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## **SAT (Site acceptance test) test results – Rev00**

### **P2004625 – SVAF: Sea- and sewage water test heat pump test results**

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*Udarbejdet af*  
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## 1 Preface

This document describes the results from SAT test performed to evaluate the heat pump delivered by GEA. The SAT test is described in another document "P2004625-SVAF-SAT test-Rev04". The heat pump is installed at Sjælandsbroens sewage pumping station.

The heat pumps have passed the test on all points except for test 2.6 Saturated temperature limit on intermediate stage. Here the limit on the low stage compressors discharge pressure and high stage compressors suction pressure kept the system from reaching the expected limits. This is being worked on by the manufacturer of the compressors GEA and is expected soon to be in place.



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## 2.1 - Performance test - Seawater



	Start	Finish	Time			
Date: 14/3/2019	12:21	13:11				
Adjustments	Sensor	Design	12:21	12:30	12:56	13:11
District heating inlet temperature	TT4250	50°C	50,4	50,1	50	50,1
District heating outlet temperature	TT4223	80°C	79	78,7	78,3	78,7
District heating flow	FT4261	144m <sup>3</sup> /h	153	134	138,2	139
Seawater inlet temperature	TT4125	4,7°C	4,7	4,7	4,8	4,8
Seawater outlet temperature	TT4223	1,5°C	1,6	1,6	1,6	1,6
Seawater flow to each evaporator	FT4263/FT4162	497,1	501,1/460	502,1/456	494/452	497/453
Requirements						
Total COP <sub>H</sub> minimum (0 -> -9%)		2,87 to 3,19	2,91	3,02	3,09	2,72
District heating load (0 -> -5%)		4815 to 5069kW	4700	4900	5000	4700
Average COP <sub>H</sub> over one hour			2,99			
Heating average load over one hour			4830			

Accepted	X
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### Comments:

Trying to increase the capacity by allowing the heat pumps to go beyond their initially adjusted suction limits. We are on within the limit for COP and capacity.

## 2.2 - Performance test - Sewage water



	Start	Finish	Time			
Date: 19/3/2019	12:04	13:36				
Adjustments	Sensor	Design	12:36	12:53	13:21	13:36
District heating inlet temperature	TT4250	50°C	50,1	50	50,3	50
District heating outlet temperature	TT4223	80°C	80	79,6	79,9	80,3
District heating flow	FT4261	140.7	129,6	133,2	142	138
Sewage inlet temperature HP1	TT4127	7	7,9	7,9	7,9	8
Sewage outlet temperature HP1	TT4128	4	5,2	5,2	5,2	5,4
Sewage inlet temperature HP2	TT4125	10	10,7	10,8	10,8	10,8
Sewage outlet temperature HP2	TT4125	7	7,9	7,9	7,9	8
Sewage flow to evaporators	FT4162	529.2	568/524	559,/518	574/532	576/531
Requirements						
Total COP <sub>H</sub> minimum (0 -> -9%)		3,08 to 3,38	3,11	2,94	3,49	3,19
District heating load (0 -> -5%)		4480 to 4716kW	4500	4600	5500	5000
Average COP <sub>H</sub> over one hour			3,14			
Heating average load over one hour			4880			

Accepted	X
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### Comments:

VP1 LP is on suction pressure load inhibit. VP2 LP is in discharge pressure load inhibit. Filter on the sewage water site cleaned at 13:17.

## 2.3 - District heating maximum temperature



	Start	Finish	Time			
Date: 20/2/2019	13:00	14:00				
Adjustments	Sensor	Design	12:50	13:20	13:50	14:00
District heating inlet temperature	TT4250	57°C	44,4	44	44,2	44,2
District heating intermediate temp.	TT4227	74°C	72,8	72,8	73	73,2
District heating outlet temperature	TT4223	90°C	90	89,7	90,1	88,9
Heat pump system load	02EM4262	5000kW	5,1	5,07	5,11	5,05
COP			2,78	2,8	2,81	2,78
Source			Seawater			

Accepted	X
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**Comments:**

Instead of seawater this is run with sewage water because it gives more capacity and we have more stable system.

Setpoint 80°C adjusted at 09:23. The heat pump was ramped up to 90°C in steps of 3°C at 11:31.

Start of a stable running condition at 13:00.

## 2.4 - District heating minimum temperature



	Start	Finish	Time			
Date: 20/2/2019	08:20	09:20				
Adjustments	Sensor	Design	08:20	08:57	09:20	
District heating inlet temperature	TT4250	44°C	45	44,4	44,7	
District heating intermediate temp.	TT4227	56°C	58	58	58	
District heating outlet temperature	TT4223	66°C	66,6	66,3	66,4	
Heat pump system load	02EM4262	5000kW	4,73	4,64	4,6	
COP			3,24	3,23	3,25	
Source			Seawater			

Accepted	X
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**Comments:**  
 Instead of seawater this is run with sewage water because it gives more capacity and we have more stable system.

## 2.5 - District heating intermediate temperature limits



	Start	Finish	Time			
Date: 22/2/2019 & 14/3/2019						
Adjustments	Sensor	Design	10:22	10:41	10:56	11:16
<b>Min intermediate temperature</b>	22-02-2019					
District heating inlet temperature	TT4222	50°C	46,5	46,5	46,8	46,8
District heating intermediate temp.	TT4227	60°C	62,5	62,7	62,9	63
District heating outlet temperature	TT4227	80°C	79,3	79,9	80,2	80,3
Heat pump system load	02EM4262	3000kW	3,04	3,03	3,06	3,09
COP			3,17	3,09	3,11	3,13
Source			Seawater			
<b>Max intermediate temperature</b>	14-03-2019		<b>09:30</b>	<b>09:45</b>	<b>10:10</b>	<b>10:35</b>
District heating inlet temperature	TT4222	50°C	44,3	44	44,1	44,6
District heating intermediate temp.	TT4227	70°C	70	70	70,1	70,4
District heating outlet temperature	TT4223	80°C	79,5	79,6	79,9	80
Heat pump system load	02EM4262	3000kW	3500	3500	3500	3500
COP			2,88	2,93	2,89	2,88
Source			Seawater			

Accepted	X
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### Comments:

We could not finish the test on the 23/2/2019 since max intermediate temperature gave some problems. The test is restarted on the 14/3/2019 with seawater as a source.

## 2.6-1 - Saturated temperature limit on intermediate stage - HP1



	Start	Finish	Time			
Date: 26-03-2019 & 27/03/2019	11:01	11:15				
Adjustments	Sensor	Design	12:13	12:25	09:27	11:11
District heating inlet temperature	TT4250	50°C	43,9	45,2	43,5	43,8
District heating intermediate temp.	TT4227	68°C	65,5	65,4	64,9	64,5
District heating outlet temperature	TT4223	80°C	80,3	79,6	79,4	80,2
Compressors intermediate temp. HP1	TT500.01	25-40°C	34,6	34,2	33,5	32
Load HP1-LS		[%]	74	72	73	68
Load HP1-HS		[%]	81	79	80	80
Distribution factor		[%]	90	100	90	61
Set point HP1-LS		[bar]	11,92	12,1	11,92	11,4
Set point HP1-LS		[°C]	33,5	34	33,5	32,1
COP varmepumper			3,10/2,89	3,12/2,86	3,15/2,88	3,15/2,88
Heat pump system load	02EM4262	3700kW	3700	3700	3700	3800
			Normal	Max	Normal	Min
			26-03-2019	26-03-2019	27-03-2019	27-03-2019
Source			Seawater			

Accepted	
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### Comments:

Stable system at 11:01. Normal measurement at 11:10. Adjusted to max distribution factor at 11:17. The compressor stopped and we had to restart the system again. System stable again at 12:03. Adjusted to max distribution factor at 12:20. Change to minimum in steps at 13:36. We could control the compressor to min 10,2 bar on HP1-LS. The minimum was selected to be able to maintain the capacity. Min test could not be finished on the 26 so we continues on 27. System adjusted to 3700 kW capacity at 08:26. System stable at 08:58. Adjusted in steps to min distribution factor at 09:31. Min DF is where the limit on the suction pressure for the HP compressor is i.e. 11.4 barG and the max is where the max discharge pressure for the LP compressor i.e. 12,1 barG.



## 2.6-2 - Saturated temperature limit on intermediate stage - HP2



	Start	Finish	Time		
Date: 27-03-2019	00:56	11:35			
Adjustments	Sensor	Design	09:27	10:31	11:30
District heating inlet temperature	TT4250	50°C	43,5	43,9	43,6
District heating intermediate temp.	TT4227	68°C	64,9	65,3	65,1
District heating outlet temperature	TT4223	80°C	79,4	79,8	80,3
Compressors intermediate temp. HP2	TT500.01	25-40°C	33,5	33,9	32
Load HP2-LS		[%]	70	69	71
Load HP2-HS		[%]	77	76	81
Distribution factor		[%]	90	100	62
Set point HP2-LS		[bar]	11,92	12,1	11,41
Set point HP1-LS		[°C]	33,5	34	33,5
COP varmepumper			3,15/2,88	3,16/2,89	3,09/2,82
Heat pump system load	02EM4262	3700kW	3700	3700	3700
			Normal	Max	Min
Source			Seawater		

Accepted

### Comments:

Adjusted to max distribution factor at 09:56. Stable system at 10:06. Adjusted to min distribution factor at 11:15. Stable running condition at 11:30. Min DF is where the limit on the suction pressure for the HP compressor is i.e. 11.41 barG and the max is where the max discharge pressure for the LP compressor i.e. 12,1 barG.

## 2.7 - District heating capacity limit



	Start	Finish	Time			
Date: 19/3/2019 & 14/3/2019						
Adjustments	Sensor	Design				
<b>Max test</b>	14-03-2019		<b>12:36</b>	<b>12:53</b>	<b>13:21</b>	<b>13:36</b>
District heating inlet temperature	TT4250	50°C	50,4	50,1	50	50,1
District heating intermediate temp.	TT4257	68°C	66,3	65,6	66,6	66,6
District heating outlet temperature	TT4223	80°C	79	78,7	78,3	78,7
COP varmepumper			2,91	3,02	3,09	2,72
Heat pump system load (max)	02EM4262	5200kW	4700	4900	5000	4700
Average COP <sub>H</sub> over one hour			2,99			
Heating average load over one hour			4830			
<b>Min test</b>	19-03-2019		<b>15:36</b>	<b>15:48</b>	<b>16:04</b>	<b>16:27</b>
District heating inlet temperature	TT4250	50°C	45,6	45,6	45,1	44,7
District heating intermediate temp.	TT4257	68°C	69,6	69,3	69,4	69,3
District heating outlet temperature	TT4223	80°C	79,9	79,5	79,9	79,9
COP varmepumper			2,97	2,88	3,01	2,99
Heat pump system load (min)	02EM4262	Min	3100	3000	3100	3000
Average COP <sub>H</sub> over one hour			3,05			
Heating average load over one hour			2930			
Source			Seawater			

Accepted	X
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### Comments:

We use the values we got from the performance test for seawater as max and run the min capacity with seawater. The min capacity is reached as the lowest value where the heat pumps can run stable.

## 2.8 - Source side capacity limit



	Start	Finish	Time			
Date: 21/03/2019	11:30	13:13				
Adjustments	Sensor	Design	12:16	13:13		
District heating inlet temperature	TT4250	50°C	43,5	43,6		
District heating intermediate temp.	TT4257	68°C	65,5	64,8		
District heating outlet temperature	TT4223	80°C	80,6	79,9		
Heat pump system load	02EM4262	3000kW	3700	3600		
Seawater flow	FT4162+FT4163	145(m <sup>3</sup> /h)	116/105	504/460		
Sewage water flow through HP2	FT4162	Min/Max%	116	504		
COP			2,96/2,86	3,22/2,92		
			Min flow	Max flow		
Source			Seawater			

Accepted	X
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### Comments:

Start by reducing the flow on the seawater pump to 60% at 11:30. Low flow limit on VP2 100m<sup>3</sup>/h and on VP1 80m<sup>3</sup>/h. Increase the flow to 50% at 12:30. Increase again at 12:33 to 100%.

## 2.9-1 - Source side capacity distribution



	Start	Finish	Time		
Date: 20-03-2019	15:13	16:15			
Adjustments	Sensor	Design	15:36	16:01	16:15
District heating inlet temperature	TT4250	50°C	43,9	44	43,9
District heating intermediate temp.	TT4257	68°C	64,8	64,7	64,7
District heating outlet temperature	TT4223	80°C	79,9	79,8	79,9
COP			3,07/2,81	3,09/2,82	3,08/2,82
Heat pump system load VP2/VP2	02EM4262	3000kW	3600	3600	3600
Seawater flow (min/max)	FT4162+FT4163	78/310(m <sup>3</sup> /h)	373/508	502/452	525/421
Distribution on valves VP2/VP1		[%]	40/100	100/100	100/51
			Min VP2	Normal	Min VP1
Source			Seawater		

Accepted	X
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### Comments:

First flow to VP2 was reduced as much as possible on the control. Then both valves was adjusted to full open. Then the valve to VP1 was closed as much as possible i.e. 51%. This change was not noticed by the heat pumps. Then the valve into the evaporator was put into manual mode and closed further. Decided to redo this test because the lowest limit was not reached. The new test is 2.9-2.

## 2.9-2 - Source side capacity distribution



	Start	Finish	Time			
Date: 21-03-2019	08:08	11:20				
Adjustments	Sensor	Design	09:26	10:56	11:20	
District heating inlet temperature	TT4250	50°C	43,3	43,5	43,5	
District heating intermediate temp.	TT4257	68°C	64,3	65,2	64,5	
District heating outlet temperature	TT4223	80°C	79,4	80,5	79,3	
COP			3,2/2,96	3,27/3,06	3,14/2,94	
Heat pump system load VP2/VP2	02EM4262	3000kW	3600	3700	3600	
Seawater flow (min/max)	FT4162+FT4163	78/310(m <sup>3</sup> /h)	130/565	402/370	536/111	
Dsitribution on valves VP2/VP1		[%]	15/100	100/100	100/15	
			Min VP2	Normal	Min VP1	
Source			Seawater			

Accepted	X
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### Comments:

First we close the valve into evaporator for HP2 in steps until HP2 is on minimum capacity. At 08:43 we opened for the test heat exchanger to warm up the sewerwater to 9°C to be able to reduce the flow even more. Changed back to 100% on both valves at 09:30. The compressor VP2 closes down. Probably because the valve was changed to quickly. Some challenges in starting the system up again. The system started up at 10:10. The system stable again at 10:45. Starting to decrease the valve to VP1 at 11:02.

## 2.10-1 - Heat exchangers limits - Desuperheater HP1-LS



	Start	Finish	Time		
Date: 21-03-2019	13:00	14:51			
Adjustments	Sensor	Design	13:42	14:24	14:51
District heating inlet temperature	TT4250	50°C	43,6	43,6	43,1
District heating intermediate temp.	TT4257	68°C	64,7	64,7	64,4
District heating outlet temperature	TT4223	80°C	80,3	80,1	80,5
Heat pump system load	FT4261	3000kW	3700	3700	3700
Desuperheater HP1 LS flow	FT4269	3,5/8,8(m <sup>3</sup> /h)	34,39	25,9	1
Control signal		[%]	100	78,4	23
COP			3,19/2,89	3,26/2,92	3,24/2,94
			Max flow	Normal	Min flow
Source			Seawater		

Accepted	X
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### Comments:

The flow adjusted to normal control again at 13:48. Wait for 10 minutes inbetween measurements. Adjusted to min flow at 14:25. The system stable after changing to min flow at 14:41.

## 2.10-2 - Heat exchangers limits - Desuperheater VP2-LP



	Start	Finish	Time			
Date: 21-03-2019	15:00	15:50				
Adjustments	Sensor	Design	14:24	15:19	15:50	
District heating inlet temperature	TT4250	50°C	43,6	43,1	43,3	
District heating intermediate temp.	TT4257	68°C	64,7	65,3	64,8	
District heating outlet temperature	TT4223	80°C	80,1	80,2	80,1	
Heat pump system load	FT4261	3000kW	3700	3700	3700	
Desuperheater HP2 LS flow	FT4271	3,5/8,8(m <sup>3</sup> /h)	26,2	31	1	
Control signal		[%]	74	100	22	
COP			3,26/2,92	3,23/2,93	3,27/2,96	
Heat pump system load VP2/VP2	02EM4262	3000kW				
			Normal	Max	Min	
Source			Seawater			

Accepted	X
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### Comments:

Adjusted to max flow at 15:00. Stable heat pump at 15:05. Adjusted the flow to minimum at 15:24. Stable heat pump system at 15:40.

## 2.10-3 - Heat exchangers limits - Desuperheater VP1-HP



	Start	Finish	Time			
Date: 22-03-2019	09:22	10:12				
Adjustments	Sensor	Design	09:22	09:37	10:12	
District heating inlet temperature	TT4250	50°C	43,8	43,2	43	
District heating intermediate temp.	TT4257	68°C	65,4	65,1	63,1	
District heating outlet temperature	TT4223	80°C	80	79,9	80	
Heat pump system load	FT4261	3000kW	3700	3700	3700	
Desuperheater HP1 HS flow	FT4254	0,3/6,7(m <sup>3</sup> /h)	36	47,9	0,6	
Control signal		[%]	87,5	100	24	
COP HP/Samlet			3,12/2,86	3,13/2,87	3,10/2,84	
			Normal	Max	Min	
Source			Seawater			

Accepted	X
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### Comments:

The system is stable at 09:02. Adjustment to max flow at 09:26. System stable at 09:31. Adjusted to min flow at 09:41. Stable system at 10:02.



## 2.10-4 - Heat exchangers limits - Desuperheater VP2-HP



	Start	Finish	Time			
Date: 22-03-2019	10:29	11:20				
Adjustments	Sensor	Design	09:22	10:44	11:20	
District heating inlet temperature	TT4250	50°C	43,8	43	43,2	
District heating intermediate temp.	TT4257	68°C	65,4	64,8	65,1	
District heating outlet temperature	TT4223	80°C	80	79,9	79,7	
Heat pump system load	FT4261	3000kW	3700	3700	3700	
Desuperheater HP2 HS flow	FT4266	4,5/11(m <sup>3</sup> /h)	35,8	40,7	0,6	
Control signal		[%]	92,8	100	22	
COP			3,12/2,86	3,11/2,85	3,09/2,83	
			Normal	Max	Min	
Source			Seawater			

Accepted	X
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### Comments:

System stable at 10:29. Adjusted to max flow at 10:32. Stable system at 10:44. Adjusted to minimum flow at 10:51. System stable at 11:20.

## 2.10-5 - Heat exchangers limits - Oil cooler VP1-LS



	Start	Finish	Time		
Date: 25/03/2019	11:15	12:30			
Adjustments	Sensor	Design	11:30	11:55	12:30
District heating inlet temperature	TT4250	50°C	43,5	43,7	44,1
District heating intermediate temp.	TT4257	68°C	64,7	64,8	64,5
District heating outlet temperature	TT4223	80°C	80,2	80,5	80,2
Heat pump system load	FT4261	3000kW	3700	3600	3700
Oil cooler HP1 LS flow	FT4267	2,7/3,3(m <sup>3</sup> /h)	7,5	10,3	2
Control signal		[%]	60,1	100	35
COP			3,09/2,84	3,06/2,8	3,05/2,81
			Normal	Max	Min
Source			Seawater		

Accepted	X
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**Comments:**

The system is started at 10:30. The system stable at 11:04. Changed to max flow 11:40. Starts to reduce the flow at 11:56. First to 50%.

## 2.10-6 - Heat exchangers limits - Oil cooler VP2-LS



	Start	Finish	Time			
Date: 25/03/2019	12:32	13:30				
Adjustments	Sensor	Design	11:30	13:06	13:30	
District heating inlet temperature	TT4250	50°C	43,5	44	43,6	
District heating intermediate temp.	TT4257	68°C	64,7	65	65,2	
District heating outlet temperature	TT4223	80°C	80,2	80	80,3	
Heat pump system load	FT4261	3000kW	3700	3700	3700	
Oil cooler HP2 LS flow	FT4270	2,7/3,3(m <sup>3</sup> /h)	6,3	15,48	2,1	
Control signal		[%]	54	100	35	
COP			3,09/2,84	3,15/2,89	3,16/2,90	
			Normal	Max	Min	
Source			Seawater			

Accepted	X
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### Comments:

Adjuste to max flow at 12:36.

## 2.10-7 - Heat exchangers limits - Oil cooler VP1-HS



	Start	Finish	Time			
Date: 25/03/2019	13:33	15:31				
Adjustments	Sensor	Design	11:30	14:08	15:28	
District heating inlet temperature	TT4250	50°C	43,5	44,2	43,8	
District heating intermediate temp.	TT4257	68°C	64,7	66,3	64,6	
District heating outlet temperature	TT4223	80°C	80,2	80,1	79,5	
Heat pump system load	FT4261	3000kW	3700	3600	3600	
Oil cooler HP1 HS flow	FT4268	1,9/2,3(m <sup>3</sup> /h)	3,9	10,3	1,7	
Control signal		[%]	42	100	30	
COP			3,09/2,84	3,06/2,81	3,16/2,88	
Heat pump system load VP2/VP2	02EM4262	3000kW	Normal	Max	Min	
Source			Seawater			

Accepted	X
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**Comments:**  
 Max flow adjusted at 13:33.

## 2.10-8 - Heat exchangers limits - Oil cooler VP2-HS



	Start	Finish	Time			
Date: 26-03-2019	08:24	10:38				
Adjustments	Sensor	Design	09:54	08:35	10:38	
District heating inlet temperature	TT4250	50°C	42,3	43,2	43	
District heating intermediate temp.	TT4257	68°C	65,3	66	65,3	
District heating outlet temperature	TT4223	80°C	80,2	80,7	80,6	
Heat pump system load	FT4261	3000kW	3700	3600	3700	
Oil cooler HP2 HS flow	FT4272	4,1/5,0(m <sup>3</sup> /h)	9,7	22,4	6,4	
Control signal		[%]	63	100	54	
COP			3,11/2,84	3,09/2,86	3,17/2,91	
Heat pump system load VP2/VP2	02EM4262	3000kW	Normal	Max	Min	
Source			Seawater			

Accepted	X
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### Comments:

Started with max flow. Stable system at 08:25. Adjusted to min flow in steps at 08:40. The compressor stopped. Restarted the compressor and try to reduce the flow in smaller steps at 09:56. Min value found around 54% open valve. Then the oil temperature is around 77 which is the limit on the compressor. Stable system at 10:27.

## 2.10-9 - Heat exchangers limits - Subcooler VP1-HS



	Start	Finish	Time			
Date: 22/03/2019	11:48	12:56				
Adjustments	Sensor	Design	09:22	12:34	12:56	
District heating inlet temperature	TT4250	50°C	43,8	42,9	42,9	
District heating intermediate temp.	TT4257	68°C	65,4	65,1	64,8	
District heating outlet temperature	TT4223	80°C	80	80,3	79,7	
Heat pump system load	FT4261	3000kW	3700	3700	3600	
Subcooler HP1 HS flow	FT4263	2,2/6,7(m <sup>3</sup> /h)	14,9	20,9	1,1	
Control signal		[%]	64	100	23	
COP			3,17/2,89	3,14/3,87	3,10/2,83	
			Normal	Max	Min	
Source			Seawater			

Accepted	X
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### Comments:

System is stable at 11:48. Adjusted to max flow at 11:51. Stable system at 12: 10. Adjusted to min flow 12:38. System stable at 12:46.

## 2.10-10 - Heat exchangers limits - Subcooler VP2-HS



	Start	Finish	Time			
Date: 22/03/2019	13:00	13:41				
Adjustments	Sensor	Design	13:05	13:25	13:41	
District heating inlet temperature	TT4250	50°C	42,9	43	43,3	
District heating intermediate temp.	TT4257	68°C	64,5	65,5	64,9	
District heating outlet temperature	TT4223	80°C	80,2	79,8	80,4	
Heat pump system load	FT4261	3000kW	3700	3600	3600	
Subcooler HP2 HS flow	FT4265	3,5/17,0(m <sup>3</sup> /h)	22,4	24,4	1	
Control signal		[%]	90,1	100	23	
COP			3,07/2,81	3,11/2,84	3,04/2,79	
			Normal	Max	Min	
Source			Seawater			

Accepted	X
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### Comments:

The system is stable at 13:05. Adjusted to max flow at 13:05. Stable system at 13:13. Changed to min flow at 13:29.

## 2.11-1 - Start up and shut down times - Max capacity



	Start	Finish	Time			
Date: 20-03-2019	08:21	08:56				
Adjustments	Sensor	Design	08:36	08:41	08:53	08:56
District heating inlet temperature	TT4250	50°C	42,3	42,4	43,8	44
District heating intermediate temp.	TT4257	68°C	55,3	60,9	62,7	63,9
District heating outlet temperature	TT4223	80°C	62,5	70,8	75,3	76,95
Heat pump system load	02EM4262	5000kW	1400	2400	4300	4500
COP kompressorer/samlet			1,99/1,78	2,47/2,20	2,90/2,69	3,03/2,81
Start up time start		[Time]	08:21			
Start up time finished		[Time]	08:56			
COP Heat pumps/Total Average			1,47/1,34			
Shut down time start		[Time]	16:29			
Shut down time finished		[Time]	16:30			

Accepted	X
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### Comments:

The compressors start at 08:29. The end temperature on the district heating to the net could not reach 80°C because we didn't have the necessary capacity through the evaporators.



## 2.11-2 - Start up and shut down times - Intermediate capacity



	Start	Finish	Time			
Date: 21-03-2019	07:13	07:46				
Adjustments	Sensor	Design	07:25	07:34	07:40	07:46
District heating inlet temperature	TT4250	50°C	41,5	41,6	41,6	41,8
District heating intermediate temp.	TT4257	68°C	48,9	59,5	62,5	66,38
District heating outlet temperature	TT4223	80°C	55,4	70,8	75,1	81,7
Heat pump system load	02EM4262	5000kW	1000	2400	3000	2,96/2,74
COP kompressorer/samlet			1,76/1,59	2,62/2,28	2,64/2,50	3700
Start up time start		[Time]	07:13			
Start up time finished		[Time]	07:46			
COP Heat pumps/Total Average			2,39/2,17			
Shut down time start		[Time]				
Shut down time finished		[Time]				

Accepted	X
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### Comments:

The capacity for the system is reduced. The compressors started 07:18.