Acoustic Signatures of Heat Pumps

IEA HPT Annex 51

Effect of heat sinks and operation modes on acoustic emissions

Webinar, November 30th 2020

- Domestic heat pumps are designed to handle different heating systems *(floor heating-, radiator heating- or hot water system)*
- Water supply temperature of 35°C and 55°C
- How does it affect the emitting noise level?
- What are the causes?

- An example of an air to water heat pump.
- Change only the water temperature from 35°C to 55°C
- Maintain the heating capacity and the outdoor temperature

		A7/W35	A7/W55
Heating capacity	kW	7.0	7.3
Outdoor heat exchanger inlet	°C	7.0	7.0
Power input	kW	1.6	2.5
COP	-	4.4	2.9
Indoor heat exchanger inlet	°C	30.0	47.0
Indoor heat exchanger outlet	°C	35.0	55.0
Water flow rate	l/h	1200	790
Compressor speed	Hz	51	57
Fan speed	rpm	580	620
Sound power level	dB(A)	**59.0**	**62.0**

- Increase of emitting noise is **3 dB(A)**
- The power input, compressor- and fan speed are increased as well

		A7/W35	A7/W55
Heating capacity	kW	7.0	7.3
Outdoor heat exchanger inlet	°C	7.0	7.0
Power input	kW	1.6	2.5
COP	-	4.4	2.9
Indoor heat exchanger inlet	°C	30.0	47.0
Indoor heat exchanger outlet	°C	35.0	55.0
Water flow rate	l/h	1200	790
Compressor speed	Hz	51	57
Fan speed	rpm	580	620
Sound power level	dB(A)	**59.0**	**62.0**

Noise spectrum of the air-to-water heat pump for operating conditions of A7/W35 versus A7/W55. full load operation at A7/W55.

- An increase of water temperature results in an increase of emitting noise level, which is not desirable.

- In addition, it is preferred to run the heat pump with a reduced noise level, for an example during the night.

- Operating modes to reduce the emitting noise level

- Different manufactures – different names *(Silent mode, quiet mode, low noise operation mode)*

- How does it work?

- What are the costs?

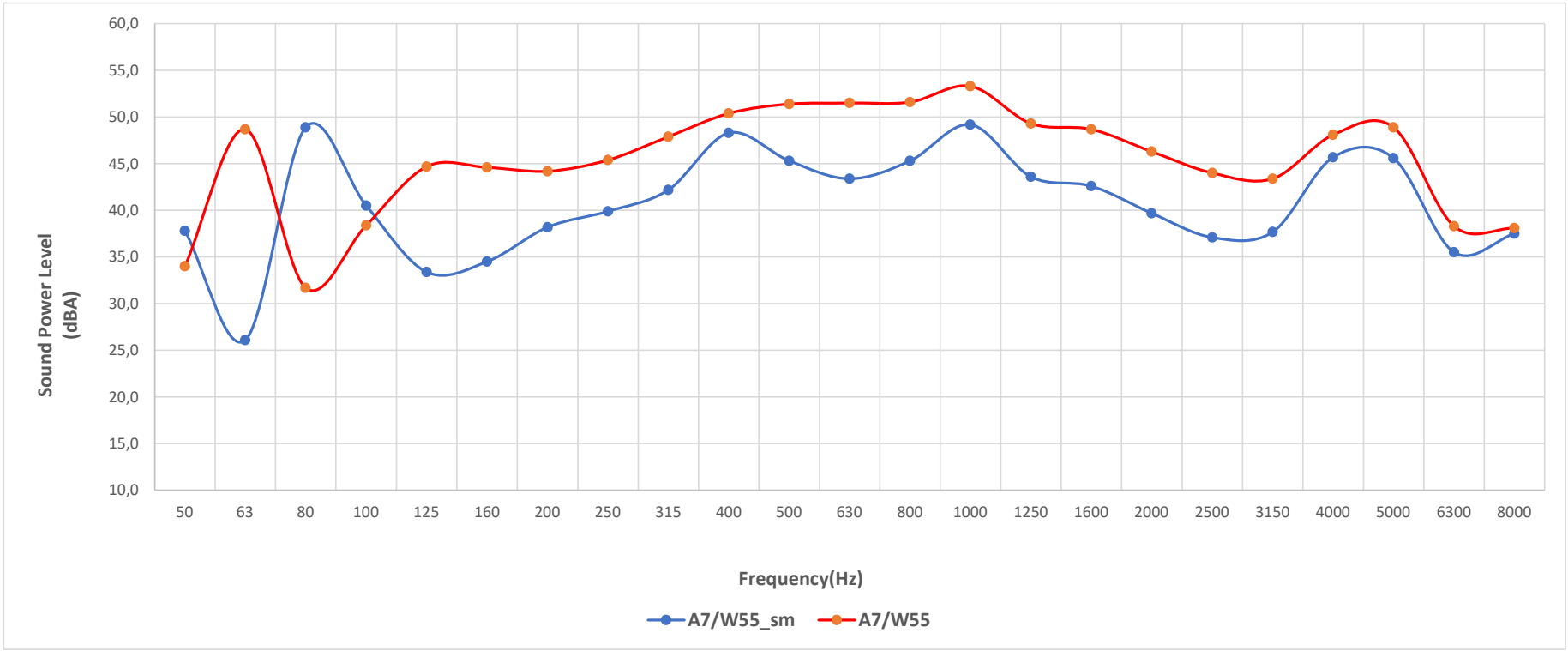
- An example of an air to water heat pump.
- Maintain the water temperature and the outdoor air temperature
- Silent mode

		A7/W55	A7/W55_silent mode
Heating capacity	kW	7.3	5.4
Outdoor heat exchanger inlet	°C	7.0	7.0
Power input	kW	2.5	1.8
COP	-	2.9	3.0
Indoor heat exchanger inlet	°C	47.0	47.0
Indoor heat exchanger outlet	°C	55.0	55.0
Water flow rate	l/h	790	580
Compressor speed	Hz	57	43
Fan speed	rpm	620	470
Sound power level	dB(A)	**62.0**	**57.0**

- Reduction of noise level by **5 dB(A)**
- The power input, compressor- and fan speed are reduced as well
- Coasts of a capacity reduction by **26%.**

		A7/W55	A7/W55_silent mode
Heating capacity	kW	7.3	5.4
Outdoor heat exchanger inlet	°C	7.0	7.0
Power input	kW	2.5	1.8
COP	-	2.9	3.0
Indoor heat exchanger inlet	°C	47.0	47.0
Indoor heat exchanger outlet	°C	55.0	55.0
Water flow rate	l/h	790	580
Compressor speed	Hz	57	43
Fan speed	rpm	620	470
Sound power level	dB(A)	**62.0**	**57.0**

Noise spectrum of the air-to-water heat pump for silent mode versus full load operation at A7/W55.



- In fact, the heat pump runs in part load condition. But the control strategies are not necessarily the same as silent mode.

- For the part load condition, the heating demand and the efficiency are on focus and it can be done by adjusting the compressor speed only.

- For the silent mode, the emitting noise level is on focus and It requires an optimal adjustment of the compressor- and fan speed.

Thank you for your attention