TESTING CAMPAIGN ON THE ENERGETICAL AND ACOUSTICAL BEHAVIOUR OF A HEAT PUMP // PART1

IEA HPT Annex 51 “Acoustic Signatures of Heat Pumps”

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AGENDA

- 1. Acoustic measurements: goals and suited devices
- 2. Deconstruction analysis: concept and experimental setup
- 3. Results

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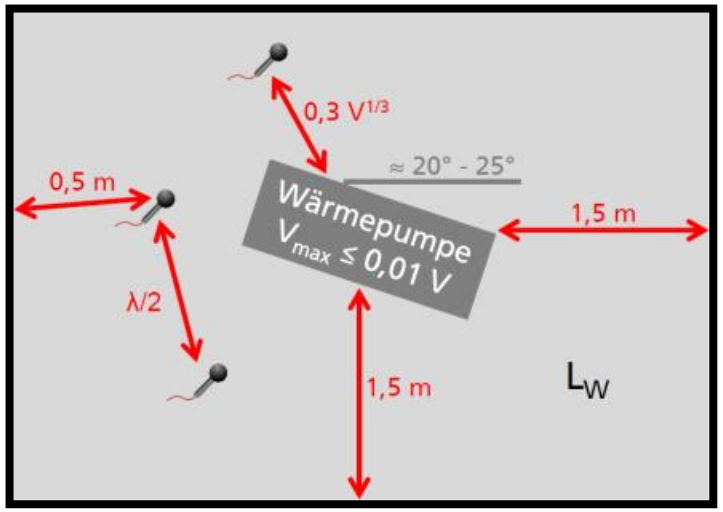
1. Acoustic measurements: goals and suited devices

- Microphones in reverberation chamber → Sound pressure → Sound Power

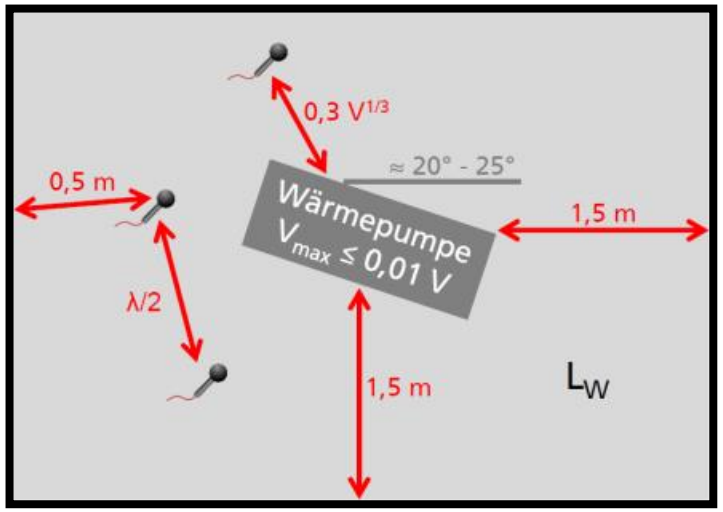


Source: avisolartech.com

1. Acoustic measurements: goals and suited devices

- Microphones in reverberation chamber → Sound pressure → Sound Power
- Comparison of spectra with accelerometers:

  → Identification of the contributions from the individual sound sources



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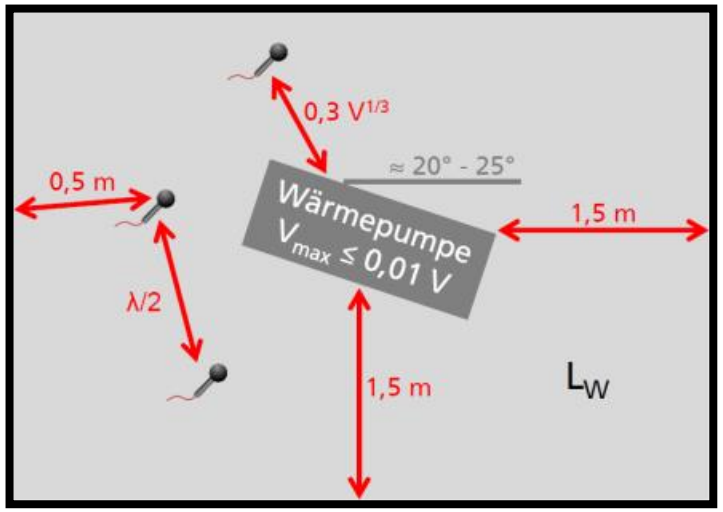

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- Microphones in reverberation chamber → Sound pressure → Sound Power
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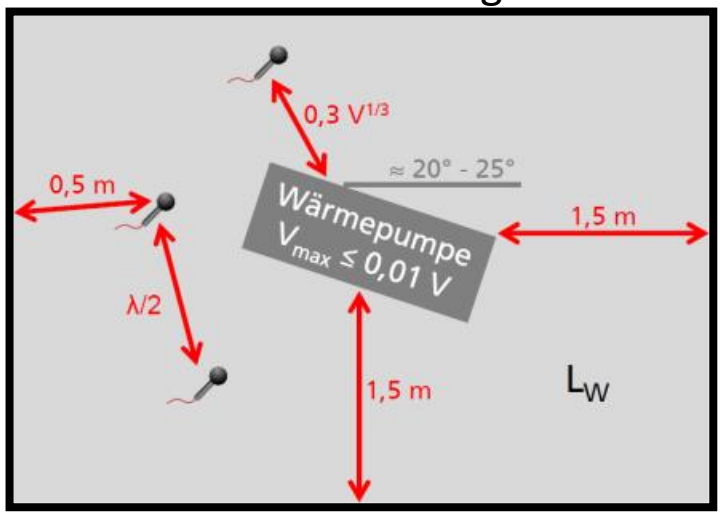
  → Identification of the contributions from the individual sound sources
- → **Assessment** of the overall noise emission

  but no direct insight into transfer paths or structural stress.



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1. Acoustic measurements: goals and suited devices

The 3D-Laservibrometer allows measurements of:

- local triaxial vibration velocities (similarly to accelerometers)
- without object contact
- many points in a short time with phase reference

  → acquisition of vibrations over a whole surface.

1. Acoustic measurements: goals and suited devices

The 3D-Laservibrometer allows measurements of:

- local triaxial vibration velocities (similarly to accelerometers)
- without object contact
- many points in a short time with phase reference

  → acquisition of vibrations over a whole surface.

→ Direct assessment of:

- precise excitation spectrum for each source
- transfer paths through the structure
- structure load/weaknesses (in theory even structure strain)

→ Also useful for **system design** and control strategy **improvements**

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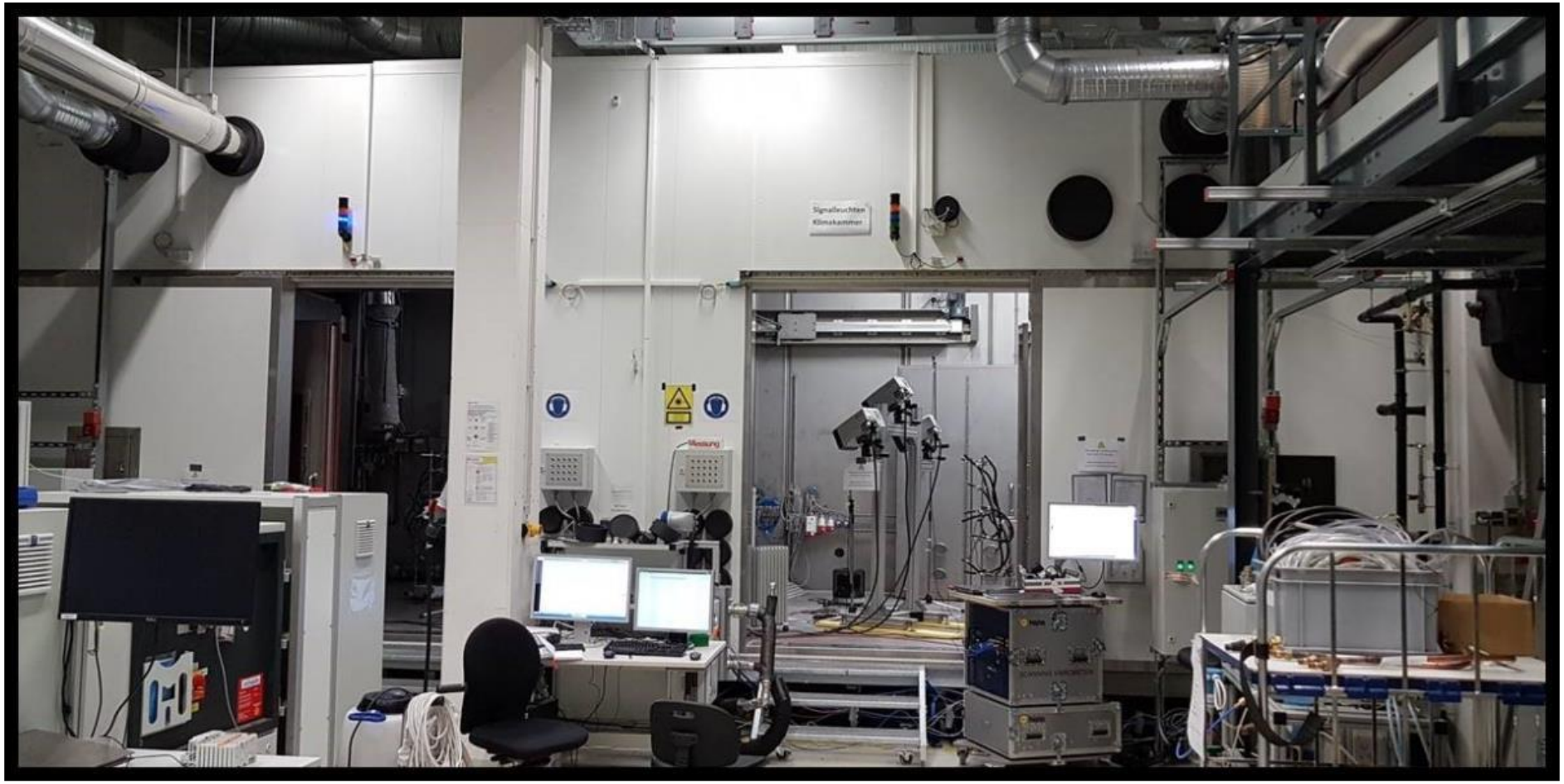
2. Deconstruction analysis: concept and experimental setup

- Thermic setup:

  Climatic chamber + cooling heat exchanger + power monitoring.



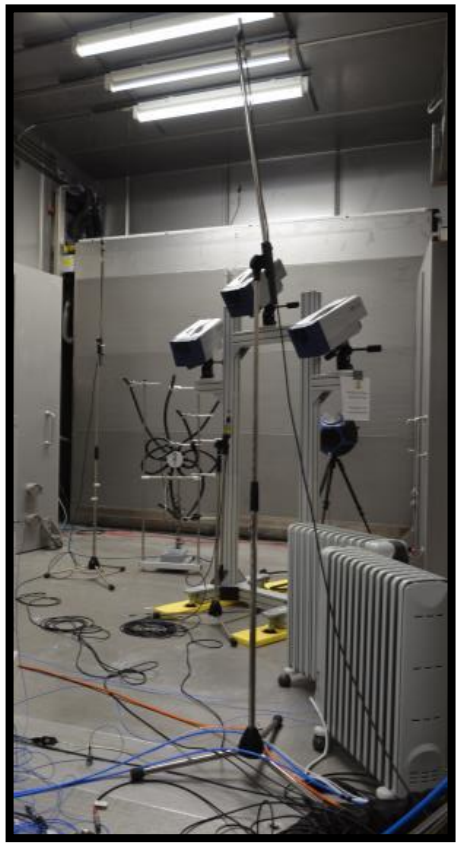
2. Deconstruction analysis: concept and experimental setup

- Thermic setup:

  Climatic chamber + cooling heat exchanger + power monitoring.

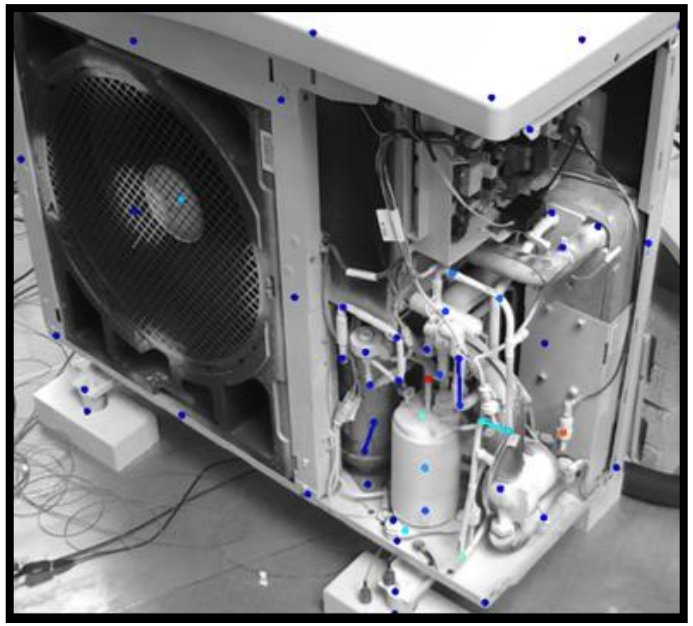
- Acoustic setup:

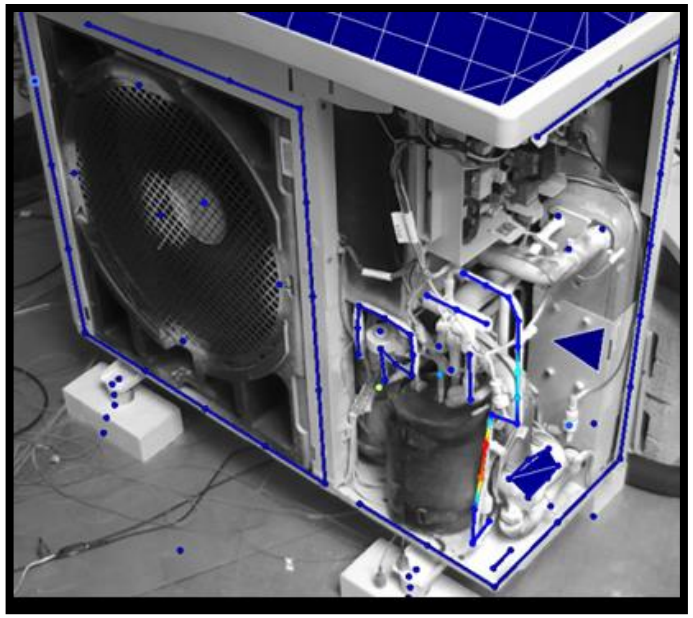
  microphones + accelerometers + 3D-laservibrometer

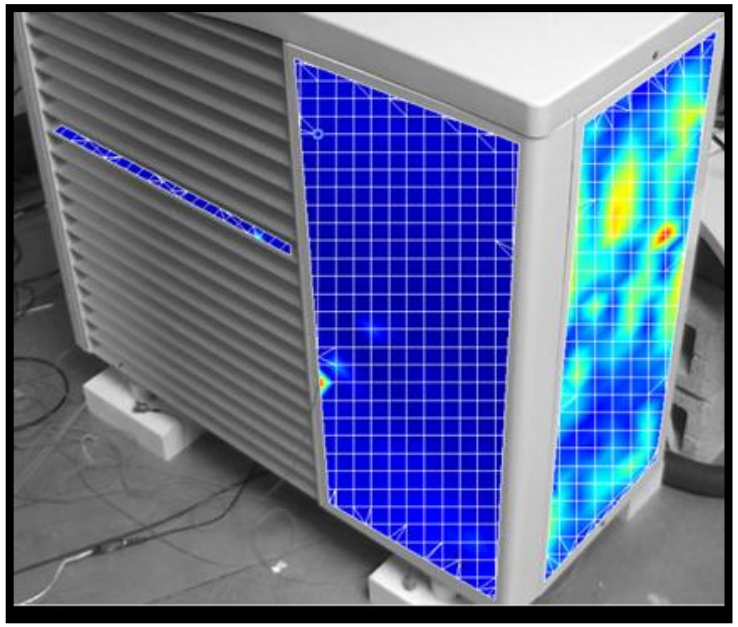


2. Deconstruction analysis: concept and experimental setup

- Measurements states
  - different states of dismantlement







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2. Deconstruction analysis: concept and experimental setup

- Measurements states
  - different states of dismantlement
  - different operating conditions (+ transient states like defrosting)

Zustand	Feuchte	Leistung	ekompositionszustai	Frostzustand	Gehäuse
A2/W35	trocken	100%	Komplett	Frostfrei	Ohne Geh
A-15/W35	trocken	100%	Komplett	Frostfrei	Ohne Geh
A-15/W45	trocken	100%	Komplett	Frostfrei	Ohne Geh
A-15/W55	trocken	100%	Komplett	Frostfrei	Ohne Geh
A-15/W65	trocken	100%	Komplett	Frostfrei	Ohne Geh
A-7/W35	Feuchtkugel -8°C	100%	Komplett	Frostfrei	Ohne Geh
A7/W35	Feuchtkugel 6°C	100%	Komplett	Frostfrei	Ohne Geh
A12/W55	Feuchtkugel 11°C	100%	Komplett	Frostfrei	Ohne Geh
A2/W35		100%	Nur Verdichter	-	Ohne Geh
A12/W55		100%	Nur Verdichter	-	Ohne Geh
A12/W55			Nur Beriselung und	-	Ohne Geh
A12/W55			Nur Berieselung	-	Ohne Geh
A12/W55			Nur Ventilator	-	Ohne Geh
A7/W35		100%	Nur Verdichter	-	Ohne Geh
A-7/W35		100%	Nur Verdichter	-	Ohne Geh
A-15/W35		100%	Komplett	-	Ohne Geh
A-15/W45		100%	Komplett	-	Ohne Geh
A-15/W35		100%	Nur Verdichter	-	Ohne Geh
A2/W35	trocken	37%	Komplett	Frostfrei	Ohne Geh
A2/W35	trocken	100%	Komplett (vor Abtau	Frostfrei	Ohne Geh
A2/W35	trocken	100%	Komplett (nach Abt	Frostfrei	Ohne Geh
A2/W55	trocken	100%	Komplett	Frostfrei	Ohne Geh
A2/W35	trocken	20%	Komplett	Frostfrei	Mit Gehä
A2/W35	trocken	20%	Nur Ventilator	Frostfrei	Mit Gehä
A2/W35	trocken	37%	Komplett	Frostfrei	Mit Gehä