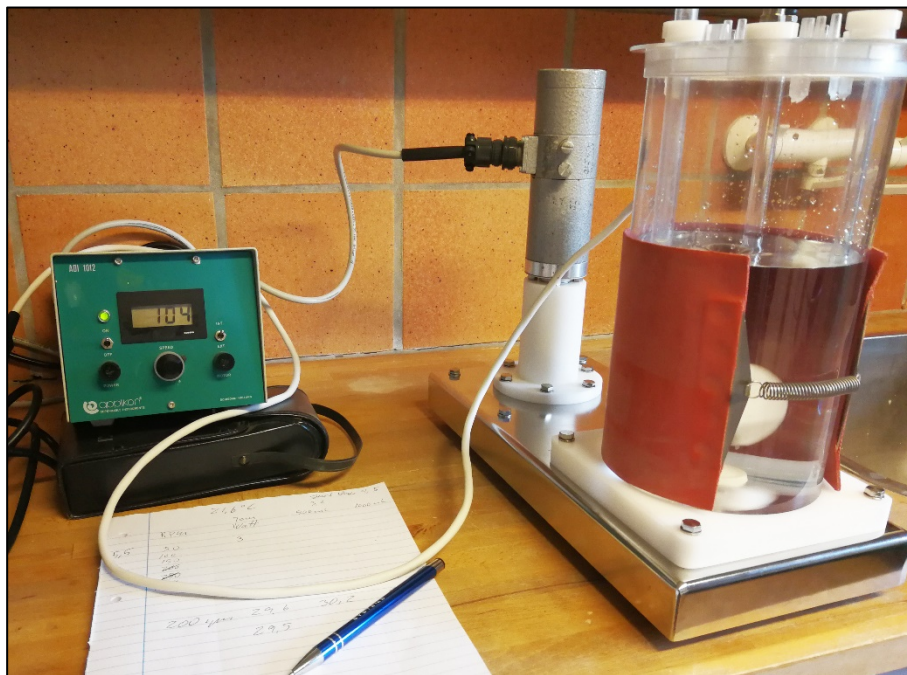


Heating blanket test

230 VAC heater testing on a 3,2-liter SUB containing 2 liter of water.



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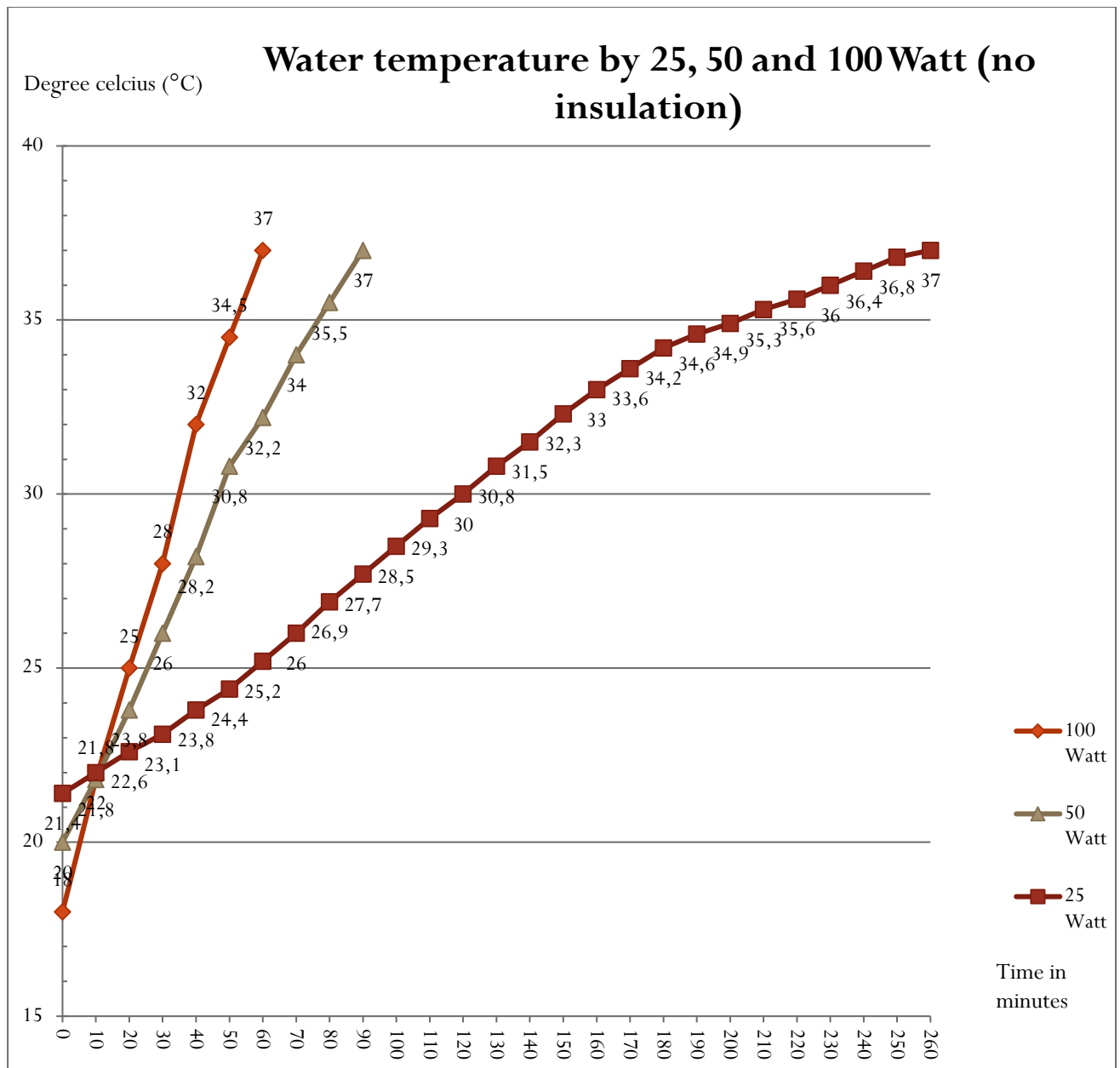
Written by: Jesper Julian Struve Andersen

Heating blanket test

230 VAC heater testing on a 3,2-liter SUB containing 2 liter of water.

The object of this report is to illustrate power needed to heat up media inside the SUB using a red heater that fits around OD 137 mm SUB.

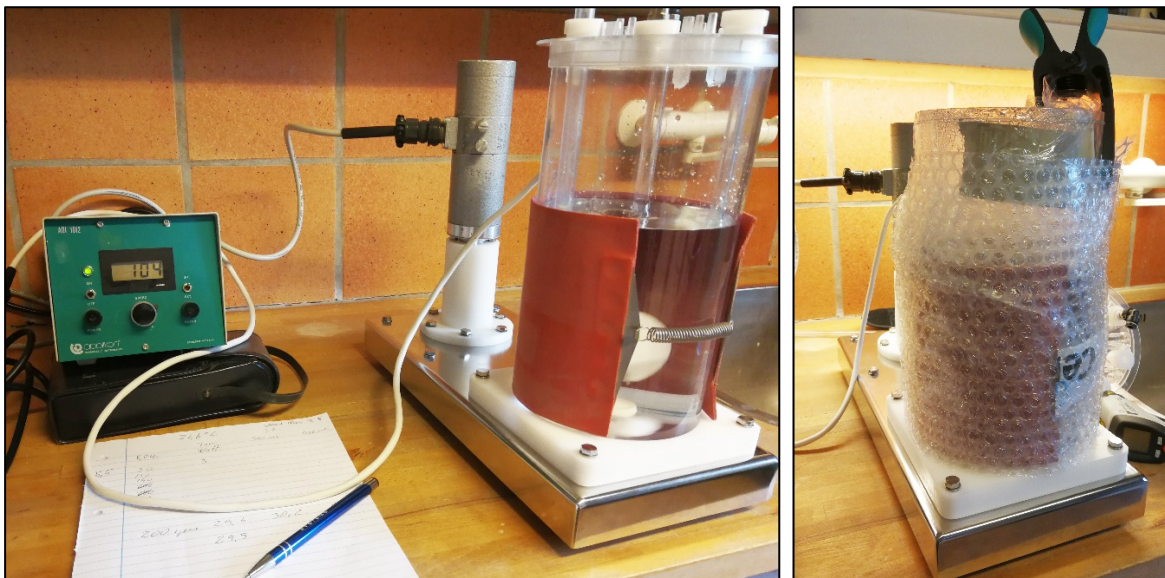
5 different tests - 50 Watt without insulation, 100 Watt without insulation, 2 tests with 25 Watt one with and one without insulation. The last test illustrate temperature drop inside the 3,2-liter SUB with insulation around the entire SUB.



Experimental setup

Used items for testing:

- 3,2-liter CellVessel SUB
- Red 230 VAC silicone heater, pn 22270
- MST(Magnetic-Stirrer-Table), pn 2250-S-12-A
- Applikon P100 VDC servo motor
- Applikon ADI 1012 motor controller
- Thermometer, digital
- Bubble wrap (insulation)



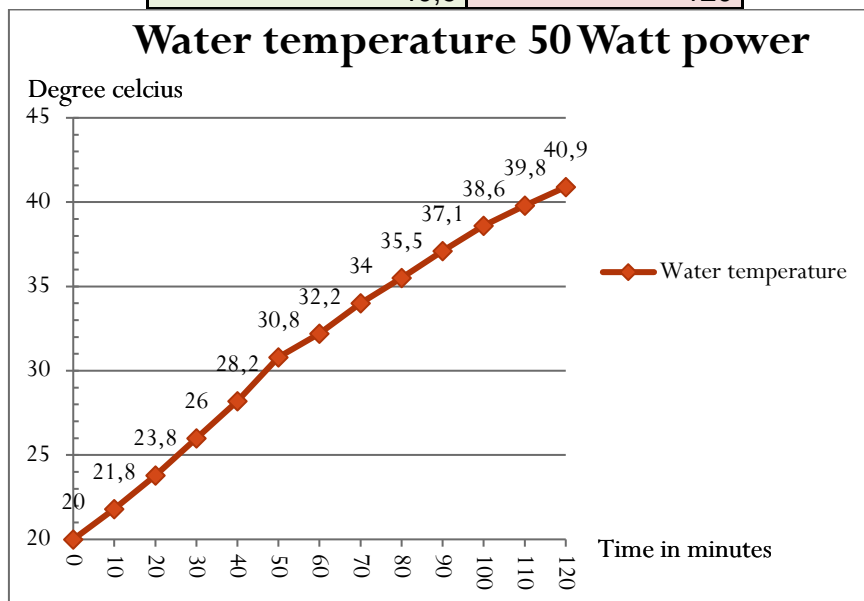
Information about setup

1. The controller is set to 100 rpm in every test run.
2. The SUB is filled with 2 liter of water in every test run.
3. The insulation is 1 layer of bubble wrap.
4. The blanket is operated at 25 and 50 and 100 Watt through altering voltage and measure Watt take-up.
5. Constant VAC added to the blanket – no regulation

Test 1: Test with 50 Watt on heater and no insolation

The test is to see how fast the water temperature is rising from room temperature 20°C to 40°C.

Test with 50 Watt power	
Degree Celsius (°C)	Time in minutes
20	0
21,8	10
23,8	20
26	30
28,2	40
30,8	50
32,2	60
34	70
35,5	80
37,1	90
38,6	100
39,8	110
40,9	120

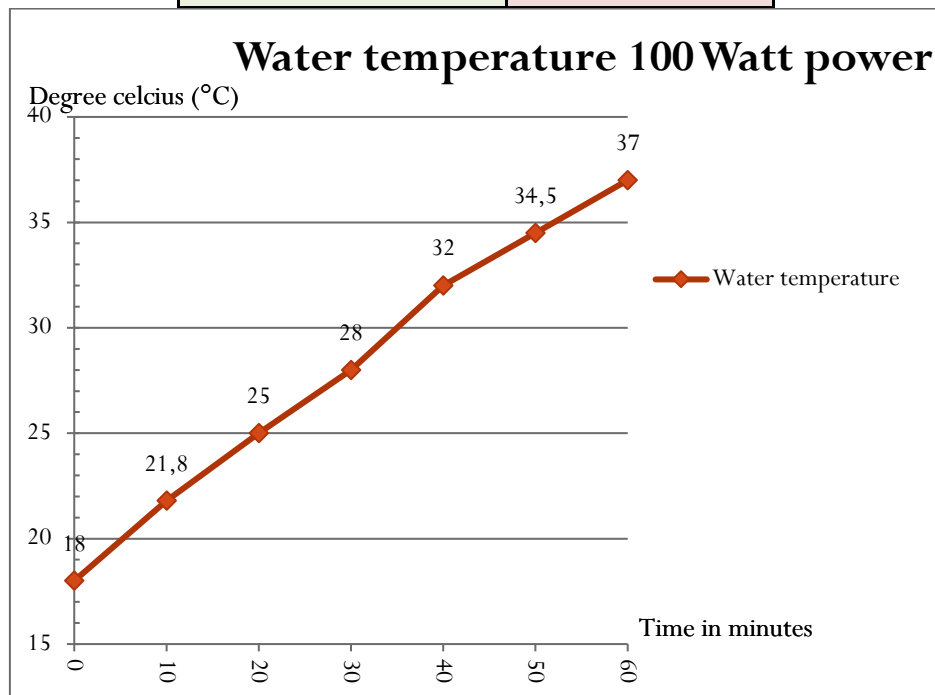


The test shows that it takes approximate 2 hours to reach a water temperature of 40°C. Or lift temperature 20 °C.

Test 2: Test with 100 Watt on heater and no insolation

The test is to see how fast the water temperature is rising from room temperature 20 °C to 37 °C.

Test with 100 Watt power	
Degree celcius (°C)	Time in minutes
18	0
21,8	10
25	20
28	30
32	40
34,5	50
37	60



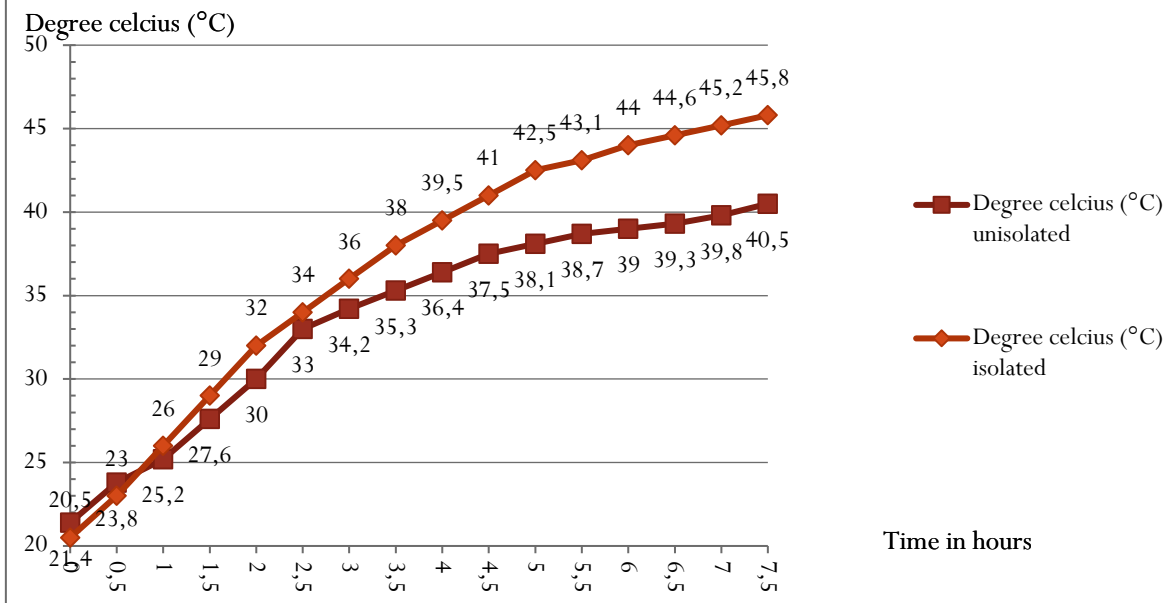
The test shows that the time is approximate 1 hour to reach a water temperature of 37 °C.

Test 3 and 4: Test with 25 Watt on heater with and without insulation

The test is to see how fast the water temperature is rising from room temperature $\approx 20\text{ }^{\circ}\text{C}$ to $40\text{ }^{\circ}\text{C}$.

Test with 25 Watt power		
Degree Celsius ($^{\circ}\text{C}$) un-insulated	Degree Celsius ($^{\circ}\text{C}$) insulated	Time in hours
21,4	20,5	0
23,8	23	0,5
25,2	26	1
27,6	29	1,5
30	32	2
33	34	2,5
34,2	36	3
35,3	38	3,5
36,4	39,5	4
37,5	41	4,5
38,1	42,5	5
38,7	43,1	5,5
39	44	6
39,3	44,6	6,5
39,8	45,2	7
40,5	45,8	7,5

Water temperature 25 Watt power



The test shows that the time is approximate 7 hours to reach a water temperature of $40\text{ }^{\circ}\text{C}$ without insulation and approximate 4 hours with insulation.

Test 5: Cooling the water with insolation

The test is to see how fast the water temperature is falling with insolation.

Cooling water with insolation	
Degree Celsius (°C)	Time in hours
46	0
43	0,5
40,5	1
38,8	1,5
36,9	2
35	2,5
33,5	3
32,5	3,5
31,6	4
30,4	4,5
29,5	5
28	5,5

