



TEST REPORT

Report no.:

300-KLAB-15-008

Product:

Type: Split air to air heat pump

Electrolux: EXH12RLEWI (Indoor) & EXH12RLEWE (Outdoor)

Customer:

Electrolux

Date:

7 April 2015

Consultants:

Kamalathasan Arumugam & Lasse S e



TEST REPORT

Date: 2015.04.07 Page: 1 of 19
Report no.: 300-KLAB-15-008 Init.: LAS/JGW
File no.: Enclosures: 0

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Component: Brand: Electrolux
Type: Split air to air heat pump
Model: EXH12RLEWI (Indoor) & EXH12RLEWE (Outdoor)
Series no.: 31000001

Dates Component tested: February 2015

Procedure: EN 14825:2013 and EN 14511:2013 part 1, 2 and 3. Test procedure calorimeter room method.

Remarks: The unit was delivered by the customer. Installation and setting of the unit's control system was done according to the manufacturer's instructions.

Conditions: Accredited testing was carried out in compliance with the current guidelines laid down by DANAK (Danish Laboratory Accreditation Scheme), please see www.danak.dk, and in compliance with Danish Technological Institute's General Terms and Conditions regarding Commissioned Work Accepted by Danish Technological Institute, February 2013.

The test results apply to the tested products only.

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Division/Centre: Danish Technological Institute
Energy and Climate
Refrigeration Laboratory, Aarhus

Date:

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Lasse Sør
Head of laboratory



Objective

The objective of this report is to verify the declared energy class in both heating and cooling mode and to provide performance characteristics of the product in terms of the Seasonal Coefficient of Performance (SCOP) and Seasonal Energy Efficiency Ratio (SEER) according to EN 14825:2013. In order to calculate the SCOP and SEER, tests were carried out at the part load conditions stated below. Furthermore, the power consumption was measured at standby mode, thermostat off mode, off mode and crankcase heater mode.

Reference Heating Season Average

Part load conditions for reference SCOP and reference SCOP_{on} calculation of air-to-air heat pumps for the reference heating season "A" = average.

Heating season "A" average				
	Part load ratio	Part load ratio %	Outdoor air dry bulb (wet bulb) °C	Indoor air dry bulb °C
A	$(-7-16)/(T_{designh} -16)$	88	-7(-8)	20
B	$(+2-16)/(T_{designh} -16)$	54	2(1)	20
C	$(+7-16)/(T_{designh} -16)$	35	7(6)	20
D	$(+12-16)/(T_{designh} -16)$	15	12(11)	20
E	$(TOL-16)/(T_{designh} -16)$		TOL	20
F	$(T_{bivalent}-16)/(T_{designh} -16)$		T _{bivalent}	20

$T_{designh}$ = -10°C (reference design temperature at reference heating season average)

$T_{bivalent}$ = -7°C (lowest outdoor temperature point at which the heat pump has a capacity which enables it to meet 100 % of the heating demand)

TOL = -10°C. In order to have the correct heating capacity supplied by the heat pump at the lowest bin temperature for average climate zone, -10°C was chosen as TOL. This ensures the most correct SCOP value.



Reference Heating Season Colder

Part load conditions for reference SCOP and reference SCOP_{on} calculation of air-to-air heat pumps for the reference heating season "C" = Colder.

Heating season "C" average				
	Part load ratio	Part load ratio %	Outdoor air dry bulb (wet bulb) °C	Indoor air dry bulb °C
A	$(-7-16)/(T_{designh} -16)$	61	-7(-8)	20
B	$(+2-16)/(T_{designh} -16)$	37	2(1)	20
C	$(+7-16)/(T_{designh} -16)$	24	7(6)	20
D	$(+12-16)/(T_{designh} -16)$	11	12(11)	20
G	$(-15-16)/(T_{designh} -16)$	82	-15	20
E	$(TOL-16)/(T_{designh} -16)$		TOL	20
F	$(T_{bivalent}-16)/(T_{designh} -16)$		T _{bivalent}	20

$T_{designh} = -22^{\circ}\text{C}$ (reference design temperature at reference heating season colder)

$T_{bivalent} = -12^{\circ}\text{C}$ (lowest outdoor temperature point at which the heat pump has a capacity which enables it to meet 100 % of the heating demand)

$TOL = -22^{\circ}\text{C}$. In order to have the correct heating capacity supplied by the heat pump at the lowest bin temperature for colder climate zone, -22°C was chosen as TOL. This ensures the most correct SCOP value

Reference Cooling Season

Part load conditions for reference SEER and reference SEER_{on} calculation of air-to-air air conditioners for the reference cooling season.

	Part load ratio	Part load ratio %	Outdoor air dry bulb °C	Indoor air dry bulb (wet bulb) °C
A	$(35-16)/(T_{designc} -16)$	100	35	27(19)
B	$(30-16)/(T_{designc} -16)$	74	30	27(19)
C	$(25-16)/(T_{designc} -16)$	47	25	27(19)
D	$(20-16)/(T_{designc} -16)$	21	20	27(19)

$T_{designc} = 35^{\circ}\text{C}$ (reference design temperature at cooling mode)



Main Test Results (Cooling and Average)

Type:				Single split air to air heat pump			
Brand:				Electrolux			
Model:				EXH12RLEWI (Indoor) & EXH12RLEWE (Outdoor)			
Serial no.:				31000001			
Production year:				n.a			
Refrigerant type:				R410A			
Refrigerant charge:				1.3kg			
Function (indicate if present)				If function includes heating: Indicate the heating season the information relates to. Indicated values should relate to one heating season at a time. Include at least the heating season 'Average'			
				Average	Yes		
Cooling	Yes			Warmer	No		
Heating	Yes			Colder	No		
Item	symbol	value	unit	Item	symbol	value	unit
Declared by manufacture design load				Declared by manufacture seasonal efficiency			
cooling	Pdesignc	x.x	kW	cooling	SEER	x.x	-
heating/Average	Pdesignh	x.x	kW	heating/Average	SCOP	x.x	-
heating/Warmer	Pdesignh	x.x	kW	heating/Warmer	SCOP	x.x	-
heating/Colder	Pdesignh	x.x	kW	heating/Colder	SCOP	x.x	-
Measured design load				Measured on & reference seasonal efficiency			
cooling	Pdesignc		kW	cooling	SEERon/SEERref	8.94/8.60	-
heating/Average	Pdesignh*	3.37	kW	heating/Average	SCOPon/SCOPref	4.81/4.80	-
heating/Warmer	Pdesignh	x.x	kW	heating/Warmer	SCOPon/SCOPref	x.x	-
heating/Colder	Pdesignh	x.x	kW	heating/Colder	SCOPon/SCOPref	x.x	-
Measured capacity cooling, at indoor temperature 27(19)°C and outdoor temperature Tj				Measured energy efficiency ratio, at indoor temperature 27(19)°C and outdoor temperature Tj			
Tj=35°C	Pc	3.73	kW	Tj=35°C	EER	3.98	-
Tj=30°C	Pc	2.60	kW	Tj=30°C	EER	6.98	-
Tj=25°C	Pc	1.64	kW	Tj=25°C	EER	10.57	-
Tj=20°C	Pc	1.50	kW	Tj=20°C	EER	14.55	-
Measured capacity for heating/Average season, at indoor temperature 20°C and outdoor temperature Tj				Measured coefficient of performance/Average season, at indoor temperature 20°C and outdoor temperature Tj			
Tj=-10°C	Ph	3.26	kW	Tj=-10°C	COP	2.78	-
Tj=-7°C	Ph	2.98	kW	Tj=-7°C	COP	3.18	-
Tj=2°C	Ph	1.79	kW	Tj=2°C	COP	4.95	-
Tj=7°C	Ph	1.17	kW	Tj=7°C	COP	5.66	-
Tj=12°C	Ph	1.22	kW	Tj=12°C	COP	7.12	-
Tj=bivalent temperature	Ph	2.98	kW	Tj=bivalent temperature	COP	3.18	-
Tj=operating limit	Ph	3.26	kW	Tj=operating limit	COP	2.78	-
Bivalent temperature				Operating limit temperature			
heating/Average	Tbiv	-7	°C	heating/Average	Tol	-10	°C
heating/Warmer	Tbiv	x	°C	heating/Warmer	Tol	x	°C
heating/Colder	Tbiv	x	°C	heating/Colder	Tol	x	°C
Cycling interval capacity				Cycling interval efficiency			
for cooling	Pcycc	x.x	kW	for cooling	EERcyc	x.x	-
for heating	Pcyh	x.x	kW	for heating	COPcyc	x.x	-
Measured degradation co-efficient				Applied degradation co-efficient			
cooling	Cdc	x.x	-	heating	Cdh	0.25	-
Electric power input in power modes other than 'activ mode' - heating/cooling mode				Annual electricity consumption including off, standby, thermostat and crankcase heater mode			
off mode	Poff	1	W	cooling	Qce		kWh/a
standby mode	Psb	1	W	heating/Average	Qhe	983	kWh/a
thermostat-off mode	Pto	11	W	heating/Warmer	Qhe	x	kWh/a
crankcase heater mode	Pck	1	W	heating/Colder	Qhe	x	kWh/a
Capacity control				Other items			
fixed	No			Sound power level (indoor/outdoor)	Lwa	x.x/x.x	dB(A)
staged	No			Global warming potential	GWP	x	kgCO2 eq.
variable	Yes			Rated air flow (indoor/outdoor)	-	x/x	m3/h

Note: * Calculated by means of the heating capacity measured at t_{bivalent}



Main Test Results (Colder)

Type:	Single split air to air heat pump		
Brand:	Electrolux		
Model:	EXH12RLEWI (Indoor) & EXH12RLEWE (Outdoor)		
Serial no.:	31000001		
Production year:	n.a		
Refrigerant type:	R410A		
Refrigerant charge:	1.3 kg		
Function (indicate if present)	If function includes heating: Indicate the heating season the information relates to. Indicated values should relate to one heating season at a time. Include at least the heating season 'Average'		
Cooling	No	Average	
Heating	Yes	Warmer	
		Colder	
		No	
		No	
		Yes	
Item	symbol	value	unit
Declared by manufacture design load			
cooling	Pdesignc	x.x	kW
heating/Average	Pdesignh	x.x	kW
heating/Warmer	Pdesignh	x.x	kW
heating/Colder	Pdesignh	x.x	kW
Declared by manufacture seasonal efficiency			
cooling	SEER	x.x	-
heating/Average	SCOP	x.x	-
heating/Warmer	SCOP	x.x	-
heating/Colder	SCOP	x.x	-
Measured design load			
cooling	Pdesignc	x.x	kW
heating/Average	Pdesignh	x.x	kW
heating/Warmer	Pdesignh	x.x	kW
heating/Colder	Pdesignh*	3.67	kW
Measured on & reference seasonal efficiency			
cooling	SEERon/SEERref	x.x	-
heating/Average	SCOPon/SCOPref	x.x	-
heating/Warmer	SCOPon/SCOPref	x.x	-
heating/Colder	SCOPon/SCOPref	3.85/3.85	-
Measured capacity cooling, at indoor temperature 27(19)°C and outdoor temperature Tj			
Tj=35°C	Pc	x.x	kW
Tj=30°C	Pc	x.x	kW
Tj=25°C	Pc	x.x	kW
Tj=20°C	Pc	x.x	kW
Measured energy efficiency ratio, at indoor temperature 27(19)°C and outdoor temperature Tj			
Tj=35°C	EER	x.x	-
Tj=30°C	EER	x.x	-
Tj=25°C	EER	x.x	-
Tj=20°C	EER	x.x	-
Measured capacity for heating/Colder season, at indoor temperature 20°C and outdoor temperature Tj			
Tj=-22°C	Ph	1.55	kW
Tj=-15°C	Ph	2.20	kW
Tj=-10°C	Ph	2.51	kW
Tj=-7°C	Ph	2.26	kW
Tj=2°C	Ph	1.42	kW
Tj=7°C	Ph	0.93	kW
Tj=12°C	Ph	1.09	kW
Tj=bivalent temperature	Ph	2.51	kW
Tj=operating limit	Ph	1.55	kW
Measured coefficient of performance/Colder season, at indoor temperature 20°C and outdoor temperature Tj			
Tj=-22°C	COP	2.01	-
Tj=-15°C	COP	2.59	-
Tj=-10°C	COP	2.99	-
Tj=-7°C	COP	3.20	-
Tj=2°C	COP	5.14	-
Tj=7°C	COP	5.96	-
Tj=12°C	COP	7.39	-
Tj=bivalent temperature	COP	2.99	-
Tj=operating limit	COP	2.01	-
Bivalent temperature			
heating/Average	Tbiv	x	°C
heating/Warmer	Tbiv	x	°C
heating/Colder	Tbiv	-10	°C
Operating limit temperature			
heating/Average	Tol	x	°C
heating/Warmer	Tol	x	°C
heating/Colder	Tol	-22	°C
Cycling interval capacity			
for cooling	Pcycc	x.x	kW
for heating	Pcyh	x.x	kW
Cycling interval efficiency			
for cooling	EERcyc	x.x	-
for heating	COPcyc	x.x	-
Measured degradation co-efficient			
cooling	Cdc	x.x	-
Applied degradation co-efficient			
heating	Cdh	0.25	-
Electric power input in power modes other than 'activ mode' - heating			
off mode	Poff	1	W
standby mode	Psb	1	W
thermostat-off mode	Pto	11	W
crankcase heater mode	Pck	1	W
Annual electricity consumption including off, standby, thermostat and crankcase heater mode			
cooling	Qce	x.x	kWh/a
heating/Average	Qhe	1335	kWh/a
heating/Warmer	Qhe	x	kWh/a
heating/Colder	Qhe	x	kWh/a
Capacity control			
fixed	No		
staged	No		
variable	Yes		
Other items			
Sound power level (indoor/outdoor)	Lwa	x.x/x.x	dB(A)
Global warming potential	GWP	x	kgCO2 eq.
Rated air flow (indoor/outdoor)	-	x/x	m3/h

Note: * Calculated by means of the heating capacity measured at t_bivalent



Calculation of SCOP_{on} and reference SCOP (Heating, Average)

The calculation of SCOP is based on the measured values shown in the table containing the main test results. If the measured heating capacity of the heat pump is within $\pm 10\%$ of the heat demand at the different part loads, the heat demand covered by the heat pump is set equal to the heat demand according to EN14825, chapter 7.4.2.2.

Data for SCOP calculation

	Outdoor air	Part load ratio	Part load	Measured capacity	COP at measured capacity COP _m	Degradation coefficient Cd	Capacity ratio CR	COP at part load COP _{pl}
	[°C]	[%]	[kW]	[kW]	[-]	[-]	[-]	[-]
A	-7	88	2.98	2.98	3.18	0.25	1.00	3.18
B	2	54	1.81	1.79	4.95	0.25	1.00	4.95
C	7	35	1.17	1.17	5.66	0.25	1.00	5.66
D	12	15	0.52	1.22	7.12	0.25	0.42	6.09
E(TOL)	-10	100	3.37	3.26	2.78	0.25	1.00	2.78
F(Bivalent)	-7	88	2.98	2.98	3.18	0.25	1.00	3.18

	Hours	Power input measured	Power input applied for SCOP calculation	Annual energy input
	[h]	[W]	[W]	[kWh]
Thermostat Off mode	179	11	10	1.77
Off mode	0	1	1	0.00
Crankcase Heater	179	1	0	0.00
Standby mode	0	1	1	0.00
			Total	1.77

Note: Prior to the SCOP calculation, the power consumption during standby mode is deducted from both the thermostat off mode and the crankcase heater mode, according to EN14825:2013.



Heating Mode - Reference Heating Season Average

	Outdoor temperature (dry bulb)	Hours	Heat demand	Heat demand covered by heat pump	Electrical back up heater	COP(pl)	Annual heat demand	Annual energy input including electrical back up heater
	Tj	hj	Ph(Tj)		elbu(Tj)		hj x Ph(Tj)	
	[°C]	[h]	[kW]	[kW]	[kW]	[-]	[kWh]	[kWh]
E(TOL)	-10	1	3.37	3.26	0.11	2.78	3.37	1.28
	-9	25	3.24	3.17	0.07	2.91	81.01	29.01
	-8	23	3.11	3.07	0.04	3.05	71.55	24.05
A and F(bivalent)	-7	24	2.98	2.98	0.00	3.18	71.55	22.50
	-6	27	2.85	2.85	0.00	3.38	76.99	22.80
	-5	68	2.72	2.72	0.00	3.57	185.09	51.80
	-4	91	2.59	2.58	0.00	3.77	235.90	62.57
	-3	89	2.46	2.45	0.00	3.97	219.18	55.26
	-2	165	2.33	2.32	0.00	4.16	384.96	92.46
	-1	173	2.20	2.19	0.00	4.36	381.20	87.43
	0	240	2.07	2.05	0.00	4.56	497.72	109.23
	1	280	1.94	1.92	0.00	4.75	544.38	114.53
B	2	320	1.81	1.79	0.00	4.95	580.68	117.31
	3	357	1.69	1.66	0.00	5.09	601.55	118.14
	4	356	1.56	1.54	0.00	5.23	553.72	105.79
	5	303	1.43	1.42	0.00	5.38	432.01	80.36
	6	330	1.30	1.29	0.00	5.52	427.73	77.52
C	7	326	1.17	1.17	0.00	5.66	380.29	67.19
	8	348	1.04	1.04	0.00	5.75	360.85	62.79
	9	335	0.91	0.91	0.00	5.83	303.95	52.10
	10	315	0.78	0.78	0.00	5.92	244.97	41.38
	11	215	0.65	0.65	0.00	6.01	139.34	23.19
D	12	169	0.52	0.52	0.00	6.09	87.62	14.38
	13	151	0.39	0.39	0.00	6.18	58.72	9.50
	14	105	0.26	0.26	0.00	6.27	27.22	4.34
	15	74	0.13	0.13	0.00	6.36	9.59	1.51
						Total	6961.12	1448.41
							SCOP_on	4.81
							SCOP_ref	4.80



Equation for the calculation of reference SCOP valid for reversible split air-to-air heat pumps and air conditioners:

$$SCOP = \frac{P_{designh} \times H_{he}}{\frac{P_{designh} \times H_{he}}{SCOP_{on}} + H_{TO} \times P_{TO} + H_{SB} \times P_{SB} + H_{CK} \times P_{CK} + H_{OFF} \times P_{OFF}}$$

Where:

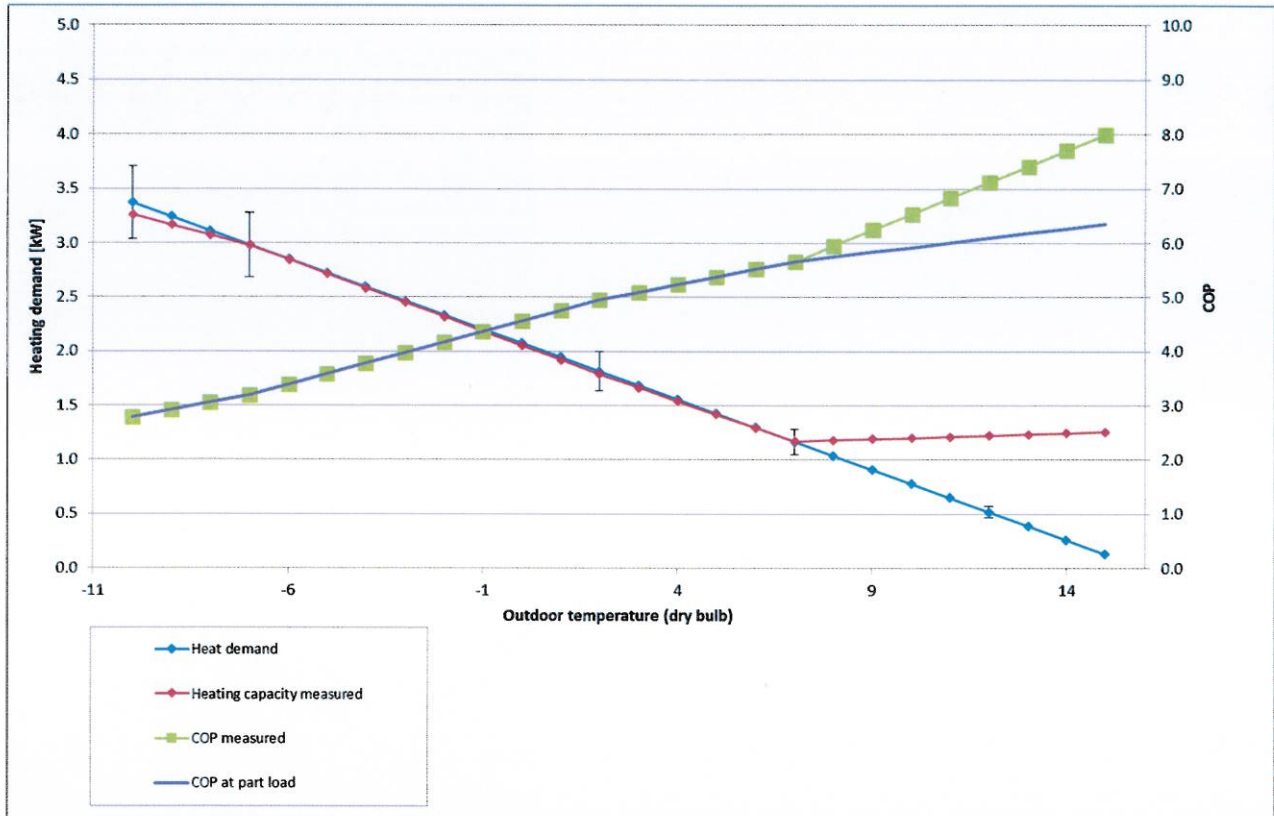
For the reference heating season average:

- $P_{designh}$ = Heating load of the building at design temperature, kW
- H_{he} = Number of equivalent heating hours (1400), h
- $H_{TO}, H_{SB}, H_{CK}, H_{OFF}$ = Number of hours for which the unit is considered to work in thermostat off mode (179h), standby mode (0h), crankcase heater mode (179h) and off mode (0h), respectively
- $P_{TO}, P_{SB}, P_{CK}, P_{OFF}$ = Electricity consumption during thermostat off mode, standby mode, crankcase heater mode and off mode, kW, respectively

For the reference heating season colder:

- $P_{designh}$ = Heating load of the building at design temperature, kW
- H_{he} = Number of equivalent heating hours (2100), h
- $H_{TO}, H_{SB}, H_{CK}, H_{OFF}$ = Number of hours for which the unit is considered to work in thermostat off mode (131h), standby mode (0h), crankcase heater mode (131h) and off mode (0h), respectively
- $P_{TO}, P_{SB}, P_{CK}, P_{OFF}$ = Electricity consumption during thermostat off mode, standby mode, crankcase heater mode and off mode, kW, respectively

Reference Heat Demand and Measured Part Load Capacity of the Heat Pump Season Average



The heating capacity of the heat pump was adjusted by means of the inverter in order to fit within 10 % of the reference heat demand. For part load conditions above 10 % of the heating demand, a degradation factor is applied to the measured COP. For part load conditions below 10 % of the heating demand, electrical heating is applied to reach the full heating demand. The corrected COP is illustrated in the diagram as 'COP at part load'.



Calculation of SCOP_{on} and reference SCOP (Heating, Colder)

The calculation of SCOP is based on the measured values shown in the table containing the main test results. If the measured heating capacity of the heat pump is within $\pm 10\%$ of the heat demand at the different part loads, the heat demand covered by the heat pump is set equal to the heat demand according to EN14825, chapter 7.4.2.2.

Data for SCOP calculation

	Outdoor air	Part load ratio	Part load	Measured capacity	COP at measured capacity COP _m	Degradation coefficient C _d	Capacity ratio CR	COP at part load COP _{pl}
	[°C]	[%]	[kW]	[kW]	[-]	[-]	[-]	[-]
A	-7	61	2.98	2.98	3.18	0.25	1.00	3.18
B	2	37	1.82	1.79	4.95	0.25	1.00	4.95
C	7	24	1.17	1.17	5.66	0.25	1.00	5.66
D	12	11	0.52	1.23	7.12	0.25	0.42	6.09
E(TOL)	-22	100	4.93	2.59	2.09	0.25	1.00	2.09
F(Bivalent)	-12	74	3.63	3.63	2.44	0.25	1.00	2.44
G	-15	82	4.02	3.37	2.37	0.25	1.00	2.37

	Hours	Power input measured	Power input applied for SCOP calculation	Annual energy input
	[h]	[W]	[W]	[kWh]
Thermostat Off mode	131	11	10	1.31
Off mode	0	1	1	0.00
Crankcase Heater	131	1	0	0.00
Standby mode	0	1	1	0.00
			Total	1.31

Note: Prior to the SCOP calculation, the power consumption during standby mode is deducted from both the thermostat off mode and the crankcase heater mode, according to EN14825:2013.



Heating Mode - Reference Heating Season Colder

	Outdoor temperature (dry bulb)	Hours	Heat demand	Heat demand covered by heat pump	Electrical back up heater	COP(p)	Annual heat demand	Annual energy input including electrical back up heater
	Tj	hj	Ph(Tj)		elbu(Tj)		hj x Ph(Tj)	
	[°C]	[h]	[kW]	[kW]	[kW]	[-]	[kWh]	[kWh]
E(TOL)	-22	1	4.93	2.59	2.34	2.09	4.93	3.58
	-21	6	4.80	2.70	2.10	2.13	28.80	20.20
	-20	13	4.67	2.81	1.86	2.17	60.72	41.00
	-19	17	4.54	2.92	1.62	2.21	77.19	49.97
	-18	19	4.41	3.04	1.37	2.25	83.81	51.76
	-17	26	4.28	3.15	1.13	2.29	111.31	65.22
G	-16	39	4.15	3.26	0.89	2.33	161.91	89.37
	-15	41	4.02	3.37	0.65	2.37	164.90	85.03
	-14	35	3.89	3.46	0.43	2.39	136.22	65.76
F(bivalent)	-13	52	3.76	3.54	0.22	2.42	195.64	87.54
	-12	37	3.63	3.63	0.00	2.44	134.41	55.04
	-11	41	3.50	3.50	0.00	2.59	143.62	55.46
	-10	43	3.37	3.37	0.00	2.74	145.05	52.99
A	-9	54	3.24	3.24	0.00	2.88	175.14	60.71
	-8	90	3.11	3.11	0.00	3.03	280.23	92.41
	-7	125	2.98	2.98	0.00	3.18	372.99	117.29
	-6	169	2.85	2.85	0.00	3.38	482.36	142.85
	-5	195	2.72	2.72	0.00	3.57	531.27	148.68
	-4	278	2.59	2.58	0.00	3.77	721.34	191.34
	-3	306	2.47	2.45	0.00	3.97	754.29	190.16
	-2	454	2.34	2.32	0.00	4.16	1060.21	254.65
	-1	385	2.21	2.19	0.00	4.36	849.13	194.75
	0	490	2.08	2.05	0.00	4.56	1017.14	223.22
B	1	533	1.95	1.92	0.00	4.75	1037.25	218.21
	2	380	1.82	1.79	0.00	4.95	690.20	139.43
	3	228	1.69	1.66	0.00	5.09	384.54	75.52
	4	261	1.56	1.54	0.00	5.23	406.34	77.63
	5	279	1.43	1.42	0.00	5.38	398.16	74.06
	6	229	1.30	1.29	0.00	5.52	297.10	53.84
C	7	269	1.17	1.17	0.00	5.66	314.09	55.49
	8	233	1.04	1.04	0.00	5.75	241.83	42.09
	9	230	0.91	0.91	0.00	5.83	208.88	35.81
	10	243	0.78	0.78	0.00	5.92	189.16	31.96
	11	191	0.65	0.65	0.00	6.00	123.90	20.63
D	12	146	0.52	0.52	0.00	6.09	75.77	12.44
	13	150	0.39	0.39	0.00	6.18	58.38	9.45
	14	97	0.26	0.26	0.00	6.26	25.17	4.02
	15	61	0.13	0.13	0.00	6.35	7.91	1.25
Total							12151.28	3190.81
							SCOP_on	3.81
							SCOP_ref	3.81



Equation for the calculation of reference SCOP valid for reversible split air-to-air heat pumps and air conditioners:

$$SCOP = \frac{P_{designh} \times H_{he}}{\frac{P_{designh} \times H_{he}}{SCOP_{on}} + H_{TO} \times P_{TO} + H_{SB} \times P_{SB} + H_{CK} \times P_{CK} + H_{OFF} \times P_{OFF}}$$

Where:

For the reference heating season average:

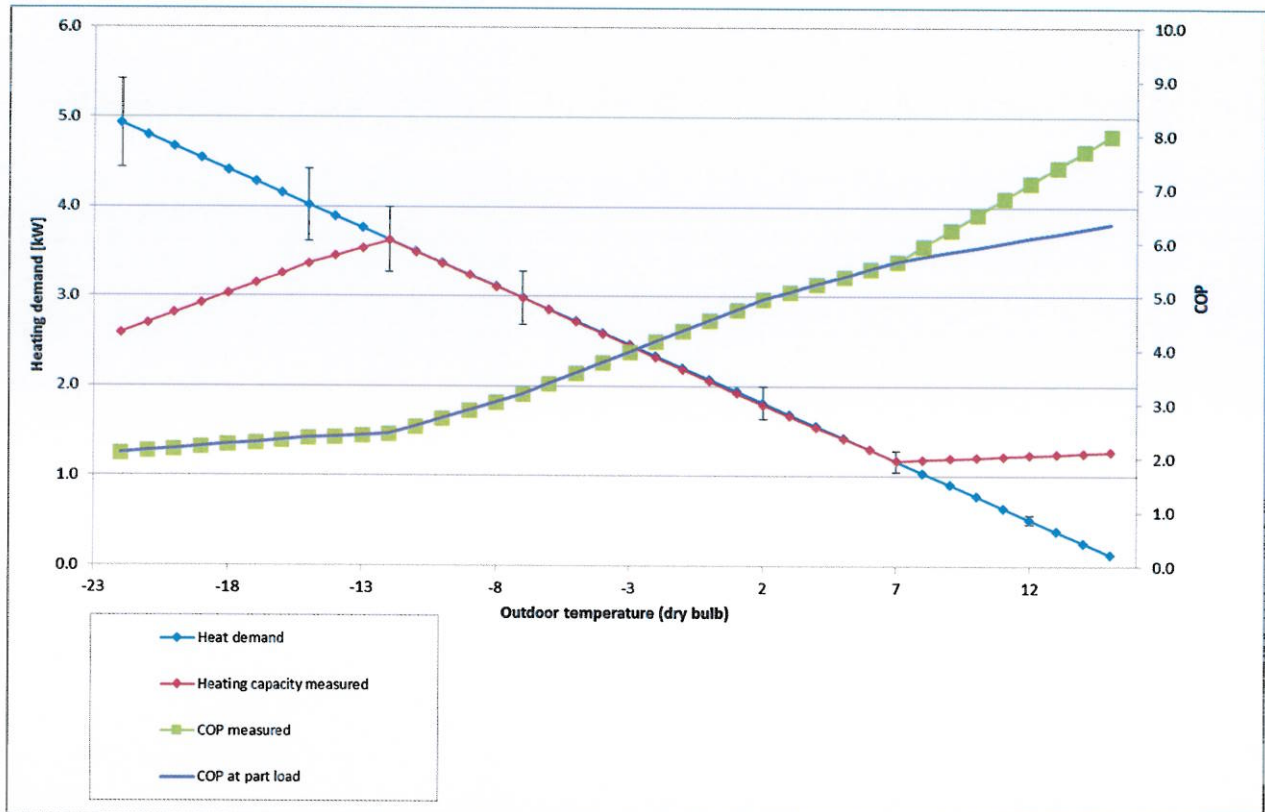
- $P_{designh}$ = Heating load of the building at design temperature, kW
- H_{he} = Number of equivalent heating hours (1400), h
- $H_{TO}, H_{SB}, H_{CK}, H_{OFF}$ = Number of hours for which the unit is considered to work in thermostat off mode (179h), standby mode (0h), crankcase heater mode (179h) and off mode (0h), respectively
- $P_{TO}, P_{SB}, P_{CK}, P_{OFF}$ = Electricity consumption during thermostat off mode, standby mode, crankcase heater mode and off mode, kW, respectively

For the reference heating season colder:

- $P_{designh}$ = Heating load of the building at design temperature, kW
- H_{he} = Number of equivalent heating hours (2100), h
- $H_{TO}, H_{SB}, H_{CK}, H_{OFF}$ = Number of hours for which the unit is considered to work in thermostat off mode (131h), standby mode (0h), crankcase heater mode (131h) and off mode (0h), respectively
- $P_{TO}, P_{SB}, P_{CK}, P_{OFF}$ = Electricity consumption during thermostat off mode, standby mode, crankcase heater mode and off mode, kW, respectively



Reference Heat Demand and Measured Part Load Capacity of the Heat Pump Season Colder



The heating capacity of the heat pump was adjusted by means of the inverter in order to fit within 10 % of the reference heat demand. For part load conditions above 10 % of the heating demand, a degradation factor is applied to the measured COP. For part load conditions below 10 % of the heating demand, electrical heating is applied to reach the full heating demand. The corrected COP is illustrated in the diagram as 'COP at part load'.



Calculation of SEER_{on} and reference SEER

Cooling Mode

The calculation of SEER is based on the measured values shown in the table containing the main test results. If the measured cooling capacity of the air conditioner is within ±10 % of the cooling demand at the different part loads, the cooling demand covered by the air conditioner is set equal to the cooling demand according to EN14825, chapter 7.4.2.2.

Data for SEER calculation

	Outdoor air	Part load ratio	Part load	Measured capacity	EER at measured capacity EER _m	Degradation coefficient Cd	Capacity ratio CR	EER at part load EER _{pl}
	[°C]	[%]	[kW]	[kW]	[-]	[-]	[-]	[-]
A	35	1900	3.73	3.73	3.98	0.25	1.00	3.98
B	30	1400	2.75	2.60	6.98	0.25	1.00	6.98
C	25	900	1.77	1.64	10.57	0.25	1.00	10.57
D	20	400	0.79	1.50	14.55	0.25	0.52	12.81

	Hours	Power input measured	Power input applied for EER calculation	Annual energy input
	[h]	[W]	[W]	[kWh]
Thermostat Off mode	221	19	19	4.13
Off mode	0	1	1	0.00
Crankcase Heater	2672	1	0	0.00
Standby mode	2142	1	1	1.61
			Total	5.74

Note: Prior to the SEER calculation, the power consumption during standby mode is deducted from both the thermostat off mode and the crankcase heater mode, according to EN14825:2013.



Cooling Mode

	Outdoor temperature (dry bulb)	Hours	Cooling demand	Cooling capacity	EER(pl)	Annual cooling demand	Annual energy input
	Tj	hj	Ph(Tj)			hj x Ph(Tj)	
	[°C]	[h]	[kW]	[kW]	[-]	[kWh]	[kWh]
	17	205	0.20	1.42	12.81	40.24	3.14
	18	227	0.39	1.45	12.81	89.13	6.96
	19	225	0.59	1.48	12.81	132.51	10.34
D	20	225	0.79	1.50	12.81	176.68	13.79
	21	216	0.98	1.53	12.36	212.02	17.15
	22	215	1.18	1.56	11.92	253.25	21.25
	23	218	1.37	1.58	11.47	299.58	26.12
	24	197	1.57	1.61	11.02	309.39	28.08
C	25	178	1.77	1.64	10.57	314.50	29.75
	26	158	1.96	1.83	9.85	310.18	31.48
	27	137	2.16	2.02	9.13	295.85	32.39
	28	109	2.36	2.22	8.42	256.78	30.51
	29	88	2.55	2.41	7.70	224.59	29.17
B	30	63	2.75	2.60	6.98	173.15	24.81
	31	39	2.94	2.83	6.38	114.84	18.00
	32	31	3.14	3.05	5.78	97.37	16.85
	33	24	3.34	3.28	5.18	80.10	15.46
	34	17	3.53	3.50	4.58	60.07	13.12
A	35	13	3.73	3.73	3.98	48.49	12.18
	36	9	3.93	3.96	3.98	35.34	8.88
	37	4	4.12	4.18	3.98	16.49	4.14
	38	3	4.32	4.41	3.98	12.96	3.26
	39	1	4.52	4.63	3.98	4.52	1.13
	40	0	4.71	4.86	3.98	0.00	0.00
					Total	3558.03	397.97
						SEER_on	8.94
						SEER_ref	8.60



Equation for the calculation of reference SEER valid for reversible split air-to-air heat pumps and air conditioners:

$$SEER = \frac{Q_c \times H_{ce}}{\frac{Q_c \times H_{ce}}{SEER_{on}} + H_{TO} \times P_{TO} + H_{SB} \times P_{SB} + H_{CK} \times P_{CK} + H_{OFF} \times P_{OFF}}$$

Where:

$P_{designc}$ = Cooling load of the building at design temperature, kW

H_{he} = Number of equivalent cooling hours (350), h

$H_{TO}, H_{SB}, H_{CK}, H_{OFF}$ = Number of hours for which the unit is considered to work in thermostat off mode (221h), standby mode (2142h), crankcase heater mode (2672h) and off mode (0h), respectively

$P_{TO}, P_{SB}, P_{CK}, P_{OFF}$ = Electricity consumption during thermostat off mode, standby mode, crankcase heater mode and off mode, kW, respectively

Reference Cooling Demand and Measured Part Load Capacity of the Air Conditioner

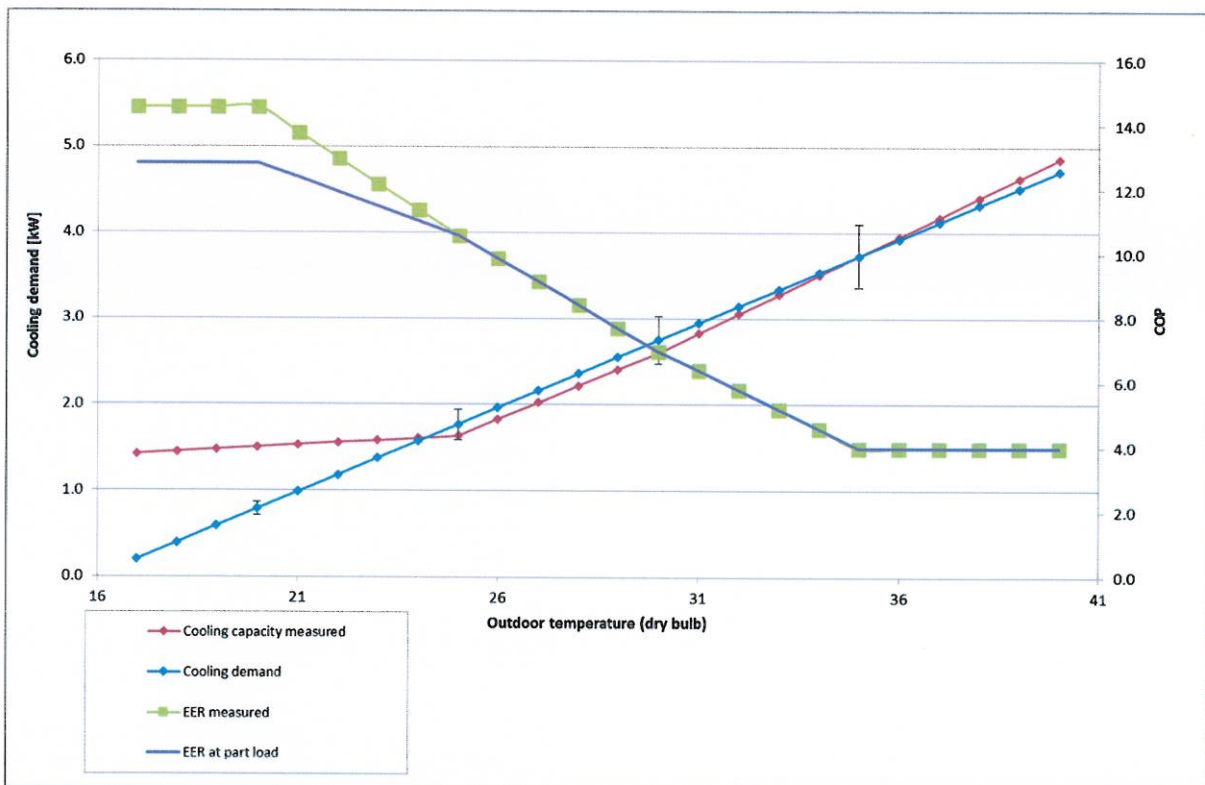


Figure 2: The cooling capacity of the air conditioner was adjusted by means of the inverter in order to fit within 10 % of the reference cooling demand. For test conditions that are not within the 10 %, a degradation factor is applied to the measured EER. The corrected EER is illustrated in the diagram as 'EER at part load'.



 DANAK

TEST Reg., no. 300



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Indoor Unit








Outdoor Unit





Rating Plate – indoor unit

		
Electrolux		
Model	PNC	Serial No.
EXH12RLEWI	946 373 019	31000001
AC 220-240V~/50Hz Max. Input: 1700W Max. Current: 7.5A Refrigerant R410A/1.3kg		Phase: 1 Weight: 11kg Outdoor unit IP: IP24
Capacity	Heating 4000W	Cooling 3500W
Input	960W	850W
Current	4.5A	3.85A
Operating pressure: Hi: 4.3Mpa Lo: 2.5Mpa		
Additional refrig. charge: 20g/m		
Contains fluorinated greenhouse gases covered by the Kyoto Protocol		
 7 332543 360154		
Made in China		
RoHS 		 6322XXXXXX

50550 GWH12TB-K3DHE5H/I



4G57240000004



Rating Plate – outdoor unit

Electrolux		
Model	PNC	Serial No.
EXH12RLEWE	946 373 069	31000001
AC 220-240V~/50Hz Max. Input: 1700W Max. Current: 7.5A Refrigerant R410A/1.3kg		Phase: 1 Weight: 43kg Outdoor unit IP: IP24
Capacity	Heating 4000W	Cooling 3500W
Input	960W	850W
Current	4.5A	3.85A
Operating pressure: Hi: 4.3Mpa Lo: 2.5Mpa		
Additional refrig. charge: 20g/m		
Contains fluorinated greenhouse gases covered by the Kyoto Protocol		
 7 332543 360185		
Made in China		
RoHS		 6322XXXXXX

