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Test of air-to-water heat pump for EN 14825

(8 appendices)

Work requested

Testing of an air-to-water heat pump in accordance to EN14825:2013, to determine the seasonal coefficient of performance, SCOP. The heat pump was tested for the average climate, and for both low temperature and high temperature applications. Additional test conditions according to EN 14511 were also performed.

Item for testing

Type of heat pump:	Air/Water, fixed capacity type, new heat pump
Manufacturer:	Danfoss Värmepumpar AB
Type designation:	Thermia Atec HP 13
Serial number, heat pump:	086U936326482593
Cold heat transfer medium:	Air
Warm heat transfer medium:	Water
Refrigerant:	R407C, 5.1 kg
Dimensions (width x depth x height):	1016x 564 x 1477 mm
Weight (empty):	155 kg

The heat pump was delivered from the manufacturer to SP's test laboratory in February 2014. No damage could be seen on the unit when visually inspected.

Place and date of testing

The heat pump was installed by SP following the instructions from the manufacturer. The heat pump was tested at SP at the department of Energy Technology during May to June 2014.

Test methods

The space heating performance of the heat pump was tested in accordance with EN 14825:2013, EN 14511-2:2013 and EN 14511-3:2011. Testing and rating at part load conditions, calculation of seasonal performance and determination of the energy consumption at thermostat off mode, standby mode, off mode, crankcase heater mode and compressor off mode were carried out in accordance with EN 14825:2013. Performance testing was performed for the standard European climate, as defined in EN 14825, average (A) at test points as shown in table 1 and table 2. The heat pump has variable outlet temperature, and a heat curve based on the outdoor temperature. For the test points where the heat pump's heating capacity is higher than what is required, the outlet temperature during the performance test is corrected according to eq. 15 in EN 14825 and the coefficient of performance is corrected, in accordance

to EN 14825, using a degradation coefficient, Cc. Heating load less than 100% of the building's heating demand is referred to as part-load ratio.

Table 1 Space heating performance testing and part-load ratio in accordance with table 12 presented in EN 14825 for seasonal performance calculations for average climate (A) and low temperature application.

Average			Outdoor heat exchanger	Indoor heat exchanger
Test point	Part-load ratio[1]	Part-load ratio %	Outdoor air Inlet dry bulb (wet bulb) temperature, °C	Inlet/outlet temperatures Variable outlet °C
A	$(-7-16)/(T_{designh}^{2}-16^{3})$	88	-7(-8)	[a]/34
B	$(+2-16)/(T_{designh}-16)$	54	2(1)	[a]/30
C	$(+7-16)/(T_{designh}-16)$	35	7(6)	[a]/27
D	$(+12-16)/(T_{designh}-16)$	15	12(11)	[a]/24
E	$(TOL-16)/(T_{designh}-16)$		TOL	Variable outlet shall be calculated by interpolation or extrapolation from the temperatures which are closest to the TOL.[a]
F	$(T_{biv}^{4}-16)/(T_{designh}-16)$		T_{biv}	Variable outlet shall be calculated by interpolation from the upper and lower temperatures which are closest to the bivalent temperature.

[1] Formula for calculating the part-load ratio of the building's maximum heating load at a specific temperature condition
[2] Reference design temperature condition for heating, $T_{designh}$ = -10°C for average climate
[3] Outdoor air dry bulb temperature, at this temperature the building's heating demand is zero
[4] Lowest outdoor air dry bulb temperature at which the heat pump is capable of covering the total heating demand of the building, T_{biv} = +2°C maximum value for average climate
[a] With the water flow rate as determined at the standard rating conditions given in EN14511-2 at 30/35 conditions

Table 2 Space heating performance testing and part-load ratio in accordance with table 18 presented in EN 14825 for seasonal performance calculations for average climate (A) and high temperature application.

Average			Outdoor heat exchanger	Indoor heat exchanger
Test point	Part-load ratio[1]	Part-load ratio %	Outdoor air Inlet dry bulb (wet bulb) temperature, °C	Inlet/outlet temperatures Variable outlet °C
A	$(-7-16)/(T_{designh}^{2}-16^{3})$	88	-7(-8)	[a]/52
B	$(+2-16)/(T_{designh}-16)$	54	2(1)	[a]/42
C	$(+7-16)/(T_{designh}-16)$	35	7(6)	[a]/36
D	$(+12-16)/(T_{designh}-16)$	15	12(11)	[a]/30
E	$(TOL -16)/(T_{designh}-16)$		TOL	Variable outlet shall be calculated by interpolation or extrapolation from the temperatures which are closest to the TOL.[a]
F	$(T_{biv}^{4}-16)/(T_{designh}-16)$		T_{biv}	Variable outlet shall be calculated by interpolation from the upper and lower temperatures which are closest to the bivalent temperature.

[1] Formula for calculating the part-load ratio of the building's maximum heating load at a specific temperature condition
[2] Reference design temperature condition for heating, $T_{designh}$ = -10°C for average climate
[3] Outdoor air dry bulb temperature, at this temperature the building's heating demand is zero
[4] Lowest outdoor air dry bulb temperature at which the heat pump is capable of covering the total heating demand of the building, T_{biv} = +2°C maximum value for average climate
[a] With the water flow rate as determined at the standard rating conditions given in EN14511-2 at 47/55 conditions

The space heating performance of the heat pump was also tested in accordance with EN 14511 and the certification reference HARP, at test points as shown in table 3. Results, with measured and calculated data shown in tabular form, are found in appendix 4.

Table 3. Test conditions for space heating test in accordance to EN 14511 and HARP

Test point	Inlet dry bulb (wet bulb) temperature, °C	Warm heat transfer medium, inlet/outlet temperature, °C
A7/W35	7(6)	30/35
A2/W35	2(1)	a/35
A7/W45	7(6)	40/45

a: Tested with heat transfer media flow rates obtained at test condition A7/W35

Test equipment

The following test equipment was used:

Name	SP inventory no.
Test rig	LV3
Data acquisition system	900 071, 201 417
Electric power meter	901 996
Flow meters	701 277
Differential pressure sensors	202 865
Dew point sensor	200 428
Resistive temperature sensors, Pt 100.	-

Heat pump settings for the space heating performance tests

The heat pump was installed by personnel from SP following the instructions from the manufacturer. The following settings were used during the measurements:

During the performance test maximum heat curve was used to keep the compressor running continuously

There is no internal warm heat transfer medium circulation pump in the unit.

Results from space heating performance testing

The test results given in this report relate only to the specific item tested and under the specific conditions described, with the specific equipment named and at the specified settings. Calculations are based on the results from the laboratory tests according with EN 14825:2013 which in its turn refers to EN 14511:2011 part 3 in a large scale when denoting the test method. The water flow rate was determined at the standard rating conditions given in EN14511-2:2013 at 30/35 conditions for the low temperature application and at 47/55 conditions for the high temperature application. Results are defined according to EN 14825.

The bivalent temperature, T_{biv}, was declared by the manufacturer. At T_{biv} the heat pump is capable of covering the total heating demand of the building. The heating demand of the building, $P_{designh}$, is determined by dividing the heating capacity measured at T_{biv}, by the formula for calculating the part-load ratio at the same temperature condition. For the formula for calculating the part-load ratio see table 1 and 2.

Table 4 $T_{bivalent}$ and $P_{designh}$ for the heat pump tested.

Low temperature application, average climate		High temperature application, average climate	
T_{biv}, °C	$P_{designh}$, kW	T_{biv}, °C	$P_{designh}$, kW
-5	10.64	-4	11.03

The unit was tested for test point E at -10°C for both the low and high temperature application in accordance to EN 14825. EN 14825 states if the declared TOL is lower than $T_{designh}$, it may be assumed that TOL is equal to $T_{designh}$.

Results from capacity tests

Table 5 below presents the total thermal output power, P_H, and the corresponding coefficient of performance, COP, at corresponding test points A-F in table 1 and table 2. The values presented are the results from the laboratory tests according with EN 14825 and EN 14511 for the average climate. The operating conditions are presented in table 1 and table 2.

Table 5 Results from the performance tests[1].

	Low temperature application, average climate			High temperature application, average climate		
Test point:	P_H (kW)	P_E (kW)	COP	P_H (kW)	P_E (kW)	COP
A	8.05	2.48	3.24	7.61	3.21	2.37
B	9.87	2.56	3.85	10.03	3.09	3.25
C	12.03	2.53	4.75	12.58	2.97	4.23
D	14.99	2.55	5.89	14.82	2.87	5.16
E	7.40	2.48	2.98	6.92	3.30	2.10
F	8.59	2.49	3.45	8.48	3.15	2.70

[1]For the test points where the heat pump's heating capacity is higher than what is required, the outlet temperature during the performance test was corrected according to eq. 15 in EN14825. Please see Appendix 2 and 3 for measured test data.

Results for measurements of power consumption during modes other than "active mode"

Table 6 below presents the measurements of the energy consumption at thermostat off mode, standby mode, off mode, crankcase heater mode and compressor off mode. The compressor off mode is needed for the calculation of the Cc-factor which is used for recalculation of COP at the test points where the heat pump's heating capacity is higher than what is required. Compressor off was therefore measured after test points B-D.

Table 6 Results for power consumption during modes other than active mode

	Low temperature application, average climate	High temperature application, average climate
Thermostat off [1](W)	81	47
Standby mode (W)	7	7
Off mode (W)	7	7
Crankcase heater mode[1] (W)	0	0
Compressor off [2] (W), For test point:	Low temperature application, average climate	High temperature application, average climate
B	65	30
C	87	37
D	65	73

[1] In accordance to EN 14825 the standby power consumption is deducted from the measured total energy consumption of the unit during thermostat off mode and during crankcase heater mode.
[2] Not defined in EN 14825. However, it is needed when calculating the Cc-factor according to eq.18. According to EN 14825, "The electrical power input during the compressor off state of the unit is measured when the compressor is switched off for at least 10 min." The heat curve was lowered until the compressor stopped. Corrections were made for power input of liquid pump, according to EN14511-3:2011.

Results for SCOP

The results obtained from the testing was used to calculate the values of the seasonal coefficient of performance, SCOP, which are presented in table 7. The results are based on the T_{biv} and $P_{designh}$ presented in table 4.

Table 7 SCOP results for low temperature and high temperature applications.

Low temperature application, average climate			**High temperature application, average climate**		
T_{biv}, °C	$P_{designh}$, kW	SCOP	T_{biv}, °C	$P_{designh}$, kW	SCOP
-5	10.64	3.82	-4	11.03	3.23

More detailed presentations of the tests, with measured and calculated results shown in tabular form, are found in appendix 1, 2 and 3.

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Appendices

1. Result, technical data sheet in accordance to EN 14825
2. Result space heating performance testing, low temperature application
3. Result, space heating performance testing, high temperature application
4. Results, space heating performance testing in accordance with EN 14511 and the certification reference HARP
5. List of components
6. Photographs
7. Uncertainty of measurement
8. Nomenclature

Results, technical data sheet in accordance to EN 14825

Model name	Thermia ATEC HP 13					
					Low temp. appli-cation	High temp. appli-cation
Function	Heating			Average "A"	Yes	
Capacity control	Fixed				Yes	
Design load	Heating	Average		Pdesignh, kW	10.64	11.03
Seasonal Efficiency	Heating	Average		$SCOP_{on}$ [1]	3.86	3.26
				$SCOP_{net}$ [2]	3.94	3.35
				SCOP[3]	3.82	3.23
Heating capacity at outdoor temperature Tj	Heating, Average		Tj = -7 °C	P_H, kW	8.05	7.61
			Tj = 2 °C	P_H, kW	9.87	10.03
			Tj = 7 °C	P_H, kW	12.03	12.58
			Tj = 12 °C	P_H, kW	14.99	14.82
			Tj = bivalent temperature, °C	P_H, kW	8.59	8.48
			Tj = operation limit, -10 °C	P_H, kW	7.40	6.92
Coefficient of performance for heating at outdoor temperature Tj	Heating, Average		Tj = -7 °C	COP	3.24	2.37
			Tj = 2 °C	COP	3.85	3.25
			Tj = 7 °C	COP	4.75	4.23
			Tj = 12 °C	COP	5.89	5.16
			Tj = bivalent temperature, °C	COP	3.45	2.70
			Tj = operation limit, -10 °C	COP	2.98	2.10
Bivalent temperatures	Heating, Average		$T_{bivalent}$, °C		-5	-4
Operation limit temperatures	Heating, Average		TOL, °C		-10[4]	-10[4]
Seasonal electricity consumption	Heating, Average		QHE/A, kW/a		3900	4775
Modes other than "active mode"	Off-mode [5], W				7	7
	Standby mode [6], W				7	7
	Thermostat-off mode [7], W				81	47
	Crankcase heater mode[8], W				0	0
Contact details for obtaining more information	Name manufacturer			Danfoss Värmepumpar AB		
	Address			Snickaregatan 1 671 34 Arvika Sweden		

Appendix 1

[1] $SCOP_{on}$ is the heat pump's average seasonal performance in active mode, presenting the hours the heat pump's heating performance is activated

[2] $SCOP_{net}$ is the heat pump's average seasonal performance in active mode excluding electricity consumption for thermostat off, standby, off mode, crankcase heating mode and that of an electrical back up heater

[3] SCOP is the units total seasonal performance factor representing the whole heating season

[4] Set to the same value as $T_{designh}$

[5] A mode where the unit is completely switched off and is not capable to be reactivated by a control device or a timer

[6] A mode where the unit is partially switched off and can by a control device or timer be reactivated

[7] A mode corresponding to the hours with no heating load, but where the heating function of the unit is switched on but the unit is not operational as there is no heating load

[8] A mode corresponding to the hours where a heating device is activated to avoid refrigerant to migrating to the compressor in order to limit the refrigerant concentration in oil at compressor start

Appendix 2

Results, space heating performance in accordance to EN 14825, average climate and low temperature application

Operating point		**1**	**A**	**B**	**C**	**D**	**E**	**F**
		30/35	**-/34**	**27.7/-**	**25.5/-**	**23.4/-**	**-/35**	**-/33.1**
	°C	**7/6w**	**-7/-8w**	**2/1w**	**7/6w**	**12/11w**	**-10/-11w**	**-5/-6w**
Data collection period	*min*	70	70	180	180	70	70	70
Transient		No	No	Yes	Yes	No	No	No
Temperature	*°C*							
Heat transfer medium, hot, outlet	t_{w2}	35.1	34.1	31.6	30.3	29.3	35.1	33.1
Heat transfer medium, hot, inlet	t_{w1}	30.0	30.9	27.8	25.6	23.4	32.2	29.7
Dry bulb air temperature	t_{a5}	7.1	-7.0	2.1	7.0	12.0	-9.9	-5.0
Wet bulb air temperature	t_{wb}	5.9	-8.0	1.0	5.8	11.0	-10.9	-6.0
Flow	*m³/h*							
Volume flow rate of heat transfer medium. Hot	q_w	2.18	2.18	2.18	2.18	2.18	2.18	2.18
Pressure difference	*kPa*							
Heat transfer medium, hot	Dp_w	-11.7	-11.7	-11.8	-11.9	-12.0	-11.7	-11.7
Electrical power	*kW*							
Total	P_T	2.736	2.429	2.506	2.479	2.493	2.425	2.434
Calculated quantities								
Thermal power	*kW*							
Total thermal output power to the heat sink	P_{1hps}	12.708	7.995	9.812	11.980	14.934	7.344	8.538
Coefficient of performance	*(-)*							
total	COP_{hps}	4.65	3.29	3.92	4.83	5.99	3.03	3.51
Correction in accordance with EN 14511								
Correction, pump power	*W*							
Heat transfer medium pump, hot	$P_{epw,s}$	53	53	53	53	54	53	53
Electrical power after correction	*kW*							
Total	P_E	2.789	2.481	2.559	2.532	2.547	2.478	2.487
Thermal power after correction	*kW*							
delivered	P_H	12.760	8.048	9.865	12.033	14.988	7.397	8.591
COP after correction	*(-)*							
Total	COP	4.58	3.24	3.85	4.75	5.89	2.98	3.45

Heat demand of the house and average outlet temperature according to EN14825

T_{biv}	-5°C						
$P_{designh}$	10.64 kW						
P_{house}:	kW	9.41	5.73	3.68	1.64	10.64	8,59
Tout, average according to eq.15 in 14825, °C				30.0	27.0	24.0	

Appendix 3

Results, space heating performance in accordance to EN 14825, average climate and high temperature application

Operating point		**1**	**A**	**B**	**C**	**D**	**E**	**F**
		47/55	**-/52**	**38/-**	**33.5/-**	**28.9/-**	**-/55**	**-/48.7**
	°C	**7/6w**	**-7/-8w**	**2/1w**	**7/6w**	**12/11w**	**-10/-11w**	**-4/-5w**
Data collection period	*min*	70	70	180	70	70	70	70
Transient		No	No	Yes	No	No	No	No
Temperature	*°C*							
Heat transfer medium, hot, outlet	t_{w2}	55.1	52.0	44.8	41.9	39.0	55.1	48.8
Heat transfer medium, hot, inlet	t_{w1}	47.0	46.9	38.0	33.5	29.0	50.5	43.1
Dry bulb air temperature	t_{a5}	7.1	-7.0	2.2	7.1	12.0	-9.9	-4.0
Wet bulb air temperature	t_{wb}	5.9	-7.8	1.0	5.9	11.0	-11.0	-5.0
Flow	*m³/h*							
Volume flow rate of heat transfer medium. Hot	q_w	1.29	1.29	1.29	1.29	1.29	1.29	1.29
Pressure difference	*kPa*							
Heat transfer medium, hot	Dp_w	-4.1	-4.1	-4.2	-4.3	-4.3	-4.1	-4.1
Electrical power	*kW*							
Total	P_T	3.790	3.194	3.067	2.954	2.855	3.279	3.128
Calculated quantities								
Thermal power	*kW*							
Total thermal output power to the heat sink	P_{1hps}	11.907	7.594	10.012	12.556	14.797	6.902	8.463
Coefficient of performance	*(-)*							
Total	COP_{hps}	3.14	2.38	3.26	4.25	5.18	2.10	2.71
Correction in accordance with EN 14511								
Correction, pump power	*W*							
Heat transfer medium pump, hot	$P_{epw,s}$	18	18	18	19	19	18	18
Electrical power after correction	*kW*							
Total	P_E	3.808	3.212	3.085	2.973	2.874	3.297	3.146
Thermal power after correction	*kW*							
delivered	P_H	11.925	7.612	10.031	12.575	14.815	6.920	8.481
COP after correction	*(-)*							
Total	COP	3.13	2.37	3.25	4.23	5.16	2.10	2.70

Heat demand of the house and average outlet temperature according to EN14825

T_{biv}	-4°C						
$P_{designh}$	11.03 kW						
P_{house}:	kW	9.75	5.94	3.82	1.7	11.03	8,48
Tout, average according to eq.15 in 14825, °C				42.0	36.0	30.1	

Appendix 4

Results, space heating performance testing in accordance with EN 14511 and the certification reference HARP

Operating point

		30/35 7/6w	-/35 2/1w	40/45 7/6w
	°C			
Data collection period	*min*	70	117.3	70
Transient		No	Yes	No
Temperature	*°C*			
Heat transfer medium, hot, outlet	t_{w2}	35.1	34.6	45.2
Heat transfer medium, hot, inlet	t_{w1}	30.0	30.7	40.1
Dry bulb air temperature	t_{a5}	7.1	2.1	7.1
Wet bulb air temperature	t_{wb}	5.9	0.8	5.9
Flow	*m³/h*			
Volume flow rate of heat transfer medium. Hot	q_w	2.18	2.18	2.07
Pressure difference	*kPa*			
Heat transfer medium, hot	Dp_w	-11.7	-11.7	-10.4
Electrical power	*kW*			
Total	P_T	2.736	2.627	3.221

Calculated quantities

Thermal power	*kW*			
Total thermal output power to the heat sink	P_{1hps}	12.708	9.810	12.215
Coefficient of performance	*(-)*			
total	COP_{hps}	4.65	3.73	3.79

Correction in accordance with EN 14511

Correction, pump power	*W*			
Heat transfer medium pump, hot	$P_{epw,s}$	53	53	47
Electrical power after correction	*kW*			
Total	P_E	2.789	2.680	3.268
Thermal power after correction	*kW*			
delivered	P_H	12.760	9.863	12.262
COP after correction	*(-)*			
Total	COP	4.58	3.68	3.75

Appendix 5

List of components

Below information is given by the manufacturer.

Type: Atec 13		*Year of production:* 2014
Part	*Manufacturer, type*	*Model number*
Compressor:	Copeland	ZH30
Expansion valve:	Danfoss	UKV-A191
Evaporator:	Lloyd Coil	4 row
Condenser:	SWEP	B25*50
Refrigerant: (type, charger)	R407C	5.1 Kg
Control system:	Inbuilt controller Software v2.2.1	
Warm heat transfer medium pump:		
Cold heat transfer medium pump:	-	-
Three way valve:		
Subcooler:	-	-
Desuperheater	-	-
Dryer filter:	Danfoss	DMB163s
Sight glass:	-	
High pressure switch:	Saginomya	31 bar
Low pressure switch:	Pressure transmitter 0.4 bar(g)	
DHW tank (type, volume):	Stainless Steel	
Insulation, DHW tank:	Fiberglass	
Back up heater:	Backer	
Fan	EBM-Papst	S3G 630-AC52-55

Photographs

Figure 1 Heat pump, outdoor unit

Figure 2 Name plate, outdoor unit

Uncertainty of measurement

The uncertainty of measurement is calculated according EA-4/16 with a coverage factor, k = 2. The results from testing are based partly on direct measurements and partly on calculations. The estimates apply to the total uncertainties including both systematic and random uncertainties. Unit terms and designations are as given in Appendix 7.

Measured data

Temperatures

t_{wo}, t_{wi}	± 0.1 K
$t_{wo} - t_{wi}$	± 0.05 K
t_{a5}	± 0.15 K
t_{wb}	± 0.4 K

Differential pressures

Δp_w	± 1 kPa

Flows

q_w	± 1 %

Electric Power

P_T	± 0.5 %
$P_{auxilary}$	± 1 W

Table values

Density

ρ_w	± 1 kg/m^3	(source: SP REPORT 1994:01)

Specific heat capacity at constant pressure

c_{pw}	± 10^{-4} kJ/(kg. K)	(source: SP REPORT 1994:01)

Calculated data

P_{1hps}, P_H	± 2.4 %
COP_{hps}, COP	± 2.5 %

Nomenclature

Designations for EN14825:

SCOP	The units total seasonal coefficient of performance representing the whole heating season
$SCOP_{on}$	The average seasonal coefficient of performance in active mode (presenting the hours the heat pump's heating performance is activated)
$SCOP_{net}$	The average seasonal coefficient of performance in active mode excluding electricity consumption from supplementary electric heater, thermostat off, standby, off mode, and crankcase heating mode
P	**Power**
$P_{designh}$	Design load at $T_{designh}$ conditions
T	**Temperature**
$T_{designh}$	Reference design temperature condition for heating (outdoor air temperature)
T_{biv}	Bivalent temperature, where the unit is capable of covering 100% of the buildings heating load (outdoor air temperature)
TOL	Operation limit temperature

Designations for capacity tests:

Beteckningar		**Designations**
COP	**Värmefaktor**	**Coefficient of performance**
COP	Värmefaktor; total; rumsuppvärmning; korrigerad enligt EN 14511	Coefficient of performance; total; space heating; corrected according to EN 14511
COP_{hps}	Värmefaktor; total. rumsuppvärmning	Coefficient of performance. space heating for heat pump system
P	**El- och värmeeffekt**	**Power: electric (active) or thermal**
P_E	Effekt; el; totalt tillförd till värmepumpsystemet; korrigerad enligt EN 14511	Power; electrical; total input to heat pump system; corrected according to EN 14511
P_H	Effekt; värme; från värmepumpsystem till värmesänka. korrigerad enligt EN 14511	Heating capacity; from heat pump system to heat sink; corrected according to EN14511
P_{1hps}	Effekt; värme; från värmepumpsystem	Heating capacity; from heat pump

	till värmesänka	system to heat sink
P_T	Effekt; el; totalt tillförd till värmepumpsystemet	Power; electrical; total input to the heat pump system
q	**Volymflöde**	**Volume flow rate**
q_w	Volymflöde; värmeöverförande medium; varm	Volume flow rate; heat transfer medium; warm
t	**Temperatur**	**Temperature**
t_{amb}	Temperatur; omgivning	Temperature. ambient
t_{a5}	Temperatur; värmeöverförande medium; kall	Temperature; heat transfer medium; cold
t_w	Temperatur; värmeöverförande medium; varm	Temperature; heat transfer medium; warm
c_p	**Specifik värmekapacitet**	**Specific heat capacity**
c_{pw}	Specifik värmekapacitet. värmeöverförande medium; varm	Specific heat capacity; heat transfer medium; warm
Δp	**Differenstryck**	**Differential pressure**
Δp_w	Differenstryck; yttre; värmeöverförande medium; varm	Differential pressure; external; heat transfer medium; warm
ρ	**Densitet**	**Density**
ρ_w	Densitet. värmeöverförande medium; varm	Density; heat transfer medium; warm

Appendix 8

Index		Indices
amb	Omgivning	Ambient
c	Värmeöverförande medium; kall	Heat transfer medium; cold
def	Avfrostning	Defrost
e	Elektrisk	Electrical
h	Uppladdning	Heating up period
hp	Värmepump	Heat pump
hps	Värmepump system	Heat pump system
i	In till värmepump	Inlet to heat pump
m	Motor; kompressor	Motor; compressor
max	Maximal	Maximum
o	Ut från värmepump	Outlet from heat pump
p	Pump	Pump
s	Tomgång	Stand by
s	Standardiserad	Standardised
t	Tappning varmvatten	Draw off sanitary water; warm
w	Värmeöverförande medium; varm	Heat transfer medium; warm
wc	Tappvatten; kall	Sanitary water; cold
wh	Tappvatten; varm	Sanitary water; hot