Ecodesign-krav for luftvarmeaggregater, større luft-luft varmepumper og fan-coil units

Christian Holm Christiansen,
Teknologisk Institut

cnc@teknologisk.dk

Indhold

1. Forordningen og omfattede produkter
2. Ecodesign-kriterier for luftvarmeprodukter
3. Krav til information for luftvarmeprodukter
4. Krav til information for fan coil units
5. Afrunding

1. Forordning (EU) 2016/2281 af 30. november 2016

Krav til miljøvenligt design af luftvarmeprodukter, køleprodukter, HT-chillers til proceskøling og fancoil-enheder:

http://eur-lex.europa.eu/legal-content/DA/TXT/PDF/?uri=CELEX:32016R2281&qid=1484569140301&from=EN

Ecodesign requirements for air heating products, cooling products, high temperature process chillers and fan coil units

http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32016R2281&qid=1484569140301&from=EN

1. Omfattede produkter

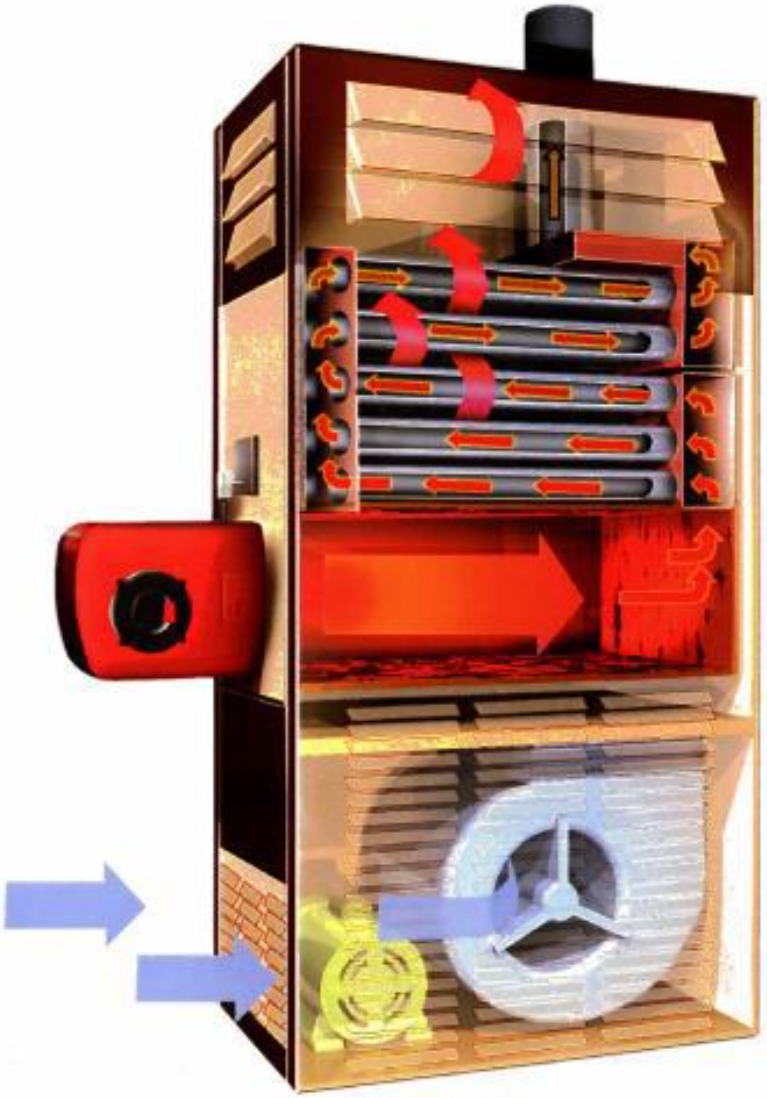
Krav til miljøvenligt design med henblik på markedsføring og/eller ibrugtagning af:

a. **Luftvarmeprodukter med en nominel varmeydelse, som ikke overstiger 1 MW**
b. Køleprodukter og HT-chillers til proceskøling med en nominel køleydelse, som ikke overstiger 2 MW
c. **Fancoil-enheder** (Fan coil units)

1. Luftvarmeprodukter

- Der er både tale om **decentrale anlæg**, der opvarmer luft til et enkelt rum (fx et værksted, hal eller lignende) og **centrale anlæg**, der **via et system af kanaler leverer varme til flere rum**.
- Varmeproducerende enhed: Luftvarmeaggregaterne er **fyret med gas eller flydende brændsel**, men kan også være **elektrisk opvarmede**.
- Produkter fyret med **faste brændsler** eller brændsler, der i overvejende grad indeholder **biomasse** (mere end 50 % fx bioolie) er **ikke omfattet af kravene**.
- **Centrale og decentrale luft-til luft-varmepumper inkl. reversible AC-anlæg, der ikke er omfattet af forordning 206/2011 (>12 kW)**

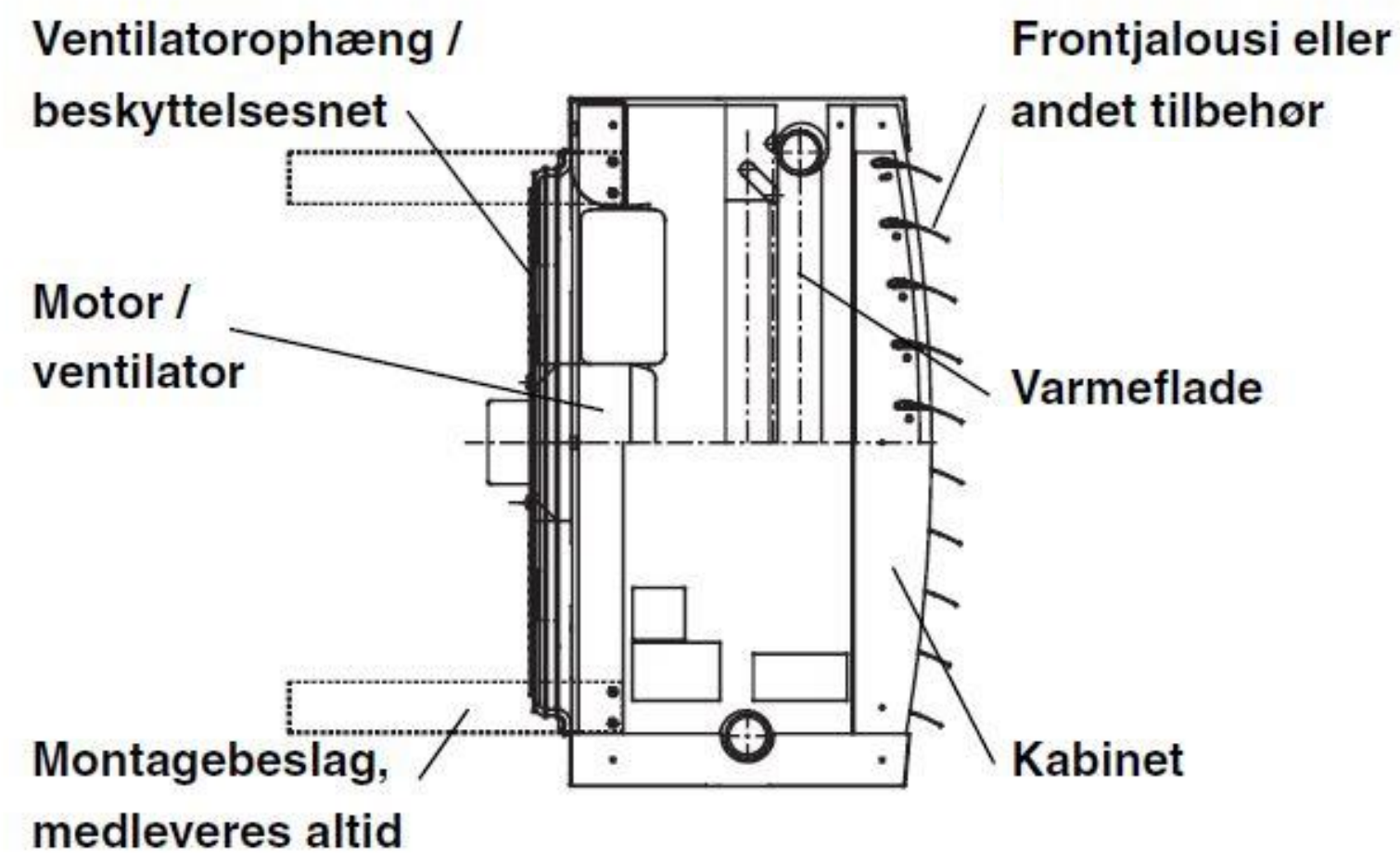
1. Luftvarmeprodukter



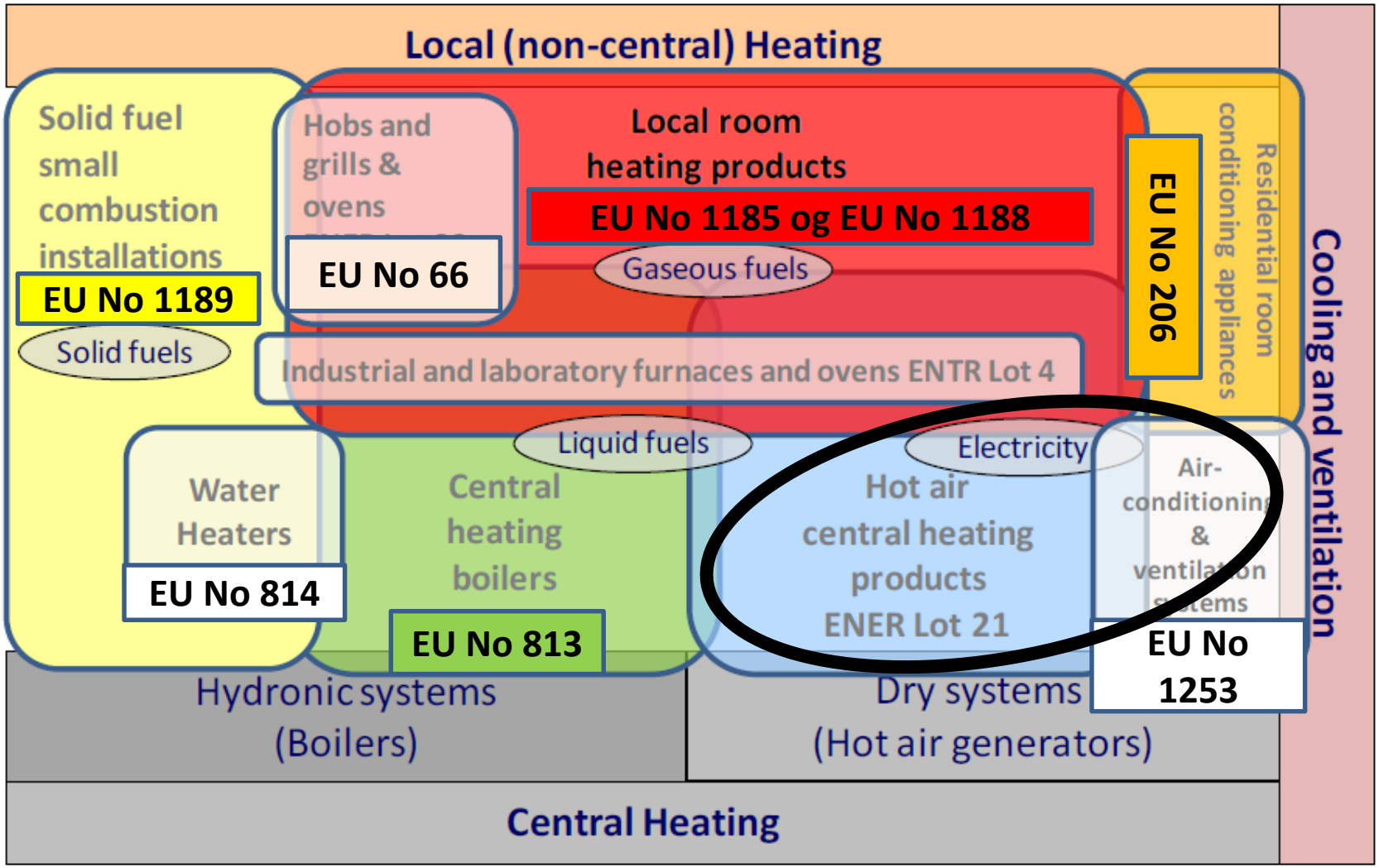
1. Fancoil-enheder

- Sørger for **cirkulation af indendørs luft** med henblik på et eller flere formål, f.eks. **opvarmning, køling, affugtning og filtrering af indendørs luft**, med sigte på at nå et niveau af termisk komfort for personer
- Omfatter **IKKE en varmeproducerende eller kuldeproducerende enhed** og heller ikke en udendørs varmeveksler.
- Apparatet kan have korte kanaler til indtag og udløb af luft, herunder konditioneret luft.
- Produktet **kan være udformet til indbygning eller have en indkapsling**, så det kan placeres i det rum, hvor luften skal konditioneres.
- Det kan have en **elektrisk varmeproducerende enhed**, som kun anvendes som **backup**.

1. Fancoil-enheder



1. Andre produkter til rumopvarmning



+ Elektriske motorer: EC No 640 og Ventilatorer: EU No 327

2. Ecodesignkrav: Årsvirkningsgrad (Seasonal space heating energy efficiency)

- Øvre brændværdi (olie- og gas)!
  - Olie: 90 % >>> 84%
  - Gas: 93 % >>> 84%
- Primær energifaktor for el på 2,5
- F(i) – Faktorer for styring, elforbrug, gennemtrækstab og pilotflamme

$$\eta_S = \eta_{S,on} - \sum F(i)$$

2. Beregning af årsvirkningsgrad

Luftvarmeprodukter: Beregningsformlerne for varmepumper er rammet ind med rødt

Calculation of the seasonal space heating energy efficiency of warm air heaters

(a) The seasonal space heating energy efficiency η_S for warm air heaters using fuels is defined as:

Brændselsfyrede: $\eta_s = \eta_{s,on} - \sum F(i)$

$$\eta_{S,heat} = SPER_{heat} - \sum F(i)$$

(b) The seasonal space heating energy efficiency η_S for warm air heaters using electricity is defined as:

Elektriske: $\eta_s = \left(\frac{1}{CC}\right) \cdot \eta_{s,on} - \sum F(i)$

$$\eta_{S,heat} = \frac{1}{CC} \cdot SCOP - \sum F(i)$$

2. Krav til årsvirkningsgrad
Trin 1: 1. januar 2018

Brændselsfyrede

Bf.: B1, C2, C4

Elektriske

	$\eta_{s,h}$ (*)
Warm air heaters using fuels except B_1 warm air heaters with a rated heat output below 10 kW and except C_2 and C_4 warm air heaters with a rated heat output below 15 kW	72 %
B_1 warm air heaters with a rated heat output below 10 kW and C_2 and C_4 warm air heaters with a rated heat output below 15 kW	68 %
Warm air heaters using electricity	30 %
Air-to-air heat pumps, driven by an electric motor, except rooftop heat pumps	133 %
Rooftop heat pumps	115 %
Air-to-air heat pumps, driven by an internal combustion engine	120 %
(*) To be declared in the relevant tables in this Annex and in the technical documentation rounded to one decimal place.	

Luft-luft VP forbrændingsmotor

Rooftop VP

Luft-luft VP elektrisk

2. Krav til årsvirkningsgrad
Trin 2: 1. januar 2021

	$\eta_{s,h}$ (*)
Warm air heaters using fuels except B_1 warm air heaters with a rated heat output below 10 kW and except C_2 and C_4 warm air heaters with a rated heat output below 15 kW	78 % (T1: 72%)
Warm air heaters using electricity	31 % (T1: 30%)
Air-to-air heat pumps, driven by an electric motor, except rooftop heat pumps	137 % (T1: 133%)
Rooftop heat pumps	125 % (T1: 115%)
Air-to-air heat pumps, driven by an internal combustion engine	130 % (T1: 120%)
(*) To be declared in the relevant tables in this Annex and in the technical documentation rounded to one decimal place.	

Luft-luft VP forbrændingsmotor

Rooftop VP

Luft-luft VP elektrisk

2. Krav til NOx-emission
Trin 1 (T1): 26. september 2018,
Trin 2 (T2): 1. januar 2021

NOx, udtrykt i mg/kWh tilført brændsel på grundlag af øvre brændværdi

Warm air heaters using gaseous fuels	T1: 100 / T2: 70
Warm air heaters using liquid fuels	T1: 180 / T2: 150
Heat pumps, comfort chillers and air conditioners, equipped with external combustion engines using gaseous fuels	T1: 70
Heat pumps, comfort chillers and air conditioners, equipped with external combustion engines using liquid fuels	T1: 120
Heat pumps, comfort chillers and air conditioners, equipped with internal combustion engines using gaseous fuels	T1: 240
Heat pumps, comfort chillers and air conditioners, equipped with internal combustion engines using liquid fuels	T1: 420

3. Informations-krav, luftvarme-produkter

Type:
B1, C2, C3
Gas, olie elektrisk

Ecodesignparametre:
NOx
Årsvirkningsgrad

Model(s): Information to identify the model(s) to which the information relates:

B_1 warm air heater: [yes/no]

C_2 warm air heater: [yes/no]

C_4 warm air heater: [yes/no]

Type of fuel: [gas/liquid/electricity]

Item	Symbol	Value	Unit		Item	Symbol	Value	Unit
Capacity					Useful efficiency			
Rated heating capacity	$P_{rated,h}$	x,x	kW		Useful efficiency at rated heating capacity (*)	η_{nom}	x,x	%
Minimum capacity	P_{min}	x,x	kW		Useful efficiency at minimum capacity (*)	η_{pl}	x,x	%
Electric power consumption (*)					Other items			
At rated heating capacity	el_{max}	x,xxx	kW		Envelope loss factor	F_{env}	x,x	%
At minimal capacity	el_{min}	x,xxx	kW		Ignition burner power consumption (*)	P_{ign}	x,x	kW
In standby mode	el_{sb}	x,xxx	kW		Emissions of nitrogen oxides (*) (**)	NO_x	x	mg/kWh input energy (GCV)
					Emission efficiency	$\eta_{s,flow}$	x,x	%
					Seasonal space heating energy efficiency	$\eta_{s,h}$	x,x	%
Contact details	Name and address of the manufacturer or of its authorised representative.							

(*) Not required for electric warm air heaters.
(**) From 26 September 2018.

3. Informationskrav, varmepumper

Information to identify the model(s) to which the information relates:
Outdoor side heat exchanger of heat pump: [select which: air/water/brine]
Indoor side heat exchanger of heat pump: [select which: air/water/brine]
Indication if the heater is equipped with a supplementary heater: yes/no
If applicable: driver of compressor: [electric motor or fuel driven, gaseous or liquid fuel, internal or external combustion engine]
Parameters shall be declared for the average heating season, parameters for the warmer and colder heating seasons are optional.

Kun krav om deklarerede data for gennemsnitsklima/"Average", deklarering af andre klimazoner muligt
(som for de små luft-luft-varmepumper, < 12 kW, Forordning EU No. 206)

3. Informations-krav, varme-pumper

Item	Symbol	Value	Unit		Item	Symbol	Value	Unit
Rated heating capacity	$P_{rated,h}$	x,x	kW		Seasonal space heating energy efficiency	$\eta_{s,h}$	x,x	%
Declared heating capacity for part load at indoor temperature 20 °C and outdoor temperature T_j					Declared coefficient of performance or gas utilization efficiency/auxiliary energy factor for part load at given outdoor temperatures T_j			
T_j = – 7 °C	Pdh	x,x	kW		T_j = – 7 °C	COP_d or $GUE_{h,dev}/AEF_{h,dev}$	x,x	%
T_j = + 2 °C	Pdh	x,x	kW		T_j = + 2 °C	COP_d or $GUE_{h,dev}/AEF_{h,dev}$	x,x	%
T_j = + 7 °C	Pdh	x,x	kW		T_j = + 7 °C	COP_d or $GUE_{h,dev}/AEF_{h,dev}$	x,x	%
T_j = + 12 °C	Pdh	x,x	kW		T_j = + 12 °C	COP_d or $GUE_{h,dev}/AEF_{h,dev}$	x,x	%
T_{biv} = bivalent temperature	Pdh	x,x	kW		T_{biv} = bivalent temperature	COP_d or $GUE_{h,dev}/AEF_{h,dev}$	x,x	%
T_{OL} = operation limit	Pdh	x,x	kW		T_{OL} = operation limit	COP_d or $GUE_{h,dev}/AEF_{h,dev}$	x,x	%
For air-to-water heat pumps: T_j = – 15 °C (if T_{OL} < – 20 °C)	Pdh	x,x	kW		For water-to-air heat pumps: T_j = – 15 °C (if T_{OL} < – 20 °C)	COP_d or $GUE_{h,dev}/AEF_{h,dev}$	x,x	%
Bivalent temperature	T_{biv}	x	°C		For water-to-air heat pumps: Operation limit temperature	T_d	x	°C
Degradation co-efficient heat pumps (**)	C_{dh}	x,x	—					
Power consumption in modes other than 'active mode'					Supplementary heater			
Off mode	P_{OFF}	x,xxx	kW		Back-up heating capacity (*)	elbu	x,x	kW
Thermostat-off mode	P_{TO}	x,xxx	kW		Type of energy input			
Crankcase heater mode	P_{CK}	x,xxx	kW		Standby mode	P_{SB}	x,xxx	kW

3. Informationskrav, varmepumper

Other items								
Capacity control	fixed/staged/variable				For air-to-air heat pumps: air flow rate, outdoor measured	—	x	m^3/h
Sound power level, indoor/outdoor measured	L_{WA}	x,x/x,x	dB		For water/brine-to-air heat pumps: Rated brine or water flow rate, outdoor side heat exchanger	—	x	m^3/h
Emissions of nitrogen oxides (if applicable)	NO_x (***)	x	mg/kWh fuel input GCV					
GWP of the refrigerant			kg $CO_{2\ eq}$ (100 years)					
Contact details	Name and address of the manufacturer or of its authorised representative.							

Informationskrav til lyd + GWP af kølemiddel

4. Informationskrav, fancoil-enheder

Information to identify the model(s) to which the information relates:

Item	Symbol	Value	Unit		Item	Symbol	Value	Unit
Cooling capacity (sensible)	$P_{rated,c}$	x,x	kW		Total electric power input	P_{elec}	x,xxx	kW
Cooling capacity (latent)	$P_{rated,c}$	x,x	kW		Sound power level (per speed setting, if applicable)	L_{WA}	x,x/etc.	dB
Heating capacity	$P_{rated,h}$	x,x	kW					
Contact details	Name and address of the manufacturer or of its authorised representative.							

Cooling test		Heating test		Sound power test
Air temperature	27 °C (dry bulb) 19 °C (wet bulb)	Air temperature	20 °C (dry bulb)	At ambient conditions without water flow
Inlet water temperature	7 °C	Inlet water temperature	45 °C for 2-pipe units 65 °C for 4-pipe units	
Water temperature rise	5 °C	Water temperature decrease	5 °C for 2-pipe units 10 °C for 4-pipe units	

Ny standard: DS/EN 1397:2015 + DS/EN 1397:2015/AC:2016

5. Afrunding

- Overgangsmetoder
- Standarder
- Fortolkninger
- Reviews