How to make any a/w-heat pump more silent
Welcome

How to make any air-to-water heat pump more silent

Michael Kraus / Product Management Axial Fans and Application Management Heat Pumps
Considerations
Considerations

Regulation, Installation, Technology

- Legal and regulatory considerations
  - Heat pumps: EN12102 including Ecodesign and Energy labelling directive
    - Will there be a legislation for even more quite heat pumps?
  - Fans: Current legislative EU/327/2011 (=ErP2015)
    - When will the next tier be active? ErP202?
    - What will be the efficiency threshold?

- Technical considerations for fans in heat pumps
  - Examples of problems of optimization
    - Acoustic & efficiency vs. compact units with small footprint
    - Sensitivity to icing vs. tip clearance (=acoustics)
    - ....
Influence parameters on acoustics
Influence on acoustic performance

What the customer hears:

„My heat pump is too loud“

What are the noise sources?

- Unfavourable installation on site
  - Reflection of sound (e.g. walls)
  - High backpressure and turbulences of air
  - Missing mechanical decoupling of structure and device
- Unfavourable design of heat pumps
  - (Fluid path: compressor, piping)
  - Air path
    - Fan
    - “System influences”
Influence on acoustic performance

Influence parameters air path

Depending on fan
- Acoustics of fan aerodynamics
- Motor noise
Influence on acoustic performance

Influence parameters air path

Depending on fan
- Acoustics of fan aerodynamics
- Motor noise
- Vibrations due to imbalance (structure borne!)
Influence on acoustic performance

Influence parameters air path

Depending on **fan**
- Acoustics of fan aerodynamics
- Motor noise
- Vibrations due to imbalance (structure borne!)

Depending on **system**
- Tip clearance
Influence on acoustic performance

Tip clearance

\[ \Delta L_w \text{ [dB(A)]} \]

Volume flow [-]
Pressure rise [-]
Influence on acoustic performance

Influence parameters air path

Depending on fan
- Acoustics of fan aerodynamics
- Motor noise
- Vibrations due to imbalance (structure borne!)

Depending on system
- Tip clearance
- Geometry of nozzle
Influence on acoustic performance

Geometry of nozzle

- Full bell mouth
- Short bell mouth
- Hole
Influence on acoustic performance

Influence of nozzle – conversion to same characteristic curve

- Converted to blue curve
- Converted to blue curve

- Full bell mouth
- Short bell mouth
- Hole
Influence on acoustic performance

Influence of nozzle – acoustics at identical characteristic curve

@identical characteristic curve

5 dB(A)

full bell mouth

short bell mouth

hole
Influence on acoustic performance

Influence parameters air path

Depending on fan
- Acoustics of fan aerodynamics
- Motor noise
- Vibrations due to imbalance (structure borne!)

Depending on system
- Tip clearance
- Geometry of nozzle
- Position of fan in nozzle
Influence on acoustic performance

Influence parameters air path

Depending on fan
- Acoustics of fan aerodynamics
- Motor noise
- Vibrations due to imbalance (structure borne!)

Depending on system
- Tip clearance
- Geometry of nozzle
- Position of fan in nozzle
- Obstruction/Turbulence (suction AND pressure side)
  - e.g. Grille, heat exchanger, struts of device

Turbulence = Noise
Influence on acoustic performance

Influence parameters air path

Depending on fan
- Acoustics of fan aerodynamics
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Depending on system
- Tip clearance
- Geometry of nozzle
- Position of fan in nozzle
- Obstruction/Turbulence (suction AND pressure side)
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Conclusion
Conclusion

Installation considerations for heat pumps
- Planner, installer, manufacturer
- Proper installation to exploit full potential of heat pumps is necessary
- Proper design to exploit full potential of fans in heat pumps is necessary
Thank you and see you again at ZIEHL-ABEGG
Contact – ZIEHL-ABEGG

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