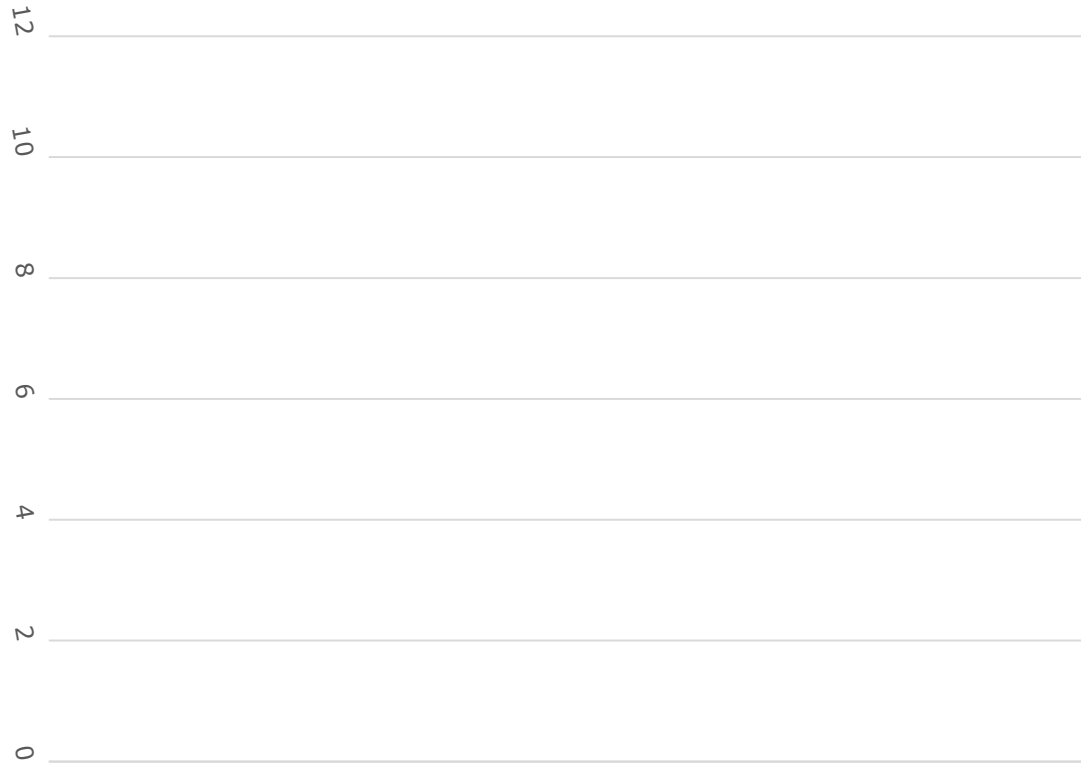
Conclusion 2: Transcritical systems suffer in hotter climates

Conclusion 3: At best Transcritical systems are 9% behind, at worst 45%

Conclusion 4: Cascade not doing too good – out of it's 'comfort zone'

Effects of setup choices

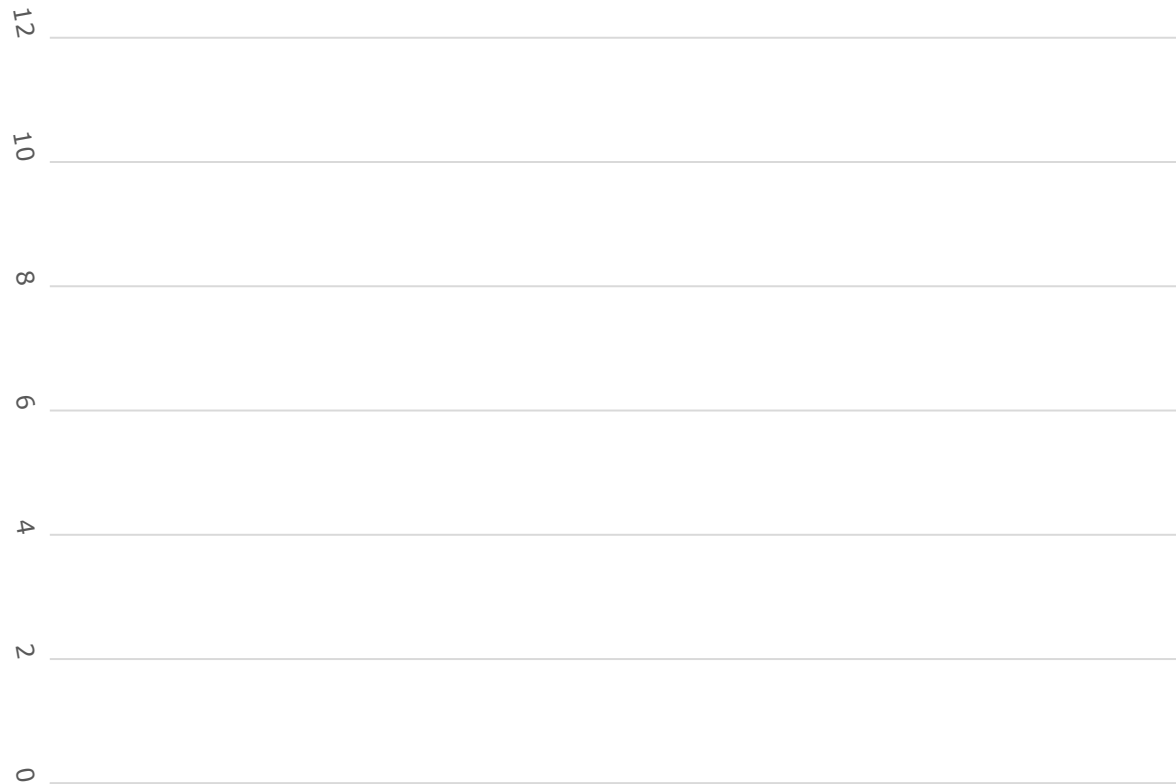
Simple ambient temperature dependent profile used



Conclusion 6: Constant load profile favors the transcritical systems

Effects of setup choices

'Flipping' load from LT/MT 300/900kW to 900/300kW



Conclusion 7: High COP of R744 LT compressors

'Optimized' systems

R744 Transcritical systems

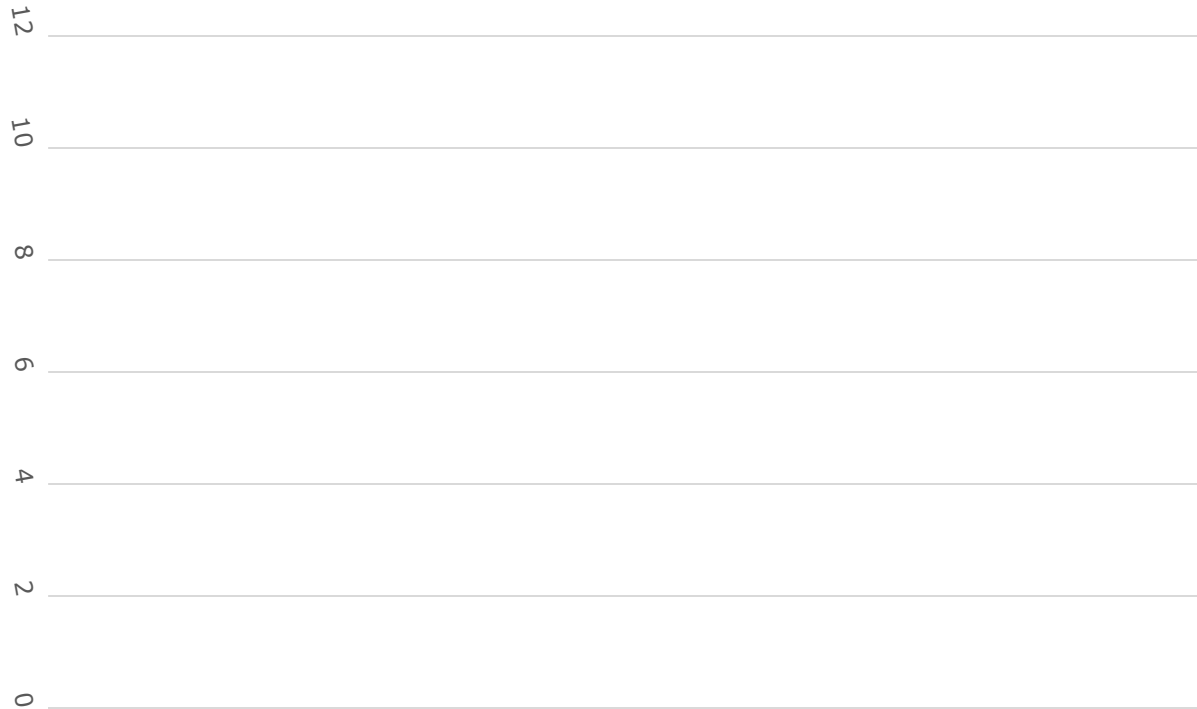
- Parallel compression (DX only)
- Hybrid/Adiabatic gas coolers
- Gas ejectors

Other systems

- Economizers added to screws
- Cascade dT reduced to 3K

'Optimized' system results

Year total power consumption relative to two stage R717



Conclusion 8: R717 two stage most efficient in all situations

Conclusion 9: R744 Transcritical deficit is miniscule at low ambient, small in medium ambient but severe in hot ambient

Note: Hybrid/Adiabatic gas coolers lessens the impact of ejectors

'Optimized' system results #2

Conclusion 8: All systems gain efficiency, but R744 Transcritical more than the traditional systems

Conclusion 9: The R744 flooded Transcritical's inability to run parallel compression (in the software), enables the DX solution to overtake it in hot climates

12
10
8
6
4
2
0

CO2 TC flooded modified with same gain from parallel compression as CO2 TC DX

Final comments

Efficiency is not everything

- Water consumption / water treatment
- Safety – personnel and products
- Maintenance costs / availability of skilled personnel
- Installation costs
- Lifetime of components
- Scope of delivery

A place / time / situation for all

The future is wide open